Hunter Valley
Corridor Capacity Improvement Strategy

ARTC's 5-year plan for the development of the Hunter Valley rail corridor

Version 3.2
April 2005

Executive Summary

Introduction

On 5 September 2004, the Australian Rail Track Corporation (ARTC) commenced a 60 year lease of the NSW interstate and Hunter Valley rail lines. ARTC previously controlled the interstate rail network within the area bounded by Albury on the NSW / Victoria border, Kalgoorlie in Western Australia and Broken Hill in western NSW. The commencement of the NSW lease consolidated control of the majority of the interstate rail network under ARTC

In 2002, ARTC developed a detailed infrastructure investment program for the NSW network in the context of the lease proposal to NSW. This investment program was worth $872 million including complementary investment on the Melbourne – Albury corridor.

It is now 3 years since ARTC's NSW investment program was developed and it needed to be reviewed and revised in light of subsequent developments, in particular the rapid growth in coal demand in the last 2 years.

This report sets out the position in regard to planning enhancement of capacity on the Hunter Valley coal network.

Current Position

At present the rail system into the Newcastle Ports has an annual capacity of around 85 million tonnes per annum (mtpa), with a surge capacity of around 10 % higher sustainable over a period of some weeks. Forecasts indicate that demand of 125 mtpa is anticipated in 2007 with a further potential rise to around 138 mtpa by 2009.

Rail capacity on the Hunter Valley network is uneven. The bulk of the coal traffic runs on the line between Whittingham (near Singleton) and the ports. North of Whittingham the coal tonnage progressively reduces as various mines and loaders are passed. The section between Whittingham and the ports has been the main focus in the plan for enhanced capacity, with other sections being attended to as appropriate to their task.

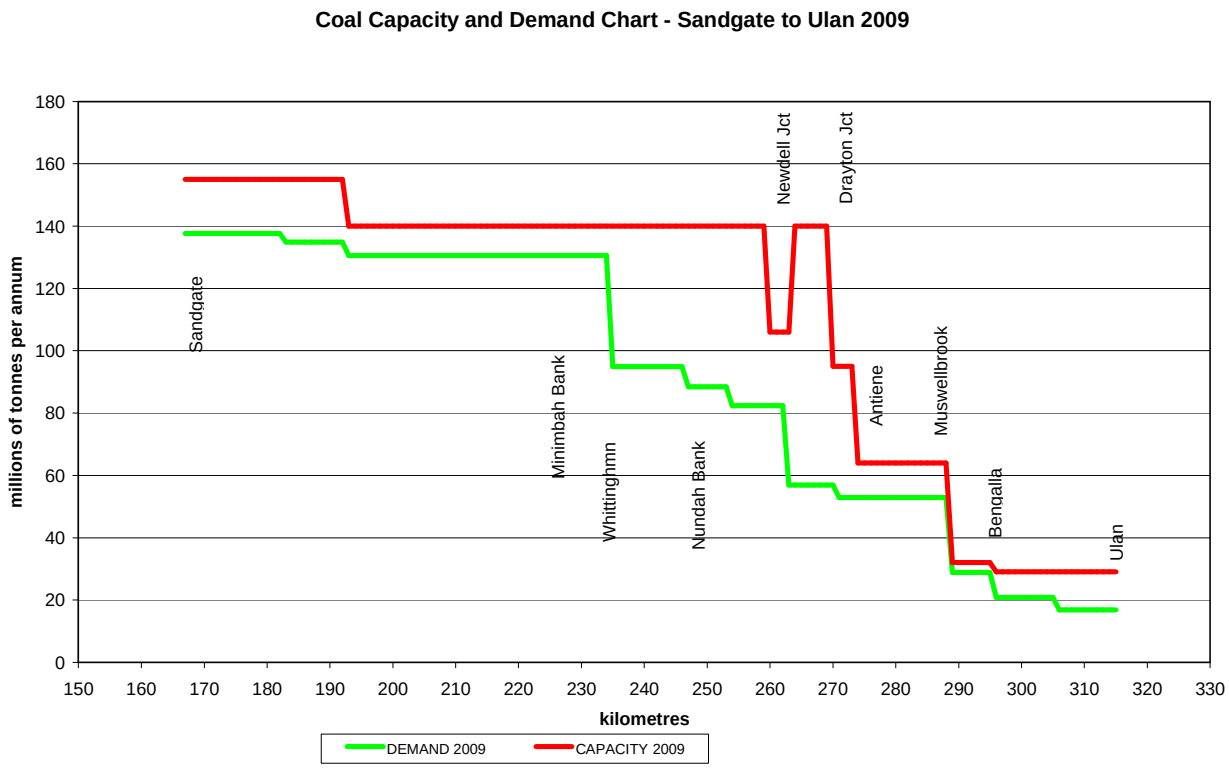
Approach

The strategy ARTC is adopting is to address existing capacity bottlenecks in the short-term and to then ensure that Hunter Valley capacity is delivered ahead of likely demand.

The basic approach has been to develop an ability throughout the length of the lower Hunter Valley to run trains at no more than 10 minute headways. In fact, detailed analysis indicates that only two sections, Minimbah Bank near Whittingham and Nundah Bank north of Singleton, currently have coal train headways in excess of 10 minutes. ARTC is proposing to raise capacity at Minimbah, initially by raising approach speeds to 80 km/h, and then by reconfiguration of the signaling to respond to the headway issue. Similar treatment is proposed for Nundah Bank

Throughout the plan there is a concept of harmonisation – making the various parts of the network compatible with demand and compatible between themselves. In this context the 10 minute headway is carried right up the lower Hunter Valley even where the demand is significantly lower than that nearer the ports. By this means it is planned to have a consistent capacity of around 140 mtpa from Drayton Junction to the ports, with subsequent extension back to the junction at Muswellbrook as that section is duplicated.

The volume that these projects are expected to deliver against anticipated demand in 2009 can be shown graphically as follows:



Focussing on the highest volume section, between Whittingham and the ports, the proposed projects have a capacity timeline as follows:

Project	Time	Project Capacity (mtpa)		Route Capacity (mtpa)	Demand (mtpa)
		from	to		
Existing	April 2005			85	85
Minimbah 80 km/h	December 2005	85	102	90	90
Sandgate Grade Separation	July 2006	90	155	102	100
Re-signal Minimbah	September 2006	102	140	115	100
Whittingham flyover	March 2007	115	140	135	115
Bi-di signalling Maitland –Branxton (a)	March 2008	135	140	140	130

NOTE (a): The bi-di signalling will have a relative effect on top of whatever capacity exists on the route.

Conclusion

In summary, once Sandgate grade separation is completed, the planned enhancement program will progressively move ahead of the anticipated demand through to 2009.

Introduction

NSW Lease

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In 2002, ARTC developed a detailed infrastructure investment program for the NSW network in the context of the lease proposal to NSW. This investment program was worth $872 million including complementary investment on the Melbourne – Albury corridor.

It is now 3 years since ARTC's NSW investment program was developed and it needed to be reviewed and revised in light of subsequent developments, in particular the rapid growth in coal demand in the last 2 years.

This study is designed to identify the constraints to higher coal capacity on rail in the Hunter Valley, the options to resolve the constraints and the proposed course of action to achieve increased coal throughput. The fundamental approach by ARTC has been to achieve increased capacity with a reserve surge capability that will be sufficient to meet the anticipated demand for export coal while achieving operational harmony between the capacities of the various line sections of the Hunter Valley rail network.

The Hunter Valley Coal Network

At present the Hunter Valley rail network has an annual capacity of around 85 million tonnes per annum (mtpa) of export coal, with a surge capacity of around 10 % higher sustainable over a period of some weeks. Forecasts indicate that demand of 115 mtpa is anticipated in 2006 with a further potential rise to around 125 mtpa by 2007, with longer range projections suggesting up to 138 mtpa in 2009.

All but a very small proportion of the export coal shipped through Newcastle is transported to the port by rail for shipping from either Carrington (Port Waratah) or Kooragang Island. The majority of this coal comes from a series of mines and loaders strung out along the Hunter Valley and is conveyed to the port on the railway that runs between Muswellbrook and Newcastle. Coal also feeds into this line from Ulan, Gunnedah, Stratford, Pelton and the southern suburbs of Newcastle, complementing the large volume of coal originating on the line itself.

Domestic coal is also transported over the same network. This sector is comparatively small but is anticipated to grow substantially within the five year forecast period.

The route consists of a dedicated double track ‘coal line’ between Port Waratah and Maitland with a shared double track line from there to Antiene and basically single track from that point north and west. The heaviest coal volumes are at the lower end of the Hunter Valley, with around 80 million tonnes out of the 85 million tonnes arriving at the port being railed over the track south from Whittingham (near Singleton).

The Hunter Valley network is capable of handling rolling stock with 30 tonne axle loading (120 tonne gross wagons and 180 tonne locomotives) with some of the outlying track sections being rated for 25 tonne axle load (100 tonne wagons and 150 tonne locomotives). There are currently 17 export coal trains made up of ‘120 tonne’ wagons and 8 made up of ‘100 tonne’ wagons. Across the whole fleet the average coal capacity is around 5,200 tonnes per train load. At the existing coal volumes an average of around 45 loaded trains per day (one every 32 minutes) are required to be run. Train lengths vary from around 1000 metres to 1550 metres apart from a small group of ‘short’ trains of 760 metres dedicated to Stratford and Gunnedah services. An additional six coal train consists are planned to be introduced over the next year or so, all with ‘120 tonne’ wagons.

Trains made up of ‘120 tonne’ wagons are restricted to 60 km/h, while all other freight trains including ‘100 tonne’ coal trains are allowed 80 km/h on the core coal network. As a consequence of the mix of trains, with 70% being ‘120 tonne’, the coal network tends to move at the slower speed.

The whole Hunter Valley coal chain is inter-related. The stockpiling and loading capability of the mines will have an impact on the trains, the trains will influence the rail infrastructure and so on.

Study Methodology

The Hunter Valley Coal Capacity Enhancement Project has involved determining the capacity of the existing Hunter Valley rail network for transport of export coal to the port of Newcastle; comparing the current capacity with the anticipated demand to identify existing and future likely constraints; reviewing options previously proposed to address these constraints and where necessary proposing additional options and selecting the preferred action to address each constraint identified.

Capacity of the rail system is fundamentally dependent of two factors:

1. The number of trains able to be run over a track section in a given time (headway)

2. The carrying capacity of the trains.

This project deals primarily with the capacity of the rail infrastructure and therefore is mainly concerned with the numbers of trains. However it recognises that a number of track issues will have an impact on the carrying capacity of trains and these are also considered.

The starting point for the definition of the projects necessary to enhance capacity of the system to meet anticipated demand has been the identification of the existing capacity of the network in terms of the numbers of coal trains able to run through each track section making up the network (track section being either plain track or a junction). This has been done by calculating the underlying headway achievable, less an allowance for the effect of conflicts at junctions and then making a deduction for the track capacity required for non-coal trains on the line and for maintenance access to the track.

The second step in project identification was to harmonise capacity along the length of the line, so that headways were either the same as the adjacent track sections or were a multiple of the adjacent achievable headway. This process tends to provide higher than required capacity as the distance from the ports increases but allows trains to be timetabled straight through with no waste capacity arising from mismatches of headways or capacity.
The third step was to relate the existing and potential capacities (the latter dependent on the options available) to the likely future demand to identify likely constraints to the export of coal through the Hunter Valley rail network.

Previously identified options for addressing each of these constraints were then reviewed and where necessary additional options were also considered and a preferred option identified for implementation or more detailed investigation.

