HUNTER ECONOMIC INFRASTRUCTURE PLAN (HEIP)

FINAL REPORT (16 OCTOBER 2013)

CONTENTS

TABLES

FIGURES

1 FOREWORD

The Hunter Economic Infrastructure Plan (HEIP) has been funded by the Commonwealth for the purpose of ensuring the region has an integrated plan that assists mining communities, improves export capacity and supports the Hunter's future economic growth.

It is the intent of this study to fortify the need for a holistic approach, so that no significant project or piece of work (however small it may seem) is overlooked nor duplicated, and different interests are addressed with a balanced hand.

The HEIP has been developed to enable a whole of supply chain view of mining related activities in the Hunter region.

The Hunter region economy and future growth is increasingly dominated by the mining sector, whose influence penetrates all spheres of socio-economic, government and community strategy and development within this region. A collation of plans and sector analysis shows that the impact of mining is creating the highest priority gaps in two sectors – roads and water.

The inbound supply chain is serviced by goods transported inbound to the mines by road. This plan focuses on the coal chain inputs and the impacts of mining and mining related freight on communities along the supply chain.

Water sourced from the Hunter River Catchment is a critical infrastructure related item that requires investigation. This Plan includes a preliminary analysis of water forecasts of demand that reflect forecast mining activities. The plan identifies the studies that will be undertaken to ensure that mining activities retain a reliable water supply into the future.

Investigative findings in relation to goods transported inbound reflect the need to define priorities among the myriad of projects that are being developed, under consideration or currently being tendered to deliver improved road infrastructure. These are concurrently aimed at correcting for current deficiencies and importantly, positioning for future additional demand.

The study has identified capacity constraints and assessed the impact that mining-related freight will have on communities situated along the supply chain. The recommendations in this Plan are the priority infrastructure improvements that will contribute most to facilitate development of industry and affected communities.

2 EXECUTIVE SUMMARY

The Hunter Economic Infrastructure Plan (this report) has been developed to enable a whole of supply chain view of mining related activities in the Hunter region. The mines in the Hunter are serviced by goods transported inbound to the mines by road (the coal chain). Many of the mines also rely on water sourced from the Hunter River Catchment for operation purposes.

Five Key Components of Economic Infrastructure

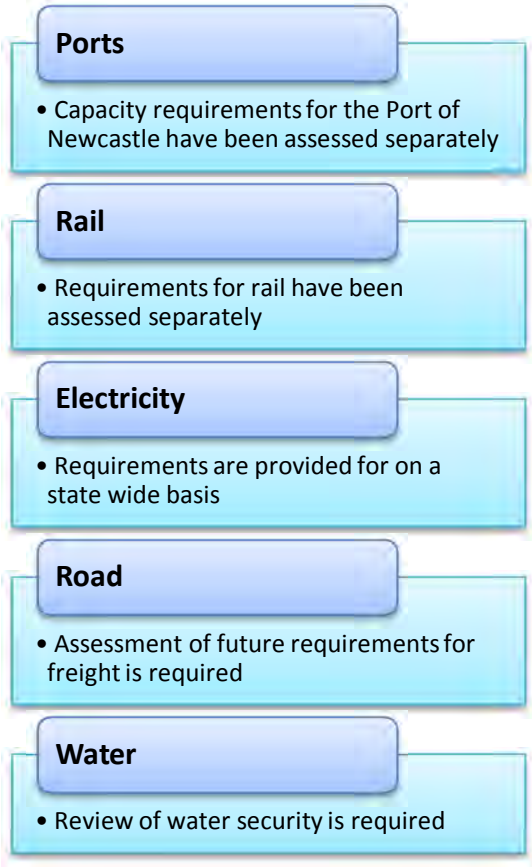
In preparing the Hunter Economic Infrastructure Plan, consideration was given to other major infrastructure requirements in the region, some of which have already been assessed. Five key components of economic infrastructure were considered. They are ports, rail, electricity, roads, and water. In relation to each of these:

Ports – Requirements for port capacity have been assessed separately. The "Newcastle Port Corporation - Draft Strategic Development Plan" (February 2013) presents the corporation's strategy for the long term development of the Port of Newcastle over the next 30 years.

Rail – Requirements for rail have also been addressed separately. The ARTC "Hunter Valley Corridor 2012-2021 Capacity Strategy" (June 2012) provides for upgrading of the rail network to accommodate the expected growth in demands from various locations in the network.

Electricity – Requirements are provided for on a state - wide basis with significant power stations already located within the Hunter Valley.

Roads – Road requirements in the region were last addressed in the Lower Hunter Transport Needs Study completed in 2009. The study confirmed the need for the Hunter Expressway from the F3 to Branxton currently under construction and some additional isolated projects. The study did not extend to the coal mine routes further west.



Water – Water security in the wake of increased mining activity has resulted in a shift in water demand patterns. There is a need to review security of supply to ensure timely action can be taken to avoid any significant reduction in the security of supply.

It was concluded that **roads** and **water** warranted further investigation as part of the Hunter Economic Infrastructure Plan.

Emerging Issues for Economic Growth

The Inbound Freight Transport Task

The Newcastle Port Corporation has forecast coal exports from the port to exceed 250 million tonnes per annum by 2020. However, it should be noted that this incorporates factors such as China's economy at the time and access to new markets as relevant to the forecast[1].

Inbound logistics quantities for coal mining activities are directly related to coal production. The amount of inbound freight required to service the mines is equivalent to 2.5 percent of the coal produced (consumed domestically and exported)[2].

Ulan and Gunnedah currently comprise 23% of the total inbound freight task. This will rise to 32% by 2031. As mining growth accelerates in these outer zones so too will transport freight kilometres.

The products inbound to mines do not lend themselves to being moved by rail. This is because the goods supplied are disparate in nature, individual deliveries are truck rather than train load size, and the coal mines themselves do not have facilities for storage of large deliveries. The "just in time" delivery system that is currently applied to these goods can only be serviced by individual trucks. Added to this is the fact that the small individual volumes combined with the distances required to be travelled to support the mines leads to use of rail being uneconomic.

For inbound mining freight west of Branxton, 63 % continues along the New England and the remaining 37% over the Golden Highway. This split will continue into the future as further growth in mining occurs.

Laden trucks inbound to the mines (one-way) currently comprise around 40 percent of the total laden regional truck movements (two-way) on the New England Highway west of Branxton. This will rise to 47 percent by 2031.

Community Impacts

This study highlights one of the most prominent emerging issues, namely the timing and nature of investment needed to protect local communities from any negative impact that are the result of increased road traffic through towns and suburbs.

Growth in the coal export industry will significantly increase heavy vehicle movements while generally boosting regional economic activity and resultant traffic. Regional population growth is also expected to grow in parallel. In addition to driving the need for road improvements along the New England Highway and the Golden Highway, this situation is expected to accelerate the need for town centre bypasses.

Flow on Impacts of the Hunter Expressway

A critical immediate issue concerns the near completion of the Hunter Expressway (expected near the end of 2013) and the flow-on impact this will have on other regional highways. It is expected that this milestone will boost the urgency around upgrading the New England Highway between the Hunter Expressway and the Golden Highway. This action is recommended within the next five to ten years, in order to minimise risk of long-lasting detriment for flows along these highways.

---

[1] NPC Annual Report 2011 - 12 states on page 10

[2] Modelling by Hyder Consulting based on mining sector advice of mine site inputs including fuel, nitrate, equipment, metals and other consumables.

The Emergence of the Golden Highway

It is evident that the Golden Highway will become a critical freight corridor comparable to that of the New England Highway today. By the year 2031 inbound mining freight flows on the Golden Highway will exceed what currently occurs on the New England Highway at Singleton.

The growth in freight warrants special consideration of the Golden Highway and upgrades required to accommodate its capability to service freight requirements.

Water Security

The NSW Government has committed to ensuring that communities and water users have access to adequate and secure water supplies. In the medium term, 5 to 20 years, the NSW State Infrastructure Strategy includes a commitment to develop a State-wide program for water supply and flood mitigation informed by the outcomes of long term water supply planning. The NSW Government will implement these measures where feasible over the medium to longer term.

The water market reforms of the 1990's have been a success in the Hunter Valley, allowing the transition from predominantly an agricultural base to include an industrial base. With the resulting shift in water demand patterns with this transition, there is a need to review security of supply to ensure timely action can be taken to avoid any significant reduction in the security of supply.

An analysis of industry water requirements to support growth under various drought scenarios is required. This will provide industry with the necessary up-to-date information to manage risks associated with water supply and drought.

Basis for Recommended Road Infrastructure Investment

This study clarifies the need and priorities for investing in road transport infrastructure based on a number of salient findings.

Growth in coal exports from the Hunter region will substantially increase the inbound mining-related freight task along the New England Highway and the Golden Highway. This expectation is supported by examination into the geographic distribution of mine-related freight sources and the major corridors used to transport them. The need to upgrade infrastructure speaks to the current flows and ensuring they are adequately accommodated over the long term, but equally important is addressing the new operational, performance and safety needs that will accompany forecast additional flows.

Shifts away from dominate mine clusters in the Hunter and Newcastle regions to mines further afield (in the Ulan and Gunnedah regions) will exacerbate some existing deficiencies while introducing new ones that have only been recently re-explored through this study. The need to deliver relevant upgrades in timely fashion with adequate financing is central to maintaining a healthy regional network as a whole. Other considerations to potentially arise include longer inbound freight travel times and extended commuter travel, both with efficiency and safety implications.

Community and social issues vary in their nature and context. Positive aspects include new employment prospects that accompany mine expansion but also herald a myriad of concerns for affected communities. These concerns include the safety of products being transported, the impact on town and business viability, and perceptions of unbalanced distribution of costs and benefits between region and state. All of this underlines the need to carefully consider the schedule and scope of future infrastructure upgrades with a view to optimising the balance between many interests while still capitalising on the unique economic opportunities presented by this region.

Recent, completed and future projects offer the chance for a synergistic, comprehensive view of infrastructure development that looks to building congruent benefits for both community and industry over the Hunter region as a whole. Many upgrades are already being investigated within this perspective and in keeping with the forecast growth in coal mining activity, other economic activities and regional population growth. The importance of getting investments right, avoiding duplication and overlaps, yet correctly identifying significant work, projects and impacts on affected communities cannot be overstated. Setting the appropriate project priorities is particularly crucial since this will inform the efficient development of mines and key traffic corridors but not at the expense of community and public interests.

On that final point, this study has developed the list of, and rationale for, project priorities over the short, medium and long term. This program is the result of delving into existing deficiencies while also examining how future impediments will play out in light of anticipated growth in mining activity, shifts in mining growth areas, major corridors used for transporting mining-related inputs, interplay of non-freight flows, the state of current and future infrastructure needs, as well as movements of the growing population. This program is founded on supporting industry and community interests synergistically.

The Projects

Recommended projects (in order of priority)	Cost ($2013)	Timing	
		Years	S/M/L*
INFRASTRUCTURE			
1. Duplication of Tourle Street Bridge and approaches, Kooragang Island	$102.5 million ($100 to $105 million)	2013–2018	S
2. Bypass replacement of the Scone Level Rail Crossing	$86 million ($70 to $95 million)	2015 to 2020	M
3. Upgrade of the New England Highway to dual carriageway from Belford to the Golden Highway (3.2 km) and grade separation of the Golden Highway / New England Highway intersection	$127.2 million ($120 to $140 million)	2015 to 2020	M
4. Widening of Singleton Gowrie Gates rail underpass and approaches	$30.2 million ($25 to $35 million)	2015 to 2020	M
5. Construction of a new crossing over the Great Northern Railway at Gunnedah	$24 million ($22 to $26 million)	2013 to 2018	S
6. Bypass of the New England Highway around Singleton – Central Corridor (6.5 km)	$160 million ($130 to $195 million)	2015 to 2020	M
7. Bypass of the New England Highway around Muswellbrook (8.5 km)	$215 million ($170 to $260 million)	2015 to 2020	M
8. Reconstruction of the New England Highway Pavement in parts from Aberdeen to Willow Tree	$29.1 million ($28 to $30 million)	2015 to 2020	M

Recommended projects	Cost ($2013)	Timing	
9. Upgrade of two roundabouts at Maitland	Hospital roundabout $4.1 million (4 to 5 million) Railway roundabout $36 million (35 to 38 million)	2015 to 2020	M
10. Investigation and potential upgrade of sections of the Golden Highway between the New England Highway and Denman	$22 million ($20 to $24 million)	2015 to 2020	M
11. Upgrade of the Golden Highway through Denman or construction of a Denman bypass	Option 1 - Road Upgrade $1.5 million ($1 to $2 million) Option 2 – Bypass $3 million ($2.5 to $3.5 million)	2020 to 2025	L
12. Road upgrades between Denman and Ulan	$60 million ($54 to $65 million)	2020 to 2025	L
13. Bypass of the Kamilaroi Highway around Quirindi	$13 million ($12 to $15 million)	2020 to 2025	L
STUDIES			
14. Water Supply Assessment: The Government is to undertake an analysis of industry water requirements to support growth under various drought scenarios, and provide industry with the necessary up-to-date information to manage risks associated with water supply and drought.			

** S/M/L = short/medium/long term priorities*

That the Government undertake analysis of industry water requirements to support growth under various drought scenarios, and provide industry with the necessary up-to-date information to manage risks associated with water supply and drought.

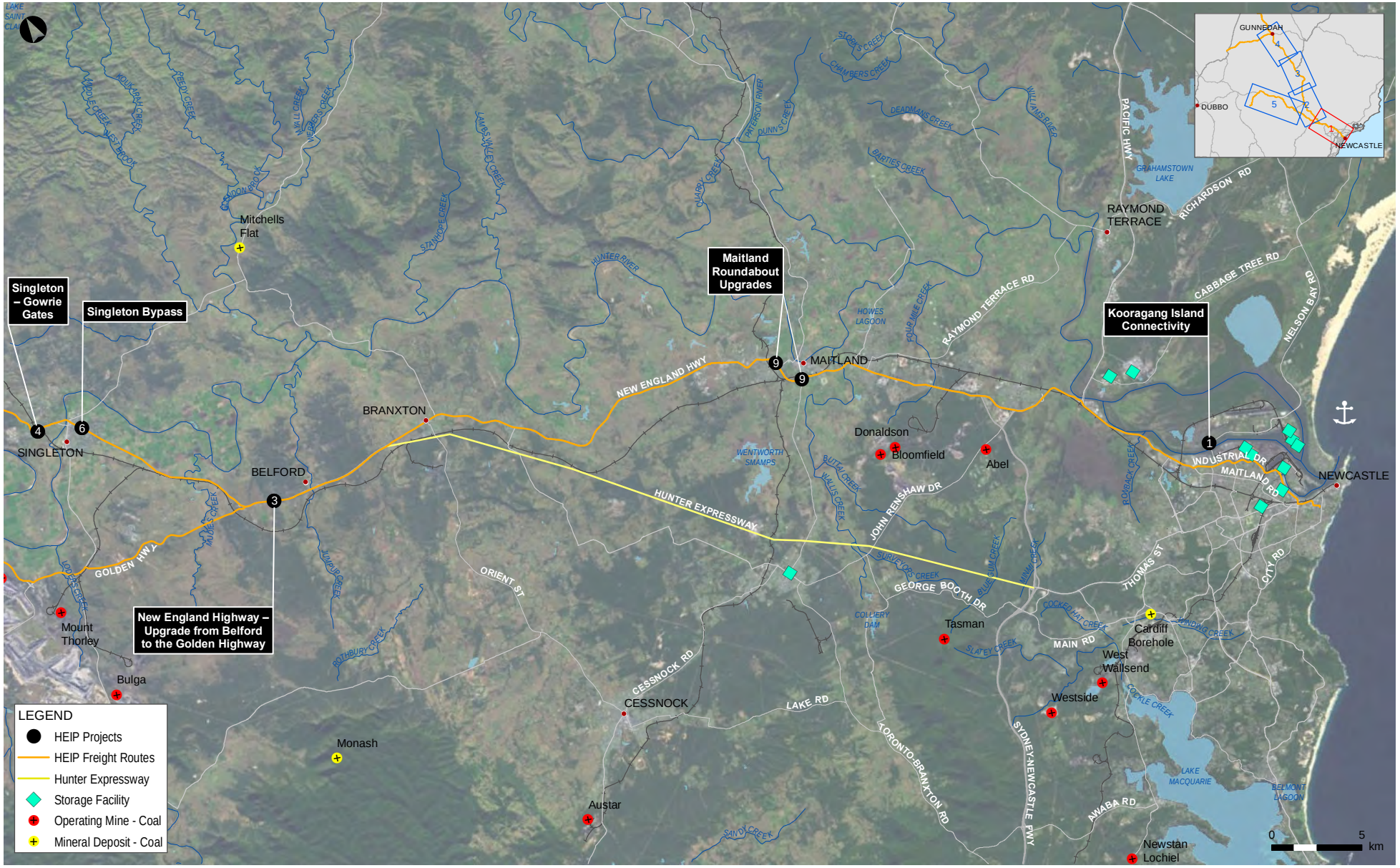


Figure 1 - HEIP Projects - Newcastle to Singleton

Imagery: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 1/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F001_HEIPProjects_r3v1.mxd
Created by : DD
QA by : AW

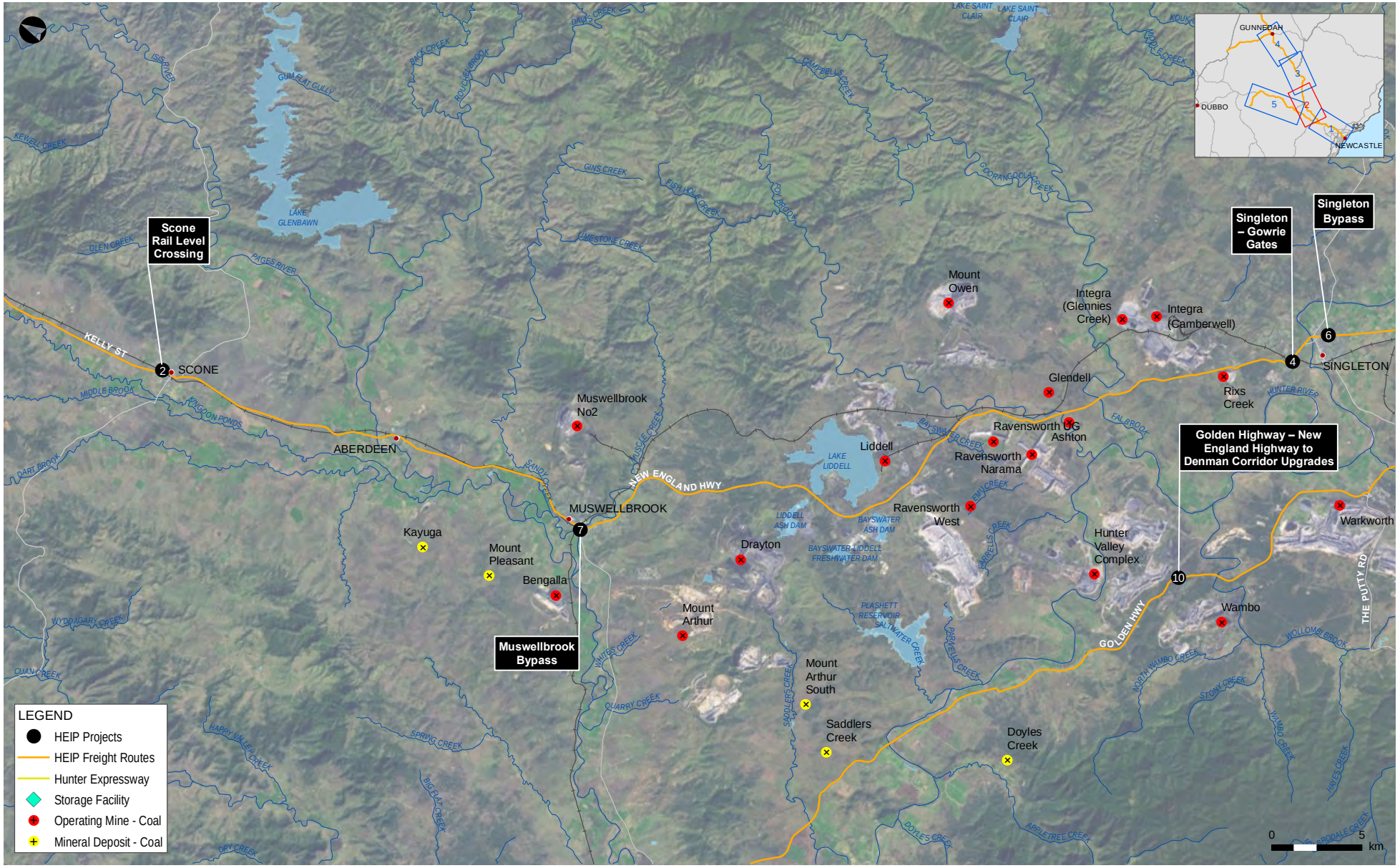


Figure 2 - HEIP Projects - Singleton to Scone

Imagery: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 1/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F001_HEIPProjects_r3v1.mxd
Created by : DD
QA by : AW

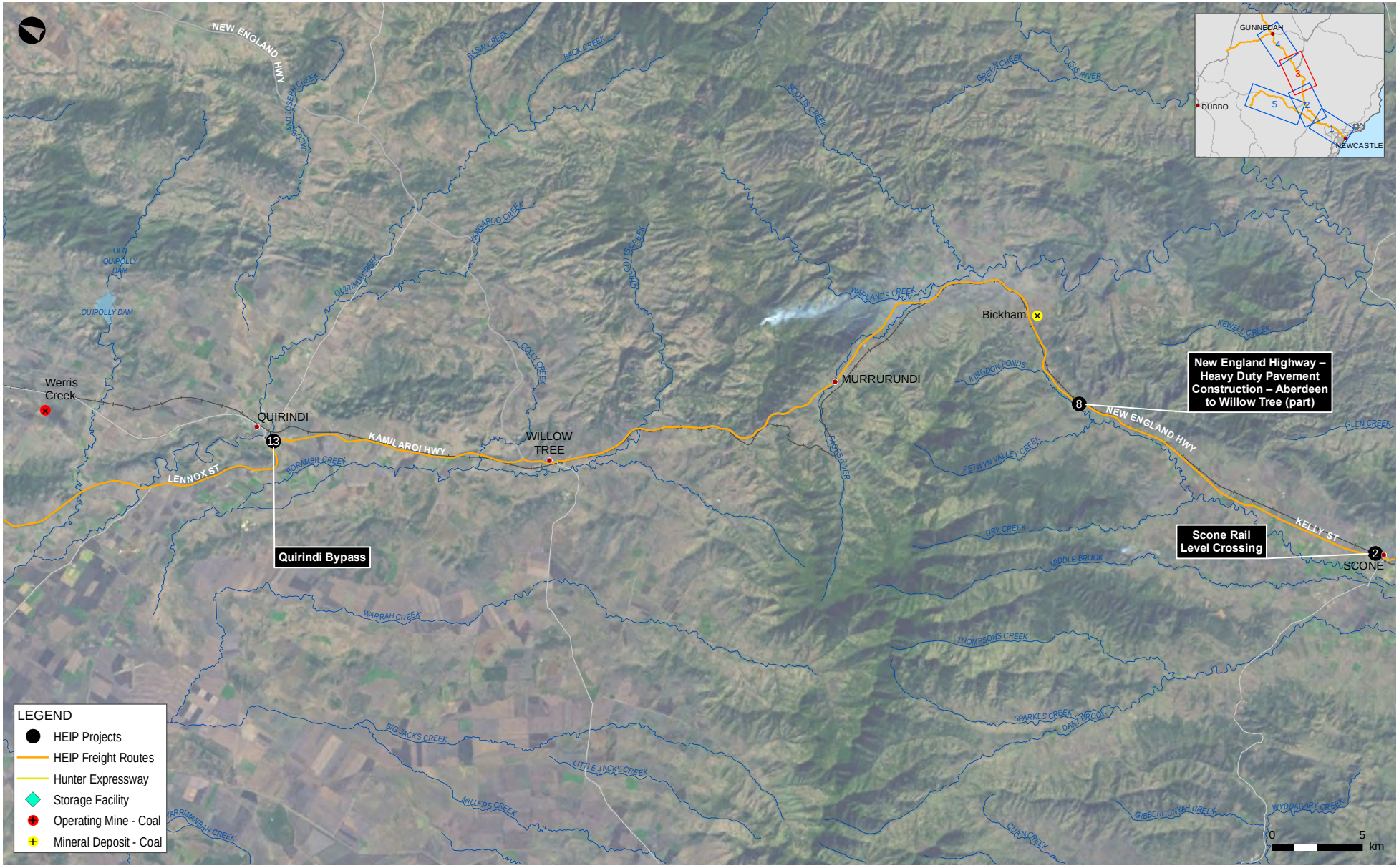


Figure 3 - HEIP Projects - Scone to Quirindi

Imagery: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 1/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F001_HEIPProjects_r3v1.mxd
Created by : DD
QA by : AW

