SECTION 6.0

Environmental Assessment

6.0 Environmental Assessment

6.1 Environment and Community Context

Kooragang Island is essentially reclaimed land created by joining Dempsey, Moscheto and Walsh Islands. The area was originally developed in the early to mid 1900s as the industrial centre for Newcastle. Officially named in 1968, Kooragang Island is a total area of approximately 2600 hectares and is bounded by the South and North Arms of the Hunter River. KCT is strategically located in the south-eastern portion of Kooragang Island, providing ready shipping access via the Hunter River and Newcastle Harbour.

As shown on **Figure 1.2**, the nearest urban areas are Fern Bay located approximately 1.7 kilometres to the east, the suburb of Stockton (North), located approximately 1.5 kilometres to the south-east of the site; and Mayfield located 1.7 kilometres to the south-west. The former BHP steelworks and current OneSteel operations area are located to the south and south-west, across the Hunter River.

6.1.1 Existing and Proposed Land Use – Kooragang Island

Industry and port facilities are located on the southern part of Kooragang Island (refer to **Figure 6.1**). PWCS is one of a number of operations on the Island including Cargill Australia, Air Liquide, Orica, Incitec Pivot, Sawmillers Exports, Newcastle Woodchipping, Cleanaway, Mountain Industries, Blue Circle Cement, Boral, Port Hunter Commodities, Sims Metals, Kooragang Bulk Facilities, and Transfield. Existing land uses include industrial and vacant industrial land.

Industrial land uses on Kooragang Island include a range of large scale operations associated with cement production, concrete batching and recycling, concrete building products, oilseed processing, fertiliser manufacturing and distribution, and ammonium manufacturing. In addition, surrounding industrial land use includes a hazardous waste management facility, LPG gas distribution facilities, a scrap metal reclamation facility, a licensed landfill and a number of engineering and fabrication operations.

There are a number of other port facilities within proximity to the KCT site. These port facilities are primarily utilised for the handling of raw materials, including alumina, petroleum coke, wood chips, phosphate rock, and a number of agricultural products, most of which are utilised in the range of manufacturing operations associated with the heavy industry land uses within the area. There are also a number of transport and logistics companies located within the Kooragang Island industrial area associated with fertiliser manufacturing operations, and aluminium production.

Within the Kooragang Island industrial area there are considerable areas of vacant land, currently zoned for industrial land uses under the Newcastle LEP 2003. Newcastle Port Corporation controls much of this land, with commercial leases being established between the Corporation and entities to utilise land within the area. Project Approval was granted to NCIG in April 2007, and construction of the NCIG third coal loading facility has begun in the location shown on **Figure 6.1**.

Kooragang Nature Reserve adjoins the northern boundary of the KCT site. Following an investigation into the natural areas and environmental importance of the site, parts of Kooragang Island were internationally recognised as a RAMSAR site in 1984. The Kooragang Wetland Rehabilitation Project was created in 1993, with ongoing support from government, local industries (including PWCS) and the community. This Project includes

Source: Port Waratah Coal Services Limited (2008, 2009)

0 0.5 1.0 2.0km
1:35 000

Legend

Kooragang Coal Terminal	Port Facilities
Heavy Industry	Golf Course
Light Industry	Nature Reserve
Vacant Land	Approved NCIG Coal Export Terminal
Urban	Suburban
Sewage Treatment	

FIGURE 6.1

Land Use

work on Ash Island, to the north-west of KCT, Stockton Sandspit to the east and Tomago wetlands to the north.

6.2 Identification of Key Environmental and Community Issues

Identification of key environmental and community issues for the EA for the Project is based on consideration of:

- the planning and environmental context for the locality (refer to **Sections 4.0** and **6.1**);
- an environmental risk analysis which was provided in the Preliminary Environmental Assessment for the Stage 4 Project to inform issue scoping for the EA (refer to **Appendix 3**);
- outcomes of the community and authority consultation process (refer to **Section 5.1**); and
- baseline studies completed as part of preparation of the EA.

Table 6.1 provides a summary of the key issues identified through these processes and provides reference to the section of the EA in which these issues have been addressed.

Table 6.1 – Key Environmental and Community Issues

Issue	**EA Reference**
Potential Air Quality Impacts and Management	Section 6.3.1
Potential Noise Impacts and Management	Section 6.3.2
Potential Water Quality Impacts and Management	Section 6.3.3
Potential Ecological Impacts and Management	Section 6.3.4
Potential Visual Impacts and Management	Section 6.3.5
Potential Traffic Impacts and Management	Section 6.3.6
Potential Greenhouse Gas and Energy Impacts and Management	Section 6.4.1

A range of other issues were also considered during the environmental assessment.

6.3 Key Environment and Community Issues

6.3.1 Air Quality

In accordance with the DGRs, a comprehensive assessment of potential air quality impacts as a result of the Project has been completed by PAE Holmes and is provided in **Appendix 4**. An overview of the air quality assessment is provided in this section.

Emissions of dust will be the main air quality issue and the assessment is based on the use of a computer-based dispersion model to predict ground-level dust concentrations and deposition levels in the vicinity of the KCT. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality criteria and predicted dust levels associated with the approved KCT operations.

The assessment is based on a conventional approach following the procedures outlined by the DECCW in its guideline document titled ‘Approved Methods for the Modelling and Assessment of Air Pollutants in NSW’ (DEC, 2005).

The potential dust generating activities associated with KCT include:

- material unloading/loading points;
- stacking and reclaiming to and from coal stockpiles, and
- wind erosion from coal stockpiles.

Importantly, the proposed Stage 4 Project will not alter the approved stockpile areas, the major potential source of dust generation associated with the KCT. The Stage 4 Project will introduce an additional material unloading/loading point at KCT. No major dust generating activities (such as large scale earthworks, etc.) are required in constructing the fourth dump station and fourth shiploader. The proposed construction will result in minimal dust emissions and while there may be a potential increase in the dust deposition level for short periods within the site, it is highly unlikely that dust emissions from the construction activities will cause an increase in the particulate levels in nearby industrial or residential areas. Hence a quantitative assessment of potential dust emissions associated with the construction activities for the Stage 4 Project has not been included in this assessment.

The DGRs also require consideration of potential odour impacts. The existing site sewage treatment plant is the only potential source of odour and this is further discussed in **Section 6.3.1.6**.

6.3.1.1 Air Quality Goals

Air quality assessment criteria relevant for assessing impacts from industrial activities relate to dust deposition and dust concentration.

Dust concentration refers to airborne dust and is measured in micrograms per cubic metre (μg/m³). Relevant criteria for dust concentration are defined in terms of two classes, total suspended particulates (TSP) and PM_{10}. TSP relates to all suspended particles which are usually in the size range of zero to 50 micrometres (μm). Particle sizes larger than 50 μm are typically measured in dust deposition levels. The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10 μm from reaching the more sensitive parts of the respiratory system. PM_{10} refers to particulate matter with a diameter less than 10 μm.

Goals for dust concentration are referred to as long term (annual average) and short term (24 hour maximum) goals. Relevant goals for TSP and PM_{10} are outlined in **Table 6.2** in relation to both Project specific and cumulative goals applied at a regional level. The TSP and PM_{10} annual average goals relate to the total dust in the air and not just the dust from the Project. Therefore, background levels need to be considered when using these goals to assess impacts (refer to **Section 6.3.1.2**).

Table 6.2 – DECCW Assessment Criteria for Particulate Matter Concentrations

Pollutant	Standard/Goal	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 µg/m^3	Annual mean	National Health & Medical Research Council (NHMRC)
Particulate matter <10 µm (PM_{10})	50 µg/m^3	24-hour maximum	DECCW
	30 µg/m^3	Annual mean	DECCW
	50 µg/m^3	(24-hour average, 5 exceedances permitted per year)	National Environment Protection Measures (NEPM)

Dust deposition levels refer to the quantity of dust particles that settle out of the air as measured in grams per square metre per month (g/m²/month) at a particular location. In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. DECCW expresses dust deposition criteria in terms of an acceptable increase in dust deposition over the existing background levels and a total allowable cumulative level. **Table 6.3** shows the maximum acceptable increase in dust deposition over the existing dust levels.

Table 6.3 – DECCW Criteria for Dust Deposition

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

6.3.1.2 Existing Air Quality

As discussed in **Section 2.3.2**, a large array of dust controls and safeguards are currently in place at KCT to ensure that the relevant criteria are met in surrounding areas. PWCS undertakes regular monitoring of the air quality in the area surrounding KCT in accordance with relevant development consent conditions and DECCW licensing requirements. The air quality monitoring program aims to determine the contribution of emissions from KCT on the nearest residential areas of Stockton and Fern Bay, as well as at the boundaries of the KCT site. In addition to the PWCS air quality monitoring program, DECCW undertakes ambient air quality monitoring in areas surrounding KCT, which have also been considered as part of this assessment.

An overview of the monitoring results collected through the PWCS and DECCW air quality monitoring programs is provided below.

DECCW Monitoring

DECCW has undertaken air quality monitoring at stations located at Beresfield, Newcastle and Wallsend since 2000. These three sites measure concentrations of PM_{10} by high volume air sampler (HVAS) and tapered element oscillating microbalance (TEOM), however, no TSP measurements are made. Monitoring data collected by the DECCW in 2001 and 2008 are shown in **Table 6.4**. The 2001 data have been used in the dispersion modelling as this dataset had the highest data capture. These data also show similar wind patterns when compared to the data collected in 2008. The 2001 data was compared to 2008 data to confirm the accuracy of the data used in the dispersion modelling.

Annual average PM_{10} was below the DECCW air quality criterion of 30 μg/m^3 in the representative monitoring periods. Maximum 24-hour average PM_{10} concentrations have been above the DECCW 50 μg/m^3 criterion on several occasions at all three monitoring locations in 2008. These are likely to be due to regional events such as bushfires and dust storms which can contribute to very high PM_{10} concentrations.

Table 6.4 - Annual average PM_{10} monitoring data in the Newcastle area (2001 and 2008)

Month	Beresfield (μg/m^3)		Newcastle (μg/m^3)		Wallsend (μg/m^3)	
	2001	2008	2001	2008	2001	2008
Goals	**50**	**30**	**50**	**30**	**50**	**30**
Jan	21	19	24	25	22	17
Feb	19	17	19	18	20	13
Mar	19	20	26	19	19	15
Apr	21	15	18	18	18	13
May	17	21	14	21	15	16
Jun	22	15	23	15	16	10
Jul	18	19	17	19	13	14
Aug	21	17	14	16	15	14
Sep	20	20	16	26	16	20
Oct	30	18	15	24	15	17
Nov	22	18	22	23	18	16
Dec	30	20	33	24	27	18
Annual Ave	**21.7**	**18.3**	**20.1**	**20.6**	**17.8**	**15.1**

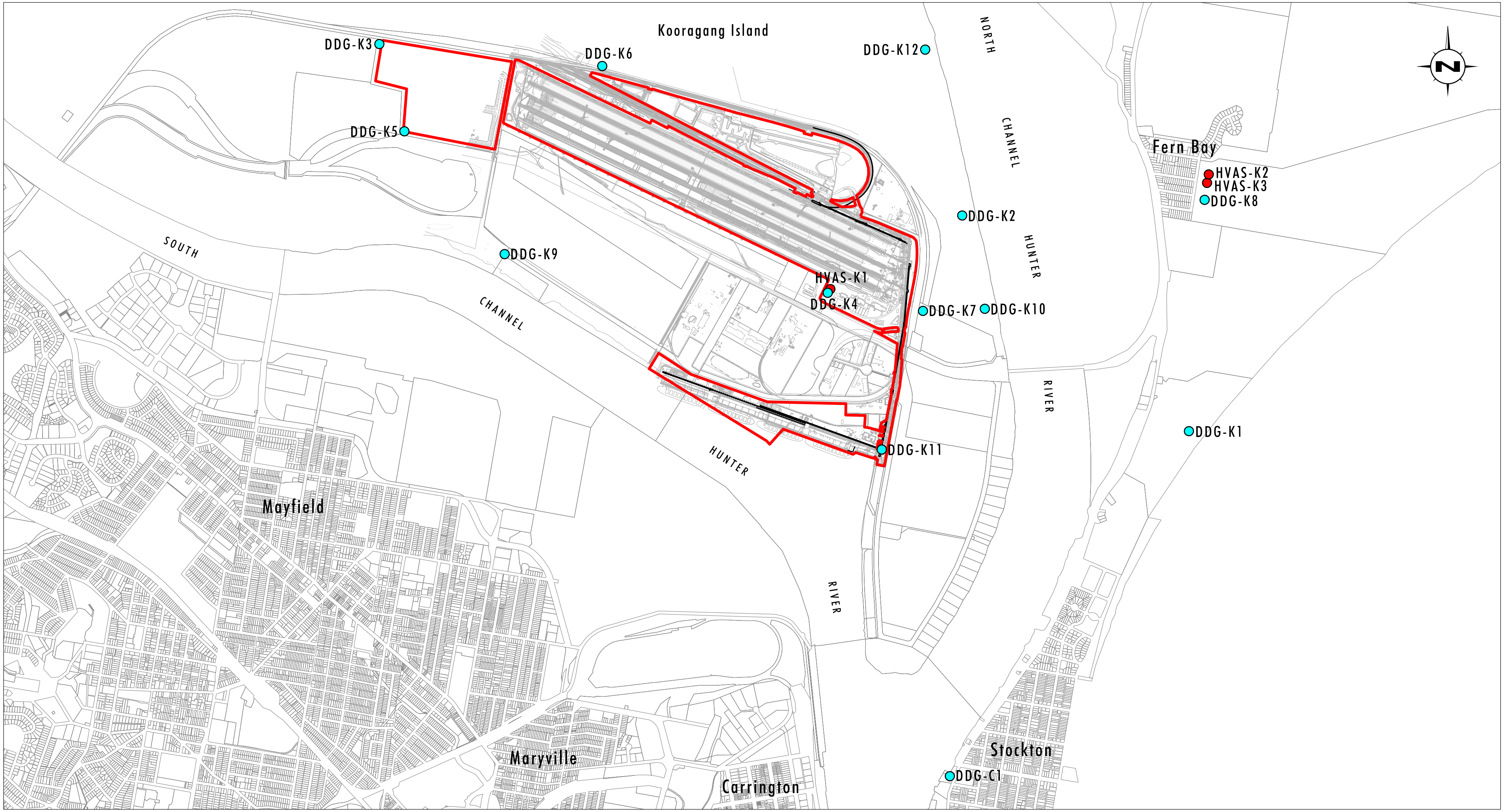
PWCS Monitoring

PWCS monitors TSP, PM_{10} and dust deposition in the area surrounding KCT. There are currently two high volume air samplers located at Fern Bay (measuring TSP and PM_{10}) and 13 dust deposition gauges surrounding the site (refer to **Figure 6.2**). **Table 6.5** summarises the dust concentration and deposition data collected at closest residential areas of Fern Bay and Stockton.

Table 6.5 - Summary of PWCS air quality monitoring – Fern Bay and Stockton

Year	Annual average TSP (μg/m^3) HVAS K2 – Fern Bay	Annual average PM_{10} (μg/m^3) (HVAS K3 – Fern Bay)	Annual average dust deposition (g/m^2/month)	
			DDG K1 - Stockton	DDG K8 – Fern Bay
2001 (data used in dispersion modelling)	41	21	1.3	1.3
2008 (recent year)	45	19	1.9	2.1
DECCW Guideline	90	30	4	4

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited

0 0.5 1.0 1.5km
1:35 000

Legend

- Kooragang Coal Terminal
- Dust Deposition Monitoring Location
- HVAS Monitoring Location

FIGURE 6.2

Dust Monitoring Locations Kooragang Coal Terminal

File Name (A4): R04_V1/2551_012.dgn

The results of the air quality monitoring indicate that the existing air quality in the vicinity of KCT is characterised as an annual average TSP of 45 µg/m^3, an annual average PM_{10} of 19 µg/m^3 and an annual average total dust deposition of approximately 2 g/m^2/month. All of these results are below the relevant DECCW air quality guidelines. Similarly to the monitoring data from the DECCW monitoring stations, there have been occurrences when maximum 24-hour average PM_{10} concentrations have been above the DECCW 50 µg/m^3 criterion. These are likely to be due to regional events such as bushfires and dust storms which can contribute to very high PM_{10} concentrations

The air quality monitoring program measures total dust deposition and dust concentration within the surrounding residential areas and, as such, the air quality monitoring results outlined above indicate the contribution from all sources to existing air quality. In order to further characterise KCT contribution to the surrounding environment, PWCS undertakes a microscopic analysis of annualised dust samples. This analysis has indicated that coal dust accounts for approximately 20% of the annual dust deposition within the Fern Bay and Stockton residential areas. The data shown on **Figures 6.3** to **6.5** clearly demonstrate that existing dust levels are below the relevant criteria at these nearest residential areas, for the period 2000 to 2008. During this period the proportion of coal dust has remained consistent or declined despite the substantial increase in coal throughput delivered to KCT since 2000. As such, the actual contribution of KCT to the air quality of the Fern Bay and Stockton residential areas is significantly lower than indicated in **Figures 6.3** to **6.5**, as these represent total dust from all sources.

6.3.1.3 Assessment Methodology

PAE Holmes completed a comprehensive assessment of potential air quality impacts as a result of the Project; this included the use of Gaussian dispersion model AUSPLUME (version 6.0) to predict the off-site dust concentration and dust deposition levels. AUSPLUME is a 'state of the art' model used throughout Australia and this is the model required for use by DECCW unless Project characteristics dictate otherwise (DECCW, 2005).

The modelling was undertaken based on the assumption that all approved KCT infrastructure (including Stage 3) has been constructed and is operational. In reality this is not the case, and is a conservative, worst case assumption. The eastern half of stockpile Pads C and D have been constructed, however the western halves are yet to be built, along with associated conveyors and infrastructure. It was assumed for the modelling that KCT is operating at full approved throughput capacity of a nominal 120 Mtpa.

In order to estimate emissions for each source, the modelling was developed on hourly time steps with the activities that would occur in that location in each hour recorded. For each hour an emission rate was calculated based on the level of activity and the wind speed at that time. All dust sources have been modelled assuming 24-hour per day operation with the plant and equipment operating at full capacity. The modelling has been performed using local meteorological data (refer to **Appendix 4**) and the dust emission estimates discussed in **Section 6.3.1.4**.

The modelling does not include dust generation associated with construction activities of the Stage 4 Project. Dust generation from the proposed construction activities will predominantly be minor earthworks involved in the preparation of building foundations which are relatively small in total area. The proposed construction activities that involve earthworks are anticipated to be short in duration and will not generate any significant dust. It is highly unlikely that the dust emissions from the construction activities will cause an increase in the particulate levels in nearby industrial or residential areas. Due to the short duration of construction activities they have not been included in the modelling.

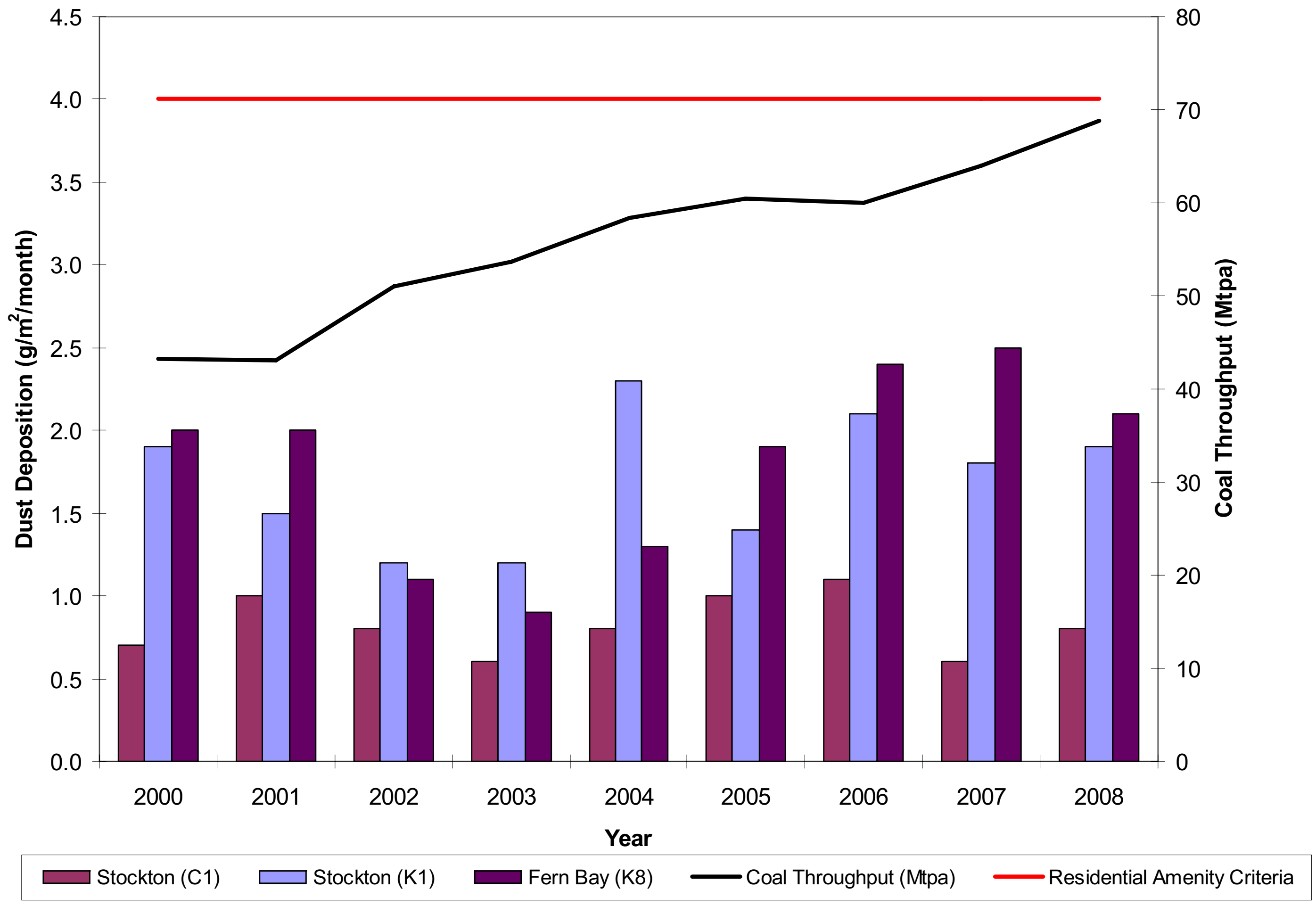


FIGURE 6.3

Dust Deposition Levels within the Fern Bay and Stockton Residential Area 2000-2008

