PORT WARATAH
COAL SERVICES

Mr K Gouldthorp
General Manager
Newcastle City Council
PO Box 489
NEWCASTLE NSW 2300

5 August 2014

Dear Mr Gouldthorp,

Without Prejudice Indicative VPA Offer – PWCS T4 Project

Note: The following is provided on a without prejudice basis and is commercial in confidence. It is provided on the basis that Council does not publicly release the terms of the offer and is for discussion purposes only. The terms of any offer also remain subject to approval by the Board of Port Waratah Coal Services Ltd.

As discussed at recent meetings, Port Waratah Coal Services (Port Waratah) proposes to make an offer to enter into a Voluntary Planning Agreement (VPA) in relation to the proposed Terminal 4 Project with Newcastle City Council pursuant to Section 93F of the NSW Environment Planning and Assessment Act 1979 (the Act), subject to agreement on satisfactory terms being reached.

Port Waratah has considered a number of matters, some of which we have previously discussed in arriving at the draft offer terms below:

a) **Project impacts:** Port Waratah remains of the view that the impact of the T4 project on the demand for Council services, infrastructure and public amenities as contemplated in the Act, is minimal. We have provided you with details of this assessment in our report "Results of Technical Assessments to Assist in Determining a Voluntary Planning Agreement, 11 April 2014". Notwithstanding this, the NSW Department of Planning and Environment have determined the impact resulting from the project to be $528,140 in local developer contributions to Newcastle City Council. Port Waratah commits to the payment of this amount upon a final decision to proceed with the project, and accordingly it is included in the proposed draft VPA offer detailed in **Table A**.

   We acknowledge that you have indicated that Council has a different view of the potential for impact on Council services and public amenities. We wish to reiterate that it would be of great assistance to our consideration of these matters if Council could provide us with some detail of its impact assessment.

b) **Project Value**: The nominated project value of $4.8 billion contains a number of items which we believe are not to be included in the project cost for the purposes of calculating a possible Section 94A levy. The Environmental Planning and Assessment Regulation 2000 (the Regulation), Section 25J clause 3 defines such exclusions, which include project management costs, the cost of permits and

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fees, the costs of land and rights of way, legal costs and contingency and escalation costs. In addition, the dredging associated with the project is not within the scope of the development consent being sought and should therefore also be excluded from the project costs. Taken together, these considerations result in the project costs relevant to the calculation of any potential levy being significantly lower than the full project cost discussed previously.

Draft VPA Commitments

As discussed above, Port Waratah agrees to accept the payment of the amount $528,140 as a developer contribution in respect of potential impact on Council services and public amenities. We note in Council's contribution plan that developer contributions are usually payable upon issuing of a construction certificate in respect of the relevant development. Port Waratah proposes to pay the contribution upon a final decision to proceed with the project, and accordingly it is included in the proposed draft VPA detailed in **Table A**.

In addition, Port Waratah offers the following community benefits which we propose would be formalised as commitments in a VPA:

a) Port Waratah will pay to Newcastle City Council $200,000 per annum for allocation towards infrastructure projects to be selected from Council's work schedule and new public facilities as listed in Schedule I of Appendix A and B to the Section 94A Development Contributions Plan 2009.
b) Port Waratah will increase the funding committed to Community Investments and Partnerships through our existing mechanisms by $150,000 per annum;
c) Port Waratah will provide additional training and development opportunities by expanding its Apprentice training program by two positions at a current value of approximately $125,000 per annum.

The detail of this offer is summarised in Table A below. On the basis that the annual commitments will be indexed by CPI, we assess the value of these commitments as approximately $20 million over a notional 30-year project life.

Additional Considerations

In addition to the draft terms nominated above for consideration in a VPA, and the overall economic value enabled by the project, significant other direct benefits flow to the community and State as a result of the project. These have been detailed at length in the project assessments and include:

- Environmental offset land purchases and associated development, valued at approximately $44m are planned for future handover to an appropriate authority, thereby returning significant value to the communities of Newcastle and the State of NSW.
- Where possible Port Waratah aims to procure goods and services locally. In 2013, 79% of our operational spending was completed in the Hunter and Central coast region. This equates to approximately $100m being spent in the local area.
- As part of the T4 program of work, Port Waratah contributed approximately $400k over two years to Green and Golden Bellfrog Research. This funding has significantly assisted Newcastle University in becoming a leading researcher in this important area of threatened species research.
- Improvements to Cormorant Road, specifically drainage and intersection improvements, i.e., traffic lights and associated lane duplication.
- Contamination removal, e.g. Multi-phase extraction of Light Non Aqueous Phase Liquids from an area outside of theT4 site footprint.

Conclusion

Port Waratah submits for Council's consideration that the proposed draft offer above constitutes significant, direct and long lasting benefits to Newcastle City Council and the local community. We look forward to continuing these discussions with you.

Yours sincerely

Hennie du Plooy
Chief Executive Officer

Appendix 4

Table A – Draft VPA

Development Contribution	Intended Use	Estimated value ($)
Department of Planning and Environment Developer Contribution Requirement	To be determined by Newcastle City Council.	$528,140. To be paid in full upon decision to proceed with project construction
Community Infrastructure Contribution	Funding for nominated Newcastle Council Projects with regard to immediate communities of PWCS and Councils Work Schedule and New Public Facilities.	$200,000 pa for 30 years. To commence in the year first coal is handled through the T4 terminal.
Increased community investment and partnership funding.	Community nominated investment and partnership projects selected through existing mechanisms.	$150,000 pa for 30 years. To commence in the year first coal is handled through the facility.
Extension of PWCS Apprentice training program	Two apprentice positions.	$125,000 pa for 30yrs
Estimated nominal value of draft VPA commitments		$20.8 million

The Regional Economic Impacts of the T4 Project in Newcastle

Glyn Wittwer
Centre of Policy Studies
Monash University

8 September 2014

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Definitions

Aggregate consumption: total household expenditure in each region deflated by CPI. Nominal household expenditure is linked to nominal labour income in the model in each region.

Aggregate investment: total investment, in real terms divided by an investment price deflator. In the model, in each industry current period capital is equal to previous period capital net of depreciation plus previous period investment.

Capital (stocks): the quantity of capital. This is summed from the industry level to the regional level using capital rental weights. The link between industry capital and industry investment is defined under "Aggregate investment".

Consumer surplus: consumer willingness to pay minus consumer expenditure

Net foreign debt: calculated at the national level, this is the stock of debt owed to foreigners minus the assets of Australians owned overseas. There is no elaborate treatment of debts and equities in the model.

Newcastle: Lower Hunter Statistical Subdivision defined as comprising the Statistical Local Areas of Newcastle, Lake Macquarie, Port Stephens, Cessnock and Maitland.

Private and public consumption: private (household) consumption and aggregate consumption are used interchangeably. Public consumption refers to current government spending, that is, non-investment expenditures.

Producer surplus: producer revenue minus producer marginal cost

Quantity: quantity of housing stocks: this is a measure of the quantity of dwellings in the model.

Real GDP: this is equal to sum of value-added in all industries (defined below) in a region plus the sum of indirect taxes in that region.

Real wage: this refers to nominal wages deflated by CPI. Each region in the model has CPI calculated separately.

Regional income: real regional income is the same as real GDP.

Rentals: this usually refers to the earnings of capital, although it could refer to the earnings of land and capital.

Terms of trade: the price of exports relative to the price of imports.

Value-added: this is the value of output exclusive of the cost of material inputs. It includes the earnings of labour, land and capital.

Welfare: a cumulative measure of the change in public and private consumption as a result of a project or policy. It is an indicator of how much better off society is with a project or policy compared to without it. It does not include non-market impacts.

Note – in reporting the variables above, reference is usually to a change in the level of a variable relative to a business-as-usual baseline. Often, % changes are reported as they do not require units. Sometimes, $ million or full-time equivalent (in the case of workers) units are used.

Executive Summary

This study models the potential economic impacts of the construction and operations of the proposed T4 Project in Newcastle. Dynamic TERM, a computable general equilibrium model, is used in this study. The model represents Newcastle, the rest of Hunter, the rest of New South Wales and the rest of Australia as four distinct regions. However, the focus of the study is on Newcastle's economy.

The total construction expenditure is $4.8 billion (2011 dollars), with most costs being incurred in year 3 ($0.9 billion), year 4 ($1.7 billion) and year 5 ($1.3 billion). Operation of the Project is modelled until year 24.

The Project has not been modeled in isolation because it is being constructed in anticipation of expansion in coal mining output in and beyond the Hunter Valley. Although this study does not concentrate on the expansion of coal mining in other regions, concurrent expansion is part of the modeled scenario. This is because the T4 Project is part of the necessary supporting infrastructure for expanded coal mining output in the rest of New South Wales.

During the construction of the T4 Project, employment rises to a peak of 1% or 2,500 jobs above forecast in year 4. In year 5, employment moves back towards forecast as real wages continue to rise. In year 6, with real wages at 1.1% above forecast in Newcastle, employment falls slightly below forecast as T4 construction expenditure winds down. With the T4 Project operating at full capacity from year 10 on, employment remains 0.2 to 0.4% or 500 to 1,000 jobs above forecast.

Aggregate household consumption remains above forecast in Newcastle in all years of the scenario, peaking at almost 2% above forecast in year 6. Thereafter, due to a combination of real wages which remain above forecast and employment which returns to above forecast from year 7, aggregate consumption persists at around 1.5 to 2.0 % above forecast.

The welfare calculation includes the impacts of both coal mine expansion in New South Wales and the construction and operation of the T4 Project, as the latter is supporting infrastructure. At a 4% discount rate, the net present value of the welfare impact is $40 billion. At a 7% discount rate, the impact is $28 billion and at a 10% discount rate, it is $21 billion.

1.0 Introduction

1.1 Background

This study models the potential economic impacts of the construction and operations of the proposed T4 coal loading facility (the T4 Project) in Newcastle using Dynamic TERM, a computable general equilibrium (CGE) model. The scenario modelled is as per the assumptions used in the benefit cost analysis and input-output analysis undertaken for the Preferred Project Report of the Modified Design. That is, for modelling purposes it is assumed that throughput commences after the construction of a nominal terminal capacity of 70 million tonnes per annum (Mtpa) (referred to as Stage 1 in the Environmental Assessment). However, in reality staging and size of staging will be subject to demand and commercial requirements.

The T4 Project is being constructed in anticipation of expanded coal mining output in and beyond the Hunter Valley. The construction phase of the T4 Project, which will cost an expected $4.8 billion from year 1 to year 6, will have substantial impacts on the local economy of Newcastle. The temporary jump in demand for labour during the construction of the T4 Project will occur as coal mines are being expanded elsewhere in New South Wales.

While the results reported in this study concentrate on the impacts on Newcastle of the T4 Project, it is appropriate to include the construction and operational phases of expanded coal mines in the rest of New South Wales in the scenario at the same time. This is because the T4 Project is being built in response to coal mine expansion. The T4 Project will be competing for labour with coal mines during the construction phase. During the operational phase, the T4 Project will be used to load additional coal in preparation for export. Consequently, the T4 Project will remove a constraint on expansion of coal exports.

1.2 The baseline and the policy scenario

Dynamic TERM uses a baseline that includes an underlying forecast for the economy of Australia. Although the model is multi-regional, the regional forecasts are driven by the industrial structure of each region, without any information on forecast regional demographics or migration.

The policy scenario includes the underlying productivity, endowment and demand shifts of the forecast baseline, but adds specific shocks to depict the scenario. This scenario includes the construction of the T4 Project in Newcastle and additional coal mining in the Hunter Valley and elsewhere. In the policy scenario, the construction phase for the T4 Project proceeds from year 1 to year 6. From year 6, expanded coal exports moved through T4 commence. In year 6, an additional 5 million tonnes (mt) of coal are produced for export in the state. This rises to 15 mt in year 7, 40 mt in year 8 and 62 mt in year 9 before plateauing at 70 mt in year 10. This scale of operations continues through to year 24.

The modelling results provide the impacts of the policy scenario *relative to the forecast baseline* in the form of cumulative deviations from the forecast baseline.

2.0 Model Results

2.1 Results

Dynamic TERM includes a theory of labour market adjustment that includes sticky wages (refer to Appendix 1). Since there is a strengthening of Newcastle's labour market relative to forecast during construction of the T4 Project, real wages rise over time relative to what they would be otherwise. The expansion of coal mines elsewhere in New South Wales further strengthens Newcastle's labour market.

Employment in Newcastle rises to 0.26% or around 600 jobs above forecast in year 2, when construction expenditure exceeds $380 million. In year 3, when expenditure rises to over $900 million, Newcastle's employment rises to 0.75% or around 1,800 jobs above forecast. At the same time, real wages in Newcastle rise to 0.5% above forecast, subduing additional jobs growth. A further increase in construction expenditure to almost $1.7 billion in year 4 is accompanied by employment rising to 1.03% or 2,500 jobs above forecast, with real wages rising further to 0.95% above forecast. In year 5, construction expenditure falls to $1.3 billion, but employment moves back towards forecast, to 0.5% above forecast as it was in year 3 when construction expenditure was smaller (i.e. $0.9 billion in year 3 compared with $1.7 billion in year 5).

With the assumption of sticky wages, there is no immediate adjustment in year 6 when construction expenditure falls to $475 million. Consequently, with real wages persisting at 0.9% above forecast, Newcastle's employment falls below forecast (-0.06% or around 150 jobs) in year 6. Thereafter, the labour market strengthens slightly again as throughput at the T4 Project increases. Over time, real wages move slightly further above forecast, plateauing at 1.5% above forecast (Figure 1).

Figure 1: Newcastle labour market (% change relative to forecast)

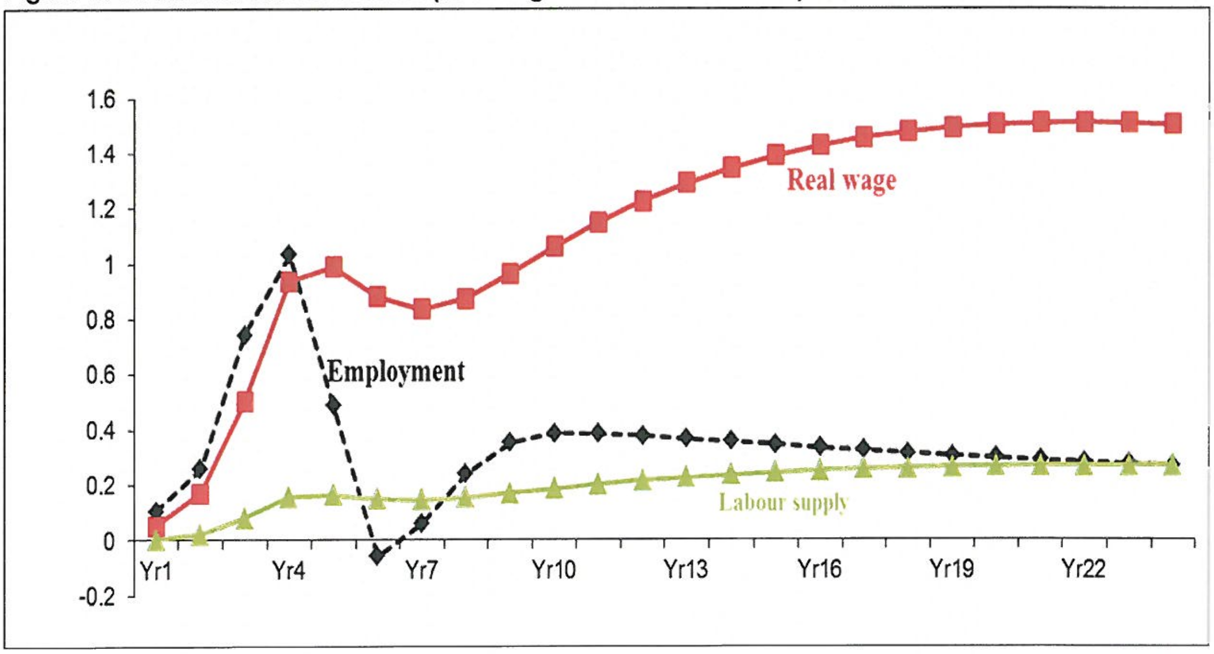
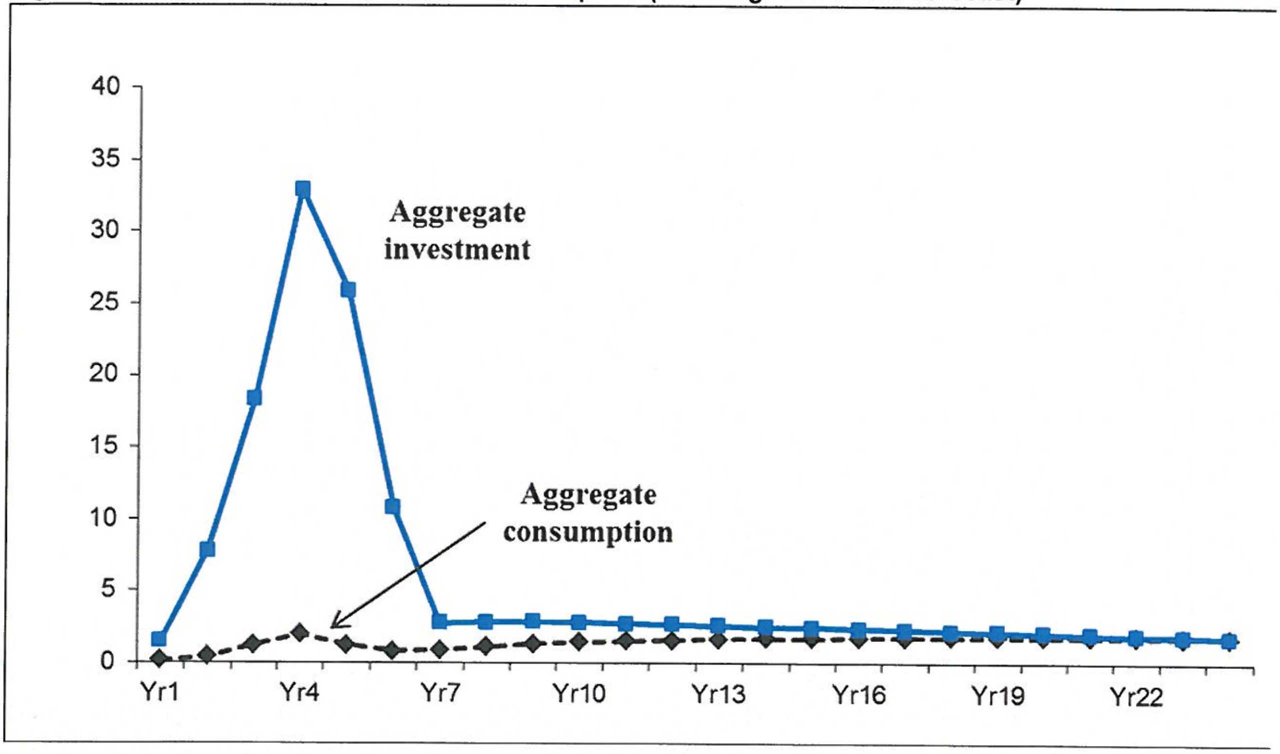
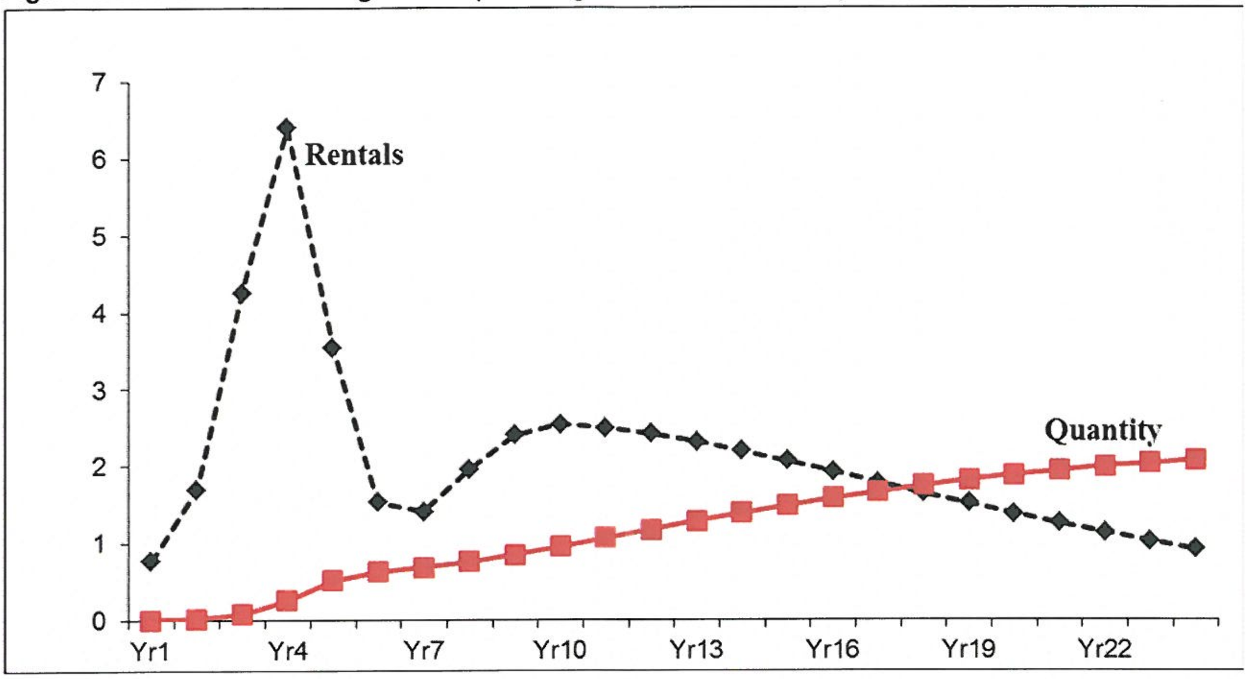


Figure 2: Newcastle's investment and consumption (% change relative to forecast)



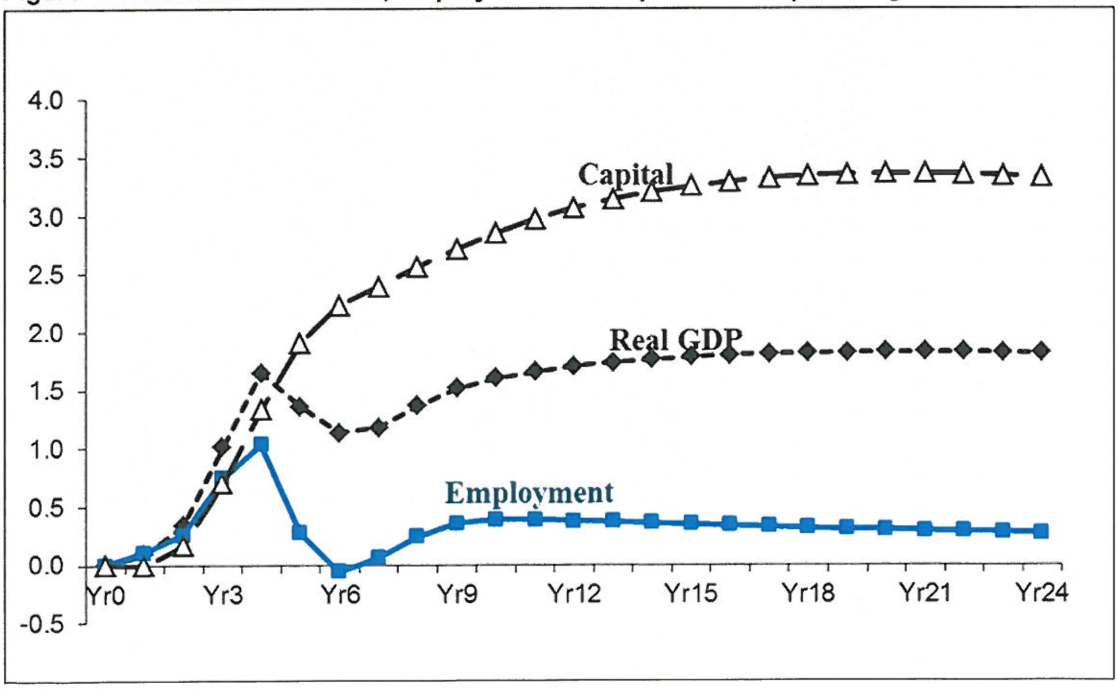
The size of the T4 Project construction relative to the Newcastle economy is reflected in Figure 2. Investment peaks in year 4 at more than 30% above forecast. Aggregate consumption peaks in the same year at almost 2% above forecast. During the operational phase of the T4 Project, aggregate consumption persists at around 1.5% above forecast.

Figure 3: Newcastle's housing rentals (% change relative to forecast)



The construction phase has an impact on Newcastle's housing rentals. At the peak of the T4 Project investment phase in year 4, rentals are more than 6% above forecast, before dropping as the T4 Project investment winds down and finishes. The housing market is strengthened during the operational phase of the T4 Project. Since housing stocks are assumed to adjust slowly, housing rentals persist above forecast throughout the time period of the simulation.

Figure 4: Newcastle's real GDP, employment and capital stocks (% change relative to forecast)



Newcastle's real GDP rises during the construction phase of the T4 Project driven mainly by the jump in employment. During the operational phase, the contribution of increased capital stocks makes a more substantial contribution to increased real GDP than employment.

Table 1 shows the percentage deviation in output by industry year-by-year in Newcastle. Table 2 shows the corresponding results for output on a value-added basis ($m, 2011 dollars).

As expected, other construction activity dominates the industry results during the construction phase. As the T4 Project operations scale up from year 6 to year 10, rail transport and other transport (which includes the T4 Project) activity increase relative to forecast. Some service industry demands are driven mainly by household consumption. These industries include hotels & cafes, trade and ownership of dwellings. Although their outputs remain above forecast in Newcastle throughout the scenario, higher than baseline real wages (with the exception of ownership of dwellings which uses no labour) subdue further output growth.

Table 1: Newcastle's outputs (% deviation from forecast)

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19	Yr20	Yr21	Yr22	Yr23	Yr24
Livestock	-0.1	-0.3	-0.8	-1.5	-1.5	-1.1	-0.9	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9
Crops	-0.1	-0.2	-0.5	-0.9	-0.8	-0.6	-0.6	-0.7	-0.8	-0.8	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Grapes	-0.1	-0.2	-0.5	-0.8	-0.8	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
OtherAgriclt	0.0	-0.1	-0.3	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2
AgrSrvFisFor	-0.1	-0.4	-0.9	-1.6	-1.6	-1.3	-1.2	-1.3	-1.4	-1.4	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.4	-1.4	-1.4	-1.4	-1.3	-1.3
Coal	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	1.0	1.3	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.1	3.2	3.4	3.5	3.6	3.8	3.9
OthMining	0.0	-0.3	-1.1	-2.2	-3.2	-3.9	-3.8	-3.2	-2.8	-2.3	-2.0	-1.6	-1.2	-0.9	-0.6	-0.4	-0.1	0.1	0.3	0.6	0.7	0.9	1.1	1.2
FoodPrds	-0.1	-0.4	-1.1	-2.0	-1.7	-1.3	-1.1	-1.0	-1.0	-0.9	-0.9	-0.8	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3
WineSpirits	-0.2	-0.5	-1.0	-1.8	-2.2	-2.2	-2.0	-1.8	-1.7	-1.6	-1.5	-1.4	-1.2	-1.1	-1.0	-0.9	-0.9	-0.8	-0.7	-0.6	-0.6	-0.5	-0.4	-0.4
OtherManuf	-0.2	-0.4	-0.8	-1.2	-0.9	-0.7	-0.7	-0.6	-0.7	-0.7	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
OtherMachnry	-0.4	-0.8	-2.2	-3.8	-3.1	-2.2	-2.1	-2.4	-2.7	-2.8	-2.9	-2.9	-2.8	-2.8	-2.8	-2.7	-2.7	-2.6	-2.6	-2.5	-2.5	-2.4	-2.3	-2.2
ElecCoal	0.0	-0.3	-1.0	-2.0	-2.3	-2.0	-1.1	0.3	1.4	2.1	2.5	2.8	3.1	3.4	3.6	3.8	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7
ElectricSup	0.0	-0.1	0.0	0.0	-0.3	-0.1	0.3	0.6	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7
GasWaterSup	0.0	0.0	0.1	0.2	-0.1	-0.2	0.1	0.4	0.7	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
ResConSrv	-0.4	-1.5	-2.1	-3.9	-4.4	-1.2	1.9	2.8	3.5	4.0	4.2	4.4	4.4	4.4	4.3	4.3	4.2	4.1	4.0	3.8	3.7	3.6	3.5	3.4
OthConstruct	0.2	2.5	9.1	14.2	12.1	13.3	15.5	15.3	15.0	14.6	14.2	13.8	13.4	13.1	12.8	12.6	12.4	12.3	12.1	12.0	11.9	11.9	11.8	11.8
Trade	0.3	0.8	1.9	3.1	2.5	1.3	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1
HotelsCafes	0.1	0.3	0.9	1.4	0.7	0.3	0.5	0.8	1.1	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.7
RoadTransprt	0.0	-0.1	-0.3	-0.5	-0.3	-0.3	0.0	0.9	1.6	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.7	1.7	1.7
RailTransprt	-0.4	-0.9	-1.9	-3.2	-2.9	-1.5	0.2	2.6	4.7	5.3	5.4	5.3	5.3	5.3	5.3	5.3	5.3	5.2	5.2	5.2	5.2	5.3	5.3	5.3
OthTransport	0.0	4.1	22.1	40.6	51.1	52.8	51.6	49.7	47.9	46.0	44.2	42.5	40.8	39.3	37.8	36.4	34.9	33.5	32.1	30.8	29.5	28.2	26.9	25.7
Communicatn	0.0	0.0	0.3	0.5	0.3	0.4	0.7	1.0	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8
BusinessSrv	0.0	0.1	0.2	0.4	0.4	0.4	0.4	0.7	0.8	1.0	1.1	1.1	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.3
OwnerDwellng	0.0	0.0	0.1	0.3	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1
GovAdm	0.1	0.1	0.3	0.4	0.4	0.4	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
Defence	0.2	0.2	0.3	0.4	0.3	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Education	0.1	0.0	-0.3	-0.7	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.8	-0.8	-0.9	-0.9	-0.9	-1.0	-1.0	-1.0
Health	0.2	-0.1	-0.7	-1.5	-1.2	-1.0	-0.8	-0.6	-0.5	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
OtherSvc	0.1	0.0	-0.2	-0.6	-0.6	-0.6	-0.4	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2

Appendix 4

Table 2: Newcastle's outputs ($m real value-added deviation from forecast)

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19	Yr20	Yr21	Yr22	Yr23	Yr24
Livestock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grapes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OtherAgriclt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AgrSrvFisFor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal	0	0	0	0	0	0	1	6	10	13	16	19	22	24	26	29	30	32	34	36	37	38	39	41
OthMining	0	0	-1	-2	-3	-4	-4	-3	-3	-2	-2	-2	-1	-1	-1	0	0	0	0	1	1	1	2	2
FoodPrds	0	0	-1	-2	-2	-2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
WineSpirits	0	0	0	0	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OtherManuf	-2	-4	-9	-13	-10	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	-7	-7	-7	-7	-7	-6	-6	-6	-6
OtherMachnry	0	-1	-3	-5	-5	-3	-3	-4	-5	-5	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6
ElecCoal	0	0	-1	-1	-1	-1	-1	0	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4
ElectricSup	0	0	0	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3
GasWaterSup	0	0	0	0	0	0	0	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3
ResConSrv	0	-2	-2	-4	-5	-1	2	4	5	6	7	7	8	8	8	8	9	9	9	9	9	9	9	9
OthConstruct	1	15	54	87	79	93	114	119	124	128	132	136	141	146	152	159	167	175	185	196	208	222	237	253
Trade	5	17	39	65	53	30	18	22	26	29	31	32	34	35	37	38	40	41	42	44	45	47	48	49
HotelsCafes	1	2	5	7	4	2	3	5	7	9	10	11	13	14	15	16	17	17	18	19	20	21	21	22
RoadTransprt	0	0	0	-1	0	0	0	1	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
RailTransprt	0	-1	-2	-3	-2	-1	0	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
OthTransport	0	7	36	65	83	87	86	85	84	83	82	81	80	80	79	79	79	78	78	77	76	76	75	74
Communicatn	0	0	1	1	1	1	2	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	8	9
BusinessSrv	1	4	9	15	17	15	18	28	37	44	50	55	60	64	68	72	75	78	81	83	86	88	90	92
OwnerDwellng	0	0	2	8	17	22	25	28	33	38	44	50	57	64	71	79	86	94	101	109	116	123	131	138
GovAdm	0	0	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
Defence	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Education	1	0	-4	-8	-8	-8	-7	-6	-6	-6	-7	-8	-10	-11	-12	-14	-15	-17	-18	-20	-21	-23	-25	-27
Health	2	-1	-8	-16	-13	-13	-10	-8	-6	-6	-7	-7	-8	-9	-10	-11	-12	-12	-13	-14	-15	-16	-16	-17
OtherSvc	1	0	-2	-5	-5	-6	-4	-2	-1	0	0	0	0	0	0	-1	-1	-1	-2	-2	-2	-3	-3	-3
Total	9	36	115	190	198	202	234	275	309	336	358	379	400	421	441	462	483	505	527	550	574	599	625	652

Table 3: Newcastle's employment (FTE deviation from forecast)

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19	Yr20	Yr21	Yr22	Yr23	Yr24
Livestock	0	-1	-1	-2	-1	-1	0	0	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Crops	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grapes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OtherAgriclt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AgrSrvFisFor	0	-1	-2	-3	-3	-2	-1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-1	-1
Coal	-22	-48	-107	-174	-161	-127	-112	-110	-111	-102	-88	-75	-63	-53	-43	-34	-26	-19	-12	-6	-1	3	8	11
OthMining	-1	-5	-16	-31	-32	-31	-27	-24	-21	-19	-16	-14	-12	-10	-8	-6	-5	-3	-2	-1	0	2	3	4
FoodPrds	-4	-13	-32	-54	-42	-27	-20	-20	-21	-21	-20	-20	-19	-18	-18	-17	-17	-16	-16	-15	-15	-14	-14	-13
WineSpirits	-1	-2	-5	-8	-7	-5	-5	-5	-5	-5	-5	-4	-4	-4	-4	-4	-3	-3	-3	-3	-3	-3	-3	-3
OtherManuf	-58	-101	-217	-319	-203	-140	-139	-149	-167	-173	-171	-169	-167	-165	-162	-159	-155	-152	-148	-144	-140	-137	-133	-130
OtherMachnry	-12	-26	-73	-129	-96	-55	-60	-76	-92	-98	-100	-100	-101	-101	-101	-100	-99	-97	-95	-93	-90	-87	-84	-81
ElecCoal	0	-4	-10	-18	-16	-8	3	17	27	31	31	32	32	32	33	33	33	33	34	34	34	34	34	35
ElectricSup	-1	-1	4	7	4	11	20	24	27	29	30	31	31	32	33	33	33	34	34	35	35	35	35	36
GasWaterSup	2	3	11	16	11	13	18	18	18	17	15	14	12	11	10	10	9	8	8	7	7	6	6	6
ResConSrv	-12	-45	-59	-106	-117	-17	78	92	104	110	112	114	114	114	113	112	111	110	108	107	105	103	101	99
OthConstruct	31	221	1064	1624	95	-286	-50	-25	-5	9	20	30	40	49	59	69	79	89	100	111	123	136	149	162
Trade	150	471	1064	1724	1300	647	323	409	474	499	503	505	506	506	505	504	503	502	500	499	498	496	495	493
HotelsCafes	21	49	147	224	130	91	111	130	145	150	149	148	146	144	142	141	139	137	135	133	132	130	129	127
RoadTransprt	-2	-4	-9	-15	-10	-8	1	28	48	52	49	47	45	43	42	40	39	39	38	37	37	36	35	35
RailTransprt	-11	-23	-44	-69	-56	-22	13	59	96	104	100	96	92	89	86	83	80	78	76	74	72	70	68	66
OthTransport	0	27	114	110	65	45	48	60	73	79	82	87	91	97	102	108	113	119	124	128	132	136	139	142
Communicatn	2	5	31	48	38	50	69	74	78	79	78	78	77	76	75	73	72	71	70	68	67	66	64	63
BusinessSrv	30	100	242	397	404	322	314	387	425	432	428	423	419	415	411	408	405	402	398	396	393	390	387	384
OwnerDwellng	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GovAdm	9	10	20	27	31	31	40	48	54	55	55	55	54	53	52	51	50	49	49	48	47	46	45	44
Defence	6	7	11	14	11	6	7	10	13	14	14	14	13	13	13	13	12	12	12	12	11	11	11	11
Education	29	-9	-103	-220	-199	-179	-138	-111	-98	-102	-112	-124	-137	-151	-164	-177	-189	-200	-210	-220	-228	-236	-242	-247
Health	58	-16	-218	-438	-348	-315	-253	-191	150	-143	-152	-165	-179	-193	-207	-221	-234	-246	-257	-268	-278	-287	-295	-303
OtherSvc	34	8	-49	-124	-136	-138	-90	-42	-8	4	5	4	1	-3	-8	-13	-18	-23	-28	-33	-38	-43	-47	-52
Total	247	603	1763	2483	663	-146	149	602	900	999	1005	1001	989	975	960	945	932	921	911	903	897	893	890	888

2.2 Welfare impacts

In a partial equilibrium framework (e.g. benefit cost analysis), welfare is calculated as the sum of producer and consumer surpluses. In a CGE model, producers and consumers are connected. Increased industry value-added adds to regional income, which feeds into the consumption function that links income to household spending, and therefore links producers and consumers. There is not necessarily a proportional link between real income and real spending, as they have different price deflators (the GDP deflator for real income and the CPI for household spending). If the terms of trade deteriorate, real consumption will shrink relative to real GDP.