Figure 4 - HEIP Projects - Quirindi to Gunnedah

Imagery: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 1/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F001_HEIPProjects_r3v1.mxd
Created by : DD
QA by : AW

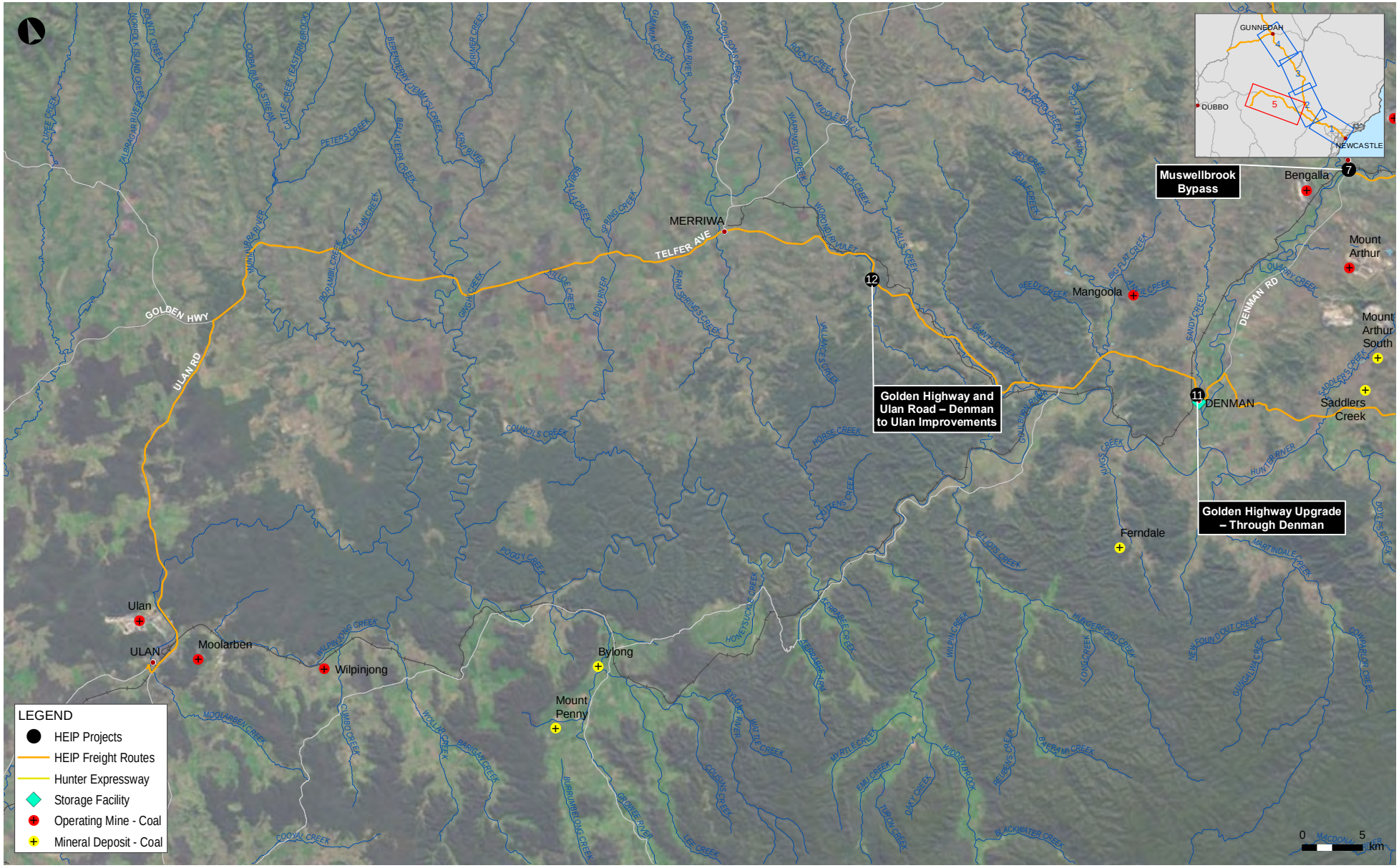


Figure 5 - HEIP Projects - Golden Highway

Imagery: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 1/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F001_HEIPProjects_r3v1.mxd
Created by : DD
QA by : AW

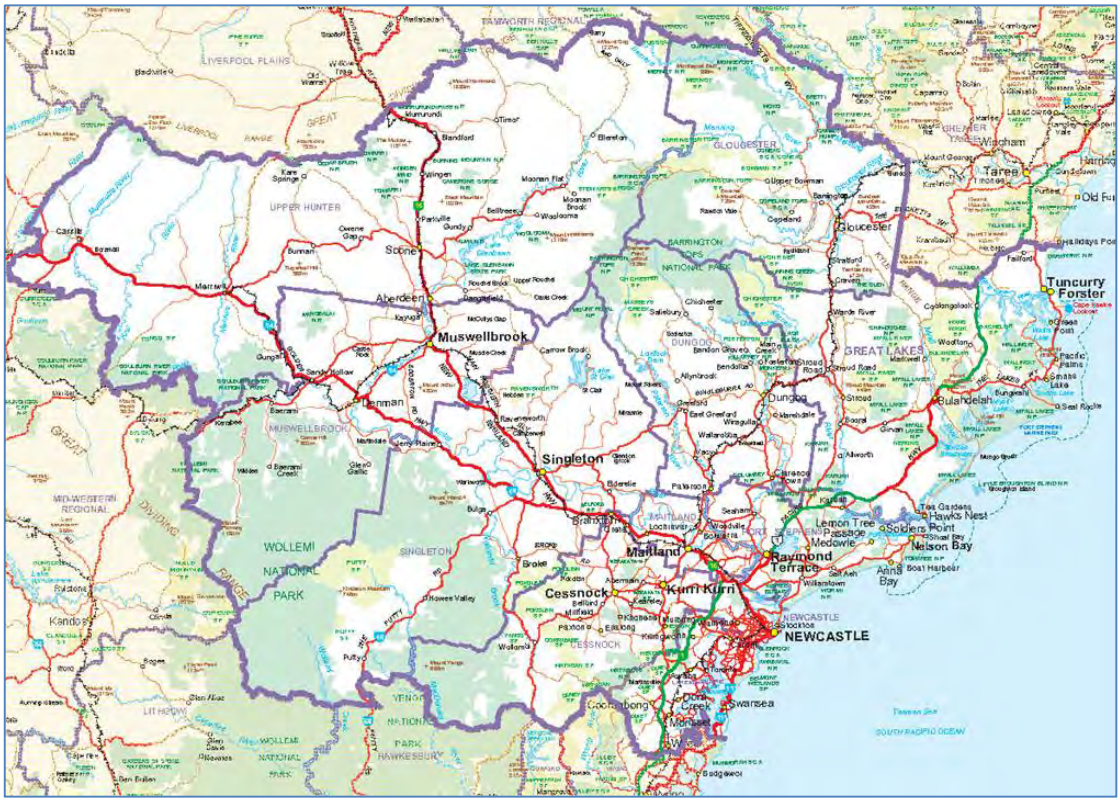
3 BACKGROUND TO THE HUNTER

3.1 ECONOMIC SNAPSHOT

The Hunter is one of Australia's economic powerhouses. It is the seventh largest urban area in Australia and encompasses 11 local government areas. In 2011-12 the region contributed $36.9 billion, more than 8% of Gross State Product and 2.6% of GDP to make it Australia's largest regional economy.

By 2036 the Hunter economy is projected to grow by nearly 75% with an output of around $64.8 billion. Average annual growth for the region over the next two decades is projected to be around 2.4%.[3]

The existing infrastructure gives the region a competitive edge in accessing Australian and international markets. The Hunter's strength is its rich resource base in coal and natural water resources. Over time the region has progressed from an employment base dominated by heavy industry to a diversified resource, services and business powerhouse.



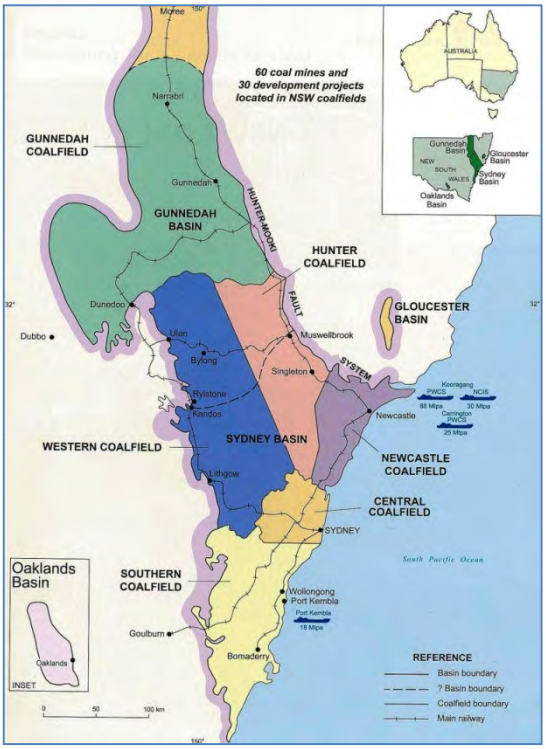
One of the most significant individual economic events that occurred in the Hunter Region in recent decades was the closure of the BHP Newcastle steelworks in 1999. Despite expectations of long term decline from some quarters the reverse occurred. From 1995 to 2010 unemployment rates in the Hunter fell more rapidly than in Australia as a whole. By 2010 unemployment was less than the national average[4]. This was driven by diversification in the local economy. The breakdown of employees by industry sector for the Hunter region now

[3] *Deloitte Access Economics, Prospects and challenges for the Hunter region - a strategic economic study (study prepared for RDA Hunter, 2013)*

[4] *Hunter Valley Research Foundation (HVRF), Diversification of the Hunter Economy – Post BHP (HVRF, Newcastle, 2011)*

resembles that of Australia as a whole rather than that of regions dependent on just one or two activities.

The Hunter Valley / Gunnedah Basin, is the largest area in Australia producing thermal coal. Smaller quantities of coal occur in the Gloucester and Oaklands Basins. Recoverable coal reserves in NSW exceed 11.5 billion tonnes. These reserves are contained within 62 operating mines and colliery holdings and more than 30 major development proposals.



Coal produced in the region is transported to the Port of Newcastle by rail, travelling distances of 15 to 120 kilometres. By 2012 the port had an annual throughput capacity of around 183 million tonnes[5].

Future growth in the Hunter will be driven by demand for its agricultural and mineral resources supplemented by its diversified industries. The diversification process is expected to continue into the next two decades. The services orientation is expected to intensify with sectors such as health, finance and education comprising around 20% of the regional economy in 2036. The region's mining sector is expected to expand, accounting for a quarter of the Hunter economy by 2036. The mining industry is projected to consolidate its industry share by about 1.9% over the next two decades while most other industries maintain relatively stable sector shares.[6]

There are potential risks associated with future intensified Asian competition for manufacturing and other low-skilled industries, eventual mine closures, commodity price changes and technological obsolescence. These risks can be addressed (in part) through the provision of appropriate infrastructure to facilitate economic diversification. The region is well stocked with existing infrastructure. However, in order to drive future growth, additional investment in appropriate infrastructure is required. This investment will contribute to greater output by increasing the productivity of the workforce and invested capital.

[5] *Newcastle Coal Infrastructure Group, NCIG General Information Presentation, August 2012*

[6] *Deloitte Access Economics, Prospects and challenges for the Hunter region - a strategic economic study (study prepared for RDA Hunter, 2013)*

3.2 PLANNING

3.2.1 PLANNING FOR THE FUTURE OF THE HUNTER

Planning for the future of the Hunter has been undertaken at state and regional levels. A number of strategies and plans have been developed which set the agenda for the future of the region. The linkages in the strategies and plans is shown below. The relationship of key plans to the issues examined in this report is also discussed.

The **NSW State Infrastructure Strategy 2012 – 2032** prepared by Infrastructure NSW presents an up to date assessment of regional requirements. The Strategy contains $2.5 billion worth of priority projects for the Hunter region. It identifies the urgency to invest in projects to support mining and other industries as well as improve quality of life.

The Hunter is seen as being a critical part of the future economic prosperity of NSW. The Hunter Coal Chain is identified as a major priority for investment. The strategy also recognises that specific transport challenges are being experienced in the coal community with rapid population growth and increased traffic through regional townships. It recommends that priority is given to addressing congestion, safety and amenity impacts for towns like Scone, Singleton and Muswellbrook.

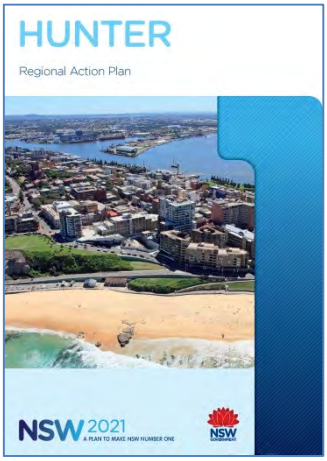
Some of the recommendations specific to the Hunter region and its economic infrastructure requirements include:

- increased capacity in the Hunter Valley Coal Chain through the Liverpool Ranges;
- a detailed assessment of the proposed upgrade to the F3 to Raymond Terrace with a view to it being built within the next ten years;
- completion of the Bridges to the Bush program to address pinch points constraining the use of HML vehicles;
- targeted investments to be made to improve local infrastructure in coal community towns;
- augmentation of the water supply for the Hunter region within the next 10 years to address population growth and the risk that the region could enter drought conditions.

These recommendations are all relevant to the operations of the coal industry.

The Strategy includes a commitment to develop a State-wide program for dams including water supply and flood mitigation functions. The growth in the Hunter Valley warrants early investigation of the needs of agriculture, industry and mining to ensure that the water infrastructure can support growth and that there is enough time to plan the delivery of supply options.

The **Hunter Regional Action Plan 2021** identifies the immediate actions arising from the State Infrastructure Strategy that the NSW Government will prioritise. Prioritised actions most directly related to the coal industry include:



- Regional Transport – Development of regional transport plans guided by the NSW Long Term Transport Master Plan.
- Freight – Improvement of freight movement through the development of the NSW Freight and Ports Strategy.
- Water Security – Identification of steps to improve the long term water security for urban, industrial and environmental use across the Hunter catchment through further development of water sharing arrangements and consideration of standards for estuary and hydrological modelling.

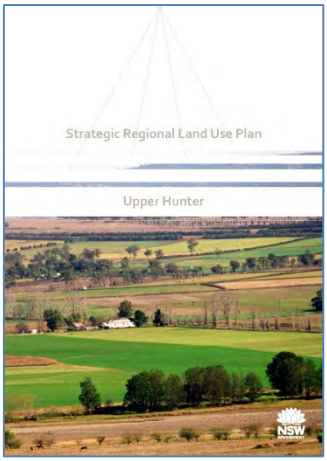
The **Hunter Regional Plan 2012 – 2022** presents a strategic approach for the region to achieve its vision which is described as being "for the growth of a vibrant and sustainable regional economy in a carbon constrained future".[7]

Key issues for the Hunter region are encapsulated in the plan. They include:

> RDA Hunter's vision for the region is for the growth of a vibrant and sustainable regional economy in a carbon constrained future.

- The importance of coal mining.
- The on-going competition for land resources and water.
- Energy supply and the means by which it is sourced.
- The imperative to diversify the industry base and the growing competition for the skilled workforce.

Growth in the Upper Hunter has been further examined in the **Upper Hunter Strategic Regional Landuse Plan**. This plan was released in 2012 following publication of the State Infrastructure Strategy. It provides a strategic framework for delivering the necessary context for Government investment priorities, servicing strategies and local environmental plan making to the Upper Hunter.



The plan is a component of the NSW State Government's "Strategic Regional Land Use Policy". The policy comprises multiple initiatives being staged over time to address land use conflict in regional areas, particularly focused on managing coal and coal seam gas issues.

[7] *Regional Development Australia, Hunter Regional Plan 2012 - 2022*

The Upper Hunter Strategic Regional Landuse Plan recognises the importance of balancing the competing needs of agriculture and resources development. Development of the coal industry places demand on the infrastructure in the region as well as its natural resources.

The plan notes that "The growth of the coal and gas extraction industries will be one of the most significant factors in shaping the communities and the infrastructure needs of the Upper Hunter region over the next few decades."

The plan highlights the fact that inbound road freight is anticipated to grow in proportion with production increases. Some committed projects are noted in the plan including the new bridge over the Hunter River at Aberdeen, a new two lane bridge over the Great Northern Railway Line and construction of the Hunter Expressway.

Impacts on local communities from infrastructure for mining, coal seam gas and agriculture are recognised. Particular areas where investment is considered necessary are:

- Transport upgrades including:
  - improved traffic management through towns (Singleton in particular);
  - improvements to rail crossings and corridors through towns (e.g. Scone overpass and Singleton overpass upgrade);
  - the potential for town bypasses (Muswellbrook, Singleton);
  - intersection and pavement upgrades, and corridor acquisitions (e.g. Muswellbrook rail corridor bypass);
  - maintenance and road quality.
- Security of water supply.

The NSW Government is committed to ensuring that communities and water users have access to adequate and secure water supplies. In the medium term, 5 to 20 years, the NSW State Infrastructure Strategy includes a commitment to develop a State-wide program for securing water supplies, informed by the outcomes of long term water supply planning, and to implement these measures where feasible over the medium to longer term. This commitment is reinforced in the NSW 2021 Hunter Regional Action Plan which includes water security as a priority action.

Growth in the Lower Hunter is currently being re-examined with the release of the discussion paper **The Lower Hunter over the next 20 years**. The discussion paper is the first step in a review of the existing Lower Hunter Regional Strategy, which was released in late 2006. The discussion paper recognises the importance of inbound flows for mine consumables and the dominance of road transport focussed on the New England and Golden Highways.

The revised Lower Hunter Regional Strategy will be shaped on community input as well as the directions set out in NSW 2021, the NSW Long Term Transport Master Plan, the State Infrastructure Strategy, and the Hunter Infrastructure Plan.

3.2.2 THE HUNTER INFRASTRUCTURE PLAN

The Hunter Infrastructure Plan is a new plan being developed by the Hunter Development Corporation (HDC) with the assistance of the Department of Planning and Infrastructure (DP&I) in consultation with industry and the community. It will provide a comprehensive, integrated and credible 20 year infrastructure plan for the Hunter Valley. It will draw on initiatives from the existing regional and state-wide plans and strategies plus new studies examining requirements for specific infrastructure. These plans include:

- The Hunter Regional Action Plan.
- The Hunter Economic Infrastructure Plan (this report).
- The Hunter Strategic Infrastructure Plan being developed by the Department of Planning and Infrastructure with Council's and The Hunter Development Corporation.
- The Hunter Regional Transport Plan being developed by Transport for NSW.
- The Upper Hunter Strategic Regional Landuse Plan and the revised Lower Hunter Regional Strategy.

3.2.3 THE HUNTER ECONOMIC INFRASTRUCTURE PLAN

The Hunter Economic Infrastructure Plan (this report) is a strategic framework used to guide infrastructure development and investment within the context of the region as a whole. This is characterised by its whole-of-supply-chain approach to understanding the nature and impact of mining-related activities in the Hunter Region. Its chief aim is to identify capacity constraints, assess the impacts on communities along the supply chain and ultimately, define and deliver on infrastructure improvements that will support congruent industry and community development in the region.

Figure 6 presents an overview of the Hunter Region and beyond identifying the locations of existing operating coal mines and other known coal deposits which are potentially commercial projects (potential future mines).

Coal produced in the region is transported by rail over distances of 15 to 120 kilometres to the Port of Newcastle. At the end of 2011, the port had a throughput capacity of around 163 million tonnes annually. Thermal coal supplies from the Hunter Valley/Gunnedah Basin are destined for both export and domestic markets.

Coal export has an associated inbound freight task made up of goods delivered to the coal mines. These are principally materials imported through the Port of Newcastle and then delivered by road via the New England Highway and the Golden Highway. Forecast increases in coal exports will increase the associated road freight movements inbound toward coal mines. It is this inter-related twin aspect of growth that underpins the need for improvements to the road systems, particularly as it pertains to supporting community development alongside economic interests within an internationally competitive marketplace.

Of key relevance to the freight task was confirming that the road infrastructure improvements associated with inbound logistics movements for regional mining are likely to have the greatest influence in terms of addressing existing and future deficiencies within the overall regional context. This is inclusive of non-mining freight flows such as interstate, grain and fast-moving consumer goods.

Many of the mines also rely on water sourced from the Hunter River Catchment for operational purposes. The industry growth in the Hunter Valley warrants early investigation of the needs of agriculture, industry and mining to ensure that the water infrastructure can support growth and that there is enough time to plan the delivery of supply options. A preliminary desktop

assessment of mine water demand and supply which has been recently undertaken, while inconclusive, points to the need for further analysis to determine suitable levels of drought preparedness. A detailed analysis of drought preparedness is needed. This requires a survey and analysis of each mine's water requirements (including proposed mines) and modelling of climatic and production scenarios.

