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Northern Sydney Freight Corridor

Scoping Phase Completion Report

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Background

The objective of the Northern Sydney Freight Corridor (NSFC) Program is to relieve constraints on the freight network between Sydney and Newcastle. It will enable the East Coast interstate rail network to meet predicted substantial growth in demand, particularly for container freight. The NSFC Program will mean less congestion, reduced travel times and more reliability in freight movement. The NSFC Program will:

- relieve the most serious bottleneck on the East Coast interstate rail network;
- create a more efficient freight rail network connecting Melbourne, Sydney and Brisbane;
- facilitate national productivity improvements;
- increase the reliability and capacity for passenger rail services on sections of the Main North Line; and
- enable the East Coast interstate rail network to meet the predicted substantial growth in demand, particularly for intermodal (container) freight.

In line with the Australian Government process, a three-phase approach is being used to assess and deliver the program – scoping, development and delivery.

In 2008 the Commonwealth Government provided $15m for a scoping phase study of the proposed NSFC. The scoping phase included identification of project objectives; development and validation of an operational model; preliminary engineering design; and costing. It culminated in production of an economic appraisal and business case. The scoping phase was completed on 7th December 2011 when program funding and signing of a Memorandum of Understanding (MoU) for implementation of the NSFC Program were announced.

This report has been prepared by Transport for NSW to summarise the outputs of the scoping phase.

Of the four projects identified, Hexham Passing Loop has completed the development phase and delivery funding has been approved by the Australian Government. Responsibility for the development and delivery of the Hexham project rests with the Australian Rail Track Corporation (ARTC). The development phase for the remaining three projects (which are to be delivered by TfNSW) is underway. Project Proposal Reports (PPR) will be submitted progressively during the development phase for approval of delivery phase funds for each project.

A more efficient rail freight network linking our biggest metropolitan centres will lead to reduced costs of transport and improved economic efficiency for the Australian economy as a whole. Increasing the freight rail share on this corridor will reduce the environmental impact of freight transport, primarily by decreasing greenhouse gas emissions created by road freight.

1 Introduction

This report has been prepared by TfNSW, to summarise the outputs of the scoping phase of the NSFC Program.

1.1 Northern Sydney Freight Corridor

The section of the Main North Line between Sydney and Newcastle is a shared passenger and freight corridor. It is part of the East Coast interstate rail network, servicing Melbourne, Sydney and Brisbane. Currently about 1.7 million tonnes or 15% of interstate freight is moved by rail between these cities. Demand for the transport of interstate freight by rail between these cities is forecast to triple over the next 10 years from 1.7 million tonnes to 5 million tonnes per annum.

The national interstate rail network is outlined in Figure 1.

Figure 1: Interstate Rail Network

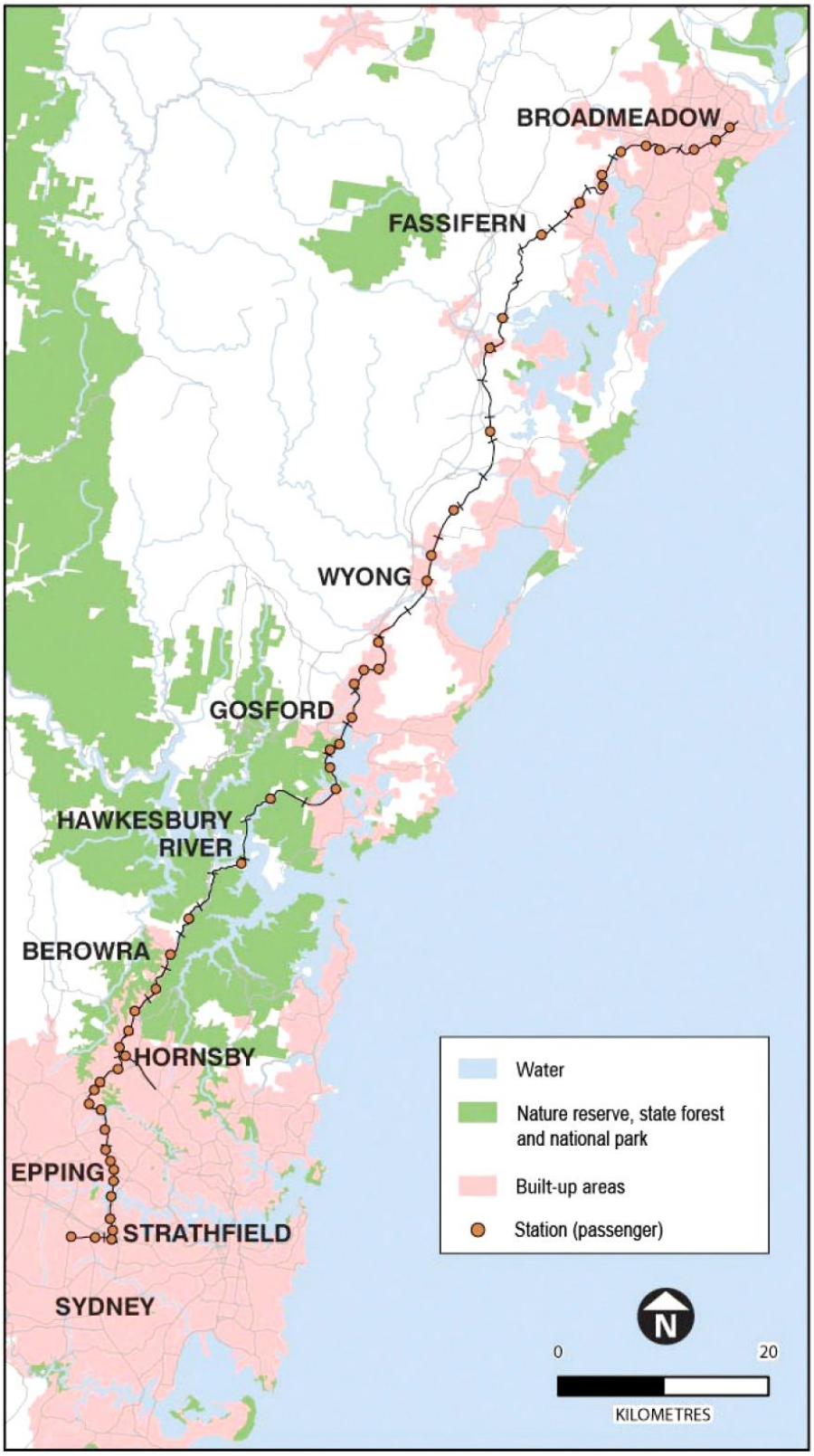
Through the Australian Rail Track Corporation (ARTC), the Australian Government has invested over $2 billion in the East Coast rail network over the past five years to improve capacity, reliability and transit times. The Australian and NSW Governments are also working in partnership to deliver improvements to the Main North Line.

The Infrastructure Australia *National Land Freight Strategy Discussion Paper* (February 2011) identifies the separation of rail freight and passenger services between Sydney and Newcastle as a key goal (refer to Section 2.1.2).

The NSFC Program has been designed to resolve the constraints between Strathfield (Sydney) and Broadmeadow (Newcastle) (refer to Figure 2). It will contribute to a more efficient freight rail network connecting Australia's three largest cities by:

- relieving the most serious bottleneck on the East Coast interstate rail network;
- improving freight train access through northern Sydney to the metropolitan freight network, Port Botany and intermodal (container) terminals;
- reducing freight transport operating costs;
- easing peak hour restrictions on freight services; and
- improving reliability of passenger services on the Main North Line.

Figure 2: Main North Line



1.2 Need for the NSFC Program

The 155 kilometre section of the Main North Line between Sydney (Strathfield) and Newcastle (Broadmeadow) is an integral part of the East Coast interstate rail network, in particular between Sydney and Brisbane. ARTC is a company owned by the Commonwealth Government which manages the interstate rail network across Australia. ARTC has a boundary with RailCorp's network at Broadmeadow, west of Newcastle where freight trains travelling south into Sydney move onto the NSW Government owned RailCorp network. Interstate freight trains are owned and operated by various private companies.

RailCorp's Main North Line provides northern Sydney and the Central Coast with a passenger service which restricts freight services to the period outside the passenger peak times (a period of approximately 17 hours per day). Other constraints for freight services on this section of the Main North Line are:

- a lack of passing loops long enough to take a contemporary 1,500 metre freight train;
- junctions at critical locations (such as North Strathfield and Hornsby) which are a major cause of delay; and
- several steep inclines.

The Metropolitan Freight Network joins the Main North Line at North Strathfield by way of a single track from Flemington. Southbound freight trains need to cross the northbound passenger train line on the Main North Line to access the freight track at Flemington. This is a major operational constraint in the network.

North of the Parramatta River, the rail line begins to rise, with four tracks between West Ryde and Epping. This is useful for holding freight trains if the rail line ahead in either direction is not immediately available and if no passenger train is timetabled on the outside tracks.

The incline north of Epping slows freight trains heading towards Hornsby and there are no holding loops longer than 600 metres. It is therefore difficult to operate a mix of passenger and freight services in this section without causing delays. North of Hornsby, the frequency of passenger train services is lower and northbound freight trains face fewer obstacles until inclines north of Morisset.

In the southbound direction, freight trains face a long and steep rise up from the Hawkesbury River to Cowan. A 1,500 metre holding loop constructed in the early 1990s at the top of Cowan allows a southbound freight train that has climbed the hill to be passed by a following passenger train. The only place to pass southbound freight trains before the Hawkesbury River is at a set of crossovers to the north of Wyong, which allow trains to 'overtake' on the adjacent running line.