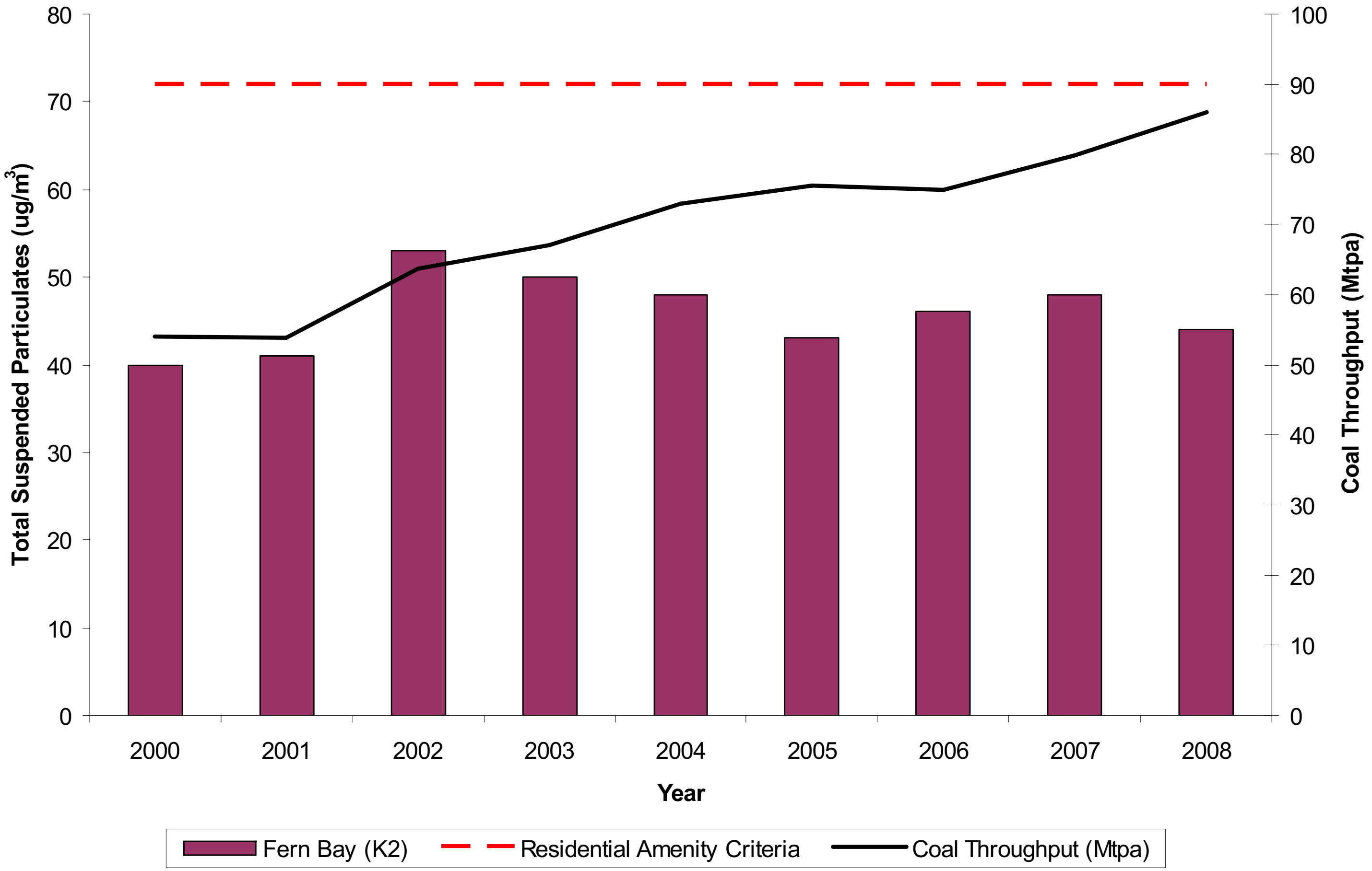


FIGURE 6.4

Dust Concentration (Total Suspended Particulates) within the Fern Bay and Stockton Residential Areas 2000-2008

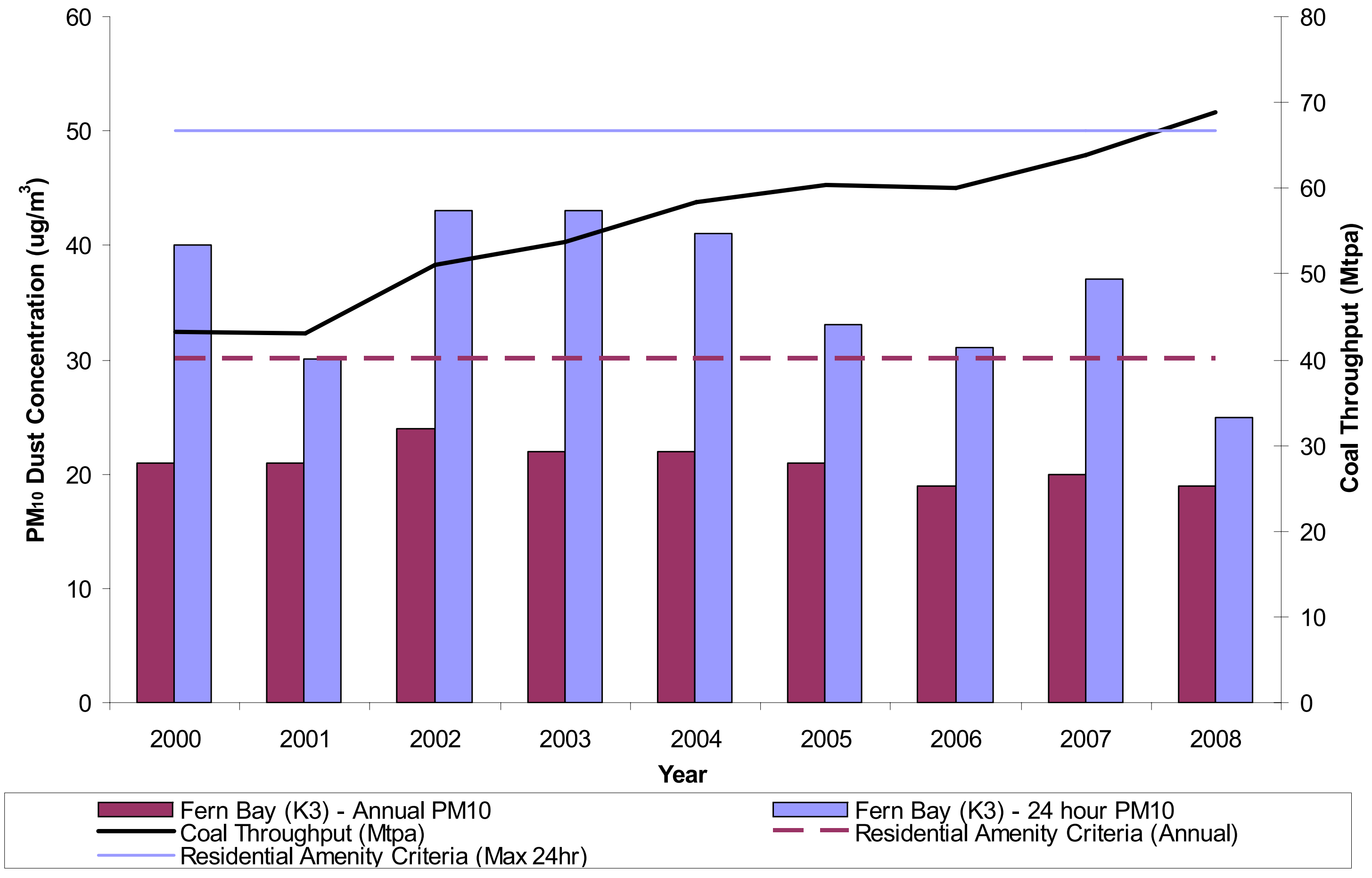


FIGURE 6.5

Dust Concentration (PM_{10})
within the Fern Bay and Stockton Residential Areas
2000-2008

6.3.1.4 Air Quality Impact

Total dust emissions have been estimated by analysing the activities taking place at the site for operation with 120 Mtpa throughput rate and with the Stage 4 infrastructure, including the additional dump station, transfer station and shiploader operational.

Dust emission estimates for the most significant dust generating activities from the Project are outlined in **Table 6.6**.

Table 6.6 - Estimated emission data used in modelling study

Activity	Annual TSP (kg/y)	
	Approved Operations	Additional Stage 4 Infrastructure
	120 Mtpa scenario	120 Mtpa scenario
Trains unloading to unloading station[1]	11,702	11,702
1st transfer between unloading station and stockpiles[1]	11,702	11,702
2nd transfer between unloading station and stockpiles[2]	11,702	11,702
Stacking to coal stockpiles	39,006	39,006
Reclaiming coal from stockpiles	33,077	33,077
1st transfer between stockpile and shiploader[2]	9,923	9,923
2nd transfer between stockpile and shiploader[2]	9,923	9,923
New transfer between stockpile and shiploader[2]	0	2,481
Transfer to buffer bins (enclosed)	0	0
3rd transfer between stockpile and shiploader	33,077	33,077
Loading coal to ships	9,923	9,923
Wind erosion from stockpiles and exposed areas	197,722	197,722
Diesel train exhausts	894	894
Annual throughput (t)	**120,000,000**	**120,000,000**
TOTAL DUST (kg)	**368,650**	**371,429**

1 Activity takes places underground – control factor applied for emission calculation purposes

2 Activity within an enclosed building – control factor applied for emission calculation purposes

This dust emission inventory shows that the largest potential source of dust emissions from the site is from wind erosion from stockpiles and exposed areas. As the approved footprint of the stockpiles is not proposed to change, there is no predicted change to the dust emissions from this source. The total throughput at KCT is not proposed to be modified and therefore the only potential additional dust impact arises from emissions from the additional Stage 4 infrastructure. As the rail receival station is totally enclosed and most conveyors are either underground or enclosed, potential increases to dust emissions are minor and relate to the additional coal transfer facilities. It is also acknowledged that there is no change in dust emissions associated with the transfer of coal from the coal stockpiles to the shipping conveyor system. PWCS does not propose to increase the infrastructure or capacity of current approved levels within this area of KCT as part of the Stage 4 Project.

The estimates from **Table 6.6** indicate that the annual dust emissions from KCT would increase from 369 tonnes to 371 tonnes with the additional Stage 4 infrastructure. This is an increase of only 0.75 per cent, a minor increase from the currently approved modelled dust emissions from KCT.

Figure 6.6 shows the predicted maximum 24-hour average PM_{10} concentrations. At the residential area of Fern Bay to the east of the site, the predicted dust concentration arising from total KCT operations, including Stage 4, is in the order of 2 $\mu g/m^3$.

The maximum 24-hour average PM_{10} prediction represents the worst day due to emissions from KCT. The predicted concentration is well below the DECCW 50 $\mu g/m^3$ criterion at the nearest residential areas and at industrial receptors on Kooragang Island. Cumulative 24-hour average PM_{10} impacts are discussed in detail in **Section 6.3.1.5**.

Predicted annual average PM_{10} concentrations due to the KCT operations are less than 2 $\mu g/m^3$ off site and less than 0.5 $\mu g/m^3$ at the nearest residential areas of Mayfield to the south-west and Fern Bay to the east, respectively (refer to **Figure 6.7**). Taking into account an average PM_{10} background concentration of 19 $\mu g/m^3$, the predicted cumulative annual concentrations are well below the air quality criterion (30 $\mu g/m^3$) at the nearest residential areas.

Predicted annual average TSP concentrations are shown in **Figure 6.8**. The model predictions show annual average TSP concentrations are less than 0.5 $\mu g/m^3$ at the nearest residential areas. Taking account of an average TSP background concentration of 45 $\mu g/m^3$, the predicted cumulative TSP concentrations are well below the air quality criterion (90 $\mu g/m^3$) at the nearest residential areas.

Figure 6.9 also includes the predicted annual average dust deposition. The contribution to dust deposition levels is predicted to be low at less than 0.05 g/m^2/month at Fern Bay. Compliance with DECCW's 2 g/m^2/month (incremental) and 4 g/m^2/month (total) air quality criteria would be achieved, based on these predictions.

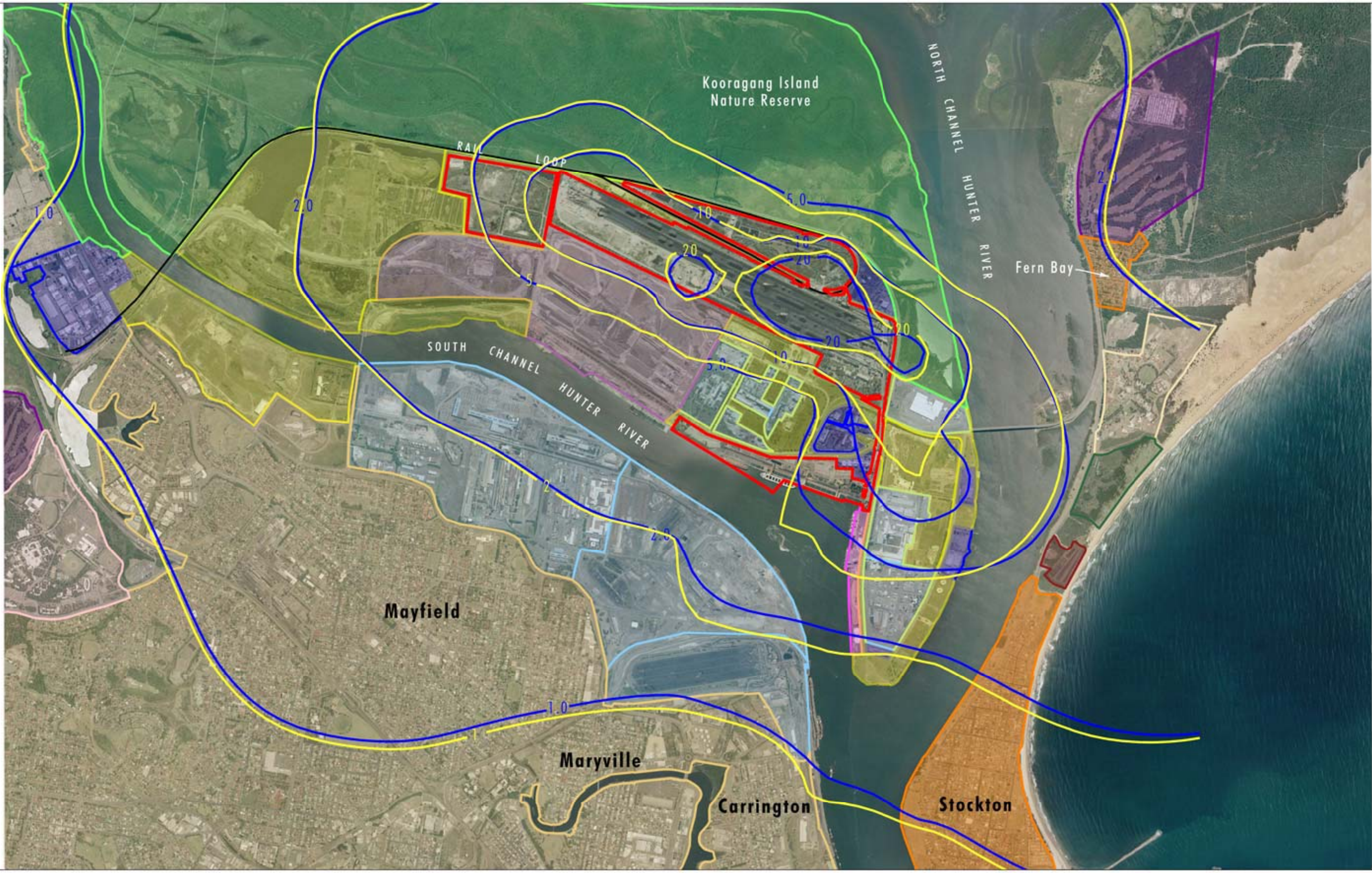
6.3.1.5 Cumulative Emissions

The DECCW guidelines (DEC 2005) require a cumulative assessment against 24-hour PM_{10} concentrations. Given that exceedances of DEC's 24-hour average PM_{10} criterion have been recorded in this area, this assessment examines the increment of the KCT operations and adopts the approach that the proposal should not cause any additional exceedances of the 50 µg/m^3 criterion at the nearest residences.

Assessment of cumulative 24-hour average PM_{10} air quality impacts is often complicated as there may be many occasions when background concentrations are already above the 24-hour average air quality criterion. As outlined in **Section 6.3.1.2**, air quality monitoring undertaken by both PWCS and DECCW in the surrounding area indicates that 24-hour average PM_{10} concentrations have exceeded the criterion of 50 µg/m^3 on a number of occasions, particularly during warmer months.

For a more refined analysis, DECCW recommends the use of contemporaneous hourly PM_{10} monitoring data to determine the potential for any additional exceedances of the 50 µg/m^3 criterion. Contemporaneous data are available for DECCW monitoring station at Beresfield for 2001, located approximately 5 kilometres west of KCT. The Beresfield site was chosen for this assessment as hourly TEOM data were available for the 2001 modelled meteorological year. As outlined in **Section 6.3.1.2** the 2001 data were compared to the 2008 monitoring data, which demonstrated that the monitoring data from 2001 is generally consistent with more recently recorded data. In addition, the annual average PM_{10}

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited (2008, 2009)

0 0.5 1 2km
1:45 000

Legend

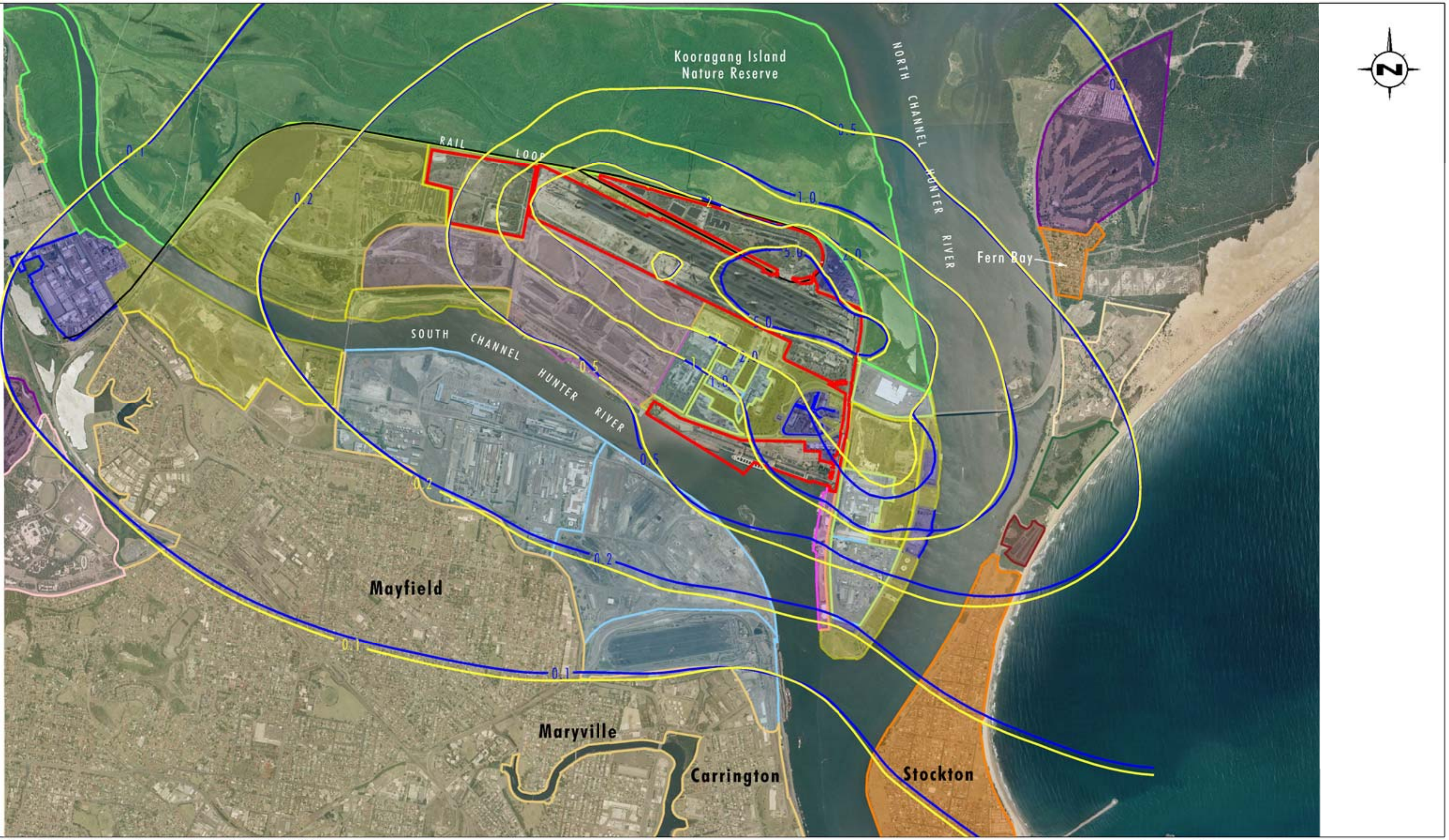
- Kooragang Coal Terminal
- Predicted PM_{10} 24hour ($\mu g/m^3$) - Stage 4 Project
- Modelled PM_{10} 24hour ($\mu g/m^3$) - Existing and Approved Kooragang Coal Terminal
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Suburban
- Approved NCIG Coal Export Terminal
- Newcastle University

FIGURE 6.6

Predicted PM_{10} 24hour Dust Concentration

File Name (A4): R04_V1/2551_014.dgn

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited (2008, 2009)

