CrossRiverRail

Department of Transport and Main Roads

Cross River Rail

Initial Advice Statement

February 2010

Queensland Government

Contents

Executive Summary

Cross River Rail is a major project for the city of Brisbane, South East Queensland and the state of Queensland. It will provide a new north-south rail line in Brisbane's inner city that includes a new river crossing and inner city train stations. From the existing southern rail network, it will pass under the central business district (CBD) of Brisbane and connect with the existing northern rail network via the Exhibition loop. The project will include a tunnel under the Brisbane River and new and upgraded train stations.

The population of the South East Queensland region is expected to double over the next 50 years from 2.8 million in 2006 to 6 million in 2056. Brisbane's CBD is the region's primary activity centre and the population of Brisbane city is forecast to grow from 991 000 people in 2006 to 1.27 million people by 2031. Employment in Brisbane city is forecast to increase from 692 362 jobs in 2006 to more than 1 million jobs in 2031. Employment in Brisbane's inner city areas is forecast to increase from 300 000 jobs to 475 000 jobs.

Brisbane's rail network is the hub of the rail network in South East Queensland, with all services passing through the inner city. By 2016, rail network extensions and service increases will be required to meet demand. The limited capacity of the Merivale Bridge and existing inner Brisbane rail tunnels significantly limit the number of additional trains that can be introduced on the rail lines servicing the region to meet passenger demand. The Queensland Government has initiated Cross River Rail to respond to the identified need for more inner city rail infrastructure, including a new rail crossing of the Brisbane River, by 2016.

The project will strongly influence the shape, economic diversification, and accessibility of the city over the next 30 years and beyond, and support future employment and population growth and distribution in the Brisbane CBD and broader inner city area. The project is a key component of an inner city transport and land use strategy, currently being jointly developed by the state government and Brisbane City Council. Without the increase in capacity to the network that will be delivered by the project, the future productive output of the capital would be significantly diminished.

Good public transport is vital to successful urban areas, enabling people to access jobs and services, employers to access labour markets, and businesses to reach customers for their services. There are well-established links between improved transport efficiency and economic growth. Maintaining adequate rail service and access is vital for the economic well-being of Queensland's largest city.

The efficient movement of freight is essential for economic growth. Recent studies indicate that freight services are expected to double by 2020. A major challenge for the rail network will be to accommodate the anticipated significant growth in passenger demand over the next 20 years while also supporting growth in freight traffic.

The Queensland Government, through the Department of Transport and Main Roads, is the proponent for Cross River Rail. The detailed feasibility phase of Cross River Rail is jointly funded by the Queensland Government and the Australian Government.

This initial advice statement has been prepared as part of the application for a declaration as a significant project under the *State Development and Public Works Organisation Act 1971* to provide

information for the Coordinator-General to decide whether to declare Cross River Rail a significant project for which an environmental impact statement (EIS) is required.

Cross River Rail is a major transport infrastructure project that will deliver substantial, long-term benefits to Brisbane, South East Queensland and Queensland. It will have a significant capital cost and provide extensive benefits to the city and South East Queensland rail network and opportunities for improved rail public transport. Cross River Rail will result in significant long-term benefits to city and regional road and transport networks, and provide opportunities for future integration of land use and public transport at nominated hubs. It will also provide benefits to communities, environmental amenity (improved air quality), enhanced accessibility and liveability.

There is significant potential for construction and operation impacts that will need to be mitigated under transparent and carefully developed management measures. The proponent will undertake extensive consultation throughout the EIS process to ensure that the community is well informed and has opportunities to make suggestions and express their views about the project.

No significant impact on matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* is anticipated. However, for certainty, the proponent will refer the project to the Commonwealth Minister for the Environment, Heritage and the Arts for a decision as to whether the project is a 'controlled action'. If the Commonwealth Minister for the Environment, Heritage and the Arts was to determine that the project is a "controlled action", the environmental assessment process under the *State Development and Public Works Organisation Act 1971* can satisfy the assessment processes under the *Environment Protection and Biodiversity Conservation Act 1999* in accordance with the Bilateral Agreement between the Australian Government and the State of Queensland.

The project governance structure includes a steering committee that provides guidance and comment on the project development and assessment. The steering committee membership includes representatives of federal, state and local government agencies, including senior representation from Brisbane City Council. There will be numerous opportunities for community input into the Cross River Rail EIS from early 2010 to completion of the process.

The Cross River Rail project

Cross River Rail aims to improve rail services in South East Queensland by increasing the capacity of the inner city rail system so that more train services can operate more often right across the South East Queensland rail network. Cross River Rail also is intended to improve rail access to key inner city destinations by building new rail stations in the inner city so that people get to where they want to go and have a wider choice of efficient public transport services.

Project objectives have been established in consideration of the key issues identified above, particularly in response to issues relating to service, access and sustainability. These objectives will form and shape concept development within the study corridor, and were used to establish a range of possible options that form the basis of the study corridor selection.

Cross River Rail will provide a new underground rail connection from the existing southern rail network, pass beneath Brisbane's inner city and connect with the existing northern rail network at or near the Exhibition loop. The project will include tunnels under the Brisbane River and new stations, which may include underground stations in the inner city, Woolloongabba and Park Road.

South of the river, Cross River Rail will be constructed in tunnel north of Fairfield station and generally follow the existing rail corridor to Park Road station, before passing beneath Woolloongabba. The project will then follow a north-west alignment under the Brisbane River and the CBD in tunnels, and then emerge onto the existing Exhibition rail loop. A new underground station at the southern end of the CBD will facilitate potential development and provide better access to existing facilities, and the project may include additional underground platforms at one of the existing stations at the northern end of the CBD. The project may include possible additional tracks within the Mayne Rail yards and additional tracks northwards to a location just south of Eagle Junction station. The existing Exhibition rail loop will be widened to accommodate a further two tracks to support Cross River Rail, passenger and other North Coast line freight services.

The detailed feasibility phase of the project will determine tunnel alignments, construction approaches, points of connection into the existing network, station locations and design, and identify any associated requirements for upgrades to existing above ground infrastructure.

The planning for this project will also consider the long-term requirements of the infrastructure as it relates to the *South East Queensland Regional Plan 2009-2031* and the *draft Connecting SEQ 2031: An Integrated Regional Transport Plan for South East Queensland*. As part of this consideration of longer term requirements, the planning for this project will further consider the creation of an inner city tunnel beneath Spring Hill linked to the Ipswich line. The possible inner city tunnel may include a new rail tunnel in inner city from Roma Street station to Exhibition Line and additional track between Merivale Bridge and Roma Street Station.

The proponent identified alternatives to the project and explored variations to previously identified options. A more detailed examination was then undertaken of technical issues and assumptions including vertical geometric constraints, the length of tunnelling required, station locations and dimensions, tunnel design and construction options, and probable costs and program requirements. The detailed examination used multi-criteria analysis to identify the study corridor for the EIS and to ensure that the project aligns with the project objectives. The evaluation process included stakeholder review and endorsement from the project steering committee and technical advisory groups.

Location of study corridor

The study corridor, containing the proposed new infrastructure, is the area that will be the primary focus of impact assessment and identification of required mitigation measures. Project impacts outside the study corridor, which may include spoil haulage and placement, construction deliveries, and potential improvements in regional air quality will also be assessed. Benefits that may be achieved beyond the study corridor as a result of the project, including improved rail services, will also be described.

The study corridor is approximately 19 kilometres long and begins just south of Salisbury Station. It generally follows the existing rail corridor to the north including Yeerongpilly, Yeronga, Fairfield and Dutton Park stations. The corridor widens to encompass the junction at Park Road Station and the 'GoPrint' site at Woolloongabba. From Woolloongabba, the study corridor travels north crossing the Brisbane River and includes part of the central business district and an area to the west of Roma Street Station. The corridor then continues north and includes the Exhibition loop, the Mayne Rail yards and extends to just south of Eagle Junction Station.

The study corridor is located within the Commonwealth Government areas of Moreton, Griffith, Lilley and Brisbane, state government electorates of Yeerongpilly, South Brisbane, Brisbane Central and Clayfield and the Brisbane City Council local government area including the wards of Hamilton, Central, Gabba, Moorooka and Tennyson.

Strategic significance of the project

Cross River Rail will support the achievement of the transport and transit outcomes in the *South East Queensland Regional Plan 2009-2031* and in so doing will support the ongoing role and function of the Brisbane CBD as the primary centre for commerce and employment in Queensland.

Cross River Rail is the flagship initiative in the draft regional transport plan accompanying the *SEQ Regional Plan* called *Connecting SEQ 2031: An Integrated Regional Transport Plan.* This plan, due for finalisation in 2010, outlines how rail is the backbone and investment priority for the SEQ transport system to support compact urban settlement and emission targets within the SEQ Regional Plan and *Climate Q: toward a greener Queensland.* Cross River Rail is the enabler of the long-term viability of the rail network.

Cross River Rail will also complement the investment in transport infrastructure in and around Brisbane, including investment in rail network improvements, busways, the road network and active transport.