The welfare impact of the Project is calculated only on the Project operations and associated coal mining expansion, without any consideration of other effects such as environmental impacts. Welfare(dWELF) is calculated at the national level as the net present value of the year-on-year deviations in private and public consumption at the national level, minus the real discounted change in net foreign debt in the final year of the simulation (year 2035):

$$\mathrm{dWELF} = \sum_d \sum_t \frac{\mathrm{dCON}(d,t) + \mathrm{dGOV}(d,t)}{(1-r)^t} - \frac{\mathrm{dNFL}(z)}{(1-r)^z}$$

Where: dCON and dGOV are the deviations in real household and government spending in region *d* and year *t*;
dNFL is the deviation in real net foreign liabilities in the final year (*z*) of the simulation; and
r is the discount rate.

At the national level, welfare impacts depend on the discount rate and on baseline assumptions about the export price of coal. The increase in Australia's welfare as a consequence of the coal mining development in NSW accompanied by the T4 Project construction and operation is $40 billion at a 4% discount rate, $28 billion at a 7% discount rate and $21 billion at a 10% discount rate (2011 dollars).

Appendix 1 - Dynamic TERM

Figure A1: Statistical sub-divisions in NSW outside Sydney that can be represented in TERM.

1	Sydney (splits possible)
2	Lower Hunter
3	Hunter
4	Wllngng
5	NwraBmdr
6	IllawrraB
7	TwdHdsT
8	Lismore
9	RchmndTw
10	CffsHrbr
11	PtMcquari
12	Clarence
13	Hastings
14	Tamworth
15	NthnSlopes
16	NthnTablelands
17	NorthCentral
18	Dubbo
19	CentMacqu
20	McqrieBar
21	UpDarling
22	Bathurst
23	CentTble
24	Lachlan
25	Orange
26	Qunbeyan
27	STblelnd
28	LwrSthCst
29	Snowy
30	Wagga
31	CentMrmb
32	LMrmb
33	Albury
34	UpMrry
35	CentMrry
36	MrryDrlng
37	FarWest

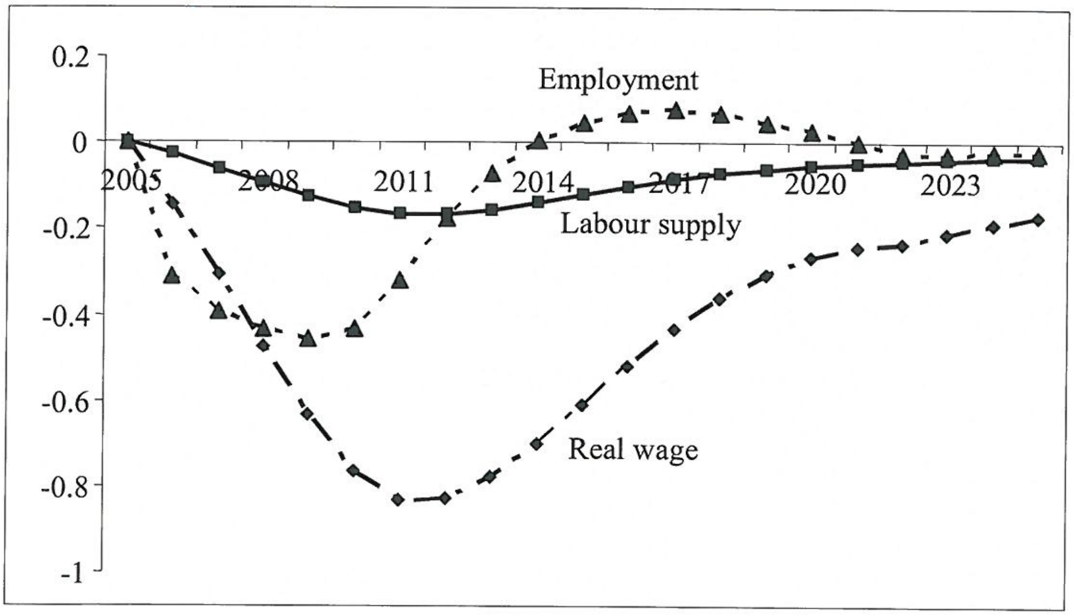
TERM was originally developed by Mark Horridge at the Centre of Policy Studies (see http://www.monash.edu.au/policy/term.htm). Since then, Glyn Wittwer has developed a dynamic version of the model, an application of which Wittwer *et al.* (2005) is an example.

In dynamic TERM, we use an underlying forecast. This may be based on the macro forecasts of other agencies. The underlying forecast or baseline gives us a year-by-year "business as usual" case.

Labour market – forecast v. policy scenario

In the theory of regional labour market adjustment, if regional labour market conditions improve or deteriorate relative to forecast, adjustment occurs in the short term mainly via changes in employment. Regional wages adjust sluggishly, with gradual adjustment in regional labour market supply (i.e., through migration between regions). Real wages will fall or rise to close the gap between employment and slowly adjusting labour supply. Once the deviation in employment is equal to the deviation in labour supply, real wages reach a turning point (either they bottom out, in the case of a weakening labour market, or peak, in the case of strengthened labour market conditions). Within this theory, adjustment in the longer term occurs via a combination of altered regional labour supply and real wages that deviate relative to those in other regions. Figure A2 shows an example, in which weakened labour market conditions in a region lead to unemployment in the short run and a lower real wage in the region in the long run.

Figure A2: An example of a weakened regional labour market with eventual recovery (% change from forecast)



CGE models such as TERM can be run under many different sets of assumptions concerning macro- and micro-economic behaviour.

Production technologies

TERM contains variables describing: primary-factor and intermediate-input-saving technical change in current production; input-saving technical change in capital creation; and input-saving technical change in the provision of margin services (e.g. transport and retail trade).

TERM's unique treatment of transport to assess the regional benefits of the project

The supply of margins originating in one region can lower the costs of moving goods between regions further afield. Previous multi-regional models (for example, Naqvi and Peter, 1996) assign the margins supply of a sale either to the origin or destination of the sale.

GEMPACK software

Dynamic TERM uses GEMPACK software for implementation (Harrison, *et al.* 2013; Harrison and Pearson, 1996).

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ECONOMIC ASSESSMENT OF THE T4 PROJECT

RESPONSE TO ISSUES RAISED BY THE AUSTRALIA INSTITUTE

AND

ADDITIONAL SENSITIVITY TESTING

PREPARED BY

GILLESPIE ECONOMICS

July 2014

EXECUTIVE SUMMARY

- The world demand for coal is predicted to continue to grow strongly with much of this growth in demand occurring in China and India.

- The T4 Project will enable increased coal exports from NSW to meet some of the forecast growth in global demand for coal.

- The need for the T4 Project was triggered under the Australian Competition and Consumer Commission endorsed Capacity Framework Arrangement because of an identified capacity shortfall based on the 2010 take or pay nominations by coal producers.

- Since the Environmental Assessment was published there has been a reduction in export forecasts. However a capacity shortfall could arise again at any time in upcoming annual producer nominations and Port Waratah Coal Services remains obligated to construct the additional capacity in certain timeframes when this occurs.

- The strategic level BCA of the T4 Project found that it would have net production benefits to Australia of between $6B and $13B (present value at 7% discount rate), depending on assumptions regarding the level of coal throughputs for T4.

- This additional report was prepared to assess the implications for the BCA of the T4 Project of adopting alternative assumptions. The alternative assumptions were raised in submissions to the exhibited Economic Assessment for the T4 Project.

- The alternative assumption include delayed development of the T4 Project, a reduction in the assumed growth rate of coal exports, all metallurgical exports being lower value semi-soft coking coal, an increase in average coal mining costs to $90/t, inclusion of royalty deductions and an effective company tax rate of $13.9%.

- The analysis indicates that even under these cumulative conservative assumptions, the T4 Project would have considerable net production benefits to NSW andAustralia – a minimum of $1.2B(present value at 7% discount rate).

- It should be noted that it is considered highly unlikely that the conservative assumptions would be applicable in unison. The sensitivity analysis adopting cumulative conservative assumptions has been undertaken purely to show there are significant benefits arising from T4 Project even when adopting the most conservative approach.

- Both Input-Output Analysis and Computable General Equilibrium Modelling were undertaken for the T4 Project. Each of these methods has strengths and weaknesses. However, they both show that the construction and operation of the T4 Project will provide consdiderable direct and indirect regional economic activity to the Newcastle region including:

  - 2,500 to 2,919 jobs during the peak year of construction; and
  - 304 to 1,000 jobs during operation of the T4 Project at 70 million tonnes per annum.

1.0 INTRODUCTION

- The world demand for coal is predicted to continue to grow strongly with much of this growth in demand occurring in China and India.

- Australia is well placed to contribute to the supply of coal to meet this growing demand. However, the ability to expand coal exports relies on the capacity of the coal supply chain (rail and port) to handle future output from coal mines.

- The T4 Project involves the construction and operation of a 4th coal terminal in the Port of Newcastle.

- The T4 Project will enable increased coal exports from NSW to meet some of the forecast growth in global demand for coal.

- The economic assessment of the T4 Project comprised:

  - A benefit cost analysis (BCA); and
  - An analysis of the regional economic activity provided by the T4 Project using input-output (IO) analysis and computable general equilibrium (CGE) modelling.

- Two project scopes were assessed. The first was of a Terminal with a total throughput capacity of 120 million tonnes per annum (Mtpa) which was presented in the Environmental Assessment (EA). The second was of a Modified Project where capacity was reduced to 70 Mtpa which was presented in the Response to Submissions/Preferred Project Report (RTS/PPR). Any reference to the T4 Project in this report is a reference to the Modified Project.

- BCA and IO/CGE analysis are not mechanised decision-making tools, but rather means of analysis that provides useful information to decision-makers.

- Decision-making is multi-dimensional. BCA is concerned with the single objective of **economic efficiency** (economic welfare) while IO analysis and CGE are concerned with the objective of **economic activity**[1] (growth). Decision-makers therefore need to consider the economic efficiency and economic activity implications of a project, as indicated by BCA and IO/CGE analysis respectively, alongside the performance of a project in meeting other, often conflicting, government goals and objectives.

[1] CGE modelling can also be used to estimate market costs or market benefits, as part of a BCA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.

2.0 BENEFIT COST ANALYSIS

2.1 Introduction

- From a BCA perspective, the T4Project cannot be considered in isolation. Its purpose and economic context must be considered, being to service the coal industry and provide the additional port capacity required to meet demand and enable mined coal to be exported to market.

- The benefit to NSW and Australia of enabling increased export of coal cannot be considered in isolation of all the costs of increased coal export e.g. mining of the coal, transporting it to port, building and operating the terminal. The scope of the BCA therefore must extend beyond just the development and operation of the terminal and be undertaken at a more strategic level.

- Because the NSW coal resource is in fixed supply, the T4 Project allows the mining of coal to be brought forward in time. Instead of mining and exporting the resource at the rate established by current approved capacity at the Port[2], the rate of extraction can be increased to that allowed by the increased capacity of the Port from the T4 Project. Three scenarios were examined in the BCA to account for different quantities of coal export allowed to be brought forward in time because of the T4 Project.This reflects uncertainty about the total recoverable coal resource in NSW. The currently identified coal reserves in NSW represent a small and changing percentage of the total coal resource with this percentage changing depending on a range of factors including the price of coal and the technology used to extract it.

- The BCA was undertaken using the threshold value approach. The net production benefits to Australiaand NSW of the increased coal exports were estimated using market values. The estimated net production benefits to Australia and NSW then provide a threshold value or reference value against which the relative value of the residual environmental impacts of mining, rail and the development of the T4 Project, after mitigation, may be considered by the decision-maker. The threshold value indicates the price that the community must value the residual environmental impacts (be prepared to pay) to justify in economic efficiency terms the no further development option.

- The estimation of threshold value relied on numerous assumptions around which there is some contention, particularly from The Australia Institute (TAI). Each of these is discussed below.

2.2 Levels of Throughput for the T4 Project

Assumption

- The BCA assumed an annual increase in coal exports through the Port of Newcastlein the order of 6.97% per annumfrom 2011,until capacity is reached.

Contention

- TAI identified that the assumed growth in exports was higher than historic average annual growth in exports from PWCS terminals.

Response

- Throughput assumptions were based on estimates by PWCS at the time the BCA was being prepared which in turn reflected expressed producer demand via long term 'ship or pay' contracts (which at that time exceeded approved terminal capacity and therefore triggered the need for the

[2]Including Port Kembla.

T4 Project) as well as prospective (uncontracted) volumes from mining projects in the planning phase.

- As identified by the Department of Planning and Environment (DP&E2014)[3], 2013 saw a 17% increase in exports over the previous year and the Newcastle Port Corporation Annual Report 2011-2012 forecasted that coal export from the Port would exceed 250 million tonnes per annum (Mtpa) by 2020, representing an average annual increase of 12%.

- Historically, coal exports through the Port of Newcastle have predominantly been to Japan, Republic of Korea and Taiwan. In addition to normal growth from these markets the major growth in demand for NSW coal is expected to come from China and India.

- Since the time that the BCA was prepared market conditions have softened.

- Additional sensitivity testing in Section 2.14 estimates threshold values for lower rates of growth in exports through the T4 Project.

2.3 Timing of Commencement of Operation of the T4Project

Assumption

- The Economic Analysis of the T4 Project was undertaken with 2011 as the first year of the analysis, construction of theT4 Project from 2013 to 2016 and the commencement of coal export through T4 in 2017.

Contention

- TAI considered that the first need for the terminal would be in 2025-26 not 2017.

Response

- The timing for theT4 Project was based on 2010 take or pay nominations by coal producers which led toPWCSidentifying capacity shortfalls at its Carrington Coal Terminal and Kooragang Coal Terminal in the Port of Newcastle by 2015. This triggered a contractual obligation for PWCS under the Australian Competition and Consumer Commission endorsed Capacity Framework Arrangements for the construction and operation of a new coal export terminal.

- Since that time market conditions have softened but a contractual obligation for PWCS to build a new coal terminal (the T4 Project)may arise at any time in response to changes in market demand.

- Additional sensitivity testing is reported in Section 2.14 for delays in the contractual trigger to develop the terminal.

2.4 Evaluation Period for the BCA

Assumption

- The BCA was undertaken for three different scenarios reflecting different assumptions aboutthe quantities of coal export brought forward in time by the T4 Projectand hence the length of time that the T4 would operate. The evaluation period was 31 years, 63 years and 40 years for Scenarios 1, 2 and 3, respectively.

[3]NSW Department of Planning and Environment (2014) Major Project Assessment: Port Waratah Coal Services Terminal 4 Project, Kooragang Island (10_0215).

Contention

- TAI considered that BCA should only be undertaken over a maximum period of 30 years.

Response

- The BCA timeframe should match the timing of costs and benefits – this differed between scenarios based on different assumptions about the available coal resource for export via the T4 Project.

- The NSW Government (2012) *Guideline for Cost Benefit Analysis of coal mining and coal seam gas projects* states that *"the costs and benefits should be estimated over the timescale of the impacts of a project. It is recommended that long-term projects should use a 50 year time-frame and where applicable a residual value for impacts beyond that time-period. However, where predictable and material, a longer time-frame can be adopted"*.

- Applications of BCA to environmental issues such as that undertaken by Garnaut (2011)[4] in a review of climate change policy used an evaluation period in excess of 80 years. BCAs of the Montreal Protocol (e.g. ACR 1997 and Smith and Vodden1989)[5]use time frames of 70 to 90 years.

- TAI refer to the NSW Government Guidelines for Economic Appraisal (NSW Treasury 2007) which refers to an evaluation period of 20 to 30 years as sufficient because most analyses will be *"relatively insensitive to the choice of a longer project period due to the discounting of future costs and benefits".*

- The NSW Treasury (2007) guideline is forsignificant spending proposals by Government agencies including proposed capital works projects and new programs. Spending proposals by Government agencies are unlikely to have significant costs or benefits past 30 years.

2.5 Coal Mix and Price

Assumption

- The BCA assumed coal exports through the T4 Project would be 20% metallurgical coal at a price of AUD$200/t and 80% thermal coal with a price of AUD$100/t.

Contention

- TAI considered that most metallurgical coal exports are lower grade metallurgical coal i.e. semi-soft coking coal, and so a price of AUD$200/t overstates the benefits of the T4 Project.

[4]Garnaut, R. (2011) Garnaut Climate Change Review Update 2011, http://www.garnautreview.org.au/update-2011/garnaut-review-2011.html

[5]ACR (1997) Global Benefits and Costs of the Montreal Protocol on Substances that Deplete the Ozone Layer, prepared for Environment Canada; Smith, D.A. and Vodden, K. (1989) Global Environmental Policy: The Case of Ozone Depletion, Canadian Public Policy, XV:4, 413 – 423.

Response

- Coal is a heterogeneous product. The actual proportion of hard versus semi-soft coking coal that will be exported in the future via the T4 Project is unknown. Similarly, the proportion of thermal coal exported of various qualities is unknown.

- The proportion of metallurgical coal and thermal coal exported in the future through the T4 Project was based on PWCS's predictions of future coal export by type, at the time of the assessment i.e. 20% metallurgical and 80% thermal coal.

- For modelling purposes no distinction was made between different qualities of metallurgical coal or thermal coal - a single value was used for metallurgical coal (all assumed to be hard coking coal) and a single value for thermal coal (all assumed to reflect the benchmark thermal coal price).

- Coal prices used in the BCA were relevant at the time. Future coal prices over the life of the T4 Project are uncertain. Current National Australia Bank (NAB) forecast of prices in June 2016 (the extent of the forecast) has prices for hard coking metallurgical coal at US$150, semi-soft coking coal at US$107 and thermal coal at US$80. The NAB forecast AUD/USD exchange rate in June 2016 is 0.80. This gives AUD prices of $188/t for hard coking coal, $134/t for semi-soft coking coal and $100/t for thermal coal, although export of coal through the T4 Project will occur further into the future than this.

- Sensitivity analysis is reported in Section 2.14 assuming that all metallurgical coal exported through theT4 Project is lower grade metallurgical coal, with a price of $134/t. The assumed price of thermal coal remains unchanged.

2.6 Mining and Transport Costs

Assumption

- The BCA assumed the average cost of future coal mining, rail transport and port servicesatAUD$60/t.

Contention

- TAI considered costs of AUD$90.91/t to be more appropriate.

Response

- The assumption of AUD$60/t was based on published information by Ernst and Young (2010) and international mining consultancy firm Marston (2010). This represented the best available public information at the time.

- The reference used by TAI i.e.Morgan Stanley (2013)is not publicly available and was prepared two years after the original BCA was undertaken and one year after the BCA of the Project was undertaken.

- Based on Morgan Stanley (2013) as reported in the Sydney Morning Herald, the cost of coal mining has increased over time in real terms.

- Costs reductions are therefore now a focus of industry.

- There is considerable uncertainty about the average costs of coal mining during the life of the T4 Project.

- Sensitivity testing reported in Section 2.14includes three different assumptions for mine, rail and port costs i.e. AUD$70/t, AUD$80/t and AUD$90/t.

2.7 Royalties

Assumption

- The BCA assumed a royalty rate of 7.2% for open cut mining and 8.2% for underground mining. It assumed that 83% of mining is open cut and 17% is underground based on proportions in the Hunter Coalfield and Newcastle Coalfield at the time the BCA was prepared.

Contention

- TAI identified that the royalty calculation has not allowed for deductions and this has a significant effect on royalty payments facilitated by the T4 Project. Previous submissions by TAI to the Planning Assessment Commission (PAC) suggest that deductions reduce royaltypayments to Government by up to 50%.

Response

- Deductions are many and varied and will differ from mine to mine. For simplicity they were not included in the strategic level BCA undertaken for the T4 Project.

- However, deductions have very little impact on the total estimate of royalties at any given assumed coal price. For example, the main deduction relating to the washing of coal reduces the effect royalty rate for open cut thermal coal from 8.2% to 7.9% and underground thermal coal from 7.2% to 6.9%. The reduction in effective royalty rate is smaller for metallurgical coal because of the high price.

- TAI has repeatedly and incorrectly subtracted assumed deductions from the royalties themselves when allowable deductions are made from coal revenue before the royalties are calculated.

- Sensitivity testing reported in Section 2.14 includes a reduction in effective royalty rates to take into consideration potential allowable deductions.

2.8 Calculation of Commonwealth Taxes Overstated

Assumption

- The BCA assumed a company tax rate of 30% of taxable income.

Contention

- TAI considered that the effective tax rate for coal mining projects is 13.9%.

Response

- The current Australian Tax Office (ATO) corporate tax rate is 30% of taxable income.

- NSW Treasury (2007) *Commercial Policy Framework: Guidelines for Financial Appraisal* requires the use of the prevailing corporate tax rate for government agencies and businesses.

- Financial appraisal text books such as Mott (1997) *Investment Appraisal*, recommend the use of the full corporate tax rate.

- An analysis of ATO data by Dr Sinclair Davidson[6], Professor of Institutional Economics at RMIT University and a Senior Fellow at the Institute of Public Affairs found that the Australian mining industry pays corporate tax at a rate close to 30% of its taxable income.

- Studies referred to by TAI that show an effective tax rate of less than 30% e.g. Richardson and Denniss (2011)[7],calculate the effective tax rate for the mining sector in relation to Gross Operating Surplus (GOS) not taxable income. GOS does not consider the costs of production such as consumption of fixed capital, interest, royalties, land rent payments and direct taxes payable on inputs.

- The Australian Treasury[8] has rejected GOS as an appropriate denominator for estimating effective tax rates.

- Notwithstanding the above, sensitivity analysis is reported in Section 2.14 for an effective tax rate of 13.9%.

2.9 Benefit Cost Analysis by TAI Using Alternative Assumptions

Issue

- TAI has undertakena BCA based on a range of alternative assumptions and concludes that the T4 Project is not financially viable and will not proceed.

Response

- The BCA undertaken by TAI is not considered credible given the assumptions it is based on.

- The TAI modelling includes incorrect estimates of royalties (as identified above), a company tax rate of 13.9%, all metallurgical coal export as low quality semi soft coking coal, a conservative price estimate for semi soft coking coal of $118/t, commencement of the throughput at T4 in 2025/26, growth in exports at low historic rates not reflective of the prospective growth in demand from China and India anda short evaluation period of 30 years that ignores significant costs and benefits of the T4 Project that would occur after this time.

- Under TAI scenarios and assumptions, economic benefits to NSW are still positive with royalties ranging from $15M to $1,493M.

- The T4 Project will only proceed if there is demonstrated demand for it. PWCS under the Capacity Framework Arrangement (CFA) is responsible for ensuring its port facilities have sufficient capacity to handle the contracted coal throughputs. Where a capacity shortfall is predicted which cannot be accommodated by further expansion of its existing coal export terminals, the CFAsinclude a contractual obligation for PWCS to build a new terminal, that is the T4 Project or its equivalent elsewhere. Construction of a new terminal must be finalised within four years of the capacity shortfall being formally acknowledged. Based on the 2010 take or pay nominations by the coal producers, a capacity shortfall was identified that triggered the need for

[6]Davidson, S. (2014)*Mining Taxes and Subsidies: Official evidence*, A Minerals Council of Australia Background Paper.
[7]Richardson, D. and Denniss, R. (2011)*Mining the truth: The rhetoric and reality of the commodities boom*, prepared for The Australia Institute.
[8]Clark, J., B. Pridmore and N. Stoney. 2007. 'Trends in aggregate measures of Australia's corporate tax level', *Economic Roundup*, Winter, pp 1 – 28)

PWCS to gain approval for and construct a new terminal (the T4 Project) by 2015. Since the Environmental Assessment (EA)was published there has been a reduction in export forecasts; however a capacity shortfall could arise again at anytime in upcoming annual producer nominations and PWCS remains obligated to construct the additional capacity in certain timeframes when this occurs.

- The T4 Project funding is based on commercial arrangements with costs to be recouped via port charges to users. It will only proceed if coal producers require it to meet their export demands, and subject to provisions of the CFAs, project approval and commercial requirements. To build the T4 Project, PWCS will be required to outlay an estimated $4.8 billion in capital expenditure. If it is unviable and not required to meet demand it will not proceed, regardless of any government approval.

2.10 External Costs Not Valued

Assumption

- The BCA was undertaken as a threshold value analysis where the market based benefits are valued in dollar terms and these provide a threshold value that non-quantified and valued environmental costs after offsetting, mitigation and compensation would need to exceed to make the T4 Project questionable from an economic efficiency perspective.

Contention

- TAI consider that unless all external costs and benefits are valued in dollar terms the BCA breaches guidelines.

Response

- The “perfect” BCA is an ideal. Different situations call for different styles and depths of analysis.

- Threshold value analysis is a recognised approach to BCA where there are difficulties in estimating in dollar terms the non-market impacts of development proposals.Threshold value analysis is specifically referred to as an appropriate approach in the Department of Planning and Infrastructure (2002) *Draft Guideline for Economic Effects and Evaluation in EIA*.

- It would be extremely difficult to attempt to identify in physical terms, and value in monetary terms, the potential external impacts that may arise from the T4 Project and upstream mine and rail projects.

- Threshold value analysis has been used many times in NSW Government decision-making processes e.g. Comprehensive Regional Assessments of Native Forestry.

- Threshold value analysis avoids the sometimes contentious matter of physically quantifying environmental impacts and then placing dollar values on them.

- Threshold value analysis leaves the trade-off between quantified and valued economic benefits and unquantified environmental costs for the decision-maker.

- Unquantified environmental impacts in the BCA would include those associated with the T4 Project facility itself as well as mining of coal and transport to Port (after offsetting, mitigation and compensation for impacts).

- The potential upstream impacts of additional coal mining in response to global demand would be subject to detailed merit assessment under the *Environmental Planning and Assessment Act 1979*.

- The potential upstream impacts from additional rail movements are regulated through the Environmental Protection Licence administered by the NSW Environment Protection Authority.

2.11 Potential Health Impacts Not Valued

Assumption

- BCA of the T4 Project was undertaken as a threshold value analysis and hence didn't specifically attempt to estimate in dollar terms the potential health costs arising from expanded coal mining production facilitated by the T4 Project.

Contention

- TAI specifically identified that the mining cost estimates '*make no consideration of the external costs such as reduced air quality and associated damage to human health'*.

Response

- The threshold value analysis leaves the consideration of potential unquantified and unvalued environmental impacts with the decision-maker.

- Individual mining projects would be subject to detailed merit assessments and consideration of any potential health effects.

2.12 Native Vegetation and Biodiversity

Assumption

- BCA of the T4 Project was undertaken as a threshold value analysis and hence didn't specifically attempt to estimate in dollar terms any potential economic costs arising from the clearing of native vegetation and biodiversity.

Contention

- TAI identified that the BCA of the T4 Project does not include values for potential ecological impacts from both mine expansion and the construction of the T4 Project

Response

- The threshold value analysis leaves the consideration of potential unquantified environmental impacts with the decision-maker.

- Individual mining projects and the T4 Project itself are subject to detailed merit assessments and consideration of potential biodiversity impacts. This includes consideration of proposed impact mitigation and offsetting measures.

- From an economic perspective, provided offsets maintain or improve ecological values as required by Government policy there will be no impacts on local or other communities that may hold values for the impacted biodiversity.

2.13 Definition of the T4 Project

Assumption

- The relevant costs and benefits of the T4 Project are those associated with the construction and operation of the T4 Project and the additional coal exports that it will facilitate.

Contention

- TAI considered that the BCA should have included the economic cost of greenhouse gas (GHG) emissions overseas from the burning of coal.

Response

- The BCA of the T4 Project is concerned with the bringing forward of coal mining to meet world demand as a result of the removal of capacity restrictions in the Hunter Valley coal supply chain.

- Coal is an intermediate good i.e. it is an input to other production processes such as production of electricity and steel making.

- Downstream uses of the coal constitute different projects, that themselves can be subject to BCA.

- A separate BCA can be undertaken of downstream uses of coal but this would involve consideration of not only the GHG emissions from the burning of coal in foreign countries but also the other costs and benefits of electricity production and the production of steel in foreign countries.

2.14 Additional Sensitivity Testing

- The BCA of the T4 Project was undertaken for three different scenarios, each reflecting different coal throughputs for T4. The results are summarised below.

Table 1- BCA Results for the T4 Project (Net Present Value at 7% Discount Rate)

	Scenario 1	Scenario 2	Scenario 3
Net Production Benefits	**$13 B**	**$31 B**	**$33 B**
Minimum Australian Net Production Benefits			
Royalties	$2 B	$5 B	$5 B
Company tax	$4 B	$8 B	$9 B
Sub-total	***$6 B***	***$13 B***	***$13 B***

*Totals not exact due to rounding.

- The most conservative scenario (Scenario 1) involved operation of the T4 Project for 19 years – throughput of 1,172 Mt. This is the scenario that additional sensitivity testing has been undertaken on.

- The minimum net benefit to Australia under this scenario is $6B comprising $2B in royalties and $4B in company tax. It is a minimum since it ignores any profits that would accrue to Australia shareholders.

- Additional sensitivity testing for the most conservative scenario (Scenario 1) is undertaken for two different timing assumptions

- **Timing Scenario 1**–the T4 Project is built in 2016 to 2019 with first coal throughput in 2020 and 5 years for throughput to reach capacity. Total throughput is 1,172 Mt; and
- **Timing Scenario 2 –**the T4 Project is built in 2020 to 2023 with first coal throughput in 2024 and 10 years for throughput to reach capacity. Total throughput is 1,172 Mt

- The results under these two different timing scenarios are first reported with same price, cost, royalty and company tax assumptions as in the BCA of the T4 Project. The following assumptions are then changed one by one with the cumulative impact of more conservative assumptions reported:
  - All metallurgical coal is assumed to be lower value semi-soft coking coal at a price of AUD$134/t;
  - A royalty deduction for washing of coal (the largest possible deduction) is included;
  - A company tax rate of 13.9% is assumed; and
  - Mining, transport and port costs are considered under three scenarios, AUD$70/t, AUD$80/t and AUD$90/t.

  The final sensitivity testing relates to the impact of an increase of 10% or 20% in assumed Australian dollar coal prices.

Table 2- Cumulative Sensitivity Testing to Net Production Benefits of the T4Project ($M present value at 7% discount rate)

	Original Assumptions	All Metallurgical Coal PCI at $134/t	Include Royalty Deductions	Company tax rate 13.9%	Mining Cost $70/t	Mining Cost $80/t	Mining Costs $90/t	Price increase by 10%	Price increase by 20%
TIMING SCENARIO 1									
Total Net Production Benefits (NPB)	**$12,749**	**$9,676**	**$9,611**	**$9,611**	**$7,457**	**$5,302**	**$3,148**	**$5,627**	**$8,106**
Minimum Australian NPB									
Royalties	$2,427	$2,160	$2,084	$2,084	$2,084	$2,084	$2,084	$2,292	$2,501
Company tax	$3,856	$2,858	$2,858	$1,324	$974	$624	$274	$648	$1,022
Sub-total	***$6,283***	**$5,019**	**$4,942**	**$3,408**	**$3,058**	**$2,708**	**$2,358**	**$2,941**	**$3,523**
TIMING SCENARIO 2									
Total Net Production Benefits	**$7,611**	**$5,588**	**$5,545**	**$5,545**	**$4,126**	**$2,707**	**$1,288**	**$2,921**	**$4,554**
Minimum Australian NPB									
Royalties	$1,368	$1,217	$1,174	$1,174	$1,174	$1,174	$1,174	$1,292	$1,409
Company tax	$1,873	$1,311	$1,311	$607	$410	$213	$16	$226	$437
Sub-total	***$3,241***	**$2,528**	**$2,485**	**$1,782**	**$1,585**	**$1,387**	**$1,190**	**$1,518**	**$1,846**

- The additional sensitivity testing shows:
  - that even under the cumulative worst case scenario i.e. Timing Scenario 2 for the most conservative coal throughput scenario (Scenario 1 in Table 1), all metallurgical export coal is low value, inclusion of deductions in the estimation of royalties, a company tax rate of 13.9% and mining costs of $90/t, the T4 Project still has considerable net production benefits to Australia i.e. $1,190M.
  - changing the Timing Scenario has the largest impact on the level of net production benefits to Australia from the T4 Project;
  - including an allowance for royalty deductions only has a small impact (3.1%) on royalties to NSW from the T4 Project;

- royalties to NSW are most sensitive to the assumption that all metallurgical coal exported is semi-soft coking coal;
- royalties to NSW are insensitive to changes in assumptions about the company tax rate and mining costs; and
- company tax estimates are highly sensitive to assumptions regarding the company tax rate, the costs of mining and the price of coal.