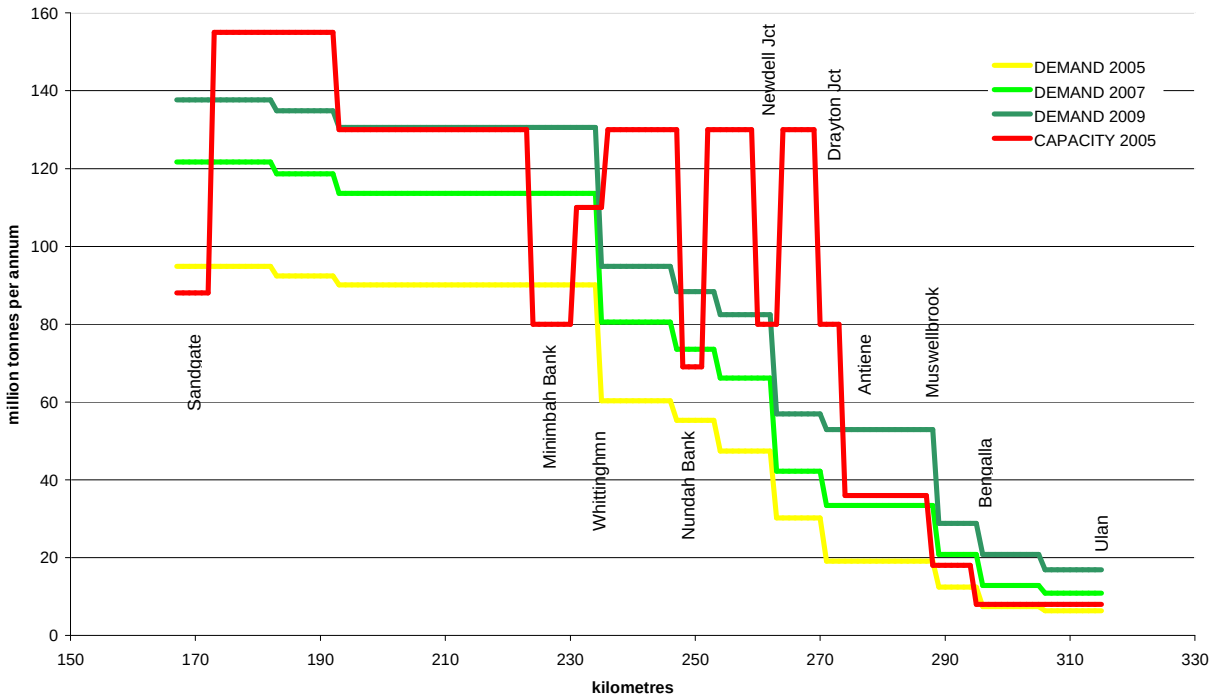
Frequently the capacity increments available as a result of improvements are large, so that significant spare local capacity will become available when a project is completed. It is generally then the case that some capacity constraint elsewhere will become the critical constraint for the line.

In this way various projects have been identified that will increase rail capacity, reduce track closure required for maintenance, and/or build reliability into the Hunter Valley coal network.

The study assumes that the existing coal throughput of 85 mtpa will rise to 125 mtpa by 2007 and as high as 138 mtpa by 2009. These estimates are based on the most recent forecasts provided by the mines to Port Waratah Coal Services in conjunction with the capacity allocation process.

These forecasts were used since they represent the high end of expectation – mining, loader, rail and port capacity will have to all be considered in achieving these tonnages. Should the growth in tonnage not occur at the forecast rate the various capacity enhancement projects can be slowed from the timings projected in this report.

The following graph shows projected volumes in 2005, 2007 and 2009 against current modelled rail capacity:



The following qualifications apply to the conclusions of the study:

- No recommendations have been made in relation to Kooragang Yard. Kooragang Yard has been considered to be part of the interface between the rail network and the port which needs to be examined separately as a system and in the light of decisions on a third coal loader currently being planned.

- The capacity gains are local to the area affected by each project, although in general the line section between the project and ports will have sufficient latent capacity to allow a reasonable proportion of the gain to be immediately achieved.

- The capacity gains take no account of the capabilities of loading and unloading interfaces – the identified rail capacity will be available at the conclusion of each project even if the coal chain is at that stage unable to make use of that capacity. The capacity gains are planned to be in line with forecasts

- Various projects have a synergy with other projects – the time line of capacity gains is based on the priority order identified here and will almost certainly change if the sequence is altered.

- The two aspects of frequency of trains (headways) and train capacity have been regarded as the drivers of rail capacity and have been given priority. The proposals are planned to target a system capacity on rail of up to 155 million tonnes per annum by 2009.

- The Sandgate grade separation, which is currently in the process of implementation, has been assumed to have been completed. Apart from the existing capability of the coal line between Maitland and Sandgate to provide 10 minute headways, there will also be the availability of at least 50 additional freight paths on the adjacent main lines as a result of the removal of flat crossing conflicts at Sandgate. These paths will be useful for through freight trains as well as trains to Port Waratah making use of the Warrabrook or Waratah crossovers. The section between Maitland and Sandgate will have no apparent impediment to carrying the forecast tonnes, nor will that section hinder the achievement of capacities planned for the route north-west from Maitland.

- Train number estimates are based on forecast tonnes and assumed average train coal carrying capacities as at 2004, with the exception that Pacific National trains will revert to 60 or 91 wagons from 53 or 80, QR will run Mt Arthur coal in 74 wagon trains from mid 2005 and that Werris Creek line trains will be increased from 42 wagons to 72 wagons toward the end of the forecast period.

- Volumes are based on an assumption that 50% of paths created are available for coal, with the balance consumed by passenger, other freight, maintenance and unscheduled delay. It should be noted that although the number of paths progressively increases as works are completed, so to does the impact of non-coal activities. Specifically, passenger services, which operate at faster speeds than coal trains and thereby cause a "shadow" effect by running down trains in front and outrunning trains behind, will have a correspondingly greater impact as train headways are reduced. Similarly, if maintenance occupies the same amount of track time, an increase in the frequency of paths has the consequence of maintenance effecting more paths. Accordingly, the 50% loss of paths currently prevailing on the network has been assumed to remain constant.

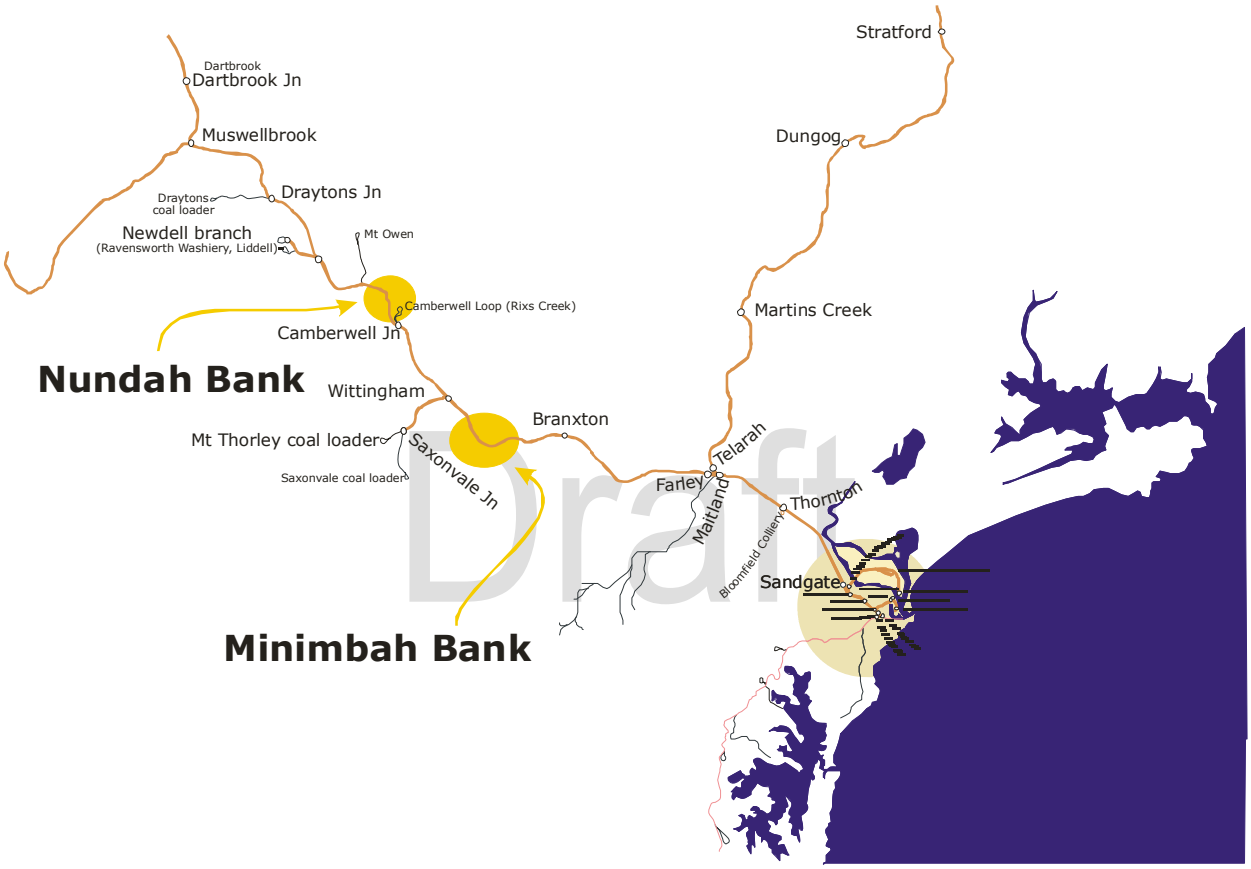
The following is a summary of the constraints to increased capacity which were identified in the study and the options considered for each constraint.

1. Need for Reduced Headways

The Constraint

The route between Muswellbrook and Sandgate has a minimum headway at the present time of around 20 minutes on Nundah Bank and 17 minutes on Minimbah Bank. Apart from a section immediately south of Muswellbrook (which will be attended to in conjunction with other work in that area) these are the only sections with a coal train headway greater than 10 minutes.

Reduction of headways at Nundah and Minimbah to ten minutes would harmonise these sections with the remainder of the system and enable the whole line from Drayton Junction to Sandgate (the junction for the two ports) to have the ability to path at 10 minute intervals.



Options

Four options have been identified to remove the headway constraint. These were:

- A track deviation with reduced grades.
- Additional tracks on the grades.
- Re-signalling on the grade to allow 10 minute headways for loaded coal trains.
- Permit increased speeds for loaded 120 tonne coal trains approaching the grades.

Track deviations would have a high capital cost, require several years to complete, would be unable to be staged, and would still need carefully designed signalling to resolve the headway issue. For these reasons deviations are not attractive as a capacity solution.

The option of a third track at Minimbah has the advantage of allowing overtaking moves as well as facilitating robust short headways, but this option has a relatively high cost and long lead time.

The last two options are low cost and relatively quick to implement.

It is proposed initially to institute limited signalling enhancements to allow '120 tonne' coal trains to run at 80 km/h on the approach to these two grades, which will reduce headways by 2.5 minutes while permitting trains to return to their former 60 or 91 wagon consist sizes. The signalling enhancements are required to ensure that there is adequate braking distance between signals on the approach to the banks. This project will only take a matter of months to implement.

As a second stage it is proposed that headways be reduced to 10 minutes at the two restrictive locations by changes to signalling to allow closer headways. The key change required is to reduce signal spacing to allow coal trains to operate at closer headways. At the same time it will be necessary to add additional signal indications to ensure that faster passenger and freight trains continue to have adequate braking distance.

An inherent consequence of reducing signal spacing is that it will provide for two coal trains to be on the bank at the same time. This increases the impact where a train fails as it is possible that the second train on the grade will not be able to restart from a stand. This increases the impact of any failure.

A third track on the grade to allow overtaking and parallel running over the slow speed sections would further enhance capacity and flexibility. Specifically it would:

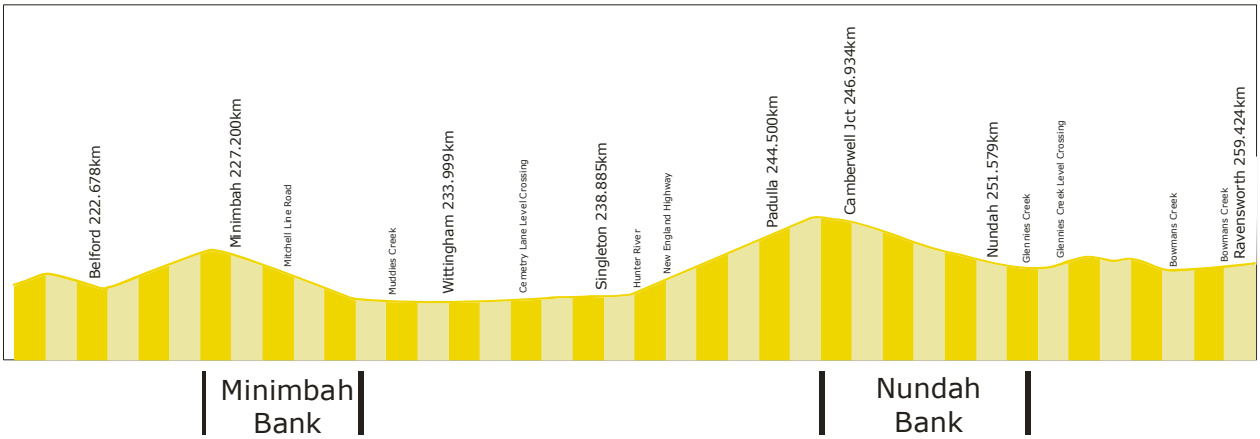
- Allow two trains to be on the grade while reducing the impact of a train stalling.
- Provide greater flexibility in recovery where a train does stall.
- Reduce the impact of the "shadow" caused by passenger trains by allowing passenger services to overtake coal trains on the grade, where the speed differential is greatest.
- Permit re-sequencing of coal trains if required.
- Reduce the impact of coal trains entering at Whittingham Junction, which can't achieve the 80 km/h approach speed and hence have a slower journey up the grade.