Legend

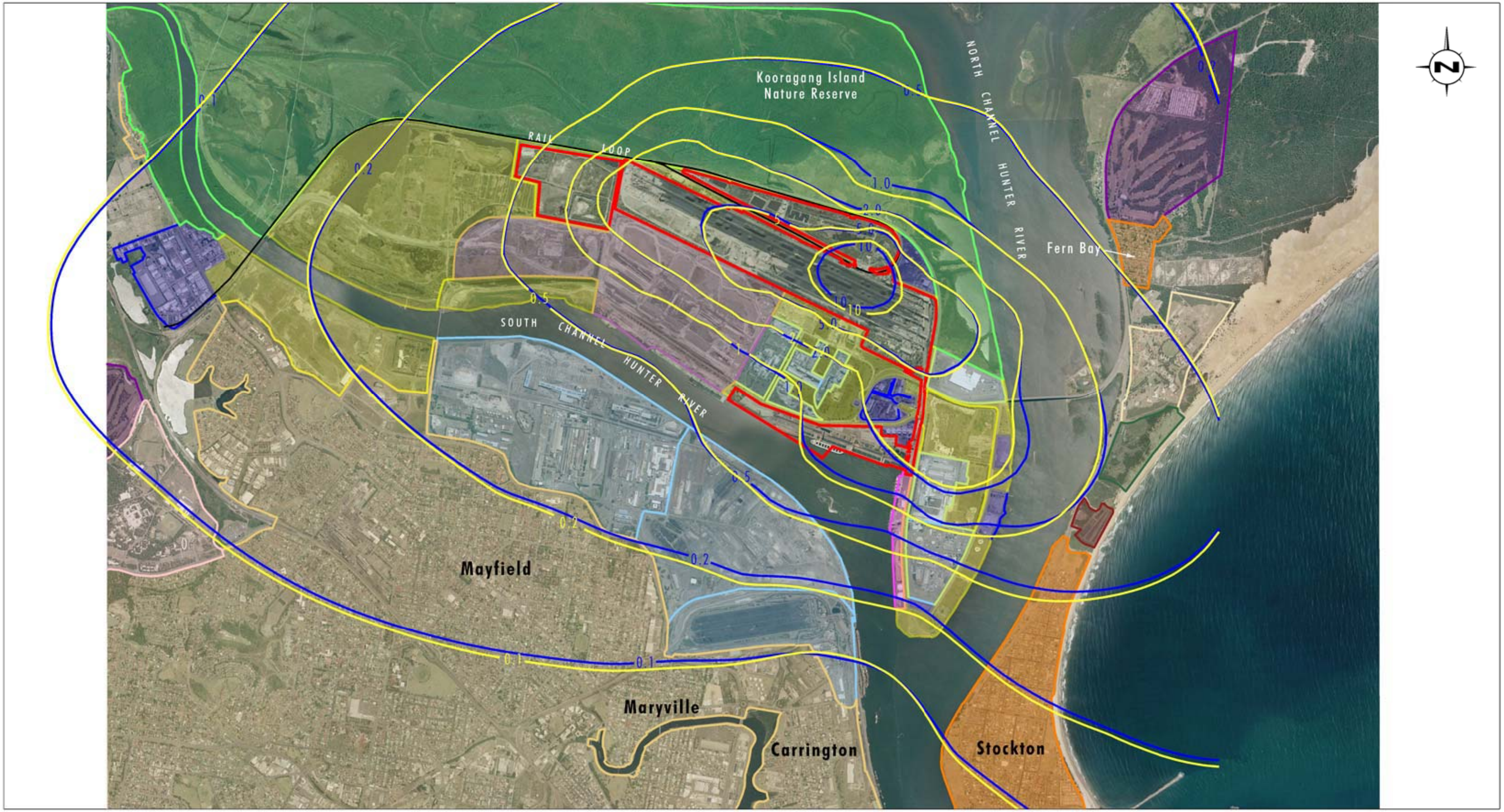
- Kooragang Coal Terminal
- Predicted PM_{10} Annual Average ($\mu g/m^3$) - Stage 4 Project
- Modelled PM_{10} Annual Average ($\mu g/m^3$) - Existing and Approved Kooragang Coal Terminal
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Suburban
- Approved NCIG Coal Export Terminal
- Newcastle University

FIGURE 6.7

Predicted PM_{10} Annual Average Dust Concentration

File Name (A4): R04_V1/2551_015.dgn

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited (2008, 2009)

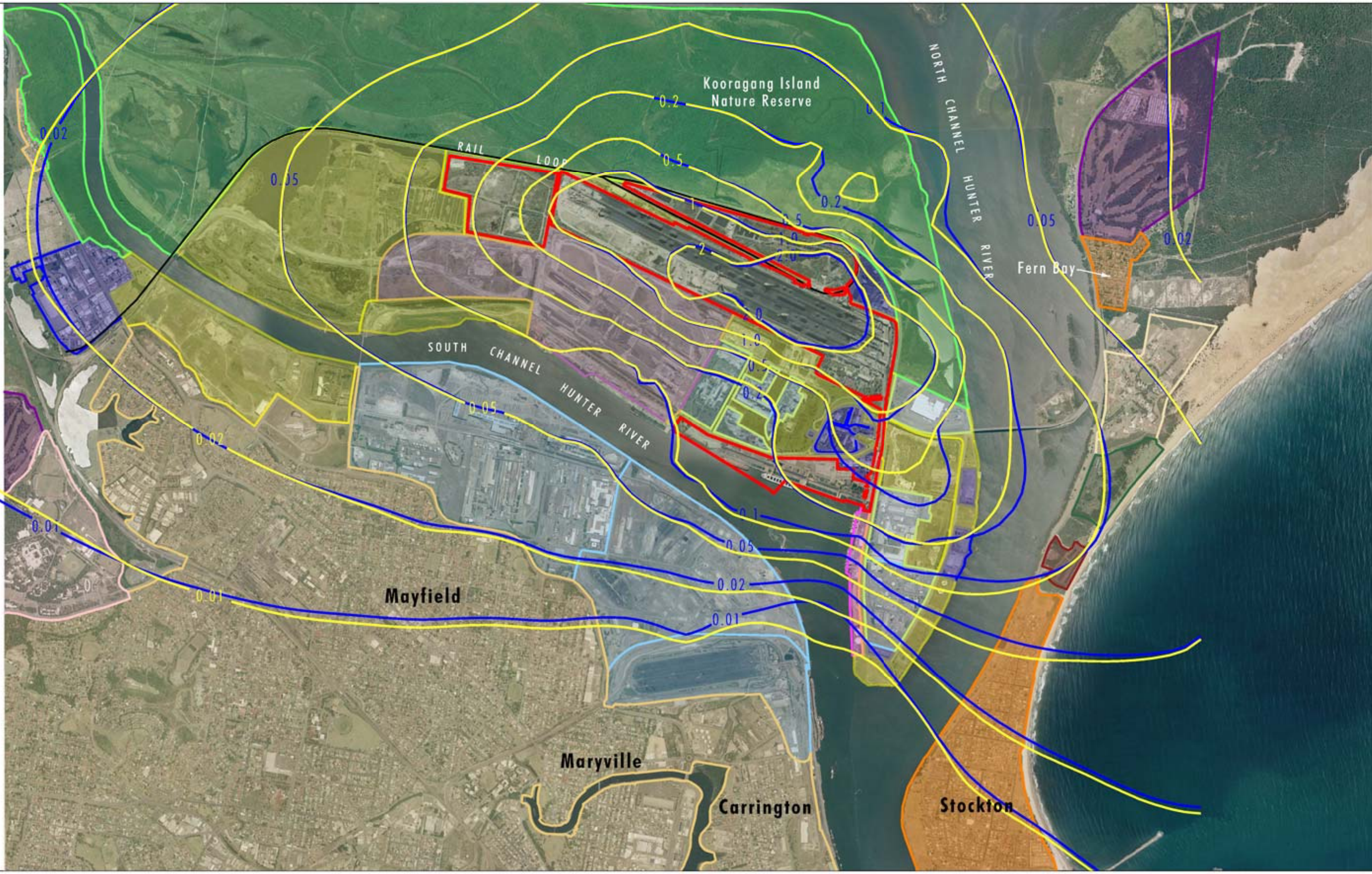
Legend

- Kooragang Coal Terminal
- Predicted Annual Average ($\mu g/m^3$) - Stage 4 Project
- Modelled Annual Average ($\mu g/m^3$) - Existing and Approved Kooragang Coal Terminal
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Suburban
- Approved NCIG Coal Export Terminal
- Newcastle University

FIGURE 6.8

Predicted Annual Average TSP Concentration

File Name (A4): R04_V1/2551_016.dgn



Source: Port Waratah Coal Services Limited (2008, 2009)

Legend

- Kooragang Coal Terminal
- Predicted Dust Deposition (g/m²/month) - Stage 4 Project
- Modelled Dust Deposition (g/m²/month) - Existing and Approved Kooragang Coal Terminal
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Suburban
- Approved NCIG Coal Export Terminal
- Newcastle University

FIGURE 6.9

Predicted Dust Deposition

concentration in 2001 (22 μg/m^3) was very similar to the annual average PM_{10} concentration measured at Fern Bay (21 μg/m^3), in the same period.

Incremental dust emissions from KCT were modelled at the three sensitive receptors chosen to represent the nearest residential areas of Mayfield, Stockton and Fern Bay.

The measured background levels at Beresfield were above the 50 μg/m^3 goal on five days in 2001. The exceedances were generally in the warmer months, towards the end of the year. This is consistent with the air quality monitoring data collected by PWCS in areas surrounding KCT, which are generally attributable to regional events, such as bushfires and dust storms. There were also a few occasions when measured concentrations were between 40 and 50 μg/m^3. The predicted annual increment of less than 0.5 μg/m^3 from KCT at all three receptor locations represents a small fraction of background levels.

For a cumulative assessment it is also relevant to consider approved or proposed developments. The most relevant potential development is the NCIG Coal Export Terminal on Kooragang Island which would have a coal throughput of up to 66 Mtpa, when fully developed in accordance with the current Project Approval.

A detailed air quality impact assessment of the NCIG proposal has been undertaken by Holmes Air Sciences (2006). Model predictions suggested that the maximum 24-hour average PM_{10} concentrations from the proposal would be 2 μg/m^3 at Mayfield and Stockton and 1 μg/m^3 at Fern Bay. Monitoring data for NCIG as an operational facility is not available as it is currently under construction.

An increase to the results of the cumulative 24-hour PM_{10} dispersion model by the estimates for NCIG and PWCS's Stage 4 Project would not present any additional instances where the total cumulative impacts are above the 50 μg/m^3 criterion. Therefore, the cumulative impacts of the Stage 4 Project are considered acceptable.

6.3.1.6 Odour Assessment

The DGRs for the Project require the assessment of potential odour impacts associated with the Stage 4 Project. The existing site sewage treatment plant is the only potential source of odour and this is further discussed in the following sections.

Odour Criteria

The DECCW Approved Methods for assessment of odour includes ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. The DECCW criteria have been refined to take into account population density. The odour glc criterion to be exceeded no more than 1 per cent of the time is presented in **Table 6.7**.

Table 6.7 – Impact Assessment Criteria for the Assessment of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants (OU, nose response time average, 99th percentile)
< ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (2000) and/or schools and hospitals	2

The difference between odour goals is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. Densely populated areas present a greater risk that individuals within the community will find an odour unacceptable than a sparsely populated area.

The area surrounding the PWCS KCT operations is considered 'Urban', in accordance with these guidelines. Therefore, the relevant impact assessment criterion for complex mixtures of odorous air pollutants for KCT is 2 OU.

Odour Emissions

KCT operates a small sewage treatment plant within the site, which is the only source of odour. The design/setup of this plant is quite simple with only one processing tank and several balance ponds. The main source of odour from this operation is the processing tank. Since no odour measurement data are available, odour emissions from the processing tank were estimated using odour measurement data from a conventional sewage treatment plant. As a conservative approach, the highest specific odour emission rate of 4.29 ou.m^3/s/m^2 from the conventional sewage treatment plant sources was used in estimating odour emission from the processing tank.

Using the highest emission rate of 4.29 ou.m^3/s/m^2, the total nose response odour emission from the activities related to the KCT plant is 279 ou.m^3/s, which is very small in comparison to a typical waste treatment plant (typically ranging from 1500 to 2000 ou.m^3/s/m^2). The total nose response odour emission is considered too low to create any impact in surrounding areas of the KCT. It can be concluded that odour emissions from the sewage treatment plant located at KCT will not create any odour nuisance.

Additionally, there have not been any enquiries received regarding the odour from the sewage treatment plant.

6.3.1.7 Conclusions and Air Quality Management

As outlined in **Section 2.3.2**, a large array of dust controls and safeguards are currently in place to ensure that air quality outside KCT is not adversely affected by emissions from the operation. The introduction of current technology of coal handling associated with the Stage 4 Project will further strengthen the dust controls. This includes the use of soft flow chutes to maintain a better coal trajectory from one conveyor to the next and thereby minimise dust emissions. In addition, improved belt cleaning systems will continue to be installed to remove greater quantities of coal and further reduce the potential for carryback dust.

An integral part of the safeguards is the continuing implementation of a specific air quality monitoring program. The program was designed in consultation with the DECCW and NCC and the location of existing monitoring sites is shown on **Figure 6.2**. The focus of the program is to monitor compliance with air quality standards in the nearby residential areas. The monitoring program also seeks to document the contribution of the operations at KCT to the air quality in the area in general. By doing so, the results of the monitoring program identify any need for further strengthening of dust controls in certain areas of the operation.

The available emission factors are somewhat limited in the amount of detail that can be included for activities with very specific dust control measures. Thus, the estimated dust emissions were taken to be conservative (that is, are a higher estimation than with detailed control measures assumed).

The modelling indicated that the contribution of dust emissions from total KCT operations, including Stage 4, is small and existing dust concentrations and deposition levels will remain below relevant DECCW criteria at surrounding residential locations. The project will not cause cumulative dust concentration or dust deposition levels to exceed relevant criteria, except under extreme circumstances when regional dust levels are already very close to the criteria. These circumstances may include dust storms or bushfires. It is concluded that air quality impacts are at acceptable levels and that air quality criteria would not be exceeded at sensitive residential receptors due to this operation.

6.3.2 Noise

In accordance with the DGRs for the Project, a comprehensive noise assessment has been undertaken by Heggies Australia Pty Limited (Heggies). This assessment includes:

- details of existing noise levels in areas surrounding KCT;
- the relevant noise impact assessment criteria;
- prediction of the noise levels that are expected to result from the Project; and
- an assessment of these noise levels against relevant criteria.

In summary, the comprehensive noise assessment has indicated that the predicted noise emissions associated with the Project are consistent with the noise emissions associated with current approved KCT operations. Importantly, the predicted noise emissions associated with the Stage 4 Project are substantially lower than the predicted impacts of the previously approved Stage 3 expansion project.

This section provides further details of the assessment findings and outlines the noise management and monitoring measures proposed as part of the Project. The full report is included in **Appendix 5**.

6.3.2.1 Existing Approach to Noise Management

As outlined in **Section 2.3.1**, PWCS has implemented an Acoustical Design, Procurement, Construction and Commissioning Process throughout the Stage 3 Expansion. This process has been exceptionally successful in reducing noise emissions from KCT to below relevant government and community criteria. The initiatives undertaken as part of this noise mitigation process (refer to **Table 6.8**) incorporate Best Available Technology to enable PWCS to achieve compliance in relation to consented noise limits.

Table 6.8 – Summary of KCT Noise Mitigation Measures and Strategy

Equipment Type	Stage 1 & 2	Stage 3 & 4
Conveyor Drives	Near-field barriers Replace noisiest drives	Low noise drive specification and compliance program prior to acceptance on site Noise reductions to gearbox, motor, coupling/brake, frame/guards and lube system
Stockyard and Shiploading Conveyors (Open Steel Assembly)	Replace highly worn idlers Replacement of suspended return idlers with staggered return idler spacing and fixed idler support frame	Low noise idler specification and compliance program prior to acceptance on site Soft-mount noise barriers Staggered return idler spacing and fixed return idler support frame

Table 6.8 – Summary of KCT Noise Mitigation Measures and Strategy (cont)

Equipment Type	Stage 1 & 2	Stage 3 & 4
Transfer Conveyors (Concrete and Metal Pan Assembly)	Replace highly worn idlers Conveyor mounted noise barriers Attenuation from enclosure	Low noise idler specification and compliance program prior to acceptance on site Low noise prefabricated conveyor gantry
Stackers, Reclaimers and Shiploaders	Replace noisiest drives and highly worn idlers	Low noise idler specification and compliance program including conveyor drives and idlers Demonstration of noise compliance by machine supplier at design stage
Buffer Bins, Chutes	Vibrating feeder with opposing phase control to 'cancel' noise effects	Soft flow chutes Vibrating feeder with opposing phase control to 'cancel' noise effects
Receival, Sample and Transfer Station buildings	Enclosed with minimum penetrations, double cladding where required Maintenance access doors closed when operating plant and equipment	Enclosed with minimum penetrations, double cladding where required Maintenance access doors closed when operating plant and equipment
Equipment start up and travel alarms	Retro design alarm systems to replace those that cause off-site disturbance	Develop alarms with frequency and volume control Design and install alarm systems[1]
Management	Maintenance and operational staff - noise awareness training Noise awareness part of the site induction training Integrated community enquiries and response program Regular noise monitoring program and analysis of results	

Note 1: Alarms are subject to procurement specifications detailing the tone frequency, noise emission levels, directionality and coverage. They are installed to optimise safety and to minimise off-site noise leakage. In the unlikely event that alarm noise remains a source of disturbance, then further on-site optimisation and tuning adjustments are implemented to achieve further noise reductions without compromising safety standards.

Despite the effectiveness of existing noise mitigation controls at KCT, PWCS has committed to the ongoing investigation of initiatives to further reduce potential noise impacts. The continued implementation of the Acoustical Design, Procurement, Construction and Commissioning process will enable the identification and targeting of specific components of the Project to further reduce noise emissions from KCT.

By implementing the Program described above, in many cases PWCS has gone well beyond Best Available Technology by promoting research and development (R&D) of practical acoustical solutions not previously commercially available or considered economically achievable. In particular, the development of low noise technology in relation to conveyor assemblies (i.e. open-steel, metal-pan, concrete-pan) and conveyor drive assemblies with demonstrated source noise reductions and incremental improvement with each phase of installed infrastructure.

The current focus of the Program is to design, construct and operate sustainable 'at source' noise minimisation for the remaining Stage 3 infrastructure and the proposed Stage 4 infrastructure. Additionally, Stage 1 and 2 plant and equipment are subject to progressive replacement in accordance with KCT's ongoing maintenance activities.

6.3.2.2 Approach to Assessment

The KCT noise model was developed to incorporate the significant noise sources associated with the proposed Stage 4 development. Additionally, surrounding terrain, aspects of the built environment and nearby receiver areas were also included in the model.

The noise model was prepared using RTA Software's Environmental Noise Model (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the NSW EPA. The acoustical algorithms utilised by this software have been endorsed by the Australian and New Zealand Environment and Conservation Council (ANZECC) and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available. The following scenarios were assessed:

- All on-site installed, approved and proposed Stage 1, 2, 3 and 4 infrastructure operating within the KCT site including rail receival (coal wagon unloading), stacking, reclaiming and shiploading conveyor systems, transfer stations as well as mobile equipment (i.e. stackers, reclaimers and shiploaders) balanced across the KCT site.

- Coal trains operating on the KCT rail loop including locomotives and wagon rakes assessed simultaneously with the KCT's operations.

The operational modelling includes all significant items of plant and equipment working concurrently to simulate and predict the intrusive LAeq(15minute) and amenity LAeq(Period) levels with coal throughput at the maximum approved 120 Mtpa. In effect, this approach to the noise modelling provides for the assessment of the total predicted noise emissions from the current approved KCT and proposed components of the Stage 4 Project.

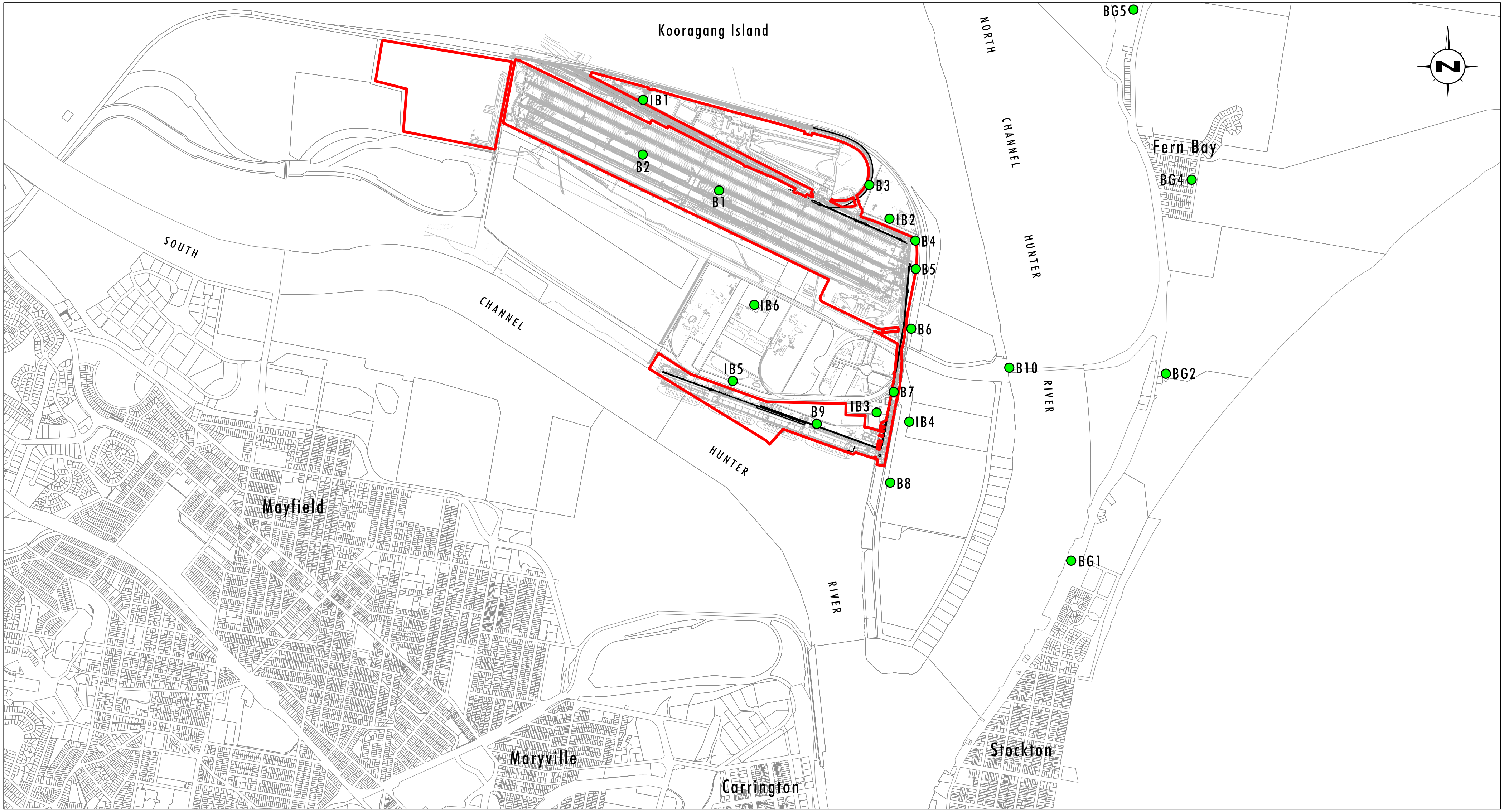
As part of KCT's continuous improvement program, all Stage 4 infrastructure will be constructed and operated using the best available technology. The SWL of 119 dBA for Stage 4 is based on PWCS's plan to implement best available noise mitigation technology. Therefore in general terms, the Stage 4 infrastructure has only marginal potential to increase off-site environmental noise emissions. In accordance with the current project approval, PWCS will continue to investigate all reasonable and feasible measures to achieve ongoing reductions in noise emissions for KCT through the continuous noise improvement program.

The Stage 4 Project predictive noise modelling involved the investigation of feasible and reasonable mitigation measures, particularly in relation to night-time operations. In order to ensure that the Stage 4 Project (including the KCT rail loop) does not introduce any noise increase at all receiver areas relative to operating noise limits, it will be necessary to reduce the noise emissions from selected existing Stage 1 and Stage 2 infrastructure. The required source noise reductions can be achieved by replacing specific infrastructure components in accordance with Stage 3 (and 4) noise specification requirements. These mitigation measures will be implemented by PWCS as part of ongoing maintenance activities and the continuous noise improvement program and have been assumed to be implemented for the purposes of the predictive modelling.