HUNTER ECONOMIC INFRASTRUCTURE PLAN

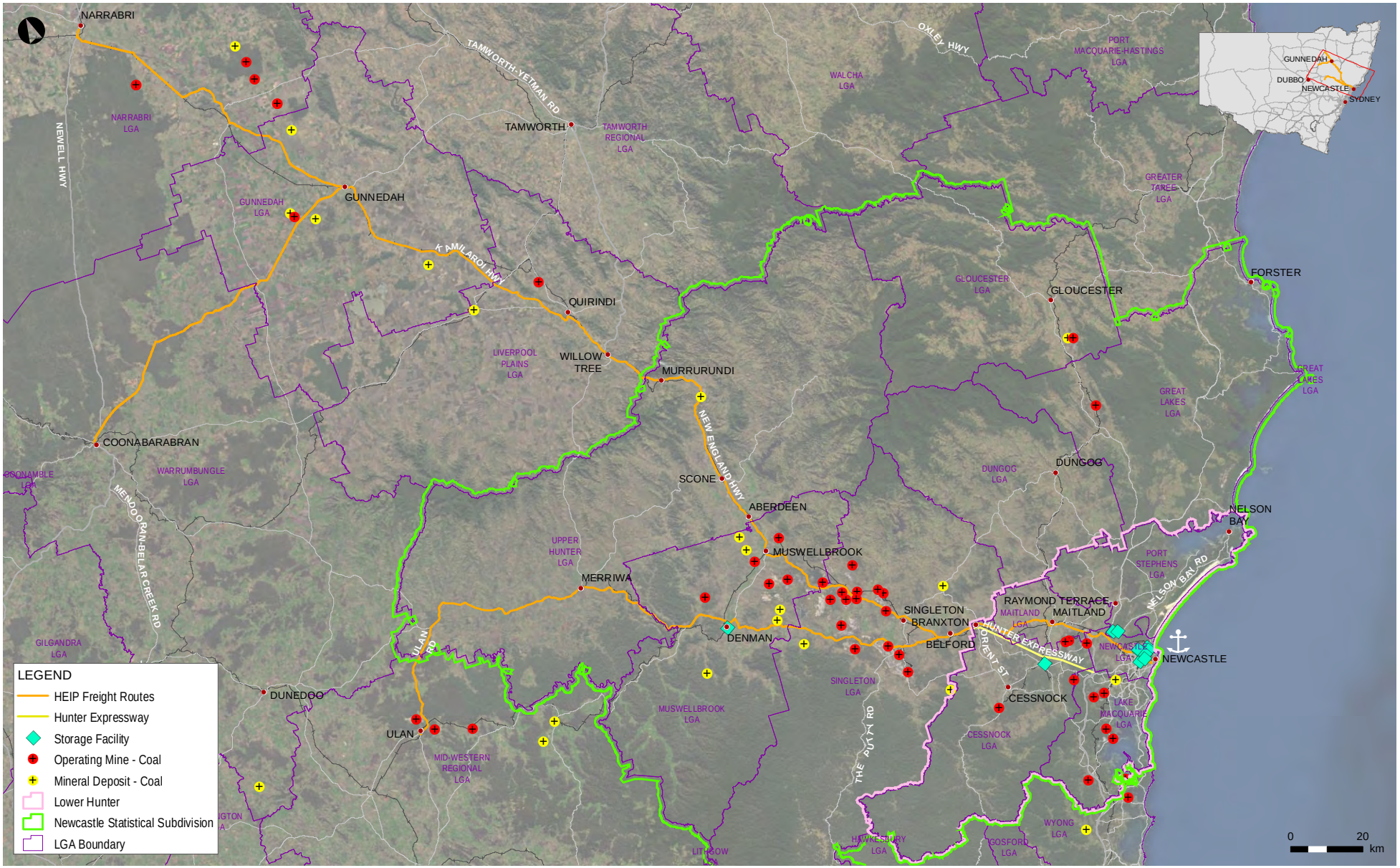


Figure 6 - Coal Mines, Deposits, and Occurrences in the Hunter Region and Beyond

HYDER CONSULTING PTY LTD
ABN 76 104 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

Date: 31/05/2013 Path: \\hc-aus-ns-fs-01\jobs\AA005712\L-GIS\A_Current\B_Maps\AA005712_F006_LGAs_r2v1.mxd
Created by : DD
QA by : AW

3.2.4 THE NSW LONG TERM TRANSPORT MASTERPLAN

The NSW Long Term Transport Masterplan (2012) presents the framework by which the NSW Government will deliver an integrated transport system. It guides the priorities by which transport funding can be allocated over the next 20 years. The masterplan recognises the importance of coal stating:

> *"Mining products equal around half of the current freight task. Coal is the largest and fastest growing commodity freight task in NSW (around 167 million tonnes in 2011), and is forecast to continue growing at a rate of four percent over the next 20 years. This means the coal freight task will grow from 167 million tonnes in 2011 to nearly 367 million tonnes in 2031. It will be NSW's largest export commodity and rail network activity for the foreseeable future."*

Transport challenges identified for freight include the need to increase network efficiency by fixing bottlenecks and removing obstacles to improved freight productivity, growth of the freight network capacity to meet the future freight and management of community and environmental impacts of freight. These factors are critical to addressing future growth in the Hunter Valley / Gunnedah Basin.

Hunter Region Facts

- The roads servicing the mines need to be upgraded and maintained to accommodate regular heavy vehicle loads.
- The roads servicing the mines need to be Higher Mass Limit (HML) compliant.
- Rail level crossings should be removed from key freight routes.
- Separation of road based freight from local townships via bypasses where practical is desirable to improve freight efficiency and minimise local community impacts.

Transport Masterplan Actions

- Expansion of the National Road Freight Network by building on existing work with the Council of Australian Governments Standing Committee on Transport and Infrastructure.
- Delivery of the Bridges for the Bush program to support more efficient freight movement.
- Identification and upgrading of Higher Mass Limit (HML) and High Productivity Vehicle (HPV) networks within NSW.
- Improved integration of land use and freight planning and protection of strategic freight corridors to support growing population centres. This is especially relevant to freight routes through and around town centres.

It can be concluded from these actions in the masterplan that the justification for road upgrades identified for freight in the Hunter Region is directly related to the commitments in the NSW Long Term Transport Masterplan.

3.2.5 TFNSW BUREAU OF FREIGHT STATISTICS STRATEGIC FREIGHT MODEL

This report contains the TfNSW Bureau of Freight Statistics Strategic Freight Model (SFM) forecasts of "laden" regional freight movements. Laden regional freight movements are required to determine future upgrade requirements and capacity constraints. Local truck movements and "unladen" movements add to the total transport task but are not the drivers in determining long term freight network strategies.

The NSW Strategic Freight Model is a world class tool operated by the Bureau of Freight Statistics within the Freight and Regional Development Division of Transport for NSW to supply the evidence base for strategic actions to improve freight network efficiency, capacity and sustainability in NSW.

The model integrates disparate data sets and prior studies into a comprehensive modelling capability to forecast freight demand and assess infrastructure capacity under various scenarios. It draws from a consolidated set of almost 90,000 lines of freight demand data drawn from various studies and datasets, to provide a comprehensive view of freight demand in NSW.

The BFS Strategic Freight Model has been updated for this study to incorporate the most recent available data on mine activity in the Hunter / Gunnedah Basin. The forecasts from the model provide an up to date assessment of the road freight task for the region.

Freight loading estimates are generated in total, by commodity or by corridor. This data is then transferred to a second module where freight flows are converted into road vehicle and rail wagon movements, using fleet capacity and utilisation assumptions. This feature is critical to ensuring infrastructure capacity assessments can be undertaken using physical attributes of vehicles as well as tonnage data. The output is then transferred to the TransCAD network modelling software to assign trips to road or rail networks and generate maps of modelled flows.

The freight simulated in the model is generally strategic regional and interstate laden freight movements. The forecasts are for movements of goods. They do not include return journeys by "empty" trucks and trains. Local truck movements such as farm trucks are not included. Total truck numbers on the road system can thus be as high as double the "laden" forecasts depending on the location.

4 THE FREIGHT TASK

4.1 HISTORIC COAL PRODUCTION

Historic coal production is summarised by cluster in **Table 1**. A cluster refers to a group of mines within the region.

Table 1: Coal Production by Cluster

Mine Cluster	Production (Mtpa)		
	2008/09	2009/10	2011/12
Gunnedah	5.69	3.49	4.94
Upper Hunter	6.52	7.00	7.14
Stratford	1.74	2.02	1.79
Central Hunter	69.23	73.16	68.83
Cessnock	2.48	2.06	2.12
Newcastle Environs	10.45	12.81	12.98
Ulan	13.48	12.93	12.49
Total	**109.58**	**113.47**	**110.30**

The 2008/09 estimates are from the New South Wales Coal Industry Profile 2010, NSW Trade & Investment, Division of Resources & Energy. The 2009/10 and 2011/12 estimates are from the more recent New South Wales Coal Industry Profile 2013.

4.2 OUTBOUND FREIGHT TONNAGE

In examining regional freight demands, this investigation has drawn heavily from published forecasts and prior studies of the Hunter Valley coal chain. Particular reports of relevance are the “Lower Hunter Transport Needs Study” completed in 2009 and the “NSW Freight Supply Chain Study – Hunter, Northern, Western Regions” completed in 2011.

In the Draft Strategic Development Plan for the Port of Newcastle (February 2013) Newcastle Port Corporation (NPC) forecast that coal exports from the port would exceed 250 Mtpa by 2020, and continue to grow towards 300 Mtpa in the long term. Domestic coal demand is assumed to continue growing in line with production, remaining at around 10 to 15 per cent of total Hunter production.

4.3 SOURCES OF GROWTH

This study confirms several important sources of future growth in the freight task. First and foremost is the continued demand for coal from the Hunter Region and its surrounding environs.

Inbound logistics generally have a direct correlation to outbound production volumes with the former comprising between 2 per cent to 3 per cent of production volumes. Variations may arise depending on industry situation and the mine itself. i.e. the state of activity of the mine.

Growth of inbound volumes for mining activities forecast for 2031 is equivalent to seeing 1,258 trucks daily travelling (one way) along critical routes in the Hunter transport network versus the current frequency of 553 trucks daily.

Inbound volumes related to mining activities are forecast to grow from 3.5 Mtpa (2011/12) to 8.2 Mtpa by 2031[9].

Significant growth is also predicted based on the potential to develop additional coal supply in the more distant Ulan and Gunnedah coal fields. Both are currently under large scale planning and development. Their place in this investigation and report is due to their reliance on roads through the Hunter Region for freight access.

Growth of the freight task will be influenced by medium term growth in production across the Hunter. This will be uneven, ranging from 6.0 percent in mining clusters of the Central Hunter to 15 percent in Ulan and Gunnedah. With accelerated growth in the outer zones there will be accelerated growth of the freight task in terms of transport tonne kilometres.

Non-Hunter freight flows represent a significant additional road freight task across the region. Interstate road freight flow (two way) on the New England Highway is now around 2.6 Mtpa and expected to grow to 3.2 Mtpa by 2031. This remains below figures for the Pacific Highway in the same category, which is currently 7.6 Mtpa and expected to grow to 9.7 Mtpa by 2031.

Road-based grain movement to Newcastle Port is around 0.3 Mtpa although these flows fluctuate with grain production cycles. Other freight flows for fast-moving consumer goods, fuel and industrial sectors are around 1.0 Mtpa currently and estimated to grow to around 1.5 Mtpa by 2031.

4.4 INBOUND FREIGHT TONNAGE

The inbound task was previously given as between 2 and 3 percent of outbound volumes (depending on the life of the mine) with higher ratios evident for start-up operations. In reference to the inbound logistics task for the coal mining sector specifically, this study confirms that the dominant transport mode is road-based.

The principal transport corridors serving the Hunter Valley mining sector are the New England and Golden Highways. Newcastle is a key node within this context. Relevant feeder roads to, and from, the Newcastle Region (including Kooragang Island) were considered within this investigation.

[9] Inbound logistics and forecasts based on assessments by Hyder Consulting derived from mining sector advice of mine site inputs including fuel, nitrate, equipment, metals and other consumables.

Road-based freight haulage requirements across the Hunter Valley are forecast to nearly double in the 20-year period from 2011/12[11]. A breakdown of this forecast growth is provided in **Table 2** bearing in mind that inbound logistics volumes have a direct correlation to coal mining production and coal exports are expected to double by 2025 (currently 121 Mtpa).

Table 2: Headline road freight demand across the Hunter Valley

Freight Sector	2011/12 Mtpa	2031 Mtpa
Coal inbound logistics	3.5	8.2
Interstate movements along the New England Highway	2.6	3.2
Grain movements by road	0.3	0.3
Other commodities	1.0	1.5
Total	**7.4**	**13.2**
Coal vs. Total	**47%**	**62%**

Table 2 shows that across the region, inbound logistics to the mining sector represents around 47% of total freight logistics (by weight) currently but will grow to around 62% by 2031.

[11] Based on modelling by Hyder Consulting for Transport for NSW using the TfNSW Strategic Model (SFM) and leveraging prior studies for NSW Roads and Maritime Services; refer to Section 3.2.5 for explanation of the SFM

4.5 TYPES OF INBOUND FREIGHT GOODS

The products that dominate the inbound requirements of the mining sector are ammonium nitrate, fuel (diesel), machinery and parts, magnetite and a range of other products grouped under 'consumables'. The total inbound volume of all these products is calculated as being 2 to 3 per cent of the outbound logistics, a ratio and correlation that was previously mentioned.

Ammonium nitrate (AN) and ammonium nitrate emulsion (ANE) is used principally as a component of explosives in the coal mining sector. The market is dominated by Orica and Incitec Pivot, whose current inbound volumes are approximately 750,000 tonnes.

The inbound product is sourced principally from Kooragang Island production (AN), Kurri Kurri production (ANE), with supplementary volumes imported and sourced from Queensland.

The common concern for transport of mining explosives is misguided since several base ingredients would have to be mixed under specific conditions for this danger to eventuate.
More in Section 4.7

Fuel (diesel) is used for ongoing machine operations and rail locomotion, in addition to being a component of explosives when combined with ammonium nitrate. The current inbound volume of diesel is around 800,000 tpa (1.0 billion litres).

Fuel is sourced from all major suppliers including Shell, Caltex and BP/Mobil, with Newcastle becoming the focal point as more product is imported following the closure of Shell (Clyde refinery) and the imminent closure of Caltex (Kurnell refinery).

Mining machinery and parts (including tyres) is the third dominant inbound input. This predominantly involves Caterpillar and Komatsu, whose inbound volumes for the mining sector vary greatly according the levels of production. New mines will require more new machines compared to older mines, which require an ongoing replacement program. As with the other key inputs, Newcastle is becoming the focal source point with assembly points for Caterpillar and Komatsu having been established at Tomago and international shipping activity also returning to Newcastle Port (Eastern Basin).

Magnetite used in the coal washing process constitutes the fourth largest input into the inbound requirements for the mining sector. Magnetite used in coal washing constitutes around 150,000 tonnes per annum.

Other major mining inputs consist largely of conveyor belting and other industrial 'consumables' that support mining operations.

Table 3 presents the estimated movement of known inbound goods, as confirmed in consultation with stakeholders[12]. Unknown quantities related to other industries are excluded.

[12] Modelling by Hyder Consulting derived from mining sector advice of mine site suppliers including fuel, nitrate, equipment, metals and other consumables. Sources included Orica, Westrac, BP and Wallenius Wilhelmsen Logistics.

Table 3: Inbound flow quantities as advised by stakeholders (tonnes)

Inbound Product	2011/12	2020	2030	2040
Ammonium nitrate	750,000	1,200,000	2,370,000	4,660,000
Fuel (diesel)	800,000	1,285,000	2,530,000	4,970,000
Machinery/parts	250,000	400,000	790,000	1,553,000
Magnetite	150,000	240,000	470,000	932,000
Other	250,000	400,000	790,000	1,553,000
Total (tonnes)	2,200,000	3,525,000	6,950,000	13,668,000

Source: aggregated from stakeholder engagement

The quantities in **Table 3** equate to around 2 per cent of production (outbound coal). However, they are considered to be the low end of the scale reflecting the current market. Considerable additional inbound consumables also occur but in smaller, disparate loads that are difficult to track. Past bottom-up studies have reliably captured 70 per cent of gross demand, therefore the choice was to estimate inbound logistics at 2.5 per cent of outbound quantities.

4.6 INBOUND SOURCE LOCATIONS

As detailed above the majority of inbound flows for the mining sector are ammonium nitrate, diesel, machinery and parts, and magnetite. These are primarily imported through the Port of Newcastle, facilitated by ready access to skilled labour and thus, resulting in Newcastle becoming a principal source for inbound material to the Hunter.

Sources of inbound flows for ammonium nitrate and ammonium nitrate emulsion

Orica at Kooragang Island – Orica currently manufactures ammonium nitrate at the Kooragang Island plant at volumes of approximately 400,000 tonnes per annum using anhydrous ammonia imported through the Port of Newcastle. This plant is being expanded to achieve a 750,000 tonnes per annum capacity.

Orica at Kurri Kurri – Orica also manufactures ammonium nitrate emulsion at their Technology Centre site at Kurri Kurri. This facility will produce up to 250,000 tonnes of ANE per annum using AN produced at Orica's Kooragang facility.

Incitec Pivot at Kooragang Island – Incitec Pivot has indicated plans to develop an ammonium nitrate production plant at their Kooragang Island facility, adjacent to Orica's facility.

> The collective investment being made by Vopak, Stolt, Orica, Incitec Pivot, WesTrac and Komatsu represents a significant financial commitment to the region, which validates confidence in the continued growth and longevity of Hunter coal mining and exports.

Sources of inbound flows for diesel fuel

Newcastle port is the principal source of diesel fuel. With Shell's refinery in Sydney now closed and the Caltex refinery facing imminent closure, most product is now imported via Newcastle. All major diesel importers—namely Shell, Caltex, Mobil and BP—have arrangements for importing, storing and distributing

product from the Newcastle Port area. Shell/Mobil and Caltex are operating from Carrington, with further terminals planned by Vopak and Stolt at Mayfield.

Sources of inbound flows for mining machinery

Newcastle Port is also the principal import location for mining machinery. Flows are dominated by the Caterpillar and Komatsu brands with much of their product being shipped by the Wallenius-Wilhemsen shipping line that recently changed its NSW port of call from Port Kembla to Newcastle (Carrington Eastern Basin). Both Caterpillar (through their dealership with WesTrac) and Komatsu have opened new, purpose-built facilities at Tomago where imported equipment is stored and assembled before transport to mine sites.

Both facilities represent a major investment into the region and support warehousing, storage and training and administration functions. Accordingly, Tomago is becoming an important hub for inbound product, as well being a centre for locally based equipment engineers to service sites across the country given Tomago's proximity to Newcastle Airport.

Storage Facilities and Staging Points

Kurri Kurri (and potentially Denman) will become important staging points between Newcastle and the mine sites due to the fact that the mine operators do not want to store product on site yet still require a 'Just In Time' approach so inbound material can be called forward as and when required.

4.7 SOCIAL IMPACTS FOR MINING-AFFECTED COMMUNITIES

Community impacts associated with mining are centred around impacts from the movement of heavy vehicles, employment issues (including the journey to and from work), and associated economic and tourism-related impacts.

The social impact on mining affected communities (in particular communities located along the supply chain) may develop as different scenarios with both negative and positive aspects. While it was not in the scope of this investigation to resolve community concerns, it is imperative that social impact remains in the foreground of government, industry and investment agendas in order to achieve the best development outcomes and longevity for the region as a whole.

Transporting certain types of product: transport of goods such as ammonium nitrate through townships will increase, and with it the public perception of dangerous goods being transported through townships or community areas. Constructing town bypasses can assist in addressing this concern if necessary. It should however be reiterated that while ammonium nitrate is a component of mining explosives, it is not an explosive in itself but a Class 5.1 oxidising agent. It only becomes hazardous when combined with diesel and an explosive charge.

Declining appeal of townships: increased freight movements can contribute to the declining tourist appeal of townships with impacts on property values felt by local residents. Impact could come in the form of increased noise, air and traffic congestion.

Conflict between non-freight local traffic and inbound freight movements: the potential for conflict between non-freight local traffic and inbound freight movements for the mining sector would be particularly poignant during peak-hour in regional centres such as Muswellbrook. There is also the potential that such issues shift to other road networks, such as the Golden Highway, as coal resources in the Ulan and Gunnedah Basins develop.

New employment opportunities: development of infrastructure facilities will create additional jobs and flow-on benefits for regional GDP. Such opportunities could arise from additional ammonium nitrate production and import fuel storage in the Newcastle/Kooragang area, the

proposed ammonium nitrate storage facility in Denman, as well as mining machinery import and assembly facilities at Tomago.

Safety issues for regional road networks: the current condition of road infrastructure is raising legitimate concerns for safety on regional road networks, especially in the context that increased freight movements inbound are projected to increase. One item of particular relevance are bridges currently unable to accommodate the expected service levels attached to increased freight movements and especially the predictive large truck movement and transport of hazardous materials. These remain a key priority for investment consideration and also to ensure that upgrade efforts are taken synergistically as part of a region-focused approach. A good example of this issue concerns the road network east of the Ulan–Moolarben–Wilpinjong complex, which requires significant upgrade works to accommodate future requirements while addressing broader community and public interests.

Future bypasses impact viability of towns: potential future bypasses for townships such as Muswellbrook and Singleton may impact negatively on the viability of local businesses.

The unbalanced distribution of costs and benefits: community perceptions are that the region is bearing the cost of coal mining (e.g. traffic congestion) while the broader state enjoys the benefits. This study reiterates the need for future investment and development planning to carefully balance industry, economic, community, public, regional and state interests.

4.8 NON-FREIGHT TRAFFIC

Between 2001 and 2011, the Hunter Valley (excluding Newcastle and Sydney) had the largest and fastest-growing population increase in NSW – up by 31,500 (equivalent to a 14 per cent increase). Non-freight traffic is predominantly associated with community or personal travel.

Commuting or ‘journey to work’ trips have been drawn out for further consideration in this investigation as it covers both general work and mining-related work trips subject to variation according to changing and new work locations.

4.8.1 JOURNEY TO WORK TRIPS

Table 4 and **Table 5** present a summary of 'journey to work' (JTW) trips conducted on a typical weekday in 2006. While **Table 4** organises the volume of trips around area of origin, **Table 5** is organised according to destination area. Estimates presented in both tables are based on 2006 census data, adjusted for gaps in reported trip details.

Table 4: Journey to Work trips organised by area of origin

All Journey to Work Trips Originating from	To				
	Internal	Remainder of Hunter Region	Newcastle	Outside Hunter/ Newcastle	Total
Narrabri	3,613	63	8	126	3,810
Gunnedah	2,832	169	0	199	3,200
Liverpool Plains	1,433	68	3	329	1,833
Upper Hunter	2,905	1,300	27	54	4,286
Muswellbrook	4,015	844	35	40	4,934
Singleton	5,965	1,417	200	118	7,700
Cessnock	6,684	3,290	2,866	584	13,424
Maitland	9,023	2,730	8,310	586	20,649
Balance Newcastle SSD	106,381	7,435	0	6,253	120,070
Outside Hunter/ Newcastle	0	2,405	5,381	1,677,371	1,685,157
Total	**142,850**	**19,721**	**16,831**	**1,685,661**	**1,865,063**

Source: Journey to Work Data 2006 (adjusted)

Table 5: Journey to Work trips organised by area destined to

All Journey to Work Trips Destined to	From				
	Internal	Remainder of Hunter Region	Newcastle	Outside Hunter/ Newcastle	Total
Narrabri	3,273	101	11	9,245	12,629
Gunnedah	2,577	86	24	13,524	16,211
Liverpool Plains	1,282	87	16	13,509	14,895
Upper Hunter	2,620	361	65	6,278	9,324
Muswellbrook	3,688	1,966	438	12,715	18,806
Singleton	5,442	3,130	1,633	27,291	37,497
Cessnock	5,994	1,545	4,085	27,746	39,370
Maitland	8,259	1,697	11,969	60,733	82,657
Balance Newcastle SSD	96,270	15,169	0	1,909	113,347
Outside Hunter/ Newcastle	0	1,516,430	0	3,897	1,520,326
Total	**129,404**	**1,540,572**	**18,242**	**176,845**	**1,865,063**

Source: Journey to Work Data 2006 (adjusted)

Table 4and **Table 5** show that current JTW trips destined for outer shires, such as Narrabri and Gunnedah, are generally self-contained within their local government area. JTW trips to these regions will increase as mining develops in these regions.

Table 6 presents a comparison of self-containment of JTW trips in total (from **Table 4**and **Table 5**) and mining-related work trips.

Table 6: Self-Containment of Journey to Work trips (all trips compared to mining-related trips)

Self-Containment of Journey to Work Trips	Trips From		Trips To	
	All Trips	Mining Trips	All Trips	Mining Trips
Narrabri	95%	62%	26%	25%
Gunnedah	88%	59%	16%	82%
Liverpool Plains	78%	77%	9%	50%
Upper Hunter	68%	8%	28%	68%
Muswellbrook	81%	71%	20%	42%
Singleton	77%	80%	15%	35%
Cessnock	50%	10%	15%	36%
Maitland	44%	16%	10%	41%
Balance Newcastle SSD	89%	61%	85%	72%
Outside Hunter/Newcastle	0%	0%	0%	0%
Total	**8%**	**22%**	**7%**	**20%**

Source: Journey to Work Data 2006 (adjusted)

From **Table 6** it can be seen that mining-related work trips within Muswellbrook and Singleton dominate local trips for the workforce. A proportion of these trips are likely to be redirected over time to newer growing mining areas, such as Narrabri and Gunnedah, leading to longer trips. These longer trips have associated negative effects including increased journey times and potential worker fatigue.