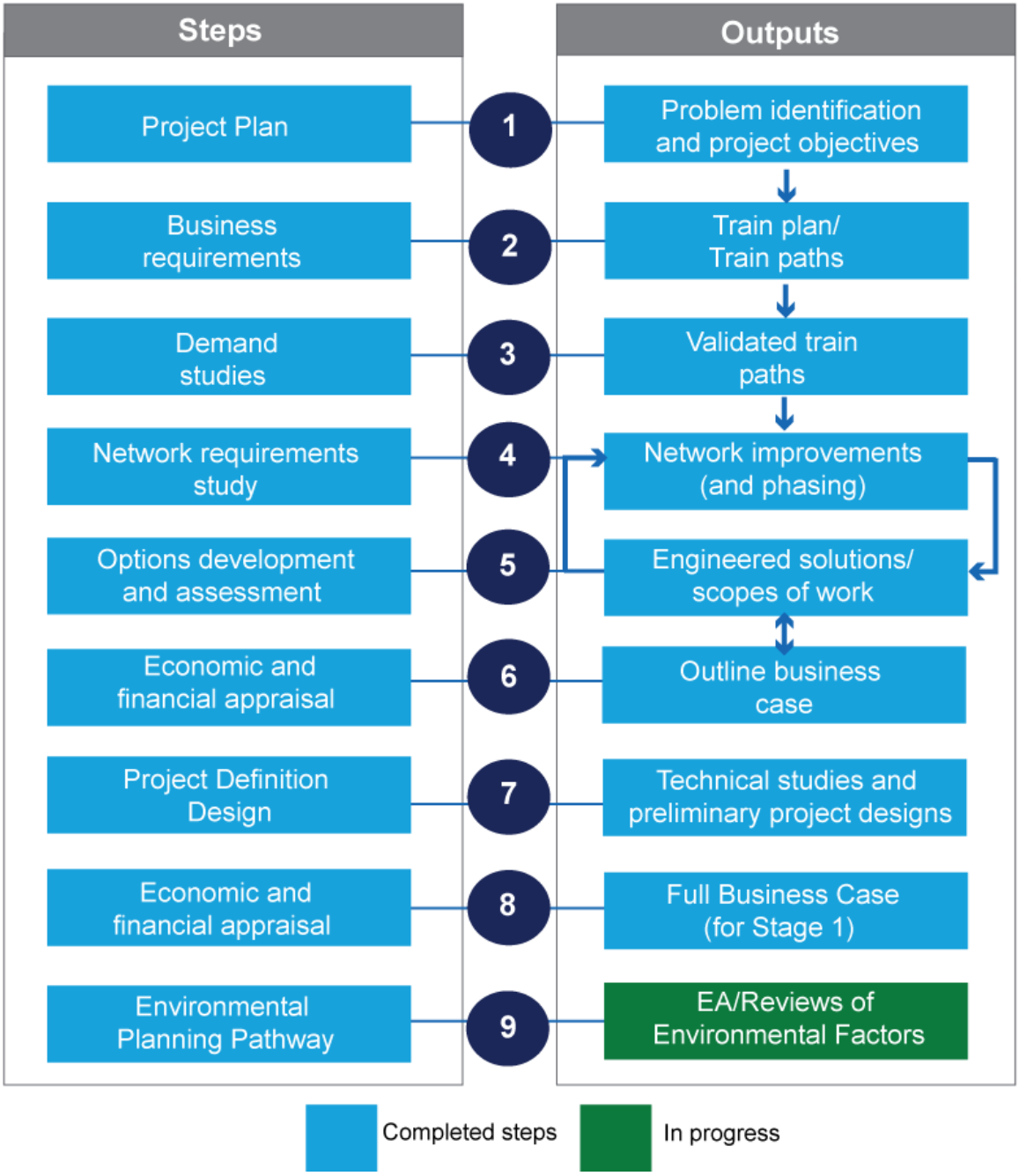
North of Morisset, northbound freight trains face two inclines before Newcastle, whilst southbound trains face a climb from the south end of Broadmeadow Yard to the Tickhole Tunnel just north of Cardiff. In summary the key challenges are:

- **Steep terrain:**
  - most significant being the long, steep inclines heading north from the Parramatta River to Berowra and heading south from the Hawkesbury River to Berowra which slows the freight trains running uphill.
  - north of Morisset, two short, steep inclines to Hawkmount and Tickhole Tunnel also affect train speeds.
- **Operations:**
  - passenger train priority limits freight trains to outside the commuter peak times (approximately 17 hours per day).
  - all stations local passenger services between Woy Woy and Wyong restrict the speed and capacity of freight trains.
  - forecast high growth in interstate intermodal freight will create demand for a total of 53 services per week by 2018 (currently 20 per week).
- **Network configuration:**
  - 'right hand turn' intersection at North Strathfield where freight trains cross oncoming passenger trains.
  - a single track section between Concord West and Flemington (where freight trains access the Metropolitan Freight Network) limits freight train movements.
  - no separate 'slow track' for freight trains going uphill between Epping and Berowra, or Hawkesbury River and Cowan.
  - very few holding loops to 'park' freight trains between Strathfield and Broadmeadow and only one holding loop of 1,500 metres, which is at the top of Cowan Bank. Therefore there is very little scope to 'step' freight trains through the RailCorp network as a path becomes available.
  - restricted holding capacity for freight trains near the ARTC interface with the RailCorp network at Broadmeadow causes delays in sequencing freight trains onto the NSFC.
  - Hornsby Station and yard has no southbound bypass track for freight trains.
  - signalling north of Hawkesbury River is generally widely spaced (some latent capacity remains in this dual track section).

1.3 NSFC Program scoping phase

The purpose of the scoping phase is to define the program of work, and prepare preliminary project definition designs, business case and preliminary planning approval documentation for the NSFC Program. The project scoping framework utilised for the NSFC Program during the development phase is shown in Figure 3 and includes nine steps, concluding in the environmental assessment phase.

Figure 3: NSFC Program scoping overview



1.3.1 Functional scope definition

The first four steps of the scoping framework were concerned with defining a functional scope for the NSFC Program through a process that identified what modifications to the rail network would be required to accommodate future growth in freight services. This development of the freight (and passenger) business requirements (Step 2) was in turn supported by demand study forecasts of major

freight generating industries (e.g. coal, steel and containerised goods) and passenger growth (Step 3).

The business requirements were the key inputs to the Network Requirements Study (Step 4). This study utilised concept level network modelling and analysis to identify how the rail network could be modified to accommodate the extra trains on the rail system.

An Options Development and Assessment Study (Step 5) was undertaken to develop a preferred program of work based on the 57 functional options identified in the Network Requirements Study. The key tasks were to:

- develop engineering options that meet the functional requirements;
- assess these options against agreed criteria; and
- inform the development of the business case assessment process.

The study was broken into two distinct phases:

- phase 1: options development; and
- phase 2: options assessment

1.3.2 Options development

The 57 functional options were reviewed to arrive at a shortlist prior to developing engineering options – the key drivers for the review were:

- Does the option meet the functional requirements?
- Is similar or same functionality provided by another option with less infrastructure?

The development of engineered options involved structured workshops to consider feasible engineering solutions for each option, the five key elements of the assessment process can be summarised as:

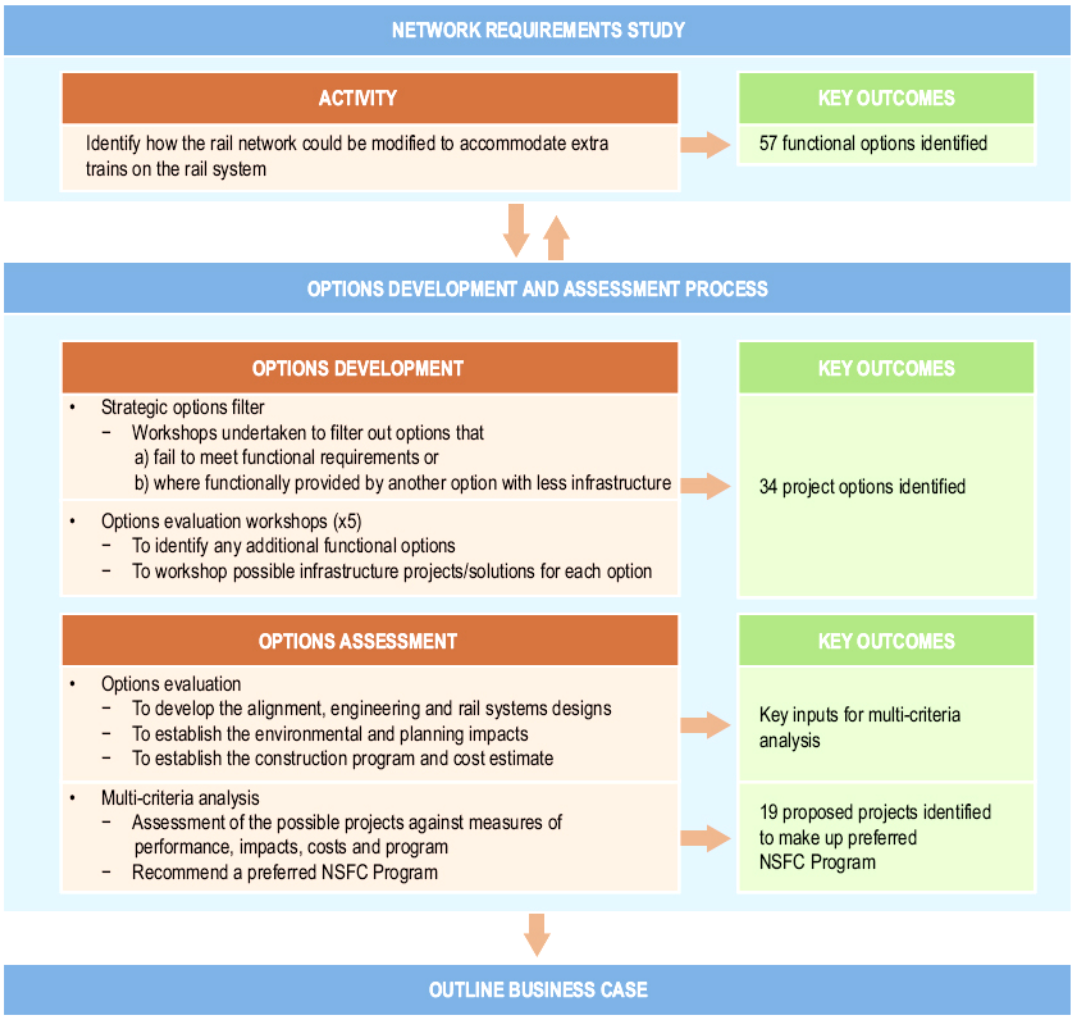
1. **Alignment:** Develop track alignment to reflect functional requirements of each option.
2. **Engineering:** A preliminary assessment of civil and structural engineering related infrastructure required to support the new track alignments (e.g. bridges, station modifications, and earthworks).
3. **Environment and planning:** A preliminary assessment of community, ecological and heritage constraints as well as noise and vibration, drainage, traffic and transport, contaminated land, and land use.
4. **Rail systems:** A preliminary assessment of signalling, communications systems and railway electrification, including the overhead wiring systems.
5. **Cost and constructability:** A strategic estimate of capital costs associated with each of the options, including a review of the construction method for each option. This process reduced the initial list of 57 functional options from the System Requirements Study to 34 project options.