Around 60% of Hunter Valley coal trains negotiate Nundah Bank compared to 90% at Minimbah. However in order that pathing is harmonised over the length of the main coal network it is proposed that headways be reduced to 10 minutes over both grades.

The speed restricted Bowmans Creek bridge at 259 km will need to be restored or rebuilt for the headway harmonisation project to succeed.

The net outcome of the higher approach speed and reconfigured signalling would be to lift the line capacity from around 70 mtpa at Nundah and 80 mtpa at Minimbah to 140 mtpa at both. This is based on 50 % of the available paths at 10 minute headways being allocated for coal working. Restoration of Pacific National '120 tonne' trains to their former length is included in the capacity enhancement estimate.

Trains departing from a stand at Whittingham (mainly from the Mt Thorley branch) will be unable to achieve the higher approach speeds at Minimbah and therefore will continue to take longer than through main line trains. This is likely to reduce the benefit arising from the 80 km/h approach speed by around 5 mtpa (which will be ultimately mitigated by construction of the third track). Trains originating from Newdell Junction and Mt Owen Junction will both be able to achieve the higher approach speeds at Nundah.



2. Junction Conflicts

The Constraint

There are a number of junctions on the Hunter Valley rail network where trains travelling from coal loading branches have material conflict with empty trains travelling in the opposite direction on the main line due to slow junction speeds and the frequency of train movements. The three junctions that stand out as having this constraint are Whittingham, Newdell and Drayton. The latter two junctions also have high maintenance turnouts which result in excessive on track maintenance time and additional train delays.

Options

Options identified to remove this constraint were:

- Relay junctions with new high speed, low maintenance turnouts.
- Provide separate entry / exit tracks.
- Grade separation.

The three junctions have very different traffic patterns and each will require different treatment to achieve the best result.

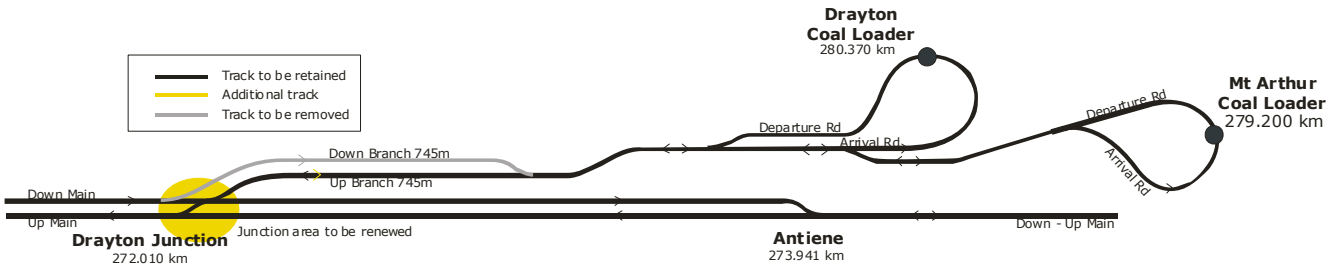
Relaying with high speed turnouts will enable reduced junction occupancy times as well as reducing ongoing maintenance costs. This is an obvious and simple option. Faster speeds through junctions may also allow simplification of the junction arrangements which would have further benefits in first cost, installation time and ongoing maintenance.

Separation of entry and exit tracks is appropriate where it is desirable to be able to hold an arriving empty clear of the main line, but may be partially offset by higher junction speeds. In general this option will have higher cost and in some cases be complicated by track ownership issues.

Grade separation is high cost but where train frequency is high could be justified to reduce conflicting moves and reduce the wear from loaded coal trains on main line turnouts and crossovers.

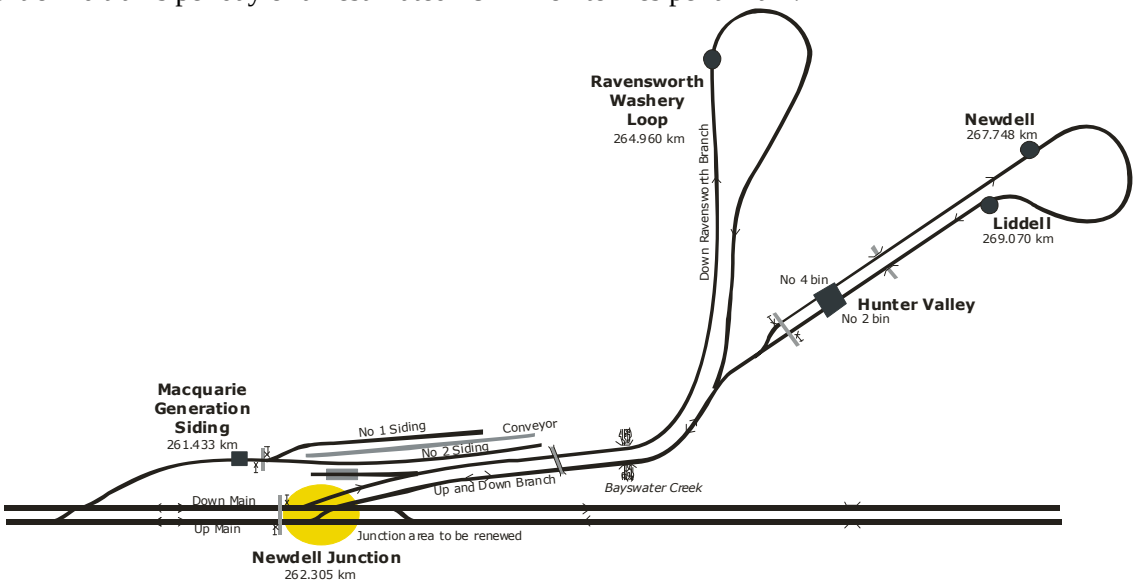
An initial assessment indicates that the first option is likely to be preferred for Newdell and Drayton Junctions, both of which have slow speed and high maintenance turnouts.

It is proposed that Drayton Junction be renewed with 1:18 turnouts, raising branch junction speeds from 25 km/h to 75 km/h. Times taken for a train exiting the branch will reduce from around 6.0 minutes now to around 3.0 minutes, effectively reducing the junction conflict time – in effect the junction could handle twice as many branch trains or an estimated increase of 8 northbound main line trains within the existing junction conflict time. Renewal of only the main line crossover and junction turnout will be required allowing removal of the branch crossing loop as a result of faster junction times, saving two turnouts in the new arrangement. Increasing junction speed for trains joining the main line will also facilitate operation of 10 minute headways. This project will increase loaded train capacity through the junction (on either the branch or main line) by the equivalent of 8 trains per day or an estimated 15 million tonnes per annum.

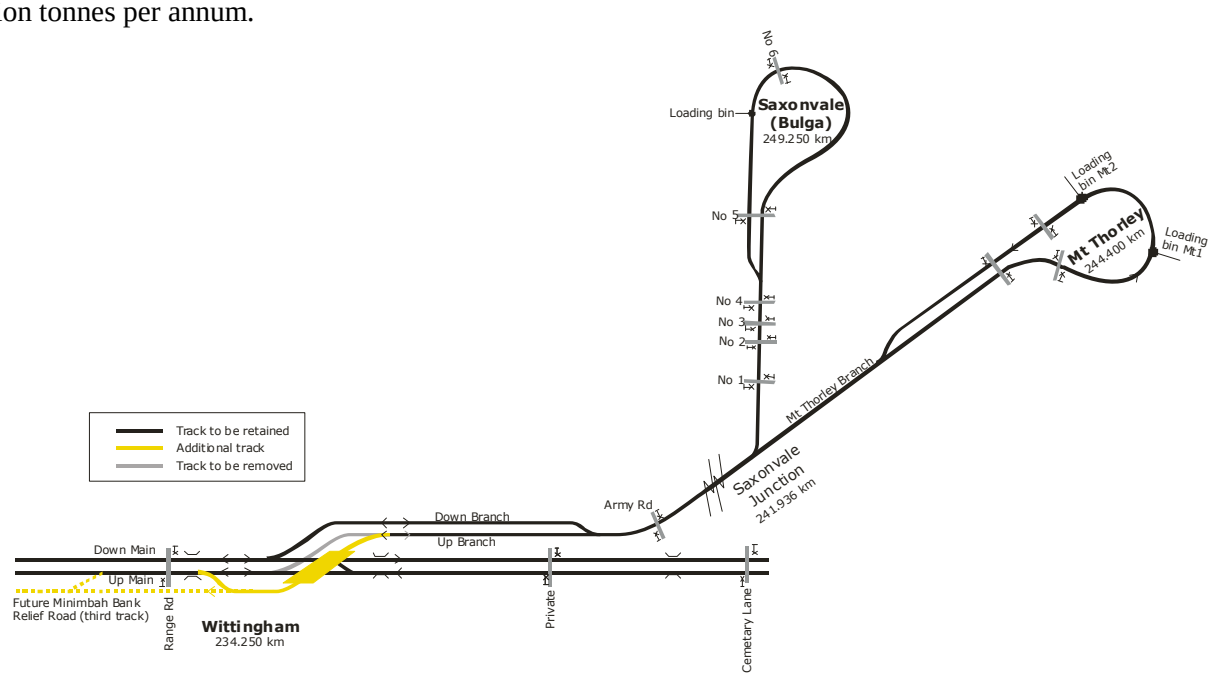


It is important to note that the privately owned Drayton branch has a 20 km/h speed restriction on it. This will limit the ability of the junction to realise the potential increased speed. A process will need to be developed to ensure that the branch line capability is upgraded to at least the minimum necessary to permit the realisation of the increased junction speed.

It is proposed that Newdell Junction also be renewed with 1:18 turnouts raising branch junction speeds from 25 km/h to 75 km/h. Times taken for a train exiting the branch will reduce from around 4.5 minutes now to around 2.25 minutes, effectively reducing the junction conflict time – in effect the junction could handle twice as many branch trains or an estimated increase of 7 northbound main line trains within the existing junction conflict time. Increasing junction speed for trains joining the main line will also facilitate operation of 10 minute headways. This project will increase loaded train capacity through the junction (on either the branch or main line) by the equivalent of 10 trains per day or an estimated 18 million tonnes per annum.



The Mt Thorley branch line consists of about 8 km of single track between a branch crossing loop at Whittingham and the junction for the two (soon to be three) balloon loops near Mt Thorley. Main line turnouts are swing nose high speed units with a number of 55 km/h speeds associated with a curve and turnout adjacent to the main line. Initial estimates indicate that the single line section will be adequate for predicted train numbers to 2009, but conflicts at Whittingham Junction are likely to become a constraint around that time (coal train numbers at Whittingham are forecast to grow from 53 to 72 trains each way daily over the 5 year period). A flyover from the Mt Thorley line to join the up main line is proposed to address this constraint. The flyover would remove conflicts with northbound main line trains, reduce the number of turnouts being used by loaded (high wear) trains and give loaded trains from Mt Thorley a small downgrade speed benefit approaching the Minimbah Bank. Reduction of junction conflicts and a marginally better approach speed to Minimbah Bank are initially estimated to improve junction capacity by the equivalent of 15 loaded trains per day, equivalent to 26 million tonnes per annum.