6.3.2.3 Existing Noise Environment

As outlined in **Section 2.3.1**, the existing noise environment in areas surrounding KCT has been monitored on a regular basis by PWCS at the locations shown on **Figure 6.10**. In addition, further monitoring has been undertaken within the surrounding area as part of noise assessments for other projects on Kooragang Island. Relevant noise monitoring has used a combination of both unattended noise logging and attended noise measurements.

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited (2007)

0 0.5 1.0 1.5km
1:35 000

Legend

Kooragang Coal Terminal
Noise Monitoring Location

FIGURE 6.10

Noise Monitoring Locations
Kooragang Coal Terminal

File Name (A4): R04_V1/2551_030.dgn

As shown on **Figure 1.2**, KCT is located within 2 kilometres of the residential areas of Fern Bay, Stockton, and Mayfield. **Table 6.9** details the receiver areas and the specific locations that are assessed for potential noise impacts.

Table 6.9 - Nearest Potentially Affected Receiver Areas and Assessment Locations

Receiver Area	ID and Location	INP Noise Amenity Zone[1]	LEP Zone
Fern Bay North	FN1 - Bayway Village Nelson Bay Road	Suburban	Residential
Fern Bay West	FW1 - 1 Fullerton Lane		Residential
	FW3 - 30 Nelson Bay Road		
	FW2 - Stockton Hospital	Hospital	Special Uses
Fern Bay East	FE1 - 21 Braid Road	Suburban	Residential
	FE2 - Fern Bay Primary School	School	
Stockton West	SW1 - 284 Fullerton Street	Suburban	Residential
	SW2 - Cnr Pembroke and Fullerton Streets		
Stockton East	SE1 - 40 Eames Avenue	Suburban	Residential
	SE2 - Stockton Primary School	School	
Mayfield West	W1 - 47 Stevenson Avenue	Urban	Residential
	W2 - 4 Groongal Street		
	W4 - Cnr Decora Cr & Elata Way		
	W3 - Mayfield West Primary School	School	
Mayfield	M1 - 68 Bull Street	Urban	Residential
	M2 - 45 Simpson Crescent		
	M3 - 1 Arthur Street		
	M4 - 52 Arthur Street		
	M5 - 21 Crebert Street		
Carrington/ Maryville	C1 - Cnr Hargrave and Young Streets	Urban	City Centre
	C2 - Cnr Harrison and Northumberland Streets		
Mayfield West	MW1 – Steel River	Commercial	Steel River
Kooragang Island	KI1 - Blue Circle Southern Cement	Industrial	Port and Industry
	IB1 - EDI Administration Building		
	IB2 - Mountain Bulk Haulage		
	IB3 - Kooragang Bulk Facilities		
	IB4 - Incitec Heron Rd		
	IB5 - Sims Metal Cormorant Rd		
	IB6 - Cargill Australia Raven St		
Mayfield North	MN1 - OneSteel	Industrial	Port and Industry

Note 1: Use of Urban and Suburban Noise Amenity Zones in accordance with the DoP's Director-General Environmental Assessment Report dated April 2007 in relation to the Major Project Assessment Newcastle Coal Infrastructure Group Coal Export Terminal.

The nearest industrial premises to the KCT site is Kooragang Bulk Facilities (KBF, location 1B3). The KBF administrative building has existing noise controls to minimise conveyor noise intrusion from the adjacent transfer conveyors associated with KCT operations.

Environmental noise monitoring is in accordance with the approved 120 Mtpa Construction Noise Management Plan and the consented Stage 3 Expansion Operating Noise Management Plan. Construction and operating noise performance is reported in accordance with KCT's Annual Environment Management Report and auditing requirements. Noise monitoring data from the current noise monitoring program has been utilised to form the basis of the assessment of potential noise impacts associated with the Stage 4 Project as outlined in the following sections.

6.3.2.4 Noise Criteria Applicable to Stage 4

Once KCT exceeds the throughput capacity of 77 Mtpa, KCT operations will be managed in accordance with the approved noise limits established as part of the 120 Mtpa project approval. Therefore, the potential noise impacts of the Stage 4 Project have been assessed against the 2007 project approved noise limits (refer to **Table 6.10**). These noise limits were determined by DoP and DECCW following consideration of detailed assessment of background noise levels and establishment of relevant criteria, in accordance with the INP, as part of the 120 Mtpa EA and approval process. It is considered appropriate that the noise criteria included as part of the recent 120 Mtpa project approval are applied to Stage 4, because:

- these have been established in accordance with the INP;
- there is no proposed change to throughput capacity ;
- PWCS proposes to apply proven best available technology to Stage 4; and
- existing Condition 2.10 of the 120 Mtpa project approval requires PWCS to continue to strive for continuous improvement in relation to noise emissions.

Table 6.10 - Project Approval 2007 - Noise Limits and Meteorological Constraints (dBA re 20 µPa)

Residential Receiver Area	$L_{Aeq(15minute)}$ Construction Day[1]	$L_{Aeq(15minute)}$ Operation Day, Evening, Night[2]	$L_{Aeq(night)}$ Operation Night[3]	$L_{A1(1minute)}$ Operation Night[3]
Fern Bay North	46	46	43	55
Fem Bay West	50	50	47	55
Fern Bay East	49	49	46	55
Stockton West	50	50	47	57
Stockton East	49	49	46	56
Mayfield West	41	41	37	56
Mayfield	44	44	38	58
Carrington	42	42	38	52

Table 6.10 - Project Approval 2007 - Noise Limits and Meteorological Constraints (dBA re 20 µPa) (cont)

Notes	The maximum allowable noise contributions apply under: a) Meteorological conditions of: wind speeds up to 3 ms^{-1} at 10 metres above ground level; or b) Temperature inversion conditions up to 3°C per 100 metres and wind speeds up to NMS^{-1} at 10 metres above the ground. For the purpose of assessment of noise from the project shall be: c) Measured at the most affected point on or within the Site boundary at the most sensitive receiver to determine compliance with LAeq(15 minute) night noise limits; d) Measured at one metre from the dwelling facade to determine compliance with LA1(1 minute) noise limits; and e) Subject to the modification factors provided in Section 4 of the NSW INP, where applicable.

Note 1: 7 days per week, 0700 hours to 1800 hours.

Note 2: 7 days per week, 24 hours a day.

Note 3: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

The relevant criteria have also been defined in accordance with the INP for other noise aspects not covered by **Table 6.10** and these are discussed in detail in the Noise Impact Assessment (refer to **Appendix 5**).

6.3.2.5 Meteorological Environment

The INP requires assessment of predicted noise levels under certain meteorological conditions that have the potential to enhance noise impacts where it is considered that the noise conditions are significant features of the prevailing meteorological environment. An assessment of prevailing meteorological conditions has been undertaken based on the meteorological data recorded at KCT. This assessment determined that wind conditions greater than 3 m/s are a significant feature of the environment during evening and night-time periods and the frequency of occurrence of moderate to strong temperature inversions is greater than 30% during the combined evening and night-time period. Therefore in accordance with the INP, these metrological conditions have been considered in the noise impact assessment.

In accordance with the INP the frequency of occurrence of moderate to strong (i.e. 1.5 to >4.0 ^{o}C/100 m) winter temperature inversions occurs more than 30% of the time during the combined evening and night-time period and therefore these conditions have been included as part of this assessment.

6.3.2.6 Operational Noise Assessment

As discussed in **Section 6.3.2.4** PWCS is seeking approval for the Project by modification to the existing Project Approval and noise emissions from the Stage 4 Project have therefore been assessed against the approved 120 Mtpa operation noise limits.

Operating Intrusive Noise Assessment

The predicted daytime and evening LAeq(15minute) operating intrusive noise levels from the Stage 4 Project to the nearest residential receiver areas and the specific noise modelling results for each of the receiver areas during daytime and evening periods are contained within **Appendix 5**. In all modelled cases, the predicted intrusive levels were below the relevant daytime and evening intrusive noise assessment criteria outlined in **Table 6.10**.

The ‘worst case’ intrusive night-time noise contours associated with the Project, under temperature inversion and drainage wind conditions where applicable, are provided in **Figure 6.11**. All predicted intrusive noise levels are below the night-time approved noise limits. As such, any intrusive noise impacts associated with the Project are considered acceptable during daytime, evening and night periods.

To assess the potential noise impact at Fern Bay (West and East) and Stockton (West and East) further assessments have been carried out to place the predicted noise levels in the context of KCT’s recent approvals and associated infrastructure development. The comparative intrusive noise levels at Fern Bay West (FW1) and Stockton West (SW1) are shown graphically in **Figure 6.12** and **Figure 6.13**.

Potential noise impacts from the ARTC managed rail loop are included in each of the four consent scenarios displayed in **Figures 6.12** and **6.13**. As shown in **Figures 6.12** and **6.13** the intrusive noise levels associated with the Stage 4 Project are consistent and marginally less than the intrusive noise levels of the approved Stage 3 and 120 Mtpa projects.

Operating Amenity Noise Assessment

The predicted daytime LAeq(11 hour) and evening LAeq(4 hour) noise amenity levels from the Stage 4 Project to the nearest residential receiver areas and the specific noise modelling results for each of the receiver areas during daytime and evening periods are presented in the full noise assessment in **Appendix 5**. As outlined in **Appendix 5**, all predicted noise amenity levels are below the daytime and evening relevant maximum levels at the surrounding receiver areas.

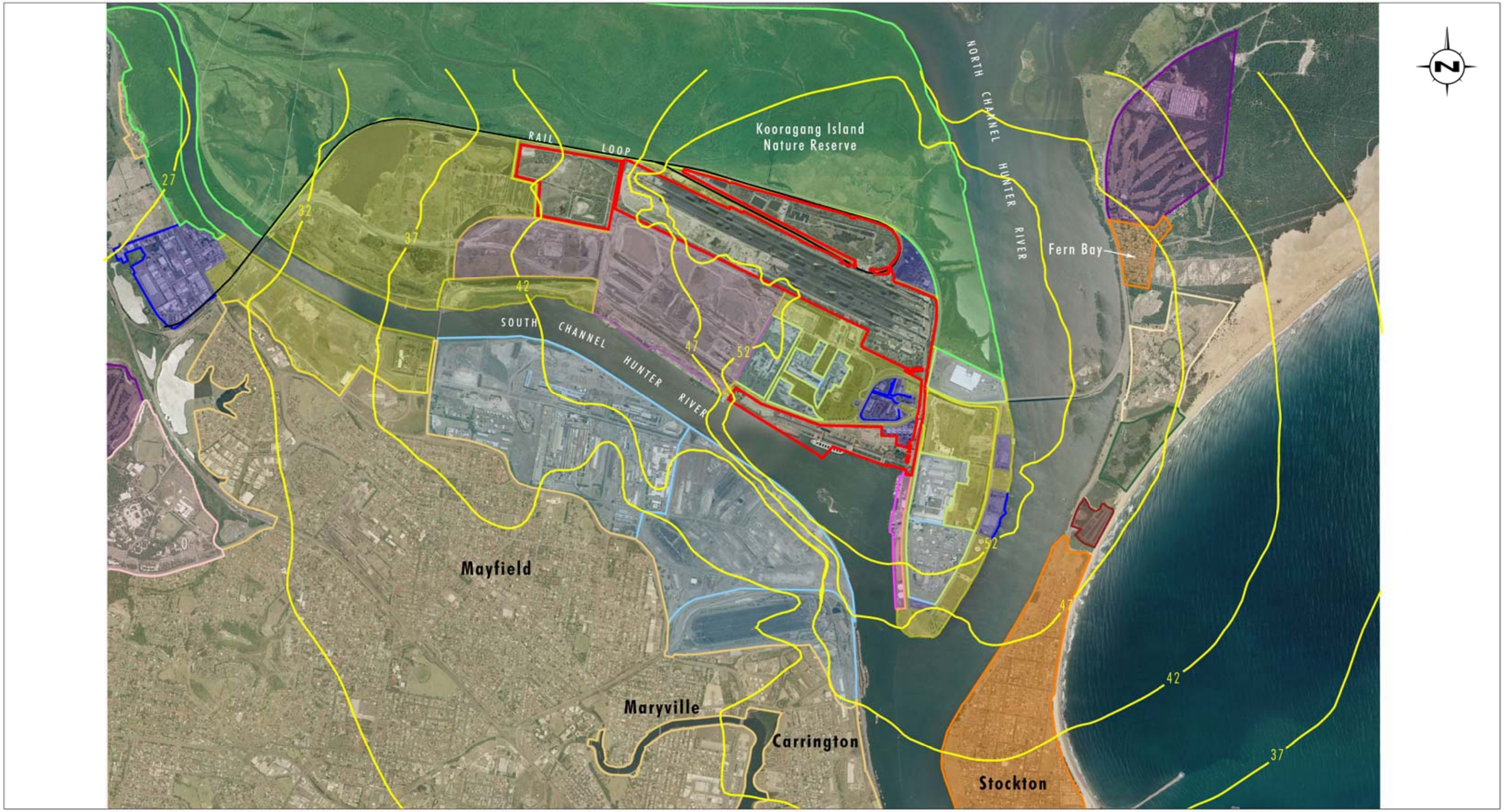
The predicted night-time LAeq(9 hour) noise amenity levels from the Stage 4 Project to the nearest residential receiver areas and the specific noise modelling results for each of the receiver areas during night-time period are presented in the full noise assessment in **Appendix 5**. As outlined in **Appendix 5**, all predicted noise amenity levels are below the respective night-time 2007 Project Approval noise limits with no incremental noise impacts associated with the Stage 4 Project.

The ‘worst case’ amenity night-time noise contours associated with the Project, under temperature inversion and drainage wind conditions where applicable, are provided in **Figure 6.14**. All predicted amenity noise levels are below the night-time approved noise limits (**Appendix 5**). As such, any amenity noise impacts associated with the Project are considered acceptable during daytime, evening and night periods.

6.3.2.7 Construction Noise Assessment

PWCS carries out construction noise monitoring in accordance with an approved Construction Noise Management Plan, with the approved construction noise limits generally consistent with DECCW’s Interim Construction Noise Guideline Policy.

A review of noise measurements during the previous Stage 3 and the current project construction phase confirms that noise emissions arising from construction activities are not discernible at the nearest residential receiver areas of Fern Bay and Stockton and any construction noise impacts are therefore minimal. As discussed in **Section 3.4**, the Project construction activities are consistent with approved daytime construction work. It is reasonable to anticipate intrusive construction noise emissions will remain indiscernible at the nearest residential receiver areas and below the approved construction noise limits. Hence, any construction noise impacts arising from the Project installation works are considered minimal.



Source: Port Waratah Coal Services Limited (2008, 2009)

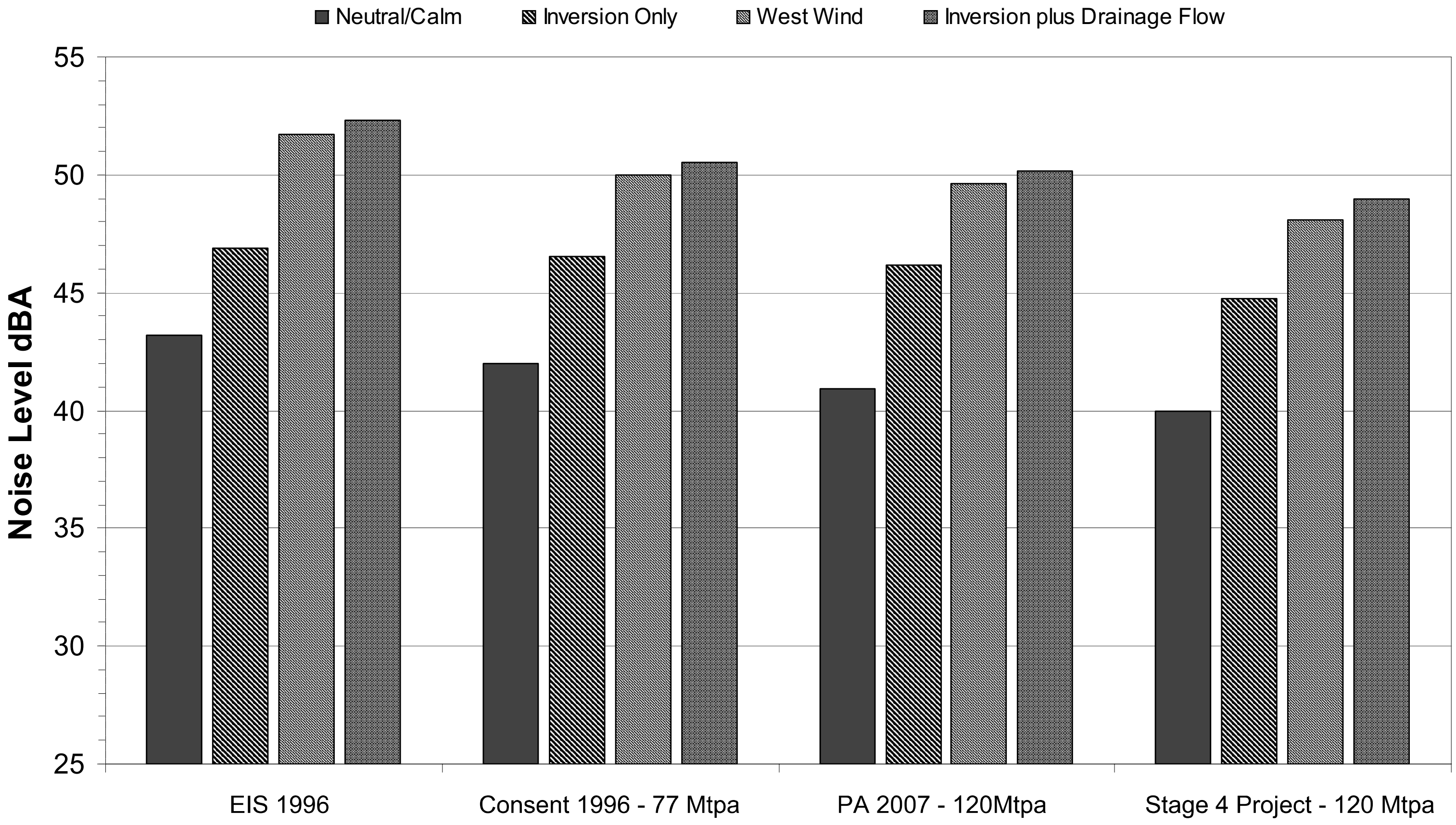
0 0.5 1 2km
1:45 000

Legend

- Kooragang Coal Terminal
- Predicted Night Time Intrusive Noise Level (dB[A]) - Stage 4 Project
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Approved NCIG Coal Export Terminal
- Suburban
- Newcastle University

FIGURE 6.11

Predicted Night Time Intrusive (LAeq[15 Minute]) Noise Contour



KCT Operating Scenario under Neutral and Noise Enhancing Weather Conditions

FIGURE 6.12

KCT Operating Intrusive Noise Levels - Fern Bay West (FW1)

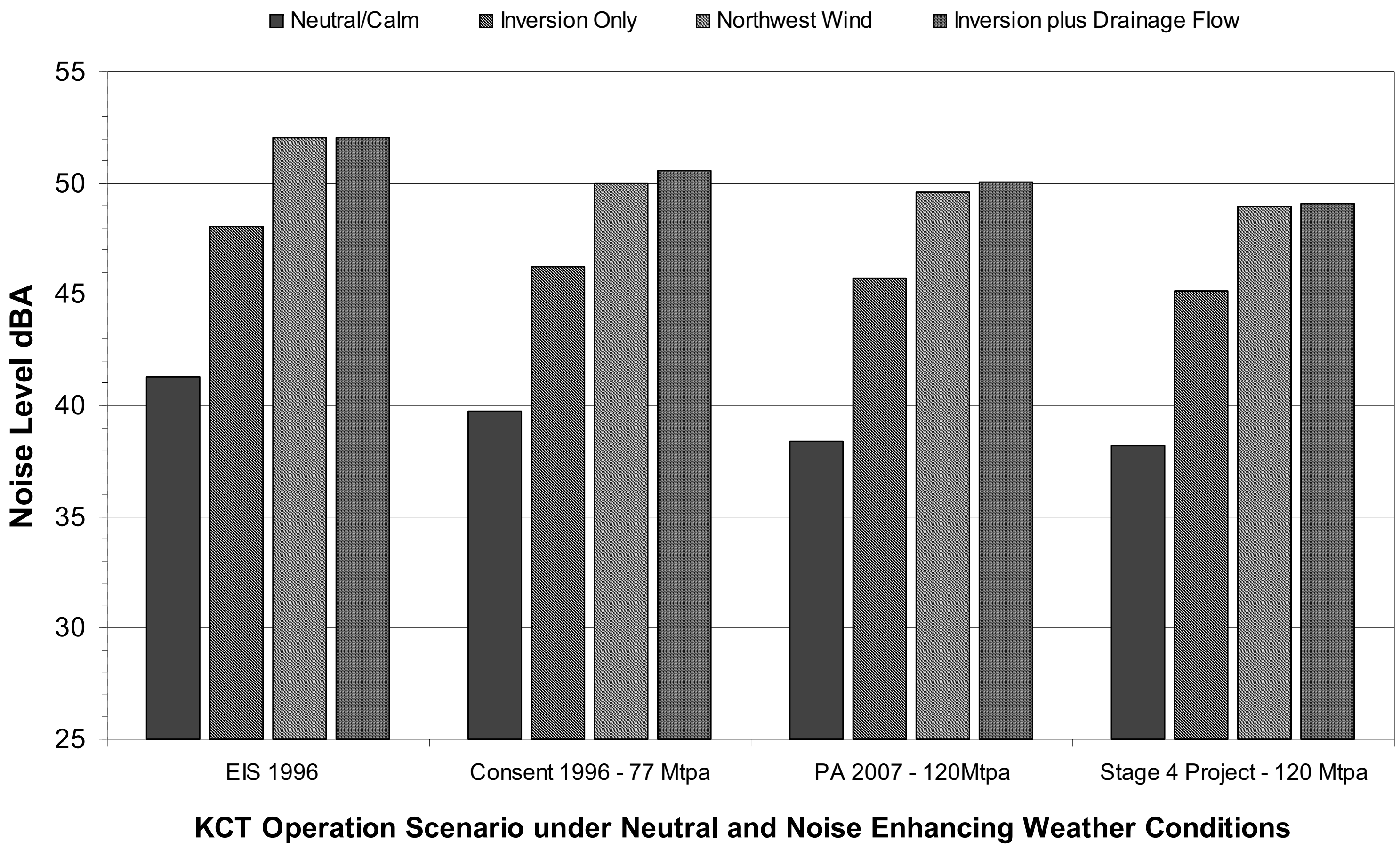
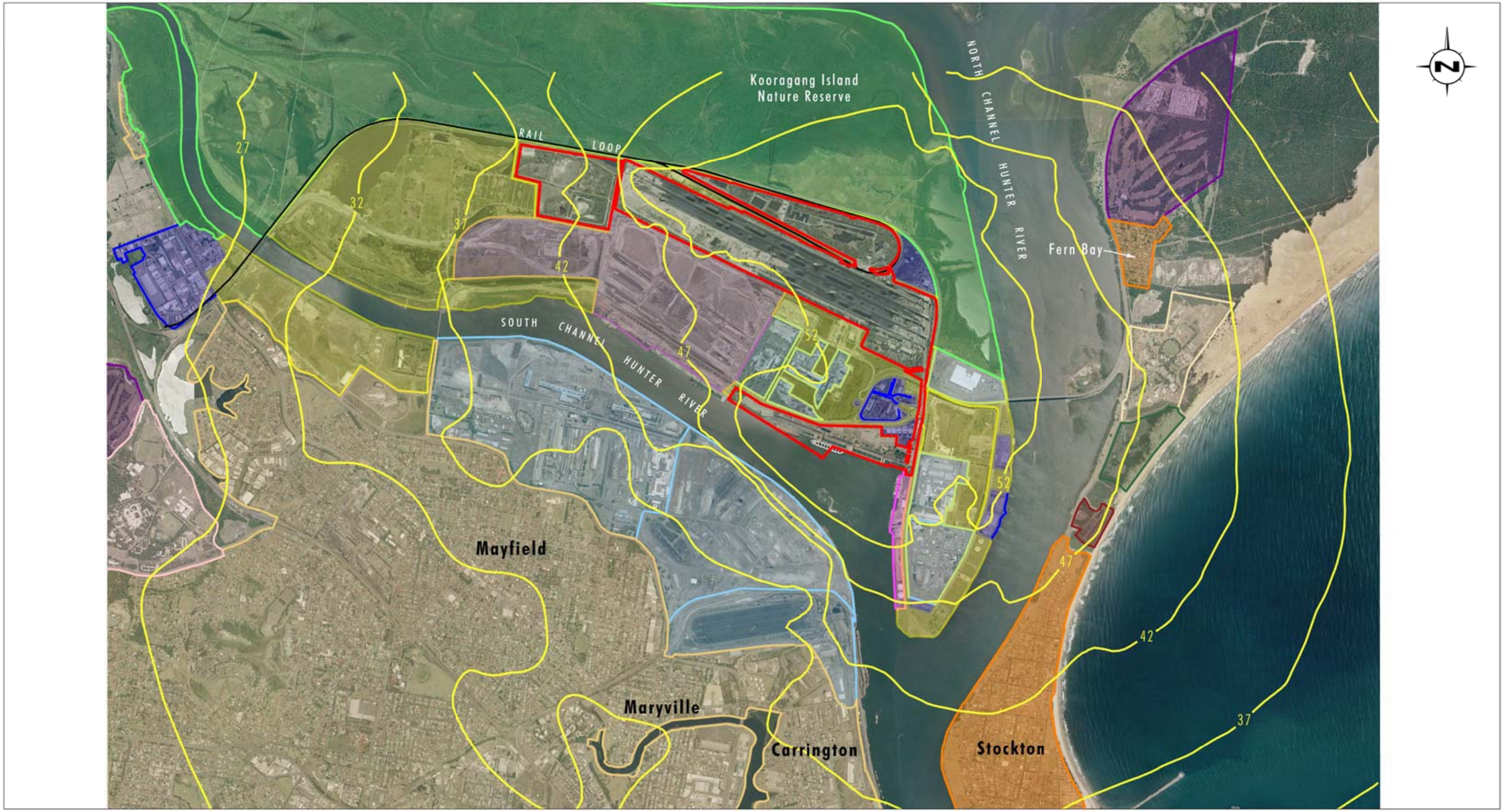