4.8.2 NON–JOURNEY TO WORK TRIPS

Household Travel Survey Data for 2010/11 from the NSW Bureau of Freight Statistics was analysed for the Hunter Region and Maitland/Cessnock in particular and from this, the investigation found that:

- Commuter trips comprise around 15 per cent of average weekday trips;
- Social and recreational trips comprise 20 per cent to 25 per cent;
- Shopping trips comprise around 17 per cent.

Overall, car travel is the dominant mode in the non-freight sector throughout the Hunter region.

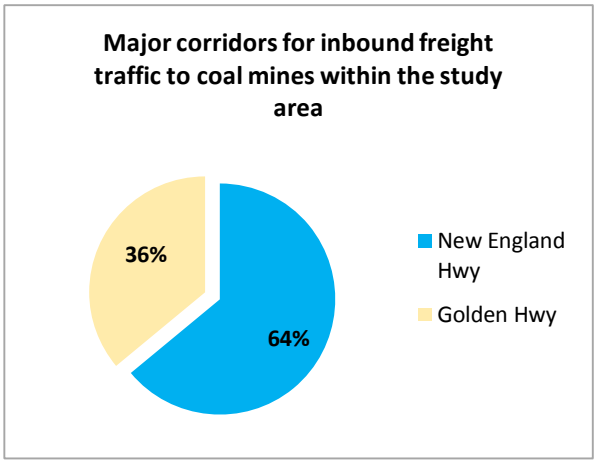
It should be noted that while commuter trips represent around 15 per cent of all trips, time of day travel is dominated by morning and evening peak trips that conflict with inbound road freight movements to the Hunter, which are timed so to arrive to be met by the incoming workforce.

4.9 GEOGRAPHICAL DISTRIBUTION OF FREIGHT

The New England Highway and the Golden Highway provide the key freight routes within the study area. Significant use of the Golden Highway highlights its importance as an infrastructure asset (in its own right), in addition to the New England Highway.

The inbound logistics task within the study area is predominantly emanating from the Newcastle/Kooragang Island areas. Secondary origins are Kurri Kurri and Tomago (and possibly Denman).

Additional points of origin for inbound cargo include Sydney, Port Kembla and Moura/Yarwun, near Gladstone in Queensland.



Within the Hunter itself, inbound destinations are traditionally dominated by mines in the Hunter and Newcastle coal fields within the geographical vicinity of Scone, Aberdeen, Muswellbrook, Singleton, Cessnock and Maitland. This has now extended to destinations closer to new mines in the Ulan area (near Gulgong) and the Gunnedah coal field (near Narrabri, Boggabri and Gunnedah).

Considering that future growth will mostly occur in the Gunnedah and Ulan coal fields, it makes sense that the increased inbound flows to these outer regions in future will generally increase the time that truck traffic spends on the regional road network as a whole. Traffic volumes to, and from, these locations will subsequently increase generating greater strain on the existing road infrastructure.

5 STRATEGIC FREIGHT MODEL FORECASTS

(The figures shown in this chapter are replicated in Appendix B)

The forecast freight inbound to the mines has been added to regional data contained in the TfNSW Bureau of Freight Statistics Strategic Freight Model to produce updated forecasts of "laden" regional freight movements. Freight loading estimates have been estimated and assigned to the road network.

5.1 INBOUND FREIGHT VEHICLE MOVEMENTS

An overview of the forecast inbound flows to the coal sector (organised by road segment) is given in **Table 7**.

Table 7: Forecast Laden Truck Movements Inbound to Mines (one-way)

Location	2011/12 Ktpa (Trucks/Day)	2031 Ktpa (Trucks/Day)	2031 minus 2011	2031 vs. 2011
Golden Highway west of Denman Road	1,164 (179)	2,674 (411)	1,510 (232)	130% (130%)
New England Highway west of Singleton	1,983 (305)	4,760 (732)	2,777 (427)	140% (140%)
New England Highway west of Branxton	3,146 (484)	7,434 (1,144)	4,288 (660)	136% (136%)
All Mines	3,545 (553)	8,223 (1,258)	4,678 (705)	132% (127%)

Source: TfNSW Bureau of Freight Statistics Strategic Freight Model

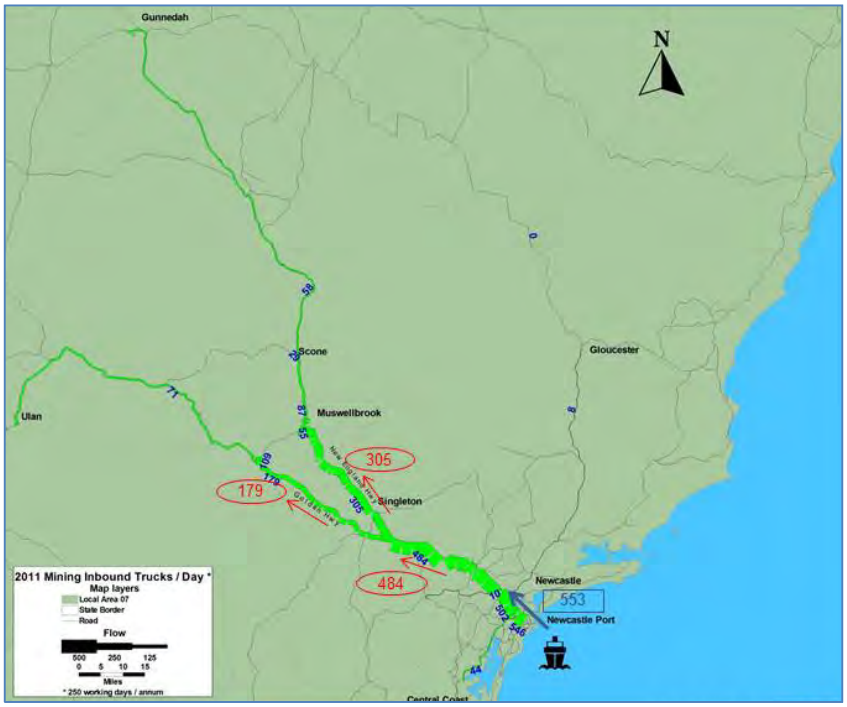
Between 2011/12 and 2031, heavy vehicle demand (one-way inbound to the mines) is estimated to rise by:

- 660 additional laden trucks per day on the New England Highway west of Newcastle—up from 484 trucks in 2011/12;
- 427 additional laden trucks per day on the New England Highway north of the Golden Highway—up from 305 trucks in 2011/12;
- 232 additional laden trucks per day on the Golden Highway west of the New England Highway—up from 179 trucks in 2011/12.

Figure 7 and **Figure 8** visually present the inbound freight forecasts for the years 2011 and 2031, as produced from the BFS Strategic Freight Model.

Both show the increased demands generated by mining activity further out from the Hunter Region in areas like Gunnedah and Ulan, which will generate freight demand on the roads in between, particularly the New England and the Golden Highway.

Figure 7: Forecast Inbound Laden Truck Movements per day for 2011



Source: TfNSW Bureau of Freight Statistics Strategic Freight Model

Figure 8: Forecast Inbound Laden Truck Movements per day for 2031

Source: TfNSW Bureau of Freight Statistics Strategic Freight Model

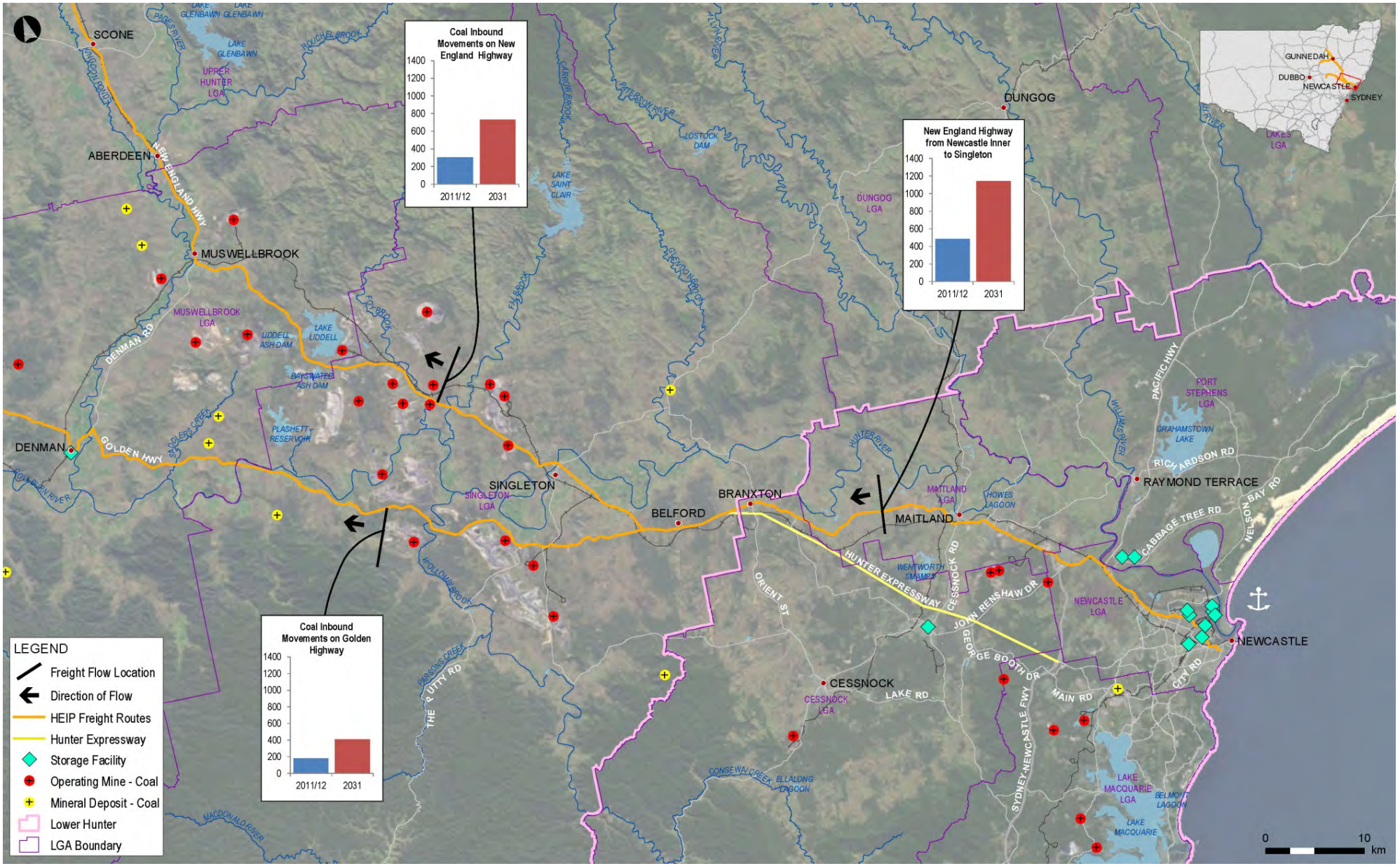


Figure 9 – Inbound Coal Mining Related Freight Flows (trucks per day)

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

5.2 TOTAL FREIGHT VEHICLE MOVEMENTS

The forecast total two-way laden freight movements are presented in **Table 8**.

Table 8: Forecast Total Laden Truck Movements (two-way)

Location	2011/12 Ktpa (Trucks/Day)	2031 Ktpa (Trucks/Day)	2031 minus 2011	2031 vs. 2011
Golden Highway west of Denman Road	2,469 (335)	4,976 (686)	2,507 (351)	202% (205%)
New England Highway west of Singleton	8,039 (1,031)	15,487 (2,020)	7,448 (989)	193% (196%)
New England Highway west of Branxton	9,309 (1,216)	18,384 (2,446)	9,075 (1,230)	197% (201%)

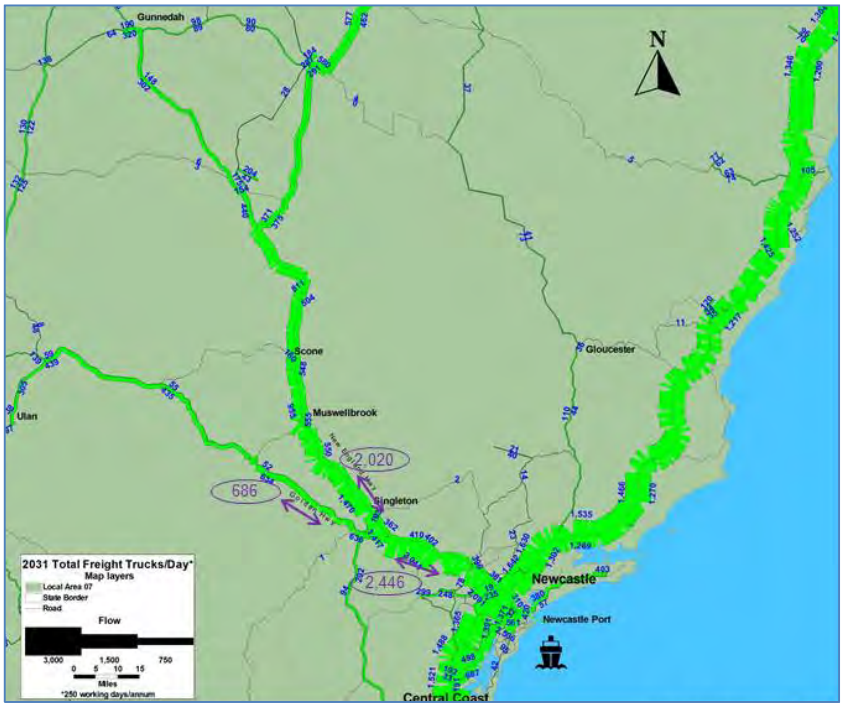
Source: TfNSW Bureau of Freight Statistics Strategic Freight Model

Figure 10 and **Figure 11** visually present the inbound freight forecasts for the years 2011 and 2031, as produced from the BFS Strategic Freight Model.

Figure 10: Forecast Total Laden Truck Movements per day for 2011

Source: BFS Strategic Freight Model

Figure 11: Forecast Total Laden Truck Movements per day for 2031



Source: BFS Strategic Freight Model

6 ROAD INFRASTRUCTURE REQUIREMENTS

6.1 THE HUNTER VALLEY NETWORK

This investigation included a desktop study that leveraged past strategic projects, available government data and private sources of data and research to assess the Hunter road network in relation to road freight flows.

Parts of the regional road network of greatest interest to the subject of this investigation was the New England and Golden Highways, although other points of interest outside these major routes (and relevant to this investigation) included the connection from Kooragang Island and the Newcastle Port to the New England Highway and the new Hunter Expressway to Branxton.

The investigation confirmed that the Golden Highway is likely to become a critical freight corridor comparable to the significance of the New England Highway, which has already been substantially investigated before this undertaking.

6.2 CORRIDOR PERFORMANCE AND IMPEDIMENTS

Current major choke points on the road network serving the Hunter are:

- Singleton south and north township;
- Muswellbrook township;
- Scone level crossings;
- New England Highway particularly at the turn off onto the Golden Highway;
- Kooragang Island.

Looking at predictive 2031 forecast freight flows, it is evident that the corridor along the Golden Highway will encounter significant impact due to the continuing development of the central Hunter region and the proposed large-scale development of the Ulan region. Several choke points and road/intersection issues may arise out of limited capacity being available from current infrastructure on the corridor.

It should be noted the Hunter Expressway is due to be completed at the end of 2013 and will provide a bypass of Maitland and Hexham. Issues associated with these locations will reduce in priority under our assessment owing to large volumes of through-traffic diverting to the expressway. This would also reduce the severity of current issues through Maitland and Hexham.

After examining freight flows as well as areas of non-freight flow origins and destinations, this investigation has been able to draw out the following salient areas where critical infrastructure improvement has not previously been targeted:

- Golden Highway pavement and road capacity;
- Golden Highway access to mine entrances;
- New England Highway pavement quality.

Within these areas, the elements of greatest interest will be those relating to safety and operational capacity, with specific focus on those within current roads and infrastructure that are insufficient for meeting predictive requirements. This will include (but is not limited to) elements like road geometry, roundabouts, intersections, road extent and bridges/ rail crossings.

Additionally, there is the potential for other issues to emerge later. This study identified several of relative significance that relate to the possible Quirindi bypass and possible additional overtaking lanes, and auxiliary lanes to allow for traffic flow to be maintained on the northern section of the New England Highway/Kamilaroi Highway.

6.3 RECOMMENDED ROAD INFRASTRUCTURE PROJECTS

Pursuant to the aims of this study and the HEIP more broadly, this investigation has assessed the constraints associated with the current 2011/12 context and extrapolated this to the 2031 forecast scenario to define some of the priority concerns and opportunities to deliver strong economic and community outcomes for the region.

The study culminates with a set of recommendations for addressing network impediments and community impacts. Further investigation and discussion will be required to understand the detailed requirements attached to these. A total of 13 key road infrastructure projects are recommended for the focus area of this investigation, namely the major freight routes across the Hunter and northern Hunter, as well as routes that connect Newcastle Port and storage facilities with the mines.

These recommendations incorporate some existing initiatives. Together they facilitate a broad regional perspective; all the more reason that they are included for investigation and discussion in this study. Several are pre-existing projects that are currently being proposed or have entered the tender process with the NSW Government.

The projects recommended are:

1. Kooragang Island Connectivity
2. Scone Rail Level Crossing
3. New England Highway – Upgrade from Belford to the Golden Highway
4. Singleton – Gowrie Gates
5. Gunnedah Second Road Over Rail Bridge
6. Singleton Bypass
7. Muswellbrook Bypass
8. New England Highway – Heavy Duty Pavement Construction – Aberdeen to Willow Tree (part)
9. Maitland Roundabout Upgrades
10. Golden Highway – New England Highway to Denman Corridor Upgrades
11. Golden Highway Upgrade – Through Denman
12. Golden Highway and Ulan Road – Denman to Ulan Improvements
13. Quirindi Bypass

Appendix A contains more details of each road infrastructure project.

6.4 AFFILIATED WORKS

This investigation found that aside from the major projects, there may be a host of smaller, more localised works that could be delivered as part of a broad program. Examples include works at intersections that provide access to mines along primary freight routes.

Grouping such works within a single program ensures that their importance is not overlooked as may be the case if viewed as individual, discrete minor works. With respect to works associated with the Golden Highway specifically, this investigation found merit for further investigation of pavement quality and capacity, as well as infrastructure capacity, especially to cope with Higher Mass Limit ratings and adequate road/intersection safety.

6.5 TIMEFRAMES AND COSTINGS

The recommended timing may vary due to the funding imperative behind each project component and the timing of the development of future coalfields.

Project	Estimated Project Cost ($2013)	Timing (Years)		
		Short (1-5)	Medium (5-10)	Long (10-20)
1. Kooragang Island Connectivity	$102.5 million ($100 to $105 million)	✓		
2. Scone Rail Level Crossing	$86 million ($70 to $95 million)		✓	
3. New England Highway – Upgrade From Belford to Golden Highway	$127.2 million ($120 to $140 million)		✓	
4. Singleton – Gowrie Gates	$30.2 million ($25 to $35 million)		✓	
5. Gunnedah second road over rail bridge	$24 million ($22 to $26 million)	✓		
6. Singleton Bypass	$160 million ($130 to $195 million)		✓	
7. Muswellbrook Bypass	$215 million ($170 to $260 million)		✓	
8. New England Highway – Heavy Duty Pavement Construction – Aberdeen to Willow Tree (Part)	$29.1 million ($28 to $30 million)		✓	
9. Maitland Roundabout Upgrades	Hospital roundabout $4.1 million (4 to 5 million) Railway roundabout $36 million (35 to 38 million)		✓	

Project	Estimated	Timing (Years)		
10. Golden Highway to Denman – Corridor Upgrades	$22 million ($20 to $24 million)		✓	
11. Golden Highway Upgrade – through Denman	Option 1 - Road Upgrade $1.5 million ($1 to $2 million) Option 2 – Denman Bypass $3 million ($2.5 to $3.5 million)			✓
12. Golden Highway Connection – Denman to Ulan corridor improvement	$60 million ($54 to $65 million)			✓
13. Quirindi Bypass	$13 million ($12 to $15 million)			✓

7 WATER INFRASTRUCTURE REQUIREMENTS

7.1 BACKGROUND

The NSW Government has committed to ensuring that communities and water users have access to adequate and secure water supplies. In the next 5 to 20 years, the NSW State Infrastructure Strategy includes a commitment to develop a State-wide program for dams (including water supply and flood mitigation functions) informed by the outcomes of long term water supply planning and implement these measures where feasible over the medium to longer term.

The growth in activity in the Upper Hunter Valley warrants investigation of the needs of agriculture, industry and mining to ensure that the water infrastructure can support growth and that there is enough time to plan the delivery of supply options.

The water market reforms of the 1990's have been a success in the Hunter Valley, allowing the transition from an agricultural to an industrial based economy. However, a fundamental attribute of the water market is that the market retains the reliability characteristics of the agricultural demand at the time of its inception. In the case of the Hunter Valley the water market was developed when it was predominantly an agricultural region where water yield was more important than reliability. Agriculture does not require water for irrigation when it rains and can make fundamental adjustments during the dry periods whereas there is a more constant water demand for many mining and industrial users regardless of conditions.

In addition to the changing demand pattern, the quantum of water demand has increased. From 2001/02 to 2011/12 coal exports transported through the port of Newcastle increased by 76%[13].

This shift in demand patterns may (if no actions were taken) lead to a reduction in the security of supply in some scenarios with more frequent and longer periods of restricted allocations and faster supply depletion causing restrictions if dam levels were to drop faster. In 2007, for example, the Upper Hunter Valley faced a major reduction in economic activity as the Upper Valley water storages' levels dropped to 27%.

At that time the NSW Government's position was that the market should be the first tool to be used to resolve security of supply issues. Since 2007 above average rainfall has met the increase in water demand.

Over time, water supply arrangements for mines have also changed. Having secured most of the high reliability water, the Hunter's mining industry is now developing with water supply arrangements that include market trading and general supply (that has lower reliability of supply). Forecast for water demand shows that the high growth of the last decade is likely to continue as most mines are working below approved capacity levels.

A broad assessment of mine water requirements is being undertaken to provide a basis for determining options to meet forecast scenarios.

