Australian Government | Infrastructure Australia

Corridor Protection

Planning and investing for the long term

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REFORM SERIES

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It leads reform on key issues including means of financing, delivering and operating infrastructure and how to better plan and utilise infrastructure networks.

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Cover: The Kwinana Freeway and Mandurah rail line in Perth have been developed on corridors protected in the past.

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Executive summary

Australia's governments have a powerful opportunity to deliver an enduring legacy to future generations by protecting critical infrastructure corridors and acquiring them early. Seizing this opportunity could underpin our nation's next phase of growth, enhancing the future economic and social prospects of all Australians. In contrast, the cost of inaction is estimated to run to billions of dollars.

Our cities and regions will grow substantially over the coming decades. Between 2017 and 2061, Australia's population is projected to increase by 16.7 million people – the equivalent of adding a new city the size of Canberra each year. This growth brings opportunities for all Australians, but it also brings challenges.

In the context of tight budgets, an ageing population and growing demand for services, delivering the infrastructure we need will become an increasing challenge. Many of the solutions lie in reforms to the way we structure markets and pay for infrastructure, but planning for and building new infrastructure will also be key.

The test for governments is how to extract maximum value from the infrastructure we already have, while delivering the infrastructure we need as efficiently as possible.

Improving long-term infrastructure planning is an important means of lowering the cost of new infrastructure. We know that planning the right infrastructure early, timing its delivery to meet demand and ensuring it is fit for purpose enhances economic opportunity and saves money.

This is particularly true when it comes to identifying and protecting infrastructure corridors.

Done well, corridor protection reduces the future financial costs of delivering infrastructure, while minimising the social costs of acquiring homes and businesses, and disrupting existing communities. It minimises the chance that infrastructure will need to be delivered in expensive tunnels; it protects against a scenario where critical infrastructure goes undelivered as a result of prohibitive costs.

This paper outlines the case for effective corridor protection for future infrastructure projects. It demonstrates that a relatively modest investment today can pay substantial dividends tomorrow.

To prove the scale of the opportunity, Infrastructure Australia has modelled a number of scenarios for the seven transport corridor protection initiatives in the 2016 *Infrastructure Priority List*.[1]

According to the independently audited model, the protection and early acquisition of just these seven corridors could save Australian taxpayers $10.8 billion in land purchase and construction costs (measured in discounted 2016 dollars).

Corridor protection reduces the future financial and social costs of infrastructure

'Corridor protection' is a broad term covering a variety of actions that governments can take to identify and protect land required to deliver future infrastructure. It is the first step in translating long-term infrastructure strategies and plans into an operating piece of infrastructure that serves the Australian community.

In effect, corridor protection provides future generations with an affordable option to proceed with a project. Governments can then determine when and how to deliver the project, knowing that the cost of delivery is likely to be much lower than if the corridor had not been protected.

The required land is usually in the form of a linear corridor. Under an effective corridor protection regime, governments typically limit development on the corridor and progressively acquire the land. As such, when it is time to deliver the project, governments own most or all of the corridor.

Corridor protection has two principal aims:

1. By protecting required land today, governments can minimise the future cost of building new infrastructure. Reserving a corridor limits development on the land that would otherwise add to project costs. Early acquisition protects against the possibility that the cost of the land will increase over time, increasing the future cost of delivering the infrastructure.
2. Corridor protection minimises the social disruption that occurs when infrastructure is delivered within developed areas.

Failing to protect corridors can result in a preferred alignment for a project being 'built out'. As a result, rather than acquire developed properties for the project, a future government may have to adopt a less direct route or decide to construct the project as a tunnel. This almost always adds substantially to the project's costs, requiring governments to draw on funds that might otherwise have been available to pursue other priorities. Ultimately, a project may not proceed at all as it becomes simply too expensive to be paid for by taxpayers or users.

We have successfully protected corridors in the past

Corridor protection has been successfully pursued in the past. During the mid-twentieth century, a number of jurisdictions applied processes to protect future infrastructure corridors from development. We are the beneficiaries of that foresight. Infrastructure now viewed as essential to the functioning of our largest cities was developed in the 1980s, 1990s and 2000s on corridors that were identified and protected in the 1950s, 1960s and 1970s. Examples include: the M4 and M5 motorways in Sydney (and parts of the M7 motorway); the M1 and EastLink motorways in Melbourne; the Mandurah rail line and Kwinana Freeway in Perth; and the O-Bahn in Adelaide.

More recently, governments have been less active in protecting new corridors.

Pro-active steps have, however, been taken following some notable state-based strategic plans acknowledging the need to identify and protect corridors for major infrastructure projects. The NSW Government has identified a number of corridors needing protection, and has commenced studies to define options for several of those corridors. In Victoria, the corridor for the Outer Metropolitan Ring/E6 has been protected, and there are proposals for the protection of other corridors. The current transport plan for Perth flags an intention to protect an underground corridor for an inner city subway.

These initiatives are to be commended and encouraged.

Building on those actions, corridor protection efforts need focussed attention from governments to fund:

- the feasibility studies and investigations necessary to define the corridors requiring protection
- where appropriate, early and on-going acquisition of the necessary properties.

Corridor protection is a pressing need in the context of Australia's wider challenges

Australia is undergoing a period of profound change. Our population is expanding, requiring governments to plan for substantial growth. This is happening both in the established parts of our cities, requiring underground and surface corridor protection, and also on their edges, where large new corridors are likely to be needed.

The early investment this will require is a challenge at a time when governments face difficult expenditure and revenue decisions to close projected 'fiscal gaps'. Governments are confronted by rising expectations for better infrastructure and services, rising costs in supporting an ageing population and a declining proportion of the population that is working and contributing to tax revenues.

Yet, without effective corridor protection policies, delivering critical infrastructure will become increasingly difficult. Otherwise, rising demand for infrastructure investment, and mounting costs of delivery, could mean governments are unable to deliver the infrastructure required to support a strong economy and our growing population.

Protection can save taxpayers and users billions of dollars

Infrastructure Australia has modelled the potential cost savings associated with protecting a corridor under a range of scenarios. We believe this is the first time modelling of this type has been undertaken in Australia. The model and its assumptions have been independently audited.

Three different scenarios were modelled:

1. **Do not protect now and acquire at construction**: a corridor is not reserved and the land required for the corridor is acquired in the two years leading up to the start of construction.
2. **Protect and acquire now**: the corridor is reserved from 2017 and all land for the corridor is acquired within two years.
3. **Do not protect now and tunnel in future**: a corridor is not reserved and: (i.) tunnelling is undertaken on parts of the route that were rezoned and developed in the intervening years; and (ii.) sections of a corridor not placed in tunnel are acquired in the two years prior to construction.

The 'protect and acquire now' and the two 'do not protect' scenarios set the 'book ends' within which other protection scenarios can also be tested. For example, various scenarios involving reserving a corridor and staged acquisition of land fall within the end points.

Even taking a conservative approach, the modelling finds that, under the 'protect and acquire now' scenario, governments could save up to $10.8 billion ($2016, at a 7% real discount rate) in the cost of developing the seven projects, compared to the 'do not protect' scenarios. In real, undiscounted terms, the savings are up to $57.1 billion ($2016).

Figure 1 presents the potential savings for the seven corridors.

The savings differ between the corridors, due mainly to variations in the size and location of the corridor. For the larger projects, failing to protect a corridor and subsequently building sections of the project in tunnel adds many billions of dollars to their cost. Smaller projects, such as the Hunter Valley rail freight re-alignment, deliver important savings from corridor protection but on a more modest scale.

The 'do not protect and acquire at construction' scenario also involves a risk that governments would have to acquire substantial numbers of houses and commercial properties. Under that scenario, housing supply pressures may have led future governments to rezone for urban development land that was otherwise intended for the corridor. This means that, in addition to the direct financial costs, failures in corridor protection will also have broader social and economic costs.

Figure 1: Potential savings from protection and early acquisition of 2016 Infrastructure Priority List corridors ($2016, 7% real discount rate)

Source: Infrastructure Australia

The savings associated with the Outer Sydney Orbital and the High Speed Rail corridors are noteworthy, both because of the scale of the potential savings and the immediate development pressures facing both corridors. In the case of the Outer Metropolitan Ring/E6 corridor in Melbourne, the Victorian Government's decision to reserve a corridor will yield substantial cost savings. These savings could be further increased if land in the corridor is acquired early.

The model used to inform this paper will enable governments to test a wide range of assumptions and scenarios before deciding whether, when and where to protect a corridor. More detailed modelling of individual corridors may yield higher or lower results.

In developing detailed business cases for corridor protection, governments may test different alignments for a project, or a variety of assumptions about the timing of a project, growth in land values and the development pressures that may affect a corridor. These more detailed investigations and modelling may lead governments to conclude that, in particular cases, corridor protection is not required.

Nevertheless, the scale of the cost savings presented in this paper strongly suggests that, in many cases, corridor protection can deliver substantial benefits for individual jurisdictions and the nation. Based on reasonable assumptions and conservative modelling, the cost of inaction appears to be prohibitively high.

Progressive acquisition of land

Over the long term, the price of land in Australia's larger capital cities has grown faster than the rate of inflation. Previous analysis by Infrastructure Australia found that, in the 20 years to 2012, underlying land values in the three east coast capital cities grew around 3% per year faster than the rate of inflation.

In such circumstances, any delay in acquiring land for a corridor can add materially to the cost of a project. Accordingly, the savings from corridor protection are likely to be maximised if the corridors are acquired now.

However, acquiring entire corridors usually requires large, upfront outlays by governments – funds that may be required for immediate infrastructure priorities. Even so, substantial sums can be saved simply by reserving a corridor and then progressively acquiring the properties in question. This approach to acquisition still avoids the large increases in land acquisition and project costs that occur when land required for a corridor is otherwise subdivided and developed.

In the early years after reserving a corridor, as a minimum, governments only need enough funding to purchase properties where the affected owners have the right under current legislation to ask governments to acquire their property. Other mechanisms are also available to minimise upfront costs for governments, while treating existing landowners fairly.

Rental revenues and value capture

Land acquired for corridor protection purposes can often be rented out, creating a revenue stream for governments between land acquisition and project construction. These revenues will at least partially offset upfront acquisition costs. In the past, governments have pursued this approach, renting properties to interested parties, including previous land owners.

Renting out the acquired properties for a productive use also minimises the risk that the community sees the land as an extension of local open space networks. Corridors protected in the past have sometimes been used as open space for a long period, making it difficult for a future government to then use the land for its intended infrastructure purpose.

As noted in Infrastructure Australia's recent paper, *Capturing Value: Advice on making value capture work in Australia*, early acquisition of land required for a corridor can also be an effective platform for value capture.

Other corridors should also be considered for protection

An effective protection framework has the potential to lower the cost of delivering projects in corridors beyond those identified in the *Infrastructure Priority List.* Around the country, governments and their advisory bodies have identified a number of other corridors that could also benefit from some form of protection. Based on the results presented in this paper, we can reasonably conclude that the cost of delivering infrastructure in many of those corridors could also be reduced through an effective protection regime.

Importantly, the case for corridor protection does not only apply to large projects in greenfield areas on the edge of Australia's cities. As our cities redevelop, protecting a range of smaller, 'first and last mile' links is likely to become increasingly important. For example, with governments encouraging greater use of public transport, land may be required to accommodate public transport improvements in and around existing centres. Likewise, targeted protection initiatives may be required to facilitate the movement of freight and deliveries in the established parts of our cities. Protecting underground corridors for future tunnels will become increasingly important. This is especially important in the established parts of our cities, where building foundations and underground carparks can compromise the alignment of planned projects.

State governments and councils will play a key role in ensuring these opportunities are pursued.

Thinking about Australia's potential development later into the century, corridors in regional areas may also need to be identified and protected. As the use of rural land changes, the risk of land use conflicts is growing. Companies are investing more in rural land to increase the productivity of farms and other rural land uses. Rural land is also being developed for new activities, such as renewable energy generation. Although the options for locating a rural corridor are likely to be broader than for those in and around our cities, we need to be mindful that any failure to identify and protect some rural corridors could have adverse consequences.

Building on the *Australian Infrastructure Plan*

In recommendation 9.4 of the *Australian Infrastructure Plan* (the Plan), Infrastructure Australia called on governments to establish effective corridor protection mechanisms and outlined the key elements of an overall corridor protection framework.

In its response to the Plan, the Australian Government formally supported Infrastructure Australia's recommendation, while noting that corridor protection is also a matter for state and territory governments.

About this paper

This paper builds on the Plan's recommendation, demonstrating the strategic and financial case for corridor protection in three chapters:

1. The strategic case for corridor protection: examines past approaches to corridor protection, and considers urban growth and fiscal trends that highlight the importance of protecting infrastructure corridors.
2. Estimating the savings from effective corridor protection: presents the results of modelling the seven corridors in the Infrastructure Priority List.
3. Conclusions and next steps: identifies issues that need to be addressed in an effective corridor protection framework.

Each chapter includes a set of findings, providing an independent and rigorous assessment of the benefits that would be delivered by timely corridor protection. These findings also make a clear case for Australia's governments to take action to establish effective corridor protection mechanisms across the country.

Infrastructure Australia will consult with governments and industry on the findings in this paper to determine the steps required to establish an effective national framework for corridor protection.

The model developed by Infrastructure Australia to generate the figures in **Chapter 2** of this paper will be made available to all governments to assist them in assessing options for protecting corridors identified in their strategic plans.

Recommendation 9.4

The Australian Government, in partnership with state and territory governments, should establish effective corridor protection mechanisms to ensure the timely preservation of surface, subterranean and air corridors, and strategic sites, for future infrastructure priorities. The mechanism should include:

- long-term strategic planning and project development work to identify corridors and lands
- a stable and independent governance framework
- shared financial responsibility between the Australian Government and its state and territory counterparts.

The strategic case for corridor protection

Findings

1. **Australia has a strong track record of protecting corridors, providing clear lessons for governments.** Many key infrastructure assets we rely on today have been built on corridors protected during the 1950s, 1960s and 1970s.
2. **Despite broad consensus on the merits of corridor protection, action to protect corridors has been the exception rather than the rule over recent years.** Governments need an increased focus on long-term planning, project development and land acquisition to ensure corridor protection is appropriately prioritised through budgetary processes.
3. **Failure to appropriately protect corridors could hold substantial costs and risks for governments and, in turn, for taxpayers.** A lack of action could result in: corridors being 'built out'; project costs rising due to the need for tunnels or longer, more indirect routes; and projects being delayed or cancelled.
4. **The fiscal challenges facing Australia's governments reinforce the need to protect key corridors.** Governments face rising costs to support a growing and ageing population, while providing the transformational infrastructure required to support Australia's economy in the twenty-first century. Without effective corridor protection, governments and the communities they serve may find that some important infrastructure projects become increasingly uneconomic and difficult to afford.
5. **Rising demand for land, particularly in our fast-growing cities, is likely to drive continued growth in the cost of acquisitions required to make way for critical infrastructure investments.** Corridor protection is essential to safeguard governments – and taxpayers – from future growth in land prices and their impact on infrastructure costs.

Defining infrastructure corridors and sites

In this paper, the term 'corridor' refers to the land required for linear infrastructure – such as, roads, railway lines, energy networks and water pipes – that Australia requires to grow economically.

The term also refers to key nodes in our infrastructure networks. This is particularly important in the transport sector. For instance, efforts to develop a more economic and sustainable freight system will require substantial strategic sites for intermodal freight terminals and new port infrastructure.[2] Protecting sites and appropriate buffers for these developments is just as important as protecting the linear corridors themselves.

Similarly, protecting sites for hubs in the passenger transport network – rail and bus stations, transport interchanges, commuter carparks – falls within the definition of 'corridor' used in this paper.

Development sites on land adjoining these nodes, such as sites for developing office or residential towers, could also be considered part of a 'corridor'. However, that is not the primary focus of this paper. Rather, the paper focuses on addressing the central public policy challenge in this area: how to protect and secure a corridor for constructing the infrastructure itself.

The term 'corridor protection' also applies to tunnels. As redevelopment occurs in the established parts of our cities, protecting subterranean corridors for tunnels will become increasingly important, particularly where a tunnel is expected to approach the surface. Underground carparks and building foundations can affect the choice of alignments for tunnels and the resulting cost of projects.

Maintaining the operational integrity of our airports is also part of corridor protection. Development controls need to be in place to manage noise-sensitive land uses around airports, and to ensure that tall structures are not allowed to impinge on operational airspace.

Protection requires action on multiple fronts

The term 'corridor protection'[3] covers a variety of government actions to identify land likely to be required for some form of future infrastructure and to then:

- control or limit development on that land, especially parts of a corridor at risk of being 'built out'
- progressively acquire that land so that, by the time the infrastructure needs to be built, most or all of the corridor is in government ownership
- apply land use controls to adjoining land to protect the future operational integrity of the infrastructure.

The principal aims of corridor protection are to minimise both the future financial cost of developing the infrastructure and the social cost and disruption to people's lives that might otherwise occur if the land is developed for other purposes. Corridor protection actions typically involve:

1. identifying a future need for infrastructure, such as a future transport link, in a strategic planning document
2. conducting further 'project development' studies to consider options for a corridor to accommodate that future infrastructure
3. considering business cases for corridor protection and, in turn, making budget provisions to meet projected land acquisition costs
4. identifying a specific corridor in a land use plan to place limits on the development that may occur on the corridor, which can then also trigger rights for affected land owners to seek compensation
5. providing fair and reasonable compensation to land owners as required by legislation, and otherwise purchasing required properties on the open market
6. managing acquired properties and using land use planning controls to manage development around the corridor; for example, by limiting noise-sensitive land uses around a corridor to protect its operational integrity.

This final point is becoming an increasingly important consideration for infrastructure planners and owners. For example, the operators of some of Australia's largest ports are increasingly concerned that, although these vital pieces of infrastructure have been established for many years, new residential development around their facilities is leading to pressure to constrain their operations, either though limits on their hours of operation or other measures.

We are the beneficiaries of previous efforts to protect infrastructure corridors

During the mid-twentieth century, most jurisdictions worked to ensure future infrastructure corridors were protected from development. In a number of cases, infrastructure now viewed as essential to the functioning of those cities has been developed on corridors that were identified and protected in the 1950s, 1960s and 1970s. Examples include the M1 and EastLink in Melbourne and the M4 and M5 in Sydney. Parts of the M7 in western Sydney were also built on a protected corridor. The rail line to Mandurah, south of Perth, is a more recent example. Appendix 1 lists these and a number of other projects developed on corridors that were protected at some point in the past.

Figure 2 shows part of the EastLink corridor that was protected in the early 1970s. Without this protection, the corridor now playing a vital role in Melbourne's transport network would probably have been 'built out', requiring the link to be constructed in a tunnel. This would have been significantly more expensive than building on the protected surface corridor.

Protecting the corridors for these projects required the:

- existence of a clear, long-term plan
- definition of a corridor with sufficient precision (usually reflected in a land use plan that had legal effect) to control land use on the required corridor, enabling affected landowners to seek compensation under certain circumstances
- existence of stable, long-term funding arrangements to meet compensation claims and other acquisition costs, such as the property rate applied by the then Melbourne Metropolitan Board of Works or the Sydney Region Development Fund. The proceeds from the charge or tax were directed to a specific fund dedicated to meeting compensation and acquisition costs, as well as some planning and administrative costs. Perth has continued with its Metropolitan Region Improvement Tax, which was introduced in the early 1960s.

With a few exceptions, notably in Perth and two corridors in Melbourne, the mechanisms used to protect those corridors were not applied as subsequent metropolitan plans in the 1980s, 1990s and 2000s extended the reach of those cities.[4] The reasons appear to vary from city to city. They include:

- administrative changes (for example, the closure of the Melbourne and Metropolitan Board of Works eliminated the Board's rating powers, which had raised funds for key metropolitan infrastructure, including road transport corridor protection)[5]
- adverse reactions to reserving a variety of road corridors when public attitudes to transport were shifting in the 1970s (in Adelaide, Melbourne and Sydney)
- actions to contain public outlays, especially those linked to dedicated funding arrangements (for example, scaling back operation of the Sydney Region Development Fund in the 1980s and 1990s).

Finding 1

Australia has a strong track record of protecting corridors, providing clear lessons for governments. Many key infrastructure assets we rely on today have been built on corridors protected during the 1950s, 1960s and 1970s.

Urban growth and land use changes drive the need for protection

Corridor protection is especially important where the use of the land on which the corridor would otherwise be located could potentially change. This is most likely to occur in and around Australia's capital cities and major regional centres, where the majority of Australia's population growth is projected to occur.

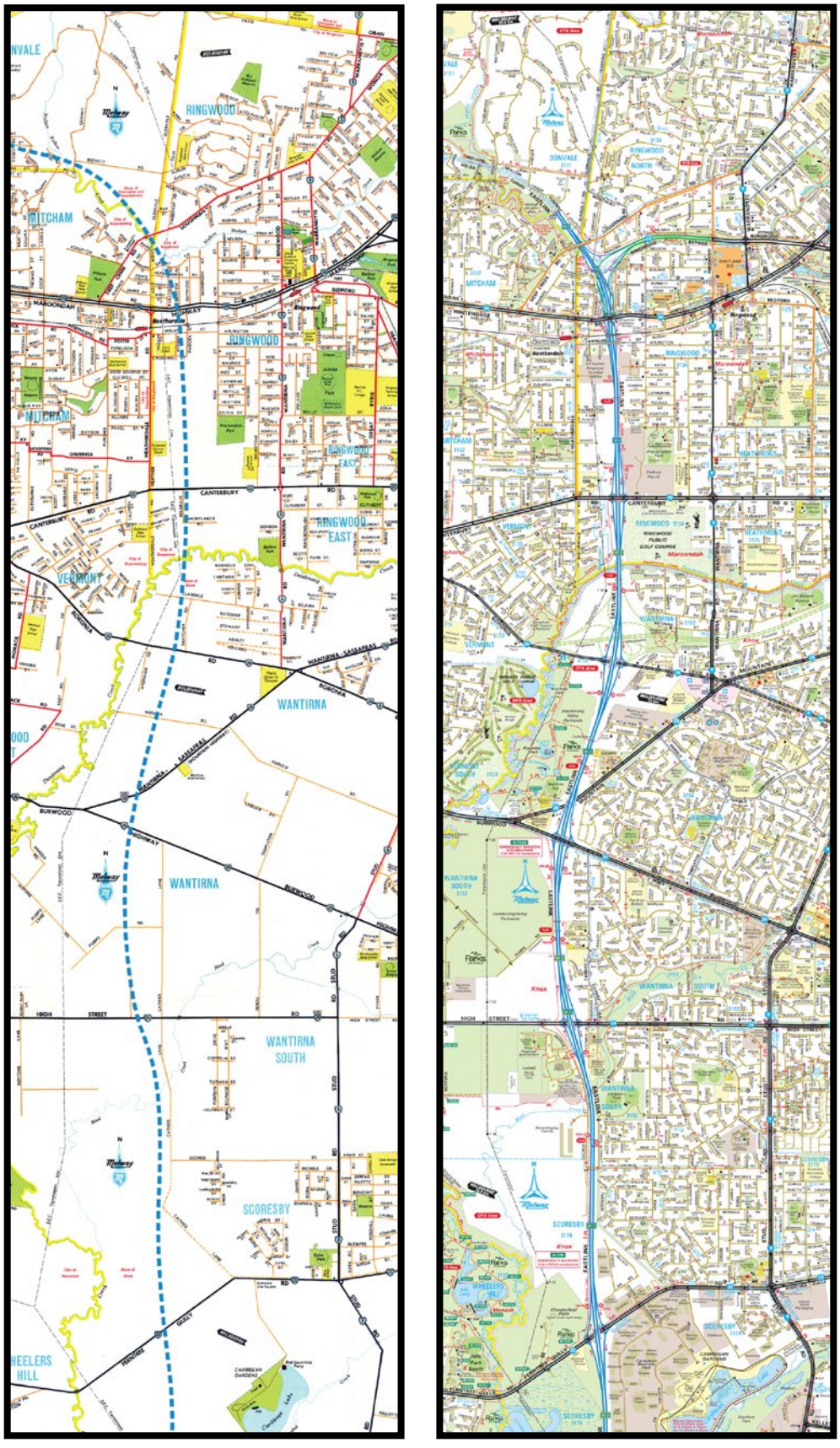
The Australian Bureau of Statistics has projected that, on medium-level assumptions, Australia's population will grow:

- by 8.2 million people (or 36.5%) between 2011 and 2031
- by 19.2 million people (or 85.8%) between 2011 and 2061.[6]

Figure 3 shows projected growth in the population of the capital cities between 2011 and 2061.[7] The same set of projections from the Bureau indicates that Australia's population will grow by 16.7 million people, or 67.5%, between 2017 and 2061.