FIGURE 6.13

KCT Operating Intrusive Noise Levels - Stockton West (SW1)



Source: Port Waratah Coal Services Limited (2008, 2009)

Legend

- Kooragang Coal Terminal
- Predicted Night Time Amenity Noise Level (dB[A]) - Stage 4 Project
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Approved NCIG Coal Export Terminal
- Suburban
- Newcastle University

FIGURE 6.14

Predicted Night Time Amenity (LAeq[9hour]) Noise Contour

File Name (A4): R04_V1/2551_025.dgn

Sleep Disturbance

Approved sleep disturbance noise limits are generally consistent with DECCW's Application Notes (February 2008) sleep disturbance guideline. The guideline recognises that the current LA1(60sec) sleep disturbance criteria of 15 dBA above the prevailing LA90(15min) level is not ideal. DECCW suggests that the LA1(60sec) level 15 dBA above the Rating Background Level (RBL) is a suitable screening criteria for sleep disturbance for the night-time period. The approved night-time noise limits, the background noise levels and DECCW sleep disturbance criteria are presented in **Table 6.11**.

Table 6.11 - Stage 4 Project Night-time Sleep Disturbance Noise Criteria (dBA re 20 μPa)

Residential Receiver Area	Approved Night-time[1] LA1(60second) Noise Limit	Night-time RBL	Sleep Disturbance LA1(60second) Criteria
Fern Bay North	55	40	55
Fem Bay West	55	40	55
Fern Bay East	55	41	56
Stockton West	57	42	57
Stockton East	56	42	57
Mayfield West	56	41	56
Mayfield	58	43	58
Carrington	52	37	52

Note 1: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

The Stage 4 Project night-time LA1(60seconds) sleep disturbance criteria are generally consistent with approved noise limits presented in **Table 6.11**.

KCT's operations comprise predominantly fixed mechanical plant (i.e. conveyors, drives and transfer stations) together with slow moving items of mobile equipment (i.e. stackers, reclaimers and shiploaders). Noise associated with multiple noise sources operating simultaneously gives rise to a relatively continuous (or steady) emission – being typical of KCT's noise emissions particularly at far-field receivers. However, some noise sources have the potential to emerge from KCT's relatively steady level including the operation of trains on the KCT rail loop as well as start-up alarms.

A review of noise events from coal unloading operations was conducted in accordance with existing Stage 3 Development Consent (DA 35/96) Condition 7 and presented in Report 7283-R6 KCT Stage 3 Expansion Train Unloading Noise Monitoring (Heggies 1998). Night-time continuous one second LAeq measurements were carried out in the nearfield adjacent to the ARTC's rail loop and KCT's coal unloading infrastructure with simultaneous far field measurements carried out at Fern Bay. The review indicated there was little (or no) emergence of on-site maximum noise levels (particularly from train movements) at Fern Bay due to distance attenuation and the prevailing (L90) background noise environment.

More recently, KCT's night-time noise emissions (Stages 1, 2 and 3 operating) were observed during noise enhancing north-westerly winds at the key receiver locations of Fern Bay West (FN1) and Stockton West (SW1). The measured intrusive and maximum noise levels arising from start-up alarms against the proposed sleep disturbance criteria are provided in **Table 6.12**, in relation to relevant sleep disturbance criteria.

Table 6.12 - KCT's Measured Maximum Noise Levels and Sleep Disturbance Noise Criteria (dBA re 20 µPa)

Residential Receiver Area	Measured intrusive $L_{Aeq(15minute)}$ Level	Measured Maximum Level	Sleep Disturbance $L_{A1(60second)}$ Criteria[1]
Fern Bay West	50	55	55
Stockton West	49	55	57

Note 1: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

The field measurement results at the two key receiver locations demonstrate a 5 dBA to 6 dBA difference between the intrusive and maximum level with the maximum level of 55 dBA being on (or below) the proposed sleep disturbance criteria. While demonstrating compliance, the Stage 4 Project alarms are subject to the KCT low noise procurement specification thus controlling off-site noise disturbance.

6.3.2.8 Road Traffic Noise Impacts

Based on DECCW's 'Environmental Criteria for Road Traffic Noise' policy (ECRTN) dated May 1999, Nelson Bay Road at Fern Bay, Cormorant Road at Kooragang Island and Industrial Drive at Warrabrook/Mayfield are classified as 'arterial roads'. The applicable noise criteria are presented in **Table 6.13**.

Table 6.13 - NSW Environmental Criteria for Road Traffic Noise

Receiver Area	Road	Policy	Descriptor	Traffic Noise Goal
Fern Bay Kooragang Island Warrabrook/Mayfield	Nelson Bay Road Cormorant Road Industrial Drive	Land use developments with the potential to create additional traffic on existing freeways/arterials	Daytime $L_{Aeq(15hour)}$	60 dBA
			Night-time $L_{Aeq(9hour)}$	55 dBA

Note that in all cases where the nominated criteria are already exceeded, traffic associated with the development should not be permitted to lead to an increase in the existing traffic noise levels of more than 2 dBA.

Off-site operational road traffic levels will not be altered by the Stage 4 Project to above those of the currently approved KCT operations. The Stage 4 Project will generate additional construction traffic levels, relative to approved levels, during the construction period which is scheduled to be undertaken for a period of up to 24 months. The Stage 4 Project construction phase is described in **Section 3.4** and a breakdown of the anticipated peak construction traffic movements is presented in **Table 6.14**.

Table 6.14 - Stage 4 Project Peak Construction Daily Two-way Traffic Movements

Vehicle Type	Daily Two-way Traffic Movements
Employee	240
Visitors/representatives	20
Heavy vehicles and deliveries	3
Concrete trucks	8 for first 18 months

The maximum increase in daytime construction related traffic flow occurs along Cormorant Road. The anticipated 1.4% increase in vehicle movements corresponds to a very small <0.1 dB increase in the existing daytime LAeq(15hour) noise level and is negligible.

Similarly, the maximum increase in night-time construction related traffic flow also occurs along Cormorant Road. The anticipated 2.6% increase in vehicle movements corresponds to a small 0.1 dB increase in the existing night-time LAeq(9hour) noise level and is also considered negligible.

6.3.2.9 Rail Noise Impacts

The ARTC controls and operates the Hunter Valley Coal Rail Network in NSW. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL No 3142).

The intent of the relevant EPL conditions is to control airborne noise by two principal means:

- Noise Limits.
- Management of noise via Pollution Reduction Programs (PRPs).

Maximum locomotive source noise levels and tonality criteria for stationary and in-service test conditions are specified in EPL Condition L6 Noise Limits. This condition does not nominate airborne noise limits at receiver locations but notes that:

> It is an objective of this licence to progressively reduce noise levels of railway operations to appropriate goals through the implementation of Pollution Reduction Programs (PRPs).

A further EPL condition (Condition U1 Noise Management for Existing Activities and Infrastructure) requires the preparation of PRPs.

It should be noted that the Main Northern Railway does not currently have a PRP, however the stated objectives of the PRP provide guidance for noise regulation for the Hunter Valley rail network. Based on the foregoing the guideline noise assessment criteria for the Main Northern Railway are presented in **Table 6.15**.

Table 6.15 - ARTC's Guideline Noise Assessment Criteria

Railway	Licence Holder	Descriptor	Rail Traffic Goal
Main Northern Railway	ATRC EPL 3142	Daytime LAeq(15hour)	65 dBA
		Night-time LAeq(9hour)	60 dBA
		Maximum LAmax	85 dBA

Prior to arrival (or departure) at KCT's rail loop, the maximum concentration of train movements along the Main Northern Railway generally occurs between Sandgate and Thornton, hence existing and future noise impacts are assessed below.

Daytime approved (average and peak LAeq(15hour)) train noise levels remain unaltered by the Stage 4 Project. The daytime 65 dBA criterion is generally achieved at distances greater than 100 metres. Sensitive receivers would not be impacted during the daytime by train noise from the Project.

As is the case for the existing train levels, the maximum (LAmax) noise criterion of 85 dBA is generally achieved by train movements at distances greater than 50 metres.

Night-time approved (average and peak LAeq(9hour)) train noise levels also remain unaltered by the Stage 4 Project. The night-time 60 dBA criterion is generally achieved at distances greater than 200 metres. Sensitive receivers would not be impacted during the night-time by train noise from the Project.

In addition, based on published briefings, the following points can be made in relation to the ARTC's improvement strategy for the Main Northern Railway:

- The ARTC released an updated version of its 'Hunter Valley Corridor Capacity Strategy: Consultation Document' in June 2009 for comment and consultation with industry, including key changes:
  - an updated timeframe with plans extending out to 2018;
  - fully revised volumes forecasts, with export volumes reaching approximately 265 Mtpa in 2018; and
  - the total projected cost of capacity enhancements is $2.29 billion over a 10 year period.
- ARTC has already engaged in the process of planning and statutory approvals for rail capacity upgrade projects. Noise impacts resulting from rail capacity upgrades will be assessed by ARTC as part of the assessment and approval of these projects.
- The upgrades referred to in the ARTC publications would be subject to a public environmental assessment process under the EP&A Act and ultimately regulation by DECCW via an EPL.
- The environmental assessment for each phase of physical upgrade in the rail network would provide the ARTC with the opportunity to develop noise mitigation works.
- PWCS also understands that the ARTC will develop and implement a noise abatement program as part of the planned upgrade of the Hunter Valley coal rail network.

6.3.2.10 Cumulative Noise Impact Assessment

There are a number of industrial land uses in proximity to KCT associated with the Kooragang Island industrial area that have been considered in the assessment of potential cumulative noise impacts (refer to **Figure 6.1**).

The DGRs for this Project required the assessment of potential cumulative noise impacts to take into account noise generation from relevant existing and approved development within the area surrounding KCT. The existing and approved developments considered in assessment of cumulative noise impacts are listed in **Table 6.16**.

Table 6.16 - Approved Industrial Development on Kooragang Island and Surrounds

Site	Operator	Approval Date	Development	Status	Source of Noise Data
Kooragang Coal Terminal (KCT)	Port Waratah Coal Services Ltd	77 Mtpa 23/07/1997 120 Mtpa 13/04/2007	Stage 1, 2 and 3A St 3 steps (1-4), 3D St 3 3Exp & St 3 completion & Stage 4	Operating Operating Construction Planned	Existing Industrial Noise Predicted Noise Amenity Levels

Table 6.16 - Approved Industrial Development on Kooragang Island and Surrounds (cont)

Site	Operator	Approval Date	Development	Status	Source of Noise Data
Newcastle Coal Export Terminal (NCET)	Newcastle Coal Infrastructure Group Ltd	66 Mtpa 13/04/2007	Stage 1 33 Mtpa Stage 2 33 Mtpa	Construction Subject to demand	Resource Strategies (2006)
Cargill Oilseed Processing Facility	Cargill Australia Ltd	04/04/2006	Stage 1 Stage 2 Expansion	Operating Approved	HLA (2005)
Extension of Shipping Channels	NSW Waterways Authority	09/08/2005	Approved	Planned Development	NSW Waterways Authority (2004)
Multi-purpose Facility	BHP Company Ltd	06/04/2001	Approved	Not yet commenced	URS (2000)
Marstel Bulk Liquids Storage Facility	Marstel Terminals Newcastle Pty Ltd	21/12/2007	Approved	Construction	HLA (2007)
Manildra Park Facility	Manildra Park Pty Ltd	02/06/2008	Approved	Construction	Heggies (2008)

One of the primary objectives of the INP is that the LAeq(period) amenity level (i.e. non-transport related) does not exceed the specified ‘acceptable’ or ‘maximum’ noise level appropriate for the particular locality and land use. This objective is generally aimed at restricting the potential cumulative increase in amenity noise levels. In accordance with the INP’s Chapter 2 Industrial Noise Criteria (Section 2.2.4), the night-time cumulative sum of existing, approved and proposed industrial noise amenity levels are presented in **Table 6.17**, together with the acceptable and maximum amenity criteria for the residential receiver areas. There are no incremental increases in the cumulative industrial noise amenity levels due to the introduction of the Stage 4 Project.

In summary, existing night-time industrial noise that generally emanates from Kooragang Island was estimated as 48 dBA at both Fern Bay (West) and Stockton (West) receiver areas, during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain moderately (4 dBA) above the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions and therefore below the maximum noise amenity level of 45 dBA.

The existing industrial noise is a feature of the residential night-time noise environment at all receiver areas. Sometimes it is not discernible, but at other times it is distinguishable, particularly during lulls in transport, domestic and natural noise sources (i.e. ocean noise).

Fern Bay (North): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated at 42 dBA during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain under the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions and below the acceptable noise amenity level of 40 dBA.

Fern Bay (West)/Stockton (West): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated at 48 dBA at both receiver areas during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain moderately (4 dBA) above the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions and therefore below the maximum noise amenity level of 45 dBA.

Fern Bay (East)/Stockton (East): Existing night-time industrial noise from Kooragang Island was estimated at 43 dBA to 44 dBA during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain within the maximum noise amenity level of 45 dBA. Similarly, industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions. Ocean noise is also a feature of the area particularly during north-easterly breezes.

Mayfield West/Carrington/Maryville: Existing night-time industrial noise generally emanates from the industrial areas located to the immediate north of the receiver areas and was estimated at 42 dBA to 45 dBA. Cumulative noise amenity levels are anticipated to increase by 1 dBA to 2 dBA and remain within the acceptable noise amenity level of 45 dBA. Due to the relatively close proximity of the industry to the residential receiver areas, noise enhancement due to weather effects is less by comparison with Fern Bay and Stockton and the industrial noise contribution is relatively more constant.

Mayfield: Existing night-time industrial noise generally emanates from the industrial areas located to the immediate north of the receiver areas and was estimated at 44 dBA. Cumulative noise amenity levels are anticipated to increase by approximately 3 dBA and remain under the maximum noise amenity level of 50 dBA.

It should be noted that for each of the cases discussed above, the likelihood of all existing, approved and proposed developments emitting maximum noise emission at any one time is remote. It is therefore considered that this assessment is relatively conservative.

Table 6.17- Night-time Cumulative Industrial Noise Amenity Levels (dBA re 20 µPa)

Receiver Area	Existing Industry Measured[1]	PWCS KCT Remainder[1]	PWCS Stage 4[1]	NCIG NCET[1]	Cargill Stage 2[1]	Channel Extension[1]	Multi Purpose (Limits)	Manildra Park[1]	Marstel Terminal[1]	Cumulative Sum (Adverse[1])	Acceptable to Maximum
Fern Bay North	42	28	34	32	27	24	30	20	20	43	40-45[2]
Fern Bay West	48	34	36	36	33	30	30	25	25	49	
Fern Bay East	43	29	35	36	28	25	30	23	22	44	
Stockton West	48	35	35	35	33	35	30	37	34	49	
Stockton East	44	31	35	35	28	30	30	34	31	45	
Mayfield West	43	32	26	39	25	33	30	20	20	45	45-50[2]
Mayfield	44	31	27	38	28	39	36	20	20	47	
Carrington /Maryville	42	24	24	31	25	30	34	25	25	43	

Note 1 Measured or predicted noise level during noise enhancing (adverse) weather conditions.

Note 2 Use of Urban and Suburban Noise Amenity Zones in accordance with the DoP's Director-General Environmental Assessment Report dated April 2007 in relation to the Major Project Assessment Newcastle Coal Infrastructure Group Coal Export Terminal.

6.3.2.11 Noise Management and Monitoring Commitments

As discussed in **Section 2.3.1**, the Stage 4 Project will employ similar noise control measures as those described in the 2006 EA (Appendix 4 Noise Impact Assessment). Hence the following conclusions can be drawn in relation to management of the introduction of the Stage 4 infrastructure:

- The Continuous Noise Improvement approach has been very successful and it can be demonstrated that the Stage 4 Project will be designed, procured, constructed and commissioned using Best Available Technology.
- While only in the construction phase, the approved 120 Mtpa operation is 'on track' to achieve the Consent noise limit of 50 dBA at Fern Bay and Stockton.
- In order to ensure that the Stage 4 Project (including the KCT rail loop) does not introduce any noise increase at all receiver areas it will be necessary to reduce the noise emissions by selected retrofitting of Stage 1 plant and equipment (or equivalent Stage 2), this will reduce the overall noise emission by at least 1 dBA.

The replacement of Stage 1 and 2 idler rolls on the transfer conveyors adjacent to the KBF building was necessary in early 2009 to meet the consented noise limit at this location. Conformance with the noise limit at the KBF building was confirmed in the June 2009 quarterly noise monitoring survey.

In order to ensure that the Stage 4 Project and in particular the proposed outbound conveyors do not introduce any noise increase at the KBF administrative building (IB3) further noise reductions to the adjacent transfer conveyors (i.e. Stage 1 conveyors 5.30/5.03 and Stage 2 conveyors 5.31/5.04) are necessary. The required source noise reductions can be achieved by the replacement of existing idler rolls in accordance with Stage 3 (and 4) noise specification requirements.

In addition to the mitigation of Stage 1 and 2 conveyors, several other noise control measures are potentially available to PWCS to address any future potential noise impacts in the vicinity of the KBF building including improvements to the Transfer House 05.01 sound transmission loss performance. However, such potential improvements are not considered necessary to meet the consented noise limit of 70 dBA.

PWCS will continue to investigate reasonable and feasible measures to manage noise as part of the continuous noise improvement program.

6.3.3 Water Quality

The DGRs for the Project require the identification of any additional impacts or changes to impacts to water quality, including both surface water and groundwaters, and water use resulting from the Stage 4 Project. This requirement includes a need to document and justify the methodology, data and assumptions used in the development and retention of water management and re-use measures. This assessment is provided in the following sections.

6.3.3.1 Surface Water Quality

As outlined in **Section 2.3.3**, PWCS has established a totally closed water management system to meet the design requirement of a 1 in 100 year design storm event or equivalent. To enable greater water harvesting and reduce dependence on potable water, the water management system for the complete Stage 3 Expansion is being implemented as part of the progressive expansion process at KCT. The existing water management system encompasses all established plant and equipment within the approved KCT footprint. Further detail on the existing water management system at KCT is provided in the following sections.

KCT Water Management System

The key components of the KCT water management system are shown on **Figures 6.15** and **6.16**. All areas of existing plant within the approved KCT footprint, including the wharf, capture water and channel it back to settling ponds for clarification prior to being held in storage ponds for re-use. The objective of the existing KCT water management system is to maximise the capture of the water, to the design capacity, collected within the existing KCT footprint for treatment and re-use as part of KCT operations. The key components of the KCT water management system include:

- diversion of clean water around the KCT site;
- stormwater capture, storage and treatment system – including a range of water capture drains, settling and clarification ponds and stormwater storage areas; and
- contaminated water treatment – including the containment of areas of potential contamination and appropriate treatment through the use of oily water separators.

On site there are two 12 megalitre (ML) settling ponds and two 10 ML clarified water ponds. The ponds are located within the rail loop and are adjacent to large stormwater detention areas (refer to **Figure 6.16**), which provide a further nominal 70 ML of storage, when needed. The 70 ML detention areas are utilised for the capture of stormwater from the KCT site and have a design capacity equivalent to the 1 in 100 year design 1 to 2 hour storm event. The water from these additional storage areas can be recovered to the clarified water ponds for re-use.