3. Single Track Sections between Antiene and Muswellbrook

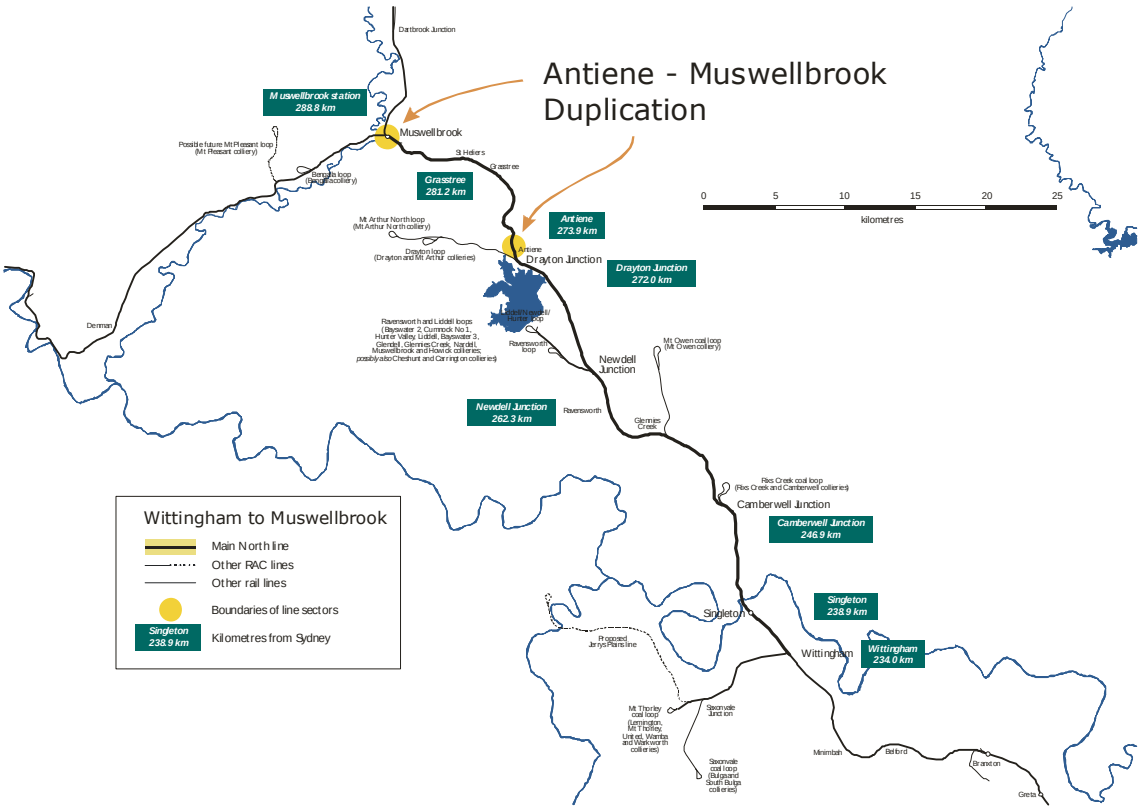
The Constraint

The two single track sections between Antiene and Muswellbrook have limited capacity compared to the adjacent track. Duplication work on this section was part completed when work stopped in the 1950's. Rock excavation at the southern end of this section and three Muscle Creek bridges between St Heliers and Muswellbrook remain to be done although most of the earthworks were constructed. While it is likely that substantial remediation work would be required to bring these formations up to contemporary standards for duplication, there will be a time and cost saving in not having significant cut and fill to perform adjacent to an operating track.

Coal developments on the Ulan line and proposed for Murrurundi, Werris Creek, Gunnedah and Boggabri would increase the numbers of coal trains through this area by 200% or more in the next 5 years. The existing track configuration (with single track Antiene to Grasstree (7 km) and St Heliers to Muswellbrook (4 km) restricts train numbers through this section to around 70 trains per day in total.

The centre of gravity of coal extraction in the Hunter is moving slowly north so that a disproportionate share of the growth tonnage is expected to occur at the northern end of the coal network.

Specific mining projects that are expected and will impact the existing single track sections are the very substantial domestic coal traffic from Wilpinjong (near Ulan) to Antiene, and new export tonnages from Anvil Hill (near Denman), Bickham (Murulla), Werris Creek, Gunnedah and Boggabri. If these projects are all realised it is anticipated that capacity of the single track section will not be sufficient by about 2008.



Options

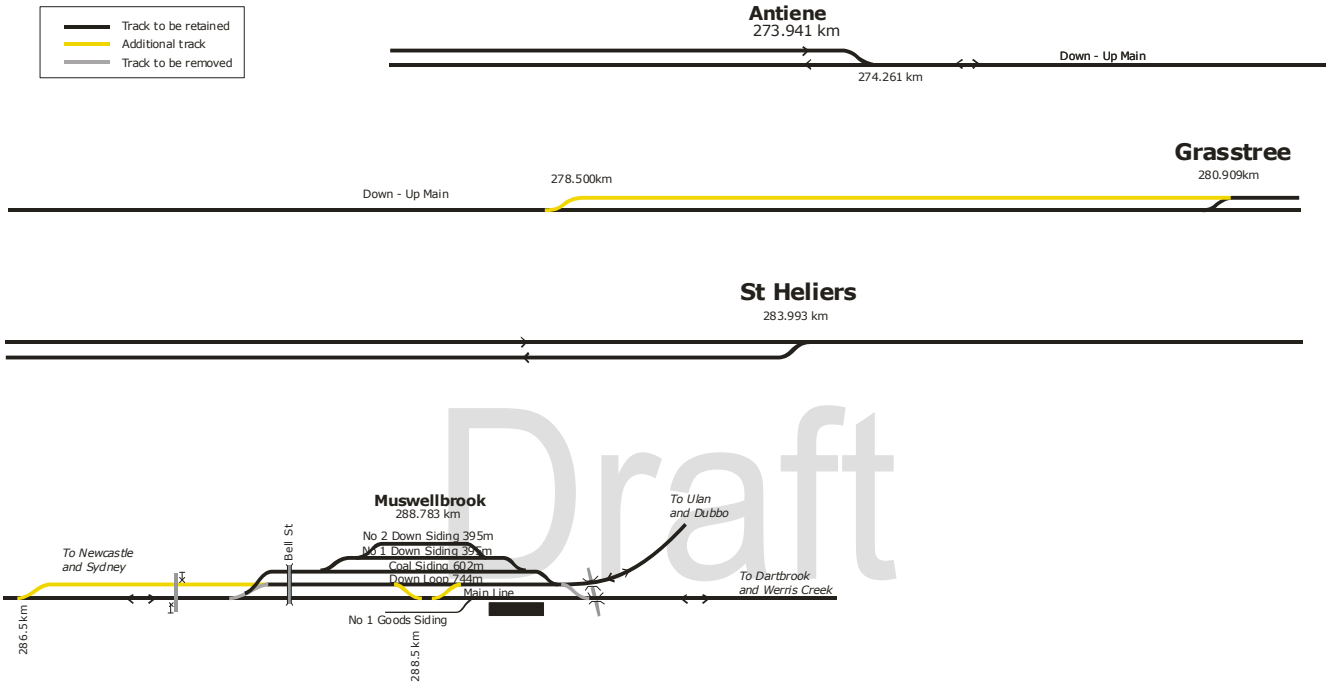
Options identified to remove this constraint were:

- Full duplication.
- Staged duplication (see also Muswellbrook Yard constraint).
- Deviation of the Ulan line from Antiene further to the west.
- Fewer, longer trains.

Full duplication would technically provide a jump in capacity from a nominal 36 mtpa to over 100 mtpa, but due to constraints on the "feeder" lines, capacity would be effectively limited to 25 mtpa, increasing to 60 mtpa with enhancements to the feeder lines.

Partial duplication as a result of the new long loop at the south end of Muswellbrook (see next constraint) would reduce the single track between St Heliers and Muswellbrook to 2 km, leaving the other single track section as the capacity controlling section.

Duplication of this section between Grasstree (280.5 km) and the summit at 278 km (2.5 km) on the largely cleared formation from the 1950's would leave two nominal 5 minute single track sections. Construction work on these sections would be considerably more complicated and expensive due to rockwork at the Antiene end and three bridges at the St Heliers end.



This configuration would be capable of handling the high end forecast train numbers (103 trains per day) for 2009, although with little margin. By adopting a staged approach, capacity can be ramped up in line with the growth of coal tonnage, rather than having a long lead time until any capacity relief can be provided. Partial duplication would provide capacity in line with the capacity required for the combined Ulan and Werris Creek lines.

Full duplication would then be completed when required for growth in train numbers to give an ultimate capacity of around 140 million tonnes per annum. Given current forecast rates of growth, full duplication would be required early in the next five year planning period.

Deviation of the Ulan line west of the town of Muswellbrook would run into significant problems with mine subsidence areas, mining leases and the normal environmental and planning processes. It would only partially solve the immediate capacity issue since the Werris Creek line would need to be retained and enhanced.

Provision of longer trains will only work to a limited degree. The longest '120 tonne' trains on the network already run to Ulan, Bengalla and Dartbrook as a matter of course. Lengthening Gunnedah line trains (which currently are short at 42 x 100 tonne wagons) will help, but not to the extent that work on the single track sections could be avoided.

An initial assessment indicates that the second option is likely to be preferred.

4. Muswellbrook to Ulan Single Track

The Constraint

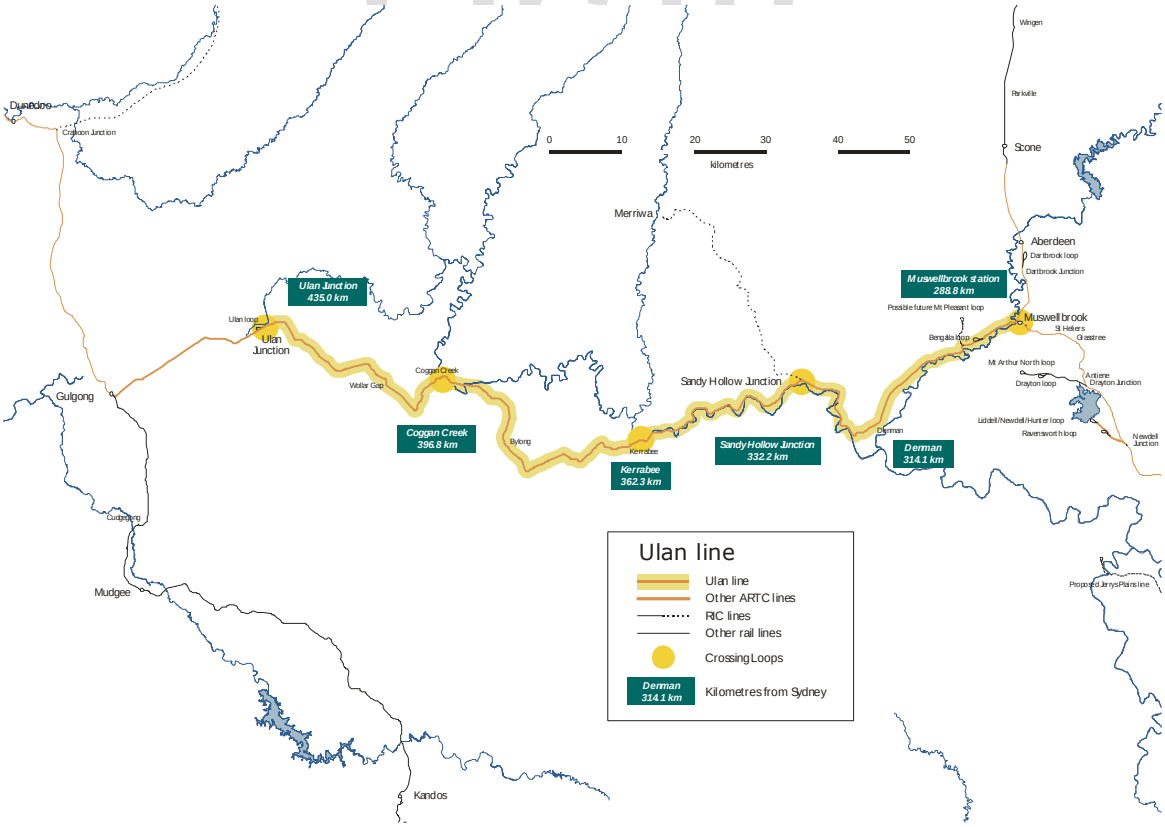
The task identified in the working predictions is for 14 paths per day on the line in 2005, growing to 19 by 2007 and 28 by 2009. A major contributor to this growth will be the Wilpinjong domestic coal haul which is due to commence at the beginning of 2007.

The Ulan line beyond Muswellbrook Staff Hut (7 km west of Muswellbrook) is operated under electric staff working and there are long distances between loops. In addition the section St Heliers to Muswellbrook Staff Hut adds significantly to the length of the busiest single line section since the loop at Muswellbrook is too short for normal coal working on this line.

Electric staff requires at least 60 minutes of avoidable delay to coal trains in each direction between St Heliers and Ulan. This entails 40 minutes dwell time each way as well as an estimated 25 minutes momentum stopping and restarting, thus reducing the line capacity.

The longest section on the line between (usable) crossing loops is between St Heliers and Sandy Hollow. This section includes Muswellbrook station which has a 50 km/h turnout at the south end and 25 km/h turnouts at the north end. Line capacity is determined by this section at the present time. The section time is 69 minutes inclusive of intermediate stopping time to operate the electric staff system. This section limits daily activity to 12 paths per day.

The crossing facility at Muswellbrook where the traffic to and from Ulan and Werris Creek merges needs to be a full length crossing loop to avoid the capacity constraint arising when Werris Creek and Ulan line trains need access to the Muswellbrook – St Heliers section at the same time. Provision of such a loop would also act as partial duplication of the section to St Heliers.



Options

Options identified to remove these related constraints were:

- Installation of CTC remote signalling.