1.3.3 Options assessment

A multi-criteria analysis (MCA) was used to assess the NSFC Program. The performance measures were based on the NSFC Program objectives for capacity, efficiency, productivity, reliability and availability, safety and included three categories:

- **performance**: capacity, productivity, reliability, availability, maintainability and safety;
- **impacts**: environment, community, sustainability, and construction; and
- **cost and program**.

Figure 4: Options Development and Options Assessment



Technical specialists assessed each of the alternative project options against these criteria and this assessment was used to compare alternatives and select the preferred project options. The MCA process reduced the number of options to 19 proposed projects. These are listed in Appendix 3.

1.4 Preferred projects

A combination of network modelling and analysis techniques (train path validation) were used to determine how the NSFC Program could be scoped to match predicted growth in freight demand. The overall aim being the least investment required to achieve a 'step change' increase in rail freight capacity. The key benefits of the proposed projects being operating cost savings of transporting freight by rail and improved reliability of train services.

The proposed projects selected as the first stage of the NSFC Program are the:

- North Strathfield Rail Underpass
- Epping to Pennant Hills Third Track*
- Gosford Passing Loops
- Hexham Passing Loop

It was determined that these four projects build capacity mainly in the off peak and shoulder periods for passenger services, because this can be achieved with the least time and cost, and in any case this infrastructure must be in place before peak period capacity can be improved.

The selection of these four projects involved a process where different combinations of several proposed projects along the corridor were refined to define a minimum scope that would deliver a 'step change' in freight capacity at the least investment cost (refer to Appendix 2).

These four projects would increase the freight capacity on the Main North Line during the core period of the day (4am to 10pm). The core freight period is the most valuable for container freight operators to meet their operational timeframes. The four projects yield a BCR of 3.0 (including wider economic benefits at a 7% discount rate).

RailCorp and ARTC undertook a validation exercise to confirm the scope and additional train paths delivered by the four projects. This validation exercise has also undergone peer review.

As explained in Section 1.3.2, during the scoping phase of the NSFC Program, 19 potential projects were identified, of which four are considered preferred (and are therefore included in the MoU). The remaining 15 projects may form future stages of the Program if further funding is made available. However implementation of subsequent stages would also depend upon what form freight strategy takes long-term, as explained below.

***Note** a name-change for this project is proposed, to 'Epping to Thornleigh Third Track'. This project connects into and makes use of an existing refuge loop just north of Pennant Hills station which runs through to just south of Thornleigh station. This refuge loop has been found not to meet the standard required for freight trains and will require refurbishment. To prevent public confusion on the extent of the project, it is proposed to change the project's name.*

1.4.1 Future options & alternatives

As described above, future stages beyond the four preferred projects were also investigated. A series of 15 additional projects were identified that might be considered in future in order to further increase freight capacity on the Main North Line. Furthermore, several out-of-corridor options were contemplated, a shortlist of which is provided below. It should be noted that at this stage none of these future alternatives is economically viable, however they may warrant consideration at a later date.

- **Hawkdev Tunnel** – Epping to Hawkesbury River passenger tunnel bypass which, in conjunction with additional sections of surface tracks over the Epping to Berowra segment, releases surface capacity for freight trains.
- **Newcastle Bypass** – in a new corridor to avoid western Newcastle, between Fassifern and Hexham.
- **Dedicated freight** – includes the two partial dedicated freight sections above plus:
  - **Hawkesbury River to Woy Woy** – passenger by-pass to release the existing surface track for freight trains.
  - **Woy Woy to Fassifern** – additional dedicated freight tracks within Main North Line corridor.

In addition several alternatives with alignments significantly different to the existing Main North Line were considered. These alternatives were considered in order to determined whether any strategically different alternatives might be possible. Similarly to the other options listed above, none of these alternatives was found to be viable at this time:

- **Melbourne-Brisbane inland rail**
- **Sydney rail bypass**
- **Hawkesbury River to Newcastle**

All future alternatives (on the Main North Line and elsewhere) will have to be evaluated in terms of their ability to provide improvements in an environmentally sound and cost-efficient manner that meets future East Coast freight demand beyond 2021. None of the future stage scenarios will render any of the four preferred projects redundant, including future additional investment in capacity upgrades outside of the Main North Line. The four preferred projects are required to manage rail freight through Sydney under all future scenarios. Alternative options are considered in further detail in Appendix 3.

High speed rail

The potential impact of the proposed high speed rail operating within the NSFC was also considered and it was found that if built within the corridor it would compete with the NSFC Program for physical space, which could impact on the potential for realising the benefits of the Program, particularly in the later stages. Further detail of the feasibility study for high speed rail connecting cities along Australia's east coast being conducted by the Commonwealth Department of Infrastructure and Transport is also provided in Appendix 3.

2 Options overview and assessment

2.1 Summary of the NSFC program

As explained in Section 1.3.2, during the scoping phase of the NSFC Program, nineteen projects were identified as preferred projects for the full NSFC Program. Stage 1 of the NSFC Program includes four priority projects which address the most significant constraints impacting freight services on the Main North Line between Sydney and Newcastle. The proposed Stage 1 scope comprises:

- North Strathfield Rail Underpass;
- Epping to Pennant Hills Third Track
- Gosford Passing Loops; and
- Hexham Passing Loop.

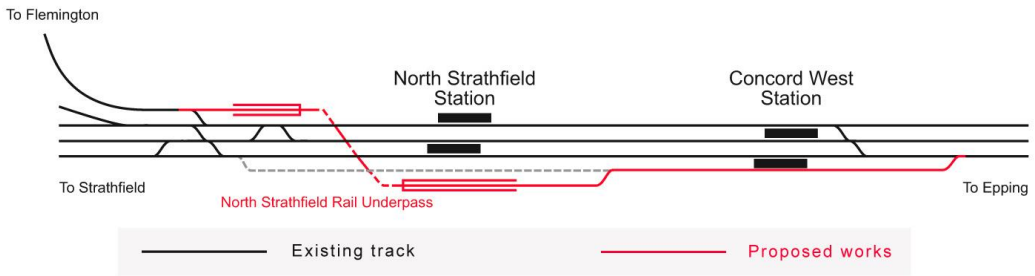
2.2 Projects

2.2.1 North Strathfield Rail Underpass

At the North Strathfield Junction, freight trains use the goods loop to run towards Homebush. This is the key constraint for freight services on the Main North Line as freight services must make a 'right hand turn' and cross the path of passenger trains at Concord West travelling in the opposite direction.

The North Strathfield Rail Underpass will enable additional paths for freight trains, reduce waiting times for freight trains and increase the reliability of both freight and passenger trains. As shown in Figure 6, the North Strathfield Rail Underpass will remove the crossing at North Strathfield Junction and will enable a 1,500 metre freight train to stand clear of the Main North Line before entering the single track section towards Flemington.

Figure 5: North Strathfield Rail Underpass indicative arrangement

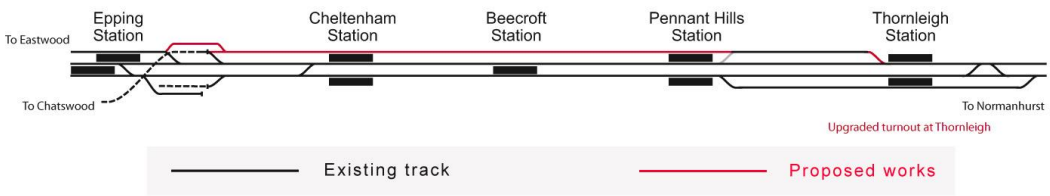


2.2.2 Epping to Pennant Hills Third Track

The Main North Line from Epping to Hornsby is a double track and has a steep climb from Epping to Pennant Hills. Freight trains run slowly up the hill between these points, at around 20-30 kilometres per hour. To overcome this issue, a third track is proposed from Epping to Pennant Hills that connects into the existing

passing loop between Pennant Hills and Thornleigh (refer to Figure 7). This will allow freight trains to run in parallel to passenger trains up the hill.

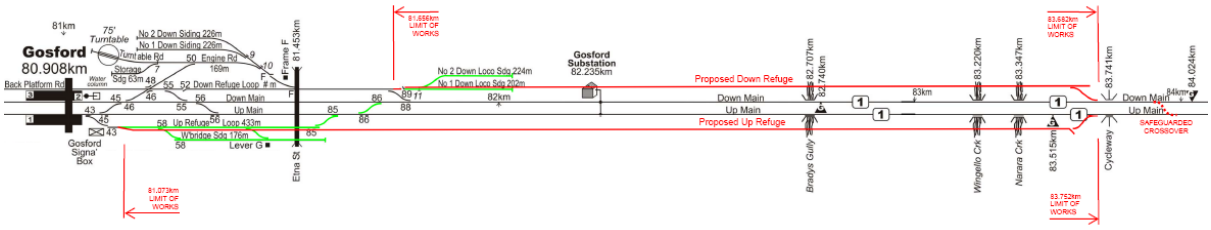
Figure 6: Epping to Pennant Hills Third Track indicative arrangement



2.2.3 Gosford Passing Loops

Passing loops are proposed at Gosford to stage the movement of freight trains through the Main North Line. This is essential in the morning peak, as trains leaving Sydney before the morning peak would reach Newcastle during the morning passenger peak period. The proposed infrastructure for Gosford is illustrated in Figure 8.

Figure 7: Gosford North Passing Loops indicative arrangement

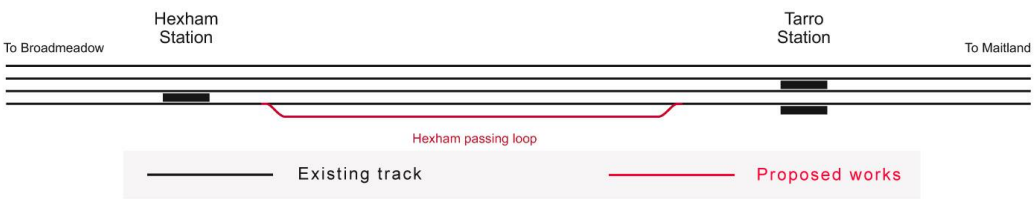


2.2.4 Hexham Passing Loop

In addition to the existing Hexham Passing Loop, another passing loop for freight trains is also proposed between Hexham and Tarro Stations, west of Newcastle, as shown in Figure 9.

