# Maldon-Dombarton Rail Link Feasibility Study

Final Report

Prepared for the
Department of Infrastructure and Transport

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Hyder

ACIL Tasman
Economics Policy Strategy

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# Glossary

| | |
|---|---|
| ATC | Australian Transport Council |
| ARTC | Australian Rail Track Corporation |
| Base case | Retain existing infrastructure as is |
| BITRE | Bureau of Infrastructure, Transport and Regional Economics |
| Central case | ACIL Tasman's forecast of expected demand relevant to a Maldon-Dombarton rail line |
| COAG | Council of Australian Governments |
| CPI | Consumer Price Index |
| CRRP | COAG Road Reform Plan |
| DIT | Department of Infrastructure and Transport, formerly called Department of Infrastructure, Transport, Regional Development and Local Government |
| DITRDLG | Department of Infrastructure, Transport, Regional Development and Local Government, now called Department of Infrastructure and Transport |
| GHG | Greenhouse Gas |
| GTK | Gross Tonne Kilometre – a measure of weight (including the locomotive and rolling stock) and distance |
| IRR | Internal rate of return |
| Km | Kilometre |
| MTEU | Million TEUs |
| Mtpa | Million tonnes Per Annum |
| NPC | Net Present Cost – the sum of future costs discounted to reflect the time value of money |
| NPV | Net Present Value – the sum of future benefits discounted to reflect the time value of money |
| NSWI&I | NSW Department of Industry and Investment, now called NSW Department of Trade and Investment, Regional Infrastructure and Services |
| NSWTIRIS | NSW Department of Trade and Investment, Regional Infrastructure and Services, formerly called NSW Department of Industry and Investment |
| NTK | Net Tonne Kilometre - a measure of weight (payload only) and distance |
| P50 or $P_{50}$ | An estimate (of construction costs) for which it is estimated that there is a 50 percent probability that the actual cost of the construction will be lower than the estimate |
| P90 or $P_{90}$ | An estimate (of construction costs) for which it is estimated that there is a 90 percent probability that the actual cost of the construction will be lower than the estimate |
| PKCT | Port Kembla Coal Terminal |
| PN | Pacific National |
| PPI | Producer Price Index |
| PSC | Project Steering Committee |
| PRG | Project Reference Group |
| PUD | Pickup and Delivery |
| SPV | Special purpose vehicle |
| TEU | Twenty-foot equivalent unit – a standard shipping container |
| Upside scenarios | Possible demand scenarios which generate additional demand which could use a Maldon-Dombarton rail line |
| WACC | Weighted Average Cost of Capital |

# Organisations consulted

In addition to comments received in relation to the Issues Paper (a list of respondents can be found at Appendix B), which sought comment from all parties interested in a Maldon-Dombarton rail line, ACIL Tasman has consulted in person or by telephone with representatives from the following organisations:

Table 1 **Organisations consulted**

| | |
|---|---|
| ARTC | Macarthur Intermodal Shipping Terminal |
| Auto nexus | Newcrest mining |
| AWB | Newnes Kaolin |
| BHP Billiton | NRE Gujarat |
| Blue Circle Southern | NSW Department of Trade and Investment, Regional Infrastructure and Services |
| Bureau of Infrastructure, Transport and Regional Economics (BITRE) | NSW Department of Transport |
| BlueScope Steel | NSW Maritime |
| Boral (Timber) | NSW Roads & Traffic Authority |
| Cement Australia | NYK Line Shipping |
| Centennial | Pacific National |
| CEVA | Patrick Auto care |
| Coolac | Peabody Energy |
| Coal works | Port Kembla Coal Terminal |
| Cusco | Port Kembla Grain Terminal |
| Eastern Iron | Port Kembla Port Corporation |
| El Zorro | Pixar |
| FRID Resources | Qube Logistics |
| Graincorp | RailCorp |
| Hamburg Süd | Standard Iron |
| Hudson Resources | Swire Shipping |
| Independent Railways of Australia (subsidiary of MIST) | Sydney Ports Corporation |
| K-Line | University of Wollongong |
| Maersk | VISY |
| Manildra | Xstrata |

# Key points

- This is a feasibility study of a potential freight rail link between Maldon (near Picton on the Main South railway line south of Sydney) and Dombarton (near Port Kembla). The Terms of Reference for the study (Appendix A) cover economic and engineering analysis, design, cost, environmental and social viability, cost-benefit evaluation, pre-construction requirements and the implications of not proceeding.
- Construction of a line was begun, then abandoned, by the NSW Government in the 1980s. It would provide an alternative to the two existing lines for the transport of freight to and from Port Kembla.
- Reasons given for completion of a line included potential increases in freight, road and rail congestion and encouragement of investment.
- Most of the ground work for a 35km Maldon-Dombarton line has been constructed, but the expensive elements – a major bridge, part of another major bridge, and a tunnel – have not been constructed.
- With advances in technology, the study has found more cost effective structures for a major bridge and for road under passes.
- A 4 km long tunnel would have a steep gradient of 1:30, but this is considered to be operationally viable. A line would include up to three passing loops, allowing up to 60 trains per day.
- The environmental impacts are attenuated because much of the line has already been built. The remaining impacts would require mitigation. None of the environmental issues present significant barriers to construction.
- Construction would take around 3-4 years for a financial cost between $624-667 million. Operating and maintenance costs are relatively minor.
- Allowance has been made, using standard values, for external costs (i.e. those met by other parties) compared with the alternatives. These include congestion, accidents; air pollution, noise pollution, water pollution costs, nature and landscape, urban separation, and greenhouse gases. Allowance has also been made for higher fuel prices and a carbon charge.
- The main type of freight is coal from mines near Lithgow and from the Port Kembla hinterland. Other freight includes grain, copper concentrates, limestone, kaolin, cement and potentially iron ore, containers and cars.
- Bulk freight relevant to a Maldon-Dombarton line is expected to grow from 11.6Mtpa in 2010 to 15.5Mtpa in 2030 (coal is respectively 10.4Mtpa and 12.3Mtpa).
- Cars imported through Port Kembla are expected to continue to use road freight to avoid double handling costs. Most container freight growth through Port Kembla is required by the NSW Government to move by rail.
- Container freight could also increase, especially towards the end of the study period if there is overflow from Port Botany.

- The existing transport system can handle this expected demand, and one of the existing lines (Moss Vale-Unanderra) can be expanded if necessary.
- Demand could be higher than expected, due to increased coal production (though major expansion is more likely elsewhere in NSW or Queensland), possible iron ore exports, or earlier overflow of containers from Port Botany and a shift of some car freight to rail. The study considers these possibilities, as well as high oil prices and a carbon charge.
- One of the existing lines is the RailCorp-owned Illawarra line from Sydney to Wollongong and beyond. It is congested with passenger and freight trains, which affect reliability. There is little scope to increase capacity.
- The other line is between Moss Vale (on the Main South line) and Unanderra (near Port Kembla). It has spare capacity and could be upgraded to handle more frequent and longer trains for well below the cost of constructing a Maldon-Dombarton line. There would be higher operating costs associated with the use of this line.
- The potential to upgrade the Moss Vale-Unanderra line means there is not a capacity problem unless there is an extremely large increase in freight demand. However some trains might have to divert from the Illawarra line, and this might need a new governance arrangement to allocate paths.
- The main benefits of a line relate to increased efficiency for train operators, a net reduction in noise and pollution impacts.
- Arterial roads in the Port Kembla area are congested; however a Maldon-Dombarton line would have little effect on the number of trucks. BHP, a major transporter of coal by truck, has advised that it would not use a Maldon-Dombarton line. Imported cars are transported by truck to avoid double handling costs, and a significant portion of this market is not expected to shift to rail.
- The net present value using a 7% real discount rate is estimated as negative $206 million – that is, constructing a Maldon-Dombarton line would not generate sufficient benefits to cover its costs. The benefit cost ratio is 0.56 – that is, estimated economic benefits are only 56% of the costs. The reasons for this result are the high cost of construction because of the terrain, and the existence of spare capacity on the Moss Vale-Unanderra line which can be increased if necessary.
- There is still a negative result under all upside scenarios modelled, except for major iron ore exports.
- Project cash flows are expected to support the funding of only around 20% of project costs. The remainder would be required from governments.
- It would not be prudent to build extra rail capacity for demand that might not eventuate, or that might eventuate many years later. However, it would be prudent to preserve the existing easement to maintain the option of constructing a Maldon-Dombarton line. Should it be required in future years the line could be approved and constructed within three or four years.

# Executive summary

A feasibility study of a potential freight rail link between Maldon (near Picton on the Main South railway line south of Sydney) and Dombarton (near Port Kembla) was announced by the Minister for Infrastructure and Transport on 8 July 2009. This followed a prefeasibility study which found that a Maldon-Dombarton line was not economically viable, but that it may have long term economic merit. The study has been undertaken for the Department of Infrastructure and Transport and the Terms of Reference for the study (Appendix A) cover economic and engineering analysis, design, cost, environmental and social viability, cost-benefit evaluation, pre-construction requirements and the implications of not proceeding with the rail line.

The study first considers the case for the line, which relates to potential freight demand relative to capacity on existing lines. It then provides engineering and environmental assessments. These are followed by cost estimates, cost benefit analyses related to expected demand and to possible higher demand, and financial analysis. The results are then interpreted and their implications explored, and are also compared to issues raised by stakeholders. The study concludes with a discussion of next steps, including investment sequencing and related trigger points for investment.

## The Maldon-Dombarton project

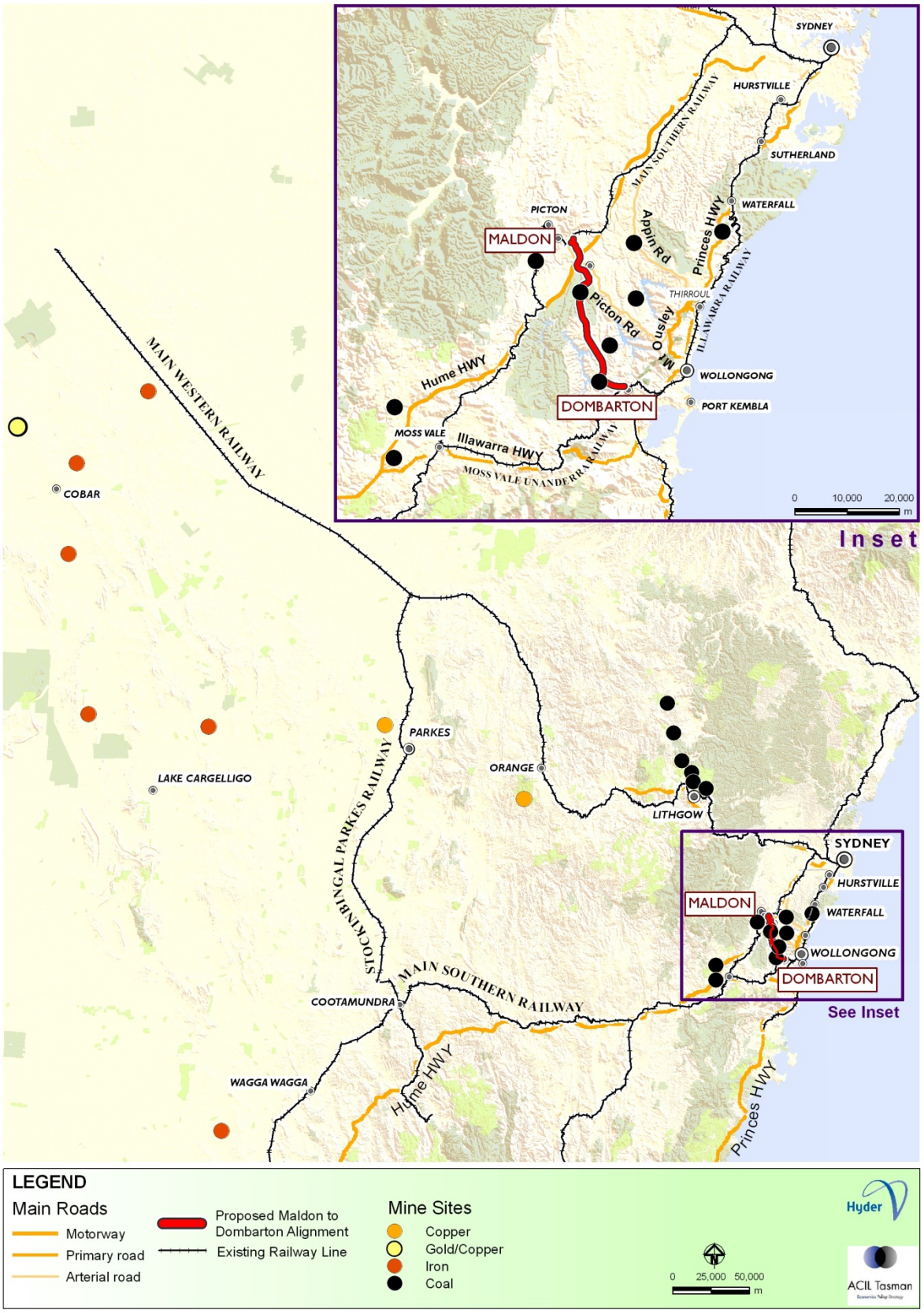
Construction of the Maldon-Dombarton line was begun, then abandoned by the NSW Government, in the 1980s. It would provide an alternative to the existing Illawarra and Moss Vale-Unanderra lines for the transport of freight to and from Port Kembla. The proposed line, the other relevant lines and the main sources of freight are shown in Figure 1.

The study considers claims that advocates for the line have referred to (in submissions to the Issues Paper and through consultations) and reports the evidence in support of the claims and quantifies the benefits which a line could provide. The following are reasons given for completion of the line:

- scenarios for potential increases in coal and other freight
- increasing congestion on the Illawarra line
- heavy truck traffic on Mt Ousley and other roads near Port Kembla
- encouragement of investment in the Port Kembla area
- indirect benefits such as reduced noise and pollution in urban areas south of Sydney.

The study finds that construction of the line is technically possible; it would take around 3-4 years to construct for a financial cost between $624-667 million.

Figure 1 **Maldon-Dombarton and related lines**






a

# Demand

## Bulk goods including coal

The main type of freight moving by road or rail to Port Kembla is coal. Other types of freight include bulk freight such as grain, copper concentrates, limestone, kaolin, cement and potentially iron ore, plus import and export containers and cars. Future demand for a potential Maldon-Dombarton line depends on overall freight demand, new demand induced by the line, constraints on other lines in the area and elsewhere in the network, preferred mode (road or rail) and NSW port capacities and developments.

The coal mainly comes from mines near Lithgow, and also from the Port Kembla hinterland. A Maldon-Dombarton line is unlikely to be used by some mines near Port Kembla that use other rail lines or whose owners prefer road, but it would provide a much more direct route for coal from the Tahmoor colliery (for which expansion is at the pre-feasibility study stage).

Initial growth is expected from the Lithgow area as mines expand, followed by decline as other mines close. Coal from this area travels on the congested Illawarra line and could switch to a Maldon-Dombarton line.

Gold and copper freight tonnages are much lower but expected to expand and kaolin (a fine clay) may be exported from Lithgow via Port Kembla. This freight could use a Maldon-Dombarton line. Grain and limestone freight have a more direct route to Port Kembla via the Moss Vale-Unanderra line while steel is expected to stay on the Illawarra line because it is less steep in the loaded direction than a Maldon-Dombarton line would be.

## Cars and containers

Cars, imported through Port Kembla, are expected to continue to use road freight to avoid double handling costs (e.g. from train to truck for the last part of the journey to the dealer).

If there is container freight growth through Port Kembla's newly developed Outer Harbour (from organic growth or from an overflow from Port Botany), the NSW Government requires that the Port generally does not exceed 120,000 Twenty Foot Equivalents (TEUs) per annum by road[1]. This is the equivalent of 10 per cent of forecast Outer Harbour container capacity moving by road. This means that any container throughput in excess of this amount must move by rail, whether on a Maldon-Dombarton rail line, the Illawarra line or the Moss Vale-Unanderra line.

[1] Concept Approval issued by the Minister for Planning on 3 March 2011

## Overall demand

Overall, bulk freight relevant to a Maldon-Dombarton line is expected to grow from 11.6Mtpa in 2010 to 15.5Mtpa in 2030 (of which coal is respectively 10.4Mtpa and 12.3Mtpa) as a result of continuing export demand. Relevant container movements increase from 24,000 to an estimated 177,000 in 2025 and 486,000 by 2030. This assumes an increase in the current maximum throughput of 3.2 million TEUs allowed at Port Botany to 5 million TEUs, so there is overflow to Port Kembla only towards 2030.

The existing transport system can handle this expected demand, and one of the existing lines (Moss Vale-Unanderra) can be expanded if necessary.

Demand could be higher than the level expected by ACIL Tasman, and the possibilities are examined in scenarios related to each of the underlying drivers. The upside demand scenarios, of uncertain timing and probability, include:

- increased coal production – a possibility at some of the mines, though major expansion is considered to be more likely in the Gunnedah basin or Queensland, which are outside the catchment area for a Maldon-Dombarton line
- possible iron ore exports that are currently being investigated, though the likely route is via the Moss Vale-Unanderra line provided it has enough capacity and is technically adequate
- an earlier overflow of containers from Port Botany, for example if there was not enough easing of Port Botany Road and rail constraints, if the current maximum throughput at the port is not increased, if there was a shift in NSW policy (currently Newcastle is the designated overflow port), or if a major shipping company shifts from Port Botany to Port Kembla
- a shift of Bulli Seam coal from road to conveyor-plus-rail, though it is not certain that Maldon-Dombarton would be the preferred line.

The upside scenarios are independent – that is, do not have a common cause – but combinations of them are considered. Other factors which have been considered include a continuation of, or increase in, high oil prices and/or a price on carbon which is levied on transport fuels.

Scenarios with less demand are also possible – in particular if favourable world coal prices did not continue through the study period (to 2030) output could decline, removing any need for a Maldon-Dombarton line.

Should mass-distance-location based road user charges for trucks be introduced in the future there might be a modal shift to rail. No policies have been announced to date to enable analysis of the impact on a Maldon-Dombarton line.

### Carbon price

ACIL Tasman anticipated a carbon tax and included it in the modelling. The impact of the recently announced carbon tax on a Maldon-Dombarton rail line is varied. It is expected to increase the cost of diesel by at least 5.5%. Freight from the Western Coalfield travels a slightly longer distance via a Maldon-Dombarton line compared to the Illawarra line and this diversion increases fuel costs and carbon taxes. Freight diverted from road to rail is likely to save carbon taxes on the assumption that the excise rebate is phased out by the time a Maldon-Dombarton line is built.

## Capacity

This section of the study considers whether there will be enough capacity on existing rail lines and roads to cope with future demand for freight to and from Port Kembla, and hence whether a Maldon-Dombarton line is needed. Potential customers need to know whether they can get permanent reliable train paths before they will commit to investment.

One of the two existing lines is the RailCorp-owned Illawarra line from Sydney to Wollongong and beyond. It is congested with passenger and freight trains, aggravated by physical constraints and peak-period restrictions. The congestion affects reliability and often causes delays or cancellations. There are approximately five spare train paths between midnight and 5am, and additional ad hoc paths can be found during the day, but capacity will become very tight (even without upside demand scenarios) over the study period. There is little scope to increase capacity on the Illawarra line without expenditure of a much higher order of magnitude than building a Maldon-Dombarton line.

The other line is between Moss Vale (on the Main South line) and Unanderra (near Port Kembla). It is used for bulk freight such as grain, limestone from southern New South Wales and coal from Tahmoor. It offers an alternative to the Illawarra line for freight that is not time sensitive (the distance from Sydney being longer, and the steep downhill gradient in the loaded direction requires a slow descent).

The Moss Vale-Unanderra line has spare capacity and could be upgraded to handle more frequent and longer trains, though with cost and time penalties for freight from the north (e.g. Lithgow) due to the longer distance. Table 2 shows a summary of these upgrades and preliminary cost estimates. The initial upgrades, mainly longer passing loops, are relatively straightforward and would double the spare capacity in tonnes (from 6.5Mtpa to 13.8Mtpa), well ahead of expected demand. Further upgrades might be needed under upside scenarios. They would add 4.7Mtpa (or possibly up to 17Mtpa) further capacity but are more technically challenging. They would require detailed engineering and

geotechnical assessment, after which a fresh comparison with a Maldon-Dombarton alternative would be appropriate. ARTC estimates, based on recent experience elsewhere on their network, are for a total financial cost (all upgrades except 30 tonne axle loads) of $176 million. This is well below the cost of constructing a Maldon-Dombarton line, allowing room for higher actual costs if conditions prove difficult.

If some coal trains had to use the Moss Vale-Unanderra line to free up paths on the Illawarra line (e.g. for container trains), a new governance arrangement involving the two track owners, RailCorp and ARTC, may be needed to handle the decisions.

Table 2 **Possible upgrades and indicative costs for the Moss-Vale Unanderra line**

| | Spare capacity (saleable paths/day) | Spare capacity (Mtpa) | Incremental capital cost ($m) | Total capital cost ($m) |
|---|---|---|---|---|
| Current. Trains limited to 669 metres, | 7.0 | 6.5 | $- | $- |
| Extend loops to allow trains up to 850 metres | 7.0 | 8.6 | 20 | 20 |
| Extend loops to 1350m, plus road bridge at Robertson plus 1350 m area to break up trains. Allows 72 wagon trains. | 7.0 | 13.8 | 103 | 123 |
| Extend Summit Tank loop | 8.1 | 15.9 | 15 | 126 |
| Extend the Summit Tank loop further | 9.4 | 18.5 | 50 | 176 |
| AC traction locos, ECP braking, 30 tonne axles | 11.1 | 32.9 | See note 2 | |

*Notes:* 1) Current services consume an average of 5.3 paths per day.

2) AC traction locomotives and electronically controlled braking are both expected to be standard in all new generation rolling stock. The capital costs to enable 30 tonne axles are unknown. See Chapter 3.3 for details and caveats.

Arterial roads in the Port Kembla area are congested, especially Mt Ousley Road. However, a Maldon-Dombarton line would have little effect on the number of trucks on these roads. BHP has advised that it would continue to cart coal to Port Kembla by truck even if the new line was built. Most auto logistics firms are expected to continue to carry cars by truck to avoid double handling costs. Potential growth in container trade beyond 120,000 TEUs per annum is obliged to use rail for Port Kembla to keep within its planning concept approval.

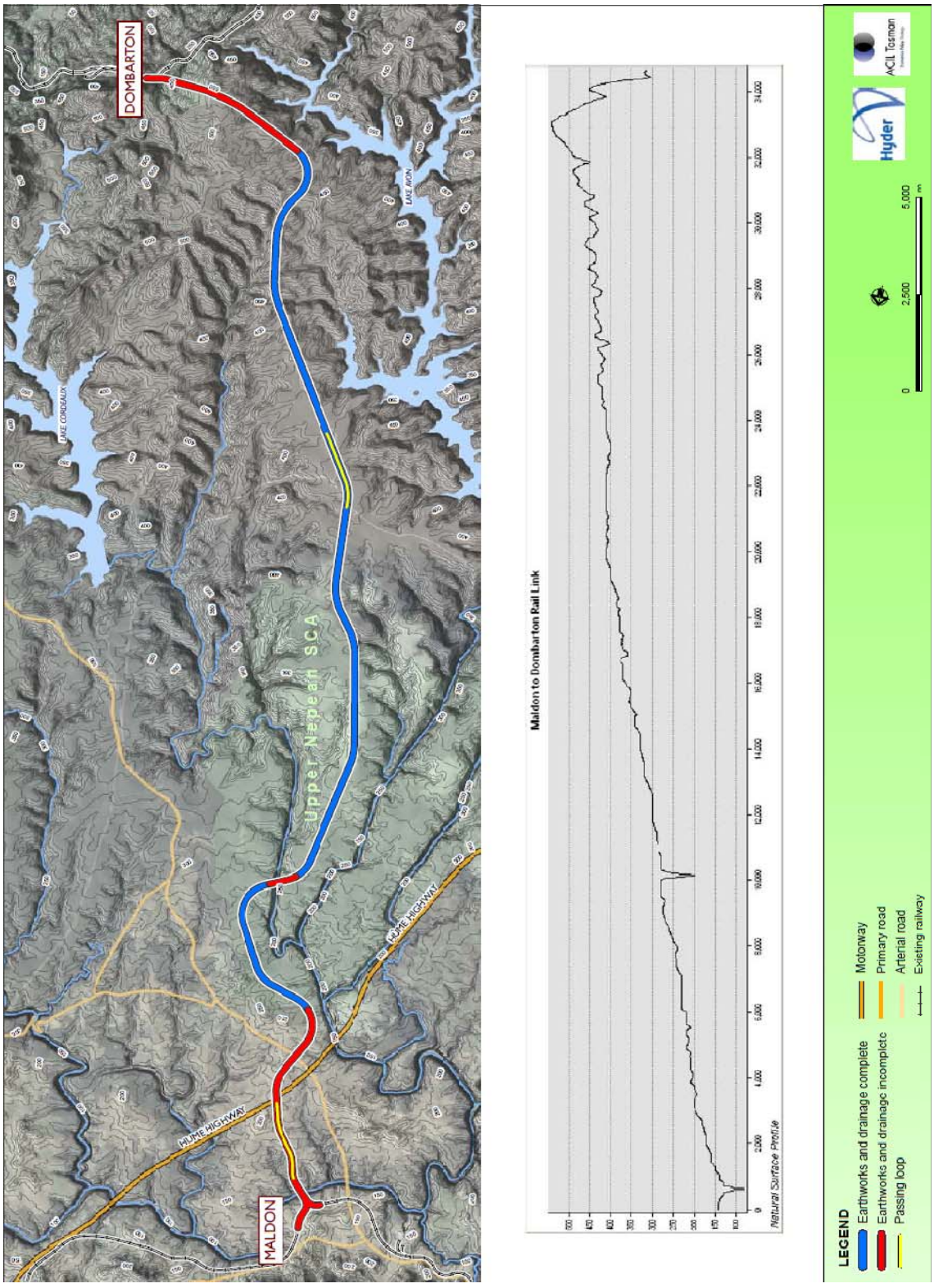
Overall, the potential to upgrade the Moss Vale-Unanderra line means there is not a capacity problem unless there is a very large increase in freight demand. However some trains might have to divert from the Illawarra line, for example if there is strong growth in container numbers.

## Engineering assessment

The 35 km route of a Maldon-Dombarton line mainly follows contour lines of hills south of Maldon, with a steep tunnel at the southern end near Dombarton. Most of the ground work has been constructed, but the expensive elements – a major bridge, part of another major bridge, and the tunnel – have not been constructed. Figure 2 shows this route:

ACIL Tasman
Economics Policy Strategy

Figure 2 **Maldon-Dombarton rail line – terrain**



After considering four alternatives, Hyder concludes that the original alignment is viable in terms of track design and cost. The partly completed (Nepean) bridge is confirmed as theoretically adequate to support the current design loading. With advances in technology a balanced cantilever design would be more cost-effective for the other (Cordeaux River) bridge than the arch structure proposed earlier. More cost-effective structures are also available for road underpasses.

The 4 km long tunnel alignment proposed in the original design has also been confirmed, after considering alternatives. The tunnel would have a steep gradient of 1:30, however this is considered to be operationally viable. Two sizes of cross-section were considered, one similar to many existing tunnels and one meeting ARTC standards that would allow larger US-type locomotives and double container stacking. Both have been costed but the larger one ("Plate F") is preferred. It would have fan ventilation (the line would not be electrified – diesel locomotives would be used).

In terms of track work, the track would have concrete sleepers, on ballast that is already in place for 70% of the line and the tunnel would have concrete slab in place of ballast. There are 12 level crossings, mainly for minor roads and fire tracks.

The line would include two 1500m passing loops, with scope for a third to be added later if required. This would enable the line to allow 25 trains per day, increasing to 60 trains per day with construction of the third loop. The minimum freight train transit time would be 55 minutes, maximum loaded operating speed 80 km/hour, and a maximum axle load of 30 tonnes.

## Environmental investigation

The environmental impacts of completing the line are attenuated by the fact that much of its length has already been built. The remaining impacts would require mitigation (e.g. water treatment) or appropriate treatment (e.g. Indigenous consultation). None of the environmental issues appear to present significant barriers to construction of a Maldon-Dombarton line. The most significant environmental impacts to be assessed related to the line crossing Sydney Catchment Authority land, the tunnel, works within riparian zones, and the building of bridges.

Drainage is important as the soils in the area are highly erodible. An effective soil conservation management plan is needed with good surface drainage, minimum vegetation clearing and vegetation stabilisation. Catch drains are needed at the top of cuttings and protection of the cutting face is required to reduce the risk of erosion and provide stability.

Other issues considered included flora and fauna, noise, indigenous heritage sites, safety and fire road level crossings, land contamination and risks.

Developments within the catchment must produce a neutral or beneficial effect on water quality, so runoff will need to be fed through water quality treatment features. An effective soil conservation management plan would need to be implemented to minimise erosion and maintain water quality.

A full environmental approval process would probably take 12 to 18 months.

## Cost benefit analysis

### Costs

The construction cost is estimated to be between $624 and $667 million in December 2010 dollars, assuming the larger of the alternative tunnel cross section sizes and allowing for measures to mitigate environmental impacts. Removing the profit element of estimated construction costs yields the resource cost of the line, which is the relevant economic cost – estimates of the resource costs are between $557 million to $596 million in December 2010 dollars.

Ongoing operating and maintenance costs would be relatively minor. The main cost risks relate to a lack of geotechnical information for the tunnel and the need to carry out different sections of work simultaneously.

The study has recognised lower operating and maintenance costs for a Maldon-Dombarton rail line compared with other rail alternatives and roads, because a newly built railway with head-hardened rail and concrete sleepers will have a substantially reduced maintenance requirement. This produces a net benefit for this aspect of a Maldon-Dombarton line.

Allowance has been made, using standard values, for external costs (i.e. those met by other parties) compared with the alternatives. These include congestion, accidents; air pollution, noise pollution, water pollution costs, nature and landscape, urban separation, and greenhouse gases (GHG).

### Benefits

Estimates were made of the economic benefits of a Maldon-Dombarton line – the main elements related to capacity and to increased efficiency for train operators, i.e. lowering the resource cost of certain freight tasks. Allowance was also made for the external benefits from a reduction in the urban residential kilometres which the freight trains will pass through if trains switched from the Illawarra line.

The calculations included a relatively large residual value reflecting net benefits that arise beyond the study period. Assumed asset lives range from 30 years for electrical to 100 years for civil works.

### Net present value

A net present value was calculated consistent with Infrastructure Australia guidelines, using a 7% real discount rate. It is estimated as negative $206 million – that is, constructing a Maldon-Dombarton line would not generate sufficient benefits to cover its costs. The benefit cost ratio is 0.56 – that is, estimated economic benefits are only 56% of the costs.

The reasons for the negative result are the high cost of constructing the line because of the terrain, and the existence of spare capacity – which can be increased for a much lower estimated cost than constructing a new line – on the Moss Vale-Unanderra line.

Sensitivity analysis with alternative capital costs, discount rates, fuel prices and a carbon charge still produce negative results.

### Upside scenarios

The study considered a range of scenarios under which demand for the line would be greater than that estimated in the base case. An extra 5Mtpa of coal from Tahmoor would improve the economics of the line from negative $206 million to negative $105 million. More modest improvements are achieved from a transfer of Appin/West Cliff coal from road to a Maldon-Dombarton line, 2% per annum growth in Lithgow area coalmines, or a shipping company shifting its container trade from Port Botany to Port Kembla. However major iron ore exports (up to 20Mtpa) could produce a positive result of up to $2 billion subject to assumptions about alternative transport routes and the net value of the ore. A major reason for negative economic results is the ability to upgrade capacity on the Moss Vale-Unanderra line in stages at lower cost than constructing a Maldon-Dombarton line (the more challenging stages would need further study).

## Financial analysis

Given that the estimated economic results of a Maldon-Dombarton rail line are negative, it is not currently worth undertaking the project from a national economic viewpoint. From a project financing viewpoint:

- project cash flows are expected to support the funding of only around 20% of project costs
- private finance under a Public Private Partnership arrangement is likely to be available to meet this proportion of costs

- regular government payments for the line being available would support higher levels of private sector funding.

With private financing potentially available for only a small portion of the total cost, the remainder would be required from governments. However if there were major iron ore or other developments (for example at Port Kembla, or the Tahmoor or East Bargo coal deposits), equity participation in the line by the developer(s) should be considered.

## Interpretation and implications

**Is there enough capacity?** There are two existing lines between Sydney and Port Kembla – do they have enough capacity to cope with future freight growth? The Illawarra line has limited spare capacity and improvements would be prohibitively expensive. The Moss Vale-Unanderra line has some spare paths now and its capacity could be augmented to cater for expected growth although some freight would have to travel further with higher costs if using the Moss Vale line. It could be further augmented – for less than the cost of a Maldon-Dombarton line – to cope with all but the more extreme combinations of possible upside growth scenarios.

Distance, price and ruling gradient are the deciding factors when choosing the preferred line. The Moss Vale-Unanderra line is the more direct route for freight from Southern NSW, and the Illawarra line is shorter for freight that passes through Sydney. The Illawarra line is more suitable for steel because of the steepness of the ruling gradient from Port Kembla to Sydney, and for containers (which are time sensitive) because of the shorter distance. If container train paths are needed in future, a new governance arrangement may be needed to move some coal trains to the Moss Vale-Unanderra line.

**Future demand.** Future demand could be higher than ACIL Tasman's estimates e.g. from additional coal, containers or iron ore. These scenarios are uncertain but plausible. It would not be prudent to build extra rail capacity for demand that might not eventuate, or that might eventuate many years later – but it would be prudent to maintain the option of constructing a Maldon-Dombarton line when needed.

**Option to build a Maldon-Dombarton line.** This can be maintained by preserving the existing easement. The cost of keeping the option open is low – no maintenance is required, and most of the land has no alternative economic use. If a Maldon-Dombarton rail line demonstrated its feasibility it could be approved and constructed within three to four years.

**Beneficiaries and contributors.** The main beneficiaries from a Maldon-Dombarton line would be Port Kembla Port Corporation, rail operators (from

reduced congestion and delays), intermodal terminals in southwest Sydney, Xstrata (the owner of Tahmoor colliery) and the Port Kembla Coal Terminal company (from less bunching in train arrivals).

There would also be a temporary improvement to the local economy and employment during construction, and noise and pollution reduction benefits from diverting freight trains from residential urban areas south of Sydney.

Most of the costs would fall on governments (taxpayers). Railcorp would also lose revenue from a decline in freight on the Illawarra line.

**Encouragement of investment.** Uncertainty around rail capacity to and from Port Kembla discourages potential investment, for example in mine expansion or container trade. This report, by clarifying the rail capacity situation – in particular, the scope for improving the Moss Vale-Unanderra line – should improve the investment climate.

**National port and freight strategies.** This study is compatible with the recently released Australian Government draft national strategy documents. Planning and corridor reservation is considered in these documents and also supports development of ports master plans and state and regional freight strategies by providing an information base.

**Implications for NSW ports strategy.** Stakeholders have suggested that it would be cheaper to facilitate growth in container trade at Port Kembla, through construction of a Maldon-Dombarton line, than to make the major investments that are being proposed to improve rail and road links to Port Botany. However the existence of rail capacity does not ensure that container trade will move to Port Kembla from Port Botany; other factors such as cost, convenience, location and service are also relevant. Furthermore, the comparison with Port Botany is not straightforward. Throughput demand at Port Botany will continue to grow, which will require landside improvements at the Port.

However, should a change to NSW Government ports policy or a shift in shipping line operations significantly alter Port Kembla container throughput, the NSW Government will need to revisit the feasibility of a Maldon Dombarton line.

**Truck numbers.** There is a strong local interest in reducing the number of trucks, or at least in reducing their growth, on the major arterial roads serving Port Kembla, and a view that a Maldon-Dombarton line would help do that.