The project also supports achievement of 'strong' and 'green' targets in *Toward Q2: Tomorrow's Queensland* by:

- *Strong* – support economic growth by developing the rail network and fast commuter links to ensure people and goods can move more reliably and efficiently
- *Green* – support cutting Queenslanders' carbon footprint by one third through reduced motor vehicle use.

The consequence of not addressing the rail network constraints identified above would have long term, adverse economic, social and environmental impacts.

Construction and operational processes

A range of construction methods will be considered as part of the reference design development. These methods may include tunnelling works, open excavation work, station infrastructure, possible building development above station and construction sites and modifications within or adjacent to existing rail corridors.

Construction impacts will be very similar to those experienced with the construction of Brisbane's road tunnels. Surface works will generate environmental impacts such as noise, vibration and air quality, while underground works will generate impacts such as noise and vibration, groundwater movement and demand for energy for the operation of tunnelling machinery. Construction traffic impacts will include the transport of construction materials and construction spoil to spoil placement sites, and possibly the rearrangement of traffic flows to accommodate surface works adjacent to stations.

The environmental effects of the operational phase of Cross River Rail are likely to be confined to specific localities such as the tunnel portals and the stations. Such effects may include noise and vibration from train movements, an increased demand for energy and the movement of people to and from stations.

Level of investment and employment opportunities

Cross River Rail has evolved from the *Inner City Rail Capacity Study (2008)*. The staging and estimated total cost for the south to north corridor was up to $8.2 billion in 2008 dollars. The funding requirement for land acquisitions for this north-south corridor was estimated to be at least $300 million. These costs are indicative only and will require significant refinement as part of the detailed feasibility studies when more detailed investigations and consultation is undertaken.

Construction of Cross River Rail will be a major source of employment with people being employed to assess, design, construct and manage the infrastructure and through opportunities for the supply of materials and equipment to the project.

When operational, Cross River Rail will generate additional employment opportunities within Brisbane, the South East Queensland region and the state of Queensland through improved transport opportunities, improved connectivity, urban renewal, and multiplier effects from the economic activity generated by the project.

Based on previous studies for projects of this nature, Cross River Rail may create in the order of 15 000 to 60 000 direct and indirect jobs, depending on how the project is delivered and the final scale of the project.

Commonwealth, state and local government requirements

Project approvals for all elements of Cross River Rail will be identified during the EIS process. Relevant instruments for assessment of the project include both local and state planning instruments, and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. Under the provisions of City Plan, the tunnel, stations and associated infrastructure works would be defined generally as a 'Utility Installation' unless explicitly exempted by special provisions.

Approvals required for the project will be identified during the EIS process and relevant requirements with State and Commonwealth legislation, City Plan Codes, Planning Scheme Policies and local laws will be considered.

Existing environment

The study corridor passes through a range of landforms and beneath the Brisbane River, and is underlain by rock of generally high strength overlain in areas of lower topography by sands, gravels and clays. These landforms have been deeply eroded by the Brisbane River system during periods of low sea level. The underlying geological strata includes both fractured rock aquifer systems and, in places, overlying alluvial aquifers. The fractured rock aquifer systems have very low primary porosity and any groundwater movement will be through secondary features such as joints and fractures. Groundwater levels along the study corridor are variable and generally reflect the topography, except in areas where the water table has been impacted by existing infrastructure and areas of reduced

recharge due to development. The study corridor contains a range of different soil types, and in places acid sulfate soils and potential acid sulfate soils may be present.

The environment in the vicinity of the study corridor has been heavily modified over many years. Modified green spaces in the study corridor include the City Botanic Gardens, the Roma Street Parklands and the banks of the Brisbane River. Existing records indicate a range of flora and fauna species present within the study corridor, although many of these records extend over a much broader range than that likely to be influenced by the project, and therefore the existing species present needs to be further assessed.

The Brisbane River is the only major waterway potentially affected by works, although track upgrade works may occur both to the north and south along existing alignments within the Enoggera Creek, Kedron Brook, Norman Creek and Oxley Creek catchments. Further, local flows may occur in overland flow paths in some areas of the study corridor. The CBD is adjacent to the Brisbane River, where there has been flooding under very infrequent extreme events. The hydrographs for similar events have been modified by upstream dams. In addition, flooding from overland flow at a number of locations throughout the study corridor has been experienced under extreme rainfall events.

The existing environment is typical of the centre of a large city, with road traffic the dominant air and noise influence. The air and noise characteristics have been extensively monitored as part of ongoing programs and other construction projects.

The study corridor includes urban areas that support residential, commercial, industrial and recreational activities. A large number of people from across the South East Queensland region travel to these areas for business, employment, recreation and shopping. In recent times there has been a significant increase in the number of residents as inner city living has resurged in popularity. There is considerable social diversity within these areas, varying with location and time, both daily and across the week.

The study corridor includes many features important to both the broader Brisbane and Queensland society, and a number of facilities visited by tourists, mostly in the city centre. This area was the centre of initial European development for Brisbane and contains many features of historic interest.

Historic use by indigenous peoples of the area contained within the study corridor is known to have been extensive. The views of indigenous groups with interests in the study corridor will be important inputs to the documentation of the cultural values and significance of the area.

The annual cost of road congestion and projected traffic growth for Queensland has been estimated by the Bureau of Infrastructure Transport and Regional Economics (BITRE) to increase from $1.2 billion in 2008 to $3 billion in 2020.

Planning schemes and government policies

The project will be developed with reference to a number of state and local government instruments, including:

- the Queensland Government *South East Queensland Regional Plan 2009-2031* and *South East Queensland Infrastructure Plan and Program 2009-2026*

- the Brisbane City Council *City Plan 2000*, City Centre Neighbourhood Plan, and City Centre Master Plan

Potential environmental impacts

Detailed investigations, preliminary design and community and stakeholder engagement will be undertaken as part of the EIS process. The studies required to support and complete the EIS may include, but are not limited to:

- preliminary project design, including urban design and landscape design, and construction planning
- traffic and transport, including railway operations, pedestrian and cycle access, road network impacts and other public transport
- land use, planning scheme provisions and urban renewal opportunities
- studies of potential bio-physical impacts
- studies of potential socio-economic impacts
- waste management
- hazard and risk.

Cross River Rail will provide substantial environmental, social and economic benefits at the regional, city and local scales through improvements to the rail network with corresponding benefits to the road network. The project will increase the capacity of the rail network with more frequent services and easier interchange between trains and other transport. Building new inner city rail infrastructure will cater for the growing number of rail passengers in both the CBD and the wider South East Queensland rail network. Cross River Rail is anticipated to provide the ability to move up to 120 000 people in the morning peak period into the inner city.

During construction there is the potential at the local level for some adverse impacts to local road traffic, which will need to be carefully considered and mitigated against through considered design and management approaches.

The biophysical environment of the study corridor has been heavily modified over many years. Significant impacts to flora, fauna and aquatic habitats are not anticipated due to the highly urbanised environment within the project corridor and recent experience on other major transport tunnel projects in Brisbane.

Construction of the Cross River Rail tunnel has potential to impact the groundwater regime along the corridor, with potential to cause consolidation and settlement, mobilisation of contaminated groundwater, activation of acid sulphate soils in low-lying alluvial areas, and the need to dispose of inflows to the tunnels during and post construction. Hydrogeological investigations involving drilling and testing will be undertaken during the detailed feasibility studies to inform the EIS process.

Tunnelling will be beneath the bed level of the Brisbane River, greatly reducing the potential for impact on the Brisbane River. The findings from this approach with the Clem7 road tunnel are that impacts on the river system are very unlikely. Construction works near overland flow paths or smaller local waterways will need to be appropriately managed to ensure that they are protected and that no adverse impacts result in the Brisbane River. No adverse impacts are anticipated on the Brisbane River or the Ramsar wetlands downstream.

There is the potential for a significant amount of waste to be generated during construction of the project including demolition materials and construction waste. The location for the disposal of material excavated from the tunnel has not been selected. Similarly, the method of transporting construction spoil has yet to be determined and will be the subject of feasibility studies informing the EIS. Depending on the nature of the excavated material, there may be an opportunity to exploit a proportion of the spoil as a valuable construction resource.

Contaminated land investigations will be undertaken as part of the EIS and management procedures developed. The removal of soil from sites registered on the Environmental Management Register will require the approval from the Department of Environment and Resource Management.

By increasing the use of electric powered public rail transport, it is expected that Cross River Rail will help reduce air quality emissions and road traffic noise across Brisbane into the future, compared to the 'do-nothing' case. This would result in a reduction in the number of motor vehicles that otherwise would use the road network with a corresponding reduction in vehicle exhaust and noise emissions. The potential for corresponding greenhouse and health benefits will be assessed.

Construction experience on other major tunnels and building excavations in Brisbane indicates that potential adverse water quality, air quality, noise and vibration impacts can be managed with appropriate and carefully managed mitigation measures.