The Hexham Passing Loop allows passenger trains to pass parallel to southbound freight trains queuing to access the Main North Line from the Hunter Line. By allowing passenger trains to pass parallel to freight trains, the Hexham Crossing Loop will allow freight trains to advance towards Sydney while waiting for an available path, thereby increasing the capacity of the Main North Line and reducing transit time and delays for freight movements.

Figure 8: Hexham Passing Loop indicative arrangement



3 Justification for the preferred option

The Scoping Phase has demonstrated (and as outlined in the Strategic Review Report) that there is a need to alleviate existing constraints to the capacity of the Melbourne to Sydney Freight route. Particularly important is the need to alleviate capacity through the Sydney to Newcastle corridor so that freight projects due to come on line soon can be fully realised, such as the Southern Sydney Freight Line and the North Coast Passing Loops.

As such it is important that the preferred option provides incremental benefits as well as value for money. The preferred option also needs to provide appropriate capacity increasing freight movement during off-peak passenger periods through the Sydney to Newcastle corridor. The NSFC Program is able to deliver these benefits and is therefore the preferred option.

The full NSFC Program was subject to extensive network modelling, analysis and business case assessment as part of a process to develop a staging strategy which would deliver freight capacity as quickly as possible for the least investment. The staging solutions differentiate between the costs and benefits of capacity/reliability improvements and transit time savings.

The project stakeholders identified that such a strategy requires that priority should be given to projects that build freight capacity during the passenger off peak because this can be achieved with least time and cost. In contrast, peak capacity comes at a relative premium, requiring significantly greater investment in time and cost. Peak access also includes those projects which have passenger benefits because building peak capacity is the key to improving passenger services.

3.1 Benefits of the NSFC Program

The NSFC Program will provide additional rail capacity as well as transit time savings and improved reliability. The largest contributor to the freight benefits is the reduction in freight transport operating costs resulting from a switch in freight transportation from road to rail on the entire East Coast rail network. These benefits would accrue to either freight transport operators (producer surplus), which would result in lower costs and increased profits, or to freight consignees (consumer surplus) as a result of lower shipment costs.

The distribution of these benefits to these different parties would be dependent on the competitive structure of the freight logistics industry. In all likelihood, these benefits would be shared between both operators and consignees.

The principal benefits resulting from the upgrade of the NSFC Program which have been quantified in the business case analysis include:

- freight transit time savings;
- rail and road truck operating cost savings;
- road freight decongestion cost savings;
- freight customer reliability and availability benefits;
- reduced externality costs; and
- road freight crash cost savings.

Furthermore, additional wider economic benefits could be realised as a result of the NSFC Program, which include labour market and productivity impacts not captured by the conventional appraisal.

A summary of the benefits in relation to the benefits of the NSFC Program is provided in Table 1.

Table 1: NSFC Program benefits

NSFC Program objective	Benefits of the NSFC Program
Capacity	Improves capacity for freight services on the Main North Line (Sydney to Newcastle) to meet growing transport demands Removes the bottleneck between Sydney and Newcastle Decreases road congestion
Efficiency	Increases volume of freight transported by rail - a more economically efficient means of transport than road Improves reliability of passenger and fright rail services, reduces transit times and reduces congestion Decreases road maintenance expenditure
Productivity	Improves productivity of trains and train crews Reduces waiting time in terminals
Reliability and availability	Reduces passenger peak period restrictions on freight services, leading to greater flexibility in rail arrival and departure times Improves rail market share and lowers freight rail costs Improves freight train reliability and availability
Safety	Decreases road accidents
Sustainability	Reduces air pollution, greenhouse gas emissions and noise
Passenger services	Improves reliability for both passenger and freight trains and improves transit times for freight trains

3.2 Results of the economic evaluation

Based on the analysis outlined above, the preliminary economic evaluation for the full program of works, has demonstrated that the NSFC Program Stage 1 has a positive benefit-cost ratio of 3.0 (including wider economic benefits at a 7% discount rate).

4 Scoping phase outputs

Figure 3 above describes the steps and outputs of the scoping phase. Of these the following key outputs are discussed in the sections below:

- Validated train paths
- Project definition design
- Costing
- Full business case (for the four preferred projects identified – excludes future stages)
- Preliminary planning approval documentation

4.1 Validated train paths

After initial operational modelling by the technical advisors, a joint validation modelling exercise was set up between ARTC and RailCorp in order to confirm exact numbers of paths to be provided by NSFC.

A summary of the current and predicted post-NSFC train paths identified by the train validation process is provided below:

Table 2: Validated train paths

Period	Direction	Current Infrastructure			NSFC	
		1000-1500m train paths	Short paths (<1000m)	Total	Future total (all 1500m-capable)	Increase
24-hr weekday	Northbound	15	12	27	41	14
	Southbound	13	10	23	36	13
Core period 04:00 to 22:00	Northbound	7	7	14	27	13
	Southbound	5	6	11	20	9
Total (over 24-hrs)	(combined)	28	22	50	77	27

4.2 Project definition design

Preliminary engineering design (to a 'project definition' level of detail) was completed for each of the projects. These final reports are listed in the References section at the end of this document.

The project definition design outlines the key construction elements of each project, along with the estimated construction timeframe and risks. A preliminary maintenance & operation stakeholder consultation process was included. This will be extended and broadened in the development and delivery phases.

4.3 Costing

Based on the project definition design documentation, a cost estimate was completed for each project. The cost estimates include direct costs; indirect costs; project management; property acquisition; risk and contingency; and escalation.

A summary of the cost estimates is provided below. Further details are available within the final costing report by Evans and Peck.

Table 3: Project cost estimates

Project / Phase	Cost estimate
Subtotal - Development Phase	$37,167,000
Hexham Passing Loop	$24,000,000
North Strathfield Rail Underpass	$403,164,373
Epping to Pennant Hills Third Track*	$477,375,762
Gosford North Passing Loops	$112,035,357
Subtotal - Delivery Phase	$1,016,575,492
Total	$1,053,742,491

4.4 Full business case

An economic appraisal was undertaken in order to allow comparison of benefits versus costs. Full details of the economic benefits are provided in the NSFC Stage 1 Business Case report by Deloitte (December 2011).

The business case concluded that NSFC's forecast economic benefits outweigh its forecast costs (ie benefit cost ratio or BCR) by a factor of 2.7, assuming a 7% discount rate. This increases to 3.0 if wider economic benefits are included, and to 4.0 if a discount rate of 4.4% is adopted as per Commonwealth requirements under the Nation Building Program.

4.5 Preliminary planning approval documentation

The Commonwealth funding approval of the NSFC Scoping Phase included the requirement to undertake the:

> *"…preparation of a concept plan under Part 3A of the NSW Environmental Planning and Assessment Act 1979 seeking broad approval of the NSFC as a whole…."*

The Scoping Phase identified a package of works (being the four preferred projects) that is forecast to satisfy rail freight demand through to 2028.

Whilst projects in future stages of the NSFC Program have been defined, these later stages have not been validated in terms of freight path outcomes. The long term NSFC freight strategy and funding has not been resolved. Further submissions have been made by NSW to Infrastructure Australia, and delivery of further stages of the program are subject to funding availability.

In light of the status of the futures stages of the NSFC Program (ie unfunded), the Project Control Group requested TCA undertake a review of the Pathway strategy to determine whether it was desirable to seek concept approval at this stage, particularly in terms of risk of delay to planning approval for the preferred projects.

An alternative approach was developed that allows the Program to meet its obligations under the EP&A Act for environmental impact assessment, whilst not binding the Commonwealth and State Governments to the Full Program of works.

The revised planning approvals approach is as follows:

- Part 5 approvals for the NSRU, Hexham Passing Loop and Gosford Passing Loops and any other project component with only minor likely environmental impacts; and
- Part 5.1 major project approval only for the third track between Epping and Thornleigh.

The cumulative environmental impacts of the four preferred projects would be assessed as part of each project, in particular additional freight train movement and their related noise impacts. However, future stages' cumulative impacts (including additional train movements) would not be included in the assessment because there is lack of certainty with respect to the long term freight strategy both in terms of alternatives to the full NSFC Program and options within the Program such as the Hawkesbury to Devlins Creek Tunnel.

This approach will include a strategic review report to provide context so that the community and decision makers can assess the four preferred projects within the context of longer term strategic options to manage rail freight access between Sydney and Newcastle and along the east coast.

The status of planning approval documentation as at January 2012 is as follows:

Table 4: Status of environmental approvals

Project	Assessment required	Status	Phase
North Strathfield Rail Underpass	Review of Environmental Factors (Part 5 of NSW EP&A Act)	Draft REF completed	Scoping phase
Epping to Pennant Hills Third Track*	Environmental Impact Assessment (Part 5.1 of NSW EP&A Act)	Preliminary environmental assessment completed to support initial planning application. Specialist studies underway.	Commenced in Development Phase
Gosford Passing Loops	Review of Environmental Factors (Part 5 of NSW EP&A Act)	Draft REF completed	Commenced in Development Phase
Hexham Passing Loop	Review of Environmental Factors (Part 5 of NSW EP&A Act)	Complete	Commenced in Scoping Phase and completed in Development Phase

5 Implementation

5.1 Governance

5.1.1 Scoping phase and development phase

The governance of the NSFC Program during the scoping phase and continuing into the development phase has been managed through the NSFC Steering Committee and the Project Control Group (PCG).

The Steering Committee has responsibility for managing key hold-point decisions. The NSFC Steering Committee comprises the executive staff of the Commonwealth Department of Infrastructure and Transport; ARTC; RailCorp; and Transport for NSW.

The PCG has responsibility for oversight of progress and endorsing project plans, briefs and approval of major professional contracts within the limits of delegation set by the Steering Committee. The NSFC PCG comprises project officers from key stakeholders Commonwealth Department of Infrastructure and Transport; Transport for NSW; RailCorp; and ARTC.

5.1.2 Delivery phase

During the delivery phase of the NSFC Program, the construction of the North Strathfield Rail Underpass, Epping to Pennant Hills Third Track and the Gosford Passing Loops will be undertaken by the Transport for NSW. ARTC will undertake the construction of the Hexham Passing Loop project.

During delivery, the Steering Committee and NSFC PCG will continue to operate to ensure appropriate oversight and management of project delivery and the NSW/Commonwealth Government interface.

5.1.3 Operation phase

During the operating phase, the North Strathfield Rail Underpass, Epping to Pennant Hills Third Track and Gosford Passing Loops will be owned and managed by RailCorp as the asset manager of Main North Line, and as such will be responsible for track maintenance and train operations. The Hexham Passing Loop will be owned and managed by ARTC as part of the leased interstate network. A new access contract is being negotiated between TfNSW, RailCorp and ARTC as part of the development phase.

