Broader Western Sydney Employment Area - Structure Plan

Transport Planning - Preliminary Analysis Report

Exhibition Draft

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NSW GOVERNMENT Planning & Infrastructure

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Overview

GHD was commissioned by the Department of Planning and Infrastructure (DP&I) to provide strategic transport planning services to develop an integrated movement network, and to assist in the spatial distribution of road, public transport and freight network as part of the Broader Western Sydney Employment Area (BWSEA) Structure Plan.

The structure plan will provide long term spatial framework to coordinate future planning and development of BWSEA. This will ensure a coordinated and efficient approach to land use planning, environmental management and transport infrastructure investment that responds to the vision for BWSEA and emerging priorities within the Sydney Metropolitan Area.

This report details the outcomes of the Transport Planning Preliminary Analysis of the BWSEA Structure Plan, which will form the basis of the transport planning process to be undertaken during subsequent stages of the planning process. Further investigation will be required to determine the optimum location of corridor options and alignments to address future land use demands for the BWSEA.

The purpose of this report is to:

- Provide transport planning input to the structure planning process.
- Document the basis of transport planning input to form part of the reporting of the structure planning process.
- Assist the development of vision, objectives and criteria to guide the evaluation of the preferred structure plan.
- Assist the development of sustainable, transit oriented structure planning principles and outcomes.
- Establish a road network that has been planned and dimensioned integrally with the land use planning.
- Define the public transport network and locations of key public transport transfer nodes.
- Define opportunities for the future development of the freight network and the establishment of intermodal terminals.

This Executive Summary provides a brief outline of the key elements and findings of the study.

Stakeholder consultation

A number of stakeholder consultation workshops and meetings were undertaken to understand current planning and other information relating to the various structure plan options proposed. Representatives from the following organisations were present:

- Australian Rail and Track Corporation (ARTC)
- Blacktown City Council
- Fairfield City Council
- Infrastructure Australia (IA)
- Liverpool City Council
- Penrith Business Alliance
- Penrith City Council
- Regional Development Australia (RDA)
- Roads and Maritime Services (RMS)
- Sydney Ports Corporation (SPC)
- Transport for NSW (TfNSW)
- Urban Development Institute of Australia (UDIA)
- Urban Taskforce
- Western Sydney Regional Organisation of Councils (WSROC)
- Western Sydney Community Forum

Issues raised in the stakeholder workshop and meetings indicated a significant convergence. Key outcomes included:

- A desire to see integration of the different elements of the public transport network, with different modes fulfilling different roles.
- A desire to optimise the integration of land use and transportation.
- A desire to see intermodal terminal(s) within BWSEA particularly at Eastern Creek.
- A need to segregate future freight and passenger lines (no shared access), based on the constraints of the metropolitan freight network.
- General agreement that land for future transit corridors needs to be set aside quickly to minimise the cost of future acquisitions.

- General agreement that planning of transportation and land use need to be undertaken to provide surety for the different stakeholders.
- Further investigation required to finalise key transport corridors and alignments through BWSEA.
- Co-location of transport corridors through BWSEA minimising land take.
- A need for detailed traffic modelling required to assess land and transport system, particularly impacts on the higher order road network (M4 and M7 motorway).

Broader Western Sydney Employment Area – Site Positioning and Role

BWSEA is bounded by the M4 to the north, M7 to the east, South West Growth Centre (SWGC) to the south and essentially the Northern Road to the west. The geographical advantages of BWSEA's location are underscored by the sites straddling of two major road network corridors for Sydney. This positions BWSEA within convenient journey times to Sydney's principle centres and Port Botany. The site is located some 45 kilometres east of Port Botany and Sydney Airport.

The scale of BWSEA provides an important competitive advantage and significant implications for the form and timing of its future urban development. The scale suggests that BWSEA will plan a pivotal role as an emerging employment, trade, industrial, freight and logistics complex extending across the Sydney metropolitan area.

BWSEA will be a critical player within this emerging economic sub-region due to its critical mass of employment opportunities. One key role for BWSEA will be the development of a freight and logistics hub complementing existing trade and industry networks and supporting investment by enabling infrastructure such as freight transit opportunities particularly by rail. The potential mix of these employment opportunities will be a crucial element in the formation of the site and reservation of regionally significant corridors.

BWSEA comprises a large site covering approximately 10,700 hectares of land and expected to eventually accommodate an employment workforce of up to 200,000 people with build-out capacity somewhere between the next 50-100 years. The likely workforce to be accommodated over the next 35 years will be in the order of 55,000 people based accommodated within approximately 2,300 hectares of service land. This assumes an average employment density of 24 jobs per hectare within this stage.

Integration with land use planning

The assessment of land use and future planning was undertaken within a context of little certainty in relation to future planning of the study area, particularly the location and alignments of future transport corridors. There is general agreement that potential transport alignments including the location of the Outer Sydney Orbital and western Sydney freight corridor are likely to change. In addition to this, it is acknowledged that planning and location of the Outer Sydney Orbital has yet to be undertaken or committed to by government agencies.

In order to inform regional and local planning, the public transport network needs to do more than solely adapt. Public transport planning and provision needs to be undertaken in consultation and conjunction with planning policies and development controls. The benefits of an integrated land use and transport planning process with respect to BWSEA include:

- Co-location of key centres, and other trip attractors along bus routes and at central points where several services converge, making it easier to access.
- Faster and more efficient bus and transit.
- Earlier introduction of public transport services, rather than relying on passenger demand to grow in the absence of an attractive service.

New transport services must also be planned in the context of an integrated transport network. This network would range from local 'feeder' bus services to public transport nodes, to direct, high quality and efficient bus corridors and heavy rail in the longer term. A successfully integrated public transport network, incorporating bus and existing and future rail travel (such as Leppington Station), would have minimal delays and costs associated with transferring from one mode or service to another.

Mode choice

A range of different modes was identified and their suitability to serve the transport needs of the study area was assessed based on the land use and employment densities proposed for the structure plan. The modes included:

- Heavy rail
- Metro rail
- Light rail
- Transit corridors (e.g transitways)
- Local bus services

It was found that heavy rail would constitute a favourable transit mode for the longer term (beyond 50 years) as and when employment densities increase over 50 jobs per hectare. Metro rail is best suited to dense urban areas with a high level of passenger loading / unloading at each station. High capacity transit corridors such as transitways could also realistically provide a transit trunk service to support the proposed employment densities in the short to medium term. Local bus services would have a role in the transit network, and would act in a support role to a trunk transit link rather than providing the trunk service itself.

Corridor options and assessment

A range of potential road transit and freight alignments were developed in response to land use and infrastructure staging as defined in the early stages of the structure planning process.

Integrated urban and regional planning requires the consideration of land use and transport together during every stage of the planning process. For this reason as well as the lack of certainty surrounding land release it was unrealistic to definitively assess the different transit modes and alignment options. Additionally, the geographic spread of release and employment densities suggests that no single mode in one corridor would serve the public transport needs of the area.

It was agreed that mode and alignment assessment at this stage of the planning process (within a context of such uncertainty) should focus on identifying a “package” of potential transit options that can respond to a range of future development scenarios. This “package” would comprise different transit responses that can evolve over time and which can precede, supersede or complement other transit options as development progresses.

Reservation of key corridors

It is imperative that the key corridors within BWSEA (such as Outer Sydney Orbital and future passenger/ freight lines) be reserved as soon as possible to provide flexibility in changes to land use and densities over the multi-decade development timeframe. Incorporation of indicative transit alignments in the next stages of the planning process will minimise land acquisition problems in the future. Further, maximum benefits of the new services can be attained through supportive urban form. Potential exists to pursue joint venture activities in order to assure coordinated and timely provision of infrastructure.

Recommended road network structure

Private vehicles are still the dominant transport mode in the region. The structure plan is based on an interconnected, legible, urban-scale grid street pattern that will provide a pedestrian-friendly environment and provide optimal opportunities for bus servicing and access.

The road network has been planned and dimensioned integrally with the land use planning. This has ensured that each road (sub-arterial and arterial roads) and its position in the road hierarchy is appropriate to its role and the traffic demands placed upon it. Future traffic modelling will confirm whether roads will operate satisfactorily under peak hour flows, for key roads such as M4 and M7 motorway.

The broad road network structure elements fulfil the requirements of BWSEA as follows:

1. Provide links to the M4 via Archbold Road (east facing ramps) and complete Southern Link Road (short term).
2. Establish and improve north-south connectivity between the current WSEA (north east portion) and SWGC which will form a key anchor through road improvements to Aldington Road, Bakers Lane, Mamre Road, Western Road, and Devonshire Road (medium term)
3. Establish and improve east-west connectivity through improvements to Luddenham Road, Adams Road, and Elizabeth Street-Fifteenth Avenue toward Old Northern Road (medium term).
4. Establish a regional bike network to develop as the road network evolves (medium term).
5. Reserve the Outer Sydney Orbital corridor to connect with existing and newly developed east-west links through BWSEA and connection to the Werrington Arterial Road to the north (long term) Bringelly Road to the south.

Recommended transit network structure

From the analysis of various options it was apparent that no one transport and land use solution could address the requirements of the study area. Consideration of development time frames and yields, staging of infrastructure improvements and potential for improvement of services meant that combinations or 'packages' of the options presented would be most appropriate.

The benefits of the individual rail and transit options are greatly enhanced through a coordinated implementation. Urban form will support the proposed transit improvements, both within BWSEA and across the wider regional area.

The broad transit network structure elements fulfil the requirements of BWSEA as follows:

1. Supportive local bus services (and required bus priority measures) as release areas are developed (short term).
2. Reserve transit corridors linking the Liverpool to Parramatta Transitway via the Horsley Drive and Fifteenth Avenue (short term).
3. Reserve transit corridors linking St Marys Station (via Mamre Road) and Mount Druitt Station via Erskine Park Drive and Roper Road (short term).
4. Reserve the transit location of a interchange (bus to bus) on Aldington Road at the intersection with Bakers Lane to complement the location of specialised centre (short term).
5. Establish a bus service along the Northern Road, Littlefields Road extension and Western Road to provide direct road based public transport to Penrith (medium term).
6. Reserve transit corridors to connect SWGC and Leppington Station as a key anchor to the south via Aldington Road, Eastern Road, Fifteenth Avenue (medium term).
7. Reserve transit corridors connecting western portion of the site near Commonwealth Land (long term).
8. Reserve the location of transit interchanges at specialised centre proposed in the Commonwealth Land (long term).
9. Reserve north-south rail corridor (linking SWRL, Western Rail Line and NWRL via Richmond Line) when threshold employment densities increase above 50 jobs per hectare near the western portion of the site (long term).

Recommended freight network structure

Forecasting conducted indicates the number of containers passing through Port Botany would at least double and treble depending on the strength of future demand. It is estimated that by 2030, container traffic would reach 7 million containers and the cap of Port Botany. Its associated infrastructure will impact on Sydney's ability to achieve a 28% freight mode share target. Over 30% of this demand could be destined for the BWSEA catchment and as a result of increasing pressure on roads, intermodal terminals (IMT) form part of the freight solution that will help to better manage road freight and shift goods from road to rail.

The broad freight network structure elements fulfil the requirements of BWSEA as follows:

1. Reserve location of a new intermodal terminal located at Eastern Creek (medium term).
2. Reserve freight rail corridor alignment (segregated) for the Western Sydney freight line through the north east corner of the existing WSEA to link proposed intermodal terminal.
3. Reserve location of a second intermodal terminal if required along the Outer Sydney Orbital near Elizabeth Drive eastern end (long term).
4. Reserve freight rail corridor (segregated) along the Outer Sydney Orbital corridor to provide potential north-south links and connections to the proposed second intermodal terminal.

The freight corridors indicated above should include reservation of land capable of accommodating intermodal terminal facilities, with potential throughout of up to one million TEU. The structure plan depicts two indicative locations for intermodal terminals, that provide integrated land use and transport solutions for handling freight at local, state and national levels.

Transport infrastructure funding

Delivering the structure plan and transport infrastructure will be challenging. The transport infrastructure costs associated with the structure plan required to meet the ultimate 200,000 jobs are quite large to commensurate the scale of transport capacity they provide. The programme will need to be funded through a balanced mix of sources. There are four main sources of funds available for the transport infrastructure required for the BWSEA:

- The Federal Government through the Nation Building Programme which incorporates a number of special funding programmes such as National Projects and Roads to Recovery. Some funds are provided for Local Government through the Financial Assistance Grants scheme.
- The State Government through its annual budget allocations to State Agencies and special programmes resulting from transport strategies such as the NSW Long Term Transport Master Plan (LTTMP) and the State Infrastructure Strategy (SIS).
- Local Government normally funds sub-arterial and local roads, cycle paths and footpaths using funds provided by Federal and State governments, developer contributions and local rates.
- The Private Sector through developer contributions levied through Section 94 or specific State Infrastructure Contributions (SICs).

1.0 Introduction

This report details the outcomes of preliminary transport analysis of the BWSEA Structure Plan. The analysis has formed the basis of the transport planning process for the structure plan development.

1.1 Background

GHD was commissioned by Department of Planning and Infrastructure (DP&I) to provide strategic transport planning services to develop an integrated movement network, and to assist in the spatial distribution of road and public transport network as part of the Broader Western Sydney Employment Area (BWSEA).

This report details the outcomes of Preliminary Transport Analysis of the broader BWSEA Structure Plan. The analysis has formed the basis of the transport planning process for the structure plan development.

1.2 Purpose of this report

The purpose of this report is to:

- Provide transport planning input to the structure planning process.
- Document the basis of transport planning input to form part of the reporting of the structure planning process.
- Document the key opportunity and constraints to guide the transport planning process.
- Guide the evaluation of the preferred structure plan from the perspective of transport and access.
- Examine a range of issues and options to determine the preferred integrated transport network for the BWSEA Structure Plan.
- Examine transport infrastructure staging to achieve optimal integration of transport and to ensure coherent development of BWSEA.

1.3 Structure plan process

The long term potential of BWSEA is subject to several key determinants:

- The site's position is highly accessible with direct access to Sydney's principal transport corridors, the M4 and M7 Motorways, making it suitable for a flexible range of land uses.
- The site's location within an emerging complex of logistics, freight, industry and commercial facilities of national and regional significance.
- The site's potential for complementary land uses and movement infrastructure with the potential freight corridor between Western Sydney and Port Botany.

An overview of the proposed structure planning process used as part of the study is shown in Figure 1. When the structure plan is completed, it will provide a long term spatial framework to coordinate future planning and development of BWSEA. This will provide a coordinated and efficient approach to land use planning, environmental management and infrastructure investment, that responds to the vision for BWSEA and emerging priorities within the Sydney Metropolitan Plan.

The preferred structure plan described in this report is preliminary in nature. The transport options are intended to illustrate the spatial implications of aspirations and objectives described in this report. In doing so, the broad assessment focuses on structural considerations of land use proposed thus far, primary road and transport networks and the possible reservation of key corridors such as the Outer Sydney Orbital key passenger and freight lines.

The transport options and corridor alignments are intended to be further reviewed as part of the detailed traffic modelling process during the plans next stages. This analysis will inform the decision making process prior to the identification and detailed resolution of the integrated transport network.

1.4 Scope and limitations

As is normal in such studies, the scope of this work entails a number of limitations.

The main limitations include:

- Limits in the certainty of key inputs to the transport network structure and public transport, road and freight planning processes (e.g. location and alignment of key corridors, such as the Outer Sydney Orbital, Western Sydney Freight Line).
- The absence of detailed traffic modelling to inform both the structure plan and impacts on infrastructure requirements of the road network. (Note: traffic modelling work to be undertaken in the next stage).
- Alignment of key corridors and intermodal terminals are indicative in nature and will need to be further investigated to determine optimum alignment options and locations.
- Road network structure focuses on the higher order road network only - motorways, arterials and sub arterials.
- The structure plan and integrated transport network makes no provision for a second Sydney airport at Badgery's Creek.

1.5 Stakeholder input

During the structure plan process the following organisations have been consulted:

- Australian Rail and Track Corporation (ARTC)
- Blacktown City Council
- Fairfield City Council
- Infrastructure Australia (IA)
- Liverpool City Council
- Penrith Business Alliance
- Penrith City Council
- Regional Development Australia (RDA)
- Roads and Maritime Services (RMS)
- Sydney Ports Corporation (SPC)
- Transport for NSW (TfNSW)
- Urban Development Institute of Australia (UDIA)
- Urban Taskforce
- Western Sydney Regional Organisation of Councils (WSROC)

1.6 Report structure

The report has been structured as follows:

Section 2: Context

This brings together the pertinent background information and defines the physical context and transportation situation affecting the study area.

Section 3: Transport vision and objectives

This section broadly outlines the vision, key themes and key objectives have been derived to respond to the key issues and challenges identified for BWSEA. Provides a range of key criteria that are used to evaluate planning options and inform the structure planning process.

Section 4: Transport structure planning – key drivers

This section outlines the key transport planning considerations that should be used to guide the structure plan process.

Section 5: Preferred structure plan

Presents the preferred structure plan and describes the proposed integrated transport network impacting the study area.

Section 6: Summary and conclusions

Presents the key findings and outcomes of the preferred structure plan and main points of the integrated transport network.

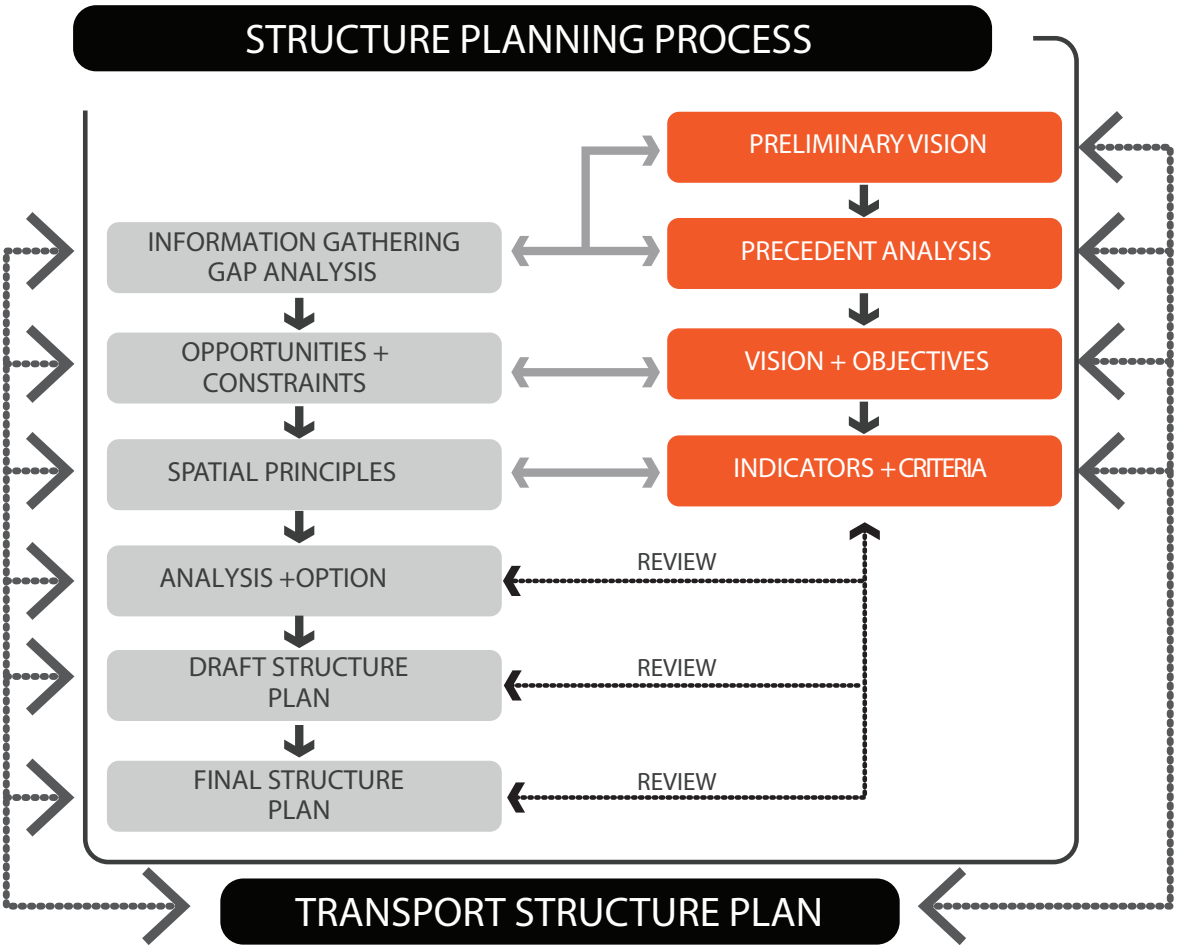


Figure 1 - Overview of the structure planning process

2.0
Context

This section reviews the background information available for the development of a structure plan for BWSEA and provides a snapshot of elements that may influence the design of the transport system.

2.1 National context

The location of Broader Western Sydney Employment Area (BWSEA) offers numerous competitive advantages for long term economic and development within the site. In order for this potential to be fully realised, the project needs to develop an understanding of the BWSEA's likely share of major economic and employment growth within Sydney over the coming decades.

Combined with a further understanding of its role as a potential national, state and Western Sydney logistics/freight hub and urban centre this will help in the definition of appropriate future land uses, and assist in the identification of infrastructure priorities required to ensure future competitiveness.

BWSEA's scale and location (refer Figure 2) imply a role far greater and more complex than a precinct plan, which are typically designed to support a short to medium term need relating to surrounding land uses and urban centres. Many of the strategic opportunities and constraints derived from BWSEA reflect this larger role and the requirements it is likely to confer.

BWSEA's central position within the linear growth corridor linking the North West and South West Growth Centres supports its potential as a logical and efficient site for future expansion in accordance with economic and demographic drivers. Its proximity to the regional cities of Penrith, Liverpool and Parramatta also aligns with the employment and transport access requirements for the western Sydney region as a whole. As one of Sydney's largest single urban development sites (10,700 hectares), BWSEA potentially has a critical mass to support an integrated mix of functions and the continued economic development of Sydney and Australia.

Accessibility to Sydney's three principal transport corridors, M4, M5 and M7 motorways, will provide continuous road based connectivity to the north, east, south and west. These strategic road based routes will be further supported by the future delivery of Westconnex, which is aimed at improving access to Port Botany and the airport precinct.

This confers potential to capitalise upon economies generated by the movement of people and goods along these corridors of regional, state and national significance. The proximity to the seaports of Port Botany and to a lesser extent Port Kembla implies a strong long term role for the BWSEA in potentially accommodating and contributing to international and regional trade economies.

Planning undertaken to date highlights the doubling of the freight task in the short to medium term likely to occur around 2031, and the need to upgrade infrastructure to help support growth through efficiently moving products to market. This includes the movement of goods through Sydney, which currently relies on constrained and shared freight corridors will be impacted by further planned growth of Western Sydney. This includes access to Port Kembla which even with current infrastructure upgrade commitments and the establishment of an Outer Sydney Orbital corridor through the site may have a role of supporting the national economy and other associated functions.

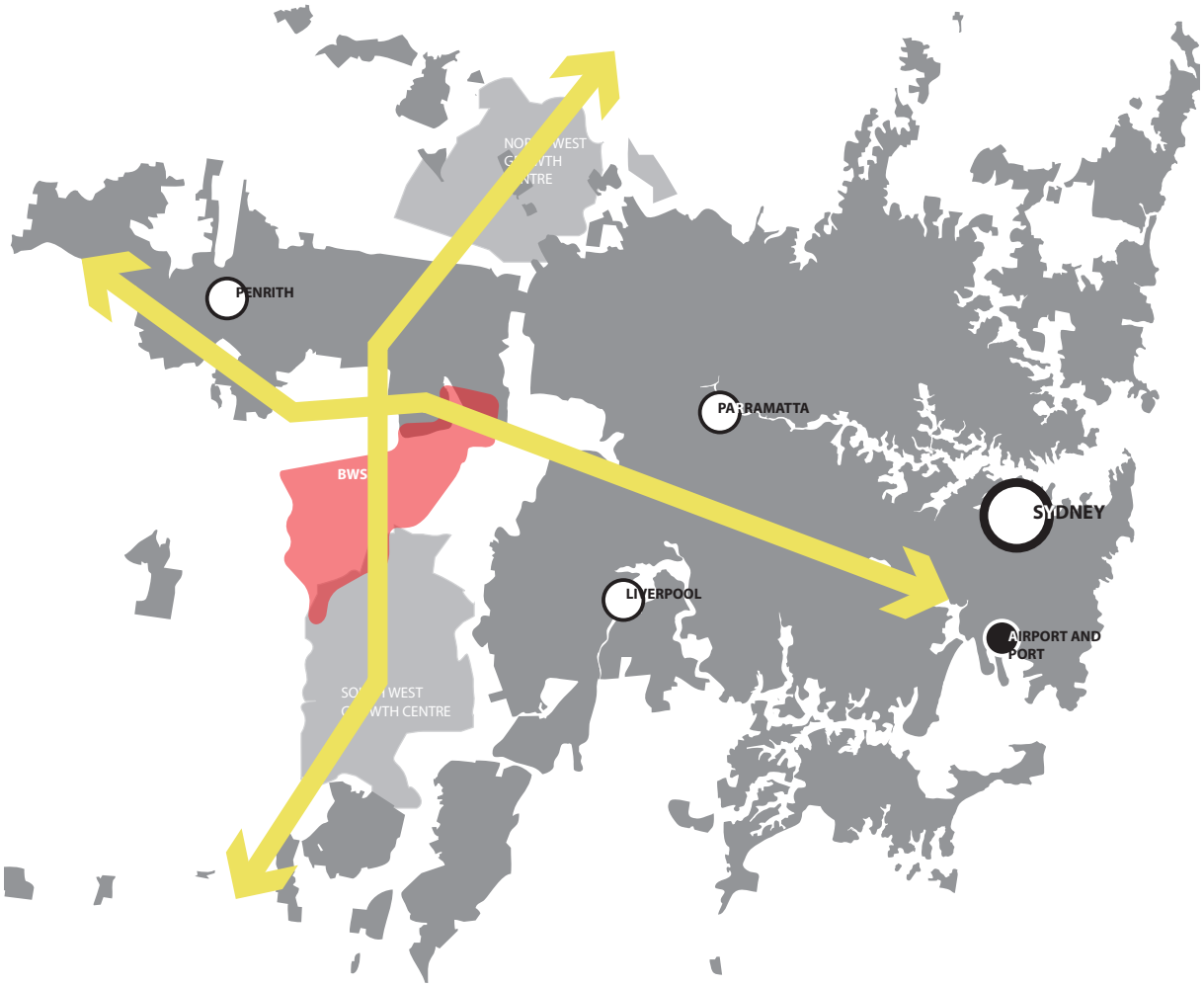


Figure 2 - Corridors of national importance

2.2 Metropolitan context

The BWSEA is strategically located near to the centre of population for metropolitan Sydney and is also well placed in relation to the expanding North West and South West Growth Corridors, with the latter abutting the broader BWSEA. These features of the broader BWSEA satisfy the State Government metropolitan planning objective of providing jobs close to where people live through providing strategically located land for employment land development. The BWSEA is a significant component of the Employment Lands Development Program, an implementation mechanism of the Metropolitan Strategy.

The access characteristics of the BWSEA are ideal, with direct access to the M4 and M7 motorways, which are key road corridors for western Sydney. The potential for a north south transport corridor bordering the western edge of the site, highlight the strategic significance of the BWSEA. The potential for the development of an intermodal terminal in the BWSEA also further enhances its strategic importance for metropolitan Sydney, which is support by a freight catchment of considerable size that is separate to that captured by Moorebank.

These transport proposals illustrate the potential of the BWSEA in strengthening metropolitan wide linkages and enhancing the role of the area in the metropolitan context.

The role of the BWSEA is identified to target and offer a freight solution through the designation of a future proposed Western Sydney freight corridor and the zoning of land to accommodate intermodal terminal facilities.

Figure 3 presents the site (coloured in red) within the context of metropolitan Sydney. The site boarders the South Western Growth Centre and is shaded in lighter grey. The figure illustrates that the BWSEA site serves Western Sydney and is located within 20km of Parramatta, Penrith and Liverpool and almost 45 km from the Sydney CBD and Port Botany.

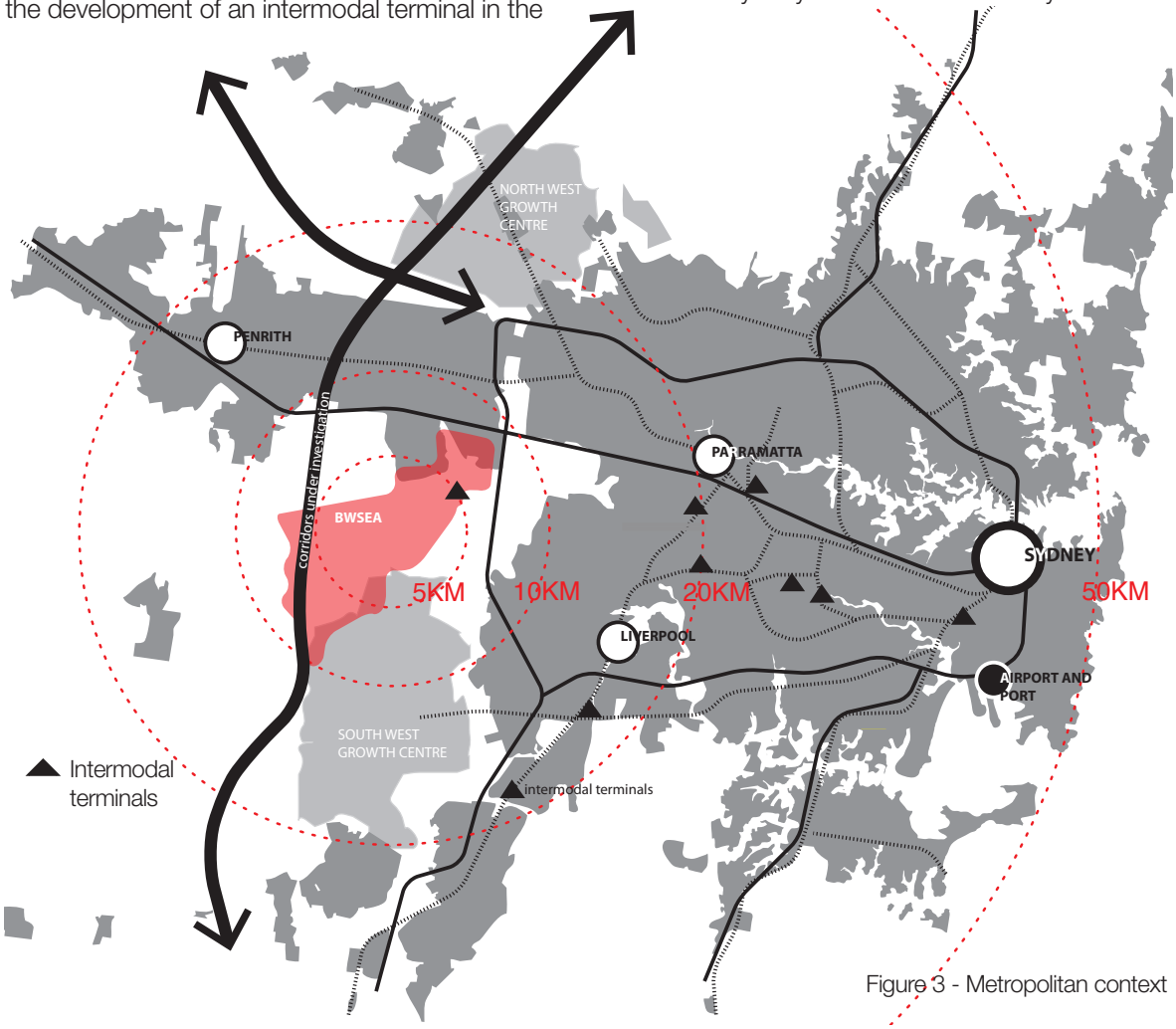


Figure 3 - Metropolitan context

Figure 4 presents Sydney's metropolitan transport network and its relationship with the site. It also highlights the potential for network enhancements and the movement corridors that it would support. The dotted yellow arrow represents a potential future rail corridor, whilst the black arrows depict the proposed future road corridors. Both are likely to have a strategic and regional network function that would assist the national and state economy by removing bottlenecks.

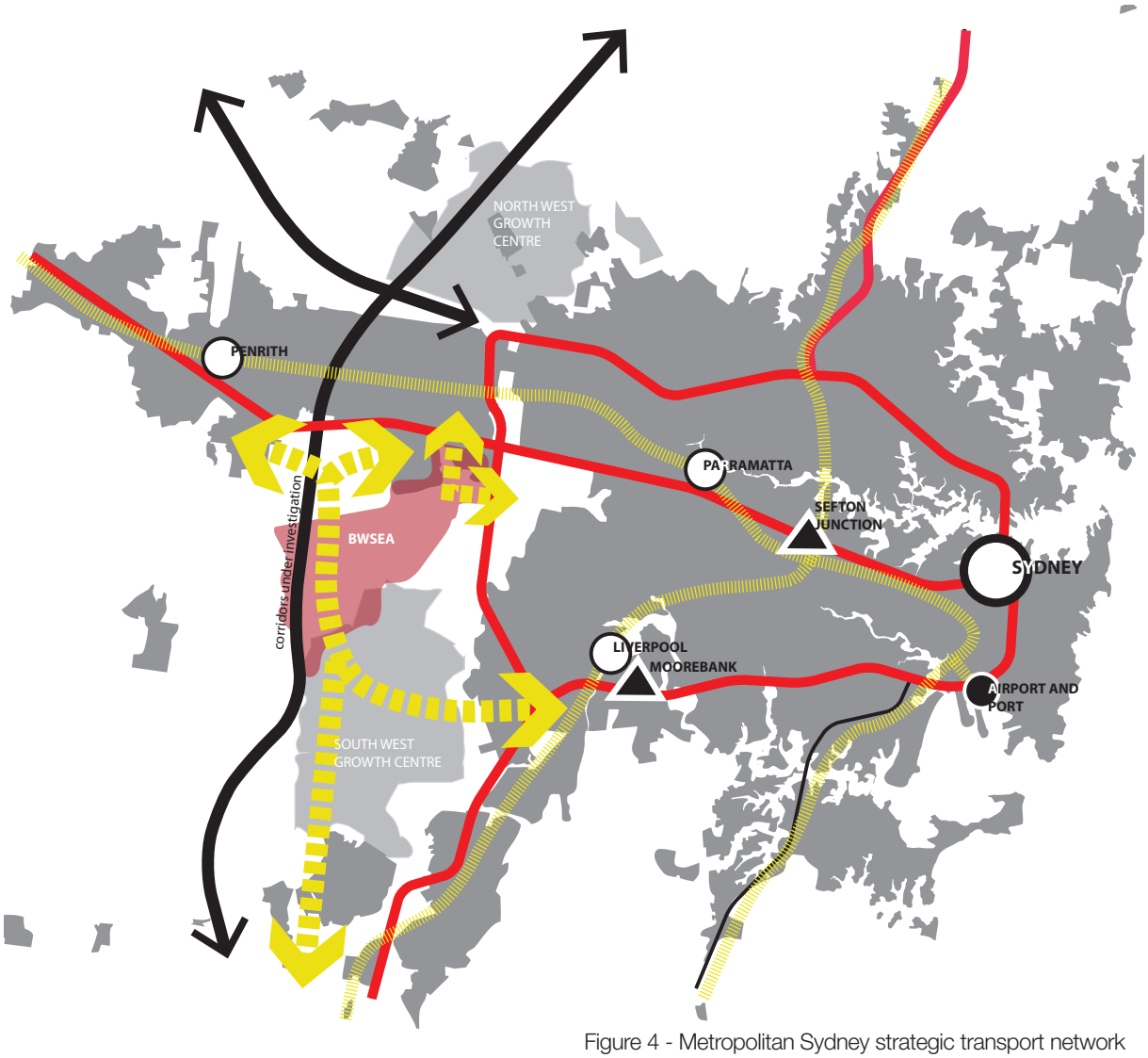


Figure 4 - Metropolitan Sydney strategic transport network

Figure 5 depicts the city wide connectivity concept that has been established and utilised throughout the structure planning option development and evaluation process. The concept presents the rail and road corridor connections to the north and south and connections to the port.