Potential impacts on properties and people near the project sites will be assessed as part of the EIS including the development of predictive models where necessary. Appropriate construction site management practices will be developed to mitigate predicted impacts and monitoring programs set out to ensure required outcomes are achieved. These management programs will be linked with consultation requirements to ensure businesses and residents are kept informed and problems are identified and minimised.

It is likely that underground stations and tunnels will have some ventilation requirements to provide fresh air, but in the absence of emissions of pollutants in large quantities, the potential impact on the ambient air quality will be very low. Potential effects of ventilation outlets on the surrounding community and changes in air quality resulting from reduced traffic volumes will be assessed as part of the EIS.

There is limited risk of long-term noise or vibration impact since most of the project will be underground. A noise and vibration assessment will be undertaken to determine impacts and any required mitigation measures, especially in areas where the project operational works are on or close to the surface.

The project is expected to deliver strong social outcomes at a regional and local level, providing people with a choice of transport mode and improved lifestyles compared to the situation if the project did not proceed. The project may also create opportunities for local businesses and urban renewal. There are also a number of potentially adverse effects that may occur in the project corridor, including land acquisition and potential displacement, disruption of local access during construction, and adverse impacts on amenity. Social and economic impact assessment will be undertaken as part of the EIS and include consultation with the community to identify issues, both positive and negative, and the development of appropriate measures to address these.

Preliminary economic assessment undertaken has indicated substantial benefits available from the Cross River Rail investment. Environmental impact studies will include comprehensive cost benefit assessments as part of a wider economic assessment that will include all significant economic benefits and impacts of the project. The project may also enable significant urban renewal opportunities at stations and nearby areas.

The construction and delivery of Cross River Rail may involve the acquisition of properties in the vicinity of the portals and the stations. Some land acquired for construction will also be required to support the operation of Cross River Rail. Land will also be acquired volumetrically to support the passage of the project beneath the surface. Property severance, if any, as a result of the project is expected to be minor given that most of the project will be constructed in tunnel and stations underground. There may be impacts on future development above and immediately adjacent to the underground sections of the project.

Consultation with local indigenous groups will be undertaken to identify and manage any cultural heritage issues within the study corridor. Native title issues will also be considered through the EIS process.

Cross River Rail is very likely to pass by or beneath a number of listed heritage sites and the potential exists for direct or indirect (vibration) effects to occur during construction. The project is not anticipated to have any adverse impacts on cultural heritage. Assessments will be undertaken as part of the EIS of all matters relevant to cultural heritage to ensure that any potential impacts are predicted and mitigations provided to ensure no discernable adverse impacts occur.

Most of the project is anticipated to be underground and accordingly there will be relatively low impacts on the landscape, with any minor impacts related to portal areas, underground station access points and temporary construction sites. Above ground station components will be designed to complement and enhance the local urban design environment.

The project may provide health and safety benefits including improved separation of passenger and freight services, improved station facilities and accessibility, and resulting improved rail passenger safety. There are also a range of potential hazards that could occur during construction and operation, if not appropriately managed, and risk management approaches will be developed. Consultation will be undertaken with relevant government agencies on issues such as fire and life safety, disability access and personal safety.

An environmental management plan will be developed as part of the EIS. The environmental management plan will seek to address the full range of aspects related to the project including design, construction, operation and maintenance. The intent of the environmental management plan is to outline the measures that are proposed to be implemented to manage the impacts of the project on the environment.

1 Introduction

1.1 Background

Brisbane is the administrative, commercial and cultural centre of Queensland, and is a leading growth centre in Australia. A key aspect of maintaining sustainable growth in Brisbane is the ongoing development of safe, attractive and efficient transport systems. The Queensland Government and Brisbane City Council have been working to provide a range of measures to continue to develop the transport system within the city in ways that also provide extended regional benefits.

The *South East Queensland Regional Plan 2009-2031* is the Queensland Government's long-term plan that will shape South East Queensland over the next 20 years, and is supported by the Council of Mayors. The current *South East Queensland Regional Plan 2009-2031* notes that over the 25 years to 2004, South East Queensland's residential population increased from around 1.5 million people to more than 2.5 million, and identifies sufficient land to accommodate a projected population of 4.4 million people and their employment and economic development needs up to 2031. The *South East Queensland Regional Plan 2009-2031* aims to reduce the impacts of traffic congestion by locating self-contained activities in well defined nodes along existing and planned transport corridors, and reducing car dependency by providing alternative transport options including increasing the availability of high-quality public transport.

The *South East Queensland Regional Plan 2009-2031* recognises that the Brisbane CBD is the region's primary activity centre and the focus of the region's radial public transport system. As it is the centre of highest employment mix and density, and it supports a large, in-centre residential population, the CBD generates and attracts a large number of transport trips. The role of Brisbane's CBD as the primary activity centre has expanded over time into the surrounding areas including Fortitude Valley, Spring Hill, Milton, Albion, Newstead, Woolloongabba, Bowen Hills, South Brisbane and West End.

The *SEQ Regional Plan* is supported by the draft regional transport plan called *Connecting SEQ 2031: An Integrated Regional Transport Plan.* This draft plan, due to be finalised in 2010, outlines the transport response to the framework for managing growth in the region outlined in the *SEQ Regional Plan*. The draft *Connecting SEQ 2031* aims to address the transport challenges facing the region through integrated infrastructure, services and policy responses. Rail is identified as the backbone and investment priority for the region with Cross River Rail the enabler of keeping the region moving out to 2031 and beyond.

Implementing the SEQ Regional Plan's principles at a local level for the inner city will occur through a new plan called the *River City Blueprint.* Brisbane City Council, in partnership with the Queensland Government, has started developing this overarching plan to guide development of the inner city to 2031 and beyond.

Brisbane's rail network is the hub of the rail network in South East Queensland, with all services passing through the inner city. By 2016, rail network extensions and service increases will be required to meet demand. The limited capacity of the Merivale Bridge and existing inner Brisbane rail tunnels significantly limit the number of additional trains that can be introduced on the rail lines servicing the region to meet passenger demand.

In response, the Queensland Government through the 2008 *Inner City Rail Capacity Study* identified and assessed options to accommodate increased rail services as part of an integrated inner city transport network that would support the future expansion of the CBD and inner city. The study considered both underground and above ground rail line options in view of the intensive development in the inner city. The Queensland Government has initiated Cross River Rail to respond to the identified need for more inner city rail infrastructure, including a new rail crossing of the Brisbane River, by 2016.

The *South East Queensland Regional Plan 2009-2031* incorporates the *Inner City Rail Capacity Study (2008)* findings that four additional rail tracks will be required in two corridors through the inner city to meet rail system demand over the next 20 years, while upgrades to the road network and the construction of an orbital motorway system will also help manage congestion and travel demand. The transport and transit components of the *South East Queensland Regional Plan 2009-2031* will be reviewed to accommodate anticipated growth to 2031 and beyond.

The proponent for Cross River Rail has reviewed the findings of the *Inner City Rail Capacity Study (2008)* against updated demographic information, revised city planning requirements and the draft *Connecting SEQ 2031: An Integrated Regional Transport Plan*. This has included a broad assessment of the three options identified in the *Inner City Rail Capacity Study (2008)* and a number of potential alternatives. All options were re-assessed in light of the project objectives and to identify the proposed Cross River Rail corridor described in Section 2.

1.2 The proponent

The Queensland Government, through the Department of Transport and Main Roads, is the proponent for Cross River Rail. Contact details for the proponent are:

Project Director, Cross River Rail

Office address:	Postal Address:	Phone, fax and e-mail:
Level 6, Transport House	GPO Box 213	Phone 1800 462 730
230 Brunswick Street	Brisbane QLD	Fax 3253 4639
Fortitude Valley QLD 4006	4001	info@crossriverrail.qld.gov.au

The detailed feasibility phase of Cross River Rail is jointly funded by the Queensland Government and the Australian Government. The Australian Government as part of its “Building Australia Fund” has contributed $20 million towards the detailed feasibility phase of the project and the Queensland Government has contributed $5 million.

1.3 Purpose and scope of this document

The proponent is seeking to have Cross River Rail declared by the Coordinator-General a “significant project for which an EIS is required” under s.26 of the *State Development and Public Works Organisation Act 1971.* Should such a declaration be made, the Coordinator-General will evaluate the environmental effect of the project and any other related matters, including any proposed mitigation measures.

This initial advice statement has been prepared as part of the application for a declaration as a significant project under the *State Development and Public Works Organisation Act 1971* and as required under s.27AB of the Act to provide enough information to allow the Coordinator-General to decide whether to declare Cross River Rail a significant project for which an EIS is required. The initial

advice statement is also prepared to provide information to enable advisory agencies and the public to have input into the terms of reference for the environmental impact statement.

In making a declaration for a significant project, the Coordinator-General must have regard to one or more of the following[1]:

a) detailed information about the project given by the proponent in an initial advice statement
b) relevant planning schemes or policy frameworks, including those of a relevant local government or of the State or the Commonwealth
c) the project's potential effect on relevant infrastructure
d) the employment opportunities that will be provided by the project
e) the potential environmental effects of the project
f) the complexity of local, State and Commonwealth requirements for the project
g) the level of investment necessary for the proponent to carry out the project
h) the strategic significance of the project to the locality, region or the state.