3.0 MODELLING OF REGIONAL ECONOMIC ACTIVITY

3.1 Introduction

- Modelling of regional economic activity as a result of the construction and operation of the T4 Project was undertaken initially using IO analysis.

- CGE has now also been undertaken of the T4 Project.

3.2 Input-Output Modelling – Throughput Assumptions

Assumption

- Input-output modelling assumes construction over four years and ramping up of throughput to maximum operation of 70 Mtpa over a five year period commencing in 2017.

Contention

- TAI considered that the results of the IO analysis of the T4 Project are misleading due to unrealistic rates of throughput.

Response

- The IO analysis used the same timing and throughput assumptions as for the BCA. See discussion above related to throughput assumptions for the BCA.

- The focus of the IO analysis was on the regional impacts of the maximum year of construction and when the T4 Project is operating at 70 Mtpa throughput. The results are then extrapolated to the construction profile and ramping up profile that is assumed. The results can be adapted to any construction and ramping up profile.

- The modelled throughputs are considered reasonable for a scenario where additional port capacity is required and the T4 Project built.

- The ultimate staging and size of staging will be subject to continued revisions of demand and commercial arrangements with coal producers.

3.3 Input-Output Modelling Methodology

Assumption

- IO analysis is an appropriate methodology for assessment of regional economic activity.

Contention

- TAI considered that IO analysis is an inappropriate method for assessing regional economic activity. TAI refers to criticisms by the Australian Bureau of Statistics (ABS), Productivity Commission and in the Warkworth Judgement and provides a preference for CGEanalysis.

Response

- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics in 1973.

- IO analysis is a cost effective and simple method that is specifically designed for estimating the market economic activity i.e. financial transactions and employment, that is associated within a project at the regional level.

- Because of the assumptions inherent in IO, economic activity estimates represent an upper bound.

- Guidelines that recognise the role of IO in estimating economic activity include:

  - Department of Planning and Infrastructure's draft *Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002)

  - US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*; and

  - Australian Bureau of Rural Science (2005) *Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia*.

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute) have with IO is its use as a substitute for BCA, not its use for estimating direct and indirect regional economic activity impacts:

  - The main *"abuse"* reported by the Productivity Commission is using IO analysis to *"make the case for government intervention"* when BCA is the appropriate method for doing this;

  - ABS's concerns with IO being "biased" refer to it being a "biased estimator of the benefits or costs of a project". A BCA was prepared for theT4 Project to examine benefits and costs;

  - Concerns of the Warkworth Judgement with IO analysis being *"deficient"* related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point), but more fundamentally for not *"assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors".*This is an inappropriate criticism of the IO method, since it does not pretend to do this; and

  - IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested in the Warkworth Judgement.

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project, particularly at the State and National level.At the regional level the system of interdependent behaviour and accounting equations that underpin CGE are mostly without econometric backing.

- A comparison of IO and CGE methods is provided in Attachment 1.

- Both IO analysis and CGE modelling were undertaken for theT4 Project. Both show substantial direct and indirect employment and other economic activity for the Newcastle Region.

- The IO analysis indicated direct and indirect employment in the Newcastle Region during the peak year of construction of the T4 Project at 2,919 compared to 2,500 estimated by CGE modelling.

- The IO analysis indicated direct and indirect employment in the Newcastle Region during the operation of the T4 Project (at 70 mtpa) at 304 jobs compared to 890 to 1,000 estimated by CGE modelling[9].

[9] Great care must be taken in the comparison of IO analysis and CGE modelling at the regional level since the CGE modelling when applied at the regional level also includes the effects of activities undertaken outside the region that have flow-on impacts to the region e.g. in this case coal mining impacts on the Newcastle region as well as the impacts of the construction and operation of the T4 Project itself.IO analysis on the other hand is only estimating regional impacts from the construction and operation of the T4 Project.

4.0 CONCLUSION

- The T4 Project will enable increased coal exports from NSW to meet some of the forecast growth in global demand for coal.

- The need for the T4 Project was triggered under the Australian Competition and Consumer Commission endorsed Capacity Framework Arrangement because of an identified capacity shortfall based the 2010 take or pay nominations by coal producers.

- Since the EA was published there has been a reduction in export forecasts. However a capacity shortfall could arise again at any time in upcoming annual producer nominations and PWCS remains obligated to construct the additional capacity in certain timeframes when this occurs.

- The strategic level BCA undertaken for the T4 Project indicated that there would be considerable net production benefits to Australia and NSW from the T4 Project.

- While the level of these net production benefits are sensitive to the timing of the T4 Project development, the assumed growth in exports, the life of operation of the T4 Project, the coal mix of exports, coal price, coal mining costs, level of royalty deductions and the effective company tax rate, even under cumulative conservative assumptions, the T4 Project would have considerable net production benefits to NSW and Australia – a minimum of $1.2B.

- It should be noted that it is considered highly unlikely that the conservative assumptions would be applicable in unison. The sensitivity analysis adopting cumulative conservative assumptions has been undertaken purely to show there are significant benefits arising from T4 Project even when adopting the most conservative approach.

- Both IO analysis and CGE modelling were undertaken for the T4 Project. Each of these methods has strengths and weaknesses. However, they both show that the construction and operation of the T4 Project will provide direct and indirect regional economic activity to the Newcastle region.

ATTACHMENT 1 – ECONOMIC METHODS – INPUT-OUTPUT ANALYSIS AND COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Input-Output Analysis

- IO analysis is a cost effective and simple method that is specifically designed for estimating the market economic activity i.e. financial transactions and employment, that is associated within a project at the regional level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an input-output table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[10] and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a BCA.
- IO analysis does not attempt to examine nonmarket environmental, social or cultural impacts.
- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested by the LEC.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

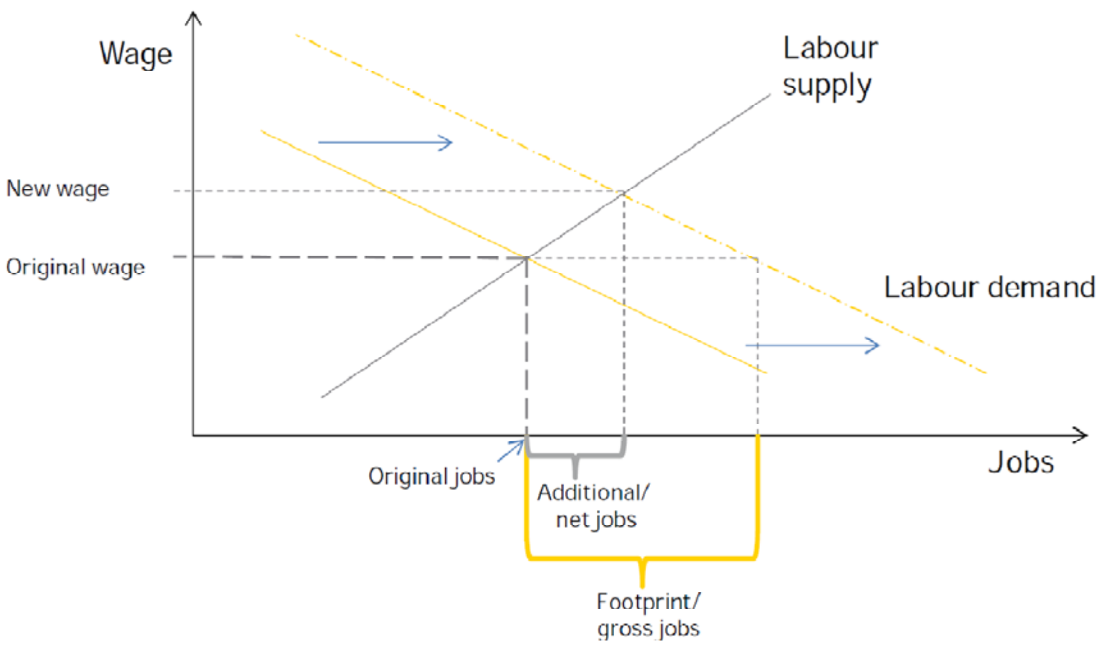
- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.
- The CGE modelling can be dynamic or comparative static[11] and has historically been applied at the State and National level for major policies and developments.

[10] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.
[11] Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

- CGE modelling estimates the additional net (positive and negative) regional economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a BCA, althoughCGE modelling can also be used to estimate market costs or market benefits, as part of a BCA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO.
- CGE modelling does not attempt to examine nonmarket environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

Comparison of IO Analysis and CGE Modelling

Figure 1 – Comparison of Employment Estimates in IO Analysis and CGE Modelling



Source: Ernst Young (2014) Capital Metro Job Creation Analysis, p. 30.

- Figure 1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity[12]. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.

- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and "crowding out" across all other sectors in the economy
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

Government Applications of IO

- Applications of IO commissioned by Government agencies include:
  - Department of Sustainability, Environment, Water, Population and Communities (2011) Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale
  - NSW Natural Resources Commission (2009) River Red Gum Assessment: Socio-economic impact assessment;
  - Victorian Environmental Assessment Council (2007) River Red Gum Forests Investigation – Socio-Economic Assessment.
  - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy.
  - Reserve Bank of Australia (2012) Industry Dimensions of the Resource Boom: An Input-Output Analysis.
  - DECCW (2009) Economic benefits of national parks and other reserves in New South Wales - Summary report, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.
  - DECCW (2006) Socio Economic Assessment of the Batemans Bay Marine National Park
  - DECCW (2006) Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park
  - National Parks Service, US Department of the Interior (2014) 2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation.

[12]This is akin to the marginal assumption in BCA.

Deloitte Access Economics

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Terry Tynan
General Manager Development
Port Waratah Coal services
PO Box 57
Carrington NSW 2294

Thursday, 18 September 2014

Dear Terry,

Economic advice – Terminal 4 Project

Thank you for approaching Deloitte Access Economics (**DAE**) to provide economic advice on the proposed Terminal 4 (T4) Project in Newcastle. You have asked us to provide: high-level comments and feedback on the previous analysis and comments to the Department of Planning and Environment (DP&E).

In particular, you have asked us to:

- Provide high-level advice on the appropriateness of the methodology adopted in the cost benefit analysis and the economic impact modelling (Computable General Equilibrium (CGE) modelling) and interpretation of results presented.
- Comment on whether the results of the impact of the expansion have been undertaken on a reasonable basis.

In providing this advice, we have considered the Director General's requirements for the preparation of the initial environmental assessment and other material (for example, public submissions).

This letter sets out the findings of our work, more specifically potential issues and questions relating to the Cost Benefit Analysis (**CBA**) and Computable General Equilibrium (**CGE**) component in the T4 economic assessment.

To undertake the review we have considered the following documents and materials:

- Economic Assessment (Appendix R) prepared by Gillespie Economics, February 2012.
- Assessment of Modified Design – Economics (Appendix S) prepared by Gillespie Economics, January 2013.
- T4 Project – Response to submissions on preferred project, prepared by EMM, January 2014.
- Terminal 4 Project Submission to the Preferred Project Report, prepared by The Australia Institute, January 2014.
- Economic Assessment of the T4 Project, response to issues raised by the Australia Institute and Additional Sensitivity Testing, prepared by Gillespie Economics, July 2014
- Regional Economic Impact Assessment by CGE Modelling, prepared by Monash University (Appendix B), November 2013 (includes Appendix B).

- Results of technical assessment to assist in determining a voluntary planning agreement, prepared by EMM, April 2014.
- Computable General Equilibrium modelling solution file, as provided by Professor Glyn Wittwer at the Centre of Policy Studies.

Considering the CBA first, the approach used is generally in keeping with good practice. Although selected assumptions used in the modelling may be open to question and debate, this is unavoidable given the nature of the T4 Project. In our view, the sensitivity analysis undertaken in the CBA has been undertaken in an appropriate manner to account for the uncertainties associated with the T4 Project and provides assessment of the benefits of the project. Of particular importance is that the CBA finds net benefits from the project under a wide range of scenarios.

Turning to the CGE modelling, we have identified two issues in relation to the economic impact modelling. The first issue relates to an inconsistency in the specification of the T4 Project in the CGE modelling compared with the CBA. The CGE modelling includes combined capital expenditure at the port as well as up-front capital expenditure at the coal mines that will use the port. The CBA uses an approach to pro-rate the capital expansion at the mines over their operational life. As such, the CGE modelling is likely to give a larger economic impact than would be expected given the results of the CBA. While we do not believe this to be a substantive issue (as it is unlikely to affect the broad conclusions of positive economic effects in both of the analyses).

Second, the economy-wide modelling was reviewed and an error found in relation to estimating the economic impacts estimated. This error was acknowledged by Professor Wittwer in discussions. This error increased the reported Gross Regional Product for Newcastle and the National welfare calculation. DAE was provided with revised CGE modelling, with this error removed. With this error removed, the Gross Regional Product and national welfare measures are reasonable in our view considering the magnitude and nature of the investment being considered. The revised national welfare estimate of $28 billion (NPV using a 7% discount rate; revised down from $35 billion) is again consistent with our calculations.

In conclusion, despite a difference in the treatment of mining capital costs between the CBA and CGE modelling, we believe that the modelling undertaken can be relied upon by decision makers and that the broad conclusion that the project is likely to deliver net economic benefits under a wide variety of scenarios is sound.

Yours sincerely,

S Brown

Steve Brown
Partner
Deloitte Access Economics

Cost Benefit Analysis

Deloitte Access Economics (DAE) undertook a detailed review of the Economic Assessment prepared by Gillespie Economics, submissions on the assessment and subsequent updates to the assessment. This review encompassed the following reports:

- Economic Assessment (Appendix R) prepared by Gillespie Economics, February 2012.
- Assessment of Modified Design – Economics (Appendix S) prepared by Gillespie Economics, January 2013.
- Terminal 4 Project Submission to the Preferred Project Report, prepared by The Australia Institute, January 2014.
- Economic Assessment of the T4 Project, response to issues raised by the Australia Institute and Additional Sensitivity Testing, prepared by Gillespie Economics, July 2014

Our review included underlying spreadsheet models. It should be noted that we did not audit the models developed by Gillespie Economics.

Overall we consider that the approach used by Gillespie Economics is generally in keeping with good practice when undertaking cost benefit analysis (CBA) and provides relevant and reliable information to decision makers.

A primary consideration in reaching this overall conclusion is that the approach to modelling the economic costs and benefits of the T4 Project align with approaches to CBA outlined in the following NSW government documents:

- NSW Treasury (2007), "NSW Government Guidelines for Economic Appraisal"; and
- NSW Department of Urban Affairs and Planning (2002), "Guideline for economic effects and evaluation in EIA".

The task of assessing the economic costs and benefits of the T4 Project is a complex one and involves analysis of the extended coal supply chain from mine to port. The overall methodology of the CBA (comparing different timings of coal production and export) is a reasonable way to assess the complex overall economic benefits of the T4 Project.

The complexity of the task does, however, require a number of forecasts, modelling simplifications and assumptions to be made. These forecasts, simplifications and assumptions are an unavoidable part of conducting this CBA but do open up the possibility for differences of opinion between economists on what the best approach to developing forecasts, making modelling simplifications and formulating assumptions is. For example, there is legitimate ground for debate between economists on issues such as forecast coal prices, the outlook of future demand and coal reserves.

The CBA conducted by Gillespie Economics (and subsequent updates) contains a large range of sensitivity tests that are used to test the responsiveness of the results to changes in forecasts and assumptions. Critically, large ranges of variation in these assumptions do not change the overall conclusion from the CBA: that the T4 Project is likely to result in net economic benefits. For example, DAE adjusted a number of assumptions in the Gillespie Economics modelling to reflect reasonable alternative data sources and found that the project still delivered net economic benefits. We consider that the sensitivity tests conducted by Gillespie Economics are an appropriate way to address uncertainty in forecasts and assumptions and are carried out in accordance with relevant guidelines.

Given the complexity of this CBA, we also consider that it was reasonable to make some modelling simplifications – particularly the pro-rating of mine capital expenditure per tonne of mine production. The consequence of this assumption is that the capital expenditure profile of expanded mining will not align with the likely actual, but unknown, capital expenditure of mining. Given these costs are discounted back to today's dollars in the CBA, this misalignment will understate the cost component of the project in the CBA. In our view, this is not a material issue in relation to the conclusions drawn in this analysis.

We also consider that there are a range of measures being taken by PWCS to mitigate against externalities that are not fully analysed or described in the CBA documents. The document "Results of technical assessments to assist in determining a voluntary planning agreement" prepared by EMM outlines, in detail, the steps PWCS has made to reduce community and environmental impacts. This document could be a ready source of qualitative information to be considered alongside the CBA.

Economic Impact Modelling

As outlined above, the economic impact modelling has been undertaken by Professor Glyn Wittwer from the Centre of Policy Studies (CoPS) at Victoria University.

Professor Wittwer is a reputable economic modeller and CoPS have been at the forefront of Computable General Equilibrium (CGE) modelling in Australia. The centre has developed software and databases that are widely used by government and private-sector consultants including DAE.

The impact analysis uses The Enormous Regional Model (TERM) one of the models that are widely used by CGE modelling practitioners. We understand this model is used by Professor Wittwer in up to ten mining and infrastructure projects per year. The model is maintained by a community of CGE practitioners; it is well documented and has been used in a number of peer-reviewed journal articles.

The modelling applied here uses standard in-house modelling assumptions. The version of the model used has been tailored to the specific needs of the T4 Project, including the regional and industry aggregations. The inputs to the model in relation to the T4 Project are consistent with the CBA in relation to both the investment and operational phases of the project.

That said, there are two matters with the CGE modelling that Deloitte Access Economics has identified with the co-operation of Professor Wittwer.

The first matter relates to the simplification made in the CBA around pro-rating the capital expenditure of mines. This pro-rating has not been adopted in the CGE modelling. Instead, the CGE modelling assumes a large, upfront capital investment in mining in contrast with the smoother, pro-rated CBA capital expenditure path for mining. While this results in an inconsistency between the two approaches, our view is the CGE modelling represents a more realistic investment path and, therefore, impact assessment.

The second matter is that for two components of the CGE analysis, Table2 and Section 2.2, nominal impacts have mistakenly been reported as real impacts, as outlined in Appendix B of the materials provided. This is a substantive error. For example, Table 2 of Appendix B modelling outlines that the project generates $1,206 million in value added in 2035. But DAE estimates the impact is closer to $600 million when reported in real terms.

The error has been identified by Professor Wittwer in correspondence and has been addressed in revised modelling provided to DAE. These revised modelling results have appropriately addressed the issue of reporting nominal impacts as real. The modelled impact to NSW Gross State Product is reasonable and broadly consistent with results DAE would expect. Similar results (i.e. regional product) for Newcastle, the Hunter and the Rest of NSW are also consistent with our expectations. In addition the revised national welfare estimate of $28 billion (NPV using a 7% discount rate) is again consistent with our calculations.

References

NSW Department of Urban Affairs and Planning (2002) "Guideline for economic effects and evaluation in EIA", http://cmsdata.iucn.org/downloads/11_guideline_for_economic_effects.pdf

NSW Treasury (2007) "NSW Government Guidelines for Economic Appraisal", http://www.treasury.nsw.gov.au/__data/assets/pdf_file/0016/7414/tpp07-5.pdf

PORT WARATAH
COAL SERVICES

18 September 2014

Mr Paul Forward
Chair
NSW Planning Assessment Commission
GPO Box 3415
SYDNEY NSW 2001

Dear Mr Forward

Following the recent PAC public hearings Port Waratah Coal Services would like to clarify some of the issues raised and in particular provide further detail in respect of the economic assessment for the T4 Project.

As part of the T4 Project, Port Waratah engaged Gillespie Economics to undertake a rigorous assessment of the economic value of the project using the NSW Government preferred 'input output model'. This work was done in compliance with the relevant Government polices and was peer reviewed by Professor Jeff Bennett who confirmed the T4 Project resulted in significant economic benefits to the Newcastle region and the NSW economy.

Following submissions by third parties (for example, The Australia Institute) regarding the type of model used by Gillespie Economics, Port Waratah engaged Professor Glyn Wittwer from the Centre of Policy Studies at Monash University to undertake further modelling of the economic benefits of the project using a 'computable general equilibrium (CGE) model'. The results of this modelling again confirmed there would be significant economic benefits to Newcastle and the NSW economy resulting from the T4 Project.

To further support the economic assessment work undertaken to date, Gillespie Economics has also rerun the 'input output model' adopting what are considered conservative assumptions which were suggested by The Australia Institute as being more appropriate. This modeling still indicates significant economic benefits from the T4 Project for Newcastle and the NSW economy even with the adoption of these conservative assumptions.

Notwithstanding this, and considering further concerns have been raised more broadly regarding economic assessments of major mineral resources projects, Port Waratah sought to have all economic assessment work of the T4 Project peer reviewed again by another independent expert. Deloitte Access Economics (DAE) was engaged in July 2014 to review this work and provide comment on its appropriateness for use in assessing the economic benefits of the T4 Project. DAE has supported the economic modeling undertaken to date, however it did identify a minor error in the CGE modelling which has since been rectified by Monash University and has not resulted in any significant impact on the results of this modelling.

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Accordingly Port Waratah wishes to submit to the PAC the following further information:

- Independent review of the T4 Project economic assessments by DAE (September 2014).
- "Economic Assessment of the T4 Project – Response to Issues Raised by the Australia Institute" by Gillespie Economics (July 2014).
- "The Regional Economic Impacts of the T4 Project in Newcastle" by Glyn Wittwer, Monash University (September 2013) – updated CGE modelling.
- "T4 Project - Results of technical assessments to assist in determining a voluntary planning agreement" by EMM (April 2014).

Port Waratah believes economic modelling of projects of this nature are a tool (one of many) for the decision maker to consider in assessing the impacts and benefits of projects. The work completed by Port Waratah demonstrates that regardless of what model is used, or how these are used, the T4 Project is likely to lead to significant economic benefits to the Newcastle region and the NSW economy.

In addition to the above, Port Waratah also wishes to provide further clarification on the following issues which were raised at the PAC public hearing:

- **Trains through Tighes Hill and Mayfield** - Many residents from Tighes Hill and Mayfield highlighted concerns regarding the perceived increased impacts in these suburbs from trains transporting coal as a result of the T4 Project. Port Waratah wishes to clarify that trains bound for the T4 Project will turn off the main track between Sandgate and Warrabrook and will not run through the inner Newcastle suburbs of Warrabrook, Mayfield, Tighes Hill or Mayfield East. Only trains servicing the Carrington Coal Terminal (CCT), which has been in operation for over 40 years, run through these inner city suburbs, and there is no proposal to increase the capacity of this existing terminal. The T4 Project will not result in any additional trains passing through Tighes Hill or Mayfield.
- **Alleged 75 breaches of CCT EPL** - Media reports and presentations during the hearings alleged that Port Waratah had breached its environment protection licence (EPL) at CCT 75 times over recent years. The 75 instances referred to relate to the reporting of stormwater overflows occurring at the CCT and are reported as required by the EPL during times of heavy or prolonged rainfall. These are not breaches of the CCT EPL. CCT has entered into pollution reduction program in respect of these discharges and continues to manage its CCT operations in accordance with changing regulatory and community expectations.
- **VPA Negotiation with Council** - Newcastle City Council, whilst supporting the project, raised the need for a full 1% project value contribution levy to be applied under Section 94 of the Act, in the event that agreement on suitable voluntary planning agreement (VPA) cannot be reached between Council and Port Waratah. Port Waratah has also provided a detailed report to Council and the Department of Planning and Environment in regard to T4 impacts on Council services and Infrastructure, which the report assesses as being minimal. While Council has stated that in their view Port Waratah underestimates these impacts, they are yet to substantiate this position.

  Despite this, Port Waratah has participated in a number of meetings with Council in a bid to negotiate a VPA and has proposed terms and a developer contribution which would not only mitigate any impacts but also deliver community benefits that substantially exceed any potential impact on Council services and infrastructure.

  PWCS is not aware of any such occasion whereby a project development to the scale of T4 has incurred a 1% contribution levy. A recent example in Newcastle is the NCIG coal terminal development which did not incur any development contribution. Copies of correspondence to Newcastle City Council are attached outlining our desire to contribute funding independent and additional to that amount identified by the Department of Planning and Environment in their draft conditions of approval as the required development contribution. Also attached is a copy of our report outlining impacts on Council services and infrastructure as a result of the T4 Project. PWCS is committed to continuing negotiations with Council with the aim of reaching agreement on a VPA terms that meet the needs of both parties.

Thank you for the opportunity to provide the above mentioned information and reports which we trust will assist you in your deliberations.

Kind regards

per.

Terry Tynan
General Manager Development

Appendix 4

EMM
EMGA Mitchell McLennan

T4 Project

Results of technical assessments to assist in determining a voluntary planning agreement

Prepared for Port Waratah Coal Services | 11 April 2014

Planning + Environment + Acoustics

Appendix 4

T4 Project

Results of technical assessments to assist in determining a voluntary planning agreement

Prepared for Port Waratah Coal Services | 11 April 2014

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T4 Project

Final

Report J11011RP8 | Prepared for Port Waratah Coal Services | 11 April 2014

Prepared by	**Rachael Russell**	Approved by	**Brett McLennan**
Position	Environmental Planner	Position	Director
Signature		Signature	
Date	11 April 2014	Date	11 April 2014

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1 Introduction

1.1 General

The purpose of this report is to provide information on the likely residual impacts of the T4 Project to form a basis for negotiations on a voluntary planning agreement (VPA) between Port Waratah Coal Services Limited (PWCS) and Newcastle City Council (NCC). Residual impacts are the impacts of the T4 Project after accounting for proposed mitigation measures and offsets.

1.2 Background

PWCS proposes to construct and operate a new coal export terminal at the Port of Newcastle, New South Wales (NSW). The proposal, known as the Terminal 4 Project, or T4 Project, will provide additional port capacity required to accommodate future growth in coal exports from the Hunter Valley and NSW more broadly. PWCS owns and operates the Kooragang Coal Terminal (KCT) at Kooragang Island and Carrington Coal Terminal (CCT) at Carrington, both in the Port of Newcastle. The T4 Project is essentially an extension to KCT.

Approval for the T4 Project is being sought under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).The consent authority under Part 3A is the NSW Minister for Planning and Infrastructure, although in this instance, this responsibility will be delegated to the NSW Planning Assessment Commission (PAC).The Part 3A process under the EP&A Act has also been accredited as the appropriate Commonwealth assessment pathway for the project.

As part of the T4 Project's approval process an environmental assessment (EA) was prepared by EMGA Mitchell McLennan Pty Limited (EMM), with input from various external specialists. It was prepared in accordance with the requirements of the Commonwealth Department of the Environment (DoE), NSW Planning and Infrastructure (P&I) and other government agencies, as given in the Director-General's Requirements (DGRs) issued on 14 March 2011, letter clarification dated 17 May 2011 and supplementary DGRs issued on 21 September 2011.

The EA was publicly exhibited between 8 March and 7 May 2012. In response, PWCS received 488 submissions, including a large number of form letters and multiple submissions from some respondents. Most of the submissions were from objectors to the project though some supporting submissions and general comments were received. All submissions were reviewed and issues raised were summarised and responded to in a combined response to submissions and preferred project report (RTS/PPR).

Following exhibition of the EA, the T4 Project's design was also modified. Modifications were made in response to submissions and government feedback, to further minimise environmental impacts, to reflect the reduced maximum proposed coal throughput capacity from 120 million tonnes per annum (Mtpa) to a nominal 70 Mtpa, and to incorporate engineering improvements and the biodiversity offset package. Accordingly, the RTS/PPR responded to submissions; described the 'preferred project', inclusive of modifications since the EA was published; assessed the environmental impacts of the modifications; and provided a revised statement of commitments for environmental management, mitigation and monitoring.

The RTS/PPR was publicly exhibited between16 September and 22 November 2013. In response, approximately 995 submissions were received, including a large number of form letters and multiple submissions from some respondents. Most of the submissions (approximately 619) were in support of the T4 Project. Objecting submissions mostly raised similar matters to those in the submissions on the EA, which it is considered are adequately addressed in the RTS/PPR. However, DP&I identified 29 matters which it requested PWCS provide responses to. Responses to those matters were provided in a 'RTS on Preferred Project 'report.

1.3 Overview of assessment reports prepared

A suite of reports have been prepared to support the T4 Project's approval process under the EPBC and EP&A Acts, several of which are referenced in this report. As background information, an overview of the assessment reports prepared to date is provided below. The T4 Project's design, including the proposed environment management, mitigation and monitoring measures, has been progressively refined throughout this process, including to incorporate outcomes of the technical assessments. This has included developing a comprehensive biodiversity offset strategy and package.

The main reports prepared to support the T4 Project's approval process are as follows:

- A **Preliminary Environmental Assessment Report** prepared by EMM (2010) to accompany PWCS's project application under Part 3A of the EP&A Act, brief relevant stakeholders about the project, provide a preliminary assessment of potential environmental impacts and identify key aspects to focus on in the EA.

- A **Referral of proposed action** to the then Commonwealth Department of the Environment, Water, Heritage and the Arts (now DoE), prepared by EMM (2011). It was prepared to inform the Environment Minister's decision on whether approval under the EPBC Act is necessary and if so, the type of assessment required. The referral provided details on the proposed action, existing environment, likely impacts on matters of national environmental significance (MNES), and measures proposed to avoid or reduce impacts. It concluded that the proposed action is likely to have a significant impact on MNES and is therefore a controlled action.

- An **Environmental Assessment** prepared by EMM (2012) to provide information about the T4 Project, assess its potential environmental, social and economic impacts, and detail the measures proposed to mitigate, manage and/or monitor potential impacts. The EA was prepared in consultation with government agencies and other stakeholders and in accordance with the relevant guidelines and policies. It addressed the relevant assessment requirements set out in the DGRs. It included detailed contamination, groundwater, flooding, hydrodynamic, surface water, ecology, noise, air quality, greenhouse gas (GHG), traffic, visual, heritage, economic and social assessments by experts in these fields. The technical assessments were prepared over several years and included environmental sampling and monitoring, quantitative modelling by industry experts and development of environmental management, mitigation and monitoring measures in consultation with relevant stakeholders.

- A combined **Response to Submissions/Preferred Project Report** prepared by EMM (2013) to respond to submissions on the EA and assess the project changes made after the EA's publication, which were mentioned in Section 1.1. The following studies prepared after the EA were also appended to the RTS/PPR:

- a review of air quality-related health effects, prepared by Associate Professor David McKenzie, the Head of the Department of Respiratory and Sleep Medicine at the Prince of Wales Hospital, and Director of the Cardiac and Respiratory Clinical Stream of the South-Eastern Sydney Local Health District;

- reports relating to contamination management and remediation, prepared by groundwater and contamination specialists at Douglas Partners and project design engineers at Aurecon Hatch, including a landfill closure plan, remediation action plan (pre-detailed design) and containment cell design report;

- an updated impact mitigation and biodiversity offset strategy prepared by ecologists at Umwelt, and including assessments of the strategy's adequacy using the NSW Government's BioBanking Assessment Methodology (BBAM) and the Commonwealth's EPBC Offsets Calculator;

- an Environmental Impact Assessment (EIA) of the proposed habitat restoration and creation works at the biodiversity offset site at Tomago, prepared by Umwelt; and

- an engineering review of alternative project designs that may better protect green and golden bell frog (*Litoria aurea*) habitat, prepared by the design engineers Aurecon Hatch, with input from technical specialists including ecologists.

• A **RTS on Preferred Project** which outlines submissions received on the RTS/PPR and responds to those matters indicated by P&I as requiring a response.

1.4 Overview of the T4 Project

The T4 Project is unchanged from the description given in the RTS/PPR and RTS on Preferred Project. A brief outline of the project is provided in this section and the indicative site layout plan is provided in Figures 1.1 and 1.2. The Tomago offset site and a concept design for the restoration project proposed there is shown in Figure 1.3.

The T4 Project application area is described in detail in the EA and RTS/PPR. In summary it comprises the:

- proposed coal terminal site on Kooragang Island and wharves and berth pockets in the Hunter River South Armin the Port of Newcastle('T4 project area'); and

- biodiversity offset site at Tomago ('Tomago offset site').

The T4 project area is located within the Newcastle local government area (LGA). The Tomago offset site is located within the Port Stephens LGA.

The T4 Project is proposed to be developed progressively in response to demand for increased coal export capacity nominated by coal producers and would provide a nominal coal throughput capacity of up to 70 Mtpa. This is in addition to PWCS's existing approved capacity of 120 Mtpa at KCT and 25 Mtpa at CCT, and would give PWCS a total approved capacity of 215 Mtpa. The project's design allows for future stockyard and rail receival expansion within the T4 project area to achieve a nominal capacity of 120 Mtpa when required by demand. Further expansion to increase throughput capacity beyond 70 Mtpa would be subject to future assessment and approval under the relevant legislation.