The evidence does not support this view. The owner of the colliery that is expected to provide the most significant growth of trucks, BHP, has stated that "it is neither economically feasible nor environmentally sound to consider a rail

connection to the Maldon to Dombarton rail link at this time." It is unlikely that autologistics companies would switch to rail because of double handling costs. From Australian and international experience rail has not proved to be economic for carriage of general freight (containers) over short distances such as Port Kembla to Sydney. To reduce truck numbers, other policies would be required such as restrictions on mining licences and changes to road user charges.

ACIL Tasman's modelling shows that this conclusion is not affected by assumptions of large fuel price increases or a carbon charge.

**Consequences of not building the line.** With the expected moderate freight growth, the consequences would be continuing congestion and noise on the Illawarra line, use of its few remaining paths at night, and increased use of the alternative via Moss Vale which could require relatively modest expenditure on upgrading that line.

If future freight is higher than expected, and with no Maldon-Dombarton line, Moss Vale-Unanderra line capacity would need to be increased more. If some of the successive increments proved difficult, or if multiple upside scenarios coincided, there would not be enough capacity in the absence of a Maldon to Dombarton line. Some of the possible freight would have to be exported through another port (e.g. iron ore through a Victorian or a South Australian port).

## Next steps and "trigger events"

While the Maldon-Dombarton line is technically feasible there is insufficient demand to warrant its construction in the near future. Smaller investments in the upgrades to the Moss Vale-Unanderra line would enable capacity enhancements and could be considered as demand rises. However there are scenarios in which a Maldon-Dombarton line could become more viable.

A Maldon-Dombarton line could be justified later if there was a very large increase in freight demand. The current easement should be retained in order to preserve the option to build the line. Events that should trigger a review of whether to build the line are:

- increases in firm freight demand that are beyond the combined capacity of the Illawarra line and an enhanced Moss Vale-Unanderra line. The question then should be whether the freight overflow was enough to justify the construction cost, whether there were routes for it through other ports and an economic comparison of the alternatives.

- any developments in NSW port related policies that increased the likelihood of a substantial part of Port Botany's container trade moving to Port Kembla. Some freight would have to be diverted from the Illawarra line to free up capacity for this.
- increases in off-peak passenger train frequency on the Illawarra line (not expected in the foreseeable future) that significantly reduced freight capacity.

As the easement is already in place it would be possible to build the line quickly. Funding decisions, environmental approvals, consolidation of land holdings and engineering design work could proceed in parallel and be completed in around 12 to 24 months. Construction would take a further two years.

# 1 Introduction

## 1.1 The feasibility study

The Australian Government commissioned this feasibility study of a potential rail link between Maldon (south-west of Sydney, on the Main South rail line) and Dombarton (near Port Kembla, on the Moss Vale-Unanderra rail line). The line (shown on Figure ES 1) would provide a more direct rail link between the port and south-west Sydney and the coal mines in the Lithgow area.

A Maldon-Dombarton railway link was considered during the construction of the Port Kembla coal loader in 1979. In October 1982 the project received concept approval from the NSW Premier. Construction was undertaken from 1983 to 1988 during which time many of the Burragorang Valley coal mines closed. Following a change in State government in 1988 the project was cancelled. The pre-feasibility study[2] for the Maldon-Dombarton rail line stated that a cost-benefit analysis of all government capital works underway or proposed at the time indicated that a Maldon-Dombarton rail line had the lowest benefit-cost ratio.

Since its cancellation there has been significant interest in a Maldon-Dombarton rail line, evidenced by task forces, inquiries and proposals to complete the line. A possible role for a Maldon-Dombarton rail line was mentioned in the 2007 Sydney –Wollongong corridor strategy published by the predecessor to the Department of Infrastructure and Transport. The Australian Government, in its release of the pre-feasibility report in 2009, announced a further $3 million to assess the feasibility of a rail line between Maldon and Port Kembla via Dombarton.

The Terms of Reference (TOR) for this feasibility study are set out at Appendix A.

The purpose of the study is to inform future Government decision-making about this project by:

a) carrying out a detailed investigation of the layout, design and cost of remaining works

b) assessing the project's viability on environmental, social and economic criteria, including an economic cost benefit evaluation

c) identifying any pre-construction requirements (such as the environmental impact assessment) to guide the construction of the project, should it proceed

[2] Maldon-Dombarton Rail Line Pre-Feasibility Study for Port Kembla Port Corporation Report, Connell HATCH, July 2009.

d) examining and costing the implications of not pursuing the project.

The Terms of Reference specify a study period to 2030, for a freight railway. The pre-feasibility study clearly determined that including passenger services would impose net economic costs on the line by increasing costs, reducing the ability to optimise freight movements on the line and generating few benefits in terms of better passenger movements.

The feasibility study was undertaken by economic consultants ACIL Tasman in conjunction with engineering consultants Hyder Consulting and with support from rail operations modellers Plateway, costing specialists Evans & Peck and merchant bankers Cranleigh.

A Project Steering Committee (PSC) was established comprising representatives from the NSW Department of Transport, the Port Kembla Port Corporation, Australian Rail Track Corporation (ARTC), and the Department of Infrastructure and Transport. The PSC provided general oversight and guidance throughout the Study, though the Study does not necessarily represent the views of PSC members or the organisations they represent. A Project Reference Group (PRG) for the study was established to ensure engagement and contribution from key public and industry stakeholders. The reference group included the Federal Members for Cunningham and Throsby and representatives from Wollondilly and Wollongong City Councils; Illawarra Business Chamber; Australian Industry Group (Illawarra); South Coast Labour Council; Regional Development Australia Illawarra; and Pacific National. Meetings were held between April 2010 and March 2011 at four defined stages of the Study's analysis. During the study an Issues Paper, two working papers, and four technical papers (engineering, costing, train operations and financing) were completed. Submissions on the Issues Paper were invited from the public and fifty responses were received. These are referred to in this report and are posted on the Department's website www.infrastructure.gov.au. The full technical reports referred to above are summarised in this report and the working papers are provided in separate documents.

## 1.2 Background

The potential 35 km-long Maldon-Dombarton line would link Maldon (near Picton in south-west Sydney) on the ARTC's Main South line, and Dombarton (at the foothills of the Illawarra plateau), which is 15 km from Port Kembla along existing double track from Moss Vale.

Heading northwest, the line from Dombarton would negotiate the steep Illawarra escarpment, climbing at a 1-in-30 gradient through a 4 km-long tunnel. Beyond the tunnel, the line would enter the Sydney Catchment

Authority Metropolitan Special Area in undulating country. Here, the line generally follows the ridge separating the Cordeaux and Avon rivers.

It then crosses the Cordeaux River, leaves the Sydney Catchment Area, passes under a number of roads (including Picton Road), under the F5 Freeway and over the Nepean River, before joining the Main South line near Maldon. For the final 20 kilometres to Maldon, the line would descend at a 1 in 60 to 1 in 80 gradient.

The location of the proposed line is shown in Figure 1 on page xiii. The terrain and gradient of the line is shown in Figure 2 on page xix

When construction stopped, approximately two-thirds of earthworks had been completed (see Figure 3), as well as the entry cuts to the tunnel entrances and construction of access roads to the tunnel and the catchment area. One of the two major structures on the line, the bridge over the Nepean River near Maldon, was partly completed but is missing the middle section. The other major bridge, over the Cordeaux river, and the Avon Tunnel near Dombarton (see Figure 4 and Figure 12) were not started apart from tunnel portals.

Figure 3 **A section of a Maldon-Dombarton alignment**

Source: Hyder Consulting

Figure 4 **Western portal of the Avon tunnel**

## 1.3 Reasons for considering completion of the line

Several reasons were put forward, in the PSC, PRG and in submissions, for completing a Maldon-Dombarton line, and will be addressed in this report. They include:

- potential increases in coal exports, container imports and other freight through Port Kembla
- congestion on the Illawarra line that connects Sydney to Wollongong and is used for most of the coal and other freight sent by rail to Port Kembla, as well as passenger services
- constraints on the other line serving Port Kembla, the Moss Vale-Unanderra line
- truck congestion on key roads near Port Kembla, especially Mt Ousley road
- a shorter route from Port Kembla to the growing logistics industry in south-west Sydney
- improved reliability for passengers and reduced noise along the Illawarra line
- other benefits beyond the direct impact of the line, including job creation and encouragement of investment.

These and other benefits were canvassed in a pre-feasibility study completed for Port Kembla Port Corporation in July 2009 by Connell Hatch and Sd+D. However, that study found that the line would have a negative return on investment, with Net Present Value estimated (using an 8% discount rate) at negative $415 million to negative $514 million. In announcing this feasibility study, Minister Albanese said that this "...followed the findings of the pre-feasibility study ... that completing the rail line has long term economic merit - but more work needed to be done before sensible investment decisions could be made."

## 1.4 Structure of this report

The central issue in this study is whether there will be enough rail capacity to handle expected freight to and from Port Kembla; the report follows the study's Terms of Reference and begins with chapters on rail and road capacity and on freight demand. These are followed by engineering, environmental and costing chapters. The results of these chapters are then brought together in chapters on cost benefit analysis, financial analysis and potential financing of the proposed line. The report ends with chapters that interpret the results, consider the implications and provide conclusions.

The appendices to this report include the terms of reference, membership of the PSC and PRG, a list of submissions received on the Issues Paper, a summary of themes from those submissions, a paper from the ARTC about the Moss Vale-Unanderra line and a letter from RailCorp about the Illawarra line. The working papers summarised in this report are provided in separate documents.

# 2 Demand

A key factor in the economics of a Maldon-Dombarton rail line is its potential demand. ACIL Tasman has made demand forecasts after consulting with potential customers, government bodies such as the Bureau of Infrastructure, Transport and Regional Economics (BITRE), the NSW Department of Trade and Investment, Regional Infrastructure and Services and NSW Maritime, and analysing trends in coal, grain and other commodities. Further information was obtained from PSC and PRG members, submissions to the Issues Paper and follow-up investigations. A list of organisations consulted is included at the beginning of this report.

The estimates of demand for a potential Maldon-Dombarton rail line take into account:

- current and future demand for freight to and from Port Kembla, irrespective of route or mode
- new demand that would be induced by a Maldon-Dombarton rail line but would probably not otherwise occur
- the preferred means of transport (road or a particular rail route) for each component of demand
- capacity limits or other constraints on road freight and on the existing rail lines
- relevant rail capacity issues elsewhere in the Sydney area
- competition between ports, and developments at ports, that could result in diversion of sea freight to Port Kembla.

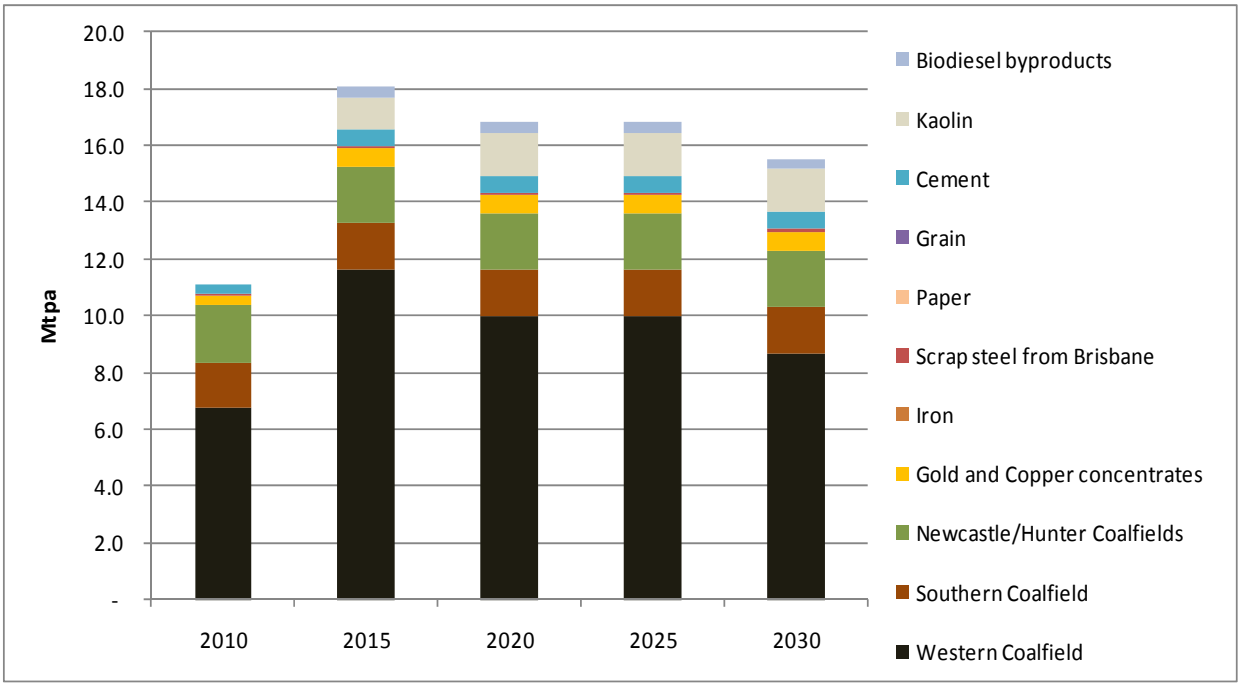
The demand forecasts were converted into forecast road movements and forecast train numbers by route, after allowing for capacity constraints and the likely configuration of trains which would serve this demand. The train numbers forecast for the potential Maldon-Dombarton rail line are a combination of trains serving demand that would naturally use that route, and trains that represent overflow from other routes when capacity on them is reached.

Passenger services were found to be uneconomic in the pre-feasibility study and are not included in the Terms of Reference (TOR) for this study. There is a bus service between Wollongong and Western Sydney which has not demonstrated significant demand, and offering passenger services on a Maldon-Dombarton rail line would add significantly to the costs while inhibiting its operation as an efficient freight railway.

The key elements of potential demand are coal, iron ore, grain, containers, kaolin (fine clay), cars, cement and copper concentrates. Chart 1 shows the

relative importance of these elements to estimated demand for a Maldon-Dombarton rail line.

Chart 1 **Expected demand for a Maldon-Dombarton rail line**




*Data source:* ACIL Tasman estimates

The following sections summarise ACIL Tasman's findings about the contribution to total demand that each of these commodities generates. A detailed discussion of potential demand for a Maldon- Dombarton rail line is contained in Working Paper 1.

## 2.1 Coal

The most important type of freight a potential Maldon-Dombarton rail line would carry is coal. Two coal districts are relevant to a potential Maldon-Dombarton rail line: the Southern Coalfield and the Western Coalfield.

### 2.1.1 Southern Coalfield

The Southern Coalfield is effectively the Port Kembla hinterland. About half of this coal is exported through Port Kembla while the other half is sold to the steel, coke, cement and other industries. The relevant mines include Tahmoor and Appin/West Cliff (Bulli Seam), both near Maldon.

The Tahmoor colliery would be a major beneficiary of a Maldon-Dombarton rail line, because it would provide a shorter route and would use it if it were available. It could expand in future:

> Xstrata... is the current owner and operator of both the Tahmoor and Baal Bone coal mines... current exports... total approximately 3Mtpa. Xstrata also has coal projects at Running Stream in the West and Bargo, the extension of Tahmoor, in the South, with the potential to produce a further 5Mtpa of coal experts via PKCT [Port Kembla Coal Terminal]. These projects are currently in prefeasibility, and could potentially commence coal export operations from 2016. *(Source: Xstrata submission)*

The proposed line runs near coal deposits, as noted in a submission to the study:

> ...the Maldon-Dombarton line's location, running along the coal seams between the Illawarra and Western Sydney, will encourage the development of new cases in the area...*(Source: CFMEU Mining and Energy)*

However the main known deposit is near the northern end of the line, and could be accessed through Tahmoor and railed from there.

The owner of the Appin/West Cliff colliery says in a submission to this study that it will continue to use trucks and would not use a Maldon-Dombarton line:

> The company currently produces approximately 7 million tonnes of saleable product [per annum]. Approximately 4Mtpa is exported with the balance being sold to the Australian steel industry at Port Kembla and Whyalla... [it is proposed to increase] production from 7.5Mtpa to a peak production of 10.5Mtpa...
>
> ... there is no likelihood that Illawarra coal's existing operations will utilise the Maldon-Dombarton link... the washery [at West Cliff] is currently undergoing a $150 million upgrade... these coal processing facilities will handle the Illawarra Coal's Bulli coal seam production for approximately the next 30 years. It is neither economically feasible nor environmentally sound to consider a rail connection to the Maldon to Dombarton rail link at this time...
>
> While we remain supporters of the proposal [a Maldon-Dombarton line] ...we cannot make a commitment to the use of such facilities since Illawarra Coal's existing operations are geographically remote from the proposed alignment of the rail link and there is no economic (or other) case to move from our existing logistics arrangements. *(Source: BHP Billiton submission)*

ACIL Tasman infers that the costs of constructing a 13km conveyor to the line and possibly building a new washery and coal wash emplacement facility[3] are prohibitive. We also note that the Illawarra line is slightly closer.

Most other mines in the Southern Coalfield are either on other lines (Moss-Vale-Unanderra, Illawarra) and would not use a potential Maldon-Dombarton rail line. No new mines are expected to become operational in the Southern Coalfield, although upside scenarios have been modelled in the cost benefit

[3] An emplacement is a dump of rock, dirt etc washed out from the coal, stored in a manner that meets environmental requirements.

analysis to determine the sensitivity of the results to the Southern Coalfield volumes – for example, increased output from Xstrata.

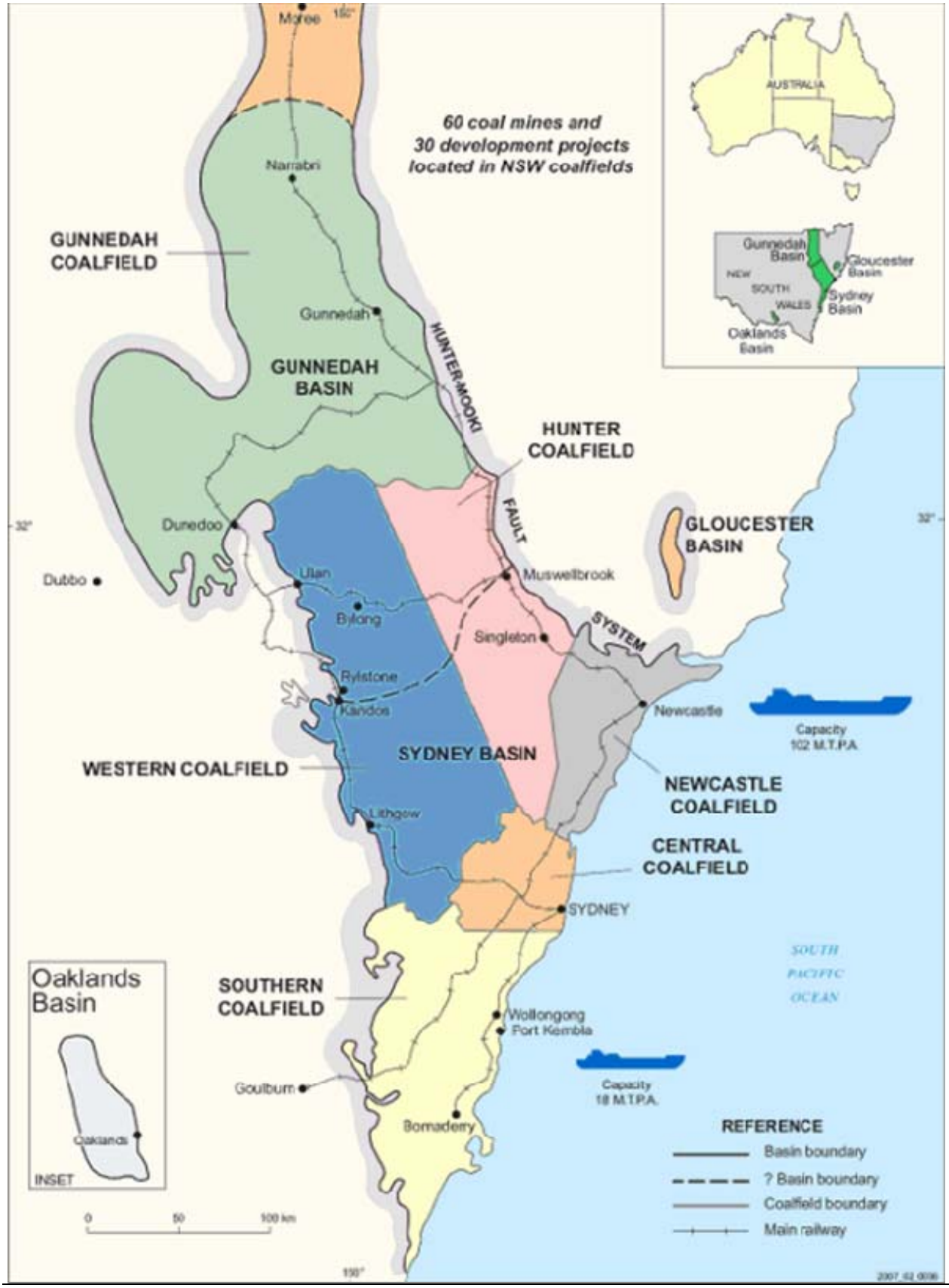
### 2.1.2 Western Coalfield

The southern part of the Western Coalfield, around Lithgow, is relevant to a potential Maldon-Dombarton rail line. Output in this area is expected to grow initially as new mines open or expand, assuming favourable international coal prices continue, and decline later in the study period (to 2030) as older mines become depleted – though upside scenarios involving growth[4] are also modelled. Some is used for power stations and the rest moves to Port Kembla on the Blue Mountains line, part of the Sydney freight network and the Illawarra line, all of which are congested. There is potential for some or all of this coal to divert to a Maldon-Dombarton rail line. It is expected that coal further north in the Western Coal District will continue to be exported through Newcastle and not switch to Port Kembla.

NSW coalfields are shown in Figure 5 and key coal tenements in the Maldon-Dombarton region shown in Figure 6.

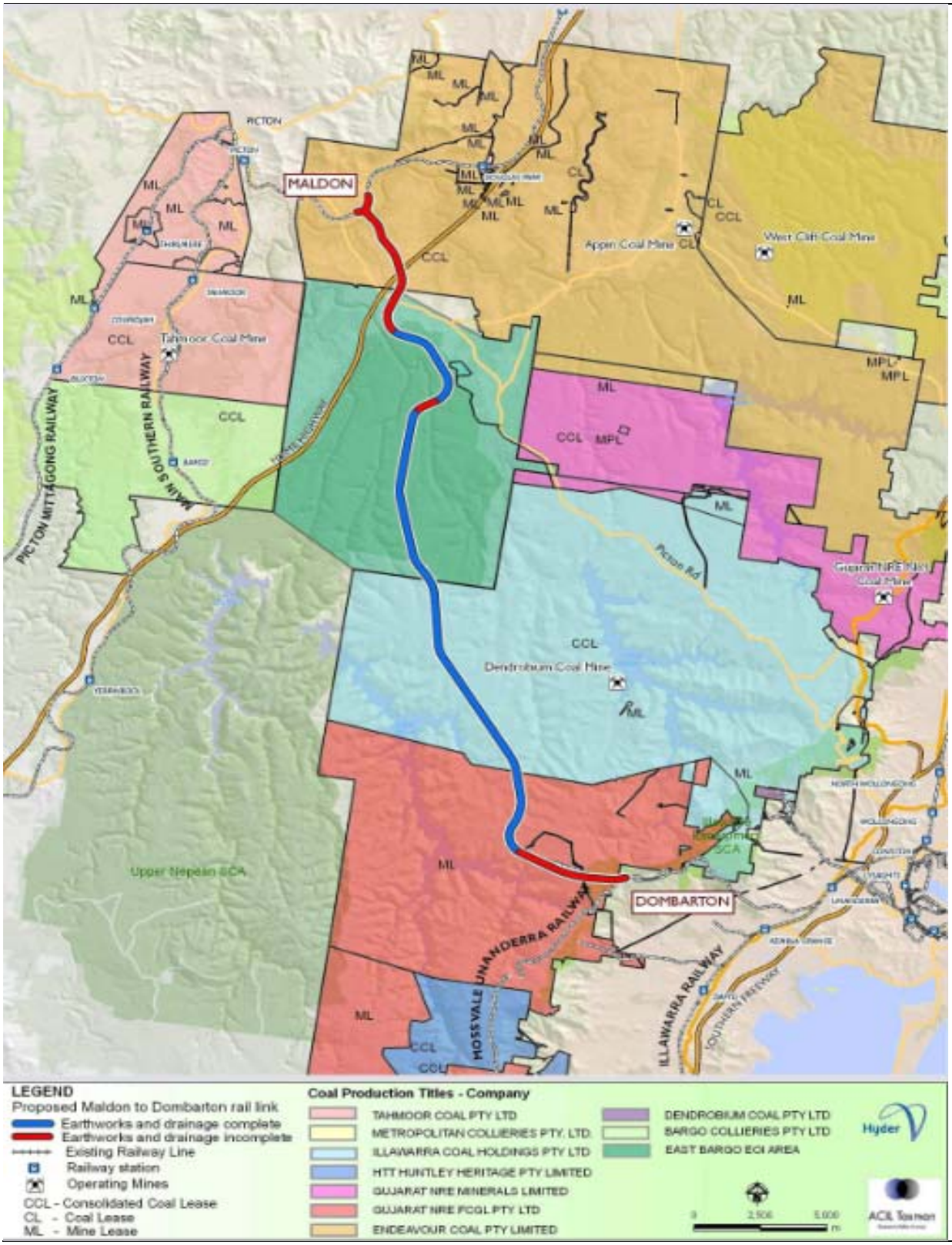
[4] One company has been talking to the Port Kembla Port Corporation about increasing its output, and another notes that it would increase exports in the unlikely event it lost a power station contract

Figure 5 **NSW coalfields**



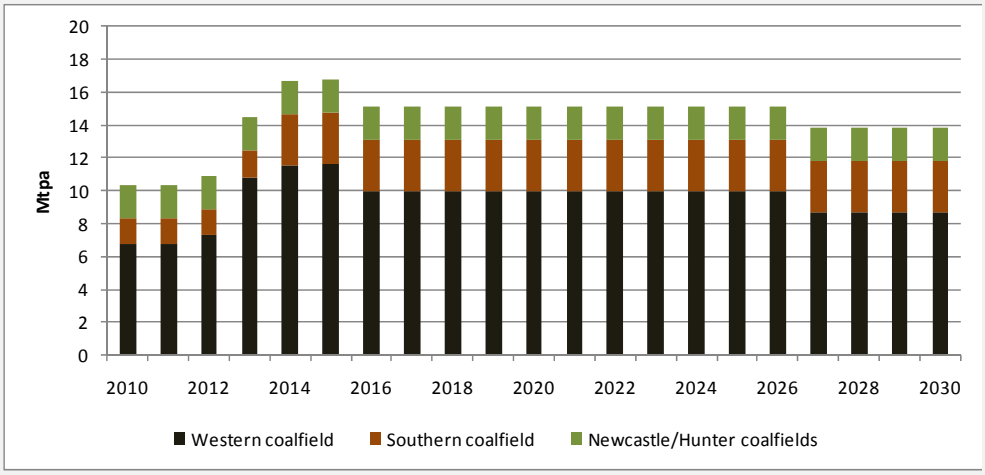

[a] *Source: NSW Department of Trade and Investment, Regional Infrastructure and Services*

Figure 6 **Major coal tenements**



Future coal output relevant to a Maldon-Dombarton rail line has been estimated on the basis of the trends over the past decade, with no allowance for the more speculative sources such as East Bargo. The forecasts are summarised in Chart 2 below. These tonnages would be lower to the extent that coal continued to be carried on the Illawarra and Moss Vale-Unanderra lines. They would be higher if East Bargo could be exploited or if Appin/West Cliff switched from road to rail.

Chart 2 **Projected volume of coal to Port Kembla relevant to a Maldon-Dombarton rail line, by coalfield, 2010 to 2030**




## 2.2 Gold, copper

Gold and copper is exported from

- Cadia Hill near Orange, through Port Kembla via the Illawarra line
- Northparkes near Parkes, through Port Kembla via the Moss Vale-Unanderra line.

Both producers expect to increase output substantially, and the Cadia Hill output (at present 0.35Mtpa) could switch to a Maldon-Dombarton rail line. There would be up to six trains per week from the Cadia mine and up to three trains per week (on the Moss Vale-Unanderra line) from Northparkes. Northparkes is not expected to use a Maldon-Dombarton rail line because the Moss Vale-Unanderra line provides a shorter link from the south west.

## 2.3 Iron ore

Iron ore deposits are being explored around Cobar, inland from Dubbo, and at Lockhart, south-west of Wagga Wagga, as well as larger deposits further away in the Broken Hill region. Potential output is up to 2Mtpa and 20Mtpa respectively.

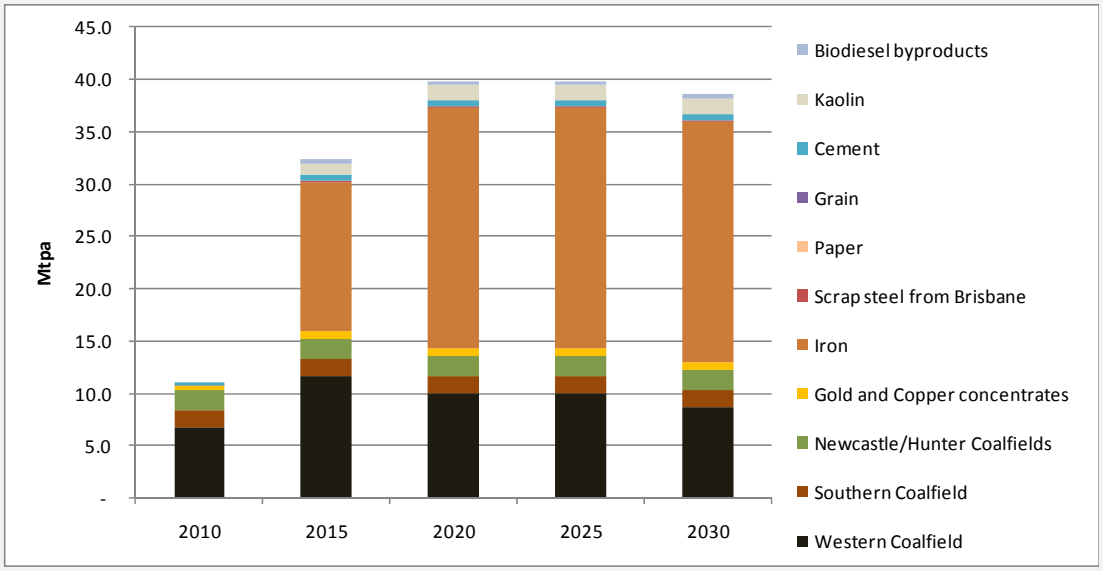
Where Port Kembla is the preferred port (and for some of these potential iron ore mines, there are a number of possible export ports), in principle either the Moss Vale-Unanderra or potential Maldon-Dombarton rail lines could be used for additional iron ore freight. The former could cope with tonnages at the lower end of the forecast range (2-3Mtpa) but it might be necessary to construct a Maldon-Dombarton rail line or upgrade the Moss Vale-Unanderra line[5] if the higher tonnages (possibly up to 22Mtpa) eventuated.

Port Kembla has indicated that if this demand eventuates it could install the necessary facilities within a few years. At this stage iron ore freight is speculative and is not included in ACIL Tasman's Central Case forecasts. However it offers a major potential upside for a Maldon-Dombarton rail line and should be built into future planning as discussed in Chapter 10.

Although the iron ore is only at feasibility assessment stage, Chapter 2 shows that there is the potential demand for a Maldon-Dombarton rail line if 22 million tonnes of iron ore were to be exported from Port Kembla. This iron ore would originate from the west or south west of Port Kembla and would naturally use the Moss Vale-Unanderra line in preference to a Maldon-Dombarton line if there is sufficient capacity and the line meets operational requirements (especially train length and axle loads). However, the Moss Vale-Unanderra line, which offers a more direct connection, would need major upgrades in order to handle this volume of iron ore, and an engineering feasibility study would be necessary. Also, if the freight volume was as high as has been suggested, even an upgraded Moss Vale-Unanderra line would be close to capacity and have little room for further growth. Should these circumstances materialise it would support the need for the development of a Maldon-Dombarton rail line.

[5] For a discussion of the cost of upgrades to the Moss Vale-Unanderra line and of the augmented capacity which would result from this see Chapter 3.

Chart 3 **Potential freight for Maldon-Dombarton line if higher volume iron ore scenario eventuates**




*Source:* ACIL Tasman estimates

## 2.4 Cement and limestone

Cement Australia would use a Maldon-Dombarton rail line, if it was economic, for cement from their Port Kembla plant to Sydney. Annual tonnages would build up to around 800,000 tonnes p.a. The alternative is trucks. The input commodities come by ship.

Blue Circle Southern has cement plants in Maldon and Berrima. It also supplies limestone from Marulan. Potential use of a Maldon-Dombarton rail line is 500,000 tonnes p.a.

## 2.5 Paper

Independent Print Media Group (IPMG) operates a large printing facility at Warwick Farm and is expected to import 135,000 tonnes of paper per annum through Port Kembla, with the intention of moving this using five rail services per week on the Illawarra line via Enfield. This freight would seem to be ideal for a Maldon-Dombarton rail line but IPMG's planning application states that the option of connecting the facility siding to the South Sydney Freight Line (SSFL) with a spur line to the south of the facility was examined and found to be unworkable, requiring the train to be broken up, shunting and long track occupancy on the SSFL with the possibility that it would block ARTC maintenance access to the SSFL.

For these reasons this freight is not expected to use a Maldon-Dombarton rail line, but would instead travel along the Illawarra line then the Sydney

Metropolitan Freight Network (MFN), entering IPMG's print works on the SSFL, approaching from the north.

## 2.6 Grain

The grain industry considers Port Kembla an efficient grain exporting port, both because of the port facilities and the convenience of the Moss Vale-Unanderra line. It is preferred to the Port of Newcastle which is considered to have inefficient rail arrangements[6] at the port and is served by the congested Hunter Valley line.

A Maldon-Dombarton rail line would not be as convenient as the Moss Vale-Unanderra line, because the grain comes in from the west and Maldon would be a detour. A possible operating advantage of a Maldon-Dombarton rail line would be that in a peak grain harvest the Moss Vale and Maldon-Dombarton lines could operate as a one-way system, with loaded grain trains moving to the Port on the Moss Vale-Unanderra line and returning via a Maldon-Dombarton line. This would allow greater capacity on the Moss Vale-Unanderra line, if this is the relevant constraint. However, it is likely that rolling stock availability, not line capacity could be the constraint on rail mode share in a peak grain harvest (and the normal practice throughout Australia is to use trucks for the overflow). It is also possible to increase the capacity of the Moss Vale-Unanderra line in other ways, as discussed in Chapter 9.1.

There is a regular domestic grain service moving approximately 0.5Mtpa of grain from Manildra, Narrandera and Gunnedah to Manildra's starch plant at Bomaderry. These six services per week are expected to remain on the Illawarra line.

Hence, although we expect grain exports through Port Kembla to remain steady at around 1.0-1.5Mtpa in a typical year, there is no grain tonnage in our forecasts for the potential Maldon-Dombarton rail line.

## 2.7 Kaolin

Sydney Construction Materials is planning to export an initial volume of 0.5Mtpa of Kaolin (a fine clay), growing to 1.5Mtpa, from Lithgow to Port Kembla. This could use the proposed Maldon-Dombarton rail line for up to three train services per week.

[6] NSW Grain Freight Review, 2009, P54: "The Newcastle terminal is the older of the two NSW terminals and is not considered to be as efficient as the Port Kembla terminal."