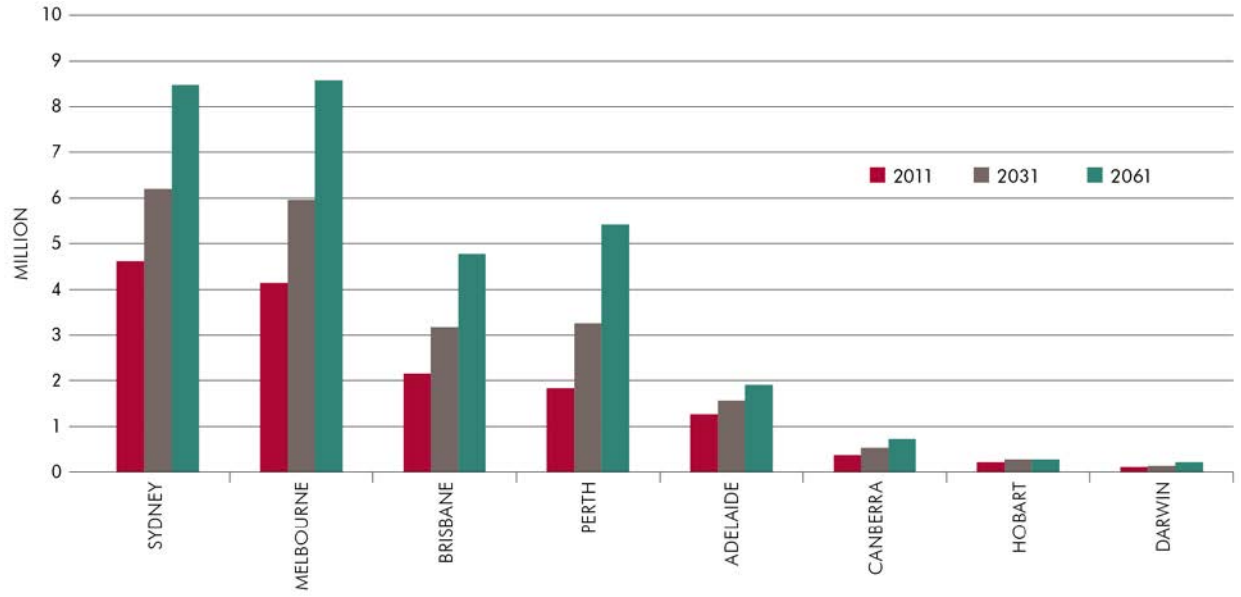
Figure 2: Maps of EastLink corridor in Melbourne available for reservation in 1966 and as delivered in 2015

1966 **2015**



Source: Infrastructure Australia (2016) Australian Infrastructure Plan, p.157, drawing upon maps developed by Melways

Figure 3: Projected population of Australian capital cities – 2011 to 2061



Source: Infrastructure Australia, Australian Infrastructure Audit (2015)

Progress in improving protection practices has been limited

During the course of its review of capital city planning processes in 2010 and 2011, the then Council of Australian Governments (COAG) Reform Council identified weaknesses in corridor protection practices.[8]

The Productivity Commission's 2014 report on Australia's infrastructure also drew attention to weaknesses in corridor protection practices, recommending that 'Australian governments should also consider ways in which land policies can be improved in this area, given the deficiencies in the current planning of land reservation in most jurisdictions in Australia'.[9]

Increasingly, state and territory strategic plans refer to the need to protect infrastructure corridors. Nevertheless, six years on from the COAG Reform Council's findings, and three years on from the Productivity Commission's recommendation, significant action to protect corridors for the nation's future infrastructure remains the exception rather than the rule.

Barriers to effective action

Corridor protection is the first step in translating long-term infrastructure strategies and plans into operating pieces of infrastructure serving the Australian community.

However, taking meaningful steps to protect corridors is proving a significant challenge. Without changes in planning, funding and governance arrangements, the corridor protection intentions of various governments are unlikely to translate into effective corridor protection practices.

Need for further planning and project development

Limits on the breadth and depth of strategic planning and 'project development' appear to have been a contributing factor in the relative decline of corridor protection as a practice.

'Project development' is the process of undertaking progressively more detailed feasibility studies to develop an understanding of potential options for future projects identified in higher-level strategic plans. Project development is essential to any corridor protection framework. It allows corridors to be identified with sufficient detail that they can be incorporated into relevant land use plans.

Taking a proposal from a concept in a strategic plan to a more fully considered proposal is a significant undertaking. On larger projects, project development processes can cost several tens of millions of dollars. Although substantial, these sums are an investment in sound decision making. Larger projects now commonly cost hundreds of millions and, increasingly, billions of dollars. Project development helps to provide assurance that taxpayer funds are being spent on well-conceived projects.

Spending on project development also helps meet the community's growing expectation that it will be involved in infrastructure decision making. This is just as relevant at the 'front end' of the project development process, when assessing options and protecting corridors for future infrastructure, as it is later on when considering more specific proposals through environmental assessment processes.

However, project development and exhibiting draft corridor proposals can present challenges for governments. Managing concerns from potentially affected land owners is complex, especially if governments are uncertain how to fund compensation and land acquisition. In such circumstances, governments may leave corridors as 'lines on maps', rather than develop specific proposals for further action.

Some governments may be concerned that corridor protection could lead to public expectations that the infrastructure will be constructed in the short-term (rather than the long-term), adding pressure to governments' budgets. However, while some individuals may misunderstand the role of corridor protection, these concerns are perhaps overstated. Effective project development and consultation processes can help the community to understand the distinction between corridor protection and project construction.

Protecting corridors must compete for taxpayer funding

With many competing demands on governments' budgets, translating the sound aims of governments' plans into practice will not be easy. Corridor identification, planning and land acquisition require expenditure in the short and medium-term to minimise or avoid long-term costs. However, experience shows that governments often defer such outlays, especially expenditure on land acquisition, to prioritise near-term spending needs.

Effective corridor protection will require a new balance between outlays with a short- or medium-term focus versus those that necessarily take a longer-term perspective.

Sound planning and budgeting can address concerns that corridor protection may create a contingent liability in relation to hardship cases.

The minimum outlays arising from a decision to protect a corridor are those associated with meeting statutory requirements; for example, acquisition and compensation mechanisms that come into play where a landowner has not been able to obtain planning approval to develop their land.[10] In those circumstances, governments need to have funds available to deal with that situation, either by purchasing the land or through other measures.[11]

These cases do not all materialise immediately once the corridor is reserved; they occur throughout the period between reserving and constructing the project. To assist with the necessary funding as cases occur, properties acquired by governments can be rented out to generate revenue – a common practice in the past. Acquisition or compensation costs can be met by regular allocations from government budgets. Corridor protection arrangements in Western Australia, especially the Metropolitan Region Improvement Tax, provide a stable basis for meeting both legislated acquisition costs and funding other, optional property acquisition.[12] Proceeds from the Tax are placed in a dedicated Metropolitan Region Improvement Fund.

Finding 2

Despite broad consensus on the merits of corridor protection, action to protect corridors has been the exception rather than the rule over recent years. Governments need an increased focus on long-term planning, project development and land acquisition to ensure corridor protection is appropriately prioritised through budgetary processes.

The cost of failing to protect corridors

Limited or ineffective efforts to reserve corridors and acquire the necessary land sufficiently early can add materially to the cost of infrastructure projects. Failure to protect corridors can result in:

- preferred corridors being 'built out', requiring projects to be diverted or placed in tunnels. Diverting a project usually makes the project longer and adds to its capital cost. Placing a project in a tunnel can multiply its cost per kilometre by 5-10 times,[13] as well as adding to the project's on-going operational and maintenance costs. Recent tunnelled motorway proposals (six lane) are expected to cost in the order of $600 million per kilometre (that is $100 million per lane kilometre) to build. Given the pressure on current and prospective transport budgets, planning for future transport links needs to identify lower cost options involving surface corridors wherever possible.
- projects being delayed because the cost of developing the project has increased beyond the short or medium-term financial capacity of the government in question. Even if the project scope remains unchanged, a deferred project can become more expensive to build if construction costs rise faster than the general rate of inflation, as occurred during the resources boom. These cost increases place greater demand on governments' budgets.

- significant social costs arising from the need to acquire a potentially large number of private properties.
- an increased risk that some projects do not proceed at all because they are simply too expensive for taxpayers and users to afford.
- significant opportunity costs, where, despite a corridor not being protected, the relevant project proceeds anyway, albeit at a higher cost. This results in governments drawing on funds that might otherwise have been available to pursue other projects.
- higher maintenance and operational costs where a project has to be placed in a tunnel.[14] These costs are not a 'one off'. They occur across the entire operational life of the project.

In addition to these direct financial costs, poor or non-existent efforts to protect a corridor can impose various economic costs, such as:

- if a project does not proceed because it becomes too expensive, its absence creates an on-going economic cost (such as growing congestion) that could have been addressed if a corridor had been protected
- where additional costs arising from poor corridor protection delay construction, the economic benefits of the project (such as travel-time savings and agglomeration benefits) are also delayed
- projects that follow a longer route (for example, to avoid development that has been allowed to occur) permanently lock in lower travel time benefits and higher maintenance costs compared to a more direct route.

We need our infrastructure to be as productive as possible. To this end, we need to avoid projects that cost more than is necessary and that offer fewer benefits than might otherwise have been the case.

To avoid these higher costs and lower benefit cost ratios, governments need to:

- identify, plan for and reserve corridors, sites and their environs for developing future infrastructure networks
- maximise the advantages of corridor protection; for example, by ensuring that corridors are integrated in metropolitan and regional land use strategies and that, where relevant, reserved corridors can be shared by multiple infrastructure networks
- ensure that the operation of infrastructure corridors (existing or prospective) is not compromised by development adjoining or in the vicinity of those corridors.

Finding 3

Failure to appropriately protect corridors could hold substantial costs and risks for governments. A lack of action could result in: corridors being 'built out'; project costs rising due to the need for tunnels or longer, more indirect routes; and projects being delayed or cancelled.

Protecting the operation of corridors

While this paper primarily focuses on construction and economic cost savings arising from corridor protection, governments must also protect the operational integrity of major infrastructure corridors from undue constraints on their efficient use. Such corridors are vitally important for the economy and for Australians' social well-being.

Periodically, communities raise concerns about the operational impacts of infrastructure corridors, especially transport corridors and facilities that cause environmental impacts, such as noise, vibration and air pollution. The pressure from 'urban encroachment' to introduce curfews or otherwise limit the use of corridors is a serious concern for those in the freight and logistics sector. For example, NSW Ports has identified protecting its ports and intermodal terminals from urban encroachment as one of five key objectives to sustainably cater for forecast trade growth.[15]

Maintaining the operational integrity of our airports is also part of corridor protection. Development controls need to be in place to manage noise-sensitive land uses around airports, and to ensure that tall structures are not allowed to impinge on operational airspace.

The *Australian Infrastructure Plan* was clear on this issue, recommending:

> *Caps, curfews and other restrictions on how our infrastructure is operated and used should be avoided where possible. Giving Australia's infrastructure the capacity to freely meet its economic and social purposes will open new opportunities for growth and development. Existing regulatory constraints should be regularly reviewed to ensure they remain relevant and new assets – including new ports and airports – should be planned to ensure curfews and other restrictions are avoided.*[16]

As our cities grow, existing and new corridors will have to be used more intensively, including when residents will be asleep or resting. We are already seeing a shift in the proportion of containers moved at nights and on weekends.[17] At the same time, as our cities grow, more people will be living around those same corridors, potentially leading to more calls for curfews or operational constraints. Applying appropriate land use controls on development adjoining existing and new corridors could minimise the risk of community pressure to constrain the use of key corridors.

This is not to suggest that infrastructure owners and operators should not comply with statutory and other mandated requirements. However, it does mean that thought will need to be given to the long-term operational and growth requirements of current and future corridors. Developing sensitive land uses around existing or prospective corridors could put the operational integrity of the corridor in question at risk.

Protection in non-greenfield locations

Underground and other corridors in established areas also require protection

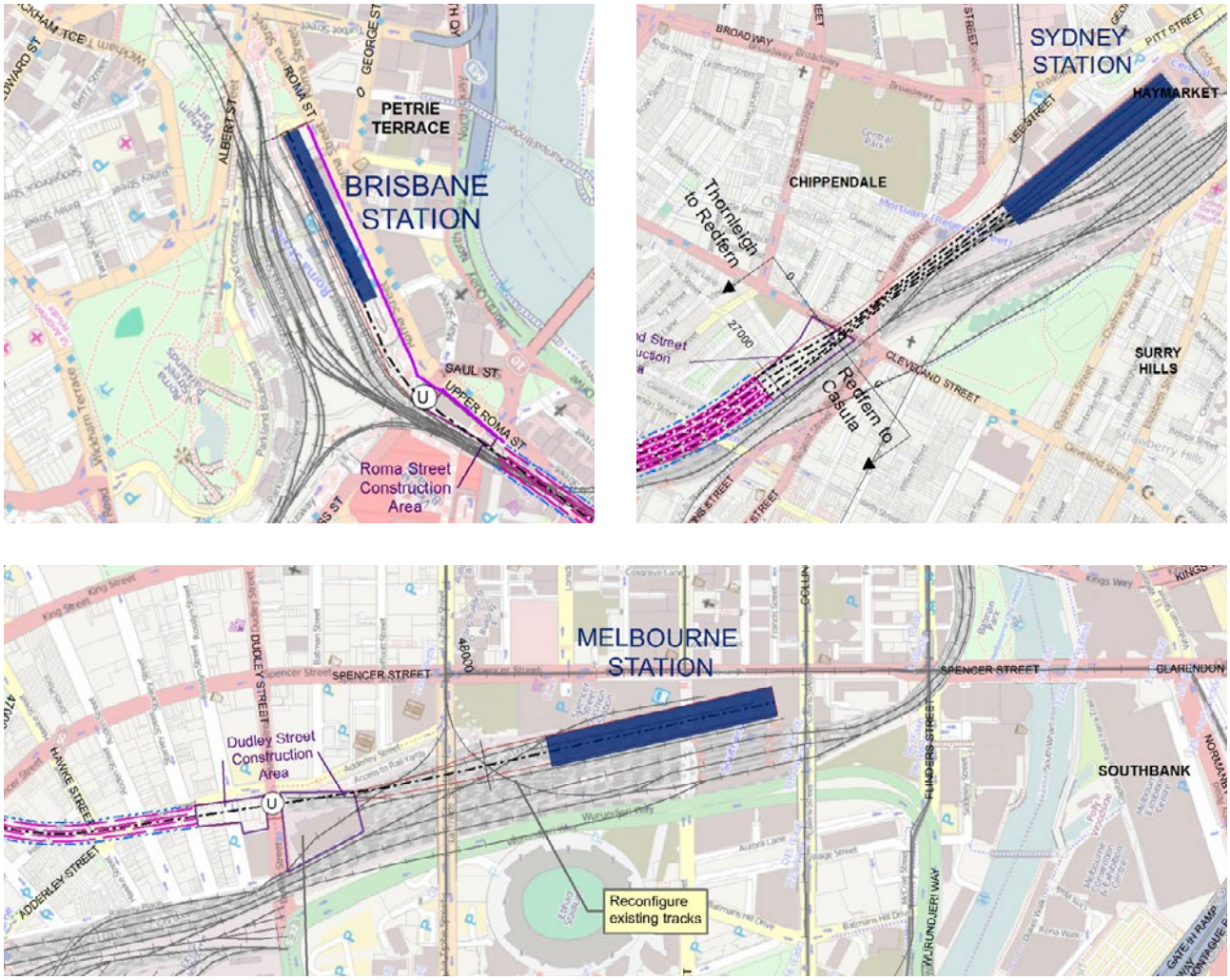
Most state and territory governments are aiming to accommodate a substantial share of population growth in the established parts of their capitals. This presents its own challenges, as securing large surface corridors in those areas is likely to encounter opposition from local residents.

Defining and protecting underground corridors will become increasingly important, principally in locations, such as near stations, where an underground infrastructure project is likely to approach the surface. In city and suburban centres, these are likely to be the very locations where new, higher-density development will require sub-surface foundations. Such development may also incorporate underground parking, loading docks and utilities that could impinge on an underground corridor.[18] In these areas, especially, identifying a corridor early enables property owners to incorporate new corridors into their development proposals.

Figure 4 shows how the proposed alignment for an East Coast High Speed Rail line could connect to the central business districts of Brisbane, Sydney and Melbourne. Protecting a corridor in these areas will require careful planning of new development close to the project.

Governments have started to provide for new tunnels in their land use plans. For example, the NSW Government has used its planning powers to establish controls on development that might adversely affect construction of a new metro rail line under the Sydney CBD.[19]

Figure 4: Maps of potential CBD station locations for the proposed East Coast High Speed Rail line in Brisbane, Sydney and Melbourne



Source: Department of Infrastructure and Regional Development (2012) https://infrastructure.gov.au/rail/trains/high_speed/phase_two_appendicies.aspx

Corridors in rural areas could also need protection

Although the risks of inappropriate development in rural areas are lower than in our cities, development proposals can still compromise effective future infrastructure investment. As the use of rural land changes, the risk of land use conflicts is growing, making the potential for development occurring on a proposed infrastructure corridor in a rural area greater now than it was in the past. For example:

- rural residential and commercial development around regional centres could limit the development of some future infrastructure corridors
- agriculture is becoming more capital intensive; for example, in the development of feed lots. Significant capital is also being invested in land forming to improve water use and in technology to improve yields and farm productivity
- rural land is being developed for new activities, notably renewable energy generation.

Although the options locating a corridor are likely to be broader than in and around our cities, we nevertheless need to be alert to the possibility that any failure to identify and protect a corridor could have adverse consequences.

At the same time, identifying a corridor across rural land that is not otherwise subject to significant development pressures may still adversely affect the owner's ability to sell the property. It can also create an expectation for governments to purchase the affected property, or compensate the owner in some other way. This underscores the need to consider carefully when and how to protect corridors in rural areas.

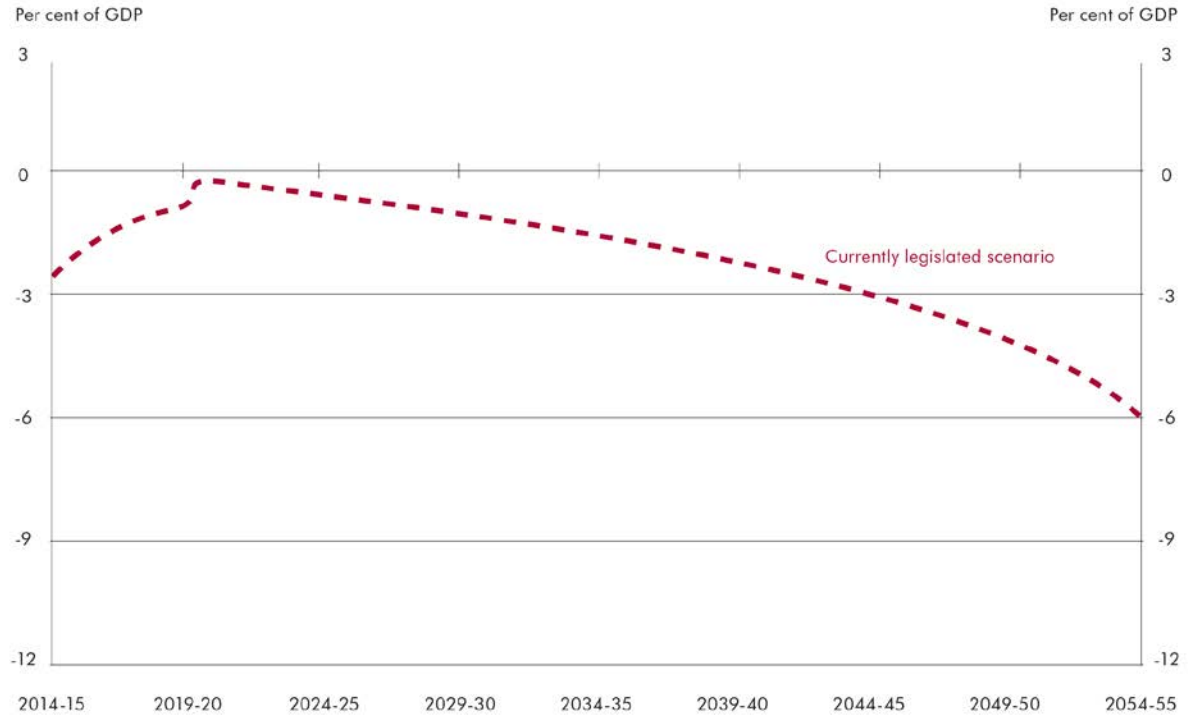
The fiscal challenges facing governments emphasise the need for protection

Finding the funds for corridor protection will be a challenge at a time when Australian Government and most state governments face difficult expenditure and revenue decisions to close projected 'fiscal gaps'.

As shown in **Figure 5**, the Australian Government's 2015 Intergenerational Report projected that, under a 'currently legislated' scenario and in the absence of policy changes, the underlying cash deficit in the Australian budget would increase from 2.5% of Gross Domestic Product (GDP) in 2014-15 to almost 6% of GDP in 2054-55.[20] This is equivalent to a present deficit of approximately $100 billion per annum. As a point of comparison, the Australian Government's estimate of the underlying cash deficit in 2017-18 is $29.4 billion or 1.6% of GDP.[21]

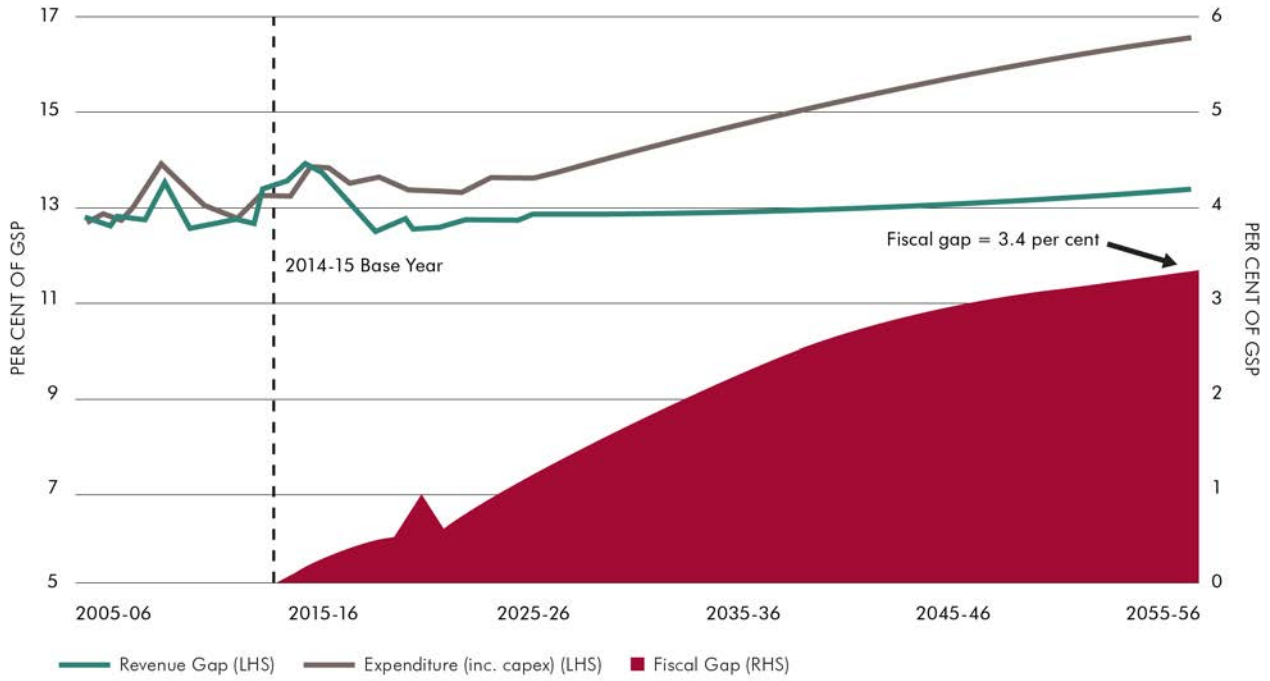
Similarly, as shown in **Figure 6**, in its recent equivalent of the *Intergenerational Report*, the NSW Government projects that the 'fiscal gap' in the state budget will grow from around 0.5% of Gross State Product (GSP) in 2015-16 to 3.4% of GDP in 2055-56.[22] This is equivalent to a present deficit of approximately $18 billion per annum. As a point of comparison, the NSW Government projects a budget surplus of $2.7 billion in 2017-18 or 0.5% of GSP.[23]

Figure 5: Intergenerational report projection of Australian Government underlying cash balance



Source: Infrastructure Australia graph based on Australian Treasurer (2015), 2015 Intergenerational Report: Australia in 2055*, p.47*

Figure 6: NSW Government projection of fiscal gap



Source: Infrastructure Australia graph based on NSW Government (2016) NSW Intergenerational Report 2016: Future State NSW 2056*, p.12*

Note: The fiscal gap in 2018–19 is high due to around $3.4 billion if Public Private Partnerships recognised in that year, mostly in transport assets.