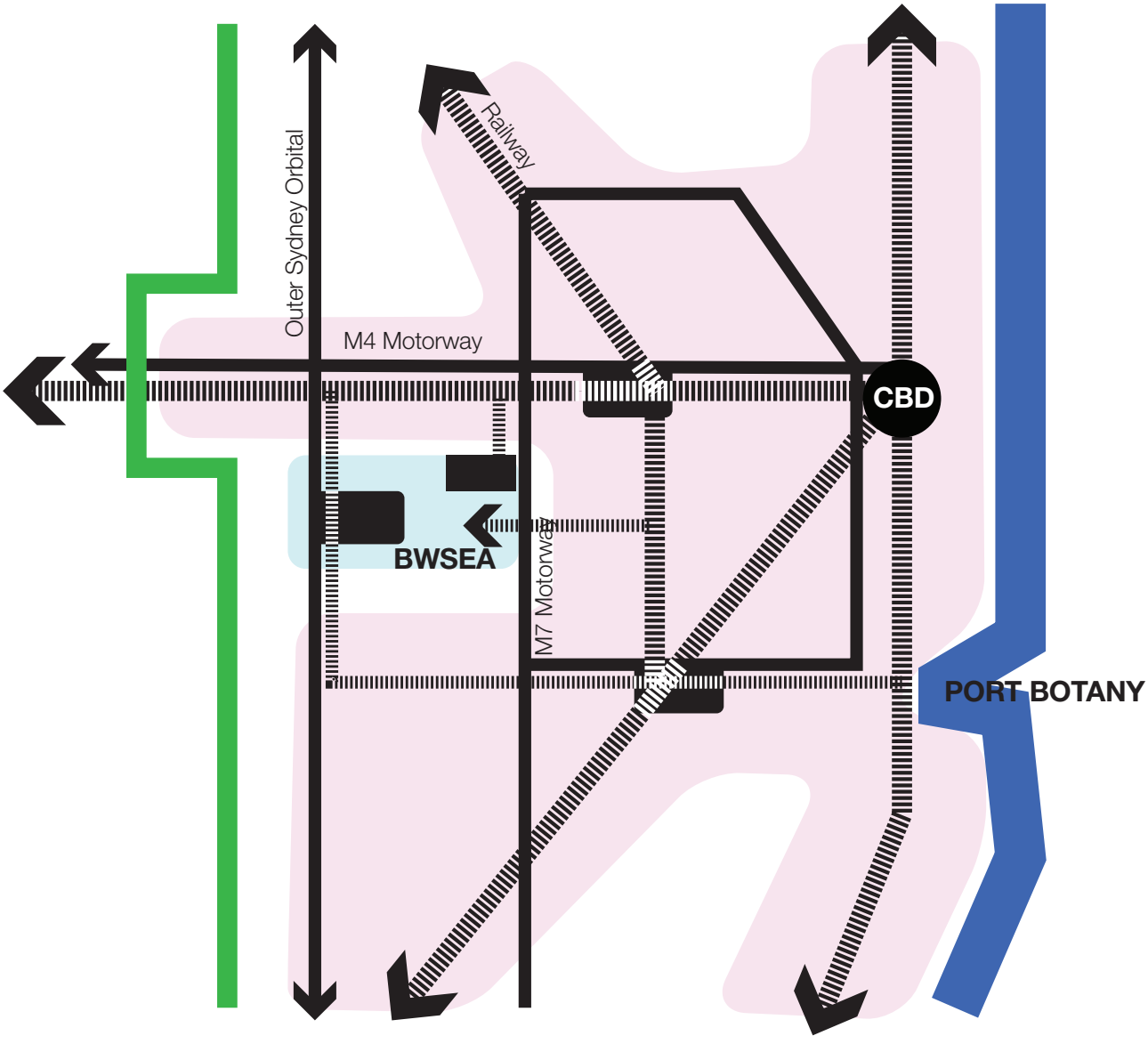


Figure 5 - City wide connectivity concept

2.3 Regional context

The BWSEA is of significance to the economic development of north western and south western regions of Sydney. The BWSEA straddles four local government areas, being Penrith, Fairfield, Liverpool and Blacktown and should provide land for a range of employment uses including warehousing, distribution, freight transport and industrial uses. The strategies developed for these regions highlight the importance of catering for the employment needs of existing and future residents within these four local government areas (the catchment) and its relationship with quality of life outcomes and infrastructure provision.

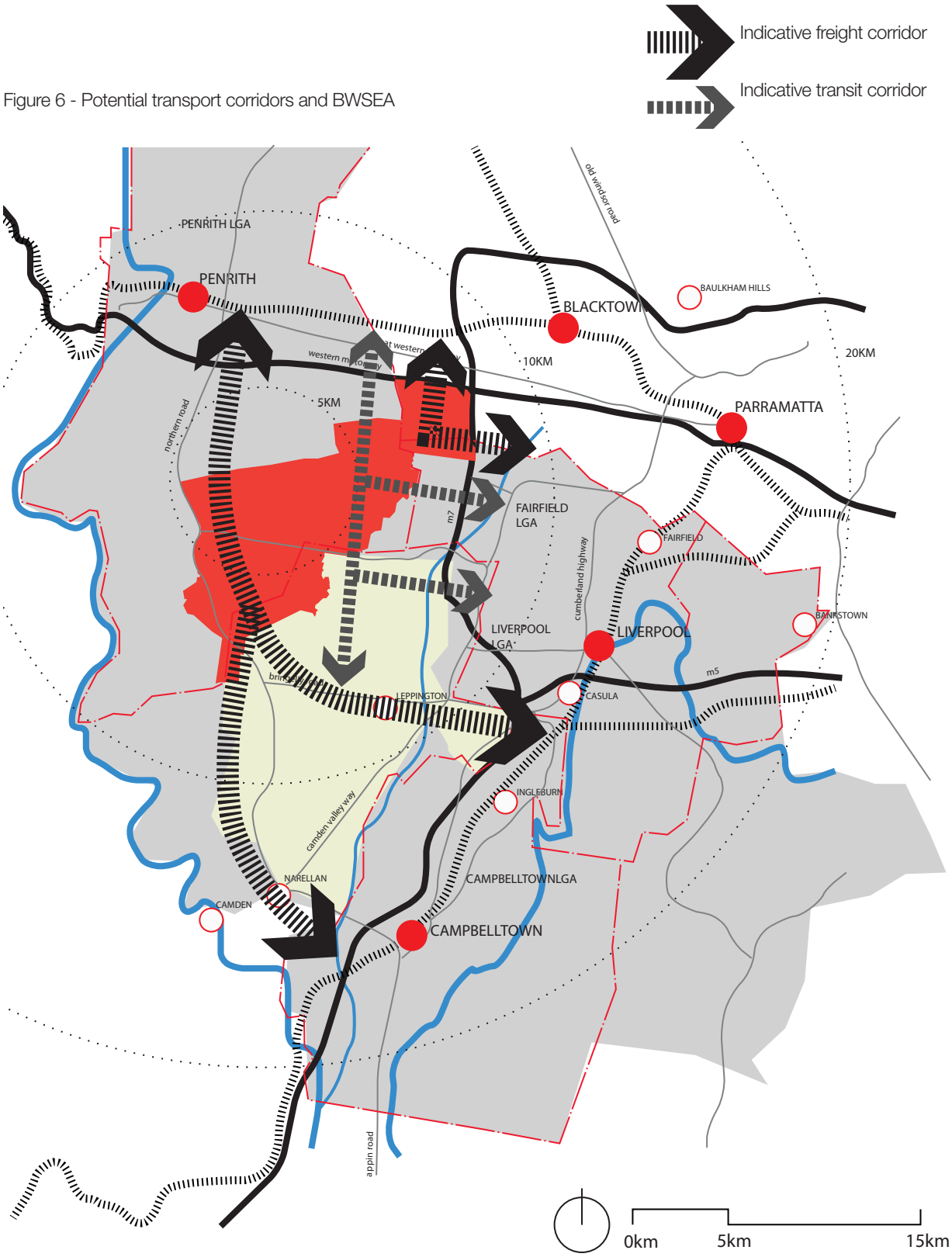
The State Government has recognised the significance of the BWSEA to the north western and south western regions through the development of the State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP BWSEA). This plan currently applies to the north eastern section of the WSEA and provides a zoning mechanism for the initial area, which will be applicable to the whole WSEA over time.

The BWSEA comprises a number of regionally significant environmental corridors and other sensitive lands, which are also recognised in the SEPP BWSEA. The significance of these corridors goes beyond local government boundaries and a regional planning approach is warranted to ensure their protection and also their integration into planning strategies and responses.

Figure 6 presents the existing transport network and potential transport connections to the BWSEA site at a regional level.

The site has the opportunity to be connected to the overall city network through a variety of modes (refer figure 6). The black arrows depict the key future road and freight connections through the site and proposed secondary connections (bus corridors and regional links) are presented in yellow. The scale on the bottom corner of the figure highlights the distances required to travel to connect with existing and planned networks.

Figure 6 - Potential transport corridors and BWSEA



2.4 Site context

The BWSEA site has a number of existing road network transport opportunity shown in figure 7. The following section presents some of the key opportunities and constraints identified during the structure planning process relevant to the specific site.

2.4.1 Land use connectivity opportunities

The current key site transport opportunities are outlined in Figure 8, Figure 9 and Figure 10, and are presented in the form of WSEA land holdings, network catchment and network connectivity.

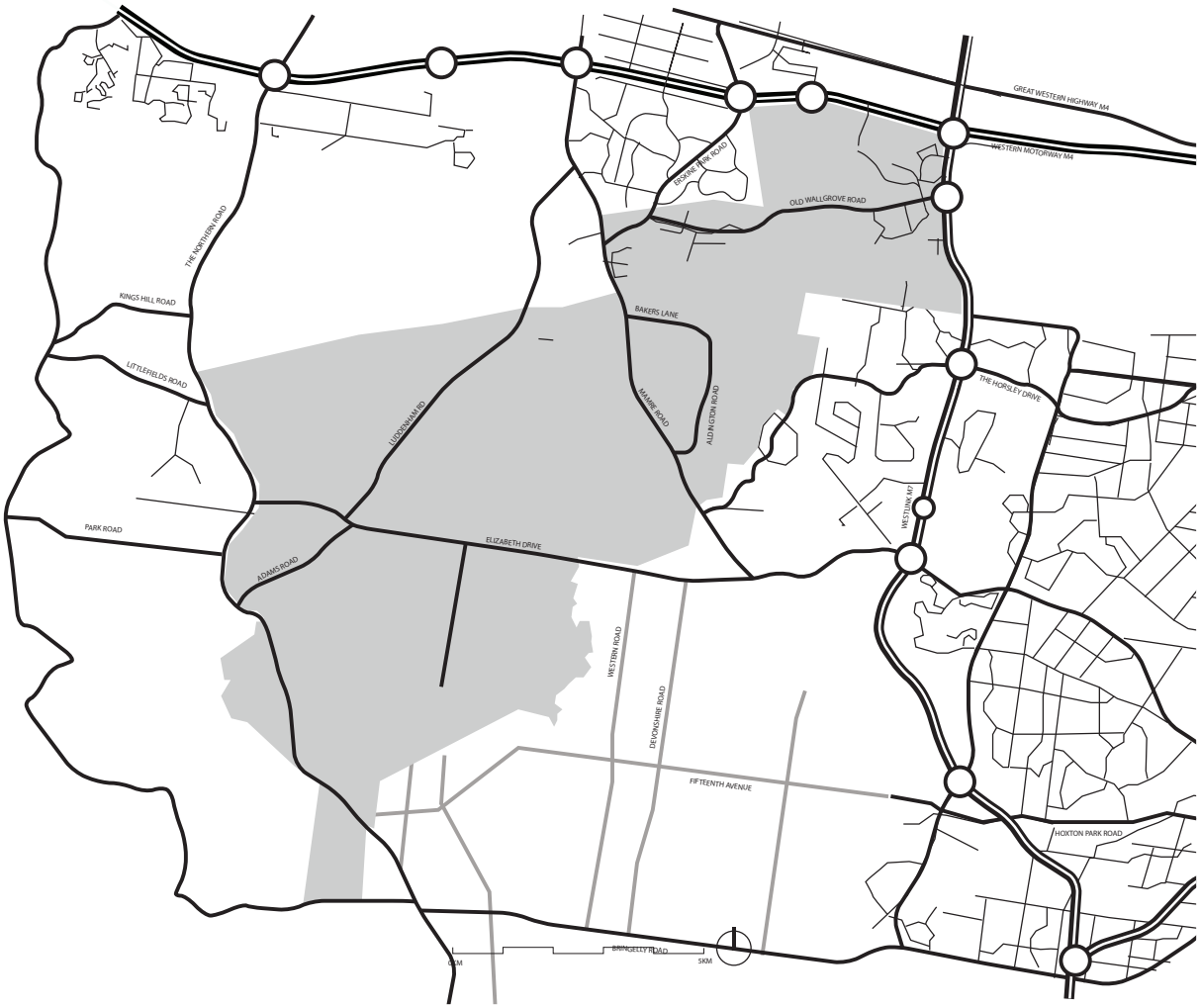


Figure 7 - The road structure context

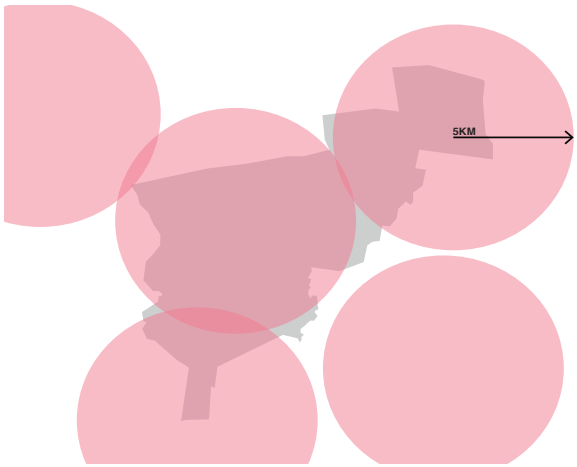


Figure 8 - BWSEA planning catchments

Figure 8 provides an understanding of the indicative local area catchments and their spatial representation across the site. Five kilometre catchments are generally considered to be appropriate for planning of access to the site.

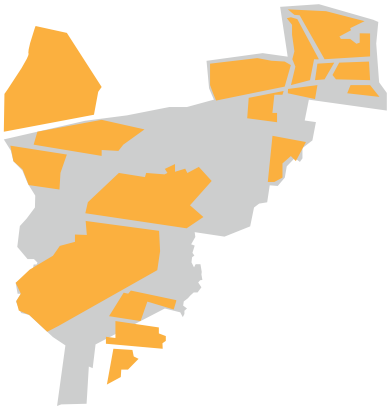


Figure 9 - BWSEA large land holding development potential

Figure 9 presents the major land holdings within the site. These provide the key opportunities for large scale precinct type development or anchor tenants with business parks, specialist centres, logistics/ freight intermodals and airports currently under consideration for areas within the site.

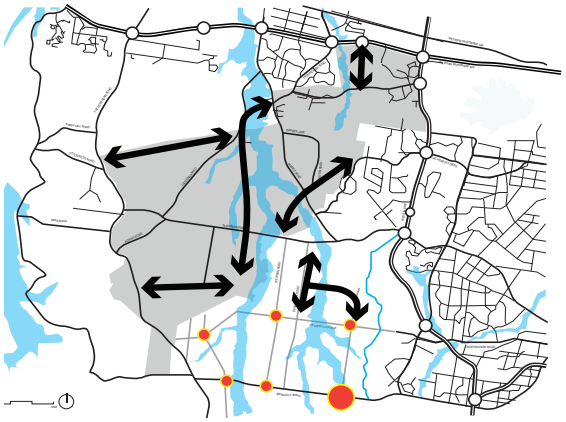


Figure 10 - BWSEA road network connectivity opportunities

Figure 10 presents the site in relation to planned connections from the South West Growth Centre (to the south) and established and planned interchanges along the M4 (north) and M7 (east) motorways.

2.4.2 Opportunities for connecting to the primary network

Figure 11, figure 12 and figure 13 provide an understanding of potential opportunities for the establishment of a primary transport network that supports the movement of passengers and freight through and within BWSEA.

Figure 11 shows the site has excellent exposure and accessibility to the proposed Outer Sydney Orbital and supports the potential for key freight and logistics functions.

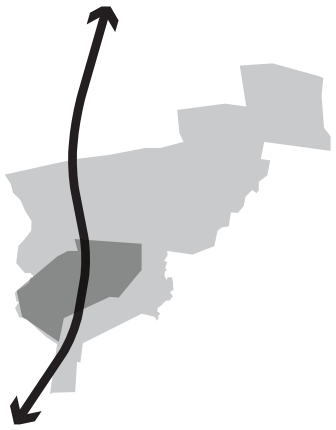


Figure 11 - Establishment of a primary transport corridor along the Outer Sydney Orbtal (indicative)

Figure 12 presents the planning of freight network extension is key to “joining up” opportunities for strategic planning of WSEA and the surrounding metropolitan freight network. This will complement already established freight corridor to the north and west of the site with future links to the south to alleviate some of the pressure on the existing freight network paticularly on the main western line.

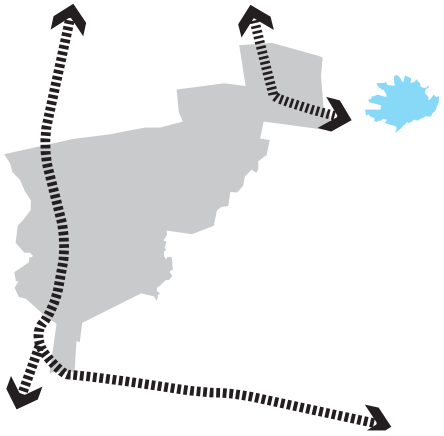


Figure 12 - BWSEA primary freight transport corridors (indicative)

Figure 13 demonstrates the public transport links should be located in such a way that they run through the core of site rather than along arterial roads. The integration of the public transport with the broader network is vital, such as the South West Rail Link (SWRL), Liverpool and Parramatta Transitway and the western rail line.

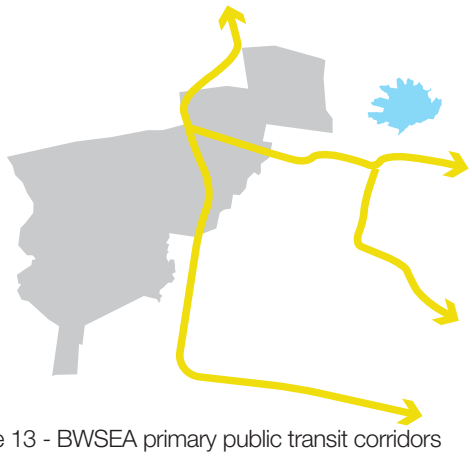


Figure 13 - BWSEA primary public transit corridors

2.4.3 Existing site constraints

Figure 14, figure 15 and figure 16 provides an understanding of potential development, environmental and physical constraints that need to be considered in the establishment of a robust structure plan for BWSEA.

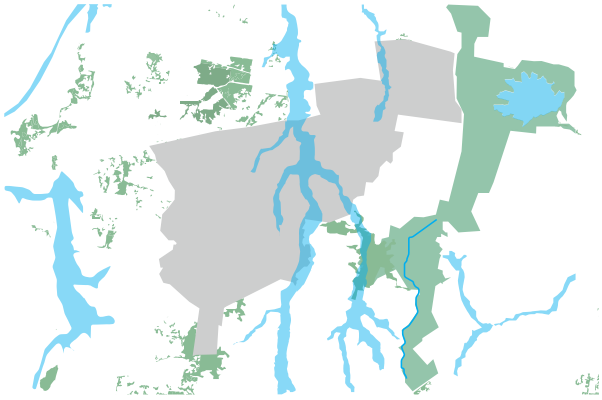


Figure 14 shows the location of water sensitive areas and green corridors could restrict east-west access and connectivity between precincts. The bridging of flood prone areas will have an impact of overall site delivery costs.

Figure 14 - Water and green corridors through the site

Figure 15 shows utility facilities situated within the north-eastern corner and to the north of the site and its related corridor connections will need to be considered in the planning of the site. All planning should be coordinated with utility supplies to avoid inefficient investment in temporary services and to explore options for shared corridors with a focus on promoting site efficiencies and sharing infrastructure provision.

Figure 15 - Utility facility and corridor constraints

Figure 16 shows the possible reservation of a proposed intermodal facility as identified in NSW LTTMP. This requires extensive land area and direct access, which may be difficult to achieve for a longer term outcome within either the Eastern Creek or Ropes Creek precincts due to the rate of urban development. Efficient and effective access to and from the surrounding road and rail networks is key to the planning of this type of facility and site constraints may also impact on a desirable outcome.

Figure 16 - Proposed intermodal terminal

2.4.4 Site accessibility

Figure 17, figure 18, figure 19 and figure 20 provides an understanding of site connectivity, gateways and regional access opportunities that should be considered in the establishment of structure planning options for BWSEA.

Figure 17 shows the site linking with different levels of public transport services with a focus on the network and key existing and planned markets to the north, south and east. Transit corridors depicted in yellow offer short to medium term opportunities for providing direct links to the mass transit system, significant growth areas and the regional cities of western Sydney. This layer is expected to be further developed beyond the medium term to better connect with proposed precincts to the west and its form and shape will be driven by the land use, its mix and intensity.

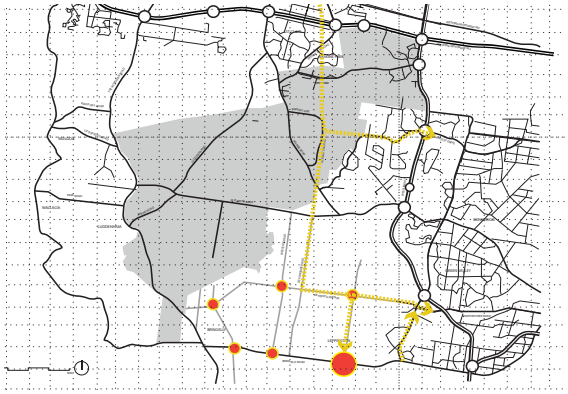


Figure 17 - Linking key transit corridors

Figure 18 broadly shows the likely establishment of a precinct profile, which considers the site's known opportunity and constraints and establishes a spatial platform for planning networks, land use and development densities.

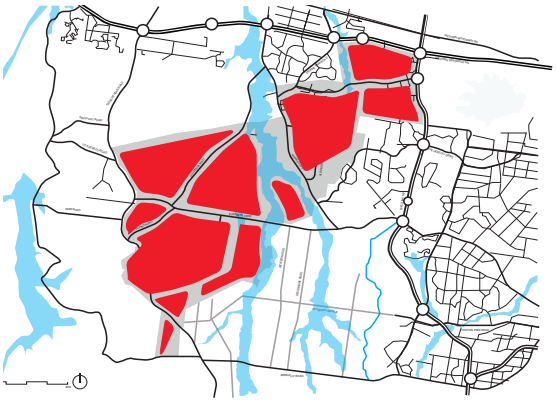


Figure 18 - Precinct planning profiles

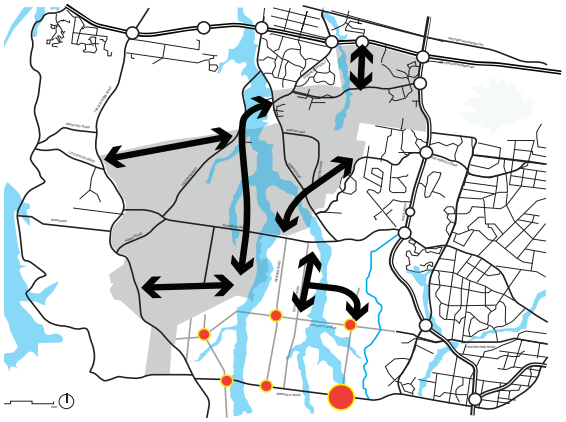


Figure 19 - Movement profiles and gateways

Figure 19 shows the possible development of key movement and access systems within the site should provide effective connections to internal precincts. The overall system should identify a hierarchy of movement corridors that have local and regional importance. These corridors should feed key gateways to the site and concentrate on serving southern, eastern and western connections with major roads and emerging transport corridors (i.e. Fifteenth Avenue, Elizabeth Drive, Hoxton Park Road and Outer Sydney Orbital, etc.).

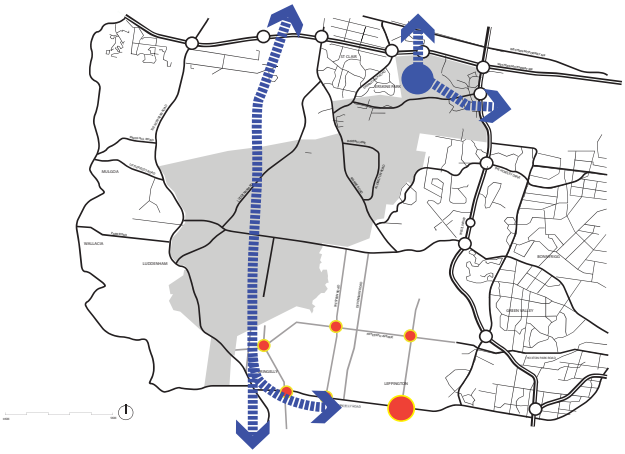


Figure 20 - Strategic freight corridors and rail access opportunities

Figure 20 shows the potential for strategic freight corridors, which should be separated where possible from internal and regional commuter corridors. Access to be planned along Outer Sydney Orbital and through linking the site with the existing Western Railway line, and possibly the proposed South West Rail Link.

2.5 Characteristics of existing transport network and demand

2.5.1 Existing Mode Shares

The existing land uses within the BWSEA are characterised by low density activities and significant distances from the existing public transport infrastructure. As expected, this results in current public transport usage being low.

Journey to work (JTW)

JTW data from the 2006 Census has been analysed to gain a better understanding of existing travel patterns for works trips. Data from the four most significant local government areas surrounding the BWSEA has been collated to develop a snapshot of existing travel characteristics. These local government areas are Penrith, Blacktown, Fairfield and Liverpool. It is noted that additional local government areas such as Camden could have been added to the analysis. However, the focus here is primarily on the LGAs with major existing residential precincts near the BWSEA.

The JTW data indicates that around 78 percent of work trips to destinations within the BWSEA come from these four surrounding local government areas. 10 percent come from local government areas further east where residential densities are higher. This indicates the need for the public transport system within the BWSEA to provide connectivity with the surrounding residential suburbs as this is where the origins of the demand for employment will come from.

It is noted that both public and active transport currently perform poorly in terms their ability to compete with access by car. The challenge is shown in Figure 21 and Figure 22, which highlights the current travel profile for residential and industrial precincts surrounding the site or areas similar in character to what may be planned in the future.

The planning of the area will need to consider integrated transport and land use solutions for the site and should account for road infrastructure provision, related investment and its impact on the surrounding transport network. This will allow transport demand to be appropriately managed and is directly related to:

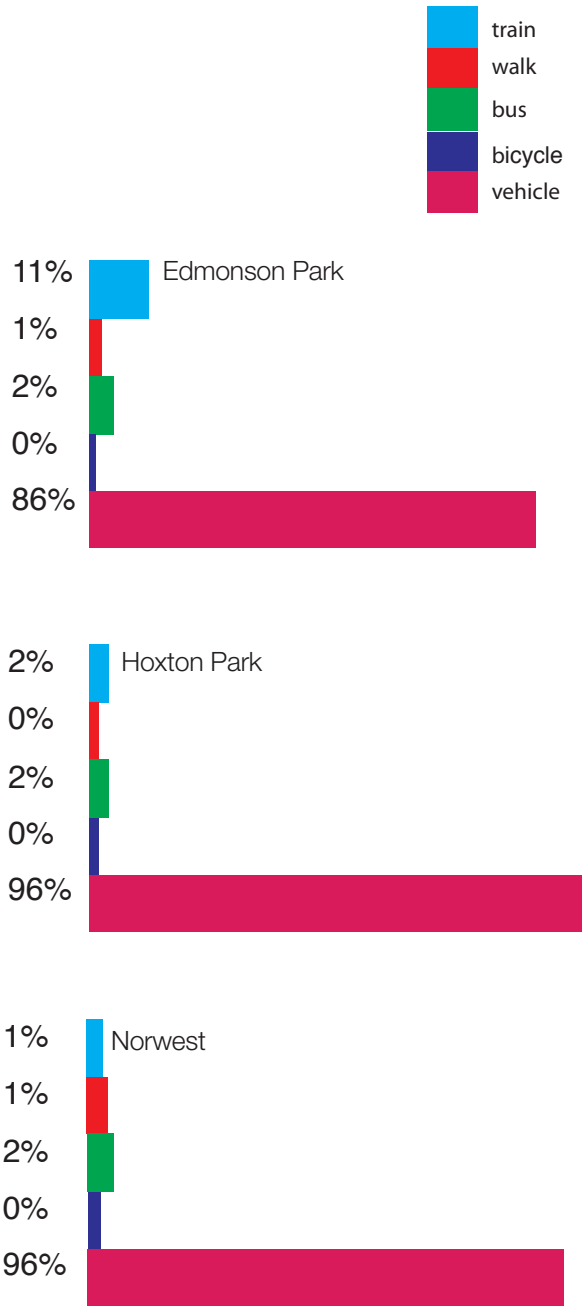


Figure 21 - Employment JTW mode share profile

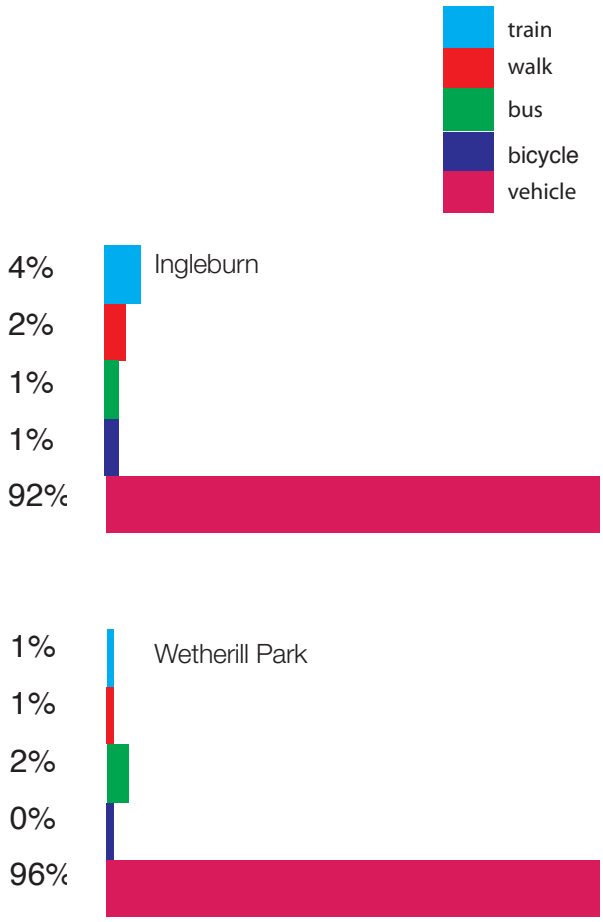


Figure 22 - Employment NSW mode shore profile

Source: BTS Journey to work data 2006

- Land use distribution, density and proximity of services.
- Access and the competitive of alternative modes due to the level of congestions.
- The competitiveness and reliability of other modes and in particular active transport.
- The quality of public transport and its ability to effectively service the land use precinct it passes through.

Household travel survey (HTS)

The HTS collects data on all trips made by people as recorded on trip diaries. It can provide a picture of overall travel patterns and mode of transport used.

The HTS data indicates that the mode used for trips within the four local government areas such as Penrith, Blacktown, Fairfield and Liverpool, to or from the BWSEA is:

- 70 percent by car
- 4 percent by bus
- 1 percent by train
- 25 percent as active transport

Active transport is walking and cycling which tends to be associated with short trips or trips connecting with another mode (e.g. walking/cycling to the railway station or shops). The high level of active transport indicates the need to account for these trips in the design of the network, particularly for access to services in the future.

2.5.2 Existing road network

The BWSEA is bound by a number of significant major roads which will provide the basis for access to the area in the future. These roads are shown in figure 23. The M4 and M7 motorways to the north and east are the primary routes by which the BWSEA will be accessed from the remainder of the Sydney Region. The M4 motorway currently is operating at or near capacity during normal peak periods and throughout the day.

Elizabeth Drive and Bringelly Road provide for east west movement internally and to the south of the network. The Northern Road provides a north south link along the western boundary which services connectivity into the region primarily from M4 and to a lesser extent from Bringelly Road and the southern end of The Northern Road. Whilst these roads are well developed, the remainder of the road network is primarily rural in nature with the exception of roads in the immediate vicinity of Eastern Creek and Erskine Park.

Three major land related constraints will define opportunities for development of the internal road network. These are:

- Locations for crossing the Sydney Water Pipeline south of Erskine Park and Eastern Creek. Crossing points currently exist at Luddenham Road, Mamre Road, and Old Wallgrove Road.
- Locations for crossing South Creek and its tributaries. Primary crossing points currently exist at Luddenham Road and Elizabeth Drive. Future crossing points are feasible in the vicinity of locations such as Bakers Lane and Abbots Road.
- Existing development within the study area such as the CSIRO Research Station, University of Sydney MacGarvie Smith Veterinary Farm, and the SITA Environmental Services Landfill Depot.

The crossing constraints will limit the design of the internal road network to existing corridors which can be developed to a higher level without major new additional infrastructure.

2.5.3 Existing road hierarchy

The RMS (previously the Roads and Traffic Authority of New South Wales) has set down the following guidelines for the functional classification of roads:

- Arterial Road – typically a main road carrying over 15,000 vehicles per day and fulfilling a role as a major inter-regional link (over 1,500 veh/hr).
- Sub-arterial Road – defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 veh/hr to 2,000 veh/hr).
- Collector Road – provides a link between local areas and regional roads, typically carrying between 2,000 and 10,000 vehicles per day. At volumes greater than 5,000 vehicles per day, residential amenity begins to decline noticeably (250 to 1,000 veh/hr).
- Local Road – provides access to individual allotments, carrying low volumes, typically less than 2,000 vehicles per day (250 veh/hr).

Peak hour volumes on all roads are typically eight to twelve per cent of the daily flows.

The structure planning for the BWSEA focusses on arterial and sub-arterial roads and motorways. Other internal roads would be designed as “Industrial Roads” with widths and geometric design being able to accommodate heavy vehicles. Lower order roads such as collector and local roads are typically associated with residential areas.