[13] Newcastle Ports Corporation Annual Report 2011/12

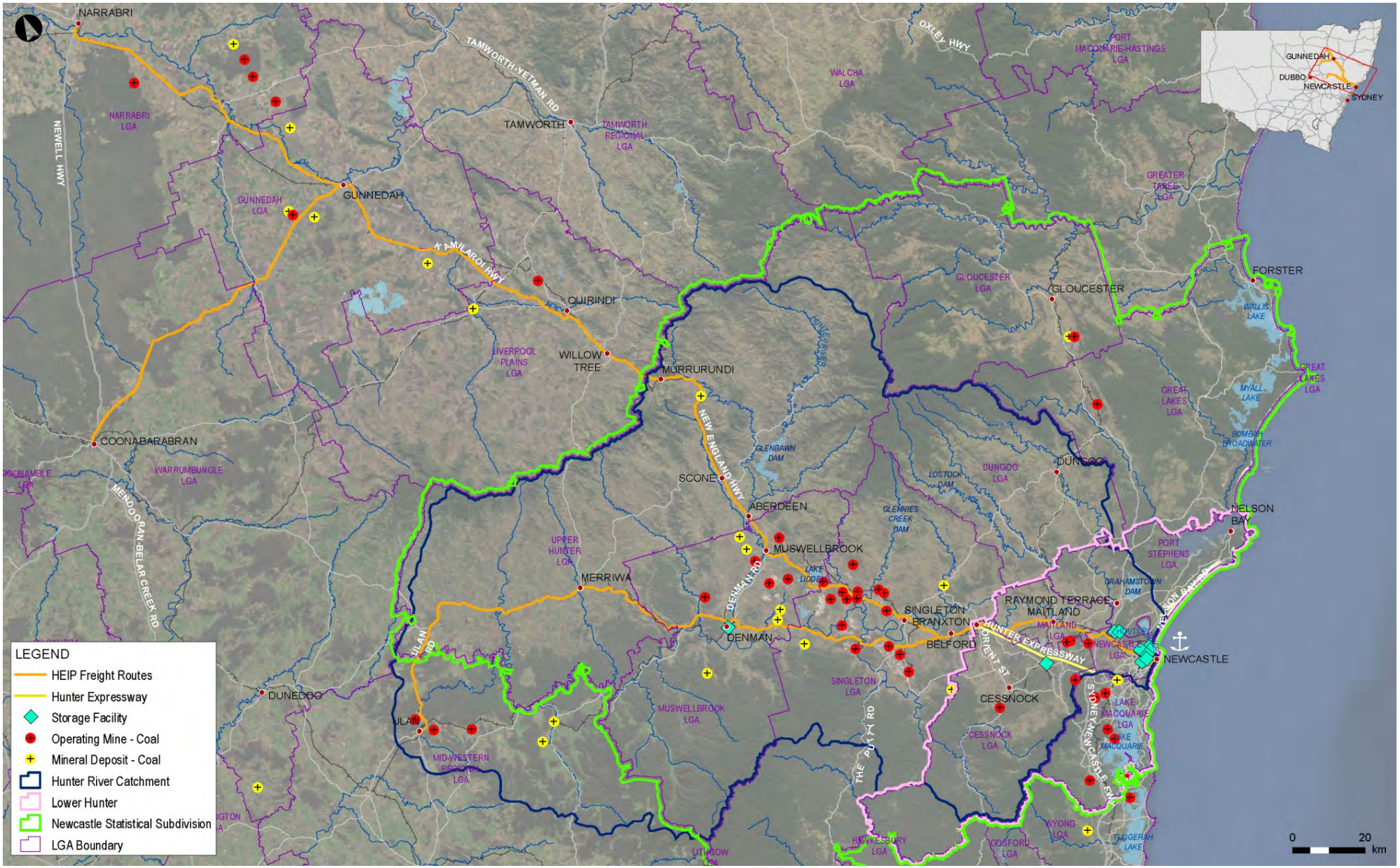


Figure 12 – Hunter River Catchment

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

7.2 WATER POLICIES AND PLANNING

Strategies employed in the Upper Hunter Valley to address security and reliability of supply need to be consistent with the agreed National (Water) Initiative Agreement 2004's water policies and planning framework. This includes the need to be consistent with the four relevant NSW Hunter Water Sharing Plans and associated regulatory requirements that are currently under review.

Under the National Water Initiative access entitlement holders are to bear the risks of any reduction or less reliable water allocation arising from reductions to the consumptive pool as a result of either seasonal or long-term changes in climate; or periodic natural events such as bushfires and drought. Risks arising as a result of changes to policy or under comprehensive water plans commencing after 2014 are to be shared over each ten year period between users and the State and Federal Governments with the major contributor to compensation being the Federal level.

The Federal Government also executes its responsibilities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This Act provides a legal framework to protect and manage defined nationally and internationally important flora, fauna, ecological communities and heritage places. The Federal Government has introduced an amendment to the Act to provide that water resources are a matter of national environmental significance in relation to coal seam gas and large coal mining development.

7.3 RECOMMENDATION

That the NSW Government undertake an analysis of industry water requirements to support growth under various drought scenarios, and provide industry with the necessary up-to-date information to manage risks associated with water supply and drought.

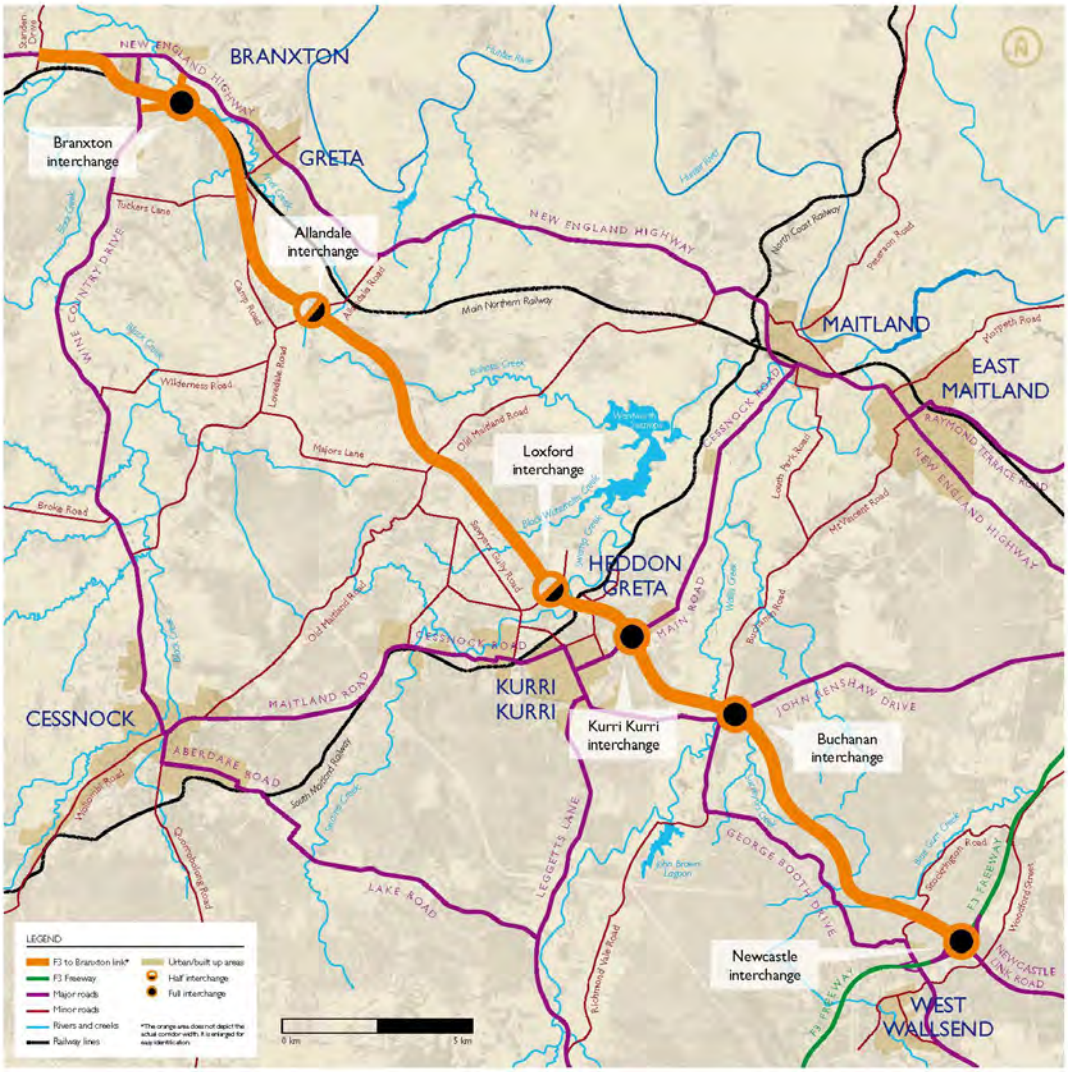
APPENDIX A – ROAD INFRASTRUCTURE PROJECTS

The following list of road infrastructure projects is based on government projects currently being planned for the Hunter Regional network, as well as projects recommended through this study in consultation with Infrastructure NSW and Regional Development Australia (Hunter).

The list specifically focuses on providing relief to freight-related travel for vehicles accessing the coal mines within the Hunter Region and adjacent areas within the Hunter Valley/Gunnedah Basin.

The projects are provided in addition to the Hunter Expressway, which is due for completion end-2013. The Hunter Expressway is a new four-lane dual carriageway that will provide a new 40 kilometre link between the F3 Freeway (at Seahampton) and the New England Highway (west of Branxton). It includes six grade-separated interchanges located at the F3, Buchanan, Kurri Kurri, Loxford, Allandale and Branxton.

Figure 13: Hunter Expressway (under construction)



Project List

1. Kooragang Island Connectivity

SCOPE: Duplication of Tourle Street Bridge and approaches, Kooragang Island

2. Scone Rail Level Crossing

SCOPE: Bypass replacement of the Scone Level Rail Crossing

3. New England Highway – Upgrade from Belford to the Golden Highway

SCOPE: Upgrade of the New England Highway to dual carriageway from Belford to the Golden Highway and grade separation of the Golden Highway / New England Highway intersection

4. Singleton – Gowrie Gates

SCOPE: Widening of Singleton Gowrie Gates rail underpass and approaches

5. Gunnedah Second Road Over Rail Bridge

SCOPE: Construction of a new crossing over the Great Northern Railway at Gunnedah

6. Singleton Bypass

SCOPE: Bypass of the New England Highway around Singleton

7. Muswellbrook Bypass

SCOPE: Bypass of the New England Highway around Muswellbrook

8. New England Highway – Heavy Duty Pavement Construction – Aberdeen to Willow Tree (part)

SCOPE: Reconstruction of the New England Highway Pavement in parts from Aberdeen to Willow Tree

9. Maitland Roundabout Upgrades

SCOPE: Upgrade of two roundabouts at Maitland

10. Golden Highway – New England Highway to Denman Corridor Upgrades

SCOPE: Investigation and potential upgrade of sections of the Golden Highway between the New England Highway and Denman

11. Golden Highway Upgrade – Through Denman

SCOPE: Upgrade of the Golden Highway through Denman or construction of a Denman bypass

12. Golden Highway and Ulan Road – Denman to Ulan Improvements

SCOPE: Road upgrades between Denman and Ulan

13. Quirindi Bypass

SCOPE: Bypass of the Kamilaroi Highway around Quirindi

PROJECT 1 – KOORAGANG ISLAND CONNECTIVITY

Project Description	Duplication of Tourle Street Bridge and approaches, Kooragang Island
Location	Newcastle, NSW
Project Status	Under investigation
Relation to Freight	Tourle Street and Cormorant Road are used by freight traffic to access port facilities at Kooragang Island. Current congestion levels impact on reliability of delivery times for inbound and outbound freight traffic.
Estimated Project Cost ($2013)	$102.5 million ($100 to $105 million)
Timing	Open to traffic in 2017

Kooragang Island is critical to the productivity of the coal industry and associated inbound traffic from the Port of Newcastle to the Hunter region and beyond. Inbound traffic includes products such as ammonium nitrate and various consumables and mechanical parts.

Tourle Street/Cormorant Road constitutes the main corridor connecting Kooragang Island to the City of Newcastle and the southern section of the Port of Newcastle. The current demand for the corridor is approximately 33,000 vehicles daily (including of 3,000+ heavy vehicles). This is forecast to increase to around 40,000 vehicles per day by 2031.

Tourle St/Cormorant Road suffers from congestion, particularly during peak periods. This reduces the productivity of freight movements on the corridor – threatening, in turn, the productivity of the Port of Newcastle on Kooragang Island.

Congestion will worsen in the future, as demand grows. The increased demand will be driven by the expansion of the Port of Newcastle, growth of the RAAF Base Williamtown / Newcastle Airport, and regional population and employment growth.

The NSW Roads and Maritime Services completed minor work to improve safety along Cormorant Road in 2011. The work involved carrying out maintenance upgrades along a 1.4 kilometre length of Cormorant Road running west from Egret Street. The full length of the road was resurfaced and wider shoulders constructed on both sides of the road and the existing Newcastle bound merge lane was extended 200 metres.

The upgrade currently proposed is in addition to the above works. It involves duplicating the existing Tourle Street bridge and its approaches in order to increase corridor capacity so it can better accommodate current and future traffic volumes. This project will improve freight productivity along the Tourle St and Cormorant Road route contributing to future productivity of the Port of Newcastle on Kooragang Island while enhancing safety and environmental performance of the corridor.

Project Cost in $2013 is $102.5 million ($100 to $105 million).

Figure A1 – Duplication of Tourle Street Bridge and approaches, Kooragang Island

(*Source:* NSW Roads & Maritime Services)

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 2 – SCONE RAIL LEVEL CROSSING

Project Description	Bypass replacement of the Scone Level Rail Crossing
Location	Scone, NSW
Project Status	Under investigation
Relation to Freight	Coal freight movements by train regularly close the level railway crossing at Scone for extended periods delaying road freight and other cross town traffic.
Estimated Project Cost ($2013)	$86 million ($70 to $95 million)
Timing	2015 to 2020

In Scone, the Great Northern Railway intersects with the road network at two level railway crossings. The crossings are located at the New England Highway and Liverpool Street, approximately 500 to 600 metres apart. Coal train operations currently divide the town by closing access over these crossings for extended periods, which results in delays for freight and other traffic within the town. Emergency services are effectively cut when coal trains are passing through the town. The delays and severance will increase in the future with more frequent and longer trains expected.

The *Lower Hunter Transport Needs Study (2009)* recommended grade separation of the New England Highway level crossing. The NSW Roads and Maritime Services is currently investigating options for a route across the rail line that is separate from the coal traffic. Work on this has progressed to five options. The options and published RMS estimated costs[14] are:

Option 1: New England Highway bypass of Scone, $95 million

Option 2: New England Highway realignment to Muffett Street plus road over rail bridge north of McLoughlin Street, $75 million

Option 3: New England Highway realignment to Muffett Street plus road over rail bridge at Sherwood Street, $65 million

Option 4: Road over rail bridge at Kelly Street level crossing, $70 million

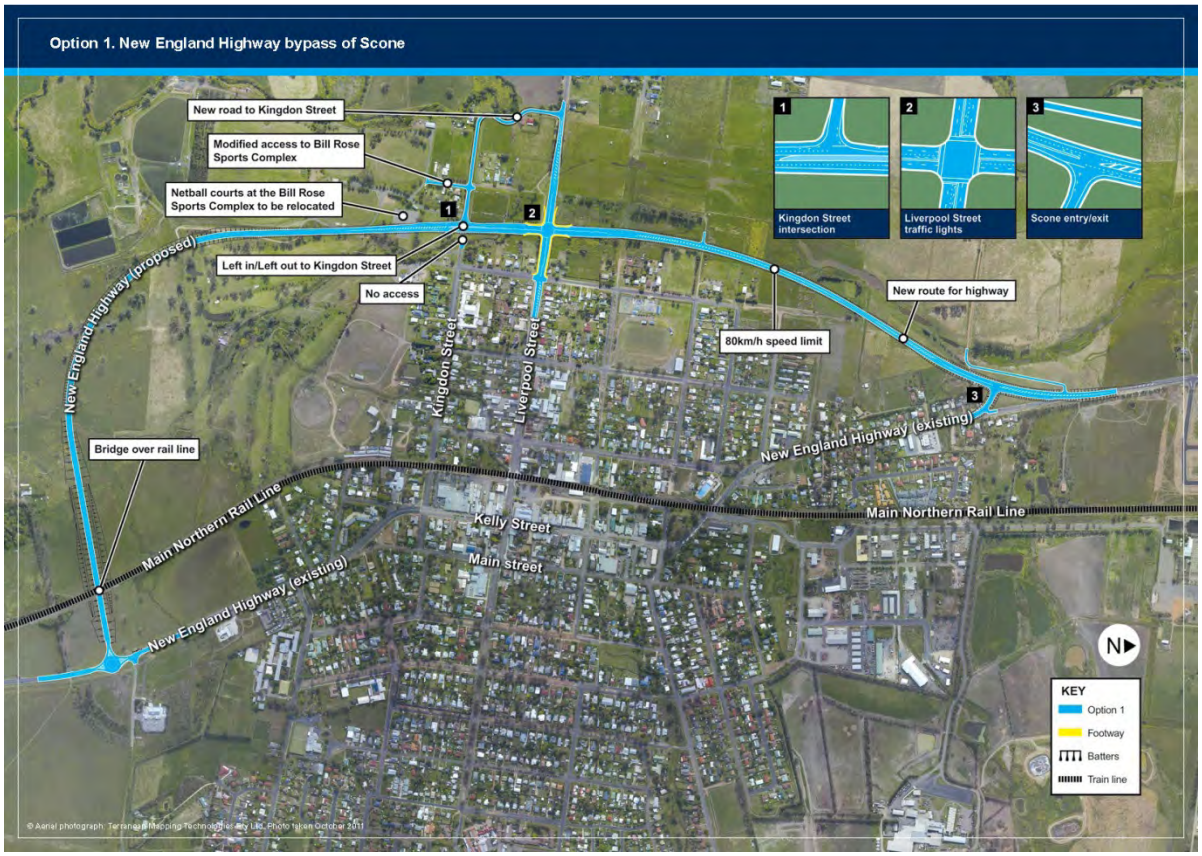
Option 5: Railway bypass of Scone, $250 million

Upper Hunter Shire Council has proposed a modified Option 4 as its preference. The modifications relate to including provisions for management of traffic movements and construction traffic. There is no significant cost difference posed by this modification.

A preferred option has not been determined at this stage. However, a Value Management Workshop conducted in December 2012 recommended further consideration of Option 1 and the modified Option 4 incorporating aspects of the Upper Hunter Shire Council proposal.

All options address the freight issue. For the purposes of this assessment a cost of estimate of $86 million ($70 to $95 million) is reported.

[14] RMS Community Update - Scone Level Crossing Feasibility Study, November 2012



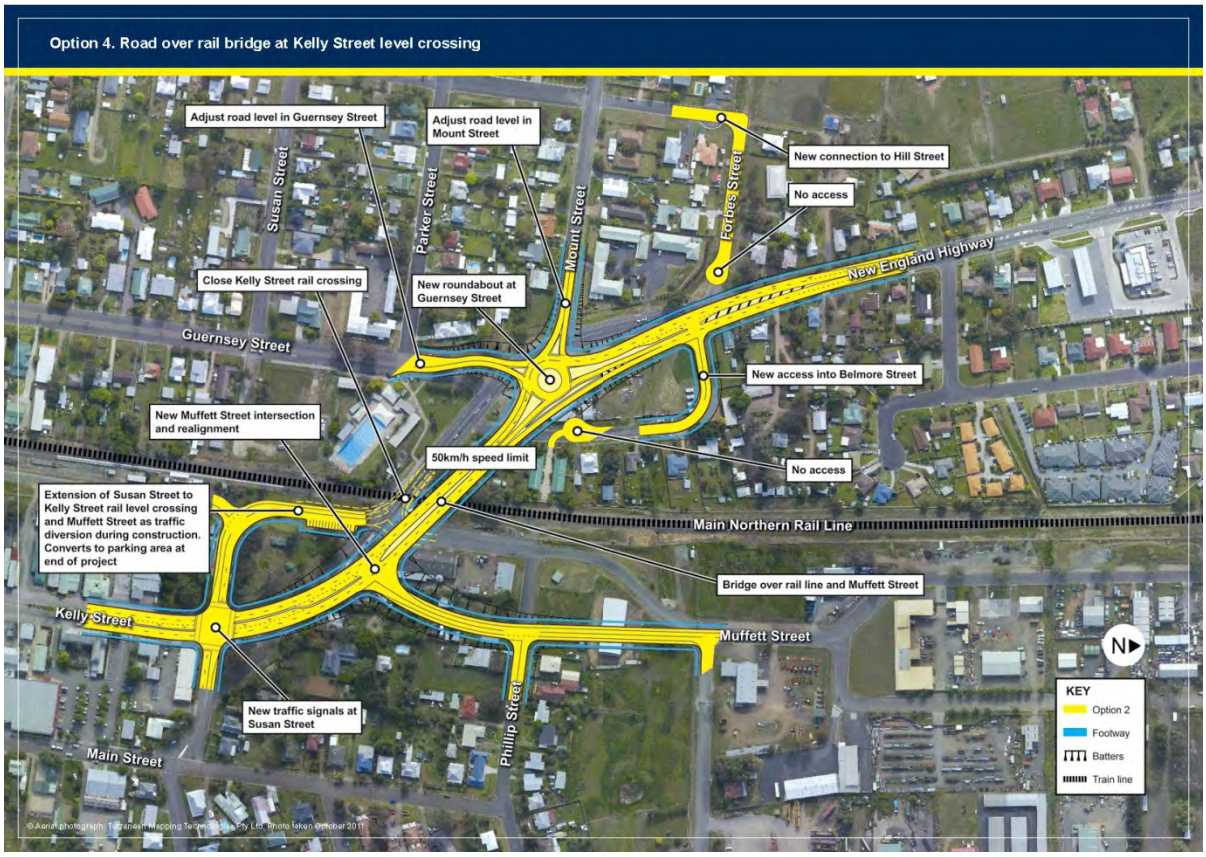


Figure A2 – Scone Level Crossing Options Identified for Further Consideration ***(Source: RMS Scone Level Crossing Options and Feasibility Study – Issues Report – Dec 2012)***

PROJECT 3 – NEW ENGLAND HIGHWAY – UPGRADE FROM BELFORD TO GOLDEN HIGHWAY

Project Description	Upgrade of the New England Highway to dual carriageway from Belford to the Golden Highway *and* Grade separation of the Golden Highway/New England Highway intersection
Location	Belford, NSW
Project Status	Recommended for investigation
Relation to Freight	The New England Highway is the only freight corridor from the soon to be completed Hunter Expressway and the mines west of Belford. Traffic flows on this section of the highway are expected to increase significantly when the Hunter Expressway is completed.
Estimated Project Cost ($2013)	$127.2 million ($120 to $140 million)
Timing	2015 to 2020

The New England Highway is currently a dual carriageway from Hexham to Maitland and reduces to a single carriageway (with overtaking lanes) from Maitland to the interchange with the Golden Highway at Whittingham.

The Hunter Expressway currently under construction will complete a freeway standard dual-carriageway link between northern Sydney (via the F3) and the New England Highway west of Branxton. Its completion is expected at the end of 2013. Completion of the link will induce additional traffic west of Belford as the link opens up new opportunities for further travel.

The growth in freight movements forecast for the Ulan and Gunnedah regions will further contribute to delays and safety concerns for the current 'at grade' intersection of the Golden Highway with the New England Highway. Grade separation of critical movements will be required in the foreseeable future, particularly to safely accommodate freight movements.

In order to address these future problems, the following is recommended for investigation:

- Widening the 3.2 km of the New England Highway between Belford and the Golden Highway from three lanes to a dual-carriageway (i.e. four lanes);
- Providing a grade separation for the intersection of the Golden and New England Highways including increased capacity on approaches.

Project Cost in $2013 is estimated to be $127.2 million ($120 to $140 million).