Other states and territories do not publish a jurisdictional equivalent of the Intergenerational Report. However, they are likely to face similar fiscal pressures to NSW. A range of issues associated with ageing of the population, including fewer people of working age and rising health outlays, are driving these fiscal challenges.

Closing these fiscal gaps will present difficult revenue and expenditure challenges for governments and the Australian community. Efforts to contain expenditure may extend to the infrastructure sector. If so, it will become increasingly important to find ways of reducing the cost of new projects. Corridor protection could make a valuable contribution to reducing future infrastructure cost pressures.

Conversely, in the absence of corridor protection, it may become increasingly difficult to afford some projects that might otherwise have been possible at a lower cost. The fiscal challenges, and the prospective costs of developing infrastructure (in tunnels especially), are such that the risks of not protecting infrastructure corridors cannot be ignored.

Finding 4

The fiscal challenges facing Australia's governments reinforce the need to protect key corridors. Governments face rising costs to support a growing and ageing population, while providing the transformational infrastructure required to support Australia's economy in the twenty-first century. Without effective corridor protection, governments and the communities they serve may find that some important infrastructure projects become increasingly uneconomic and difficult to afford.

How protection reduces the cost of future infrastructure

Corridor protection reduces the cost of providing infrastructure by:

- minimising the risk that land is rezoned in the future to allow more intense forms of development; for example, rezoning land from rural to residential purposes. This reduces acquisition costs for future infrastructure corridors by:

- minimising the increase in land prices and the price expectations of land owners that occur when land is rezoned.[24] Merely announcing a potential rezoning, or releasing a 'structure plan' flagging likely future land uses (before final zoning decisions are taken) can increase the prices that landowners expect for their land
- avoiding the further costs that arise if the rezoned land is then developed; for example, where newly zoned urban land is subdivided and developed into dwellings, shops, and schools.

- avoiding 'real' increases in the cost of land, that is where land prices rise faster than the general rate of inflation and/or government revenues.

Rising costs due to subdivision and development of land required for corridors

To minimise the cost of infrastructure projects, governments need to acquire land as early as possible in the development process.

As land on the fringe of our cities is converted from rural and agricultural purposes to various forms of urban development, developers and property owners invest funds to:

- subdivide previously rural land by: preparing subdivision applications; extending utilities to each lot in a subdivision; constructing roads within the subdivision; and paying developer contributions to government agencies for off-site infrastructure
- erect houses, factories, offices and other buildings on the lots created through the subdivision process.

As a result, when acquiring properties for corridor protection purposes, governments are likely to pay a higher price for land once it has been subdivided, and a higher price again once the subdivided land has been built on.

Similar patterns can occur in redeveloping areas of our cities, as land is rezoned for higher value uses, and as development in line with the new zoning begins to occur. In those situations, too, early corridor protection and acquisition will often deliver the best value and outcomes for taxpayers.

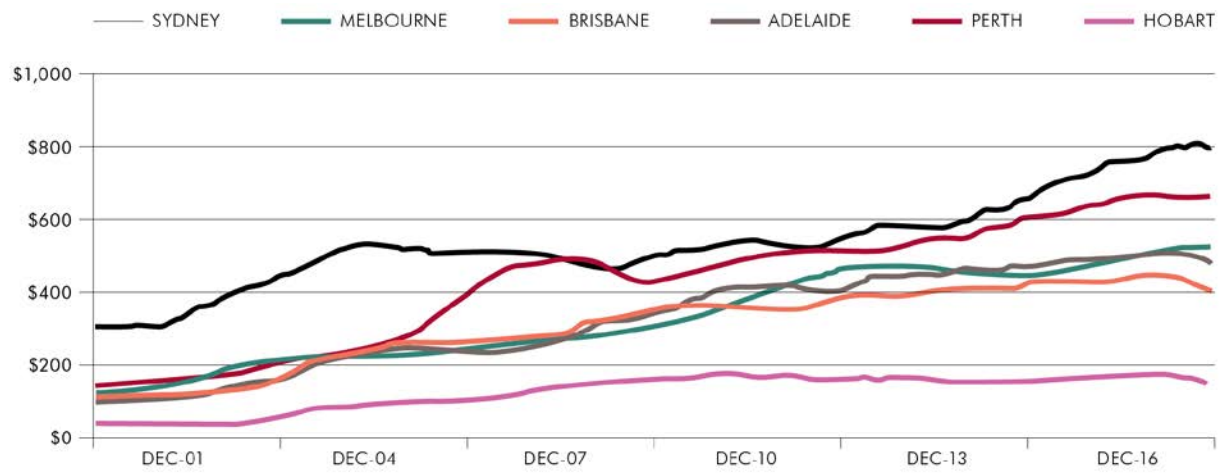
Rising costs due to increases in urban land values

Government data shows that urban land values can increase substantially over time. For example, research previously commissioned by Infrastructure Australia showed that, between 1993 and 2012, land values in the three east coast capital cities typically increased at between 3-6% per annum above the rate of inflation.[25]

Such increases reflect overall economic conditions and the market for land in our cities. They are independent of increases in land values arising from decisions about the zoning and development of particular parcels of land.

More recent research shows a similar picture. Prices for vacant residential land in the state capitals tripled between 2001 and 2016.[26] In contrast, the average increase in the Australian Bureau of Statistics Consumer Price Index for the six capitals was around 46% over that period.[27] As shown in **Figure 7**, even after taking account of differences in the size of residential lots, the data shows a steady, long-term increase in the median price of vacant residential land.[28]

Figure 7: Median rate per square metre of residential vacant land sales, state capital cities 2001 – 2016



Source: CoreLogic (2017)

These increases in land prices have real consequences for infrastructure provision. Conversely, effective corridor protection and early acquisition can lower the cost of providing infrastructure. For example, the Western Australian Planning Commission has reported that buying the land ahead of the 'urban front', before land is rezoned for urban purposes, dramatically lowers the cost of providing infrastructure. In a paper published in 2007, the Commission presented a number of case studies, including one in relation to a prospective 23 km section of the Kwinana Freeway. The paper noted:

> *Acquisitions included land for the freeway and its intersections, as well as land parcels that will be severed by the freeway. The land was purchased on the market and by negotiation well before the approach of the urban front. The total outlay was $5.88M, an average of $24,300 per hectare. Land values along the route have risen exponentially since then. If land acquisition for the freeway from Safety Bay Road to Gordon Road had to be acquired now by MRWA [Main Roads Western Australia] the cost would be close to $120M. If the land had to be compulsorily resumed the cost would be at least $145M.*[29]

Finding 5

Rising demand for land, particularly in our fast-growing cities, is likely to drive continued growth in the costs of acquisitions required to make way for critical infrastructure investments. Corridor protection is essential to safeguard governments – and taxpayers – from future growth in land prices and their impact on infrastructure costs.

The broader economic and social case for protection

Pursuing corridor protection delivers a broader, if hard to calculate, economic benefit. The economic benefits of corridor protection lie in:

- signalling and providing certainty about future land use, allowing land markets to operate more effectively in areas around where a corridor has been protected
- avoiding the cost of investment on land (both private and associated local public infrastructure) that would otherwise have to be demolished.

The protection and acquisition of a site for the Western Sydney Airport demonstrates these broader economic benefits. Without the airport site (and an adjoining buffer) being reserved in the late 1980s and early 1990s, it is unlikely that the airport would now be proceeding. We could reasonably expect that: some of the airport site might have been rezoned for urban development; and adjoining areas might have been developed for housing and other noise-sensitive uses. In the absence of Western Sydney Airport's development, Sydney's economic growth could be constrained by inadequate capacity at Kingsford Smith Airport.[30]

Corridor protection can also minimise a range of social and other costs (financial, legal) that could arise, especially if land is developed and then has to be acquired for an infrastructure project.

The legal and financial case for protection

Only governments have the power of 'eminent domain', which allows them, where necessary, to compulsorily acquire land for a public purpose. The private sector does not have this power. Nor do private companies have the power to regulate the use of land they do not own.

Given these legal and financial constraints, governments are necessarily responsible for establishing and applying an effective corridor protection regime.

Estimating the savings from effective corridor protection

Findings

6. **Corridor protection could provide substantial savings for taxpayers.** Infrastructure Australia has modelled the impact of corridor protection under a range of scenarios across seven corridors included on the *Infrastructure Priority List.* Corridor protection and early acquisition across these corridors could save Australia approximately $10.8 billion ($2016, at a 7% real discount rate). In undiscounted terms, these savings represent around $57.1 billion of avoided costs ($2016).
7. **Corridor protection requires immediate action by governments.** Corridors for the Outer Sydney Orbital and High Speed Rail initiative face particular short-term development pressures due to their proximity to major population centres. Protecting these corridors should be a focus for state and federal governments.
8. **Costs associated with early acquisition of land can be partially offset by property revenues during the period prior to construction.** Where corridors were protected in the past, governments normally rented the properties to interested parties until the land was required for the project in question. Over the seven corridors modelled, rental revenues generated could be around $4.2 billion ($2016, at a 7% real discount rate) or $7.7 billion ($2016, undiscounted). Early acquisition of properties for the purpose of corridor protection can also be an important platform for value capture.

Governments can save taxpayers large sums of money through corridor protection. Infrastructure Australia has undertaken financial modelling to investigate the scale of these potential savings and compare the cost of developing projects under different protection scenarios.[31] This chapter presents the results of that modelling.

The scenarios and key assumptions

The modelling covers the seven transport corridor protection initiatives in the *2016 Infrastructure Priority List.* The potential savings from protecting each of the corridors are shown in **Figure 8.**[32]

For each corridor, three scenarios were modelled:

- **Do not protect now and acquire at construction**: where no corridor is reserved and land required for the corridor is acquired in the two years leading up to the commencement of construction
- **Protect and acquire now**: where the corridor is reserved from 2017 and all land for the corridor is acquired within two years
- **Do not protect now and tunnel in future**: where no corridor is reserved and: (i) tunnelling is undertaken on parts of the route that have been rezoned and developed; and (ii) other land is acquired in the two years prior to construction.

2

Figure 8: Potential savings in project costs from protection and early acquisition of 2016 Infrastructure Priority List corridors ($2016, 7% real discount rate)

Source: Infrastructure Australia

These three scenarios were selected because they provide a clear and relatively simple illustration of the financial benefits of corridor protection and early land acquisition.

The 'protect and acquire now' and the 'do not protect' scenarios set the 'book ends' within which other protection scenarios can also be tested. For example, various scenarios involving reserving a corridor and staged acquisition of land fall within the end points.

Important: while care has been taken in developing the routes and associated assumptions, this modelling is high level. Its findings are indicative of the potential savings available from corridor protection. They are sufficiently robust to demonstrate the 'policy case' for reforming corridor protection processes. However, the modelling is not a substitute for the detailed costing, property identification and options analysis that governments would need to undertake prior to reserving a specific corridor. The corridors shown in this report are simply an indication of where a project might be located. If a government chooses a different location for a corridor, or a different timing for its development, then the findings will change.

Like any form of modelling, the results depend on the underlying assumptions. In this case, whenever possible, Infrastructure Australia has relied on the best publicly available information on each corridor, using assumptions concerning:

- potential future rezoning of land, based on state and local governments' plans and projections of future population growth
- differences in land values for properties with different zoning
- the amount of land that is developed following rezoning and the associated higher costs of acquisition
- the rate of growth in underlying land values
- revenue from rental of acquired properties; for example, the percentage of properties rented and the revenue yield
- the costs per kilometre of constructing the anticipated transport projects on the surface and in tunnels.

The modelling takes a conservative approach. It takes into account costs directly related to land/property purchase and makes high-level assumptions about the cost of constructing the relevant project 'at grade' (on the surface) and in tunnel. However, it excludes the potential savings from local and project-specific development costs, such as relocating local roads and utilities, that would occur in the two 'do not protect' scenarios.

The potential savings from early corridor protection depend in part on when the projects themselves might proceed. This reflects underlying real increases in the cost of land and the cost of construction. Appendix 3 includes a table showing the assumed project start dates, where possible drawn from existing reports or public statements. If projects start later than the modelling assumes – for example, if construction of the high-speed rail line were to start later than set out in the most recent (2013) feasibility study – the cost of developing the relevant projects under the 'acquire later' and 'tunnel' scenarios is likely to increase. Accordingly, the savings from corridor protection would also increase.

Appendix 3 sets out the overall approach to the modelling, including maps of the seven corridors. More detailed assumptions, notably on potential zoning and land use changes that may place pressure on the corridors, are set out in a technical supplement available on Infrastructure Australia's website.

Audit of the modelling

Infrastructure Australia has pursued a robust and conservative approach to the modelling. The modelling has been independently audited by a firm with experience in economics, infrastructure and property development.[33] The audit scope covered both the structure and logic of the model itself, as well as the veracity of its assumptions. After considering the results of the audit, changes were made to some of the model's assumptions.

Protection and early acquisition could provide significant savings

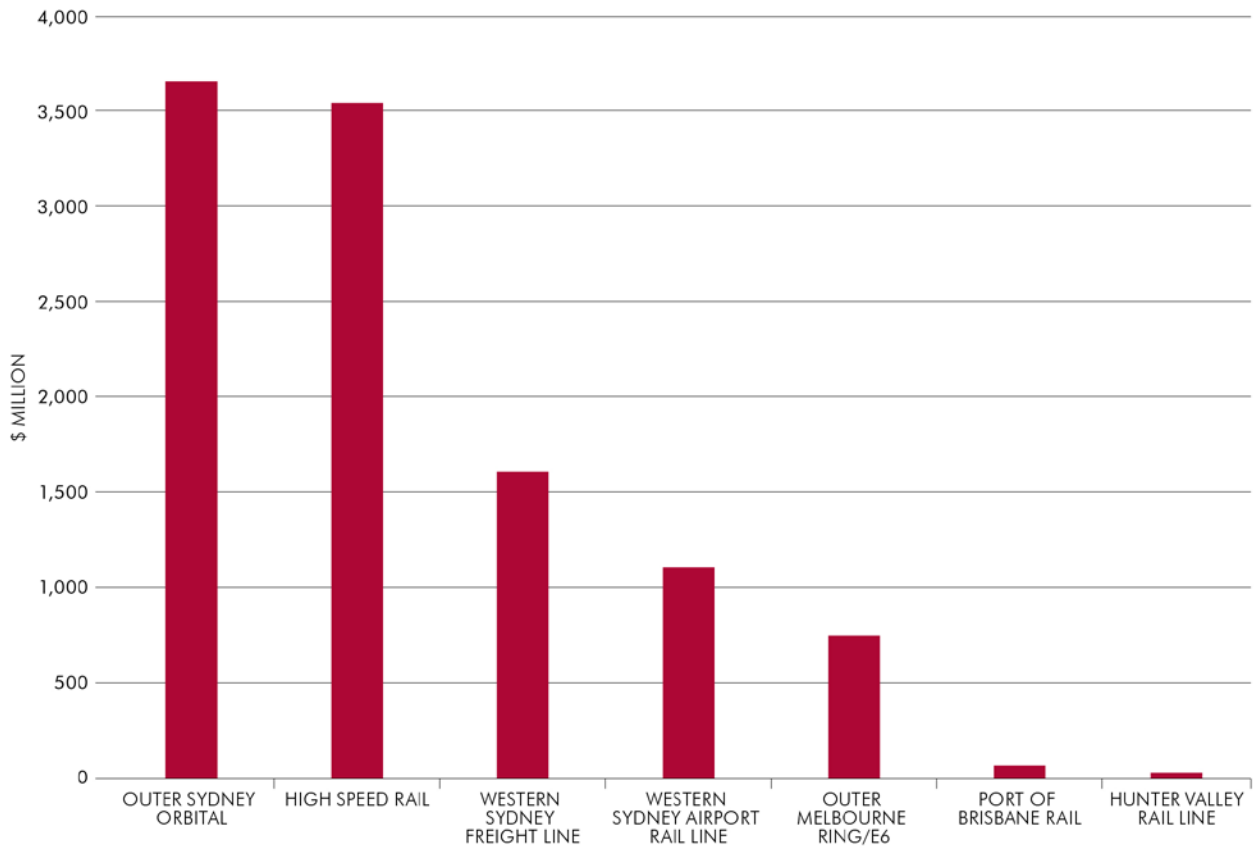
Corridor protection and early acquisition could save up to $10.8 billion ($2016, at a 7% real discount rate) across the seven projects on the 2016 *Infrastructure Priority List.* The largest savings are associated with corridors with significant forecast rezoning and development. These pressures are most prominent in and around the capital cities. In undiscounted terms, the saving is equal to $57.1 billion ($2016).[34]

Figure 9 shows the potential savings for each corridor. The difference in estimated savings between the Outer Sydney Orbital and Melbourne's Outer Metropolitan Ring/E6, which are both 80-90 km long, is due to the Melbourne corridor being protected through a 'public acquisition overlay'. In contrast, the Outer Sydney Orbital has not yet been protected. Even so, as shown in the figure below, significant savings can still be made from acquiring land for the Outer Metropolitan Ring/E6 corridor sooner rather than later and from protecting a connecting corridor and site for the proposed Western Interstate Freight Terminal.[35] The savings for the other corridors are lower. This is because the corridors are smaller, requiring significantly less land to be protected.

Finding 6

Corridor protection could provide substantial savings for taxpayers. Infrastructure Australia has modelled the impact of corridor protection under a range of scenarios across seven corridors included on the *Infrastructure Priority List.* Corridor protection and early acquisition across these corridors could save Australia approximately $10.8 billion ($2016, at a 7% real discount rate). In undiscounted terms, these savings represent around $57.1 billion of avoided costs ($2016).

Figure 9: Potential savings from protection of corridors ($2016, 7% real discount rate)



Source: Infrastructure Australia

Protection requires upfront expenditure, but is cheaper than acquiring land later

Corridor protection requires upfront expenditure from governments for a project that may not be constructed for some years. Even so, the cost of protecting a corridor and acquiring the corridor early is likely to be significantly less than acquiring the necessary land at a later date.

This is because underlying growth in land values, rezoning and development increase the price of acquiring land, resulting in either a higher land acquisition cost and/or more tunnelling. **Table 1** provides a breakdown of costs of each scenario for the seven corridors. Given the focus in this paper is on discounted costs, these figures have been highlighted in **Table 1.** For context, undiscounted figures are included in the table.

Table 1: Estimated project costs of initiatives under three scenarios – $2016, million, 7% real discount rate (first) and $2016, million, undiscounted (second)[a]

Scenarios	Land acquisition costs	Construction costs[b]	Rental income[c]	Total cost	Additional cost compared to protect and acquire now scenario
Outer Sydney Orbital					
Protect and acquire now	550 / 651	1,989 / 10,063	201 / 448	2,338 / 10,266	n/a
Do not protect and acquire at construction	2,887 / 11,576	1,989 / 10,063	n/a	4,877 / 21,639	2,538 / 11,372
Do not protect and tunnel	114 / 455	5,889 / 29,791	n/a	6,003 / 30,246	3,665 / 19,979
High Speed Rail					
Protect and acquire now	4,349 / 5,151	27,324 / 110,862	1,571 / 3,215	30,102 / 112,798	n/a
Do not protect and acquire at construction	4,637 / 14,033	27,324 / 110,862	n/a	31,961 / 124,894	1,859 / 12,097
Do not protect and tunnel	2,866 / 8,549	30,780 / 125,004	n/a	33,645 / 133,553	3,544 / 20,755
Outer Melbourne Ring/E6[d]					
Protect and acquire now	2,883 / 3,416	4,027 / 10,350	545 / 869	6,365 / 12,897	n/a
Do not protect and acquire at construction	2,556 / 5,206	4,027 / 10,350	n/a	6,583 / 15,556	219 / 2,659
Do not protect and tunnel	2,499 / 5,089	4,613 / 11,858	n/a	7,113 / 16,947	748 / 4,050
Western Sydney Rail[e]					
Protect and acquire now	521 / 617	1,698 / 7,503	225 / 470	1,995 / 7,651	n/a
Do not protect and acquire at construction	1,400 / 4,901	1,698 / 7,503	n/a	3,099 / 12,404	1,104 / 4,754
Do not protect and tunnel	44 / 154	2,458 / 10,858	n/a	2,502 / 11,012	507 / 3,362
Western Sydney Freight Line					
Protect and acquire now	5,125 / 6,074	543 / 1,309	1,567 / 2,517	4,102 / 4,866	n/a
Do not protect and acquire at construction	5,163 / 10,517	543 / 1,309	n/a	5,707 / 11,825	1,605 / 6,960
Do not protect and tunnel	5,027 / 10,238	587 / 1,413	n/a	5,613 / 11,651	1,511 / 6,785

Scenarios	Land acquisition costs	Construction costs[b]	Rental income[c]	Total cost	Additional cost compared to protect and acquire now scenario
Port of Brisbane Freight Line					
Protect and acquire now	146 / 173	320 / 1,366	71 / 147	396 / 1,392	n/a
Do not protect and acquire at construction	135 / 441	320 / 1,366	n/a	455 / 1,808	60 / 415
Do not protect and tunnel	74 / 243	387 / 1,651	n/a	461 / 1,894	66 / 501
Hunter Valley Freight Line					
Protect and acquire now	13 / 15	210 / 663	5 / 10	218 / 668	n/a
Do not protect and acquire at construction	8 / 22	210 / 663	n/a	219 / 686	1 / 18
Do not protect and tunnel	5 / 13	246 / 778	n/a	251 / 791	33 / 122

Source: Infrastructure Australia modelling

(a) Totals may not add up due to rounding

(b) The construction cost estimates above are based on average per kilometre construction costs derived from similar projects. The estimates exclude the cost of certain elements such as major stations and road interchanges, which would add to the cost of the relevant project, especially in the tunnelled scenario. More detailed studies for individual projects are likely to provide more accurate cost estimates. In the case of High Speed Rail, the Australian Government's 2013 study estimated the project to cost $58.9 billion at a 7% discount rate. About 80% ($47 billion) of that cost is attributed to construction. The construction cost range of $27.3-30.8 billion reported above is based on the average cost per kilometre of at-grade and tunnelled construction. It is a less detailed cost estimate than used in the High Speed Rail study, as it does not include the cost of railway stations, interchanges and signalling.

(c) Rental income has been deducted from the sum of land and construction costs in the 'protect and acquire now' scenario to arrive at a total cost.

(d) The Victorian Government has established a public acquisition overlay on land required for the Outer Metropolitan Ring (OMR) and E6, but not for the Western Interstate Freight Terminal (WIFT) near Truganina and its connections to the OMR and the existing interstate rail line. Providing the overlay remains in place, the risk of development occurring on the OMR/E6 corridor is relatively remote. The 'acquire at construction' and 'tunnel' scenarios therefore reflect: (1) increases in the cost of acquiring the underlying land covered by the overlay; (2) the cost of acquiring land for the WIFT site and connections (including an allowance for development that may otherwise occur on the land); and (3) for the 'tunnel' scenario, the cost of the WIFT-related tunnels.

(e) The Australian and NSW Governments are finalising a study which assesses a number of options for improved transport accessibility in Western Sydney. This study is expected to provide more detailed estimates than provided here. In addition, different options will have different costs.

In all cases, developing the relevant projects under the 'protect and acquire now' scenario is less expensive than development under the 'do not protect' scenarios. As noted earlier, if project construction begins later than the date assumed in the modelling, the potential cost savings are likely to increase.

Outer Sydney Orbital and High Speed Rail corridors

The Outer Sydney Orbital and the High Speed Rail corridors are noteworthy, both because of the scale of the savings that could be realised and the range of short-term development pressures they face.

Outer Sydney Orbital

The NSW Government is considering options for an Outer Sydney Orbital corridor in its strategic plans.

Areas through which an Outer Sydney Orbital corridor might pass are also attractive areas for development in the short to medium term. The most pressing locations are likely to be near the future Western Sydney Airport. Land near the airport site has been declared part of the NSW Government's Western Sydney Employment Area.

Rezoning applications for land in this area are under consideration by local councils and the NSW Government. These pressures are likely to intensify as the airport proceeds to construction and becomes operational in the mid-2020s.

In addition, a number of 'Priority Growth Areas' identified by the NSW Government are aimed at addressing greenfield housing demand in Sydney until the early to mid-2030s, when the city is projected to have a population (on medium assumptions) of around 6.4 million people. Metropolitan planning is now underway for the early to mid-2050s, when Sydney's population is projected to be around 8 million people.

Experience in Australia's cities shows that, although governments are encouraging greater redevelopment in the established parts of our cities, greenfield development on the fringe of our cities remains an important means of addressing housing supply. Further greenfield development beyond the current priority growth areas is possible, if not likely. Corridor protection is especially important to avoid the possibility that alignment options beyond the current Priority Growth Areas are not closed out.