The existing major arterial roads in the area are:

- The M4 Motorway provides an east-west link through the centre of the Sydney Metropolitan Area. It has six lanes and is designed to a freeway standard.
- The M7 Motorway forms part of the existing Sydney Orbital Network. It has four lanes and is also designed to a freeway standard.
- Wallgrove Road is a north south link running parallel to the M7 motorway. It has four lanes along the Western Sydney Employment Hub at Eastern Creek and two lanes south of the Sydney Water Pipeline. The two lane section is rural in design.
- The Northern Road is a north south link running along the western boundary of the study area. It has two lanes with a mixed urban/rural design.

Sub-arterial roads which supplement the major arterial roads include:

- Elizabeth Drive provides an east – west link between Luddenham and Liverpool. It has two lanes for most of its length with a mixed urban / rural design.
- Mamre Road provides the main north – south internal function internally to the study area. It has two lanes linking Elizabeth Drive at Kemps Creek to the M4 and Great Western Highway.
- Luddenham Road is a north – south link between Elizabeth Drive and Mamre Road. It has two lanes with a rural design.
- Bringelly Road to the south is an east – west link currently planned to be upgraded to a four lane road. It will form an important role in providing access to and from the study area.

Other rural roads will contribute to connectivity in the ultimate road network for the Broader Western Sydney Employment Area. They include Badgerys Creek Road and Fifteenth Avenue and are currently two lane rural standard roads in general.

2.5.4 Motorway interchanges

Figure 23 shows the location of existing M4 and M7 Motorway interchanges in the vicinity of the study area. Existing interchanges include:

- M7 / Cowpasture Rd, M7 / Elizabeth Drive, M7 / The Horsley Drive, M7 / Wallgrove Rd at Old Wallgrove Rd and M7 / M4 Light Horse Interchange; and
- M4 / Roper Rd (east facing ramps only), M4 / Mamre Rd and M4 / The Northern Road.

Future interchanges are planned along the M4 Motorway (east facing ramps only) at the Werrington Arterial (Gipps Street) and Archbold Road. The connection at the Werrington Arterial is planned to align with the potential Outer Sydney Orbital Transport Corridor.

Provision of additional interchanges beyond those already planned along the M4 is constrained by limited distances between the interchanges restricting the development of merge and diverge lanes for safe ramp access.

There exists some room physically for an additional interchange on the M7 south of Elizabeth Drive. However, this would be impacted by environmental constraints presented by the adjacent Western Sydney Parklands.

2.5.5 Existing public transport network

The existing public transport network comprises heavy rail services to the north along the western line, to the east along the Cumberland line, and to the south via the soon to be completed South West Rail Link to Leppington. Bus services on the existing road network within the BWSEA are limited. However, local bus services within surrounding residential precincts are well established.

Regional rail services

The western rail line provides the primary access to the area from the north. The Cumberland line and other associated services provide primary access from the east. Whilst there is spare capacity on these lines in the vicinity of the BWSEA, capacity constraints exist further along the lines themselves.

Regional bus operations

Bus interchanges with the heavy rail network including the soon to be completed South West Rail Link provide the pivot points from which the public transport needs of the BWSEA can be best addressed. Like interchanges at Blacktown and Penrith the existing interchange at Mount Druitt and St Mary's will provide a hub for bus routes servicing the BWSEA. Similar interchange functions are also available on the existing Cumberland Line.

Bus transitways are in operation outside the study area. These transitways can perform part of the future public transport function with routes extending into the BWSEA. The most significant existing transitway for the BWSEA is the Liverpool-Parramatta T-way. This runs between Parramatta and Liverpool via the Great Western Highway, along the Sydney Water pipeline from Prospect reservoir and then on to Hoxton Park and Liverpool. It caters for a significant resident population which could make use of the transitways for services extending into the BWSEA.

Local bus operations

Research indicates that only 16% of workers in Greater Western Sydney use the train, 2% walk and 2% use the bus to commute to work. Existing and planned primary bus services within the study area travel along three routes, which are identified to be:

- Penrith to Luddenham
- Liverpool to Penrith
- Liverpool to Badgerys Creek

To enhance public transport viability these services should integrate with the existing bus services in the area and connect to the centres surrounding them including St Mary's, Mt Druitt, Liverpool, and the future centre at Leppington.

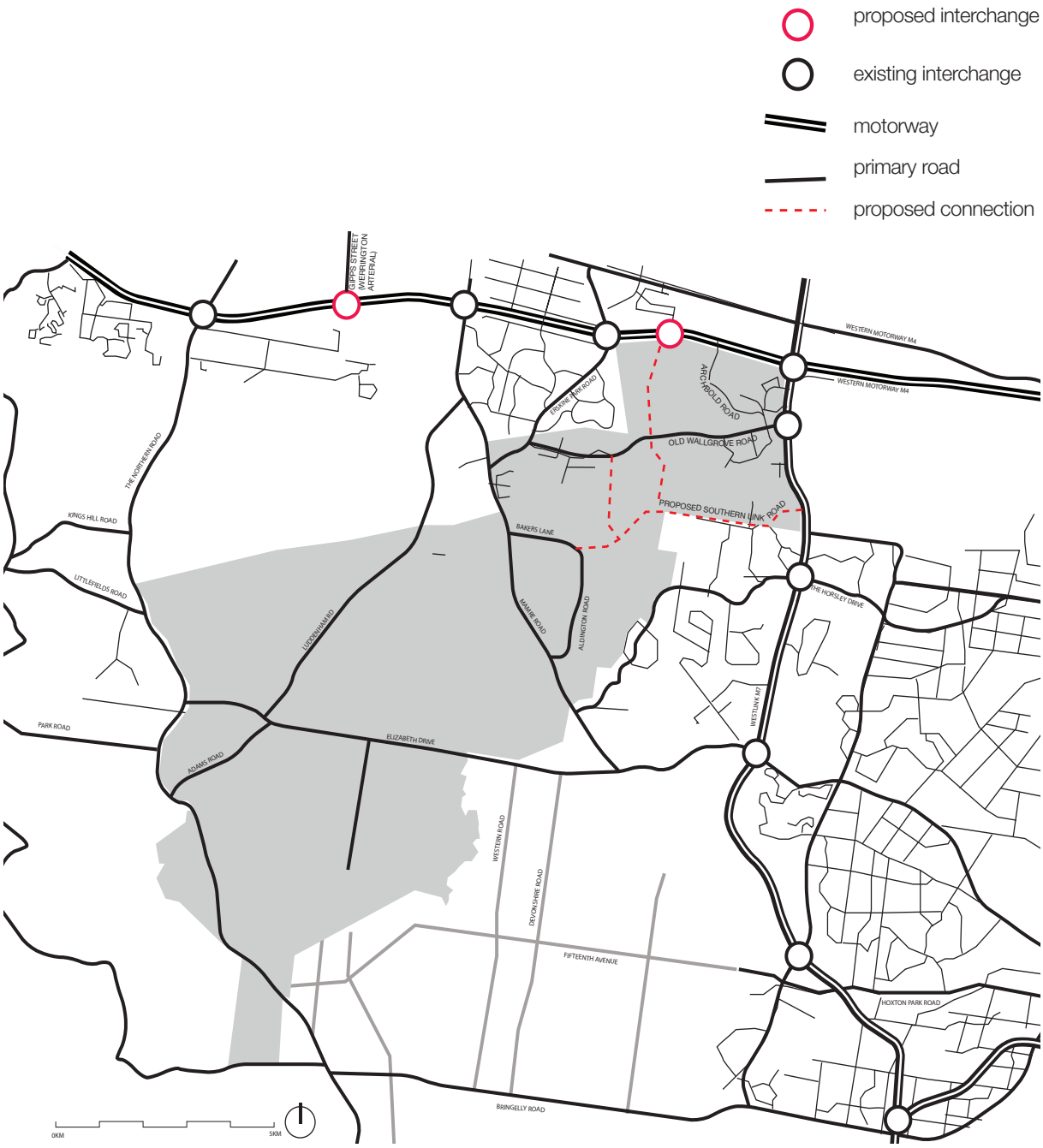


Figure 23 - Existing road network

2.5.6 Freight growth and network distribution

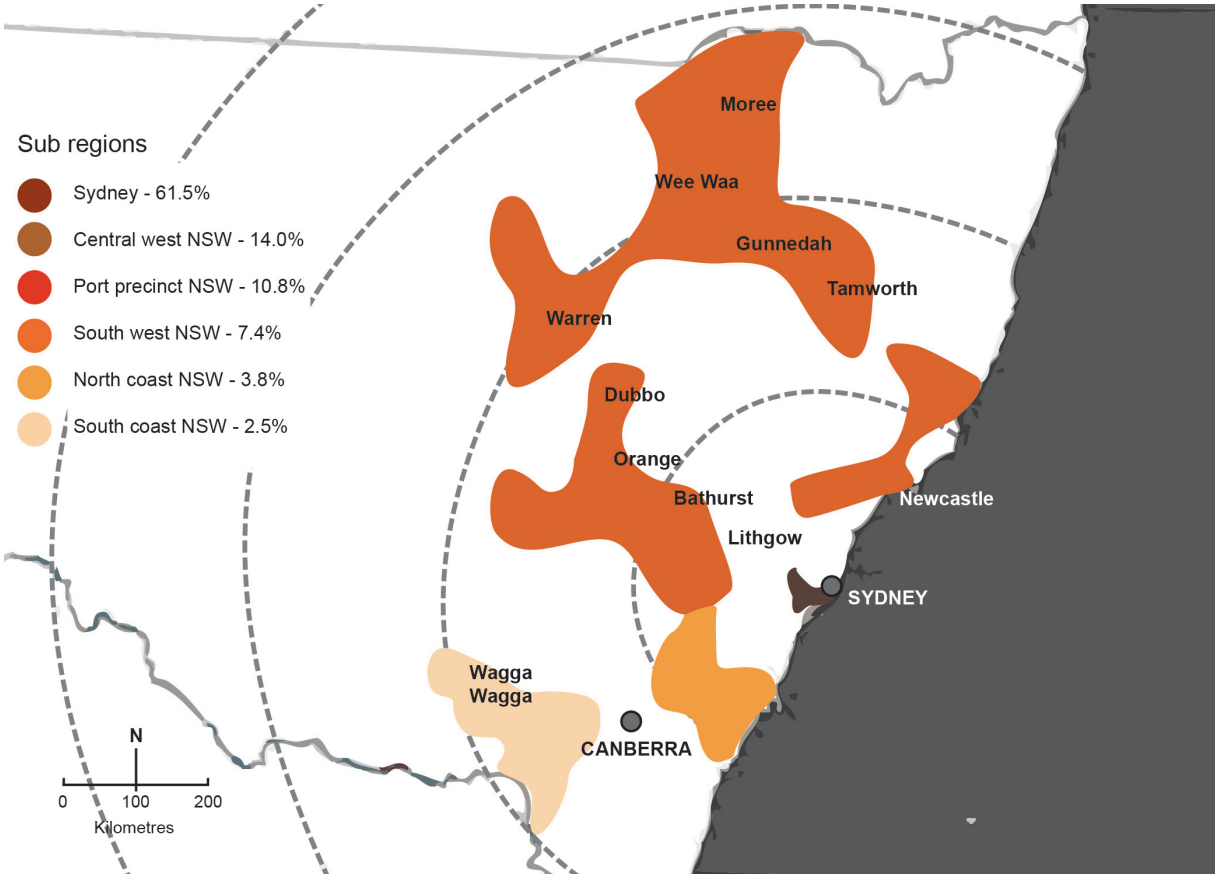
Growth in freight is identified to form around industrial activity clusters and requires reasonable access to the strategic transport network. Desired freight efficiency improvements will need to consider the limitations of the freight network and plan for upgrades around markets and emerging areas over the longer term to allow targets and industry efficiency to be achieved. The supply and management of imported containers and the exporting of empty containers will play a key role in helping to achieve freight efficiency outcomes.

Origin and destinations

Figures 24, 25 and 26 provide an understanding of the key origin and destinations of full container traffic in Sydney and NSW. This information disregards empty container distribution, which is directly associated with the destinations of imported containers and the location of empty container parks and is discussed further in the subsequent sections.

Figure 24 - Origins of full export containers within NSW (2009)

Source: Logistic Review 2010/2011, Sydney Ports Corporation (May 2012)



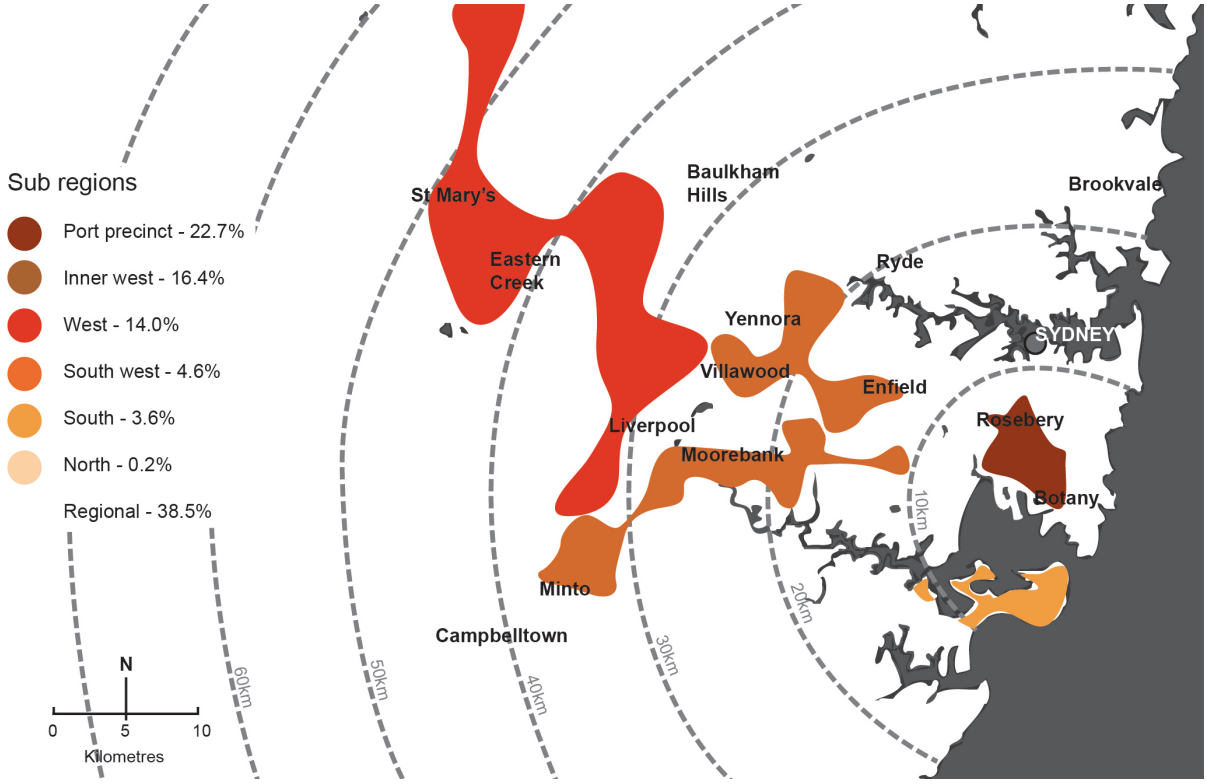
Imported containers

Review of available historical data has highlighted the following distribution trends:

- Currently around 95% of imported containers are destined for Metropolitan Sydney.
- Approximately 50% of imported containers are destined for areas in Sydney's Central West, Industrial West and Blacktown and influenced by congestion and poor freight access to rail.
- Liverpool, Penrith, and Sydney's South West and North West represented less than 16% of recorded destinations for imported containers in the 2009 surveys.
- Sites accessible from the M4, M5 and M7 corridors play a significant role in the transporting of imported containers in 2009 and include Wetherill Park/ Smithfield, Eastern Creek, Moorebank, Greystanes and Arndell Park.
- Imports into Botany, City and the east have remained static, whilst movement to Penrith, Blacktown and Liverpool continues to grow.

Figure 25 - Full export container origins in metropolitan Sydney (2009)

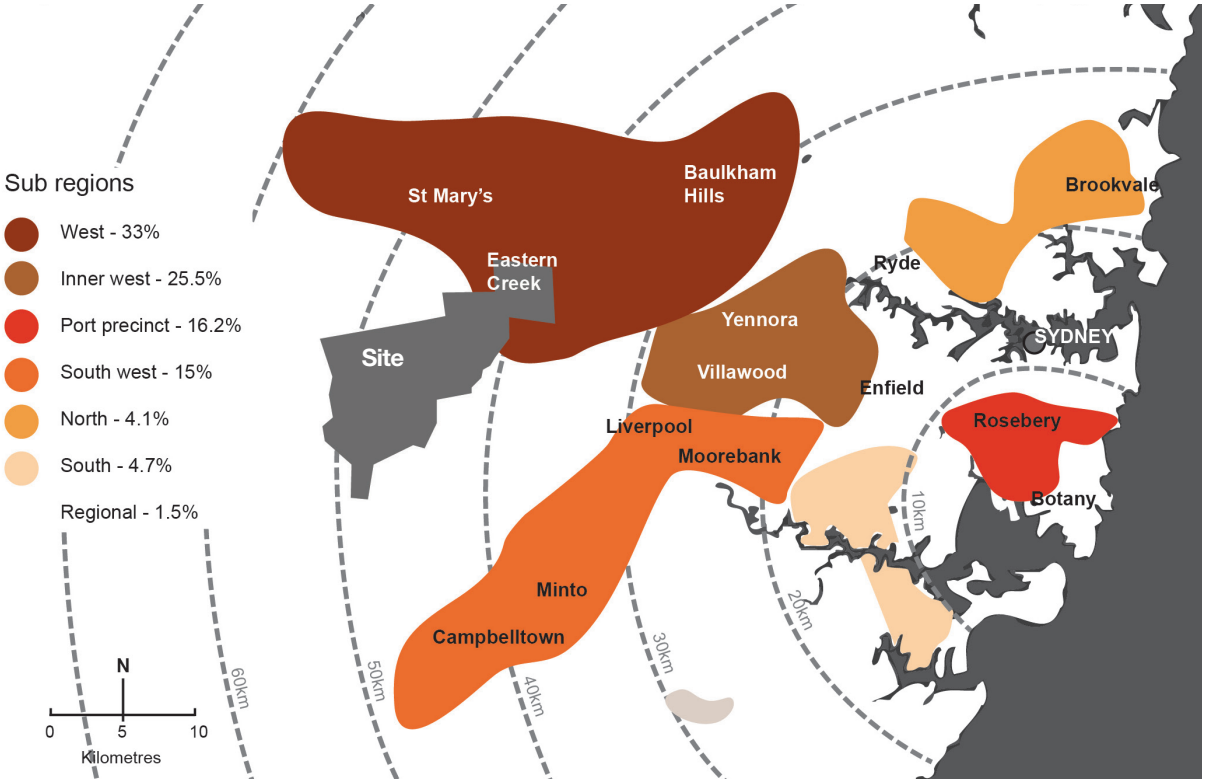
Source: Logistic Review 2010/2011, Sydney Ports Corporation (May 2012)



- Planned or potential intermodal terminal locations at Enfield, Moorebank, Eastern Creek, Londonderry, Badgery's Creek and Appin will assist in the handling of freight by rail and are identified as emerging areas that could potentially attract significant growth up to and beyond 2040.
- The majority of the above areas are identified to accommodate 200,000 TEUs per annum and in some cases more than 400,000 TEUs.
- Eastern Creek is predicted to accommodate a significant proportion of growth up to 2040 and is identified to have one of the highest growth rates in Sydney from a relatively low base. The planned expansion of BWSEA under the current structure plan will further influence growth trends here and at Badgery's Creek.
- All the emerging areas have a good level of access to Sydney's motorway network and will need to be supported by improvements to the rail freight network.
- In addition to the above, traffic to regional areas is also estimated to increase significantly and will require consideration of its rail freight infrastructure needs.

Figure 26 - Import container destinations in metropolitan Sydney (2009)

Source: Logistic Review 2010/2011, Sydney Ports Corporation (May 2012)



Empty containers

Predictions based on the review of historical data sets highlights the following:

- The number of total imports could increase by seven fold from the 0.95m TEUs recorded in 2009/ 2010.
- The current Empty Container Park (ECP) operational storage capacity levels cannot accommodate this increase.
- If the overall facility capacity is not increased then the predicted growth will not occur as the NSW Import Export container cycle will be adversely effected.
- To allow this growth to occur both the operational storage capacity will need to significantly increase and dwelling times will need to be reduced below 5 days.

The above operational efficiency is not achieved under the current industry structure. It will require changes in operational procedures and infrastructure planning together with industry incentives to help direct change. This is particularly relevant due to the viability of the current empty container business model. This business is known affordable prices globally for the storage of empty containers and not in a position to implement or direct change.

The infrastructure levy introduced in 2010 at ports along the east coast is estimated to improve the commercial viability of the business and encourage operators to expand ECP operation and capacity levels. An additional levy, which is associated with improving the rotation of stock and linked to dwell time of empty containers in ECPs may also assist improve existing and planned capacity in the ECPs.

Based on background information it appears that current port operational deficiencies impact on the way empty containers are moved and where they are situated. Some of this is associated with current rail operations network configuration and time slot allocations. This has resulted in a high proportion of existing facilities being located within the port precinct (approximately 50%) or within a short distance of the port (approximately 40%). Other facilities are situated near to strategic transport corridors and historical industrial lands (approximately 10%), and rely on road for accessing the port.

Additional facilities are currently planned and are estimated to add 75% to the existing capacity with the majority of this located over 20km from the port and includes facilities at Moorebank IMT (potential site), Enfield IMT (potential site), Minto IMT and Eastern Creek IMT (potential site). The Eastern Creek IMT could play a significant role in the handling of empty containers and offer a higher capacity than other facilities.

Freight demand

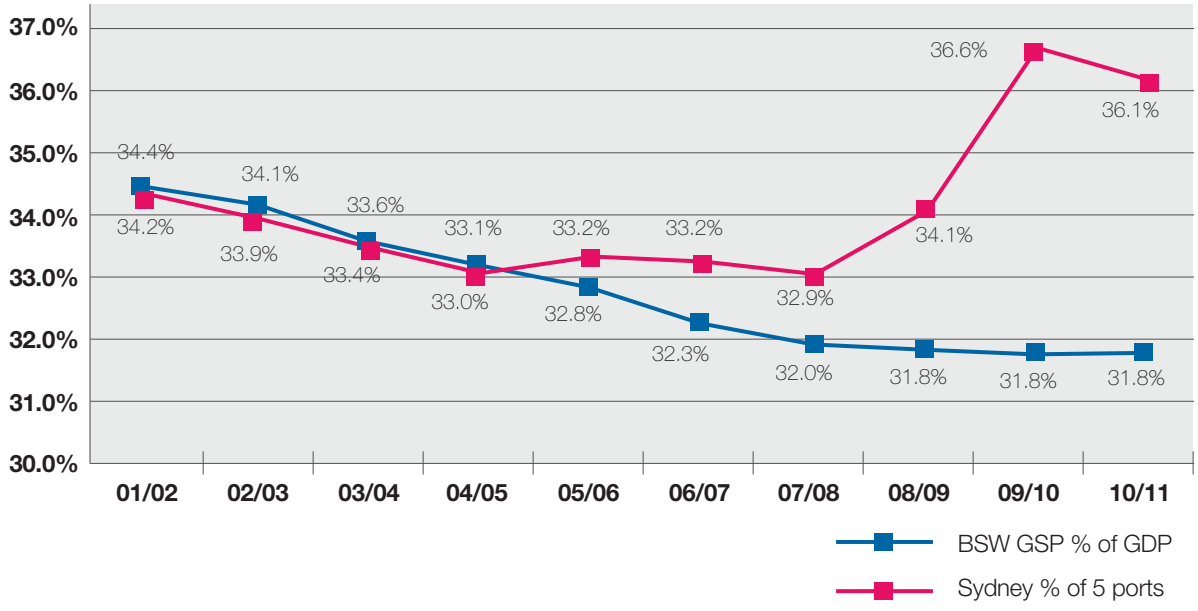
The NSW government has in place a target to double the proportion of rail freight to and from Port Botany to 28% by 2020. This will necessitate, among other things, significant infrastructure investment and capacity provision such as the development of the Moorebank Intermodal Terminal and dedicated rail freight lines.

Passenger movements at Kingsford Smith Airport are expected to grow to nearly 80 million by 2029, whilst the air freight task is forecast to grow from 471,000 tonnes in 2007 to 1,077,000 tonnes in 2029. This represents an average annual growth rate of 3.8%. The projected growth in the air freight task to 2029 will place further demands on land infrastructure to support the movement of cargo to and from the airport. The future task of circa 1 million tonnes represents the equivalent of approximately 45,450 truck trips per year contributing to the demand for road space.

The growing freight task stimulated by population growth will also be affected by a structural change in trade. The increasing role of the import trade (as illustrated in Figure 27) via Sydney relative to the State's contribution to GDP will place further pressures on infrastructure and supply chain capacity.

Figure 27 - NSW GSP as proportion of Australian GDP and Sydney proportion of Import TEUS of Australia's 5 major capital city ports (combined)

Source: GHD analysis of NSW Treasury Budget Papers and BITRE Waterline data

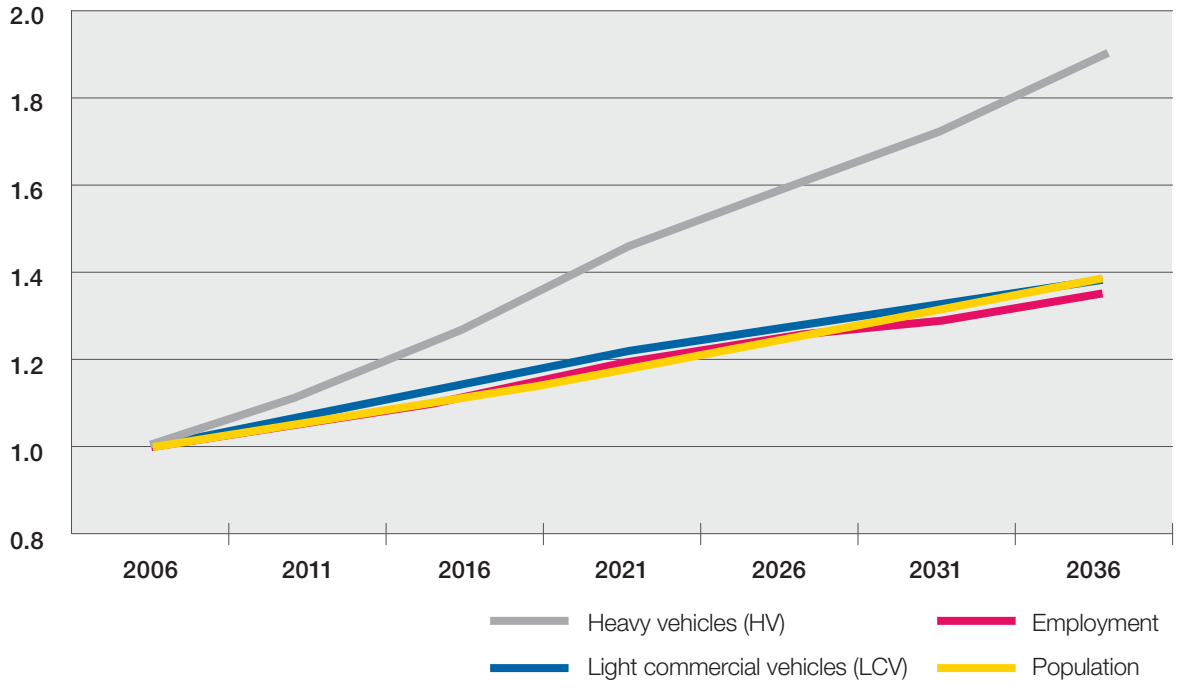


In terms of implications of economic growth and traffic to and from NSW ports, it is worth noting that road freight and the freight task in general in greater Sydney have grown faster than the NSW economy as a whole.

As shown in Figure 28, the future prediction for NSW indicates a strong linear correlation between population, employment and light commercial vehicle traffic. This trend will require a significant uplift in road traffic involving heavy vehicles as demand for freight services grow at a rate well in excess of population and employment.

Figure 28 - Indexed growth in road freight trips in NSW

Source: Infrastructure Australia: National Ports Strategy



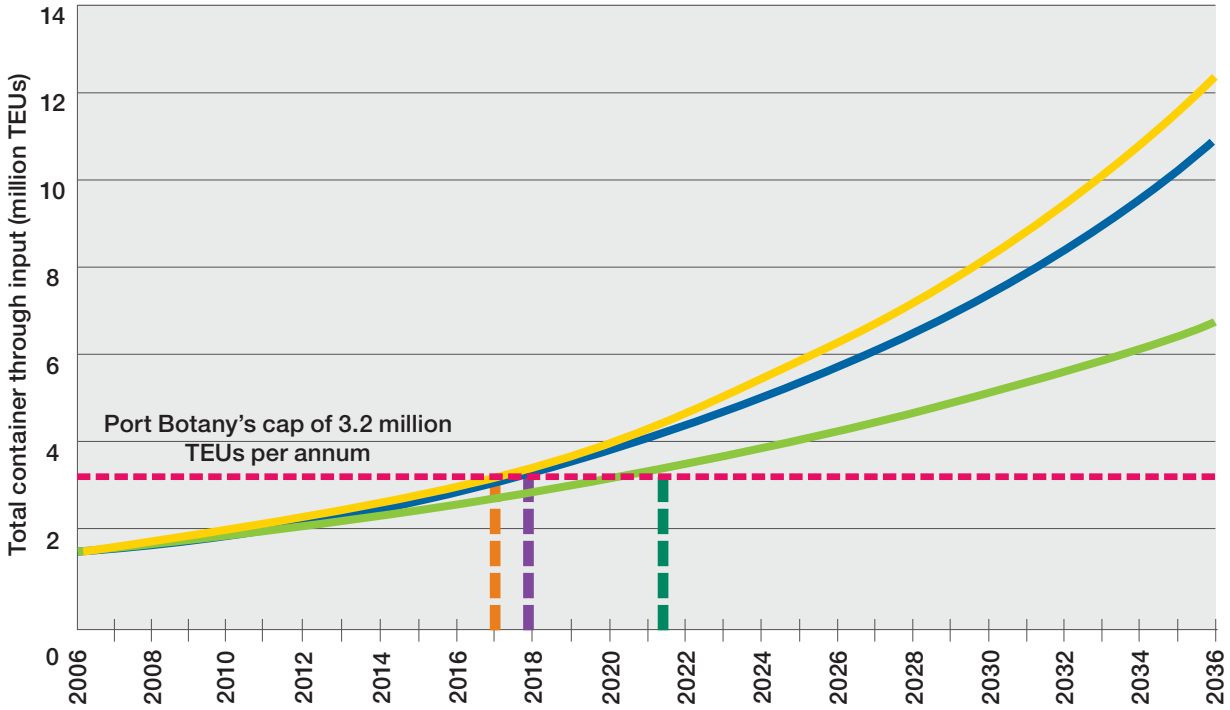
Growth predictions

The expectation is for population growth in the Greater Sydney to occur in the sub-regions of North West, South West and West Central with estimated rates of growth between now and 2036 of 40% to 50%. By 2056, it is likely that the population of these sub regions combined will double and have a population equivalent to that of all of the Greater Sydney Area (GMA) today (circa 5 million persons). Over the same time lines, employment in these areas is expected to also double and as a result increase its total Sydney employment stock by around one fifth to account for just over one job in every three in the GMA.

Over the next 20 years, Port Botany will remain the key container port in NSW. Given current planning and investments implemented to-date, an important issue will be its capacity and size to allow for future growth in terms of throughput. Container trade at Port Botany is projected to grow from around 2 million TEUs now to 10.9 million TEUs by 2036. However, capacity is currently capped at 3.2 million TEUs as illustrated in the Figure 29.

Figure 29 - Port Botany container throughput – historic and forecast

Source: Infrastructure Australia: National Ports Strategy



2.5.7 Provision for pedestrians and cyclists

There is no dedicated pedestrian and cycle network within the Investigation Area (refer to Figure 30 below). A cycleway is provided along the M7 corridor. An existing on road cycleway is provided on the M4 motorway. Walking and cycling facilities are also provided within the Western Sydney Parklands for recreational use.

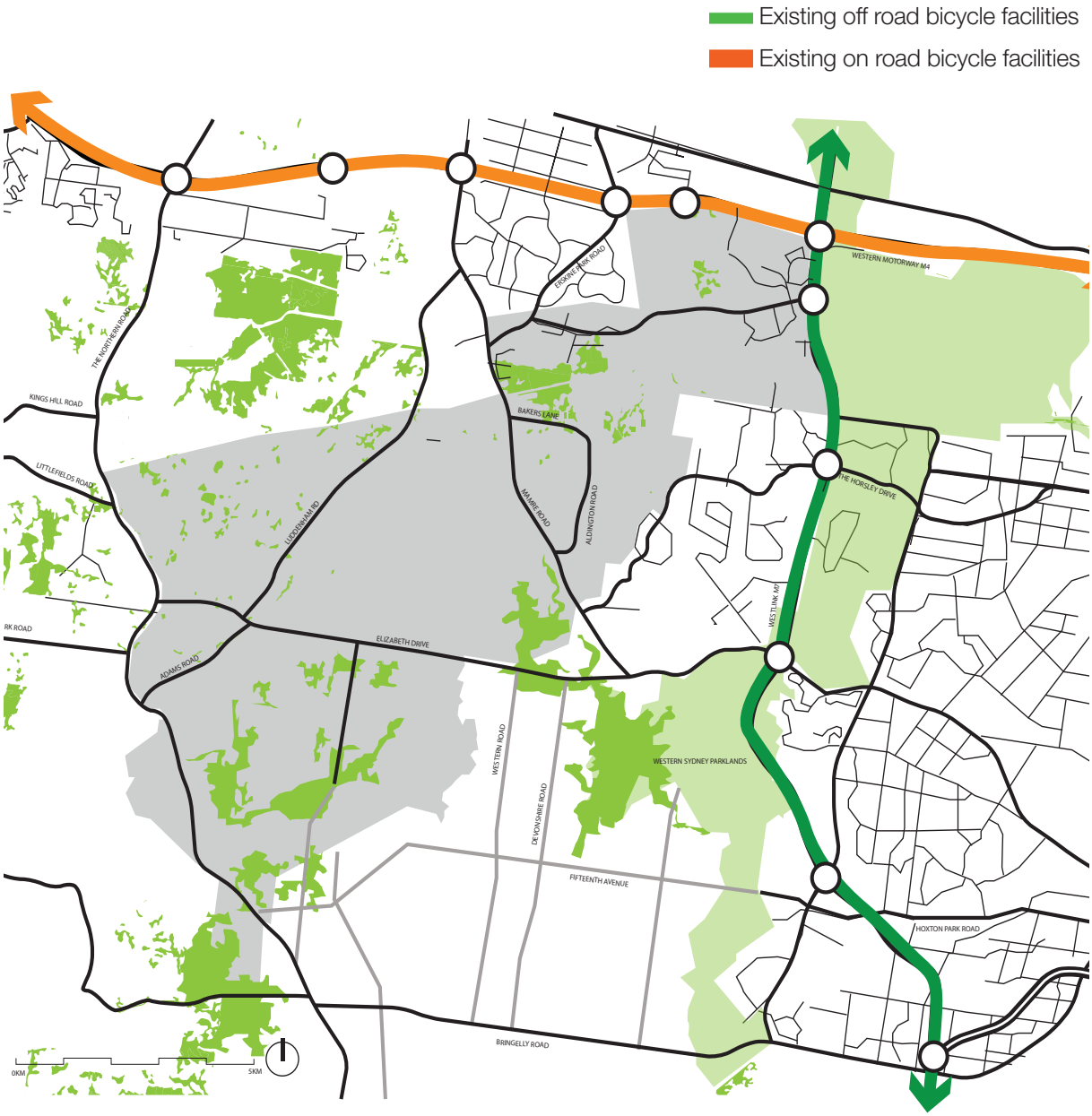


Figure 30 - Existing bicycle network

2.6 Policy and strategy

2.6.1 Key policy documents

There are a number of government policies and strategies relevant to the BWSEA site. These policies have been reviewed to ensure the structure plan for the site is aligned with the current policies and directions of the government. Both Federal and State Government Strategies have been reviewed. Table 1 presents a summary of the policies and strategies reviewed and highlights the relevant aim and targets of the study in relation to the BWSEA site.