1.4 Environmental assessment and approval process

Cross River Rail is a major transport infrastructure project that will deliver substantial, long-term benefits to Brisbane, South East Queensland and Queensland. It will have a significant capital cost, and provide extensive benefits to the city and South East Queensland rail network and opportunities for improved rail public transport. Cross River Rail will result in significant long-term benefits to city and regional road and transport networks, and provide opportunities for future integration of land use and public transport at nominated hubs. It will also provide benefits to communities, environmental amenity (improved air quality), enhanced accessibility and liveability.

There is significant potential for construction and operation impacts that will need to be mitigated under transparent and carefully developed management measures. The proponent will undertake extensive consultation throughout the EIS process to ensure that the community is well informed and has opportunities to make suggestions and express their views about the project.

The implementation of Cross River Rail will require a range of approvals, as set out in Section 2.12.

The proponent is seeking to have the environmental assessment required for the project conducted under the requirements of Part 4 of *State Development and Public Works Organisation Act 1971*. The *State Development and Public Works Organisation Act 1971* contains requirements for environmental assessment and public review of an EIS, and the relationship of the environmental impact assessment process with the *Sustainable Planning Act 2009.* Other assessment could be carried out under alternative processes, including through the guidelines process for a community infrastructure designation or non-statutory environmental assessment processes. The proponent considers that the EIS process under the *State Development and Public Works Organisation Act 1971* provides an effective and transparent option for a rigorous statutory assessment of the environmental effects of this significant infrastructure project.

The EIS process under the *State Development and Public Works Organisation Act 1971* will involve an extensive process of consultation, integrated with the technical environmental studies and concept

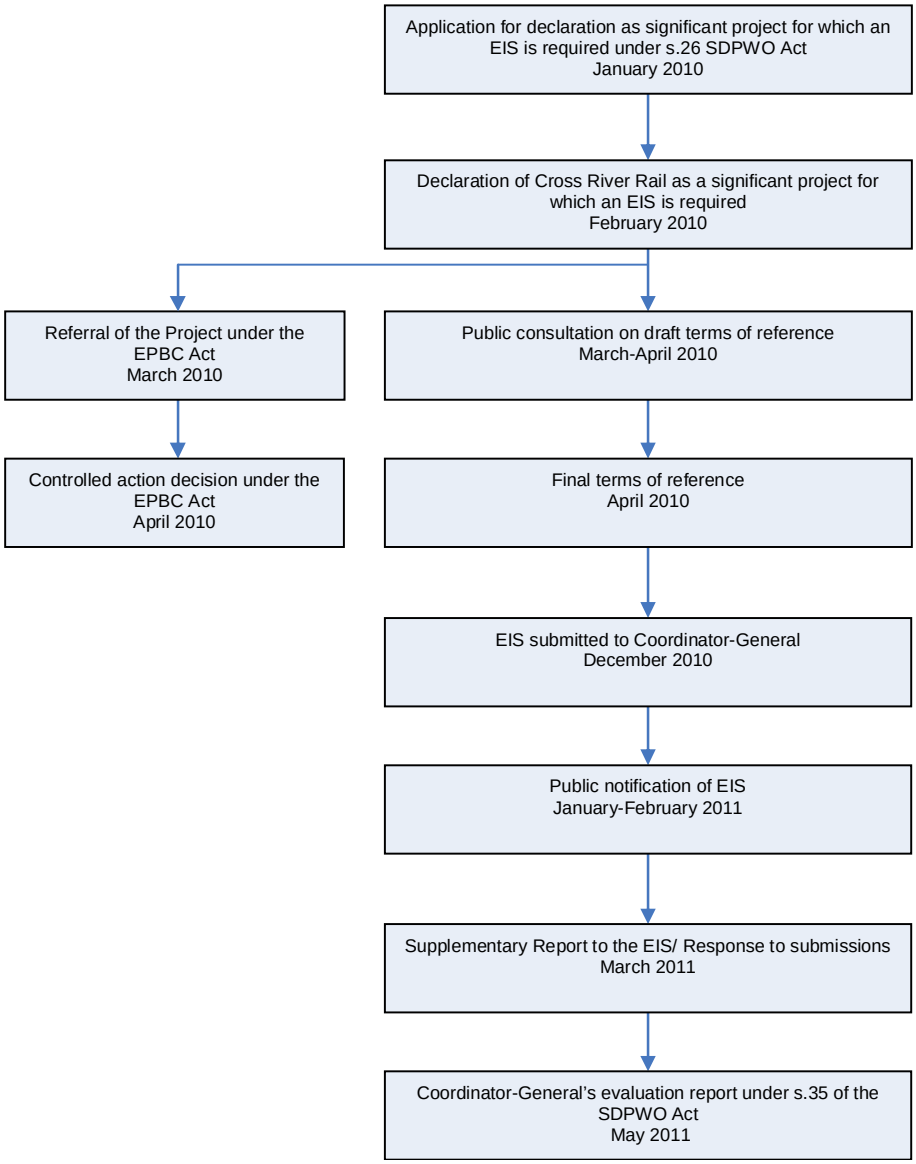
[1] ***State Development & Public Works Organisation Act 1971, section 27***

development. The consultation process will include the statutory notifications for the draft terms of reference for the EIS, and the EIS.

Consideration also needs to be given to the potential for impacts on matters of national environmental significance identified under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. No significant impact on matters of national environmental significance is anticipated. However, for certainty, the proponent will refer the project to the Commonwealth Minister for the Environment, Heritage and the Arts for a decision as to whether the project is a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999.*

If the Commonwealth Minister for the Environment, Heritage and the Arts was to determine that the project is a "controlled action", the environmental assessment process under the *State Development and Public Works Organisation Act 1971* can satisfy the assessment processes under the *Environment Protection and Biodiversity Conservation Act 1999* in accordance with the Bilateral Agreement between the Australian Government and the State of Queensland.

1.5 Indicative timeline for environmental impact statement process



1.6 Community and stakeholder engagement

The proponent is committed to extensive engagement with the community and stakeholders throughout the project, especially as an integral part of the EIS process. This will include engagement with a broad and diverse range of stakeholders involving the community, local government, state government, federal government, interest groups and industry. This will allow all interested parties the opportunity to be well informed about the project, to have input into its development and to ensure that all concerns are addressed during the environmental impact assessment processes.

The project governance structure includes a steering committee that provides guidance and comment on the project development and assessment. The steering committee membership includes representatives of federal and local government agencies, including senior representation from Brisbane City Council.

Brisbane City Council has the primary responsibility for planning the future of Brisbane and ensuring development occurs in accordance with those plans. Brisbane City Council is seen as a key partner in the determination of the final configuration of the project and the development of the required measures that will guide its construction, and how the project fits into the city fabric during operation.

There will be numerous opportunities for community input into the Cross River Rail EIS from early 2010 to completion of the process including:

- commenting on the draft terms of reference which sets the scope of the EIS
- giving input into community values and which issues and opportunities need to be explored in the preparation of an initial design and completion of the EIS
- reviewing and giving feedback on the alignment, station and construction options
- commenting on the EIS.

Throughout the EIS period, information about Cross River Rail will be available on the project website and the project team will be available to answer queries. Community engagement is an essential part of the Department of Transport and Main Roads' strategic priorities and an integral part of the planning of Cross River Rail. Engagement activities are planned to maximise the opportunity for members of the public to have a say about the project. These activities will be varied, offering many different ways to give feedback including public displays, information sessions, online forums, pre-paid feedback forms and one-on-one meetings.

2 The proposal

2.1 Project description

Cross River Rail will provide a new underground rail connection from the existing southern rail network, pass beneath Brisbane's inner city and connect with the existing northern rail network at or near the Exhibition loop. The project will include tunnels under the Brisbane River and new stations, which may include underground stations in the inner city, Woolloongabba and Park Road.

South of the river, Cross River Rail will be constructed in tunnel north of Fairfield station and generally follow the existing rail corridor passing through Fairfield, Dutton Park and Park Road stations, before passing beneath Woolloongabba. The tunnel location and alignment will be determined during the development of the project reference design. Additional tracks and construction staging areas may be required within the existing rail corridor in the south beginning just south of Salisbury station, and including the Yeerongpilly and Yeronga stations.

The project will then follow a north-west alignment under the Brisbane River and the CBD in tunnels, and then emerge onto the existing Exhibition rail loop. A new underground station at the southern end of the CBD will facilitate potential development and provide better access to recreation, parkland facilities, Queensland University of Technology and the government precinct. The study corridor includes a large proportion of the central business district and an area to the west of Roma Street station. The final route and station locations will be determined during the development of the project reference design.

The project may include possible additional tracks within the Mayne Rail yards and infrastructure to remove junction conflicts. The existing Exhibition rail loop will be widened to accommodate a further two tracks to support Cross River Rail, passenger and other North Coast line freight services.