## 2.8 Biofuel

Manildra produces ethanol at Bomaderry, south of Port Kembla; although any implications for rail are relatively minor and long term.

National Biofuels is developing a soybean biodiesel plant in Port Kembla. In the longer term approximately 1.3Mtpa of soy beans will be brought in from three areas in NSW, some using the proposed Maldon-Dombarton rail line. Soy meal by-products from the plant and some of the biodiesel output could also be transported on the line.

## 2.9 Steel

BlueScope Steel's plant at Port Kembla uses iron ore brought in by ship, limestone railed from Marulan, and coal railed from nearby for blending with coal from Newcastle. The steel from the plant is mainly transported by sea and rail; the Illawarra line is preferred because its ruling gradient of 1:75 is less steep than on a Maldon-Dombarton or Moss Vale – Unanderra lines (both 1:30). In 2010 BlueScope Steel moved 2Mtpa of coal from Newcastle to Port Kembla (discussed in section 2.1). ACIL Tasman also forecast movements of approximately 7,000 TEUs per annum of containerized steel and some 0.1Mtpa of scrap steel from Brisbane moving on rail from and to Port Kembla.

## 2.10 Cars

Port Kembla is NSW's car import port. The auto logistics companies use trucks to get the cars to Sydney and elsewhere in NSW, on economic grounds related to double handling and rolling stock investment costs. Some companies have expressed an interest in using rail, but it is a marginal decision; as such this freight may be more responsive to government policies on road pricing and carbon pricing than other forms of freight. The Illawarra line is expected to have a number of paths available in the evening and on weekends and a Maldon-Dombarton rail line would not change the "pick up and delivery" cost (PUD cost) problem which makes rail freight of automotives unprofitable over short distances.

ACIL Tasman does not expect these cars to move by rail, although it has tested the impact of this on the economics of the line as an upside scenario. This upside scenario might eventuate, but as will be shown, it does not significantly lift the economic case for a Maldon-Dombarton line.

## 2.11 Containers

Port Kembla currently handles approximately 18,000 containers (measured in Twenty-foot equivalent units, or TEUs) per annum. The port has concept approval for development of its Outer Harbour to handle up to 1.2 million TEUs per annum if served on the land side by rail. For space reasons only a small portion could be handled by truck. The March 2011 Concept Approval for the development under Section 75O of the NSW Environmental Planning and Assessment Act requires that no more than 120,000 TEUs per annum be moved by road. Some secondary trades (e.g. ships serving Pacific Islands) are starting to use Port Kembla, and future growth may occur in response to constraints in Port Botany or its landside links.

The major shipping companies advise that they prefer to stay at Port Botany. Shipping Australia, in a submission to this study, said:

> Members are... keen about an alternative port for the overflow of containers from Port Botany is identified and planned soon, given the long lead time... Would one of the international shipping companies move from Port Botany to Port Kembla? In our opinion it is likely that initially, smaller ship operators servicing niche markets could consider relocating services to Port Kembla. *(Source: Shipping Australia).*

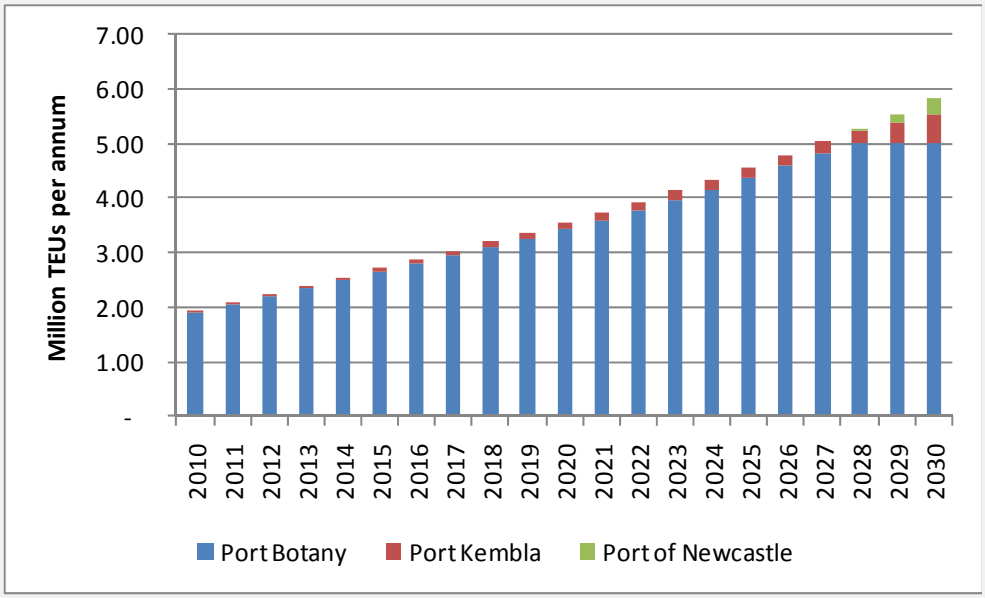
Port Botany is being expanded and the NSW Government has made proposals to improve its congested road and rail connections. Port Botany has a planning-related throughput cap of 3.2 MTEUs per annum; for modelling ACIL Tasman –bearing in mind the recent port expansion and the landslide proposals-has assumed that this would be increased to 5 MTEUs per annum (56% higher than at present), though actual port capacity is understood to be considerably higher. With the 5 MTEUs assumption, Port Botany would reach the limit towards the end of this Study period (around 2029). This is based on a scenario of annual growth tapering off from 8% to 5% over the forecast period. Should Port Botany's planning-related cap be higher, it would be reached later. The date would also be deferred if shipping companies decided to send the containers that overflowed the Port Botany facilities through another existing facility, notably Melbourne.

If Port Botany reaches its limit in 2029, then other ports would need to serve an additional 300,000 TEUs of container movements each year to keep pace with demand.

It is not certain that Port Kembla would be able to capture all of the overflow containers. The Port of Newcastle could also capture some of this overflow, although its links to Western Sydney (a key destination expected to receive more than 50% of import containers[7]) are not as good as Port Kembla's would be if a Maldon-Dombarton rail line were available. The NSW 2003 Ports Growth Plan identified the Port of Newcastle as the future overflow container port, but it is assumed that in future either or both of Newcastle and Port Kembla could be used.

Chart 4 shows the forecast container throughput in NSW under ACIL Tasman's assumptions.

Chart 4 **NSW container throughput, estimated by port**




*Source:* ACIL Tasman estimates

Significant overflow to Port Kembla is therefore judged to be unlikely until at least the end of the study period. Alternatively, a major shipping company could be attracted to Port Kembla because it could then set up its own vertically integrated stevedore; this could happen at any time and cannot be forecast. It has been examined as an upside scenario for a Maldon-Dombarton rail line.

[7] NSW Import Export Container Mapping Report, Sea Freight Council of NSW, February 2004.

Metropolitan Sydney International Container Origin/Destination Analysis, Sydney Ports Corporation, August 2000.

## 2.12 Overall demand

The demand forecasts are summarised in Table 3. This summary is the expected demand for potential traffic on a Maldon-Dombarton rail line. The 2010 column covers those parts of current freight that might in future use a Maldon-Dombarton rail line, and does not include freight that is considered unlikely to use it (e.g. grain is expected to stay on the Moss Vale-Unanderra line, as is paper and automotive freight).

Table 3 **Freight relevant to a Maldon-Dombarton rail line (Base Case)**

| | | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Bulk Freight | | | | | | |
| Coal | | | | | | |
| Western Coalfield | Mtpa | 6.75 | 11.65 | 10.00 | 10.00 | 8.70 |
| Southern Coalfield | Mtpa | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 |
| Newcastle/Hunter Coalfields | Mtpa | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Other Ores | | | | | | |
| Gold and Copper concentrates | Mtpa | 0.35 | 0.65 | 0.65 | 0.65 | 0.65 |
| Iron | Mtpa | - | - | - | - | - |
| Other bulk | | | | | | |
| Scrap steel from Brisbane | Mtpa | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 |
| Paper (IPMG) | Mtpa | - | - | - | - | - |
| Grain | Mtpa | - | - | - | - | - |
| Cement | Mtpa | 0.30 | 0.60 | 0.60 | 0.60 | 0.60 |
| Kaolin | Mtpa | 0.50 | 1.10 | 1.50 | 1.50 | 1.50 |
| Biodiesel | Mtpa | - | 0.38 | 0.38 | 0.38 | 0.38 |
| | | | | | | |
| Total Bulk | Mtpa | 11.59 | 18.07 | 16.82 | 16.83 | 15.53 |
| | | | | | | |
| Non-Bulk | | | | | | |
| Automotive | Units | - | - | - | - | - |
| | | | | | | |
| Containers | TEUs | 17,352 | 56,626 | 118,067 | 169,401 | 478,180 |
| Containerised steel | TEUs | 6,944 | 7,131 | 7,363 | 7,596 | 7,828 |
| All container movements | TEUs | 24,296 | 63,756 | 125,430 | 176,996 | 486,008 |

Figure 7represents the flows of freight in the Base Case which could be contested by a Maldon-Dombarton rail line:

Figure 7 **Freight flows in the Base Case (2015)**


*Source:* ACIL Tasman estimates

Figure 8 represents what this freight flow might look like with a Maldon-Dombarton rail line:

Figure 8 **Potential freight flows with a Maldon-Dombarton line (2015)**


*Source:* ACIL Tasman estimate

# 3 Capacity

Underlying this study is the question of whether there is enough existing rail capacity to meet rail freight demand to and from Port Kembla. Two lines exist (Illawarra and Moss Vale - Unanderra); the question of whether or not there is enough capacity on these lines to cope with freight growth is central to analysis of the benefits of a third line.

A related issue is whether a new line would attract freight from road and reduce the number of trucks on heavily used roads in the area, especially Mt Ousley Road.

A Maldon-Dombarton line would be designed to accommodate high tonne axle loads, long trains (up to 1800 metres), and wider outlines (such as Plate F locomotives) but the estimated capital cost is much higher than preliminary estimates for upgrading the Moss Vale-Unanderra line. As shown in section 6.5.1 a Maldon-Dombarton rail line would become economic if demand significantly exceeded capacity on the Moss Vale-Unanderra line.

## 3.1 Train operations and capacity analysis

Train operations specialists Plateway were engaged to analyse journey times and capacity on the proposed line, and to assess capacity on parts of the wider network that are relevant to the line. Key points from their analysis are that:

- journey times were analysed for typical trains, allowing for the distance, locomotive type, gradients and positioning of passing loops. The journey time from Unanderra to Picton (near Maldon) was estimated at 55-80 minutes (depending on train type etc) and in the opposite direction 58-85 minutes. The southerly direction is slightly slower because a 1:75 to 1:60 grade has to be climbed before reaching the tunnel.
- new types of locomotives with AC traction (e.g. modern US types from General Electric and General Motors) would handle the line better than old types, because they are better suited to the steep gradients
- alternative locations for passing loops were considered. Two were identified for construction at the outset and one for the construction later as train numbers increase
- an alignment that avoided the cost of relocating a gas pipeline near the northern end of the proposed line would be too steep for Tahmoor trains to negotiate with current power to weight ratios
- a Maldon-Dombarton line would provide for an additional 8.5 coal train cycles (return trips) per day with no loops, 9.5 coal train cycles per day with one loop, 12.5 with two loops and 30 with three loops.

- return cycle times from Tahmoor to Port Kembla would be almost 3 hours shorter on Maldon-Dombarton than on a Moss Vale-Unanderra line. The existing Tahmoor trains would struggle on the 1:60 grade on a Maldon-Dombarton line and would benefit from more power
- trains from the Lithgow area or from north of Sydney would take 10 to 20 minutes longer via a Maldon-Dombarton rail line than on the Illawarra line, but would benefit from a reduction in waiting times and greater reliability so the overall journey time would reduce or at worst remain the same
- the Illawarra line is effectively operating at capacity except for five paths between midnight and 5am. As freight grows these paths would be used (with no capacity spare after 2029 based on ACIL Tasman's demand forecast), with cost consequences, and excess freight would need to use the Moss Vale-Unanderra line
- the Western line from Lithgow has capacity for additional freight trains because the part with the heaviest traffic has quadruple tracks. It is possible to augment the capacity of Southern Sydney Freight Line and the main South line should this be needed.
- the Sydney Metropolitan Freight Network is traversed by trains travelling from Lithgow to the Illawarra, Moss Vale-Unanderra or potential Maldon-Dombarton lines. It is also traversed by other freight trains, and will come under strain as freight grows. Increased freight use of short cuts on the western side of the Sydney network – such as the existing Harris Park Y link or a proposed new western link – would help by providing a link between the Western line and the Southern Sydney Freight Line (and hence Maldon-Dombarton or Moss Vale-Unanderra). This would avoid congested parts of the Sydney network and would increase the benefits of a Maldon-Dombarton rail line.
- the complex Unanderra- Coniston Junction is operating at about 50% of capacity and so can handle increased freight before work is required.

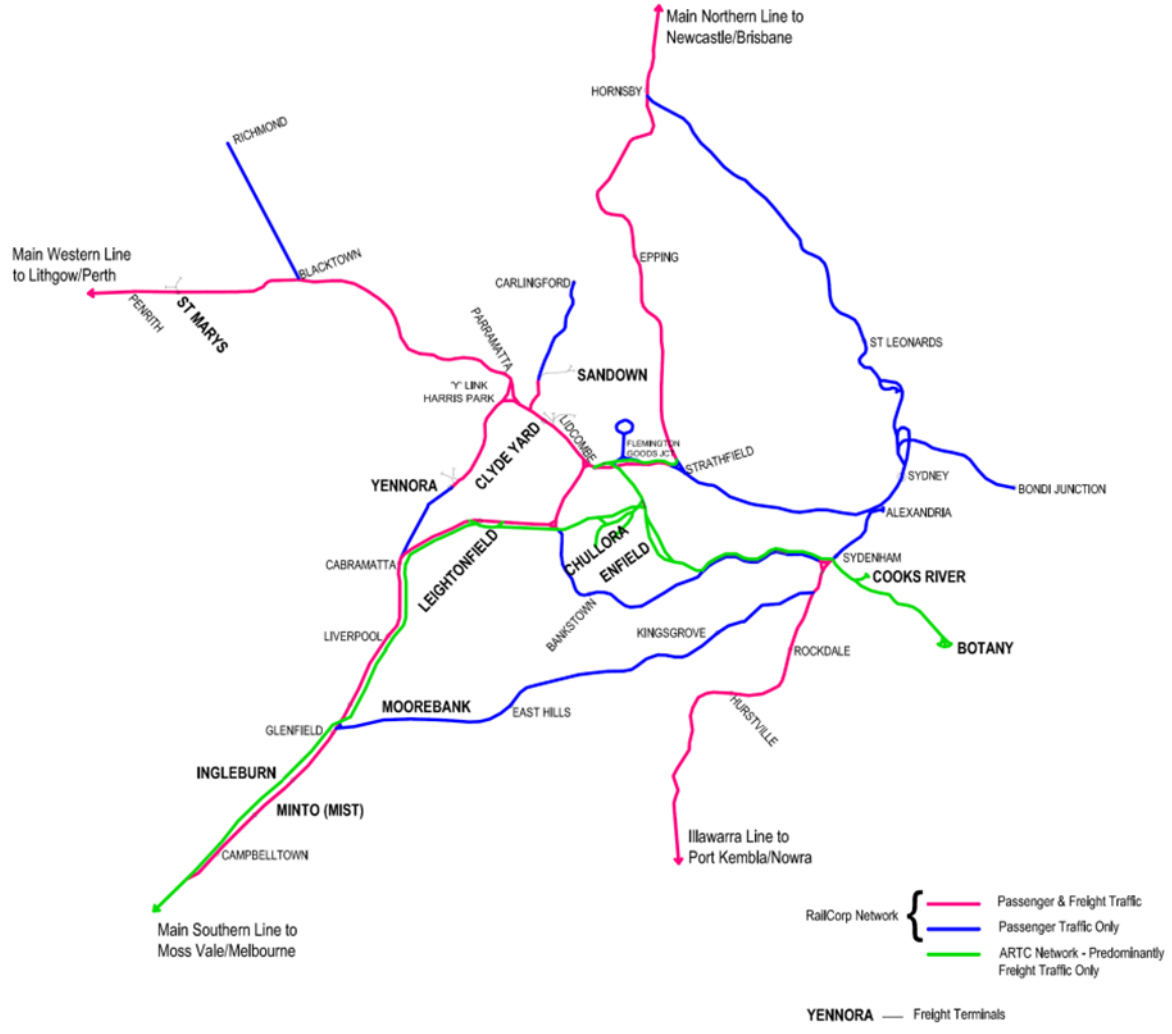
The Sydney network is shown in Figure 9.The importance of considering the wider network was confirmed in submissions to this study:

> The Maldon-Dombarton link could play an important role in improving the reliability and efficiency of the supply chains from the Western and Southern coalfields. For this to occur the link must be supported by sufficient auxiliary infrastructure for the increase in traffic along the route, so that freight transport on lines adjoining the link is not disadvantaged. *(Source: NSW Minerals Council)*

> The feasibility study must examine the capacity of the proposed link from a whole-of-supply-chain point of view...[ including] the interaction with existing rail lines which the link will join, and interfaces between each element of the supply chain... *(Source: Xstrata Coal)*

> Port Kembla Coal Terminal (PKCT) is contemplating an upgrade project that requires certainty across the total supply chain capability... Continued need by NSW Western coalfield producers... to approach the inner Sydney rail network prior to being able to progress to the Maldon-Dombarton rail link [will be problematic]... To deal with the Maldon-Dombarton rail link in isolation from the "in-feed" and "out-feed" rail infrastructure might lead to an imperfect business case. *(Source: Port Kembla .Coal Terminal)*

Figure 9 **Sydney rail network**




Note: This map is drafted on the assumption that all relevant leases are transferred to ARTC as planned.

Source: *Plateway*

## 3.2 Capacity on the Illawarra line

RailCorp's Illawarra line, from Sydney to Wollongong (with a spur to Port Kembla) and Nowra, is intensively used for both passenger and freight services. The freight services are mainly coal trains from the Lithgow area. The Illawarra line will effectively be operating at capacity during the day once near-term increments in demand are accommodated. Congestion north of Sutherland restricts increases in the numbers of freight trains, and could only be resolved with major investment, understood to be much greater than the cost of a Maldon-Dombarton line. Apart from ad hoc paths, any growth in freight train numbers would have to be accommodated at night.

Some of the submissions to this study discussed Illawarra line problems, for example:

> CityRail trains can often be slowed by long and slow moving coal trains on these busy lines. Waterfall for example is one location where passenger trains are often slowed by coal trains calling into the "refuge" sidings there. *(Source: TweedRail Society)*
>
> The construction of this rail link would appear to benefit the Marrickville Local Government Area by providing an alternative route for coal trains... specifically, persons who live along these lines would benefit from reduced noise and vibration...*(Source: Marrickville Council)*

Analysis by Plateway during this study concludes that at present there are five available freight paths between midnight and 5am. RailCorp's view is similar. ACIL Tasman's demand forecasts imply that these paths will be used up by 2029, after which (in the absence of a Maldon-Dombarton line) overflow would have to go to the Moss Vale-Unanderra line.

The tight capacity is affecting reliability, and we expect that operators would switch most of their freight trains from the Illawarra line to a Maldon-Dombarton line if it was available. A submission to the study confirmed this:

> PKPC [Port Kembla Port Corporation] is strongly of the view that if the Maldon-Dombarton line is constructed there would be a significant movement of coal freight from the Illawarra line [whose problems are] that many rail paths are located on an ad hoc basis; significant queuing is encountered...; the travel time is slow.... the Maldon Dombarton line is... critical infrastructure [without which it] is highly unlikely that Port Kembla port will be able to fulfil its potential... *(Source: Port Kembla Port Corporation)*

## 3.3 Capacity on the Moss Vale-Unanderra line

The Moss Vale-Unanderra line provides alternative rail access to and from Port Kembla. It is the preferred route for freight from southern New South Wales, e.g. limestone, and for freight from the inland Parkes-Cootamundra line, e.g.

grain. It is also used to take coal from Tahmoor (near Maldon) to Port Kembla. It has spare capacity, though it can get tight in peak grain periods.

The Moss Vale-Unanderra line could be used as an overflow line for freight coming through Sydney, though it imposes cost and time penalties on train operators because the route is 100 kilometres longer than the Illawarra line – a deterrent especially for container traffic.

With the current configuration, capacity is limited to 14.6 paths (in each direction) per day. Current trains consume an average of 5.3 paths per day, leaving 9.3 paths available for new traffic. ACIL Tasman has assumed that only 75% of these available paths are able to be utilised over the course of a year, giving an average 7 spare paths per day. These paths could accommodate an additional 6.5Mtpa of bulk freight.

The Moss Vale – Unanderra line can accommodate increased demand as capacity can be enhanced in stages, largely by extending passing loops – approximately $20 million to achieve 8.6Mtpa spare capacity with loops extended to allow easier passing of standard coal trains and another $103 million to achieve 13.8Mtpa spare capacity, well in excess of expected demand. More detail is provided in a separate paper from the ARTC, included as Appendix F to this report. The decision-making process for achieving these increases is discussed in section 9.7.

A submission to this study broadly supported this approach:

> The high-growth scenario of the Illawarra Freight Study for the Moss Vale line confirms the views of RailCorp and the ARTC that future growth can be accommodated on the existing network without recourse to major new capital investment. The current rail freight load inland from Port Kembla is virtually zero. In the Sydney Wollongong Corridor Strategy improving the capacity, efficiency and productivity of the Moss Vale to Port Kembla rail line has been identified as one of the short-term priorities, further strengthening the case using the link between Moss Vale and Port Kembla. *(Source: Wingecarribee Shire Council)*

Additional ways of increasing capacity on the Moss Vale-Unanderra line include increasing axle loads, train lengths, using AC Traction locomotives and ECP braking, as well as running some trains on a circular route (e.g. full trains on that line, empties returning via the Illawarra line).

A summary of potential upgrades and the estimated cost for these upgrades is shown in Table 4:

Table 4 **Possible upgrades and indicative costs for the Moss-Vale Unanderra line**

| Upgrade | Description | Spare capacity (saleable paths/day) | Spare capacity (Mtpa) | Incremental capital cost ($ million) | Total capital cost ($ million) |
|---|---|---|---|---|---|
| Status quo | Do nothing. Trains limited to 669 metres, to optimise paths. | 7.0 | 6.50 | $- | $- |
| Stage 1 | Extend loops to allow standard coal train of up to 850 metres<br>($5 million per loop, 200m extensions) | 7.0 | 8.60 | $20 | $20 |
| Stage 2 | Stage 1 + Extend loops to 1350m, $12m per loop plus road bridge at Robertson ($5m).<br>Also need 1350 m area to break up trains. If no options at Port Kembla then estimated $50m cost for this. This allows 72 wagon trains. | 7.0 | 13.80 | $103 | $123 |
| Stage 1&2 at the same time | Do not do stage 1, extend loops to 1350m, $12m per loop plus road bridge at Robertson ($5m).<br>Also need 1350 m area to break up trains. If no options at Port Kembla then estimated $50m cost for this. | 7.0 | 13.80 | $111 | $111 |
| Stage 3 | Stage 2 + Summit Tank loop could be extended toward Dombarton, allowing 72 wagon trains | 8.1 | 15.90 | $15 | $126 |
| Stage 4 | Stage 3 + Extend the Summit Tank loop down the hill to approximately 103.4 km with 72 wagon trains | 9.4 | 18.50 | $50 | $176 |
| Stage 5 | Stage 4 + AC traction/ECP braking, 82 wagon trains 30 tonne axle loads (TAL).<br>There will be (unknown) capital costs related to enabling 30 TAL over whole route. Costs related to AC Traction and ECP braking also not included, although expected to be standard in all new generation rolling stock. | 11.1 | 32.90 | $- | $176 |

*Note:* Costs are estimated by ARTC based on its experience with similar projects. The attached ARTC letter at Appendix F discussed design and planning issues.

*Data source*: ARTC

The costs are indicative but the stage 1-4 total cost would have to be over three times as high before it approached the Maldon-Dombarton cost. Stages 1 and 2 are relatively straightforward. Stages 3 and 4 involve more extensive works; an engineering feasibility study would determine whether there were additional costs. If there were, and if they were high enough, the case for a Maldon-Dombarton line could be revisited. If all stages were needed in quick succession, Maldon-Dombarton is an alternative – though, on present information, a much more expensive one.

## 3.4 Capacity – roads

Road capacity was a theme in stakeholder discussions and submissions, for example:

> The Mt Ousley Road has excessive numbers of heavy trucks. Including a massive 5 million tonnes of coal on road. No other city in Australia is subject to this imposition. And if this was not bad enough, a long standing curfew has been lifted and permission given for the tonnages to be increased. In other words, more road crash risk, noise and air pollution, plus congestion. To add insult to injury, the operations of the heavier trucks are arguably subsidised by low fuel taxation (only

> about 22 cents per litre for diesel used by big trucks after rebates as against the 38 cents a litre paid by motorists) and for the road damage they do, low annual registration charges. As noted by the Henry Tax review, mass distance charges are long overdue. The least that the present feasibility study can do is to properly estimate what it is costing the community to have so much coal on road. *(Source: Wollongong Transport Coalition)*
>
> During 2008-09 the Department of Planning processed a Major Projects application by the Port Kembla Coal Terminal (PKCT) to lift a long standing curfew on road deliveries by coal trucks to the PKCT and to lift already high levels of road haulage of coal of some 5.1 million tonne per annum (mtpa) of coal to the PKCT to a maximum of 10 mtpa (with additional conditions past 7.5 mtpa). The application resulted in the NSW Department of Planning receiving 122 written objections... Although the road system is coping, under some stress, with about 6 mtpa on coal from the Appin Westcliff coal complex, 12 mtpa is likely to impose unacceptable impacts. *(Source: Philip Laird)*
>
> ... main roads such as the Picton Road, the Appin Road, the Mt Ousley Road and the F6 Road already have too many heavy trucks. The remedy would be both completion of the Maldon Dombarton railway and a quota on the number of heavy trucks. *(Source: Neighbourhood Forum 5)*
>
> RTA has raised concerns with the ability of the port to achieve a modal split of 90% of freight movements by rail. This concern has been reinforced as the first development application for development within the [Port Kembla Outer Harbour] has proposed all movements by road and generates 2/3 of the traffic movements proposed for PKOH in its entirety... while it is not clear if construction of the Maldon-Dombarton rail link is likely to reduce traffic congestion by attracting existing road freight movements onto rail, it is considered that this rail link is vital in providing alternatives for future users...*(Source: NSW Roads and Traffic Authority)*

Of the three key and heavily used roads in the area, discussion with NSW RTA indicated that Picton Road and Appin Road can be steadily improved as traffic increases, but Mt Ousley Road would be much more difficult to improve because of the steep and unstable terrain. A key question in this study is whether a Maldon-Dombarton rail line would result in a switch from road traffic to rail- e.g. coal, containers, cars and steel.

Some of the coal that is trucked to Port Kembla is from mines whose location means they would not use a Maldon-Dombarton line. Coal from Bulli Seam (Appin/West Cliff) could in principle be taken to a railway by conveyor, but BHP states that it intends to stick with road transport in part because of the cost of relocating its washery and coal wash storage facility (see section 2.1). An alternative view, from a submission to this study, is:

> As an alternative to coal trucks, the Maldon-Dombarton rail link should be completed and coal companies be required to use it. Until then, there should be production limits imposed on the mines near Appin. *(Source: Martin Laird – Wollongong University Student Association)*

Port Kembla's container trade is currently served by road. As trade builds up there will be enough critical mass to make up a regular train, which could use spare capacity on the Illawarra line, Moss Vale-Unanderra line, or potential Maldon-Dombarton line. Port Kembla's environmental approval for its outer harbour development constrains container movement by road to a maximum of 120,000 TEUs p.a.

It is not clear that car transport will switch to rail, as the relevant firms estimate that rail would be uneconomic or marginal.

Some steel that at present is trucked from Port Kembla to Villawood (approximately 150,000 tonnes per annum) is expected to switch soon to rail and we understand that this could be accommodated by RailCorp in current allocated paths, or by a Maldon-Dombarton rail line, if it is available.

## 3.5 Capacity - conclusions

Relative to expected demand over the forecast period, there is not a general rail capacity problem, though there are specific constraints and costs.

Some additional freight could be carried on the Illawarra line at night (possibly with extra expense for sidings in or near to the Port Kembla area if additional train storage cannot be created within Port Kembla). The Moss Vale-Unanderra line could also be used to carry additional freight, although the costs of using this line are higher for some freight because of the longer distance and transit time. There would obviously be a negative impact on residents adjacent to the Illawarra line as a result of increased movements of coal at night, though an alternative route via a Maldon-Dombarton rail line might face the same issue in southern Sydney if there were night operations.

If a Maldon-Dombarton line was constructed and rail access costs were competitive then most existing rail freight on the Illawarra line would divert to it because it would be more reliable.

Terminal investments, coal mine expansions and potential customers of the Port Kembla Outer Harbour development could be deterred as a result of uncertainty about the future availability of rail capacity. This report should help as it sets out the capacity situation for the Illawarra and Moss Vale-Unanderra lines.

Only the largest upper demand scenarios, or a combination of upper demand scenarios, as discussed in Chapter 7 would exhaust the total potential capacity of the existing lines. At that point there could be a case for building a Maldon-Dombarton line, provided the freight that could not be accommodated on existing lines was great enough to satisfy a cost benefit test.

# 4 Engineering assessment

## 4.1 Introduction

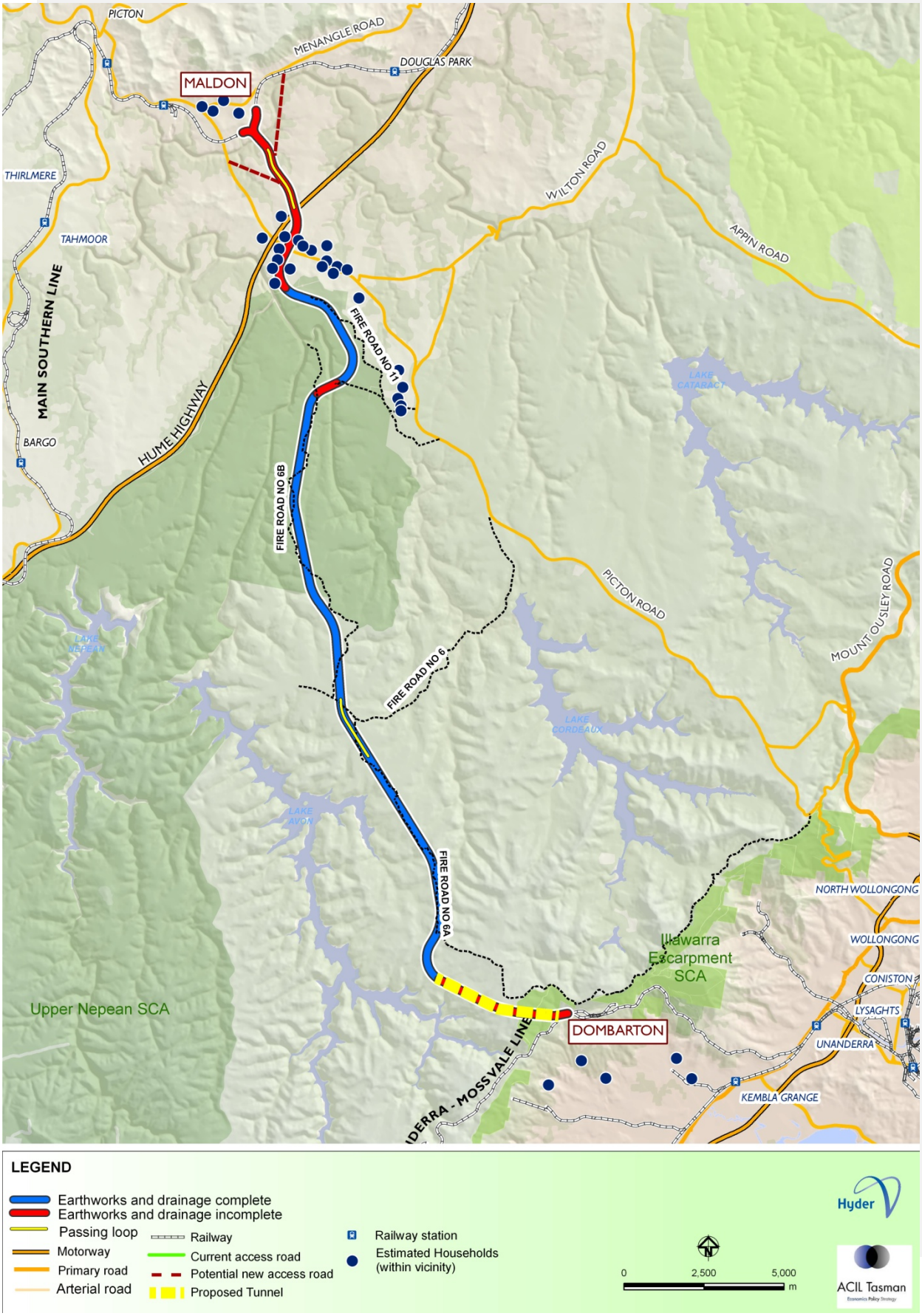
The route of a potential Maldon-Dombarton rail line would mainly follow the contour lines of the hills in the region. Along the approximately 35km route length of the rail line there are two significant bridge structures and a 4km long tunnel. Approximately 70 per cent of the earthworks, track formation, drainage and bottom ballast have been constructed, including the approaches to the mid span of the Nepean River Bridge. A section of approximately 5km length, the Avon Tunnel and the Cordeaux River Bridge has not been constructed.

Figure 10 shows samples of the work completed, and the following map, Figure 11, shows completed and uncompleted sections of the line.

Figure 10 **Part of existing alignment, and Eastern portal of the Avon tunnel**

*Source:* Hyder Consulting

Figure 11 **Completed and uncompleted works**



The engineering assessment considered the rail track including civil and drainage design, structural design of the bridges, culverts along the line and geotechnical and tunnel design. As part of the engineering assessment a gap analysis was undertaken between the original design and what is required by current standards. The assessment also considered the route alignment and potential viable alternatives as well as operational requirements for the line such as tunnel ventilation.

## 4.2 Rail alignment and track

Hyder has undertaken a comprehensive review of the rail alignment developed for the construction of the rail line in 1983. The railway and associated infrastructure were inspected on two occasions and an aerial survey was undertaken to determine the extent of construction undertaken. The assessment of the earthworks required to complete the line was based on the aerial survey and the concept design alignment developed.

Following due consideration of possible alternative route alignments, Hyder concludes that the existing alignment is viable both in terms of track design and cost.

The route is approximately 35km long. The track configuration is a single rail track with passing loops and has two junctions for connections to the North South Rail Corridor and the Moss Vale – Unanderra line. In addition to the Avon Tunnel and the two significant bridge structures at the Nepean River and Cordeaux River, there are four overbridges and a short tunnel under the F5 Freeway (Hume Highway). The maximum gradient of the line is 1 in 30 (downwards in the southerly direction towards Port Kembla) through the 4 km proposed tunnel. The next steepest section is to the north of the tunnel, upwards in the southerly direction, where the maximum gradient is approximately 1 in 60.

To meet ARTC Standards, the track structure would comprise specified concrete sleepers on ballast and 60 kg rail, with a resilient fastening system. The bottom ballast used in the constructed sections complies with current standards and can be reused.

There are 12 level crossings on the section of line where the earthworks and drainage have been completed. No other level crossings are needed. There are three fire roads along the alignment.

The design criteria and standards used for a Maldon-Dombarton rail line are summarised in Table 5.