High Speed Rail

Land use planning processes in NSW, Queensland, Victoria and the ACT have foreshadowed the development of land otherwise required for the proposed High Speed Rail corridor. It appears these planning and rezoning processes have largely started since the *High Speed Rail Study Phase 2 Report* was released in early 2013. In some cases, the rezoning processes are well-advanced. Key areas are at:

- Mt. Gilead and Wilton, south of Sydney
- land near Warnervale, north of Sydney
- areas on Melbourne's northern fringe
- land on the western edge of the Gold Coast.

In addition, strategic planning processes are flagging the potential to rezone further land for urban development or rural-residential development. Examples include potential:

- development on Brisbane's southern fringe; for example, in the southern parts of the Logan local government area between Flagstone and Kagaru
- development in and around the Hunter Valley; for example, increased commercial development around Morisset, industrial development near Beresfield, and both residential and rural residential development near Raymond Terrace in the Port Stephens local government area
- rezoning of land for industrial development east of Mount Ainslie in the Australian Capital Territory.

In total, approximately 60 kilometres of the High Speed Rail corridor is presently at some risk of being built on. (See the technical paper available on Infrastructure Australia's website for details of the areas in question.) If this development occurs, it will add material cost to any future High Speed Rail project.

Finding 7

Corridor protection requires immediate action by governments. Corridors for the Outer Sydney Orbital and High Speed Rail initiative face particular short-term development pressures due to their proximity to major population centres. Protecting these corridors should be a focus for state and federal governments.

Acquiring a large number of houses can be challenging for governments

The 'acquire at construction' scenario is expected to involve governments acquiring a large number of properties. For the larger projects, this could run to hundreds of, and probably several thousand, private properties. Acquiring a large number of private dwellings could be a difficult decision for future governments. In the absence of corridor protection, future governments may be more likely to choose to develop these projects with longer sections of tunnel.

However, the modelling shows that, for some of the larger projects, tunnelling has the highest cost of the three scenarios. This emphasises both the scale of the cost savings from corridor protection and the risk that, without adequate corridor protection, major projects may be deferred or, possibly, abandoned.

Some of the costs of acquisition can be offset by using the land productively in the interim

Corridor protection can result in governments owning land for some years. This land can often be rented out, delivering a revenue stream to governments between acquisition to construction. Where governments have protected corridors in the past, land acquired ahead of construction has often been rented to interested parties, including previous land owners.

The modelling includes high-level projections of potential revenue that could be received under the 'protect and acquire now' scenario. The conservative assumptions used in the modelling are set out in **Appendix 2.**

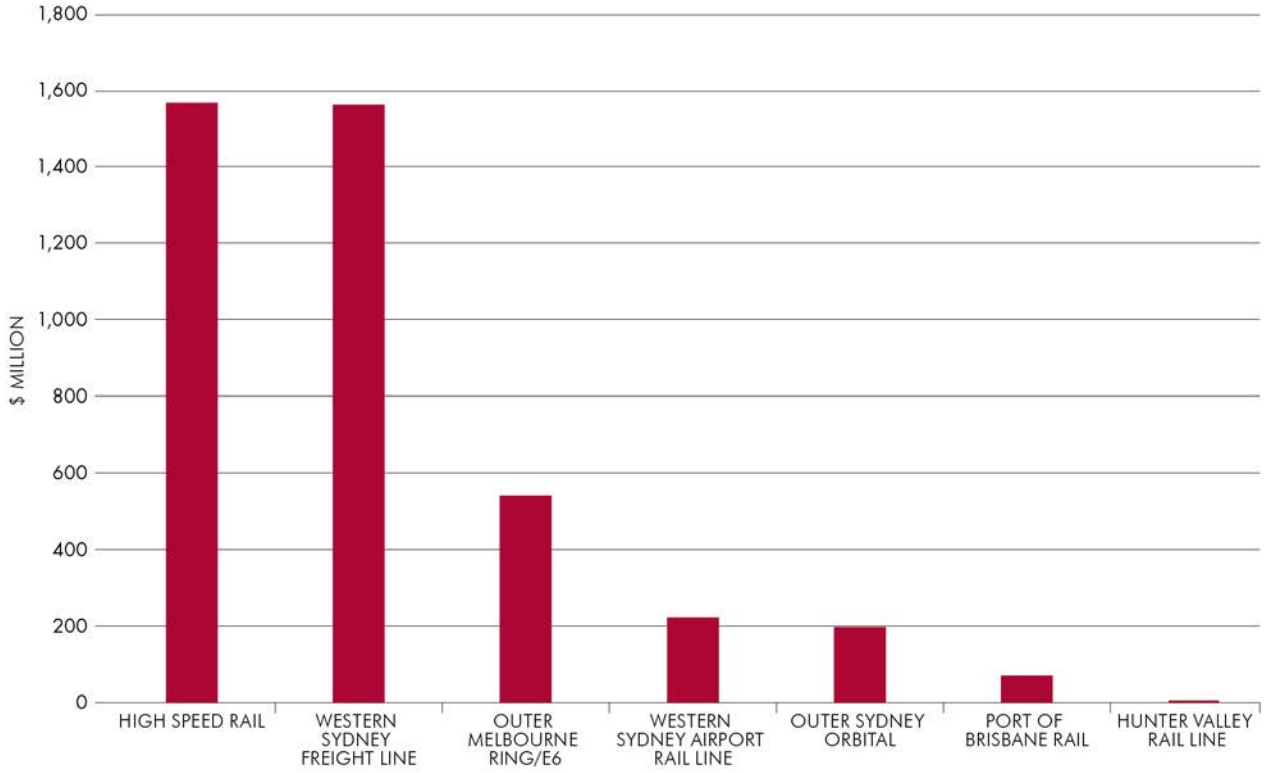
Rental income could be significant, with approximately $4.2 billion ($2016 at a 7% real discount rate) or $7.7 billion ($2016, undiscounted) being received across the seven projects. **Figure 10** illustrates the estimated rent received for each project if the corridors were to be acquired in the next two years.

Renting out the acquired properties for a productive use also minimises the risk that the community sees the land as an extension of local open space networks. Corridors protected in the past have sometimes been used as open space for a long period, making it difficult for future governments to then use the land for its intended infrastructure purpose.

Although potential rental revenue is significant, it should not be considered as the sole means of funding corridor protection. The amount of rent received will vary, depending on the timing of construction, the duration of any lease, permissible interim land uses, and the location and size of the land parcels.

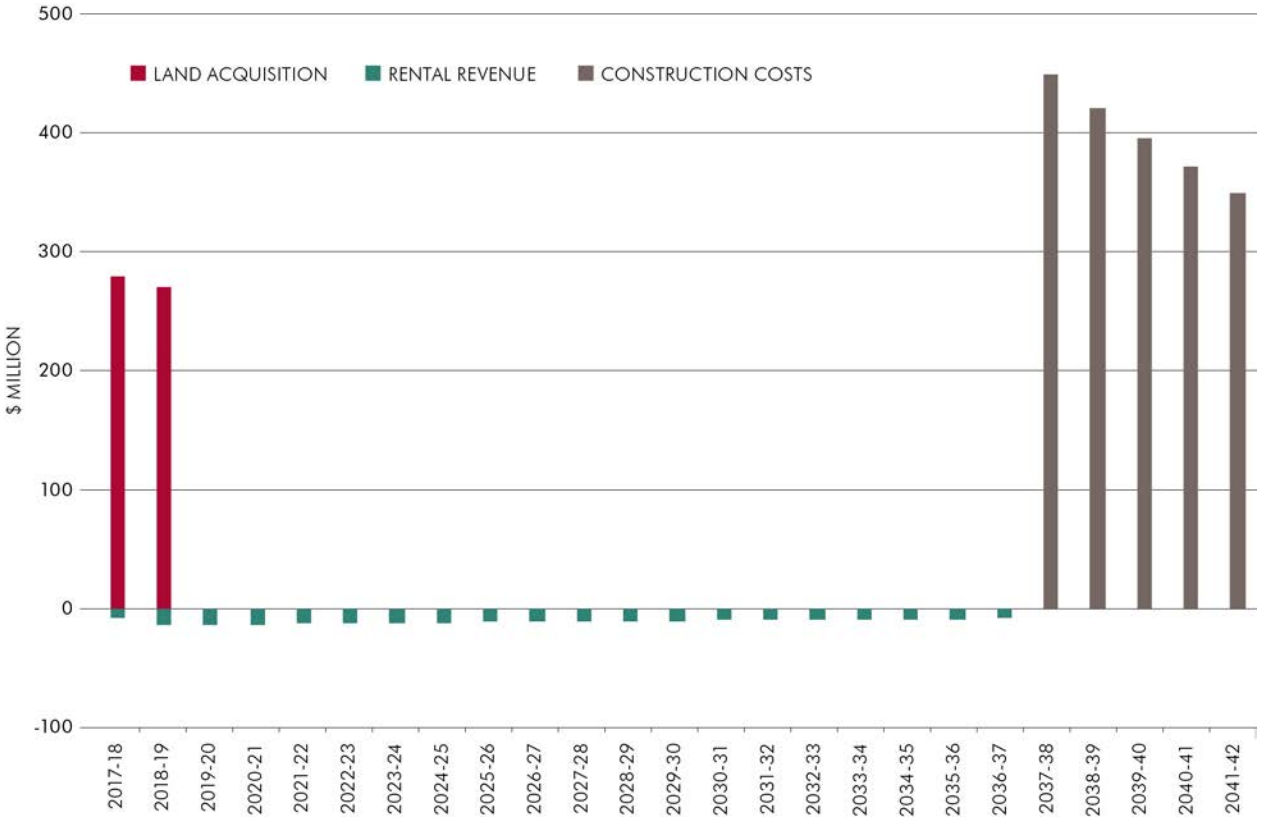
The flow of revenues would commence after the initial outlays on land acquisition, and continue in annual increments until the land is required for construction of the project. As an example, **Figure 11** shows the timing of costs and revenues for the Outer Sydney Orbital.

Figure 10: Estimated revenue if the corridors were immediately acquired ($2016, 7% real discount rate)



Source: Infrastructure Australia modelling

Figure 11: Project costs and revenue, Outer Sydney Orbital, ($2016, 7% real discount rate)



Source: Infrastructure Australia modelling

Beyond any rental income, governments acquiring land in the short term can be reasonably confident that, over time, the value of any acquired properties will increase at least in line with inflation. This is not speculative purchasing of land for property development purposes. Rather it is buying land at the right time to protect the corridor and minimise the cost of providing infrastructure in the future. If, after careful consideration, future governments change strategic planning priorities and do not see a need for the corridor, the acquired land can be sold.

As noted in Infrastructure Australia's recent paper on value capture, early acquisition of land required for a corridor can be an effective form of value capture:

> *If a government owns land in a planned future transport corridor, this allows governments to capture up to 100% of the value uplift in this land between purchase and eventual delivery of the infrastructure.*[36]

After a project has been constructed in a protected corridor, any surplus land can be sold for appropriate development, or retained as a buffer to adjoining development. The value of this land will reflect, among other things, the property's comparative accessibility and attractiveness arising from investment in the project.

Finding 8

Costs associated with early acquisition of land can be partially offset by property revenues during the period prior to construction. Where corridors were protected in the past, governments normally rented the properties to interested parties until the land was required for the project in question. Over the seven corridors modelled, rental revenues generated could be around $4.2 billion ($2016, at a 7% real discount rate) or $7.7 billion ($2016, undiscounted). Early acquisition of properties for the purpose of corridor protection can also be an important platform for value capture.

Further corridors

The savings mentioned above are only those associated with the seven transport corridors in the *2016 Infrastructure Priority List*. They do not include potential savings from protecting a number of other corridors, across the country, that governments have identified as needing some form of protection. For example, the recently released *2017 Infrastructure Priority List* includes a new proposal from the Queensland Government to protect a corridor between Salisbury and Beaudesert.

Based on the results presented in this paper, it seems reasonable to conclude that the cost of delivering infrastructure in many of those corridors could also be reduced through an effective protection regime. However, a clear case-by-case analysis of each corridor is required.

Short- to medium-term acquisition costs – a staged approach

Even though the 'protect and acquire now' scenario involves much lower overall costs than the two other scenarios, it may be challenging for governments to commit sufficient funds in the short term to acquire all the properties required to fully protect a given corridor.

A staged approach to acquisition would minimise short-term expenditure, while still offering substantial cost savings. This approach has regard to the rising cost of land acquisition through the property development process. It involves:

- applying a land use reservation over the corridors
- focusing acquisition on:
  - meeting costs associated with legislated acquisition obligations
  - key sites offering significant value for taxpayers; for example, properties that come on the market and are also at real risk of development. In general, these sites will be in and around the capital cities.

This approach would:

- avoid the very large increase in acquisition and other costs that happens once subdivision and urban development occur
- reduce (but not avoid) the impact of real increases in land costs.

Other approaches, such as governments taking a shared interest in a property, can minimise upfront outlays once a reservation or public acquisition overlay has been created.[37]

Purchasing land as part of corridor protection efforts involves comparatively low financial risks for governments. Over the long term, urban land prices have risen faster than the rate of inflation. So, if a government decides (after careful consideration) not to proceed with a previously protected corridor, it can sell all or part of the corridor and be reasonably confident that it will receive more than the price at which the land was purchased.

Conclusions and next steps

Finding

1. **A national framework for corridor protection is required to guide coordinated and meaningful action by all levels of government.** This framework should guide governments to:
   - prepare agreed, robust plans
   - prepare feasibility studies on the corridors arising from those plans
   - establish joint funding and governance arrangements to protect and capture the value in those corridors.

This paper demonstrates that action needs to be taken to protect corridors for the important infrastructure that will support Australia's development during a period of profound growth and change. In many cases, unless governments act to protect our major infrastructure corridors from development, the ideas and 'lines on maps' set out in current strategic plans will remain just that.

Although the need for corridor protection is increasingly well-recognised, translating that recognition into action remains both complex and challenging. The supporting statements on corridor protection in strategic plans are welcome, but active steps are required to protect the corridors needed for Australia's future infrastructure.

Increasingly, the ability of individual governments to protect corridors and secure opportunities to provide affordable infrastructure will come under pressure. The fiscal pressures facing all jurisdictions mean that, for nationally significant corridors, governments at all levels will have to work together on corridor protection.

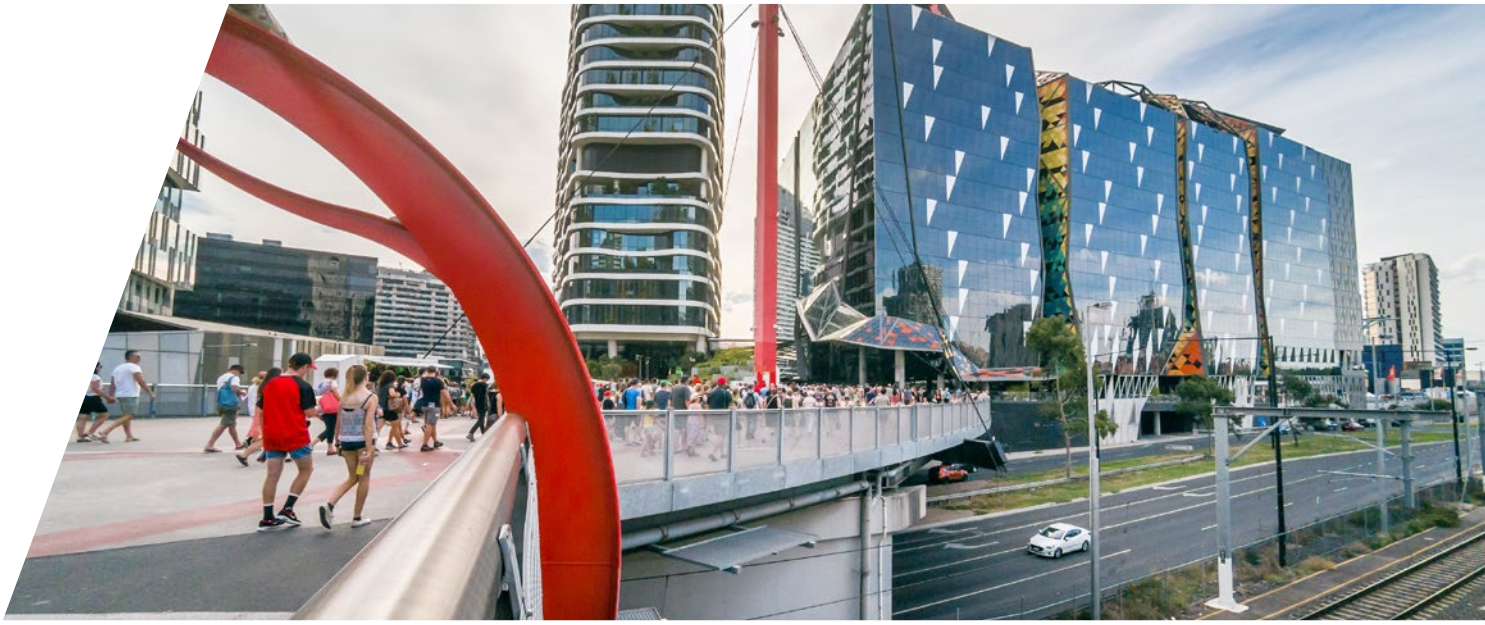
Reform in this area is likely to be difficult.

Shared investment in corridor protection in the short term is likely to deliver substantial benefits in the medium to long term. This approach requires governments to work collaboratively to:

- prepare agreed robust plans
- prepare feasibility studies on the main corridors arising from those plans
- establish joint funding and governance arrangements to protect and capture the value in those corridors.

Governments acknowledge the need for action

Australian governments around the country should be commended for acknowledging the need for corridor protection.



The *Australian Infrastructure Plan* and Australian Government response

The *Australian Infrastructure Plan*, released in February 2016, recognised the importance of introducing stable and effective inter-governmental corridor protection measures. Recommendation 9.4 in the Plan reads:

> *The Australian Government, in partnership with state and territory governments, should establish effective corridor protection mechanisms to ensure the timely preservation of surface, subterranean and air corridors, and strategic sites, for future infrastructure priorities. The mechanism should include:*
>
> - *Long-term strategic planning and project development work to identify corridors and lands*
> - *A stable and independent governance framework*
> - *Shared financial responsibility between the Australian Government and its state and territory counterparts.*

In its response to the Plan, released on 24 November 2016, the Australian Government stated that it:

> *... supports this recommendation, noting this is also a matter for state and territory governments. The Australian Government recognises the importance of ensuring that the future infrastructure needs of the country are well-planned for and that economic infrastructure is protected appropriately from incompatible uses. This is critical to driving productivity and reducing future costs. To support this work in November 2015, the COAG Transport and Infrastructure Council agreed to develop a work program to protect transport corridors and precincts. The majority of projects will be completed during 2017.*[38]

Recent state and territory initiatives

Governments are taking some steps to identify opportunities for corridor protection. For example:

- the NSW Government's *Long-Term Transport Masterplan*, released in late 2012, identifies 19 corridors across Sydney that require some form of protection.[39] Work is underway to identify the proposed alignment of some corridors, although action to reserve and begin to acquire the corridors has yet to occur.
- in *Plan Melbourne*, the Victorian Government refers to the potential to reserve land for future transport corridors.[40] Infrastructure Victoria's recently released 30-year infrastructure strategy recommends a number of corridors for further study and, potentially, for some form of corridor protection.[41]
- in its March 2016 *State Infrastructure Plan*, the Queensland Government states that a '… review of regional plans across the state will consider the strategic importance of identifying and protecting corridors.'[42] The *State Infrastructure Plan* refers also to the potential for co-locating infrastructure in corridors.
- in its 2015 *Integrated Transport and Land Use Plan*, the South Australian Government states that 'Our priorities … [will include] Protecting freight corridors and facilities … Ensuring efficient freight movements on vital corridors while also preserving and protecting the amenity of local neighbourhoods poses some difficult challenges. To achieve this important balance, The Plan addresses ways to safeguard freight routes, corridors and facilities from the encroachment of inappropriate or incompatible land use. In cases where existing land use alongside freight routes is already sensitive, land use policy will be implemented to minimise or avoid any potential further conflicts'. The plan also confirms that the Government will '…preserve corridors for train network extensions in outer Adelaide'.[43]

- in its 2014 State Planning Strategy 2050, the Western Australia Government highlights '…the need for the strategic identification of future land areas and precincts, the definition of buffers, the provision of land for infrastructure corridors'.[44] Enabling corridors to be used for multiple purposes is also noted as an issue.
- investigations into the Inland Rail line and a proposed east coast High Speed Rail line have both emphasised the importance of corridor protection.

Next steps

Translating aspiration into action requires an overarching framework to establish processes that:

- are sufficiently precise that they can be incorporated into inter-governmental agreements
- allow jurisdictions some ability to adapt to local circumstances
- allow the Australian Government and state/territory governments to refine and evolve their joint corridor protection priorities.

In establishing such a framework, we need to strike the right balance between too little and too much specificity. Too little creates a risk that: any framework is little more than a lowest common denominator list of objectives; and governments do not feel accountable for their commitments. Too much creates a risk that: some governments will not sign-up to the framework; and the framework proves to be unreasonably rigid.

Infrastructure Australia believes a set of national corridor protection protocols is required to provide a foundation for the truly effective, stable corridor protection environment envisaged in the *Australian Infrastructure Plan.* These protocols could then be translated into bi-lateral agreements between the Australian Government and the state/territory governments. In essence, the protocols could set out processes for:

- agreeing the corridors to which the protocols will apply
- establishing joint governance arrangements, such as a joint board, to oversee corridor protection efforts and report to the respective governments
- making commitments to fund jointly any necessary strategic planning and project development studies
- agreeing the level of protection to be applied to a corridor; for example, creating a reservation or a public acquisition overlay in parts of a corridor at risk of being 'built out'
- determining and making contributions into a joint corridor protection fund
- agreeing decisions on how to manage and dispose of acquired properties
- agreeing land use management measures to be applied to land adjoining existing and prospective corridors
- resolving any disputes.

While corridor protection is a matter where governments need to act, all Australians have an interest in effective corridor protection. The Australian community is the ultimate beneficiary of effective corridor protection. Businesses, communities and individuals all benefit from lower-cost, more productive infrastructure.

Infrastructure Australia will consult with governments and industry on the findings in this paper and the steps that need to be taken to establish an effective national framework for corridor protection.

The model will be made available to all governments to assist them in assessing options for protecting corridors identified in their strategic plans.

Finding 9

A national framework for corridor protection is required to guide coordinated and meaningful action by all levels of government. This framework should guide governments to:

- prepare agreed, robust plans
- prepare feasibility studies on the corridors arising from those plans
- establish joint funding and governance arrangements to protect and capture the value in those corridors.

List of findings

1. **Australia has a strong track record of protecting corridors, providing clear lessons for governments.** Many key infrastructure assets we rely on today have been built on corridors protected during the 1950s, 1960s and 1970s.
2. **Despite broad consensus on the merits of corridor protection, action to protect corridors has been the exception rather than the rule over recent years.** Governments need an increased focus on long-term planning, project development and land acquisition to ensure corridor protection is appropriately prioritised through budgetary processes.
3. **Failure to appropriately protect corridors could hold substantial costs and risks for governments and, in turn, for taxpayers.** A lack of action could result in: corridors being 'built out'; project costs rising due to the need for tunnels or longer, more indirect routes; and projects being delayed or cancelled.
4. **The fiscal challenges facing Australia's governments reinforce the need to protect key corridors.** Governments face rising costs to support a growing and ageing population, while providing the transformational infrastructure required to support Australia's economy in the twenty-first century. Without effective corridor protection, governments and the communities they serve may find that some important infrastructure projects become increasingly uneconomic and difficult to afford.
5. **Rising demand for land, particularly in our fast-growing cities, is likely to drive continued growth in the costs of acquisitions required to make way for critical infrastructure investments.** Corridor protection is essential to safeguard governments – and taxpayers – from future growth in land prices and their impact on infrastructure costs.
6. **Corridor protection could provide substantial savings for taxpayers.** Infrastructure Australia has modelled the impact of corridor protection under a range of scenarios across seven corridors included on the *Infrastructure Priority List.* Corridor protection and early acquisition across these corridors could save Australia approximately $10.8 billion ($2016, at a 7% real discount rate). In undiscounted terms, these savings represent around $57.1 billion of avoided costs (in $2016).
7. **Corridor protection requires immediate action by governments.** Corridors for the Outer Sydney Orbital and High Speed Rail initiative face particular short-term development pressures due to their proximity to major population centres. Protecting these corridors should be a focus for state and federal governments.

8. **Costs associated with early acquisition of land can be partially offset by property revenues during the period prior to construction.** Where corridors were protected in the past, governments normally rented the properties to interested parties until the land was required for the project in question. Over the seven corridors modelled, rental revenues generated could be around $4.2 billion ($2016, at a 7% real discount rate) or $7.7 billion ($2016, undiscounted). Early acquisition of properties for the purpose of corridor protection can also be an important platform for value capture.