Table 1 - Policy and strategy: project direction notes

Strategy name	Strategic aims
Council of Australian Governments (COAG) Road Reform Plan	One of the three key areas targeted by the COAG Road Reform Plan (CRRP) is the creation of an incentives framework for the efficient use of road infrastructure and to support the movement of freight by rail.
Nation Building Program	The program sets a requirement that all cities should have in place by 2014 a land freight strategy that is consistent with the National Land Freight Strategy. These strategies should identify: • Key bottlenecks and pressure points • Develop land use plans that provide adequate provision for ports, freight terminals and transportation corridors • Support decision making process that focuses on achieving whole-of supply chain productivity gains in freight to facilitate forecast demand • Manage travel demand through policies that reduce congestion
Our Cities, Our Future' is a 'National Urban Policy', Major Cities Unit of the Australian Government, May 2011.	The policy framework recognises that traffic congestion can only be tackled by better managing demand through understanding the importance of trip purposes, prioritising movement, offering alternatives and containing demand through better planning of centres and services. It supports the planning of transport around catchments, with the provision of walking and cycling infrastructure focused on catchments around activity centres. The key transport related aims of this policy and associated programs are to: • Improve accessibility and reduce dependence on private vehicles • Better manage network capacity to achieve reductions in travel times and congestion levels

Strategy name	Strategic aims
NSW 2021 - A plan to make NSW Number One' (NSW 2021), NSW Government, Dec 2011	State Government's 10 year strategic business plan, which aims to rebuild the economy, return quality services, and strengthen our local environment and communities. It is focused on the interests of the customer and supports the development of an integrated transport system. The strategy sets the following goals, targets and action plans, which are used to set priorities for funding, guide decision making: • Reducing travel times by improving peak hour travel speeds • Improving network reliability by providing priority to public transport • Supporting alternative travel modes by targeting reliability through 95% of services running on time, and setting improved mode share targets for metropolitan Sydney (28%) • Improving road safety through reducing fatalities to 4.3 per 100,000 population by 2016
Draft NSW Freight and Ports Strategy, TfNSW, Nov 2012	The plan focuses on reserving key freight corridors and encouraging early planning to better integrate future transport corridors. It identifies proposed sites for intermodal terminals that will be utilised to accommodate new or expand existing freight demand and provides recommendations for integrating these with the metropolitan and state freight networks. Proposed network improvements include: • The Outer Sydney Orbital and Maldon Dombarton Rail Line to separate freight and passenger rail movements • Intermodal terminals including preserving land near Eastern Creek • Reserving land for road and rail freight corridors such as the proposed Western Sydney Freight Link It also identifies the key roles of Ports, which includes Port Kembla as a bulk export port for mainly coal and grain and importing motor vehicles, and Port Botanyas a container port, which is likely to reach its capacity by 2030-40.
NSW Long Term Transport Master plan, TfNSW, Dec 2012	The long term goal of the transport plan is to support the "development of Greater Sydney as a network of centres with strong connectivity between growth centres and economic centres such as Parramatta, Penrith, Liverpool, Macquarie Park, the Port Botany and Sydney Airport precinct." The plan highlights relevant transport themes, such as customer experience (with a focus on network reliability and improving information), supporting the economy (serving corridors, enhancing access to ports and maintaining transport assets), safety improvements (reducing conflict and simplifying the system) and getting more out of urban networks (focus on reducing congestion by fixing bottlenecks and prioritising movement). The Plan focuses on connecting to the North West and South West Growth centres to established and emerging employment centres in the medium and longer term, removing bottlenecks and reserving corridor to accommodate future needs and supporting growth. It recognises the need to work with federal government to develop corridors of state and national importance including the planning of an Outer Orbital Transport Corridor. The plan also highlights a need to plan for the future expansion of Port Kembla, in doing it identifies a role for rail and the need to avoid or address existing constraints in the Sydney Metropolitan Freight Network (MFN).

Strategy name	Strategic aims
Metropolitan Plan for Sydney 2036	The Metropolitan Plan is a strategic document outlining the NSW Government's vision for Sydney over the next 25 years. This long term planning framework sets Sydney's land use targets with an aim of managing growth, strengthening its economic position and improving its liveability ratings by 2036 through: • Promoting growth in Western Sydney through establishing 50% of the total population here and half of the 760,000 additional jobs with a focus on cities and centres. • Encourage residential and employment growth in areas with available or planned public transport capacity (80% of new homes within a walking catchment of an existing or planned centre with good public transport access).
South West Growth Centre – Road Network Strategy (Rev 8), RTA, June 2011	Provides a comprehensive strategy and vision for the establishment of a road network in the South West Growth Centre. This includes consideration of road network staging, defines how the road network supports centres, and defines the public transport network and the type of active transport infrastructure that should support roads.
Growth Centres Road Framework (RTA)	The document defines the desired road hierarchy, public transport route design and desirable road section configuration
Sydney's Rail Future: Modernising Sydney's Trains	The plan focuses on addressing key bottle necks relating to congestion on rail lines that serve the CBD. It also identifies a list of key actions that are aimed at increasing service frequency, improving express rail services to Parramatta, Blacktown and Penrith; and better connecting regional cities with growth in south-west Sydney.
National Land Freight Strategy, Discussion Paper, 2011, Infrastructure Australia	The priority actions of the strategy are: • Promoting the national land freight network and improving infrastructure and access including South Sydney Freight line, and access to Port Botany and Port Kembla. • Planning of corridors and sites to support growth including Eastern Creek and Moorebank. • Ensures that plans can be executed and governance is transparent.
National Ports Strategy, COAG, IA and NTC, 2011	The document is focused on developing a national network of ports with a focus on: • Planning of infrastructure • Ensuring plans can be executed • Improving landside efficiency, reliability, security and safety • Improving transparency and accountability
Australian Infrastructure Progress and Action, COAG, June 2012, IA	The document is focused on developing a consolidated network throughout Australia with priorities set at a national level rather than a state level. There is a focus on improving freight efficiencies throughout the network with reference to ports in NSW at Newcastle, Port Botany and Port Kembla.
Regional Plan for Sydney – RDA, August 2012	The plan aligns with the Metropolitan Strategy with a strategic priority of supporting "industry development which creates more diverse and innovative jobs closer to home, and generating jobs closer to where people live to reduce congestion and improve liveability.

2.6.2 Key reports

A number of previous studies have been undertaken in relation to the BWSEA. These studies in table 2 have been reviewed to understand the work completed to date and the key findings of both the site constraints and recommendations to further improve the structure plan for the site.

Table 2 - Key reports: project direction notes

Strategy name	Strategic aims
MR154 The Northern Road Upgrade between the Old Northern Road - Traffic and Transport Assessment Report, SKM August 2012, Roads and Maritime Services	The Northern Road upgrade project comprises of upgrading 15km of The Northern Road, from The Old Northern Road to Mersey Road. This improvement will upgrade an existing two lane rural to four lane urban divided road with an allowance for an ultimate six lane configuration. It will be designed for a signposted speed limit of 80km/hr and allow for a 45m corridor that accommodates 2m wide shoulders and 3m shared paths.
Joint Study on Aviation Capacity in the Sydney Region	The study examines the aviation needs of the Sydney region and identifies how to meet these requirements in the short, medium and long term. The study highlights that: • By 2035 Sydney (Kingsford-Smith) Airport will continue be the most important airport in Australia for both passengers and freight and will need to accommodate 76 million passenger movements and 460,000 aircraft movements. • From around 2030, an additional airport will be needed to supplement the capacity of Sydney (Kingsford-Smith) Airport. • The Badgerys Creek site remains the best site for an additional major airport.
Western Sydney Freight Line Options Study (Final), DIPNR, Sept 2005.	One of the two short-listed scenarios included a requirement for a major intermodal terminal in Sydney's outer west near Ropes Creek. This terminal would be dependent on the feasibility of constructing a Western Sydney Freight Line (WSFL). The preferred option comprises of an alignment along Ropes Creek, across the Warragamba-Prospect Water Supply pipelines, Prospect Creek and linking Yennora and Leightonfield to the Southern Sydney Freight Line (SSFL). This can be achieved through a cut-and cover tunnel or an 18km viaduct and requires further investigation.

Strategy name	Strategic aims
Austral and Leppington North (ALN) Precincts Transport Assessment, Draft, AECOM, 2011	This report identifies road network features that support the development of Austral and Leppington North Precincts including: • The primary freight routes along Bringelly Road and Camden Valley Way • Fifteenth Avenue to accommodate a comprehensive bus network as stated in the South West Growth Sector Bus Servicing Strategy with bus priority and indented bus bays, focus on centres, and utilising safe crossing points.
WSEL IA – Freight Transport Analysis, Sd+D, 2008	The study provides an overview of the interface points and transport corridors and provides a strategic assessment and guidance for the Structure Plan. The key recommendations are: • Moorebank and Enfield intermodal terminals are needed to service the domestic and international container markets and service different catchment zones than BWSEA. • The proposed terminal at Eastern Creek is viable and appropriate in the present planning paradigm however rail links back to the existing rail network at Villawood are sub-optimal and will impact on Western Sydney communities. • A holistic and long term approach is required to the planning for freight through the provision of an integrated transport corridor in Western Sydney (an outer orbital link), which can help to accommodate growth (WSELIA, Southwest and Northwest) and offer strategic freight efficiency improvements. • Terminal and corridor footprints need to be acquired and reserved.
WSEL Preliminary Transport Assessment, SKM, July 2009	Provides a structure plan and infrastructure strategy including staging for a 10,447 ha area. The strategy aligned with government policy and identifies priority areas for release. Key transport upgrades recommended as part of the plan include upgrading the M7, Wallgrove Road, public transport linkages to Leppington, new road links within WSELIA, and new connections to Werrington Arterial, Erskine Park Link Road and Archbold Road for access to the M4, Edmondson Avenue for access to the south, Chandos Road for access to the east and Burley Road to the Aldington Road to connect to Mamre Road. The report is focused on defining the proposed upgrade to Bringelly Road between Northern Road and Camden Valley Way. The findings indicate the ultimate design (2036) should provide: • Four lane divided carriageway from the Northern Road to King Street and a six lane divided carriageway from King Street to Camden Valley Way • Signalised intersections and a target signpost travel speed of 80km/hr • A design that can accommodate B-Double freight traffic • Bus routes with bus priority measure • An off-road shared path for pedestrians and cyclists

Figure 31 - Site access and connectivity

2.7 Transport opportunities

The transport planning organisational concept shown in figure 31 has been developed to facilitate a greater degree of responsiveness to the site constraints and connectivity between development parcels and interfaces with major road and transport networks. The opportunities plan provides for the following:

- The potential for a central mass transit spine forming a direct corridor in the north, east and south.
- The site responds to the emerging nodes and planned road network within the adjoining South West Growth Centre.
- Aligns a freight corridor on the western fringe with the options of forming part of an Outer Sydney Orbital Transport Corridor.
- Interfaces with the Western Line used to transport freight to the north, west and west of the site.
- Provides site options for major freight and logistics employment uses (at north-east and south-west site areas), which are situated within highly accessible locations fronting the M4, M7 and future Outer Sydney Orbital Transport Corridor.
- Offers public transport connectivity to the north to reduce pressure of existing road corridors and offer access alternatives.
- Creates core precincts within BWSEA that are supported by primary and secondary transport corridors.
- Identifies additional lateral transport corridors (east-west) to support core precincts and freight and logistics employment uses at the north-east and south-west corners of the site.


BROADER WESTERN SYDNEY EMPLOYMENT

3.0
Transport vision and objectives

This section outlines the vision, key themes and objectives to respond to the issues and challenges identified for Broader Western Sydney Employment Area.

3.1 The vision for BWSEA

The preparation of a draft vision for BWSEA will be used to interpret the sites physical and potential economic characteristics. The vision for BWSEA is summarised below:

- Make a significant economic contribution to the State.
- Be a major contributor to secure employment land satisfying future land demand.
- Enable a range of employment opportunities for the state, metropolitan Sydney and Western Sydney.
- Predetermined and sequential development facilitating connection with surrounding areas and optimising public investment.

3.2 Key themes

Snapshot of the key themes identified to date as part of the evaluation process includes:

1. Federal and state economic development (indirect contribution)
2. Accessibility (transport planning responsibility)
3. Maximise economic contribution (indirect contribution)
4. Optimising public investment (indirect contribution)
5. Consolidation of key lands
6. Providing a variety of employment types
7. Staging (indirect contribution)
8. Context
9. Governance

3.3 Key objectives

The following provides a broad outline of the objectives for the site. This work is currently being refined by DP&I and will be progressively updated as part of the refinement process.

Objective #1: Federal and state economic development

- Capitalise on federal employment investment opportunities such as the federal freight network.
- Integrate the site into broader State infrastructure investment, in particular connection with ports and airports.
- Provide a spatial plan that responds to economic sectors targeted for national and state economic growth.
- Clarify governance infrastructure for the site ensuring that there is confidence and transparency in the development of the BWSEA.

Objective #2: Accessibility

- To provide an integrated land use and transport structure for BWSEA, ensuring efficient distribution and access to a variety of transport modes.
- To provide a clear transport hierarchy support efficient movement of goods and people.
- Ensure access to differential employment types and hubs.
- To ensure accessibility to planned and existing centres and services.

Objective #3: Maximise economic contribution

- To target land use that provides unique development potential within the context of the city, and responds to the aspirations of the Metropolitan Strategy.
- To concentrate employment activity around areas of high accessibility, amenity and infrastructure investment.
- To reflect broader national and state economic targets and sector development.
- To provide a clear hierarchy of uses responsive to the needs of anticipated workers, and visitors and site users.

Objective #4: Optimising public investment

- To coordinate layout of infrastructure building on existing networks and supply.
- To concentrate employment activity around areas of high accessibility, amenity, and infrastructure investment.
- To provide appropriate infrastructure at the appropriate time for the range of intended land uses.
- To phase facilities and essential infrastructure to serve employment functions as they emerge.

Objective #5: Consolidation of key lands

- To target employment land use that provides unique development potential within the context of metropolitan Sydney.
- To concentrate employment density around areas of high accessibility, amenity, and infrastructure investment.
- To develop and use land in an efficient manner, utilising principles of colocation and consolidation to minimise the uptake of land for utilities.
- To provide an integrated land use structure for BWSEA ensuring efficient distribution and access to a variety of land area and types.

Objective #6: Providing a variety of employment types

- To protect specific land parcels for various types of employment land development.
- Establish clear locational criteria for land use types to provide for a range of employment opportunities in BWSEA.

Objective #7: Staging

- Provide staged infrastructure ensuring appropriate facilities and services are available through the life of the project
- Federal, State and Local infrastructure roll out to be integrated into the overall timing for land development.
- Consider land ownership as a major opportunity and potential catalyst for stage development.
- Investigate flexibility in ownership structure to facilitate the staging and implementation of the plan.

Objective #8: Context

- Protect strategic corridors as defined by the structure plan in the context of broader state aims.
- Respond to broader environmental systems ensuring retention of habitats and natural processes.
- Generate spatial opportunities that respect existing natural processes and systems.
- Ensure integration of planned infrastructure with existing surrounding regional and local networks.
- Integrate federal level proposed uses and land holdings into the spatial planning for the BWSEA.

Objective #9: Governance

- Develop a clear implementation and management framework associated with the spatial plan.
- Structure Plan will require a Governance framework dealing with Local, Regional, State and Federal implementation issues and opportunities.

3.4 Key criteria and indicators

In order to inform the structure planning process and preferred option developed by AECOM, a set of assessment criteria was identified from the perspective of transport, access and land use planning. The criteria aims to cover a broad number of qualitative and quantitative factors to allow a broad assessment of the preferred option (refer to Section 5.0). The criteria has been developed to commensurate the high level strategic nature of the structure planning process to provide a clear 'top-down' view of the future transport needs for BWSEA. The assessment criteria are described in Table 3 below.

Table 3 - Assessment criteria indicators and measures

Item	Indicators	Measurement
Criterion 1: Integration of land use and transport	1.1 Maximise the proportion of employment areas within walking distance of transit service	This describes the potential to serve a large portion of existing and proposed employment areas. For the purposes of this study, the walking catchment of a rail station is 1200 metres, transit corridor is 800 metres and 400m from a bus stop.
	1.2 Optimise opportunities for delivering transit oriented development	Transit oriented development takes advantage of nodes on public transport networks by increasing density of developments and creating mixed uses in the more accessible locations. In turn, public transport provision becomes integrated with trip attractors and nurtures patronage and development in the corridor between them.
	1.3 Optimise transit staging to serve the short, medium and long term land release requirements	It is recognised that the study area will be progressively developed over the next 30-100 years. Ideally, the transport network would be able to be staged to match increase in patronage demand.
Criterion 2: Network Issues	2.1 Maximise potential for integration with existing and planned transport infrastructure	Transit infrastructure must be considered from an holistic viewpoint. Proposed infrastructure network must integrate within existing and planned networks.
	2.2 Support the strategic aims of the NSW Long Term Transport Master Plan	TfNSW have outlined their medium to long term plans regarding key transport infrastructure and strategic corridors (road, rail or freight). The ability for structure plan to work within this context and be flexible enough to achieve these outcomes.
	2.3 Maximise potential for strategic connections to the higher order road network to cater for trips with the site as well as those passing through the region.	As BWSEA further develops, increased pressure will be placed on the existing arterial road network. To this an appropriate level of network capacity and density of arterial roads will be required for the full range users of the road network, including car based local and regional trips, freight and commercial movements, public transport, walking and cycling.
Criterion 3: Impacts	3.1 Minimise impact on developable areas	Pockets of the study area have already been developed. Optimal solutions will minimise adverse impacts on these areas.
	3.2 Minimise impacts on areas of environmental significance	The study area has a number of water sensitive and green corridor areas. The integrated transport network needs to avoid or minimise impacts on these areas.
	3.3 Minimise land acquisition costs	Land acquisition can be a major cost component of road and transit provision projects. Alignments and corridors that pass over many fragmented lots can significantly escalate capital costs. A number of existing road corridors exist in the study area, which could be used and upgraded. Use of these could minimise project costs

4.0 Transport structure planning - key drivers

This section outlines the key transport planning considerations used to guide the structure planning process.

4.1 Land use and transport integration

The key objective of the land use strategy is to achieve better integration between land uses and public transport. Improved integration would be achieved by allowing higher densities and clusters of different land uses together around public transport nodes and corridors, such as around rail stations and high quality transit corridors. By allowing higher densities and a greater mix of land uses, including local employment, destinations are closer together, reducing travel distances. Higher densities would also reduce land consumption, support public transport services and reduce car use.

In developing the structure plan for BWSEA, therefore, it is necessary to:

- Recognise that land use influences transport patterns, and that land use and transport planning need to be implemented in a coordinated manner.
- Understands that different types and mixtures of land use will have varying effects on the demand for transport.
- Recognises the potential for higher densities and clusters of land uses around public transport nodes will promote increased use of public transport.

The following subsections provide guidance for the land use and transport structure.

4.1.1 Land use types

Land uses within the BWSEA will drive the design of the road, freight, and public transport network. The primary land uses will be related to industrial activities associated with goods distribution and some manufacturing. Commercial uses would be required to service the primary land use.

Residential uses are possible but would be complementary to the development of the area with the bulk of future residential growth occurring in the already defined South West and North West Growth Centres.

Some specific sites have been identified in the past which require consideration as part of the overall development of the area. These sites include:

- Commonwealth Land owned at Badgerys Creek which has been identified at various times as a potential location for a Second Sydney Airport Site.
- Aldington Precinct – A potential mix of employment generating land uses (office, retail and industrial) previously proposed for the eastern of the Aldington Precinct between Mamre Road and the M7 and north of Elizabeth Drive.
- Non employment related land uses including a proposal for Capitol Hill including a golf course and residential estate on 170 hectares with a local retail centre of around 4,000m^2. This site could also accommodate a range land use including integrated business and logistics facilities, services manufacturing, warehousing and a distribution hub.
- A golf course residential estate at Twin Creeks.
- Further development of the SITA Environmental Solutions Waste Facility off Elizabeth Drive.
- Other private sector proposals for individual sites.

Figure 32 shows the indicative land ownership of lots over 50 hectares within BWSEA.

4.1.2 Land use density

Caution over achievable land use densities needs to be expressed in developing the structure plan for the region. A key factor to attracting investment will be the opportunity for lower density industrial activities to operate without impediment. The road network in particular will need to be designed so that access to large lot developments is as efficient as possible to service limited number of developments within large areas. Higher density development will be limited to specific centres which require higher quality road and public transport access.

The density of the development will largely be driven by market requirements. Large warehouse distribution centres are typically low density developments with requirements for significant space to accommodate internal freight servicing movements. Provision of transport interchanges within major town and/or specialist centres with higher densities than traditional warehousing and manufacturing industries will assist in warranting a robust public transport system to support the sustainability of the region.

The location and design of these centres needs to incorporate accommodation of trip ends for transport routes via interchanges that can range from a simple dedicated layover for buses, to a more integrated public transport interchange with local retail and commercial facilities.

4.1.3 Location of centres

The locality of land use and the quality of infrastructure that surrounds it will have an impact on how people travel and the overall transport infrastructure needs together with success of any proposed incentives that are used to manage travel. A focus on centres, catchments, density and transport options for certain precincts within BWSEA will allow travel demand to be managed, support public transport services through the site and allow for the costs associated with infrastructure provision to be optimised.

The locality of freight and intermodal facilities is also critical to the management of movement and conflict, improving freight movement reliability and associated infrastructure needs. These types of facilities should be situated near to high order roads that are designed to accommodate freight and the metropolitan freight network and separated when possible.

The planning of the area should focus on the locality of land use and its precincts, its association with movement corridors, land use mixes and the need to travel and its impact on network reliability in the shaping of an appropriate integrated transport and land use solution for the site.

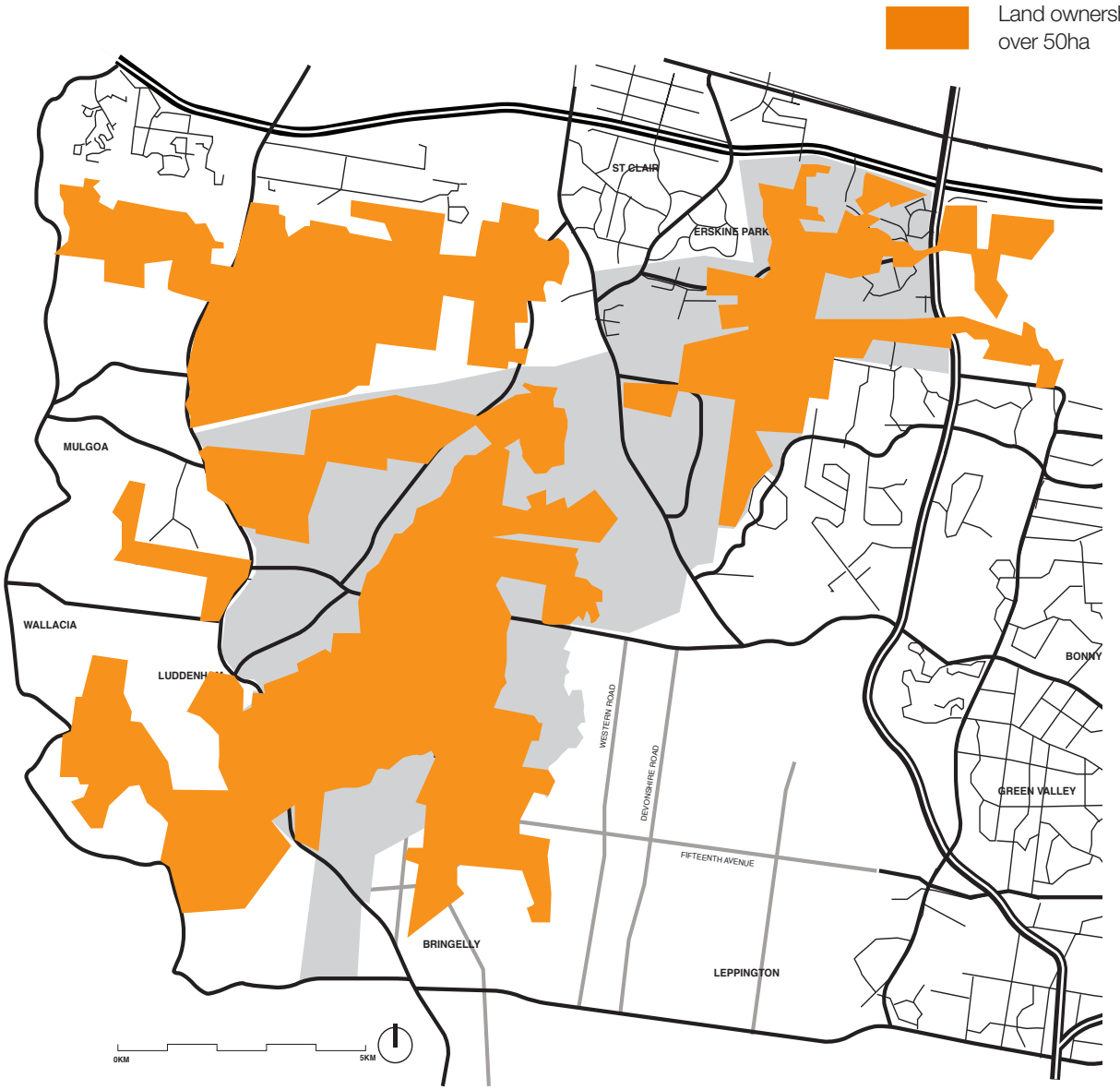


Figure 32 - Indicative land ownership lots over 50Ha

4.1.4 Land use and transport integration concept

A preliminary structural concept (refer to Figure 33) illustrates the potential development of corridors servicing employment use and centres for BWSEA. The structural concept positions key land uses and transport connections (orange area for intensive employment, light blue for less intensive uses and purple area for freight and industrial/manufacturing related uses) to complement established and planned transport infrastructure.

The facilitation of primary and secondary transport infrastructure and the optimisation of this through providing high quality connections to the M4, M7, Outer Sydney Orbital and other freight corridors.

Each option presented, considers conceptually the constraints of the site and the transport opportunities to support future potential anchor employment precincts. The alignment of transport and land use is discussed further in Figure 34, Figure 35 and Figure 36.

Creation of a series of potential desirable employment precincts serving different industry types within BWSEA. The intensity of employment land uses are shown by the orange and purple and should be directly related to the potential of the proposed transport network and the site opportunity and constraints mapping.

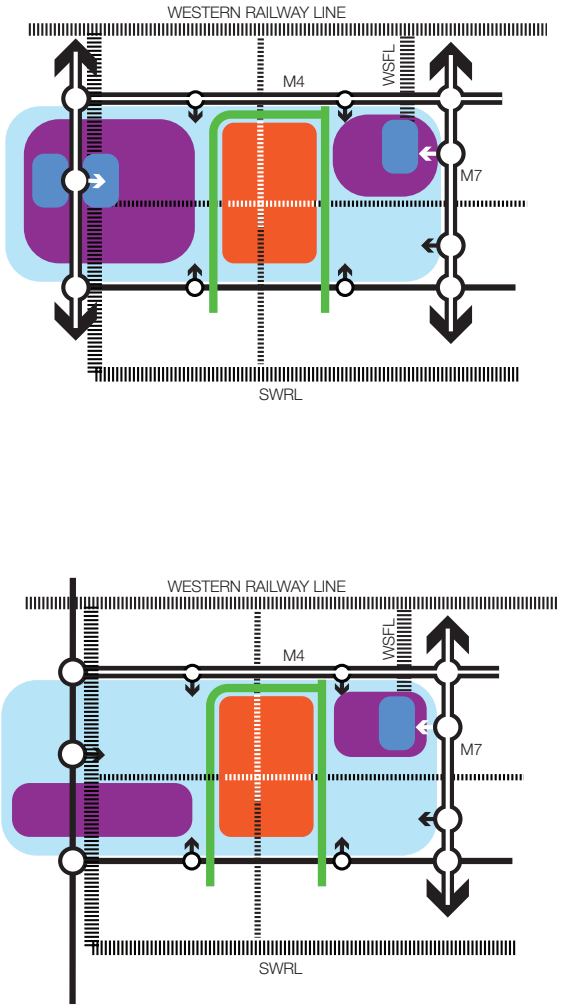


Figure 33 - Concept site structure plan options

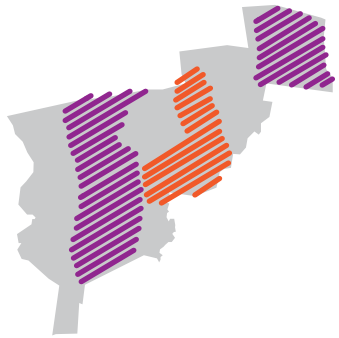


Figure 34 - Precincts and zoning concept

There is potential to establish both employment that attracts job density, as well as employment clusters that are reliant on access to the surrounding transport network. Figure 34 reflects the distribution of employment types across the site, the density and intensity of this usage reflects the investment in transport infrasture i.e. higher intensity and higher usage will reflect a higher level of accessibility.

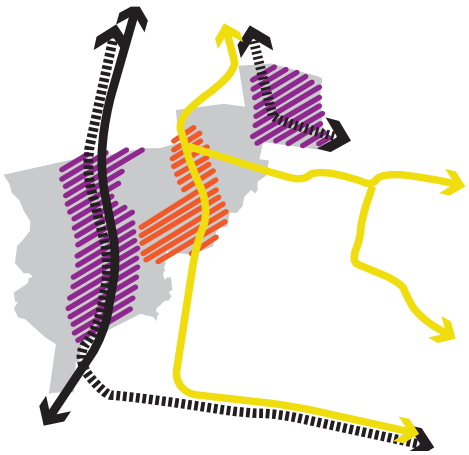


Figure 35 - Employment precincts and public transport concept

Figure 35 broadly demonstrates precincts are structured to focus on external connectivity needs and corridor functions. Establishment of key strategic transport corridors linking proposed employment precincts with the proposed Outer Sydney Orbital. Transit network coverage is represented in yellow and provides efficient links to surrounding centres and regional transitway corridors on the eastern fringe.

The reservation of a potential mass transit corridor that extends from the current SWRL and will be dependent on the land use it serves and density.

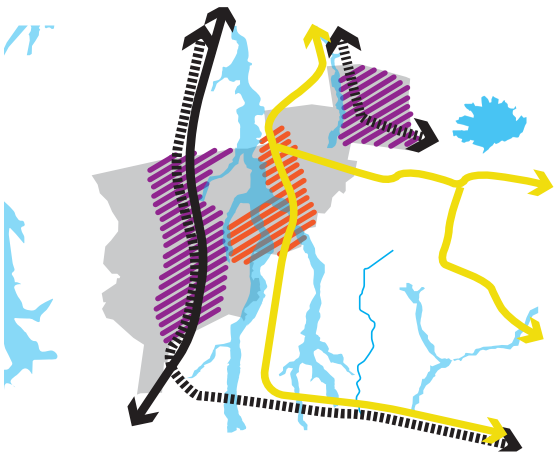


Figure 36 - Freight corridors and precinct concept

Figure 36 shows potential freight precincts and corridors represented in black and provide access to north-east via the planned Western Sydney freight line and south-west precincts offering highly desirable accessibility opportunities. The north south freight corridors has the potential to be extended to both the south and north to serve more longer term needs associated with port access and freight access through the Sydney metropolitan freight network.

4.2 Public transport network structure

The primary objective for the public transport network structure is to provide surrounding residents and commuters with an accessible and efficient travel alternative to the car. This means improving the frequency, speed and reliability of buses and trains, through increased co-ordination, improved facilities and better priority. More attractive public transport for BWSEA will provide an alternative means of accessibility than the car, and thus can help to reduce the environmental and social impacts of car dependence which currently exists.

In developing the structure plan for BWSEA, therefore, it is necessary to:

- Understand the local and regional public transport needs; balance and integrate them with the needs of the broader public transport networks.
- Focus on the users of the public transport services, and plans and operates public transport to best serve the users.
- Provide public transport links in such a way that they run through the core of development rather than along arterial roads.
- Recognises that as the intensity of development increases, it will be increasingly important to capture a higher proportion of trips on public transport in order to slow the rate of growth in general traffic and to manage congestion.
- Reserve corridor space to accommodate transport routes and corridors as highlighted in the NSW LTTMP.

The following subsections provide guidance on the public transport network structure planning parameters.

4.2.1 Focus on people

The provision of a public transport service that is sufficiently attractive that people choose to use it, that the transport and access objectives (and development ambitions) of BWSEA can be achieved. Public transport cannot compete with private vehicles in all cases, but can be highly competitive for a sufficient proportion of trips to maintain the required levels of access.

A key objective of the public transport network serving the BWSEA is to provide access for more people, more efficiently, on the available transport corridors, thus reducing impacts on the traffic network, which is far less efficient in carrying high volumes of people within a constrained corridor.

The key to achieving the required mode share to public transport is to understand and respond to the needs and expectations of the people that will (potentially) choose to use the public transport network.

This is a critical shift in thinking about transport planning: every decision and consideration needs to focus on the aim to attract people to using public transport.

4.2.2 Integration with land use

Fundamentally, public transport serves and is served by land use. The public transport network structure must therefore be developed in such a way that reflects the land use structure and vice versa.

A public transport system's utility, efficiency and potential to achieve its mode share targets is dependent on the degree to which it integrates with the land use it serves at the regional, local and detail design levels.

For transport planning (and public transport in particular), residential and employment densities constitute a crucial planning parameter. Trip generation is largely dependent on land use and intensity of development, which is measured by density of population or employment. In essence, density constitutes a critical 'third dimension' of spatial planning.

The benefits of an integrated land use and transport planning process with respect to new and redeveloping urban areas include:

- Co-location of key facilities, shops and other trip attractors along bus routes and at central points where several services converge, making it easier to access local facilities for residents and commuters.
- Faster and more efficient bus routes, serving areas without undue deviations through outlying areas with limited through road connections.
- Earlier introduction of public transport services, rather than relying on passenger demand to grow in the absence of an attractive service.

4.2.3 Network structure - interconnected grid

The public transport network ideally constitutes a 1 - 1.5 km interconnected grid structured on public transport transfer nodes. The links are preferably slightly closer together on radial routes (i.e. towards centres) and slightly further apart on cross-town routes.

This structure offers a high level of redundancy in the public transport network, which improves options and choices to users as well as the robustness of the network structure and operations to respond to evolving needs.

4.2.4 The importance of anchors

Transit lines are much more efficient if they run between anchors. An anchor is anything that gives many people a reason to use a line all the way to its endpoint. Good anchors generally comprise an area of intense land use but could also incorporate (and benefit from) a transfer node, where other elements of the transit network can feed the line.