Appendix 4

Source: Aurecon Hatch, 2013; SMEC, 2013

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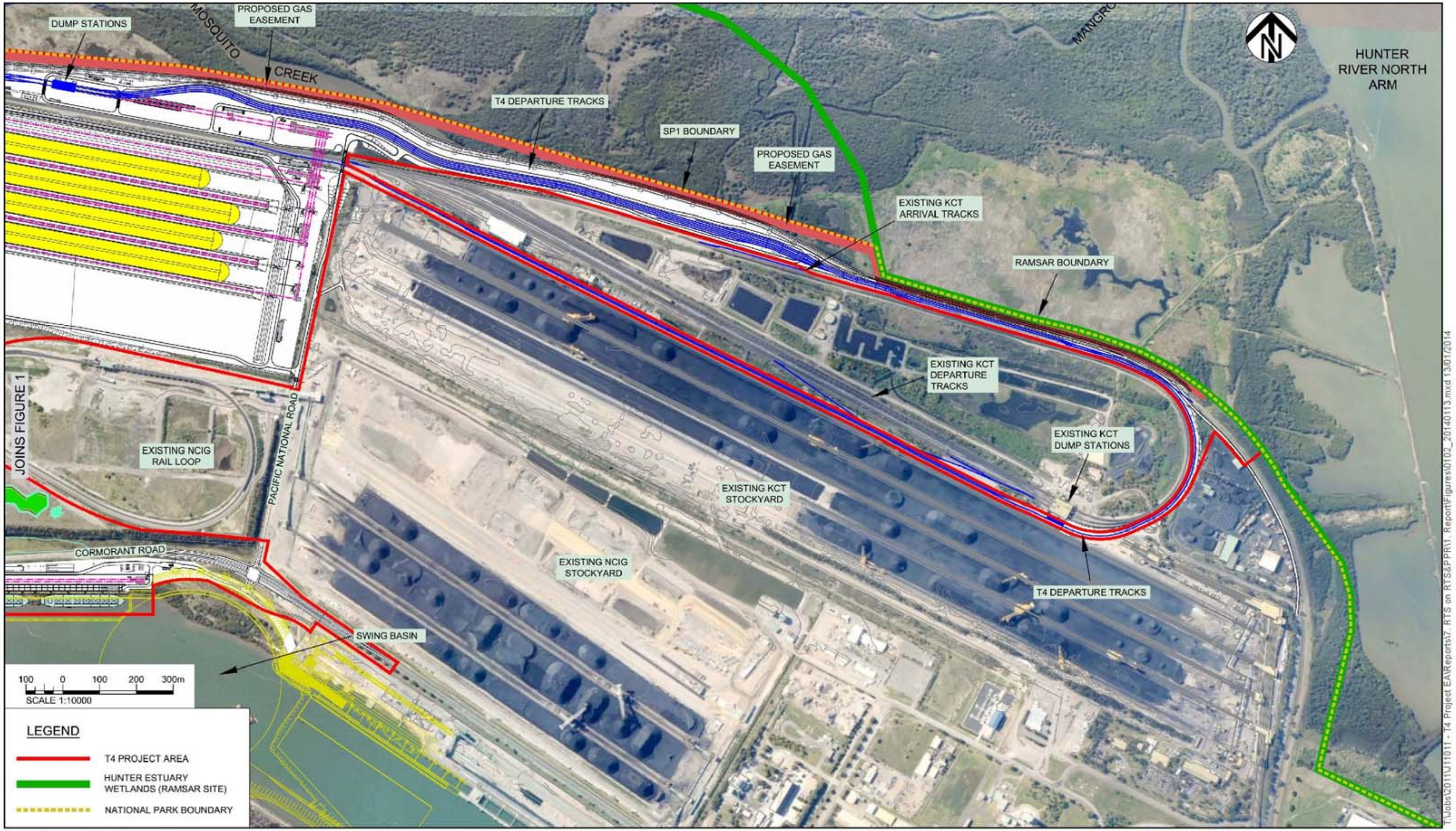
PORT WARATAH COAL SERVICES

T4 Project (indicative layout) - western view

FIGURE 1.1

Appendix 4



Source: Aurecon Hatch, 2012; SMEC, 2013

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T4 Project (indicative layout) - eastern view

FIGURE 1.2

Appendix 4

Source: IDS, 2012; Umwelt, 2012

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PORT WARATAH COAL SERVICES

Tomago offset site - restoration project concept design

FIGURE 1.3

All coal will be received by rail, stockpiled and then shipped to market. The T4 Project is subject to detailed design and will be further refined, however generally it includes the following:

- **Site preparation:** ground treatments including preloading will take place to create suitable foundation conditions for development. Sand dredged from the Hunter River South Arm will be pumped to the proposed stockyard area, to provide preload and fill. This will be supplemented by imported fill such as sand, gravel and rock, trucked in from elsewhere. Contamination management and remediation works will be undertaken including capping, barrier walls and pumping out and treating some contamination.

- **Rail infrastructure and coal receival:** rail infrastructure will comprise up to four arrival tracks generally along the same alignment as the existing rail lines servicing Kooragang Island. These tracks will converge into up to two dump stations, where coal will be unloaded from trains. There will be up to four departure sidings, which will combine into a single track around the outside of KCT's rail loop, leading to Kooragang Island's departure track over the Hunter River rail bridge.

- **Coal stockyard and stockpiles:** a relatively level stockyard with benches and berms will be constructed following ground treatments. There will be up to four coal stockpile pads, oriented in an east west direction, and yard machines for stacking and reclaiming coal.

- **Wharf and berth infrastructure:** wharf and berth facilities are proposed on the north side of the Hunter River South Arm, near the Tourle Street Bridge. Up to two shiploaders and berthing for up to three ships is proposed.

- **Conveyors:** coal conveyors, feeders and transfer stations will extend through the stockyard to deliver coal from the dump stations to the stockpiles, and then to the shiploaders at the wharf, via buffer bins.

- **Infrastructure and services:** new infrastructure will be constructed including roads, electricity supply, dust suppression and fire fighting systems, fences, amenities, landscaping, car parks and water management infrastructure. Some existing infrastructure and services will be relocated such as electricity transmission lines, water lines, fibre optic cable and Jemena's gas lines. Existing KCT infrastructure, systems and workforce, including administration, stores and maintenance facilities and environmental management and monitoring systems, will also be used.

- **Environmental management, mitigation and monitoring:** a comprehensive suite of environmental management, mitigation and monitoring measures, equipment and systems will be in place. This will include, but not be limited to, real-time monitoring of particulate matter; green and golden bell frog habitat ponds across the site; biodiversity offsets at Ellalong Lagoon and next to Brundee Swamp Nature Reserve; and habitat restoration and creation works at a biodiversity offset site at Tomago, adjoining the Hunter Wetlands National Park and Hunter Estuary Wetlands Ramsar site. The offset sites at Ellalong Lagoon and next to Brundee Swamp Nature Reserve are located within the Cessnock and Shoalhaven LGAs, respectively.

- **Workforce:** a construction workforce of up to an estimated 1,500 people is proposed. The T4 Project will be operated by PWCS's existing workforce and approximately 80 additional employees, supported by contractors as required.

Further details on the proposed T4 Project are provided in the EA, the RTS/PPR and RTS on Preferred Project report.

1.5 Purpose of this report

NCCs *Section 94A Development Contributions Plan 2009* (the 'Section 94A Plan'), which was updated in April 2013, sets out provisions for the payment of ‘developer contributions’ to offset the costs of the council providing social infrastructure generated as a result of demand from development.

Under the Section 94APlan, levies are generally applied at a fixed rate depending on the costs of the development. Under Part A of the plan, which relates to the whole of the Newcastle LGA except Blue Gum Hills and the Newcastle City Centre, development which exceeds $200,000 is required to pay a maximum levy of 1% of the cost of the development.

Calculation of contributions based on levies of this nature are unsuited to large developments such as theT4 Project as the levies are generally not commensurate with the demand they generate and do not account or credit community facilities or amenities provided by the proponent. This is recognised in clause 17 of the Section 94APlan which provides for voluntary planning agreements (VPAs) to be negotiated between a proponent and council. Clause 17 states:

> If an applicant does not wish to pay the section 94A levy applicable to their development they may offer, instead, to enter into a voluntary planning agreement with Council under section 93F of the *Environmental Planning and Assessment Act 1979* in connection with the making of a development application or in an application for a modification under section 96 of the Act.
>
> The applicant’s provision under a planning agreement may be additional to or instead of paying a levy in accordance with a condition of development consent authorised by this plan. This will be a matter of negotiation with Council. The offer to enter into the planning agreement together with draft agreement should accompany the relevant development application.

VPAs are regulated under section 93F to 93L of the EP&A Act and clauses 25B to 25H of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). Clause 93F(1) of the EP&A Act states that a VPA is:

> ...a voluntary agreement or other arrangement under this Division between a planning authority (or 2 or more planning authorities) and a person (the developer):
>
> (a) who has sought a change to an environmental planning instrument, or
>
> (b) who has made, or proposes to make, a development application, or
>
> (c) who has entered into an agreement with, or is otherwise associated with, a person to whom paragraph (a) or (b) applies,
>
> under which the developer is required to dedicate land free of cost, pay a monetary contribution, or provide any other material public benefit, or any combination of them, to be used for or applied towards a public purpose.

Clause 93F(2) states that a public purpose includes (without limitation) any of the following:

> (a) the provision of (or the recoupment of the cost of providing) public amenities or public services,
>
> (b) the provision of (or the recoupment of the cost of providing) affordable housing,
>
> (c) the provision of (or the recoupment of the cost of providing) transport or other infrastructure relating to land,
>
> (d) the funding of recurrent expenditure relating to the provision of public amenities or public services, affordable housing or transport or other infrastructure,

(e) the monitoring of the planning impacts of development,

(f) the conservation or enhancement of the natural environment.

Accordingly, while a public purpose generally relates to matters such as provision of (or paying for) public amenities, services, housing, transport and infrastructure, it also relates to conservation and enhancement of the environment.

PWCS stated in the sections 13.3.3iii and 14.4.5iii of the PPR/RTS that it is open to considering negotiating a VPA with NCC that accurately represents the agreed increase in demand for public amenities and public services within the area, caused by the T4 Project.

The purpose of this report is to provide information on the likely residual impacts of the T4 Project to form a basis for negotiations on a VPA between PWCS and NCC. The report relies on the technical assessments prepared to inform the EA and RTS/PPR, including assessments for the following aspects:

- groundwater and contamination;
- surface water and flooding;
- ecology;
- noise and vibration;
- air quality;
- greenhouse gas (GHG);
- transport and access;
- visual;
- heritage;
- economics; and
- social.

For most of these aspects, information is provided on:

- relevant baseline environmental conditions;
- the results of the technical assessment;
- proposed mitigation measures and offsets to ameliorate any potential impacts; and
- likely residual impacts taking into account the mitigation measures and offsets.

Appendix 4

2 Groundwater and contamination

2.1 Introduction

Groundwater and contamination assessments were prepared by Douglas Partners for the EA. The groundwater assessment was independently reviewed by Dr Bill Ryall. The assessments were used to determine remediation requirements and options to effectively manage site contamination during and following development. Updated assessments were also prepared by Douglas Partners for the RTS/PPR to assess the modified T4 Project design.

2.2 Baseline conditions

Subsurface investigations indicate that the T4 project area typically comprises fill material (waste and dredged material) overlying silty clay, silt, sand, silty sand, sandy clay, clay and siltstone. Acid Sulphate Soil (ASS) screening tests and detailed analytical testing of soil samples done as part of the EA found that the natural soils and sediments within the T4 project area are potential ASS.

Soils in the T4 project area have elevated concentrations of a range of contaminants, reflective of past waste emplacement, reclamation and filling. Fill includes material dredged from the Hunter River and waste from the former BHP Billiton steelworks and subsidiaries, including coal washery reject, slag, coal fines, oil/tarry sludge, clayey silt filter cake, kiln wastes, cell scale (gypsum and manganese dioxide), asbestos, basic oxygen steel-making (BOS) flue dust and lime sludge.

Groundwater beneath the T4 project area is contained in an upper unconfined aquifer in the fill material, and a generally confined aquifer within the underlying estuarine sediments separated by a clay aquitard. Groundwater, primarily within the upper unconfined aquifer, interfaces with surface water bodies in and around the T4 project area. Groundwater beneath the T4 project area has elevated concentrations of a range of contaminants, reflective of past waste emplacement, and closely linked to soil contamination. Groundwater pH and concentrations of metals (primarily manganese) and polycyclic aromatic hydrocarbons (PAHs) exceeding ANZECC (2000) trigger levels for protection of slightly to moderately disturbed aquatic ecosystems have been recorded across most of theT4 project area.

There are three licensed groundwater bores identified on Kooragang Island, between 1.5 and 2.3 km east of the proposed stockyard area, within Kooragang Island's industrial area. Groundwater dependent ecosystems (GDEs) in and around the T4 project area are saltmarsh and mangrove forest communities located along the Hunter River South Arm and the northern and western edges of the T4 project area.

2.3 Impact assessment

There is low level contamination with industrial residues across the T4 project area, and localised areas where contaminants are more concentrated. Soil contaminants include metals, hydrocarbons (total PAHs, benzo(a)pyrene, total recoverable hydrocarbons), BTEX (benzene, toluene, ethyl benzene, total xylenes) and elevated pH.

The project has been designed to minimise disturbance of contaminated materials with limited excavation. General contamination across the T4 project area will be adequately managed by the monitoring and capping strategies currently approved by the Office of Environmental and Heritage (OEH) for the Kooragang Island Waste Emplacement Facility (KIWEF) and Delta EMD site under Environment Protection Licences (EPLs) 6437 and 7675. The T4 Project is consistent with these strategies and will provide a low permeability sealing layer across the site that would be equivalent or superior to the approved capping.

The 'loading' with fill material and infrastructure and the associated 'squeezing' of the soil profile is likely to cause short-term increases in groundwater flows (horizontal and vertical), which could temporarily increase leaching of soil contaminants and the rate of contaminated groundwater movement towards surface water bodies. To mitigate these effects and manage groundwater contaminants, a number of measures are proposed as detailed below.

Modelling results show that, with the proposed mitigation measures, off-site contaminant levels will not increase to an extent that would threaten environmental values or human health. The proposed mitigation measures will improve the long-term environmental condition of the T4 project area and surrounds by addressing risks associated with the existing contamination.

Some saline water from the Hunter River will infiltrate to groundwater when dredged material is placed across the T4 project area. With the proposed mitigation measures in place, the changes in salinity levels in ponds and wetlands outside the footprint of T4 Project infrastructure will be insignificant. These water bodies experience natural fluctuations in salinity that will continue to occur with the T4 Project. There will be some saline inflows to tidal flats to the north, but these are naturally saline due to tidal influences.

No significant changes to water levels at surface water bodies surrounding the T4 project area are anticipated as the levels are mainly controlled by rainfall, evaporation and tidal inundation, not by groundwater.

When ground preparation is completed, capping will reduce rainfall infiltration and groundwater flow rates and levels, resulting in a decrease in the flux of contaminants. This is a beneficial outcome and will reduce long-term risks posed by contaminants in the T4 project area.

The T4 Project will not impact the three bores on Kooragang Island licensed for irrigation and industrial use.

2.4 Mitigations

PWCS has committed to the following contamination and groundwater mitigation and management measures for the T4 Project:

- Contamination remediation and management measures will be implemented in accordance with a remediation action plan (RAP). The preferred options, based on current available information, are as follows, though are subject to detailed design:
    - Construction of a barrier wall (soil-bentonite or similar) to contain tar waste at Ponds 5 and 7, founded within the clay aquitard (subject to detail design).
    - Installation of permeable reactive barrier (PRB) along the northern side of Area K7 and the northern and eastern sides of the Fines Disposal Facility (FDF), founded within the clay aquitard (subject to detailed design).

- Extraction of LNAPL contamination at Site B (in the vicinity of Well B-01) using a suitable extraction method such as multi-phase extraction. Alternative methods for source removal could also be considered subject to the results of future remediation trials. Responsibility for implementing the extraction will be determined in consultation with the Environment Protection Agency (EPA). Remediation of the dissolved-phase plumes associated with the LNAPL source zones will be by Monitored Natural Attenuation, with contingencies for active remediation in the event that the plumes approach sensitive ecological receptors such as surface water bodies.

- Installation of a cap nominally 0.5 m thick with permeability ≤ 1x10-8 m per second or equivalent such as a geosynthetic clay liner (GCL), over the existing surface at the Delta EMD site, prior to emplacing dredge material.

• Mitigations will be in place during dredge material emplacement to minimise the risk of saline dredge water infiltrating to sensitive ecological receptors, as follows (subject to detailed design):

  - Construction of a low permeability barrier wall on the northern and western sides of Deep Pond before dredge material emplacement, to reduce the migration of saline dredge waters through the rail embankment towards wetlands to the west and north-west.

  - Construction of a low permeability barrier along the southern side of Easement Pond to reduce the migration of saline dredge water to wetlands to the south.

  - Installation of a liner or equivalent around the southern end of the dredge decant pond (located at the southern-central portion of Deep Pond), prior to emplacing dredge material.

• A cap nominally 0.5 m thick, with permeability ≤ 1x10-8 m per second (or equivalent) will be constructed over the majority of the T4 project area, details of which will be confirmed during detailed design.

• Detailed assessment, design and pricing of contamination management and remediation options will be undertaken, including supplementary targeted investigations and remediation trials to confirm the measures to be implemented. Once the measures have been finalised, and following detailed design, the RAP will be updated to include the final contamination management and remediation measures. The RAP will include a remediation schedule, validation testing programme and contingency measures. Relevant reviews will be undertaken by an EPA accredited auditor during investigations, remediation trials and final RAP preparation. The RAP may be finalised in stages, for the respective contamination management and remediation measures. The final RAP(s) will be reviewed by the auditor and a site audit statement report(s) prepared prior to starting the management/remediation work it relates to.

• Landfill closure will be undertaken in accordance with an EPA-approved landfill closure plan(s).

• Health protection requirements during construction will be included in the a construction environment management plan (CEMP), site occupational health and safety (OHS) safety plan and Work Method Statements. They may include use of specific personal protective equipment (PPE) and procedures in areas where contaminants may exceed the safe threshold values, and use of exclusion zones where appropriate. As soon as possible after site works commence, quantitative exposure assessments will be carried out by an occupational hygienist. Based on the results, PPE requirements may be varied.

- The new rail embankment will be designed to minimise effects on groundwater flows, including to OEH Wetland 1 and Railway Road Pond.

- Excavated material will be managed through a materials management plan (MMP), which will be part of the CEMP. The MMP will include reuse and disposal specifications for excavated material. Depending on its classification, excavated material may be re-used as general fill, placed in a purpose-built containment cell(s) within the T4 project area, or classified to the EPA's Waste Classification Guidelines, treated (if required) and disposed of at an appropriately licensed facility off-site.

- A detailed site selection and design process will be undertaken for a containment cell(s) within the T4 project area before construction starts. This will include further geotechnical work to define the volume of material to be deposited in the containment cell(s) and the most appropriate ground improvements. The containment cell will satisfy EPA requirements for containment of waste material.

- An ASS management plan (ASSMP) will be developed and implemented for any dredged material brought to site and for disturbance of any potential acid generating materials (coal reject materials or potential acid sulphate soils (PASS)). The ASSMP will form part of the CEMP and will include routine pH monitoring of dredged materials and dredge return water, contingencies for treatment if required, and proven measures to neutralise any acid generation from PASS disturbed during earthworks, such as lime treatment.

- Groundwater and surface water monitoring plans will be developed and implemented for the T4 Project's construction and operations, as part of the CEMP and environmental management system (EMS). This will include water quality monitoring to assess the effectiveness of the controls and identify any requirements for additional mitigations. Monitoring will include:

  - groundwater salinity upstream of BHPB Wetlands, Blue Billed Duck Pond, OEH Wetland 1 and Railway Road Pond during construction;

  - water levels at OEH Wetland 1 and Railway Road Pond during construction;

  - groundwater quality on both sides of the PRBs and potentially around the containment cell(s); and

  - monitoring to assess if contaminants are entering the T4 project area from adjacent areas.

  Measures will be in place for monitoring and maintaining contamination remediation and management structures, including the caps, to ensure their effectiveness.

Subject to detailed design, the following mitigations will be in place to minimise the risk of aquifer connectivity:

- diaphragm walls (or similar) and jet grouted (or similar) floors or walls keyed into the deep clay, for dump station and conveyor tunnel excavations which penetrate into the Estuarine Aquifer;

- horizontal directional drilling for installation of the gas pipeline, will be considered thereby minimising the extent of excavations (subject to geotechnical conditions being suitable); and

- sheet pile walls founded in the clay aquitard material to limit groundwater ingress to excavations below the water table.

2.5 Residual impacts

The management and remediation strategies proposed are extensive and have been designed to meet regulatory requirements and ensure that the T4 Project can be constructed and operated in a manner that protects human health and the environment. The T4 Project provides an opportunity to reduce the existing contamination risks, including risks to the adjacent wetlands and the Hunter River, and contribute to the responsible development of an area that is heavily contaminated.

Should the management and remediation strategies be adopted, there are likely to be no adverse residual impacts to public amenity or services in relation to contamination and groundwater.

Appendix 4

3 Surface water and flooding

3.1 Introduction

Surface water and flooding assessments of the T4 Project were undertaken by SMEC and WorleyParsons, respectively for the EA. These assessments were updated for the RTS/PPR.

3.2 Baseline conditions

The T4 project area is within the Lower Hunter Estuary of the Hunter River catchment. The Hunter River is classed as a 'waterway affected by urban development'. At the T4 project area, Kooragang Island divides the Hunter River into two arms, referred to as the north and south arms. The T4 Project's wharf and berth facilities are proposed to be developed on the south bank of the Hunter River South Arm. At this location the Hunter River South Arm has a channel width of between 230 and 350 m and channel depth of approximately -2 to -4 m AHD.

The channel is proposed to be deepened to create navigable shipping channels berth pockets adjacent to the foreshore. The dredging works will be undertaken by PWCS under an existing development consent (DA-134-3-2003-i) held by NSW Maritime which will be modified. The channel and flow regime of the Hunter River South Arm have previously been modified by revetment structures, reclamation and upstream flood gates and by dredging downstream of the proposed T4 Project berth locations.

Surface drainage within the T4 project area is mostly highly modified. There are engineered drainage structures includingculverts, drains and levees, and artificially formed drainage depressions and ponds. The ponds have formed due to rail embankments, levees and past landfill activities, for example ponding within cells which were constructed for waste emplacement and not filled. The main ponds in the T4 project area are known as:

- Deep Pond (approximate 23 ha surface area);
- Ponds 9 to 12 (approximate 6.8 ha combined surface area);
- Railway Pond (approximate 4.5 ha surface area);
- Railway Road Pond (approximate 0.5 ha surface area);
- Easement Pond (approximate 2.6 ha surface area);
- Easement Pond South (approximate 1 ha surface area); and
- FDF Pond (approximate 1.9 ha surface area).

These ponds are recharged by rainfall and localised runoff and surface flow occurs between some of them. Deep Pond also has connectivity with surface water bodies outside the T4 project area; it is recharged by inflow from Blue Billed Duck Pond, located to the south-east, and discharges to tidal wetlands at the edge of the Hunter River South Arm, via culverts under the NCIG rail loop. The only other ponds in the T4 project area which have direct surface connection to external water bodies are Easement Pond South, which discharges to the BHPB Wetlands, and Easement Pond, which may discharge to Long Pond during prolonged wet weather.

Ponds in the T4 project area also interact with groundwater. In particular, substantial downward leakage is likely to occur through the base of Easement Pond, and Ponds 9 to 12 are essentially 'windows' to the groundwater system. Groundwater seepage also occurs from Deep and Railway Ponds, through the rail embankment toward OEH Wetlands 2 and 3 to the north and potentially, to a very limited extent, from Deep Pond toward OEH Wetland 1 and Swan Pond to the west.

There are also some water bodies that are only partly within the T4 project area. The main ones are Long Pond, just north of Cormorant Road, and creeks and wetlands north and west of the T4 project area that extend into the proposed rail and utility corridor, known as Swan Pond, OEH Wetlands 1, 2 and 3, Mosquito Creek, Mosquito Creek Tributary, Eastern Watercourse and Eastern Freshwater Wetland. These water bodies are described as follows:

- **OEH Wetlands 1, 2 and 3 -** these wetlands total approximately 21 ha and are located near the northern boundary of the T4 project area, where the proposed rail and utility corridor will be. OEH Wetlands 2 and 3 are inundated at high tide. OEH Wetland 1 is primarily recharged by surface runoff and shows minimal response to tidal fluctuations. If the wetlands overtop, surface flow occurs toward Swan Pond and eventually the Hunter River South Arm (OEH Wetland 1) and toward tributaries of the Hunter River North Arm (OEH Wetlands 2 and 3). OEH Wetlands 2 and 3 interact with groundwater, including minor seepage from Deep and Railway Ponds in the T4 project area.

- **Swan Pond** -a saline pond west of the T4 project area, a small area of which is in the proposed rail and utility corridor. It has tidal connection to the Hunter River South Arm and is likely to receive limited groundwater recharge from the T4 project area.

- **Long Pond** - an artificial pond of approximately 3.4 ha, located just north of Cormorant Road. It is recharged by surface water runoff and groundwater. Long Pond has limited surface connection with the Hunter River South Arm; it can overtop the road and discharge to the river following prolonged heavy rainfall.

- **Mosquito Creek** – a tidal creek approximately 60 m wide and over 2.5 m deep that conveys Hunter River North Arm flows to adjoining wetlands in the national park. Mosquito Creek previously connected the Hunter River North and South Arms, however, was partly filled by construction of the Kooragang Island main rail line in 1966; flows south of the rail embankment were blocked at this time. Water level monitoring found negligible attenuation of the tidal prism between the upstream and downstream ends of Mosquito Creek.

- **Mosquito Creek Tributary** – a tidal tributary of Mosquito Creek, approximately 50 m north of the existing rail embankment, that conveys flows north-east to wetlands there. At the proposed rail embankment location it is 8 to 10 m wide and 1.5 to 2 m deep.

- **Eastern Watercourse**- an estuarine watercourse approximately 850m east of Mosquito Creek. Its southern extent comprises a lagoon about 200m long and 20 to 30m wide, that is a remnant of Mosquito Creek, previously isolated by filling. Similarly, the northern portion is a former tributary of Mosquito Creek. A levee has been constructed across it around 150 m north of the lagoon, which appears to block flows to/from the north. The levee and filling to the east and west likely prevent lower level tidal exchange, as evidenced by higher salinity measurements north of the levee (40 mS/cm compared to 18 mS/cm in the lagoon). Water level monitoring south of the levee showed limited tidal response (2 to 3 cm) indicating water level is predominantly groundwater-influenced and the lagoon does not receive daily tidal exchange. However, some tidal exchange may occur between the wetlands to the west and the lagoon during high spring and king tides.

- **Eastern Freshwater Wetland** –a freshwater wetland complex east of the Eastern Watercourse. Its hydrologic regime is likely to be controlled by direct rainfall and evapotranspiration, though minor runoff recharge could occur from its periphery. Groundwater is likely to keep the open water bodies permanently full, with some seasonal variability.

The main surface water features surrounding the T4 project area are:

- **Blue Billed Duck Pond** - an artificial pond of approximately 2 ha, located on the BHPB emplacement land, to the south of the NCIG rail loop. It receives surface runoff, including overflows from the adjacent BHPB Wetlands, and discharges to Deep Pond via piped culverts under the NCIG rail line. Groundwater interaction is likely.

- **BHPB Wetlands** - an artificial pond approximately 5.8 ha in area, located on the BHPB Billiton emplacement land, to the south of the NCIG rail loop. It receives surface water runoff, including overflows from Easement Pond South and discharges to Blue Billed Duck Pond. Groundwater interaction is likely.

- Intertidal and freshwater wetlands within the Hunter Wetlands National Park and Hunter Estuary Wetlands Ramsar site, to the north and west of the T4 project area.

Water quality of the ponds in and around the T4 project area has been characterised by monitoring undertaken by various parties since 1981. This has included monitoring at numerous locations within the T4 project area since 2000.

Monitoring results indicate that mean pH and mean concentrations of several metals (aluminium, cadmium, chromium, copper, lead, mercury, nickel and zinc), as well as ammonia, cyanide, total phosphorus and TSS exceed the ANZECC (2000) trigger values at the Hunter River and/or other water bodies in and around the T4 project area. All water quality results have been conservatively compared against the guidelines for slightly to moderately disturbed ecosystems. Water quality monitoring results are summarised in Table 3.1.

Table 3.1 Summary of surface water monitoring results – mean values

Analyte[1]	ANZECC default trigger values		Freshwater wetlands			Estuarine wetlands/estuary			
	Freshwater	Estuarine	Blue Billed Duck Pond	Easement Pond	Railway Pond	Deep Pond	Long Pond	OEH Wetlands	Hunter River
pH	6.5 - 8	7 - 8.5	**8.8**	**8.3**	**8.3**	**8.8**	**8.6**	7.7	7.9
EC (µS/cm)	125 - 2,200	-	1,236	**2,925**	**3,419**	13,238	15,980	17,340	45,110
TSS	~ 15.6 – 130 (6-50 NTU)	~ 1.3-26 (0.5-10 NTU)	46.5	-	-	16.5	**39.1**	15.7	24.9
TP	0.05	0.03	**0.34**	-	-	**0.30**	-	**0.24**	**0.08**
Ammonia	0.90	0.91	0.21	-	-	0.45	**1.01**	**0.93**	0.17
Cyanide	0.007	0.004	0.004	0.005	-	**0.012**	**0.021**	**0.039**	0.004
Phenol	0.32	0.40	0.035	-	-	0.017	0.028	0.058	0.058
Aluminium	0.055	-	**0.42**	**0.07**	**0.08**	0.32	-	0.07	0.60
Cadmium	0.0002	0.0007	**0.034**	**0.042**	**0.036**	**0.018**	**0.010**	**0.011**	**0.002**

Table 3.1 Summary of surface water monitoring results – mean values

Analyte[1]	ANZECC default trigger values		Freshwater wetlands			Estuarine wetlands/estuary			
	Freshwater	Estuarine	Blue Billed Duck Pond	Easement Pond	Railway Pond	Deep Pond	Long Pond	OEH Wetlands	Hunter River
Chromium	0.001	0.0044	**0.010**	**0.072**	**0.075**	**0.011**	**0.010**	**0.012**	**0.008**
Copper	0.0014	0.0013	**0.009**	**0.013**	**0.016**	**0.018**	**0.017**	**0.054**	**0.015**
Iron	-	-	0.63	0.08	0.09	1.05	0.52	3.08	0.87
Lead	0.034	0.044	0.034	**0.084**	**0.100**	0.026	0.031	0.011	0.008
Manganese	1.9	0.08	0.41	0.10	0.13	0.09	0.03	0.03	0.01
Mercury (µg/L)	0.06	0.1	**0.27**	**0.58**	**0.73**	**0.14**	0.08	0.07	**0.13**
Nickel	0.011	-	**0.013**	**0.013**	**0.015**	0.066	0.058	0.010	0.013
Potassium	-	-	29.5	58.2	105	230	-	515	360
Sodium	-	-	385	446	477	3463	-	13900	9075
Zinc	0.008	0.015	**0.169**	**0.018**	**0.017**	**0.091**	**0.107**	**0.098**	**0.056**

Notes: ANZECC trigger value exceedances are in blue font.

1. All values are in mg/L except pH, EC and mercury.

3.3 Impact assessment

3.3.1 Alteration to existing flow regimes

The T4 Project will alter the existing surface flow regime (albeit already highly modified)within the T4 project area, but OEH Wetland 1, Easement Pond South, Railway Road Pond, the southern part of Deep Pond, Long Pond and parts of OEH Wetlands 2 and 3 will all be retained.

The groundwater assessment in the EA concluded that, subject to implementing the proposed mitigations, there would be no significant impacts to existing surface flow regimes at Long Pond or outside the project area. This included at the BHPB Wetlands, Blue Billed Duck Pond and wetlands in the national park and Ramsar site.

Hydrodynamic modelling has demonstrated that, even with no mitigation, the T4 Project was not likely to result in any far-field hydrodynamic impacts in the Hunter River estuary. Potential localised impacts are discussed in the following sections.

i Mosquito Creek Tributary

The proposed rail embankment for the T4 Project, if not mitigated, will block the southern end of the Mosquito Creek Tributary channel, which conveys tidal flows from Mosquito Creek to wetlands to the north.

Hydrodynamic modelling indicated that this would not significantly impact tidal inundation of wetlands fed by Mosquito Creek Tributary at times when Mosquito Creek's water level is above 0.8 m AHD, including during high spring tides. This is because at these times Mosquito Creek overflows and overland tidal exchange occurs with Mosquito Creek Tributary and the adjacent wetlands.

However, during low and medium water levels, without mitigation, the proposed rail embankment would inhibit tidal flows between Mosquito Creek and Mosquito Creek Tributary, and adversely affect the tidal regime of wetlands fed by the tributary. PWCS proposes to mitigate this by constructing a channel north of the rail embankment, that connects Mosquito Creek and Mosquito Creek Tributary. The channel will be designed and constructed to have similar hydraulic characteristics to the existing southern section of Mosquito Creek Tributary. Modelling demonstrated that a constructed channel with these characteristics would maintain the existing tidal regime in Mosquito Creek Tributary and the receiving wetlands. With the channel in place, the maximum change in water level (compared to the existing scenario modelled) would be less than 0.05 m. Accordingly, provided the proposed mitigation measures are implemented, the T4 Project is unlikely to significantly impact the tidal regime of wetlands outside the project area which are fed by Mosquito Creek Tributary.

ii Eastern Watercourse

During high spring tides, periodic tidal exchange occurs between the greater wetland area and the wetlands around the southern end of the Eastern Watercourse, including the salt lagoon. This tidal exchange occurs from the west, through a mangrove area. A levee across the Eastern Watercourse, in the national park, blocks tidal flows to this area from the north.

Hydrodynamic modelling demonstrated that the T4 Project would have negligible impact on the wetland area north of the levee. This is the case with or without mitigation, as would be expected, given that this area is typically inundated from overland flow from Mangrove Creek to the north-east, which would not be affected by the proposed works.

Modelling indicated that the rail embankment is likely to block the overland flow path that facilitates tidal exchange from the west. If unmitigated this is likely to impact the tidal regime of the wetland area around the southern end of the Eastern Watercourse. In the EA it was proposed to modify or remove the levee at the Eastern Watercourse channel, to reinstate the estuarine channel and enable tidal exchange by this route (instead of from the west). Further investigations and consultation with NPWS have confirmed that this is a suitable mitigation. Hydrodynamic modelling, assuming the levee is removed at the Eastern Watercourse channel, demonstrated that this would enable tidal exchange to continue with the wetland area south of the levee during high spring tides as currently occurs. Peak water levels across the area would be approximately 0.05 m higher than existing levels however a tidal regime similar to existing conditions would be maintained.

iii Summary

If the proposed mitigation measures are implemented, the T4 Project is unlikely to significantly impact the tidal regime of wetlands outside the project's disturbance footprint.

3.3.2 Water quality

i Construction

Water quality impacts during construction of the T4 Project may include:

- the potential for hydrocarbon spills from construction equipment, for example diesel spills, to affect receiving water quality;
- the potential for surface runoff and dredge water to erode and entrain soil/sediment from exposed surfaces or stockpiles, and elevate suspended solid concentrations and turbidity in receiving waters; and

- the potential for any contaminants in dredged material to impact water quality of dredge return water.