Table 5 **Design and performance standards**

| Requirements | Performance |
|---|---|
| Maximum freight train transit time from Maldon-Dombarton junction | 55 min |
| Maximum freight transit time from Wilton to Avon Passing loops | 33 min |
| Desirable maximum operating speed | 80kph for loaded, 100kph empty excluding speed at the junctions and tunnel |
| Maximum speed at junctions | 60 kph |
| Maximum axle loads | 30 tonnes |
| Gauge | 1435 mm |
| Minimum horizontal curve radius | 800 m |
| Maximum gradient | 1 in 30 |
| Number of passing loops | 2 |
| Length of passing loops | To accommodate 1,800 m train |
| Maximum train length | 1,500 m |
| Electrification | Non-electrified (assumed diesel) |
| Single / double track | Single track |
| Vertical clearance | 7.1 m Plate F; double-stacking containers |
| Track structure on open track | Ballasted on concrete sleepers |
| Track structure in the tunnel | Non-ballasted (reinforced concrete slab)/ballast |
| Maintenance access roads | Around the passing loops |
| Level crossings | At Fire Roads crossing the line and at the both ends of the passing loops |

*Data source*: Hyder Consulting

The length of the proposed passing loops is approximately 1800m.

The new design is based on standards dated 1 July 2010. Some elements of the new standards differ from the standards used in the original design such as increased minimum loading requirements for railway bridges.

## 4.3 Water runoff and drainage

As the corridor passes through a catchment authority area, issues related to water runoff and erosion are environmentally important. This has been discussed in further detail in Section 5 Environmental Investigations as well as the Working Papers 1 and 2.

The proposed railway is located within the plateau divided by the Nepean River and its tributaries which have their headwaters in the Illawarra escarpment. The alignment approximately follows the catchment crest between Avon and Cordeaux River Systems. Approximately 50 cross drainage systems have already been constructed and it was estimated that 19 cross drainage systems need to be constructed for the completion of the project.

Hyder has undertaken hydrologic and hydraulic assessments of the waterway crossings that have been constructed and those designed along the existing track alignment.

The hydraulic assessment of the existing and proposed cross drainage structures determined that they have the required capacity in accordance with current ARTC standards and engineering industry practices. Further information on the hydrologic and hydraulic assessment is outlined in Working Paper 1.

## 4.4 Bridges

Existing design drawings for the following bridges were reviewed for applicability of previous bridge designs in relation to current design standards and whether the form of construction was still feasible and cost-effective.

- Railway bridge over Nepean River (existing viaducts, and proposed main between them)
- F5 Freeway (Hume Highway) bridge over M-D railway
- Condell Park Road bridge over M-D railway
- Picton Road bridge over M-D railway
- Janderra Lane bridge over M-D railway
- Railway bridge over Cordeaux River.

The Nepean River Crossing and the Cordeaux River Bridge represent the two significant bridge structures along the rail link.

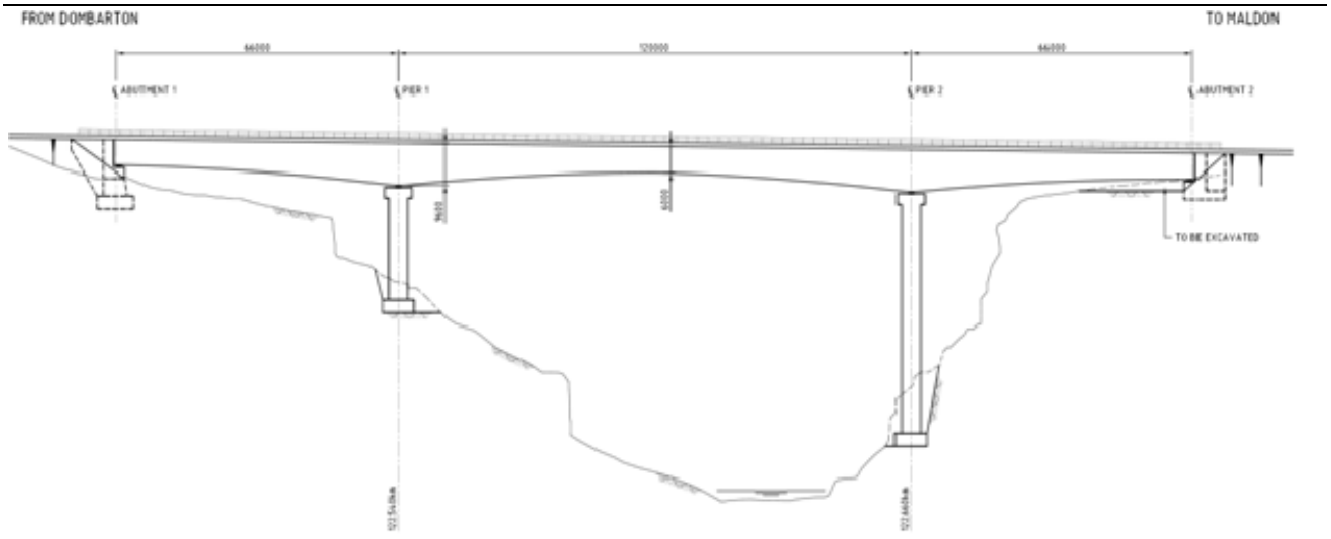
The viaduct approaches to the Nepean River Crossing main span have already been constructed. The engineering structural analysis of the existing bridge design confirmed the approaches and the mid span to be adequate for current standard loadings. The condition assessment of the constructed approaches deemed the structure to be adequate for use. The assessment was based on visual inspection and no further testing was undertaken.

Figure 12 **Partly completed Nepean Bridge**

*Source:* Hyder Consulting

The original design for the Cordeaux River Bridge proposed an arch structure. The structural analysis of the existing bridge design confirmed the design to be adequate for current standard loadings. However, with subsequent advances in technology and well developed construction methodologies in Australia for balanced cantilever bridges, Hyder concludes that a balanced cantilever design would be more cost effective

Figure 13 **Balanced Cantilever Bridge Option (Cordeaux River)**




*Data source:* Hyder Consulting

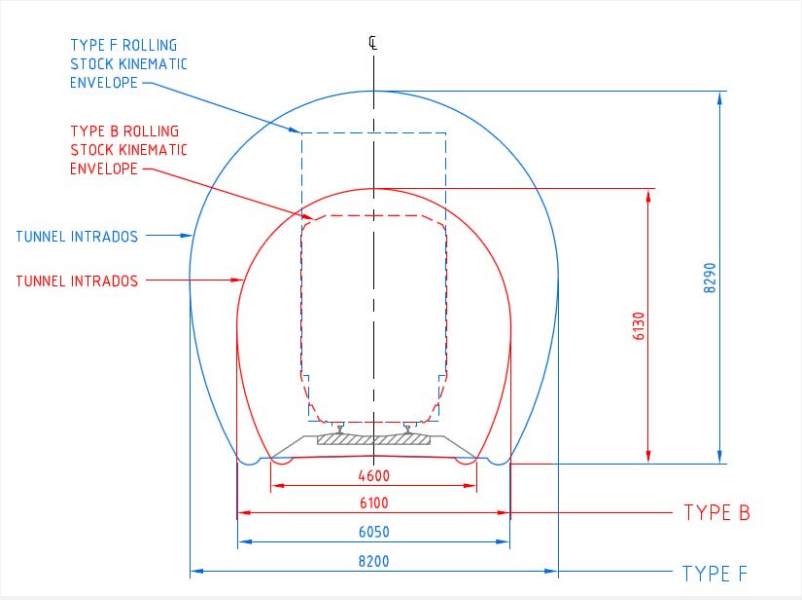
With regards to the proposed bridge on the F5 freeway over the Maldon to Dombarton rail line it is recommended that a short tunnel is constructed under the freeway instead of construction of a bridge structure. This would reduce the traffic disruption on the freeway during the construction period which would reduce the construction cost. A concept design of the proposed tunnel has been provided in Working Paper 1.

There are various culverts and fauna underpasses that have been constructed. Hyder recommends that these are used with the exception of the corrugated steel structures that would require replacement.

## 4.5 Avon tunnel

Two options are provided for the size of the tunnel, larger size (Plate F) and smaller (Plate B) – see Figure 14. The costs of each option have been estimated. .Both tunnel sizes are to current ARTC standards but the larger size would allow cheaper US type locomotives and double stacked containers to be able to use the tunnel. The larger size of the tunnel would also benefit the ventilation process of the tunnel. From previously undertaken geotechnical investigations, the ground conditions of the area where the tunnel would be constructed have been analysed. The analysis classified the ground in three categories based on the material strength. The construction methodology proposed varies for the sections of the tunnel with different ground properties. The recommended use of ballast or concrete slab within the tunnel also varies and is based on the ground properties.

Figure 14 **B and F type tunnel and loading gauge cross sections**




*Source:* Hyder Consulting

## 4.6 Rail route options

Five route options along the same corridor were considered – an updated version of the original design, an option without a tunnel, two options with realigned tunnels that were less steep, and a small variation to avoid relocating a gas pipeline.

After a comprehensive review, the alternative route options were deemed cost prohibitive due to increased earthworks or higher environmental impact.

It was decided to lower a gas pipeline to avoid having to build up the railway to maintain sufficient clearance between the two. If the railway was raised, the gradient would have been too steep to safely operate in wet conditions. This issue was not identified in previous studies and its resolution has slightly increased the capital costs of the line, by $15 million.

More detail on the engineering analysis is provided in Working Paper 1.

# 5 Environmental investigation

## 5.1 Key issues

Hyder undertook a preliminary environmental investigation of the proposed line, within the context of the relevant Commonwealth and NSW legislation and the existing site conditions.

The most significant impacts to be assessed were those posed by the location of the line within Sydney Catchment Authority land, the four kilometre tunnel, undertaking works within riparian zones and the building of bridges to cross waterways and roadways.

Issues identified and discussed in the environmental report were:

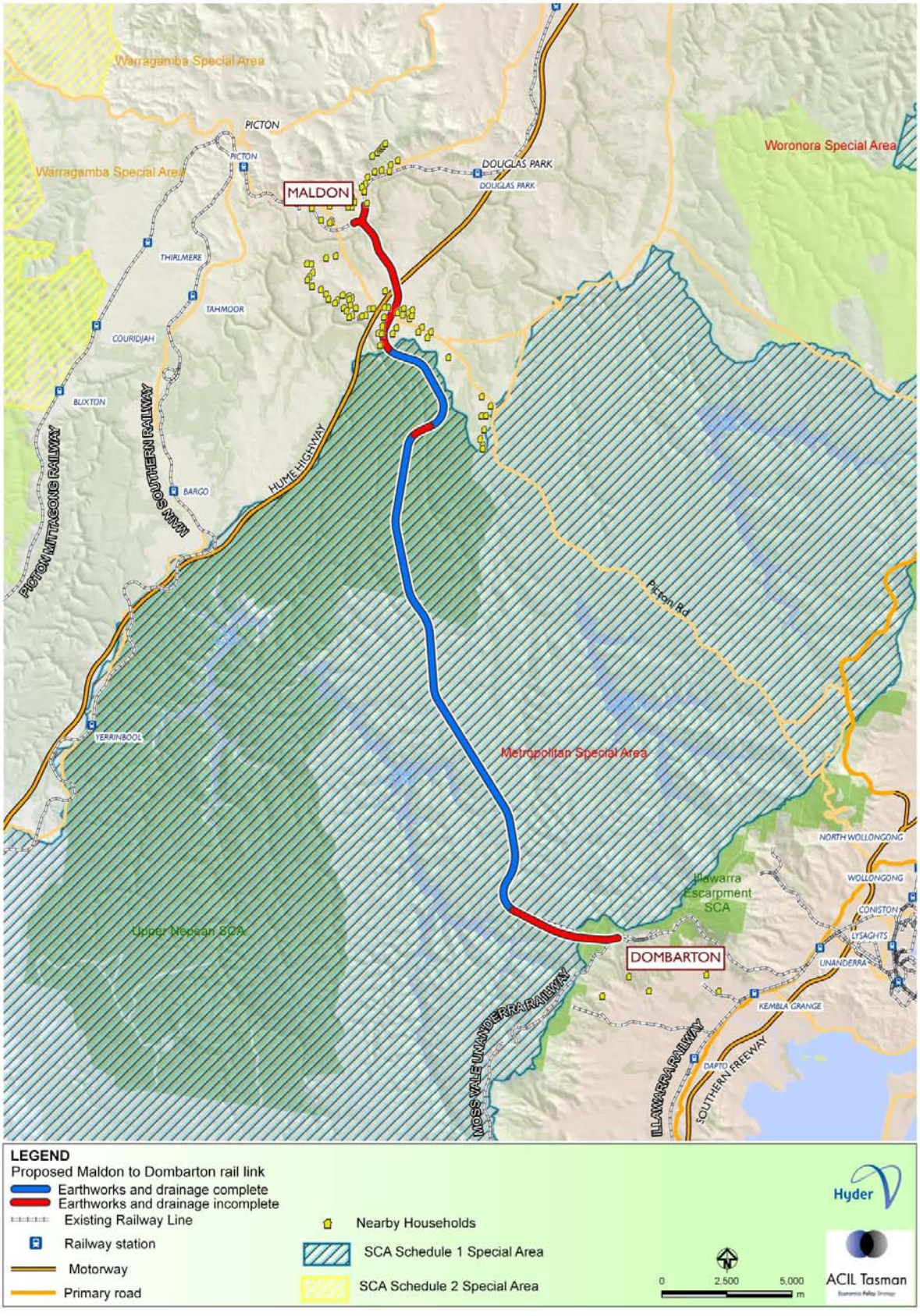
- Land use
- Geology, topography and soils
- Surface water, flooding and groundwater
- Flora and fauna
- Social
- Noise and vibration
- Climate and air quality
- Visual amenity
- Heritage
- Traffic and transport
- Waste management
- Land contamination
- Hazards and risks
- Greenhouse gases.

The assessment of the environmental aspects was undertaken considering the major environmental constraints as well as any impacts resulting from construction or operation that may impact the environment.

Following the assessment of the environmental impacts, an environmental risk appraisal was undertaken to further provide guidance on the (unmitigated) impacts of the proposal.

Figure 15 shows the completed and uncompleted parts of the line, and the location of the catchment area and of houses (mainly at the northern end).

Figure 15 **Land use and conservation areas**



## 5.2 Drainage

The proposed railway is located within the plateau divided by the Nepean River and its tributaries which have their headwaters in the Illawarra escarpment. The proposed rail alignment approximately follows the catchment crest between Avon and Cordeaux rivers systems and crosses both the Cordeaux and Nepean rivers. Environmental limitations identified in the study included degradation during construction and operation, such as sediment laden run off during construction and impacts on local water quality.

Soils within the project area are highly erodible, so an effective soil conservation management plan needs to be implemented to minimise erosion and maintain water quality. To achieve this, effective surface drainage, minimum vegetation clearing/site disturbance and vegetation stabilisation is required. Where the surface drainage is required, the ballast already in place will need to be reworked.

The addition of catch drains at the top of cuttings and protection of the cutting face is required to stop/prevent erosion and ensure the stability of these areas.

Much of the railway is located within land managed by the Sydney Catchment Authority (SCA), which requires that any developments within the catchment must only produce a neutral or beneficial effect on water quality. Hence existing drainage systems may need modification to ensure that track runoff gets fed through the proposed water quality treatment features.

Flooding is not expected to impact the line, as cross-drainage systems are proposed for all waterways crossed by the alignment.

## 5.3 Catchment authority requirements

The railway section located within the SCA will likely require water quality treatment devices to be installed to comply with the SCA guidelines. In addition, some existing drainage systems in the area may need to be modified to divert track runoff through the proposed water quality treatment device/s.

All water entering the catchment from water quality basins and or the Proposal drainage system would need to conform to or improve upon the criteria detailed in National Health and Research Medical Council (NHRMC) Australian Drinking Water Guidelines and or the Australian and New Zealand Environment Conservation Council water quality guidelines.

Previous studies have demonstrated that the soils for the area are quite reactive, and hence represent a risk of increasing suspended solids in any surface runoff, as well as being susceptible to erosion from unmanaged surface flows. Stormwater would most likely need to conform to the current stormwater treatment criteria provided by the NSW DECCW (as a minimum) prior to discharge. Furthermore, sediment and litter are likely to be collected during frequent storms and would also require management and possible treatment. Guidelines administered by the NSW DECCW are recommended as the minimum criteria for the proposal during both construction and operation.

## 5.4 Groundwater

Preliminary geotechnical investigations for the tunnel have indicated that there is likely to be approximately 2.5 megalitres (ML) of groundwater per week entering the tunnel structure as a result of the tunnel location. It is not currently known how groundwater is being intercepted by the tunnel. There is likely to be a concentration of hydrocarbons, sulphates and coal dust within the tunnel and there is potential for groundwater to become contaminated within the tunnel. The impacts upon groundwater-dependant ecosystems have not been assessed at this stage.

## 5.5 Further assessment

Should the proposed line proceed to the detailed study stage, the following would require investigation:

- a detailed ground survey and further analysis to confirm the results so far. Criteria for water quality parameters should be discussed with the SCA prior to construction.
- the propensity for upland swamps and micro-climate-specific ecosystems in the area
- detailed scoping of further access tracks needs, in a hydrological and water management context.
- detailed groundwater modelling of the tunnel section to identify the interaction with groundwater in the area, and the potential effects on overall water quality of the catchment. Geotechnical design should consider sealing the interior of the tunnel to prevent the passage of any contaminants into the groundwater
- a specific storm water assessment for the site.

## 5.6 Conclusion and next steps

A range of environmental issues have been identified. The impacts of completing the construction are attenuated by the fact that much of it has already been completed. The remaining impacts would require mitigation (several aspects of which are allowed for in the capital costs, e.g. temporary fencing to prevent machinery incursions beyond the easement) or appropriate treatment under the environmental approval processes (e.g. consultation with Indigenous stakeholders).

At this stage, that of a feasibility study, it does not appear that any of the environmental issues are "showstoppers".

The preliminary environmental investigation identifies the issues that would have to be examined in greater detail if a decision was made to proceed to a full environmental assessment. The time taken for a full assessment is usually up to 24 months although in this case, with much of the work completed (and the associated environmental impacts already incurred) it may be possible to reduce that to 12 to 18 months.

More detail on environmental issues and related legislation is provided in Working Paper 2.

# 6 Cost Benefit Analysis

## 6.1 Methodology

A comprehensive assessment of the costs and benefits of viable options was undertaken to gauge the net benefit to society as a whole. Cost-benefit analysis (CBA) is a technique that provides a systematic approach to ensuring this requirement is met. Guidance on CBA is provided in the Infrastructure Australia publications *Outline of Infrastructure Australia's prioritisation methodology (2010)* and *Reform and Investment Framework Templates for use by Proponents (2010)* as well as other publications such as the *National Guidelines for Transport System Management in Australia* published by the Australian Transport Council in 2006.

Box 1 **Cost benefit analysis**

CBA requires that as many costs and benefits as possible are "monetised", that is, expressed in monetary terms. In evaluating the costs and benefits of an investment, resource costs are used because they reflect the cost to society of an undertaking. If an investment causes a reduction in the resource costs of producing an item then society has gained.

How this benefit is distributed is irrelevant in this type of analysis. The owner of a railway could pocket all the gains, or could pass them on in the form of price decreases; these are merely transfers of the benefit between producers and consumers. The true benefit to society is the change in resource costs for a given activity. Thus the economic appraisal considers only the resource cost of actions – not the financial cost.

Future costs and benefits are discounted to "present values" to take into account the time value of money, in line with Infrastructure Australia guidelines a real discount rate of 7% has been used for this analysis with sensitivity tests performed at values of 4% and 10%.

In assessing the economic costs and benefits of a Maldon-Dombarton rail line a forecast of the future resource costs of transporting goods to and from Port Kembla and the relevant freight origins/destination has been modelled. ACIL Tasman's forecast of the costs and benefits of future freight on existing roads and railways is called the **Base Case**, and the forecast of the costs and benefits of transporting this freight using a Maldon-Dombarton rail line has been called the **Central Case**. ACIL Tasman has also modelled upside scenarios where additional sources and quantities of freight are modelled and the costs of transporting this on a Maldon-Dombarton rail line are compared with the costs using existing infrastructure.

A net benefit of a Maldon-Dombarton rail line would arise where that line allows existing freight to be transported at lower cost than in the Base Case, or where a line induces new freight to be transported by enabling activities which would not otherwise occur (creating value added).

## 6.2 Costs of a Maldon –Dombarton rail line

It is important to distinguish between the direct and indirect costs and benefits of the project. The direct costs and benefits relate to the specific objectives of the project, while the indirect costs and benefits relate to its spin-offs – typically its social or environmental costs and benefits.

### 6.2.1 Direct costs

The direct costs of the line are relatively straightforward, namely the capital and ongoing operating and maintenance costs of the line. The direct costs of a Maldon-Dombarton rail line have been assessed (in present value terms) as:

Table 6 **Direct costs of a Maldon-Dombarton rail line**

| Direct Costs | Present Value, $ million |
|---|---|
| Construction cost ($P_{50}$) | -$470.8 |
| Operating costs | -$7.3 |
| Maintenance costs | -$97.7 |
| **Direct costs** | **-$575.8** |

*Data source*: ACIL Tasman, derived from Evans & Peck

The following sections summarise the estimates of direct costs. A detailed description of the direct and indirect costs of a Maldon-Dombarton rail line can be found in Working Paper 2.

#### Construction costs

Specialists Evans & Peck (E&P) were engaged to estimate the construction costs of building a Maldon-Dombarton line, based on engineering analysis by Hyder which was reported in Working Paper 1.

The E&P work was peer reviewed by technical specialists in Hyder and ARTC. E&P prepared a construction cost estimate to +/- 10% at P50 and P90 (see the Glossary for a definition of these terms) in accordance with the standards contained in the E&P document *Best Practice Cost Estimation for Publicly Funded Road and Rail Construction,* which has been adopted by the Department of Infrastructure and Transport, completed in 2009. The objectives were to:

- undertake an initial desktop review of the various options and provide feedback on the constructability of the solutions
- develop cost estimates taking into consideration current engineering construction methodology

- estimate costs for obtaining environmental approvals
- include costs for integration of the line onto the existing rail network, with particular reference to ARTC requirements
- undertake a full risk assessment.

The methodology was to:

- review the site location and existing conditions
- review the scope of work completed to date
- undertake a high level constructability study of options to assess suitability with the previously completed works
- develop budget cost estimates based on the information and designs provided by Hyder Consulting and feedback from ARTC
- participate in a Peer Review with ARTC
- complete a risk assessment and using Monte Carlo simulation techniques perform a quantitative analysis of the inherent and contingent risks in order to obtain an objective view of the risk in the project (P50 and P90).

The estimated project cost in September 2010 was:

- $649.3 million at the P90 level
- $608.4 million at the P50 level.

These Evans & Peck estimates are in September 2010 dollars. ACIL Tasman converted them to December 2010 dollars for the purposes of its analysis.

The estimates include allowances for the mitigation of key environmental risks identified in the environmental part of Working Paper 2, in particular treatment and disposal of groundwater, protection of rivers, mitigation of heritage impacts, and study and protection of flora and fauna. Contractors' margins of 13.6% are also included in these totals and are removed for the economic appraisal.

Evans & Peck has subsequently costed some optional extra items, two of which ACIL Tasman suggests should also be included in the project costs:

- Head hardened rail - $8.9 million. This is a more cost-effective type of rail which allows a higher tonne axle load and lower maintenance costs.
- Tunnel portal ventilation (fans), including power supply - $3.0 million. This was added in response to concerns raised by Pacific National during a meeting of the Project Reference Group. If a Maldon-Dombarton rail line is used enough to be economically viable it is preferable that the tunnel can be quickly cleared of fumes and heat so that ventilation does not become an impediment to efficient running.

These values were rebased to December 2010 dollars which added approximately $5.7 million to the cost. Table 7 shows the breakdown of the

project costs and a comparison with cost estimates reported in a Maldon-Dombarton Rail Line Pre-Feasibility Study completed in 2009.

Table 7 **Comparison with pre-feasibility costs**

| Description | A. Pre-feasibility ($P_{50}$) cost estimate, indexed to December 2010 dollars | B. Evans & Peck ($P_{50}$) estimate in December 2010 dollars | C. Evans & Peck ($P_{90}$) estimate in December 2010 dollars |
|---|---|---|---|
| Site Infrastructure | $3.8 | $17.6 | $18.8 |
| Bridge crossings | $118.2 | $53.5 | $57.2 |
| Tunnel construction | $130.1 | $148.4 | $158.5 |
| Additional cost of Plate F tunnel outline | n.a | $53.3 | $57.0 |
| Tunnel Ventilation | n.a | $3.2 | $3.4 |
| Head hardened rail | n.a | $9.5 | $10.1 |
| Earthworks and drainage | $87.2 | $70.2 | $75.0 |
| Railway construction and minor works | $49.7 | $42.9 | $45.8 |
| Railway electrical and signalling | $14.2 | $10.7 | $11.4 |
| Sub-Total | $403.2 | $409.3 | $437.3 |
| Project Indirect Costs | $80.7 | $145.0 | $154.9 |
| Contractor Margin | Included above | Included above | Included above |
| TOTAL BASE ESTIMATE | $483.8 | $554.3 | $592.2 |
| Risk Contingency Allowance | $89.5 | $69.9 | $74.7 |
| TOTAL RISK ADJUSTED ESTIMATE | $573.4 | $624.2 | $666.9 |

*Data source*: *Data source: Evans & Peck*

The major cost items are the tunnel and bridges.

The tunnel size was designed as "Plate F", a standard adopted by ARTC that would allow the use of relatively low cost US locomotives (as seen in the Pilbara) and allow double stacked containers. If instead the tunnel size was to be Plate B, similar to many current Australian tunnels (including on the Moss Vale-Unanderra line) that require locomotives of a smaller profile and single stacking of containers, the capital cost saving would be in the order of $53 million or 7.7% of total costs. This is a significant additional cost, but one justified by both current ARTC clearances strategy and to maximise the efficiency of future rail freight on the line. The additional capital cost is not enough to significantly affect the financial and economic results for the project.

While the main difference between the pre-feasibility estimate and the P50 Evans & Peck estimate relates to the larger tunnel, there is also different treatment of the estimate of indirect costs.

Table 8 shows a breakdown of Evans & Peck's estimate of indirect costs.

Table 8 **Indirect costs**

| Indirect cost | Cost ($ millions, December 2010) | P90 Estimate - Description |
|---|---|---|
| Indirect Costs for all supervision & overheads | $103.52 | This cost covers all project management, administration, insurance and development costs for the projects incurred by both the contractor and the client. General Industry allowances are 18% – 25% for the contractor and 3% to 10% for the client depending on the type of contract, location and complexity of works |
| Design Costs | $28.98 | This cost covers all design and construction support services. Industry benchmarks range from 5% to 12%. Evans & Peck have adopted 5% of Direct Costs for the completion of the detail design for all outstanding civil, structural, geotechnical and track-work. A further 2% has been allowed for the provision of as-built drawings and construction support by the design team. |
| Defects Liability | $10.34 | This covers all costs associated with rectification of defects during a two year period after completion of the works. As this project is in a very sensitive environment and has risks associated with the tunnel and ground conditions Evans & Peck adopted an allowance of 2.5% of Direct Costs |
| Temporary Fencing | $4.09 | This covers all costs associated with the supply, installation and maintenance of temporary fences and gates throughout the project site for the duration of the project. There is a significant fencing cost because of the need to ensure that construction activities do not encroach on Sydney Water Catchment Lands |
| Mobilisations | $2.27 | This cost covers all plant and equipment mobilisation / demobilisation cost. This project is considered technically complex and has specialist plant and equipment such as the Tunnel Boring Machine. |
| Signalling Design Costs | $2.05 | This covers all costs associated with the design of the signalling and communications system for the project including integration into the existing networks at both Maldon and Dombarton. |
| Survey | $1.14 | This covers all costs associated with the initial cadastral survey for design inputs and the contactor survey costs during construction and at completion for “As built” drawings. Typical Industry allowances are 0.25% - 0.5% of Direct Costs - Evans & Peck have adopted approximately 0.3% of Direct Costs. |
| Water Supply | $0.91 | This covers all costs associated with the provision of both potable water and construction water for the project. |
| QA testing set - up | $0.57 | This covers all costs associated with the establishment of an onsite NATA registered testing laboratory for the storage of concrete cylinder and the compliance testing for concrete and earthworks. |
| **TOTAL INDIRECT COSTS** | **$154.86** | $P_{90}$ estimate, December 2010 dollars |

*Data source*: Evans & Peck, ACIL Tasman

The basis for the estimates in the pre-feasibility study was not disclosed, so it is not possible to provide reasons for the differences between the indirect cost estimates in that study and this one. It is possible that the earlier study included certain costs that Evans & Peck considers indirect under other items. Some costs such as estimates for bridges and railway construction were lower than in the pre-feasibility study. It is common for more detailed analysis, as in this Feasibility Study, to produce higher estimates than in preliminary studies.

### Risk

Two prominent risks have been identified:

- Avon tunnel. This item has a high risk sensitivity due to the fact that there is only very limited geotechnical information and consequently a work methodology has not been confirmed. The tunnel has been priced using a combination of work methodologies (Road Header and Drill and Blast). Depending on the final work methodology based on confirmed geology, the cost of the tunnel could be substantially higher than currently estimated.
- Supervision and Overheads (25% of direct costs). This project is spread over 35kms, including works within the Sydney Water Catchment. Depending on the program of works and the finalized scope of works, there is a significant potential for the project to take more time to complete than if the works are not carried out simultaneously.

The construction of a Maldon-Dombarton line has been assessed to start in 2012 and complete at the end of 2013. The $P_{50}$ estimate of the resource cost of construction is $556 million, with a present value of $471 million.

### Maintenance costs

Maintenance would be carried out on track, turnouts, signalling and communications, bridges, culverts, retaining walls, formation, fences, drainage and water treatment ponds.

The annual maintenance cost of the track has been calculated by Plateway at $10,500 of fixed maintenance expenditure per track kilometre based on comparable sections of track in the Inland Rail Alignment Study (2010) and $0.59 per thousand gross tonne kilometres (GTKs) of variable maintenance expenditure per track kilometre.[8]

The total annual maintenance per track kilometre is $22,120; this compares with the ARTC track average of $22,500 per kilometre[9].

The track maintenance cost is therefore expected to be $0.77 million per annum. This will increase in higher demand scenarios because major track maintenance would need to be brought forward.

Future maintenance costs incurred after the study period have been captured in the calculation of the residual value of a line.

[8] This is the charge for the expected demand discussed in section 2. The overall track maintenance charge is $1.11 per thousand GTK, which compares with $1.28 for the Hunter Valley network, $1.50 in Transport NSW's Container Freight Improvement Strategy submitted to Infrastructure Australia (July 2010), $1.59 to $0.98 in the Inland Rail Alignment Study and $1.28 for the Hunter Valley rail network.

[9] This compares with the Inland Rail Alignment Study's estimate of the most likely range of $17,900 to $45,000 per track kilometre for a railway carrying 10 to 30Mtpa.

### Operating costs

The operating costs of the line would consist of operations planning, train control and transit management, track maintenance, signalling and power costs. Apart from maintenance these costs are fixed, assumed to remain at the same in real terms. Although maintenance expenditure is mostly fixed, higher line utilisation causes major periodic maintenance to be brought forward creating a semi-variable component to costs. The incremental operating costs of the line over the study period have been assessed to be $0.84 million per annum, with a present value of $7.3 million. Operating costs after the study period have been captured in the calculation of the residual value.

## 6.2.2 Indirect costs

As freight is diverted to a Maldon-Dombarton line there are changes in the variable operating and maintenance costs of other rail alternatives and roads. ACIL Tasman has applied unit rates (detailed in Working Paper 2) to determine the operating and maintenance costs for all relevant freight on all routes. In this way the Base Case, for example, calculates the maintenance cost of carrying Western Coal on the Illawarra line and this is compared against the maintenance cost of carrying this freight on the Main South and Maldon-Dombarton lines.

A similar calculation is carried out for each potential source of demand. This explains why the maintenance cost seems large – it is the maintenance cost of all relevant freight, on all lines and roads. This total is then compared to the maintenance cost in the Base Case. If diverting freight to a Maldon-Dombarton rail line causes a net decrease in maintenance costs to society, then this is shown as a benefit of a line.

### External costs

The indirect costs of a Maldon-Dombarton rail line include the external costs associated with construction and operation of a Maldon-Dombarton rail line, these include:

1. Accident costs
2. Air pollution
3. Noise Pollution
4. Water
5. Nature and Landscape
6. Urban Separation
7. Greenhouse gases
8. Congestion

These external costs have been valued using standard values contained in the ATC's *National Guidelines for Transport System Management in Australia* and updated to 2010 prices. As shown below in Table 9:

Table 9 **Unit values for external costs (December 2010 prices)**

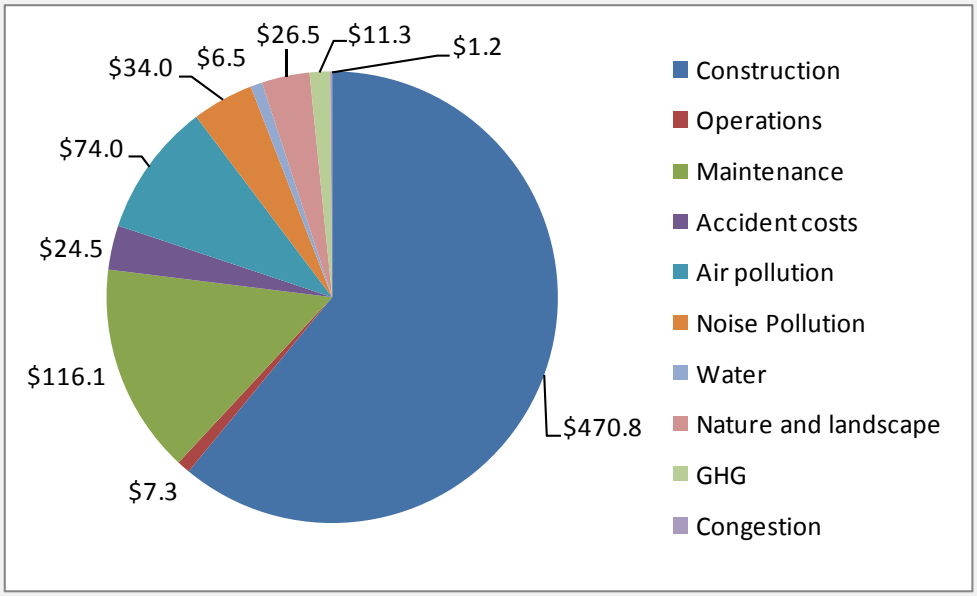
| | Source (inflated to Dec 2010 dollars) | Road (c/ntk) | Rail (c/ntk) |
|---|---|---|---|
| **Accident costs** | Booz Allen Hamilton (2001) | 0.41 | 0.04 |
| **Air pollution** | | | |
| Urban | ATC (2006) | 1.12 | 0.38 |
| Rural | ATC (2006) | 0.01 | - |
| **Noise Pollution** | | | |
| Urban | ATC (2006) | 0.30 | 0.16 |
| Rural | ATC (2006) | 0.03 | 0.02 |
| **Water** | | | |
| Urban | ATC (2006) | 0.11 | 0.01 |
| Rural | ATC (2006) | 0.07 | 0.01 |
| **Nature and Landscape** | | | |
| Urban | ATC (2006) | 0.30 | 0.09 |
| Rural | ATC (2006) | 0.12 | 0.03 |
| **Urban Separation** | | | |
| Urban | ATC (2006) | 0.26 | 0.09 |
| Rural | ATC (2006) | | |
| **GHG** | Booz Allen Hamilton (2001) | 0.08 | 0.03 |
| **Congestion** | ATC (2006) | 0.10 | - |

*Data source*: ACIL Tasman updates of selected sources.

These standard values are then applied to the net tonne kilometres associated with different route options to derive an estimate of the external costs of an option.