9. **A national framework for corridor protection is required to guide coordinated and meaningful action by all levels of government.** This framework should guide governments to:

   - prepare agreed, robust plans
   - prepare feasibility studies on the corridors arising from those plans
   - establish joint funding and governance arrangements to protect and capture value in those corridors.

Appendix 1

Examples of Projects Developed on Previously Protected Corridors and Key Sites

Jurisdiction/ Project	Planning	Corridor Protection Activity	Development of Project
NSW			
M2 motorway	1951 *Cumberland County Plan*	1950s and 1960s	Construction occurred in the 1990s. At time of planning approval, there was local opposition to using the surface corridor (the opponents advocated placing the project in tunnel), as parts of the protected corridor had remained as bushland.
M4 motorway	1951 *Cumberland County Plan*	1950s and 1960s	Construction occurred over a number of stages, with the initial section occurring in the early 1970s and most of the project constructed in the mid-late 1980s and early 1990s.
M5 motorway	1951 *Cumberland County Plan*	1950s and 1960s	Construction occurred over a number of stages, with the initial section built in the early 1980s. Most of the project was constructed in the 1990s and early 2000s. A section of the eastern end was built in tunnel (on environmental grounds), although a corridor had been protected.
Victoria			
M1	Need for a corridor identified in the *Melbourne Metropolitan Planning Scheme* (MMPS) from 1954-1988 and in subsequent municipal planning schemes.	Corridor originally protected in 1950s.	First sections were developed in the 1960s. Other sections in the 1970s, 1980s and 1990s. Parts of corridor were wide enough to allow successive widening from 4 to 6 to 8 lanes.
EastLink motorway	Originally included in 1969 *Melbourne Transportation Plan* (then identified as F35 Freeway).	Corridor protected in planning schemes in mid 1960s.	Project development and construction occurred between 2003 and 2008.

Jurisdiction/ Project	Planning	Corridor Protection Activity	Development of Project
Victoria			
M80 motorway	Need for a corridor was identified in the 1969 *Melbourne Transportation Plan*.	Corridor originally protected in the 1970s.	Construction occurred between the late 1980s and late 1990s. Further widening occurred in the 2000s.
Melbourne Airport future development	*Melbourne Airport Strategy* and its associated EIS were approved by State and Commonwealth Governments in 1990. Commonwealth approval required Victoria to undertake planning controls to ensure the airport could develop to its ultimate capacity and to protect its flight paths.	Wide spaced, four runway configuration for the airport's ultimate development. (Very long-term timeframe 2050+). Included ground transport access, environmental management framework, flight path protection and identification of noise-affected areas. Included in the State Planning Policy Framework component of all planning schemes in 1997 as a document to which planning authorities must have regard.	
Avalon Airport future development	The *Avalon Airport Strategy* was released by the Victorian Government and Department of Defence in 1993.	Wide spaced, three runway configuration for the airport's ultimate development. (Very long-term timeframe 2050+). Included ground transport access, flight path protection and identification of noise-affected areas. Included in the *State Planning Policy Framework* component of all planning schemes in 1997 as a document to which planning authorities must have regard.	

Jurisdiction/ Project	Planning	Corridor Protection Activity	Development of Project
South Australia			
Various projects on corridors identified in 1969 *Metropolitan Adelaide Transport Plan*	Mid 1960s	1970s	The O-Bahn was developed on the Modbury Transport Corridor in the mid-late 1980s. The Southern Expressway was constructed in the mid-late 1990s.
Western Australia			
Southern section of the Kwinana Freeway, near Mandurah	1960s/1970s: *Perth Regional Transport Study*, for example: • *Perth Bunbury Route (Kwinana Freeway) – Where Should It Go?* (1984) • *Peel Regional Strategy* (1994) • *Inner Peel Region Structure Plan* (1997)	1988-2004: The land for the section of the Kwinana Freeway extension within the Peel region was reserved for Primary Regional Roads in the Peel Region Scheme in 2003.	The southern Kwinana Freeway extension was opened in September 2009.
Mandurah Rail Line	*Metroplan (Metropolitan Strategy)* (1990) *Inner Peel Region Structure Plan* (1997)	1993-2003: The land for the section of Mandurah Passenger Railway line within the Peel Region was reserved for a railway in the Peel Region Scheme in 2003.	Early to mid-2000s. Construction completed in December 2007.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& O-BAHN
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Appendix 2

Modelling of the Savings from Protection of Corridors in the *Infrastructure Priority List*

This appendix summarises the main assumptions underpinning the modelling reported in **chapter 2.** A separate technical paper, available from Infrastructure Australia's website, sets out more detailed background information and assumptions on each corridor.

Main assumptions

Defining the corridors

With some exceptions, governments have not yet defined the corridors with any precision. Infrastructure Australia started with the best publicly available information on the likely representation of the corridors. However, the precision of corridor definitions varied greatly, for example:

- Outer Metropolitan Ring/E6 in Melbourne – the Victorian Government has defined a precise corridor, and included that corridor as a 'public acquisition overlay' in statutory land use planning instruments. However, that statutory corridor does not include a proposed intermodal terminal site at Truganina. For the purposes of the modelling, a 300-hectare site and two connecting corridors were included, one from the proposed Outer Metropolitan Ring and one from the existing interstate rail network near Sunshine North.
- East Coast High Speed Rail – a corridor has been defined with a reasonable degree of precision, although firm decisions by governments to protect that specific alignment (or any other alignment) have not yet been taken.
- Western Sydney Airport Rail Line (south of the airport site) – the NSW Government has publicly exhibited an indicative corridor.
- Outer Sydney Orbital – only the first stage from the north of Western Sydney to the M5 motorway south of Campbelltown was modelled.

In the case of the Outer Sydney Orbital, and in other instances, governments have simply identified a broad 'investigation area'. Where this is the case, Infrastructure Australia has used its judgment based on: analysing existing land use zoning and development patterns, an understanding of relevant strategic plans, and balancing the need to moderate costs while minimising disruption to existing development.

The corridors were further divided into a number of segments, mainly reflecting the anticipated future form of the infrastructure; for example, whether the infrastructure is expected to be 'at grade', in tunnel, or in a 'dive' (a transition from surface to tunnel or a transition from the surface to a viaduct).

Approach to determining amount of required land

The modelling assumed that only the land required for a corridor itself is acquired. In practice, for some properties, only part of a property will be acquired. In other cases, the whole of a property will have to be acquired and any surplus land after excising the corridor would then be sold.

Given the purpose of this report – to make the policy case for corridor protection – individual properties were not taken into account. When governments use the model developed by Infrastructure Australia to assess the savings from protecting a particular corridor, a detailed analysis can be undertaken, addressing individual property severance issues.

Scenarios

Three scenarios were tested:

1. **Do not protect now and acquire at construction**: a corridor is not reserved and the land required for the corridor is acquired in the two years leading up to the start of construction.
2. **Protect and acquire now**: the corridor is reserved from 2017 and all land for the corridor is acquired within two years.
3. **Do not protect now and tunnel in future**: a corridor is not reserved and: (i.) tunnelling is undertaken on parts of the route that were rezoned and developed in the intervening years; and (ii.) sections of a corridor not placed in tunnel are acquired in the two years prior to construction.

The first scenario assumes no corridor protection, running the risk that current or future governments may zone for development land that would otherwise be required for the project. Where development occurs on the land needed for the corridor, the developed properties (such as houses and businesses) would need to be acquired.

The second scenario presents what might be considered an 'ideal' corridor protection scenario. It includes early acquisition of properties, minimising the additional costs associated with real increases in urban land prices.

The third scenario explores the circumstance where the corridor has not been protected, development subsequently occurs on the relevant land (in at least part of the corridor), but the government of the day decides that it is too difficult to acquire the houses and other development that have occurred in the interim. As a result, the relevant sections of the project have to be built in a tunnel.

Estimating land acquisition costs

Advice from consultants has been used to estimate 2016 unimproved and improved land values along each corridor. A typical value has been estimated for each zoning type by corridor segment. The land values were reviewed as part of the modelling audit.

In practice, land values vary along and within each corridor, reflecting the characteristics of individual parcels of land. However, for the purposes of this modelling, the estimated values are considered to be a reasonable guide.

Development premiums

The modelling assumes that land attracts a premium once it has been developed. For example, the cost of acquiring a residential block that has been developed is likely to be significantly higher than a vacant block. The assumed premium ranges from 75-300%, depending on the zoning of the land and where it is located. The premiums were established after considering the results of the audit and reviewing government land value data.

Capital cost assumptions

Unit cost information from a variety of sources, including from recent projects, was used to develop the per kilometre construction costs shown in **Table 2.** The figures exclude the cost of railway stations and road interchanges. In the case of underground infrastructure, these costs could be substantial. Details of the source information are in the technical paper available on the Infrastructure Australia website.

Table 2: Assumed per kilometre costs of construction ($2016, millions)

Corridor	Surface alignment	Tunnel alignment	Comment
Port of Brisbane Freight Rail	18.6	54.8	n/a
Outer Sydney Road and Rail Link	66.5	407.1	Assumes four-lane road tunnel. Addition of average road and freight rail construction cost.
Western Sydney Airport rail connection	81.9	219.0	n/a
Western Sydney freight line and intermodal terminal	18.6	54.8	n/a
Hunter Valley freight rail realignment	18.6	54.8	n/a
Outer Metropolitan Ring/E6 and Western Interstate Freight Terminal (WIFT)	66.5	407.1	Assumes four-lane road tunnel. Addition of average road and freight rail construction cost. See detailed technical paper re WIFT.
High speed rail	48.1	166.0	Based on HSR phase 2 report, uplifted for Consumer Price Index and construction cost escalation

Revenue assumptions

Under the 'protect and acquire now' scenario, the modelling assumes that:

- 50% of unimproved properties will be rented out for some interim use; for example, as a carpark or an extension of a private garden. The exception was the High Speed Rail project, where the modelling assumed no rental return from rural unimproved land.
- 80% of improved properties will be rented out.

Estimates of net rental revenue take into account normal outgoings associated with rental properties such as lease management and periodic repairs. The modelling assumes (conservatively) a 4% per year net rental revenue. This figure is lower than the 5-8% return that might ordinarily be obtained on privately rented properties. The lower return acknowledges the possibility that, as the properties cannot be rented into the long-term future, rentals may be slightly lower than would otherwise be the case. That said, as the corridors are not expected to be developed for their infrastructure purpose for 10-30 years, the acquired properties could generally be rented for extended periods.

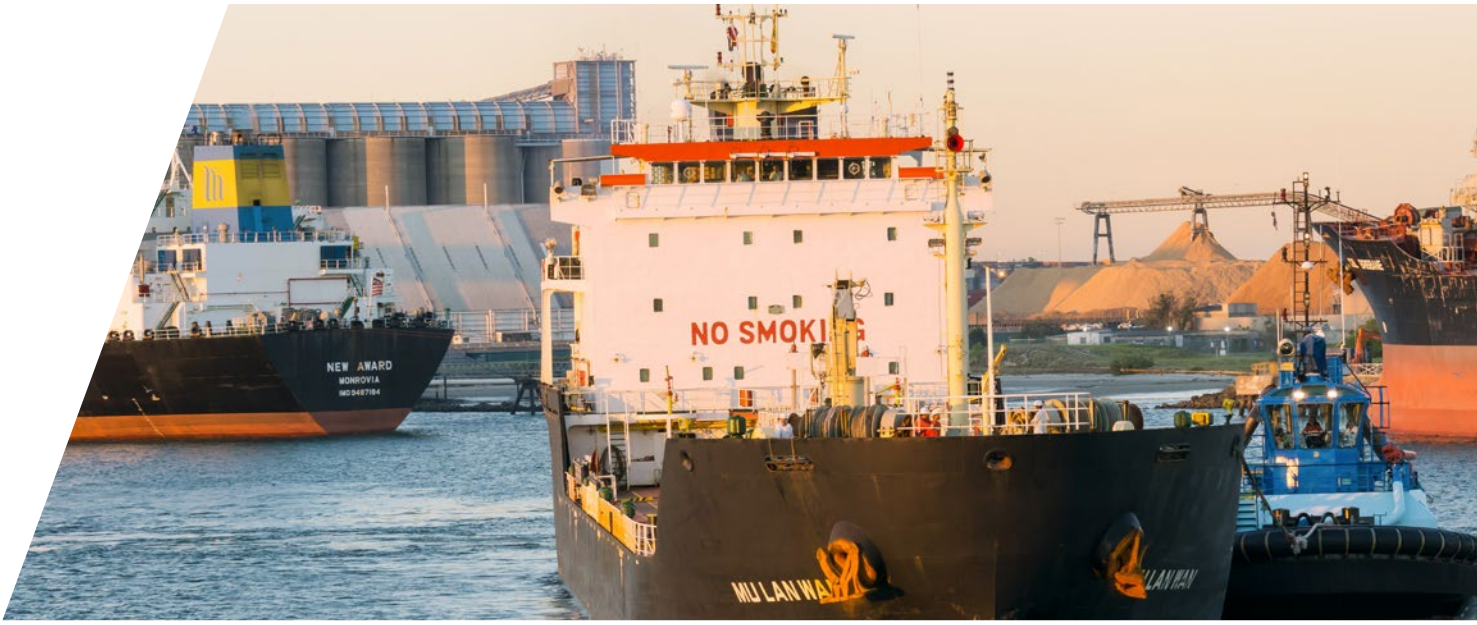
Assumed project start dates

Table 3 shows the assumed start dates for the projects. The rationale for these dates is set out in the separate technical paper available on the Infrastructure Australia website.

Table 3: Assumed start and finish dates for construction of projects in protected corridors

Corridor/Project	Assumed Start Date	Assumed Completion Date
Port of Brisbane dedicated freight rail connection	1 July 2034	30 June 2040
Outer Sydney Orbital Road and Rail Link	1 July 2037	30 June 2042
Western Sydney Airport rail connection	1 July 2035	30 June 2040
Western Sydney freight line and intermodal terminal	1 July 2027	30 June 2030
Hunter Valley freight rail realignment	1 July 2031	30 June 2034
Outer Metropolitan Ring/E6	1 July 2027	30 June 2032
High Speed Rail – Melbourne to Sydney		
• Melbourne to Canberra	1 July 2027	30 June 2037
• Canberra to Sydney	1 July 2024	30 June 2032
High Speed Rail – Sydney to Brisbane		
• Sydney – Newcastle	1 July 2033	30 June 2042
• Newcastle to Gold Coast	1 July 2046	30 June 2056
• Gold Coast to Brisbane	1 July 2039	30 June 2049

Source: Infrastructure Australia and High Speed Rail Phase 2 study



Treatment of discount rates

Discounting is a way of accounting for changes in the value of money over time. For example, it takes account of inflation and timing preferences. It allows us to make a 'like for like' comparison of investments and future savings in today's dollars.

Infrastructure Australia's project assessment framework applies a 7% real discount rate when undertaking economic cost-benefit analysis.[45] A 7% real discount rate has been used in this paper when presenting the potential savings from corridor protection.

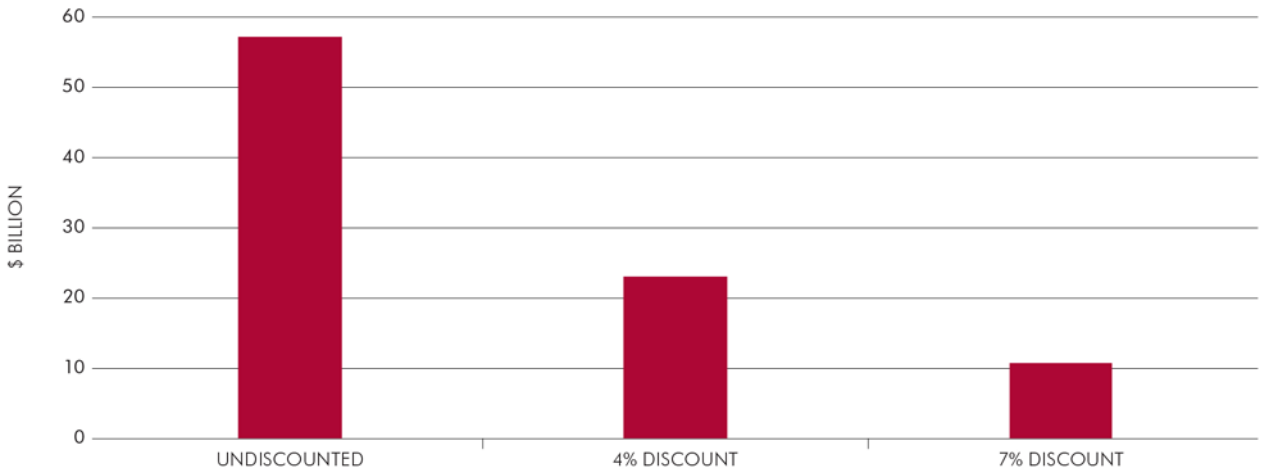
The assessment framework also suggests sensitivity tests using a 4% or 10% real discount rate. A 4% real discount rate has also been tested as a sensitivity test. This is particularly relevant in the case of the High Speed Rail corridor, and, potentially, corridors for the Outer Sydney Orbital and the Port of Brisbane freight rail connection.

The *High Speed Rail Study Phase 2 Report* published by the Australian Government in 2013 used a 4% real discount rate, noting that, '… a four per cent discount rate has been assessed as more suitable for large scale and long-life infrastructure projects such as HSR, and has therefore been adopted as the discount rate applied for the primary evaluation of HSR.'[46]

At a 4% real discount rate, the savings from protecting the seven corridors is estimated to be $23.1 billion ($2016).

Project costs and benefits are also commonly presented in undiscounted terms. Given these different perspectives, **Figure 12** compares the total undiscounted and discounted savings for the seven corridors. The positive values (using both discounted and undiscounted figures) demonstrate that: corridor protection is worth pursuing; and governments could usefully undertake more detailed analysis of the corridors in the *Infrastructure Priority List.*

Figure 12: Comparison of total savings from corridor protection on an undiscounted and real discounted basis ($2016)



Source: Infrastructure Australia

Maps of the corridors

Maps of each corridor are set out on the following pages, and are also included in the technical paper.

Figure 13: Port of Brisbane Dedicated Freight Rail Connection

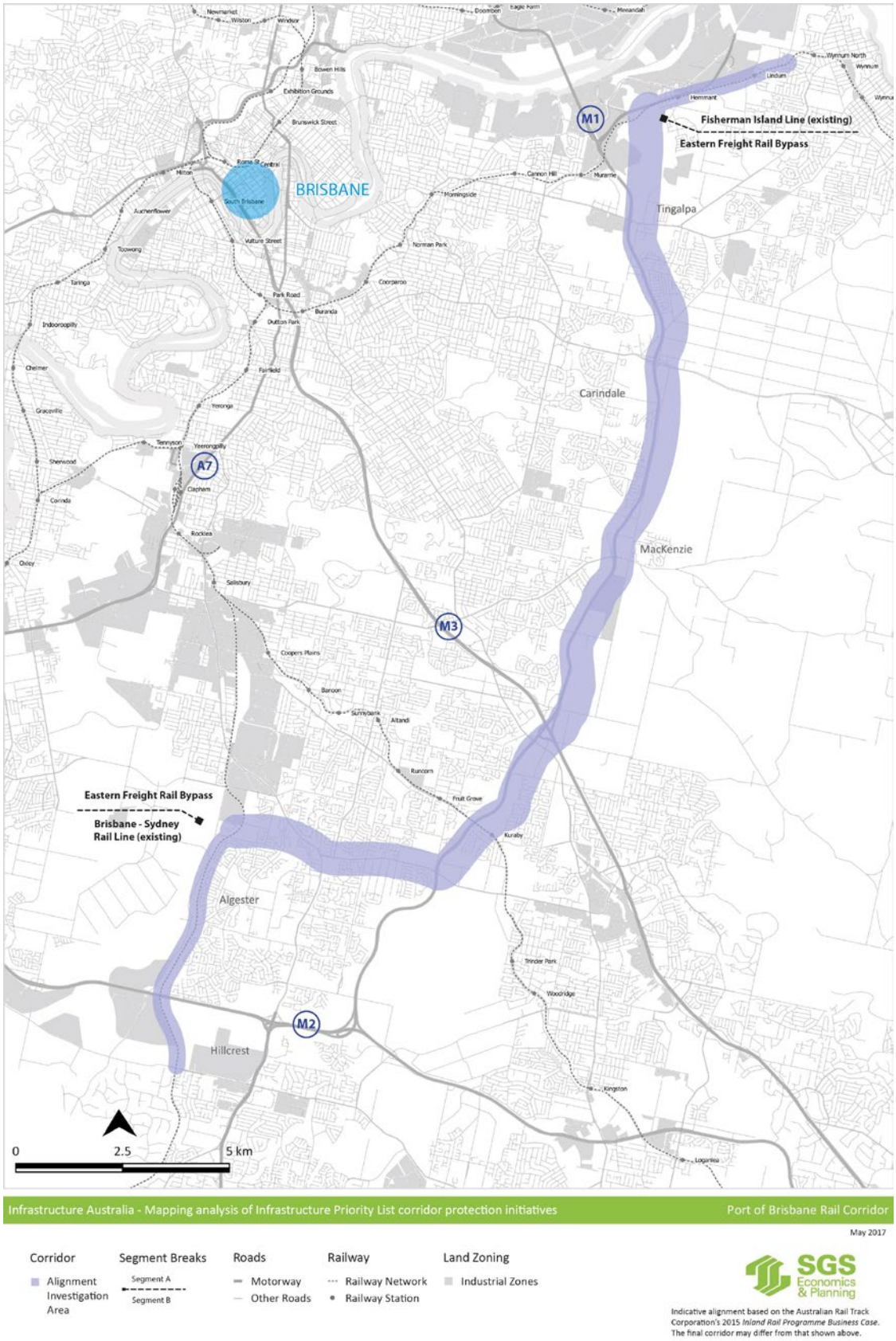
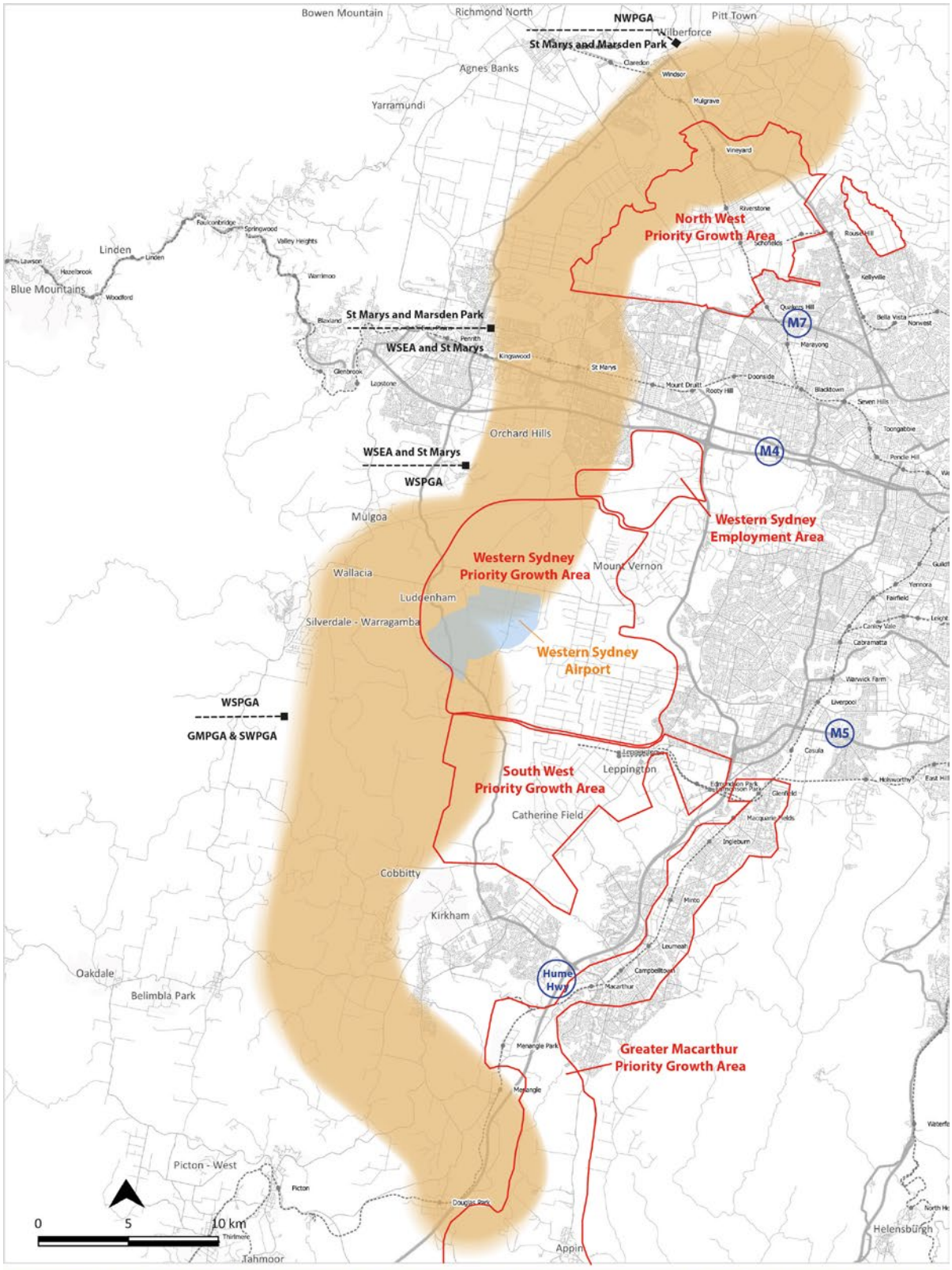


Figure 14: Outer Sydney Orbital Road and Rail Link



Infrastructure Australia - Mapping analysis of Infrastructure Priority List corridor protection initiatives

Outer Sydney Orbital Road and Rail Link - Stage 1

May 2017

Corridor
- Alignment Investigation Area

Segment Breaks
- Segment A
- Segment B

Roads
- Motorway
- Other Roads

Railway
- Railway Network
- Railway Station

SGS Economics & Planning

Indicative investigation area based on the NSW Government's June 2015 newsletter, *Outer Sydney Orbital: Corridor Preservation*. The final corridor may differ from that shown above.