5.2 Delivery strategy

In undertaking any procurement strategy, a key objective of both the Commonwealth and NSW Governments is to achieve value for money, in terms of the capital cost and the whole of life costs of the NSFC Program. The value for money is considered within the context of the objectives of any project and the risk management strategy.

The NSFC Program involves a number of discrete but related projects along the corridor between Strathfield and Newcastle. The selection of the contracting strategy will depend on the risk profile for each project, which considers issues such as the complexity of the work, competency required, brownfield/greenfield separation, scope detail, the size of the project, timeframe and any constraints.

The scheduling for the NSFC Program has involved discussion with some of the key stakeholders, including RailCorp, to determine likely track availability and timing of critical resources, such as signalling and electrical high voltage commissioning engineers.

The final delivery strategy will be resolved in the development phase.

5.3 Financing and funding

A number of options have been considered for the financing of the NSFC Program. Although the NSFC Program will deliver significant economic benefits, the financial returns are not sufficient for the private sector to fund the NSFC Program on the basis of the projected revenue increase.

As the NSFC Program involves augmentation of an existing rail corridor within an existing rail network assigning revenues to the Program would be difficult. A 'build-own-operate' structure would not be feasible because the NSFC Program is a series of works that modifies the existing rail network and can not be operated or maintained separately to that network.

The four preferred projects are being jointly funded by the Australian and NSW Governments. The Australian Government is contributing capped funding of $840m and the remaining actual cost will be funded by the NSW State Government.

5.4 Environmental impact assessment

5.4.1 Approvals strategy

The environmental impact assessment and planning approvals process for the NSFC Program will involve the environmental impact assessment of the proposed projects pursuant to the provisions of the NSW *Environmental Planning and Assessment Act 1979*.

Appropriate investigation into potential impacts, and any need for referral to the Commonwealth Government on matters of National Environmental Significance as defined in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* will also be undertaken.

5.4.2 Noise mitigation strategy

Each of the four projects within the NSFC Program will be assessed through separate environmental impact assessment processes. To ensure consistency between the noise and vibration assessments which will be prepared for each respective project it is important that the consideration of noise and vibration impacts for the NSFC Program adopts a strategic approach. The noise and

vibration assessments will also have regard to cumulative impacts across the entire NSFC Program.

Accordingly, a program-wide noise and vibration strategy, the NSFC Noise Mitigation Strategy, is being prepared to provide the overarching principles and range of indicative reasonable and feasible options available to minimise the corridor wide impacts of the NSFC Program. The consideration of mitigation options will include:

- **Physical measures** – such as noise barriers, rail dampers, track fixing systems, and dwelling treatments; and
- **Operational measures** – such as improvements to locomotives and wagons, and changes to maintenance regimes.

The Noise Mitigation Strategy will establish a framework to guide the detailed noise and vibration assessments for the environmental impact assessments for each of the projects within the NSFC Program, and provide an indication of broad scale impacts likely to be experienced as a result of the NSFC Program.

The Noise Mitigation Strategy is being developed by TfNSW in consultation with a number of stakeholders including RailCorp and ARTC. Freight operators, the NSW Office of Environment and Heritage, and the Department of Planning and Infrastructure will also be consulted as part of the development of the Noise Mitigation Strategy.

5.5 Consultation

A consultation program will be undertaken during the environmental impact assessment process for each project of the NSFC Program. The Strategic Review Report will be used to support this consultation and the strategic justification for the NSFC Program.

6 Conclusion

The NSFC Program will enable the East Coast interstate rail network to meet substantial predicted demand growth, particularly for container freight. The NSFC Program will mean less congestion, reduced travel times and more reliable freight movement between Sydney and Brisbane. It will provide additional capacity at the major bottleneck on this corridor – Strathfield to Broadmeadow – during the times of day critical to time-sensitive container freight. It will also help to alleviate growth in road freight, thereby preventing road crashes and reducing air pollution.

The Scoping Phase recommends that the following four projects form Stage 1 of the NSFC Program:

- North Strathfield Rail Underpass;
- Epping to Pennant Hills Third Track
- Gosford Passing Loops; and
- Hexham Passing Loop.

The business case concluded that the benefits of Stage1of the NSFC Program outweigh its forecast costs with a BCR factor of 2.7, assuming a 7% discount rate (without WEBs).

With the signing of a Memorandum of Understanding between the Commonwealth and NSW governments on 7th December 2011 the scoping phase of the NSFC program is now complete. This report documents the process adopted within, and outputs of, the scoping phase. The key deliverables produced in the scoping phase are:

- Validated train paths
- Project definition design
- Project cost estimate
- Full business case (for the four projects identified)
- Preliminary planning approval documentation

The development phase of the program has been underway in 2011 in parallel with the scoping phase, being funded in the interim by NSW until the MoU was signed. The program now moves to completing the development phase, with delivery funding approval for the three remaining Stage 1 projects anticipated during 2012.

References

The following public documents were referred to in the preparation of the Scoping Phase Completion Report:

Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2009, *Information Sheet 34 Road and rail freight: Competitors or complements?* BITRE

Department of Transport and Regional Services (DOTARS), 2007a, *Sydney Urban Corridor Strategy,* DOTARS

DOTARS, 2007, *Sydney-Brisbane Corridor Strategy*, DOTARS

Ernst and Young, 2006, *North-South Rail Corridor Study Executive Report*, Ernst and Young

NSW Government, 2005, *The Metropolitan Strategy, City of Cities — A Plan for Sydney's Future*, NSW Government

NSW Government 2006, *A New Direction for NSW: State Plan*, NSW Government

NSW Government, 2010, *Metropolitan Transport Plan: Connecting the City of Cities*, NSW Government

NSW Government, 2011, *Infrastructure Australia Submission (August 2011)*, NSW Government

The following documents were produced during the Scoping Phase and referred to in the preparation of the Scoping Phase Completion Report:

SAHA, 2009, *Northern Sydney Rail Corridor Freight Demand Assessment: Final Project Findings*, SAHA

SAHA, 2009, *Northern Sydney Rail Corridor, Full Economic and Financial Assessment,* SAHA

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Deloitte, 2011, *Northern Sydney Freight Corridor Program – Stage 1 Business Case*, Deloitte

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Worley Parsons, 2009, *Northern Sydney Freight Corridor: System Requirements Study*, Worley Parsons

Transport NSWIndec, 2010, NSFC *Stage 1*(Train Path) Validation Report, Transport NSW

Parsons Brinckerhoff & GHD 2010, Project Definition Design Report – North Strathfield Rail Underpass, Parsons Brinckerhoff & GHD

Arup 2011, Project Definition Design Report – Epping to Thornleigh Third Track, Arup

Arup 2011, Project Definition Design Report – Gosford Passing Loops, Arup

Currie & Brown, 2010, Cost Plan Peer Review

TfNSW, 2011, Strategic Review Report

Appendix 1 – strategic context

This section identifies key strategic policies and legislation for freight planning in NSW and Australia, demonstrating the need for the NSFC Program.

Nation Building Program

The Commonwealth Government introduced the *Infrastructure Australia Act 2008* to establish Infrastructure Australia. Infrastructure Australia is tasked with the responsibility to develop a strategic blueprint for Australia's future infrastructure needs and, in partnership with the states, territories, local government and the private sector; facilitate its implementation.

The NSFC Program is included on the Infrastructure Australia priority list and funding has been allocated under the Nation Building Program. The Australian Government, jointly with the NSW Government, announced funding for the delivery of the NSFC Program in December 2011.

National Land Freight Strategy, 2011

The Infrastructure Australia National Land Freight Strategy Discussion Paper (February 2011) provides a case and priorities for a national land freight network strategy, and an indicative list of projects and programs that Infrastructure Australia has flagged for inclusion in a long term national land freight network plan.

In the discussion paper, Infrastructure Australia seeks comments on its preliminary views about a national land freight network strategy, including its goals, objectives, strategic directions and priorities. The separation of rail freight and passenger services between Sydney and Newcastle is identified as a key goal in the discussion paper.

The NSFC Program accords with the Commonwealth's aims and priorities for the long term national freight network.

Sydney-Brisbane Corridor Strategy, 2007

The Sydney-Brisbane Corridor Strategy details the importance of good connections between Sydney and Brisbane for passenger and commercial freight traffic as well as tourism. The Sydney-Brisbane Corridor Strategy identifies short-term priorities in relation to the north Sydney rail network, which include:

- increasing rail capacity between North Strathfield and Newcastle; and
- improvement in rail and intermodal terminal capacity in Sydney and Brisbane particularly related to ports activities.

Interstate and Hunter Valley Rail Infrastructure Strategy, 2008

ARTC has prepared a north-south corridor strategy for the Melbourne–Sydney–Brisbane interstate rail network, which forms part of ARTC's 2008-2024 Interstate and Hunter Valley Rail Infrastructure Strategy. The north-south investment program is aimed at reducing transit times between the three cities, improving the availability of services to meet growing freight demand and improving the competitiveness of rail compared to road freight.

A key project of the north-south corridor investment program is the construction of the Southern Sydney Freight Line (SSFL) to provide independent and priority freight train access through southern Sydney. The SSFL provides a dedicated freight line between Macarthur and Sefton, allowing passenger and freight services to operate independently.

The Strategy identifies capacity enhancement through northern Sydney as a critical investment requirement for the north-south corridor, in order to improve capacity and reliability over this critical segment of the corridor.

Sydney Urban Corridor Strategy, 2007

The Sydney Urban Corridor Strategy was jointly developed by the Australian and NSW Governments in 2007. The strategy outlines a number of short-term strategic priorities to 2015 to address issues of capacity, efficiency, productivity, reliability, safety, security and sustainability both directly and indirectly. These include:

- Manage growth of rail freight and passenger services on the shared network and facilitate separation between the freight and passenger operations leading to improvements in capacity and reliability of the public transport system to alleviate congestion.
- Improve north-south freeway connections to the orbital network through motorway links from the Westlink Motorway to the Sydney to Newcastle Freeway and the Southern Freeway.
- Improve coordination of freeway and motorway management and pricing, including consideration of measures to control the volume of traffic during commuter peak periods, such as ramp metering.
- Enhance capacity along the Hills Motorway, Western Motorway, South Western Motorway and Westlink Motorway corridors.