The costs of a Maldon-Dombarton rail line, both direct and indirect, have been summarised in Chart 5:

Chart 5 **Costs of a Maldon-Dombarton rail line ($ million, present value)**




*Source:* ACIL Tasman estimates

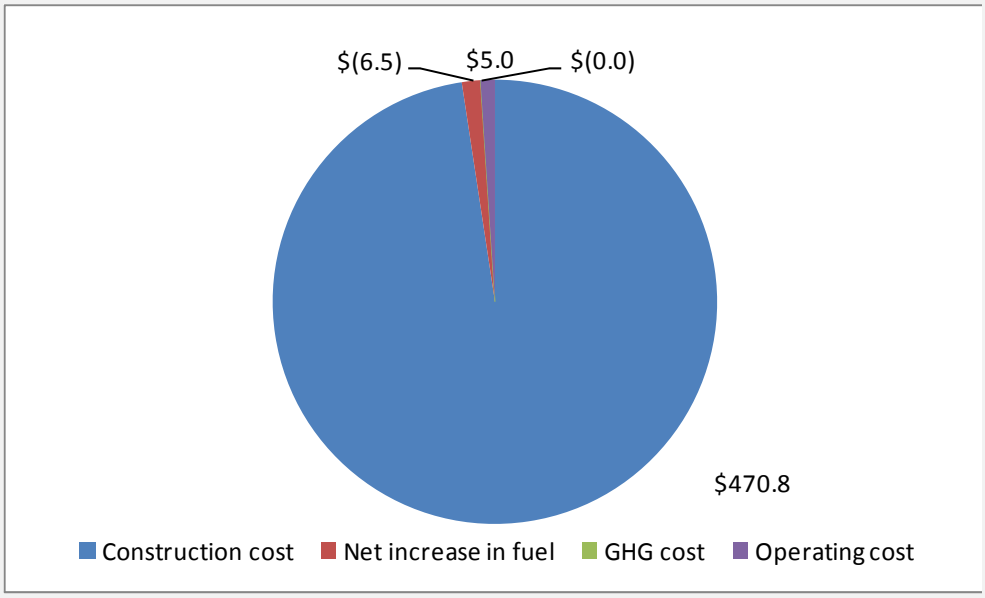
Chart 5 shows how the construction costs dominate total costs. This is because the line would be expensive, with two bridges, four kilometres of tunnel and a number of road underpasses to be constructed within 35 kilometres. As with all infrastructure projects this work would need to be undertaken before any benefits of the line could be realised. In contrast, the significant benefits of the line occur in the future, and increase over time, as Port Botany, the Illawarra line, the Moss Vale-Unanderra line and roads become more congested. For example, it is not until after 2027 that Port Botany is expected to reach capacity and a significant overflow of containers could begin moving to and from Port Kembla.

The costs outlined in Chart 5 are to be compared with the costs of moving this freight using the alternative lines (Moss Vale and Illawarra lines) and roads as assessed in the Base Case. A Maldon-Dombarton rail line would reduce many of these costs:

- it would reduce the amount of time spent queuing in the Sydney network with some labour, capital and fuel savings
- it would reduce noise and air pollution resulting from the freight journeys through residential areas in the Illawarra and southern Sydney (replacing these kilometres with more kilometres in industrial areas in Sydney's south west)
- it would result in significant cost savings related to the Tahmoor-Port Kembla coal export task
- it would result in a reduction in overall track and road maintenance costs (mostly from reducing the maintenance on the Illawarra line).

When compared against the Base Case, there is a small increase in net operating costs – because fixed maintenance costs on the Illawarra line must continue to be incurred, and a Maldon-Dombarton line has created new fixed maintenance costs. There is also an insignificant increase in fuel consumption and greenhouse gas emissions because more fuel is consumed on a journey via Maldon. However, construction costs dominate the net costs of a Maldon-Dombarton line as shown in Chart 6:

Chart 6 **Net costs of a Maldon-Dombarton line ($ million, present value)**




*Source:* ACIL Tasman estimates

## 6.3 Benefits of a Maldon-Dombarton rail line

A Maldon-Dombarton rail line is compared to the economic costs and benefits of alternative railway lines and road freight. The potential benefits of a line relate to capacity, discussed in Chapter 3, and to increases in efficiency for the train operators that switch to a Maldon-Dombarton line – lowering the resource costs of freight tasks. Whether this reduction in cost is passed on to customers is irrelevant in economic terms – it would represent a transfer from rail operators to customers without affecting economic efficiency.

### 6.3.1 Possible relaxation of capacity constraints

Benefits arise for commodities which are considered to be constrained by the existing transport options; that is, freight which in the future cannot move by its preferred means to its destination. A benefit to a Maldon-Dombarton rail line only arises if the line eases the constraint – if the constraint is not present in the Base Case, or there is a cheaper alternative investment which would ease the constraint then there is no benefit from a Maldon-Dombarton line.

Over most of the forecast period (2010 to 2030) capacity is expected to be adequate (unless major upside scenarios eventuate - see Chapter 7 for further information), assuming greater use of night paths and modest upgrades to the Moss Vale-Unanderra line, but towards the end of the study period problems may become more significant, particularly if Port Botany becomes capacity constrained and Port Kembla's container task grows (see Chapter 3 for a more detailed discussion of available capacity on the Illawarra line and Moss Vale-Unanderra lines).

Port Kembla may not be able to fully benefit from the current 5 spare paths on the Illawarra line at night unless additional investment is undertaken for train storage (new or longer sidings) in or near the port, and /or for a second coal dump station, doubling the number of trains which can unload at a given time.

### 6.3.2 Diversion to a less urbanised rail route

Further benefits accrue as a result of relocating freight movements from the Illawarra line, with its proximity to residential urban development, to the Main South and Maldon-Dombarton lines.

There would be some saving in track maintenance costs because the Main South and a Maldon-Dombarton line would have a lower maintenance cost per gross tonne kilometre than the Illawarra line. This is because a Maldon-Dombarton rail line would be a newly built line with concrete sleepers, head-hardened rail, built to carry heavy axle loads, and it has significantly less signalling and urban safety assets than the Illawarra line has. The Main South line is a lower maintenance cost- line than the Illawarra line.[10]

However, there would be an increase in train fuel costs from diversion from the Illawarra to a Maldon-Dombarton rail line because of the longer kilometres and less favourable gradients. This net increase in fuel use is after taking account of the reduction in train dwell time compared to the Illawarra route.

### 6.3.3 Train operating cost savings

The average dwell time for freight trains (scheduled and unscheduled) on the Illawarra line is almost 2.5 hours. These dwells increase labour costs, have a capital cost because existing assets are not being used efficiently and also have a small fuel and GHG cost because engines continue to idle while the trains are held. These dwells reflect passenger priority as well as difficulties in recovering a late-running train (a sign that the line use is close to capacity).

[10] On the basis of the maintenance costs for this line published in the Inland Rail Alignment Study (2010) and compared to maintenance costs contained in NSW Transport's Container Freight Improvement Strategy (2010). This is intuitive because there are fewer signals and crossings per kilometre on the Main South line than on the Illawarra line.

There are also efficiency impacts at Port Kembla, because trains arrive bunched up before and after the commuter peaks. This creates an inefficient workflow at the port.

Having a dedicated freight route via a Maldon-Dombarton rail line reduces conflicts with passenger services and would allow a more regular delivery of coal at Port Kembla.

Also, for trains from Tahmoor to Port Kembla a Maldon-Dombarton line would reduce the distance travelled by 40% and would reduce crewing costs by 70% (because the train no longer needs to be configured for push-pull).

### 6.3.4 External cost savings

The benefits of a Maldon-Dombarton rail line include the net impact on the external costs of operating train services to Port Kembla. Where trains are diverted from the Illawarra line, there is a small net saving in external costs which arises from a reduction in urban kilometres in residential areas (although a small increase in overall kilometres reduces this benefit). Diverting the Tahmoor train from the Moss Vale-Unanderra line to a Maldon-Dombarton line also generates economic benefits from a significant reduction in kilometres, including urban kilometres.

If a Maldon-Dombarton rail line were to divert freight from road to rail there would be significant savings in external costs as a result. The standard values for the external costs of road freight are significantly higher than the external costs of rail freight for all categories of external cost. However, a Maldon-Dombarton line is not expected to generate significant diversion of road freight.

### 6.3.5 Other benefits

It is possible that a Maldon-Dombarton line could facilitate other developments, which it has not been able to quantify with sufficient precision to include in its economic analysis as these developments are not very advanced in preparation. There is also a question of causation – some projects may go ahead with or without a Maldon-Dombarton line (Moorebank Intermodal Terminal, for example). While a Maldon-Dombarton rail line may have synergies with this proposed terminal, it will not be the cause of the Terminal's construction. The only benefits which could be allocated to a Maldon-Dombarton rail line would be the additional benefits created by a line – which at this time are not measureable with any reliability.

A key development which was investigated was the Port Kembla Outer Harbour. The Concept Approval for this development requires that no more than 120,000 TEUs (10% of designed capacity) are moved by road. Clearly, if there were no spare rail capacity, this development could not continue and meet its planning approval.

The external costs of the container freight movements have been captured in the Base Case and Central Case as follows: ACIL Tasman has assumed that if a Maldon-Dombarton rail line is not built, that is, in ACIL Tasman's Base Case, this freight would instead move by rail along the Illawarra line or Moss Vale line (depending on available capacity). If a Maldon-Dombarton rail line is built then this container freight from Port Kembla would use it. The difference in external costs is a net benefit to a Maldon-Dombarton rail line.

Some submissions to the Issues Paper made note of other investments which are apparently dependent on a Maldon-Dombarton line, for example an intermodal terminal at Maldon.

In particular ACIL Tasman has noted that the logistics industry is growing rapidly in south-west Sydney, with 50% of containers expected to pass through this region by 2030. A Maldon-Dombarton line would provide a shorter link to that area from Port Kembla.

Port Kembla's Outer Harbour development is linked to its ability to use rail to move the increasing container task from the port. If the Illawarra and Moss Vale-Unanderra lines cannot provide sufficient capacity then Port Kembla may have to defer investment in Port Kembla container trade. This could also impact on local residents' support for the expansion of the port.

Scarce capacity on the Illawarra line may be making it difficult for new train operators to establish a regular service which could compete with the incumbent freight operator, Pacific National. Spare capacity may encourage more competition in rail haulage and this would be expected to bring costs down and improve service to customers.

### 6.3.6 Residual value

The study period for this appraisal is from 2010 to 2030 as defined by the Terms of Reference of the Feasibility Study. Many of the assets which would be constructed as part of a Maldon-Dombarton railway line would have expected asset lives much longer than the duration of the study period. This means that the assets would be generating net benefits (or costs) beyond the end of the study period. It is therefore appropriate to value the future net benefits which would be embodied in the rail line at 2030. Infrastructure Australia requires that residual value be shown as a benefit in cost benefit analyses.

Box 2 **Residual values**

ACIL Tasman has calculated the residual value of a Maldon-Dombarton rail line using a forward looking estimation of benefits (using Gordon's Growth Model), which is consistent with Infrastructure Australia guidelines.

Under this methodology the residual value of the line reflects the net benefits arising from the demand and cost scenario being evaluated. If the line generates significant economic benefits in use this is reflected in a high residual value. If the line is not generating benefits then it has no residual value. The growth rate is calculated on a determination of long-run trends from the cost-benefit model and is capped at 2.8% in real terms because it is unlikely that any benefit will grow significantly faster than long run GDP growth in perpetuity.

This calculation was carried out for the residual value at the end of the study period (2030); this value was then discounted back to its present value for inclusion in the cost benefit analysis. The present value of the residual value is approximately $205 million.

The residual value calculated on this basis is sensitive to the discount rate (as shown in section 6.5) and also the rate of growth (which varies depending on the demand scenario).

An alternative (and more common) method of calculating the residual value is to look at the cost and expected life of the asset, applying straight line depreciation on the resource cost of the assets and evaluating the net asset value at the end of the study period. This is then discounted back to its present value for inclusion in the cost benefit analysis.

The estimated asset lives of the relevant assets are shown in Table 10 below:

Table 10 **Maldon-Dombarton railway asset lives**

| | Asset life (years) |
|---|---|
| Site Infrastructure | 50 |
| Bridge crossings | 100 |
| Tunnel construction | 100 |
| Additional cost of Plate F tunnel outline | 100 |
| Tunnel Ventilation | 30 |
| Earthworks and drainage | 40 |
| Railway construction and minor works | 40 |
| Railway electrical and signalling | 30 |
| Project indirect costs | 30 |

*Data source:* Overwrite this text with the table's data source

Using the undepreciated resource cost of assets to calculate the residual value of the line generates a value of $317 million in 2030, which has a present value of $82 million at the start of 2011.

There is a difference in valuations under the two approaches, with the cost-based method being $110 million lower than the value-in-use.

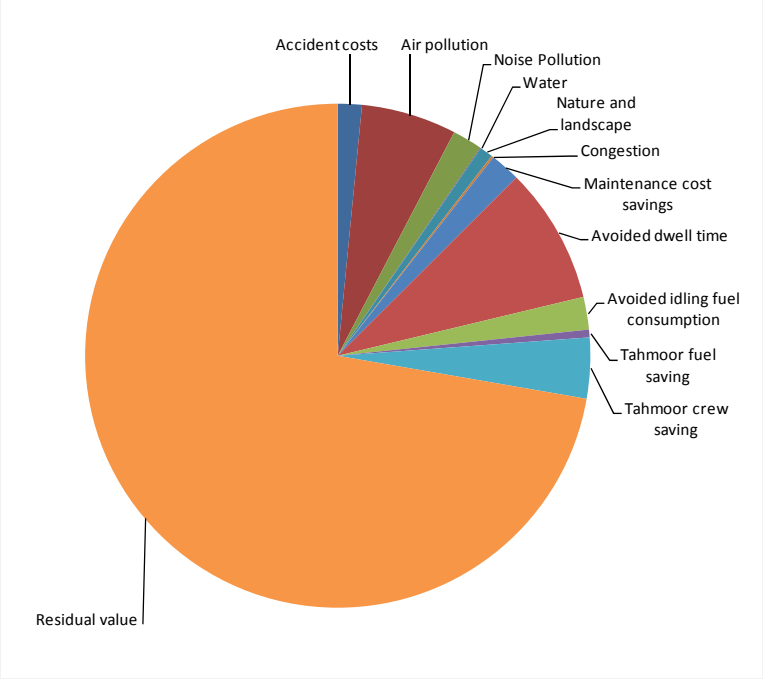
ACIL Tasman determined that using a cost-based measure to value the residual value could be considered inappropriate for the following reasons:

- A cost-based method of valuing the residual value takes no account of the use to which the asset is put
- A cost-based method would ascribe a higher residual value to an asset if it were "gold plated" or if the assets were deemed to have a longer life than is reasonable
- A valuation based on value-in-use is forward looking
- Depreciation is not a relevant economic cost, unless it accurately reflects the decrease in the economic value of the asset
- A cost-based method of valuing the residual value is only consistent with the requirement to classify the residual value as a benefit if the depreciated cost accurately reflects the value of the economic benefits of the line

ACIL Tasman valued the residual value based on the value in use of the line (see Box 2), yielding a present value of $192 million, although this increases in upside demand scenarios. The residual value is a composite of the residual value of benefits generated by all of the private and external net benefits of the line. In Chart 7, the fact that the residual value accounts for 72% of the net benefits simply reflects that for those benefits identified, approximately 28% of their total present value occurs within the study period 2010-2030, with significant future benefits expected after 2030.

The benefits of a Maldon-Dombarton rail line are summarised in Chart 7.

Chart 7 **Net Benefits of a Maldon-Dombarton rail line ($ million, present value)**



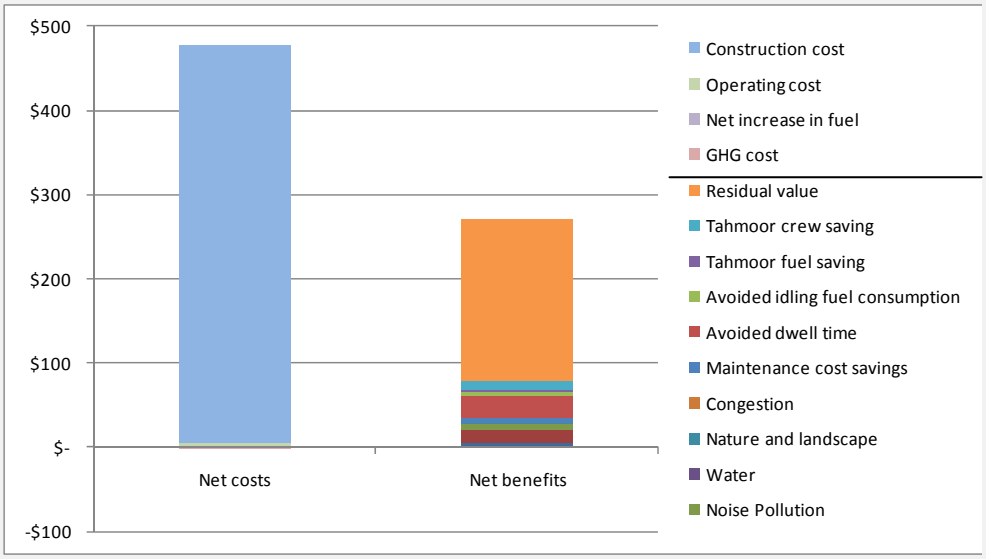

*Source:* ACIL Tasman estimates

## 6.4 Net present value and benefit-cost ratio

The net present value of a Maldon-Dombarton rail line has been assessed as negative $206 million. That is, constructing the line would not generate sufficient benefits to cover its costs. The Benefit-Cost ratio is 0.56 which means that the benefits of the line are only 56% of the costs for the line.

Chart 8 shows the net costs compared to the net benefits of the line.

Chart 8 **Comparison of net costs and benefits ($ million, present value)**




*Source:* ACIL Tasman estimates

The reason for this result is that there are already two railway lines which serve the Sydney to Port Kembla market and that diverting from one railway line to another (at a high capital cost) does not generate sufficient benefits to society.

The Illawarra line is the shorter option, with better grades which requires less fuel consumption than a Maldon-Dombarton rail line. The benefits from diverting freight from the Illawarra line is that cost penalties associated with passenger priority and congestion would no longer be suffered, Port Kembla could operate more efficiently by receiving coal trains more evenly throughout the day, and there would be a small net saving in external costs by diverting trains to a less urbanised route.

The Moss Vale-Unanderra line is another option for taking freight from Sydney to Port Kembla. This railway is not a desirable route because it is more than 100 kilometres longer than the Illawarra line, it suffers from steep gradients (as would a Maldon-Dombarton railway), and is prone to rock falls. There would be a significant increase in operating costs for train operators as a result of using the Moss Vale-Unanderra line. There would also be an increase in external costs as a result of using the Moss Vale-Unanderra line – it is a

longer route overall, with a similar number of urban kilometres to the Illawarra line.

However, there are currently five spare paths during the day, and more paths could be obtained at lower capital cost than a Maldon-Dombarton rail line. If the Illawarra line reaches capacity, it may be economically efficient for overflow freight to use the Moss Vale-Unanderra line, rather than building a Maldon-Dombarton rail line, which would cause three railway lines to be underutilised, rather than allowing two lines to be highly utilised.

## 6.5 Sensitivities

The expected NPV of a Maldon–Dombarton rail line is negative $206 million. This is because of the significant capital cost of the line compared to the small benefits which mostly arise because freight is being diverted from one railway to another railway of similar length.

### 6.5.1 How much demand is needed to make a Maldon-Dombarton line viable?

A key concern throughout this project has been to identify whether a lack of rail capacity has deterred profitable exports, particularly from the coal industry. The capacity of the Illawarra and Moss Vale-Unanderra railway lines has been evaluated, with the conclusions detailed in Chapter 3.

A scenario was created to answer this question of how much coal freight would need to be created by the construction of a Maldon-Dombarton rail line to make the line economic.

A key feature of this scenario is that the coal freight must be caused (induced) by the creation of a Maldon-Dombarton rail line. Otherwise it would remain unexploited. In this circumstance it is appropriate to consider the economic value added by the coal exports as a benefit of a Maldon-Dombarton line. ACIL Tasman has estimated the value added by the collieries in the Western Coalfield to be $10 per tonne, based on ABS data[11] adjusted for recent price and cost indices. In this circumstance a Maldon-Dombarton line becomes economic if it induces 2.6Mtpa from the Western Coalfields. This is 2.6Mtpa that could not travel by any other railway line.

There are not many circumstances in which the Moss Vale-Unanderra line is not an option for freight from the Western Coalfield. When a Moss Vale-Unanderra comparator is included in the analysis, it is not until there is an

[11] ABS 84150DO002_200607 Mining Operations Australia, 2006-07. Adjustments made to approximate NSW profitability and transport characteristics, cost inflation and expected prices.

additional 7.6Mtpa of coal seeking to move between the Western Coalfield and Port Kembla that the lower operating (and external) costs of a Maldon-Dombarton line compensate for the higher capital costs of this option. This analysis assumes that the Illawarra line does not have the capacity to serve this freight.

### 6.5.2 Other sensitivities

The NPV of a Maldon-Dombarton line was tested for its sensitivity to the capital cost estimate and discount rate.

#### Capital costs

The resource capital costs for a Maldon-Dombarton line have been estimated by Evans & Peck at the P50 and P90 levels. The impact that this has on the NPV of the line is shown in Table 11.

Table 11 **Sensitivity to capital costs**

| | Capital cost | PV of capital cost | NPV |
|---|---|---|---|
| | ($ million, 2010 dollars) | ($ million, 2010 dollars) | ($ million, 2010 dollars) |
| P50 | $557.2 | $470.8 | -$206.1 |
| P90 | $596.0 | $503.6 | -$238.9 |
| Difference in estimates | 7.0% | 7.0% | 15.9% |

*Data source*: ACIL Tasman estimate

#### Discount rate

Because the residual value is calculated using Gordon's Growth Model, and this has a divisor of the discount rate less the growth rate of net benefits, the residual value is very sensitive to changes in this parameter. Table 12 and Table 13 show the sensitivity of different components of NPV to the discount rate.

Table 12 **Sensitivity to discount rates**

| | NPV with residual as "Value in Use" | Residual value on "Value in Use" basis | Non residual value NPV | If residual value was cost-based | NPV with residual value on cost basis |
|---|---|---|---|---|---|
| | ($ million, 2010 dollars) | ($ million, 2010 dollars) | ($ million, 2010 dollars) | ($ million, 2010 dollars) | ($ million, 2010 dollars) |
| 4% discount rate | +$628.4 | +$1,034.0 | -$405.6 | $81.8 | -$323.8 |
| 7% discount rate | -$206.1 | +$192.3 | -$398.4 | $81.8 | -$316.6 |
| 10% discount rate | -$320.3 | +$65.1 | -$385.4 | $81.8 | -$303.6 |

*Data source:* ACIL Tasman

The NPV (with the residual held constant on the cost-based measure) seems to move in a counter intuitive way, given that typically in infrastructure projects, lower discount rates lead to increasing the benefits over time relative to the costs. However, in this example the capital costs are so large relative to benefits that reducing the discount rate makes the NPV worse.

Table 13 **Impact of changes in discount rate of NPV components**

| | NPV with residual value on cost basis | Change in NPV | Being: | |
|---|---|---|---|---|
| | | | Change in PV of capital | Change in PV of benefits |
| 4% discount rate | -$323.8 | -$7.2 | -$34.5 | +$27.2 |
| 7% discount rate | -$316.6 | $0.0 | $0.0 | $0.0 |
| 10% discount rate | -$303.6 | +$13.0 | +$31.2 | -$18.2 |

*Data source:* ACIL Tasman

# 7 Downside and upside scenarios

The analysis which has preceded this section is based on ACIL Tasman's forecasts of demand, which are based on reasonably firm information and are conservative. The main downside scenario is that of a substantial drop in international coal prices. Some of the mines would then become marginal because of moderate coal quality and expensive mining conditions. The consequence of such a downside is the status quo – there would be no need for a Maldon-Dombarton line.

Upside scenarios for a Maldon-Dombarton line include:

- possible iron ore exports, currently at the pre-feasibility stage, are potentially large. For up to 18.5 million tonnes the most likely route is an upgraded Moss Vale-Unanderra line, subject to engineering assessment of ability to carry out necessary upgrades
- expansion of coal production. A number of mines are investigating an increase in their output, and some are investigating technologies to increase the size of their viable reserves. An estimate of the upper end of possible coal increases is difficult, since no one mine dominates. Up to 10 million additional tonnes could be produced from various mines
- substantial increase in container trade throughput. This could occur through a change in NSW Government port policy, particularly if the Port Botany cap remained at 3.2 MTEUs or a major shipping company could switch activity from Port Botany to Port Kembla once the Outer Harbour development is complete
- increased demand for rail caused through a modal shift for Bulli Seam output. BHP may be induced to switch the Bulli Seam output from road to rail by changes in regulatory and/or road pricing policy. However the distance to the Illawarra line by conveyor is slightly shorter. (Some other coal could potentially switch from truck to train, but on lines other than Maldon Dombarton).

Working Paper 2 detailed preliminary upside scenarios which have been refined for this Final Report. Table 14 summarises the results of the upside scenarios (sorted in terms of the most-favourable to a Maldon-Dombarton rail line) before discussing them in more detail in subsequent sections.

Table 14 **Summary of upside scenarios ($ million, present values)**

| Scenario | Summary of scenarios | Cost of upgrades to Moss Vale line | Base case + Upgraded Moss Vale line | Maldon-Dombarton | Difference | Benefit-Cost ratio[b] |
|---|---|---|---|---|---|---|
| | | **PV** | **PV[a]** | **PV[a]** | **NPV[a]** | **BCR** |
| 1 | Central case demand, P50 Construction cost | $0 | $1,166 | $960 | -$206.1 | 0.56 |
| 2 | Central Case demand, P90 Construction cost | $0 | $1,166 | $927 | -$238.9 | 0.53 |
| 3 | Half the auto market uses rail | $0 | $1,166 | $965 | -$201.0 | 0.57 |
| 4 | +300,000 TEUs transfer to PK in 2020 | $0 | $1,149 | $951 | -$197.7 | 0.58 |
| 5 | PB capped at 3.2 MTEUs | -$34.8 | $1,243 | $975 | -$267.5 | 0.33 |
| 6 | Bulli Seam By Rail (Maldon-Dombarton) | $- | $1,166 | $968 | -$198.4 | 0.57 |
| 7 | Bulli Seam By Rail (Illawarra) | -$5.2 | $1,253 | n/a | $86.7 | 3.09 |
| 8 | 2% growth per annum in western coal | $- | $1,489 | $1,247 | -$241.4 | 0.49 |
| 9 | 5Mtpa additional output from Tahmoor region (e.g. East Bargo) | -$14.3 | $1,491 | $1,387 | -$104.8 | 0.70 |
| 10 | Iron Ore (2-3Mtpa) - Wagga Wagga region | $- | $1,825 | $1,673 | -$151.4 | 0.67 |
| 11 | Iron Ore (up to 20Mtpa) - Broken Hill region | -$120.7 | $4,359 | $6,848 | $2,488.9 | 6.24 (see text) |

[a] These PVs relate to the relevant costs and benefits modelled. The PVs are high because the value added from all relevant mining is assigned to the freight task to model impact of capacity constraints on value-added. The net benefit of any line relates only to the difference in PVs – in this case, being strongly influenced by the value-added obtained by relieving a capacity constraint.

b The Benefit-Cost ratio relates the net benefits of a Maldon-Dombarton rail line compared to the net benefits of the relevant Base Case/ Base Case + Upgraded Moss Vale-Unanderra line

These results are mainly negative largely because of the cost of building the line compared to the small net benefits obtained by diverting freight from a railway line of similar distance (the Illawarra line), albeit to a line with more attractive operating characteristics.

Operating and external costs are relatively minor. The results would be less negative, or in some cases could become positive, if two or more of these upside scenarios were combined. If a combination of these scenarios were to occur which leads to full capacity on both the Illawarra and Moss Vale-Unanderra lines and substantial unmet demand, then there could be a large benefit to constructing a Maldon-Dombarton line. This would be because capacity constraints on the existing line may be restricting the export of coal or iron ore, and a Maldon-Dombarton line could induce demand by removing this constraint.

The Illawarra line has five remaining paths per day and in a number of scenarios reaches its operating capacity well before 2030. In these scenarios there is then overflow freight to the Moss Vale-Unanderra line, which may need upgrading to accommodate it. There is an operating cost penalty attached to the longer and slower freight journey, but the overflow freight would generally avoid the curfew problems associated with freight along the Illawarra line. ARTC has indicated that it can undertake upgrades to accommodate an additional 18.5 million tonnes per annum of new demand or overflow demand, and that more could be accommodated over time as trains move to distributed power, ECP braking and possibly 30 tonne axle loads on the lines leading to the Main South line.

A key feature of these scenarios is that only one scenario causes the Moss Vale-Unanderra line to exceed its maximum possible capacity after all feasible upgrades (this is the possibility of 20 million tonnes per annum of iron ore from the Broken Hill region). The Illawarra line is likely to reach capacity in the medium term (approximately 2029 in the ACIL Tasman modelling), but the Moss Vale-Unanderra line can be upgraded to allow more, longer and heavier trains, increasing spare capacity to 18.5 million tonnes or 9.4 saleable paths per day.

In the following sections the modelled upside scenarios are described and the relevant details of the modelling are described.

## 7.1 Scenario 1 - ACIL Tasman's central demand forecast

This is often described in this study as the Central Case, with the forecast demand as detailed in section 2. In this scenario all forecast Western coal, Tahmoor coal, Newcastle coal (to Bluescope Steel), copper concentrates, scrap steel, kaolin, concrete, biofuel, containers switch to a Maldon-Dombarton rail line (but cars remain with road freight) as described in section 2.

The NPV of this scenario is negative $206.1 million if a Maldon-Dombarton rail line is built.

## 7.2 Scenario 2 - P90 Construction cost estimate

This scenario is described in section 6.5.2. The higher capital cost estimate generates a lower NPV for the project of negative $238.9 million.

## 7.3 Scenario 3 - Half the NSW auto logistics market shifts to rail

This scenario models the impact of shifting half of the contestable automotive freight from road to a Maldon-Dombarton line (reflecting a view from one of the three companies that the choice was marginal). The contestable automotive freight has been defined as including cars and motorbikes, but excluding large vehicles and also vehicles being delivered to the Illawarra region and southern Sydney dealerships.

Automotive freight is one of the few types of freight which is contestable with road, with one logistics firm informing the study that it is considering moving this freight on to rail via the Moss Vale line, although this is a marginal decision.

Despite automotive freight being one of the most likely to transfer from road to rail the tonnes and number of truck movements are not particularly significant overall. Half the automotive logistics market would be approximately 30 million net tonne kilometres each year, or 1 percent of the total freight under consideration. The market is expected to grow by 1.7% per annum over the study period, reflecting population and GDP growth, as well as a trend towards saturation of the per capital vehicle ownership at about 78 vehicles per hundred persons.

Because of the small size of the market, the reduction in road use from half of the automotive market shifting to rail only adds $5 million to the NPV of a Maldon-Dombarton rail line. Its overall NPV remains negative $201 million.

## 7.4 Scenario 4 - A shipping company shifts to Port Kembla

This scenario investigated the impact of a shipping company offering a service out of Port Kembla before Port Botany reaches capacity. ACIL Tasman has modelled this as 300,000 TEUs no longer being served by Port Botany, but instead by Port Kembla from 2020.

This has a number of effects – it generates train movements (90% of the total task) from Port Kembla, which are assumed to utilise night paths on the Illawarra line. This is compared to 60% of this moving by truck and 40% by train from Port Botany (over a shorter distance). This also defers the date at which Port Botany reaches its capacity limit– so this scenario is essentially measuring the effect of bringing forward the overflow of freight from Port Botany to Port Kembla (which on the assumptions in this report was expected to occur in 2028 anyway).

The NPV of this scenario is $8 million higher than scenario 1. This is because of the slight reduction in external costs and increase in the residual value of a Maldon-Dombarton line. Its overall NPV remains negative $198 million.

## 7.5 Scenario – 5 Port Botany's planning constraint remains at 3.2 Million TEUs

In this scenario Port Botany's planning constraint remains at 3.2 million TEUs per annum and overflow of containers happens in 2019 rather than 2028 as is assumed in the Base Case.

The result of this planning cap is that a longer freight trip is induced. The net economic impact is slightly negative. Of the freight that has been diverted to Port Kembla, 60% formerly moved by road over an assumed 40 kilometres and 40% travelled by train over a similar distance from Port Botany. This has been replaced by 90% of that freight travelling by rail for 95 kilometres and 10% of that freight moving by road over a similar distance.

The net impact is to increase the costs (direct and indirect costs) for this freight by approximately 10%, using standard values. The NPV of this scenario is negative $268 million. This means that compared to the Base Case with a 5 million TEU planning constraint, a Maldon-Dombarton rail line which is accompanied by a 3.2 million TEU Port Botany planning cap has increased the net costs to society.

## 7.6 Bulli Seam output moves to a Maldon-Dombarton line

This scenario investigated the impact of this coal moving from its current (30 km) road haul on to a Maldon-Dombarton line. Bulli Seam (Appin and West Cliff collieries) sends over 7Mtpa of coal to Port Kembla by road each year, and is a significant generator of heavy vehicles on Appin Road and Mt Ousley Road. It generates 70% of the road freight that ACIL Tasman considers could be contested by a Maldon-Dombarton line. Moving this freight to rail would generate $21 million of savings in external costs such as road accidents, pollution (air and noise) fuel and GHG emissions, but also in reduced road maintenance and congestion costs. There would be higher private costs related to this task as a result of a longer overall journey, this increases costs by a PV of approximately $20 million. The overall improvement in NPV from shifting the Bulli Seam coal to rail is $8 million, to negative $198 million.

Against this improvement there would be significant private costs borne by BHP Billiton related to moving its washery, building a conveyor to a rail head and other infrastructure to enable a shift to rail.

BHP Billiton has stated in its submission to the Maldon-Dombarton Rail Link Issues Paper that it would not use rail, therefore this scenario would be likely to require some policy or legislative change to come about – for example, planning consent for mine expansions being dependent on rail freight, or changes in road use pricing.

## 7.7 Scenario 7 - Bulli Seam output moves to the Illawarra line

When investigating the possibility of moving the Bulli Seam output on to a Maldon-Dombarton rail line it is notable that the nearest railway is in fact the Illawarra line. Although this scenario does not propose to assess the technical feasibility of this solution, it may be possible to move the Bulli Seam output on to the Illawarra line. This scenario considers the economic benefit from doing so.

The private costs of creating the infrastructure to link to the Illawarra line are not known, and are likely to be significant. However, ACIL Tasman estimates that the social benefits of doing so would create a NPV of $86.7 million as a result of reduced congestion, accidents and pollution. The reason that this option has a positive NPV compared to diverting to a Maldon-Dombarton rail line is that no significant capital outlay needs to be made for additional freight on the Illawarra line, particularly since this freight will be joining the it near to

the port (and south of the most congested sections). It is assumed that the Illawarra line will have sufficient capacity for this freight.

However the private costs of moving this freight on to rail will be significant (e.g. installing a long conveyor), and as described in the previous section, BHP Billiton do not intend to use rail for the output from Bulli Seam. Therefore the overall NPV and BCR are not known.

## 7.8 Scenario 8 - 2% per annum growth in the Western Coalfield mines

This scenario investigates the impact of 2% per annum growth in the volume of coal from the Western Coalfield. This causes the Illawarra line to exceed its capacity by one path between 2024 and 2026 (after which point Charbon mine closes, releasing capacity), but this one coal service could be diverted down the Moss Vale-Unanderra line without significant additional costs.