A suite of erosion, sediment, spill and leak controls are proposed to be implemented as part of a CEMP, to minimise the potential for off-site surface water impacts. These controls are described below and include capture of suspended solids and surface water monitoring to assess the effectiveness of the controls.

As part of the ground improvement works, sand will be pumped from the dredging operations to the proposed stockyard area. Dredge water will be generated, as well as surface runoff from the site. These waters will be contained within a bunded area in the stockyard area, and directed to Deep Pond for settling treatment, prior to discharging back into the Hunter River South Arm (under licence). The proposed return of sediment-treated dredge water to the Hunter River is consistent with practices for other dredging campaigns in the Hunter River South Arm, including at NCIG and KCT.

The capture efficiency of the proposed sedimentation basin (Deep Pond) during Stage 1 of construction (when dredge material emplacement will be occurring) was assessed using the basin sizing methods outlined in Landcom (2004)*Managing Urban Stormwater: Soils and Construction*(referred to as the Blue Book) and guidance in the DECC (2008)*Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries*. Based on these guidelines and the size of the proposed stockyard, the preliminary calculations indicate that, during dredging operations, a minimum settling volume of approximately 26,000m^{3}will be required to meet the requirements of Landcom (2004). The volume of Deep Pond is estimated to be over 100,000m^3 and as such will meet settlement requirements during dredge material emplacement.

Following filling of the site, settling ponds will be constructed to contain sediment movement within the site. Preliminary calculations indicate that a minimum settling volume of approximately 61,000 m^3 will be required to meet the requirements of the Landcom (2004)Blue Book. The settling volume offered by the two primary ponds and the secondary pond is approximately 94,000 m^3 and so will meet settling requirements.

A surface water quality monitoring program will be developed and implemented to monitor water quality within the on-site settlement ponds and ensure the water quality objectives (to be defined in the CEMP) are met.

ii Operation

There is potential for runoff from operational parts of the T4 project area to entrain contaminants such as suspended solids, dissolved inorganic salts and heavy metals. This includes aluminium, copper, iron and nickel, particularly from the coal storage area .Minor concentrations of contaminants could also arise from the corrosion of structures and plant, particulate loads from vehicles, atmospheric deposition and minor leaks and spills from vehicles and plant. Due to the strong association between suspended solids and many other contaminants, including hydrocarbons and heavy metals that adhere to suspended solids(Duncan 1999; DLC 1998), a system that is efficient in removing suspended solids is proposed, which will also be effective for reducing other contaminants.

All runoff from operational areas will be captured in sedimentation basins and directed to the settling pond system prior to re-use on-site. During periods of prolonged wet weather, the storage capacity of the Clearwater Pond may be exceeded, resulting in discharge to the Hunter River. An assessment of the sediment removal efficiency of the settling pond system was undertaken to assess the water quality of discharges. Table 3.2 shows the sediment removal efficiency at the outlet of Clearwater Pond during a 90th, 95th and 99th percentile peak daily discharge flow. The sediment removal efficiency objective is 90% removal of TSS (defined as having an average particle size of 20 µm).

Table 3.2 Clearwater Pond sediment removal efficiency

Discharge event (percentile)	Peak daily flow (m^3/s)[1]	Capture efficiency (%)
90th	0.97	98.7
95th	1.4	97.7
99th	2.1	96.0

Notes: The peak daily flow is the peak predicted during a discharge event, which may occur for a number of days. The reported peak flow is the average flow over the day.

The results in Table 9.2 indicate that the sediment removal efficiency objective of 90% is predicted to be exceeded by the Clearwater Pond, with a capture efficiency of 96% for a 99th percentile discharge event. This level of capture efficiency will also substantially reduce the concentration of other contaminants in the water column such as hydrocarbons and heavy metals that adhere to suspended solids.

The quality of runoff and off-site discharge during operations is likely to be better than that at KCT. Monitoring results at KCT's two main water management ponds, known as Settling Pond 1 and Clarified Pond 1, are provided in Table 9.3. Settling Pond 1 receives surface runoff and return process water from most of KCT. Clarified Pond 1 receives water pumped from Settling Pond 1, for re-use on-site.

Table 3.3 KCT water quality data – mean values

Analyte	ANZECC Default Trigger Values - Freshwater	Settling Pond 1	Clarified Pond 1
pH	6.5 - 8	**8.2**	8.0
TSS (mg/L)	15.6 - 130	19.1	-
TP (mg/L)	0.05	**0.10**	-
Aluminium (mg/L)	0.055	**0.59**	**0.39**
Ammonia (mg/L)	0.90	0.03	0.03
Cadmium (mg/L)	0.0002	**0.0005**	**0.0005**
Chromium (mg/L)	0.001	0.001	0.001
Copper (mg/L)	0.0014	**0.002**	0.001
Cyanide (mg/L)	0.007	0.005	0.001
Iron (mg/L)	-	0.370	0.250
Lead(mg/L)	0.034	0.001	0.001
Mercury (µg/L)	0.06	<0.0001	<0.0001
Manganese (mg/L)	1.9	0.055	0.050
Nickel(mg/L)	0.011	0.002	0.001
Phenol (mg/L)	0.32	<1.0	<1.0
Zinc(mg/L)	0.008	**0.035**	**0.028**

Notes: ANZECC trigger value exceedances are in blue font.

Comparison of the KCT water quality results in Table 3.3 with those for existing water bodies in and around the T4 project area (Table 3.1) shows that:

- mean TSS concentrations are generally lower at KCT's water management ponds than the surrounding water bodies considered, including the Hunter River;
- mean nutrient concentrations (TP and ammonia) at KCT's water management ponds are generally similar to or lower than the surrounding water bodies, including the Hunter River; and
- mean metal concentrations at KCT's water management ponds are generally similar to or lower than the surrounding water bodies, except for aluminium. Mean aluminium concentrations were similar at KCT's Settling Pond 1 and the Hunter River but higher than at most other surrounding water bodies considered.

Monitoring results indicate that a number of analytes have exceeded the default ANZECC (2000) trigger values for slightly to moderately disturbed freshwater ecosystems at one or both of the KCT water management ponds. Other than aluminium, exceedances at KCT were similar to or less than the exceedances at the surrounding water bodies, including the Hunter River. Therefore it is expected that if site discharges were to occur, the quality of receiving waters would not be significantly affected.

3.3.3 Water balance

Water balance model results for the project operating at the nominal maximum capacity of 70 Mtpa are summarised in Table 3.4for dry (10th percentile), average and wet (90th percentile) rainfall years.

Table 3.4 Typical water balance for dry, average and wet years

Aspect	Units	Dry year[1]	Average year[1]	Wet year[1]
Rainfall	(mm/year)	778	1,121	1,541
Water sources				
Surface water runoff	ML/year	683	1,052	1,554
Potable water supply	ML/year	399	212	207
Total	**ML/year**	**1082**	**1264**	**1761**
Water demands				
Stockpile dust suppression	ML/year	594	559	530
Other water demands	ML/year	398	398	398
Total net demands[2]	**ML/year**	**992**	**958**	**929**
Evaporation losses	(ML/Year)	61	84	88
Total water loss[2]	**ML/year**	**1,054**	**1,042**	**1,017**
Water loss meet by harvested runoff	ML/year	655	830	810
Water loss meet by potable supply	ML/year	399	212	207
Water harvesting efficiency[3]	(by calc)	**68%**	**87%**	**87%**

Table 3.4 Typical water balance for dry, average and wet years

Aspect	Units	Dry year[1]	Average year[1]	Wet year[1]
Site overflow[4]				
Average overflow volume	ML/year	**43**	**260**	**666**
Site overflow coefficient[5]	(by calc)	0.06	0.25	0.43

Notes:
1. *Results for dry, average and wet years are representative of 10th percentile, average and 90th percentile rainfall years respectively. Reported results from each category have been determined based on the average results from five representative rainfall years.*
2. *Total not exact due to rounding.*
3. *Average water harvesting efficiency is the percentage of potential process water demand that is met by surface water re-use. Potable water demands are not included in this calculation.*
4. *An overflow event is defined as a period of continuous overflow. The overflow event is counted following a 72-hour period of no overflow.*
5. *Overflow coefficient is the total overflow volume/total surface water runoff.*

The results in Table 3.4 show the likely range of operating conditions for the surface water management system. They indicate that surface runoff to the water management system will vary from 683 ML/year in dry years to 1,554 ML/year in wet years. Predicted water demand (potable water and runoff captured on-site) is relatively constant, varying from 929 to 992 ML/year, depending on water requirements for coal stockpile dust suppression, which are higher in dry years. The overall requirement, accounting for evaporative losses, is higher at 1,017 to 1,054 ML/annum.

Modelling indicates that water demand and evaporative losses exceed estimated surface water runoff in dry years. The system is 'storage constrained' at these times, with greater demand for imported water. At these times, overflows from the Clearwater Pond would be limited to wet weather events when total runoff exceeds the available storage. During average and wet years, runoff is predicted to be similar to or exceed demand and the system is considered 'demand constrained'. In these wetter years, the storages are more likely to be full or close to full and overflow more frequently.

The water balance model was used to predict likely average overflows (averaged over the 110-year rainfall record on which the model was based) to the Hunter River South Arm. The results are provided in Table 3.5, along with the water management objectives established in consultation with the EPA, specifically that:

- the average frequency of site discharge is to be no more than 1 in 3 months; and
- the average annual volumetric discharge from the site is to be less than 25% of total surface water runoff (ie 75% of average volumetric runoff is re-used on-site).

The water balance was rerun incorporating adjustments to rainfall, evaporation and dust suppression water use ,to evaluate potential effects of climate change. The assumptions were based on DECCW (2010) estimates of projected climate change impacts in the Hunter Valley by 2050. A comparison of the water balance modelling results for the existing and projected 2050 climate scenarios are also included in Table 3.5.

Table 3.5 Comparison of water balance model results with water management objectives

	Model results – existing climate	Model results – 2050 climate change scenario	Objective
Overflow frequency	1 in 3 months (90 days)	1 in 3 months (91 days)	1 in 3 months (90 days)
Overflow coefficient[1]	0.25	0.25	0.25
Surface water re-use efficiency[2]	79%	76%	N/A

Notes: 1.Total overflow volume/total surface water runoff over the 110 year record.

2. Surface water re-use efficiency is the percentage of potential process water demand that is met by surface water re-use. Potable water demands are not included in this calculation.

The results indicate the proposed water management system will meet the relevant objectives. Overflows to the Hunter River would occur on average once every 90 days. The predicted overflow coefficient of 0.25 indicates that 25% of runoff would overflow from site, with 75% captured and re-used on-site. The projected 2050 climate would not significantly alter the performance of the surface water management system, as increased runoff volumes would be offset by increased demand for dust suppression.

Should controlled discharge from the site during operations be proposed in the future, this would be under an EPL and subject to agreement with the EPA.

3.3.4 Flooding

Map 4-L of the BMT WBM (2012) *Newcastle Floodplain Risk Management Study* indicates that some T4 Project components are partially located within a mapped floodway.

Flood modelling has demonstrated that dredging associated with the T4 Project will in fact have a positive impact on flood levels in the vicinity of the T4 project area. In principle, any increase in the available floodway area is likely to cause locally reduced water levels and velocities in the vicinity of the development. In the case of the T4 Project, there is proposed to be an increase in waterway area (ie due to the proposed dredging activities in the Hunter River South Arm), and therefore there is a corresponding reduction in the upstream flood levels and velocities.

The *Floodplain Development Manual* (Department of Infrastructure, Planning and Natural Resources 2005) guideline on development in floodways generally does not recommend development in floodways that cause elevated water levels and velocities affecting neighbouring (upstream, downstream or adjacent) properties. In addition, for any development in a floodway it is typically required to be demonstrated that the development proposal can withstand the velocities and forces imposed upon the proposed structures.

The 4 Project's impact on flood levels for various scenarios was assessed through detailed two-dimensional hydrodynamic modelling and flood impact assessments. The maximum predicted difference in water level resulting from the T4 Project (under a present day climate scenario) was a reduction in the 100 year ARI flood level of approximately 320 mm. Similar reductions are also reported for assessed climate change scenarios. The estimated water level reductions occurred for approximately 1.6 km upstream of the Tourle Street Bridge, and for fluvial flooding scenarios for an area immediately downstream of the Tourle Street Bridge. The hydrodynamic modelling and flood impact assessments also showed no significant impacts on flood levels north of the T4 project area, including within the Hunter River North Arm.

Similar results were derived when two-dimensional hydrodynamic modelling was undertaken for the NPC's South Arm Dredging Project. The results are published in Patterson Britton & Partners (2003) *Potential Impacts of Proposed Dredging of South Arm on Tidal Hydrodynamics, Flooding and Water Quality, Issue No. 3*, contained as Appendix F to the GHD (2003) EIS for the proposed extension of shipping channels in the Port of Newcastle.

In terms of the NCC requirement for no development within a floodway, since it has been demonstrated that there is no significant impact of the proposed development within the floodway areas, in terms of impacts on upstream, downstream or adjacent properties, and that all proposed structures (embankments and wharf structures) within the floodway areas will be designed to withstand all forces imposed by floodwaters and debris, there should be no reason why the development should not be allowed to proceed.

Furthermore, it is not clear how a maritime project within a busy working port is proposed to proceed, if the entire Hunter River channel (ie both the North and South arms) is designated as a floodway precluding any development. Port development inherently would always be within a floodway of any river system, as shipping is required to utilise the deeper section of the channel, where the majority of flood conveyance occurs and flood depths and velocities are highest.

3.4 Mitigations

PWCS have committed to the following measures for the T4 Project:

- An erosion and sediment control plan will be designed and implemented prior to and during construction in accordance with guidelines in Landcom (2004) *Managing Urban Stormwater – Soils and Construction*. The principal objective of surface water management during construction will be to prevent contamination of surface and ground waters. The erosion and sediment control plan will form part of the CEMP. It will include the following measures:
    - existing ponds to be retained near construction areas (Railway Road Pond, OEH Wetland 1, Long Pond, Easement Pond South and the southern portion of Deep Pond) will be fenced with construction webbing and marked as 'no go' areas;
    - where appropriate, silt fences, diversion drains and/or bunds will be provided to contain and convey stormwater, dredge water and sediment movement, in particular around existing water bodies that are to be retained;
    - where practical, construction plant and materials will be stored and maintained away from temporary and permanent drainage features;
    - refuelling procedures will be included in the CEMP and may include refuelling within bunded areas and/or undertaken by appropriately trained staff with appropriate spill clean-up kits available;
    - dredge return water discharged (under licence)to the Hunter River South Arm will be tested in accordance with EPL conditions;
    - where appropriate, a silt curtain (skirt with floats and ballast) will be installed in the Hunter River South Arm during construction of the wharf facilities and at the dredge water return point;

  - where necessary, stockpiles and exposed areas will be watered to reduce the likelihood of sediment entrainment through wind driven processes;
  - where appropriate early re-vegetation or sealing of completed elements of the development will be undertaken to reduce potential sediment laden run off;
  - all plant and machinery will be regularly inspected and maintained to reduce the likelihood of oil/grease leaks;
  - appropriately sized spill kits will be provided to facilitate the rapid remediation of any accidental spill of potential contaminants; and
  - construction areas and surface water controls will be regularly inspected.

- A surface water quality monitoring program will be developed and implemented to monitor water quality during construction as follows (target quality levels will be in the CEMP):
  - Within the on-site settlement ponds and at locations upstream and downstream from the dredge return water release point in the Hunter River South Arm, during discharge events and monthly at other times. Monitoring parameters will include but not be limited to turbidity, electrical conductivity and pH.
  - At identified water bodies external to the T4 Project, weekly during dredging operations, to confirm the effectiveness of the surface water management controls.

- A realigned estuarine channel will be constructed to the north of the rail embankment, connecting Mosquito Creek and one of its tributaries (Mosquito Creek Tributary), to maintain the existing tidal flow regime to wetlands potentially affected by disturbance to the southern end of Mosquito Creek Tributary. The timing and construction methodology for the channel will ensure that flows to the Mosquito Creek Tributary (and receiving wetlands) are maintained during construction. Erosion and sediment controls associated with this work will be detailed in the CEMP. Elements to be taken into account in the detailed design include:
  - The channel will be designed and constructed to have a similar geometry to the existing channel in terms of top width, invert levels and cross-sectional profile, to ensure hydraulic characteristics similar to the existing channelare maintained.
  - Geotechnical investigations will be used to determine if temporary channel bank support is required during construction and establishment.
  - Restoration and final landform on the banks of the constructed channel will be determined during detailed design. This will include investigating the potential to reinstate mangroves.

- Works will be undertaken to avoid impacting the tidal regime of the wetland complex near the Eastern Watercourse. The mitigation design will be finalised prior to construction. Subject to approval from NPWS, this could involve modifying or removing the existing levee at the Eastern Watercourse channel, to maintain tidal flows to the wetland complex by this route.

- Drainage will be provided within the rail embankment (eg drainage from rail ballast to jump-up pits) to maintain flows into the Eastern Freshwater Wetland from the rail area.

- The hydraulic connection of the southern portion of Deep Pond with Blue Billed Duck Pond will be unchanged and flows will continue to discharge to the Hunter River South Arm at the existing discharge point via a drainage channel that will be constructed linking the southern sections of Deep Pond to the existing culverts under the NCIG rail line.

- During operations the following mitigation measures will be in place to reduce contaminant and sediment movement from the site:

  - stockyard perimeter drains to convey all collected surface water to settlement ponds;

  - pit and pipe systems to convey surface water from yard machine berms and adjoining access roads to the perimeter drains;

  - clean-out sumps to capture coarse sediments and accidental oil spills (dump stations, conveyor inclines, transfer houses, buffer bins and the sampling area);

  - an underdrain network under the coal stockpiles connected to the perimeter drains;

  - local sediment swales adjacent to the rail batter; and

  - a series of settlement ponds to treat all surface water generated from the operational areas of the site.

- The surface water management system will maximise re-use of captured stormwater runoff on-site.

- The site water management system will be designed so that the average overflow frequency to the Hunter River does not exceed one in 90 days (average frequency).

- The wharf area water management system will be designed to prevent off-site overflows from the wharf area during 1 in 100 year event, 2 hour rainfall duration design criteria.

- The site water balance model will be progressively validated to demonstrate compliance with the site surface water management system overflow objectives. To assist with model calibration, the following will be undertaken:

  - pond levels will be monitored using continuous level loggers;

  - site overflows will be gauged to enable the calculation of overflow volumes; and

  - process water use will be metered.

- To ensure operational surface water controls achieve the specified treatment targets and identify any aspects for improvement, a surface water quality monitoring program will be implemented during operations, as part of the EMS. Water quality trigger levels will be included in the EMS. All monitoring results will be retained in an appropriate database that will be available to relevant agencies on request. In addition to water quality sampling, the monitoring program will indicatively require:

  - monitoring of water levels in settling ponds to assess pond freeboard capacity;

  - annual monitoring of sediment levels in settling ponds;

- weekly inspection of sediment sumps, oil traps and transfer ponds, to ensure the capture of any oil spills;
- annual internal audit to ensure monitoring and recording of data is being undertaken in accordance with the EMS; and
- annual (and as needed) review of the monitoring program to reflect regulatory or operational changes.

- If monitoring results exceed specified trigger values, the following contingency and response measures will be implemented:
  - review operating methods to identify and resolve any issues that may be resulting in suspected degradation of water quality;
  - if the above review does not resolve the water quality issue, undertake further investigations, which may include increasing the monitoring frequency and sampling locations to identify and confirm any suspected degradation of water quality; and
  - if a source of poor water quality is identified, investigate to determine the most effective improvement measure and implement additional controls if deemed suitable.
- If the site overflow frequency objective is exceeded, the following contingency and response measures will be implemented:
  - potentially, spray irrigate the grassed area south of the coal stockpiles; and
  - consider additional options to improve quality of water overflowing off-site.

3.5 Residual impacts

While the T4 Project will alter the existing, albeit highly modified, surface flow regime within the T4 project area, the proposed water management systems and controls will ensure there are no significant adverse impacts to water quality or flow regimes in surrounding wetlands or the Hunter River, including the Hunter Wetlands National Park and Hunter Estuary Wetlands Ramsar site. The management and systems and controls proposed have been designed to meet regulatory requirements.

The T4 Project is unlikely to be significantly impacted by flooding or to impact flooding or effects on sea level rise at any downstream areas.

There is unlikely to be any residual impacts to public amenity or services in relation to surface water and flooding.

4 Ecology

4.1 Introduction

An ecology assessment was prepared by Umwelt for the EA and independently reviewed by a team of experts including Professor Michael Mahony, Associate Professor Ross Goldingay, Dr David Robertson, Dr Pia Laegdsgaard and Phil Straw. An updated assessment was also prepared by Umwelt for the RTS/PPR to assess the modified T4 Project design with input from Professor Michael Mahony and Phil Straw.

4.2 Baseline conditions

The T4 project area is located in the far north-eastern corner of the Sydney Basin Bioregion and Hunter subregion. A diverse range of flora and fauna assemblages occur in the local area, with a mixture of coastal and inland influences. The T4 project area is located adjacent to the Hunter Wetlands National Park which encompasses the former Kooragang and Hexham Swamp Nature Reserve, Stockton Sandspit and part of Ash Island and includes the Hunter Estuary Wetlands Ramsar site. The Hunter Estuary Wetlands Ramsar site comprises two locations, approximately 2.5 km apart, within the former Kooragang Nature Reserve and at the Wetlands Centre Australia.

Other conservation areas within 10 km of the T4 project area include Tilligerry State Conservation Area (SCA), Tilligerry National Park, Worimi National Park, Worimi Regional Park, Worimi SCA, and Glenrock SCA. The Lower Hunter Biodiversity Conservation Corridor provides a vegetated link from Watagans National Park to the Tilligerry National Park near Port Stephens on the coastal plain. This corridor is highly significant and allows for fauna movements such as seasonal migration and juvenile dispersal. The corridor occurs broadly to the north of the T4 project area, running through Ash Island and the western side of Fullerton Cove.

To characterise ecological features of the T4 project area a detailed review of relevant literature and vegetation mapping was undertaken as well as searches of relevant ecological databases. This background information was then used to design ecological surveys (aquatic and terrestrial) that were commensurate with the biology/ecology of species and the extent of potentially suitable habitat identified within and adjoining the T4 project area. Targeted searches were carried out for 22 threatened flora species and four threatened fauna species, which are known to occur in or near the T4 project area or considered likely to occur in the T4 project area based on the species' known distribution and the presence of suitable habitat. An aquatic survey was undertaken within the T4 project area to assess the likely impact on aquatic ecology and included an analysis of cores from river sediments.

The results of the review are summarised below.

- 116 plant species were recorded in the T4 project area by Umwelt. An additional 150 species have been recorded in the vicinity of the T4 project area during surveys for other projects. Forty-one plant families were recorded. Of the plants recorded, 58 (50%) were not native to the T4 project area and seven were noxious weed species.
- Five vegetation communities were identified and mapped in the T4 project area, including:
  - Saltmarsh (21.5 ha), including one variant, Saltmarsh Variant (with Freshwater Influence), which conforms to the endangered ecological community (EEC) Coastal Saltmarsh;
  - Mangrove Forest (32.1 ha);

- Freshwater Wetland (30 ha), including three variants, Freshwater Wetland Variant 1 (with Saltmarsh Influence), Freshwater Wetland Variant 2 (with Mangroves) and Freshwater Wetland Variant 3 (Occurring in Fill). Freshwater Wetland Variant 1 and 2 were found to potentially conform to the description of the Freshwater Wetlands on Coastal Floodplains EEC;
- Disturbed Land (190.3 ha); and
- Tree Planting (3.1 ha).

- One threatened flora species, pondweed, was recorded in the T4 project area.
- A total of 128 vertebrate fauna species were recorded during surveys of the T4 project area, including 86 bird species, nine reptile species, 10 amphibian species and 23 mammal species. Eleven of these species (8.6%) were introduced species (mammals and birds).
- The following threatened fauna species under the NSW *Threatened Species Conservation Act 1995* (TSC Act)or EPBC Act have been recorded within or flying over the T4 project area:
  - green and golden bell frog (*Litoria aurea*), listed as endangered under the TSC Act and vulnerable under the EPBC Act, was recorded on numerous occasions during Umwelt's targeted surveys and in previous surveys across the T4 project area.
  - seven threatened bird species were recorded within the T4 project area during the surveys undertaken by Umwelt. A further seven threatened bird species have been previously recorded within the T4 project area by HBOC between 1993 and 2007.
  - seven threatened mammal species were recorded by Umwelt. One additional threatened mammal species, the eastern false pipistrelle (*Falsistrellus tasmaniensis*) has been previously recorded within the T4 project area in 2009.
- A total of 61 EPBC Act listed migratory species have been recorded in the T4 project area by Umwelt, Hunter Birds Observer Club (HBOC) and OEH, of which 27 are listed under international treaties for migratory birds.
- A diverse array of benthic, epibenthic and macroinvertebrate fauna taxa was recorded in mangrove forests and saltmarsh within the T4 project area .No threatened or protected fish or macroinvertebrate species were identified.

4.3 Impact assessment

The T4 Project's ecological impacts will mainly arise from clearing and habitat loss. Some 75 ha of natural vegetation and habitat will be disturbed, made up of 18.8 ha of Saltmarsh (EEC under the TSC Act), 28.9 ha of Mangrove Forest and 27.3 ha of Freshwater Wetland (of which 4 ha are listed as an EEC under the TSC Act). A further 21.3 ha of open water, including 20.3 ha of the artificial Deep Pond, will be disturbed as well as 183.1 ha of other highly disturbed and modified land.

The T4 Project is likely to impact known habitat of 23 threatened fauna species, including the Australasian bittern and green and golden bell frog, which may be significantly impacted in the absence of mitigation measures. It is also possible that the project could significantly impact a further six threatened fauna species, one threatened flora species, and migratory shorebird species listed under international conservation conventions. The T4 Project is not expected to adversely affect the adjacent Hunter Wetlands National Park or Hunter Estuary Wetlands Ramsar site.

The T4 Project has been designed to avoid or minimise ecological impacts as much as possible. Maximum use has been made of disturbed areas; habitat loss has been minimised by measures like aligning rail tracks to avoid some water bodies that provide green and golden bell frog habitat, retaining around 5.2 ha of Deep Pond and retaining around 0.7 ha of Freshwater Wetland in Easement Pond South. Other impact avoidance measures include channel realignment works and ground level modifications to prevent any impacts to the tidal regime of wetlands beyond the rail embankment's footprint within the Hunter Wetlands National Park and Hunter Estuary Wetlands Ramsar Site.

PWCS will use a range of management strategies to limit impacts on native flora and fauna in the project area and in adjacent habitats, including creating an extensive and complex series of habitat features for the green and golden bell frog that form a linkage across the T4 project area.

4.4 Mitigations

4.4.1 General

Railway Road Pond, OEH Wetland 1, Long Pond, approximately 0.7 ha of freshwater wetlands in Easement Pond South, and approximately 5.2 ha of the southern portion of Deep Pond will be retained. If directional drilling is not appropriate for relocation of Jemena's gas pipeline in the vicinity of OEH Wetland 2, avoidance of this wetland, where possible, will be taken into account in selecting the pipeline alignment, and measures will be included in the CEMP to minimise impacts on the wetland.

The CEMP and EMS will include an ecological management plan that will be submitted to the relevant authorities for approval. It will include measures to limit impacts on native flora and fauna, including:

- feral animal and noxious weed control routinely undertaken in the T4 project area, including for the plague minnow (*Gambusia holbrooki*);
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the T4 project area;
- site access control; and
- ongoing monitoring and maintenance of habitats to be retained in the T4 project area and impact mitigation activities. The management and monitoring procedures, methods and timeframes, including provisions for adaptive management, will be documented in the ecological management plan.

4.4.2 Green and golden bell frog

If the T4 Project is approved and constructed, PWCS commits to the following measures which will be detailed in the ecological management plan (that will form part of the CEMP and EMS):

- All known habitat for the green and golden bell frog (*Litoria aurea*) in the T4 project area will be subject to pre-clearance and green and golden bell frog relocation procedures.

- Training in relation to the green and golden bell frog will be incorporated into the site induction process.

- PWCS, with relevant involvement by the University of Newcastle, will assess the need for a hygiene protocol similar to the DECC (2008) Hygiene Protocol for the Control of Disease in Frogs. If required, it will be incorporated into the ecological management plan and site induction procedure.

- Where handling of frogs is necessary, the risk of pathogen transfer will be minimised as follows:

  - hands will be either cleaned and disinfected between samples or a new pair of disposable gloves used for each sample;

  - a 'one bag – one frog' approach to frog handling will be used; and

  - a 'one bag – one sample' approach to tadpole sampling will be used.

Following removal of green and golden bell frog habitat from the T4 project area and until the proposed frog habitat corridor is in place, regular monitoring of water levels in OEH Wetland 1 will be undertaken during summer. In the event that this monitoring indicates drying of OEH Wetland 1, additional water will be provided to it, in consultation with green and golden bell frog specialists.

A series of habitat features for the green and golden bell frog will be retained and created across the T4 project area. The created habitat features will:

- Incorporate clusters of vegetated wetlands, including large and small permanent and ephemeral ponds, designed to provide habitat for the green and golden bell frog.

- Link known green and golden bell frog habitat across Kooragang Island to Ash Island.

- Be subject to an independently reviewed monitoring, evaluation and reporting process that will include field monitoring and population viability analysis. Population monitoring protocols and performance criteria will be developed in consultation with leading green and golden bell frog researchers during development of the ecological management plan.

- Be supported by appropriate off-site actions such as funding for captive breeding. Captive-bred individuals will be released into the corridor if monitoring demonstrates that such a contingency measure is necessary.

- Where possible, integrate with and supplement the works and research being undertaken on lands outside of the T4 project area, for example other projects on Kooragang Island.

- Where possible, be designed to provide habitat for other native flora and fauna species that currently occupy freshwater wetland habitats of the T4 project area, including pondweed (*Zannichellia palustris*), Australasian bittern (*Botaurus poiciloptilus*) and black-necked stork (*Ephippior hynchusasiaticus*).

A culvert will be constructed to assist frog movement between the constructed habitat west of the proposed water management ponds and the existing habitat in OEH Wetland 1.

The green and golden bell frog habitat corridor's design will be finalised during detailed design, taking into account learning's from other habitat creation and restoration projects, such as at Sydney Olympic Park and the Hunter Wetlands Centre Australia. The detailed design will be subject to peer review and approval of relevant authorities.

A habitat corridor management plan (HCMP) will be developed for the green and golden bell frog habitat corridor, as part of the ecological management plan, and will be peer reviewed. The HCMP will include a population monitoring plan, disease and hygiene management plan (if required), genetic management plan and habitat management plan. It will outline trigger-action-response-plans.

Subject to approval of the T4 Project, frog habitat ponds will be constructed in Zone 1 during the first phase of the T4 Project's construction, once this area has been capped and remediated in accordance with the EPA's landfill closure requirements. Proposed habitat ponds in Zones 2 and 3 will be constructed once the first phase of the T4 Project's construction is complete. The cluster of ponds proposed in the north of Zone 3 (to the north-west of Deep Pond) would be constructed after site works in this area have been completed.

4.4.3 Hollow-dependent species

A tree felling procedure will be developed and implemented as part of the ecological management plan to minimise the potential for impacts on native fauna species (particularly tree-roosting micro-bats) as a result of the clearing of hollow-bearing trees identified in mangrove forest.

4.4.4 Electricity lines

PWCS will assess the use of bunting on above-ground power lines in key migratory bird flight paths, to discourage birds from using these areas and minimise risk of impact.

4.4.5 Biodiversity offset measures

If the T4 Project is approved and constructed, PWCS commits to implementing the following biodiversity offset measures:

- Establishment and long-term protection of the Tomago offset site in the Hunter estuary to conserve existing estuarine and freshwater vegetation and habitats, including Freshwater Wetlands EEC, Coastal Saltmarsh EEC, mangrove habitat and habitat for the Australasian bittern and other threatened species. A habitat restoration project will be undertaken at the Tomago offset site that will include creating habitat for shorebirds and saltmarsh. The restoration project's design will be finalised during detailed design in consultation with relevant government agencies.

  The detailed design phase for the Tomago Offset Site Restoration Project will include further site investigations, including ASS and groundwater investigations; investigate the need for assisted rehabilitation of saltmarsh; finalise details of a mangrove control program; investigate options to integrate the site with the Hunter Wetlands National Park; and consider strategies to minimise impacts to the eastern grass owl (*Tyto longimembris*).

  Construction of the Tomago Offset Site Restoration Project will start during the T4 Project's detailed design phase. Its construction will be managed in accordance with a site-specific CEMP that will be prepared prior to works, and include:

  - an acid sulphate soil management plan;

  - a groundwater management plan;
  - an erosion and sediment control plan;
  - a vegetation management plan;
  - a tree felling procedure; and
  - a construction traffic management plan.

  PWCS will investigate the feasibility and practicality of relocating the white-bellied sea eagle nest to a suitable location within, or in close proximity to, the Tomago offset site, outside the proposed area of inundation.

- Establishment and long-term protection of the Ellalong offset site, that allows for conservation of Freshwater Wetlands EEC, a drought refuge for water bird species and habitat for threatened and migratory species recorded in the T4 project area.
- Establishment and long-term protection of the Brundee offset site, that allows for the conservation of part of a breeding population of green and golden bell frogs, as well as Freshwater Wetlands EEC and habitat for the Australasian bittern and other threatened species.
- Funding:
  - a green and golden bell frog captive breeding program, in association with NCIG, to be undertaken by the University of Newcastle and used in approved translocation projects to supplement the wild population. It could also be used to trial the effectiveness of created habitat; and
  - ongoing research into population dynamics for the Kooragang Island green and golden bell frog population.
- Development of an ecological monitoring program to assess the success of the biodiversity offset strategy.

The land-based biodiversity offset sites will be secured prior to construction commencing. The mechanism for securing their long-term conservation will be determined in consultation with the relevant government agencies.

A biodiversity offset site management plan will be prepared for each of the offset sites which will outline the management and monitoring requirements for the site, as well as completion criteria. The site management plans will be prepared prior to construction. Management and monitoring strategies will be employed at the land-based biodiversity offset sites, in accordance with the site-specific biodiversity offset site management plans, to maintain and improve their biodiversity values. This will include measures for:

- fencing and access control;
- weed and feral animal control;
- bushfire management;
- general ecosystem monitoring; and

- adaptive management.

4.5 Residual impacts

A comprehensive set of mitigation measures have been proposed to manage the ecological impacts of the T4 Project. Further, a Biodiversity Offset Strategy has been developed to compensate for any residual impacts. The conservation and restoration of the proposed offset sites will ensure that the biodiversity values in the surrounding region are maintained and improved and the continued viability of threatened species and communities that could be significantly affected by the T4 Project, over the medium to long term.