The NSFC Program fulfils the first of these strategic priorities within the Sydney Urban Corridor Strategy by facilitating the separation of freight and passenger trains services. The overall result improves the reliability of both passenger and freight services.

NSW 2021

NSW 2021 (Department Premier and Cabinet 2011) is a 10 year plan to guide policy and budget decision making in NSW. The main target that is relevant to the program is to double the proportion of container freight moved by rail from Port

Botany. Achieving this target would also help meet targets in relation to the efficiency of the road network through easing road congestion.

Long Term Transport Masterplan, 2012

The NSW Government is currently developing the Long Term Transport Masterplan with an estimated completion date of November 2012. This plan will be a comprehensive plan for all modes of transport across NSW. The plan will identify a clear direction for transport over the next 20 years, while building on current commitments.

Appendix 2 – demand and capacity

Forecast freight demand

The East Coast freight market can be split into six key segments:

- interstate (containerised);
- regional (containerised);
- steel;
- grain;
- coal; and
- building materials (mainly sand, aggregates and cement).

Interstate container freight currently has the largest number of trains and is forecast to experience the highest levels of growth of any market segment (refer to Table 1 for a summary of the forecast growth in each of the key market segments). Currently, East Coast freight train operators are unable to satisfy containerised freight customer requests for afternoon departures and early morning arrivals due, in the large part, to the restrictions on access through the Sydney metropolitan rail network. Partly as a consequence rail has a very low share of the shorter haul containerised freight markets but is more competitive in the longer haul markets such as Melbourne to Brisbane where overnight delivery by road or rail is not possible.

Table 5: Current and forecast annual tonnages

Market segment	2008	2018		2028		2038	
		Low	High	Low	High	Low	High
Interstate intermodal	1,659	5,035	9,738	6,388	15,297	8,098	20,979
Regional intermodal	782	970	1,081	1,165	1,315	1,388	1,629
Port of Newcastle (2020)	0	0	0	4,320	4,320	4,320	4,320
Steel	1,215	1,392	1,615	1,572	2,057	1,771	2,607
Grain	568	628	641	690	715	738	776
Coal	5,150	6,881	14,903	5,253	14,657	1,000	15,503
Building products	160	160	1,180	160	1,680	160	1,680
Total	9,534	15,066	29,157	15,299	40,041	13,155	47,314
Total excluding Wyong	9,534	15,066	24,157	15,299	35,041	13,155	42,314
Total including Port of Newcastle	9,534	15,066	29,157	19,549	44,361	17,475	51,634

Source: SAHA International – Northern Sydney Rail Corridor Freight Demand Assessment, Final Project Findings, Appendix A (February 2009) p 5

Currently rail transports only about 1.7 million tonnes or 15% of interstate freight between Sydney, other capital cities and Brisbane because of the competitive advantage road freight obtains due to rail's scheduling restrictions. By comparison, on the very long haul routes between Perth and both Sydney and Melbourne, rail carries upwards of 70% of freight.

The NSFC Program demand study has forecast potential demand for at least 5 million tonnes of interstate container freight per annum by rail between Sydney, other capital cities and Brisbane which would represent about a 50% market share of interstate freight on rail by 2018.

The reason for the forecast sharp increase in demand through to 2018 is a projected market response to the NSFC Program's improvements to the availability and reliability of freight paths, and potential increases in energy costs. Following the market adjustments, demand growth is likely to be just above economic growth. Growth in coal volumes is harder to predict because it is contingent on future mine development and decisions concerning long term use of coal for power generation. It is noted that coal trains mostly operate between the Central Coast and Newcastle and do not significantly affect the key network capacity constraints south of the Hawkesbury River.

The outlook for building products is somewhat similar to coal in that the forecast volumes depend on whether potential new projects proceed (and use rail transport). The high forecast includes the potential volumes associated with these projects.

The steel market scenario is forecast to be stable over the long term with the high growth scenario aligning with GDP growth of 3-4% and the low growth scenario being half the rate of GDP growth. The grain market is mature and likely to only grow in response to domestic consumption responding to population growth.

Table 2 describes the annual tonnages identified in Table 1 into train movements per week required to satisfy the freight task. These train movements were used in the business case to calculate the freight benefits. Total growth in all freight trains is forecasted to be between 1.5 and almost three fold during the 10 year period from 2008 to 2018.

Table 6: Round trip train movements per week

Market segment	2008	2018		2028		2038	
		Low	High	Low	High	Low	High
Interstate intermodal	20	53	102	58	140	65	166
Regional intermodal	9	12	13	14	16	17	20
Port of Newcastle (2020)	N/A	N/A	N/A	29	29	29	29
Steel	12	13	15	15	20	17	25
Grain	8	9	9	10	10	11	11
Coal	18	29 - 80	47 - 116	19 - 59	51 - 132	6	40 - 120
- to Port Kembla	11	11	19	6	19	6	7
- to power stations	7	17 - 69	17 - 69	13 - 54	21 - 85	N/A	21 - 85
- Wyong coal	N/A	N/A	11 - 28	N/A	11 - 28	N/A	11 - 28
Building products	3	3	19	3	27	3	27
Total	71	118 - 170	207 - 276	119 - 159	264 - 345	117	298 - 369
Total (without Wyong)	71	118 - 170	196 - 248	119 - 159	253 - 317	117	278 - 341
Total (including Port of Newcastle)	71	118 - 170	207 - 276	148 - 188	293 - 374	146	318 - 399

Source: SAHA International – Northern Sydney Rail Corridor Freight Demand Assessment, Final Project Findings, Appendix A (February 2009) p 6

Network requirements

Currently the Main North Line (Sydney to Newcastle) has practical capacity for approximately 23 freight trains per day in each direction, not all of which can accommodate trains of the standard 1500m length. Of these 46 trains per day, 25 trains would typically operate during the core operational period between 04:00–22:00 (11 southbound and 14 northbound). The core period is particularly relevant to the interstate container market which is time sensitive and mostly needs paths during this time of the day to satisfy customer requirements.

NSFC will significantly increase the practical freight train capacity on the Main North Line during the core operational period of the day (04:00 – 22:00) from 11 to 17 movements southbound, and 14 to 23 movements northbound. Over the 24 hour period NSFC will increase capacity from 23 to 32 movements southbound, and 27 to 37 movements northbound (although the practical capacity will be limited to 32 in each direction due to the need for trains to balance). All paths will be 1500m-capable. NSFC will resolve the most pressing constraints on the Main North Line (Sydney–Newcastle) and will provide enough additional capacity to accommodate demand up to about 2028 (when further capacity would be required to accommodate subsequent growth).

The most serious network constraints are generally south of Berowra where suburban passenger operations place more pressure on the capacity of the rail network. Consequently Stage 1 investment focuses on resolving crossing conflicts at Concord West (which affects both Up and Down freight trains) and the impact of the Epping–Pennant Hills gradient on freight train operations. Whilst Cowan Bank is also a very significant constraint on freight operations, the density of all rail traffic competing for paths is lower and two freight paths an hour is achievable outside of passenger peak periods. South of Hornsby however, this is generally not achievable.

Appendix 3 – future options and alternatives

As described in Section 1.3 and 1.4, various future stages of the Program have been considered. These future stages consist of an additional 15 potential Main North Line upgrade projects as listed below:

1. Islington Junction Holding Road
2. Rhodes to West Ryde 3rd Track
3. Thornleigh to Hornsby 3rd Track
4. Thornleigh to Hornsby 4th Track
5. Hornsby Bypass
6. ATP interface / signalling works – Stage 2
7. Berowra to Hawkesbury River 3rd Track
8. Duplication to Flemington Markets
9. Strathfield Junction passenger underpass
10. Concord West to West Ryde 4th Track
11. Epping Turnback Modifications
12. Epping to Pennant Hills 4th Track
13. Hornsby to Berowra 3rd Track Bi-Directional
14. Wyong Passing Loop
15. ATP interface / signalling works – Stage 3

Several potential strategic alternatives were also identified as part of the scoping phase. These are alternatives for later stages of the NSFC Program only, as the four preferred projects are required irrespective of which any long term strategy is adopted.

None of the future stage scenarios will render any of the four preferred projects redundant, including future additional investment in capacity upgrades outside of the Main North Line. The four preferred projects are required to manage rail freight through Sydney under all future scenarios.

The long-term strategic alternatives are discussed below.

Melbourne-Brisbane inland rail

There has been considerable discussion in recent years on developing an inland rail route that would emulate the role of the Newell Highway in the road freight market (refer to Figure 9). The principal driver for the Melbourne-Brisbane Inland Rail Option is the potential it offers for reduced journey times and operating costs

between Melbourne and Brisbane, avoiding the access restrictions and delays associated with transiting Sydney.

The difficulties in developing this route primarily relate to:

- the historic development of the NSW country rail network which is a mainly East-West radial network; and
- the long distances and relatively low freight volumes in regional NSW.

The railway line from Melbourne via Albury and Cootamundra to Parkes is now all high quality mainline with concrete sleepers and (mostly) heavy rail. Extending this corridor through to Brisbane requires long sections of new alignment, the upgrading of secondary lines, and the conversion of light narrow gauge track to standard gauge mainline. The descent of the Great Dividing Range from Toowoomba to the outskirts of Brisbane requires a completely new alignment through highly challenging terrain.

An extensive study of an Inland Route was commissioned by the Australian Government in 2008, and managed by ARTC on its behalf. The final report of that study was released in August 2010. The study concluded that:

- There is demand for the railway that would result in a freeing of capacity through Sydney (removing five northbound Melbourne-Brisbane services per day from the existing coastal railway by 2030 and around ten by 2050).
- The optimised route (developed from approximately 50,000 options) would achieve an average Melbourne–Brisbane transit time (terminal-to-terminal) of around 20.5 hours over a distance of 1,731 kilometres; utilising approximately 65% of existing corridors.
- This alignment is estimated to provide freight in the Melbourne–Brisbane corridor with a rail option that is approximately 7 hours faster and around 170 kilometres shorter than the existing coastal railway. It is also expected to be more competitive on transit time, reliability, availability and, in particular, door-to-door freight prices, relative to road transport using the Newell Highway.
- The results of a financial assessment (prepared from the point of view of a track operator) suggest that the Inland Rail does not appear viable on a standalone commercial basis.
- From the broader point of view of rail users and the wider community, economic analysis suggests an Inland Route will achieve a positive economic net present value at a 7% real discount rate if operations commence around 2035, when total tonnage demanding the railway is above around 25 million tonnes per annum. If this level of demand were to be reached sooner, economic viability would also be reached sooner.