A transit line serves two different functions. It covers an area, and it also connects points. In planning transit lines, the ends of the lines are especially critical.

Along the middle of a line, people from many origins are on the transit service, heading to the many different destinations that the line serves. As the service approaches the end of the line, however, it is useful to reach fewer and fewer destinations. Ridership tends to drop off towards the ends of lines accordingly. If a line were placed on a uniformly developed area without any special nodes of intense activity, the number of people on a bus or light rail as it travelled along the line could be expected to follow a bell curve distribution, with ridership highest in the middle of the route and lower towards the ends.

In the case of BWSEA, there are a number of potential anchors, depending on the scale at which the development is viewed. BWSEA itself could be considered an anchor at the regional level. The public transport network for BWSEA would be anchored in north by the Western Railway Line, to the east by Liverpool to Parramatta Transitway and the south by the South West Rail Link (currently under construction). Proposed transit interchanges and all railway stops could be viewed as a strong anchors, refer to Figure 37.

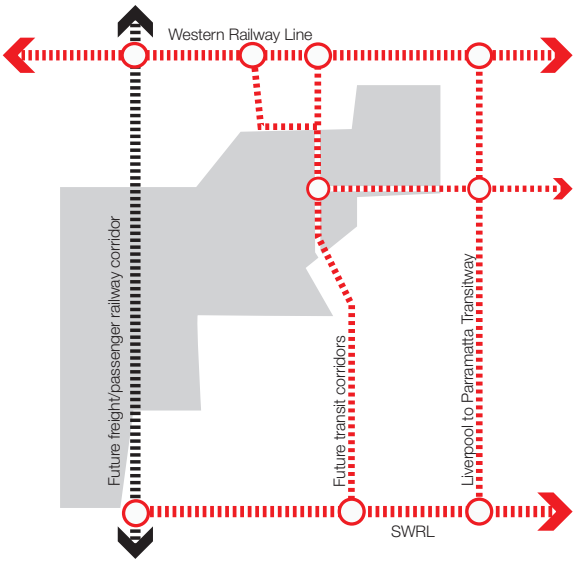


Figure 37 - Public transport corridors and anchors

4.2.5 Network legibility

Legibility (in this context) refers to the ease with which users can understand the public transport system (including its structure and the different service products it provides). It has been said that if the first and second tier public transport network cannot be easily understood, it will not be easy to use. A good guide is that if the network routes and service characteristics of a quality public transport system can be easily presented on a map, then the community that it serves will readily adopt the public transport system.

4.2.6 Route network alignments

Route alignments play a critical part in achieving high operating speeds and good levels of reliability for public transport. Two examples are:

- Tight curves (whether mid-block or at intersections) necessitate the slowing of public transport vehicles.
- Turns at intersections not only have a speed penalty but generally necessitate more complicated signal phasing, making it more difficult to provide operational priority to public transport vehicles while also having more significant impacts on the private traffic network.

As a result, alignments on the first and second tier public transport network should only make turns when required from a network structure perspective. They should not be planned to make arbitrary turns to 'fit in' with plans that have failed to adequately consider public transport requirements.

4.2.7 Relationship with planned transport infrastructure

The planning for public transport needs to be consistent with current State Government planning and consider the potential of the site beyond the current State Government strategy planning horizon (2031). The structure planning options need to consider the primary public transport options for serving the site, which will be driven by the need to service select land use types, centres and density, crossing opportunities and the connectivity with the surrounding region.

NSW Long Term Transport Master Plan (TfNSW, December 2012) outlined a strategic plan for the provision of transport services and infrastructure in the Sydney Metropolitan area. This document identified two core public transport corridors for investigation and improvements. They are:

- Erskine Park Road – Roper Road – Carlisle Avenue: Orchard Hills to Mt Druitt (pinch point corridor)
- Mamre Road: St Mary's to Kemps Creek (new corridor)

These primary bus corridors should be designed with consideration of the need to plan for the future and the possible need for transit style boulevard, bus rapid transit and light rail connecting with the west and south.

When designing a long-term bus network, network legibility and route design are the primary guiding criteria. The South West Sector Bus Servicing Plan (February 2009) identified planning criteria for the provision of services that are applicable to the Broader Western Sydney Employment Area.

Three criteria relevant to the structure planning for the employment lands are:

- Network Legibility – Peak and off-peak services should use the same route wherever possible.
- Route Design – Regional Routes to be between 10 and 25 kilometres in length. Routes to be between 30 and 60 minutes in duration. Maximum diversion from the fastest or shortest route (between termini) to be no more than 20%.
- Patronage - Peak period patronage to be in the range of 50% (25% at other times) seated capacity and 85% of the legal bus capacity (averaged by the number of trips operated during any 20 minute period) at maximum load point.

Figure 38 shows the strategic routes of a restructured bus system for Sydney in 2031, representing the Mass Transit and Intermediate Transit levels for buses. The network will operate to a high frequency to service cross-metropolitan travel needs.

The opportunity for the introduction of a primary public transport corridor is supported by the following:

- The designation in the NSW LTTMP for a proposed extension of the core bus network through the site by 2031.

- Related feeder service route opportunities to the east, which provides connection to the existing Liverpool to Parramatta transitway (extension to an existing strategic route and access to two regional cities).
- Related feeder service route opportunities to the west, which provides connection to the existing strategic bus routes between Penrith city (regional city), WELLS precinct and Mount Druitt (rail network).

Possible public transport corridor reservations to also be considered of regional and national importance are:

- The Outer Sydney Orbital also provides an opportunity for a public transport corridor, however this is not defined in any strategy at this point in time, and its need is likely to be required beyond the current State Government planning horizon (2031).
- Similar the need for a light or heavy rail connection is not currently understood and no new rail connections are identified beyond what is stated in the current planning for the North West and South West growth centres.

Some preliminary investigations have been undertaken into the extension of the South West Rail Link and North West Rail Link (via Richmond Line), which highlighted that an extension of the line through the western section of BWSEA.

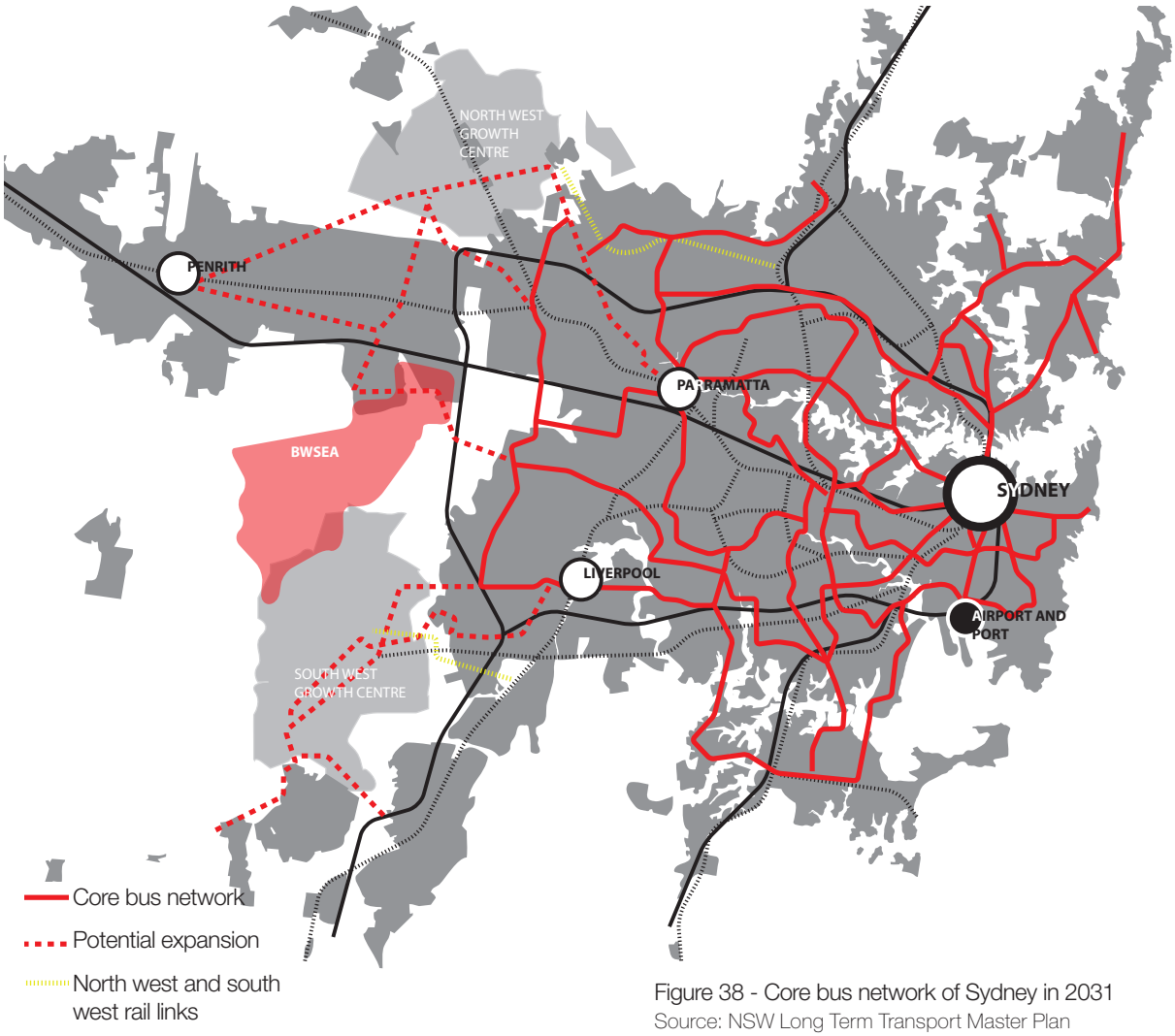


Figure 38 - Core bus network of Sydney in 2031
Source: NSW Long Term Transport Master Plan

4.3 Road network structure

The key objective of an integrated road network structure for BWSEA is to effectively cater for a variety of trip purposes while managing the impacts of roads on the community. The structure and strategy should ensure the road network provides safe and effective access by the full range of road users, including public transport, pedestrians and cyclists, private vehicles, freight and service vehicles.

In developing the structure plan for BWSEA, therefore, it is necessary to:

- Consider how the travel task and demand patterns of the region will change from the current ones.
- Carefully plan the regional and local transport network in such a way that reflects both these interrelated elements of the travel demand.
- Provide an integrated approach to road network planning and management across the various categories of roads such as local, regional, state and national roads.
- Understand the function of roads can vary along their length according to movement and access functions, and therefore objectives and tools for management should also vary.

The following subsections provide guidance for the road network structure.

4.3.1 Road corridor cross sections

Road corridor cross sections are too often defined based only on their role in the traffic network. This neglects a range of other roles in the overall transport-land use system. As an example, it is important to consider the following situations:

- An arterial road fronting an industrial area with land uses requiring high levels of vehicular access.
- A sub-arterial road fronting a mixed use area on one side and an industrial area requiring high levels of people access on the other.

The difference between the cross sections is far greater than simply the difference between a arterial and sub-arterial road. It extends to provision for public transport corridors, how frontages are dealt with, provisions for pedestrians and cyclists etc.

Figure 39 to 42 show typical cross sections adapted as part of the South West Growth Centre Road Network Strategy.

4.3.2 Roads with transit links

Roads with public transport links running along them should be the location of land uses with the highest degree of 'mixed useness' as well as the highest intensities. On this basis:

- Transit lines should run through the core of development.
- It is critical that they constitute attractive and active pedestrian environments. This incorporates good levels of pedestrian connectivity to and along the public transport links.
- The highest intensity development should be located in the areas closest to the public transport system as these will be the areas where the highest mode shares to public transport will be achieved. This 'immediacy' between development and public transport is thus crucial.
- Although areas in close proximity to public transport require high levels of pedestrian amenity (which would incorporate well-designed pedestrian spaces and landscaping), they are rarely the appropriate location for regional open space corridors, which would tend to break down the immediacy between land use and public transport.

4.3.3 Major roads without transit links

Major roads without public transport links running along them should be the location of land uses requiring high levels of access by vehicles but lower levels of generation of person trips. On this basis:

- Arterial roads should run around development parcels. Land uses requiring high levels of vehicular access should be located along the arterial road network. Access to major parking facilities should be located on the arterial road network.
- They should provide effective and efficient road access but at the same time they should provide at least the basic standard of pedestrian facilities, including footpaths, safe crossings and connectivity.
- They should allow for grade separated road interchanges at motorway connections and be located in areas of low land values as they have a significant negative impact on surrounding land uses and require a significant area of land.

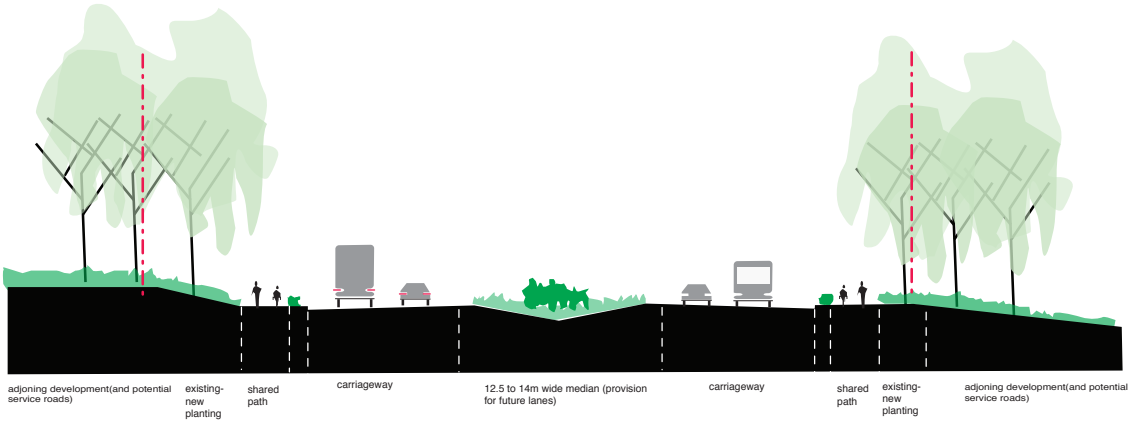


Figure 39 - Principal arterial typical cross section

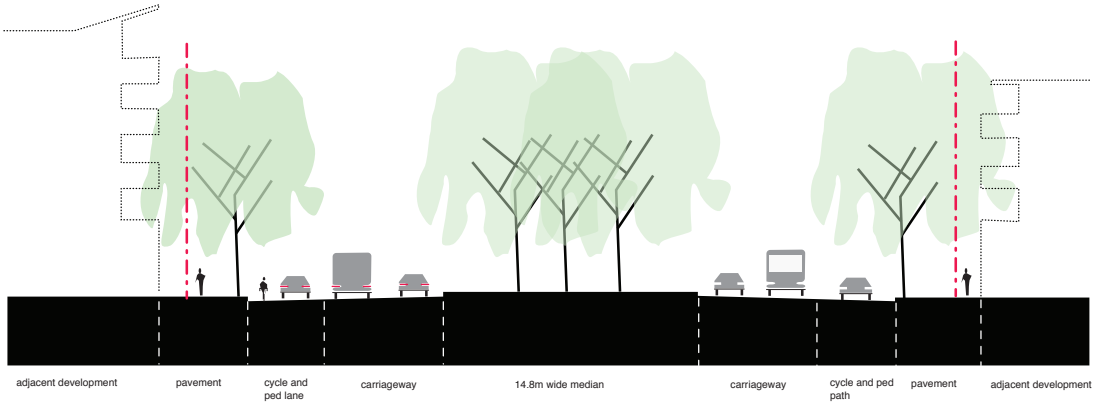


Figure 40 - Transit boulevard typical cross section

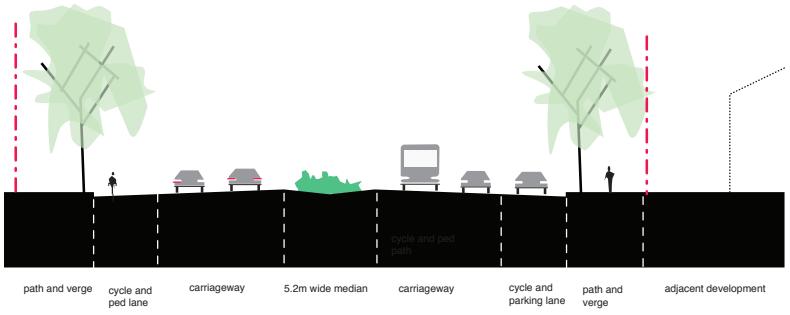


Figure 41 - Sub arterial (4 lanes) typical cross section

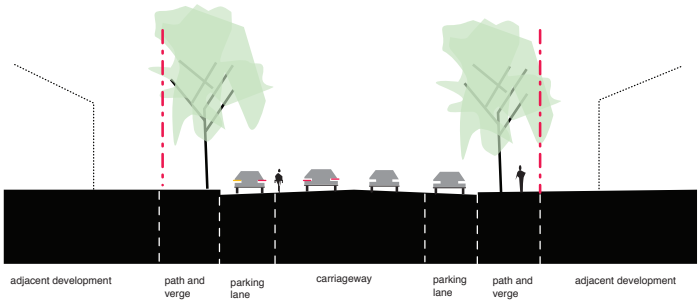


Figure 42 - Sub arterial (2 lanes) typical cross section

Source: South West Growth Centre Road Network Strategy

4.3.4 Road hierarchy for industrial areas

The future road hierarchy to be defined for the BWSEA should align with the road hierarchy set out for the South West Growth Centre. As these two development areas are neighbouring this provides an opportunity for a consistent road network and may support efficiency in asset management and infrastructure provision.

The road hierarchy is based on four categories of major road, each offering a differing balance between transport and land use function to help reduce the number of conflicting priority movements. These four categories are Motorways, Arterials, Sub- Arterials, and Transit Boulevards. A conceptual view of this accessibility hierarchy is presented in figure 43, whilst Table 4 presents the general requirements of each road type included in the road hierarchy.

The arterial roads will provide the main access routes within, into and out of BWSEA carrying both freight and commuters. Transit boulevards and sub arterial roads should link to the principal arterial network and provide more of a community focus and structure for the development of the built environment.

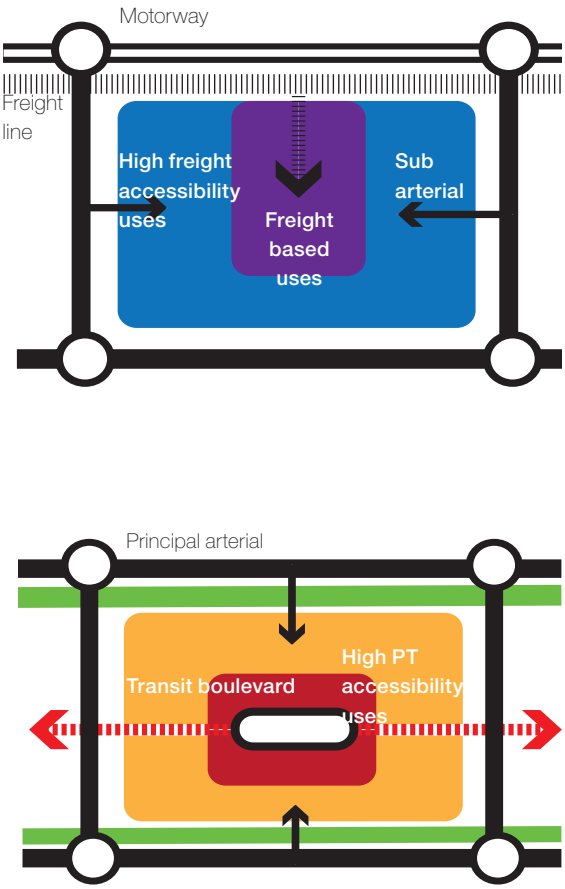


Figure 43 - Conceptual hierarchy illustrating land use relationship with transport infrastructure
Source: South West Growth Centre Road Network Strategy

4.3.5 Road type definitions

The definitions of each key road type that will be required to be considered as part of establishing a road network strategy for BWSEA is provided below.

The RMS Network and Corridor Planning Practice Notes provide a basis definition for roads within a study area. Functions relevant to the BWSEA are:

Motorways

Motorway are the highest form of arterial road that are considered separately due primarily to traffic function and strict access control via grade separated interchanges. Motorways provide high speed transportation and serve regional movement trends with signposted travel speeds of up to 110km/h. They interface with the arterial road network through grade-separated intersections (interchanges) and access is restricted. It is generally desirable to provide adequate spacing between interchanges along the route with a design profile from interchanges of every 3km to 5km. It is also highly desirable to provide adequate spacing between parallel routes to allow for a lower order network to evolve and effective service surrounding land use.

Arterial roads

Arterial roads provide major regional and inter-regional traffic movement in a safe and operationally efficient manner. They provide the link between motorways and the sub arterial road system and serve regional commuter and freight movement. The signposted travel speed is typically 80km/h or 70km/h and is largely dependent on its transport function and is impacted by centres and access from frontage property. Access is typically controlled through the rationalisation of intersections and conflict is managed through signalisation or grade separation.

It is noted that commercial, industrial access requirements and public transport initiatives need special consideration in developing network management strategies for arterial roads. Access to land is generally limited on modern arterial roads.

The balance between traffic function and access should favour traffic movement, focusing on capacity and congestion management.

Table 4 - Accessibility for road types

Functional classification	Limitations to direct access	Length of trip served	Need for continued traffic mobility	Service to adjacent land
Motorways	Very High	Long	Very High	No Direct Access
Arterial Roads	Partial Controls on Access	Moderate to Long	High	Limited Access from Travelled Way. Service roads used for abutting landuse
Sub-Arterial Roads	Limited Controls on access	Moderate	Moderate	Access to adjacent land more important but limited where possible
Transit Boulevards	Limited Controls on access	Moderate	Moderate	Access to adjacent land more important but limited where possible
Industrial Roads	No Controls on Access	Short	Low	Important

Sub-arterial roads

Sub-arterial roads of a higher order serving the BWSEA provide a support role to the surrounding urban arterial roads for the movement of traffic during peak periods and access for freight. They provide the link between the arterial road network and industrial roads servicing he subdivisions within the employment areas. They distribute traffic and bus services between the surrounding road network and the commercial and industrial zones.

Two additional category of roads are relevant to the BWSEA. They are transit boulevards and Industrial Roads as defined below.

Transit boulevards

Transit boulevards provide for dedicated bus priority along routes within the developed area. They connect with arterial and sub-arterial roads, with posted speeds of 60km/h and 50km/h. They access to a mix of transport and land service function in varying degrees along their lengths. These public corridors are strongly associated with residential and commercial activities to support public transport and vice versa.

Industrial roads

Industrial Roads are the remaining rods within the employment areas providing direct access to businesses. They are generally wider than local roads within residential areas and are designed for freight movements. The road networks for industrial roads do not form part of the Structure Plan as they are a subset better defined with sub-division of lands and the development of DCPs for the area.

Table 5 presents accessibility criteria for the various road types defined for the BWSEA. Table 6 presents typical characteristics.

Table 5 - Typical characteristics of road types

Functional classification	Posted speed limits	Design capacity (veh/hr/ln)	Lanes (each way)	Intersection spacing	Road reservation width*	Median	Cycling
Motorways	100 to 110	1800	2 to 3+	3 to 5 km	80-120m	Wide	Off Road
Arterial Roads	80	1400	2 to 3	1 km	45-70m	Wide	Off Road Adjacent
Sub-Arterial Roads	60 to 80	1200	1 to 2	0.5 km	+/-45m	Up to 5 m	On/Off Road
Transit Boulevards	60	1200	1 + transit lane	0.5 km	35-45m	Up to 5 m	On/Off Road
Industrial Roads	50	800	1	n.a.	30-35m	No Median	On Road

* Indicative widths provided (subject to further investigation)

Road hierarchy for freight activities

The "Metropolitan Road Freight Hierarchy on the State Road Network Practice Note" (DoT) defines Greater Metropolitan Area Road Freight Hierarchy criteria for use in transport planning for the major freight routes in Sydney's Greater Metropolitan Area. State roads used for freight are categorised as:

- Primary - Connect regions, and services strategically important ports, airports, industrial areas, freight terminals, intermodal terminals and hubs.
- Secondary - Connect within regions, and services significant clusters of major business and freight origins and destinations within a region.
- Tertiary - Connect within major subregion, and services groupings of business and freight origins and destinations.
- Other State Roads - Connect generally, and services within a subregion general freight needs within a locality.

Based on the criteria classifying these roads are summarised in Table 6.

Table 6 - Greater metropolitan area road freight hierarchy.
Source: Metropolitan Road Freight on the State Road Network Practice Note

Criteria	Primary	Secondary	Tertiary	Other state roads
Heavy vehicle volumes (AADT)	> 4,000	1,000 to 5,000	200 to 2,000	-
Light commercial vehicle volumes	Very high	High	Medium	Low
Spacing (km)	Approx. 5 km	2 to 4 kms	1 to 3 kms	-
Number of lanes	4 or more	4 or more	2 or more	2 or more
Intersection treatment	Grade separated or traffic signals	Traffic signals	Roundabouts or uncontrolled	Uncontrolled
Speed limit (km/h)	60, 80, 100, 110	60, 80	60	60

4.4 Freight network structure

The key objective of an integrated freight network structure for BWSEA is to effectively offer opportunities for safe and efficient movement of freight by road and rail to and from the site. The structure and strategy provides opportunities for both the rail and road network to effectively connect with the surrounding regional network and internally provide direct, safe and appropriately designed access points and routes to key anchor precincts, such as intermodal terminals and industrial precincts.

To achieve this through the development of the structure plan for BWSEA, it is necessary to:

- Maximise access opportunities that are available from the regional rail and road networks that can be designed to accommodate freight.
- Situate land uses that are mass attractors of freight near to key freight moving facilities, such as motorway interchanges and rail corridor limiting travel distances and conflict points.
- Develop opportunities to improve and support the freight task by reserving corridors for freight to improve efficiency at a regional level and to surrounding catchments.
- Consider how freight demand and the travel task across the region will change from the current situation.
- Offer opportunities for the transporting of freight by road to rail by identifying potential sites for intermodal terminal facilities.
- Provide an integrated approach to connecting freight facilities and land use to the regional rail and road networks in a manner that will help support future growth in freight at a local, regional, state and national level.
- Provide a road system that minimises conflict between pedestrians/cyclists and heavy vehicle movements.

The following subsections provide guidance for the freight network structure.

4.4.1 Road freight network

The future road hierarchy to be defined for the BWSEA should align with the surrounding freight movement network and heavy vehicle demand corridors identified in the NSW LTTMP. As both the regional and BWSEA transport networks develop it provides an opportunity for consistent freight networks and corridors to evolve and allows for efficiency in the management of assets and the staging of infrastructure.

Major roads that have a designated freight corridor function are typically situated in locations that connect land uses that require high levels of access by goods vehicles with the major freight movement corridors. These corridors typically have a lower need for access by public transport, active transport, general traffic and commuters. On this basis:

- Arterial roads with a high freight function typically offer short direct routes between motorway interchanges and anchor freight facilities and industrial precincts.
- Land uses requiring high levels of freight vehicular access are typically located adjacent to a primary road and rail freight movement corridor and situated within easily access of an arterial road designated and appropriately designed to accommodate freight.
- The plan should provide effective and efficient road access and at the same time provide at least the basic standard of pedestrian facilities, including footpaths, safe crossings and appropriate connectivity with the surrounding network.
- Corridors with a freight function should avoid conflict with centres and other areas likely to attractive high levels of urban activity or are sensitivity to noise.
- A connected road freight network should allow for direct grade separated road interchanges at motorway access points and be located in areas of low land values as they are likely to have both negative impact on surrounding land uses and require a significant area of land.

4.4.2 Road corridors with freight functions

Road corridors with a freight function should be designed around the following key principles:

- To function as an arterial road for regional access purposes or in the case of access from surrounding precincts to function as a sub arterial or a higher order route.
- To serve as a short section of high order road that provides a direct link between either a motorway or surrounding industrial precinct, intermodal terminal or freight logistics precinct.
- Offer a legible route that is easy to signpost from grade separated motorway interchanges and visible provides an efficient access route for regional freight.
- Avoid steep gradients and significant curves, and provide adequate sight distances to points of conflict.
- Accommodate high mass vehicles, such as B doubles or super B doubles.
- Control conflict along the arterial road network through the provision of signalised intersections and appropriately designed slip lanes.
- Accommodate industrial type land use frontages, avoid direct access from isolated sites and provide high order road connections from industrial precincts to help concentrate and minimise the number of potential conflict points.
- Provide separated cycling and pedestrian pathways to promote safety.
- Avoid having the freight corridor along bus routes, and adjacent to residential areas, schools and service centres.

4.4.3 Freight rail network

Freight movement along the rail network is primarily impacted by a lack of appropriately designed facilities and the network being shared with passenger rail in the metropolitan rail network. When the network is shared in urban areas the priority is given to passenger trains above freight, which is held at designated areas of the network until network capacity becomes available.

The purpose of the rail freight network within BWSEA is to:

- Make our transport systems more efficient and better integrated by offering direct and safe access to the regional freight rail network.
- Provide efficient connectivity from planned land use to ports and key markets.
- Offering a potential future corridor and connection options to the existing and planned freight network.
- Bring together two modes of transport to offer opportunities to switch goods from road to rail on to the next step in the supply chain.
- Offer the potential for additional intermodal terminals that can address national policy solutions in relation to both a rail shuttle connecting ports handling interstate rail.
- Offer opportunities for the creation of flexible and commercially viable and appropriately designed terminals to attract users.
- Assist Sydney in the handling of predicted container growth passing through Port Botany from approximately 2 million today to as many as 7 million containers by 2030.

The strategy to address capacity and operational constraints in the freight network is reserving designated strategic freight corridors and developing a network of new intermodal terminals (IMTs), which can facilitate the efficient movement of freight by rail. Planned improvements currently being advanced and delivered focus on a 20 year horizon, freeing up capacity on designated corridor and consist of the following projects (refer Figure 44):

- Southern Sydney Freight Line (SSFL) a single dual directional freight rail line separated from the passenger system, operational since January 2013 and is understood to have limited spare capacity which is reserved for Moorebank and Enfield IMTs.
- Third container terminal and supporting rail facility improvements at Port Botany.
- Enfield and Moorebank IMTs.

- Northern Sydney Freight Corridor (NSFC) a shared line built within an existing corridor that is being delivered in stages and expected to reach capacity by 2028.
- Port Botany Rail Line improvements with the first stage opening in 2014 to provide capacity enhancements through resignalling, Botany Yard rationalisation, grade separation and additional tracks.
- Western Sydney Freight Line (WSFL) is currently at early stage of planning and directly effects the BWSEA. It comprises a connection to the Main Western line and requires connection to SSFL. The alignment of the corridor experiences potential funding, built environment and future network capacity constraints that still have to be resolved if port access is to be achieved.
- Maldon to Dombarton rail line offers an alternative and more direct rail freight access route from the Main Southern line to Port Kembla. It has potential capacity limitations due to steep gradients and tunnels and currently relies on the SSFL for access from Sydney.

The above projects address the shorter term needs for Sydney and allow for more freight to access the port from specific freight corridors. These capacity improvements are unlikely to satisfy demand beyond 2030 and don't currently address the access requirements by rail from BWSEA to ports.

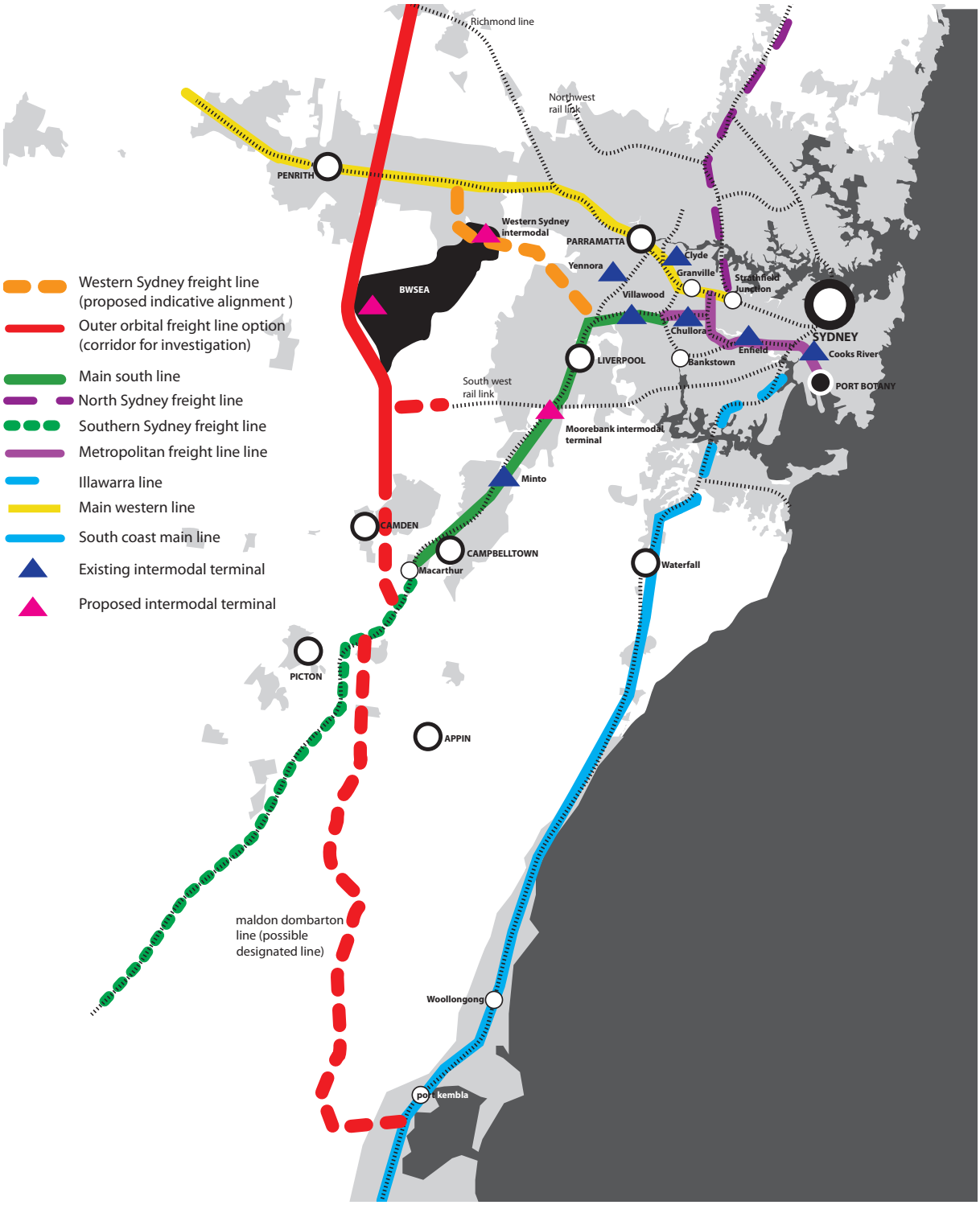


Figure 44 - Metropolitan freight network

4.4.4 The need and characteristics of intermodal terminals

Forecasting conducted indicates that the number of containers passing through Port Botany would at least double and could even treble depending on the strength of future demand. It is estimated that by 2030, container traffic would reach 7 million containers and the cap of Port Botany and its associated infrastructure will impact on Sydney's ability to achieve a 28% freight mode share target. Over 30% of this demand could be destined for the BWSEA catchment and as a result of increasing pressure on roads, intermodal terminals (IMT) form part of the freight solution that will help to better manage road freight and shift goods from road to rail.