Therefore, there will be no residual impacts, particularly to public amenity or services in relation to ecology.

Appendix 4

5 Noise and vibration

5.1 Introduction

A noise and vibration assessment was prepared by SLR Consulting for the EA which was independently reviewed by Najah Ishac. The assessment considered the noise and vibration impacts of both the construction and operation of the T4 Project, cumulative noise impacts and noise impacts from road and rail transport. An updated assessment was also prepared by SLR consulting for the RTS/PPR to assess the modified design of the T4 Project.

5.2 Baseline conditions

The T4 Project area is located on Kooragang Island adjoining the KCT and NCIG Coal Terminal. The area is dominated by industrial, transport, distribution and port facilities. To the north and west are estuarine wetlands, mangroves, saltmarsh and pastured and forested lands. The nearest residential areas are at Fern Bay to the east, Stockton to the south-east, Mayfield to the south, and Warabrook to the south-west.

The existing noise environment in the local area is influenced by urban and industrial noise sources, including road and rail traffic, and natural sounds such as wind and ocean noise. Industrial noise from Kooragang Island, including from KCT, is distinguishable in the evening and night at Fern Bay and Stockton, particularly during lulls in transport, domestic and natural noise. Other receiver areas are relatively unaffected by noise from KCT, though can experience noise from other industrial facilities.

The T4 Project was assessed, from a noise perspective, as an extension to the KCT and background noise levels were determined excluding the existing KCT activities.

5.3 Impact assessment

Noise assessment criteria were determined for the assessment location and period (day, evening and night) in accordance with the *Industrial Noise Policy* (EPA 2000). Three sets of criteria were established comprising both intrusive $LA_{eq(15minute)}$, amenity $LA_{eq(period)}$ and sleep disturbance ($LA_{1(1minute)}$ criteria. The criteria used for the construction noise assessment were determined in accordance with the *Interim Construction Noise Guideline* (DECC 2009).

Noise levels were predicted to comply with the relevant criteria for all assessed scenarios and conditions and at all assessment locations, with the following exceptions:

- T4 Project construction only – there are no park facilities at the location and while accessible, it is unlikely this area would be regularly visited. The criterion for the National Park only applies when the area is in use.
- T4 Project Stage 2 construction, concurrent with KCT and T4 Project Stage 1 operations – minor to moderate (1 to 4 dBA) exceedances of the intrusive criteria at some locations at Fern Bay and Stockton during the evening and/or night. These exceedances are due to the approved KCT operating noise, not the T4 Project.
- T4 Project operations only – intrusive and amenity are predicted to comply with the relevant criteria at all assessment locations, for all assessed periods and meteorological conditions.

- T4 Project and KCT operations – minor to moderate (1 to 4 dBA) exceedances of the intrusive and amenity criteria at some Fern Bay and Stockton locations during the evening and/or night, from the combined operation of the T4 Project and KCT at maximum capacity. These exceedances are due to the approved KCT operating noise, not the T4 Project.

The cumulative assessment, considering all existing and approved future industrial developments as well as the T4 Project operating at maximum capacity, found there would be no appreciable incremental increase in cumulative noise levels. The increase due to the T4 Project under worst-case noise-enhancing meteorological conditions was predicted to be minor (1.1 dBA) at Sandgate and negligible (<1 dBA) at all other assessed locations.

The change in road traffic noise as a result of the T4 Project is predicted to range from nil to a negligible 0.8 dB increase during the peak of Stage 1 construction. A difference in noise levels less than 1 dBA is not noticeable and complies with the provision in the *Environmental Criteria for Road Traffic Noise*(EPA 1999) that traffic associated with a development should not increase existing traffic noise levels by more than 2 dBA.

Although coal trains travelling to the project area are beyond the operational control of PWCS, a broad assessment of rail noise was made. The maximum increase in rail noise due to the coal trains servicing the T4 Project is predicted to be up to 0.7 dBA. Rail noise currently exceeds the OEH trigger levels and EPL goals at some houses near the rail corridor. As a result of the T4 Project, these trigger levels and goals are predicted to increase by up to 50 m. Maximum pass-by noise levels would not change.

There is minimal potential for vibration impacts. Buffer distances between proposed piling and sensitive receivers are sufficient to achieve compliance with the criteria for damage and annoyance.

5.4 Mitigations

The following noise and vibration mitigation and management measures were committed to by PWCS for the T4 Project:

- during construction vibratory equipment will be used in a manner which minimises noise impacts at sensitive receivers, for example avoiding piling outside of standard hours;
- vibration monitoring and piling energy management will be applied as required during piling activities to achieve compliance with the relevant criteria;
- alternative alarms for mobile construction equipment will be used where appropriate, such as quacker type alarms or those with selectable frequency and volume control;
- conveyor drives will be low noise specification;
- noise monitoring of the conveyor drives will be undertaken to ensure compliance with the low noise specifications;
- near field noise barriers or enclosures will be installed around conveyor drives where practical and necessary for noise mitigation;
- low noise specification idlers and random spacing will be implemented on the return idlers for the stockyard and ship loading conveyors;
- transfer conveyors will be covered where practical, and fitted with low noise specification idlers;

- stackers, reclaimers and shiploaders will be low noise specification, including conveyor drives and idlers;
- stacker, reclaimer and shiploaders compliance with low noise specification will be required by the supplier at the design, manufacture and commissioning stages;
- belt feeders and soft flow chutes will be implemented at the buffer bins and chutes and the buffer bins will be enclosed where appropriate;
- sample stations will be enclosed with minimum penetrations, and dump stations will be partially enclosed (roof and side walls with openings only for train ingress/egress);
- equipment alarm systems with frequency and volume control will be installed;
- construction, maintenance and operational employees will undergo noise awareness training, including as part of the site induction training;
- an integrated community enquiries and response program will be in place during construction and operations;
- a programme will be in place for regular noise monitoring and analysis of results during construction and operations; and
- PWCS will participate in EPA's recommended strategic noise assessment, management and reduction strategy for the Hunter Valley Coal Rail Network.

PWCS's existing noise management and monitoring systems will be extended to the T4 Project where practical, including the EMS, noise management plan, Coordinated Environmental Monitoring and Management Protocol and Procedure and the Continuous Noise Improvement Programme. PWCS's existing noise management plan will be reviewed, updated and implemented to ensure that noise is effectively managed throughout construction. The updated plan will form part of the CEMP.

5.5 Residual impacts

Provided that the mitigation measures described above are implemented, with the exception of exceedances in the Hunter Wetlands National Park during the day and evening, at the nearest accessible point within 50 m of its boundary with the T4 project area, noise and vibration associated with construction and operation of the T4 Project alone is expected to comply with relevant noise criteria. Noise and vibration is also anticipated to be acceptable at the nearest potentially affected receiver areas.

Therefore, there will be no residual noise or vibration impacts on public amenity.

Appendix 4

6 Air quality

6.1 Introduction

An air quality assessment was prepared by ENVIRON for the EA which was independently reviewed by Dr Nigel Holmes. The assessment was undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005). An updated assessment was also prepared by ENVIRON for the RTS/PPR to assess the modified design of the T4 Project.

6.2 Baseline conditions

Existing monitoring data were used to characterise existing ambient air quality and assess cumulative air quality impacts. Particulate matter sizes monitored are total suspended particulates (TSP), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) and particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$). Existing air quality in the region is influenced by emissions from industry and other human activities, such as domestic fuel burning and vehicle emissions, and by natural sources, such as airborne sea salt and windblown dust. Regional events, such as dust storms and bushfires, contribute episodically to suspended particulate matter concentrations.

6.3 Impact assessment

The air quality assessment determined that all assessed air pollutants will remain well below the applicable air quality criteria and standards, other than 24-hour average concentrations of PM_{10}.

Baseline 24-hour average PM_{10} concentrations (existing plus the contribution from approved future developments excluding the T4 Project) were predicted to exceed the OEH criterion at the assessment locations on one day over the year assessed. This meets the National Environment Protection (Ambient Air Quality) Measure goal of no more than five exceedances per year. The T4 Project is not predicted to result in exceedances on any additional days of the year. This meets OEH's requirement that where background concentrations are elevated, it must be demonstrated that no additional criteria exceedances will occur as a result of a proposed activity.

No exceedances of the Ambient Air Quality NEPM advisory reporting standards for $PM_{2.5}$ were predicted, when using the 2010 baseline data. While exceedances of this standard have previously been recorded in the region during events such as bushfires and dust storms, the T4 Project-related increment is predicted to be small compared to such background peaks.

Although coal trains travelling to the project area are beyond the operational control of PWCS, a broad assessment of rail dust was made assuming a coal delivery rate of 120 Mtpa. Peak 24-hour PM_{10}concentrations from rail wagons travelling to the project area, were predicted to be 3 – 13 $\mu g/m^3$ at 20 m from the rail corridor. The predictions are based on conservatively high emission estimates with the significance of this increment dependent on the baseline air quality en-route and the presence of sensitive receptors close to the rail corridor.

The OEH criteria for particulate matter are designed to protect human health and wellbeing. One type of particulate matter is coal dust. ENVIRON reviewed literature on the health implications of coal dust exposure and the basis for ambient air quality standards. It found the existing OEH air quality criteria for particulate matter offer, as a minimum, equivalent protection for communities exposed to coal dust generated from mechanical attrition processes, that is eroded by handling or wind entrainment.

6.4 Mitigations

PWCS's existing air quality management and monitoring systems will be extended to the T4 Project, including the EMS, air quality and dust management plan, Coordinated Environmental Monitoring and Management Protocol and Procedure and the environmental operating procedure for air quality in development. This includes:

- PWCS's existing air quality and dust management plan will be reviewed, updated and implemented to ensure that dust emissions are effectively mitigated throughout construction; and
- the EMS will be revised and updated, if required, to incorporate relevant air quality mitigation and management measures.

PWCS commits to implement the following measures for construction:

- Where possible, disturbance of contaminated materials will be avoided.
- The RAP and MMP will detail management measures for T4 Project earthworks that will further minimise the potential for trace metal/metalloid and odour emissions.
- The air quality and dust management plan, to be developed as part of the CEMP, will be prepared in consultation with the EPA and will be endorsed by the EPA before construction starts. It will include the following procedures:
    - the extent of exposed areas will be minimised as far as practical throughout the construction period;
    - where appropriate, exposed areas for long periods will be chemically stabilised, hydromulched or otherwise stabilised;
    - roads and other trafficked areas will be watered as required. Applying water extenders to improve the control effectiveness of wet suppression will be considered;
    - the prevailing wind direction and speed will be considered in short-term planning of construction operations, particularly when operations are close to sensitive receptors;
    - consideration will be given to modifying construction activities under adverse meteorological conditions (such as dry, windy conditions), particularly when sensitive receptors are located downwind of the site;
    - double-handling of material will be minimised; and
    - stockpiles of construction materials will be located in protected areas where possible.

PWCS commits to the following measures for operations:

- dump stations will be partially enclosed (roof and side walls with openings only for train ingress/egress);
- dust suppression sprays will be provided;
- bottom dumping of coal will be undertaken;

- belt conveyors will be partially enclosed where practical (ie excluding yard and ship conveyors);
- ‘soft’ flow hood and spoon-type chutes will be provided on transfers which reduces coal degradation potential;
- a belt cleaning system will be provided on all conveyors;
- water sprays on coal in transit will be provided where appropriate;
- transfer houses will be clad;
- dust suppression (water) sprays will be provided on stockpiles;
- wind guards will be installed on yard and ship conveyors where appropriate;
- vehicle movements will be minimised within the stockpile area;
- earthen bund walls and/or tree screening will be used, to minimise wind velocities on-site or to remove dust through impaction, where appropriate;
- variable height stackers will be provided, so that drop heights can be minimised;
- dust suppression will be included on stackers and reclaimers;
- the discharge chute at the end of the boom conveyor on shiploaders will be enclosed;
- ship loader spouts will be extendable to allow loading to occur low in vessel holds;
- dust suppression sprays will be provided on shiploaders;
- there will be provision for a launder system on the ship loader conveyor to return spillages;
- the buffer bins near the shiploaders will be enclosed as appropriate;
- progressive sealing of permanent internal access roads will be undertaken;
- any coal spillages will be cleaned up in a timely manner;
- landscaping of open areas will be undertaken, where practical;
- a predictive/reactive air quality control system will be applied. It will be a real-time management system that uses continuous particulate matter and meteorological monitoring data, and meteorological forecast data, to identify triggers for contingency dust management measures, such as additional use of water sprays. This system may be fully automated, incorporating trigger alarms, automated reports and SMS and email alarms to prompt contingency measures;
- PWCS employees will be trained to ensure dust minimisation is prioritised and visual triggers and arising actions are effectively implemented; and
- PWCS will continue to work with the Australian Rail and Track Corporation (ARTC) and coal producers around reducing fugitive dust emissions from trains.

PWCS is investigating additional controls to determine their suitability for the T4 Project. The investigations for coal moisture management based on dust extinction moisture levels and 'optimum moisture levels' and the effectiveness of wind barriers will be undertaken and completed prior to operations commencing.

6.5 Residual impacts

The T4 Project complies with relevant air quality criteria. Subject to the implementation of the mitigation measures detailed above, the T4 Project is not expected to significantly affect surrounding air quality. Therefore, there will be no residual air quality impacts on public amenity.

7 Greenhouse gases

7.1 Introduction

An energy and GHG assessment was prepared by ENVIRON for the EA. A GHG emissions inventory of the T4 Project was prepared in accordance with the relevant international and Australian standards. An updated assessment was also prepared by ENVIRON for the RTS/PPR to assess the modified design of the T4 Project.

7.2 Baseline conditions

GHGs are naturally present in the atmosphere and contribute to its warming and other atmospheric changes by absorbing long-wave radiation reflected from the Earth's surface. Human activities that release GHGs, such as burning fossil fuels and deforestation, have increased atmospheric GHG concentrations and associated warming of the Earth's surface (Intergovernmental Panel on Climate Change (IPCC) 2007). The most important GHGs originating from human activity are carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) (IPCC 2007).

7.3 Impact assessment

The assessment considered three scopes of emissions in respect of the T4 Project's construction and operation. These comprise:

- Scope 1: GHG emissions from sources owned and controlled by PWCS; namely emissions from diesel and unleaded petrol consumption by the T4 Project plant and equipment, slow oxidation of stockpiled coal and fugitive sulphur hexafluoride (SF6) emissions from substations in the T4 project area;
- Scope 2: GHG emissions from consuming purchased electricity; and
- Scope 3: indirect GHG emissions from upstream and downstream activities; namely diesel consumed by locomotives bringing coal from the mines to the terminal, fuel oil consumed by ships transporting the coal, and coal consumed by the end-user.

Annual GHG emissions (Scope 1 and 2) from the T4 Project operating at maximum capacity will only be a very small contributor to the 2030 projected global (0.0001%),national (0.01%) and NSW (0.04%) CO2-e emissions. Average annual Scope 3 GHG emissions for the T4 Project at maximum capacity are estimated to be 174.2 Mt CO2-e, which represents 0.25% to 0.32% of the 2030 estimated global CO2-e emissions. Scope 3 emissions are beyond the control of PWCS with the vast majority of Scope 3 emissions (estimated 99%) are related to the combustion of coal by the end user and the remainder are from transporting coal to and from the terminal.

7.4 Mitigations

PWCS proposes to implement a number of design, control and operational management measures to minimise energy use and GHG emissions associated with the T4 Project. These include:

- energy efficiency checks will be undertaken during commissioning of new equipment;

- the SCADA system will be used to monitor and optimise the feed rate for the receival, stacking, reclaim and ship loading conveyors;
- LED lighting will be installed on conveyor gantries and walkways where appropriate;
- where practical, low intensity GHG hot water systems, such as solar hot water, heat pump storage or gas instantaneous systems will be installed rather than conventional electric storage;
- energy efficient air conditioning systems will be installed;
- consideration of energy efficiency will be required in the formal tender assessment process for contractors and suppliers;
- use of alternative, low GHG emission fuels, such as Ethanol 10 and Ultra Low Sulphur Diesel will be investigated for the T4 Project passenger and heavy equipment fleet;
- a GHG reduction target and monitoring plan and a climate change risk register will be developed and implemented; and
- other options such as installing sub-metering to identify key areas of energy consumption will be considered further during detailed design.

7.5 Residual impacts

Residual impacts on public amenity or public services are primarily related to Scope 3 emissions resulting from coal consumption overseas and transportation of coal to and from the terminal. These impacts are beyond the control of PWCS and beyond the responsibility of NCC.

8 Transport and access

8.1 Introduction

A traffic assessment was prepared by EMM for the EA which was independently review by the former NSW Roads and Traffic Authority director, Ken Dobinson. Details on transport matters other than road traffic, that were not covered in the technical report, including capacity of the rail network and port to accommodate additional trains and vessels associated with the T4 Project were provided in Chapter 14 of the EA. An updated assessment was also prepared by EMM for the RTS/PPR to assess impacts of the modified design of the T4 Project.

8.2 Baseline conditions

Existing traffic volumes and growth trends on the road network surrounding the T4 project area were determined by review of Road and Maritime Service's (RMS) past traffic counts and by traffic counts (tube counts and intersection counts) undertaken in May and October 2011.

RMS's counts between 1995 and 2010 indicate that daily traffic volumes on the major road network have been increasing, with an average 1.6% per annum increase at the Stockton Bridge and 1.3% per annum increase at the Tourle Street Bridge. Stockton Bridge's daily traffic volumes have been increasing at approximately 90% the rate of those at the Tourle Street Bridge. This indicates the long-term increases are mostly related to traffic growth north of Kooragang Island, with a lesser contribution from development on Kooragang Island.

Since 2006 there has been a significant increase in the short-term construction workforce on Kooragang Island, as well as some growth in the island's operational workforce. During the October 2011 traffic counts around 1,200 construction workers were driving to and from Kooragang Island each weekday to work on the KCT and NCIG expansion projects, and contributed to peak-hour traffic volumes. Peak-hour traffic congestion occurs on the arterial route through Kooragang Island in the morning and afternoon, with vehicle delays and queues at several intersections.

Peak-hourly flows recorded at Tourle Street Bridge show that the road is currently operating unsatisfactorily and beyond its capacity. Some of the intersections that will be used by T4 Project traffic were identified by SIDRA analysis to be operating at or beyond capacity during peak-hour periods, including:

- Industrial Drive/Woodstock Street, which was operating over capacity (Level of Service F) during the four peak hour traffic periods assessed;
- Cormorant Road/NCIG Wharf Access Road (private road), which was operating over capacity (Level of Service F)during three of the four peak-hour traffic periods assessed;
- Cormorant Road/Pacific National Access Road (private road) and Cormorant Road/Delta EMD Access Road (private road), which were operating over capacity (Level of Service F) during two of the four peak hour traffic periods assessed; and
- Cormorant Road/Egret Street and Teal Street/Raven Street, which were operating over capacity(Level of Service F) during the 4.00 to 5.00 pm peak.

8.3 Impact assessment

8.3.1 Road

The potential traffic impacts associated with the T4 Project mainly relate to traffic generation during construction, particularly during Stage 1, when workforce numbers and deliveries will be the highest. Little additional traffic will be generated by the T4 Project's operation as it will be largely staffed by PWCS's existing workforce and all coal movements will be by rail, internal conveyors and ship.

Access to the T4 project area is proposed to be from existing and new access points off Cormorant Road, Tourle Street and Industrial Drive, as well as through KCT, which will be upgraded as necessary to safely accommodate T4 Project traffic.

Traffic generation will be greatest during Stage 1 of construction. An estimated peak construction workforce of 1,500 of people was predicted in early 2015 for the purposes of modelling impacts, which will be around 300 more than the construction workforce that was in place for KCT and NCIG in October 2011; these projects have predominantly finished and are expected to be completed before construction of the T4 Project starts.

To reduce peak traffic volumes a shuttle bus service is proposed to transport approximately 300 construction workers to and from the T4 Project's work sites on Kooragang Island. With this service, the peak workforce that will travel by car (around 1,200 people) will be no greater than the KCT and NCIG construction workforce that was in place during the peak of this combined construction. Therefore, there would be no net change in daily traffic volumes on the surrounding road network. After the peak months of Stage 1, the construction workforce is likely to drop considerably and traffic generation will be significantly less than occurred for KCT and NCIG.

Daily traffic generation is predicted to be highest on the Tourle Street Bridge, with 2,510 vehicle movements during the peak months of Stage 1 construction and 1,319 in the peak months of Stages 2 and 3. This equates to an 8.6% increase to average daily traffic volumes recorded in RMS's most recent surveys at the Tourle Street Bridge (29,173 in 2010) during the peak months of Stage 1 construction. The increase will be less than 6% for all other locations and construction phases.

At three intersections, namely Industrial Drive and Tourle Street; Cormorant Road and Pacific National Access Road; and Cormorant Road and Teal Street intersections, the existing or proposed intersections will continue to operate with generally good levels of service (either Level of Service A, B or C) under all of the existing and year 2017 and year 2022 traffic scenarios considered.

At the three remaining intersections, namely Cormorant Road and Delta EMD Access Road; Cormorant Road and Egret Street; and Teal Street and Raven Street intersections, the existing peak hour intersection delays for the left turn egress are generally acceptable during most of the morning peak hour traffic periods. However, delays at these intersections increase to Level of Service F during the two afternoon peak hour traffic periods, in particular during the busiest commuter peak (4.00 – 5.00 pm) traffic period. The afternoon peak hour traffic delays for the left turn egress traffic at these intersections will continue to increase in the future, in particular during the busiest 4.00 – 5.00 pm commuter peak traffic period, as a result of the continuing background traffic growth on Cormorant Road, with very little influence from T4 Project related traffic.

The T4 Project area is large enough to accommodate the estimated peak demand of 980 car parking spaces on site.

8.3.2 Port capacity

Vessel movements within the Port of Newcastle are managed by Newcastle Port Corporation (NPC). The Hunter Valley Coal Chain Coordinator Limited and NPC modelled existing and projected port traffic. The modelling showed that the port can accommodate additional ships to service the T4 Project's nominal maximum throughput, while other commercial and recreational vessels continue to operate. The T4 Project does not include any structures or activities that would prevent commercial or recreational vessels from using the Hunter River South Arm.

8.3.3 Rail corridor capacity

ARTC manages the Hunter Valley rail network and owns the rail lines. ARTC regularly reviews the future capacity of the network considering updated demand estimates provided by all users, that is passenger, non-coal freight and coal freight users. ARTC has an ongoing five-year future capital works program to provide capacity enhancements so the network can accommodate the projected future demand for all uses.

ARTC's most recent review report was published in 2013 and identified a program of works to increase rail capacity to meet the projected demand including projected coal export volumes at the Port of Newcastle. This included building additional rail loops or track and lengthening existing ones. The works needed to accommodate projected coal export volumes at the port will continue to be reviewed annually so that the required works are identified and funded.

8.4 Mitigations

PWCS has committed to preparing a Traffic Management Plan for the T4 Project prior to construction. The plan, which will form part of the CEMP, will be prepared in consultation with RMS and NCC, and will include the following measures:

- Construction of a new four-way traffic signal controlled intersection to replace the existing Pacific National Access Road and NCIG Wharf Access Road T-intersections on Cormorant Road. The detailed design will be finalised before construction, in consultation with RMS and NCC. Timing for the intersection upgrade will be agreed with RMS during the detailed design.

- If the construction workforce exceeds 1,200 people, a dayshift shuttle bus(es) will be used to transport the additional employees (beyond 1,200) between the T4 Project's work sites and an offsite parking location(s)/pick up point(s) away from Kooragang Island. The off-site parking/ shuttle bus pick-up point(s) will be at location(s) that do not cause significant adverse traffic or parking impacts. They will be assessed and documented as part of the traffic management.

- Where possible construction traffic departures between 4.00 and 6.00 pm during the peak of construction will be staggered so that less vehicles leave during the 4.00 to 5.00 pm peak.

- PWCS will consider the preparation of a workplace travel plan in consultation with other stakeholders such as other industry on Kooragang Island.

- Internal roads and bridges will be designed and constructed in accordance with the relevant RMS,ARTC and Australian Standards.

8.5 Residual impacts

It was found that subject to the implementation of the proposed traffic mitigation measures, including road upgrades, the T4 Project will not have any significant adverse impact on traffic capacity, congestion or road safety on the surrounding local and major roads. The poor performance of intersections on Cormorant Road is as a result of the continuing background traffic growth on Cormorant Road, with very little influence from T4 Project related traffic.

9 Visual

9.1 Introduction

A visual assessment was prepared by Spackman Mossop Michaels as part of the EA and reviewed as part of the RTS/PPR.

9.2 Baseline conditions

The region surrounding the T4 project area has both high and low scenic quality attributes. The high quality attributes include natural features such as distant hills, valleys, meandering rivers and river terraces that feed into estuarine areas with beaches and dunes along the coastline. Lower quality scenic attributes include industrial areas around the port, including on Kooragang Island and the south bank of the Hunter River South Arm, transport and utility corridors and heavily modified urban residential areas. Perceptions of scenic qualities are however subjective and can vary from person to person. For example industrial areas are considered to have low scenic quality for the purpose of this study however, community consultation for this EA identified members of the local community that valued views of the working harbour and industrial use of the foreshore.

9.2.1 Commercial

Newcastle’s city centre (CBD) is on low-lying land at the mouth of the Hunter River, approximately 6 km south-east of the T4 project area. The CBD has a commercial core surrounded by mixed uses, public recreation spaces, foreshore and high density residential areas. Commercial areas mostly have modern multi-storey buildings though some historic buildings remain. One and two-storey Victorian terrace dwellings are typical of the residential areas within the city centre. There are views north from the CBD across the working harbour to industrial areas at Walsh Point and Kooragang Island.

9.2.2 Industrial

Industry, in particular port-related industry, is a significant part of Newcastle’s history and local context. Industrial and port-related land uses are located around the Port of Newcastle on Kooragang Island and at Mayfield on the southern side of the Hunter River South Arm. Industry on Kooragang Island is dominated by heavy export and processing infrastructure and coal stockyards. Visible features include elevated conveyor systems, coal stackers and reclaimers, shiploaders, coal stockpiles, wharves, large tanks, pipe work, stacks and sheds, buildings and port facilities of different sizes. Other prominent visual features on Kooragang Island include a wind turbine, transmission lines and port navigation and communication towers. Transport corridors include Cormorant Road, which is the main thoroughfare across Kooragang Island, and rail infrastructure. Heavy industry and utilities such as transmission lines dominate views along Cormorant Road.

There is a variety of heavy and light industry, including port-related industry, on the southern side of the Hunter River South Arm. These areas are dominated by steel-clad, steel framed structures, which have large floor spaces, and are mostly up to 15 m high.

Tomago and Hexham are located approximately 3.5km to the north and 4.5 km to the north-west of the T4 project area, respectively. Tomago is mostly a heavy industry area and includes the Tomago aluminium smelter, FORGACS Shipyard, Valley Longwall International and the Tomago Sandbeds water treatment works. It is on low-lying ground north of the Hunter Wetlands National Park, on the Hunter River North Arm. Hexham is on the low-lying south bank of the Hunter River, upstream of the junction of the Hunter River north and south arms. The built up area at Hexham includes industrial and port-related activities.

9.2.3 Residential

Many of Newcastle's residential suburbs are in low-lying river terraces, which restrict views of the T4 project area, however, there are some elevated residential areas which have views to the site. The landscape character and land use of residential areas near the T4 project area are described below.

Areas proximate to the T4 project area which potentially have views of it include Mayfield to the south and Sandgate to the west.Mayfield straddles raised topography to the north-west of Newcastle's city centre. The dominant housing is detached dwellings, usually with large back gardens. The area has a number of parks, reserves and ovals. Sandgate is on low-lying land to the west of Mayfield and has a small number of mixed industrial businesses and residences adjacent to the Hunter River South Arm. The Main North Railway runs through Sandgate and a large cemetery is between the railway and the Pacific Highway to the north.

Residential areas further away from the T4 project area which potentially have views of it include Fern Bay, Stockton, Tomago, Warabrook, Waratah and West Waratah.

Stockton is on a low-lying peninsula north of Newcastle's city centre and east of the T4 project area; it forms the north bank of the Hunter River mouth. The dominant housing type is detached dwellings which front onto wide streets.

Fern Bay is north of Stockton, approximately 4 km east of the proposed stockyard area, on the low-lying Hunter River banks at the entrance to Fullerton Cove. The dominant housing is detached dwellings usually with large back gardens.

Waratah, West Waratah and Warabrook are south-west of Newcastle's city centre, and south of the T4 project area on elevated topography. The suburbs include a mix of detached residential dwellings and some commercial and industrial uses. On the hill tops there are recreational areas, including Braye Park, which have views of the city centre, walking areas and picnic facilities.

Tomago is located approximately 3.5km north of the T4 project area, on low-lying ground to the north of Hunter Wetlands National Park. It has a small residential community.

9.2.4 Natural

Natural features around the T4 project area include landscapes of the Hunter Wetlands National Park, Hunter Estuary Wetlands Ramsar site and less developed areas along the Hunter River North Arm. These areas are characterised by flat, low-lying landforms with coastal lagoons, vegetated marshes and forested wetlands.

The Hunter Wetlands National Park has coastal lagoons, vegetated marshes and forested wetlands. Large areas of the national park are inaccessible or are only accessible by boat which limits the number of visitors to these areas. Special interest groups such as the University of Newcastle and HBOC do however use the area for scientific purposes. Canoe tours are undertaken in the Iron Bark Creek system.

Ash Island is west of Kooragang Island on low lying terrain at the junction of the Hunter River South and North arms. It includes an education centre and guided walks are conducted through the area.

9.3 Impact assessment

The visual assessment identified and assessed 25 representative viewpoints within a zone of visual influence (ZVI) for the T4 Project. The ZVI is the area in which the T4 Project may be viewed and was determined based on an analysis of aerial photos, topographic maps, cadastral data and the preliminary T4 Project design.

A qualitative assessment of the potential landscape and visual impacts of the T4 Project was undertaken for the 25 viewpoints, assuming no mitigation measures such as screening or camouflage/disguise treatments. It considered three evaluation criteria:

- type of effect and probability of effects occurring;
- magnitude of change; and
- likely visual sensitivity of receptors.

The significance of likely landscape and visual impacts was evaluated using the assessment matrix provided in Table 9.1, which is the same as that used in the EA.

Table 9.1 Landscape and visual assessment evaluation of significance matrix

Magnitude of Change	**Visual Sensitivity**		
	High	**Medium**	**Low**
High	Substantial	Moderate/Substantial	Moderate
Medium	Moderate/Substantial	Moderate	Slight/Moderate
Low	Moderate	Slight/Moderate	Slight
Negligible	Slight	Slight/Negligible	Negligible
Key:	Significant	Not Significant	

Source: Spackman Mossop Michaels (2012).

This qualitative assessment identified that 21 of the 25 representative viewpoints are likely to only experience low levels of visual change as a result of the T4 Project. Without mitigation, four of the viewpoints could be significantly affected by the modified T4 Project (Viewpoints 12, 13, 15 and 24), ranked as 'moderate/substantial' or 'substantial' in the significance evaluation.

A critical viewpoint assessment was undertaken for each of these viewpoints, considering both the unmitigated and mitigated project design. Visual mitigations considered include vegetation screening and colour paint treatments applied to elevated infrastructure to minimise its visual impact, as per PWCS's commitments detailed below.

Without mitigation, some T4 Project infrastructure will be visible from Viewpoints 12, 13, 15 and 24, which may increase the extent of industry visible. Vertical elements such as the yard machinery and shiploaders are likely to break the skyline at some viewpoints. With mitigation, the T4 Project is likely to successfully integrate with the existing landscape, including approved future industrial developments, so that visual impacts at the most affected viewpoints will be moderate, ie not significant. The T4 Project will appear similar to the adjoining industrial and port facilities.

Table 9.2 Critical viewpoint assessment – construction and operations

Viewpoint	Sensitivity	Magnitude of change		Level of effect	
		Without mitigation	With mitigation	Without mitigation	With mitigation
12 – Braye Park, Waratah West	High	Medium	Low	Moderate/substantial	Moderate
13 – Bull Street, Mayfield West	High	High	Low	Substantial	Moderate
15 – Tourle Street Bridge	Medium	High	Medium	Moderate/substantial	Moderate
24 – Fort Scratchley, Newcastle	Medium	High	Medium	Moderate/substantial	Moderate

9.4 Mitigations

PWCS has committed to the following visual mitigation and management measures for the T4 Project:

- colour treatments will be applied to the yard machinery, shiploaders, buffer bins and elevated conveyors to reduce the level of visual change, particularly in regard to these structures against the skyline;
- where feasible, landscape planting will be undertaken to screen infrastructure and soften views of the T4 Project from near field locations such as Tourle Street Bridge and Cormorant Road;
- the camouflage/integration and landscape planting strategy will be finalised during the detailed design stage for the T4 Project and incorporated into a landscape and visual management plan, to be prepared prior to starting construction of the T4 Project; and
- measures will be developed in the detailed design phase, and included in the landscape and visual management plan, to minimise light spill and glow to surrounding areas. This may include:
  - avoidance of upward lighting;
  - use of directional light fittings and screening of lighting to limit light spill; and/or
  - use of lighting systems that minimise the area that is lit and the period of time it is lit.

9.5 Residual impacts

The visual assessment found that should the recommended visual mitigation measures be implemented, including landscape planting for screening and camouflage/disguise treatments to elevated infrastructure, the T4 Project will successfully integrate with the existing landscape so that visual impacts at the most affected viewpoints are not significant. The T4 Project will appear similar to the adjoining industrial and port facilities.

Therefore, there are no residual impacts to public amenity or services in relation to visual matters.

10 Heritage

10.1 Introduction

A heritage assessment was prepared by EMM as part of the EA and reviewed as part of the RTS/PPR, The heritage assessment considered both Aboriginal and non-Aboriginal heritage values.

10.2 Baseline conditions

10.2.1 Aboriginal heritage

Several Aboriginal heritage investigations have been conducted on Kooragang Island. None of these assessments identified any Aboriginal artefacts, sites, landform or other places of special significance to Aboriginal people, with the possible exception of a midden (site 38-4-41) identified around 1970 (discussed below).

An Aboriginal Heritage Information Management System (AHIMS) search was conducted by EMM in March 2011 and updated in August 2013. These searches did not identify any Aboriginal sites recorded within the T4 project area. However, records of three Aboriginal sites were returned for other locations on Kooragang Island:

- Site 38-4-41 is a midden generally referred to as the 'Tourle Street midden' in past reports, although noted in the AHIMS record as 'Dempsey Island (by new bridge)'. This site was identified by a survey around 1970, potentially located near the Tourle Street Bridge. However, the site has not been found again, despite focussed survey attempts to locate it. There is no evidence that this site exists at the given coordinates.