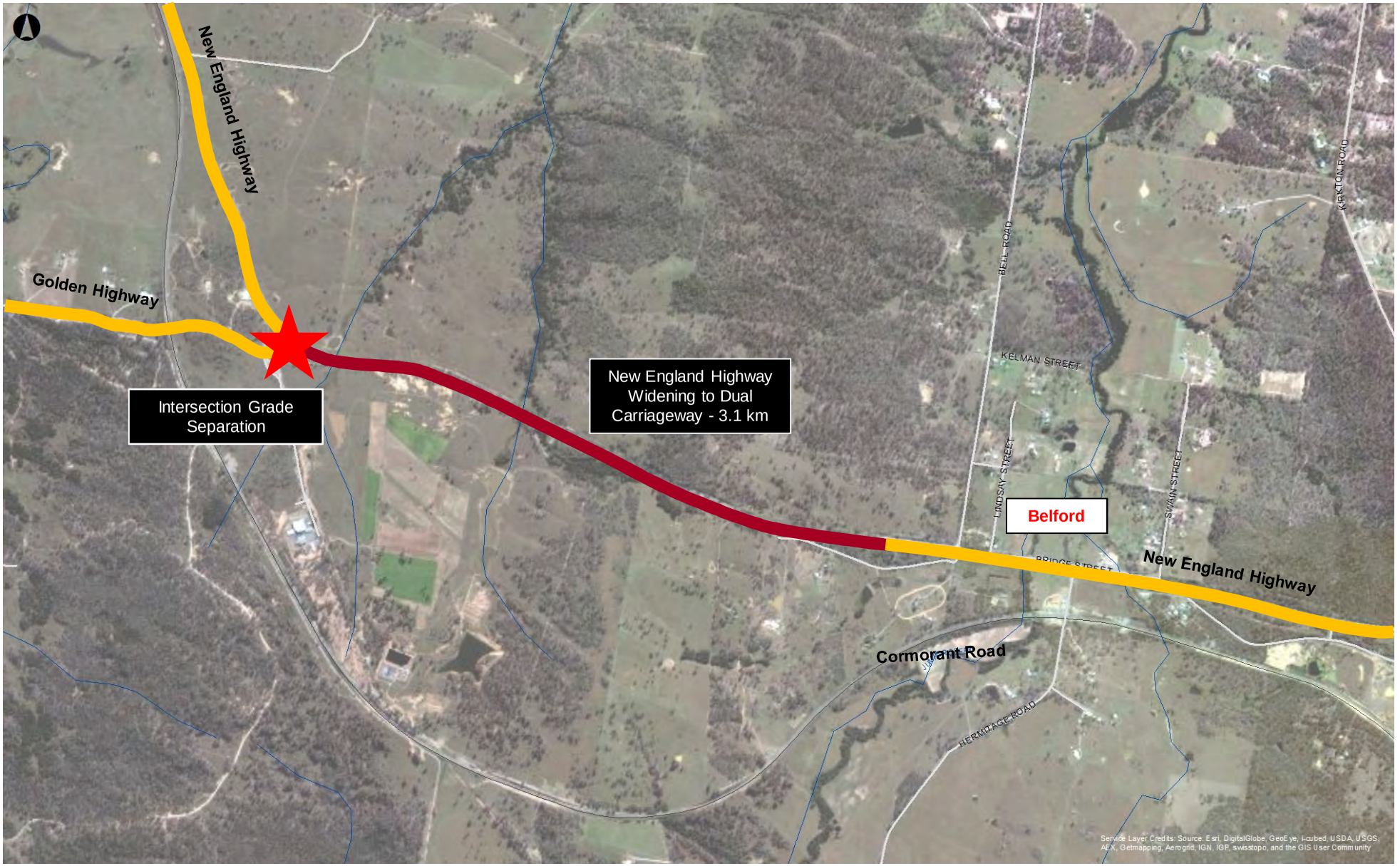


Figure A3 – New England Highway – Upgrade from Belford to The Golden Highway

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 4 – SINGLETON – GOWRIE GATES

Project Description	Widening of Singleton Gowrie Gates rail underpass and approaches
Location	Singleton, NSW
Project Status	Recommended for investigation
Relation to Freight	The Singleton Gowrie gates are a rail underpass on The New England Highway. The width of the underpass is limited. Many oversize vehicles require closure of the road to pass through. Some oversize vehicles are required to take an 34 kilometre detour via local streets. The narrow width and clearances also presents a safety risk for freight traffic.
Estimated Project Cost ($2013)	$30.2 million ($25 to $35 million)
Timing	2015 to 2020

The Great Northern Railway passes over the New England Highway on the western side of Singleton at the Gowrie Gates. The rail underpass at Gowrie Gates currently has a significant vertical clearance (around 7.6 metres) but limited clear width. Due to this limitation current demand from some over-dimension vehicles using the New England Highway in Singleton cannot be met. This is affecting freight access and efficiency since over-dimension vehicles are required to take a 34 kilometre detour using local roads.

The improvements recommended are for widening the underpass on either side and increasing the vertical clearance in order for safer movements of over-dimension (restricted access) vehicles to be permissible. Restricted access vehicles (inclusive of their load) have a width in excess of 2.5 metres and/or a height in excess of 4.3 metres.

Widening the underpass will require the existing bridge structure to be replaced, which is estimated to cost $30.2 million. Detailed investigation and design is required to determine the final cost. The need for this project will become less pressing if the Singleton Bypass is completed within the immediate term.

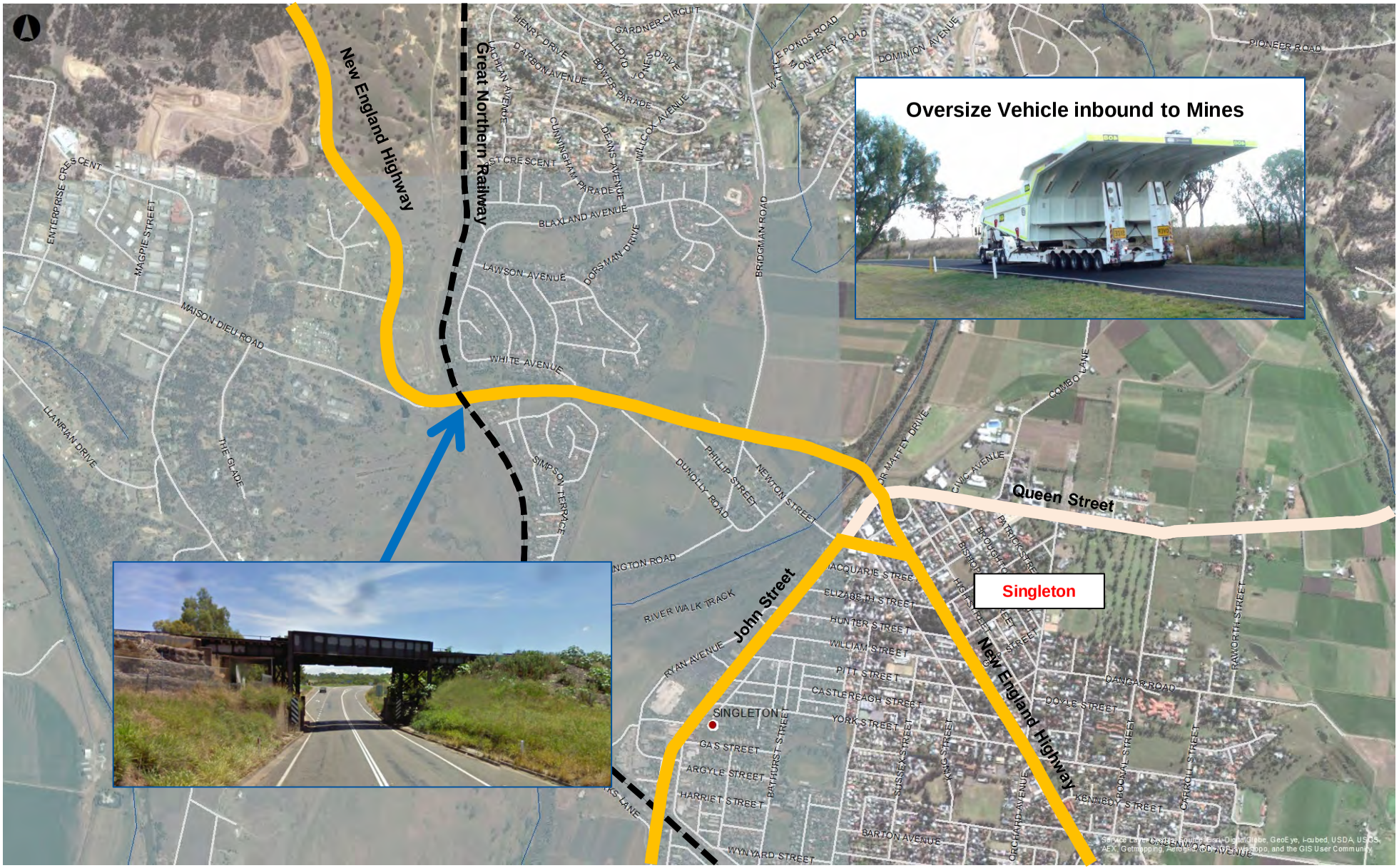


Figure A4 – Singleton Gowrie Gates

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 5 – GUNNEDAH SECOND ROAD OVER RAIL BRIDGE

Project Description	Construction of a new crossing over the Great Northern Railway at Gunnedah
Location	Gunnedah, NSW
Project Status	Under investigation
Relation to Freight	The existing bridge over the Great Northern Railway cannot accommodate Higher Mass Limit (HML) vehicles. Provision of an HML compliant route will assist in giving freight operators the incentive to upgrade their fleets which service both mines and other activities to HML.
Estimated Project Cost ($2013)	$24 million ($22 to $26 million)
Timing	2013 to 2018

The Oxley Highway passes over the Great Northern Railway via the Dr P.H. Stanley Bridge in Gunnedah. The existing bridge cannot accommodate Higher Mass Limit (HML) vehicles.

A level crossing located at New Street sees traffic congestion that causes queuing back through the intersection with the Oxley Highway. Subsequent delays are expected to increase as the length and frequency of coal trains using the rail line increases to keep pace with continued development of the regional coal industry.

Another level crossing located at Carroll Street is used exclusively by local traffic.

Gunnedah Bridge upgrade is required to make the entire region HML compliant. This then encourages suppliers to adopt HML for their entire fleet of which coal is one customer.

In 2012, the NSW Government committed to improving road freight productivity by either replacing or upgrading bridges over the next five years at 17 key locations in regional NSW (the Bridges for the Bush initiative). Construction of a new overpass to accommodate Higher Mass Limit (HML) vehicles over the Great Northern Railway in Gunnedah was included in this package and $16 million in funding has been committed. This upgrade is critical to the coal industry in the Gunnedah Basin as it removes the only remaining HML deficient link on the Oxley Highway.

The NSW Roads & Maritime Services is currently developing draft concept options for the new overpass, which will be located in the vicinity of the existing level crossing at New Street. The strategic cost estimate for the new bridge is around $24 million, which is greater than the $16 million originally allocated under the Bridges for the Bush initiative. The increased cost reflects upgrades required to road approaches.

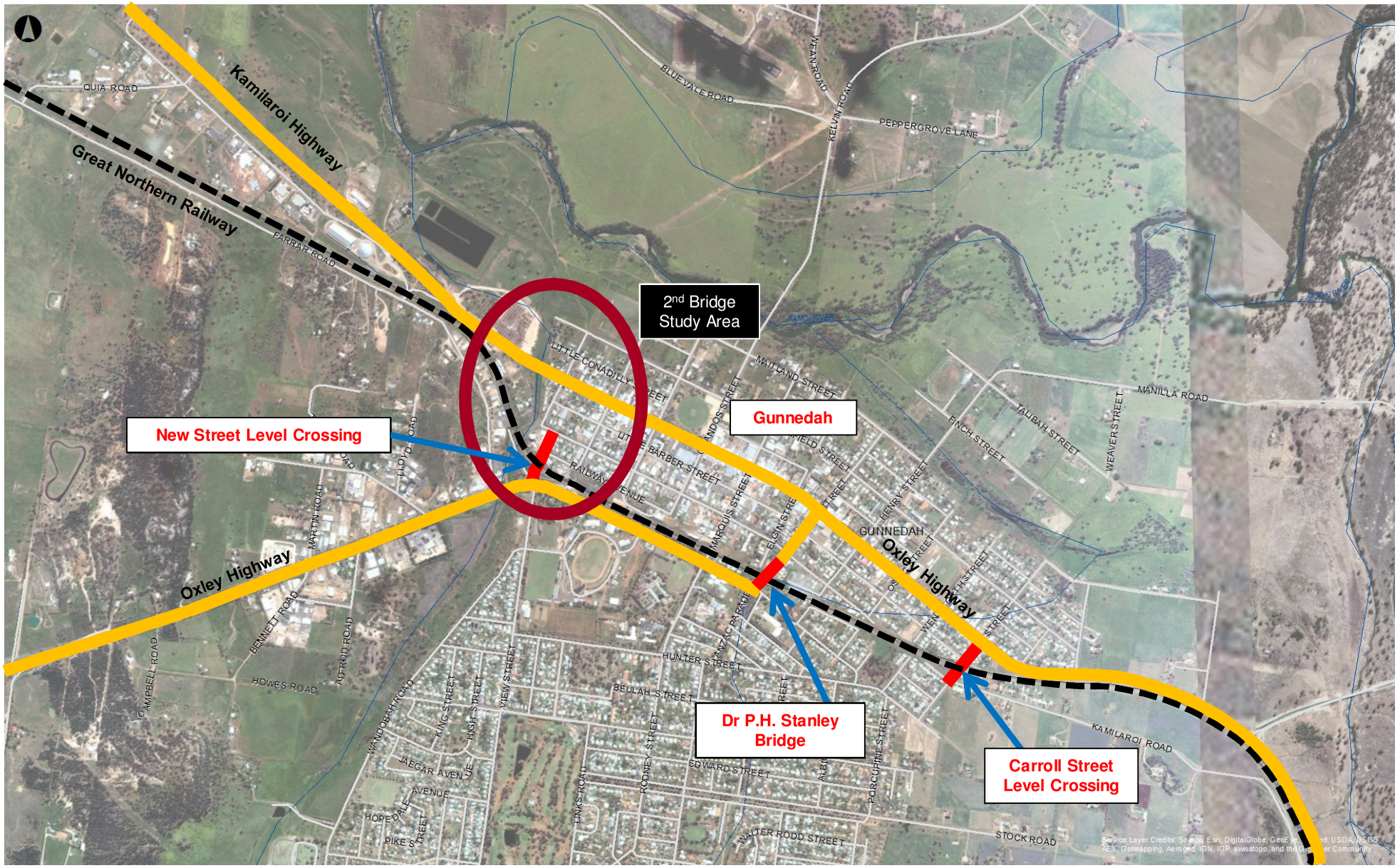


Figure A5 – Gunnedah Second Road over Rail Bridge

(Source: NSW Roads & Maritime Services)

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 6 – SINGLETON BYPASS

Project Description	Bypass of New England Highway around Singleton
Location	Singleton, NSW
Project Status	Under investigation
Relation to Freight	Freight traffic currently passes through the town of Singleton. The bypass will remove the freight traffic from the centre of town and reduce freight travel times.
Estimated Project Cost ($2013)	$160 million ($130 to $195 million)
Timing	2015 to 2020

Singleton is a key regional centre located in the Upper Hunter that is strategically located on the New England Highway, between the Hunter coal mining and agricultural regions. The New England Highway is a key strategic freight corridor that passes through the centre of Singleton and provides a critical link to the Upper Hunter coal mines and the Gunnedah basin.

Local and through-traffic movements in Singleton are currently strong and growing. Over 26,000 vehicles use the highway at the Hunter River Bridge daily—of this, some 15 per cent are heavy vehicles. Traffic volumes along the New England Highway in Singleton have been linearly increasing by around 2.5 per cent per annum since 2001.

The New England Highway currently has insufficient capacity to accommodate the growing freight and local traffic demands. The corridor is also experiencing significant congestion due to through-traffic using the New England Highway. Through traffic speeds are reduced considerably below the posted speed limits, particularly in the centre of Singleton near the Hunter River Bridge.

Traffic demands on this section of the New England Highway is forecast to increase in the future, driven by regional population growth and the expansion of the coal mining industry in the Upper Hunter and Gunnedah basin. Corresponding to this, traffic flows at the Hunter River Crossing in Singleton are forecast to grow from 26,300 vehicles daily in 2012 to 29,300 vehicles daily by 2030.

The additional 3,000 vehicles daily (by 2030) cannot be satisfactorily accommodated on the existing road system. All other factors being equal and unchanged, the projection for associated travel times of through-traffic on this section of New England Highway is expected to increase from around 16 minutes in 2012 to 23 minutes in 2030 (equivalent to a 41 per cent increase).

There are three possible strategic options for addressing these issues: divert through-traffic to an existing alternative route; add capacity to the existing route; construct a Singleton Bypass.

The first two options have been examined and found to be unfeasible due to physical constraints and impact on local traffic, so the bypass option is the sole, feasible long term solution. NSW Roads & Maritime Services has already identified four corridor options to deliver on this solution and warrant detailed analysis:

Option 1 Northern Corridor: covers all options to bypass the town on the eastern and northern side before linking back into the New England Highway to the south of Rixs Creek (north of Singleton) and Whittingham (south of Singleton).

Option 2 Central Corridor: covers all options that traverse through all or part of the existing urban area of Singleton.

Option 3 Southern Corridor: utilises the Golden Highway and then turns north before Mt Thorley (along Putty Rd) and across the Hunter River at various locations to the west of Singleton.

Option 4 Western Corridor: utilises the Golden Highway and extends further west than the Southern Corridor Option before turning north and travelling through Hambledon Hill or Gouldsville.

Flood liability and risk is a significant cost and implication for determining the preferred route, and will be a key factor in determining a route alignment. The 'western corridor' route appears to offer the most significant land use and development benefits to Singleton, while potentially providing some commercial and residential expansion opportunities that are not available with other routes.

For the purposes of this investigation, Option 2 Central Corridor has been adopted for costing purposes since it gives the most direct route for minimising freight travel. However, it is noted that all four options address freight requirements.

The strategic cost to implement Option 2 Central Corridor (6.5 km) has been estimated a rate of $20 to $30 million per kilometre. This results in an overall cost of $130 to $195 million.

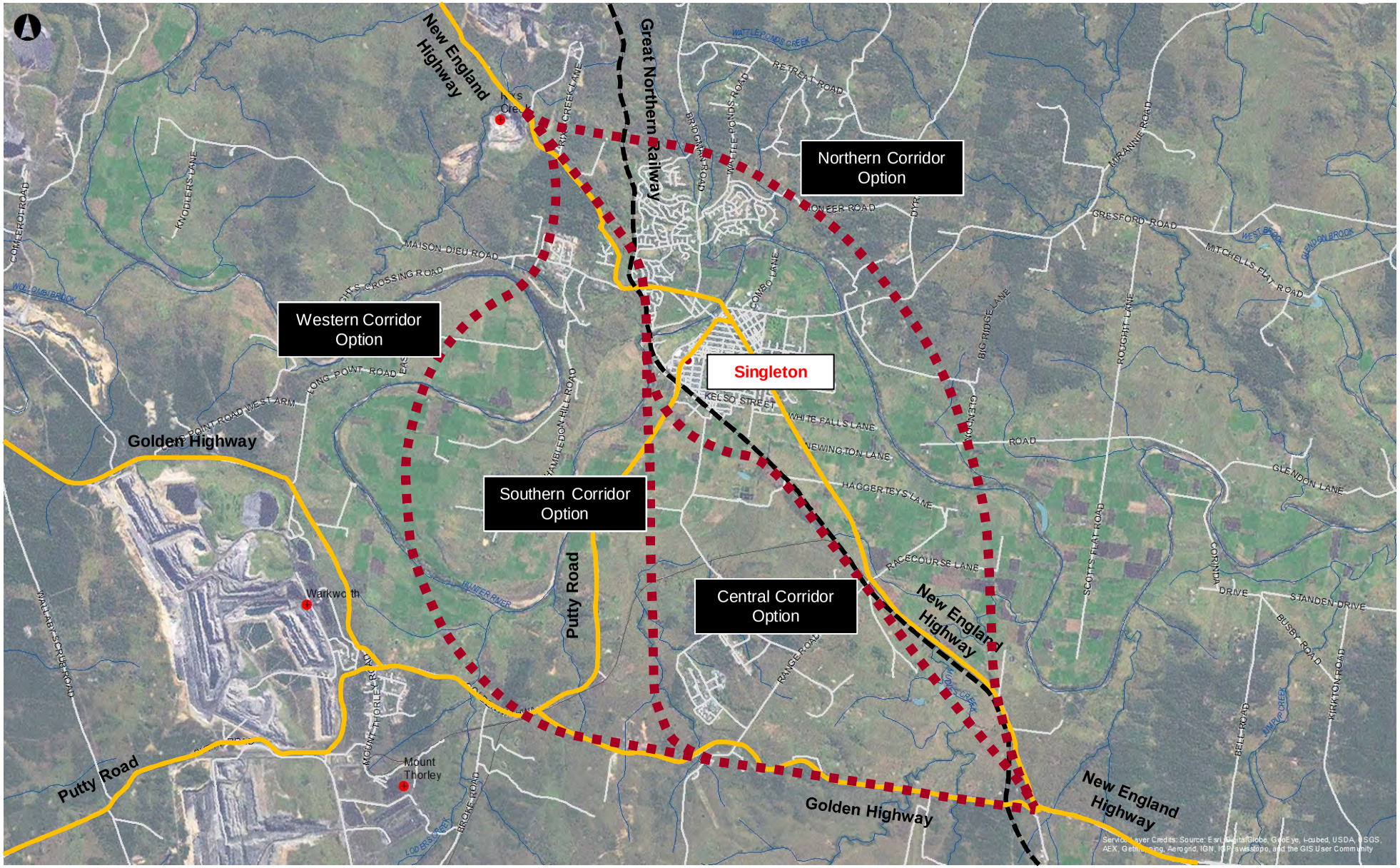


Figure A6 – Singleton Bypass Corridor Options

(Source: NSW Roads & Maritime Services)

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 7 – MUSWELLBROOK BYPASS

Project Description	Bypass of New England Highway around Muswellbrook
Location	Muswellbrook, NSW
Project Status	Under investigation
Relation to Freight	Freight traffic currently passes through the town of Muswellbrook. The bypass will remove the freight traffic from the centre of town and reduce freight travel times.
Estimated Project Cost ($2013)	$215 million ($170 to $260 million)
Timing	2015 to 2020

Muswellbrook is a crucial link to Upper Hunter coal mines due to its location on the New England Highway and the proximity to the likes of Mt Arthur Coal, Bengalla Coal and other local mines. Muswellbrook and the New England Highway provide the only direct link to Scone and Gunnedah, both being key strategic locations for future growth in the Hunter region.

Freight traffic through Muswellbrook will increase significantly over the next 20 years. This in addition to the projected population growth for the Hunter region will exacerbate current capacity issues experienced within Muswellbrook, specifically on the New England Highway.

A town bypass has been proposed to effectively accommodate existing and future traffic demands. The preferred route for this has been defined in the Muswellbrook Local Environment Plan (2009). It is approximately 8.5 kilometres in length and crosses over the Northern Railway at Muscle Creek Road. Interchanges are proposed at Coal Road and Sandy Creek Road, as well as at the two ends where it connects with the New England Highway.

Some significant benefits from constructing the Muswellbrook Bypass are:

- removing conflicts between local traffic and through-traffic in the town centre;
- reducing heavy vehicle movements through the town centre;
- reducing congestion for through-traffic using the New England Highway.

Federal Government funding of $10 million has recently been allocated to completing the planning studies so that the project becomes ‘shovel ready’. Development of the concept design and associated environmental impact assessment is expected in coming months.

The strategic cost to complete the project (8.6 km) has been estimated a rate of $20 to $30 million per kilometre (including interchanges). This results in an overall cost of $170 to $260 million.