Figure 15: Western Sydney Airport Rail Connection

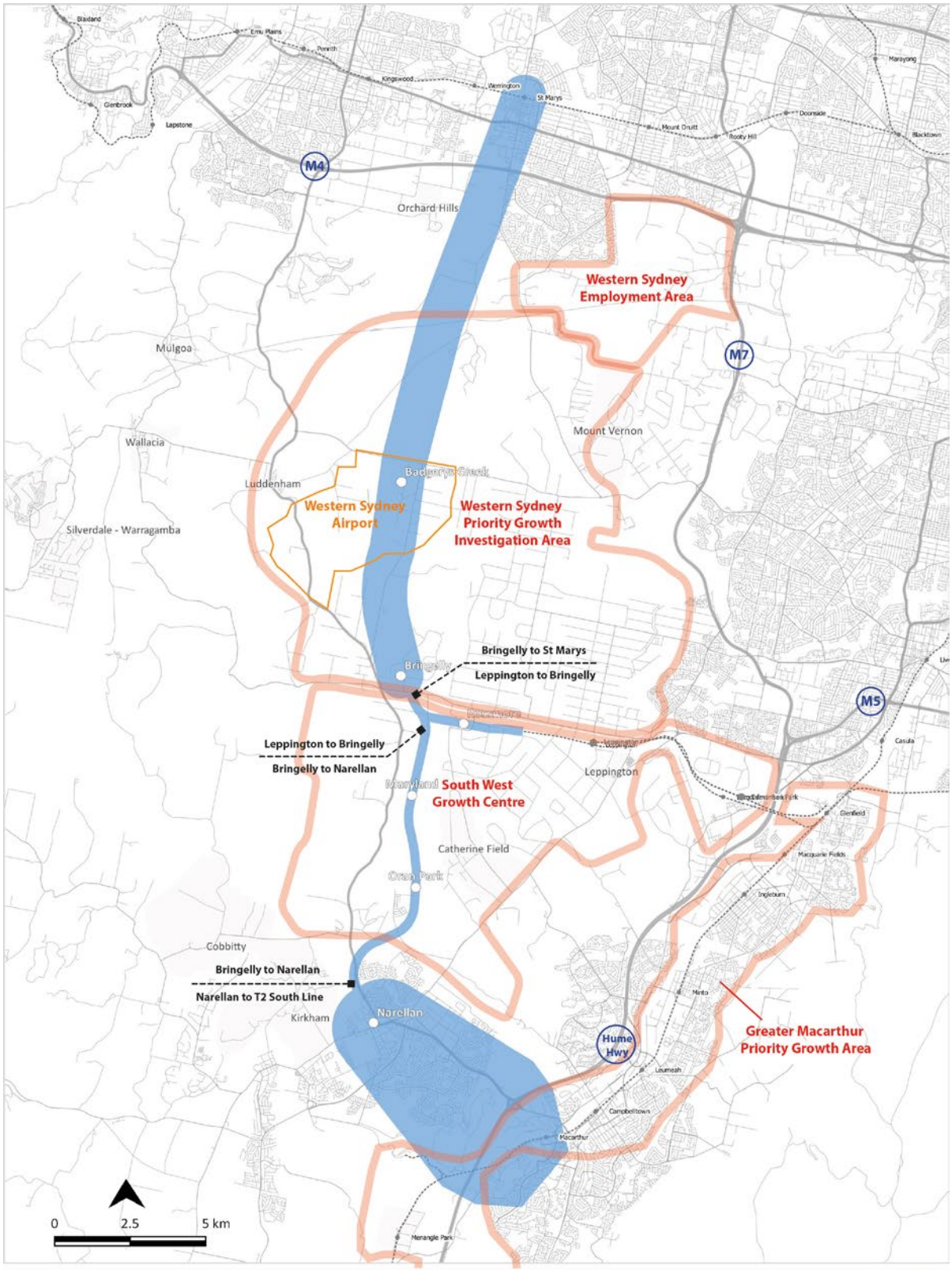


Figure 16: Lower Hunter Freight Rail Alignment

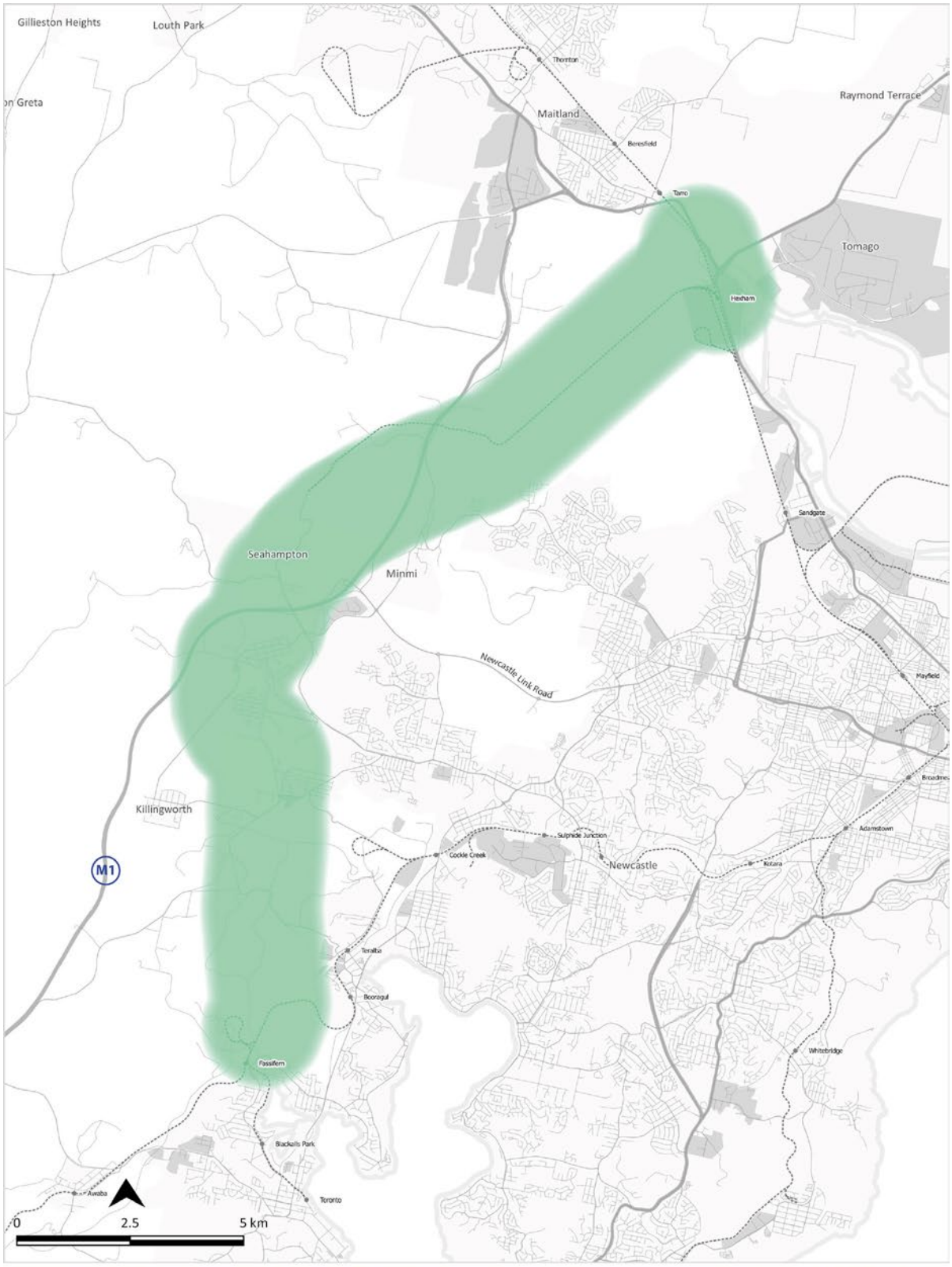
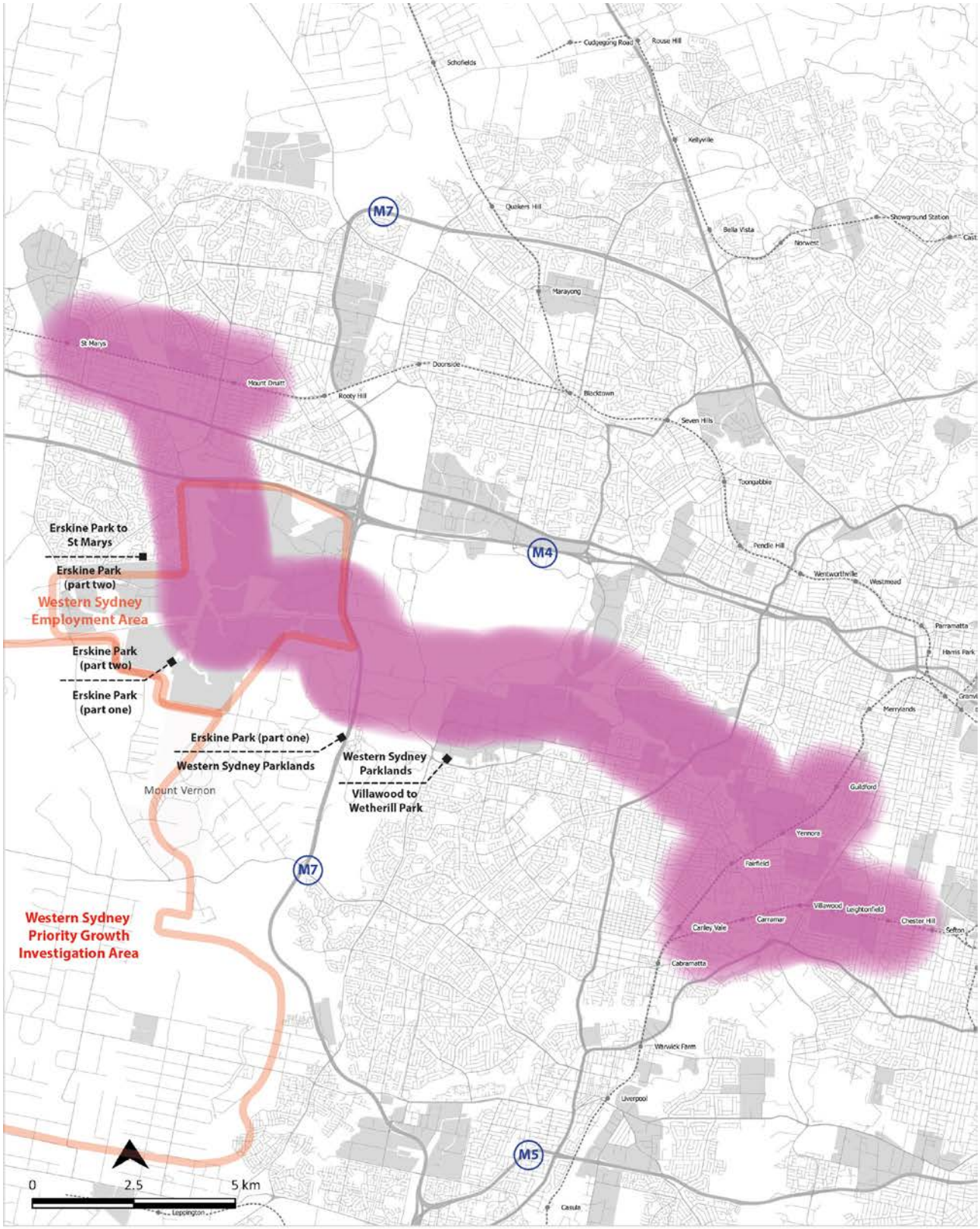


Figure 17: Western Sydney Freight Line and Intermodal Terminal



Infrastructure Australia - Mapping analysis of Infrastructure Priority List corridor protection initiatives — Western Sydney Freight Line and Intermodal Terminal Access

May 2017

Corridor: Alignment Investigation Area

Segment Breaks: Segment A / Segment B

Roads: Motorway; Other Roads

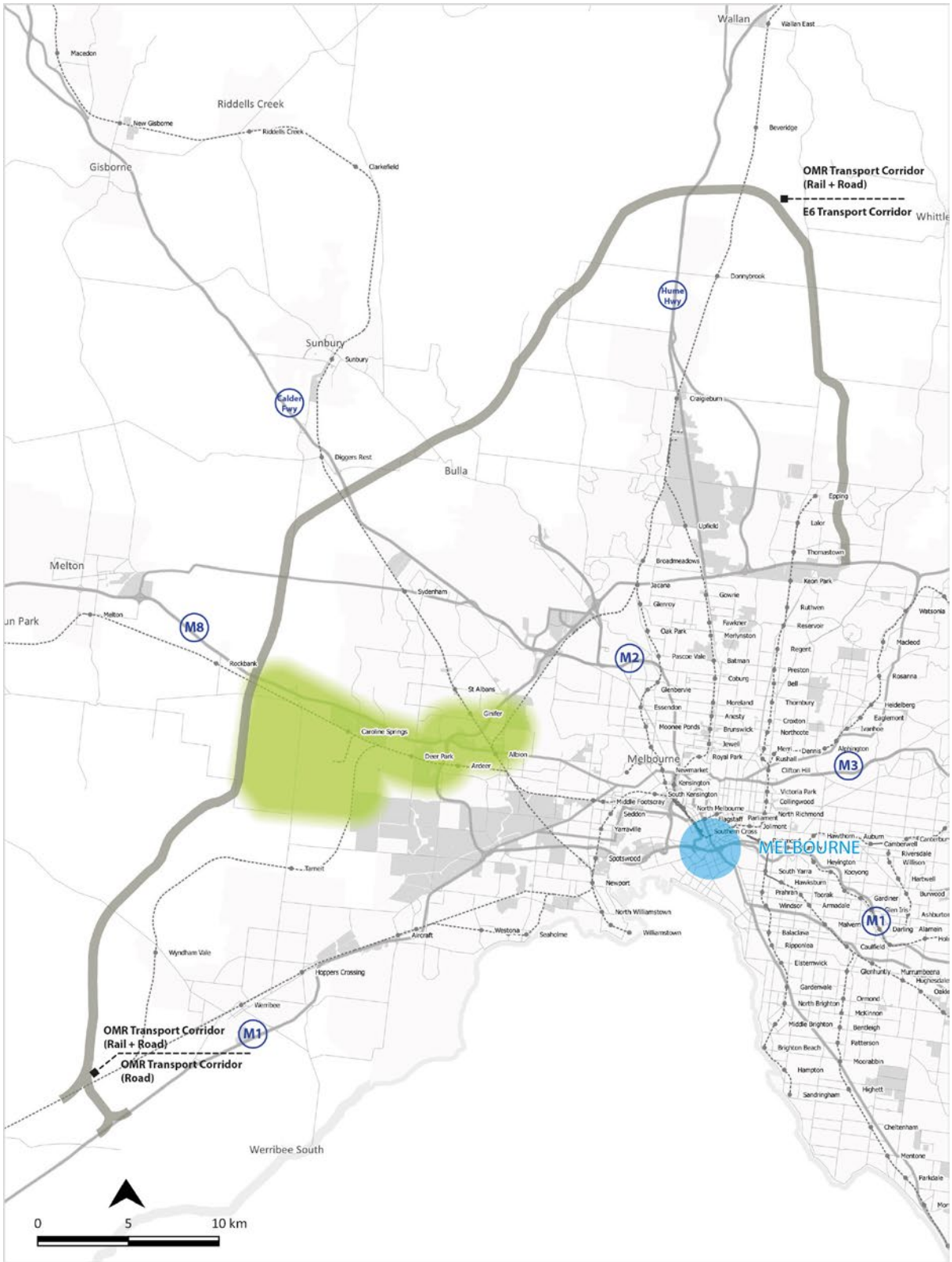
Railway: Railway Network; Railway Station

Land Zoning: Industrial Zones

SGS Economics & Planning

Indicative investigation area based on the NSW Government's June 2015 newsletter, *Outer Sydney Orbital and Bells Line of Road – Castlereagh Connection corridor identification and preservation process*. The final corridor may differ from that shown above.

Figure 18: Outer Metropolitan Ring/E6



Infrastructure Australia - Mapping analysis of Infrastructure Priority List corridor protection initiatives — Outer Metropolitan Ring-E6 in Melbourne

May 2017

Corridors
- Alignment Investigation Area
- Outer Metropolitan Ring/E6 Corridor

Segment Breaks
- Segment A
- Segment B

Roads
- Motorway
- Other Roads

Railway
- Railway Network
- Railway Station

Land Zoning
- Industrial Zones

SGS Economics & Planning

Indicative alignment and investigation area based on the Victorian Government's Public Acquisition Overlay for the OMR/E6 and, in broad terms, *Plan Melbourne 2017-2050* for the Western Interstate Freight Terminal and its potential connections. The final corridors may differ from that shown above.