- Increasing train speeds.
- Additional loops.
- By-pass Muswellbrook to the west.

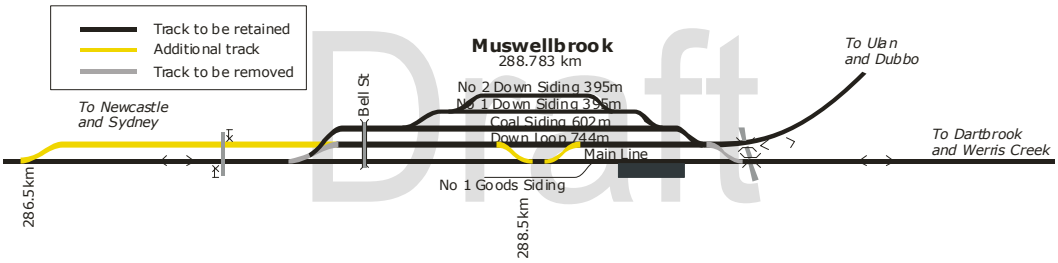
Installation of CTC will eliminate the currently required dwell times, thus reducing the cycle times for coal trains by up to 2 hours. This will have a significant effect on both capacity and reliability.

Provision of intermediate follow on signals (not possible with the existing system) would provide additional capacity by allowing flighting of trains in one direction at a time.

Increasing coal train speeds would not have a great effect on times overall (there is significant curvature and gradients on the Ulan line), but increasing track speeds through Muswellbrook will have a significant effect in the longest single line section.

Increasing track speeds through Muswellbrook depends on rationalising the north end of Muswellbrook station, but in so doing it will improve train speeds on both the UIan and Werris Ck lines. It will also facilitate provision of a long crossing loop capable of handling all trains. A secondary (social) benefit is the removal of much of the crossing activity away from the immediate town area.

Based on Ulan line trains running at 50 km/h at the north end of Muswellbrook station (instead of 25 km/h, improved as a result of removing the north end junction from its current location entirely) coupled with a crossing loop with normal 1:18 turnouts between 286.5 km and 288.5 km, there will be a saving of 7 minutes in run time as well as reduction of the longest single line section from 57 to 49 minutes. This will enable capacity of the Ulan line to be raised by 4 trains per day.



Capacity of the Werris Creek line will also be enhanced by increasing north end track speed from 35 km/h to 60-70 km/h while having a similar benefit from the new crossing loop. Capacity on this line, which includes typically up to 10 grain and general freight trains and one long distance and three local passenger trains (a fourth terminates at Muswellbrook) in each direction will be enhanced by a lesser amount but would amount to around 3 trains per day.

The remaining single track section between Muswellbrook and St Heliers would be around 2 km long, but would include three of the Muscle Creek bridges that are in need of remediation or renewal (one of the Muscle Ck bridges is just on the double track at St Heliers but may be able to be more effectively renewed by moving the junction south by around 150 metres).

By-passing Muswellbrook to the west is only realistic for the Ulan line (as noted in Section 3). The Werris Creek line would gain no operational advantage in by-passing Muswellbrook.

An initial assessment indicates that the first three options are all likely to be required.

Installation of CTC will remove the need to stop and this alone will lift line capacity to 15 trains per day – just adequate for 2005. Completion of the Muswellbrook yard and loop projects will further improve this by reducing times on the longest section to allow 19 paths per day, just adequate for 2007 tonnages. Provision of an additional loop between Muswellbrook and Sandy Hollow (at about 311-312 km) and another between Kerrabee and Coggan Creek (possibly around 383 km) will allow line capacity to meet the 2009 tonnages, with additional potential capacity available by splitting the Sandy Hollow to Kerrabee section with another new loop. It should be noted that Wilpinjong (at around 414 km) will effectively be a crossing place in the section Coggan Creek to Ulan (around half the trains will terminate or originate there) thus obviating the need for an intermediate crossing loop there.

It is understood that design of half of the CTC project has been completed to a reasonably detailed level and the remainder is well advanced. Despite this the requirement for additional capacity by early 2007, when the Wilpinjong loader comes on line, will put this project under considerable time pressure. Provision of CTC to Sandy Hollow or Kerrabee, the new loop around 311 km and the Muswellbrook yard and loop project as a first and urgent stage would provide breathing space sufficient to allow the remainder of the project to be completed without the line becoming capacity constrained

In all the above estimates of capacity it has been assumed that trains to or from Bengalla loader (around 5 km west of Muswellbrook) will be able to work to that location concurrently with Ulan line trains in the section west of the loader junction. This location is forecast to require 8 paths (4 loaded trains) per day by 2009.

Background traffic (grain, ore, general and inter-modal) on the Ulan line has been assumed to remain constant over the project period at 6 paths per day. It should be noted that these trains are generally well below the maximum permitted train length on the corridor and growth can readily be accommodated by increasing train length.

5. Conflict between Maintenance and Train Running

The Constraint

The requirement for on track maintenance inevitably results in some loss of capacity for coal trains, becoming more significant as coal tonnages increase (higher maintenance requirement with greater loss of coal capacity for same time on track).

Options

Infrastructure options identified to remove this constraint were:

- Additional tracks to allow more on track time while retaining train running capacity.
- Bi-directional signalling, allowing some train running while maintenance is being carried out.

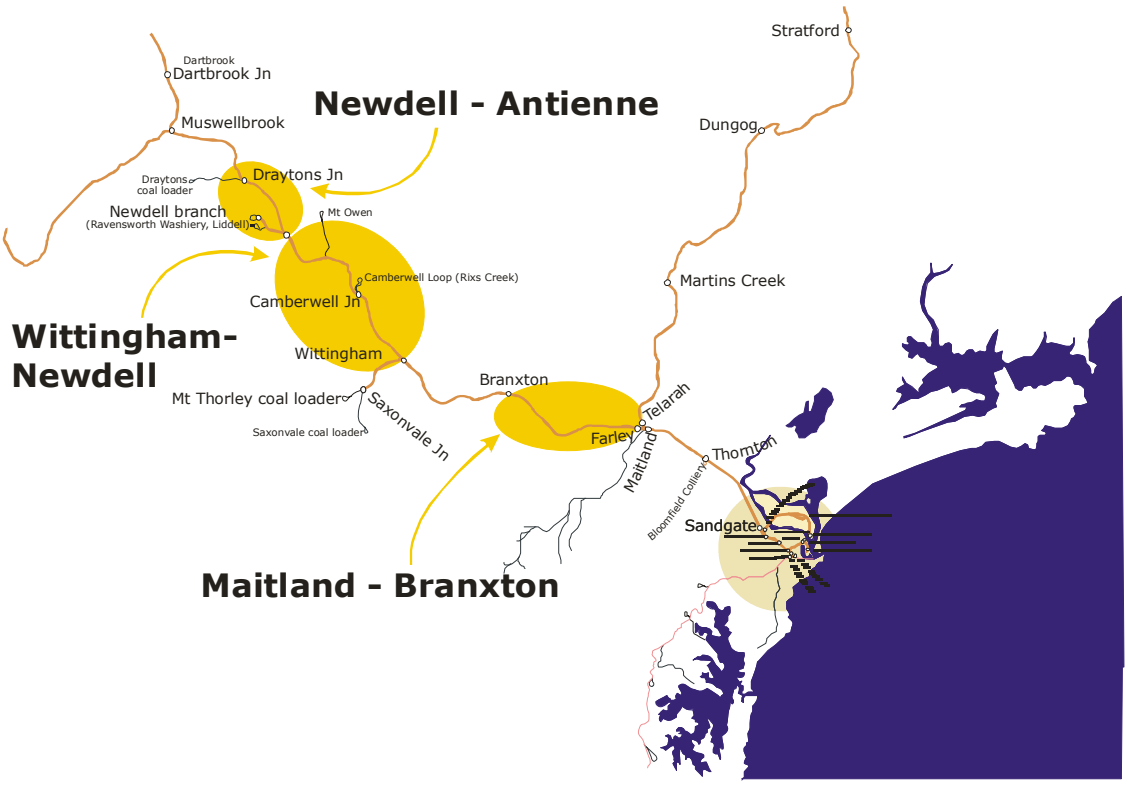
For both of these options a secondary benefit is the ability generally to recover from train or track failures more quickly than would be the case with a single track or with uni-directional track.

Provision of an additional track is a high-cost, long lead-time option that would only be appropriate where capacity enhancement is approaching its limit with the existing number of tracks. Bi- directional signalling, while not cheap, provides a degree of operational flexibility without the cost of extra track and will allow postponement of track enhancement in some cases.

A further solution is to invest in higher production rate track maintenance equipment that will allow the same task to be completed in shorter possession windows. ARTC is currently developing an equipment acquisition strategy and the benefits of this will be further assessed against the costs of the infrastructure solutions.

An initial assessment indicates that bi-directional signalling is the preferred infrastructure solution. If adopted it is envisaged that it would be implemented in three stages:

a) Maitland to Branxton
b) Whittingham to Newdell Junction
c) Newdell Junction to Antiene



These projects would interface with the bi-directional signalling already installed between Branxton and Whittingham. They would avoid the loss of paths due to maintenance and failures rather than add capacity as such. It is estimated that the projects would between them release track capacity equivalent to around 3 mtpa associated with planned work. Each of the three projects would release a further 1.5 mtpa each 'saved' from failures and short notice maintenance. The total benefit of the combined projects is therefore estimated to be in the order of 7.5 mtpa..

Stages b) and c) would also facilitate the operation at coal branch junctions by allowing standing empty trains to be by-passed by following trains.

6. Limited Capacity on the Main North Line beyond Dartbrook

The Constraint

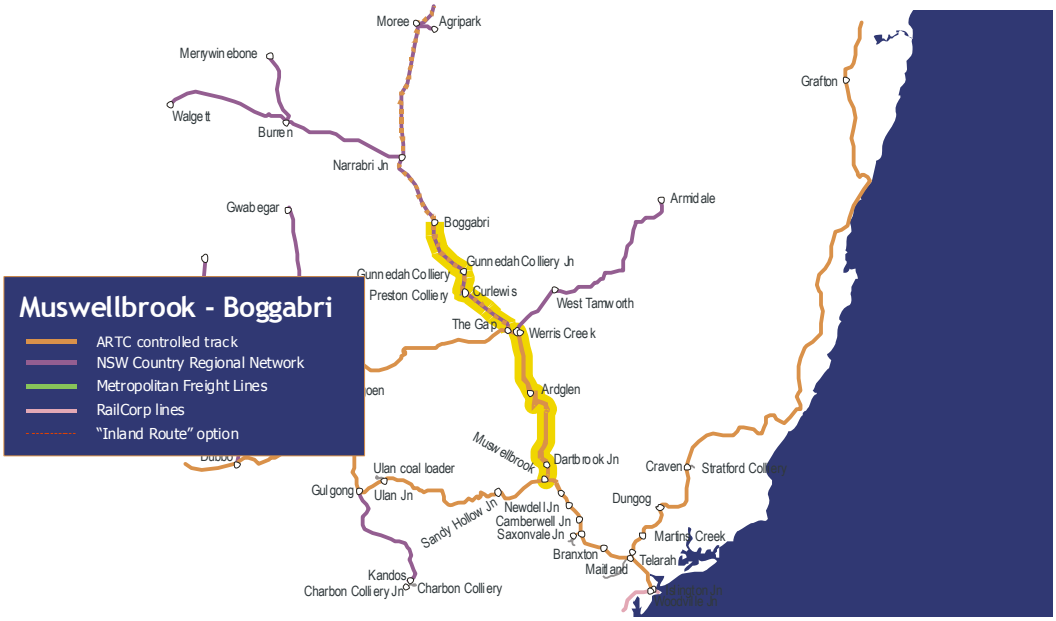
The Muswellbrook – Werris Creek – Boggabri line is highly complex, having passenger trains, a higher level of background freight activity, existing loops that are relatively short, a major grade section over the Liverpool Range, and five places where trains terminate and originate along the route. The typical loop length is between 650 and 750 metres with some shorter and several north of Werris Creek longer.

2005 predictions indicate a need for 31 paths per day at the Muswellbrook end down to 16 paths per day at the Boggabri end. These are expected to grow to 34/16 by 2007 and 47/25 by 2009. The higher rate of growth in the latter part of the five year project is a reflection of the number of new developments that have yet to come into production.

Existing capacity, based on maximum length coal trains of 42 wagons, is estimated to be 43 paths per day as far as Werris Creek and 26 beyond to Boggabri, sufficient to cover demand through to about 2007. However it is evident that longer coal trains will be required to enable demand beyond 2007 to be handled

The Ardglen Bank is a particular impediment. Severe grades are encountered on the short section between Murrurundi and Willow Tree which dictates limits for train operation for the whole Werris Creek to Newcastle line. The requirement for 'banker' locomotives over this section for coal and grain means that this section will reach capacity earlier than the remainder of the line because the return of banker locomotives adds 50% to train numbers that need to be handled.