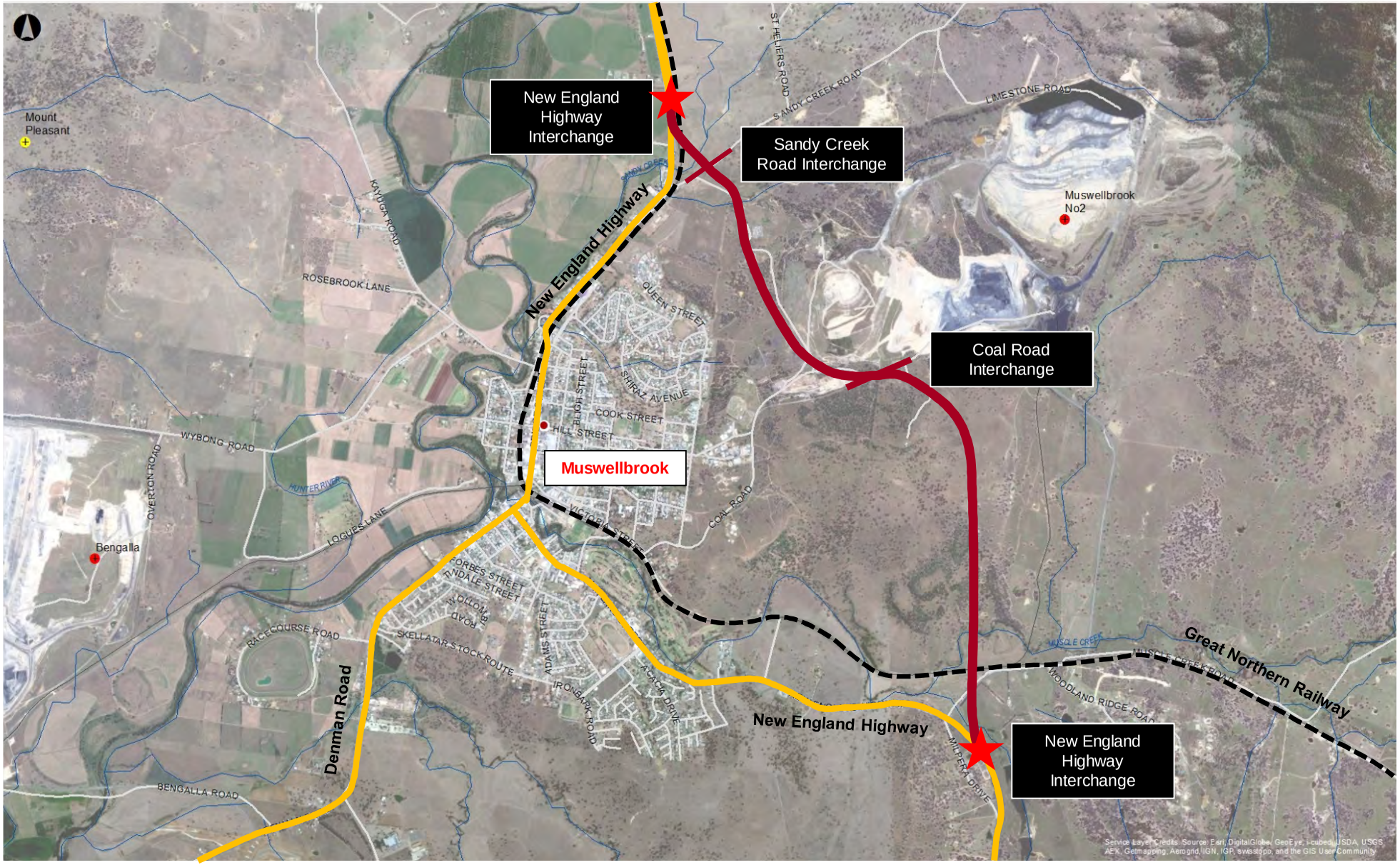


Figure A7 – Muswellbrook Bypass

(Source: NSW Roads & Maritime Services)

PROJECT 8 – NEW ENGLAND HIGHWAY – HEAVY DUTY PAVEMENT CONSTRUCTION – ABERDEEN TO WILLOW TREE (PART)

Project Description	Reconstruction of New England Highway Pavement in parts from Aberdeen to Willow Tree
Location	New England Highway – Aberdeen to Willow Tree, NSW
Project Status	Recommended
Relation to Freight	The New England Highway is the primary freight route in the corridor. Prolonged freight activity has weakened the pavement in sections.
Estimated Project Cost ($2013)	$29.1 million ($28 to $30 million)
Timing	2015 to 2020

The New England Highway between Aberdeen and Willow Tree contains sections that are showing advanced ageing, fatigue and understrength pavements. This part of the highway has particular state importance as it facilitates interstate freight movements, while providing access to the agricultural, coal mining and tourism industries based in the Upper Hunter and Gunnedah regions.

The existing pavements are typically thin; consisting of unbound natural gravels. Around 40 per cent of the pavements are 30 years or older, which is well past their theoretical design life. These structural deficiencies together with increasing heavy vehicle use of the New England Highway have significantly hastened pavement deterioration further.

Future increases in freight traffic will place even higher loads on existing pavements, resulting in yet more damage. This has flow-on detriment for travel reliability on this route associated with increased frequency of damage to the road surface, reduced speed zones, and the potential for accidents. This will additionally create a need for more regular maintenance, which imposes further delays on freight and other traffic. Providing pavement upgrades before this level of risk takes hold is the most cost effective solution for addressing the needs of long term freight movements.

The distance from Aberdeen and Willow Tree is around 70 kilometres. Around 10 kilometres of the highway requires pavement reconstruction at this stage. The cost of these works is estimated to be $29.1 million ($28 to $30 million).

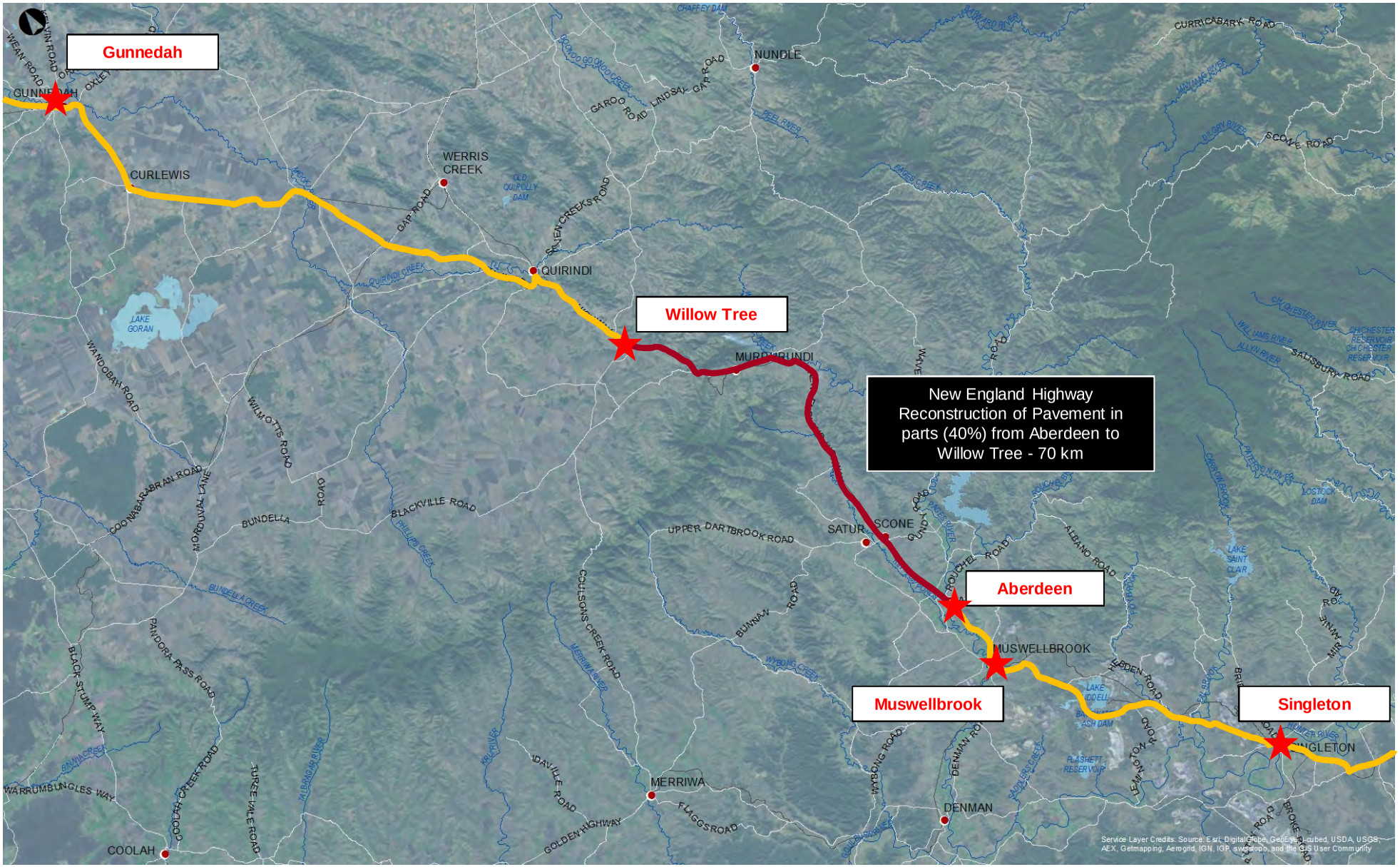


Figure A8 – New England Highway – Aberdeen to Willow Tree

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 9 – MAITLAND ROUNDABOUT UPGRADES

Project Description	Upgrade of two roundabouts at Maitland, NSW
Location	Maitland, NSW
Project Status	Under investigation
Relation to Freight	A proportion of freight traffic will continue to pass through the town of Maitland following completion of the Hunter Expressway. The roundabouts will reduce delays to freight traffic.
Estimated Project Cost ($2013)	Hospital roundabout = $4.1 million (4 to 5 million) Railway roundabout = $36 million (35 to 38 million)
Timing	2015 to 2020

The NSW Roads and Maritime Services has allocated $45 million in funding for upgrades and safety improvements at two roundabouts in Maitland situated along the New England Highway. The roundabouts are located at Church Street (near Maitland Railway station) and High Street (near Maitland Hospital).

The soon to be completed Hunter Expressway will provide some relief for traffic in Maitland although freight-related traffic inbound to coal mines will continue to pass through Maitland. These flows are primarily associated with storage and manufacturing facilities in the northern areas of Newcastle. Upgrading these roundabouts will provide substantial benefit to this remaining inbound freight activity and for the existing regional traffic that continues to use Maitland for 'journey to work' and other purposes.

The preferred layout for the upgraded hospital roundabout will centre on improving the existing roundabout and installing new traffic lights at the Johnson Street/New England Highway intersection. The cost of these works is estimated to be $4.1 million ($2013).

The preferred layout for the upgraded Railway Station roundabout involves the grade separation of the New England Highway (for eastbound traffic) over the roundabout. The cost of these works has been estimated by NSW Roads and Maritime Services to be $35 million ($2012). An additional 2.4 per cent is assumed between 2012 and 2013 based on the BITRE Road Construction and Maintenance Price Index between 2010–11 and 2011–12.

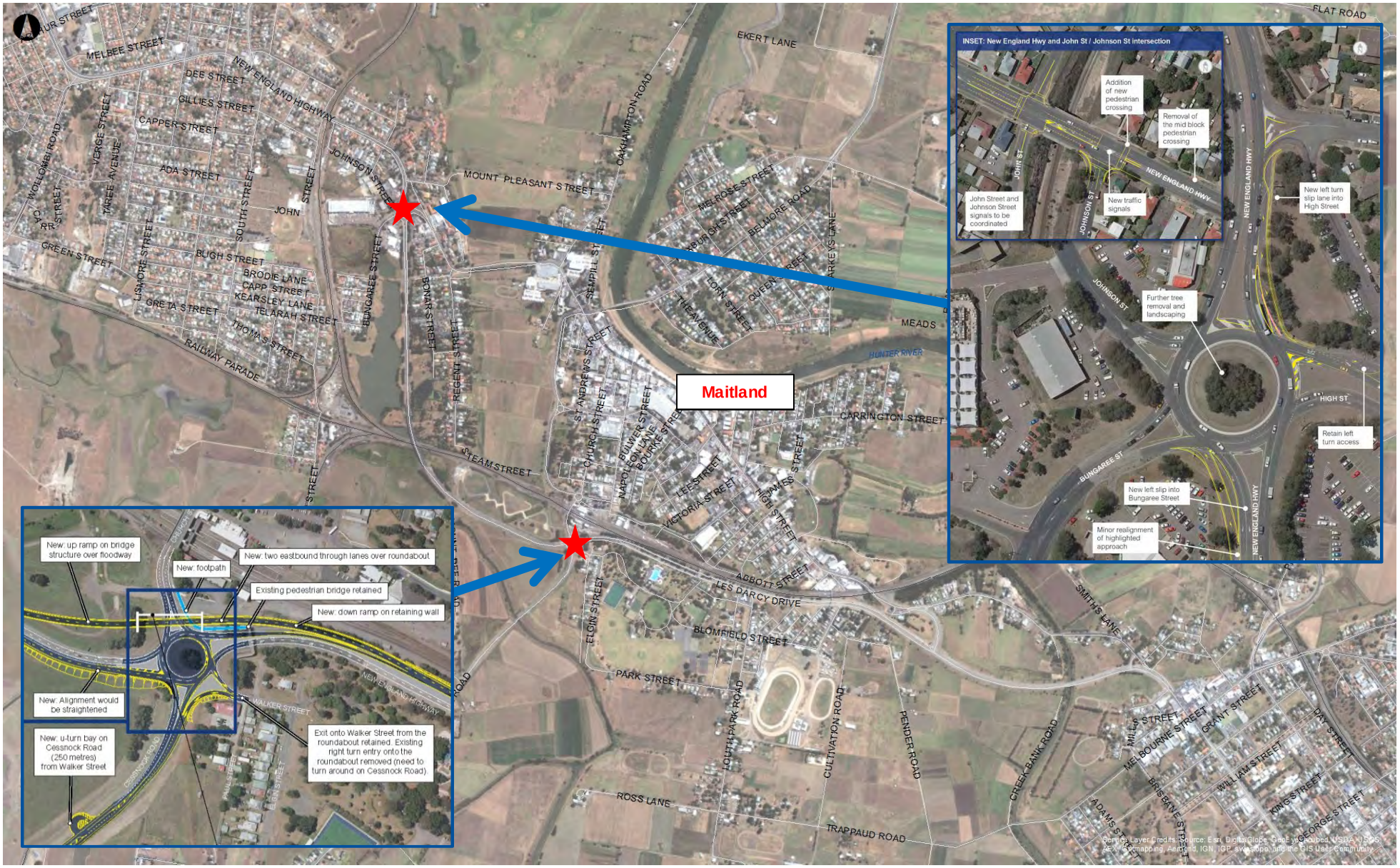


Figure A9 – Maitland Roundabout Upgrades

(Source: NSW Roads & Maritime Services)

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 10 – GOLDEN HIGHWAY TO DENMAN – CORRIDOR UPGRADES

Project Description	Investigation and potential upgrade of sections of the Golden Highway between Singleton and Denman, NSW
Location	Singleton to Denman, NSW
Project Status	Recommended
Relation to Freight	Inbound freight traffic on the Golden Highway will increase to levels compatible to existing inbound freight on the New England Highway north of Singleton. Upgrades are required to accommodate this increased freight.
Estimated Project Cost ($2013)	$22 million ($20 to $24 million)
Timing	2015 to 2020

The distance between the New England Highway and Denman is approximately 68 kilometres. This section of the Golden Highway has numerous mine access points.

Examples of locations needing priority improvement include the installation of acceleration and/or deceleration lanes at intersections and overtaking lanes. These will increase the efficiency of traffic flow on the route to Denman while addressing current deficiencies.

Future freight traffic movements associated with the planned expansion of the Ulan mining basin will exacerbate existing access and traffic flow issues along this corridor. This investigation recommends that further study of road and intersection conditions be undertaken.

This study recommends an allowance for 30 per cent of the 68 kilometre length to upgraded (i.e. 20 kilometres). At an average cost of $0.5 to $0.6 million per lane kilometre (and one lane each way), the total cost for the recommended works is between $20 to $24 million

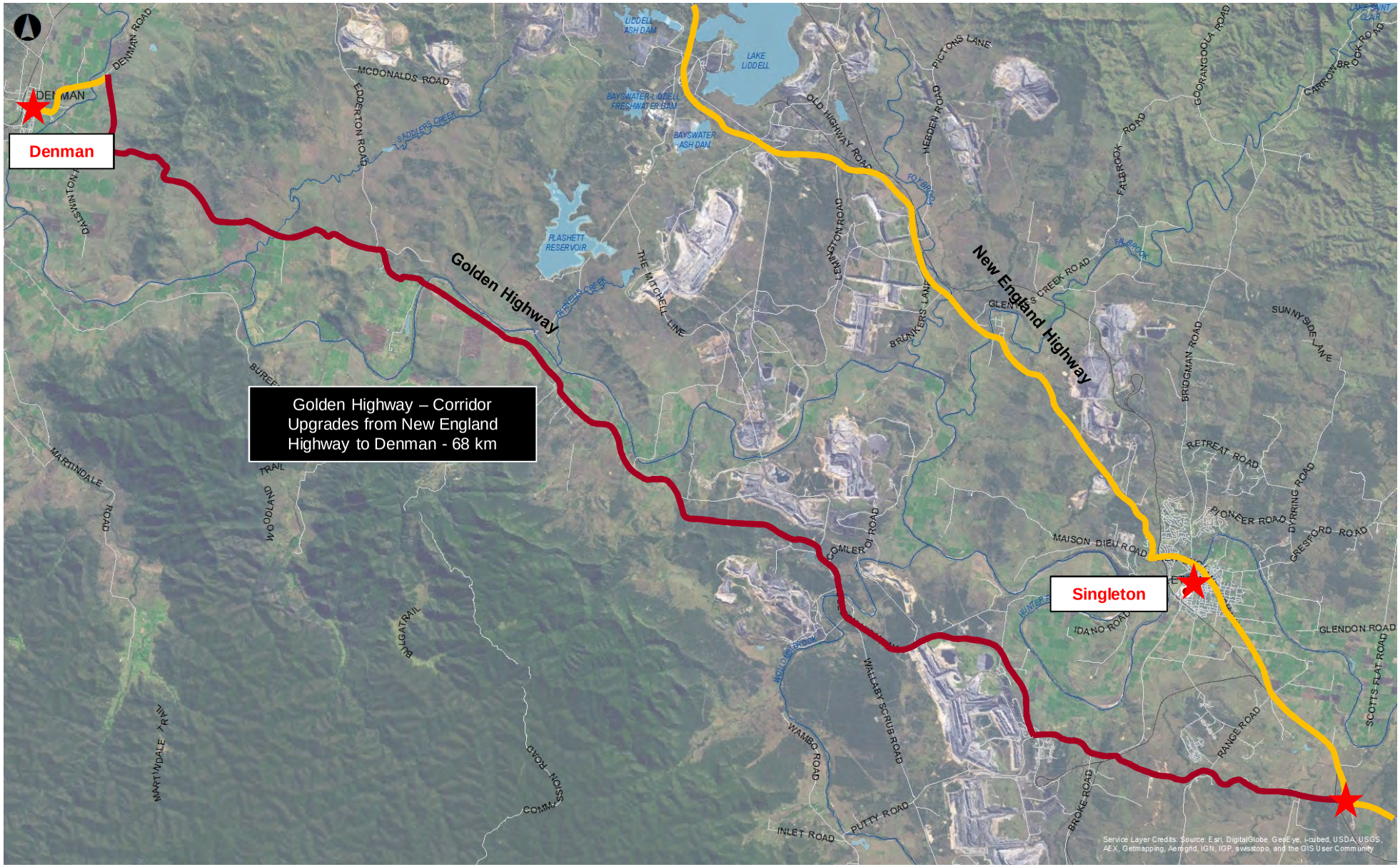


Figure A10 – Golden Highway – New England Highway to Denman Corridor Upgrades

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 11 – GOLDEN HIGHWAY UPGRADE – THROUGH DENMAN

Project Description	Upgrade of Golden Highway through Denman / Denman Bypass
Location	Denman, NSW
Project Status	Recommended
Relation to Freight	Inbound freight traffic on the Golden Highway will increase to levels compatible to existing inbound freight on the New England Highway north of Singleton. Upgrades are required to reduce impacts on the town of Denman.
Estimated Project Cost ($2013)	Option 1 – Road Upgrade = $1.5 million ($1 to $2 million) Option 2 – Denman Bypass = $3 million ($2.5 to $3.5 million)
Timing	2020 to 2025

The Golden Highway passes through the town of Denman via the intersection of Crinoline Street with Palace Street. It runs adjacent to local properties situated on the eastern side of the town before continuing to Sandy Hollow, Merriwa and beyond.

With freight and mining-related traffic volumes along the Golden Highway forecast to increase (due to expansion of the Ulan region), conflicts associated with traffic flow, safety and social issues through Denman are expected.

Two options for improving conditions on the Golden Highway at Denman have been identified.

Option 1 Road Upgrade: this involves around 1 kilometre of the existing Golden Highway that will deliver improved safety at property access points. It encompasses upgrading the intersection of the Golden Highway with Crinoline and Palace Streets. This option is estimated to cost around $1.5 million.

Option 2 Denman Bypass: this option involves constructing a bypass that will cross Sandy Creek north of Kenilworth Road. The bypass would be around 1.5 kilometres in length and would function to redirect freight and mining traffic away from the township, leaving use of the existing route to local residents and businesses based within the town itself. The bypass is estimated to cost around $3 million at $2 million per kilometre ($2.5 to $3.5 million per kilometre)

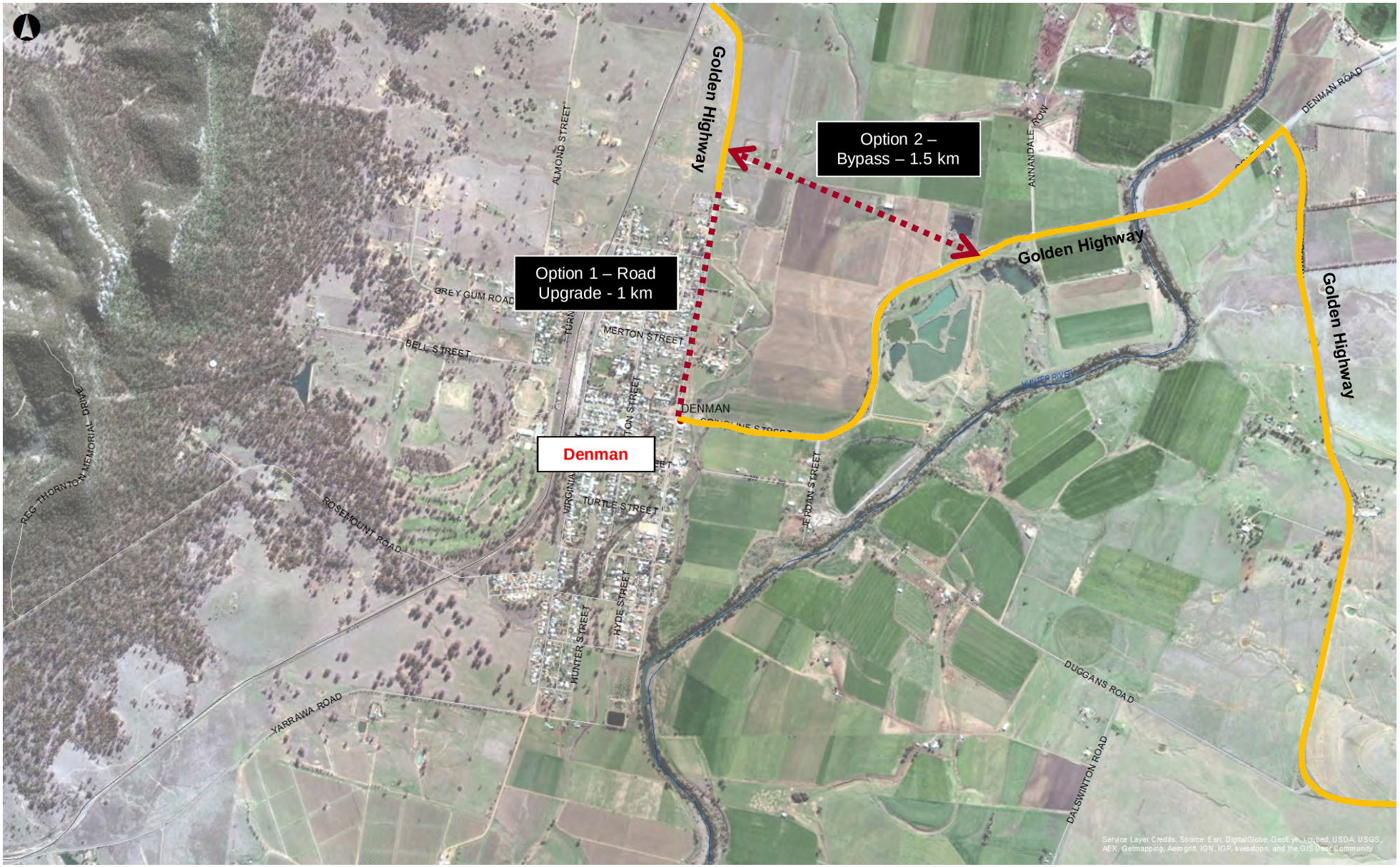


Figure A11 – Golden Highway Upgrade Through Denman

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 12 – GOLDEN HIGHWAY CONNECTION – DENMAN TO ULAN CORRIDOR IMPROVEMENTS

Project Description	Road upgrades between Denman and Ulan
Location	Golden Highway – Denman to Ulan (including Ulan Road)
Project Status	Recommended
Relation to Freight	Inbound freight traffic on the Golden Highway will increase to levels compatible to existing inbound freight on the New England Highway north of Singleton. Upgrades are required to accommodate this increased freight.
Estimated Project Cost ($2013)	$60 million ($54 to $65 million)
Timing	2020 to 2025

The Golden Highway and Ulan Road provide a crucial link to the mines in the mid-western/Ulan region. A significant increase in freight and associated traffic will be using this corridor as a result of the planned expansion of mines within the basin.