The project will include:

- A passenger rail tunnel (either twin tube or single tube) between Fairfield station and Exhibition station to provide a significant enhancement in inner city rail capacity. The tunnel would be designed to allow for use by all existing and new City train rolling stock to ensure flexibility in operations.
- New underground stations at Woolloongabba and in the southern end of the CBD, with further consideration of the value of an underground Spring Hill station or improved connectivity to the Spring Hill commercial precinct.
- Underground stations would incorporate the development of 250m long platforms to allow for the introduction of nine carriage trains on the network in future.
- Possible underground platforms at the current Park Road station and at Roma Street station or Central station to enhance passenger interchanging between Cross River Rail and existing rail lines.
- Potential to upgrade surface rail stations at Bowen Hills, Park Road, Exhibition and potential station upgrades between Dutton Park and Salisbury.
- Quadruplication of track on the Exhibition line between tunnel connection and Mayne Yards to allow for all train movements – passenger, freight and stabling manoeuvres.
- Infrastructure to remove junction conflicts between Bowen Hills and north of Wooloowin station to allow sufficient capacity for all train movements – passenger and freight.

- Additional track capacity between Fairfield and Salisbury to allow for an increased frequency of passenger movements in the peak periods, and passenger and freight movements in the off-peak in a strategically important rail freight corridor. In the development of the reference design, consideration will be given to the benefits and costs for freight, passengers and the surrounding community in extending the tunnel further to the south.
- Consideration of grade separation of the Cleveland and South Coast lines at Park Road junction to remove inefficient crossing movements.

The detailed feasibility phase of the project will determine tunnel alignments, points of connection into the existing network, station locations and design, and identify any associated requirements for upgrades to existing above ground infrastructure.

The location and size of construction worksites as well as the methods and potential impacts of the removal of spoil and transportation of materials will also be determined as part of the detailed feasibility phase.

The planning for this project will also consider the long-term requirements of the infrastructure as it relates to the *South East Queensland Regional Plan 2009-2031* and the *draft Connecting SEQ 2031: An Integrated Regional Transport Plan for South East Queensland*. As part of this consideration of longer term requirements, the planning for this project will further consider the creation of an inner city tunnel beneath Spring Hill linked to the Ipswich line. The possible inner city tunnel may include a new rail tunnel in inner city from Roma Street station to Exhibition Line and additional track between Merivale Bridge and Roma Street Station.

Cross River Rail will also consider potential implications of the project on the proposed future metro system from Toowong to Newstead, which is not part of Cross River Rail. The proposed future metro rail system has been outlined in press releases by the Premier and will be further developed through the review of the proposed draft *Connecting SEQ 2031* later this year.

The detailed feasibility phase of the project will include the following activities:

- development of a reference design
- an environmental assessment
- preparation of a business case detailing the economic impacts and benefits of the project, and
- community and stakeholder engagement throughout the process.

The tasks that follow the detailed feasibility phase include:

- government approvals to proceed
- land acquisition
- procurement for construction
- detailed design and construction
- operation and maintenance.

2.2 Location of study corridor

The study corridor is approximately 19 kilometres long and begins just south of Salisbury Station. It generally follows the existing rail corridor to the north including Yeerongpilly, Yeronga, Fairfield and Dutton Park stations. The corridor widens to encompass the junction at Park Road Station and the 'GoPrint' site at Woolloongabba.

From Woolloongabba, the study corridor travels north crossing the Brisbane River and includes part of the central business district and an area to the west of Roma Street Station. The corridor then continues north and includes the Exhibition loop, the Mayne Rail yards and extends to just south of Eagle Junction Station.

The study corridor is located within the Commonwealth Government areas of Moreton, Griffith, Lilley and Brisbane, state government electorates of Yeerongpilly, South Brisbane, Brisbane Central and Clayfield and the Brisbane City Council local government area including the wards of Hamilton, Central, Gabba, Moorooka and Tennyson.

The study corridor, containing the proposed new infrastructure, is the area that will be the primary focus of impact assessment and identification of required mitigation measures. Project impacts outside the study corridor, which may include spoil haulage and placement, construction deliveries, and potential improvements in regional air quality will also be assessed. Benefits that may be achieved beyond the study corridor as a result of the project, including improved rail services, will also be described.

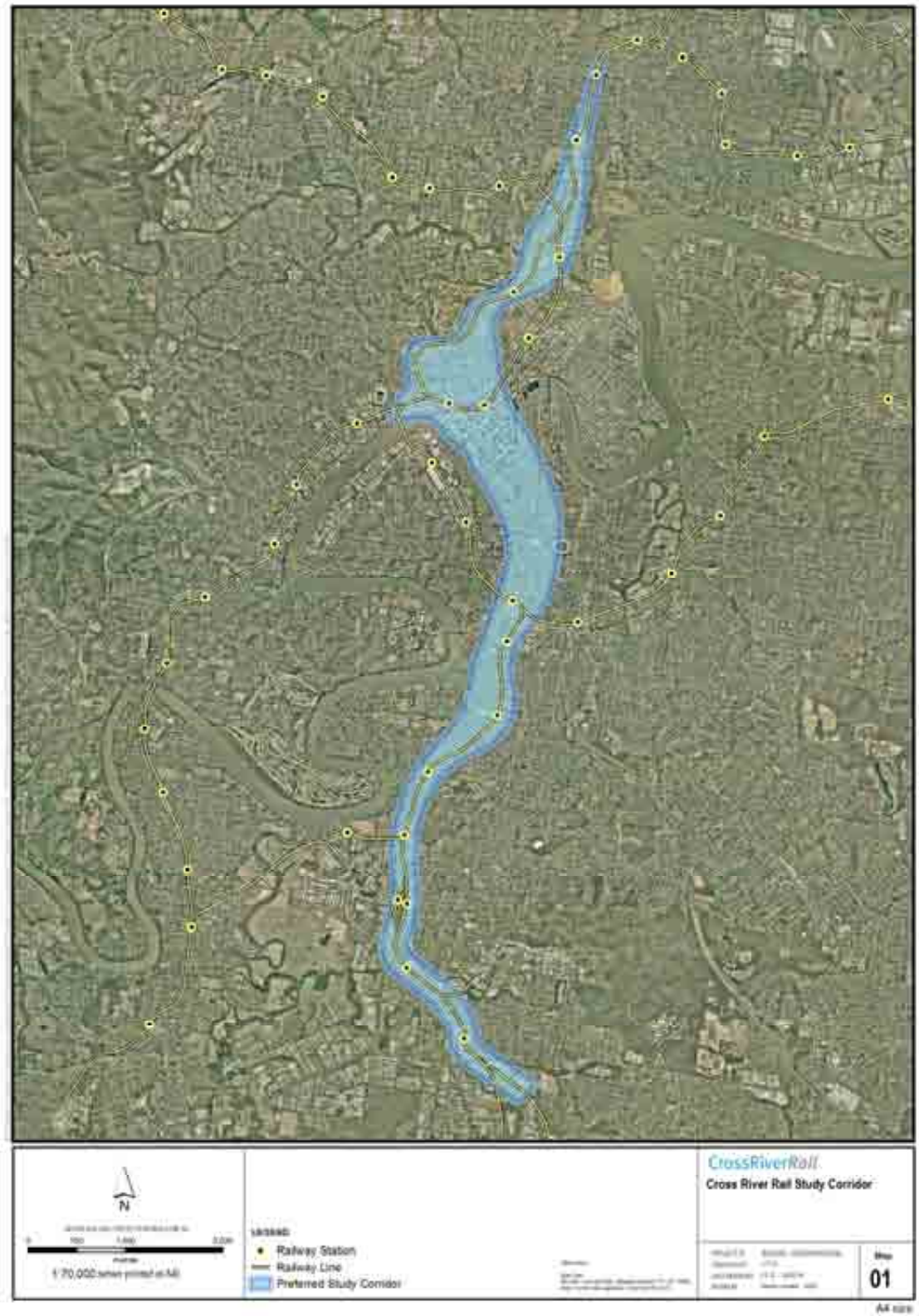


Figure 1: Cross River Rail preferred corridor for further investigation

2.3 Key issues

The population of the South East Queensland region is expected to double over the next 50 years from 2.8 million in 2006 to 6 million in 2056.

Brisbane's CBD is the region's primary activity centre and the population of Brisbane city is forecast to grow from 991 000 people in 2006 to 1.27 million people by 2031 – an increase of 28% (*South East Queensland Regional Plan 2009-2031*, p.17). Employment in Brisbane city is forecast to increase from 692 362 jobs in 2006 to more than 1 million jobs in 2031 – an increase of more than 300 000 jobs. Employment in Brisbane's inner city areas is forecast to increase from 300 000 jobs to 475 000 jobs, which is a 58% increase.