Figure 19: East Coast High Speed Rail – Corridor Overview

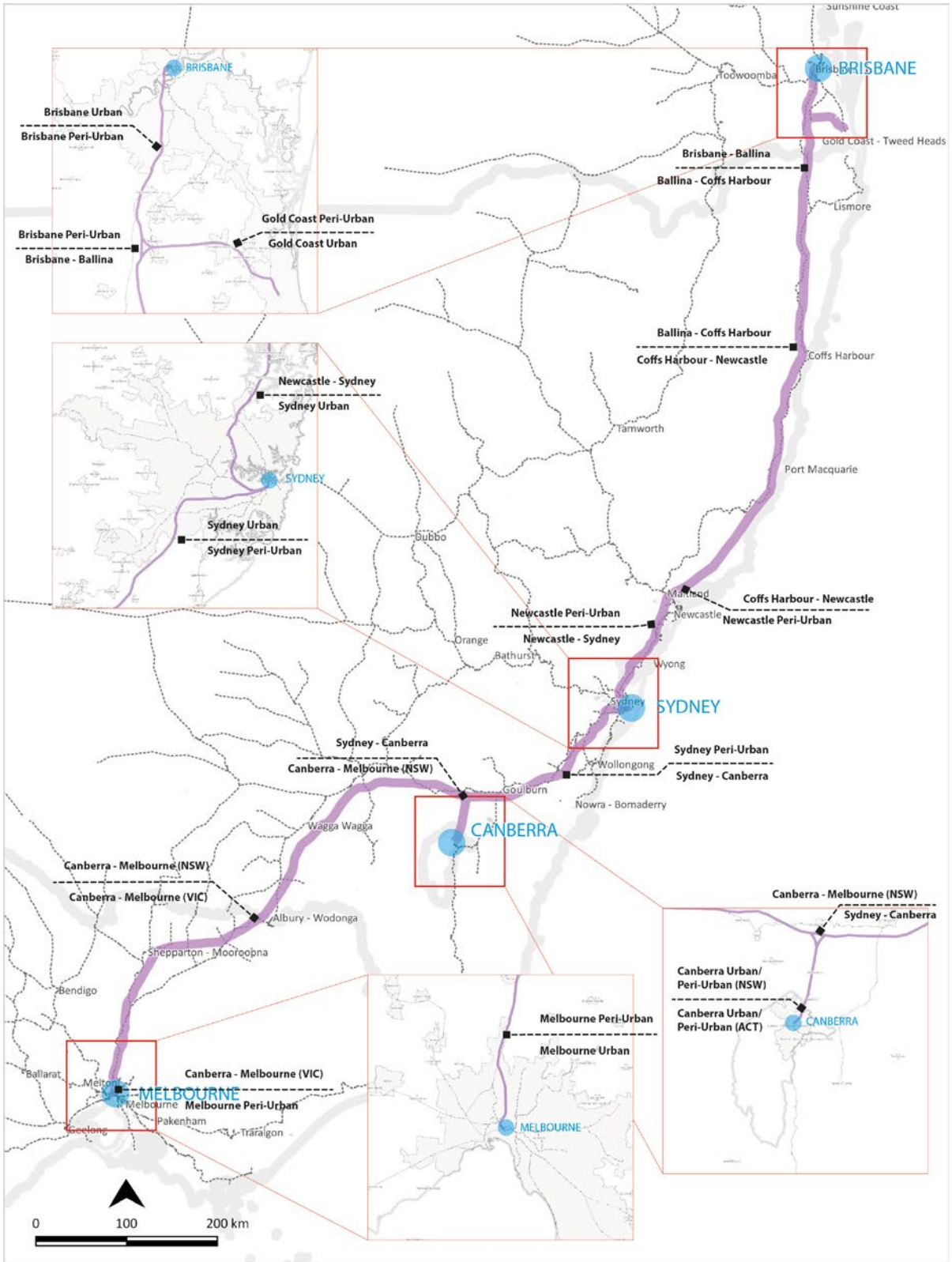


Figure 20: East Coast High Speed Rail Line – Brisbane to northern NSW

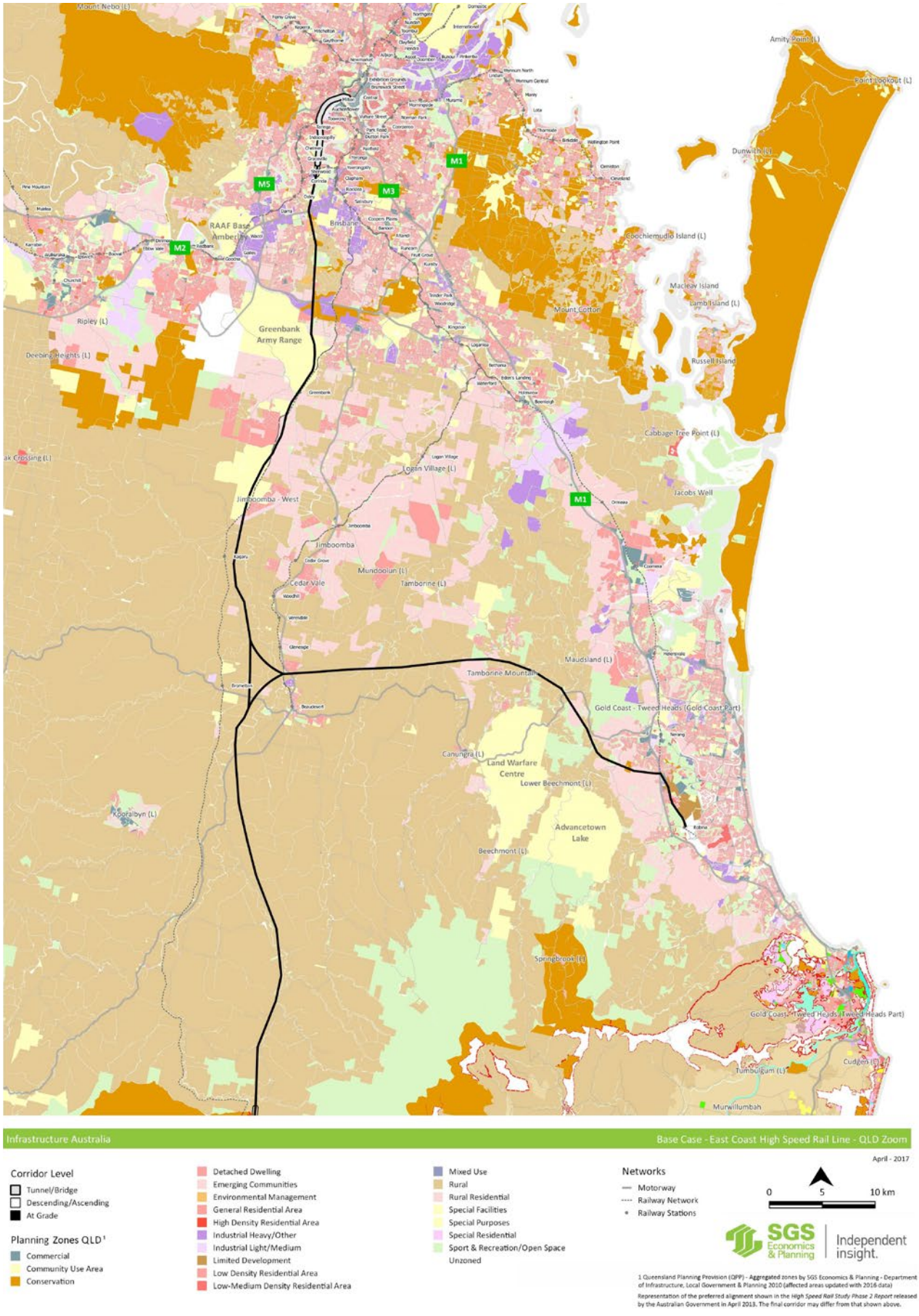


Figure 21: East Coast High Speed Rail Line – Northern NSW to northern Sydney

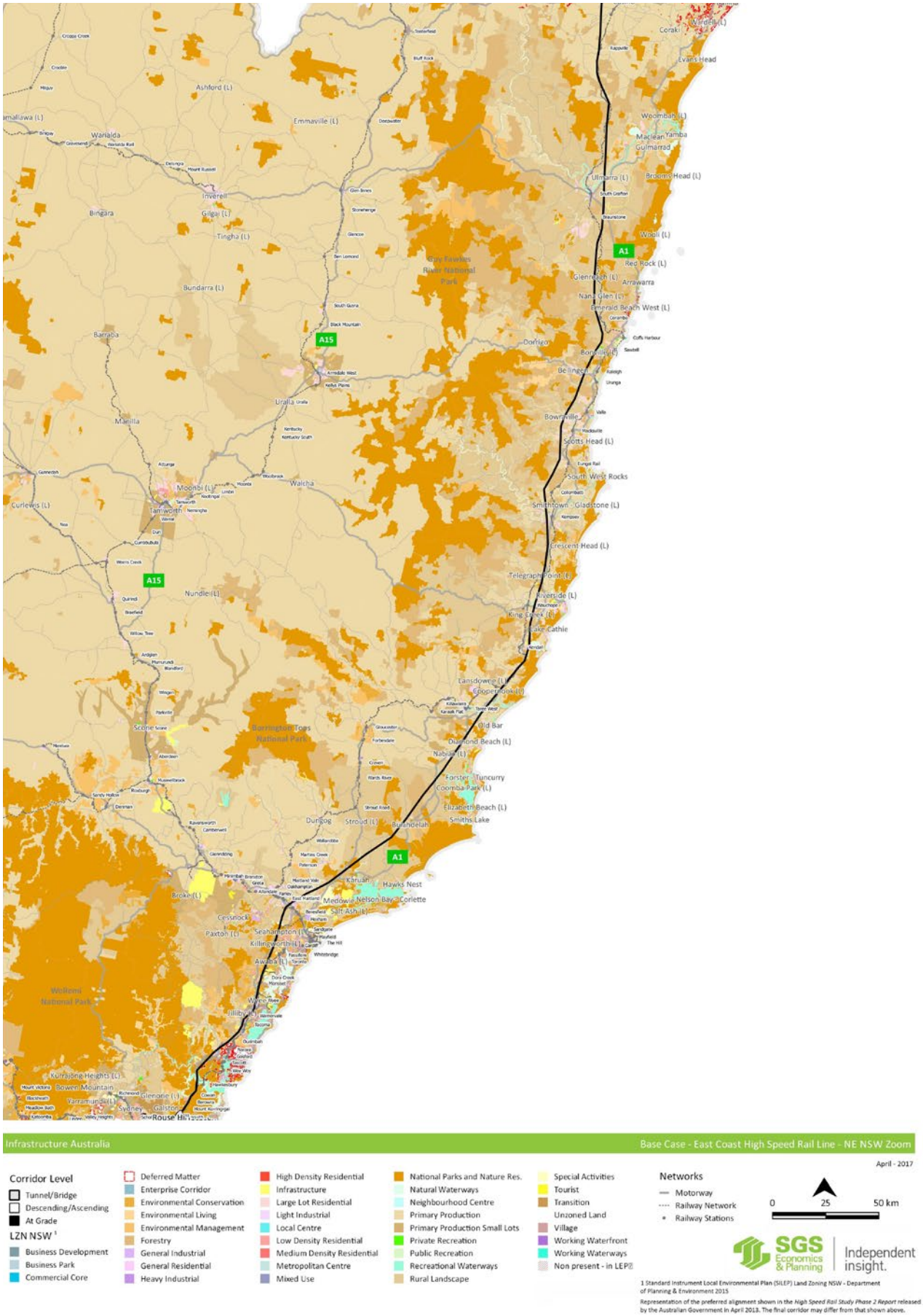


Figure 22: East Coast High Speed Rail Line – Northern Sydney to Mittagong

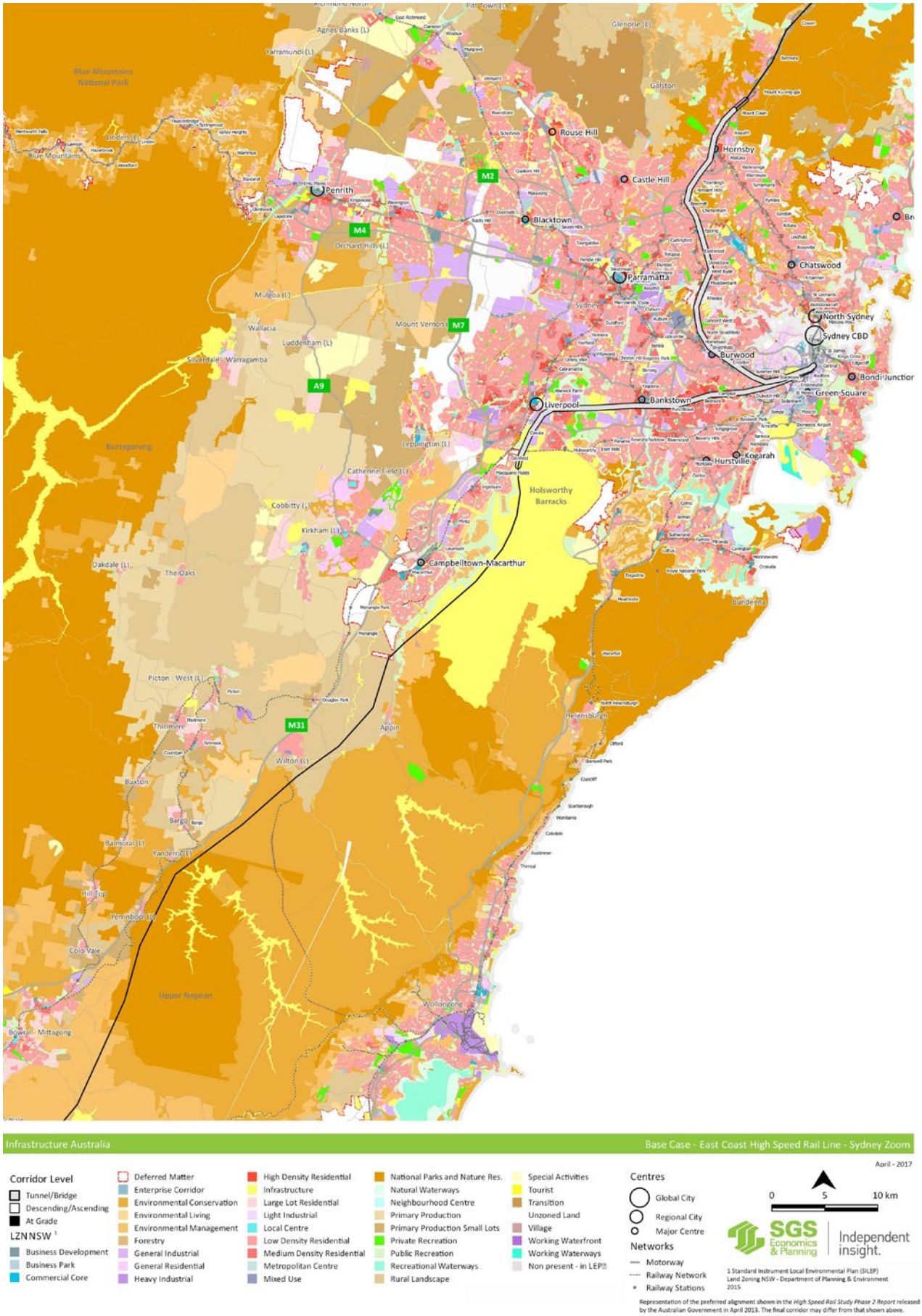


Figure 23: East Coast High Speed Rail Line – Canberra deviation

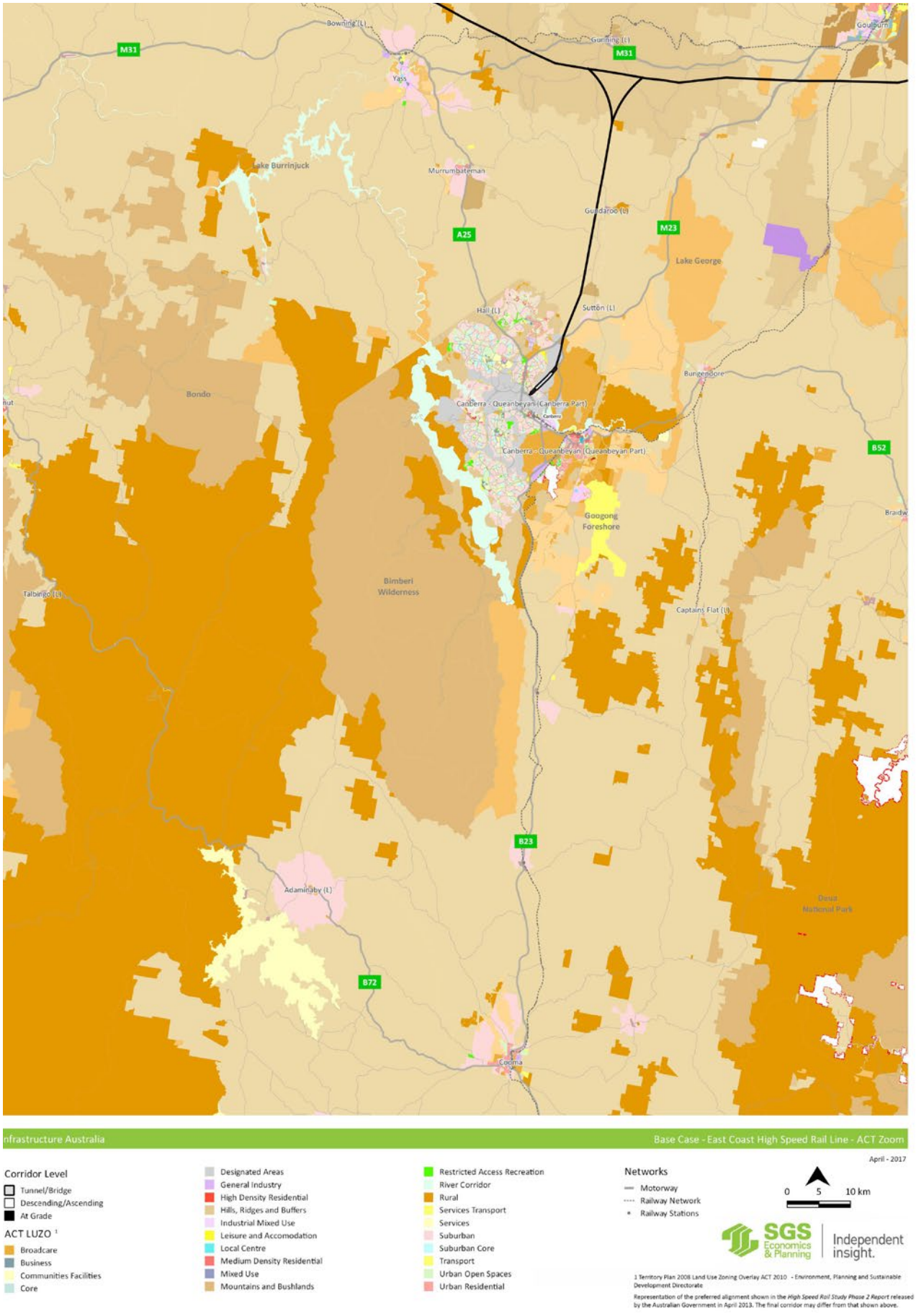


Figure 24: East Coast High Speed Rail Line – Mittagong to northern Victoria

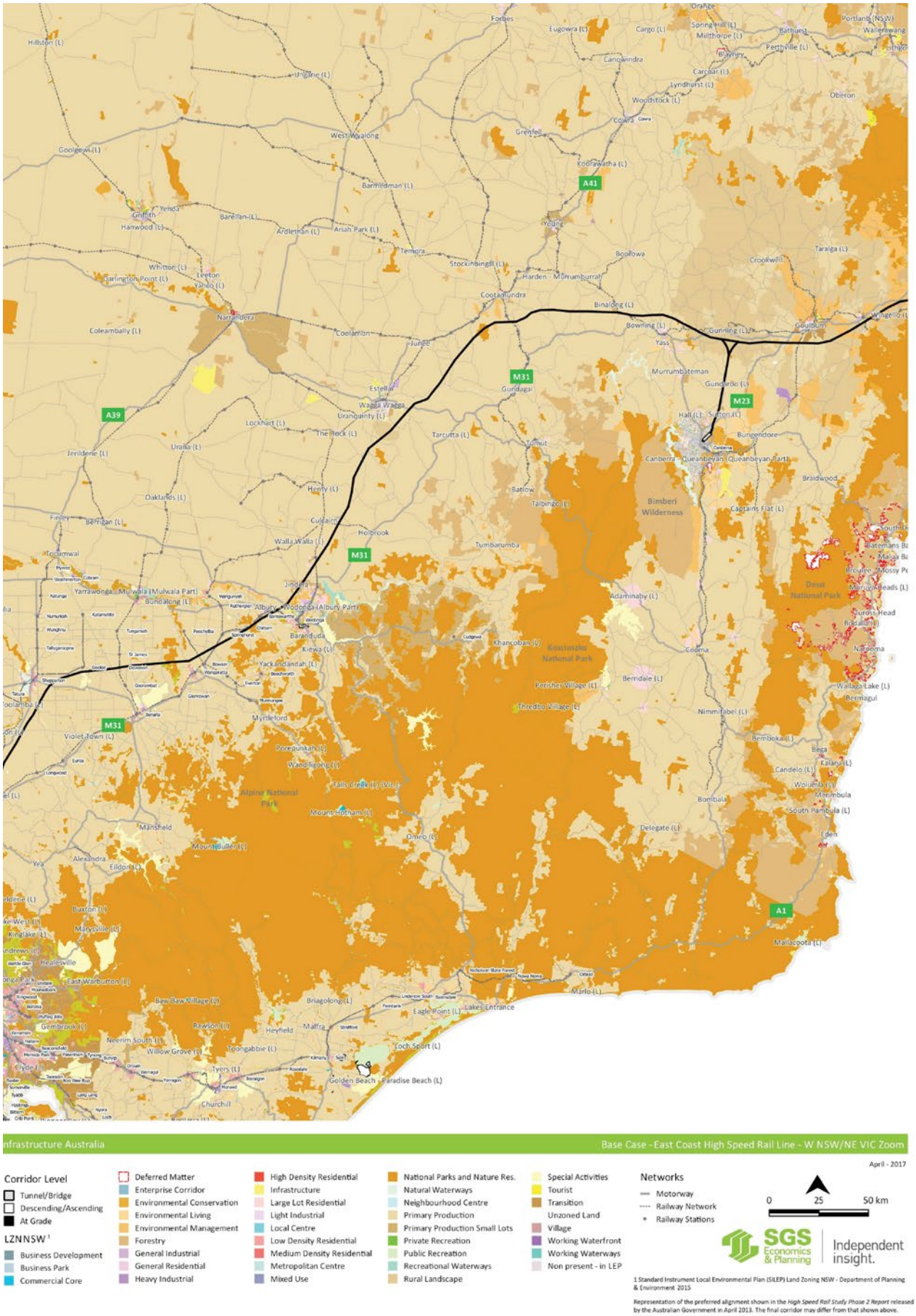
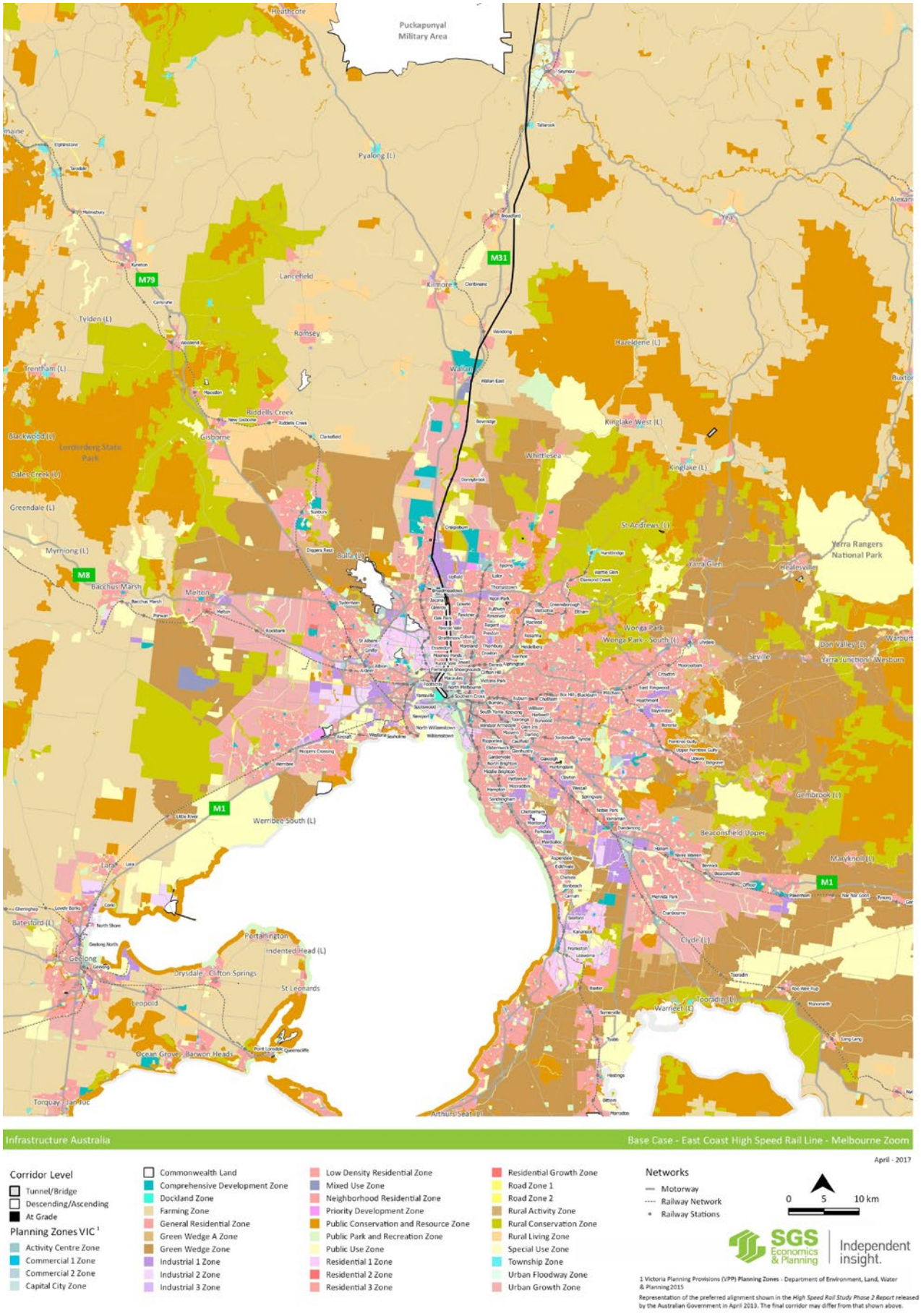


Figure 25: East Coast High Speed Rail Line – Northern Victoria to Melbourne



Appendix 3

List of tables

List of figures

References

1. An additional corridor requiring protection has been included in the recently released 2017 Infrastructure Priority List.
2. Modern intermodal terminals can be quite large – sometimes 200 to 400 hectares (or about 2-4 square kilometres). For example, the Moorebank terminal precinct in south-western Sydney comprises 241 hectares of developable land. See http://www.micl.com.au/theprecinct/
3. Corridor protection is sometimes referred to as 'corridor preservation' or 'corridor reservation'.
4. The two corridors were for: a rail link to Melbourne Airport; and, more recently, the proposed Outer Metropolitan Ring/E6.
5. The Melbourne Metropolitan Board of Works' rates were not used for rail corridors. Responsibility for rail corridors fell to the Victorian Railways Commissioners and later the Victorian Government. In practice, although a number of road corridors in Melbourne were protected, few if any rail corridors were protected. Like the Sydney Region Development Fund, the Board's rates were also used to acquire metropolitan parks and to consolidate land for development (old and inappropriate subdivisions). The Board's rates also covered water supply, sewage and drainage infrastructure, and catchment protection.
6. Australian Bureau of Statistics (2013) *Population Projections, Australia, 2012 (base) to 2101*, Available at http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3222.02012%20(base)%20to%20 2101?OpenDocument
7. The Bureau published the projections in late 2013. The Bureau's Series B (medium) projection of Australia's population at 30 June 2016 was 24.36 million, up from.22.72 million at 30 June 2012. The Bureau's recent estimate of Australia's population at 30 June 2016 is 24.13 million, slightly lower than was projected for that year. Nevertheless, Australia's population has still grown by more than 1.4 million people in just four years.
8. In 2009, the Council of Australian Governments (COAG) agreed on nine criteria for effective strategic planning of Australia's capital cities. The third criterion dealt with whether capital city planning processes:

   > *provide for nationally-significant economic infrastructure (both new and upgrade of existing) including: a) transport corridors; b) international gateways; c) intermodal connections; d) major communications and utilities infrastructure; and e) reservation of appropriate lands to support future expansion.*

   The COAG Reform Council's 2011 report, *Review of capital city strategic planning systems – Report to the Council of Australian Governments*, found several jurisdictions' strategic planning systems were only partially consistent with this criterion. It concluded that 'improving freight transport and intermodal networks to support forecast port and airport capacity and growth in the freight task' is a key priority (p.2). The report also found that 'The Western Australian Government's Metropolitan Region Scheme stands out as a mechanism for identifying and reserving land for urban expansion and transport corridors'. (p.13)
9. Productivity Commission (2014) Public Infrastructure – Volume 2, Available at http://www.pc.gov.au/inquiries/completed/infrastructure, pp.364-365
10. The terminology varies from jurisdiction to jurisdiction. For example, the term 'reservation' is commonly used in NSW; whereas, the term 'public acquisition overlay' is used in Victoria.
11. For example, the Victorian Government has a 'loss on sale' mechanism for assessing the diminution in value where a property has been sold at a lower price than might have been expected in the absence of a reservation (or 'public acquisition overlay' to apply the term used in Victorian legislation).

12. The Metropolitan Region Improvement Tax (MRIT) has been in place since 1960. The MRIT is collected in a defined region covering greater Perth. Some areas on Perth's fringe, such as the Peel region, are not covered by these arrangements. As Perth expands, the coverage of the MRIT may need attention.

13. In its submission to the Productivity Commission's infrastructure inquiry, the then Office of the Infrastructure Coordinator indicated that tunnels could be up to 8-10 times the cost of equivalent infrastructure built on the surface. The modelling reported in chapter 3, uses a more conservative ratio of approximately 5-6 times, based on simple per kilometre comparisons between various 'at grade' and tunnelled projects. However, this approach may understate the potential costs of tunnelling, particularly in urban environments, where the cost of multiple underground intersections or 'on/off ramps' can add substantially to the complexity and cost of a project. As the number and scope of such intersections is a matter for more detailed project development, we have adopted a more conservative approach in the modelling.

14. These costs include higher operational costs for ventilation and lighting of the tunnels, as well as costs from operating additional fire control, and electronic messaging systems. Maintenance costs for the tunnels themselves can also be higher than those for projects built on the surface. For example, a 2010 review of the Sydney Orbital road network by the then NSW Roads and Traffic Authority observed, 'An analysis of current tolling on the Sydney Orbital motorway network highlights a number of issues. The highest tolls per kilometre have been applied to tunnels which have the highest cost of construction, operation and maintenance per kilometre'. See NSW Roads and Roads and Traffic Authority (2010) *Post Implementation Review: M7 Motorway, Cross City Tunnel and Lane Cove Tunnel*, Available at http://www.treasury.nsw.gov.au/ppp/nsw_projects/projects_which_have_been_awarded/roads/lane_cove_tunnel, p.49

15. NSW Ports (2015) Navigating the Future: *NSW Ports' 30 Year Master Plan*, Available at http://www.nswports.com.au/publications/, p.3

16. Infrastructure Australia (2016) Australian Infrastructure Plan, Available at http://infrastructureaustralia.gov.au/policy-publications/publications/Australian-Infrastructure-Plan.aspx, p.20

17. Sydney Ports Corporation

18. As some of the engineering requirements of railways are more demanding than road transport (principally the minimum radii of curved track and maximum vertical grade), greater attention will need to be given where centres in our cities are planned to be served by underground rail systems. On the other hand, as rail tunnels often have a smaller cross-section than a road tunnel, this may provide some flexibility in corridor routing.