Background traffic amounts to 26 paths per day as far as Scone, then 20 to Werris Ck, 18 to Gunnedah and 16 to Boggabri, and these have been assumed to remain constant over the five year project period.



Options

Options identified to remove the related constraints of train lengths and severe grades were:

- Lengthening selected loops between Muswellbrook and Boggabri to allow consolidation of coal and grain into longer but fewer trains.
- Re-alignment over the Liverpool Range to increase capacity at that location.

- Duplication of track on the north face of the Liverpool Range.

Lengthening of crossing loops is an option that can be implemented progressively provided future train lengths and eventual train frequencies are established with reasonable certainty at an early stage.

Re-alignment over the Liverpool Range on a new route is likely to be the more expensive option, but would have the advantage of removing the grade as a constraint.

Duplication of the existing north face track to provide capacity for the 'banker' operation would probably be quicker and lower cost than re-alignment, but would not remove the root cause of the capacity problem.

An initial assessment indicates that the new route at the Liverpool Range may be desirable in the longer term, provided that a mainly surface route can be located. Anecdotal evidence indicates that this is possible by tracking west of the existing route between Blandford and Willow Tree

Simulation indicates that there are several options available that will allow trains of 72 x 100 tonne wagons, compared to the existing 42 wagon trains. Technical length limit for trains will be in the region of 1300 metres due to issues with in-train forces on the steep grades. Regardless of the type of train employed, there will be a need to enhance infrastructure if the high end 2009 forecasts are realised.

Indications are that new loaders at Murulla and Werris Creek are likely to come on line ahead of expansion in the Gunnedah / Boggabri region. It is proposed that loop extensions be commenced reasonably early in the project working from south to north between Muswellbrook and Werris Ck. This will allow implementation of Murulla working in 72 wagon trains and, provided there are no technical impediments to long train working over Ardglen Bank, similar implementation from Werris Creek.. This part of the loop extension plan should be targeted for completion by late 2007. Loop extension north of Werris Creek should be considerably easier, partly due to terrain but particularly while there is electric staff working on that section. This should be programmed for completion by late 2008 in time for the 2009 coal task. It should be noted that the loop extension plan includes provision of a number of new loops to replace inadequately placed existing loops and remediation at Scone and Gunnedah to fix bad alignments. The plan will allow the 2009 task to be handled with capacity ranging from 72 paths at the Muswellbrook end to 30 paths at the Boggabri end.

It is proposed to create a new loop and bank engine base at around 372 km (foot of the grade, replacing Willow Tree), which with extension of Ardglen Loop and retention of the short Kankool Loop (for passenger and returning bank engines) will be just adequate up to 2009. Beyond that time (or more realistically a coal task exceeding around 12 mtpa) some other solutions for this section will need to be found.

Dartbrook coal traffic, amounting to around 7 paths (3.5 loaded trains) per day by 2009) will be able to be handled quite comfortably by the new arrangements.

Consolidation of grain trains into longer consists taking advantage of the increased loop lengths should enable saving of an additional path.

Secondary issues that need to be dealt with are:

- The restriction of loaded 100 tonne coal wagons to 65 km/h. This restriction adds to the section times and makes train handling over the undulating sections of track harder than would be the case with 80 km/h.
- The speed restricting configuration of Scone Loop which has an asymmetric configuration, and a short loop that is only of real use for passenger working.
- The speed restricting configuration at Gunnedah which has the main (platform) track running through the diverging leg of turnouts at both ends of the station.

7. Wagon Capacity and Train Length Limitations

The Constraint

The core Hunter coal network is now operating to a 30 tonne axle load standard. Coal wagons making use of this limit are built to the full width and height allowable for standard rolling stock outlines. Increasing axle loading to higher limits would allow more coal to be hauled for a given number of trains. To achieve additional loading while retaining similar wagon lengths to now will require wider and higher rolling dimensions than are now able to be run. A secondary issue is the inability to acquire and run standard design heavy haul locomotives and wagons 'off the shelf', resulting in long acquisition lead times and additional acquisition costs.

Secondary coal routes in the Hunter network have a 25 tonne axle load limit. It would be desirable to bring lines at this standard that serve mining areas with long life reserves up to the same standard as the core of the network.

Options

Options considered are:

- Increase axle loading to the American standard of '286,000 lb' (= 32.5 tonnes axle load).
- Increase axle load to higher than 32.5 tonnes.
- Enlarge the coal route rolling stock outline to AAR plate E outline (15ft 9in by 10ft 8in)
- Bring selected 25 tonne axle load lines up to the same standard as the core network

Increasing axle loading to the American standard in conjunction with an enlarged rolling stock outline would allow up to 12 tonnes additional coal per wagon within the same train length constraints as now (i.e. 60 wagon trains would go from 5700 to 6420 tonnes of coal). Increasing to higher than 32.5 tonne axle loads would tend to get back into purpose built rolling stock with similar lead times and costs as now.

Lifting 25 tonne lines to 30 tonne axle load standard (with ability to go higher when that becomes the standard) will allow significantly more efficient train operations on these lines – notably, this would apply on the route between Muswellbrook and Boggabri.

The higher axle load and larger rolling stock outline are projects that will be a long time in realisation. Their benefit will come when the existing infrastructure is reaching its technical capacity and track amplification or other high cost response is the answer. However both projects, which should ideally be done conjointly, need to be established as goals early on and progressively implemented with every project that involves track or structures. For instance provision of newly duplicated track, new main line crossovers and rebuilding bridges will all involve adjustment to meet the new dimension and strength standards.

8. Miscellaneous Issues

There are a number of additional issues that are either of a minor nature, or have a minor impact on the enhancement of capacity on the Hunter Valley corridor. The items identified in this category are:

1. Signalling and remote control of XYZ crossovers between the main line and coal line at the entry to the Port Waratah complex.

2. Improved 123 / 124 crossover at Waratah.

3. Shunting procedure at Steggles Siding (181 km, between Beresfield and Thornton).

4. 65 km/h line speed through Thornton (182 km) on the coal lines.

5. 50 km/h speed through Maitland (193 km) on the coal lines.

6. High speed crossover between coal and main lines at Maitland.

7. The single passenger platform on the up side at Singleton.

8. Camberwell and Mt Owen junctions.

9. The public level crossing on the branch approximately 800 metres from the junction at Drayton Junction.

10. The asymmetric track arrangement at Scone resulting in speed restrictions through that location.

11. Track arrangement through Gunnedah.

12. 65 km/h speed limit on 100 tonne wagons (when loaded) between Boggabri and Muswellbrook.

13. Low speed limits on loader branch lines.

14. Provision of adequate maintenance sidings for the Hunter Valley network.

These items are discussed below and in general are proposed to be dealt with in conjunction with major adjacent projects. In some cases the issues require separate treatment, while others are more appropriate to maintenance budgets.

1. XYZ Crossovers at Waratah

This set of three crossovers is currently a manually worked emergency facility.

The proposal is to equip the turnouts with point motors and control them from Broadmeadow Control Centre as a normal running route. This would allow up freight trains requiring access to Port Waratah to run on the up main line to Waratah and then cross over to the coal lines at the entry to Port Waratah, without obstructing the opposing main line as happens at Warrabrook for the same move. Trains running from Port Waratah and requiring routing to the main line would have the choice of crossing at XYZ crossover or at Warrabrook using 134 crossover.

The additional flexibility gained would facilitate the sequencing of trains in and out of Port Waratah (particularly trains of different types – coal, grain, steel etc) as well as enabling use of the additional Main Line capacity created by the Sandgate grade separation.

Ability to use spare main line capacity to manage the Hunter Valley coal task, either by parallel routing (e.g. Stratford on the main, Mt Thorley on the coal) or as a way of gaining maintenance access to the coal lines, is

implicit in the overall Hunter Valley Corridor Strategy. The ability to use the main line as a way of easing Coal Line conflicts at Sandgate (coal) junction is also an issue.

This project will involve signalling and therefore is likely to be reasonably significant. It may be able to be incorporated into other regional signalling programs, but if not it should be established as a stand alone project for early attention.

2. 123 and 124 Crossovers at Waratah

These parallel crossovers at the down end of Waratah allow down trains to cross from the Main to Coal, or for up trains to cross from the Coal to Main. The usefulness of these crossovers is reduced by limited clearances with the result that the signalling is set up to prevent clearing for parallel cross moves. It is understood that these crossovers are a high maintenance item.

It is proposed that the track arrangements be altered to have a single ladder crossover using higher speed turnouts. This will shorten the time for trains to undertake cross moves, as well as reduce maintenance. The adjacent Coal lines are restricted to 40 km/h so provision of a 50 km/h ladder would be appropriate. This project is of low priority and may be appropriately included in the maintenance capital program.

3. Steggles Siding

This stockfeed siding is a bit over 400 metres long and trails off the down coal line at 108.7 km. Existing procedures require at least part of the shunting train to be left on the running line at all times. As a result when wagons are being placed and/or lifted from the siding no other train can use the down coal line.

It is proposed that the siding be altered so that the shunting trains can be 'locked away' in the siding to allow through trains to run past. It is preferable to extend the shunt train time than to delay the procession of empty coal (and grain) trains, an issue that will gain in importance as coal tonnages grow. This project is essentially a small scale stand alone project that should be able to be dealt with reasonably quickly.

4. Speed Restriction through Thornton

A speed restriction of 65 km/h applies though Thornton on the coal lines. The reason for the restriction is unclear but probably relates to the junction, crossovers and / or signalling, since the (nominal) track geometry is the same as Tarro, which has a higher track speed. It would be desirable to have Thornton cleared for 80 km/h running before raising the '120 tonne' train speeds from 60 km/h – the effect of retaining the 65 km/h speed at Thornton would actually negate most of the potential time gains otherwise achievable by higher speed running.

An associated issue is the Bloomfield branch junction and the ladder crossover at the up end, involving a very tight curve on the branch and slow speed turnouts in the ladder. In order to path trains between the branch and coal lines, or coal lines and main lines with shorter conflict times it may be desirable to replace the existing turnouts, when they become due for renewal, with high speed turnouts further toward Beresfield.

It is proposed that the reason for the 65 km/h speed be clearly identified and the costs and benefits of remediation be investigated as part of the extension to 80 km/h coal train running. This should be done in conjunction with the next item – Speed Restriction through Maitland

5. Speed Restriction through Maitland

A speed restriction of 50 km/h applies though Maitland on the coal lines. The reason for the restriction is unclear but could be related to track geometry through the station area and/or signal sighting distances. It would be desirable to lift the speed on the coal lines through Maitland so that through freight trains can maintain momentum and keep headways to a reasonable minimum through this area.

At present up loaded trains that have reduced to 50 km/h through Maitland take until near Metford before they have returned to their maximum speed, only to then have to reduce to 65 km/h at Thornton. Any action to improve track speed through Maitland should be done in conjunction with improved speed through Thornton

(see previous item). These two projects are not of high priority at this stage, but enough analysis to identify the factors that lie behind the reduced speeds and possible solutions would be advisable at an early date.

6. High Speed Crossover at Maitland

Some years ago the track arrangements at Maitland were altered to provide direct routing between the Main Line and North Coast line, and between the Coal Line and North Western line. This provides an appropriate layout for the majority of trains on each route.

Completion of the Sandgate grade separation in 2006 will open up a number of additional paths on the main line between Maitland and Waratah which will be of advantage for increasing numbers of trains running to or from the North West line (e.g. through freight trains to south of Newcastle, grain and coal to Port Waratah. The existing link between the two lines at Maitland is an awkward slow speed connection through two spare platforms and is quite inappropriate to maximisation of throughput on either line.

A high speed crossover between the up NW line and the down North Coast line at the divergence point, with another high speed crossover between the down and up Main Lines at a suitable tangent track (probably at the up end of Maitland) would allow loaded freight trains to be routed to either the up coal or up main without any significant speed or time impost. Down trains wanting to be routed from the down main to the down NW line would use the crossover at the point of divergence and the Farley crossover at low speed, although with the expectation that the latter would be replaced by a high speed installation at a later date.

This project is of mid ranking priority, but would be most efficiently done as part of the bi-di project to obtain the synergies of modifying the signalling only once. It is recommended that this project be incorporated into the scope of the Maitland – Branxton bi-di project.