The analysis completed as part of the structure planning process is based on available market predictions and identifies the need for two IMT situated in the north east and west sections of BWSEA structure plan. This finding is based on unconstrained estimates and continuation of historical growth trends, which may change as a result of time, market conditions and the further restructuring of the economy.

The market and estimated growth beyond a 20 year horizon in the current context is difficult to visualise and plan, especially when the size of the network constraints, funding needs and change in industry structure are considered. However, the need for two IMT in the locations identified with the allocated associated facilities are appropriate at this stage in the planning process

The modern IMT is not a stand-alone facility, but a composite business incorporating a number of varied activities, which are essential to the overall viability, competitiveness and efficiency in providing an acceptable alternative to direct road transport. The activities required in broad terms include:

- Rail access and handling facilities
- Road access and handling facilities
- Logistics facilities including warehouses/ distribution centres

Key operator characteristics of intermodal terminals

The NSW Sea Freight Council produced a document dated 8th March 2004 and titled *"Regional intermodal terminals, indicators for commercial sustainability"*. The appendices for this report highlights time sensitivity issues associated with the operation of typical intermodal terminals, which should be used in the planning of intermodal terminals.

The document indicates the following observations from the transfer of goods via such a facility:

- Rail has the ability to move more weight per vehicle journey than that offered by road.
- Multiple handling activity of intermodal operations means that time sensitivity can be an important service issue, affecting the viability of rail for perishables and the competitive movement of consumer goods.
- Storage, internal movement and sorting are an important component of this type of facility.
- Rail is particularly sensitive to rail line height restrictions, the number of rail services and the quality of the rail line, which impact on the availability of the line and journey speeds.
- Goods that are attracted to rail are likely to be transported in large quantities and stored for longer periods than those that are typically transported by road.
- Reserved land for rail terminal to receive, unload/load and dispatch domestic container trains (900m intra-state and up to 1800m inter-state trains).

Spatial requirements

From a spatial perspective in terms of the reservation of land and corridors, the current integrated land use and transport network structure appears to realise and acknowledge the short, medium and longer term opportunities the site can offer. It achieves this by making allows for strategic north-south corridors, offering direct connections to Wetherill Park, preserving a freight corridor to the east that connects to the Main Western rail line and making allowance for alternative connection options to Port Botany and Port Kembla. This is supported by the positioning of intermodal terminals in proximity to existing and planned strategic transport corridors and industry clusters.

In terms of intermodal terminals (IMT), each activity has different criteria for land area and positioning within the IMT. Critical infrastructure must be accommodated and provision for supporting facilities with long term parameters used to size the IMT. Based on 1 million TEU throughput, a port IMT would have an area size of 90 hectares and a facility with just domestic function can be reduced to approximately 70 hectares.

Key infrastructure elements that support an IMT include:

- Rail sidings (arrival/departure, marshalling and load/unload for 600m trains).
- Reserve load for rail terminal to receive, unload/ load and dispatch domestic container trains (900m intra-state and up to 1,800m inter-state trains).
- Hardstand areas for loading and unloading and storage.
- Empty container storage, cleaning and repair yards.
- Reserved land for warehousing and distribution centres.
- Road access and internal roadways.
- Services - water, electricity, telecom, lighting, sewer and stormwater/ drainage.

4.5 Active transport network structure

The primary objective of active transport is to encourage greater use of walking and cycling as a means of transport and recreation within BWSEA. Walking and cycling are valued due to their low cost, low impact, wide suitability and health benefits. Safety is also an important element for walking and cycling, with improved layouts required at intersections and provision of walking and cycling paths that are protected from road traffic. The active transport network also needs to be integrated with the land use, road network and public transport network to assist access to existing and potential bus and rail networks.

In developing the structure plan for BWSEA, therefore, it is necessary to:

- Provide quality pedestrian and cycling environments around transit corridors and facilities.
- Understand the key walking and cycling needs in the region and the need for the separation of pedestrians and cyclists from motor vehicle traffic.
- Recognise that all trips involve walking at either the beginning or end of the journey, resulting in the need for connections between parking and public transport areas and destinations.
- Recognise that walking and cycling paths can form key routes between destinations.
- Understand that walking and cycling trips perform a variety of functions, not only travel from an origin to a destination, but such trips are also undertaken for recreation and/or health benefits, which can be influenced by the amenity of the route.

The following subsections provide guidance for the active transport network structure.

4.5.1 Integration with current and future infrastructure

The BWSEA currently has limited cycling facilities with the exception of a shared path along the M7 alignment and a planned shared path along the northern side of the Erskine Park Link Road from Lenore Lane, Erskine Park to Old Wallgrove Road, Eastern Creek. The Western Sydney Parklands contains provisions for recreational cycle travel. Liverpool Council has installed an extensive bicycle network for its residential precincts to the east of the BWSEA. These routes can feed into the future bicycle network within BWSEA.

It is envisaged that bicycle storage facilities / spaces will be provided near key transport interchanges for commuters. Development sites would also be expected to provide for bicycle parking. It should be noted that storage facilities are particularly required at interchanges where a cyclist rides from home to a public transport service that completes the “Journey to Work” trip. These locations where bicycle storage is required are typically located on the perimeter of the BWSEA at future bus interchanges at locations such as Mount Druitt, Leppington, and Liverpool.

Bicycle parking will also be provided throughout the proposed centres as an integral part of the streetscape.

4.5.2 Integration with other transport modes and urban planning

Pedestrian and bicycle plans cannot be considered in isolation from other forms of transport and urban planning. This applies to the integration of pedestrian and bicycle plans with access to existing and potential bus and rail networks, and with the encouragement of higher density, mixed land-use developments. The later is particularly important if shops and services are located close enough to walk or cycle to. Urban design also plays a role in achieving satisfactory pedestrian and bicycle plans. Residents must be able to walk or bicycle to shops. Pedestrian and bicycle plans also need to encourage access to bus stops and rail stations.

4.5.4 Feed transit nodes

Pedestrians must walk to access public transport services. The length and quality of the walk will to some extent determine whether the person will choose to use public transport. Therefore, walking catchments of public transport nodes are an important tool in the promotion of public transport use.

The catchment area of public transport services can be greatly enhanced with the aid of bicycles. Provision of safe routes and bicycle parking will encourage more public transport use with less need for park and ride car parking.

4.5.5 Designing an active transport network structure for BWSEA

Sound planning and the provision of high quality facilities for pedestrians and cyclists constitute a crucial element of the transportation strategy and structure plan.

We recognise that in order to promote cycling, it will be necessary to build the transportation and access network from the 'bottom-up' (i.e. pedestrian and cyclist) as well as the 'top-down' (railway and bus corridors).

The structure plan has been developed on the basis that there will be a safe, amenable and attractive pedestrian environment. Similarly, cycling will be promoted through a network comprising dedicated bicycle facilities and streets that are made safe for cycling through traffic planning, carriageway design and streetscape treatments.

4.6 Network capacity

Traffic demand modelling will be undertaken during the next stages of the planning process using a mesoscopic model (AIMSUN) to provide an indication of network capacity required for BWSEA under future land use projections. The modelling outputs from this process will indicate locations that proposed road network on BWSEA is approaching capacity and where congestion is likely to occur.

The objectives of the future modelling process for BWSEA will be to:

- Assess the potential of the land use / urban structure (proposed by the master planners) to meet the transport objectives.
- Test the potential of different transport links within BWSEA.
- Refine the preferred transport network to serve BWSEA in such a way that supports the aims of the public transport network and is sensitive to the environmental constraints and needs of the surrounding community.
- Differentiate how proposed modifications will serve the mobility generated within BWSEA as opposed to mobility generated on the surrounding regional network.
- Recommend improvements to the regional and local road network to accommodate the estimated demand to and from BWSEA.
- Analyse the effect of the future traffic flows on critical intersections and examination of the potential for improvement at each.
- Identification of a feasible option by optimising development (land use optimisation) and transport network optimisation.

In the absence of detailed traffic modelling at this stage, the structure plan has been developed with consideration to the following road and transport capacity elements.

4.6.1 Road network design criteria

The road capacity is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or road, during a given time period under the prevailing roadway, traffic and control conditions.

Traffic flows on major roads are typically assessed using a Level of Service Criteria. The Level of Service is a qualitative measure describing operational conditions within a traffic stream. In general there are six (6) Levels of Service from LoS A to LoS F, with LoS A representing the best performance and LoS F the worst. Road authorities and transport providers typically regard exceeding of LoS D as the threshold for upgrading a facility.

The physical capacity / saturation flow for roads relates to the physical capacity at where the Level of Service changes from E to F. The equivalent design capacity is the capacity at Level of Service D. It is the capacity at which a road is designed for to accommodate traffic on opening and into the foreseeable future (10 to 20 years after opening). The design capacity is used to assess whether roads require upgrading.

The capacity of the road network is defined in peak hour traffic volumes. It is influenced by a number of factors including:

- Intersection / Interchange design
- Mix of vehicles – heavy versus light
- Adjacent landuse activities particularly landuses with direct access

In order to maximise capacity and hence efficiency of the road network, access to higher level roads is limited in order to minimise friction and maximise throughput between intersections. Intersections should be designed with adequate storage for vehicles leaving the primary road in order to minimise conflict with through traffic movements.

Transport demand modelling will be undertaken to provide an indication of the network capacity required within BWSEA under the land use projections to be adopted as part of the structure plan process.

Section 4.3 identified typical design capacities for road types allowed for in the structure plan. These are:

- Motorways – 1,800 vehicles per hour
- Arterial Roads – 1,400 vehicles per hour
- Sub-Arterial Roads – 1,200 vehicles per hour
- Transit Boulevards – 1,200 vehicles per hour
- Industrial Roads – 800 vehicles per hour

The intersecting interchange design must be able to accommodate these design capacities.

Motorways

Table 7 presents level of service criteria for basic segments of a freeway or motorway road.

The design capacity for motorways associated with the BWSEA has been set at 1800 vehicles per hour per lane which is similar to the Maximum Service Flow of 1860 vehicles per hour at Level of Service D.

Table 7 Level of Service Criteria for Basic Segments of Urban Motorways
Source: Adapted from guidelines in AUSTROADS Guide to Traffic Engineering Practice, Part 2 - Roadway Capacity and analysis of Sydney Roads.

Level of Service	Volume/ Capacity Ratio (V/C)	Maximum Service Flow (MSF) Per Lane (vehicles per hour)
A	0.35	700
B	0.54	1,080
C	0.77	1,540
D	0.93	1,860
E	1	2,000
F	> 1	

Arterial/sub-arterial roads

The physical capacity/saturation flow for arterial and sub-arterial roads in the Sydney Metropolitan Area is generally 1,500 vehicles per hour per lane. The equivalent design capacity is 1,200 to 1,400 vehicles per hour per lane. This is the capacity at Level of Service D. It is the capacity at which a road is designed for to accommodate traffic on opening and into the foreseeable future (10 to 20 years after opening).

It is noted that some arterial and sub-arterial roads have lower physical and design capacities due to constraints which prevent provision of full intersection treatments at key locations (adequate turn bays etc.). These roads tend to be the older roads for which provision for widening is limited. Roads such as Parramatta Road and Victoria Road fall into this category.

Motorway interchange capacity

Grade separated interchanges are provided along motorways to minimise conflict with exiting and entering traffic. The capacity of the interchange will depend on the amount of through traffic and the design for access onto the lower order roads below.

At motorway entrance terminals the merging manoeuvres which occur in the motorway lane adjacent to a ramp should desirably take place at the speed of the motorway traffic stream, and without interference with it. The principle factor governing the capacity of motorway terminals is the volume and nature of traffic in the adjacent motorway lane immediately upstream of the entrance ramp.

The capacity of a merge area is controlled by the capacity of the downstream segment of the motorway. That is, the total flow arriving on the upstream motorway from through traffic and the merge ramp cannot exceed the basic motorway capacity of the resultant downstream flow. Provided the merge area is adequately designed, turbulence itself in the merge area does not affect this capacity.

The proportion of heavy vehicles will greatly influence the capacity of the motorway interchange. The capacity of motorway merging areas is 2,200 passenger cars per hour per lane (pcphpl) for four lane motorways. Heavy vehicles on average are equivalent to around 5 passenger cars per hour per lane (pcphpl) on average. Taking into account heavy vehicles, the design capacity of the merge at a motorway interchange is around:

- 1,830 vehicles per hour per lane if around 5 percent are heavy vehicles
- 1,570 vehicles per hour per lane if around 10 percent are heavy vehicles

The traffic demand modelling to be undertaken in the next stages will identify the heavy vehicle demands which will influence the ultimate capacity of the motorway interchanges proposed for BWSEA..

4.6.2 Mode choice design capacity

Within the study area, the most appropriate choice of transit system will be governed by existing and potential development densities as well as direct linkages to key destinations. Of the modes described above, heavy rail and transit corridors (or bus priority corridors) appear to fit best within the context of BWSEA. From this a broad description of the suitability and capacity of each mode is given below.

Heavy rail

Heavy rail is already present throughout much of Sydney. It is characterised by exclusive rights of way, usually with grade separated crossings of roads and pedestrian paths.

In Sydney, an electrically powered eight car train carries approximately 1000 passengers, and minimum headways are approximately three minutes. Station spacings are usually 1.5km to 3km. Heavy rail alignments are characterised by large radius turns (minimum 400m) and gentle gradients (maximum 3%). Line capacity (per direction) is approximately 30,000 passengers per hour.

An extension of the heavy rail network would have many advantages. From a land use perspective, it presents a very good opportunity for transit oriented development around stations in the form of medium to high densities and mixed uses. It would be possible to reinvest contributions from these higher densities into new transport infrastructure.

Metro rail (rapid transit network)

Metro rail does not yet feature in Sydney's transport network. It is similar to heavy rail, but is generally characterised by the ability to travel at slightly steeper grades and on tighter curves.

Metro rail trains would probably be longer than existing heavy rail trains (up to 10 carriages), would be single deck and have more doors to facilitate quicker loading and unloading. Vehicles often have a limited number of seats to accommodate higher passenger loads. Line capacity is often similar to heavy rail (e.g. London Underground 28,000 per hour per direction).

From a system perspective, metro rail would be used on parts of the network with high traffic and short stop spacing. Metro rail is also considered unsuitable for the study area. Metro rail is best suited to dense urban areas with a high level of passenger loading / unloading at each station. Potential rail trips expected to be undertaken from the study area are expected to be relatively long in duration. Therefore, if rail services are to be provided, traditional heavy (suburban) rail would appear more suitable at this point in time.

Light rail

Light rail, a modern version of a tram, has recently been introduced to Sydney and will be extended to the inner west (Lilyfield to Dulwich Hill), to the south east (Central Station to Randwick) and Sydney CBD. Light rail is relatively quiet, and usually powered by an overhead electric line. It can operate in exclusive rights of way (as heavy rail does), but can also mix with street traffic.

A Sydney light rail vehicle carries approximately 220 passengers, and the minimum practical headway is two minutes. This equates to a capacity of 6,600 passengers per direction. Minimum curve radius is 20m and maximum track gradient is 8.5%. Station spacing is generally 500m – 1000m.

Light rail is considered to be an unlikely mode choice for the study area. An isolated line would serve little purpose, as services could only operate along the corridor before transfer to transitway or rail at the terminus, potentially increasing travel times. Nevertheless, there is benefit in having proposed transit corridors being designed to allow upgrade to light rail at a later time, should passenger numbers warrant this expansion. This would best occur within a sub-regional network of light rail, closely integrated with the regional heavy rail network, in much the same way as a transitway system would operate.

Transitways

Transitways are a recent addition to Sydney's public transport network with the Liverpool to Parramatta transitway opening in 2003.

Transitways are segregated roadways or dedicated bus lanes that will allow buses to travel at high speeds (up to 80km/hr) and high frequencies, thus giving buses better reliability than traditional bus services. Transitway stations will be spaced at 600m – 800m, and higher order stations will resemble light rail stations, featuring sheltered platforms, real time service information, CCTV, emergency contact points and commuter parking. While the above characteristics describe current transitway proposals, the term "transitways" can also describe trunk bus services operating in different circumstances (e.g. integrated with general traffic where traffic congestion does not increase travel times).

Each bus is expected to carry 54 passengers. On the basis of a limiting headway of 1 minute (due to loading constraints) the line capacity of the T-way would be some 3,200 passengers per hour.

The chief advantage of transitways (over purely line-haul operations) is the ability of the buses from surrounding low density areas to pick up passengers and join the transitway mid-trip, proceeding to major centres in express conditions without the need for passengers to change services. Another significant advantage in developing areas is the ability of bus priority measures to be provided in a graduated fashion over time in response to land use changes.

The Liverpool to Parramatta Transitway infrastructure is already in operation to the east of BWSEA. An extension of intensive bus priority measures beyond this location would allow good public transport connectivity to BWSEA, Parramatta and beyond to centres such as Mount Druitt, St Marys, Leppington and the Sydney CBD.

Local buses

Local bus services cover almost all of the Sydney area. Services in outer suburban areas often link to local rail stations and shopping centres ("feeder services"), while inner city services link residential areas to the CBD and other trip destinations.

Buses generally have a maximum capacity of approximately 60 passengers per vehicle and stop spacing is usually every 400m. Minimum headways can be less than 1 minute, but in the Sydney context, suburban services generally operate at 10-15 minute frequencies during peak times, and 30-60 minutes during off peak.

Private companies provide bus services in the outer suburban areas of Sydney (such as the study area).

Local bus services would feature in the future transit operation of the BWSEA. However, bus routes would generally provide feeder services to local rail stations (Mount Druitt, St Marys, Leppington) and key centres. While the dense network of stops provides comprehensive coverage of passenger catchments, it also often results in relatively long travel times.

5.0 Preferred structure plan

This section presents the preferred structure plan and describes the proposed integrated transport network.

5.1 The structure plan

The Broader WSEA comprises approximately 10,700 hectares of land generally bounded by the M4 Motorway to the north, the M7 Motorway to the east, the proposed Outer Sydney Orbital alignment to the west and the South West Growth Centre to the south.

The BWSEA has a specific mandate to provide for the future needs of employment for Sydney. The location, within an area bounded by significant regional infrastucture, facilitates this function, utilising the existing infrastructure alignments both transport based and services based.

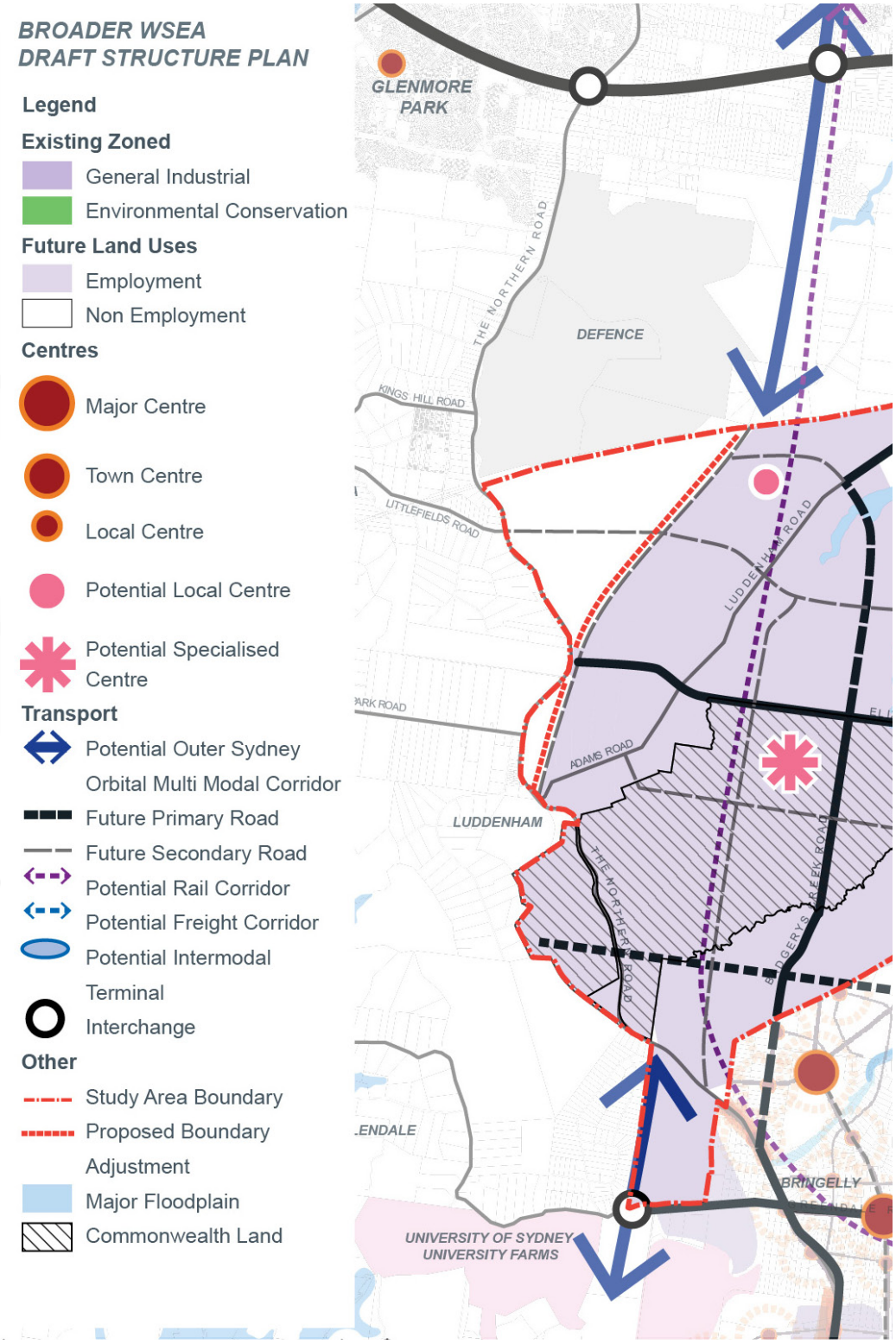
The structure plan shown in Figure 45, responds to a number of drivers including citywide employment demand as well as broader national demand specifically around the provision of long term distribution and goods. The site supplements connections to future intermodal, port and airport requirements.

The plan distinguishes on a broad level the distribution of employment and suggests a series of specialised centres focussed on employment. The detailed precinct structure has not been addressed in this plan and defines more broadly the structure and density of this anticipated land use.

The site contains water management and flood prone areas which have a significant consequences in terms of layout and cost of development.

An established public transit framework exists to the east and south of the site. These connections can be supplemented to service BWSEA. The South West Rail Link and the Outer Sydney Orbital transport corridor further connect the site and allow freight access supporting the functions for this area.

Ultimately this plan will require development and may require revision should Badgery's Creek airport be defined on this site.


BROADER WSEA
DRAFT STRUCTURE PLAN
Legend
Existing Zoned
General Industrial
Environmental Conservation
Future Land Uses
Employment
Non Employment
Centres
Major Centre
Town Centre
Local Centre
Potential Local Centre
Potential Specialised Centre
Transport
Potential Outer Sydney Orbital Multi Modal Corridor
Future Primary Road
Future Secondary Road
Potential Rail Corridor
Potential Freight Corridor
Potential Intermodal Terminal
Interchange
Other
Study Area Boundary
Proposed Boundary Adjustment
Major Floodplain
Commonwealth Land
GLENMORE PARK
THE NORTHERN ROAD
DEFENCE
KINGS HILL ROAD
LITTLEFIELDS ROAD
LUDDENHAM ROAD
ADAMS ROAD
LUDDENHAM
BRINGELLY
UNIVERSITY OF SYDNEY UNIVERSITY FARMS

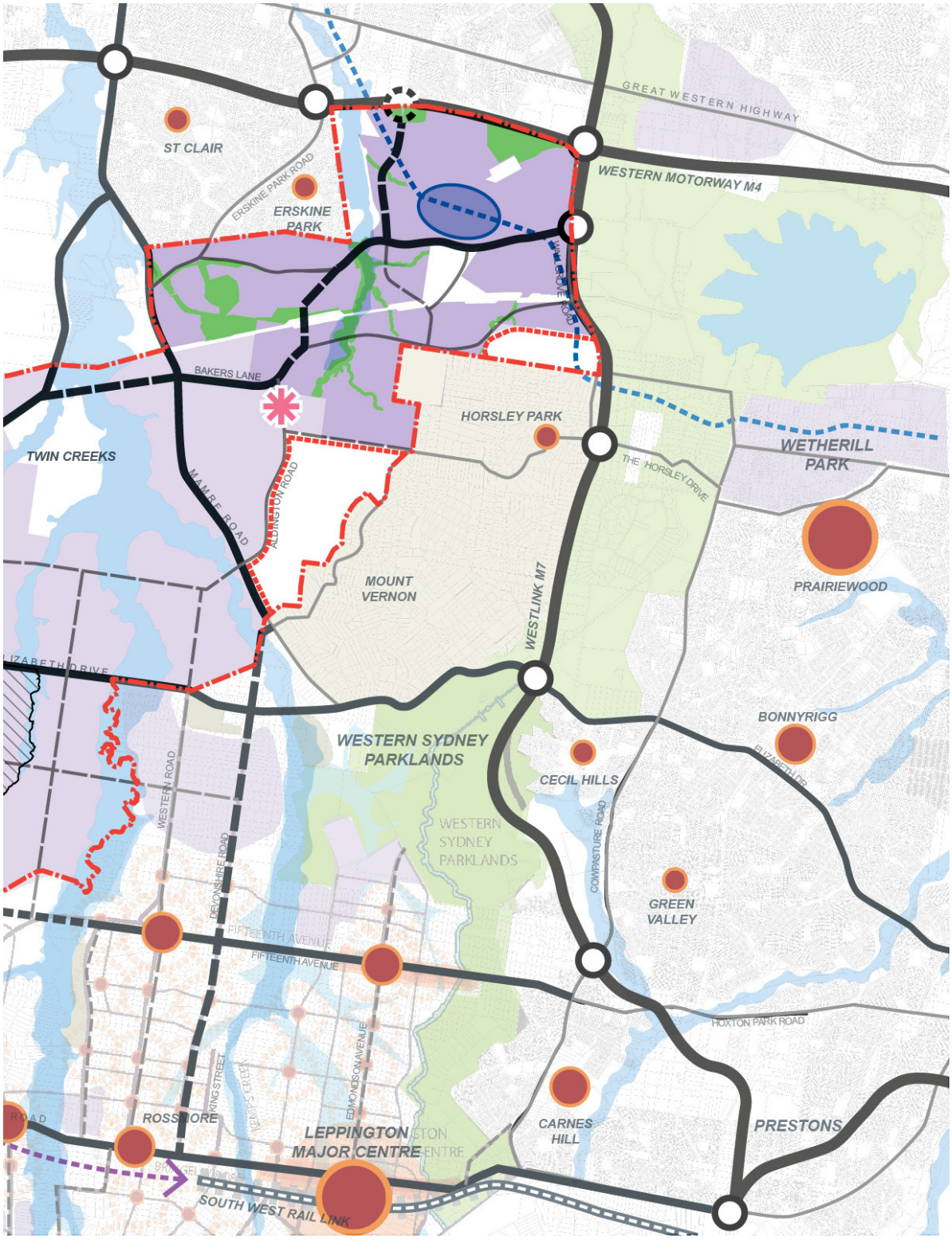


Figure 45 - The structure plan

Source: AECOM

5.2 Preliminary land use plan

5.2.1 Land use determinants

The intention is to provide for a significant amount of industrial, freight and logistics employment opportunities within BWSEA. This reflects the large scale of the site with its established industry, and logistics development and associated transport opportunities with the M4 and M7 and proposed Outer Sydney Orbital corridor.

The composition and timing of land uses and product types should in the first instance be determined by BWSEA's capacity to assume a realistic share of metropolitan growth for Sydney, and compatibility with on-going investment in major industrial and logistics developments anchored by Port Botany and Sydney Airport.

Land use and transit infrastructure investment should support development of the proposed Outer Sydney Orbital of mixed industrial, business and logistics opportunities linking the North West and South West Growth Centres. BWSEA will have a key role within this corridor identified in the NSW LTTMP.

5.2.2 Land use distribution

Land use distribution within BWSEA should seek to support an economical and efficient outlay of transport infrastructure. Investment in high quality transit corridors with the reservation of future rail corridors will support regional mass transit network connections, and the viability of a network accessible with mixed use activity centres within BWSEA.

5.2.3 Trip containment

High quality movement connections and land use synergies should be established with adjoining employment and residential focused areas. This will seek to support for a high level of transport containment through the provision of job and business opportunities near residential areas. The intention to achieve a balance between surrounding residential, business and employment opportunities within the site as means of encouraging a degree of transport containment and supporting the creation of a self-sufficient live-work-study-play offer.

5.2.4 Preliminary land use

In response to the current understanding of long term economic drivers and the key elements of the BWSEA vision, the land use employment estimates prepared by Urbis have aimed for a mix of land use and product types relevant to the site's context and suitability.

BWSEA comprises a large site covering approximately 10,700 hectares of land and expected to eventually accommodate an employment workforce of up to 200,000 people with build-out capacity somewhere between the next 50-100 years. The likely workforce to be accommodated over the next 35 years will be in the order of 55,000 people accommodated within approximately 2,300 hectares of service land. This assumes an average employment density of 24 jobs per hectare within this stage.

The land use estimates and employment capacity (assuming full build-out) for BWSEA is provided in Table 8 and Figure 46.

Table 8 - Employment land demand forecasts and employment capacity of BWSEA precincts
Source: Urbis

			Total employment lands (Ha)	Freight and logistics jobs	Other industrial jobs	Industrial lands (Ha)	Total industrial jobs	Office jobs	Total	Employ-ment density
Forecast demand 2011-2046		Greater Western Sydney	6,597	21,553	80,847	5,399	102,400	138,728	242,343	
Employment lands job potential	A	Existing WSEA	2,228	8,463	28,481	2,228	36,944	25,071	62,015	27.8
	B	Aldington Road	451	2,015	6,782	451	8,797	0	8,797	19.5
	C	South Creek	1,613	7,206	24,250	1,613	31,456	0	31,456	19.5
	D	Luddenham Road West	823	3,678	12,378	823	16,056	0	16,056	19.5
	E	Adams Road	407	1,816	6,113	407	7,929	0	7,989	19.5
	F	Commonwealth Land (Badgery's Creek)	1,700	6,452	21,715	1,444	28,167	22,970	51,137	30.5
	G	SW growth centre industrial	1,200	5,359	18,036	1,200	23,395	0	23,395	19.5
		Total	8,396	34,989	117,754	8,166	152,744	48,041	201,014	23.9

5.3 Transport concept

5.3.1 Transport concept

This section provides a brief outline of key elements of the transportation network planned for the BWSEA. It also includes a brief summary of the key principles relevant to the structure planning process.

5.3.2 The principles

The transport planning principles for BWSEA structure plan are as follows:

- Provide an integrated approach to road network planning across the various categories of roads such as local, regional, state and national roads.
- Understand the function of roads can vary along their length according to movement and access functions.
- Provide a structured approach to road network development that recognises the changing role many roads within BWSEA will play, as the area becomes increasingly urbanised for roads such as Luddenham Road, Adams Road, Aldington Road, Bakers Lane, Badgerys Creek Road, Western Road, Devonshire Road and Fifteenth Avenue.
- Establish a road network to provide maximum value to the different land uses and activities with BWSEA for instance:
  - Facilitating the efficient movement of road freight to and from key industrial and logistics areas
  - Ensuring fast and reliable bus access to key centres and providing passage to regional through-traffic in such a way that minimises impacts on local networks and land uses
- Manage the competing demands for access to the road network, from pedestrians, cyclists, public transport services, commercial/freight trips and personal trips, which can be local, sub-regional or regional in nature.
- Concentrate higher densities and clusters of land uses around transit nodes and transit corridors to promote increased use of public transport in the future.
- Recognise that as the intensity of development increases, it will be increasingly important to capture a higher proportion of trips on public transport in order to slow the rate of growth in general traffic and to manage congestion.
- Ensure that key corridors for heavy rail (freight and passenger lines) and transit are reserved as part of the structure planning process to minimise land acquisition problems in the future, so that transit infrastructure can service the growing needs of BWSEA over the next 30+ years.
- Establish an integrated transport system that allows the accessibility to all modes of public transit. Focus highest intensity land uses around primary public transport such as rail stations and transit corridors within a 1200m and 800m walking catchment respectively.
- Understand the local public transport needs and balances and integrates them with the needs of the broader public transport networks such as Western Railway Line, North West Rail Link (NWRL), South West Rail Link (SWRL) and Transitways.

5.3.3 An integrated transport network

An integrated transport network will be necessary to enable the efficient movement of people to and from the various parts of the BWSEA. The movement network in the structure plan allows for the integration of both public and private modes of transport.

The private transport network essentially provides a grid road patterned block system that is highly permeable for both east-west and north-south connections. The road network allows clear and direct access to key centres and proposed inter-modal terminals, but is also flexible to allow buses to run on most roads.

The road network has been developed on the basis of overlaying a ‘coarse’ regional bike network on the road network structure.

A. Existing WSEA

B. Aldington Road

C. South Creek

D. Luddenham Road West

E. Adams Road

F. Commonewealth land

G. SW growth centre industrial

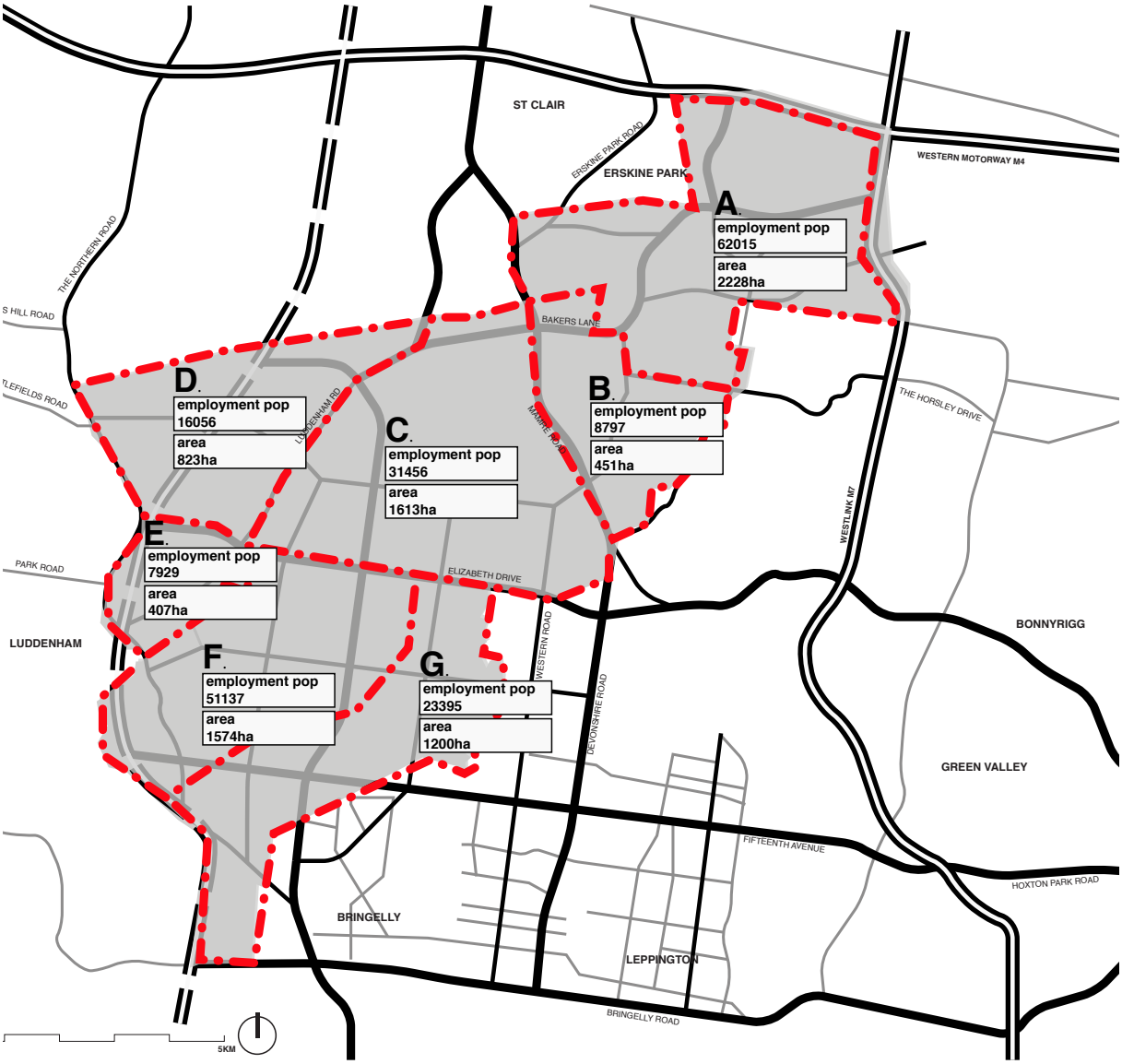


Figure 46 - BWSEA precinct plan

The transit corridors connect proposed centres within the study area with expansion into already established corridors to the north (Western Railway Line), to the east (Parramatta to Liverpool Transitway) and new corridors to the south (SWRL). Local bus services will pick up the lateral movements across BWSEA, connecting to the higher order public transport system.