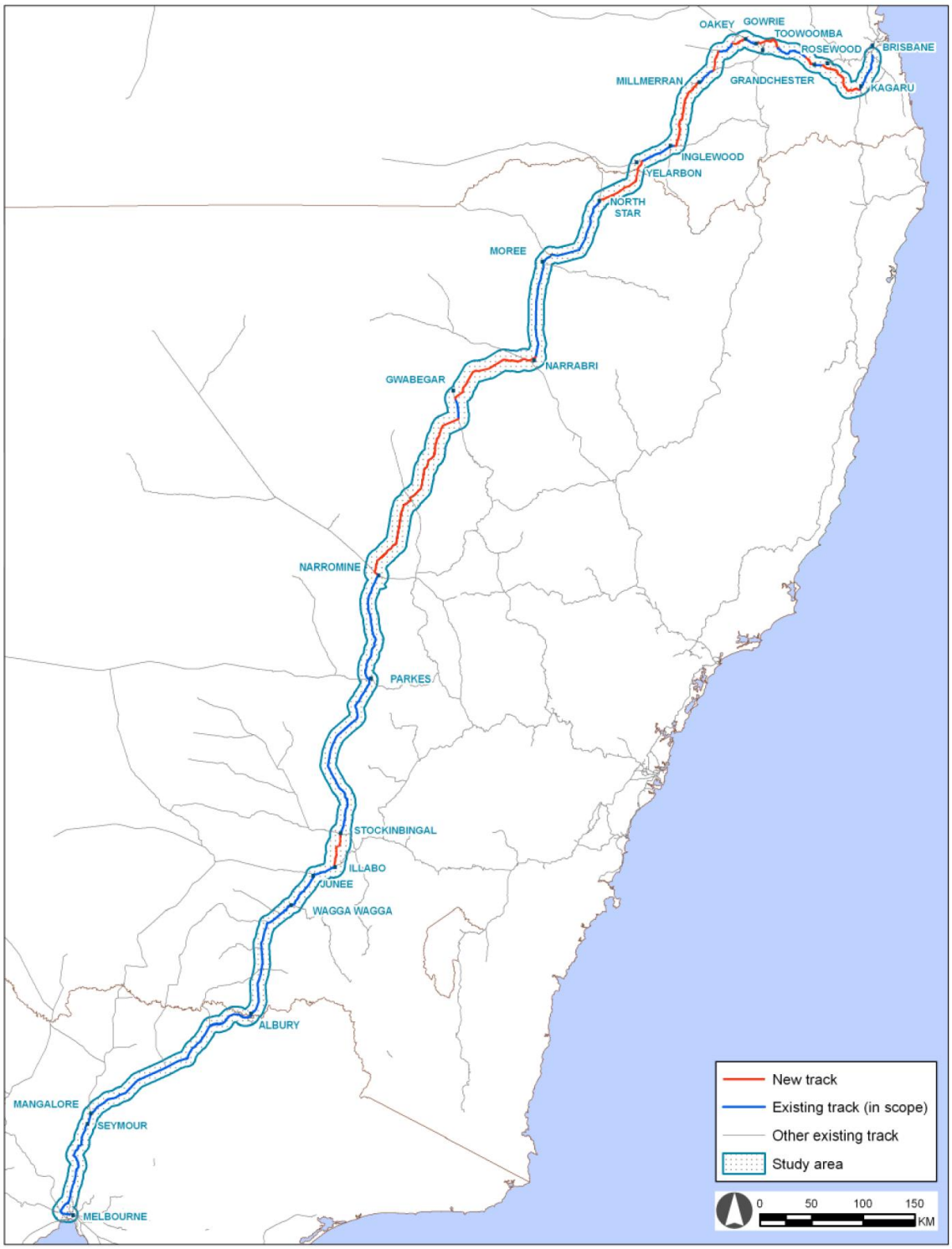
The study recommended that it would be appropriate to re-examine the project between about 2015 and 2020, or when tonnage approaches the level identified (and after results of initial coastal railway upgrades can be assessed in terms of actual levels of capacity, reliability and demand growth achieved).

It was also recommended that consideration should be given in the meantime to whether steps need to be taken by governments to reserve and protect the alignment so that it is available if the railway is eventually built, and in the 2011/12

budget the Australian Government subsequently announced $300 million in funding for corridor preservation commencing from 2014.

The Inland Route provides a longer term option for the Melbourne-Brisbane corridor. However, it does not invalidate the requirement for capacity enhancement on the Main North Line to meet short to medium term demand growth in the various markets outlined earlier in this report (refer to Section 3.1), including the Sydney-oriented interstate and intrastate markets that would not be served by the Inland Route.

Figure 9: Melbourne-Brisbane Inland Rail alignment



Sydney rail bypass

As part of its options development phase, TCA considered alternatives for bypassing Sydney. Given the existing congestion on the Main North Line and restrictions on freight train movements into Sydney, a rail bypass may offer benefits if it can be constructed as a dedicated freight corridor capable of servicing all east coast markets. In order to provide at least four reliable paths per hour in each direction, the bypass would need to be double track from the outset.

More than 75% of road and rail interstate traffic entering the Sydney metropolitan area has its destination within Sydney. Consequently a bypass rail route would need dedicated links to the Metropolitan Freight Network and Sydney rail freight terminals (including Port Botany), in order to remove trains serving Sydney from the congested Main North Line. These include through-services between Melbourne and Brisbane that add and detach wagons in Sydney. This occurs regularly as the traffic volumes available to particular operators do not, at present, support separate services for each destination (refer to Figure 10).

A route could come off the Main South Line, in the vicinity of Glenfield, parallel to the alignment of the Westlink Motorway. Following completion of the SSFL, unrestricted freight access from that direction will be secured.

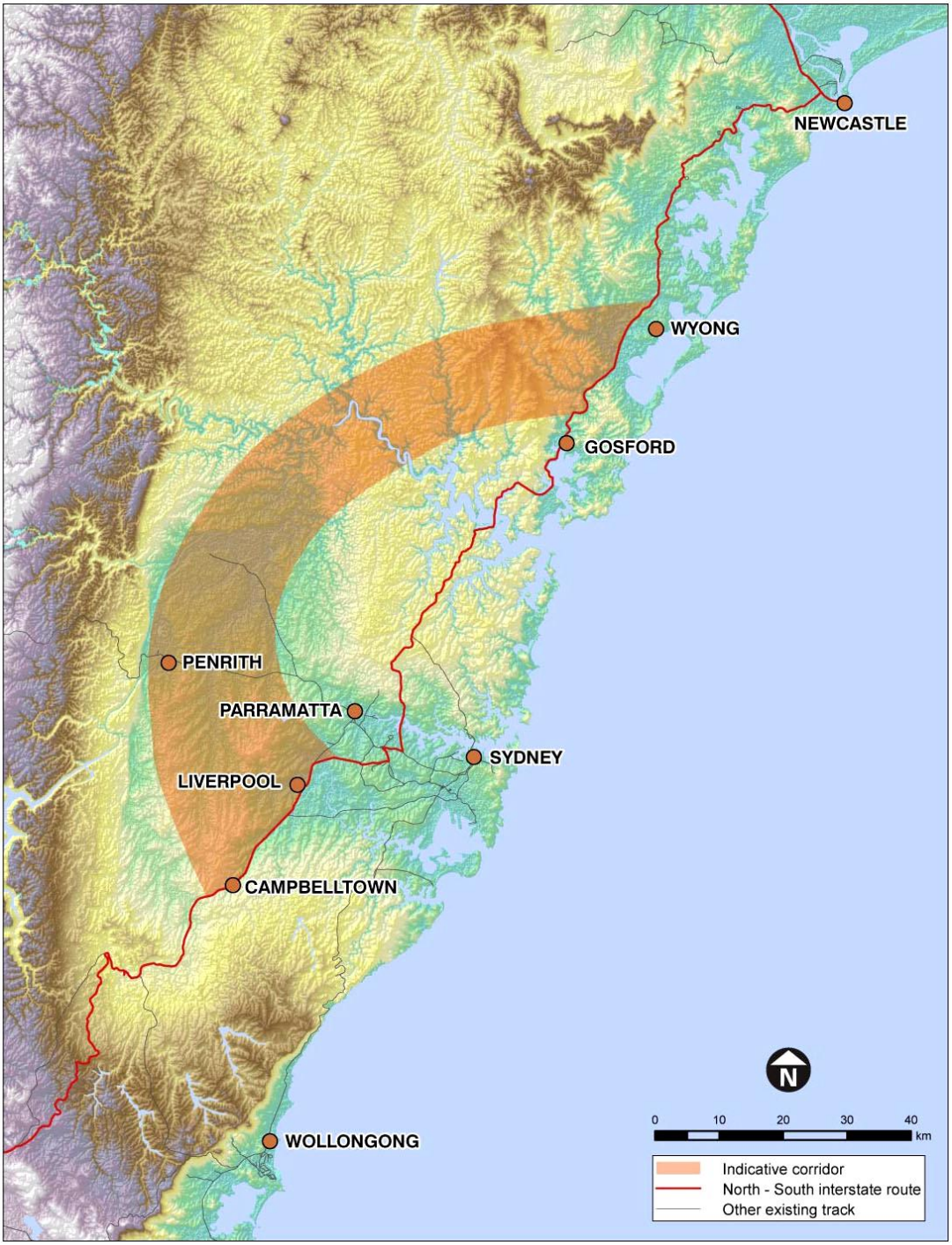
There is the possibility of a line further west between Campbelltown and Penrith. This is a much longer route that resembles the original proposal for a line from St Marys, intended to divert western coal around Sydney to the proposed Maldon-Dombarton Line and beyond to Port Kembla.

If freight rail connections are constructed from Leightonfield to a new rail freight terminal at Eastern Creek, it would be possible to link this facility directly to the northern portion of a Sydney rail bypass. This could provide access to the south if sufficient capacity was available on the SSFL.

Development of a suitable new rail alignment around the north of Sydney is a difficult task. It would involve the resumption of a large number of properties and require numerous grade separations of existing roads and water courses. In addition, it would impact areas of national parks. The route could be considered jointly with that for a far western Sydney road bypass. The differing requirements of the two modes in terms of alignments would, however, pose significant challenges to the possibility of a joint corridor. The rail curvature and gradients would have to be much gentler than that required for a road alignment, particularly if operating speeds of approximately 115 kilometres per hour are to be achieved.