7. Single Passenger Platform at Singleton

Although the track through Singleton has been double track for several decades the original single platform has been left to cater for passenger business in both directions. With the increasing frequency of coal trains the need for down passenger trains to cross to the up line to access the platform is now becoming an obstruction to up coal trains. This will certainly be a hindrance to achievement of a consistent 10 minute headway as part of coal capacity enhancement. At present there are four local and one long distance down passenger trains requiring access to the Singleton platform daily, none of which terminate there.

There would seem to be several options to resolve this impediment.

1. A duplicate platform on the down side - this would require all the contemporary disabled and other access and would probably need to displace one of the yard tracks. Ramped access to the down end overbridge might simplify the access issues to make this option workable, albeit with potential loss of the down end of the yard sidings.

2. Use of bi-di (proposed between Whittingham and Newdell Junction) and strategically placed crossovers to allow transposal of up coal trains to the down main when down passenger trains are accessing the single platform (when a down passenger train is at Singleton there would not normally be any down freight trains within 10-20 minutes either ahead or behind).

3. Slew the up and down main lines to leave the single platform on a passenger loop rather than a main running line. While this would not entirely resolve the conflict situation it would at least enable up coal trains to operate normally while a passenger train was at the platform for an extended period.

4. Eliminate the first down and last up local service (see Scone project) thus reducing the impact of this issue

The first option is most attractive as a complete solution but is likely to have the highest incremental cost. The second option would provide a fair degree of freedom to keep trains running while down passenger trains were at the platform and does not involve any additional expenditure over the already projected cost of bi-di working. Elimination of the first down and last up local passenger train is appealing for a number of reasons and should be further explored regardless of the option chosen for Singleton.

Resolution of the platform issue at Singleton is not high priority at present but will come into prominence as coal tonnages build up. It is proposed that the issue be initially dealt with as part of the bi-di project. If the issue remains as a constraint at high coal volumes after bi-di is implemented, then construction of a simple down track platform with minimal facilities could be investigated.

8. Camberwell and Mt Owen Junctions

Both these loaders have moderate throughput in the order of 4 - 5 trains per day. ARTC does not expect these numbers to rise to any great extent.

Both junctions are low speed and located on the up side of the main line (i.e. down empty trains need to cross the up main to enter the branch line). In time it would be desirable to have higher speed main line turnouts installed, although for differing reasons. Camberwell Junction is at the top of Nundah Bank and as the numbers of trains on the main line increase it will be an advantage for empty trains to be able to cross to the branch in as short a time as possible to limit delays to following or opposing trains. Stopping a loaded coal train on approach to this junction is not an option under normal operating conditions, so empty trains are likely to be delayed.

Mt Owen has a similar problem but without the complication of approach grades for loaded trains. However in this case the ability of loaded trains to accelerate off the branch without restraint in order to gain momentum for Nundah Bank will be an important aspect in achieving uniform 10 minute headways through to Sandgate.

It is recommended that plans be prepared to replace both these junctions with ‘standard’ 1:18 turnouts in the medium term, possibly when existing turnouts are life expired or damaged.

9. Drayton Branch Road Crossing

The public level crossing on the Drayton Branch around 800 m from the main line junction causes delays to trains departing and arriving at the branch. Operating practices require loaded trains to be held back around 1 km from the junction until the departure signal is cleared, extending the time to be clear on the main line by several minutes. Benefits of the project to improve the junction with high speed turnouts will be partially negated by the continued impact of the level crossing.

Separate proposals for a new Macquarie Generation siding from Antiene to a new unloader are for a rail underpass below the Drayton line. It may be possible to divert the road to use the same underpass, thus eliminating the crossing altogether, or alternatively to either relocate and/or provide protection of the crossing to remove the existing operational constraints. It is proposed that this project be linked with either the provision of the Macquarie Generation siding or replacement of Drayton Junction as is appropriate.

10. Scone Track Alignment

The loop at Scone is short (410 m) and has an asymmetric layout requiring traverse of a curved turnout leg for all trains. This results in slow speed through the station area. Constraints of level crossings and town proximity make extension of the loop unattractive. Passenger trains are the only services that now actually transact business at Scone. It is proposed that the track arrangement at Scone be altered to give an unrestricted run through the number 2 (non platform) road at Scone with the platform on the loop being retained for passenger trains.

There is currently a morning down and evening up railcar movement which is primarily for positioning purposes. Reconfiguration of the loop at Scone would permit the railcar to be stabled at Scone platform without impeding normal through freight operations, thereby freeing up capacity south of Scone.

It is proposed that sorting out the alignment through Scone be incorporated with the Werris Creek line loop extension project.

11. Track Alignment through Gunnedah

Gunnedah has its platform on the loop, requiring 25 km/h speeds at both ends of the station. Activity at the station includes passenger business (2 trains per day) and quite substantial business for Manildra (who have their own locomotive to operate their various sidings at Gunnedah). This location is unsuited for extension to provide a long loop.

It is proposed that the straight track through the station (number 2 road) be set up as the main line in conjunction with replacement of electric staff working with remote control signalling (which is part of the Werris Creek – Boggabri loop extension project). Passenger trains will still be able to access the platform while Manildra operations will be simpler and cheaper to manage as compared to now (the station is continuously manned for all but 16 hours of the week).

12. Speed Limit for Loaded 100 Tonne Wagons

Loaded 100 tonne coal wagons are restricted to 65 km/h between Muswellbrook and Boggabri. As coal tonnages build up this restriction will provide a minor impediment to capacity as compared to running at 80 km/h. It is likely that limited approval to run up to 80 km/h at selected locations will allow virtually all the benefits of faster running without having to upgrade or up-rate the track throughout.

This project is of low priority. It is proposed that locations be identified where higher speeds would be of advantage in order to identify the upgrade and maintenance implications that would be involved. Implementation of this proposal would probably best be undertaken as part of the normal maintenance routine.

13. Speed Limits on Mine Branch Tracks

The various upgrade projects include improvement to most of the lower Hunter loader junctions. In some cases the branch lines between the junctions and balloon loops are restricted to very low speeds (reported to be as low as 20 km/h in some cases). Low speed will largely negate the advantages of higher speed main line turnouts and could jeopardise achievement of a consistent 10 minute headway. The fact that certain branch lines are privately owned is a complication.

It is proposed that branch tracks for a distance of two train lengths from the junction (nominally 3000 metres) be kept at a standard that will allow entry/exit speeds to match the crossover speeds at the junction. This would allow minimum time empty train clearance of the main line, and unencumbered acceleration of loaded trains, running to/from the branch. It would be an advantage for the longer branches to have a reasonable speed for their full length but that is primarily a matter for the track / loader owner and their train operator.

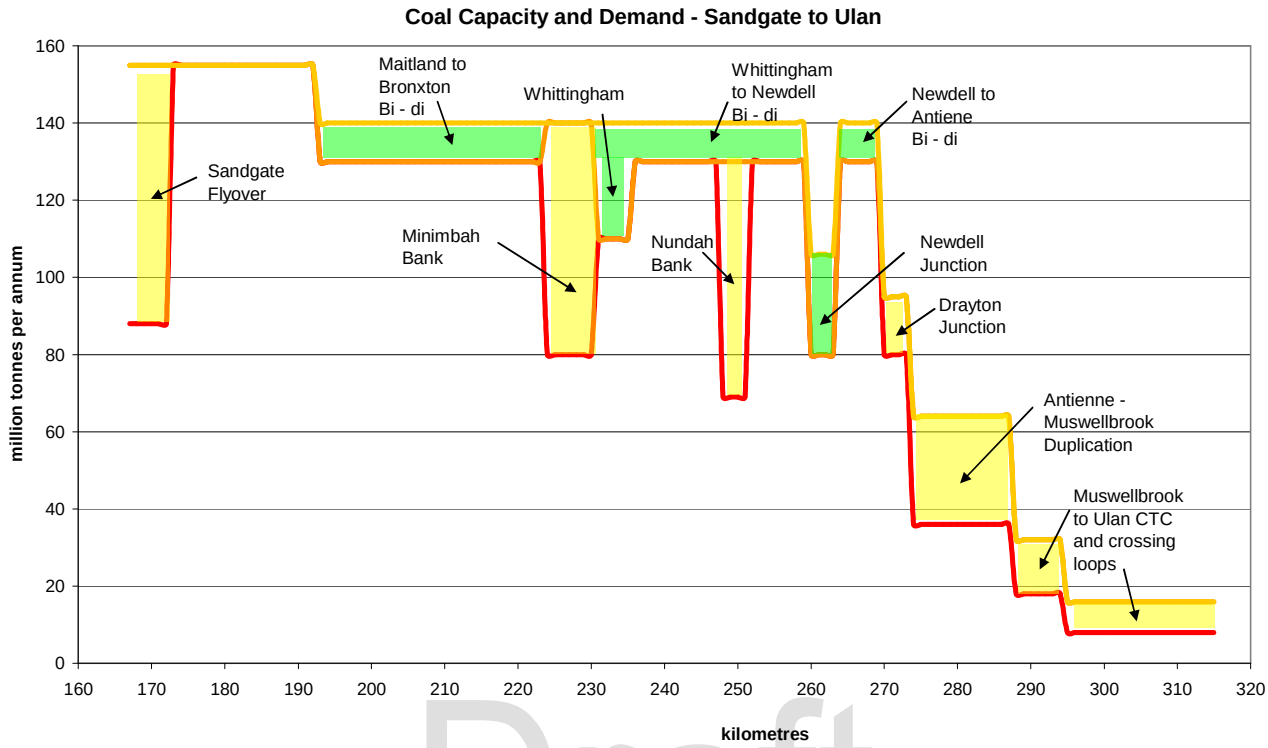
14. Provision of Maintenance Sidings

As train frequencies increase it will become progressively harder to get ‘on track’ time for maintenance. Provision of suitable sidings for heavy track maintenance machinery will be an important aspect of efficient maintenance.

It is proposed that maintenance siding requirements be identified by the maintenance people and where there are shortfalls as compared to requirements that appropriate facilities be incorporated into the overall enhancement program (in order to pick up on construction synergies).

Recommended Projects and Capacity

The following chart shows the projects recommended for implementation as the preferred options for delivering capacity ahead of demand in the Hunter Valley.



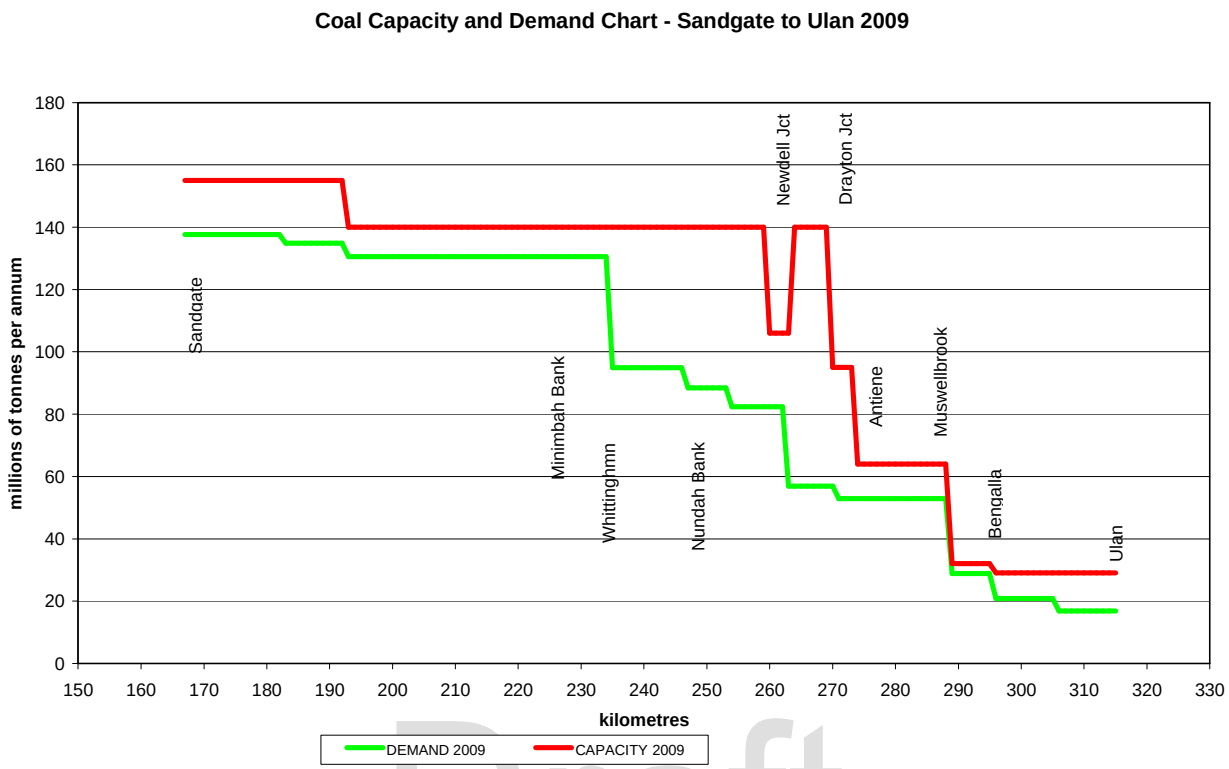
The following table shows the recommended projects with their required delivery dates to meet the current demand growth profile, estimated construction timeframes and the consequential required start dates.