5.3.4 Outer Sydney Orbital Alignment

The Outer Sydney Oribital was identified by the NSW LTTMP as a potential transport corridor. This corridor is likely to provide links between The Northern Road at Bringelly to the currently planned Werrington Arterial at the M4. The alignment of this corridor has yet to be determined and route alignment studies are being proposed in the short to medium term to examine various alignment options.

In this context, a high level strategic corridor identification and evaluation exercise was initially undertaken based on data collection and consultation with stakeholders during the structure planning process. Three possible alignment options have been identified as part of the structure plan for the Outer Sydney Orbital within the BWSEA.

The three proposed Outer Sydney Orbital alignment options illustrated in Figure 47 can be described as follows:

- Option 1 – Western alignment through Commonwealth Land
- Option 2 – Central alignment through Commonwealth Land
- Option 3 – Eastern alignment through Commonwealth Land

A range of principles has been developed in order to assess broadly the alignment options from the perspective of transport and access. These are outlined below.

Site Coverage – Public transport links and transfer nodes

- Optimise opportunities for delivering transit oriented development through macro development parcels.
- 'Centring' of public transport links in the macro development parcels defined by the arterial road network.
- Appropriate distribution/structuring of transfer nodes within site.

Site Coverage – Major road links and interchanges

- Alignment of higher order road links around macro development blocks parcels.
- Location road interchanges such that they minimise impacts on macro development parcels.
- Minimise impacts on developed areas.

Integration of Land Use and Transport

- Optimise opportunities for transit oriented development
- Note the potential negative effect of site boundaries on the potential for TOD around public transport links and nodes.
- Note the influences and impacts that higher order roads (motorway) and interchanges have on macro development parcels.
- Note the influences and impacts that the shape of development parcels has on development.
- Minimise impacts on developed areas.

It is recommended that a further investigation be undertaken regarding the road space and alignment requirements to service the Outer Orbital transport corridor. A future corridor study will investigate in further detail the constraints and opportunities affecting the reservation of land for a future Outer Sydney Orbital.

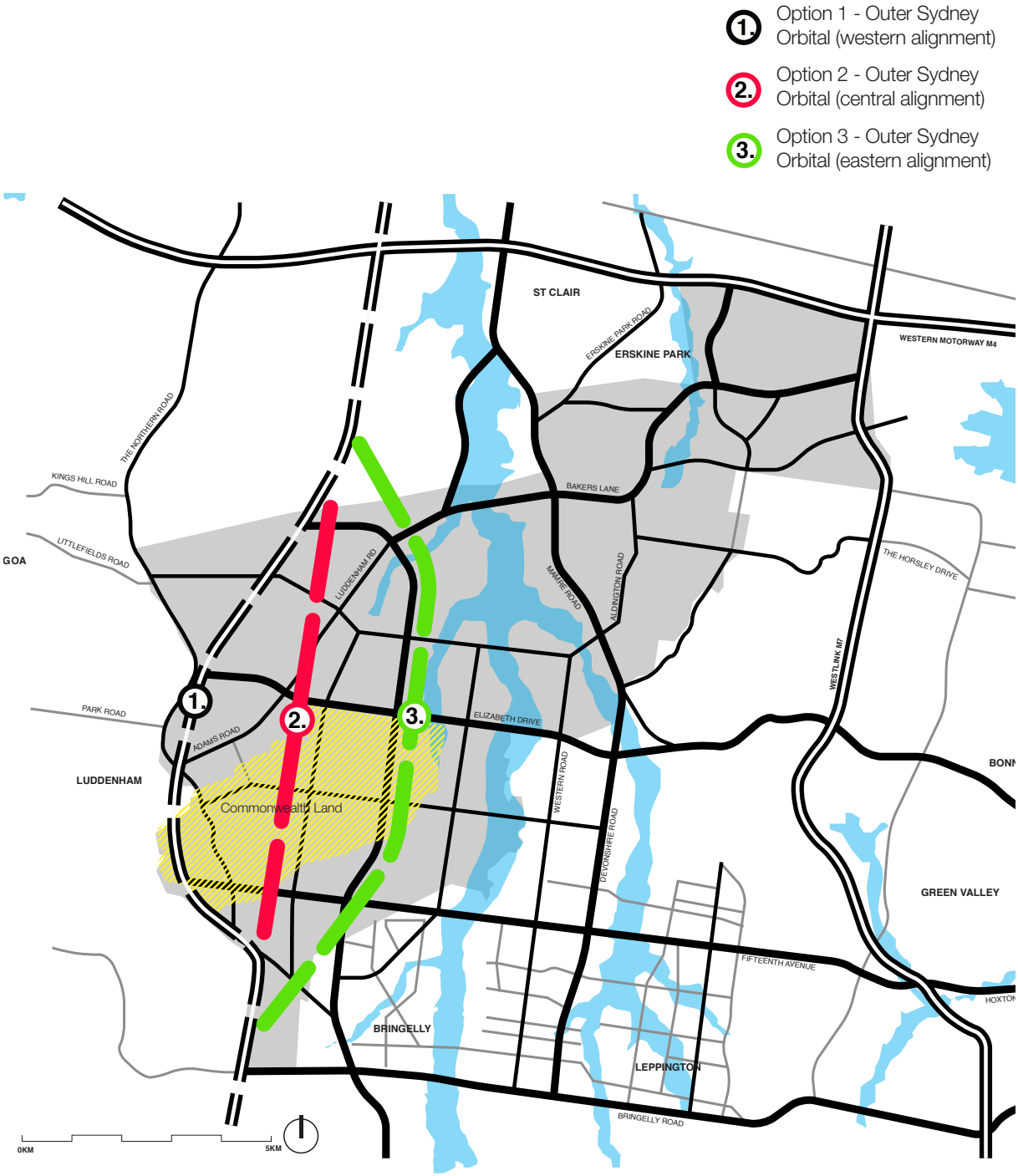


Figure 47 - Outer Sydney Orbital alignments

Option 1 – Western alignment

Principle	Assessment
Site Coverage – Public transport links and transfer nodes	The layout of the alignment and its interaction with public transport network offers good opportunities for transit oriented development through the core of the Commonwealth Land and BWSEA.
Site Coverage – Major road links and interchanges	The location of proposed interchanges will impact at a single location (Fifteenth Avenue) on the western boundary of the Commonwealth Land. Longer lineal alignment length for connections to Werrington Arterial Road (to north) and Bringelly Road (to south).
Integration of land use and transport	Land use on the western side of the Outer Sydney Orbital is unlikely to be optimised. The layout of the alignment offers good opportunities for a mass transit corridor within the Commonwealth Land to form a spine of the development. Provides good access to possible intermodal terminal located on the western fringe of BWSEA. Provides a good buffer between rural to the west, and industrial/freight land uses to the east, as proposed within the structure plan.

Option 2 – Central alignment

Principle	Assessment
Site Coverage – Public transport links and transfer nodes	The layout of the alignment offers poor opportunity to establish a future mass transit corridor through the Commonwealth Land. The layout of the alignment and its likely future interaction with public transport network offers minor opportunities for transit oriented development along the central alignment.
Site Coverage – Major road links and interchanges	The central alignment will require at least two grade separated interchanges (at Elizabeth Drive and Fifteenth Avenue) within the Commonwealth Land. Shorter lineal alignment length for connections to Werrington Arterial Road (to north) and Bringelly Road (to south). The layout of the alignment will take up a larger land area within the Commonwealth Land as compared to Option 1 and 3. Provides good access to possible intermodal terminal located on the western fringe of BWSEA.
Integration of land use and transport	The layout of the alignment divides a key integrated consolidated land holding. Provides access to land on both sides of the alignment avoiding single loaded development. Integration of land use will be severely impacted on by the width of this corridor, and will be difficult to integrate into broader land use planning.

Option 3 – Eastern alignment

Principle	Assessment
Site Coverage – Public transport links and transfer nodes	The layout of the alignment and its interaction with public transport network offers good opportunities for transit oriented development through the core of the Commonwealth Land. The site layout means that there is good public transport at the south west portion of the site in order to achieve the required level of coverage as and when employment densities increase in the future.
Site Coverage – Major road links and interchanges	The location of proposed interchanges will impact at a single location (Elizabeth Drive) on the eastern boundary of the Commonwealth Land. Services higher intensity employment on its western site, and lower employment on eastern side due water sensitive areas. Longer lineal alignment length for connections to Werrington Arterial Road (to north) and Bringelly Road (to south). Provides moderate access to possible intermodal terminal located on the western fringe of BWSEA.
Integration of land use and transport	Land use on the eastern side of the alignment is unlikely to be optimised. Services higher intensity employment on its western site, and lower employment on eastern side due water sensitive areas. Location of the alignment is close to water sensitive areas running through the middle of BWSEA. The layout of the alignment offers good opportunities for a mass transit corridor within the Commonwealth Land to form a spine of the development.

5.3.5 A road network integrated into the urban environment

The structure plan is based on an interconnected, legible, urban-scale grid street pattern that will provide optimal opportunities for bus/freight servicing and access (refer to Figure 48). The road network has been planned and spatially dimensioned integrally with the land use planning. This has ensured that the higher order road network and its position in the road hierarchy is appropriate to its role and the traffic demands placed upon it.

Traffic modelling to be undertaken in the next stages will confirm the overall road network structure to accommodate critical peak hour flows. The AIMSUN mesoscopic model will be used to examine in further the detail the predicted traffic flows on the BWSEA road system for 2036.

We have integrated the transport planning principles above with a firm view of the broader aims of the structure plan to ensure the following outcomes:

- The road hierarchy is compatible with the land use and range of roles that each key road is likely serves. This incorporates a grid of arterial and sub-arterial roads to distribute traffic within BWSEA and promoting access to the regional road network.
- A hierarchy of roads that allows clear and direct access to the M4, M7 and the future Outer Western Sydney Orbital identified in the Long Term Transport Master Plan (LTTMP).
- Providing a road layout that will permit the evolution of the BWSEA to respond to the challenges and opportunities met in the future in terms of intensification and changes in land use.
- The alignment of roads and intersections support the existing road structure and form (e.g. the extension of Badgerys Creek Road, Western Road, Devenshire Road from the south, and the retention of existing road corridors such as Luddenham Road, Adams Road, Aldington Road and Bakers Lane).
- Roads with transit links running along them have been the located near centres with the highest degree of ‘mixed useness’ as well as the highest intensities.
- Road network has been broadly spatially dimensioned to support the aims of the structure plan:
  - main roads such as motorways and arterial roads are proposed to each have a width capable of providing six travel lanes.
  - provide sufficient space to accommodate the needs of transit corridors and freight services.
  - the lesser roads such as sub-arterials be capable of providing four travel lanes

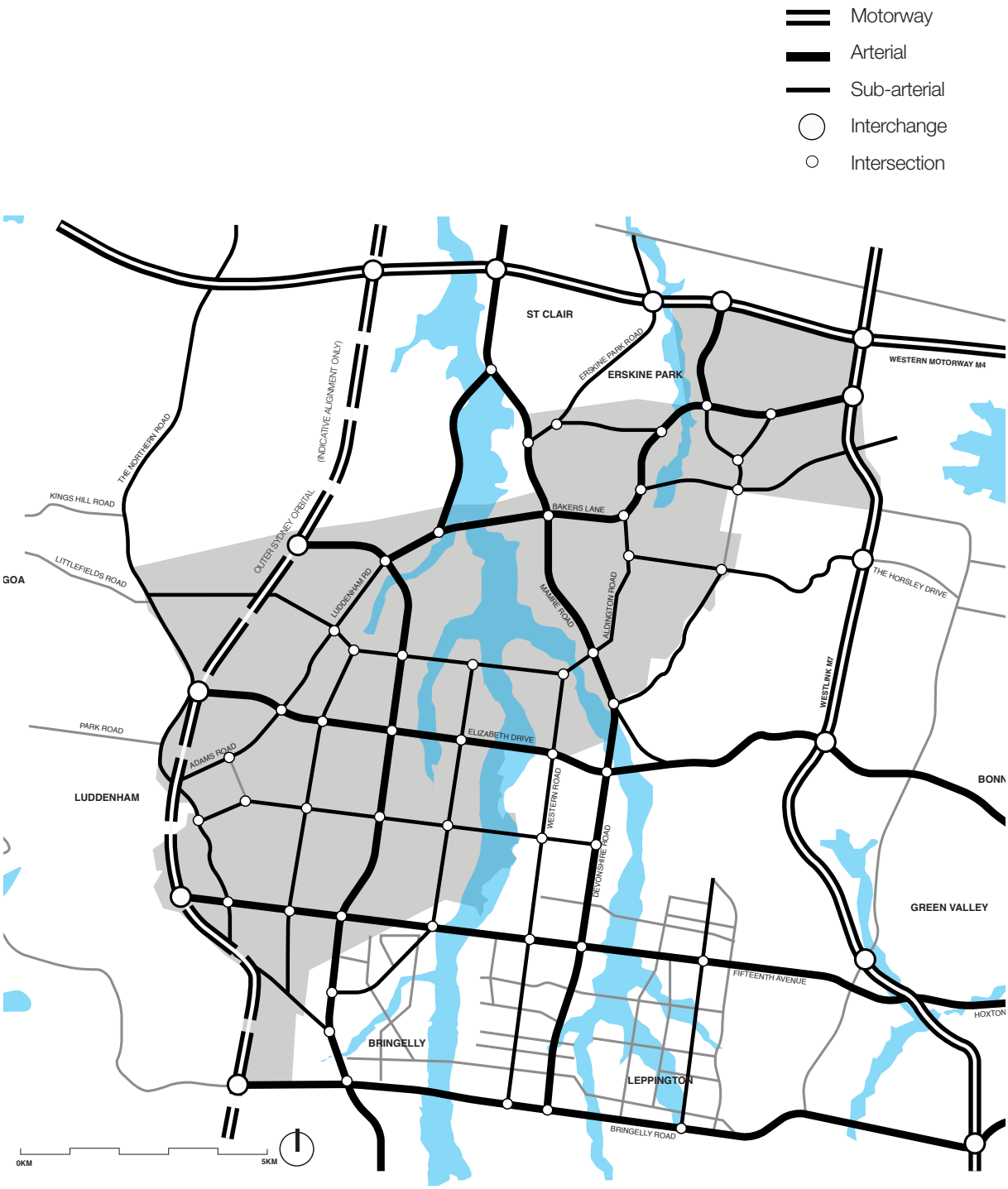


Figure 48 - BWSEA road network structure

5.3.6 Public transport network – transit and local bus services

The structure plan has been developed on the basis of a strong commitment to bring transit corridors into the BWSEA rather than relegating them to either the M4 and M7 edge of the study area. Transit will activate and be activated by development within the centres proposed for BWEA. Importantly, transit will be visible and a key element of the BWSEA's function.

It is proposed to establish the transit corridors along Horsley Drive, Aldington Road, Bakers Lane Western Road, Fifteenth Avenue, and Mamre Road (refer Figure 50 for details). The transit corridors promote transit access to existing Liverpool to Parramatta Transitway (to the east) and railway services to the north (Western Line) and in the future the SWRL. This would bring transit and local bus services into high-capacity interchanges with direct access to the proposed railway services including St Mary's and Mount Druitt stations.

The structure plan ensures that transit conditions can be provided for bus services running between the proposed centres and transit corridors. By providing an appropriately dimensioned road network layout, reliable and rapid access can be provided for transit services within a useful and attractive urban design framework.

Local bus services are an integral part of the transportation strategy and the structure plan. The public transport network has been established to promote integration of local bus services with transit corridors and future connections to rail services (Western Line and SWRL). Figures 50 shows the indicative arrangements for local buses based on the road network proposed for the structure plan.

Further bus access could be provided along The Northern Road to Littlefields Road extension and Western Road to provide connections to Penrith. This could be upgraded to a transit corridor once future demand increases.

Figure 49 shows the passenger catchments likely to be serviced by the proposed public transport network.

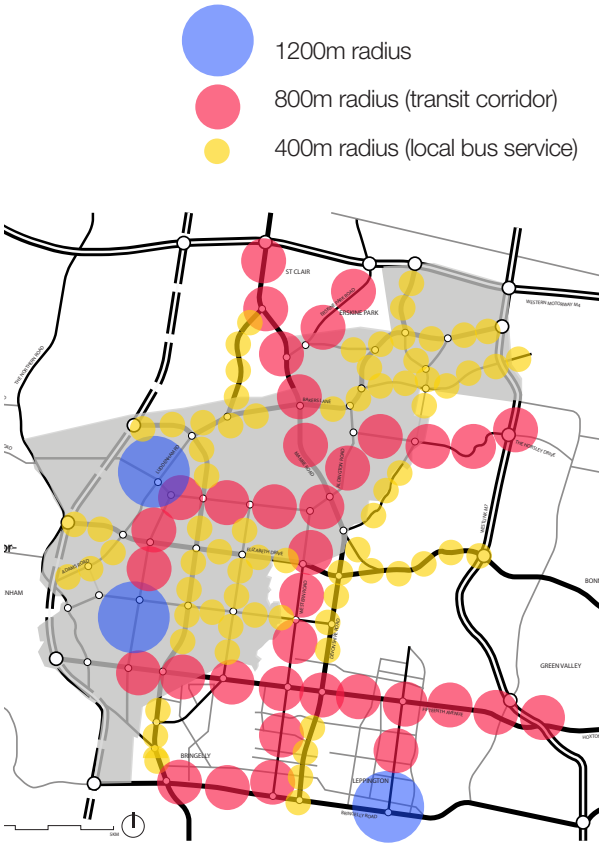


Figure 49 - Passenger catchments within study area

Figure 50 - BWSEA Public transport structure

5.3.7 Public transport network – preservation of railway corridor

The structure plan broadly sets aside a corridor along the western side of BWSEA to accommodate an indicative railway alignment (refer to Figure 51 showing the rail network). The extension of the heavy rail network and the preservation of this corridor would have many advantages. From a land use perspective, it presents a very good opportunity for transit oriented development around future stations in the form of higher densities and mixed uses particularly within the Commonwealth lands. It would be possible to reinvest contributions from these higher densities into new transport infrastructure.

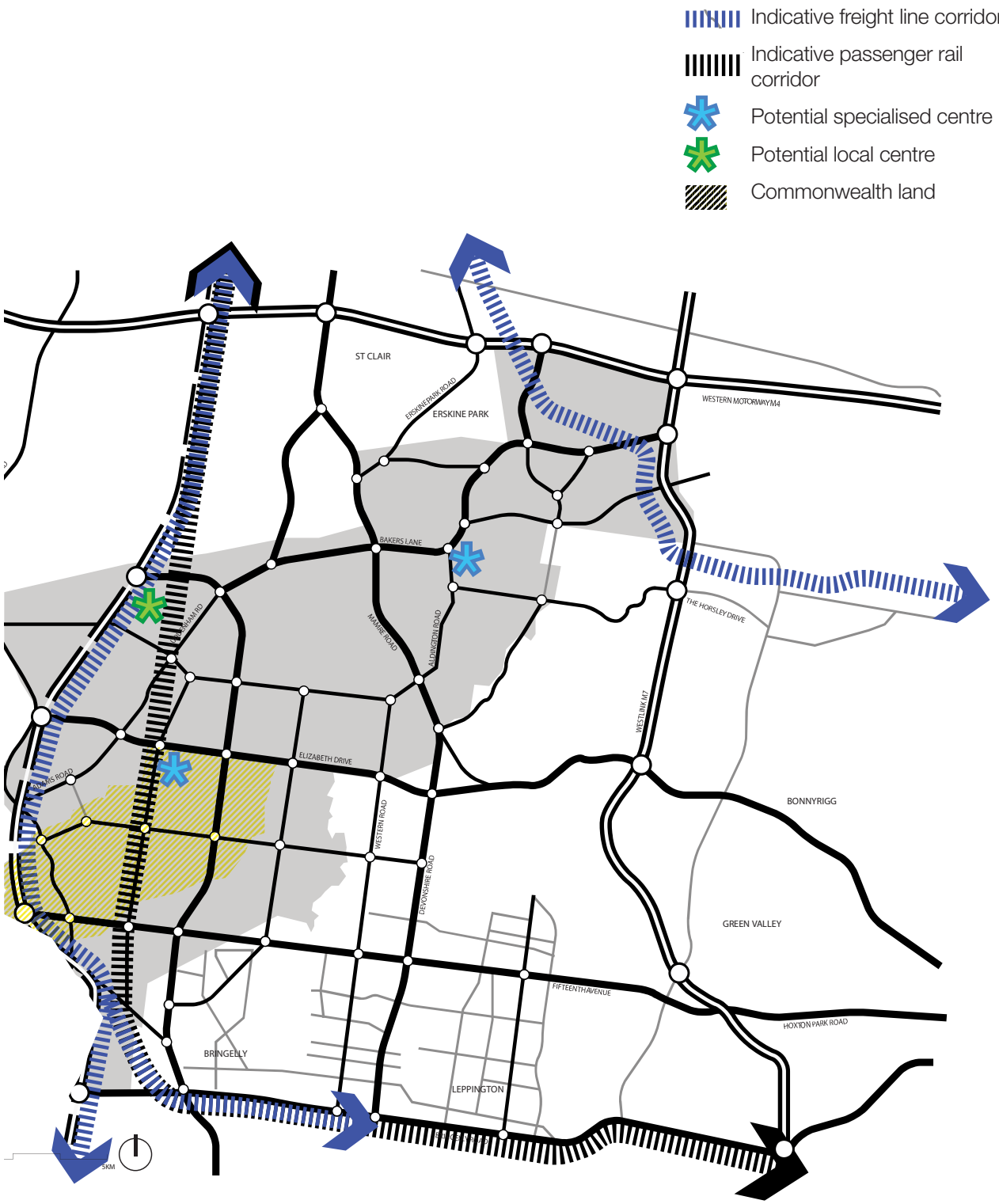
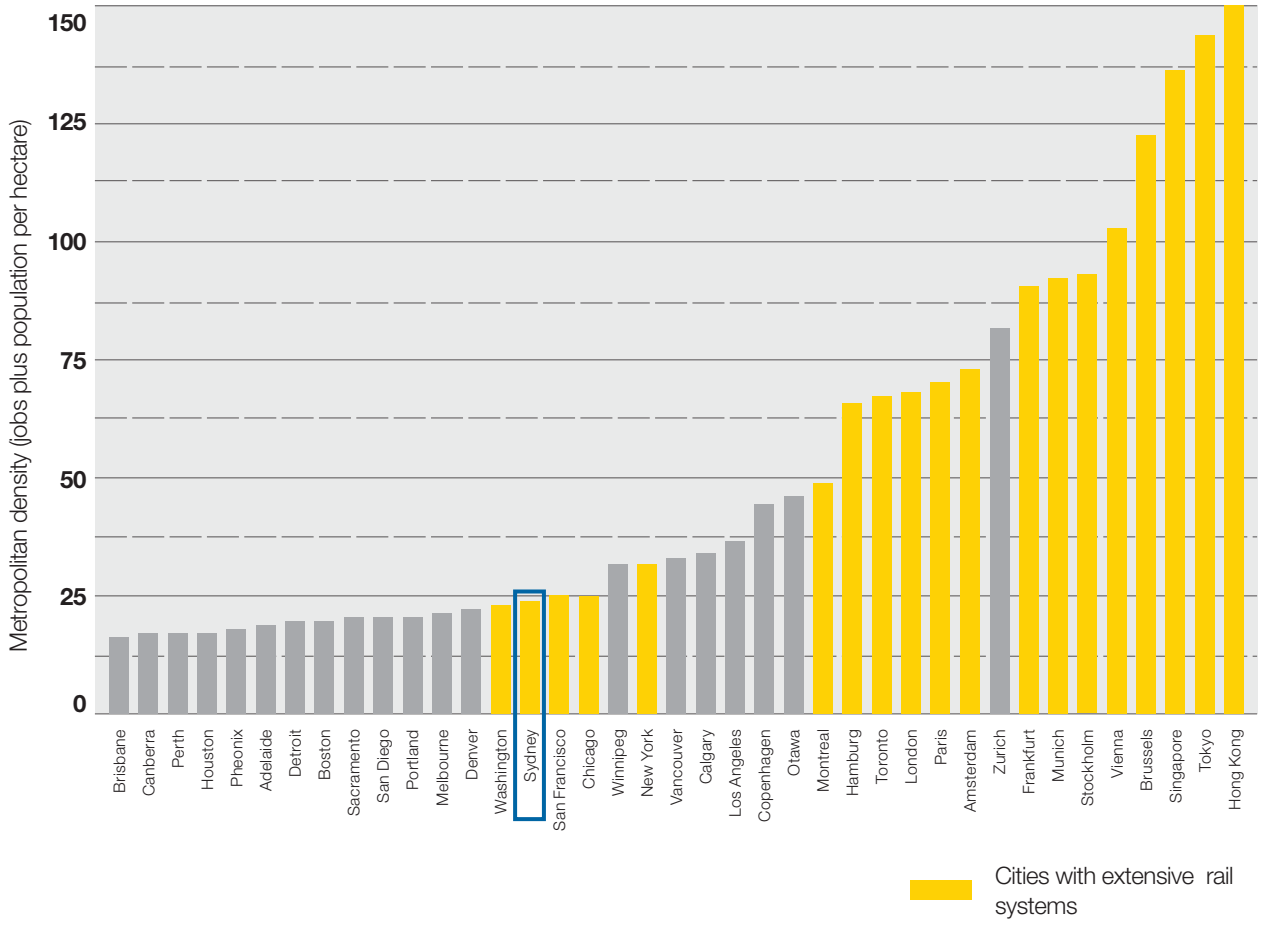


Figure 51 - BWSEA Rail network structure

The size and density of cities and development areas is closely linked with the sort of mass transit systems (e.g. heavy rail) which tend to be adopted. The average employment density for BWSEA is nearly 24 jobs per hectare. Analysis of cities around the world by Newman and Kenworthy (1998) shows that there appear to be density thresholds that apply to rail-based systems. For example virtually all cities with a metropolitan activity density (jobs plus population per hectare) of over 50, or an inner suburbs activity density above 100 tend to have extensive rail and metro systems (refer to Figure 52 and 53). The threshold for light rail is much lower around 20 to 40.

Whilst heavy rail capacities may not be required for BWSEA in the short to medium term, provision for heavy rail is readily accepted by the development community as an incentive for transit oriented development.

Figure 52 - Metropolitan density for cities with and without rail systems



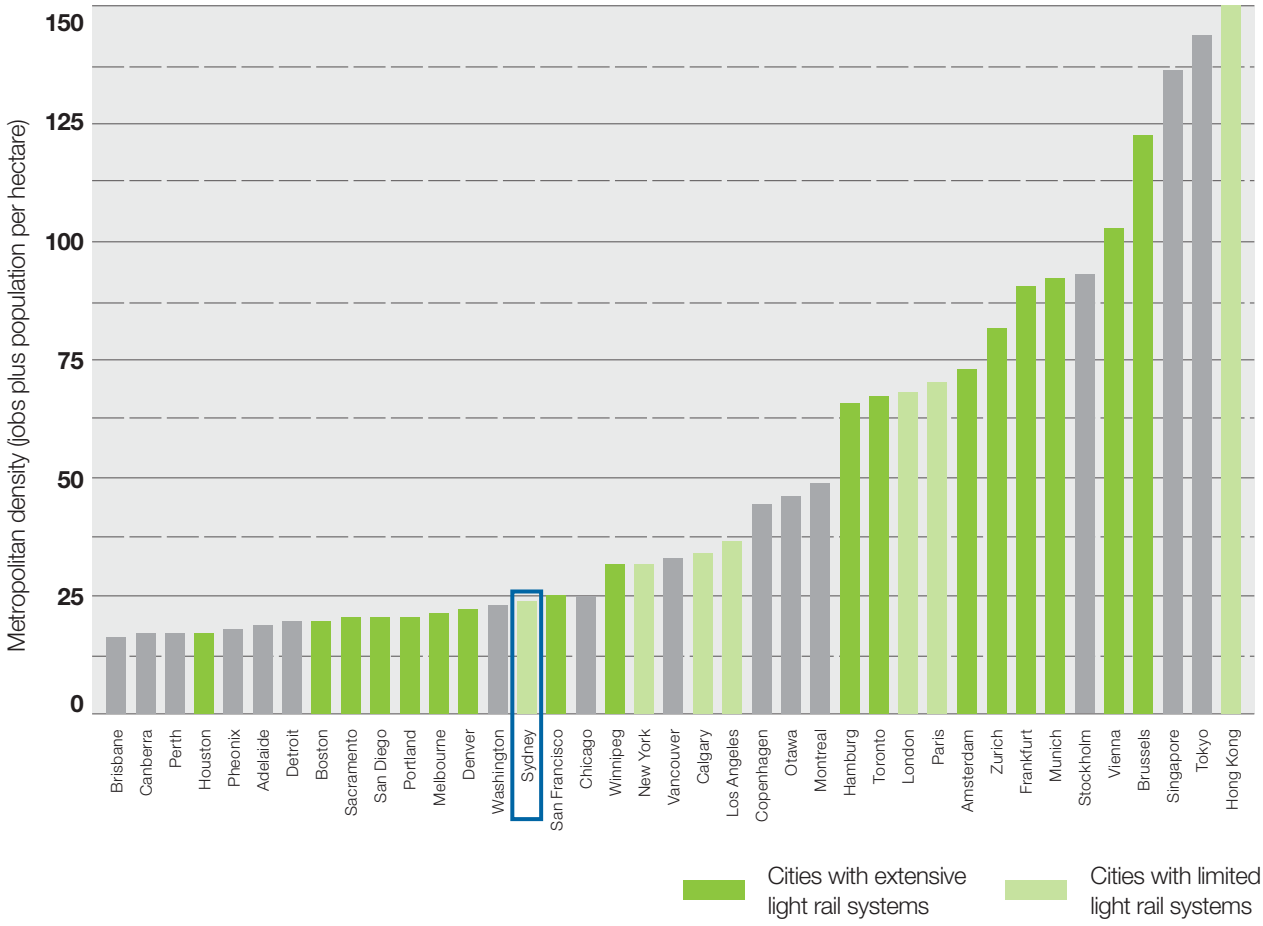
Integration with other railway lines such as the NWRL, Western Line and SWRL will allow for a diverse range of destinations throughout the existing and future metropolitan rail network.

Incorporation of a railway corridor into the structure planning process at this stage will minimise land acquisition problems in the future. Further, maximum benefits of the new services can be attained through supportive urban form. Potential exists to persue joint venture activities in order to assure coordinated and timely provision of infrastructure.

Additionally, the geographical spread of release areas also suggests that no single mode in one corridor will serve the public transport needs of the area. Mode and alignment assessment at this stage of the structure planning process, within a context of uncertainty, should focus on reserving a corridor for potential transit options that can respond to a range of future land use scenarios.

The preservation of this corridor provides an opportunity to accommodate a different transit response evolving over time whilst preceding, superseding or complimenting other transit options as development progresses at BWSEA.

Figure 53 - Metropolitan density for cities with and without light rail systems



5.3.8 Freight network – preservation of intermodal terminals and freight corridors

BWSEA will be a critical player within this emerging economic sub-region due to its critical mass of employment opportunities. One key role for BWSEA will be the development freight and logistics hub complementing existing trade and industry networks and supporting investment in enabling infrastructure such as freight transit opportunities particularly by rail. The potential mix of these employment opportunities will be a crucial element in the formation of the site and regionally significant intermodal terminals and freight corridors.

The Western Sydney Freight Line (WSFL) proposed directly effects BWSEA at the north east portion of the site. It comprises a connection to the Main Western Line and requires connection to the Southern Sydney Freight Line (SSFL). It is proposed to establish an intermodal terminal at Eastern Creek near Old Wallgrove Road and Archbold Road in line with the NSW LTTMP and Freight Strategy.

If the continued freight demand in the longer term continues unabated in Western Sydney, there will be a need for an additional intermodal terminal within BWSEA. If this is required in the next 50 years, a second intermodal terminal located at the Outer Sydney Orbital near Elizabeth Drive can be accommodated within the BWSEA (refer Figure 56). This will be complemented by a proposed freight line connecting the western line to the north and possibly the Southern Sydney Freight Line to the south. As discussed earlier, the rail alignments of these corridors will need to be further investigated during the detailed planning process.

The freight corridor should include the reservation of land accommodating intermodal terminal facilities with the potential throughout capacity of one million TEU. The spatial requirements for potential intermodal terminal, located within BWSEA is shown in Figure 54 and 55.