From 2028, the growing Western Coal freight combines with the overflow container freight from Port Kembla and causes an increasing overflow to the Moss Vale-Unanderra line (1 train in 2028, 3 in 2029 and 5 trains in 2030). After 2030 the number of coal trains spilling over to the Moss Vale-Unanderra line increases to a maximum of 13 coal trains diverted by 2035. From 2032 upgrades would be needed on the Moss Vale-Unanderra line to accommodate this spillover coal, although when the overflow peaks in 2035 the Moss Vale-Unanderra line has sufficient (upgraded) capacity for the task.

In 2030 there is just enough capacity on the Illawarra and Moss Vale-Unanderra lines to accommodate this growth in Western Coalfield volumes without capital investment. Overall, the effect of 2% growth in Western Coalfield volumes on the Base Case would be to use spare capacity on the Illawarra and Moss-Vale line at no additional capital cost – there are higher operating costs for this diverted freight, but these are not higher than the capital cost of building a Maldon-Dombarton line.

Until 2028 the capacity of the Illawarra line is exceeded by only one train path for four years. This means that the cost of diverting this coal train is small. The effect of fully utilising the Illawarra line and then using spare capacity on the Moss Vale-Unanderra line is economically efficient, and the economic costs of doing so are very low. This compares to building a Maldon-Dombarton rail line and carrying this freight on that line, with slightly higher economic costs per tonne, and with much higher capital costs.

The impact of increased coal freight on a Maldon-Dombarton rail line compared with highly utilised Illawarra and (upgraded) Moss Vale-Unanderra lines is therefore an NPV of negative $241 million.

## 7.9 Scenario 9 - Extra 5Mtpa from East Bargo/Tahmoor from 2020

Tahmoor colliery's coal export task is the single biggest private beneficiary of a Maldon-Dombarton rail line, with the resource costs of this task alone being reduced by $1.6 million per annum, and the journey length being reduced by 58%. This is equivalent to a saving of approximately $1 per tonne per annum on this service.

Xstrata is carrying out a prefeasibility study to increase the output of the mine by some 5Mtpa. It is assumed that this increased output is from new reserves, or diverted from domestic supply, so that it does not have the consequence of bringing forward the closure date of the mine. An increase of 5Mtpa would improve the NPV of a Maldon-Dombarton line by $102 million to a NPV of negative $104 million. This increase reflects reduced private costs and a reduction in external costs compared to freight via the Moss Vale-Unanderra line.

ACIL Tasman has modelled the amount of coal from Tahmoor colliery which would make a Maldon-Dombarton line feasible in combination with all the other freight modelled in the Central Case. This has been estimated at 14Mtpa, significantly above Tahmoor's current export task of 1.6-2Mtpa.

## 7.10 Scenario 10 - Iron ore exports of 2-3 million tonnes

This scenario investigates the likely impact of 2-3Mtpa of iron ore moving to Port Kembla from a mine near to Cobar in central NSW. This freight is expected to move to Port Kembla from the south, approaching via Cootamundra. The Moss Vale-Unanderra line is therefore the quicker and shorter line to bring this freight to Port Kembla. It has been determined that the Moss Vale-Unanderra line has sufficient capacity to accommodate this freight without additional capital investment.

The impact of this freight on the economics of a Maldon-Dombarton line is an improvement in the NPV of $55 million to negative $151 million. There would be private gains from taking this ore via a Maldon-Dombarton line, particularly gaining from the lower maintenance costs on this line, and the Plate F outline of the tunnels (this assumes that the entire journey from Cobar to Port Kembla can accommodate Plate F locomotives), but these gains would be insufficient to cover the cost of constructing the line and the higher external costs of moving this ore along a longer route.

## 7.11 Scenario 11 - Iron ore exports of 20 million tonnes

A scenario was modelled with a very large upside related to iron ore exports. It would involve many complexities and has required a number of assumptions to model.

The iron ore would be expected to originate around Wagga Wagga, and would travel to Port Kembla[12] via Moss Vale. The Moss Vale-Unanderra line would be the natural route to Port Kembla, but would require capital upgrades to accommodate trains of this length. A preliminary estimate of the required capital cost is $176 million, to obtain enough capacity to handle 18.5 million tonnes plus any costs to upgrade tracks leading to a Maldon-Dombarton rail line to allow 30 tonne axle loads.

A large iron ore task would require efficient modern trains with ECP braking and distributed power. This would make maximum use of existing rail infrastructure.

ARTC estimates that it might be possible to obtain nearly 33Mtpa of additional capacity on the Moss Vale-Unanderra line if all possible upgrades are undertaken, 30 tonne axle loads are permissible to the line and the trains using the Moss Vale-Unanderra line use ECP braking and distributer power. This possible capacity would depend on detailed engineering and geotechnical assessments. If the predicted capacity proved optimistic, and the line could not accommodate 20Mtpa of iron ore in combination with the other uses of that line, there would be a constraint on this ore reaching a port for export.

The only alternative available which would provide sufficient capacity is to build a Maldon-Dombarton rail line. Because the iron ore would be approaching from the south a Maldon-Dombarton line would be a longer journey, but would compensate for this with lower unit maintenance costs, longer passing loops, and Plate F clearances for larger locomotives (this assumes that the entire journey from Wagga Wagga to Port Kembla can accommodate Plate F locomotives), which could enable significant cost savings for rail operators or their customers.

Because this freight might be stranded without a Maldon-Dombarton rail line (unless it could be exported via another state) it may be appropriate to apply the expected value added by the mine as a benefit of the line. ACIL Tasman has assumed the value added by an iron ore mine with the expected

[12] South Australian ports might be an alternative.

characteristics of this scenario to be $20 per tonne per annum, though this will depend on ore quality (now being researched) and mining costs.

The economics of a Maldon-Dombarton rail line are compared against the Base Case of an upgraded but capacity constrained Moss Vale-Unanderra line. The NPV of this scenario, on these assumptions, would be positive $2.5 billion. This present value of benefits includes $666 million of value added from the induced iron ore and operational benefits over the study period and a residual value for the line of $2.1 billion. Against this are set costs with a present value of $633 million. The result is indicative only, somewhat assumption-driven given the limited information available.

Clearly, if it is not possible for 20 million tonnes of iron ore to get to market without a Maldon-Dombarton rail line (i.e. the Moss Vale-Unanderra line cannot be upgraded enough and there are constraints on routes to ports in other states) then it would be a viable private investment – the miner and/or Port Kembla could fund the construction of the line.

## 7.12 Impact of a carbon price

The analysis underpinning the economics of a Maldon-Dombarton rail line was undertaken prior to the Australian Government announcement[13] that a carbon tax will be charged after 1 July 2012. This section presents a qualitative assessment of the impact of the tax on the economics of a Maldon-Dombarton line (which, in short, is not substantial).

The mechanics of the tax are still being fine-tuned at the time of this report, but it is expected that a carbon tax of $23 per tonne of carbon dioxide-equivalent ($CO_2$-e) will be applied from 1 July 2012, and that this price will escalate in real terms by 2.5% per annum until carbon permits are traded (expected from July 2015). A carbon price of $23 per tonne has been calculated by ACIL Tasman to increase the price of diesel by approximately 5.5% from its June 2011 level.

The international carbon price expected in 2015-16 is expected to be $29 per tonne in 2010 prices[14] and is expected to increase at approximately 5% per annum in real terms. By 2030 the carbon price is expected to be $52.60 in 2010 prices[15]. The average carbon price between 2012-13 and 2030 is therefore

[13] Prime Ministerial announcement: "Energy efficiency - creating a clean energy future", 10 July 2011

[14] Treasury estimates from the MMRF reported in "Strong growth, low pollution: modelling a carbon price", July 2011, Table 5.2

[15] Treasury estimates from the MMRF reported in "Strong growth, low pollution: modelling a carbon price", July 2011, Section 5.1.2.

calculated to be $33.50 per tonne in 2010 prices. ACIL Tasman assumes that the temporary exemption of heavy road vehicles will expire before a Maldon-Dombarton line could be built.

A carbon price was anticipated by ACIL Tasman and was included in its forecasts of future fuel costs. ACIL Tasman assumed a carbon price of $20 per tonne of $CO_2$-e in 2010 dollars, with annual escalations based on the Australian Treasury's "CPRS-5" forecasts. These escalations were lower than those in the recently announced policy, resulting in a carbon price of $35 per tonne by 2030. A much larger increase in fuel costs was expected to come from an increase in the cost of a barrel of crude oil from 2010/11 levels of US$80 for a barrel of West Texas Intermediate to a price of approximately US$130 in 2010 dollars over the study period.

The impact of the recently announced carbon tax on a Maldon-Dombarton rail line is varied. Freight from the Western Coalfield travels a slightly longer distance via a Maldon-Dombarton line compared to the Illawarra line and this diversion increases fuel costs and carbon taxes. Freight diverted from road to rail would save on save carbon taxes but such a diversion is not expected to happen.

The carbon charge announced in July 2011will make little difference to the demand forecasts in this paper because the earlier assumptions were similar and the assumed change in international oil prices is much more significant.

## 7.13 Combinations of upside scenarios

The upside scenarios, summarised in Table 14, are independent of each other - they do not have a common cause (except in the general sense of a buoyant world economy). However if two or more occurred simultaneously, the effect would be to use up Illawarra and potential Moss Vale-Unanderra line capacity sooner. Combinations of the larger upsides would more readily exhaust this capacity and advance the case for a Maldon-Dombarton line. The test would then be whether there was enough overflow to justify the capital cost, and routes to ports in other states should also be considered.

# 8 Financial analysis

The cost benefit analysis considered the project from an economic viewpoint – that is, from a national point of view. The financial analysis considers it on the merits of a project to be financed. For a financial analysis all revenue is counted (with no allowance for the fact that much of it would be a transfer from RailCorp revenues), external costs and benefits are ignored, and a different (market) discount rate is used. A non-cash cost, depreciation, is included in evaluations of profitability, as is the interest cost of debt.

The Net Present Value (NPV) of cash flows is also carried out to determine whether the project cash flows are sufficient to cover the Weighted Average Cost of Capital (WACC). The WACC (debt plus equity) has been estimated as 12.29% nominal pre tax or 9.16% real pre-tax and is applied to project cash flows.

## 8.1 Financial costs

Specialists Evans & Peck, working from an engineering analysis undertaken by Hyder, prepared a construction cost estimate to +/- 10% at P50 and P90 (meaning a 50 or 90 percent probability of the cost being below the estimate.) The estimated project financial cost (in December 2010 dollars) is:

- $667 million at the P90 level
- $624 million at the P50 level.

Annual operating costs of $840,000 are expected, as are annual maintenance costs of on average $1.25 million. The maintenance costs are expected to be semi-variable with regard to the volume carried on the track.

Straight line depreciation of the capital cost over the expected useful lives of assets leads to a return of capital of $15.5 million per annum. Using a real pre-tax WACC of 9.16% (parameters to this estimate are discussed in Working Paper 2), the return on capital from 2014 to 2030 averages $48.4 million per annum. These costs and the consequent financial NPV of the costs are shown in Table 15.

## 8.2 Financial revenue

Also in Table 15 is a calculation of the tonnes which are forecast to be carried on the line. Dividing the Present Value (PV) of costs by the PV of volume allows a rough calculation of the average price which would need to be charged to cover the financial costs of a line for the forecast demand. This has been calculated as $35.187 per thousand gross tonne kilometres (GTK). This compares with ARTC's current charges for use of the Moss Vale-Unanderra line of $1.043 per train kilometre plus $6.594 per thousand GTK. Clearly at the cost-recovering access charge a Maldon-Dombarton line would be prohibitively expensive.

Of course, there are reasons why the ARTC charge may be so much lower, for example significantly lower value of the asset base, or higher volumes to spread operating and capital costs across. But for an investor seeking to earn a return of capital and a return on capital it is highly unlikely that there will be sufficient revenue to cover the costs of the line.

Table 15 **Present Value of costs and revenue and cost-recovering price**

| | | Annual data ($ millions in December 2010 prices unless otherwise stated) | | | |
|---|---|---|---|---|---|
| | $PV_{2014-2030}$ | 2015 | 2020 | 2025 | 2030 |
| Operations cost | **$7.1** | $0.8 | $0.8 | $0.8 | $0.8 |
| Maintenance cost | **$10.4** | $1.2 | $1.2 | $1.3 | $1.4 |
| Return of capital[a] | **$130.8** | $15.5 | $15.5 | $15.5 | $15.5 |
| Return on capital[b] | **$433.6** | $58.3 | $51.2 | $44.1 | $37.1 |
| **Costs to be recovered** | **$581.9** | **$75.9** | **$68.8** | **$61.7** | **$54.8** |
| Million GTK (roundtrip) | 16,538 | 1,924 | 1,945 | 2,032 | 2,364 |
| **Required Price (Dollars per KGTK)** | **$35.187** | | | | |
| **Revenue** | **$581.9** | **$67.7** | **$68.4** | **$71.5** | **$83.2** |

a Return of Capital is similar to depreciation. It relates to the consumption of the initial investment. An investment of $100 with a life of 100 years may see a return of capital of $1 per annum, after 100 years, the investment of capital will have been fully repaid to the capital owner.

b Return on Capital is the required return to the investor. In this financial analysis it is the net asset value at the start of the financial year multiplied by the WACC. An investor would not normally invest in a capital asset unless expects to receive at least the required return on capital (represented by the WACC).

*Data source:* ACIL Tasman estimates

ACIL Tasman also estimated the revenue from a line if it charged the same flagfall and variable GTK rate as the Moss Vale – Unanderra line. In this circumstance the line would be earning revenue of (on average) $13.7 million per annum (as shown in Table 16).

Table 16 **Costs and revenues if priced at the same rate as the Moss Vale-Unanderra line**

| | | Annual data ($ millions in December 2010 prices unless otherwise stated) | | | |
|---|---|---|---|---|---|
| | $PV_{2014-2030}$ | 2015 | 2020 | 2025 | 2030 |
| Costs to be recovered | $581.9 | $75.9 | $68.8 | $61.7 | $54.8 |
| Million GTK (roundtrip) | 16,538 | 1,924 | 1,945 | 2,032 | 2,364 |
| Revenue | $113.7 | $13.3 | $13.4 | $13.9 | $16.1 |
| Price | | | | | |
| **Flagfall ($/train KM)** | **$1.04** | | | | |
| **Variable ($ per KGTK)** | **$6.59** | | | | |

*Data source:* ACIL Tasman estimates

The PV of revenue if a Maldon-Dombarton rail line charged the same access charges as the Moss Vale-Unanderra line would be $113.7 million, which would only cover 20% of the PV of costs of the line over this period.

Table 17 summarises the financial results of a Maldon-Dombarton rail line every five years. Througout the study period from 2010 to 2030 the line never makes a financial profit.

Table 17 **Financial profitability of a Maldon-Dombarton line**

| | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| Revenue[1] | $15.31 | $17.83 | $21.46 | $28.73 |
| Operating costs | $0.97 | $1.12 | $1.29 | $1.48 |
| Maintenance costs | $1.41 | $1.62 | $1.93 | $2.48 |
| Depreciation | $15.47 | $15.47 | $15.47 | $15.47 |
| Interest | $28.73 | $27.18 | $24.88 | $21.44 |
| **Operating profit /(loss)** | **$(31.27)** | **$(27.56)** | **$(22.11)** | **$(12.14)** |

1 – If revenue was charged at the current unit rates for the Moss Vale-Unanderra line, see Table 16

The operating costs have assumed that the line is operated by ARTC; if the project is considered as a standalone entity then the financial results would be considerably worse because additional expenditure on safety accreditation and control facilities would be incurred.

## 8.3 Project financing

Using the above cash flows, merchant bankers Cranleigh conclude that:

- Project cash flows will support the funding of only around 20% of project costs.
- Private finance under a Public Private Partnership arrangement is likely to be available to meet this proportion of costs.
- Regular government payments for the line being available would support higher levels of private sector funding.

The private sector is unlikely to take demand risk, but the market could be tested again closer to commencement.

More detail is provided in Working Paper 2.

# 9 Interpretation and implications

In this Chapter we consider what the foregoing analysis means for the issues underlying the Terms of Reference and the main themes emerging from stakeholders (through submissions and the Project Reference Group). The chapter starts with the core issue of freight capacity to and from Port Kembla compared with expected demand. It then considers wider issues such as investment, port strategy and road freight.

## 9.1 Is there enough capacity?

Underlying this study is the question of whether there is enough existing rail capacity to meet rail freight demand to and from Port Kembla. Two lines exist (Illawarra and Moss Vale - Unanderra); the question of whether or not there is enough capacity on them to cope with freight growth is central to analysis of the benefits of a third line.

Analysis for this study by train operations specialists Plateway, using ACIL Tasman's demand forecasts, shows that the Illawarra line - already at capacity during the day - will be at capacity for the full 24 hour period within the next few years (after allowing some paths to remain unused to provide a buffer for reliability). The remaining spare paths – currently approximately five between midnight and 5am – will be taken up with expected growth in freight (mainly coal from a large mine near Lithgow, and kaolin, a fine clay used in industrial processes). According to the NSW Department of Transport, capacity enhancements to the Illawarra line would be extremely expensive, we understand well above the cost of a Maldon-Dombarton line. Overflow freight from further growth would have to be accommodated on the Moss Vale-Unanderra line unless a Maldon-Dombarton line was built.

The Moss Vale-Unanderra line is currently constrained by short passing loops, though could currently take eight or nine extra trains per day. The passing loops can be lengthened (allowing more trains to cross), another loop installed and other enhancements may be possible for much less than the cost of a Maldon-Dombarton line (preliminary estimates of between $20 and $176 million, depending how much was done[16]). Capacity could be increased in stages to over 20Mtpa (possibly to over 30Mtpa), well in excess of expected demand (see the separate paper from the ARTC).

[16] See section 3.3. $176 million covers four stages of upgrade; a further (5th) stage has not been costed.

For freight which currently uses the Illawarra line the journey would be longer via Moss Vale, but the cost benefit analysis shows that the net present value of the extra operating cost (and external costs) is much lower than the equivalent cost of building a Maldon-Dombarton line.

A caveat is that the cost estimates are preliminary, based on ARTC experience elsewhere, and have not been analysed as deeply as the estimate in this report for a Maldon-Dombarton line. The first two stages are relatively simple but the following stages are successively more technically challenging. As the work would be enhancements to an existing line (brownfield rather than greenfield) the ARTC expects it to be feasible. If detailed engineering, geotechnical and hydrological studies showed particular difficulties, the implication would involve higher costs. However the $600+ million financial cost of a Maldon-Dombarton line allows substantial "room" for Moss Vale-Unanderra upgrade costs to be higher than the preliminary estimates.

Although this deviation would be suitable for coal and other mineral freight because the delivery is not time sensitive, it would be less suitable for containers and cars which are more time sensitive and for which road freight is a viable alternative. Steepness also makes the Moss Vale-Unanderra line (and a Maldon-Dombarton line) less suitable for steel, which would be moving up the steepest slopes when loaded. These types of freight would ideally get priority on the Illawarra line, while some coal that is now on that line would instead go to Port Kembla via the Moss Vale-Unanderra line.

The two lines have different owners with different access charges, and customers will generally prefer the shortest route. If growing demand for limited space on the Illawarra line meant that some of that freight had to move to the Moss Vale-Unanderra line, a new governance arrangement might be needed to allocate paths.

If demand was substantially higher than expected, through a combination of some of the upside scenarios discussed in this report, the capacity enhancement possibilities for the Moss Vale-Unanderra line could be exhausted. A Maldon-Dombarton line could then be built if the overflow freight was enough to justify the cost and if there was not a net advantage to sending some of the additional freight to another port.

The conclusion on capacity is that there is enough to meet expected levels of demand, and to meet demand substantially higher than those levels, because capacity on the Moss Vale-Unanderra line can be increased for a reasonable cost (subject to the caveat above). However the option of building a Maldon-Dombarton line might be worth exercising in future if there is a much larger than expected increase in freight to and from Port Kembla.

## 9.2 The nature of future demand for the line

Often demand studies produce a central estimate with sensitivities either side of it. This case is somewhat different. ACIL Tasman has produced forecasts of expected demand based on current information. It comprises current demand with adjustments for known changes such as mine closures and announced expansions, and is conservative in the sense that it does not allow for possible, but not yet certain, developments that would add to freight demand.

A number of such upside scenarios have been discussed in this report – e.g. additional coal, commencement of iron ore exports or a switch of container trade from Port Botany. There is not sufficient information to assign probabilities or likely timings to these developments - they are judged to be uncertain but plausible. The overall demand picture is therefore one of an expected level that is only moderately higher than is experienced now, and possible increases (some of them large) to that level at unknown times in the future.

It would not be prudent to build additional railway capacity for demand that might not eventuate, or that might eventuate many years after the investment was made. On the other hand it would be prudent to be ready to make a decision to construct the capacity, so it can be completed in time to meet real increases in demand, otherwise that demand will be stifled and business opportunities lost. Means of doing this are discussed later in this Chapter.

## 9.3 Option to build a Maldon-Dombarton line

Although the analysis in this report suggests a Maldon-Dombarton line is not warranted in the near future, and shows that expected demand could be carried on existing lines for the whole study period (to 2030) there are plausible upside scenarios under which there would be too much freight for the existing lines. It is therefore worth preserving the option of constructing a Maldon-Dombarton line in the future provided the cost of protecting that option is reasonable. The cost relates to continuing to protect the existing easement, and is minimal. No maintenance is required – it has had, and needed, no maintenance since work was abandoned in the late 1980s. The opportunity cost of the land – its value in alternative use – is low. It is zero for most of the length because it passes through bush, although there is an opportunity cost for a short portion at the northern end, around Wilton, indicated by adjacent property development.

If the easement is preserved, exercise of the option to construct the line at some stage in the future would be much cheaper than if the easement was abandoned and if land had to be compulsorily acquired with compensation. Construction would also be faster as the process of compulsory land acquisition can be protracted.

Later construction might also benefit from further advances in tunnel boring or bridge technology.

This is the "real options" approach to investment decision making under uncertainty- find cheap ways of preserving the upside option (in this case, keep the easement) while minimising the cost of the downside (by not building the line until it is really needed).

The steps required to proceed to construction, with the easement in place, would be:

- Identify financing (e.g. government with or without a private sector equity contribution) and decide on ownership structure (the question of who would operate the infrastructure is secondary)
- Consolidate ownership of the easement, now spread over several public sector entities
- Proceed in parallel with detailed design work and with environmental approvals (12-24 months)
- Construct the line (two years)

ACIL Tasman therefore estimates a total time of around four years.

## 9.4 Encouragement of investment

A theme in feedback from some stakeholders has been that uncertainty around rail capacity to and from Port Kembla is deterring investment. Examples from submissions to this study follow:

> It is suggested that a Maldon-Dombarton line would stimulate regional development. MACROC supports the completion of the Maldon Dombarton rail line believing that it would deliver the following regional benefits:
>
> - increase Sydney and West Sydney's economic competitiveness
> - improve freight transport efficiency
> - assess the economic development of Port Kembla...
> - provide support for potential employment and land development in Southwest Sydney... MacArthur Regional organisation of Councils

> ... the project has the potential to have many flow on benefits...[these] include attracting new business to the region -- or encouraging existing ones to expand -- driven by strong, faster and more reliable freight links... this, in turn, will support jobs growth.... *Illawarra Business Chamber*

The examples that have been given include potential new business at the port; other examples relate to inland freight terminal(s). In particular shipping companies who might consider transferring part of their operations from Port Botany to Port Kembla, would be deterred by not knowing whether permanent train paths were available (the recent approval of the Outer Harbour development was contingent on 90 per cent of containers moving from the port by train).

This report should help clarify the train capacity issue. In particular, as discussed above and in the attached ARTC letter, there is spare capacity and substantial scope for increasing it on the Moss Vale-Unanderra line. The ARTC said it would respond positively to firm requests for additional train paths (but investments would need at least 18 months notice). The Illawarra line is close to effective capacity, but at present there are five spare paths between midnight and 5 am which could be used for container trains. Even as other freight grows, in principal RailCorp could protect paths for container trains and shed surplus coal and other bulk traffic onto the Moss Vale-Unanderra line.

A possible large-scale development that could exhaust the enhanced capacity of the Moss Vale-Unanderra line is that of iron ore. There are uncertainties at present about whether or not it will prove to be of a quality suitable for economic exporting, and a final decision would have to be made about which port to use. However if it proves to be commercially feasible and if Port Kembla is confirmed as the export port, the Moss Vale-Unanderra line could provide capacity during part of the ramp up period, allowing time to build a Maldon-Dombarton line.

It follows that, with the publication of this report and the associated ARTC paper, and with retention of the Maldon-Dombarton easement which preserves the option to construct the line when needed, there should be no deterrent to business and investment on the grounds of rail capacity, assuming capacity is allocated efficiently.

## 9.5 National port and freight strategies

Infrastructure Australia recently released a *National Ports Strategy* (December 2010) and a *National Land Freight Strategy Discussion Paper* (Prep 2011). The two documents have only moderate implications for this Maldon-Dombarton feasibility study. This study is compatible with both documents.

### 9.5.1 National Ports Strategy

The *National Ports Strategy* focuses on a "coordinated approach... to the future development and planning of Australia's major ports and freight infrastructure." It identifies four priorities, listed here with comments in brackets on the Maldon-Dombarton aspects:

1. planning for relevant ports (Port Kembla is planning expansion through its Outer Harbour development, which would be assisted by greater clarity about available and projected rail capacity)
2. ensuring plans can be executed (execution of Port Kembla's container plans requires 90 per cent use of rail, which in turn relates to the rail capacity question. Growth of most of its other trades also requires adequate rail capacity.)
3. improving land slide efficiency, reliability, security and safety of container ports (it would be physically very difficult to improve the main road constraint affecting Port Kembla, i.e. Mount Ousley Road, but relevant regulatory and pricing policies have been identified in this feasibility study. This priority also requires adequate rail capacity).
4. promoting clarity, transparency and accountability. (This feasibility study should help improve clarity and transparency related to current and potential rail capacity on the lines serving Port Kembla).

The actions proposed in the *National Ports Strategy,* for example a nationally consistent environmental management regime and introduction of international key performance indicators, are mainly in the purview of the Port Kembla Port Corporation. However there is one action – that of "using some port roads as a test case for the road reform programme" – that may be relevant to an issue arising from this study. Mt Ousley Road is congested and expensive to maintain, and could be a candidate for trialling new types of road user charging.

The *National Ports Strategy* says little about the government decisions to favour development of one port instead of another. However, as discussed in this feasibility study, stakeholders have made a case for such decisions relating to Port Botany and Port Kembla -- that is, a question of NSW ports strategy.

### 9.5.2 National Land Freight Strategy Discussion Paper

The discussion paper on a National Land Freight Strategy Discussion Paper proposes a national freight network that includes Port Kembla. It does not mention Maldon-Dombarton but does discuss corridor reservation[17].

It also states that "the Moorebank terminal project in Sydney... needs to be progressed as a priority" which is of relevance to Port Kembla in the context of any container developments that required 90 per cent use of rail, in turn implying substantial use of intermodal terminals in the south-west Sydney area that suit service from Port Kembla, such as Moorebank.

## 9.6 Implications for NSW port strategy

Some stakeholders have suggested that investment in enabling container trade at Port Kembla should be seen as an alternative to investing to enable increased container trade at Port Botany. The Port Kembla investments include the Outer Harbour development and a Maldon-Dombarton rail link (given that Outer Harbour containers are required to move mainly by rail). At Port Botany the wharves have just been extended and the planned investment relates to landside improvements, i.e. increased rail and road capacity to ease congestion. These investments would be very expensive and it was suggested that the money would be better spent near Port Kembla. The following is an example of a submission on this matter:

> What impact would freight volumes greater than 3.2 million TEUs (at Port Botany) have on Sydney's road and rail network and... what is the capacity of Sydney's freight rail system?...What are the options for handling Sydney's import and export freight demand once the 3.2m TEU cap at Port Botany is reached sometime between 2017 and 2020? What would be the relative economic benefits of a Port Kembla, Maldon-Dombarton rail link system for handling parts of the state's container demand once capacity is reached at Port Botany? *(Source: Regional Development Australia – Illawarra)*

A decision to direct road and rail investment resources from the Port Botany area to the Port Kembla area is beyond the terms of reference for this feasibility study of a Maldon-Dombarton rail line, but it is noted that there are several considerations that would need to be borne in mind here:

- It is not clear that there will be an overflow of containers from Port Botany to Port Kembla, or that a major shipping company will move from Port Botany to Port Kembla, even if there was additional road and rail expenditure near Port Kembla. These events may or may not happen. A policy change would be needed – as took place for cars – to force containers to Port Kembla

[17] In Chapter 4

- Port Botany has just been expanded and has significant spare portside capacity and, as the landside links there are congested, it is not plausible to expect no landside improvements to serve the port expansion (and ACIL Tasman has made a technical assumption for its modelling that the Port Botany planning cap is increased from the present 3.2 million TEUs p.a. to 5 million TEUs p.a.)
- Port Botany containers are not all substitutable by containers through Port Kembla, as some of them go to destinations that are closer to Port Botany. (The area potentially served by both is south, west and southwest Sydney)
- The cost of road improvements in the Port Botany area cannot be fully attributed to port-related trucks as the roads are also used by other vehicles
- If there is a substantial shift of container trade from Port Botany (for which the landside rail share target is 40 per cent[18]) to Port Kembla (for which the equivalent target is 90 per cent) there would be a greater need for intermodal terminal capacity at the likes of Moorebank as trucks can often bypass the terminals and proceed straight to the final destination.

## 9.7 Implications for rail governance arrangements

At present railway operators obtain and pay for train paths from the track owners, RailCorp and ARTC.

These arrangements would come under strain if it became necessary to divert some freight trains from the congested Illawarra line onto the Moss Vale-Unanderra line, as the latter involves approximately 100 km greater distance, higher rail access charges and higher train operating costs (a trade-off between reliability and delay related costs, which favour the Moss Vale-Unanderra line, and distance related costs, which favour the Illawarra line). The trains that are diverted could involve part or all of a given customer's freight and some customers rather than others. There will be commercial incentives to prefer one alternative and to resist the other.

[18] 2010 NSW State Plan, Page 11.

There is no entity in place to provide a framework for these decisions, and for addressing questions such as whether or not the diversion should apply only to "new" freight that "caused" the capacity shortfall (e.g. from an expanding coal mine) or to some other freight, and whether or not the extra cost of using the Moss Vale-Unanderra line should be shared amongst all. A framework would also provide a degree of certainty to the ARTC which would have to make a business case for each of the capacity enhancements that would be needed to the Moss Vale-Unanderra line as freight increases.

Such a framework will be needed within a few years as the Illawarra line is nearing capacity. The arrangements for the Hunter Valley Coal Chain Coordinator, based on take or pay contracts between mines and track owners, may provide a starting point although the membership would have to be broader as not all of the freight in question is coal and not all of it goes to from Port Kembla.

## 9.8 Employment effects

Using input-output analysis, it is estimated that construction of a Maldon Dombarton line would create 200 direct full-time equivalent jobs (FTEs) in NSW over two years, 896 indirect, flow-on FTEs over a range of industries in the state, and 106 FTEs elsewhere in Australia.

Without construction of the line, many of these people would find employment elsewhere. However, in an area with employment below the state average the job creation effects of this investment are important to the local stakeholders.

## 9.9 Reducing the growth in truck numbers

While coal trucks are very visible on the roads in the area they comprise less than 3% of average vehicle movements[19], and their incidence of accidents is in line with that[20]. A reduction in coal traffic would reduce accidents, congestion and environmental impact.

Feedback from stakeholders, in discussions in the Project Reference Group and through submissions, indicates a strong interest in reducing the number of trucks on key roads, especially Mount Ousley Road, or at least reducing growth in the numbers. A common theme was that construction of a Maldon-Dombarton rail line would help achieve this objective.

[19] Environmental Assessment of existing options & increased road hours for Port Kembla coal terminal traffic study, Cardno Eppell Olsen (2008)

[20] Data provided by NSW Road Traffic Authority

Attention has focused especially on trucks carrying coal to Port Kembla or Bluescope Steel, and trucks carrying cars and containers from Port Kembla. Coal truck numbers would further increase if planned mining expansions take place; the switch of car importing from Sydney to Port Kembla has put car carrying trucks on the roads; and expansion of container trade at Port Kembla has also resulted in increased truck movements, with a significant expansion of Port Kembla planned for the near future.

The analysis in this report has established that constructing a Maldon-Dombarton line would have little effect on truck numbers. Two of the coal mines that use trucks are located in positions that would not suit use of a Maldon-Dombarton line. Another coal mine that might be able to use that line has indicated that it intends to continue using trucks. Two of three car carrying (auto logistics) firms have indicated that they would continue using trucks and the third is uncertain.

Container traffic at Port Kembla is growing steadily and at present is served by truck; the Port Corporation expects container numbers to reach a critical mass that would justify a daily train. However it is not certain that the mode shift would actually happen, as rail suffers a disadvantage in the short haul of containers because of the expense of pickup and delivery - for nearly all customers the container has to be transferred to a truck for the last part of its journey. (That is also the reason why two of the car carrying companies are reluctant to use rail).

The truck issues do not arise with the scenario in which there is a large switch of container trade from Port Botany to the new Outer Harbour at Port Kembla, because the environmental approval for that development requires a maximum of 120,000 TEUs moved by truck per annum. The Outer Harbour's physical configuration does not suit the use of trucks. (Of course this means that for the Outer Harbour container to develop there would have to be enough rail capacity).

The conclusion is that construction of a Maldon-Dombarton line would make little difference to the problem of growing truck numbers on congested roads in the area. To reduce truck numbers other government policies would be required, e.g. changes in regulation or road pricing.

Planning powers could be used to make coal mine expansion contingent on a switch away from trucks. The planned long term reform in the road use charges paid by trucks[21], with registration and fuel excise charges being replaced by direct charges that varied according to mass, distance and location, could be used to impose higher charges on Mount Ousley Road which is congested and expensive to maintain. Combined with these approaches, allowing higher productivity road vehicles would also reduce vehicle numbers and improve safety on affected roads.

If such policy changes were made - and it is understood that the new road user charge regime is still some years away - and if these were successful in encouraging coal and cars to move from road to rail, there would still remain the question of whether there was a case of building a Maldon-Dombarton line. As discussed above, extra rail freight can be accommodated on existing lines unless the increase in tonnage is much larger than expected. Nevertheless new policies that discouraged road freight would advance the time at which a Maldon-Dombarton line was justified.

## 9.10 Consequences of not building the line

With little growth in expected demand beyond 2015, the consequences of not building the line would be relatively modest, comprising:

- Continuing costs related to congestion on the Illawarra line, being delays to freight trains and sometimes to passenger trains
- Continuing or increasing external costs, notably pollution and noise, on the Illawarra line
- Use of the remaining paths (at night) on the Illawarra line, with some freight diverted to the Moss Vale-Unanderra line which (depending on the number of trains) could require some upgrading
- Possible investment required on increased train holding capacity in the Port Kembla area (to stable some of the night trains until the port could handle them) and on capacity upgrades to the Moss Vale-Unanderra line
- Congestion on the main south line near Maldon due to shunting of Tahmoor trains, a problem as interstate train numbers increase, which would require upgraded signalling to resolve.

As there would be little diversion of the road freight to a Maldon-Dombarton line, road freight will continue to grow with or without the line unless policies are changed.

[21] The COAG Road Reform Plan

There would be greater consequences under upside demand scenarios:

- Increasing diversion of trains to the Moss Vale-Unanderra line once the Illawarra line reached capacity, involving a 100km longer journey and higher operating costs (for trains to/from Sydney or Lithgow area)
- Investment to increase the capacity of the Moss Vale-Unanderra line
- Under a combination of upside scenarios, an inability to meet all freight demand.

# 10 Conclusions

## Feasibility

It is technically feasible to complete the building of the line. Construction would take two years once detailed engineering work, environmental approvals and funding were in place. The alignment would be similar to that on which work has started, but advances in technology allow a cheaper type of bridge construction for the Cordeaux River.