The bulk of the region's population growth is expected to be accommodated outside of Brisbane. However, Brisbane will retain its place as the region's primary activity centre which will see around 175 000 more people working in inner Brisbane by 2031. This will lead to a massive increase in commuter trips originating in the outer region to Brisbane with rail best placed to capture this demand. In 2008, 53 000 people travelled into the inner city by rail between 7.00 am and 9.00 am each weekday. This is expected to increase to between 70 000 and 80 000 by 2016 and between 150 000 and 200 000 by 2031 (draft *Connecting SEQ 2031*, 2009). More train services from the outer regions to inner Brisbane will be required to both cope with demand and ensure public transport remains an attractive alternative to driving.

The efficient movement of freight is essential for economic growth. Recent studies indicate that freight services are expected to double by 2020. A key transport policy goal identified in the draft *Connecting SEQ 2031* is to support the economic prosperity and employment growth in the region, by moving freight and business traffic efficiently and reliably. This is a major challenge for the rail network: to accommodate the anticipated significant growth in passenger demand over the next 20 years while also supporting growth in freight traffic.

In 2008, 56 train services were required in the one-hour morning peak to move passengers into the inner city. By 2016, this could rise to 91 train services. Based on current infrastructure and operating paradigms, the current inner city rail network cannot handle this increased number of train services.

If inner city rail infrastructure is not expanded, additional rail services cannot be added and passengers will inevitably be left behind in the morning peak or they will use alternative travel – the rail system will be at full capacity. There will simply not be enough capacity in the system to accommodate the required number of trains into the inner city.

The key capacity constraints in the inner city are as follows:

- there are currently four tracks through the inner city, and the ability to add additional tracks in the existing corridor, or upgrade stations, is extremely limited
- the inner city rail network is the 'hub' of the rail network in South East Queensland, and its capacity limits the number of additional trains which can be introduced on the lines servicing the region
- the inner city capacity 'threshold' can be lifted to 42 trains per hour each way (total 84) – this is expected to be reached by 2016
- updated passenger demand forecasts have identified the rate of growth is exceeding previous forecasts – passenger rail services to cater for this demand, if introduced on the network, would exceed inner city capacity prior to 2016

- current service forecasts indicate 92 trains per hour by 2016, and 141 trains per hour by 2026, highlighting a need for two new rail corridors in the inner city by 2026 to cater for this growth
- freight services traversing the inner city network are also expected to grow, with between 100 and 200 additional services each week by 2026 depending on growth scenarios that may eventuate.

A number of major inner city destinations are not currently accessible by rail. Rail passengers travelling to inner Brisbane are able to access Central, Roma Street, South Brisbane, South Bank, Milton, Albion, Fortitude Valley and Bowen Hills. Major inner city areas that are less accessible by rail, being outside the preferred distance from a station that defines a walkable catchment include:

- Parliament/Queensland University of Technology (QUT)
- financial district of CBD (Eagle Street area)
- Woolloongabba/Kangaroo Point
- Newstead
- RNA/Royal Brisbane and Women's Hospital
- West End
- New Farm
- Kelvin Grove.

In addition, the location of existing inner city stations restricts accessibility to key destinations. Brisbane's stations are located on the periphery of the CBD. Consequently many passengers who use the rail network are forced to walk more than one kilometre from their place of work or study to access a station. To improve accessibility, more rail stations are needed in more parts of inner Brisbane. This will establish new trip opportunities, attract more passengers to the rail system, alleviate pressure on the bus network and contribute to a reduction in urban congestion into the future. The long-term plan for Brisbane is for an integrated public transport system that uses a variety of modes, including metro rail services, which promote interchange opportunities to improve service and access across the region.

The rail network will need to play a much larger role in supporting the region's freight and passenger needs and securing Brisbane's transport and economic future. Maintaining adequate rail service and access is vital for the economic well-being of the state's capital city. There are well-established links between improved transport efficiency and economic growth. South East Queensland's growing transport task is best addressed by an overall, balanced and sustainable approach to investment in multiple modes of transport, including public transport, road transport and active transport.

Traffic congestion is a growing problem in the region. Congestion stifles productivity and bears a significant economic cost. If freight vehicles are consistently caught in traffic congestion, the region will lose its ability to attract and retain industry (draft *Connecting SEQ 2031*). By 2020, it is expected that congestion will cost the Brisbane economy around $3 billion per annum (*Urban Transport Challenge*, p.3).

Rail based public transport provides a more effective use of community resources and public transport generally provides for more efficient and equitable access to employment and services. Rail specifically provides a more sustainable form of transport with lower environmental and health impacts in comparison to road-based transport. Motor vehicles cause almost half of all air pollutants in South East Queensland. Well-located public transport encourages development along defined and

accessible transport corridors and in defined centres thereby limiting urban sprawl and protecting green spaces.

2.4 Project objectives

Cross River Rail aims to improve rail services in South East Queensland by increasing the capacity of the inner city rail system so that more train services can operate more often right across the South East Queensland rail network. Cross River Rail also is intended to improve rail access to key inner city destinations by building new rail stations in the inner city so that people get to where they want to go and have a wider choice of efficient public transport services.

Project objectives have been established in consideration of the key issues identified above, particularly in response to issues relating to service, access and sustainability. These objectives will form and shape concept development within the study corridor, and were used to establish a range of possible options that form the basis of the study corridor selection.

Service

- to ensure the inner city rail infrastructure caters for patronage and service growth over the next 20 years
- to enable a transformation of passenger rail services in South East Queensland through new technology and standards delivering higher capacity and enhanced service quality
- to remove the conflicts between different rail service types and improve freight capacity.

Access

- to improve access to inner city attractors/generators and future inner city development
- to provide high quality strategic interchange facilities within the public transport network
- to ensure the project aligns with a longer term plan for the development of the transport network in South East Queensland.

Sustainability

- to ensure the project represents value for money, taking account of project risk
- to support sustained economic growth of the region through improved access to employment and effective movement of freight
- to increase rail's mode share and reduce energy consumption and greenhouse gas emissions and manage traffic congestion
- to integrate with and be a catalyst for urban redevelopment consistent with planning scheme intentions and opportunities
- to facilitate transit oriented development that incorporate the sustainable social and lifestyle benefits associated with proximity to high quality public transport
- to minimise impacts during construction and operation.

2.5 Project justification and alternatives considered

In response to the project objectives identified in 2.4 above, a range of possible alternatives was considered, leading to the identification of the study corridor as described in Section 2.1.

The *Inner City Rail Capacity Study (2008)* prefeasibility study was undertaken in 2007 and 2008 to identify viable solutions to address capacity constraints for Brisbane's inner city rail network. The *Inner City Rail Capacity Study (2008)* study area broadly included the rail network triangle between Bowen Hills, Park Road and Milton rail stations. The objectives of the *Inner City Rail Capacity Study (2008)* were to:

- identify a preferred integrated land use and transport strategy for inner city Brisbane, particularly in relation to the rail network
- identify and assess the options for future development of the rail network, including river crossing(s)
- support best value integrated transport and land use outcomes
- provide input to the 2008 update of the *South East Queensland Infrastructure Plan and Program 2009-2026*.

The *Inner City Rail Capacity Study (2008)*:

- identified more than 70 potential options (using a 'paired approach' – the aim was to identify options that contained both a 2016 alignment and a 2026 alignment to handle identified growth)
- selected 10 preferred options for further assessment against agreed criteria
- reduced these 10 options to six options for detailed assessment
- recommended a short list of three options for detailed technical feasibility.

Based on updated information, a further review was undertaken in mid-2009 of the *Inner City Rail Capacity Study (2008)* outcomes. The review identified three options worthy of further consideration:

- Woolloongabba, Spring Hill, Gregory Terrace and the RNA in tunnel
- Woolloongabba, Newstead, and Fortitude Valley in tunnel
- Merivale Bridge or tunnel.

The proponent then identified other alternatives to the project, and explored variations to previously identified options. A more detailed examination was then undertaken of technical issues and assumptions including vertical geometric constraints, the length of tunnelling required, station locations and dimensions, tunnel design and construction options, and probable costs and program requirements. The detailed examination used multi-criteria analysis to identify the study corridor for the EIS and to ensure that the project aligns with the project objectives. The evaluation process included stakeholder review and endorsement from the project steering committee and technical advisory groups.

2.6 Strategic significance of the project

Cross River Rail will support the achievement of the transport and transit outcomes in the *South East Queensland Regional Plan 2009-2031* by fostering compact urban form and connecting communities. It will also support the ongoing role and function of the Brisbane CBD as the primary centre for commerce and employment in Queensland.

Cross River Rail is the flagship initiative in the draft regional transport plan accompanying the *SEQ Regional Plan* called *Connecting SEQ 2031: An Integrated Regional Transport Plan.* This plan, due for finalisation in 2010, outlines how rail is the backbone and investment priority for the SEQ transport system to support compact urban settlement and emission targets within the *SEQ Regional Plan* and *Climate Q: toward a greener Queensland.* Cross River Rail is the enabler of the long-term viability of the rail network.