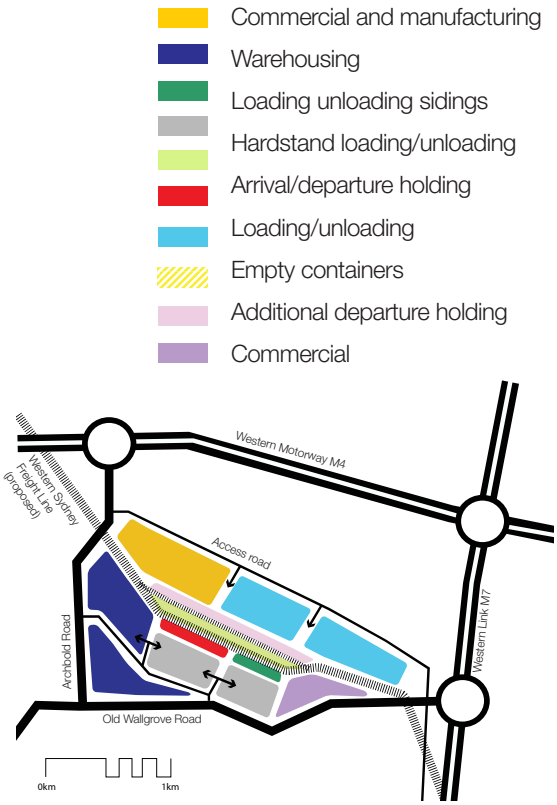


Figure 54 - Area 1: Eastern Creek indicative intermodal terminal

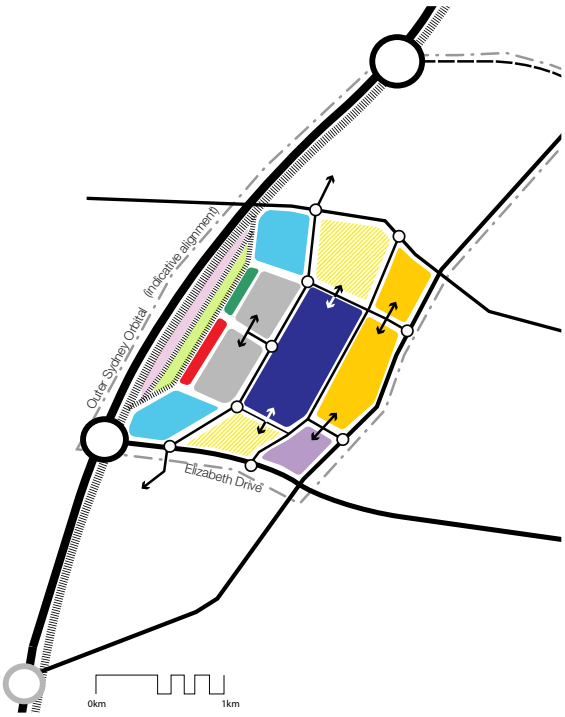


Figure 55 - Area 2: Indicative intermodal terminal (western fringe of BWSEA)

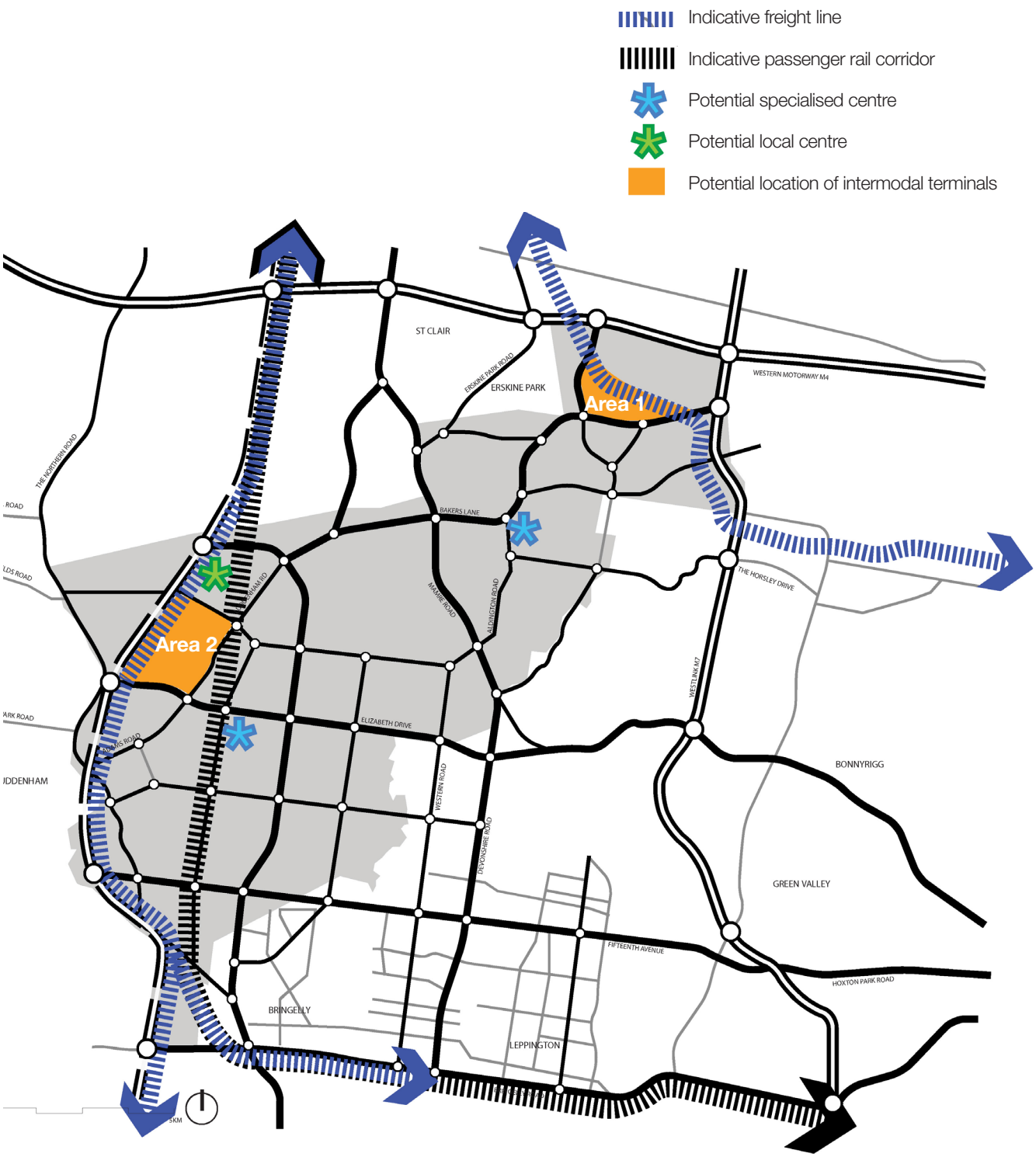


Figure 56 - Location of intermodal terminals

5.3.9 Active transport

The bicycle network has been developed on the basis of overlaying a 'coarse' regional bike network on top of the structure plan developed for BWSEA. Off road paths are provided between centres and key employment zones. These paths are supplemented by provision for widened shoulders on other roads for safer cycle travel.

Figure 57 shows the broad strategic routes identified for existing and future priority bicycle paths in the BWSEA network. It is based on achieving direct accessibility to key development sites and maximising attractiveness of active transport. The routes have been defined as shoulder or off-road. Off road routes will involve the provision of dedicated cycle ways or shared paths alongside roads or within reserves. Shoulder routes allow for widening of carriageways so that cyclists can travel on road with a safe separation from moving vehicles.Provision for cyclists will occur along other routes dependant on the ultimate development breakdown.

Pedestrians will be provided for on all routes with pedestrian paths provided on both sides of the roads where active landuses abut them. Whilst the majority of off road cycle routes are anticipated to be paths shared with pedestrians, paths may need to be separated where high levels of activity occur near employment centres.

During the next stages of the planning process, pedestrian pathways and shared cycle/pedestrian pathways will form an essential element in the design of the road hierarchy at BWSEA. The shared cycle/ pedestrian regional pathways will be located off-street (i.e. separate paths) and will follow the internal road network alignments.

Figure 57 - BWSEA future regional bike network

5.4 Ability to meet key criteria

This section incorporates a qualitative assessment of the preferred structure plan option. The assessment of the preferred structure plan from the transport, access and land use perspective was undertaken via a range of criteria, developed in consultation with DP&I and the objectives outlined in Section 3.0 of this report. The assessment process is subsequently explained in more detail in the relevant subsection.

5.4.1 Assessment process

The process adopted for the assessment of the preferred structure plan could be classified as a multi-criteria assessment. A qualitative approach has been adopted based on the following considerations:

- Being an initial, broad-level assessment, the purpose of the structure plan is to inform decision-making through a discussion of challenges and opportunities at this stage of the planning process.
- A significant degree of further investigation is required to determine the optimum road and transport network alignments with the required degree of certainty.
- No process of weighting the criteria has been undertaken.

The assessment of a preferred structure plan been undertaken by assessing each scenario by sealed colour coded rating system. The green colour shows a clear the advantage as opposed to red colour, which shows a distinct disadvantage when compared to the supporting criteria.

5.4.2 Assessment of preferred structure plan

Comments relating to the assessment for each criterion (and distribution of rating points) have been provided under each issue. The assessment is provided Tables 9 to 11 following.

Key

Table 9 - Criterion 1: Integration of land use and transport

Principles	Assessment	Rating
1.1 Maximise the proportion of employment areas within walking distance of transit service	Good level of coverage provided by a public transport network layout (note: local and collector roads not shown). The coverage and structure of passenger catchments is reasonably good, with adjustments to site coverage. This structure offers a high level of redundancy in the public transport network, which improves options and choices to users as well as the robustness of the network structure and operations to respond to evolving needs.	
1.2 Optimise opportunities for delivering transit oriented development	The highest intensity development and proposed centres are located in the areas closest to the public transport system as these will be the areas where the highest mode shares to public transport will be achieved. This 'immediacy' between development and public transport is thus crucial. "Centring" of public transport links in the macro development parcels defined by the arterial road network. Reserving rail corridor on the western side optimises the opportunities and value that the first tier public transport and transfer nodes can bring to BWSEA.	
1.3 Optimise transit staging to serve the short, medium and long term employment and land release requirements	In the initial stages, it is proposed to establish the transit corridors on Fifteenth Avenue, Western Road, Aldington Road, Bakers Lane, and Mamre Road. Local buses would also stop in this area. This would provide opportunities for transit interchanges at proposed centres to promote transit access and activate BWSEA centre in the short to medium term. From a transport planning perspective, by reserving a railway corridor on the western side, the potential exists to connect to both the NWRL and SWRL in the long term. This provides the opportunity for an additional, more powerful attractor for transit users as well as stimulating further development.	

Table 10 - Criterion 2: Network Issues

Principles	Assessment	Rating
2.1 Maximise potential for integration with existing and planned transport infrastructure	BWSEA is well located to benefit from transport infrastructure proposals for the region. These proposals have been incorporated in the structure plan and these include: • Direct access to the M4 and M7. New connections at Archbold Road and Gipps Street (known as Werrington Arterial) with the M4. • Proximity to the existing Liverpool to Parramatta Transitway, with potential future extensions to BWSEA from the east (via Horsley Drive and Fifteenth/Hoxton Park Road). • Proximity to the Western Railway Line, with potential future transit connections to BWSEA from the north (via Mamre and Erskine Park Road) to St Marys and Mount Druitt Stations respectively. • Direct access to the proposed South West Rail Link to Leppington, with potential future transit connections to BWSEA from the south (via Western Road, Fifteenth and Edmondson Avenues) to the railway line. • Structure plan sets aside a corridor along the western side to accommodate a future railway line, accounting for the possibility of future extensions north-south linking NWRL and SWRL. • Structure plans sets aside two freight corridors at Eastern Creek (north eastern corner of site) and near Badgerys Creek (western fringe of site). Based on future freight demand and capacity issues there is a strong need to reserve these corridors in the long term.	
2.2 Support the strategic aims of the NSW Long Term Transport Master Plan (LTTMP)	Transit corridors within BWSEA are in line with core bus network and public transport corridors identified in the NSW LTTMP. Mamre Road, Erskine Park Road, Horsley Drive and Fifteenth Avenue are earmarked as future transit corridors. Outer Sydney Orbital Transport Corridor including the Werrington Arterial Road. • Structure plan sets aside the following corridors identified in the LTTMP. • Western Sydney Freight Line including the Eastern Creek Intermodal Terminal. Structure plan also sets aside another Intermodal Terminal on the western fringe of the site.	

Principles	Assessment	Rating
2.3 Maximise potential for strategic connections to the higher order road network to cater for trips within the site as well as those passing through the region.	Road network defined based on its role in the traffic network and the overall transport-land use system. Primary arterial road network located to complement land uses requiring high levels of access (such as industrial/freight/logistics) by vehicles but lower levels of generation of person trips. Good coverage of arterial links to attain the required coverage of BWSEA. North-south and east-west connectivity provides effective and efficient road access to the higher order road network. Road network developed to include the separation of internal and regional trips, where possible, so internal roads serve local trips, while higher capacity roads serve regional travel. Sub-arterial road fronting a mixed use area wherever possible requiring high levels of people access. The provision of transit services along sub-arterials has also been provided. Adequate distribution of grade separated road interchanges along the M4, M7 and Outer Orbital Corridor to cater for regional travel needs. The number and location of road interchanges avoids contraction of traffic activity at a single location, by distributing traffic to the north, east, south and west.	

Table 11 - Criterion 3: Impacts

Principles	Assessment	Rating
3.1 Minimise impact on developable areas	Alignment of arterial road links around existing development areas wherever possible. Location of grade separated road interchanges have been provided such that they minimise impacts on development parcels. Existing utility facilities generally follow road corridors proposed within the structure plan.	
3.2 Minimise impacts on areas of environmental significance	Integrated transport network developed to generally avoid (wherever possible) environmental and physical constraints. Future east-west road connections within the BWSEA will need to bridge over several water sensitive areas.	
3.3 Minimise land acquisition costs	Structure plan retains existing roads with BWSEA such as Luddenham Road, Adams Road, Bakers Lane, Aldington Road, Old Wallgrove Road and Mamre Road thereby minimising land acquisition costs. These roads will need to be upgraded to cater for expected future traffic demands. Alignment and corridors generally pass over land ownership lots over 50ha. There will be some areas where the integrated transport network will pass over smaller fragmented lots.	

5.5 Transport infrastructure strategy

A key aspect in the timely and cost effective provision of infrastructure is the integration of land release strategies with the planning and implementation of infrastructure. This is to ensure that the use of existing infrastructure and any spare capacity is maximised early in the process to minimise upfront infrastructure investment and generate economic activity and a cash flow of contributions to facilitate investment in new or upgraded infrastructure.

BWSEA will be developed in stages over many years and initially the staging will be based on land ownership, market demand, cash flow and design considerations. In this context, BWSEA may take 50-100 years to be fully developed and over that time there will be many revisions in response to changes in policy, market demand, land ownership and community needs. Lessons from other land release areas demonstrate the importance of building in flexibility to accommodate future changes and ensuring land use strategies do not preclude this. Most importantly, corridors must be preserved. Corridor preservation is a key recommendation in both the State Infrastructure Strategy and the Freight and Ports Strategy.

It is important to understand the short and medium term changes in demand and service level requirements as land is developed and occupied. Although a particular capacity or service level is required for ultimate development, infrastructure can usually be provided in stages to match demand and lower levels of service can be tolerated in the short term.

The structure plan for BWSEA has identified transport infrastructure to service the ultimate development. It has also identified certain elements to service a proposed development staging. Infrastructure planning and implementation is by its nature incremental and the smart sequencing of infrastructure will minimise the upfront cost of a staged development.

The key aspects of this approach include:

- Assessing infrastructure demand over the proposed development period and identifying critical short term demands
- Detailed investigation of existing infrastructure capacity to identify thresholds
- Critically reviewing design criteria to identify any short term reduced “level of service” opportunities
- Preparing an infrastructure constraints and capacity map and overlaying it with the proposed project staging plan
- Preparing an infrastructure sequencing plan which moderates the development staging plan as required taking advantage of infrastructure capacity
- Preparing and integrated development strategy incorporating market demand, development staging infrastructure sequencing and cash flow.

5.5.1 Importance of corridor preservation

A number of significant transport corridors have been identified in Commonwealth and State Strategies that will affect the structure plan. These have been incorporated in transport planning elements together with other critical corridors. The preservation of such corridors is the first step in a staged transport infrastructure plan. There are a number of different requirements for corridor preservation.

- *State or nationally significant infrastructure* such as the Outer Sydney Orbital Motorway and the Northern and Western Sydney Freight Lines. The need for these elements exceeds the requirements of the BWSEA and the location and nature will be determined in consultation with other strategies. The corridors have been generally located and defined in the structure plan, however, extensive additional work taking into account National, State and Local needs is necessary before they can be accurately defined. This work will need to be undertaken in parallel with the next phases of the BWSEA planning process.

- *Regionally significant infrastructure* such as new and upgraded arterial and sub arterial roads and mass transit corridors. These elements are required specifically for BWSEA however connect to external regions. They have been generally located and defined and will be accurately defined in subsequent phases of the BWSEA planning process. In some cases the corridors follow existing rural roads which will require widening and geometric adjustment.
- *Collector and local roads* which are part of land subdivision. These will be located and defined during the development and subdivision process and will not require earlier corridor preservation.

5.5.2 Initial staging considerations

The potential programming for land uses needs to be determined as part of a broader review of the BWSEA overall employment mix and staging. In the immediate term, there may be some potential for an early win of employment product within the north-eastern portion of the site. This area is most readily accessible to established transport and utility infrastructure. It is the area least constrained by physical and environmental constraints based on current development patterns.

Development options for land within the western portion of the site (i.e. Luddenham Road West, Adams Road, Commonwealth Land Badgerys Creek and SWGC Industrial) are determined by both regional and national infrastructure considerations, including the Outer Sydney Orbital and future rail and freight connections.

Freight related infrastructure for the two intermodal terminals proposed at Eastern Creek and near Elizabeth Drive (western end) and Outer Sydney Orbital will need to be developed in advance in order to provide facilities for freight related commerce.

Should the rail and freight link go ahead as reserved in the structure plan (in the form of land set aside), the nature of this portion of the site means that it will be the most complex and expensive to resolve, but may also afford some of the highest densities and land use clusters around these significant transport corridors. Should the rail and freight line not proceed in the longer term, options for this area will be determined by value generated by regional accessibility and proximity to local employment opportunities.

5.5.3 Staging to achieve optimal integration of transport

The transportation strategy has ensured that landuse and transport have been integrated at every stage and in every aspect of the structure plan. The position of BWSEA provides an important logistics centre for Western Sydney and an increasingly important employment area. Proposed transport corridors identified in the NSW LTTMP within Western Sydney supports BWSEA's potential for logical expansion in accordance to economic and demographic drivers. These elements provide a critical element of sound integration of transportation and land use.

The development of the transportation network should be staged in such a way that efficiently and effectively meets the aims of the structure plan and transportation strategy. A primary aim of the structure plan and transport strategy that supports it is to cluster proposed centres in such a way that a 'critical mass' of trip generation is established within transit catchments from the earliest stages of development.

Improved integration would be achieved by allowing higher densities and clusters of different land uses together around public transport nodes and corridors, such as around future rail and freight corridors and high quality transit corridors. By allowing higher densities and a greater mix of land uses, including local employment, destinations are closer together, reducing travel distances.

Importantly, the staging will also ensure that transport can function efficiently, to optimally serve the needs of the BWSEA and re-enforce a coherent urban structure at all stages of development.

5.5.4 Staging to ensure coherent development of BWSEA

The structure plan will ensure that in the early years and through to full development, transit will be an integral part of BWSEA. Staging the development of BWSEA should occur in alignment with the roll out of transport infrastructure. The financial sustainability of this type of transport infrastructure depends on the population and employment to support the proposed service.

Initially, a network of regular and reliable buses converging at transit interchanges in the heart of BWSEA will play an important role. High levels of transit service will be a critical element of the broader plan to develop the 'riding habit' from the earliest years of the development and to ensure sustainable modal shares as BWSEA matures.

By establishing a transit interchange in the heart of the first stage of development (Precinct A), will ensure that transit is visible and accessible from early stages. In the later stages, a higher capacity transit services will be established to serve other centres (Precinct B and C) to the overall development and with close access to the railway and freight corridors on the western portion of the site.

The indicative staging described below has been formulated in conjunction with the establishment of the road network and transit facilities to ensure that BWSEA evolves in a coherent and efficient manner.

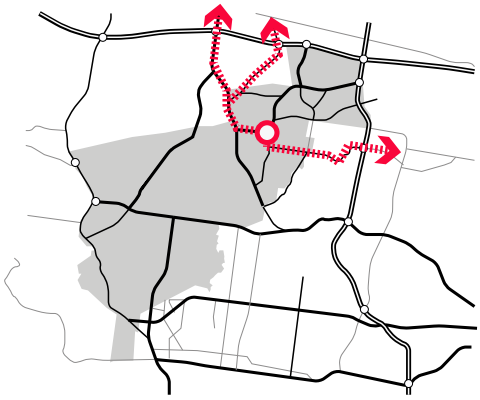


Figure 58 - **Stage 1**

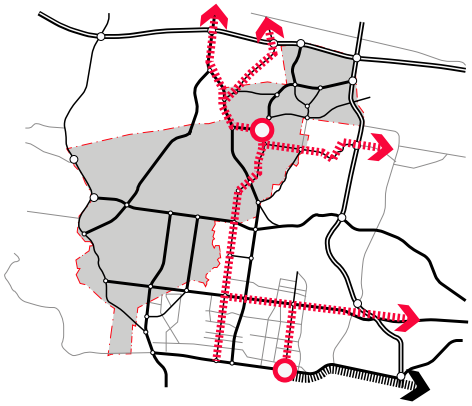


Figure 59 - **Stage 2**

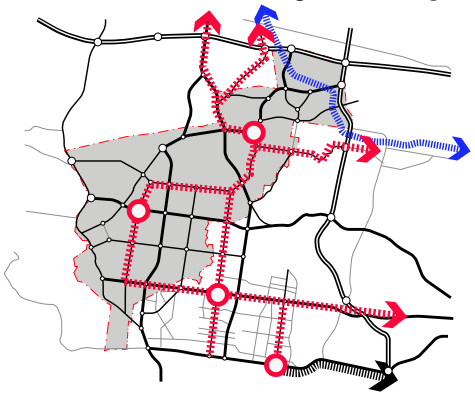


Figure 60 - **Stage 3**

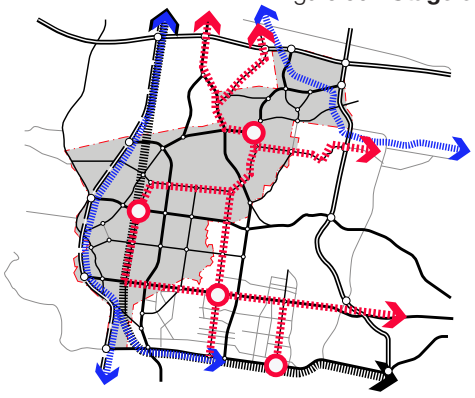


Figure 61 - **Stage 4**

Stage 1 – Consolidation and delivery of first transit interchange

The employment parts of the proposed specialist centre east of Bakers Lane (Precinct A) are expected to be developed in the early stages. It is proposed to stage the road system in the core area to provide quality access to development centred on Aldington Road and Bakers Lane and then to gradually extend the road network system. It is proposed to develop roads progressively to provide access to these areas and to service the higher order road network with connections to the M4 (via Archbold Road, Roper Road and Mamre Road) and M7 (via Old Wallgrove Road, Southern Link Road and Horsley Drive).

The introduction of a transit interchange centred on Aldington Road and Bakers Lane will be the catalyst for the concentration of development in the core area. This will need to be complemented with transit corridors along Horsley Drive, Bakers Lane, Mamre Road and Erskine Park Road. These transit corridors will provide important links to the Western Railway Line (St Marys and Mount Druitt Stations) to the north, and the Liverpool to Parramatta Transitway to the coast.

In the short term, the transit interchange and proposed corridors will provide a point of attraction for transit users. They will access transit services by foot, bicycle, local bus, and car.

Stage 2 – Expanding BWSEA to link with south west growth centre

This stage sees the expansion of BWSEA to the South Growth Centre in particular to Leppington. It is proposed to utilise existing east-west road corridors such as Elizabeth Drive, Fifteenth Avenue and Bringelly Road as the catalyst to progressively introduce new north-south links along Western Road, Devonshire Road and Aldington Road.

The SWRL will be the backbone of SWGC's public transport network carrying the vast majority of its passengers with the highest productivity and level of service. The expansion of transit corridors linking the proposed specialised centre (Precinct A) and Leppington will provide the most direct route between the two centres linking residential and employment areas to key public transit nodes. The transit corridors along Aldington and Western Roads will provide faster and more efficient bus routes and would assist in attracting new passengers to bus services providing direct access to BWSEA.

Stage 3 – Increasing east-west connectivity

A key issue for the BWSEA is the availability and quality of east-west road connections. At present, a limited number of roads currently with more minor roles, such as Luddenham Road, Adams Road and Elizabeth Street (western end), provide parallel east-west routes for traffic movement. Further development will require greater demand for access for local and regional travel particularly east-west connectivity through BWSEA.

This stage sees the expansion and upgrading of key east-west arterial road connections with several bridge crossings of water sensitive areas. It is envisaged that these links will extent to connect to the Northern Road during the interim period whilst a decision is made on the Outer Sydney Orbital with the latter to be considered in Stage 4.

It is proposed to have the arterial road network supplemented by east-west sub-arterial roads providing parallel routes. The main function of these sub-arterial roads are to provide high levels of people access to fronting developments with sufficient space to accommodate the needs of transit services.

It is proposed to have a transit corridor to the west of Badgerys Creek Road linking the proposed centre (Precinct F) located near Elizabeth Drive and Badgerys Creek Road whilst a decision is being made on new railway lines (for passenger and freight) on the western side of BWSEA. A successfully integrated public transport network, incorporating bus and rail travel, would help to encourage travel by public transport rather that car, while reducing the land take of the built-up urban area.

In order to provide for a more balanced employment structure for freight and logistics within BWSEA, it is proposed to have an intermodal terminal located at Eastern Creek near Old Wallgrove Road and Archbold Road) as identified in NSW LTTMP. A freight line extending from the Western Rail Line through the north-eastern corner of the site will need to be established.

During this stage new transport services will be further developed throughout the area in the context of an integrated transport network. This network would range from local 'feeder' bus services to public transport nodes, to direct, high quality and efficient transit corridors and connections to heavy rail (at Leppington Station).

Stage 4 – Building a comprehensive picture

As BWSEA and South West Growth Centre develop to their full potential, demand for access to regional transport facilities and employment will grow. These developments will have significant travel impacts across the region, including Penrith, Blacktown, Fairfield, Campbelltown, Camden and Liverpool local government areas (and beyond). A mix of travel options will need to be provided to support additional growth corridors, including public transport, freight transport and the demand for road capacity will require significant road upgrades.

The introduction of the Outer Sydney Orbital will provide significant regional movement opportunities between major centres and to BWSEA road network. It is proposed to have grade separated road interchanges for all east-west arterial links from BWSEA to the Outer Sydney Orbital.

The structure plan makes provision (in the form of land set aside) for north-south passenger and freight rail links into and out of the site and the location an Intermodal Terminal (at the Outer Sydney Orbital and Elizabeth Drive).

Timing of new railway lines (for passenger and freight) on the western side of BWSEA would depend on the State Government. This might be built in stages, first to SWRL and then on to join the Western railway line, and then connecting to the NWRL via Richmond Line. In the longer term, railway services will provide an additional, more powerful attractor for transit and freight users. Any new railway stations within BWSEA will also constitute another layer of interchange, complementing transit corridors and local bus services.

The specialist employment centre located near Elizabeth Drive and Badgerys Creek Road will be easily accessed by the road and public transport network to enable access by a range of modes.

5.6 Transport infrastructure funding

5.6.1 Funding sources

There are four main sources of funds available for the transport infrastructure required for the BWSEA.

These are:

1. **The Federal Government** through the Nation Building Programme which incorporates a number of special funding programmes such as National Projects and Roads to Recovery. Some funds are provided for Local Government through the Financial Assistance Grants scheme
2. **The State Government** through its annual budget allocations to State Agencies and special programmes resulting from transport strategies such as the Long Term Transport Master Plan (LTMP) and the State Infrastructure Strategy (SIS).
3. **Local Government** normally funds sub-arterial and local roads, cycle paths and footpaths using funds provided by Federal and State governments, developer contributions and local rates.
4. **The Private Sector** through developer contributions levied through Section 94 or specific State Infrastructure Contributions (SICs). SICs have been utilised for Sydney's North West and South West Growth Centres. The level of contribution has varied but has been 50% and 75% of the cost of certain infrastructure.

In addition some major transport infrastructure such as the Outer Sydney Orbital or the Eastern Creek Intermodal Terminal is expected to be suitable for financing through Public Private Partnerships.

However, as described in the State Infrastructure Strategy (page 198) *"All new infrastructure is ultimately funded via taxation or user charges. Private financing in its own right does not create more money for infrastructure development."* and *"The Government's capacity to fund new infrastructure is limited to the difference between revenue (primarily taxation) and recurrent expenditure on Government services and policies."*

5.6.2 Funding gap

It has been recognised that there are insufficient funds available to develop transport infrastructure in a timely manner. This "funding gap" has been recognised in the NSW Long Term Transport Master Plan. *"While substantial, our current level of road funding is not sufficient to upgrade and maintain the road network over the long term."* (page 322)

The LTMP has considered a number of ways to reduce costs and increase funding and included a number of specific recommendations. Similarly, the SIS (page 202) has recommended six strategies to *"unlock the funding required for the delivery of the Strategy's identified priorities"* These include a number of new initiatives which will *"involve difficult choices."*

Infrastructure Australia in its June 2012 Progress Report (page 15) identified the need to address two long term challenges:

"Facing up to the fiscal gap confronting governments - the cost of projects will almost certainly exceed the funds likely to be available for spending on infrastructure

Willingness to pay – there is a substantial *'disconnect' between infrastructure expectations in the community and the nation's willingness to pay for infrastructure".*

5.6.3 Specific projects

It is critically important to preserve corridors at the earliest stage in the planning process. This will significantly reduce the cost of land acquisition and ensure that land is available thus avoiding more costly infrastructure designs.

The Outer Sydney Orbital, the Western Sydney Freight Line and the Eastern Creek Intermodal Terminal have been identified in Commonwealth and State Transport Strategies. These have already been earmarked for further investigation and subsequent funding. The SIS has recommended corridor preservation within the next 5 years. These will require funding for investigation to identify corridors and subsequent land acquisition.

Similarly, detailed investigation will be required to identify corridors for the Mass Transit Routes and Arterial Roads thus enabling early acquisition.

Figures 55-58 sets out an initial staging plan for the various elements of transport infrastructure, and the expected timing for significant funding at development stages (ie investigation, corridor acquisition, development approval, construction)

5.6.4 Timing of developer contributions

The majority of local and sub-arterial roads will be funded by the developer through the construction of specific works or payment of levies. In the early stages of a land release this usually creates significant cash flow problems as the upfront funding requirements are often very large and the developer relies on sales to generate cash flow.

For single ownership areas, the developer can often manage expenditure, debt and sales to match an overall cashflow and thus fund initial infrastructure. However, for multiple ownership areas this is much more difficult as the “first” developer usually has to fund a disproportionate share of infrastructure. Also the physical location of the development site may require construction of extensive infrastructure to provide connection to the overall network.

This can impede the release of developed land and affect overall planning targets.

The Contributions Plan needs to recognise these issues and ensure there is adequate cashflow and funding to match the staged land release.

6.0
Summary and findings

This section presents the findings and outcomes of the preferred structure plan, and the key elements of the integrated transport network.

6.1 Overview

The structure plan developed for BWSEA will provide a long term spatial framework to coordinate future planning and development. The structure plan and its transport planning elements define specific spatial outcomes to reflect and support land use, economic development, environment protection and infrastructure investment.

The BWSEA Structure Plan provides a robust basis for coordinated and responsive sequencing of more detailed master planning, precinct planning and associated transport infrastructure servicing in response to emerging market and economic conditions.

From the transport planning perspective, the structure plan has sought to address the following:

- Define the core elements of the national, metropolitan, regional and local development context for BWSEA.
- Identify the key constraints and opportunities for BWSEA.
- Establish transport vision and objectives to guide the generation and evaluation of the structure plan for future development.
- Coordinate the translation of key transport planning drivers into desirable and measurable spatial development outcomes.
- Develop an integrated transport and land use solution to cater for expected travel demands likely to be imposed by BWSEA development.
- Provide indicative staging and funding plans to ensure coherent development of BWSEA.

6.2 Key outcomes

Key outcomes identified as part of the structure planning process includes the following:

Context of the site

- BWSEA is located with Sydney's principal metropolitan transport corridors providing a logical and efficient location for long term employment growth.
- BWSEA has a high level of accessibility on the higher order road (M4 and M7 motorways) network for emerging industry and logistics facilities of international and regional significance.
- BWSEA has a vast scale providing an important competitive advantage but entailing significant implications for the form and timing of its future development and infrastructure provision.
- BWSEA will provide an important logistics centre for Sydney which will require significant regional movement opportunities between major centres and Sydney's motorway network (current and planned).

Reservation of key corridors and land

- The opportunity to reserve a corridor for the Outer Sydney Orbital with grade separated road interchanges at key access connections to serve regional travel along this high capacity link.
- The opportunity to reserve a north-south rail (passenger) corridor linking the South West Rail Link and North West Rail Link (via Richmond Line). This will be dependent on whether densities can support this choice of transport mode in the future.
- Land for future transit corridors (rail and freight) needs to be set aside quickly to minimise the cost of future acquisitions.
- Consultation with key stakeholders so that key transit corridors are reserved as soon as possible before development proceeds at a rapid pace.

- The opportunity to reserve the Western Sydney freight line and north-south freight corridor through BWSEA to aleviate freight network constraints on the western line to Port Botany, and other freight movements heading south.
- The opportunity to reserve two terminals within BWSEA to cater for future freight demand for Western Sydney over the next 35+ years.
- The reservation of this land should be capable of accomidating intermodal terminal facilities with potential throughout capacity of up to one million TEU.

Integrated transport network

- Provision of an interconnected, legible, urban-scale grid street pattern that will provide a pedestrian-friendly environment and optimal opportunities for transit servicing and access.
- A desire to see integration of the different elements of the public transport network, with different modes fulfilling different roles.
- There are two railway lines (Western and South West Rail Link) that could provide an excellent first-tier public transport network around BWSEA. Transfer nodes between the first- and second-tier public transport networks constitute a critical consideration in terms of public transport network structure and operation.
- The establishment of transit interchanges at proposed specialised centres and at key transfer nodes to promote transit access and activate BWSEA in its early years.
- A desire to optimise the integration of land use and transportation by allowing higher densities and clusters of different land uses together around public transport nodes and corridors, such as around rail stations and high quality transit corridors.
- BWSEA offers excellent physical dimensions for transit oriented development, or development in such a way that can effectively and efficiently provide access by public transport.
- Ensure timely land release of both employment and surrounding residential areas to assist and support future transit movements through BWSEA.
- Local bus services are an integral part of the transportation strategy and structure plan.
- Sound planning and the provision of high quality facilities for pedestrians and cyclists constitute a crucial element of the transportation strategy and structure plan.

Transport infrastructure staging

- Opportunity to integrate Eastern Creek (north-east portion of site) with the proposed South West Rail Link during initial staging, enabling access between multiple trip origins and destinations linking residential and employment areas to key public transit nodes.
- Consideration of the vast size, timeframes and employment yields of BWSEA, staging of infrastructure improvements and potential improvement of services necessitates the need for combinations or 'packages' of options to provide a comprehensive transport and land use solution for the study area.
- If transport demand grows to a point that necessitates a staged upgrade within BWSEA, there will be significant impact on the travelling public when the upgrade is affected unless there is a reservation where the new mode can be constructed quasi-independently of the existing mode.

Transport infrastructure funding

- The capital infrastructure costs of the structure plan are very large, commensurate with the scale of transport capacity that it provides.
- Future developers will benefit greatly from the increased accessibility afforded to their developments by the proposed transport network in the structure plan. Private developers will need to contribute to the cost of infrastructure provision through value or cost-sharing mechanisms.
- The capital infrastructure costs will be funded by a combination of developer cost-sharing contributions, private finance, government grant and government-backed borrowing. The appropriate balance of these sources of funds should be determined by the State and Federal Government. The balance will vary depending on the prevailing economic environment, other demands on the Government's resources and the availability and cost of credit and equity for privately funded elements of the structure plan.

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