Each of the existing shipping berths within the wharf area has a stormwater storage lagoon (Lagoons K4, K5 and K6) which are interconnected. K5 and K6 lagoons are pumped to K4 lagoon. K4 is then pumped to a high point within the main site and drains into SP1. The K4, K5 and K6 lagoons are each constructed with an overflow channel to the Hunter River.

The water management system will overflow if a storm event exceeds the design criteria of a 1 in 100 year 1 to 2 hour storm event or during periods of prolonged wet weather.

Water from the eastern half of the stockyard flows into a channel and drains to SP1. The sediment in the water settles over a period of time (about one to two days) so that the level of Total Suspended Solids (TSS) is reduced. The water is then pumped to CWP1, before being pumped to the 80 kL tank and circulated throughout the site for re-use as process water. If there is too much water flowing into SP1 and the level of TSS is too high to pump it to CWP1, then it can be pumped to a stormwater detention basin.

Water from the western half of the stockyard flows into a channel and is pumped to SP2. The sediment in the water settles over a period of time (about one to two days) so that the level of TSS is reduced. Water is then pumped to CWP2, before being pumped to the 80 kL tank and re-used as process water. If there are excessive amounts of water entering SP2 and the level of TSS is too high to pump it to CWP2, it can be pumped to a stormwater detention basin.

Once the captured water passes through the clarifying ponds it is available for delivery to the pump house for reticulation across the site for wetting coal and stockpiles to control dust, wash down and clean up, fire fighting systems and landscape irrigation. The clarification ponds are designed to enable adequate settling time for the reduction in key parameters,

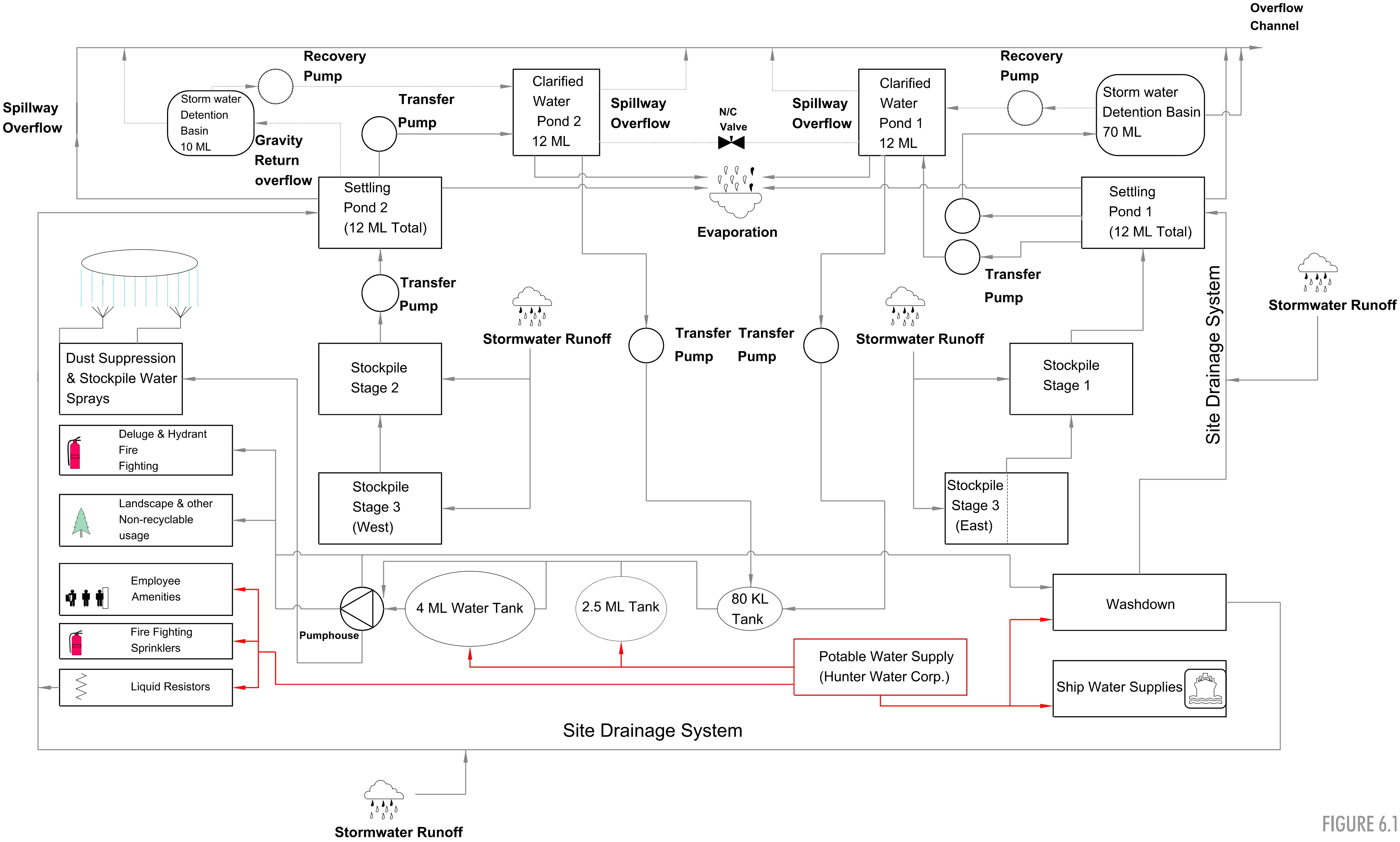


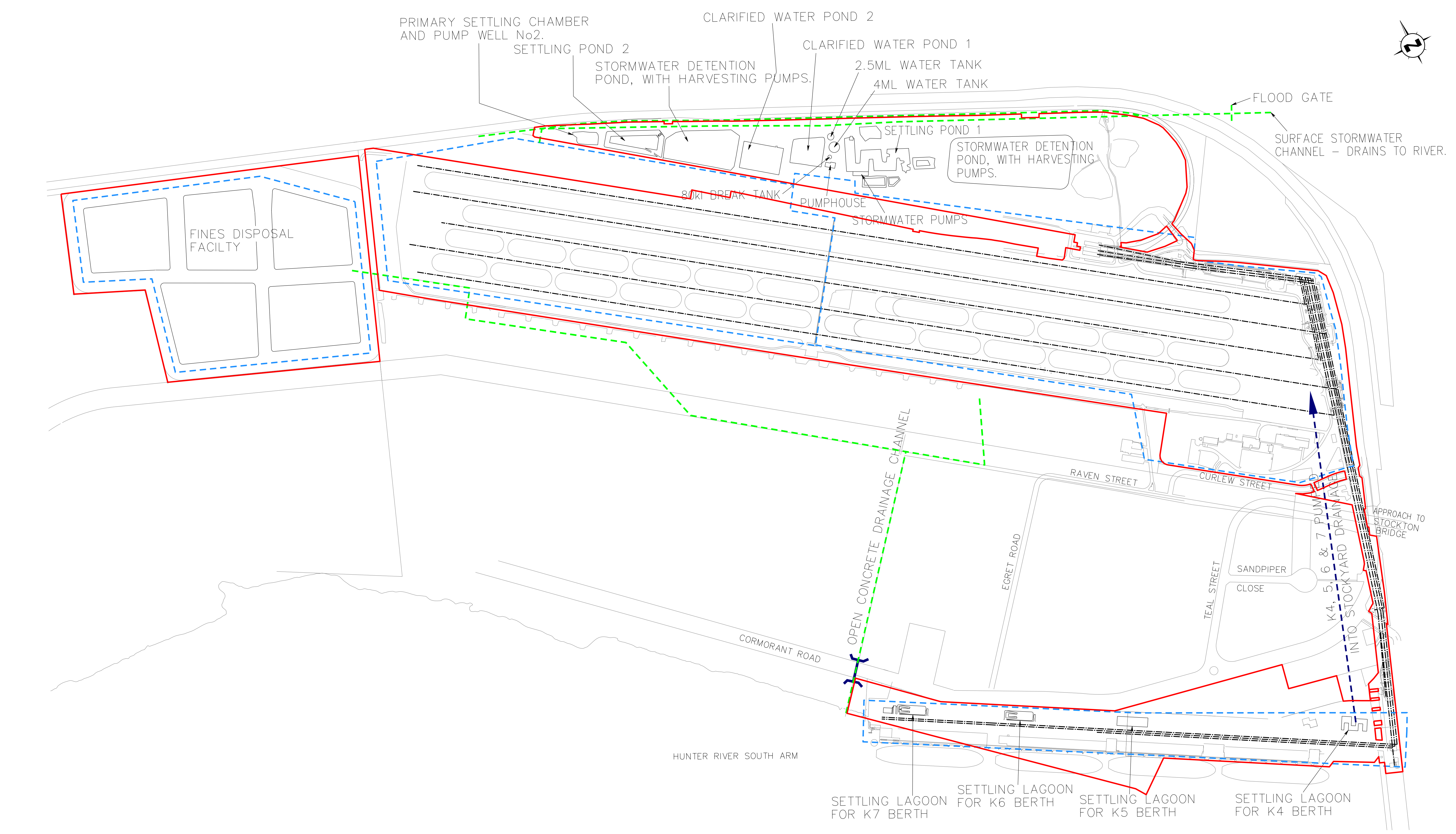
FIGURE 6.15

Schematic of Water Management System
Kooragang Coal Terminal

Source: Port Waratah Coal Services Limited (2007)

File Name (A4): R04_V1/2551_022.dgn

Umwelt
Environmental Consultants



Source: Port Waratah Coal Services Limited (2007)

0 200 400 600m
1:11 000

Legend
- Kooragang Coal Terminal
- Pump Delivery Pipeline
- Catchment Boundary
- Culvert
- Open Channel Drainage

FIGURE 6.16

Plan of Water Management System Kooragang Coal Terminal

including TSS for re-use within KCT. The water quality is regularly monitored to ensure it is suitable for the purpose of recycling.

Water only overflows from the ponds during extreme or prolonged wet weather that exceeds the design event capacity of the KCT water management system. Overflows are controlled within an existing stormwater channel which provides a vegetated flow path to the North Arm of the Hunter River. The location of the rail loop embankment between the stormwater channel and the adjacent Kooragang Nature Reserve provides a barrier to protect the Kooragang Nature Reserve in the unlikely event that the capacity of the stormwater channel is exceeded.

In the event of an overflow of the water management system due to rainfall in excess of the design event or as a result of prolonged wet weather, PWCS undertakes indicative volume measurement and water quality monitoring at the overflow point.

Identification of Additional Impacts Associated with the Stage 4 Project

As outlined in **Section 3.0**, the Stage 4 Project includes the construction and operation of additional plant and equipment which includes minor areas outside of the approved KCT footprint. These areas relate to the proposed augmentations to the rail loop to service the proposed fourth dump station. This area is located in previously disturbed areas associated with the existing rail corridor servicing KCT, managed by ARTC. All other plant and equipment associated with the Stage 4 Project is contained within the existing KCT water management system and will be managed through the continued use of this system as part of ongoing KCT operations.

During construction of the proposed plant and equipment associated with the Stage 4 Project, PWCS will install all appropriate erosion and sediment control structures to manage water quality. Water captured in areas disturbed through construction activities will be directed to the existing KCT water management system for treatment and re-use on site. This includes water from additional areas associated with the rail loop, which will be captured and diverted to the existing KCT water management system, located within the centre of the rail loop (refer to **Figure 6.16**).

Upon the commissioning of the proposed augmentations of the rail loop, the ongoing management of water from this area will revert back to the ARTC, as part of the management of the rail loop servicing KCT. PWCS will consult with ARTC throughout the design, construction and commissioning process for the proposed rail loop augmentations in relation to the long term management of water within this area.

6.3.3.2 Groundwater Quality

An assessment of the potential groundwater impacts associated with the Stage 4 Project has been undertaken by Douglas Partners and is included as **Appendix 6**. An overview of the assessment, in relation to the identification of potential impacts to groundwater quality associated with the Stage 4 Project, is provided below.

Existing Groundwater Resources

There are two known groundwater aquifers within the vicinity of the KCT site and the broader Kooragang Island area. A perched aquifer exists close to ground surface and is associated with the filling of land for the establishment of industrial land at Kooragang Island. This aquifer is referred to as the Fill aquifer. An additional aquifer occurs at depth and is associated with a naturally occurring aquifer system associated with the surrounding estuarine area. This aquifer is referred to as the Estuarine aquifer. Historical monitoring has defined the locations of these aquifer systems across the KCT site and are summarised in **Table 6.18**.

Table 6.18 – Summary of Subsurface Conditions and Geotechnical Units at KCT

Unit	Name	Description
1	Fill	Dredged fines, dredged sand and other granular fill to depths ranging from 2.6 m to 5.9 m, mainly comprising sand with some fines/clay. This layer forms the **Fill Aquifer**.
2	Alluvial Clay	Silty clay and clay, generally soft to firm where not pre-loaded, and up to stiff where previously loaded. The alluvial clay ranges in thickness up to 12 m across the site. This layer forms a confining layer or **Aquitard**, but is not always present.
3	Sand	Fine to medium grained sand with some shell fragments, generally medium dense then becoming dense to very dense. The sand extends to depths of about 30 m to 50 m across KCT. This layer forms the **Estuarine Aquifer**.
4	Estuarine Sediments	Stiff to very stiff estuarine clay and sandy clay, becoming hard in places, and underlain by various layers of clayey sand, gravelly sand and further clay layers, extending to bedrock.
5	Bedrock	Bedrock typically comprises siltstone and sandstone of the Tomago Coal Measures. The depth to rock varies across KCT from about 35 m to 80 m.

As indicated in **Table 6.18**, the aquifer systems are separated by a low permeable clay layer that effectively forms an aquitard between the aquifer systems. Whilst the permeability of the aquitard is low, it is sufficient to enable some vertical flow between the fill and estuarine aquifers to occur naturally.

The historical monitoring of groundwater within the KCT site indicates a considerable variation in depth and occurrence of the groundwater systems across the KCT site. Based on the historical monitoring, characteristics in relation to depth, flow and water quality of the aquifer systems within KCT include:

Fill Aquifer

The Fill Aquifer is at the surface and is therefore unconfined. This means the water table fluctuates within the thickness of the aquifer, and groundwater is free to drain to the surface where the water table intersects the surface, such as at drains. The Fill Aquifer is recharged primarily by rainfall. Groundwater flow within the fill is primarily sub-horizontal, generally flowing towards the closest surface drainage feature. Groundwater in the Fill Aquifer travels in a general northerly direction towards the tidal flats associated with the North Arm of the Hunter River.

Estuarine Aquifer

The Estuarine Aquifer is confined, which means that there is no free water table within the layer, the potentiometric or phreatic surface (the height at which a water table would form in a bore connected only to the Estuarine Aquifer) is above the base of the overlying clay aquitard. The phreatic surface is, however, below the water table in the Fill Aquifer, thereby allowing vertical flow from the Fill Aquifer to the underlying Estuarine Aquifer. Groundwater in the Estuarine Aquifer travels in a general northerly direction towards the North Arm of the Hunter River. In June 2008 the groundwater levels in the lower aquifer at the dump station site are interpolated to be at about RL 2.2 metres which compares to about RL 2.0 metres in

2006 and RL 1.6 metres in December 1999. The variations in level are likely to be due to changes in response to prior rainfall conditions.

In addition, historical monitoring undertaken at KCT has identified the occurrence of Potential Acid Sulphate Soils (PASS) primarily associated with the clay aquitard between the fill and estuarine aquifer systems and also at depth within the sediments associated with the estuarine aquifer. PWCS has managed the PASS identified on site through the construction activities associated with previous components of KCT through the implementation of an Acid Sulphate Soils Management Plan and associated procedures for treatment and remediation.

Potential Impacts associated with the Stage 4 Project

The components of the proposed Stage 4 Project that have the potential to impact on groundwater include:

- proposed fourth dump station – as outlined in **Section 3.3.2**, this will include an excavation of approximately 15 metres deep, 12 metres wide and 66 metres long, which is consistent with the design of the existing dump station infrastructure. The excavation associated with the proposed dump station will require the removal of approximately 10,500 m^3 of material;
- inbound coal conveyor – this conveyor will extend from the approximate base of the fourth dump station linking the fourth dump station to the stockyard area. This conveyor will extend below ground for approximately 200 metres to the east of the proposed dump station. The construction of the proposed inbound conveyor will require the excavation of approximately 10,000 m^3 of material; and
- establishment of footings associated with coal conveyor and transfer house infrastructure.

The potential impacts and proposed groundwater management associated with these components of the Stage 4 Project are outlined below.

Fourth Dump Station and Inbound Conveyor

Historically, PWCS has managed groundwater interactions during construction of the existing dump station through traditional dewatering techniques that have included the establishment of external dewatering bores to minimise groundwater intrusion into the excavation during construction. This traditional approach included dewatering for a period of up to six months during construction, with water being stored on site for treatment prior to discharge off site in accordance with an EPL. Whilst PWCS has successfully managed this process to minimise impacts as part of past construction works, the proposed fourth dump station has been designed to further minimise interactions with existing groundwater systems.

As outlined in **Section 3.3.2**, the proposed fourth dump station will be constructed by installation of diaphragm walls and the use of a jet grouting technique that provides for the establishment of a temporary floor to the dump station to allow excavation of the material from within the walls with minimal interaction with the existing groundwater system. Once the excavation of material from within the walls is completed then the construction of the permanent dump station floor can be carried out above the temporary floor. Material excavated from the dump station will be treated (where required) and re-used on site as construction material.

The proposed construction methodology of the dump station, comprising diaphragm/sheet pile walls and jet grouting of the floor structure, will result in a low permeability structure which can be constructed within minimal dewatering. Based on the excavation volume of approximately 20,500 m^3 and based on a specific yield in the range 0.2 to 0.3 the volume of pore water contained in this soil will be in the order of 4000 m^3 to 6000 m^3 (i.e. 4 to 6 ML). It is proposed that this volume of water will be dewatered from the excavation for management, which is outlined further below.

Once the proposed fourth dump station has been constructed it is expected that some minimal seepage from groundwater will occur and is predicted to be in the order of approximately 3.5 m^3/day. This rate is substantially reduced from the dewatering rates associated with traditional dewatering techniques. As such, the groundwater assessment (refer to **Appendix 6**) indicates that potential drawdown effects on existing groundwater systems will be insignificant and be less than seasonal variations in water table level.

The effective management of the potential interactions with groundwater is reliant on design and construction of the fourth dump station and associated conveyor tunnel. PWCS will undertake an appropriate design, construction and validation program, including independent review of design and ongoing monitoring during construction and commissioning, for the establishment of the proposed fourth dump station and associated conveyor tunnel to ensure potential groundwater interactions are controlled and minimised.

Specifically, the following measures will be undertaken to reduce the risk of excessive leakage of the structure:

- selection of an experienced contractor with a proven record of installing successful jet grouting floor structures;
- design the jet grouted structure to withstand potential uplift forces. This could include one or a combination of the following measures:
  - extend floor across/below base of diaphragm walls to transfer uplift to walls;
  - adopt thickness of floor to provide sufficient strength to resist bending due to upwards pressure on base of wall;
  - install ground anchors through floor into underlying soil;
  - set the jet grout floor deeper than the final dump station floor to allow a mass of soil to remain over the jet grout floor to hold it down. A separate floor would be required to be constructed above the remnant soil mass.
- adoption of an appropriate grid spacing to suit the proposed equipment and soil conditions and reduce the risk of gaps between the grout plugs;
- careful monitoring of the jet grouting process, including jet pressures and grout takes;
- hydraulic testing of the completed structure by undertaking pumping tests to assess for leakage;
- coring of the grouted floor to check consistency of thickness and strength of the grouted floor; and
- application of secondary grouting if considered necessary from the results of construction monitoring, pumping tests and coring.

The proposed construction techniques have been demonstrated to be successful in a range of construction projects in a range of environments (refer to **Appendix 6**).

As indicated above, historical groundwater monitoring has indicated that existing water quality in groundwater systems has elevated levels of a number of parameters that exceed relevant water quality guidelines. Specific investigations of water quality within the vicinity of the proposed fourth dump station (refer to **Appendix 6**) highlighted the existing groundwater quality exceeded a range of relevant water quality parameters, particularly in relation to a number of metals, including iron, copper and zinc, and Total Polycyclic Hydrocarbons (TPH). The review of historical groundwater monitoring undertaken as part of the groundwater assessment (refer to **Appendix 6**) has highlighted that relative groundwater quality fluctuates within the vicinity of the proposed fourth dump station location.

It is considered that the groundwater produced as a result of dewatering can be managed by either of the following:

- re-injection of the water into the Estuarine Aquifer, with minimal treatment; or
- on-site treatment prior to re-injection and/or re-use on site through the existing KCT water management system.

Further investigation of the management options will be undertaken during detailed design to determine the most appropriate option. Re-injection of dewater extracted from the fourth dump station would require the establishment of a series of wells. Based on the expected volumes of water requiring re-injection it is expected that one to three wells installed into the Estuarine Aquifer would be sufficient for re-injection and would be expected to lead to insignificant mounding of the water table. Where re-injection is utilised the re-injection bores would be located on the KCT site in previously disturbed areas, and areas of appropriate compaction, to minimise potential environmental impacts. In addition, the re-injection bores will be designed appropriately (i.e. fully cased) to minimise any potential environmental impacts.

The quality of the groundwater at the specific dump station site would be verified prior to re-injection to ensure that the background groundwater quality will not be affected. Based on existing results to date, the re-injected water would be of similar quality to the background water quality. The process of re-injection will lead to aeration of the water which may actually attenuate the concentrations of some potentially present contaminants. Where further monitoring indicates significantly elevated water quality parameters, specific treatment of dewater prior to re-injection could occur if required to minimise potential impacts through the re-injection process. The specific treatment option will be investigated by PWCS based on the results of additional monitoring, and could include the use of a portable treatment plant on site.

Although minimal groundwater drawdown is expected outside the sealed structure, the soil inside the structure will be de-saturated, aerating the upper clay layer and the upper parts of the Estuarine Aquifer, which have been identified as PASS. This could possibly lead to oxidation of the PASS and generation of acidic groundwater conditions. The water will be fully contained within the sealed structure and therefore will not impact on the surrounding groundwater. The material removed as part the construction of the proposed fourth dump station and associated conveyor will be managed in accordance with the Acid Sulphate Soils Management Plan (ASSMP) (refer to **Appendix 6**) which includes on-site treatment and management of this material.

Conveyor and Transfer House Infrastructure

As outlined in **Section 3.3.3**, all conveyor and transfer infrastructure will be designed to be consistent with existing and approved KCT infrastructure. All proposed conveyors will be elevated above ground and will be housed in galleries with integrated floor and walls with the conveyor partially enclosed to control dust and weather effects, all supported by trestles on piled footings. This design of conveyor structure and support minimises the level of ground disturbance during construction. The trestle footings will only require minor excavation during construction, comprising a 2 metre deep pile cap supported on driven piles up to 30 metres long.