The Golden Highway was not originally designed to be a significant freight corridor and there are numerous locations where the route is inadequate for the forecast traffic volumes. Further route investigation is recommended in order to determine the required program of works needed so the corridor can accommodate the increased traffic flow forecast for the Golden Highway.

The upgrades likely to be required include:

- Improved lane widths to accommodate Higher Mass Limit traffic;
- Provision of auxiliary lanes to accommodate right-turning vehicles at major intersections to help maintain highway efficiency;
- Provision of alternating overtaking lanes on grades that allows slow vehicles to be passed and reduce disruption to traffic flow as a result;
- Pavement reconstruction.

The distance between Denman and Ulan is around 136 kilometres. This investigation recommends allowing for 80 per cent of this corridor to be upgraded (109 kilometres). At an average cost of $0.5 to $0.6 million per lane kilometre (with one lane each way), the total cost for the works would be between $54 to $65 million.

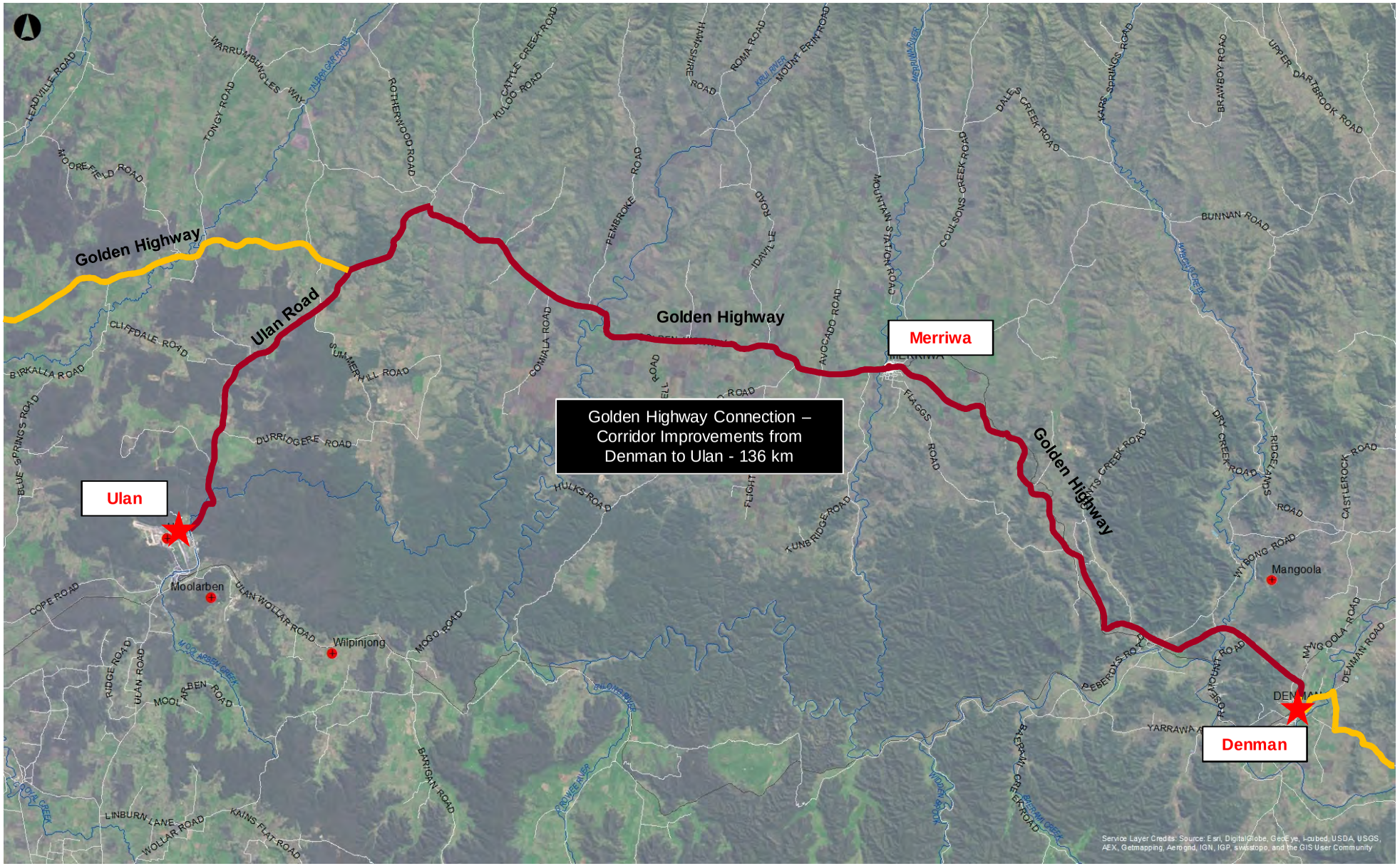


Figure A12 – Golden Highway Connection – Denman to Ulan Corridor Improvements

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

PROJECT 13 – QUIRINDI BYPASS

Project Description	Bypass of Kamilaroi Highway around Quirindi
Location	South Street, Quirindi
Project Status	Recommended
Relation to Freight	Inbound freight traffic on the Kamilaroi Highway will increase significantly with increase mining activity. A bypass is required to reduce impacts on the town of Quirindi.
Estimated Project Cost ($2013)	$13 million ($12 to $15 million)
Timing	2020 to 2025

Quirindi is a township located on the Kamilaroi Highway en route to Ulan. The Kamilaroi Highway currently passes through Quirindi via a T-intersection at Loder Street, adjacent to residential properties. Limiting the volume of freight traffic passing through this intersection is desirable to minimise long term impacts on the local community.

This investigation recommends an alternative route for traffic be determined that complements the expansion of the Gunnedah basin. A bypass in the vicinity of South Street presents an opportunity to remove through-traffic from the town with minimal disruption to local activities.

Upgrading South Street (approximately 1.0 to 1.5 kilometres) would encompass two new intersections with the Kamilaroi Highway (slip lane left turns in and out) and upgrade of South Street to create a two-lane highway standard at 7.5 metre seal (3.5 metre lane widths) and 2 metre shoulders. Property access onto South Street may need to be redirected.

An estimate cost of $13 million ($12 to $15 million) is appropriate to cover the extent of these upgrade works.

Figure A13 – Quirindi Bypass

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

APPENDIX B – FORECAST LADEN TRUCK MOVEMENTS PER DAY

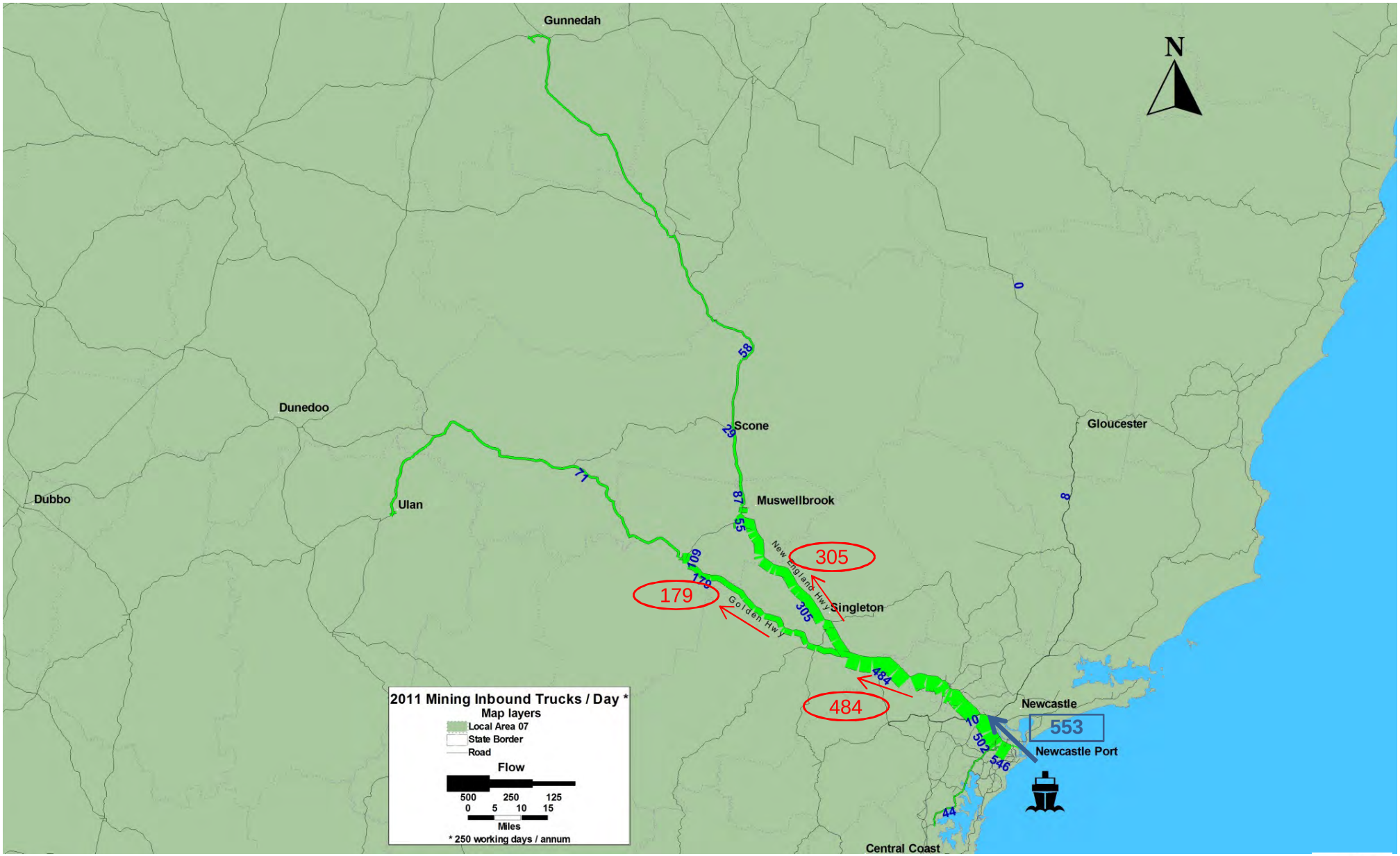


Figure B1 – Forecast Inbound Laden Truck Movements per day for 2011

(Source: TfNSW Bureau of Freight Statistics SFM*)*

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

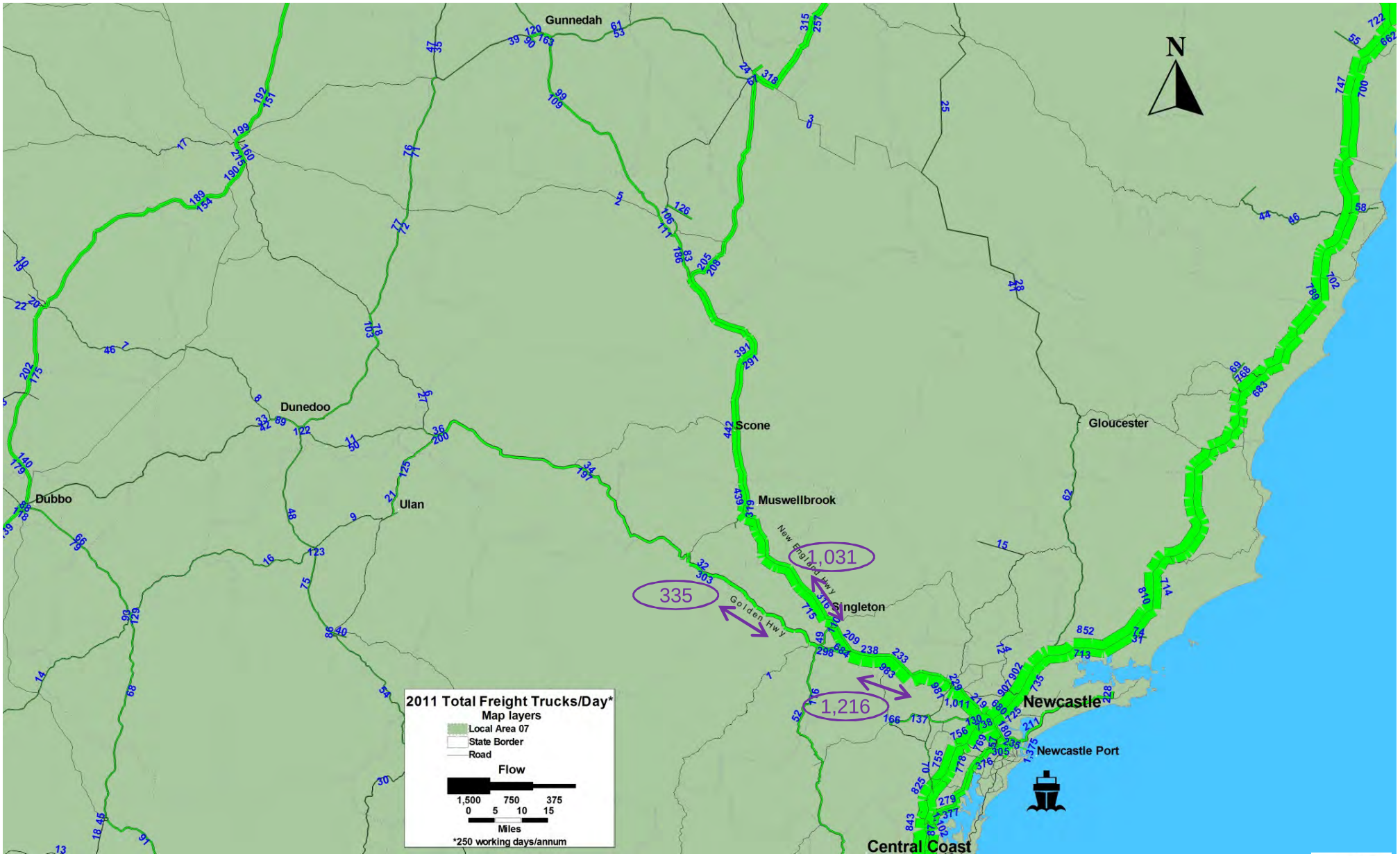


Figure B2 – Forecast Total Laden Truck Movements per day for 2011

(Source: TfNSW Bureau of Freight Statistics SFM*)*

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

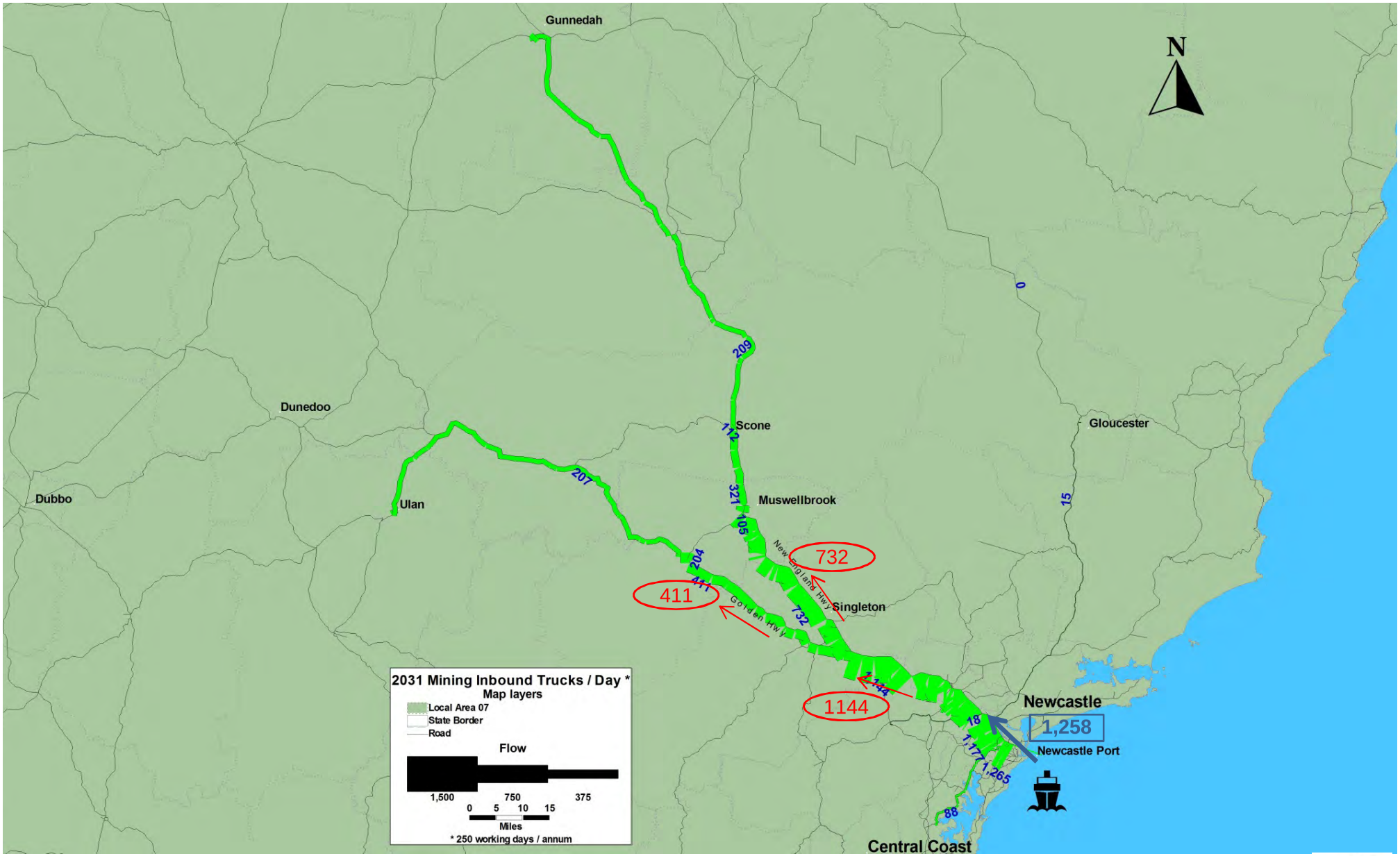


Figure B3 – Forecast Inbound Laden Truck Movements per day for 2031

(Source: TfNSW Bureau of Freight Statistics SFM*)*

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060

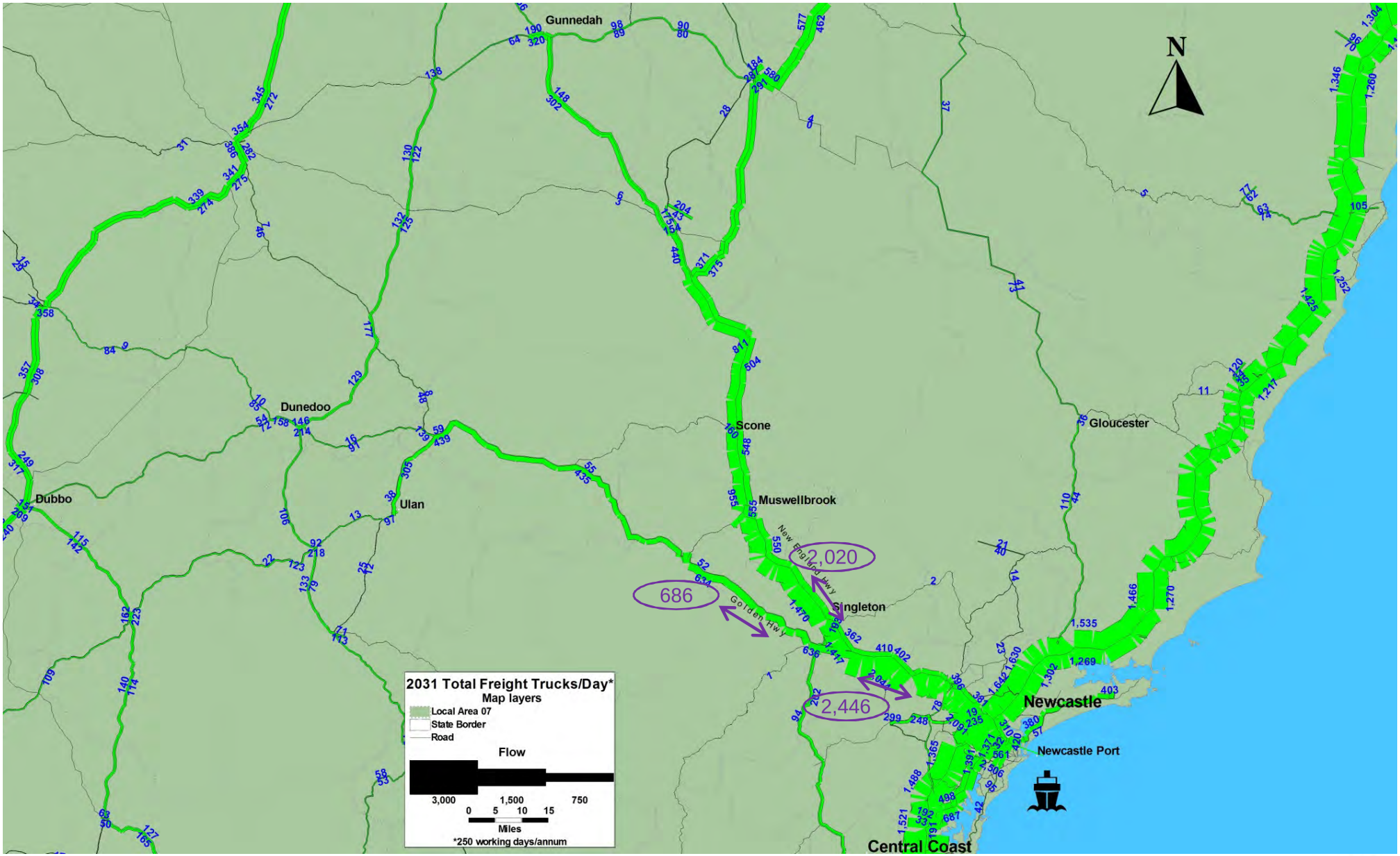


Figure B4 – Forecast Total Laden Truck Movements per day for 2031

(Source: TfNSW Bureau of Freight Statistics SFM*)*

HYDER CONSULTING PTY LTD
ABN 76 485 289
Level 5, 141 Walker St
North Sydney NSW 2060