19. See, for example, the NSW Government's *Infrastructure State Environmental Planning Policy* available at http://www.planning.nsw.gov.au/Policy-and-Legislation/Infrastructure/Infrastructure-SEPP

20. Australian Government (2015), 2015 *Intergenerational Report: Australia in 2055*, Available at http://www.treasury.gov.au/PublicationsAndMedia/Publications/2015/2015-Intergenerational-Report, p.xiv

21. Morrison, The Hon Scott, MP and Cormann, Senator the Honourable Mathias, (2017) *Budget Strategy and Outlook: Budget Paper No. 1, 2017-18*, Available at http://www.budget.gov.au/2017-18/content/downloads.htm, p.1-7

22. NSW Government (2016) *NSW Government Budget 2016-17: Budget Paper No. 5 – Intergenerational Report*, Available at http://www.budget.nsw.gov.au/, p.12

23. NSW Government (2017) NSW Government Budget *2017-18: Budget Overview*, Available at https://www.budget.nsw.gov.au/nsw-budget-2017-18-budget-papers. A $4.5 billion surplus in 2016-17 reflects, in part, the proceeds from some asset sales. The surplus is projected to fall to $1.5 billion in 2020-21.

24. In some jurisdictions, the relevant land acquisition and compensation legislation provides that, even where a corridor has been reserved, the zoning of nearby land is considered in the price governments pay for the corridor land. The valuation has regard to what the land might have been zoned in the absence of the reservation. These provisions emphasise the importance of purchasing land before the land is rezoned, ahead of the 'urban front' mentioned in the Western Australian example in the next section.

25. Urbis Valuations (2013) *Report on Historic Land Value Growth in East Coast Capital Cities*, Available at http://infrastructureaustralia.gov.au/policy-publications/publications/Historic-Land-Value-Growth-in-East-Coast-Capital-Cities-July-2013.aspx

26. CoreLogic (2017) *Capital city vacant land selling prices continue to rise as prices fall in regional Australia*, Available at http://blog.corelogic.com.au/2017/02/capital-city-vacant-land-selling-prices-continue-rise-prices-fall-regional-australia/?utm_source=Newsletter&utm_campaign=PP27FEB17&utm_medium=Email&utm_content=text&j=68727544&e=stephen.alchin@infrastructure.gov.au&sfmc_sub=939031427&l=8000399_HTML&u=591382916&mid=10873698&jb=0

27. See Australian Bureau of Statistics (2017) *Consumer Price Index, Australia*, Catalogue No 6401.0, Table 5, Available at http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6401.0Mar%202017?OpenDocument

28. Although the price increases may have been due in part to other cost drivers, such as increases in the cost of developing and servicing residential lots, the land price increases are unlikely to have been due wholly to those factors.

29. Western Australian Planning Commission (2007) *The case for retaining the metropolitan region improvement tax*, Available at https://www.planning.wa.gov.au/dop_pub_pdf/MRIT_Sept_07_Reprint.pdf, p.7

30. The 2012 *Joint Study on Aviation Capacity in the Sydney Region* found that the cost of not accommodating the projected growth in aviation demand in the Sydney region would be substantial: by 2060, NSW would have foregone $30.6 billion in expenditure, $17.5 billion in gross state product (measured in 2010 dollars) and 57,000 jobs. The Environmental Impact Statement for Western Sydney Airport projects that construction of the airport will create $2.3 billion in value add across Sydney, of which $1.9 billion will be in Western Sydney. Operation of the Stage 1 airport is projected to generate $205 million in 2031, of which $77 million is expected to occur in Western Sydney.

31. The model itself was developed by EY, under direction from Infrastructure Australia. The modelling presented in this paper was undertaken by Infrastructure Australia.

32. The latest *Infrastructure Priority List* is dated November 2016. The corridor protection initiatives are described in the February 2016 list, specifically at pp.35-43 in Infrastructure Australia (2016) *Australian Infrastructure Plan: The Infrastructure Priority List – Project and Initiative Summaries*, available at http://infrastructureaustralia.gov.au/projects/infrastructure-priority-list.aspx. The *Infrastructure Priority List* includes a corridor for a Western Sydney Airport fuel pipeline. This corridor was not modelled on the grounds a detailed scope and route alignment has not been released.

33. The modelling was audited by Urbis.

34. Appendix 3 provides further detail comparing the discounted and undiscounted savings.

35. The savings are also achieved by protecting a site and connecting corridors for the proposed Western Interstate Freight Terminal. One of the connections could join with the Outer Metropolitan Ring, which has been conceived as a multi-modal corridor.

36. Infrastructure Australia (2017) *Capturing Value: Advice on making value capture work in Australia*, Available at http://infrastructureaustralia.gov.au/policy-publications/publications/Capturing-Value.aspx, p.50

37. The Victorian Government has used this approach. Where a landowner affected by a public acquisition overlay claims that their ability to sell a property at a fair price has been compromised by the existence of a public acquisition overlay on the property, the government can negotiate an amount that represents the 'loss on sale' associated with the overlay. This amount is paid to the vendor. In exchange, the government secures a proportionate interest in the value of the land. For its part, as overall property prices rise, the government secures its share in the increased value of the property.

38. Australian Government (2016) *The Australian Government's Response to Infrastructure Australia's Australian Infrastructure Plan*, Available at: https://infrastructure.gov.au/infrastructure/publications/index.aspx#anc_response-aip, p.59

39. NSW Government (2012) *Long Term Transport Master Plan*, Available at http://www.transport.nsw.gov.au/content/nsw-long-term-transport-master-plan, p.209

40. Victorian Government (2017) *Plan Melbourne*, Available at http://www.planmelbourne.vic.gov.au/the-plan, p.51

41. Infrastructure Victoria (2016) *Victoria's 30-year Infrastructure Strategy*, Available at http://yoursay.infrastructurevictoria.com.au/30-year-strategy/

42. Queensland Government (2016) State Infrastructure Plan – Part A, Available at http://dilgp.qld.gov.au/infrastructure/state-infrastructure-plan.html, p.37

43. South Australian Government (2015) *Integrated Transport and Land Use Plan*, Available at http://transportplan.sa.gov.au/, p.17

44. Western Australian Government (2014), *State Planning Strategy 2050*, Available at http://www.planning.wa.gov.au/publications/6561.asp, p.53

45. Infrastructure Australia (2016) *Assessment Framework Overview*, Available at http://infrastructureaustralia.gov.au/projects/assessment-framework-overview.aspx

46. AECOM et al (2013) *High Speed Rail Study Phase 2 Report: Appendix Group 5 Economic, social and environmental appraisal, Appendix 5B, Cost Benefit Analysis*, Available at https://infrastructure.gov.au/rail/trains/high_speed/index.aspx, p.5

Accessible longform charts and graphics

Figure 1: Potential savings from protection and early acquisition of *2016 Infrastructure Priority List* corridors ($2016, 7% real discount rate)

Figure 1 shows a map of the south-eastern corner of the Australian mainland from just north of Brisbane to Melbourne. Seven corridor protection initiatives in the 2016 Infrastructure Priority List are named and shown on the map. These initiatives were modelled by Infrastructure Australia in preparing this paper. The map also shows the potential saving in the cost of constructing each project if the relevant corridor is protected. The cost savings are presented in 2016 dollars, discounted at seven percent. The seven initiatives are as follows:

- Port of Brisbane freight rail connection ($66 million)
- Lower Hunter rail freight alignment ($33 million)
- Outer Sydney Orbital road and rail link ($3,665 million)
- Western Sydney Airport rail connection ($1,104 million)
- Western Sydney freight line and intermodal terminal access ($1,605 million)
- Outer Melbourne Ring Road/E6 ($748 million)
- Corridor for an east coast High Speed Rail line ($3,544 million).

Figure 2: Maps of EastLink corridor in Melbourne available for reservation in 1966 and as delivered in 2015

Figure 2 shows two road maps of the same area of eastern Melbourne in 1966 and 2015. The maps were prepared by Melways. The 1966 map shows there was comparatively little urban development in the area at that time. The map includes a dashed line showing where, a few years later, a corridor was protected for what was to become the EastLink motorway. The 2015 map shows:

- firstly, the EastLink motorway built on the corridor that had been protected in the late 1960s and early 1970s
- secondly, that much of the land that was undeveloped in 1966 had been developed over the intervening years.

But for the corridor being protected, it is highly likely that land required for the motorway would have been subdivided and built upon between the early 1970s and the early 2000s. As a result, construction of the motorway through this area would have required either: houses and other development to be demolished, or the road to be built in a tunnel.

Figure 3: Projected population of Australian capital cities – 2011 to 2061

Figure 3 is a bar graph showing the estimated resident population of Australia's capital cities in June 2011 and medium-level projections of each city's population in June 2031 and June 2061. The population projections followed release of the 2011 Census results, and were published by the Australian Bureau of Statistics in November 2013, (ABS Catalogue 3222.0). The projections formed a key input to the Australian Infrastructure Audit, which was published by Infrastructure Australia in 2015.

City	Estimated population in 2011	Projected population in 2031	Projected population in 2061
Sydney	4,608,949	6,206,843	8,493,740
Melbourne	4,169,366	5,984,219	8,580,556
Brisbane	2,147,436	3,190,129	4,787,996
Perth	1,833,567	3,248,550	5,451,406
Adelaide	1,264,091	1,566,929	1,920,727
Canberra	367,985	520,412	740,903
Hobart	216,273	247,320	270,655
Darwin	129,106	170,153	225,873

Figure 4: Maps of potential CBD station locations for the proposed East Coast High Speed Rail line in Brisbane, Sydney and Melbourne

Figure 4 shows maps of the proposed capital city CBD station locations of a proposed east coast high speed rail network. The maps are drawn from the *High Speed Rail Study Phase 2 Report* published by the Australian Government in April 2013. The proposed stations are in densely built up areas on the fringe of the respective CBDs.

Figure 5: Intergenerational report projection of Australian Government underlying cash balance

Figure 5 is a simplified representation of a graph from the *2015 Intergenerational Report* published by the Australian Government. The graph shows the projected underlying cash balance of the Australian budget – in essence, the balance of projected expenditure and revenue excluding interest costs – over the period from the 2014-15 financial year to the 2054-55 financial year. The cash balance is presented as a percentage of Gross Domestic Product (or GDP). The graph shows the projected change in the cash balance under the *Intergenerational Report's* 'currently legislated scenario'. The cash balance starts in 2014-15 at a deficit (i.e. spending greater than revenue) of approximately 2.75% of GDP. The deficit is projected to reduce to around 0.5% of GDP in 2020-21, before progressively increasing to around 3% of GDP in the early 2040s and around 6% of GDP in 2054-55.

Figure 6: NSW Government projection of fiscal gap

Figure 6 is a copy of a graph from the NSW Government's *Intergenerational Report 2016: Future State NSW 2056*. Using 2014-15 as a base year, the graph shows the NSW Government's projections of total revenue, total expenditure and the 'fiscal gap' – in essence the deficit – between 2015-16 and 2055-56. Revenues (excluding interest) are projected to equal around 13% of Gross State Product (GSP) over the projection period, although revenues are projected to be as high as 14% of GSP in 2017-18. Expenditure (including net capital expenditure) starts at 13.1% of GSP in 2014-15, rising to 13.9% of GSP in 2025-26, before progressively increasing to 16.6% of GSP in 2055-56. The fiscal gap starts at 0% of GSP in 2014-15, rising to about 0.7% of GSP in the early 2020s, then 2% of GSP in the early 2030s, then 2.7% of GSP in the early 2040s, and finally 3.4% of GSP in 2055-56.

Figure 7: Median rate per square metre of residential vacant land sales, state capital cities 2001-2016

Figure 7 is a representation of a graph prepared by the firm CoreLogic in early 2017. The graph shows changes in the median sale price of vacant residential land in the six state capital cities between December 2001 and December 2016. To avoid potential distortions associated with the sale of properties of different sizes, the data shows changes in the sale price per square metre of residential land. Vacant residential land sales data are relevant for the purposes of this paper, as they provide an indication of land price movements in outer suburban areas where potential infrastructure corridors might be developed. The graph shows that land prices rose in all capital cities between 2011 and 2016. Vacant residential land prices in the six cities grew broadly as follows:

- Sydney: from approximately $300 per square metre in 2001 to $800 per square metre in 2016
- Melbourne: from approximately $150 per square metre in 2001 to $530 per square metre in 2016
- Brisbane: from approximately $120 per square metre in 2001 to $400 per square metre in 2016
- Adelaide: from approximately $100 per square metre in 2001 to $480 per square metre in 2016
- Perth: from approximately $150 per square metre in 2001 to $650 per square metre in 2016
- Hobart: from approximately $40 per square metre in 2001 to $160 per square metre in 2016.

Figure 8: Potential savings in project costs from protection and early acquisition of *2016 Infrastructure Priority List* corridors ($2016, 7% real discount rate)

Figure 8 is the same as Figure 1 in the Executive Summary. The figure shows a map of the south-eastern corner of the Australian mainland from just north of Brisbane to Melbourne. Seven corridor protection initiatives in the 2016 Infrastructure Priority List are named and shown on the map. These initiatives were modelled by Infrastructure Australia in preparing this paper. The map also shows the potential saving in the cost of constructing each project if the relevant corridor is protected. The cost savings are presented in 2016 dollars, discounted at seven percent. The seven initiatives are as follows:

- Port of Brisbane freight rail connection ($66 million)
- Lower Hunter rail freight alignment ($33 million)
- Outer Sydney Orbital road and rail link ($3,665 million)
- Western Sydney Airport rail connection ($1,104 million)
- Western Sydney freight line and intermodal terminal access ($1,605 million)
- Outer Melbourne Ring Road/E6 ($748 million)
- Corridor for an east coast High Speed Rail line ($3,544 million).

Figure 9: Potential savings from protection of corridors ($2016, 7% real discount rate)

Figure 9 is a bar graph showing the potential savings from protecting the seven corridors, measured in 2016 dollars at a 7% real discount rate. The corridors and their associated savings are shown in descending order from left to right as follows:

Corridor name	Potential savings
Outer Sydney orbital	$3,665 million
High speed rail	$3,544 million
Western Sydney freight line	$1,605 million
Western Sydney airport rail line	$1,104 million
Outer Melbourne ring road/E6	$748 million
Port of Brisbane rail	$66 million
Hunter Valley rail line	$33 million

Figure 10: Estimated revenue if the corridors were immediately acquired ($2016, 7% real discount rate)

Figure 10 is a bar graph showing the estimated revenue if the corridors were immediately acquired, measured in 2016 dollars at a 7% real discount rate. The corridors and their rental income are shown in descending order from left to right as follows:

Corridor name	Rental income
High speed rail	$1,571 million
Western Sydney freight line	$1,567 million
Outer Melbourne ring road/E6	$545 million
Western Sydney airport rail line	$225 million
Outer Sydney orbital	$201 million
Port of Brisbane rail	$71 million
Hunter Valley rail line	$5 million

Figure 11: Project costs and revenue, Outer Sydney Orbital, ($2016, 7% real discount rate)

Figure 11 is a bar graph showing estimated land acquisition costs, rental revenue and construction costs for the Outer Sydney Orbital under the 'protect and acquire now' scenario, measured in millions of 2016 dollars at a 7% real discount rate.

Under this scenario, all land is assumed to be acquired over two years. The estimated land acquisition costs are $279 million in 2017-18 and $271 million in 2018-19.

Rental income from the acquired properties is assumed to occur from the time of acquisition until the commencement of construction of the project. It was assumed that construction would commence in 2037-38. Some rental occurs in the first two years, as land is acquired. The estimated rental revenues, measured in discounted 2016 dollars, are:

Year	Rental revenue
2017-18	$7 million
2018-19	$13 million
2019-20	$13 million
2020-21	$12 million
2021-22	$12 million
2022-23	$12 million
2023-24	$11 million
2024-25	$11 million
2025-26	$11 million
2026-27	$10 million
2027-28	$10 million
2028-29	$10 million
2029-30	$9 million
2030-31	$9 million
2031-32	$9 million
2032-33	$9 million
2033-34	$8 million
2034-35	$8 million
2035-36	$8 million
2036-37	$8 million

Construction is estimated to take five years, commencing in 2037-38. The estimated construction costs are:

Year	Construction
2037-38	$449 million
2038-39	$422 million
2039-40	$396 million
2040-41	$372 million
2041-42	$350 million

Figure 12: Comparison of total savings from corridor protection on an undiscounted and real discounted basis ($2016)

Figure 12 compares the potential savings associated with protecting the seven corridors, measured in 2016 dollars, on an undiscounted and discounted basis. In undiscounted terms, the saving is $57.1 billion. At a 4% real discount rate, the saving is $23.1 billion. At a 7% real discount rate, the saving is $10.8 billion.

Figure 13: Port of Brisbane Dedicated Freight Rail Connection

Figure 13 shows an indicative alignment investigation area for the Port of Brisbane dedicated freight rail connection. The proposed corridor is based on an alignment prepared by the Australian Rail Track Corporation during development of the Inland Rail Programme Business Case in 2015. The alignment for the rail connection uses the exiting rail line from near Hillcrest to Algester in southern Brisbane. It then heads broadly east to near the suburb of Kuraby. At that point, the proposed alignment heads north, running close to the M1 motorway. Near Hemmant, the proposed rail alignment joins the existing rail line before heading to the port.

Figure 14: Outer Sydney Orbital Road and Rail Link

Figure 14 shows an indicative alignment investigation area for the Outer Sydney Orbital Rail and Rail Link. The investigation area is based on previously published documents previously published by the NSW Government. The investigation area is shown as a broad corridor approximately 80 kilometres in length by around five to eight kilometres wide. The investigation area starts in north-western Sydney near Pitt Town, traverses the western edge of the NSW Government's North West Priority Growth Area, before heading south to the area between Kingswood and St Marys. The investigation area continues further south towards Orchard Hills, then west of the Western Sydney Airport site. Finally, the investigation area heads south of the airport site, west of Cobbity, and then in a south-easterly direction towards the M5 motorway and Main Southern Rail line near Douglas Park.

Figure 15: Western Sydney Airport Rail Connection

Figure 15 shows an indicative alignment investigation area for the Western Sydney Airport Rail Connection. The investigation area is based on the alignment shown on a map in the Western Sydney Rail Needs Discussion Paper, published by the Australian and NSW Governments in September 2016. The investigation area is of variable width, and starts at St Marys. The corridor heads south under the site of the proposed Western Sydney Airport. South of the airport site, the corridor is more closely defined, based on documents published by the NSW Government. At this point, the corridor splits in two directions: firstly, east towards the existing Leppington railway station, and, secondly, south to Narellan. Between Narellan and Macarthur, a broader investigation area is shown.

Figure 16: Lower Hunter Freight Rail Alignment

Figure 16 shows an indicative alignment investigation area for the Lower Hunter freight rail alignment. The investigation area is broadly 3 kilometres wide by approximately 30 kilometres long. The investigation area heads north from Fassifern, then east of Killingworth, then west of Minmi towards Hexham.

Figure 17: Western Sydney Freight Line and Intermodal Terminal

Figure 17 shows an indicative alignment investigation area for the Western Sydney freight line and intermodal terminal. The investigation area is broadly 3 kilometres wide by approximately 25 kilometres long. The investigation area commences at three points in the east: near Chester Hill, Cabramatta and Guildford. It then heads broadly a westerly direction via Merrylands, across the M7, to Erskine Park. The proposed intermodal terminal is located within the NSW Government's Western Sydney Employment Area. North of the terminal site, the investigation area heads broadly in a northerly direction before splitting in each direction at the Main Western Rail Line between St Marys and Mt Druitt.

Figure 18: Outer Metropolitan Ring Road/E6

Figure 18 shows the Outer Metropolitan Ring/E6 corridor in Melbourne, and an alignment investigation area for both the Western Interstate Freight Terminal and rail connections from the terminal site to the existing interstate rail line and the Outer Metropolitan Ring corridor. The Outer Metropolitan Ring/E6 corridor precisely reflects an existing public acquisition overlay contained in land use planning instruments for western Melbourne. The corridor is approximately 90 kilometres long, and of variable width. The corridor starts at the Princes Freeway near Werribee, then heads north towards Rockbank, then north-easterly towards Diggers Rest. The corridor lies north-west of the Melbourne Airport site. The corridor continues in a north-easterly direction, crossing the Hume Freeway north of Beveridge. East of the Hume Freeway and railway line, the corridor is named the E6. It turns south and continues on to a point near Bundoora, where it joins the M80 road corridor. The investigation area extends broadly from the interstate rail line north of Sunshine, through Deer Park and Caroline Springs, then on the Outer Metropolitan Ring corridor.

Figure 19: East Coast High Speed Rail – Corridor Overview

Figure 19 shows an indicative alignment for the overall High Speed Rail project. The alignment is based on the preferred alignment shown in the High Speed Rail Phase 2 Study Report, published by the Australian Government in April 2013. This alignment is also the source of the more detailed maps at Figures 20 to 25. In the north, the alignment extends from Brisbane to Sydney, broadly via Coffs Harbour, Port Macquarie and west of Newcastle. A spur line connects that alignment from near Beaudesert in south-east Queensland to the Gold Coast. In the south, the alignment extends from Sydney to Melbourne, broadly via Goulburn, Yass, Wagga Wagga, Albury-Wodonga and Shepparton. A spur line connects from the mainline high speed line at a point north of the ACT into Canberra.

Figure 20: East Coast High Speed Rail Line – Brisbane to northern NSW

Figure 20 shows an indicative alignment for the high speed rail line from Brisbane to a point just south of the Queensland and New South Wales border. The alignment is shown overlaid on a high level representation of current land use zones. The alignment is proposed to be in tunnel for a short distance south of the Brisbane CBD. The alignment then broadly heads south, including along the eastern edge of the Greenbank Army Range, past Jimboomba towards Beaudesert and then further south to the New South Wales border. The Gold Coast spur line starts near Beaudesert and heads east towards Tambourine Mountain, before heading south-east towards a terminus at Robina.

Figure 21: East Coast High Speed Rail Line – Northern NSW to northern Sydney

Figure 21 shows an indicative alignment for the high speed rail line from northern NSW to the central coast of NSW. The alignment is shown overlaid on a high level representation of current land use zones. The alignment generally runs within ten to twenty-five kilometres of the coast line, other than a section in northern NSW.

Figure 22: East Coast High Speed Rail Line – Northern Sydney to Mittagong

Figure 22 shows an indicative alignment for the high speed rail line from Broken Bay, north of Sydney, to Mittagong south of Sydney. The alignment is shown overlaid on a high level representation of current land use zones. The alignment is proposed to be built at grade as far south as Mt Colah, before entering a tunnel that heads broadly south to Burwood, and then east to a terminus at the existing Central Station on the southern edge of the Sydney central business district. South of Central, the alignment heads in tunnel in a south-westerly direction via Bankstown to Holsworthy. At Holsworthy, the alignment rises to grade, and then proceeds east of Campbelltown and Macarthur, continuing east of the M5 motorway and Mittagong.

Figure 23: East Coast High Speed Rail Line – Canberra deviation

Figure 23 shows an indicative alignment for a spur line from the main high speed rail line north of Canberra into the centre of Canberra. The alignment is shown overlaid on a high level representation of current land use zones. The spur line starts approximately 40 kilometres north of Canberra, and heads south. The alignment passes through the Majura Valley, before heading in tunnel under Mount Ainslie and into a terminus in Civic.

Figure 24: East Coast High Speed Rail Line – Mittagong to northern Victoria

Figure 24 shows an indicative alignment for the high speed rail line between south-western New South Wales and central Victoria. The alignment is shown overlaid on a high level representation of current land use zones. The alignment heads broadly westwards from north of Canberra to near Cootamundra, before heading south-west. The alignment passes east of Wagga Wagga, west of Albury-Wodonga, and east of Shepparton.

Figure 25: East Coast High Speed Rail Line – Northern Victoria to Melbourne

Figure 25 shows an indicative alignment for the high speed rail line from central Victoria through to a terminus on the edge of Melbourne's central business district. The alignment is shown overlaid on a high level representation of current land use zones. In the north, the alignment starts east of the Puckapunyal military base. The alignment then heads south, passing west of Seymour, east of Broadford to Wallan on Melbourne's northern fringe. In Melbourne, the alignment broadly follows the alignment of the existing interstate rail line towards Broadmeadows, before heading in tunnel to a terminus at Southern Cross Station.

Corridor Protection
Planning and investing for the long term

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