The construction of the conveyors and other structures is expected to have relatively minor impacts on groundwater. It is expected that occasional shallow and localised excavations will be required for installation of pile caps. These are unlikely to require dewatering and if dewatering was required then it would be localised and short term and only affect the Fill Aquifer. Any dewatering associated with the pile cap construction would be accommodated in the existing water management system at KCT.

The installation of piles and pile caps will require excavation of soil and this will be undertaken in accordance with the ASSMP, where relevant.

6.3.4 Ecology

In accordance with the DGRs for the Project, an assessment of potential ecological impacts associated with the Stage 4 Project has been undertaken by Umwelt. The full assessment report is provided in **Appendix 7**, with a summary provided below.

It is important to note that all Stage 4 infrastructure is located in existing disturbed areas, with only very minor potential for ecological impacts. The Ecology Assessment has been prepared by Umwelt to provide information about the potential impact of the Project on native flora and fauna species, endangered populations, threatened ecological communities (TECs) and their habitats occurring in the project area and on adjoining lands.

As outlined in **Section 1.0**, the Stage 3 development consent (DA 35/96) provides for the current approved footprint of KCT (refer to **Figure 1.2**). All relevant ecology considerations were taken into account during the EIS process and subsequent development consent requirements for the Stage 3 Expansion. Further details on the previous assessment and development consent requirements for the Stage 3 Expansion are provided in **Appendix 7**.

The project area for the Ecology Assessment comprises the areas located outside of the current approved KCT footprint associated with the Stage 4 Project. As outlined in **Section 1.1**, this relates to the proposed rail loop augmentation that is located on previously disturbed land, as shown on **Figure 1.3**.

In addition, the DGRs require the assessment of potential impacts on the ecological features of lands adjoining KCT. As shown on **Figure 1.1**, the northern extent of Kooragang Island includes Kooragang Nature Reserve, which forms part of the RAMSAR listed Hunter wetlands, and is located immediately north of KCT (refer to **Section 6.3.4.1**). The Stage 4 Project has the potential to impact on Kooragang Nature Reserve through potential off-site emissions of dust, noise and water, and the potential for groundwater interactions. These potential impacts have been assessed as negligible, as outlined below.

6.3.4.1 Regional Context

KCT is situated in the south-east portion of Kooragang Island directly adjacent to the Kooragang Nature Reserve (refer to **Figure 6.1**) on the reclaimed land above the now buried Dempsey and Moscheto Islands (ERM Mitchell McCotter 1996). Kooragang Island formerly consisted of seven small islands and channels with dredging and reclamation in the 1950s and 1960s converting the estuarine habitats into one island for industrial purposes.

Kooragang Island is predominantly composed of estuarine and freshwater wetland communities with exotic pastures derived from the clearing of the woodlands and vast areas of industrial land.

The Hunter Estuary Wetlands comprise Kooragang Nature Reserve, Hexham Swamp Nature Reserve, Shortland Wetlands and the SEPP 14 listed wetlands associated with the lower Hunter River Estuary, north of Newcastle. The wetlands occur within the delta of the Hunter River, which represents one of the largest coastal basins in NSW and extends further inland than any other coastal catchment. Kooragang Nature Reserve and Shortland Wetlands are listed under the Ramsar Convention on Wetlands of International Importance. Kooragang is the largest estuarine wetland reserve in NSW. The Kooragang Nature Reserve is a hub for wildlife. Over 250 species of birds live in or visit the Hunter River estuary; about half of these species are waterbirds, of which 34 are migratory shorebirds.

6.3.4.2 Assessment Methodology

The assessment addresses potential impacts on any threatened species, endangered population, TECs, or their habitat (terrestrial or aquatic) that may occur on, or in the general vicinity of the project area.

Literature Review

Extensive ecological assessment was conducted in 1996 as part of the EIS for the Stage 3 expansion of KCT (ERM Mitchell McCotter).

The ERM Mitchell McCotter flora and fauna assessment identified five vegetation communities present within the KCT site and in proximity to the current Stage 4 Project. These are:

- sedgeland/rushland – community comprising rushes and sedges to 2 metres tall, dominated by common reed (*Phragmites australis*). The community occurs around the edges of artificial drainage depressions and ponds;
- open forest – comprising planted tree screens dominated by eucalypts (*Eucalytpus sp.*), wattles (*Acacia longifolia var sophorae; Acacia saligna*), camphor laurel (*Cinnamomum camphora*) and swamp she-oak (*Casuarina glauca*);
- mangroves – grey mangrove (*Avicennia marina*) occurs along the edge of the water management channel inside the rail loop;
- saltmarsh – dominated by samphire (*Sarcocornia quinqueflora*) and *sueda australis* and occurring adjacent to the mangrove forest; and
- disturbed areas dominated by weeds such as bitou bush (*Chrysanthemoides monolifera*).

No rare or threatened flora species were recorded during the flora surveys. A total of 34 fauna species were recorded during targeted surveys undertaken in the study area, comprising 23 bird species, 7 mammal species, 3 amphibians and 1 unidentified reptile (snake). The 1996 fauna surveys included the identification of the following threatened species:

- Australasian bittern (*Botaurus poiciloptilus*);
- eastern bentwing-bat (*Minopterus scheibersii oceanensis*); and
- green and golden bell frog (*Litoria aurea*).

Ecological Database Searches

In order to identify all potential threatened species, endangered populations and TECs with the potential to occur in the project area, an assessment of relevant ecological databases was completed. These database sources comprised:

- a 10 kilometre radius search from the centre of the project area of the DECCW Atlas of NSW Wildlife (July 2009);
- a 10 kilometre radius search from the centre of the project area of the DEWHA Protected Matters Database (July 2009).

Records from these database searches were combined with records derived through literature reviews and professional opinion to identify the range of potentially occurring threatened species. The identification of potentially occurring threatened species was then used to assist in the development of appropriate survey methods.

Site Inspection

An inspection of the project area was undertaken by a senior ecologist on 21 July 2009. All components of the project area that are to be impacted by the Project were inspected to determine ecological values and the potential for native flora and fauna species to occur.

Species were recorded opportunistically during all aspects of the site inspection.

6.3.4.3 Ecological Impact Assessment

The site inspection confirmed that the proposed components of the project are to be undertaken within the existing disturbance footprint of the KCT or in highly disturbed industrial land surrounding the existing rail loop. No areas of native vegetation were identified in the project area.

The site inspection also confirmed the abovementioned vegetation communities and fauna habitats recorded at the KCT site are the relevant communities in proximity to the Stage 4 project components. Seven bird species were also opportunistically recorded during the site inspection. These bird species recorded are considered to be commonly associated with disturbed habitats and included:

- feral pigeon* (*Columba livia*);
- common mynah* (*Acridotheres tristis*);
- masked lapwing (*Vanellus miles*);
- superb blue wren (*Malurus cyaneus*);
- Australian magpie (*Gymnorhina tibicen*);
- magpie lark (*Grallina cyanoleuca*); and
- noisy miner (*Manorina melanocephala*).

* introduced species

Threatened Species Assessed Under the Environmental Planning and Assessment Act 1979

Three threatened species have been previously recorded in the project area. These species include:

- Australasian bittern (*Botaurus poiciloptilus*);
- eastern bentwing-bat (*Minopterus scheibersii oceanensis*); and
- green and golden bell frog (*Litoria aurea*).

Since the preparation of the Stage 3 Expansion EIS in 1996 (ERM Mitchell McCotter 1996), coastal saltmarsh has also been listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995*.

The full ecological assessment in **Appendix 7** provides an assessment of the potential impact of the Project on each threatened species, endangered population and EEC previously recorded or considered likely to occur within 10 kilometres of the project area. The assessment indicates that the Project is not likely to impact on threatened species, endangered populations or EECs previously recorded or considered to potentially occur within the project area.

The Fisheries Management Act 1994

No *Fisheries Management Act 1994* (FM Act) listed threatened aquatic flora or fauna species were recorded within the project area.

The Hunter River does not provide known habitat for any threatened species listed under the FM Act and the Project will not impact threatened aquatic species, populations or EECs potentially occurring within the project area.

SEPP 44 Assessment

The area is not considered to be core koala habitat as defined under SEPP 44 due to a lack of preferred koala food trees listed in Schedule 2 of SEPP 44. The preparation of a Koala Plan of Management is not required. SEPP 44 does not place any constraints on the Stage 4 Project.

Indirect Impacts on Adjoining Wetlands

As noted in earlier sections, KCT is situated directly adjacent to the Kooragang Nature Reserve. For this reason, particular attention has been given to groundwater management associated with construction of the Stage 4 dump station and the associated section of underground conveyor. The groundwater assessment discussed in **Section 6.3.3** confirms that the proposed detailed dewatering management process will ensure no discernible impacts on groundwater levels within the KCT site and therefore no impact on the adjoining Kooragang Nature Reserve. Consequently there will be no indirect groundwater impacts on the adjoining wetland habitat.

Conclusion

All relevant ecology considerations were taken into account during the EIS process and subsequent development consent requirements for the Stage 3 Expansion. The Project does not propose to significantly alter the approved footprint of KCT. Site inspection by an ecologist has confirmed that the infrastructure associated with the Project will be constructed on previously disturbed land. There will be no changes associated with the water management system. As such, the Project is not likely to impact on the ecological values of KCT or the adjoining Kooragang Nature Reserve.

6.3.5 Visual Aspects

As required by the DGRs, an assessment of the visual impacts associated with the Project has been undertaken. This includes an assessment of the existing visual character of the area and the potential visual impacts of the project.

Existing Visual Amenity

The Stage 4 Project will be located on the south-eastern side of Kooragang Island (refer to **Figure 1.2**). The dominant land uses adjacent to the project area include coal handling and loading facilities, and the current construction of a coal export terminal by NCIG on land directly adjacent to KCT. The NCIG coal export terminal will have wharves and shiploaders, coal stockpiles, combined stackers/reclaimers, a number of conveyors over Cormorant Road and administration buildings. As noted in **Section 6.1** and shown on **Figure 6.1**, Kooragang Island is dominated by large-scale industrial uses including concrete batching and recycling, engineering and manufacturing, fertiliser manufacturing and distribution, port facilities and coal loading. Mayfield, which is located across the South Arm of the Hunter River is a heavily industrial/commercial area with the Steel River Industrial Estate and the old BHP Steelworks site which is approved for redevelopment as a multi-purpose export facility.

Fern Bay residential area is located approximately 1.7 kilometres to the east of KCT across the North Arm of the Hunter River. Stockton (North) residential area is located approximately 1.5 kilometres to the south-east of KCT.

Kooragang Island has little vertical relief and is relatively flat. The existing visual character of the area is dominated by industrial and port related developments and Stockton Bridge. These structures are dominant components of the visual character of the area when viewed from surrounding areas such as Stockton. The Stage 4 Project will not introduce any new types of light sources visible to residents at night. The lighting on the Stage 4 Project will be consistent with the existing lighting in the area.

Assessment Methodology

The visual analysis undertaken for the Project included the identification of locations from which views of the Project may be possible. Some of the more prominent aspects of the Stage 4 Project include the fourth shiploader, the outbound conveyor over Teal Street and the conveyor transfer house. Other elements of the Stage 4 Project such as the fourth dump station, some conveyors and fourth rail loop are unlikely to be visible to the public due to their location in relation to existing KCT infrastructure and surrounding land uses.

The initial assessment found that the major viewing points to existing infrastructure were restricted to Teal Street and Stockton Bridge. Views from the Fern Bay residential area to the east are restricted to obstructed views associated with vegetation and long distance (greater than 1.5 kilometres). Views from the Stockton residential area to the south-east are restricted to obstructed views as a result of existing infrastructure on Kooragang Island.

A representative viewing location was selected for each area predicted to have potential views of the Project and a further detailed visual assessment completed using photo montage analysis. The visual assessment identified two locations where views of the Project may be possible. The public viewpoints utilised for the detailed visual assessment are shown on **Figure 6.17** and are briefly described as follows:

Umwelt
Environmental Consultants

Source: Aerial Photo: Port Waratah Coal Services Limited (2008, 2009)

0 0.25 0.5 1.0km
1:25 000

Legend

- Kooragang Coal Terminal
- Stage 4 Project Infrastructure
- VP2 Viewing Point

FIGURE 6.17

Visual Assessment Points

- VP1 - is located in the centre of Stockton Bridge walkway facing to the west towards the proposed Teal Street Conveyor.
- VP2 - is located on the eastern side of Stockton Bridge on the roundabout facing west towards Stockton Bridge.
- VP3 - Stockton - residential area.
- VP4 - Cormorant Road – existing industrial development.
- VP5 - Raven Street – facing east towards Stockton Bridge.

Visual Impacts

The findings of the visual impact assessment are discussed below for each viewing point.

Viewing Point 1 – Stockton Bridge

The proposed Stage 4 infrastructure has been digitally overlaid on a photo of the existing VP1 environment to make a photomontage; this provides an indication of what the proposed infrastructure will look like from VP1. Motorists travelling south over Stockton Bridge have unobstructed views of the existing KCT infrastructure. From VP1, motorists will be able to view aspects of the proposed Stage 4 Project including the outbound conveyor system, proposed new transfer house, and proposed extensions to the two existing transfer houses (refer to **Figure 6.18**). The proposed outbound conveyor that crosses over Teal Street has highest potential for visual impact. The other Stage 4 infrastructure is consistent with and visually blends in with the existing industrial structures of the area.

The underside of the proposed outbound conveyor will be located approximately 8 metres above the road surface and is approximately 2.6 metres in height. The conveyor will only be seen by passing motorists, it will not be identifiable from residential areas. This outbound conveyor is consistent with the existing and approved infrastructure of the area. NCIG is currently constructing a third coal terminal on land adjacent to KCT. NCIG has approval for two over road conveyors along Cormorant Road. Taking into account the short viewing time for motorists and the existing industrial structures of the area (including the NCIG over road conveyors), the proposed outbound conveyor is not expected to significantly impact on the visual amenity of the area.

Viewing Point 2 – Roundabout on eastern side of Stockton Bridge

From VP2, on the roundabout on the eastern side of Stockton Bridge, a number of components of the Stage 4 infrastructure will be visible to members of the public (refer to **Figure 6.19**). These components include the proposed outbound conveyor system and the proposed new transfer house.

From VP2 these visible components of the Stage 4 infrastructure are consistent with the existing visual amenity of the area. From this location other visible industry in the area includes the Hi-fert Distribution Centre, Kooragang Bulk Goods Facility, The Pacific Carbon Plant and existing PWCS conveyors and transfer houses. Due to the heavily industrial nature of the environment the visible Stage 4 infrastructure will not have an identifiable impact on the visual amenity of the area.

Viewing Point 3 – Stockton

As **Figure 6.20** demonstrates, Stockton residents have heavily obstructed views of the proposed Stage 4 infrastructure. From VP3 residents have general views of the heavily

Base Source: Port Waratah Coal Services Limited (2008, 2009)

0 200 400 800m
1:15 000

Legend

Proposed Stage 4 Infrastructure
Viewing Location

FIGURE 6.18

Viewing Point 1
Stockton Bridge

Umwelt
Environmental Consultants

Base Source: Port Waratah Coal Services Limited (2008, 2009)

0 200 400 800m
1:15 000

Legend

Proposed Stage 4 Infrastructure
Viewing Location

FIGURE 6.19

Viewing Point 2
Eastern end of Stockton Bridge

FIGURE 6.20

Viewing Point 3
Stockton

industrialised environment of Kooragang Island. Due to the shielding of other structures on Kooragang Island, Stockton residents cannot specifically view the proposed Stage 4 infrastructure.

Viewing Point 4 - Cormorant Road

From VP4 (refer to **Figure 6.21**) the existing KCT shiploaders can be viewed. However the proposed fourth shiploader is considered unlikely to have a significant visual impact on the amenity of the area. The fourth shiploader is proposed to be built adjacent to the three existing KCT shiploaders at the approved K7 wharf. Adjacent to the K7 Wharf NCIG are in the process of constructing additional shiploaders. The fourth shiploader is consistent with the existing and approved visual amenity of the area and does not need to be considered further.

Viewing Point 5 - Raven Street

The proposed Stage 4 infrastructure has been digitally overlaid on a photo of the existing VP5 environment to make a photomontage; this provides an indication of what the proposed infrastructure will look like from VP5. From **Figure 6.22** the proposed outbound conveyor system is clearly visible to members of the public. From this particular viewing location the conveyor appears to be a dominant feature. However, motorists travelling along this road are on a local road within a heavily industrialised area and are not general commuter traffic. That is, the users of this road would not associate the conveyor to be out of character with the industrial land uses within this area. The outbound conveyor will only be visible for a short period of time and is not inconsistent with other conveyors in this general area (e.g. NCIG is constructing two over road conveyors along Cormorant Road). The outbound conveyor is consistent with the existing infrastructure of the area and will not significantly impact on the visual amenity for these road users.

Mitigation Measures

Although the Project is considered unlikely to significantly impact on existing visual amenity, the following visual controls will be implemented as part of the Project:

- all proposed Stage 4 infrastructure will be designed and constructed to be consistent with existing PWCS infrastructure; and

- all new infrastructure will be finished in colours which blend in with the tones of the existing industrial infrastructure adjacent to it.

6.3.6 Traffic

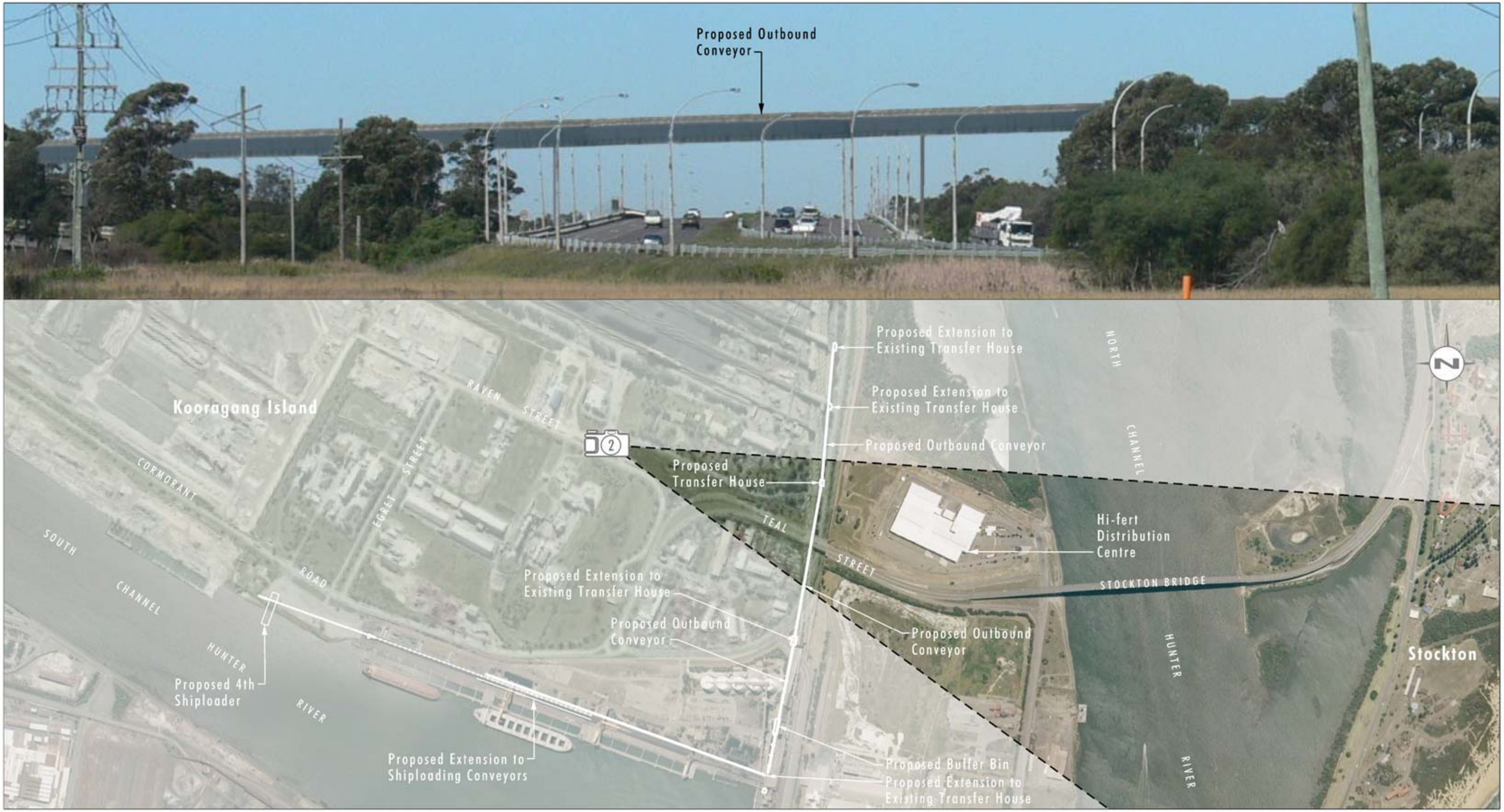
In accordance with the DGRs for the Project, a comprehensive construction traffic assessment has been undertaken by Stapleton Transportation and Planning Pty Ltd (STAP). The full assessment report is provided in **Appendix 8**, with a summary provided below. This assessment provides details of existing traffic levels on the local transport network, and the impact that Stage 4 construction traffic may have on the local transport network. There will be no additional traffic generated by the operation of the Stage 4 Project, and therefore an operational traffic assessment is not required.

On Kooragang Island, and specifically sites off Cormorant Road, storage, processing and distribution sites still dominate, specifically because of the berthing facilities available on the northern side of the Hunter River. Major projects approved in recent years include the PWCS KCT upgrade; the Newcastle Coal Infrastructure Group Coal Export Terminal (NCIG CET); the Cargill Oilseed Processing Plant (Cargill OPP); and many other smaller industrial projects. KCT is located in a heavily industrial district; there is no residential population on

FIGURE 6.21

Viewing Point 4
Cormorant Road
(Energy Australia Windmill)

Umwelt
Environmental Consultants



Base Source: Port Waratah Coal Services Limited (2008, 2009)

0 200 400 800m
1:15 000

Legend
Proposed Stage 4 Infrastructure
Viewing Location

FIGURE 6.22

Viewing Point 5
Raven Street, Kooragang

File Name (A4): R04_V1/2551_034.dgn

Kooragang Island. The NCIG CET is currently under construction and STAP has included the NCIG construction traffic in this assessment, thus adopting a conservative approach. However, the NCIG current construction program is due for completion in early 2010 and the Stage 4 Project would not begin construction before 2011. It is unlikely that construction vehicles from the two projects will overlap.

6.3.6.1 Assessment Methodology

STAP used the SIDRA model to assess intersection performance as a result of construction of the Stage 4 Project. SIDRA is an RTA approved intersection performance model that determines key performance measures for 'isolated' intersections, be they priority, roundabout or signal controlled. SIDRA looks at both the Level of Service (LoS) and the delay that vehicles will experience.