PROJECT	Project Type		Required By		Months Available	Pre-Construction Time	Construction time	Months to Start
80km/h approaching Minimbah, Nundah	Signalling	small	Q4-2005	Dec-05	9	3	6	0
10 minute headway Minimbah	Signalling	small	Q3-2006	Sep-06	18	3	12	3
Third Road Minimbah	civil	large	Q2-2008	Jun-08	39	8	24	7
Whittingham Flyover	civil	large	Q1-2007	Mar-07	24	8	15	1
10 minute headway Nundah	Signalling	small	Q3-2006	Sep-06	18	3	6	9
Third Road Nundah	civil	large	Q2-2009	Jun-09	51	8	24	19
Ulan line CTC	Signalling	large	Q2-2006	Jun-06	15	3	12	0
Muswellbrook Loop and junction	Renewal	small	Q3-2006	Sep-06	18	3	6	9
Ulan Line first additional loop	civil	small	Q4-2006	Dec-06	21	8	6	7
Ulan Line second additional loop	civil	small	Q3-2007	Sep-07	30	8	6	16
Stage 1 duplication Antiene to Grasstree	civil	large	Q4-2006	Dec-06	21	8	9	4
Completion of duplication Antiene to Muswellbrook	civil	large	Q2-2010	Jun-10	63	4	6	53
Newdell Junction	Renewal	small	Q4-2007	Sep-07	30	3	6	21
Drayton Junction	Renewal	small	Q2-2008	Jun-08	39	3	6	30
Bidirectional signaling Maitland to Minimbah	Signalling	large	Q1-2008	Mar-08	36	7	18	11
Bidirectional signaling Whittingham to Newdell	Signalling	large	Q3-2008	Sep-08	42	7	18	17
Bidirectional signaling Newdell to Drayton	Signalling	large	Q3-2009	Sep-09	54	7	18	29
Loop Enhancement Boggabri Line (6 loops)	Civil	large	Q4-2007	Dec-07	33	8	24	1
Loop Enhancement Boggabri Line (6 loops)	Civil	large	Q2-2008	Jun-08	39	8	24	7
Improved signaling Werris Ck to Boggabri	Signalling	large	Q2-2008	Jun-08	39	7	24	8
Ardglen Bank capacity Improvement	Civil	large	Q4-2009	Dec-09	57	12	36	9
Remote control of XYZ crossover at Waratah	Signalling	small	Q2-2006	Jun-06	15	3	6	6
Mine Branch track speeds	Renewal	small	Q4-2007	Dec-07	33	3	6	24
Higher axle loads and bigger rolling stock outline	Renewal	ongoing	Progressive over a number of years starting from Newcastle end.					

The scope of the projects, their timing and their capacity impacts are summarised in the following table:

Project	Scope	Benefit	Approximate Timing (months to complete)	Notes	Capacity pre work MTPA	Capacity after work MTPA
80km/hr running for "120T' coal trains	a) Introduce 4th signal aspect where required for braking from 241 km to 228 km (north of Singleton to near Minimbah).	Overall capacity increase estimated to be 17 to 22 MTPA due to capacity increase on upgrades and longer trains. Saving of at least 2.5 minutes on 'ruling' headway. Return by PNL to 60 and 91 wagon trains will contribute to capacity gains	9		85	102
	b) Introduce 4th signal aspect where required for braking from 264.2 km to 249 km (Newdell Junction to near Nundah).		9		69	86
	c) Introduce 4th signal aspect where required for braking at other locations along route.		36		tbd	tbd
Minimbah Bank Resignalling	Resignalling from Whittingham to 224 km (2.5 km past summit) with two aspect (two active signal heads) would provide for 10 minute headways with coal trains while allowing existing train speeds for fast trains (130kph on bank) to remain. Signal spacing would be proportional to coal train speed on the bank with signal spacing at 550-800 m on the top 3km of the grade.	Capacity increase of around 35 MTPA due to improving headway to 10 minutes with potential for 8 minutes.	15	Issue is one of headway not stalling on grade. Existing 'ruling' headway (53 wagons @ 60kph max) is 16.2 min (approx 18.0 min for 80 wagons). Increasing approach track speed to 80kph would reduce these figures by around 3.5 minutes (but Mt Thorley trains starting from Whittingham Junction would not achieve 80kph). Two aspect signalling would give five indications compared to existing three or four with single aspect signalling. Design signalling to accommodate future 3rd track.	102	140
Third Road Minimbah	Third track within existing track corridor.	Allows overtaking and improves reliability of short headways	32		tbd	tbd
Whittingham Flyover	Flyover at Mt Thorley junction.	Flyover for loaded trains to cross over empty northbound track, will reduce conflict delays and estimated to increase capacity by equivalent of 15 loaded trains	23	Jerry's Plains branch will complicate train running even with no change of tonnage.	115	140
Nundah Bank Resignalling	Equivalent to Minimbah Bank resignalling.	Capacity increase of around 50 MTPA due to improving headway to 10 minutes with potential for 8 minutes.	9	Although lower train numbers the same headway is required so paths are harmonised along the whole line.	96	140
Third Road Nundah	Third track within existing track corridor.	Allows overtaking and improves reliability of short headways	32		tbd	tbd
Ulan Line CTC	Replace electric staff working with CTC.	Gives direct benefit of 4 MTPA plus an additional 4MTPA when Muswellbrook Yard taken into account	15	Need to allow for follow on moves and for additional loop requirements for future tonnage increases.	8	22
Muswellbrook Loop and junction	Project to raise speeds at north end of yard to increase capacity, provide a full length crossing loop, reduce maintenance.	This project will increase capacity on both the main and branch lines (including some small gains from reduced on track maintenance time) and enhance overall reliability.	9	Reduce single track section length toward Ulan and toward Werris Creek.	in Ulan CTC	in Ulan CTC
Ulan Line additional loops			14		in Ulan CTC	in Ulan CTC
Antiene to Muswellbrook Duplication (2 Sections)	a) Stage 1 duplication Antiene to Grasstree	Staged approach proposed, constructing Muswellbrook Loop and easier part of Grasstree - Antiene section early then remainder when necessitated by tonnage. Antiene turnout restricts headways between there and Drayton Jn and is high wear	17	Issues include Antiene turnout (which junction remains, Muscle Creek bridges (4 no.), bi-directional or up/down signalling. Note MacGen facility branch near Antiene.	36	38
	b) Completion of duplication Antiene to Muswellbrook		10		38	64
Newdell Junction	Replacement of low speed junction turnouts with heavy duty high speed turnouts.	Times taken for a train exiting the branch will reduce from around 4.5 minutes now to around 2.25 minutes, effectively reducing the junction conflict time – in effect the junction could handle twice as many branch trains or an estimated increase of 7 northbound main line trains within the existing junction conflict time. Increasing junction speed for trains joining the main line will facilitate operation of 10 minute headways. Reduced maintenance will increase paths available over a typical year (not quantified). New junction should increase capacity by equivalent of 10 loaded trains	9	Increase main line train speeds from 60 to 80kph for coal and branch speeds from 25 to 75kph. Faster speeds and less on track maintenance will allow branch configuration to remain - standing empty train on main can be bypassed using bi-directional running.	90	108
Drayton Junction	Similar to Newdell Junction but junction should be able to be reduced to 3 turnouts (plus one reverse direction crossover?) by using bi-directional running to bypass waiting empty train.	Times taken for a train exiting the branch will reduce from around 6.0 minutes now to around 3.0 minutes, effectively reducing the junction conflict time – in effect the junction could handle twice as many branch trains or an estimated increase of 8 northbound main line trains within the existing junction conflict time. At the same time renewal of the main line crossover and junction turnout and abandoning the branch crossing loop will be possible with faster junction conflict times, saving two turnouts in the new arrangement. Increasing junction speed for trains joining the main line will facilitate operation of 10 minute headways . Reduced maintenance will increase paths available over a typical year (not quantified). New junction should increase capacity by equivalent of 8 loaded trains	9		80	95
Bi-directional signalling Maitland to Minimbah		It is assumed (subject to better data yet to be obtained) that two paths per week would be saved, equivalent to around 0.5 million tonnes per annum. In addition the project would give the ability to bypass trains under failure conditions (greater reliability).	25		135	140
Bi-directional signalling Whittingham to Newdell		As for Maitland - Branxton Bi-directional Signalling plus empty trains standing at junction could be bypassed by other empty trains by using opposing track reducing need for loops or duplication on branch lines (Camberwell, Mt Owen, Newdell/Ravensworth).	25		135	140
Bi-directional signalling Newdell to Drayton		As for Maitland - Branxton Bi-directional Signalling plus simplified Drayton Junction Renewal.	25		135	140
Loop Enhancement Boggabri Line (12 loops)	Project to allow longer trains for coal and grain (subject to limitations at Ardglen) to release paths used by existing short trains south of Muswellbrook.	Existing capacity based on 42 wagon trains. Loops to be to be lengthened to allow 72 wagon trains plus new loops.	32		6	19 Mus-WCk 8 WCk-Bog
Improved signalling Werris Ck to Boggabri	Replace electric staff working with CTC.	reduce dwell by 20 minutes each way = higher capacity	31		8	10
Ardglen Bank capacity Improvement	A study is required to examine future options.	Capacity greater than 10MT per annum will require realignment or duplication over the north face of the Liverpool Range.	48	Ardglen grade will be line capacity constraint at as low as 6 loaded coal trains daily. 65 km/h speed on loaded '100 t' coal wagons and speed limiting track configuration at Scone are secondary issues	4	10
Remote control of XYZ crossover at Waratah	This is a minor project which will be necessary to support other planned improvements.	Improve flexibility to use Main Lines for Port Waratah trains (additional coal capacity Maitland - Sandgate, flexibility for maintenance)	9		n/a	n/a
Mine Branch track speeds	Branch tracks to two train lengths from the junction to be upgraded if necessary to achieve entry/exit speeds matching crossover speeds at junction.	Reduce main line conflict times. Allow achievement of 10 minute headways on main line	9		n/a	n/a
Adopt Higher Axle Loads	From 30 tonnes to 32.5 tonnes (AAR Standard).	Capacity increase for wagons from 120 tonnes gross to 130 tonnes gross. This would allow a progressive improvement over time as rolling stock is replaced. It could result in 10 to 12% increase in train capacity if introduced in conjunction with AAR outline gauge. Adoption of these standards would allow importation of 'off the shelf' equipment from just about anywhere in the world, with potential for reduced equipment costs.	Long Term - implement progressively	This is a long term option. It would require progressive implementation over a long period with all new work constructed to the higher proposed standard.		+11%
Adopt AAR Rolling Stock Outline (Plate E)	Proposed outline gauge 3.25 m wide (10' 8") by 4.8 m high(15' 9").	Adoption of these standards would allow importation of 'off the shelf' equipment from just about anywhere in the world, with potential for reduced equipment costs. It would also permit additional width and height of wagons which would give higher axle loads without the requirement to lengthen wagons.	Long Term - implement progressively	This is a long term option. It would require progressive implementation over a long period with all new work constructed to the higher proposed standard.		in above
Kooragang Island Arrival Road Upgrade	This project needs to be considered as part of an overall coal terminals system review. Further study required.		tbd			

Projected Hunter Valley demand and capacity in 2009 can then be illustrated graphically as follows:



As illustrated by this graph, the planned projects should be able to comfortably accommodate the high levels of demand currently being projected for the Hunter Valley coal industry.

Focussing on the highest volume section, between Whittingham and the ports, the proposed projects have a capacity timeline as follows:

Project	Time	Project Capacity (mtpa)		Route Capacity (mtpa)	Demand (mtpa)
		from	to		
Existing	April 2005			85	85
Minimbah 80 km/h	December 2005	85	102	90	90
Sandgate Grade Separation	July 2006	90	155	102	100
Re-signal Minimbah	September 2006	102	140	115	100
Whittingham flyover	March 2007	115	140	135	115
Bi-di signalling Maitland –Branxton (a)	March 2008	135	140	140	130

NOTE (a): the bi-di signalling will have a relative effect on top of whatever capacity exists on the route.

In summary, capacity on rail will be broadly in line with capacity of the rest of the coal supply chain until the Sandgate grade separation is completed. After that time the planned enhancement program will progressively move ahead of the anticipated demand through to 2009.