- Site 38-4-1123 'Stockton 13B' is an erroneous record located exactly 1 km west of partner site records on Stockton Beach, indicating the incorrect entry of map coordinates into the AHIMS system.

- Site 38-4-50 is an artefactsite located near the Hunter River North Arm, more than 550 m north-east of the T4 project area.

10.2.2 Non-Aboriginal heritage

Search of the Australian heritage database and NSW heritage list and inventory in March 2011 and August 2013 did not identify any heritage items or places within the T4 project area. There are four items of local cultural heritage significance recorded on Kooragang and Ash Islands:

- a palm tree at Walsh Point, although it is noted as 'removed' on the photograph associated with the record;

- the School Masters House on Ash Island, approximately 3 km north-west of the T4 project area;

- 'Tongues Tree Fig', located approximately 3 km north-west of the T4 project area; and

- '131 Radar Igloo' WWII structure, located approximately 2.5 km north-west of the T4 project area. This site is also identified as having state significance under the name '131 Radar station (former)'.

A search of the historic shipwrecks database on 18 March 2011 indicated that shipwrecks are known only around the mouth of the Hunter River on the Oyster banks and near Nobbys Head. No shipwrecks are listed in the Hunter River South Arm near the T4 project area.

10.3 Impact assessment

10.3.1 Aboriginal heritage

For the purpose of the heritage assessment, the T4 project area was divided into areas classified as either:

- 'modified and disturbed';
- 'partially modified and disturbed and previously surveyed'; or
- 'area for inspection'.

The 'area for inspection' was inspected on 20 May 2011 and 20 December 2011. They identified that the area was disturbed and had no archaeological potential because of filling, water logging and landform modification. No archaeological survey was warranted. Representatives of the local Aboriginal groups involved in the assessment confirmed that no specific Aboriginal heritage values were present. It was not considered necessary to survey the remainder of the T4 project area as it is modified and disturbed to the extent there is no potential for archaeological visibility or survival of archaeological evidence, or has previously been surveyed and found to have no Aboriginal sites or potential for Aboriginal sites.

All land has value to the Aboriginal community stemming from the original connection of people to the land. Aboriginal stakeholders consulted about the T4 Project shared memories of fishing and collecting quail eggs around Kooragang Island and Carrington. However, the heritage assessment did not identify any specific socio-cultural heritage values relating to the T4 project area.

10.3.2 Non-Aboriginal heritage

Literature reviews and database searches undertaken by EMM did not identify any non-Aboriginal heritage items within the T4 project area. No historic relics were identified during the field inspection. Although old parish maps indicate prior rural subdivision of the land within the T4 project area, no physical evidence is known to remain or could have possibly survived the past industrial impacts on the land. As there are no non-Aboriginal cultural heritage values associated with the T4 project area, there will be no impact to non-Aboriginal heritage as a result of the T4 Project.

10.4 Mitigations

The T4 project area does not have any archaeological potential or specific cultural heritage values, Aboriginal or non-Aboriginal. The majority of it has been modified and disturbed and the entire T4 project area has no archaeological potential. Accordingly, the T4 Project will not have any impact on cultural heritage value and no heritage management or monitoring measures are required. Despite this, contingency measures will be in place in the unlikely event that cultural heritage material is located.

10.5 Residual impacts

There will be no heritage impacts from the T4 Project. As such, there will be no residual impacts.

11 Economics

11.1 Introduction

An economic assessment was prepared by Gillespie Economics as part of the EA and updated as part of the RTS/PPR. Both assessments were peer reviewed by Dr Jeff Bennett. In addition, a separate economic assessment was prepared by Monash University and presented in the RTS on the Preferred Project document.

11.2 Impact assessment

The economic assessments undertaken by Gillespie Economics included a benefit cost analysis (BCA) to compare the T4 Project's estimated benefits and costs over time, input-output (I-O) modelling to determine economic activity or stimulus associated with the T4 Project. In the RTS on Preferred Project document, computable general equilibrium (CGE) modelling was undertaken by Monash University as an alternative to I-O modelling to ascertain economic activity from the project.

11.2.1 Benefit cost analysis

The BCA incorporates the estimated benefits and costs to Australia of the T4 Project’s construction and operation, as well as associated coal supply chain activities such as rail upgrades and coal mining. The project’s main economic benefit is the associated coal export earnings it allows to be generated earlier than they would otherwise be, by increasing port capacity to meet demand.

The BCA estimates that the total net production benefits of the T4 Project, associated infrastructure and mining varied from $13 billion (B) to $33 B depending upon the modelling assumptions. These benefits would be distributed between numerous stakeholders, including the:

- Commonwealth Government in the form of company tax, estimated at between approximately $3,856 million (M) (present value) and $8,551M (present value) for Scenario 3;
- NSW Government via royalties, estimated at between approximately$2,427M (present value) and $4,884M (present value);
- local communities through mining company contributions to community infrastructure, for example donations and sponsorships; and
- coal mining companies and their shareholders.

Conservatively assuming 100% foreign ownership, the minimum net production benefit accruing to Australia (from company tax and royalties) is predicted to be in the order of between $6 B (present value) and $13 B (present value).

It is evident that there are potentially significant net production benefits to Australia that would be foregone, due to port capacity constraints, if the T4 Project is not developed. The T4 Project will allow Australia and NSW to capture the economic benefits of helping to supply the increasing world demand for coal and the energy derived from it.

i Input-output modelling

The economic stimulus the T4 Project's construction and operation would bring to the NSW and regional (Newcastle statistical subdivision) economies has been estimated. Direct and indirect flow on effects of the project's employment, revenue and purchases of goods and services were considered. While the T4 Project will stimulate investment along the coal supply chain, this analysis only considered stimulus generated by the coal terminal itself.

The economic stimulus during construction of the T4 Project are summarised in Table 11.1 for the peak year and total duration of construction, assumed for the purposes of this assessment to take four years. The results indicate that the T4 Project will provide substantial stimulus to the NSW and regional economies during its construction phase.

Table 11.1 Estimated direct and indirect economic impacts during construction

Economic indicator	NSW economy		Regional economy[2]	
	Per annum (peak construction)	Total	Per annum (peak construction)	Total
Output (gross business turnover)	$1,146 M	$2,370 M	$770 M	$1,654 M
Value added	$511 M	$1,053 M	$317 M	$681 M
Household income	$352 M	$726 M	$227 M	$486 M
Employment[1]	4,256 jobs	8,778 job years	2,919 jobs	6,268 job years

Notes: 1. Job years is the amount of work equal to the output of one person working for one year.

2. The regional economy was taken as the Newcastle statistical subdivision, including the Newcastle, Lake Macquarie, Cessnock, Maitland and Port Stephens LGAs.

The revised results for operations are summarised in Table 11.2. The results show that operation of the T4 Project is predicted to provide substantial stimulus to the NSW and regional economies.

Table 11.2 Estimated direct and indirect economic impact during operations

Economic indicator	NSW economy		Regional economy	
	Per annum (70 Mtpa)	Total (nominally to 2035)	Per annum (70 Mtpa)	Total (nominally to 2035)
Output (gross business turnover)	$472 M	$7,895 M	$418 M	$7,002M
Value added	$363 M	$6,079 M	$336 M	$5,621M
Household income	$41 M	$692 M	$24 M	$409 M
Employment[1]	492 jobs	8,236 job years	304 jobs	5,089 job years

Notes: 1. Job years is the amount of work equal to the output of one person working for one year.

11.2.2 Computable general equilibrium modelling

A CGE analysis was undertaken for the T4 Project and presented in the RTS on Preferred Project document, in addition to the I-O analysis already undertaken and presented in the EA and RTS/PPR. Both approaches indicate that the T4 Project will provide significant economic activity, including employment, to the Newcastle region.

The CGE analysis indicates a regional construction workforce of up to 2,500 people as a result of the T4 Project and regional employment of between 500 and 1,000 when the T4 Project is operating at full capacity. This is comparable to the I-O analysis which indicated construction employment impacts of up to 2,919 and regional employment of 304 jobs when the T4 Project is operating at full capacity. The higher regional workforce during operation of the T4 Project indicated by the CGE modelling, partly reflects the influence of expanded coal mining in the Hunter Valley and beyond on the Newcastle economy. These influences are not captured by the IO modelling.

The CGE modelling also indicates additional value-added for the Newcastle economy of between $434 M and $1.2 B when the T4 Project is operating at maximum capacity, in comparison to the $336 M indicated by the I-O modelling. Again the higher figure from the CGE modelling partly reflects the influence of expanded coal mining on the Newcastle economy.

The CGE modelling also indicates increased economic activity for the Newcastle economy as a result of the T4 Project in terms of additional aggregate investment, aggregate consumption, real gross domestic product, capital stocks, real wages and housing rentals. The CGE analysis concludes that the T4 Project (as modelled) will result in a welfare impact on the Australian economy of $35 B (at 7% discount rate). The equivalent figures assuming discount rates of 4% and 10% are $55 B and $22 B respectively. 'Welfare' is a cumulative measure of the change in public and private consumption as a result of a project or policy. It is an indicator of how much better off society is with a project or policy compared to without it.

11.3 Mitigations

The T4 Project is predicted to provide substantial economic benefit and stimulus to the Australian, NSW and regional economies. Accordingly, no mitigation measures are considered necessary. Notwithstanding the above, PWCS have committed to:

- encouraging major contractors supplying goods and services to PWCS to support local businesses where possible; and
- where appropriate, PWCS will continue to procure locally and use the services of local companies.

11.4 Residual impacts

There will be no adverse residual economic impacts from the T4 Project. Conversely, there will be significant economic benefits from the project, particularly to the Newcastle economy.

Appendix 4

12 Social

12.1 Introduction

An social assessment was prepared by Coakes Consulting as part of the EA and updated as part of the RTS/PPR.

It should be noted that baseline conditions are those as reported in the EA which was published in February 2012. This included results of the 2006 Population and Housing Census because the results of the 2011 Population and Housing Census had not been published by the time the EA was. Notwithstanding this, the updated social assessment presented in the RTS/PPR utilised the results of 2011 Census data.

12.2 Baseline conditions

12.2.1 Population demographics

The Newcastle LGA's residential population was 141,752 in 2006 (ABS 2007a). In June 2009, the population was estimated to be 154,777 persons (Hunter Valley Research Foundation (HVRF) 2011). The 2006 population of Newcastle and the Hunter Region is presented in Table 12.1. The 'Hunter Region' referred to in this chapter is defined as the Australian Bureau of Statistics'(ABS) Hunter Statistical District. It includes the LGAs listed in Table 12.1. Current forecasts suggest an annual population growth rate of 0.6% over the next two decades for the Newcastle LGA, which is lower than the rate expected for the broader Hunter Region (0.9%) (HVRF 2011).

Table 12.1 Population of Newcastle LGA and the Hunter Region - 2006 census

LGA	Population
Newcastle	141,752
Cessnock	46,206
Lake Macquarie	183,139
Maitland	61,881
Port Stephens	60,484
Dungog	8,062
Gloucester	4,800
Great Lakes	32,764
Muswellbrook	15,236
Singleton	21,940
Upper Hunter Shire	12,976
Total Hunter Region	**589,240**

Source: ABS.

The age distributions of the populations within the Newcastle LGA, Hunter Region and NSW are presented in Table 12.2. The Hunter Region broadly reflects the age distribution of NSW, with variances evident in the 0-14 year age group, 20-24 year age group and the over 65 age group. In comparison to NSW and the Hunter Region, the Newcastle LGA is characterised by a lower percentage of persons in the 0-14 year age group and a greater percentage of persons between 20 and 24 years old, and over 65. The age distribution for the Newcastle LGA and Hunter Region is however generally representative of the broader population, and therefore does not present distinct issues for population planning.

Table 12.2 Age distribution, Newcastle LGA, Hunter Region and NSW: 1996, 2001, 2006

	Newcastle LGA				Hunter Region				NSW			
Age	**1996**	**2001**	**2006**	**1996-2006**	**1996**	**2001**	**2006**	**1996-2006**	**1996**	**2001**	**2006**	**1996-2006**
0-14	18%	18%	17%	↓	22%	21%	20%	↓	21%	21%	20%	↓
15-19	7%	7%	7%	-	7%	7%	7%	-	7%	7%	7%	-
20-24	10%	9%	9%	↓	7%	6%	6%	↓	7%	7%	7%	-
25-34	15%	15%	14%	↓		13%	12%	↓	15%	15%	14%	↓
35-44	14%	14%	14%	-	15%	15%	14%	↓	15%	15%	15%	-
45-54	11%	13%	13%	↑	12%	14%	14%	↑	13%	13%	14%	↑
55-64	8%	9%	10%	↑	9%	10%	12%	↑	9%	9%	11%	↑
65+	17%	16%	16%	↓	14%	15%	16%	↑	13%	13%	14%	↑

Source: ABS.

12.2.2 Industry and employment

The most common industry of employment in the Newcastle LGA is health care and social assistance, which has experienced growth between 2001 (13.5%) and 2006 (15%) (both in absolute terms, and as a percentage of the overall workforce). This is followed by retail trade (11%) and manufacturing (10%), industries which have grown in absolute terms, but experienced decline as a percentage of the overall workforce between 2001 and 2006 (ABS 2007b). The most common occupations in the LGA are professionals (24%), clerical and administrative workers (15%), trade workers (14%), community and personal services workers (10%), managers (10%) and sales workers (10%). While the mining sector is a marginal employment sector in the Newcastle LGA (1%), it represents a more dominant sector in the Hunter Region more broadly, and many jobs in the Newcastle LGA supported by the mining industry.

PWCS employs over 400 local workers and engages around 310 contracting businesses for its activities. PWCS is a significant provider of jobs in the industry classification labelled 'transport, postal & warehousing', which comprised 4% of the employed workforce in Newcastle in 2006 (ABS 2007). Employees and their families contribute to local economies through real estate markets (purchase or rental), purchase of goods and services, participation in recreation and community groups, and use of community services and infrastructure. Most of PWCS's employees live in the Newcastle LGA (42%), followed by the Lake Macquarie LGA (34%). This suggests that most of the socio-economic contributions from employees are located close to the T4 project area and the majority of the social and economic benefits of local employment by PWCS stay within these LGAs.

12.2.3 Workforce participation, income and cost of living

Over the 2001 and 2006 census periods there has been a steady decline in unemployment in NSW generally. This decline has been more pronounced in the Hunter Region and, in particular, the Newcastle LGA, where unemployment declined from 12% in 1996, to 7% in 2006. More recent figures indicate that unemployment in the Hunter Region has continued to fall and was below 5% in 2010 (HVRF, 2011). The rate has remained below the NSW average since 2008. In the Newcastle LGA and the broader Hunter Region, the decline in unemployment has coincided with an increase in the size of the labour force, as well as consistent and high levels of workforce participation, indicating strong economic growth.

Individual, family and household incomes increased over the period 2001 to 2006 in the Newcastle LGA and Hunter Region, but both are less than the NSW median. While rent and median housing repayments are slightly lower in the Newcastle LGA, relative to NSW as a whole, they are comparatively higher when considered as a proportion of weekly income. This suggests potentially higher cost-of-living pressures for those renting and repaying mortgages within the Newcastle LGA and Hunter Region.

12.2.4 Education

The proportion of Newcastle LGA residents with post-secondary school qualifications is broadly consistent with that observed in NSW. Bachelor and higher degrees (eg postgraduate degrees) appear more prevalent in the Newcastle LGA (14.7%) compared to the Hunter Region (9.6%) more broadly, where certificate-level qualifications are more common. These findings are consistent with the dominant industries and occupations of employment in the region including professionals, managers and community and personal services workers, that must attain certain levels of higher education.

12.2.5 Health

Some health indicators, such as percentage of low birth weight babies, immunisation rates, annual infant death ratio and incidence of private health insurance, suggest poorer health in the Newcastle LGA, compared to NSW overall. There are also greater numbers of people requiring aged care. Overall, these findings are consistent with data described by HVRF (2011) suggesting higher incidences of various diseases and associated mortality in the Hunter Region, compared to NSW as a whole, and that Hunter residents were more likely to report poorer self-assessment health scores than the overall result for NSW.

12.2.6 Public infrastructure

Public built infrastructure throughout Newcastle is well developed, with various community facilities and schools, health care and social assistance, open space and recreational areas, public amenities and utilities. The Newcastle LGA is also serviced by Newcastle airport, situated approximately 20 km north of Newcastle's CBD, which supports both domestic and international routes.

12.2.7 Housing

There is a state-wide decline in housing and rental availability/affordability that is reflected in the Newcastle LGA, and is considered to represent a risk area for the physical and economic capital.

There are a high proportion of single-occupant dwellings in the Newcastle LGA (30% of occupied dwellings) compared to the Hunter Region (25%) and NSW (24%), which may reflect the young adult population in Newcastle, including University of Newcastle students residing in the city, as well as the aged population, which is often characterised by smaller household size.

Median house prices in the Newcastle LGA have increased over recent years from $146,000 in 2000 to $312,000 in 2004, and $368,000 in 2010. While this trend is reflected NSW-wide, when considered in comparison to incomes in the Newcastle LGA, this increase in house price raises problems of housing affordability. Similar stress has been recognised in the private rental market, which represents 23% of all occupied dwellings in Newcastle (Housing NSW 2008).In addition, rental market availability has been decreasing, from 1.8% to 1.5% between January and April 2011 (with figures below 1% considered as a critical shortage (REINSW 2011). Median weekly rent continues to increase in the Newcastle LGA, surpassing the regional average and approximating the NSW average.

12.2.8 Social cohesion and participation

Social cohesion and community participation indicators can be used to examine social capital. Such indicators include the level of volunteering, population mobility, immigration, English as a second language and crime. Table 12.3 provides some additional indicators of social capital vulnerability.

Table 12.3 Selected indicators of social cohesion and participation: Newcastle LGA, Hunter Region and NSW, 2006

	Newcastle LGA	Hunter Region	NSW
Percent of individuals with a different address five years ago	17%	14%	14%
Percent of individuals born overseas that speak English "not well" or "not at all"	8%	4%	13%
Percent of population not born in Australia	18%	15%	31%
Percent of adult population that do not volunteer	75%	74%	73%

Source: ABS.

Table 12.3 shows that the population in the Newcastle LGA is more mobile than in the Hunter Region or NSW more broadly. This may indicate a less stable community. The Newcastle LGA has slightly less people volunteering, compared to the Hunter Region and NSW, which is assumed to impact on community participation and therefore potentially result in weaker social capital. The Newcastle LGA has a lower proportion of immigrants with poor English language skills compared to NSW, suggesting that language barriers are unlikely to inhibit communication and community cohesion.

The prevalence of crime in a community can provide an indication of social capital, including harmony and cohesion within the community. Crime offence statistics analysed and presented by HVRF (2011) indicate higher rates (per 100,000 population) of certain crimes in the Newcastle LGA compared to neighbouring LGAs and NSW overall. In particular, non-domestic assaults (violence-related), disorderly conduct offences and malicious damage to property are higher in the Newcastle LGA.

HVRF included crime-related questions in its wellbeing survey (HVRF, 2011), which showed that perceptions of the prevalence of crime are much higher in the Newcastle LGA than any other LGA studied in the Hunter Region (see HVRF, 2011 for further details). In the Newcastle LGA, more people reported a problem with 'louts, youth gangs, prowlers or loiterers' and 'vandalism or graffiti'.

Despite some concerning trends in social capital, the HVRF (2008)*Wellbeing Watch* found that on balance, Hunter Region residents felt happy, satisfied with their lives and standard of living and were optimistic about their future. Not all residents recorded high levels of wellbeing with 13.5% of residents reporting low wellbeing scores. Those in the 40-49year age bracket were more likely to report a lower wellbeing score as well as Indigenous residents, sole parents and single persons (HVRF 2008).

12.3 Port Waratah Coal Services

PWCS regularly undertakes community engagement activities with community groups and the broader community of residents that surround the Port of Newcastle. PWCS also has a strong sense of corporate and social responsibility and prides itself on its contributions and participation with the local community and public in general.

More generally, PWCS contributes to community activities and projects through a community investment program. This program supports key community organisations such as:

- Hunter Medical Research Institute;
- Newcastle Surf Life Saving Club;
- Hunter Prostate Cancer Alliance;
- Westpac Rescue Helicopter;
- Samaritans; and
- Salvation Army.

PWCS has implemented a Schools Engagement Program in partnership with local schools to support young people and local families. This has been a long term priority of PWCS and includes the following Carrington schools; Tighes Hill Public School, Carrington Public School and Mayfield East Public School. In 2013, PWCS also supported high schools students in the region through its support of skills development programs such as the Newcastle F1 in Schools Challenge, Hunter Valley Electric Vehicle Festival and Maths and Science Engineering Challenge. In 2013 PWCS agreed to a three year partnership with Carrington Public School which will support a maths, literacy and music program within the school.

PWCS has provided over $3.8 M in support to the local community through sponsorships, donations and community investments since 2003. In 2013 PWCS provided over $735,000 in support to the local community including; supporting the Carrington Tennis Courts to refurbish the tennis courts, Many Rivers Microfinance to support a Business Development Officer working with start-up businesses in Newcastle and NCC to run the first Christmas in the City initiative.

For 2014, PWCS has committed to provide $750,000 in support to local organisations – with $50,000 specifically targeted to neighbouring suburbs of KCT and CCT.

Each year PWCS invests over $1 M in its apprenticeship and traineeship programs. Over thirty years, PWCS has hosted over 100 apprentices with program partner Novaskill and in 2012 PWCS was awarded the NSW Large Host Employer of the Year by the Group Training Association.

Port Waratah also supports up to 20 trainees at any given time – including having a specific Vision Impairment Traineeship which is facilitated in partnership with Vision Australia. At any given time PWCS supports up to 12 VET school scholarship students ($4,200 per annum and paid work placements) and up to eight university scholarship students who receive $7,000 per annum in support plus paid work experience over summer holidays.

In everyday operations, PWCS provides a community hotline for residents and other community representatives to facilitate feedback and comment on their existing operations. An analysis of the PWCS community enquiries database before the EA was prepared for January 2007 to October 2011 shows that, from a total of 139 enquiries, most of them originated from the southern suburbs of Mayfield East, Carrington, Tighes Hill and Maryville. The third highest number of enquiries overall came from Stockton in the east, and the fifth highest from Fern Bay in the north. There were minimal to no enquiries west of the port complex. A basic analysis of these enquiries shows that a key focus of community enquiries is noise and dust, with a small number categorised as 'other'.

12.4 Impact assessment

12.4.1 Modelling scenarios

TheT4 Project's workforce is expected to comprise people already living in the local area and those that may move to the area temporarily or long-term to work on the project. Given that the workforce mix is not yet known, a range of possible scenarios were assessed, assuming different portions of the workforce are sourced locally, versus relocate to the area in the short term, requiring temporary accommodation, and long-term, bringing their families and requiring rental or purchased housing.

The workforce modelling assumed workers temporarily relocating to the area would all stay in short-term accommodation such as hotels in the Newcastle LGA. It was also assumed those relocating long-term (for more than two years) would bring their families and the proportion that would settle in Newcastle and each of the surrounding LGAs would be similar to PWCS's existing workforce distribution. Family sizes were assumed to be the same as the average LGA household sizes determined in the 2011 Census.

Potential impacts were assessed by comparing the predicted population influx against recent available data on the existing population of each assessed LGA and housing and accommodation availability.

i Construction workforce modelling scenarios

Three construction workforce modelling scenarios were modelled and assessed as defined in Table 12.4. Scenario A is PWCS's anticipated workforce mix and assumes that most of the workforce will be local residents. Scenarios B and C consider worst case alternatives for housing and accommodation demand in the long and short term respectively.

Table 12.4 Peak construction workforce modelling scenarios

Workforce composition	Scenario A		Scenario B		Scenario C	
	%	No.	%	No.	%	No.
Existing residential	85.0	1,284	50	755	40	604
Temporarily relocate to Newcastle LGA (short-term)	1.5	23	25	378	45	680
Relocate to Newcastle, Lake Macquarie, Port Stephens, Maitland and Upper Hunter LGAs (long-term)	13.5	204	25	378	15	227
Total	**100**	**1,511**	**100**	**1,511**	**100**	**1,511**

Notes: A peak construction workforce of approximately 1,500 people is proposed. Coakes used a modelling dataset that assumed a construction workforce of 1,511 people.

ii Operational workforce modelling scenarios

Two operational workforce scenarios were modelled and assessed, as defined in Table 12.5. Scenario A assumes 60% of the operational workforce is sourced locally and that the remainder moves to the area long-term. This is reasonable based on similar projects in the area. Scenario B is a hypothetical worst case from a housing demand perspective, where the entire workforce is sourced from outside the region.

Table 12.5 Peak operational workforce modelling scenarios

Workforce composition	Scenario A		Scenario B	
	%	No.	%	No.
Existing residential	60%	49	0%	0
Relocate to Newcastle, Lake Macquarie, Port Stephens, Maitland and Upper Hunter LGAs (long-term)	40%	32	100%	81
Total	**100%**	**81**	**100%**	**81**

Notes: Approximately 80 additional PWCS employees are proposed to operate the T4 Project at 70 Mtpa, to be confirmed during detailed design. Coakes used a modelling dataset that assumed an operational workforce of 81 people.

iii Population change

a. Construction

A peak construction workforce of up to approximately1,500 people is anticipated for the T4 Project. Based on the Burdge (2004) social consequence model, population changes of less than 1% are considered to have negligible social consequence. Accordingly, the predicted population change of up to 0.46% from the short-term relocating construction workforce (considered a conservative assessment as many workers are likely to already reside within the Newcastle and Lower Hunter) is anticipated to have negligible social impact in the Newcastle LGA (Table 12.6).

Table 12.6 Predicted peak population change and social impacts due to short-term relocating construction workforce – Newcastle LGA

	Scenario A	Scenario B	Scenario C
Peak workforce temporarily relocating to Newcastle LGA	23	378	680
Population increase in Newcastle LGA[1]	0.02%	0.25%	0.46%
Social consequence[2]	**Negligible**	**Negligible**	**Negligible**

Notes: 1. Calculated based on a Newcastle LGA population of 148,535, recorded in the 2011 Census.

2. Based on Burdge (2004) social consequence model.

Long-term estimates of peak population change due to construction workers and their families moving to Newcastle and the surrounding LGAs to work on the project are provided in Table 12.7. Results are provided for PWCS's anticipated workforce mix (Scenario A) and the hypothetical worst case (Scenario B). The peak population change across the LGAs is predicted to be between 0.10% and 0.26%, which according to Burdge's (2004) social consequence model is negligible and would have negligible social impact.

Table 12.7 Predicted peak population change and social impacts due to long-term relocating construction workforce and their families

LGA	Population[1]	Average household size[1]	Existing PWCS workforce distribution	Estimated population increase[2]				Social consequence[3]
				Scenario A		Scenario B		
				No.	%	No.	%	
Newcastle	148,535	2.4	42%	206	0.14	381	0.26	Negligible
Lake Macquarie	189,005	2.5	34%	173	0.09	321	0.17	Negligible
Port Stephens	64,808	2.5	11%	56	0.09	104	0.16	Negligible
Maitland	67,479	2.7	9%	50	0.07	92	0.14	Negligible
Upper Hunter	73,535	2.7	4%	22	0.03	41	0.06	Negligible

Notes: 1. Source: 2011 Census data.

2. Predictions of total populations increase have assumed each employee that relocates to a LGA long-term and brings their family has a family size equivalent to the average household size for each LGA, as determined in the 2011 Census.

3. Based on the Burdge (2004) social consequence model.

For the worst-case cumulative scenario of 381 people relocating to the Newcastle LGA under Scenario B (including families), plus a short-term relocating workforce of 378, the change to the existing Newcastle LGA population would still be less than 1%, with negligible social consequence.

b. Operational

It is estimated that an additional 80 PWCS employees will be required to operate the T4 Project at 70 Mtpa. The estimated population increase from employees and their families moving to the area for the project is shown in Table 12.8for the reasonable (Scenario A) and worst case (Scenario B) scenarios. Even for the worst case scenario, the population change in the Newcastle and surrounding LGAs would be negligible (below 1%) and have negligible social impact.

Table 12.8 Projected population change and social impact due to relocating operational workforce and their families

LGA	Population[1]	People relocating to region		Estimated population increase		Social consequence
		Scenario A	Scenario B	Scenario A	Scenario B	
Newcastle	148,535	31	82	0.02%	0.05%	Negligible
Lake Macquarie	189,005	27	69	0.01%	0.04%	Negligible
Port Stephens	64,808	9	22	0.01%	0.03%	Negligible
Maitland	67,479	8	20	0.01%	0.03%	Negligible
Upper Hunter	73,535	3	9	0.00%	0.01%	Negligible

Notes: 1. Source: 2011 Census data.

2. Approximately 80 additional PWCS employees are proposed to operate the project at 70 Mtpa, to be confirmed during detailed design. Coakes used a modelling dataset that assumed an operational workforce of 81 people.

c. Combined construction and operations

It is likely that construction will coincide with operations at some stage, and the T4 Project's operational and construction workforces both be present in the region. However, this would not occur when either workforce is at its peak. Population change would be less than for the worst case construction scenario assessed, that is, would still be negligible.

iv Housing and accommodation

a. Construction workforce

Housing and accommodation impact assessments have been updated for each assessment scenario. It has been conservatively assumed that each worker will require one house, room or apartment, while in reality some workers may share accommodation, which would reduce demand.

Predictions of peak demand for short-term accommodation in the Newcastle LGA are provided in Table 12.9. Based on the estimated spare capacity of 480 rooms, the results indicate there is sufficient accommodation available for Scenarios A and B, although Scenario B potentially fills most vacancies. However, should a higher proportion of the short-term workforce be sourced from outside the local area than anticipated by PWCS, such as for Scenario C, demand may exceed existing capacity. While potentially beneficial for the accommodation providers, this could result in short-term accommodation shortages, with possible flow on effects to the rental market should temporary workers seek rental housing instead.

Table 12.9 Estimated short-term accommodation availability and peak construction demand in the Newcastle LGA

Scenario	Estimated spare capacity	Construction workforce requiring short-term accommodation	Short-term accommodation surplus/deficit
A	480	23	+ 457
B	480	378	+ 102
C	480	680	- 200

The estimated rental availability in the Newcastle LGA is provided in Table 12.10, along with various predictions of demand from the long-term relocating construction workforce. Rental availability for the Newcastle LGA specifically was considered as it was an issue raised by stakeholders during consultation undertaken as part of the social assessment. The results indicate that rental requirements can be met by the existing market. However, as in the EA, increased demand is predicted which should be considered in the context of existing pressures on Newcastle's rental market. This is the driver behind PWCS's commitment to undertake a housing and accommodation study closer to the start of construction, when more information is available, to verify potential impacts and inform strategies to minimise predicted impacts, if required. The more the T4 Project can draw on existing local workforces, the less impact there will be on the short-term accommodation and rental markets in the Newcastle LGA. For example, if PWCS's anticipated workforce mix is achieved (Scenario A), the T4 Project will have minimal impact on the accommodation and rental markets.

Table 12.10 Estimated rental availability in the Newcastle LGA and peak demand from long-term relocating construction workforce

Scenario	Rental dwellings available[1]	Long-term construction workforce requiring rental dwellings[2]	Rental capacity required for T4 Project
A	258	24	9%
B	258	45	17%
C	258	27	10%

Notes: *1. Source: Real Estate Institute of New South Wales (2012), based on Newcastle average of 1.3%.*

2. Assumes 42% of the long-term relocating construction workforce move to the Newcastle LGA, of which 28% require rental housing.

Estimates of available housing stock and relocating construction workforce demand for purchased housing are presented in Table 12.11. The results indicate there is sufficient availability to accommodate the relocating construction workforce.

Table 12.11 Estimated housing availability and construction workforce demands

LGA	Dwellings available for purchase[1]	Estimated dwellings required for purchase by relocating construction workforce[2]					
		Scenario A		Scenario B		Scenario C	
		No.	% of total available	No.	% of total available	No.	% of total available
Newcastle	1,361	62	4.55%	114	8.41%	68	5.03%
Lake Macquarie	1,914	50	2.60%	93	4.85%	55	2.09%
Port Stephens	590	16	2.68%	30	5.13%	18	3.05%
Maitland	599	13	2.16%	24	4.09%	14	2.40%
Upper Hunter	674	6	0.85%	11	1.60%	6	0.96%
Total	**5,138**	**147**	**2.9%**	**272**	**5.3%**	**161**	**3.1%**

Notes: *1. Based on Hunter Valley Research Foundation (HVRF) (2011) data on average number of properties for sale and detached houses being constructed in the Hunter Region.*

2. Based on 2011 Census data, it is assumed 72% of the long-term construction workforce will seek to purchase a house (across all LGAs).

b. Operational workforce

The estimated rental and purchase housing availability and demand predictions for the operating workforce in Table 12.12for the hypothetical worst case Scenario B. The results indicate that the operational workforce will have a negligible impact on housing demand and availability.

Table 12.12 Estimated peak operational workforce demand for rental and purchased housing – worst case (Scenario B)

LGA	Predicted T4 Project employees[4]	Rental dwellings available[1]	Rental dwellings required[2]		Dwellings available for purchase[3]	Dwellings required for purchase[2]	
			No.	% of total available		No.	% of total available
Newcastle	34	258	10	4%	1361	24	2%
Lake Macquarie	28	229	8	3%	1914	20	1%
Port Stephens	9	93	3	3%	590	6	1%
Maitland	7	90	2	2%	599	5	1%
Upper Hunter	3	94	1	1%	674	2	0%
Total	**81**	**764**	**23**	**3%**	**5138**	**58**	**1%**

Notes: *1. Source: Real Estate Institute of New South Wales (2012), based on Hunter average of 1.4%.*

2. Based on 2011 Census data, it is assumed 28% of workers will rent and 72% will require a house to purchase (across all LGAs).

3. Based on HVRF (2011) data on average number of properties for sale and detached houses being constructed in the Hunter Region.

4. Approximately 80 additional PWCS employees are proposed to operate the project at 70 Mtpa, to be confirmed during detailed design. Coakes used a modelling dataset that assumed an operational workforce of 81 people.

c. Cumulative impacts

It is likely that construction will coincide with operations at some stage, but this would not occur when either the construction or operating workforce is at its peak. It is highly unlikely the combined workforce would exceed the conservative estimate of approximately 1,500 construction workers in the peak month, which has been assessed. Accordingly, the combined workforce would have less demand for (and impact on) housing and accommodation than the peak construction workforce assessed in the previous sections.

v Community services

As outlined in the EA, Newcastle has a wide range of community services, facilities and infrastructure, including health facilities, education services (childcare, schools, university and TAFE), indigenous and multicultural services, public utility infrastructure and services, parks and recreation facilities. Based on their existing capacity and the negligible population change predicted, there is low potential for the T4 Project's construction and operational workforces to impact community services and infrastructure. This is consistent with the EA results.