Level of Service (LoS) is a basic performance indicator assigned to an intersection based on average delay. For signalised and roundabout intersections, LoS is based on the average delay to all vehicles, while at priority controlled intersections LoS is based on the worst approach delay.

The assessment is based on peak construction traffic during the proposed 24 month construction period when there are approximately 300 construction personnel for a period of approximately 6 months.

6.3.6.2 Existing Traffic Conditions

The existing road network surrounding and servicing the project area is shown in **Figure 6.23** and a brief description of the relevant roads is provided below. Traffic volume data for the local road system has been determined by traffic counts undertaken as part of the traffic assessment in July 2009. RTA data has been sourced for traffic volumes for each of the surrounding roads.

Cormorant Road

Cormorant Road is a part of Main Road (MR) 108 and is a State Road under the jurisdiction of the RTA. Cormorant Road accommodates traffic movements between Newcastle (and regional links) and Kooragang Island and then northern centres. MR 108 comprises a number of individually named sections (i.e. Tourle Street, Cormorant Road, Teal Street, Nelson Bay Road). Based on the traffic counts undertaken in July 2009 STAP estimates that the current average flow of vehicles on Cormorant Road is approximately 24,000 per day.

Cormorant Road provides two lanes over the new Tourle Street bridge with a 60 kilometre per hour (km/h) posted speed limit, then 80 km/h posted speed limit through Stockton. On the approach to Egret Street it widens to a four lane undivided carriageway, which continues to the roundabout at the intersection of Teal Street. To the east of the Teal Street roundabout the road continues as a wide two lane undivided road providing access to significant industrial local roads (Heron Street, Curlew Street).

Egret Street

Egret Street is a wide local industrial road with a 60 km/h posted speed limit. It connects to Cormorant Road at its southern end and turns to Raven Street at its northern end. Egret Street is under the jurisdiction of Newcastle Port Corporation.

Umwelt
Environmental Consultants

Source: Port Waratah Coal Services Limited (2008, 2009)

0 0.5 1.0 1.5km
1:25 000

Legend

Kooragang Coal Terminal

FIGURE 6.23

Local Road Network

Raven Street

Raven Street is a wide local industrial road with a 60 km/h posted speed limit. It connects to Egret Street at its western end; provides an intersection with Curlew Street to the north; and then winds back to Teal Street north of the intersection with Cormorant Road, where access is restricted by median to left in and left out. Raven Street is under the jurisdiction of Newcastle Port Corporation.

Curlew Street

Curlew Street is a wide local industrial road with a 60 km/h posted speed limit. It connects to Raven Street at its western end and then extends to Cormorant Road to the east. Curlew Street provides access to the KCT north-east of Raven Street. Curlew Street is under the jurisdiction of Newcastle Port Corporation.

6.3.6.3 Existing Intersection Performance

The key local and regional traffic intersections within the vicinity of the KCT site include (refer to **Figure 6.23**):

Industrial Drive & Cormorant Road

This is a major signalised intersection which – based on observations, and discussions with the RTA and Council for recent past projects on Kooragang Island and through Newcastle – provides significant capacity by virtue of the number of approach and turn lanes on each leg of the intersection, and traffic flows significantly below future design capacity. This intersection has significant capacity available and operates at a very high LoS and as such a SIDRA analysis was not deemed necessary for this intersection. The traffic generated by the Stage 4 Project will have no impact on the general operation of this intersection during peak periods as a result of the relatively low Stage 4 Project flows and the short construction timeframe.

Cormorant Road & Teal Street

This high capacity roundabout was updated some years ago by the RTA after operating as a priority intersection with poor geometry and a history of incidents. The Stage 4 Project has the potential to impact the operation of this intersection through the construction period, and has been assessed in detail. The SIDRA analysis shows that the intersection of Cormorant Road and Teal Street currently operates at a high LoS during the peak periods, with low average delays and significant spare capacity. The LoS of the intersection is rated as ‘A’, which is a good rating.

Cormorant Road & Egret Street

This intersection previously operated as a priority T-intersection allowing all movements, but significant delays were experienced by vehicles departing Egret Street to Cormorant Road (right hand turn) based on the speed and volume of passing traffic in Cormorant Road. As a result, the right hand turn from Egret Street to Cormorant Road was restricted as one of the DoP conditions for the development of the NCIG CET. The left hand turn from Egret Street to Cormorant Road has an LoS worst movement rating of ‘B’, which means it is good with acceptable delays.

The existing local traffic network shows that it currently operates at a high level of performance, with significant spare capacity; numerous available local routes; and caters for all vehicle types. The entry points to the site in particular are well away from the key activity intersections and have clear access paths that will be utilised to minimise network impacts.

6.3.6.4 Construction Traffic Impacts

Construction of the Stage 4 Project is expected to take 24 months with the construction work force set to peak between 10 and 15 months. The construction work force will peak at approximately 300 personnel for the period of 6 months. The remainder of the construction period personnel will number between 100 and 150 individuals. The construction materials required for the Project are estimated to generate approximately 200 heavy vehicles (400 heavy vehicle trips) over the 24 month construction period. This equates to an average of less than one heavy vehicle movement per day over the construction period. This minor level of heavy vehicle demand is unlikely to impact on the local network even if there is a peak in demand at any one time.

Construction staff will access the site at three different locations, which will include off-street car parking areas to accommodate proposed construction workforce (refer to **Figure 6.24**):

- existing approved KCT site access points in Curlew Road and Raven Street (Designated by STAP as Access Point 1A - Curlew Street; and Access Point 1B – Raven Street) – 40% of staff;
- existing approved KCT site access point in Cormorant Road (Access Point 2) – 40% of staff;
- existing approved KCT wharves access points in Cormorant Road east of the Teal Street roundabout; and in Heron Road south of Cormorant Road (Access Point 3) – 20% of staff.

Work hours are expected to be nominally from 7.00 am to 6.00 pm, with additional shift construction work at times. The Stage 4 Project construction period morning arrival would generally correspond with the existing morning peak hour (7.00 am to 8.00 am), while the evening departure peak period would generally occur after the existing afternoon peak hour (3.30 pm to 4.30 pm). For the peak construction period when there are up to 300 personnel on site, some 240 arrival trips would be generated in the morning peak period, and 240 departure trips during the peak afternoon period. It has been estimated that up to 85% of the construction workforce will arrive from Newcastle (i.e. from Industrial Drive and then Cormorant Road), while 15% will arrive via Stockton Bridge.

A SIDRA analysis was undertaken for the year 2012 (predicted final year of construction), with the existing traffic flows factored at a 1.5% annual increase to represent traffic growth. This base situation has been analysed alone to determine the effect of general background traffic flow changes on the two intersections without the additional construction traffic associated with the Stage 4 Project. A SIDRA analysis was then undertaken for the year 2012 with the predicted traffic growth and the construction traffic associated with the Stage 4 Project to assess what impact the Stage 4 construction traffic would have on local network performance.

The operation of the intersection of Cormorant Road and Teal Street is virtually unchanged by the Stage 4 construction traffic, and continues to operate at a LoS ‘B’ with significant spare capacity and only moderate delays to the worst approach. The average delays to all movements represent a LoS ‘A’. The operation of the legal movements at the intersection of Cormorant Road and Egret Street are similarly virtually unchanged by the additional construction traffic, with the left hand turn from Egret Street to Cormorant Road in particular generally unaffected by the short term increases in eastbound flow in Cormorant Road. This movement would operate at a LoS ‘C’ under legal conditions in 2012 as a result of average annual increases in the passing flow, and remain at LoS ‘C’ with the additional peak Stage 4 Project construction traffic. Overall, the increase in delay between the existing and future tests is only four seconds, straddling LoS ‘B’ and LoS ‘C’ threshold.

Source: Port Waratah Coal Services Limited (2008, 2009)

0 0.5 1.0 1.5km
1:25 000

Legend

- Kooragang Coal Terminal
- Majority of Truck/Construction vehicle Access
- Truck/Construction vehicle Access
- Extra Large/Wide Loads
- Access Point

FIGURE 6.24

Traffic Site Access

File Name (A4): R04_V1/2551_029.dgn

Based on the availability of numerous local access routes; the moderate construction traffic demands; the reduction in trip generation from adjacent local construction projects (specifically NCIG CET); and the significant capacity within the Kooragang Island Industrial Precinct, STAP has concluded that the construction traffic generated by the Stage 4 Project will have no significant impact on the local traffic network. The existing road network has sufficient capacity to cater for the predicted construction traffic volumes and no road upgrades will be required.

6.3.6.5 Traffic Management

PWCS already manages traffic as part of ongoing operations, including Stage 3 construction activities in accordance with approved procedures. PWCS will continue to manage construction traffic (including Stage 4) in accordance with existing construction traffic management procedures.

To further minimise potential construction traffic impacts, the following traffic management commitments have been made:

- that the existing KCT Construction Traffic Management Protocol operating at the site be revised to account for the completion of the Tourle Street Bridge and the more efficient regional connectivity provided by the new bridge to Industrial Drive and Pacific Highway;
- that the designation of authority and responsibility for on and off-site heavy vehicle movements as outlined in the KCT Construction Traffic Management Protocol be retained for the duration of the Stage 4 Project;
- construction personnel for the Stage 4 Project will utilise existing KCT construction parking locations. Site access points are located in proximity to the existing construction parking areas and will not be required to change.

6.4 Other Environment and Community Issues

6.4.1 Greenhouse Gas and Energy

Although it was not required by the DGRs, a comprehensive greenhouse gas assessment has been prepared for the Project by SEE Sustainability Consulting. The objectives of the assessment were to include an estimate of the energy consumption and greenhouse gas emissions being produced from the Project, and a breakdown of energy use and greenhouse gas emission at the Project site, given the proposed throughput capacity of 120 Mtpa has been approved. The full greenhouse assessment report is provided in **Appendix 9**.

The project will not alter the current approved throughput capacity of KCT of 120 Mtpa. As such, the potential Scope 3 emissions associated with diesel consumption from coal transport and emissions associated from the combustion of coal will not change as a result of the Stage 4 Project. The Scope 3 emissions associated with coal transport and coal combustion for a throughput capacity of 120 Mtpa were included in a previous greenhouse gas assessment (SEE, 2007).

In addition, as the Stage 4 Project will not alter the current approved throughput capacity of KCT of 120 Mtpa, the predicted electricity consumption at maximum approved capacity is not expected to be different as a result of the Stage 4 Project. The predicted Scope 1 and 2 energy consumption and greenhouse gas emissions are therefore unchanged as a result of the Stage 4 Project.

For completeness, an assessment of the potential impacts associated with the predicted GHG emissions is provided in the following sections.

6.4.1.1 Greenhouse Assessment Policy Context

In NSW there are a number of policies in place that outline the methodologies for undertaking a greenhouse gas emissions assessment (GHG assessment) as part of the preparation of an EA. The primary policies include:

- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol;
- the National Greenhouse Accounts (NGA) Factors, January 2008 and June 2009 versions.

The GHG protocol establishes an international standard for accounting and reporting of GHG emissions by entities. Under the GHG Protocol the establishment of operational boundaries involves identifying emissions associated with an entity's operations, categorising them as direct or indirect emissions, and identifying the scope of accounting and reporting for indirect emissions.

Three 'Scopes' of emissions (Scope 1, Scope 2, and Scope 3) are defined for GHG accounting and reporting purposes. These scopes are briefly outlined below.

Scope 1 emissions refer to direct emissions associated with a development. Direct GHG emissions are defined as those emissions that occur from sources that are owned or controlled by the entity. Direct GHG emissions are those emissions that are principally the result of the following types of activities undertaken by an entity:

- generation of electricity, heat, or steam. These emissions result from combustion of fuels in stationary sources, e.g. boilers, furnaces, turbines;
- physical or chemical processing. Most of these emissions result from manufacture or processing of chemicals and materials, e.g. the manufacture of cement, aluminium, adipic acid and ammonia, or waste processing;
- transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in entity owned/controlled mobile combustion sources, e.g. trucks, trains, ships, aircraft, buses and cars; and
- fugitive emissions. These emissions result from intentional or unintentional releases, e.g. equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; chlorofluorocarbon (CFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport.

Scope 2 emissions are a category of indirect emissions that accounts for GHG emissions from the generation of purchased electricity consumed by the entity.

Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity. Scope 2 emissions physically occur at the facility where electricity is generated. Entities report the emissions from the generation of purchased electricity that is consumed in its owned or controlled equipment or operations as Scope 2.

Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of Scope 3 activities provided in the GHG Protocol are extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

Scope 3 emissions have not been included in the assessment of emissions associated with the Project. The World Business Council for Sustainable Development and World Resources Institute *Greenhouse Gas Protocol* 2004 considers the reporting of Scope 3 emissions to be optional. If an organisation believes that Scope 3 emissions are a significant component of the total emissions inventory, these can be reported along with Scope 1 and 2. However, it should be noted that reporting Scope 3 emissions can result in double counting of emissions and can also make comparisons between organisations and/or projects difficult because reporting is voluntary. Both direct (Scope 1) and indirect (Scope 2) emissions have been assessed as part of this greenhouse assessment.

6.4.1.2 Assessment Methodology

The assessment is based on information provided by Umwelt and includes annual production schedules, annual electricity consumption and annual diesel and petrol consumption for the Project.

The energy use estimates used were based on the following assumptions:

- the electricity figure was based on electricity usage data for PWCS's existing KCT operations. It is assumed to include electricity used in the conveyors, stackers, reclaimers and shiploaders, lighting and general power, stockpile sprays and pumping. It is assumed that the electricity requirements of the proposed Project will reflect the existing per tonne of coal handled consumption figures;

- diesel and petrol consumption figures are expected to remain at current approved levels;

- the diesel and petrol consumption figures were multiplied by 38.6 GJ/kL and 34.2 GJ/kL respectively to arrive at the total GJ of diesel and petrol consumed (DoCC 2009, Table 4, p. 17);

- the energy content of the coal was calculated based on 85% being thermal coal with an average energy content of 26.69 GJ/tonne, and 15% being coking coal with an average energy content of 30 GJ/tonne (DoCC NGA Factors Table 1 2008).

The Project's estimated greenhouse gas emissions associated with energy consumption, however, are provided in the full greenhouse report in **Appendix 9** and are based on the assumption that the Scope 2 emissions factor for electricity is 0.89 kgCO2-e/kWh, the Scope 1 emissions factor for diesel is 69.9 kgCO2-e/GJ or 2.7 TCO2-e/kL, and the Scope 1 emissions factor for petrol is 69.9 kgCO2-e/GJ or 2.4 TCO2-e/kL.

6.4.1.3 Greenhouse Impact Assessment

The assessment found that the majority of the Project's estimated annual on-site Scope 1 and 2 energy usage is associated with electricity. The Project's major electricity consumption activities include lighting, power, electric motors, conveying coal and powering mobile equipment, stockpile sprays and pumping.

The Greenhouse Gas and Energy Assessment for the Stage 4 Project has found that for the approved throughput of 120 Mtpa of coal handled:

- annual on-site electricity consumption is estimated to be 515,879 GJ;

- annual on-site diesel and petrol consumption are estimated to be 386 GJ and 3,762 GJ respectively;

- therefore the estimated **total annual Scope 1 and 2 energy consumption is 520,027 GJ**;

- the Scope 1 and 2 annual energy consumption for the Project is dominated by electricity use at 99.2%;

- the energy index for the Project at 120 Mtpa throughput capacity is estimated at **0.0043 GJ/tonne of coal handled**;

- the total **Scope 1 and 2 greenhouse gas emissions** associated with the on-site operations of the Project are estimated to be **127,826 TCO_2-e pa** (excluding coal transport and end use). This represents approximately 0.022% of Australia's total greenhouse emissions of around 576 million TCO_2-e pa (DoCC, National Greenhouse Inventory 2006);

- the Scope 1 and 2 annual greenhouse emissions for the Project are dominated by electricity use at 99.8%;

- the Scope 1 and 2 greenhouse emissions index for the Project is estimated at **0.0011 TCO_2e/tonne of coal handled**.

As mentioned in **Section 6.4.1.1** a Scope 3 assessment was not undertaken for this greenhouse assessment. The reason for this is that a Scope 3 assessment was undertaken during the 2007 (120 Mtpa) Project Approval. The Stage 4 Project will not alter the current approved throughput capacity at KCT of 120 Mtpa. As such, the potential Scope 3 emissions associated with diesel consumption from coal transport and emissions associated with the combustion of coal will not change as a result of the Stage 4 Project. Regardless of the fact that Scope 3 emissions will not increase as a result of the Stage 4 Project, PWCS will continue to strive to reduce KCT's Scope 1, 2 and 3 emissions by way of the mitigation measures outlined in **Section 6.4.1.4**.

6.4.1.4 Greenhouse Gas and Energy Management

PWCS will continue to assess and implement where possible, energy and greenhouse management initiatives during the Project. Some of the opportunities for improving energy efficiency and reducing greenhouse emissions from the Project are discussed below. KCT greenhouse mitigation measures are largely focused on energy management and energy efficiency, in particular the efficient plant and equipment and optimisation of existing operations. Whilst emissions from the transport of coal are outside the control of PWCS, PWCS will cooperate with transport operators in implementing ways of reducing their emissions.

PWCS is therefore assessing the viability of the following energy and greenhouse mitigation measures for the Project:

- review energy efficiency in plant and equipment procurement – consideration to be given to the life cycle cost advantages obtained by using energy efficient components;

- review the opportunity to install additional sub-metering for offices, workshops, conveyors, stackers and reclaimers to enable focused attention on areas of major energy consumption;

- review operational initiatives such as shutting down plant and equipment when not moving coal;
- review control and temperature settings for air conditioning units in offices and switchrooms;
- review automatic control of lighting;
- review potential energy efficiency opportunities in water pumping and dust suppression systems, e.g. variable speed drive pumps;
- review changes in power consumption with installation of new equipment and install power factor correction equipment to suit;
- review by Pacific National and Queensland Rail on possible ways of reducing the diesel used in transporting coal to KCT; and
- review by shipping companies on possible ways of reducing the diesel used in transporting coal from KCT to the export destination.

The objective of these measures is to seek further opportunities to reduce greenhouse gas emissions.

6.4.2 Maritime Safety

There is no increase in throughput capacity of KCT operations as a result of the proposed Stage 4 Project and therefore there will be no increase in the number of ships utilising KCT. The number of ships will remain at the level that was approved in the 120 Mtpa project approval, i.e. 1300 vessels per year (or 3 – 4 per day). During the 120 Mtpa project assessment PWCS consulted with the NPC and confirmed that sufficient navigational capacity was available for the additional shipping and that marine safety would not be jeopardised as a result of the 120 Mtpa Project.

The NPC is responsible for the management of maritime movements and incidents in the Port. It has conducted appropriate maritime oil spill response training and has a detailed environmental management plan and an environmental procedures manual in place.

6.4.3 Cultural Heritage

As part of the KCT Stage 3 Expansion EIS (ERM Mitchell McCotter 1996), an assessment of cultural heritage within the Stage 3 Expansion footprint and wider Kooragang Island area was undertaken. The objectives of the assessment were to determine the presence of archaeological relics or Aboriginal places within the Stage 3 footprint area and to assess the likely impacts of the Stage 3 Expansion on heritage items.

Kooragang Island is located 3 kilometres west of Newcastle Bight, an area regarded as archaeologically sensitive and significant. Archaeological sites are commonly associated with wetland and estuarine environments given the abundance of resources available to Aboriginal people. Given the regional context of Kooragang Island, it is likely that the KCT site was used extensively by Aboriginal people. Due to the extensive changes to Kooragang Island from 1950 onwards, it is considered unlikely that any cultural heritage items would be present within the KCT site. This was confirmed by the identification of two sites on Kooragang Island in DECCW (then NPWS) records, neither of which were located on the KCT site. It is unlikely that excavations as a result of the Stage 4 Project will encounter any cultural heritage items; consequently cultural heritage does not require further assessment.

6.4.4 Socio-Economic

KCT is the largest coal export terminal in Australia and as such there are extensive socio-economic benefits associated with the Project at a regional, state and national level. Construction of the Stage 4 Project infrastructure would result in a maximum of 300 construction personnel being employed for approximately 6 months. For the remaining 18 months of construction between 100 and 150 personnel would be employed.

Capital expenditure for the Project is in the order of $500 million. The federal government will gain revenue from the Project, in the form of company tax, excise on imported equipment and goods, fuel excise and other assorted taxes such as the goods and services and income taxes.

The state government can expect economic benefits from the Project including revenue from rail freight, port charges, payroll tax and a number of other taxes, royalties and payments for services from statutory bodies.

Local government receives financial returns from rates and charges paid by company employees and by other people attracted to the area as a result of the flow-on effects of employment in the coal mining industry.

The mining of black coal is one of Australia's major industries, creating thousands of jobs, fuel for low cost electricity generation and is a major source of revenue for the Australian economy. Australia is the world's largest black coal exporter; our coal export industry was worth approximately $A24 billion in 2007-2008 (Australian Coal Association, 2009). As global demand for coal increases, the value of the Australian coal export industry will continue to rise. New South Wales and Queensland account for almost all of Australia's coal exports. In NSW alone the coal export industry is worth approximately $A8.5 billion a year (Australian Coal Association 2008). All but a very small proportion of the export coal shipped through Newcastle is transported by rail for shipping from either Kooragang Island or Carrington (Port Waratah Coal Services).

Constraints in the coal transport and handling infrastructure in New South Wales and Queensland in recent years have limited Australia's capacity to respond to the largely unforeseen strong growth in world coal consumption (ABARE, 2006). These constraints were highlighted by the impact that the combined rail and export terminal constraints had on Hunter Valley Coal Exports (ABARE, 2006).

The global demand for black coal is predicted to increase as China and India continue to increase their domestic consumption of coal. Global black coal consumption is predicted to increase by 2.1% a year between 2005 and 2025, and will reach 7.6 billion tonnes in 2025 (ABARE, 2006). Given the constraints of the Hunter Valley rail line and port facilities, infrastructure improvement projects need to occur if Australia is going to be able to meet projected global demand for black coal. The ARTC has released annual infrastructure enhancement strategies since 2005, setting out how ARTC planned to ensure that rail corridor capacity in the Hunter Valley would stay ahead of coal demand. These strategies set out the projects and upgrades that are to occur in that year, i.e. ARTC is committed to address the current constraints affecting coal export on the Hunter Valley rail line. ARTC's infrastructure enhancement strategy, the Stage 4 Project at KCT and the approved NCIG third coal terminal at Kooragang Island will allow the Hunter Valley to respond to the projected increasing demand for Australian black coal. Being able to respond to this demand will improve both the NSW and national economies and will result in the creation of jobs.

The Stage 4 Project itself will allow KCT to have increased 'sprint capacity' to meet the overall 120 Mtpa throughput following short term disruptions to operations. Short term delays in throughput result from a variety of occurrences, such as closures of the coal transportation chain, planned and unplanned maintenance outages and port and rail interruptions due to bad weather. The construction of the fourth coal handling stream will improve the coal handling ability of KCT and will result in efficiency improvements.