Cross River Rail will support achievement of 'strong' and 'green' targets in *Toward Q2: Tomorrow's Queensland* by:

- *Strong* – support economic growth by developing the rail network and fast commuter links to ensure people and goods can move more reliably and efficiently
- *Green* – support cutting Queenslanders' carbon footprint by one third through reduced motor vehicle use.

The consequence of not addressing the rail network constraints identified above would have long term, adverse economic, social and environmental impacts.

2.7 Construction and operational processes

A range of construction methods and options may be applied to the project, to be determined during the detailed feasibility phase of the project as part of the reference design development. These methods may include:

- tunnelling works that, subject to the ground conditions and potential surface impacts, may include construction by tunnel boring machines, excavation by road headers, rock breakers and blasting
- open excavation work for both some sections of the new railway including open cuttings and cut and cover work) and station infrastructure
- station construction and access arrangements
- possible building development above station and construction sites
- modifications within or adjacent to existing rail corridors including the realignment of existing tracks and the construction of new tracks.

Construction impacts will be very similar to those experienced with the construction of Brisbane's road tunnels. Surface works will generate environmental impacts such as noise, vibration and air quality, while underground works will generate impacts such as noise and vibration, groundwater movement and demand for energy for the operation of tunnelling machinery. Construction traffic impacts will include the transport of construction materials and construction spoil-to-spoil placement sites, and possibly the rearrangement of traffic flows to accommodate surface works adjacent to stations.

The quantities of construction materials and of construction spoil will be determined through the detailed feasibility studies, and rely as much on the proposed horizontal and vertical alignments as on the type of construction and method of delivery. Furthermore, the means of transportation will be determined through the detailed feasibility studies (eg road, rail, river, others). The design development will inform the EIS and enable an assessment of the impacts of construction transport requirements on the transport system.

The operation of the project and how it is integrated into the South East Queensland rail network will be considered as part of the reference design development and assessed in the EIS.

The environmental effects of the operational phase of Cross River Rail are likely to be confined to specific localities such as the tunnel portals and the stations. Such effects may include noise and vibration from train movements, an increased demand for energy and the movement of people to and from stations.

The purpose of the EIS is to identify these construction and operational impacts, and propose effective measures to mitigate and manage such impacts to the extent possible. The consultation program will keep the community informed as to the potential scale and intensity of the impacts, and enable input to the development and refinement of possible mitigation measures.

2.8 Associated infrastructure requirements

Cross River Rail will include the following infrastructure requirements:

- establishment of work sites and access arrangements to facilitate the construction works
- utility provision and relocation (including potable water, sewage, gas, telecommunications, power, and stormwater drain provision and relocation)
- rail tracks both at the surface and in tunnels
- tunnels, including fire and life safety systems, ventilation systems and lighting and communications systems
- underground stations including access and egress provisions, passenger amenity facilities and safety features
- possible enhancements to existing stations
- connections to the existing rail network
- ventilation of underground stations and possibly tunnels, although no noxious emissions are anticipated from electrically powered rail operations
- provision of power for construction and operations including feeder cables and substations
- provision of telecommunications and data provision within the operating project.

2.9 Level of investment and employment opportunities

Cross River Rail has evolved from the *Inner City Rail Capacity Study (2008)*. The staging and estimated total cost for the south to north corridor was up to $8.2 billion in 2008 dollars. Submissions to Infrastructure Australia estimated a funding requirement of $20 million to undertake the detailed feasibility study that included the identification of a preferred north-south corridor to be constructed by 2016, the development of a business case and the undertaking of extensive community and stakeholder consultation. The funding requirement for land acquisitions for this north south corridor was estimated to be at least $300 million.

These costs are indicative only and will require significant refinement as part of the detailed feasibility studies when more detailed investigations and consultation is undertaken. Elements contributing to this cost are likely to include, but not be limited to:

- study costs (ground survey, preliminary design, detailed design, transport and EIS,)
- land acquisition costs and compensation
- other necessary compensatory or mitigation measures

- construction costs (earthworks, trackwork, signalling and electrification, possible substations, stations and station facility upgrades, road relocations, relocation of utilities, tunnels, bridges, culverts, noise treatments, visual treatments and landscaping).

Construction of Cross River Rail will be a major source of employment with people being employed to assess, design, construct and manage the infrastructure and through opportunities for the supply of materials and equipment to the project.

When operational, Cross River Rail will generate additional employment opportunities within Brisbane, the South East Queensland region and the state of Queensland through improved transport opportunities, improved connectivity, urban renewal, and multiplier effects from the economic activity generated by the project.

Cross River Rail is a significant project and will create a substantial number of new jobs. While further assessment will be undertaken as part of the EIS process to determine the potential employment created by the project, previous studies for a project of this nature indicate that for every one billion dollars spent, around five to eight thousand jobs are created. That means that this project may create in the order of 15 000 to 60 000 direct and indirect jobs, depending on how the project is delivered and the final scale of the project. It is likely that a project of this size and nature may create in excess of twenty thousand direct and indirect jobs during the construction phase alone.

A detailed assessment of job creation, skills development and training opportunities will be included within the EIS.

3 Project Approvals

Project approvals for all elements of Cross River Rail will be identified during the EIS process. Relevant instruments for assessment of the project include both local and state planning instruments, and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

3.1 Local planning instruments

Under the provisions of Brisbane City Council's *City Plan* the tunnel, stations and associated infrastructure works would be defined generally as a 'Utility Installation' unless explicitly exempted by special provisions. There will be above ground surface works associated with station entries and connections to the existing rail infrastructure that would include a range of development including:

- carrying out building work
- carrying out operational work
- reconfiguring a lot
- making a material change of use of premises.

Any development approvals required for the project will be identified during the EIS process.

City Plan Codes

The following *City Plan* codes may be relevant to the project during both construction and operation. Any requirements under these codes will be addressed during the EIS process:

- Acid Sulfate Soils Code
- Biodiversity Code
- Filling and Excavation Code
- Industrial Amenity and Performance Code
- Industrial Design Code
- Landscaping Code
- Light Nuisance Code
- Operational Works Code
- Services, Works and Infrastructure Code
- Stormwater Management Code
- Subdivision Code
- Transport, Access, Parking and Servicing Code
- Waterway Code
- Wetland Code.

City Plan Policies

The following *City Plan* policies may be relevant to the project during both construction and operation. Any requirements under these planning scheme policies will be addressed during the EIS process:

- Acid Sulfate Soil Planning Scheme Policy
- Air Quality Planning Scheme Policy

- Brisbane River Corridor Planning Scheme Policy
- Community Impact Assessment Planning Scheme Policy
- Consultation Planning Scheme Policy
- Environmental Impact Assessment Planning Scheme Policy
- Hazard and Risk Assessment Planning Scheme Policy
- Heritage Register Planning Scheme Policy
- Impact Assessable Uses Planning Scheme Policy
- Management of Urban Stormwater Planning Scheme Policy
- Natural Assets Planning Scheme Policy
- Noise Impact Assessment Planning Scheme Policy
- Planting Species Planning Scheme Policy
- Transport, Access, Parking and Servicing Planning Scheme Policy
- Transport and Traffic Facilities Planning Scheme Policy

3.2 Local Laws

The following Brisbane City Council local laws may be relevant to the project during construction or operation. Any requirements under these local laws will be addressed during the EIS process:

- The 'Gabba Traffic Area Local Law 2000
- Heavy and Long Vehicle Parking Local Law 1999
- Natural Assets Local Law 2003
- Streets, Bridges, Culverts Etc 2003
- Public Health, Safety and Convenience, 2003
- Parking and Control of Traffic, 2007.

3.3 Other Legislation and Approvals

The approvals that will be required will depend on a number of factors, including physical location, site characteristics and construction methodology. Commonwealth and Queensland legislation that may be relevant to the project, including related permits and approvals, are set out below:

Legislation	Department	Trigger	Permit/Licence
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 2000	Department of the Environment, Water, Heritage and the Arts	Development that has a significant impact on: - World Heritage places - National heritage places - Ramsar wetlands - the Great Barrier Reef marine park - listed threatened species and - ecological communities - listed migratory species - development involving a Commonwealth marine area - nuclear actions - the environment on Commonwealth land	Approval from the Commonwealth Minister for Environment, Heritage and the Arts is required if activity is likely to have a significant impact on a matter of national environmental significance.