Consideration would have to be given to how Sydney-bound freight trains might use a northern Sydney bypass line to avoid the existing route as, without re-routing these trains, the current problems with congestion on the existing Main North Line would remain. The Main West Line is already busy, particularly through Parramatta and is more constrained than the Main North corridor. Amplification of the Main West Rail Line in order to feed trains to a northern Sydney rail bypass would be very difficult.

Figure 10: Indicative corridor for a Sydney rail bypass



The concept of constructing a rail bypass around Sydney is therefore a long-term proposition. It needs to include a link to the metropolitan freight network and would require detailed alignment analysis, environmental impact assessment and route acquisition prior to commencement of construction. In order to be of benefit the entire project would have to be completed in one stage and would need to have a dedicated connection to an extended metropolitan freight network. Whilst it is premature to estimate the possible cost, it could be expected to run into many

billions of dollars and could take in the order of 10-15 years to complete. Given the components of this project could not come online incrementally, the capacity benefits of this approach would not be realised until completion.

Realignment of sections of the existing Main North Line

The inland routes must be weighed against the option of investing in an upgrade of the existing Main North Line. Such an option could be staged to provide progressive benefits to both passenger and freight services, and would require little corridor acquisition. An incremental strategy, which could give many of the advantages of building an entirely new line, would be to progressively bypass portions of the existing route. This could increase speed, by removing sharp curves and steep gradients, which are frequently found in conjunction.

There are a number of potential route options. These relate to whether the new route is primarily for freight trains or whether it is developed for passenger services, thereby allowing greater freight access to the existing route. The various proposals are set out in geographical order below, commencing from the south end of the line.

a) Epping to Hawkesbury River

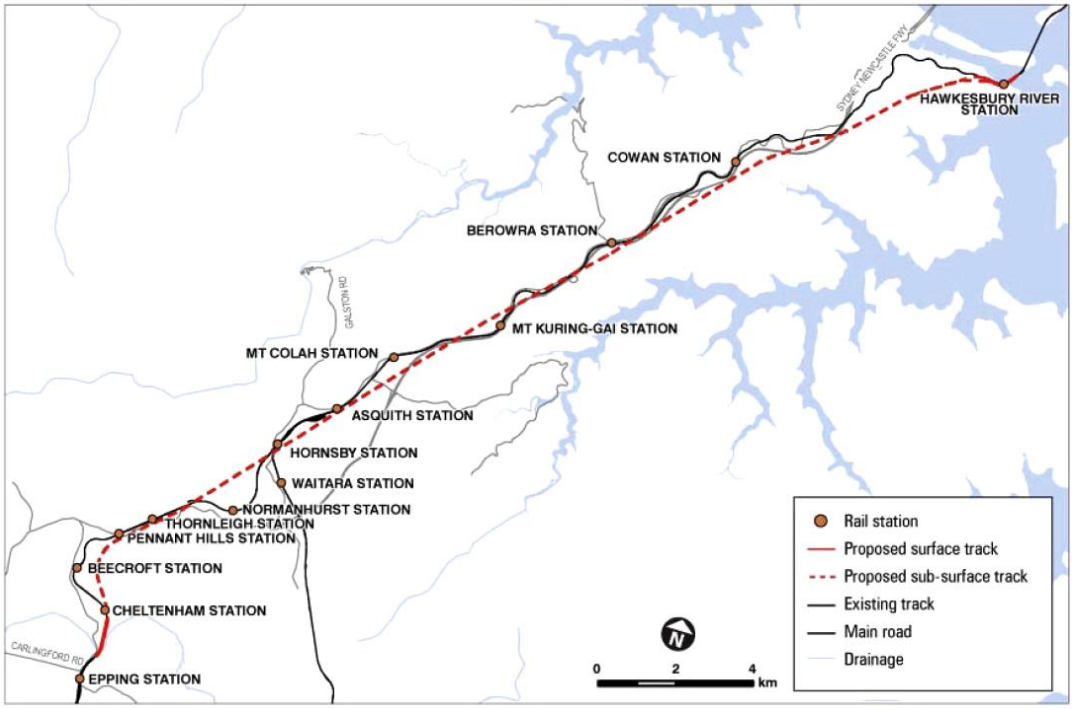
North of the Parramatta River, a number of options exist to bypass the bottlenecks associated with the steep climb up to Hornsby and down to the Hawkesbury River. In Europe, where the Alps represent a considerable barrier to much heavier freight flows that pass through Switzerland, construction has commenced of long 'base tunnels' that largely avoid the climbs up to the existing passes.

In the Sydney context, a new tunnel from just north of the M2 Motorway at Devlin's Creek, to the Hawkesbury River, in the vicinity of the existing Hawkesbury River Station (an Epping to Hawkesbury River tunnel), would remove the two worst gradients on the line and save approximately 15-20 minutes for passenger trains from the north to Sydney (refer to Figure 11). The higher cost of this alternative could be offset by the considerable reduction in disruption along the surface corridor.

There are however two potential disadvantages to a base tunnel. Firstly, whilst not to the extent of a Sydney rail bypass, it is an all or nothing solution that would require considerable upfront expense prior to any benefit being delivered. Secondly, it raises a series of issues about the traffic mix and preferred traction for rolling stock operation in the new tunnel. All freight services in the corridor are now diesel operated. However, diesel operation through a 27 kilometre tunnel is not practicable, given the proposed frequency of both freight and passenger trains.

The above problem could, theoretically, be overcome by using electric locomotives to haul the freight trains. In practice, freight operators obtain major efficiencies by using the same diesel locomotives all the way from Brisbane to Sydney and onwards to Melbourne. Not only would a change of traction be uneconomic; it would increase journey times by around 30 minutes as locomotives were changed over at each end. It would also be extremely expensive for all operators to provide their own electric locomotives.

Figure 11: Epping to Hawkesbury River Tunnel Alignment



An alternative would be to construct the Epping-Hawkesbury River tunnel purely for electric passenger services. The resulting reduction in traffic on the existing surface line would enable the future freight task of up to four freight trains per hour in each direction for 24 hours per day to be handled by the surface route. The construction of the North West Rail Link will reduce the future demand for passenger services between Berowra and Epping so that the existing two tracks could accommodate both freight and passenger services.

b) Hawkesbury River to Newcastle

North of the Hawkesbury River, a number of possible realignments have been suggested. The first is directly north of the Hawkesbury, where the existing route winds along the west side of Mullet Creek.

Previous studies into a high speed passenger alignment between Sydney and Newcastle have suggested that a high speed alignment could bypass this section by tunnelling into the sandstone ridge immediately north of the Hawkesbury and then cross Mullet Creek by bridge, prior to entering a further tunnel direct to Woy Woy. Analysis by Worley Parsons (2009) indicated that, whilst this proposal would release the existing tracks for freight-only operation, this is not required in the medium term to meet capacity requirements through this section of the Main North Line.

A number of potential realignments are possible north of Gosford, either in conjunction with increasing speeds for a high speed passenger service to Newcastle, or to avoid severe curvature and heavy grades for freight trains. The most significant is the suggestion of returning to the original alignment for passenger trains between Cardiff Workshops and the existing Tickhole Tunnel on the approaches to Newcastle. Whilst consideration should be given to alignment

improvements, in general, it would be considerably more economic to stay adjacent to the existing corridor.

Newcastle bypass

The final potential major realignment is a freight rail bypass of western Newcastle. Preliminary studies have been carried out on a route which diverges from the existing railway at Fassifern and joins the existing Hunter Valley Line in the vicinity of Hexham. This is sometimes considered in conjunction with further new construction joining Hexham with the existing North Coast Line in the vicinity of Stroud Road.

A range of alternative alignments may be practicable and could provide linkages to alternative locations for the proposed Hunter intermodal terminal (Hyder, 2008). A number of rationales exist for these proposals. The Fassifern-Hexham Link would have value if increasing coal traffic from south of Fassifern, or additional regional container traffic from Newcastle and the proposed intermodal terminal at Beresfield, created a situation that additional track was required to relieve congestion on the bank between Adamstown and Cardiff.

The bypass would also have value in shortening transit times for Brisbane container traffic, particularly in conjunction with the route north to Stroud Road. It has been estimated that the Hexham-Fassifern link would save 15 minutes on its own, and almost 60 minutes in conjunction with the link to Stroud Road. This latter route would also provide more direct access from the Gloucester Coalfield to the port at Newcastle.

Development of a freight-only route

A desirable long-term objective would be to separate freight and passenger operation between Newcastle and Sydney. It has been possible to achieve this in southern Sydney, as the sections of railway traversed by the SSFL require only two tracks for passenger operation. This would also be possible north of Epping but passenger train frequency south of Epping will require more than two tracks by 2022.

A bi-directional third track for passenger operation and a separate, single freight track within the corridor would also not be operationally effective. A single freight track would be insufficient to guarantee four freight paths per hour in each direction and RailCorp would require more than three tracks south of Epping to manage contra-peak requirements.

An alternate approach is to examine the role that the passenger-only rail tunnel between Epping and the Hawkesbury River might play in the long-term development of an independent freight route. In this regard, it could form an effective first stage as the passenger tunnel would enable the existing surface tracks between the Hawkesbury River and Berowra to be predominantly freight tracks and it would also avoid the need for four tracks between Berowra and Hornsby. At a later stage, the proposed Hexham-Fassifern Link could provide a freight-only corridor west of Newcastle. In conjunction with freight-only tracks within the Main North Line corridor between Gosford and Warnervale, a substantial

amount of dedicated freight rail track would become available, with the potential to ultimately fill in the remaining sections when demand required.

High speed rail

In October 2010, the Commonwealth Government announced a feasibility study to determine the economic benefits and financial viability of a new high speed rail network connecting the cities along Australia's east coast. The study is being managed by the Commonwealth Department of Infrastructure and Transport.

The feasibility study builds on previous studies by considering the preferred alignment of a high speed rail network having regard to user requirements, and engineering, land use and environmental constraints.

As part of the core network element at the centre of the East Coast Corridor, the Newcastle-Sydney 'spine' will be a central aspect of this work. Options for links northwards to Brisbane and southwards to Canberra and Melbourne will also be considered.

Should the Commonwealth Department of Infrastructure and Transport identify the existing Sydney to Newcastle rail corridor (the Main North Line) as a preferred alignment for any future high speed passenger rail network, it would compete with the NSFC Program for physical space within the corridor, which could impact on the potential for realising the full benefits of the Program, particularly the later stages.