It is feasible to operate the line without special equipment despite the steepness of the tunnel, which would be ventilated.

The environmental consequences of completing the construction and operating the line are not major and can be mitigated against, for example with appropriate drainage and sound barriers. Environmental approvals would take 12 to 24 months to obtain and would remain valid for five years.

## Cost

The estimated cost of construction is $624 million.[22] Operating costs, and post-construction employment, are relatively minor.

## Cheaper to upgrade an existing line

Freight that could use the line is expected to grow moderately over the study period to 2030 and could be accommodated on existing lines. The Illawarra line is nearing capacity but the Moss Vale-Unanderra line can have its capacity increased in stages at much lower cost than construction of a Maldon-Dombarton line. The early stages are modest but the latter ones would be more challenging and would need detailed engineering assessment.

New governance arrangements would be needed to manage the overflow from the Illawarra line onto the Moss Vale-Unanderra line (given its longer distance and higher rail access charges).

[22] This is the P50 estimate of construction costs, which means a 50% probability that costs will be less than $624 million. The P90 estimate of costs is $667 million, which means there is a 90% probability that construction costs will be less than $667 million.

## Rail capacity and investor confidence

This report and associated papers provide details on capacity on the Illawarra and Moss Vale-Unanderra lines which should help improve confidence of investors contemplating developments that require rail capacity. The owners of both lines (respectively RailCorp and the ARTC) should periodically update and publish information on available permanent train paths in order to maintain investor confidence.

## Trucks

A Maldon-Dombarton line would have little effect on the growth in truck numbers on key roads in the area. Freight customers who at present use trucks have said they would continue to use them even if the line was there.

## Upside scenarios

There are plausible if uncertain scenarios involving substantial increases in freight relevant to a Maldon-Dombarton line. Some of the relevant coal mines are contemplating substantial increases in output, and there is a possibility of major new freight in iron ore. There is also a possibility of some of Port Botany container freight shifting to Port Kembla and using rail for the landside connection to Southwest Sydney.

A combination of these scenarios could exhaust the expansion possibilities on the Moss Vale-Unanderra line and justify construction of a Maldon-Dombarton line.

## Future policies

Possible future policy changes could increase freight relevant to a Maldon-Dombarton line. They include policies that discourage use of trucks and, in the longer term, policies to increase off peak passenger train frequency on the Illawarra line which would greatly reduce the number of paths available for freight trains.

## Economic analysis

With expected levels of demand, or with some of the upside demand, there is no need for a Maldon-Dombarton line provided the Moss Vale-Unanderra line is improved as required. Because an alternative is available more cheaply, the cost benefit analysis of a Maldon-Dombarton estimates that it would have negative net present value of $206 million or a benefit cost ratio of 0.56. The result remains negative under most upside scenarios.

## Financial analysis

Financial analysis indicates that a Maldon-Dombarton project would not generate sufficient revenue from rail access charges to cover its capital costs. Private investors would not be attracted unless the government paid most (approximately 80%) of the capital cost. In the more optimistic upside scenarios where there were major new exports of iron ore or a major increase in coal exports, private equity contributions from those companies could help finance the line.

## Next steps

If freight increases substantially, modest upgrades can augment capacity on the Moss Vale-Unanderra line. If major upgrades are needed and prove to be substantially more expensive than expected, a Maldon-Dombarton line could be revisited as an alternative. For this reason, it is important to preserve the rail corridor to retain this option.

If it was decided to proceed with a Maldon-Dombarton line, preparatory work (design, environmental approvals, funding) could be completed in 12 to 24 months, followed by construction which would take 2 years.

## Retain alignment

As a Maldon-Dombarton line might be needed in future, its easement should be retained in order to keep open the option of construction.

# A Terms of Reference

## Introduction

The proposed Maldon-Dombarton rail link is a 35 kilometre standard gauge rail line connecting the Illawarra Line from Wollongong to the Main Southern Line running from Sydney via Campbelltown. The line was originally proposed and partially constructed by the NSW Government, commencing in 1983. Construction ceased in 1988 following a reassessment of the demand case by the NSW Government. The rail corridor is not believed to have been compromised.

Approximately two-thirds of earthworks along the rail corridor have been completed, as well as the entry cuts to the tunnel portals and construction access roads to the tunnel and catchment area. However some significant infrastructure has not been constructed, including a number of bridges.

Considerable changes to the legal framework for environmental assessment have occurred since the initial Environmental Impact Assessment was completed in 1983 and further environmental assessment would be required before construction could commence. Parts of the rail corridor now fall within the Sydney Water Catchment Metropolitan Special Area.

The *Maldon-Dombarton Rail Line Pre-Feasibility Study* was completed and released on 8 July 2009. The Australian Government announced a funding commitment of $3 million towards a Feasibility Study of the Maldon to Dombarton Rail Line. The Study will examine the current and future demand for the line, determine the most appropriate alignment and technical requirements to meet the expected demand and provide a detailed costing for completing construction of the line. The timeframe for the feasibility assessment is to 2030.

The feasibility study will also provide advice and options on the most appropriate means of funding the construction of the line.

## Objectives

The Feasibility Study will conduct a detailed analysis of existing structures, engineering requirements, demand for usage of the line, economic and financial modelling and land use and environmental planning issues.

The purpose of the study is to inform future Government decision-making about this project by:

a) carrying out a detailed investigation of the layout, design and cost of remaining works;

b) assessing the project's viability on environmental, social and economic criteria, including an economic cost benefit evaluation;

c) identifying any preconstruction requirements (such as the environmental impact assessment) to guide the construction of the project, should it proceed; and

d) examining and costing the implications of not pursuing the project.

## Scope of work to be undertaken

In order to fulfil the study objectives and deliver key outputs, an indicative project task list is as follows:

### 1. Demand for usage of the line

The study will expand and test the analyses of the current and future freight markets conducted in the pre-feasibility study, with particular regard to:

- assessing and 'stress testing' the accuracy of trade predictions and forecast growth and the assumptions made in developing these forecasts;
- examining alternative freight routes to which future demand for freight services on this line might be concentrated in the event construction of the line does not proceed, and whether there is likely to be future capacity to absorb this demand on those routes;
- examining and assessing the line's capacity to improve the connectivity of the freight rail network with existing and proposed intermodal terminals at Enfield, Eastern Creek, Moorebank, Minto, Ingleburn, Moss Vale and Wollondilly (and any others which the consultant deems appropriate as identified in the consultant's submission);
- developing of train path modelling, with consideration of construction design updates and future demand on the intra and interstate networks of which Maldon to Dombarton would connect and
- engaging with key stakeholders, and in particularly with relevant above rail operators and freight logistics organisations.

### 2. Engineering assessment

The study will assess the engineering requirements for the completion of the line. Tasks include the following.

- Identification of any alignment enhancements options and recommend an optimal alignment (if different from current alignment).
- A comprehensive construction gaps analysis from the original design to current standards.
- Refining and updating the design of bridges, tunnel, other rail infrastructure and associated signalling and road infrastructure to meet current legislative

requirements and standards, with particular consideration to the following issues and the assumptions made about them in the pre-feasibility study.

a) technical aspects, including:
   - hydrological design;
   - the adequacy of the current tunnel design for diesel freight locomotives, including tunnel ventilation
   - locomotive capability to operate on a 1:30 gradient;
   - land use management issues including the impact of designs on potential future industrial and residential developments in areas adjacent to the corridor.

b) current and future operational requirements, including:
   - freight demand and supply developments in Illawarra, Sydney and other potential markets;
   - train path modelling as undertaken under Scope 1 : Demand for the Line; and
   - environmental and social concerns.

**3. Land use and environmental assessment**

The study will review any issues that associated with land use and environmental planning matters may impact the construction of the line, including clarifying and updating land use planning requirements related to integrating the line into the ARTC network.

The study will conduct an environmental assessment for the completion of the line, including an assessment against requirements in the *Environmental Protection and Biodiversity Conservation Act (Cth) 1999*. The study will have particular regard to:

- soil and water management;
- social and cultural heritage matters;
- incident management issues; and
- the Sydney Catchment Authority Metropolitan Special Area's Special Areas Strategic Plan of Management.

**4. Economic and Financial Analysis**

The study will undertake an economic analysis of the construction of the line. This will include:

- identification and quantification of all significant economic costs and benefits associated with completing and not completing the line, including but not limited to:
  a) direct and indirect employment due to the construction and operation of the line;

b) improvements or constraints to the connectivity of the freight rail network, including between major intermodals such as Port Botany and Port Kembla;

c) impacts on industries that would use the Maldon to Dombarton rail link;

d) impacts on the demand and future capital expenditure requirements for the Illawarra line, the Main South line to Moss Vale and the Sydney to Melbourne interstate freight rail line; and

e) economic costs and benefits derived from environmental costs or benefits, including but not limited to impacts on greenhouse gas emissions.

- analysis of the financial and funding options, including consideration of options for private sector financing of construction of the line, such as public private partnerships and private finance initiatives;
- analysis of the economic costs associated with not constructing the line; and
- preparation of a discounted NPV with discount rates for:
  a) a commercial organisation with a BBB+ investment grade rating; and
  b) the Australian Government.

In preparing the NPV, the study will:

- identify and use industry best practice in determining discount rates and asset residual values; and
- provide separate NPV calculations for capital and operating results.

**5. Benefit and Cost Estimation**

The study will provide construction and operating cost estimations to +/-10% at P50 and P90 in accordance with the standard contained in the *Best Practice Cost Estimation for Publicly Funded Road and Rail Construction.* A detailed Benefit Cost Analysis (BCA) is also to be undertaken. In developing the cost estimates and BCA, the study will consider matters including:

- current engineering construction methodology in determining cost estimations
- comprehensive identification of project components for which design will be undertaken, and the likely cost of undertaking these design works
- integrating the line onto the existing rail network, with particular reference to ARTC requirements, and
- estimating the costs associated with obtaining the required planning and environmental approvals;
- a full risk assessment; and
- an indication of the likely annual below rail (infrastructure) operating and maintenance costs.

The BCA shall be consistent with Appendices D and E of the Outline of Infrastructure Australia's Prioritisation Methodology.

As well as economic costs and benefits, the study should include an examination of social and environmental costs and benefits and who will benefit / bear them.

Cost estimates are to be dissected and provided into discrete tender components, which are to be recommended in the study. Estimates should be provided at a minimum for the following:

- rail and sleeper acquisition
- rail installation including ballast
- bridge construction (show cost of each bridge)
- tunnel construction including tunnel lining
- earthworks including drainage
- signalling and electrical works
- remediation of existing works
- project management
- design and/or redesign of existing drawings
- commissioning
- contingency
- other as deemed relevant to the project

# B Respondents to the Maldon-Dombarton rail link issues paper

The following is a list of public submissions to the Maldon to Dombarton Rail Link Feasibility Study Discussion Paper.

## Groups

- BHP Billiton Illawarra Coal
- Blue Mountains Commuter and Transport Users Association Inc
- Blue Mountains City Council
- Canterbury Council
- Centennial Coal
- Central NSW Councils
- CFMEU Mining & Energy
- Dapto Neighbourhood Forum 8 Convener
- Gujarat NRE Coking Coal Limited
- Healthy Cities Illawarra
- Illawarra Business Chamber
- Lithgow City Council
- Macarthur Regional Organisation of Councils
- Marrickville Council
- Neighbourhood Forum 5
- NSW Minerals Council
- Port Kembla Coal Terminal
- Port Kembla Pollution Meeting
- Port Kembla Port Corporation
- Regional Development Australia Illawarra
- Regional Development Australia Sydney
- Roads and Traffic Authority
- Stockland
- Shipping Australia Limited
- South Coast Labour Council
- South East Australian Transport Strategy Inc
- Sutherland Shire Council
- Transport Network Associates

- Tweed Rail Society
- Walker Corp
- Wingecarribee Shire Council
- Wollondilly Council
- Wollongong City Council
- Wollongong University Student Association
- Wollongong Transport Coalition
- Xstrata Coal

### Individuals

- Barnett E
- Cronin, M and McRae, J
- Gardiner A
- Halford A
- JM & S Waples
- Kotevski T
- Philip Laird
- S & Y Dare
- Lebow L
- McQueeney R J
- Newnam L
- Riles L
- Tognetti K

# C Summary of submissions

Over 50 submissions were made after publication of the Issues Paper. This appendix summarises the main themes and quotes from a selection of the submissions. Some submissions are not quoted where key points have been made in other submissions. All submissions were reviewed during the study, and the full set is available on the Department of Infrastructure and Transport website www.infrastrucutre.gov.au.

## C.1 Coal

### Issues

Coal company expansion plans; whether there is or will be sufficient rail capacity.

> Xstrata... is the current owner and operator of both the Tahmoor and Baal Bone coal mines... current exports... total approximately 3Mtpa. Xstrata also has coal projects at Running Stream in the West and Barco, the extension of Tahmoor, in the South, with the potential to produce a further 5MTpa of coal experts via PKCT. These projects are currently in prefeasibility, and could potentially commence coal export operations from 2016. *(Source: Xstrata Coal)*
>
> PKCT is contemplating an upgrade project that requires certainty across a total supply chain capability. This upgrade project may proceed without the Maldon-Dombarton rail link. *(Source: Port Kembla Coal Terminal)*
>
> The Maldon-Dombarton link could play an important role in improving the reliability and efficiency of the supply chains from the Western and Southern coalfields. For this to occur the link must be supported by sufficient auxiliary infrastructure for the increase in traffic along the route, so that freight transport on lines adjoining the link is not disadvantaged. *(Source: NSW Minerals Council)*
>
> PKCP is strongly of the view that if the Maldon-Dombarton line is constructed there would be a significant movement of coal freight from the Illawarra line [whose difficulties are] that many rail paths are located on an ad hoc basis; significant queuing is encountered...; the travel time is slow.... the Maldon Dombarton line is... critical infrastructure [without which] is highly unlikely that Port Kembla port will be able to fulfil its potential... *(Source: Port Kembla Port Corporation)*
>
> ...the Maldon-Dombarton line's location, running along the coal seams between the Illawarra and Western Sydney, will encourage the development of new cases in the area... *(Source: CFMEU Mining and Energy)*
>
> As an alternative to coal trucks, the Maldon-Dombarton rail link should be completed and coal companies be required to use it. Until then, there should be production limits imposed on the mines near Appin. *(Source: Martin Laird)*

### Comment

Tahmoor would benefit from a Maldon-Dombarton line, though could continue to use the route via Moss Vale at greater cost. This study does not forecast other major long term growth in the areas serviced by a potential Maldon-Dombarton line – growth is more likely in the Gunnedah Basin and Queensland. Some of the deposits said to have potential impact are of low quality. Some are on other rail lines or would use road - transport of a growing coal freight task from Bulli Seam (Appin and West Cliff) would not be affected by the Maldon-Dombarton rail line (see comment from BHP Billiton in section C.4).

## C.2 Container transport

### Issue

Rail capacity will be needed for growth in container trade at Port Kembla, especially from the new Outer Harbour development from which 90% of containers are required to use rail. Overflow from Port Botany may come to Port Kembla.

> Even moving more containers by rail is not going to address growth at this level [ 7 million TEUs at Port Botany by 2030] and who seriously believes that 40% rail could be achieved at Port Botany... there is considerable opposition to the super-sized Moorebank Intermodal, likewise for the M5East and M4 East and ramps... there were never any costings of infrastructure required for Port Botany compared to what was needed for Newcastle and Report Kembla.. *(Source: Lynda Newnam)*
>
> What impact would freight volumes greater than 3.2 million TEUs (at Port Botany) have on Sydney's road and rail network and... what is the capacity of Sydney's freight rail system?...What are the options for handling Sydney's import and export freight demand once the... is reached sometime between 2017 and 2020? What would be the relative economic benefits of a Port Kembla, Maldon-Dombarton rail link system for handling parts of the state's container demand once capacity is reached at Port Botany? *(Source: Regional Development Australia – Illawarra)*
>
> The expansion of Port Botany without supporting infrastructure will routinely result in traffic gridlock once it is fully operating... Port Kembla can increase its container handling capacity and the area's prosperity but this is dependent on the Maldon to Dombarton rail link being completed... *(Source: Anne Gardiner)*
>
> Members are... keen about an alternative port for the overflow of containers from Port Botany is identified and planned soon, given the long lead time... Would one of the international shipping companies move from Port Botany to Port Kembla? -- In our opinion it is likely that initially, smaller ship operators servicing niche markets could consider relocating services to Port Kembla. *(Source: Shipping Australia)*

### Comment

Any overflow form Port Botany would be towards the end of study period and has been included in the analysis, as Port Kembla's Outer Harbour Master Plan requires that 90% of containers from the port move by rail. An individual major shipping company might decide to shift, but this cannot be counted on.

Comment is made in the report on relevant aspects of broader NSW ports policy, including complexities relating to assessment of landside transport issues at Port Botany.

## C.3 Car transport

### Issue

Trucking of new cars from Port Kembla has added to road congestion.

> The new cars now being transported by road from the port are only one of the added uses clogging further our already clogged transport corridors. We were recently given a presentation for Cement Australia who have plans in progress right now that will put an estimated extra 232 B-double-26 tonne trucks onto the roads to Sydney each day. This was stated to be considered as "minimal impact". *(Source: Port Kembla Pollution Meeting)*

### Comment

The explanation for new car transport on road rather than rail is double handling costs. Adding a new line would not change this.

## C.4 Reduction in number of trucks

### Issue

Concern about the number of trucks on Appin Road, Picton Road and especially Mount Ousley Road. Accident and congestion costs.

> The Mt Ousley road has excessive numbers of heavy trucks. Including a massive 5 million tonnes of coal on road. No other city in Australia is subject to this imposition. And if this was not bad enough, a long standing curfew has been lifted and permission given for the tonnages to be increased. In other words, more road crash risk, noise and air pollution, plus congestion. To add insult to injury, the operations of the heavier trucks are arguably subsidised by low fuel taxation (only about 22 cents per litre for diesel used by big trucks after rebates as against the 38 cents a litre paid by motorists) and for the road damage they do, low annual registration charges. As noted by the Henry Tax review, mass distance charges are long overdue. The least that the present feasibility study can do is to properly estimate

what it is costing the community to have so much coal on road. *(Source: Wollongong Transport Coalition)*

...One B-Double is equivalent to the [road] damage done by about 20,000 cars... for each track that has replaced by rail there is an increase in safety by a factor of 20... *(Source: Dr Keith Tognetti)*

During 2008-09 the Department of Planning processed a Major Projects application by the Port Kembla Coal Terminal (PKCT) to lift a long standing curfew on road deliveries by coal trucks to the PKCT and to lift already high levels of road haulage of coal of some 5.1 million tonne per annum (mtpa) of coal to the PKCT to a maximum of 10 mtpa (with additional conditions past 7.5 mtpa). The application resulted in the NSW Department of Planning receiving 122 written objections... Although the road system is coping, under some stress, with about 6 mtpa on coal from the Appin Westcliff coal complex, 12 mtpa is likely to impose unacceptable impacts (see section below re Port Kembla expansion). *(Source: Philip Laird)*

Given the extra length involved in using the Moss Vale-Unanderra line and its steep grades, those consigning bulk and nonbulk freight will be likely to choose road freight. However main roads such as the Picton Road, the Appin road, the Mt Ousley Toad and the F6 Road already have too many heavy trucks. The remedy would be both completion of the Maldon Dombarton railway and a quota on the number of heavy trucks. *(Source: Neighbourhood Forum 5)*

RTA has raised concerns with the ability of the port to achieve and modal split of 90% of freight movements by rail. This concern has been reinforced as the first development application development within the [Port Kembla Outer Harbour] has proposed all movements by road and generates 2/3 of the traffic movements proposed for PKOH in its entirety... while it is not clear if construction of the Maldon-Dombarton rail link is likely to reduce traffic congestion by attracting existing road freight movements onto rail, it is considered that this rail link is vital in providing alternatives for future users... *(Source: NSW Roads and Traffic Authority)*

The company currently produces approximately 7 million tonnes of saleable product. Approximately 4Mtpa is exported with the balance being sold to the Australian steel industry at Port Kembla and Whyalla... [it is proposed to increase] production from 7.5Mtpa to a peak production of 10.5Mtpa...

It is important that the study recognises that there is no likelihood that Illawarra coal's existing operations will utilise the Maldon-Dombarton link... the washery [at West Cliff] is currently undergoing a $150 million upgrade... these coal processing facilities will handle the Illawarra Coal's Bulli coal seam production for approximately the next 30 years. It is neither economically feasible nor environmentally sound consider a rail connection to the Maldon to Dombarton rail link at this time...

While we remain supporters of the proposal [a Maldon-Dombarton line] ...we cannot make a commitment to the use of such facilities since Illawarra Coal's existing operations are geographically remote from the proposed alignment of the rail link and there is no economic (or other) case to move from our existing logistics arrangements. *(Source: BHP Billiton)*

### Comment

A Maldon-Dumbarton line would make little difference to the level of truck traffic because BHP says it will not switch Bulli Seam coal to rail transport. Firms choose to send containers and cars by truck even though rail is available now - trucks are cheaper because they avoid double handling. Some steel travelling by road is expected to switch to rail shortly. Other road freight would not be affected by the new line.

The problem is worst on Mount Ousley Road. Picton and Appin Roads can be upgraded as traffic increases. The study discusses other policy changes that could reduce the growth in truck numbers.

## C.5 Illawarra line

### Issue

The Illawarra line is congested, passenger and freight trains are delayed, and it cannot handle growth.

See above comment from Port Kembla Port Corporation

CityRail trains can often be slowed by long and slow moving coal trains on these busy lines. Waterfall for example is one location where passenger trains often slowed by coal trains calling into the "refuge" sidings there. *(Source: TweedRail Society)*

The construction of this rail link would appear to benefit the Marrickville Local Government Area by providing an alternative route for coal trains... specifically, persons who live along these lines would benefit from reduced noise and vibration... *(Source: Marrickville Council)*

### Comment

The Illawarra line is operating close to capacity, though has some spare paths at night. Train delays and noise are allowed for in the cost benefit analysis. It would be very expensive to upgrade this line, but it is feasible to upgrade the Moss Vale-Unanderra line (see below). Construction of a shortcut between the main Western and Southern lines (together with use of the Moss Vale-Unanderra line or a potential Maldon-Dombarton line, as proposed by the NSW Department of Transport, would allow coal from the Lithgow area to avoid inner Sydney areas such as Marrickville.

## C.6 Moss Vale-Unanderra line

### Issue

The question of whether the Moss Vale-Unanderra line can help cope with freight growth.

> The high-growth scenario of the Illawarra Freight Study for the Moss Vale line confirms the views of RailCorp and the ARTC that future growth can be accommodated on the existing network without recourse to major new capital investment. The current rail freight load inland from Port Kembla is virtually zero. In the Sydney Wollongong Corridor Strategy improving the capacity, efficiency and productivity of the Moss Vale to Port Kembla rail line has been identified as one of the short-term priorities, further strengthening the case using the link between Moss Vale and Port Kembla. *(Source: Wingecarribee Shire Council)*
>
> Before any decision is made not to proceed with completing the Maldon Dombarton-Railway smaller scale substitute projects should be costed to determine investment required to provide for increased capacity and improved reliability of rail freight movements between Port Kembla and western NSW, western Sydney, Port Botany and Newcastle. *(Source: Transport Network Associates)*

### Comment

This line can be upgraded in stages, though the latter stages would require substantial engineering and geotechnical analysis. It is no steeper than the tunnel section of a Maldon-Dombarton line. The Moss Vale- Unanderra line imposes no detour for freight from southern NSW; there is for freight to/from the Sydney area and from the Lithgow area. Time and cost penalties are factored in to the cost benefit analysis.

## C.7 Rail network

### Issues

Rail capacity at either end of M-D should be considered too – a whole-of-supply chain approach.

> The feasibility study must examine the capacity of the proposed link from a whole-of-supply-chain point of view...[ including] the interaction with existing rail lines which the link will join, and interfaces between each element of the supply chain... (Source: Xstrata Coal)
>
> PKCT is contemplating an upgrade project that require certainty across the total supply chain capability... Continued need by NSW Western coalfield producers... to approach the inner Sydney rail network prior to being able to progress to the Maldon-Dombarton rail link will problematic... To deal with the Maldon-Dombarton rail link

in isolation from the "in-feed" and "out-feed" rail infrastructure might lead to an imperfect justice case. (Source: Port Kembla Coal Terminal)

### Comment

In this study wider network issues were analysed by Plateway. ARTC and RailCorp advise that capacity at the Sydney end is tight but will remain adequate. Upgrades have been proposed in a submission to Infrastructure Australia.

## C.8 Investment

### Issue

It is suggested that a Maldon-Dombarton line would stimulate regional development.

MACROC supports the completion of the Maldon Dombarton rail line believing that it would deliver the following regional benefits:

- increase Sydney and West Sydney's economic competitiveness
- improve freight transport efficiency
- assess the economic development of Port Kembla...
- provide support for potential employment and land development in Southwest Sydney... (Source: MacArthur Regional Organisation of Councils)

... the project has the potential to have many flow on benefits...[these] include attracting new business to the region -- or encouraging existing ones to expand -- driven by strong, faster and more reliable freight links... this, in turn, will support jobs growth.... (Source: Illawarra Business Chamber)

Walker Corporation [... owns a site of 107 ha of the Maldon-Dombarton and main and I intersection... the Precinct has the potential to supply industrial land to accommodate businesses which will

- both support, and benefit from, rail freight connections with Port Kembla and Sydney
- provide a point with freight could be transferred from rail to Hume Highway.

Creation of a Maldon industrial precinct will have economic benefits which should be factored into the feasibility study... (Source: Walker Corporation)

### Comment

The case near the northern end of a Maldon-Dombarton line would benefit. Port Kembla would benefit if the line allowed it to compete with Port Botany. In other areas the absence of a M-D line should not be an inhibition as alternative transport is available.

## C.9 An unnecessary project?

### Issue

Would a Maldon-Dombarton line be viable?

> Let the miners pay for the Rail. Mining is the most profitable industry and was going to be taxed accordingly. If it's unpopular to tax them make them pay for the rail infrastructure. Stick to this and we won't be wasting the community's money anymore on Rail white elephant projects. *(Source: Tony Kotevski)*

### Comment

The study concludes that existing lines can meet expected demand. If demand is significantly higher, and becomes greater than the combined capacity of the Illawarra line and an upgraded Moss Vale-Unanderra line, there could be a case for a Maldon-Dombarton line. There is a case for major customers contributing to the cost of rail capacity, through access charges and/or equity investment.

# D Membership of PSC and PRG

The study has been guided and informed by a Project Steering Committee chaired by the Department of Infrastructure and Transport, and a Project Reference Group whose members include many of the key stakeholders.

## D.1 Project Steering Committee

The PSC provided general oversight and guidance throughout the Study, though the Study does not necessarily represent the views of PSC members or the organisations they represent. Members of the Project Steering Committee include:

- Department of Infrastructure and Transport
- NSW Department of Transport
- Port Kembla Port Corporation
- Australian Rail Track Corporation

## D.2 Project Reference Group

A Project Reference Group (PRG) was established to provide input from, and engage with, key stakeholders. The findings of the final report do not necessarily reflect their views.

The Project Reference Group membership consisted of:

- Asciano Pty Ltd
- Australian Industry Group
- Illawarra Business Chamber
- Regional Development Australia
- South Coast Labour Council
- Wollondilly Shire Council
- Wollongong City Council
- Federal Member for Throsby
- Federal Member for Cunningham.

ACIL Tasman
Economics Policy Strategy

# E NSW Department of Transport Statement

NSW GOVERNMENT | Transport

Mr Richard Wood
General Manager – Rail and Intermodal
Nation Building – Infrastructure Investment
Department of Infrastructure and Transport
GPO 594
Canberra ACT 2601

Dear Mr Wood

Please find attached advice provided by RailCorp to The Department of Transport regarding the capacity of the Illawarra Rail Line to accommodate additional freight traffic.

This advice is provided in response to the request tabled at the Project Steering Committee for the Maldon-Dombarton Rail Line Feasibility Study and reflects the current capacity of the line.

This advice is provided using a reference day (Tuesday) and a reference point (Hurstville) as these points provide an appropriate indication of capacity.

It should be noted that the advice provided also refers to paths available in the "Down" direction (away from Central Station and toward Port Kembla) as this is the focus of comments and queries in regard to capacity.

You will note that the summary of the advice provided by RailCorp is that there are 6 additional paths available in the Down direction and that these paths present between 12am and 4am.

I trust this information is of assistance. Please contact me if you have any queries in relation to this advice.

Yours sincerely

Simon Hunter
**A/Director, Freight, Ports and Airport Strategy**
27/4/2011

COM/05275

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**Advice from RailCorp re pathing on the Illawarra line**

RailCorp analysis has identified 24 pathing opportunities for export coal trains (not including Wongawilli trains) as well as two coal trains for Bluescope domestic coal.

In addition the 7 flexible non coal paths (shown in table 1) may also be convertible to coal paths. However it needs to be noted that these paths and the six additional coal paths have not been tested for linear continuity past Enfield.

Our additional comments on timetabling capability on the Illawarra corridor:

- The significant differences in running performance between loaded freight trains and passenger services on Jannali and Loftus banks + tonnage signal operations south of Loftus.
- Mortdale Depot operations and other depot movements, which precede and follow the morning and evening commuter peak operations. These extend up to 3 hours either of the peaks. These movements also include various 'rail clean" runs early in the morning and late at night, which also constrain freight pathing.
- At Hurstville pathing is restricted by terminating or reversing services which almost entirely done on either of the Illawarra Local platform plus by departing southbound services conflicting with Up Illawarra services where the quad track becomes two tracks.
- At Sutherland the usual pattern for freight paths is that they must slot between Up Cronulla passenger services crossing from the branch to the Up Main as the freighter is approaching plus the freighter has to have sufficient headway for a following down passenger service through Sutherland to avoid delays.
- Waterfall terminating services at time block through access to freight and intercity services, which requires such services to be routed via the Refuges or in the case of freight services - require them to be held outside Waterfall before a through path becomes available.
- Wollongong local terminators and storage movements in and out of the yard or to and from Port Kembla for decanting affect through access significantly particularly early morning and late evenings as services wind up and wind down each day. In some instances both through lines are occupied at Wollongong by local services.
- The convergence of 3 lines at Coniston and Unanderra North Junctions, namely the Inner Harbour, Port Kembla Branches and the South Coast line through a combination of single and double track configurations add further challenges within the Illawarra Region of getting freight paths through.
- Single tracked Coalcliff Tunnel section is a constraint but in relation to the above 7 factors it is relatively minor largely because network traffic density is reduced in this area and the single track section is relatively short.

Table 1:

| Summary of Existing Down Loaded Paths (Tuesday reference day) | | |
|---|---|---|
| | | |
| Mandatory Export Coal [1] | 13 | |
| Flexible Export Coal [2] | 5 | |
| Ad hoc Export Coal | 6 | |
| **Total Export Coal** | | **24** |
| Mandatory Domestic Coal | | 2 |
| Mandatory Non-coal Freight | 8 | |
| Flexible non-coal Freight | 7 | |
| **Total Non-Coal Freight** | | **15** |
| **Total Paths** | | **41** |

[1] Includes mandatory Tahmoor (3) and Metropolitan Colliery (3)

**Table 2: Timing point - Hurstville**

| Timing Point Hurstville | Train Number | Frequency |
|---|---|---|
| 0000 – 0100 | --44 (0016) | Monday to Thursday |
| | -031C (0021) | Friday |
| | -027C (0038) | Tuesday, Wednesday & Friday |
| | 5930 (0036) | Thursday |
| | CB78 (0058) | Tuesday to Friday |
| | | |
| 0100 – 0200 | CB78 (0101) | Monday |
| | 1901 (0109) | Tuesday to Friday |
| | 1901 (0112) | Monday |
| | JW74 (0124) | Monday (Bluescope) |
| | BB88 (0130) | Monday |
| | JW74 (0150) | Tuesday to Friday (Bluescope) |
| | --46 (0156) | Monday |
| | | |
| 0200 – 0300 | 1929 (0214) | Monday |
| | 1931 (0214) | Tuesday to Friday |
| | BB88 (0236) | Tuesday to Thursday |
| | --52 (0246) | Monday |
| | BB88 (0246) | Friday |
| | | |
| 0300 – 0400 | 003C (0329) | Tuesday to Friday |
| | | |
| 0400 – 0500 | --02 (0401) | Monday |
| | --50 (0401) | Tuesday to Friday |
| | | |

| Timing Point Hurstville | Train Number | Frequency |
|---|---|---|
| 0400 – 0500 | 005C (0427) | Monday to Friday |
| 0500 – 0600 | --04 (0521) | Monday to Friday |
| 0600 – 0700 | | |
| 0700 – 0800 | | |
| 0800 – 0900 | | |
| 0900 – 1000 | | |
| 1000 – 1100 | 8938 (1020) | Monday and Thursday |
| | 5938 (1020) | Tuesday and Friday |
| 1100 – 1200 | 011C (1107) | Monday to Friday |
| | 015C (1131) | Monday to Friday |
| 1200 - 1300 | CB96 (1203) | Monday to Friday |
| | 1907 (1219) | Monday to Friday |
| | LS98 (1234) | Monday to Friday |
| 1300 – 1400 | 019C (1304) | Monday to Friday |
| 1400 – 1500 | CA64 (1402) | Monday to Friday |
| | 1933 (1431) | Monday to Friday |
| 1500 – 1600 | | |

| Timing Point Hurstville | Train Number | Frequency |
|---|---|---|
| 1600 - 1700 | | |
| | | |
| 1700 – 1800 | | |
| | | |
| 1800 – 1900 | | |
| | | |
| 1900 – 2000 | PW4 (1919) | Monday |
| | 018X (1919) | Tuesday |
| | XW4 (1919) | Wednesday & Thursday |
| | 024M (1919) | Friday |
| | | |
| 2000 – 2100 | --20 (2021) | Monday to Friday |
| | BB74 (2032) | Monday to Friday |
| | 8934 (2059) | Monday to Friday |
| | | |
| 2100 – 2200 | CA70 (2153) | Monday to Friday |
| | | |
| 2200 – 2300 | 025C (2220) | Monday |
| | BW4 (2220) | Tuesday to Friday |
| | 1937 (2252) | Monday, Wednesday & Friday |
| | 1935 (2252) | Tuesday |
| | 5930 (2252) | Thursday |
| | | |
| 2300 – 2400 | JW62 (2317) | Monday to Friday (Bluescope) |
| | --44 (2356) | Friday |
| | 5930 (2353) | Wednesday |
| | | |

ACIL Tasman
Economics Policy Strategy

# F Australian Rail Track Corporation Statement

ARTC

## Unanderra – Moss Vale Capacity Analysis

**Executive Summary**

Port Kembla Port Corporation has identified a range of potential future bulk export and import container traffics that may use the port as their export or import gateway.

A critical issue for the feasibility of these traffics is the ability to secure rail capacity. In response, and following local community requests, the Australian Government has commissioned an economic feasibility study of the Maldon – Dombarton railway. This line was partly constructed in the early 1980's but was cancelled in 1988. It would provide an alternative route from Sydney to Port Kembla.

Critical to the conclusions of the Maldon – Dombarton study is an assessment of the ability of the ARTC line between Moss Vale and Unanderra to accommodate any overflow volume that is unable to secure path capacity on the RailCorp Illawarra line, as well as growth in volume that would choose the Moss Vale – Unanderra as its natural route to the port.

The Unanderra – Moss Vale line consists of a 53.3 km single track section from Moss Vale to Dombarton, and an 8.3 km double track section from Dombarton to the interface with the RailCorp network at Unanderra. It has four existing short loops: Calwella (670m), Robertson (669m), Mt Murray (764m), and Summit Tank (712m) that break up the single line section into roughly four equal parts.