12.5 Mitigations

PWCS has committed to the following, which will be included in the social impact management plan:

- PWCS will engage other Kooragang Island businesses and industries and implement an integrated approach to forward planning for Kooragang Island that seeks to improve the island's environs and aligns with the Newcastle City Council 2030 Strategic Plan and other community values- the Kooragang 2030 Strategy. PWCS envisages taking a leadership role in developing the Kooragang 2030 Strategy. This long-term initiative could include:
  - collaborating and engaging with other industry to improve island environs and develop a sustainable and identifiable hub;
  - identifying how PWCS and other industry could contribute to NCC's commitment in its 2030 Strategic Plan to create an innovative, learning and renewable city;
  - pursuing opportunities to assist in the development of the region's future industry leaders, through support, education assistance, and mentoring of young people; and
  - addressing concerns from locals that Kooragang Island is unsightly, for example by assisting with the preparation of beautification programs.
- PWCS will undertake a housing and accommodation study closer to the start of construction. Its main objectives will include:
  - better understand key drivers in Newcastle's housing and accommodation market (demand) and the market's capacity to respond to change; and
  - verify the results of the housing and accommodation assessment in the EA and RTS/PPR.

  The assessment will determine whether the T4 Project's construction workforce will impact the demand or capacity of the housing and accommodation market in Newcastle. If negative impacts are identified, strategies will be developed to accommodate the project's workforce in a manner that minimises impacts, including mechanisms to monitor housing and accommodation impacts (if required).

- PWCS will develop and enact a Community Development and Engagement Plan, including:
  - establishing regular communication and consultation mechanisms with key stakeholders;
  - undertaking a regular community perceptions survey that builds on the baseline attitude survey undertaken as part of the EA;
  - social impact monitoring, including six monthly consultation with key stakeholder groups;
  - a 'community dust profile' to better understand dust concerns in the community, and including the following:
    - ascertain resident perceptions of dust sources and exposure;
    - identify strategies at a household level that are currently being used to address dust issues;
    - identify strategies that may more effectively address dust issues at a community level;
    - identify community awareness of PWCS's existing dust monitoring and management;
    - identify community information requirements regarding dust; and
    - provide information to the community on PWCS's dust management practices.
- PWCS will continue local training and employment programs targeting the local/regional workforce, university graduates and young people.
- PWCS's strategic community sponsorship program will be continued.
- PWCS's community investment programs will focus on areas of need within the community.

12.6 Residual impacts

The social assessment found that there is negligible potential for population change or associated social impacts as a result of the project's construction or operating workforces. Based on previous and current experience, PWCS anticipates that its construction and operating workforce will predominately be local residents. However, should this not be the case, there is potential for people moving to the area for the project to increase cumulative pressures on the housing and accommodation market, particularly Newcastle's rental market. To address this potential impact, PWCS has committed to a housing and accommodation study closer to the start of construction. This will be to verify potential impacts and if required, inform strategies to minimise potential impacts.

13 Summary

The purpose of this report is to provide information on the likely residual impacts of the T4 Project to form a basis for negotiations on a VPA between PWCS and NCC. Residual impacts are the impacts of the T4 Project after accounting for proposed mitigation measures and offsets.

This report, which relies on the results of the technical assessments of the T4 Project prepared to inform the EA, RTS/PPR and RTS on Preferred Project report, has found that should the proposed mitigation measure and offsets be adopted and implemented, other than GHG emissions, traffic matters and social, there is unlikely to be any adverse residual impacts from the T4 Project's construction and operation.

A summary of the results are provided in Table 13.1.

Table 13.1 Summary of results

Technical assessment	Chapter	Residual impact				Comment
		Nil	Low	Medium	High	
Groundwater/ contamination	2	x				Improved outcome predicted
Surface water/ flooding	3		x			Complies with water quantity and quality criteria agreed with EPA
Ecology	4	x				Long term gains predicted
Noise/ vibration	5		x			Complies with noise criteria for T4 Project operating alone
Air quality	6		x			Complies with air quality criteria
Greenhouse gas	7			x		Related to Scope 3 emissions which are beyond the control of PWCS
Transport/ access	8		x			Poor performance of intersections during peak periods on Cormorant Road are a result of background traffic growth - not T4 Project related
Visual	9		x			With mitigation, the project will successfully integrate with surrounding industrial landscape
Heritage	10	x				No impacts
Economics	11	x				Significant economic benefits predicted
Social	12		x			Potential impacts on rental market but only if the construction/ operational workforce is not predominantly local

Residual GHG impacts are from Scope 3 emissions, which are indirect emissions from upstream and downstream activities. Mitigation of Scope 3 emissions would require the implementation of measures beyond the control of PWCS.

There will be some residual traffic impacts with the poor performance of intersections on Cormorant Road. However, the poor performance is as a result of continued background traffic growth on the road with little influence from the T4 Project related traffic. Access to the T4 project area will be significantly improved by the construction of a new four-way traffic signal controlled intersection to replace the existing Pacific National Access Road and NCIG Wharf Access Road T-intersections on Cormorant Road.

PWCS anticipates that its construction and operating workforce will predominately be local residents. If this is the case, there is likely to be negligible potential for population change or associated social impacts as a result of the project's construction or operating workforces. However, should this not be the case, there is potential for people moving to the area for the project to increase cumulative pressures on the housing and accommodation market, particularly Newcastle's rental market. To address this potential impact PWCS has committed to a housing and accommodation study closer to the start of construction. This will be to verify potential impacts and if required, inform strategies to minimise potential impacts.

Economically, the T4 Project is expected to result in significant benefits to the Newcastle economy. It will also lead to the remediation of a significantly contaminated site.

At the peak of construction, it is expected that the T4 Project will create approximately 1,500 direct construction jobs. During operations, it is expected to generate approximately 80 jobs, additional to PWCS's existing workforce. In addition to direct jobs, the T4 Project is expected to generate a significant number of indirect jobs, particularly in Newcastle.

Net production benefits to be distributed to a range of stakeholders including government are predicted to be between $13 B and $33 B. Total output (gross business turnover) from the T4 Project's construction, including flow on effects is predicted to be $2,370 M in NSW, around 70% of which is predicted to be in the Newcastle region. The equivalent figure for operations (nominally to 2035) is $7,895 M in NSW, almost 90% of which is predicted to be in the Newcastle region.

A range of contamination remediation and management measures are proposed to be implemented by PWCS to reduce the risks posed by existing site contamination, including risks to wetlands in the national park and Ramsar site and to the Hunter River. This will improve the long-term environmental condition of the T4 project area and surrounds and contribute to the responsible development of an area that is contaminated. This would be done at PWCS's own cost and as such, the project provides the opportunity for private sector investment in remediating significantly contaminated State-owned land.

Appendix 4

Appendix 4

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1. Purpose

1.1 Introduction

Port Waratah Coal Services (PWCS) are expanding its coal export facilities in Newcastle, NSW. The coal will be received by rail, stockpiled in a stockyard, reclaimed and loaded on to vessels bound for export markets.

During the construction phase of the project a range of construction activities are required across the project site. Access to these construction areas will be provided using the existing access roads and tracks on the project site. To meet HSEC and performance requirements, these roads and tracks will be subject to a range of improvements, traffic control and access restrictions.

Site security and access control implemented across the site will establish PWCS as the principal tenant of the T4 project site.

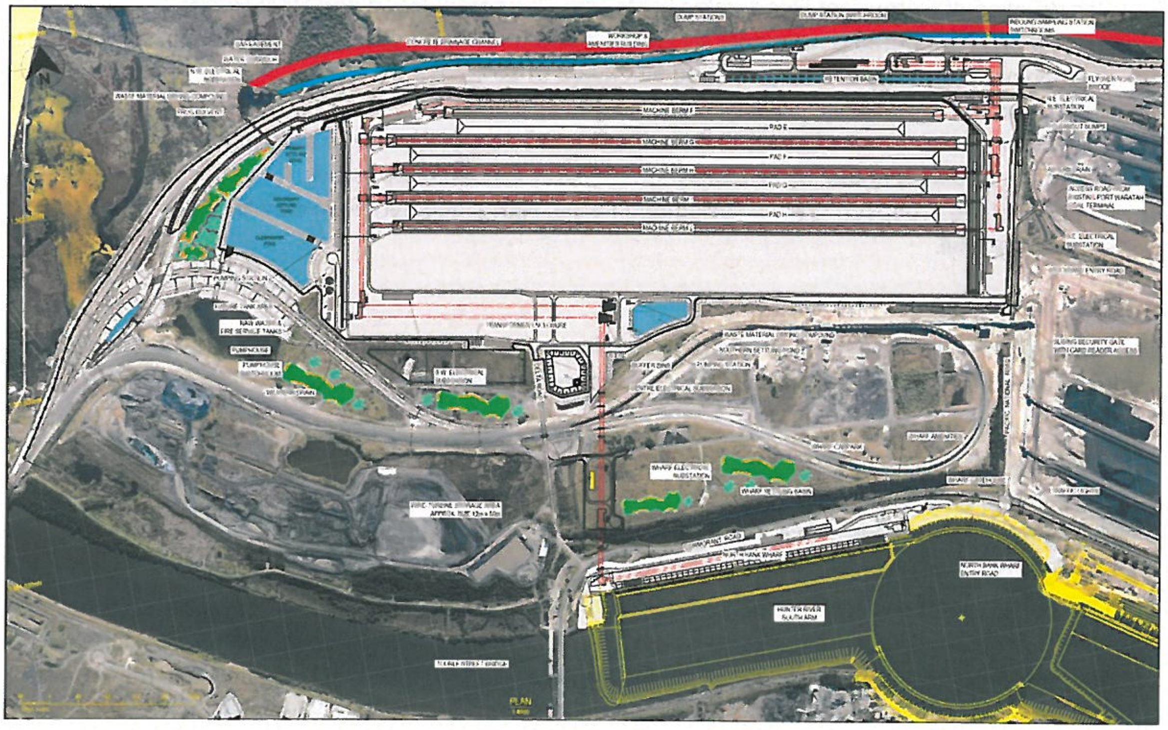


Figure 1-1 Site Overview with Aerial Photograph – Extract from drawing KL410150

1.2 Report Purpose

The purpose of this plan is to detail constructability issues identified during the feasibility study, explains the mitigation strategy and issues that need to be addressed or accounted for during detail design and project execution.

2. Summary of Site Construction

The following section provides a summary of the construction methodology to be used on the T4 project and an overview of the execution schedule.

2.1 Construction Methodology

A detailed construction methodology for the T4 Project is provided within the Construction Methodology Plan (Doc 61202-0000-PL-CM-1003). The following sections provide a brief overview of the critical areas of work.

2.1.1 Early works

The following enabling works are required prior to the commencement of onsite construction works:

- Construction of offsite parking facilities, details of these can be found in the Offsite Facilities Plan
- Construction of Cormorant Road traffic lights (cnr Cormorant Road and P&N Road)
- Relocation of overhead power lines south of Cormorant Road adjacent to the proposed wharf development and north of the proposed stockyard in SP1.
- Relocation of the Jemena Licensed Gas Pipeline in SP1
- Installation of barrier cut off walls and Permeable reactive barrier walls around the north and eastern boundaries of the future stockyard and west around deep pond.
- Capping of the proposed dredge reclamation area, with a geo-synthetic clay liner and wear course material.

2.1.2 Dredging

The variability of material in the Hunter River requires a number of dredging techniques to ensure works progress in line with the project schedule. Broadly these can be separated into 5 different work packages:

- Dredging of Unsuitable Materials
- Dredging of Soft Sediments
- Dredging of Hard Rock
- Dredging of Sand
- Dredging of Bottom Clays.

The unsuitable material will be removed by a backhoe dredge and sealed hopper barges will be required to excavate and transport the material to a wharf where it will be dewatered and mixed with cement/lime to modify its consistency. The material must reach a 'spadable' consistency before it can be transport by truck to the reclamation area for disposal. An alternative option will be to dispose offshore if toxicity test results show it is acceptable to do so.

A soft sediments (silt) layer with a thickness of between 0.5m to 7.0m sits over the sand and must be removed before a cutter suction dredge (CSD) can commence pumping sand into the reclamation area. This layer of silt resides in very shallow water and presents a significant removal challenge for standard dredging equipment and methodologies. Therefore a medium size Backhoe Dredge (BHD) and Split Hopper Barge (SHB) shall progressively remove and dispose of the material to an off-shore disposal site.

An extremely hard layer of rock identified during a previous Hunter River dredging campaign is expected to extend into the T4 dredging footprint. The presence of this 'high strength' rock will result in a difficult dredging operation with a high commercial risk. Several options are available for dredging this rock (excluding blasting) however the preferred methodology is removal with a Backhoe Dredge as has been done previously.

All of the available sand will be dredged by a CSD and placed in the reclamation area, dewatered and used for fill or preloading. The dredging contractor will be responsible for managing the reclamation area, providing sand to the civil contractors and meeting all environmental conditions associated with dredging and reclamation activities.

There are bottom clays in the departure channel area that will require dredging towards the end of the dredging campaign. Scheduling conflicts with equipment may result in a situation where a backhoe is not available and a trailer and cutter dredge will be on site and will be required to dredge the clays and transport them to the off-shore disposal area.

2.1.3 Ground Improvements

Due to the existing ground conditions on the project site a significant ground improvement campaign is required. The two primary methods for improving the existing ground beneath the future site are preloading and mass soil mixing.

Preloading of the existing ground shall be utilised within the stockyard area. This is considered the option least likely to exacerbate environmental issues in the area. The preload will be placed over the bench level to a height of ten metres extending approximately 250m from east to west. Geotechnical monitoring shall be undertaken to ensure adequate compaction is achieved. The preload material shall then be rolled from east to west over the length of the stockyard.

Mass soil mixing is the proposed methodology for improving the soft clays beneath the proposed rail embankment and to improve the silts that will be left from the dredge reclamation process to allow construction of the rail embankment and settlement ponds in the area currently known as Deep Pond. This mixing method is extremely effective and utilises existing ground materials while producing no waste.

2.1.4 Dump Station Civil

The dump stations and tunnels will be constructed from north to south to ensure an efficient construction sequence that allows for ongoing construction of the second dump station during commissioning of the first dump station. The dump station will be constructed by utilising diaphragm walls under bentonite support. A working platform at ground level and a series of dewatering points will be required for the construction. The extracted water will be retained and processed onsite to avoid contaminated run-off into the adjoining wetlands.

The excavation of the soil contained between the walls of each dump station chamber will be done using the "top-down" method. Initially, as the soil above the feeder slab level is removed, horizontal temporary steel propping beams will be installed between the diaphragm walls. At the required level, the reinforced concrete feeder slab will then be cast onto the insitu soil. The soil below the feeder slab will then be excavated down to the level at which the conveyor slab will be poured.

The dump station tunnels will be constructed in parallel to the dump station construction. The dump station tunnels have common walls between them to allow excavation down to the cast insitu floor slab, these walls can be either sheet piled or cutter soil mixed walls to control the volume of inflow water.

Once both walls for tunnel one have progressed approx. 100m, excavation will commence with temporary propping beams used to support the walls. The tunnel floor slab will then be cast as an on floor slab. A cranage area to the north of tunnel 1 will be setup at approximately the halfway point of the tunnel and once the floor slab is complete beyond this location, the pre cast tunnel sections will be lowered to the tunnel floor where they will be transported on a hydraulic jacking trolley to their final location. This process will continue with the cranage location moved to the head of the tunnel once excavation and casting of the floor slab are complete. The pre cast tunnel sections will then be overlaid with a layer of stabilised sand before backfilling. This process shall then be repeated for the remaining tunnel.

2.1.5 Rail Track and Signalling

The rail embankment is to be constructed from dredged sand recovered from the stockyard reclamation area. It is intended to transport the majority of this sand fill from the stockyard to a single stockpile location west of the proposed dump station by means of a modular quarry type conveyor travelling over on a temporary bridging structure. This sand will require large volumes of water for conditioning which could be pumped dredge water recovered during dredging, however allowance has also been made to take the required volume of water with the water required for the dump station construction direct from a Hunter Water main.

The main embankment is capped with a 300mm thick layer of recycled concrete or similar, with a cross section M profile where by the outer tracks and access roads drain toward dish drains at the top of the batters and the centre tracks to a 450mm drainage line that discharges via cross drains to the outside of the rail loop. The batters will be top soiled and seeded with grasses and salt bushes to provide replacement habitat where possible for the areas disturbed by construction.

The tracks will be constructed from the areas around the connection points working back towards the dump station, with the final areas around the dump station completed following civil and rail level completion of the dump station.

To ensure success of the future signalling commissioning it is intended to upgrade significant components of the existing signalling system prior to bringing any of the T4 rail network on line. This includes upgrading the existing Route Relay Interlocking (RRI) system with a Computer Based Interlocking (CBI) as well as relocating some existing signals and cable routes. It is proposed that Microlok II will be used in keeping with the adjoining ARTC network and NCIG terminal.

It is intended that during construction interim cable routes will be utilised, which will be kept above ground in a trafficable Ground Level Troughing (GLT) to assist with cable relocations and terminations.

Connection into the existing rail network and commissioning of the T4 rail system will be scheduled to occur in the designated Australian Rail Track Corporation (ARTC) outages to minimise disruption to Kooragang Coal Terminal (KCT) Operations.

2.1.6 Stockyard Final Earthworks (Inc. Berms)

At the completion of pre loading within the stockyard to the final formation, works shall commence. The berms shall be constructed using stabilised sand in 300mm layers. The berms will be over built in width and height to allow for trimming back by excavators and graders to a stable final profile. Drainage, electrical conduits and water piping will, where practicable, be installed before the final trim and before installation of road pavements and rail tracks to ensure a smooth final finish.

Simultaneously the stockyard drainage will be installed by open trenching prior to placement of the final stockyard capping, this 500mm thick layer of cement and bentonite stabilised sand may be mixed in-situ or mixed separately before being placed and compacted.

The stockyard surface drainage will not be installed until completion of all crane works in the areas, to reduce the risk of damage and re-work. The areas will be profiled to the surface drainage profiles following removal of the pre-load and suitable erosion control put in place to ensure adequate drainage of the construction site prior to the installation of the final drains.

2.1.7 Structural Mechanical Works

The structural construction works throughout the T4 project will predominantly follow a conventional stick build approach for the various building structures such as dump station (above rail level), transfer houses, tripper houses and sample station buildings with minimal constructability issues. The structural works will commence as soon as the building concrete foundations are completed by the civil works contractor. Full and part modularisation and site pre-assembly options for these structures will be further explored during the detail design and implementation phase and with the specific construction contractors. Mechanical equipment within the various buildings will be progressively installed in conjunction with the structural erection of the building and as elevated concrete floors are completed.

Conveyor ground modules and elevated conveyor gantries are repetitive structures that will be delivered to site and installed as completely assembled modules (refer Modularisation Study Report) as the respective areas become available and following foundation installation by the civil works contractor. Where possible part-modularisation of such things as conveyor loading stations; head and tail pulley assemblies; drives stations, take up towers and frames and feeder structures will also be explored. Site pre-assembly of structural frames, platforms and assemblies including where possible mechanical components will be undertaken at ground level adjacent to the build sites to reduce working at height safety hazards, improve installation durations and reduce build interface issues.

The dump station structures and mechanical equipment will be constructed in a bottom up fashion from the feeder level, to the dump hopper, to the rail level concrete floor and up to the dump station building. This sequence is required given that the feeder and hopper equipment are all located in the below ground dump station chamber. The belt feeder must be installed prior to the dump hopper and rail level concrete floor installation. The hopper in each dump station will be installed in five main modules that include the hopper shell segments pre-assembled to rail and transverse structural beams. The conveyor located in the lower floor of the dump station will have some large frames installed through the feeder level prior to the installation of the feeder, however most equipment will be installed via the exit end of the tunnel at the east side of the dump station.

The two Buffer Bin and Outbound Sampling station facilities will be constructed using conventional stick-build and multi-modular construction methods utilising adjacent preassembly areas. The buffer bin shells will be fabricated off-site as complete bins and then broken down into transportable segments to match the site access limitations. These bin segments will then be preassembled on site into 3 bin modules and sequentially lifted into position, i.e. bottom hopper section first followed by the mid bin and top bin modules. Subsequent structural/mechanical modules for the sampling levels and top of bin coal feed levels could also be preassembled and lifted into position to reduce the amount of working at heights hazards.

For a detailed structural-mechanical construction methodology refer to the Construction Methodology Plan Doc. No.: 61202-0000-PL-CM-1003.

2.1.8 Stockyard Machines

The machines will have been pre-assemble and modularised into sub-assemblies at the fabrication works. These sub-assemblies will generally be: long travel bogie equalisers, bogie portal structure, slewing structure, counterweight assembly and boom assembly, with an additional tripper car assembly for the stackers, and bucketwheel for the reclaimers.

These sub-assemblies will be shipped via heavy lift vessel (HLV) to the port of Newcastle. The sub-assemblies will either be offloaded to a local wharf and barged across to a suitable barge landing area on Kooragang Island, or offloaded directly onto K11 from the HLV. Hydraulic assisted transporters will deliver the sub-assemblies to site by road. Each shipment of sub-assemblies will generally take two weeks to deliver to site. Generally 2-3 shipments are required, depending on size, level of complexity and level of pre-assembly.

Construction and final assembly of each machine will take place at the eastern end of their respective stockyards. An approximate laydown and crane pad area of ~200m long, and ~40m wide is required adjacent each machine berm. An equivalent length of machine berm rails must be in place directly adjacent this crane pad area for the construction to commence. For the most efficient construction flow, the entire width of the stockpad floor in that area should be dedicated to machine laydown and cranepad.

Securing dedicated and sufficient laydown area will reduce any need for risky, inefficient and costly double-handing of the sub-assemblies during construction.

The entire laydown and construction area are required to be hardstanded to approximately 400-600kPa ground bearing pressure (GBP), or greater. This is to ensure stability of the loads as they are stooled off after transport, and stability of the cranage during the construction lifts. Therefore the minimum GBP required will be a function of the mass of the individual sub-assemblies and the size and capacity of cranage, and is to be determined through consultation with the Machine D&C Contractor during mobilisation to site.

Once delivered to site, the machine sub-assemblies will be lifted and assembled onto the machine berm rails in a series of heavy and potentially dual crane lifts.

2.1.9 Wharf

The T4 wharf has been designed as a combi wall structure to maximise the usable land area for operations and to enable the wharf construction to occur in parallel to the dredging works. The wharf construction will proceed from east to west to minimise schedule duration with tie in to the shiploader deliveries. Given the site land restriction the contractor will be required to secure an offsite storage yard for pile storage, precast concrete works, steel reinforcing works and non essential equipment. The mobilisation of the equipment to the site for installation will be under a "just in time" methodology. The proposed methodology is based on a land construction with the intent to minimise the water based plant and equipment required and hence minimise the interaction with the dredging contractor.

The contractor shall be required to construct a safe working platform prior to mobilising crane or piling equipment. The working platform shall be constructed through imported engineering fill and/or soil mixing. Installation of the wharf piles will follow the soil mixing from east to west over the length of the wharf. As the piles are completed the front and anchor piles walls are connected via tie rods and the front wall coping beam completed. The area behind the wharf front wall is then backfilled up to final level and the wharf furniture installed.

The contractor shall then remove any remnant material above RL-1.0 NHTG from the seaward side of the front wall to permit dredging works to continue.

2.1.10 Wharf Shiploaders

The shiploaders will need to be constructed entirely offshore and partially or wholly commissioned before being dis-assembled ready for transport to K11 by heavy lift vessel (HLV). The final shiploader design will dictate the level of commissioning of disassembly required, if any.

The offloading of the shiploaders, and any re-assembly, will be conducted primarily by the HLV's onboard cranes during the offload sequence, with assistance as required by land-based cranage. If land-based cranage is required, the concrete wharf deck or hardstanded area must be able to withstand 400-600kPa of ground-bearing pressure (GBP), or greater, dependent upon the mass of the assemblies and the crane capacity and configuration.

The shiploaders will be offloaded directly onto the wharfs machine rails, although some assistance from engineered, hydraulically assisted transporters may be required if the reach to the tripper rails are beyond the lift radius of the ships cranes.

Dependent upon the final design of the shiploader tripper structure, the construction of the wharf conveyors may or may not be a necessary pre-requisite to commence the delivery sequence.

The off-load and re-assembly can generally be completed within a 7-10 day period but is heavily dependent upon the final design of the shiploader.

2.2 Schedule

The T4 project schedule and sequencing of construction activities has been developed in line with the project objective to deliver first coal on ship as soon as possible to meet conditions of the long term commercial framework.

The critical path from commencement of site works through to the first coal throughput can be broadly described as being as follows:

- Establishment of offsite parking facilities and road works required for immediate site access
- Onsite set-up of EPCM offices, contractor facilities and lay down yards
- Construction of environmental controls including the cut-off walls and temporary frog fencing
- Initial earthworks required to commence the reclamation campaign and working platforms for the construction of facilities.
- Dredging and reclamation of usable sand for site reclamation
- Stockyard construction starting at the north eastern corner working in a south westerly direction, this allows for the earliest delivery and construction of critical yard machines.
- Construction of the initial stacker, reclaimer and ship loader
- Construction of the conveyors, transfer houses and buffer bins inline with the land becoming available post reclamation.
- Sequence commissioning of the initial inbound and outbound streams required to deliver first coal throughput.

It must be noted that not included in the list above are the dump station and the wharf construction activities which are near critical and without careful management during the construction phase could see them impact the critical path and first coal delivery.

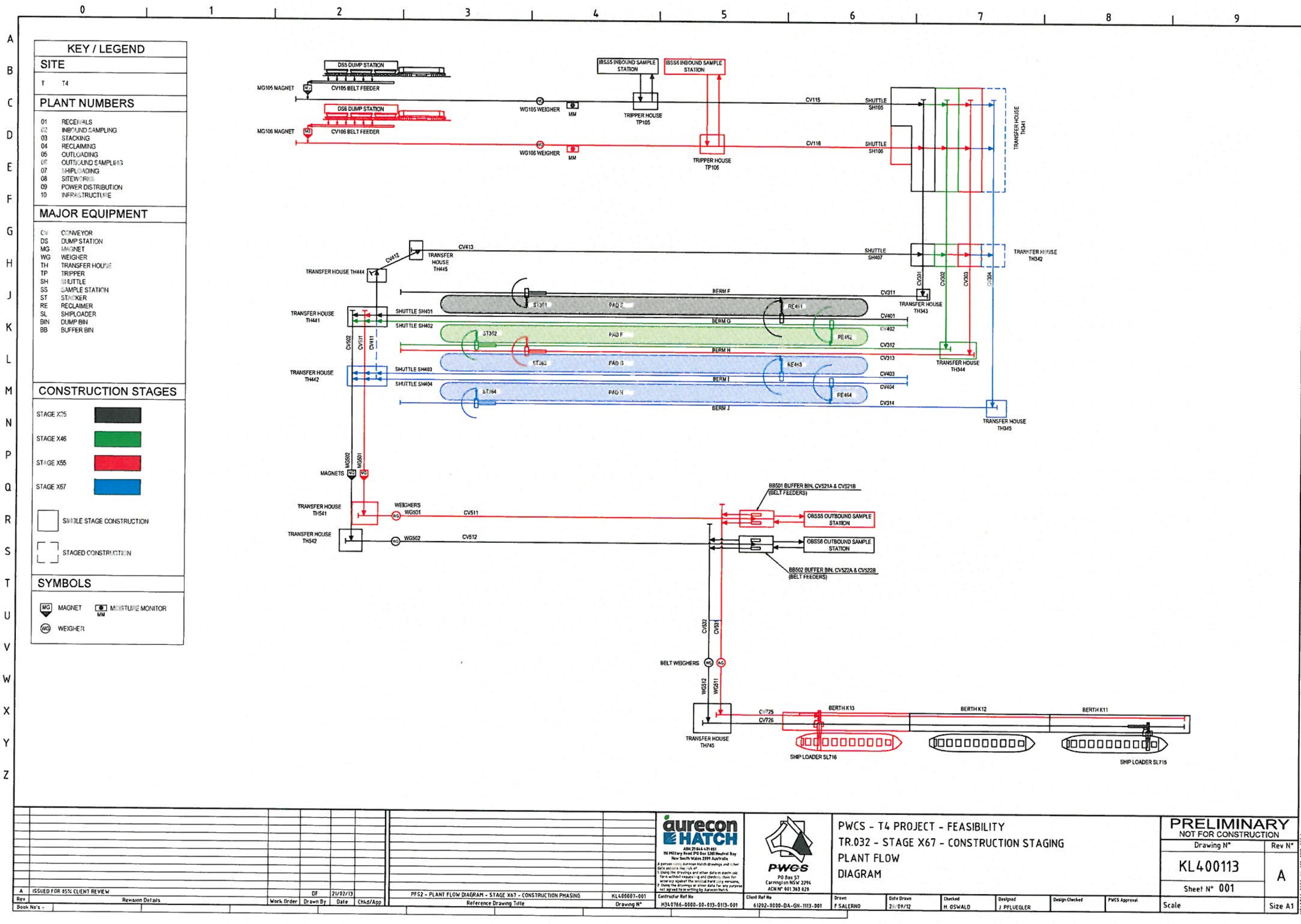
The construction period which sees the greatest contractor interaction and peak workforce occurs from approximately 18 months post commencement of site works to 36 months. It is in this 18 month period when all of the major contractors are mobilised to site and working on their respective packages. The major contractors working on site during this period include the ground preparation, bulk earthworks, stockyard civil works; stockyard works structural and mechanical works, berth construction and the dredging contractor. The site work force is expected to peak at 1,500 people at approximately 24 months after site works commencement.

3. Modularisation

A modularisation study was carried out during the study, this includes both option to modularise infrastructure on site prior to construction and brining modularised components to site. This study further looked at the constraints surrounding delivery of large component to the site and this constructability issue is not addressed within this report.

Refer Modularisation Study Report, Doc. No. 61202-0000-RE-PM-1005.

Appendix 4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07 SHIPLOADING
08 SITEWORKS
09 POWER DISTRIBUTION
10 INFRASTRUCTURE
MAJOR EQUIPMENT
CV CONVEYOR
DS DUMP STATION
MG MAGNET
WG WEIGHER
TH TRANSFER HOUSE
TP TRIPPER
SH SHUTTLE
SS SAMPLE STATION
ST STACKER
RE RECLAIMER
SL SHIPLOADER
BIN DUMP BIN
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STAGE X55
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SYMBOLS
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MOISTURE MONITOR
WEIGHER
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DS6 DUMP STATION
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IBSS6 INBOUND SAMPLE STATION
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CV115
CV116
SHUTTLE SH105
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CV413
CV412
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SHUTTLE SH403
SHUTTLE SH404
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BERM G
BERM H
BERM I
BERM J
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RE403
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CV302
CV303
CV304
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CV313
CV314
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CV402
CV403
CV404
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TRANSFER HOUSE TH344
TRANSFER HOUSE TH345
CV501
CV502
CV411
MG501
MG502
MAGNETS
WEIGHERS WG501
WG502
TRANSFER HOUSE TH541
TRANSFER HOUSE TH542
CV511
CV512
BB501 BUFFER BIN, CV521A & CV521B (BELT FEEDERS)
BB502 BUFFER BIN, CV522A & CV522B (BELT FEEDERS)
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OBSS6 OUTBOUND SAMPLE STATION
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CV532
BELT WEIGHERS
WG511
WG512
TRANSFER HOUSE TH745
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CV726
BERTH K13
BERTH K12
BERTH K11
SHIP LOADER SL716
SHIP LOADER SL715
aurecon HATCH
PWCS
PO Box 57
Carrington NSW 2294
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Rev
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Drawn By
Date
Chkd/App
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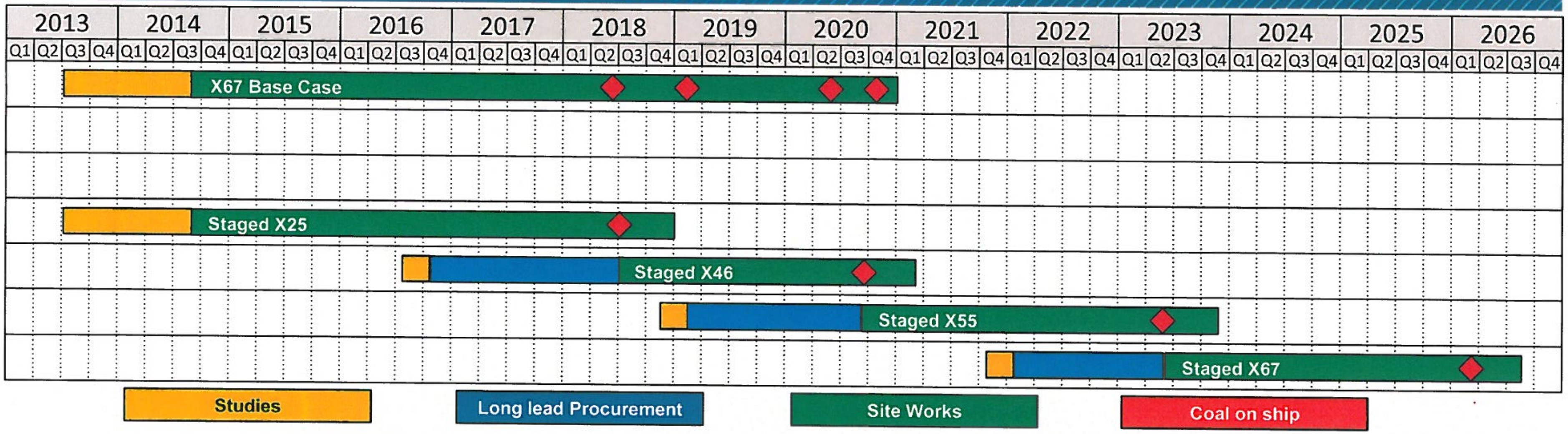
Checked
H OSWALD
Designed
J PFLUEGLER
Design Checked
PWCS Approval

Appendix 4

Appendix 4

Schedule



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Environmental Approval	03-2014	03-2014	-	-	-
Commence Stage	06-2013	06-2013	07-2016	11-2018	10-2021
Commence site works	08-2014	08-2014	06-2018	10-2020	05-2023
First Coal on ship	05-2018	06-2018	10-2020	05-2023	02-2026

PWCS aurecon HATCH

Appendix 4