A key feature of the Unanderra – Moss Vale line is the long continuous 1 in 30 descent between Summit Tank and Unanderra. It also features extensive curvature of 200 m radius, particularly on the descent from Summit Tank to Unanderra. Downhill trains are limited to 25 km/h on this section due to braking issues.

Current 'typical' operations add to 37 trains per week each way, or an average of 5.3 per day. This is primarily coal, limestone and grain, with a small amount of ore, flour and a heritage passenger operation.

The current timetable provides for 86 paths per week in each direction. 58 of these are allocated to specific traffics but 'typically' only 37 are used, leaving 49 available. Over the past 18 months, actual average path utilisation has in fact been 29 per week, leaving 57 paths per week available in practice.

At this time all of the potential volume growth remains uncertain. This discussion therefore looks at potential options for enhancement of the Unanderra – Moss Vale line from a generic perspective. Summit Tank – Unanderra is the capacity limiting section. Accordingly, the main focus of this analysis is on that section.

With the current configuration, capacity is limited to 14.6 paths (in each direction) per day. Current trains consume an average of 5.3 paths per day, leaving 9.3 paths available for new traffic. For an operationally intense bulk traffic like coal or iron ore it is prudent to assume that only 75% of these available paths are able to be utilised over the course of a year, giving an average 7 spare paths per day.

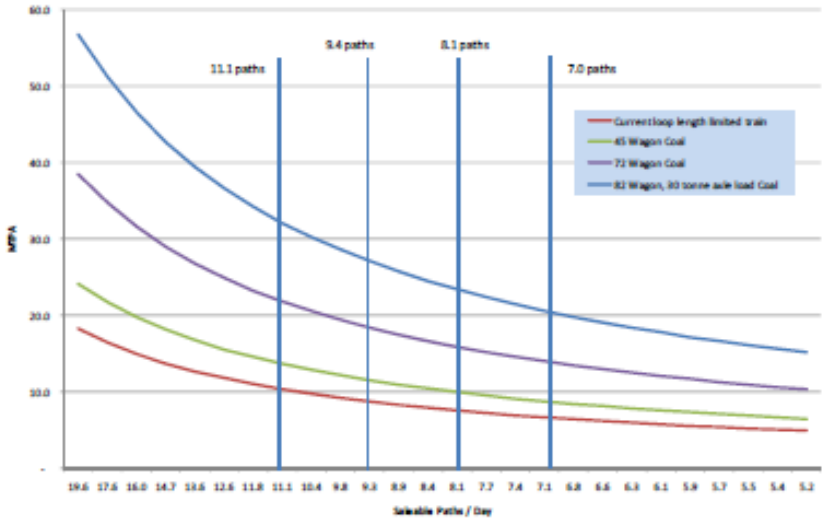
Options to increase capacity on the Summit Tank – Dombarton section are:

- Summit Tank loop could be extended 1.2 km toward Dombarton giving 8.1 spare paths.
- Summit Tank loop could be extended down the hill to approximately the 103.4 km point. Due to operational issues arising from the steep gradient this is a relatively inefficient solution, but increases spare paths to 9.4.

- Full double track between Summit Tank and Dombarton would be complex and expensive, but would increase spare paths to 32.9.
- There is an option to introduce AC traction locomotives and ECP braked wagons, which due to their superior braking capability may not need to be limited to 25 km/h. Combined with the extended Summit Tank loop option this would give 11.4 saleable paths.

Figure A below shows potential capacity (mtpa) given numbers of potentially available paths and options for train sizes that might take advantage of these paths.

**Figure 5 : Capacity (mtpa) for Illustrative Trains**




The available capacity ranges between 6.5 mtpa and 75.8 mtpa.

Capital costs for the required infrastructure enhancement, including complimentary investments in the four existing loops to match the required train lengths, are estimated (order of magnitude only) at:

- $20 m to get to 8.6 mtpa.
- A further $53 m to achieve 13.8 mtpa. A 1350 m loop near the port to break-up the longer train used in this scenario train may also be required, which could have a cost in the order of $50 m.
- 15.9 mtpa requires a further investment in the order of $15 m.
- An additional $50 m to achieve 18.5 mtpa.
- An estimate of the cost of full double tracking has not been attempted, while options using AC traction locomotives and ECP braked trains have only a rollingstock cost.

At this point in time the requirement for enhancement of the Unanderra – Moss Vale line is only speculative.

The best way to enhance the line will depend on the specific task and optimisation of the logistics strategy for that task. Accordingly, an investment program can only be developed in the context of a firm proposal from a customer.

ARTC will work with potential customers and their rail operators to develop an optimised solution and, subject to satisfactory commercial arrangements, will undertake the investment necessary to ensure that the capacity is made available if required.

## Introduction

Port Kembla Port Corporation has identified a range of potential future traffics that may use the port as their export or import gateway. These essentially fall into two categories: bulk exports and import containers. The bulk exports are largely dependent on demand and mine feasibility, while the potential for large volumes of import containers is dependent on decisions around the future development of Port Botany, in particular its landside linkages.

In response to these future potential traffics, plans for enhancement of the port have been developed. The two key enhancements are the redevelopment of the Outer Harbour, and the expansion of the privately owned coal loader.

A critical issue for both the feasibility of the bulk export projects, and the port expansions, is the ability to secure rail capacity. Specifically, a condition of consent for the outer harbour expansion is that 90% of container traffic generated be carried by rail. Likewise, most bulk export traffics have rail haulage as a condition of consent, though road haulage is generally an uneconomic option anyway, other than for those mines in relatively close proximity to the port[1].

In response to these port issues and local community requests, the Australian Government has commissioned an economic feasibility study of the Maldon – Dombarton railway. This line was partly constructed in the early 1980's but was cancelled in 1988. It would provide an alternative route from Sydney to Port Kembla by connecting ARTC's Sydney – Melbourne line at Maldon (near Picton) to its Unanderra – Moss Vale line at Dombarton (half-way up the escarpment) via a relatively direct route. Although a substantial amount of formation was completed along with some structures, only around 15% of the total scope of work by value is already in place.

From the work done on the Maldon – Dombarton study, there are only two current or potential traffics for which the proposed line would be materially more efficient than current options: Tahmoor coal, and containers to / from south-western Sydney. For coal from the western coalfield around Lithgow, the RailCorp Illawarra line is slightly shorter, though with current operating constraints it does impose material levels of both planned and random delay. For traffic from the south (primarily grain and limestone), the Unanderra – Moss Vale line is more direct and efficient. Maldon – Dombarton may also be a viable route for coal mined in the Appin area, but this is currently road hauled and BHPB has indicated that it would not be economic to shift to rail[2].

Given the high cost of completion of the Maldon – Dombarton line ($605 m at a P50 estimate in $2010), an economic case for the line only arises if there is a material growth in volume and a consequent shortfall in capacity on the natural routes for that increased volume. This is most likely to occur on the Illawarra line, where there is some foreseeable demand growth, few remaining spare paths, and no cost-effective options for capacity enhancement. In this scenario, the options become the diversion of overflow traffic to the Unanderra – Moss Vale line, or the construction of Maldon – Dombarton.

While diverting overflow traffic to the Unanderra – Moss Vale line imposes material additional operating costs and would require the recovery of capital spent on capacity enhancements, under most scenarios this is likely to represent a lower total cost solution than meeting the significant capital costs of completing Maldon – Dombarton. Maldon – Dombarton would only be economically justified where volumes were large, which allows the capital cost to be amortised over a significant traffic base, and in which case the capital cost of enhancing Unanderra – Moss Vale would also become significant.

[1] In the case of Port Kembla there is a significant amount of coal already road hauled to the port from mines in the immediate vicinity.
[2] BHP Billiton Illawarra Coal submission to the Maldon – Dombarton Feasibility Study, page 2.

There is also potential for a number of new minerals traffics to be developed that would access Port Kembla from the south and for which the Unanderra – Moss Vale line is the natural route. In the first instance it is expected that these would be accommodated by enhancement of the Unanderra – Moss Vale line, though the high end potential volumes may exhaust the cost-effective enhancement options, in which case Maldon – Dombarton may be a desirable solution.

**The Unanderra – Moss Vale Line**

The Unanderra – Moss Vale line consists of a 53.3 km single track section from Moss Vale to Dombarton, and an 8.3 km double track section from Dombarton to the interface with the RailCorp network at Unanderra.

The connection to the Sydney – Melbourne mainline at Moss Vale is by way of a triangle junction, allowing access from both north and south, while the connection at Unanderra is a single junction facing north. Trains heading to Port Kembla share the RailCorp network for 3.2 km before diverging onto the double track North Fork which provides direct access to the coal, grain and general purpose facilities at Inner Harbour by way of a flyover across the RailCorp Port Kembla branch, or they take the single track triangle junction that connects to the Port Kembla branch and provides access to the OneSteel facilities and Outer Harbour.

The single line section between Dombarton and Moss Vale has four existing short loops: Calwella (670m), Robertson (669m), Mt Murray (764m), and Summit Tank (712m). The four loops break up the single line section into roughly four equal parts.

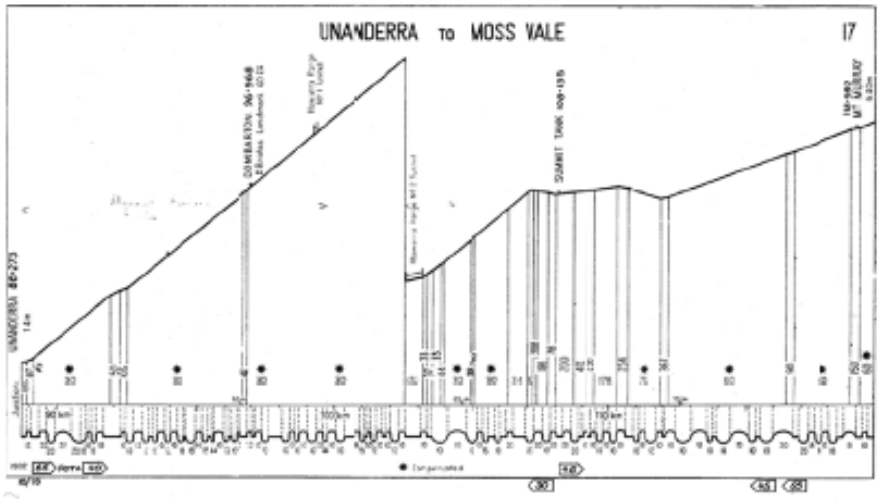
Figure 1 shows an overview of the track (with the single-track line in green and double-track / loops in red).

Figure 1: Google Earth view of the corridor.

A key feature of the Unanderra – Moss Vale line is the long continuous 1 in 30 descent between Summit Tank and Unanderra. Figure 2 shows this gradient. It is not good practice to stop trains on a gradient this steep as a normal operating procedure and accordingly there are no loops currently located on this section. Construction of loops on this section is not considered an acceptable option for future capacity enhancement. This section is therefore the capacity limiting section for the corridor.

The Unanderra – Moss Vale line also features extensive curvature of 200 m radius, particularly on the descent from Summit Tank to Unanderra.

Figure 2: Curve and gradient diagram: Unanderra to Mt Murray




**Demand**

*Current Demand*

As at early 2011 the following services typically operate on the Unanderra – Moss Vale line:

- Coal – (Mon-Fri) 2 per day each way, (Sat and Sun) 1 per day each way
- Grain – (7 days) – seasonal, up to 2 per day each way
- Limestone (7 days) – 1 per day each way
- Flour (Tues) – 1 per week each way
- Ore (Mon/Wed/Fri) – 3 per week each way

This adds to 37 trains per week each way, or an average of 5.3 per day.

There is also a heritage passenger service scheduled for three services per week each way, but it has only operated approximately once per fortnight over the past 18 months and has not been included as a regular operation.

In practice, there has been an average of 1.3 grain trains per day over the last 18 months, while the limestone service has had around 9% of its services cancelled. For current volumes Tahmoor coal requires an average of 9 paths per week on average across a year against the nominal 12 above.

The current timetable (May 2011) provides for the following paths over a one week period:

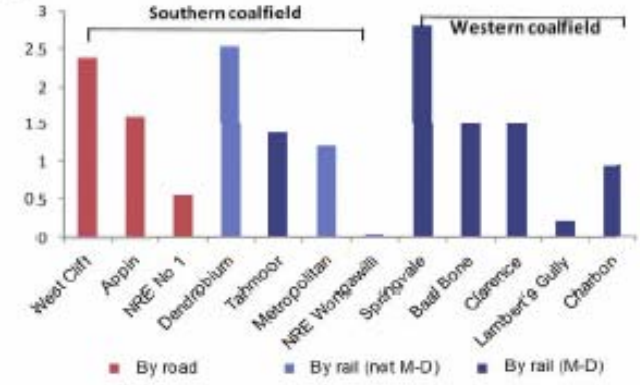
- Coal – 26
- Grain – 22
- Limestone – 7
- Heritage passenger – 3
- Spare – 28

This is a total of 86 paths. 58 of these are allocated to specific traffics but 'typically' only 37 are used, leaving 49 available. Over the past 18 months, actual average path utilisation has in fact been 29 per week, leaving 57 paths per week available in practice.

During a RailCorp Illawarra possession, 4 additional coal services operate each way from the Western mines. During a RailCorp south-western possession, intermodal and some general freight trains operate to and from Sydney via the Illawarra. Each of these possessions occurs four times per year.

As already noted, important to the Unanderra – Moss Vale line is the coal currently using the Illawarra line. The following graph shows coal exported through Port Kembla in 2009 by mine. Note that the Tahmoor mine uses the ARTC network between Tahmoor and Port Kembla via Moss Vale while Dendrobium, Metropolitan and NRE Wongawilli use the Illawarra line and privately owned track around Wollongong. The western coalfield volume all uses the Illawarra line.

Figure 3 – 2009 Coal Volumes




*Prospective Demand*

There are a number of mining projects for which the natural path to port would be via the Unanderra – Moss Vale line. All of these are, at this stage, highly speculative and a considerable number of years into the future. The projects are:

- Eastern Iron - iron ore from the Cobar region (speculatively a 3 mtpa order of magnitude)
- Tahmoor coal - prefeasibility study underway on increasing output from 2 mtpa to 7 mtpa.
- Standard Iron - iron ore from the Lockhart (Wagga Wagga) region (20 mtpa order of magnitude)
- Cockatoo Coal - Sutton Forrest / Hume coal projects (speculatively 3 mtpa order of magnitude)

In addition, it has been suggested that the Coalworks Oaklands project could export via Port Kembla. It would potentially be operationally advantageous for this coal to be exported from a Victorian portif suitable port facilities were available. This project also has a strong emphasis on coal gasification rather than export and it is not possible to speculate on an export coal volume at this time.

Of more immediate relevance is potential overflow from the Illawarra line.

Current forecasts are for western coal to increase over the next five years from 6.7 mtpa to 11.7 mtpa in 2015 before falling back to around 10 mtpa as older mines are exhausted. This is particularly driven by the new Airly mine and expansion at Springvale.

In addition, there are a number of non-coal projects that may seek paths on the Illawarra line in the next five years or sooner, including:

- 300,000 mtpa increase in copper concentrates.
- 600,000 mtpa of cement.
- 1.5 mtpa of sand (kaolin).
- 380,000 mtpa of biodiesel.
- 50,000 – 200,000 teu of import shipping containers (approximately 350,000 – 2,000,000 mtpa)

It is highly uncertain what impact these new and expanded traffics will have and how paths will be allocated. For instance, it is unlikely that the import container traffic would be able to tolerate the additional journey time and cost of operating via Moss Vale. There may well be pressure therefore for coal, which can sustain higher costs and longer journey times, to be diverted to the Moss Vale route to release paths for other traffics.

If all of these traffics were to eventuate, total path demand on the Illawarra line has been estimated by consultants for the Maldon – Dombarton study at 36 pairs in 2015[3]. It is understood that the Illawarra line has a total of approximately 31 available paths in the down (southbound) direction, resulting in up to 5 trains needing to be diverted to the Unanderra – Moss Vale line if all of the growth eventuated.

The Illawarra line has more capacity in the northbound than the southbound direction as most trains are empty and hence operating at well below the constraints of the ruling gradient. It is possible, and probably desirable, that diverted trains would only operate to Port Kembla via Moss Vale and the return journey would remain on the Illawarra line, significantly reducing the capacity demands on the Unanderra – Moss Vale line.

A high level analysis of the incremental cost of having to operate coal trains via Moss Vale rather than the Illawarra line suggests that the above-rail cost is in the order of $2 per tonne. There would also be a material increase in track access charges, but as RailCorp charges are confidential it is not possible for ARTC to assess a dollar value of this effect. The cost increase if trains operated via Moss Vale in only one direction is closer to $1 per tonne. While the cost increase is material, it is not sufficiently high to represent an insurmountable barrier to coal diverting to this route, particularly at current world market prices for coal[4].

**Capacity**

*Introduction*

At this time all of the potential volume growth remains uncertain. This discussion therefore looks at potential options for enhancement of the Unanderra – Moss Vale line from a generic perspective. As already noted, Summit Tank – Unanderra is the capacity limiting section. Accordingly, the main focus of this analysis is on that section. The Main South, being double track, is unlikely to present a capacity constraint, though some work may be required on overtaking facilities and signal headways depending on the detail of any volume growth that eventuates.

Typically ARTC uses capacity analysis at this strategic level as a conceptual guide to addressing capacity constraints. As more and better information becomes available on both

[3] Maldon – Dombarton Study, Rail Operations Working Paper, Plateway, Tables 16 and 18.
[4] This analysis was undertaken using ARTC internal train cost modelling tools. The analysis looked at six different train types from a 42 wagon, 25 tonne axle load train to a 63 wagon train at 30 tonne axle loads. Major costs that vary with route are fuel and locomotive maintenance. Fuel price was assumed to be $1.30 per litre and the fuel consumption rate a combination of a fixed consumption of 1.6 litres per locomotive kilometre and variable of 3.2 litres per '000 trailing tonne kilometres. Locomotive types were a mixture of older 82 class, and new AC traction TT class, with the 82 assumed to have a maintenance cost per kilometre of $1.15 and the TT class $0.90.

the operating and construction environments, enhancement solutions are refined to optimise them for the specific task. The proposals and conclusions in this analysis should therefore be taken as a snapshot of the best thinking on options at this time.

*Section Running Times*

Section running times are fundamental to the calculation of capacity. Benchmark section running times appear in the Train Operating Conditions (TOC) manual[5] and are often used for strategic analysis as well as train planning purposes. However, as these times are based on past experience they are often insufficient for forward looking analysis which may involve loops at different locations or different standard train consists.

The alternative is simulation using train dynamic simulation software, which gives greater scope for testing alternative solutions. There is usually a good correlation between TOC and simulated times for the same infrastructure / train consist scenario. However, in analysing the Unanderra – Moss Vale line it is apparent that this is not the case.

Pacific National encountered this issue in work undertaken in 2003 and as a result undertook a more detailed investigation into actual train running times. The following table compares the TOC times for the capacity limiting Summit Tank – Dombarton section to PN and ARTC simulated times, and to the actual results PN observed.

| | Up | Down | Average |
|---|---|---|---|
| TOC | 36 | 34 | 35 |
| PN "Actual" Average | 33 | 21 | 27 |
| PN "Actual" Fastest | 30 | 21 | 26 |
| PN Simulated | 29 | 24 | 27 |
| ARTC Simulated | 27 | 18 | 23 |

. For the purposes of the analysis in this document the PN actual average section running times have been adopted. Where forward looking analysis is required, ARTC simulations have been used, but with a pro rata adjustment to calibrate them to the PN observed actual transit times.

The major limiting factor for the Unanderra – Moss Vale line is the operating requirement that trains do not exceed 25 km/h on the downhill journey from Summit Tank to Dombarton. This requirement is adopted to minimise the risk of a driver losing control of the train braking on this very steeply graded section.

Advances in train technology mean that this restriction may be able to be eased for suitably equipped trains. Specifically, AC traction locomotives, and wagons sets equipped with electronically controlled pneumatic (ECP) braking, are able to provide better train handling. Analysis undertaken by independent consultants on the Maldon – Dombarton study has suggested that AC traction locomotives with ECP wagon sets could operate safely at 45 km/h on a 1 in 30 grade[6]. This would need to be carefully reviewed and trialled before a decision was taken to allow such an easing of the speed restriction. However, simulation suggests that this practice would reduce the section running time in the downhill direction from 33 minutes to 19 minutes. This would reduce the average section running time from 27 minutes to 20 minutes.

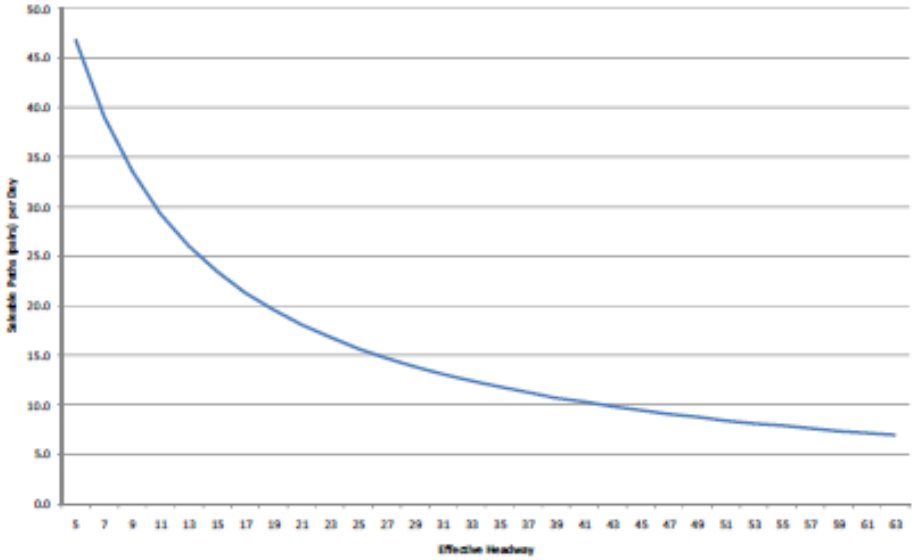
[5] Available at http://www.artc.com.au/library/TOC%20Manual_Illawarra%20Section%20Pages.pdf
[6] Maldon – Dombarton Study, Rail Operations Working Paper, Flatway, page 7.

*Path Capacity*

ARTC has a well established methodology for determining track capacity and identifying options for capacity enhancement. This methodology has been the basis for planning in the Hunter Valley for the past six years and has been adopted for the following analysis.

In its simplest form, capacity in terms of train paths has a straightforward relationship with headways (ie, the running time between loops). This is illustrated in figure 4.

**Figure 4 : Headway versus Saleable Paths**




This relationship takes into account the practical utilisation rate of single line track but does not make an allowance for maintenance downtime, or peaks and troughs in demand.

Note that this relationship only holds where train characteristics (and hence running times), and loop lengths, are homogeneous and there are no significant junction conflicts. More complex analysis is required if any of these conditions do not hold true.

*Summit Tank – Dombarton Capacity Enhancement Options*

Running times on the Summit Tank – Dombarton section as determined by PN analysis of actual transit times, the current average allocated paths per day, and consequential spare paths per day, are shown in Table 1. The table also shows the incremental increase in path numbers achieved from three enhancements between Summit Tank and Dombarton which are discussed further below, together with an ECP-braked train option.

Table 1

| | Start km | End km | Distance | Down Time | Up Time | Average | Practical paths | Current Allocated Paths | Spare Paths | Saleable Paths (75% of spare paths) |
|---|---|---|---|---|---|---|---|---|---|---|
| Summit Tank to Dombarton | 108.0 | 97.0 | 11.0 | 21.0 | 33.0 | 27.0 | 14.6 | 5.3 | 9.3 | 7.0 |
| Extended Summit Tank to Dombarton | 106.8 | 97.0 | 9.8 | 18.0 | 29.3 | 24.1 | 16.1 | 5.3 | 10.8 | 8.1 |
| 103.4 km to Dombarton | 103.4 | 97.0 | 6.4 | 13.2 | 29.3 | 21.3 | 17.8 | 5.3 | 12.5 | 9.4 |
| Full double track | 97.0 | 97.0 | - | n/a | 29.2 | n/a | 48.1 | 5.3 | 43.9 | 32.9 |
| Extended Summit Tank to Dombarton with ECP | 106.8 | 97.0 | 9.8 | 18.0 | 16.8 | 17.9 | 20.5 | 5.3 | 15.2 | 11.4 |

With the current configuration, capacity is limited to 14.6 paths (in each direction) per day.

Current trains consume an average of 5.3 paths per day, leaving 9.3 paths available for new traffic. For an operationally intense bulk traffic like coal or iron ore it is prudent to assume that only 75% of these available paths are able to be utilised over the course of a year, giving an average 7 spare paths per day. Note that the 37 paths treated as 'currently allocated' have not been adjusted to reflect the 75% saleable factor. As already noted, actual average utilisation over the year is only 29, which is equivalent to 78% utilisation of these 'allocated' paths.

Summit Tank loop could be extended 1.2 km toward Dombarton (to approximately the 106.8 km point) before the steep descent becomes an issue. This creates a longer loop than is strictly necessary but would reduce the average Summit Tank – Dombarton section time to 24.1 minutes. This would increase the number of spare paths to 8.1.

A further enhancement would be to extend the Summit Tank loop down the hill to approximately the 103.4 km point. This is the last tie in point before the Illawarra Range No 2 Tunnel. While this creates capacity benefit, it is relatively inefficient as safeworking rules would prevent a loaded train from leaving Summit Tank until the empty train was fully onto the double track. This investment would reduce the average section time to 21.3 minutes and increase the number of spare paths to 9.4.

The final infrastructure enhancement option analysed is to double track in whole or in part between 103.4 km and Dombarton. This would be a complex and expensive engineering task, especially if the tunnels were duplicated, but there is no prima facie reason that it is impractical. For full double-track the capacity is determined by the following headway, which in this case would be the Extended Summit Tank to Dombarton section time given that operating rules would preclude two trains being on the downgrade simultaneously. In this case the capacity is simply the number of paths that can be accommodated at the following headway over a 24 hour period, of which 75% would be saleable. This equates to 32.9 paths.

Although not analysed, an intermediate step to full double track, or an alternative to extending down the hill to the 103.4 km point, would be to extend the second track from Dombarton up the escarpment. Uphill trains are already required to start from a 1 in 30 gradient at Dombarton, so this does not represent an additional operating challenge and extension from the bottom of the hill avoids the operating problem that downhill trains can't leave Summit Tank until uphill trains are clear of the turnout point. However, the line is on the side of the escarpment at this point and this would represent the most challenging option from an engineering perspective.

As already noted, the option of going to AC traction and ECP braked wagon sets could significantly reduce the running time in the downhill direction. Using the Extended Summit Tank option as an example, this reduces the average section running time to 17.9 minutes and gives 11.4 saleable paths. However, this probably overstates the benefit of this option as it would only be achieved if all trains were ECP braked.

*Moss Vale – Summit Tank Capacity Enhancement Options*

The run times and consequent spare capacity for the sections between Moss Vale and Summit Tank are shown in table 2.

Table 2

| | Start km | End km | Distance | Down Time | Up Time | Average | Practical paths | Current Allocated Paths | Spare Paths | Saleable Paths |
|---|---|---|---|---|---|---|---|---|---|---|
| Moss Vale to Calwella | 150.1 | 139.7 | 10.4 | 10.0 | 12.0 | 11.0 | 28.3 | 5.3 | 24.0 | 18.0 |
| Calwella to Robertson | 139.0 | 128.4 | 10.6 | 11.0 | 13.0 | 11.5 | 28.4 | 5.3 | 23.1 | 17.3 |
| Robertson to Mt Murray | 127.7 | 119.4 | 8.3 | 14.0 | 16.0 | 15.0 | 23.4 | 5.3 | 18.1 | 13.6 |
| Mt Murray to Summit Tank | 118.6 | 108.9 | 9.7 | 15.0 | 17.0 | 16.0 | 22.3 | 5.3 | 17.0 | 12.8 |

Each of the sections provides sufficient capacity to match the maximum available on Summit Tank – Dombarton except under the full double-track option. Accordingly, enhancement of this section would be primarily directed at accommodating train length increases, as discussed below.

*Train Length / Axle Load*

The shortest loop on the line, Robertson, is 669 metres and for the line to operate at its full capacity in train path terms would require limiting all trains to this length.

In practice, trains operate to a variety of lengths, including longer than 669 metres. This reduces crossing options and decreases train path capacity, but given the current adequate spare capacity this is not a major issue. Tahmoor coal trains currently operate at 805 metres. When Superfreighters are diverted over the line during RailCorp possessions they are permitted to operate at up to 1,500 metres.

One meahcnism to increase capacity is through the operation of longer trains. In the Hunter Valley for instance, train sizes to the Gunnedah basin have been increased from 42 wagons to 72 wagons and trials are underway on 82 wagon trains (using AC traction and ECP braking). To optimise the outcome requires loop extensions aligned to the train length increases, and suitable infrastructure for the longer trains needs to be provided across the origin – destination route. An increase in train length from the current 45 wagon coal train to an approximately 1300 metre, 82 wagon train would enable a susbtantial increase in tonnage capacity.

It should be noted though that before a significantly longer and heavier train was permitted to operate it would be necessary to undertake computer simulation and trials to validate feasibility. While Superfreighters up to 1500 m already use the line, safe operation is a function of trailing weight as well as length.

A further enhancement to capacity that can be applied under any loop extension scenario would be to go to 30 tonne axle loads. This would increase capacity by approximately 27% compared to current 25 tonne axle load limits given a typical coal wagon tare weight. However, it is obviously necessary to go to 30 tonne axle loads across the whole origin – destination route and whether this is feasible would require an analysis of the specific circumstances of the proposal. Bridge load limits and train operating / braking performance are critical issues as well as general track structure.

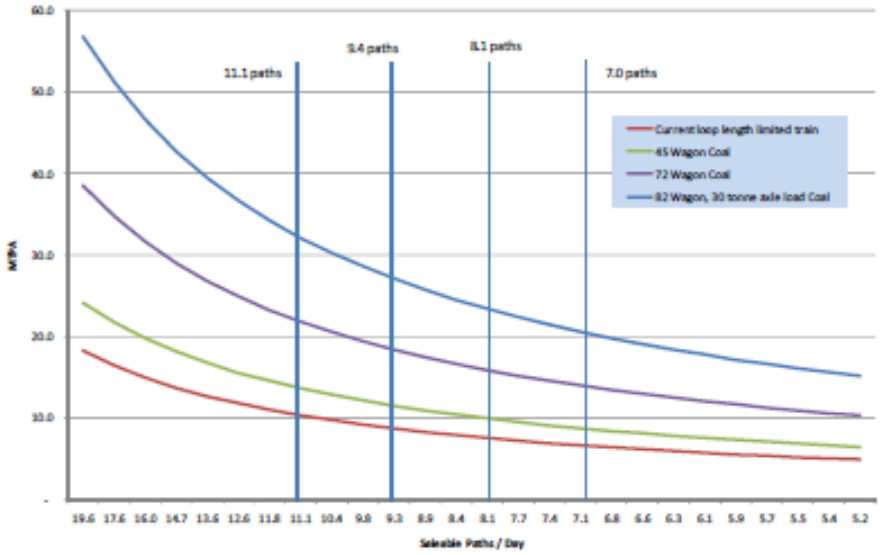
*Tonnes Capacity*

Capacity in tonnage terms can be directly determined by multiplying the daily number of path pairs by the average train net weight and multiplying by 365. (Note that it is not practical to

operate 365 days per year, but the factors used in calculating saleable train paths per day include an adjustment for maintenance and other disruptions.)

Figure 5 converts saleable paths to capacity in million net tonnes per annum.

**Figure 5 : Capacity (mtpa) for Illustrative Trains**




Key points from this analysis are:

- There is extensive opportunity to incrementally enhance the Unanderra – Moss Vale line to accommodate additional volume.
- As already noted, the current standard coal train is 805 m long, which exceeds the length of all of the loops. To optimize capacity requires a train no longer than 669 metres. Such a train can carry 2552 net tonnes (red line in figure 5), giving a spare capacity of 6.5 mtpa.
- If all loops were extended to accommodate the current standard 45 x 100 tonne wagon coal train (green line in figure 5), this gives spare capacity of 8.6 mtpa. This involves approximately 600 metres of loop extensions in total.
- To optimise capacity it would be desirable to go to something like the 72 x 100 tonne wagon trains (purple line in figure 5) now used to the Gunnedah basin (with distributed power and assuming that they are split into two sections for dumping). This configuration would require an extra 500 metres of loop extension per loop plus a 1350 metre loop near the port, or 3.35 km of new construction in total. It would give spare capacity of 13.8 mtpa (plus any capacity increment from extending existing trains).
- Construction of the extended Summit Tank (8.1 paths) and assuming the 72 wagon train (purple line) would increase spare capacity to an estimated 15.9 mtpa.
- Further extension to the 103.4 km point (9.4 paths) and assuming a 72 wagon train (purple line) gives estimated spare capacity of 18.5 mtpa.

- The extended Summit Tank with an AC traction / ECP braked 82 wagon train (11.1 paths) would give estimated 26.2 mtpa, while increasing the axle load to 30 tonnes (blue line in figure 5) under this scenario would give estimated 33.0 mtpa.

- Full double track would lift estimated capacity to around 75.8 mtpa assuming the 82 wagon train, at 25 tonne axle loads.

*Capacity Enhancement Costs*

To assist in assessing the merits of alternative enhancement options it is useful to have an understanding of order-of-magnitude costs. The following discussion provides cost estimates for a number of enhancement solutions. It is important to emphasise though that these costs are based on recent experience with similar scale Hunter Valley projects. Until site specific design and analysis is undertaken cost remain highly uncertain and the following estimates should be treated as indicative only.

To extend all loops to accommodate a standard coal train to get to 8.6 mtpa would cost around $20 m ($5 m per loop, total extension of 600 m).

To extend all loops to 1350 metres to achieve 13.8 mtpa would cost $53 m in total. This assumes a generic cost of $12 m per loop extension, plus $5 m for a road bridge at Robertson. By moving straight to this length (without going to 850 m first) there would be significant economies. It would cost around $14 m per loop (plus the bridge) for $61 m. A 1350 m loop near the port to break-up the train may also be required depending on how operations into the port were managed. Options for such a holding loop are limited and a solution could have a cost in the order of $50 m.

15.9 mtpa requires a relatively straightforward extension of Summit Tank loop approximately 1.2 km. It would cost in the order of $15 m.

18.5 mtpa requires a challenging bit of work through some major cuttings with poor access. It is 4.4 km. Cost would be in the order of $50 m.

Complete double-track would be a large and complex project including significant tunnelling and no attempt has been made to estimate costs for this scope.

*Capacity Enhancement Timeframes*

Current experience with Hunter Valley projects is that the timeframe for construction of a simple project is around 2.5 years if it involves a Part 3a planning approval. Actual on-site construction time is only around 6 months with the balance being taken up by design and environmental approvals. The environmental approvals stage involves particular uncertainty with the exact requirements, and hence timeframe, uncertain until initial environmental investigations are undertaken. Construction time generally increases commensurate with the complexity of the works and the project to extend Summit Tank loop 4.4 km could involve around 2 years construction time following environmental approval.

Projects of less than $30 million which have no significant environmental impacts may qualify for a less extensive environmental review process in which case the design and environmental assessment phase can be reduced to around six months.

Given these timeframe it would be desirable to have a reasonable period of notice of any major new traffic to allow adequate time for projects to be completed, though for the initial enhancements a timeframe of 12 to 18 months notice is likely to be adequate.

## Conclusion

At this point in time the requirement for enhancement of the Unanderra – Moss Vale line is only speculative.

The best way to enhance the line will depend on the specific task and optimisation of the logistics strategy for that task. Accordingly, an investment program can only be developed in the context of a firm proposal from a customer.

ARTC will work with potential customers and their rail operators to develop an optimised solution and, subject to satisfactory commercial arrangements, will undertake the investment necessary to ensure that the capacity is made available if required.