Legislation	Department	Trigger	Permit/Licence
Native Title Act 1993	National Native Title Tribunal	Native title	If native title is not extinguished, notification procedures or an Indigenous Land Use Agreement required
Queensland Legislation			
Aboriginal Cultural Heritage Act 2003	Department of Environment and Resource Management	Duty of care to take all reasonable and practicable measures to ensure an activity does not harm Aboriginal cultural heritage (s23). If an EIS is required for the Project, a CHMP must be developed and approved.	Cultural Heritage Management Plan required
Building Act 1975 and Sustainable Planning Act 2009	Department of Infrastructure and Planning or Brisbane City Council	Building works that are assessable against the Building Regulation 2006	Development Permit (Building Works)
Dangerous Goods Safety Management Act 2001	Brisbane City Council	Storage of certain quantities of flammable and combustible liquids	Licence required
Coastal Protection and Management Act 1995 Sustainable Planning Act 2009	Department of Environment and Resource Management or Brisbane City Council	Operational work that is tidal work	Development Permit for Operational Works
Environmental Protection Act 1994 and Sustainable Planning Act 2009	Department of Environment and Resource Management	Making a material change of use of land listed on the Environmental Management Register or Contaminated Land Register	Development approval
Environmental Protection Act 1994 Sustainable Planning Act 2009	Department of Environment and Resource Management	Making a material change of use of premises for an environmentally relevant activity. Relevant ERAs for the Project may include: ERA 8: Chemical storage; ERA 15: Fuel Burning; ERA 16: Extractive and screening activities ERA 43: Concrete Batching ERA 57: Regulated Waste Transport	Development Approval Registration Certificate
Environmental Protection Act 1994	Department of Environment and Resource Management	Removal and treatment or disposal of contaminated soil Management of contaminated land	Permit to remove and treat or dispose of contaminated soil
Explosives Act 1999	Department of Employment, Economic Development and Innovation	Possession, storage and use of explosives	
Fisheries Act 1994 Sustainable Planning Act	Department of Employment, Economic Development and Innovation	Development in a fish habitat area Operational work that is the constructing or raising of a waterway barrier work Operational work that is the removal, destruction or	Development approval

Legislation	Department	Trigger	Permit/Licence
		damage of a marine plant	
Land Act 1994	Department of Environment and Resource Management	Short term occupation and construction within road reserves (excluding State roads)	Permit to occupy
Nature Conservation Act 1992	Department of Environment and Resource Management	Taking, using, keeping or interfering with cultural or natural resource of a protected area.	License or Permit required (s62)
Nature Conservation Act 1992	Department of Environment and Resource Management	Taking, using, keeping or interfering with a protected animal.	License or Permit required (s88)
Nature Conservation Act 1992	Department of Environment and Resource Management	Taking, using, keeping or interfering with a protected plant.	License or Permit required (s89)
Nature Conservation Act 1992	Department of Environment and Resource Management	Taking, using, keeping or interfering with wildlife not protected under the Act, but found in an area identified as a critical habitat, or major interest by a conservation plan	License or Permit required (s97)
Queensland Heritage Act 1992	Department of Environment and Resource Management	Development by the State on a registered place	Prepare a report under s.71 Queensland Heritage Act
Transport Planning and Coordination Act 1994 and Acquisition of Land Act 1967	Department of Transport and Main Roads	Purposes for which land may be resumed and the resumption process.	Resumption of land.
Transport Infrastructure Act 1994	Department of Transport and Main Roads	Works on or interfering with a railway	Approval of railway manager
Transport Infrastructure Act 1994	Department of Transport and Main Roads	Works on or interfering with a State controlled road	Written approval of the chief executive
Transport Infrastructure Act 1994	Department of Transport and Main Roads / Brisbane City Council	Temporary road closure	Approval required
Urban Land Development Authority Act 2007	Urban Land Development Authority	Development within an Urban Development Area	Approval under the relevant development scheme
Vegetation Management Act 1999 and Sustainable Planning Act 2009.	Department of Environment and Resource Management	Clearing of native vegetation	Permit required
Water Act 2000	Department of Environment and Resource Management	Chapter 2, Part 8: Destroy vegetation, place fill or excavate in a watercourse	Riverine Protection Permit required (s266)

4 Existing environment

4.1 Natural environment

Terrain

The study corridor passes through a range of topographical land forms and elements.

The topography of the southern part of the study corridor consists of undulating terrain with minor surface catchments between hills. The study corridor passes to the east of the ridge on which Dutton Park and Boggo Road precincts lie. North along the alignment from the Park Road rail station the topography is relatively flat across Woolloongabba before gradually rising to a maximum of about 30 metres above sea level at the crest of the remnant quarry wall cliffs at Kangaroo Point. From the cliffs there is a fall to the Brisbane River.

After crossing the Brisbane River there is a gradual rise through the City Botanic Gardens to the CBD. The elevation is relatively constant through the CBD before a steady rise to Spring Hill. From there, the landform falls steadily to the floodplain of Enoggera Creek at Bowen Hills and Mayne. North of Enoggera Creek, the terrain of the study corridor rises along a valley formed by a series of connected hills and ridges along Lutwyche Road, Windsor, to an elevated saddle across to Albion and the higher ground of Hamilton and Clayfield. From this saddle, the study corridor falls gently to the north towards Wooloowin.

Geology, hydrogeology and soils

The study corridor is underlain by the Neranleigh-Fernvale Formation and the Bunya Phyllite, which is the oldest bedrock in the Brisbane region, formed about 420 to 350 million years ago. In some areas these formations are covered by Brisbane Tuff formed from volcanic ash falls about 220 million years ago. The Triassic age Brisbane Tuff generally comprises fine to coarse grained volcanic rocks formed as the result of pyroclastic (volcanic ash) flows. The rock is generally of very high strength.

Following the Triassic volcanic eruptions, rivers deposited sands and gravels along channels and floodplains to produce the conglomerates and sands of the Aspley Formation and more mature finer silts and shales of the Tingalpa Formation of predominantly mudstones with interbedded sandstones and conglomerates. In the recent past, after widespread erosion, deposition of Quaternary Alluvium occurred particularly during high stands of the sea over the last two million years.

This geology has been deeply eroded by the Brisbane River system during periods of low sea level. The course of the Brisbane River has changed little since Tertiary times, and appears to have been established even earlier. As sea levels rose, the deeply dissected land surface was subsequently in-filled by alluvial and estuarine sediments to form the flat, low-lying plains of the Brisbane River.

The hydrogeological regime of the study corridor within which tunnelling will be undertaken comprises two broad aquifer types:

- a fractured rock aquifer system of either the Brisbane Tuff, Neranleigh-Fernvale Beds or Tingalpa Formation; and
- narrow and isolated Quaternary alluvial systems associated with valleys that have eroded into the older bedrock.

Overriding these aquifer systems is the impact of the Brisbane River which is incised through Brisbane Tuff and the underlying Neranleigh-Fernvale Beds.

The Neranleigh-Fernvale Beds that occur along the study corridor predominantly on the northern side of the river, comprise mainly quartz arenite and phyllite with occasional quartzite and localized meta-basalt. From a hydrogeological perspective the Neranleigh-Fernvale Beds can be described as an aquifer of very low to low permeability.

The Brisbane Tuff is a very hard welded tuff or ignimbrite. It has effectively no primary porosity and any groundwater movement will be through secondary features such as joints and fractures. It occurs along the study corridor on the southern side of the river, between the river and Park Road Station, and on the northern side in the area of Exhibition and Bowen Hills Stations.

The Tingalpa Formation that comprises variable sandstones and shales, is present at the southern end of the study corridor between Fairfield and Park Road Stations. Testing of the formation for other tunnel projects indicates that it is generally of low permeability.

Quaternary alluvium comprising variable deposits of clay, silt, sand and gravel, but with clay predominating, infills topographic depressions and low-lying areas along the study corridor. The alluvium is expected to be relatively thin (<10m) and is confined to the upper catchment of Norman Creek on the southern side of the river, an area along the northern side of the Brisbane River and in the Victoria Park area at the northern end of the study corridor.

Groundwater levels along the study corridor will be variable and will generally be a subdued reflection of the topography, except in areas where the water table has been impacted by existing infrastructure. Similarly groundwater quality will be variable with pH ranging from slightly acidic to slightly alkaline and the total dissolved salts ranging from fresh to saline, the brackish to saline groundwater occurring in areas close to the Brisbane River which is tidal. Previous experience on the S1 Sewer project and Department of Environment and Resource Management databases indicate that areas of groundwater contamination may be present with the potential to be mobilised by any induced groundwater flows.

The development of Brisbane over time has impacted the groundwater regime through lowering of groundwater levels due to the construction of deep drains, sewers and tunnels and a reduction of recharge as a result of tree-clearing and construction of buildings, pavements and roadways.

The study corridor contains different soil types including prairie soils with some sandy alluvial surface soils, lithosols and shallow podzolic soils. Most surface soils are classed as easily erodable to erodable. Acid sulfate soils and potential acid sulfate soils are expected in the study corridor.

Ecosystems

The environment in the vicinity of the study corridor has been heavily modified over many years. Modified green spaces in the study corridor include the City Botanic Gardens, the Roma Street Parklands and the banks of the Brisbane River.

The Department of Environment and Resource Management online database lists records of sightings of one vulnerable amphibian, one vulnerable bird, one presumed extinct bird, two vulnerable insects and one rare plant occurring within or in the vicinity of the study corridor. The Department of the Environment, Water, Heritage and the Arts Protected Matters Tool Database lists matters of national

environmental significance and other matters protected by the *Environment Protection and Biodiversity Conservation Act 1999*. A number of species are noted as potentially occurring within the study area, although the database considers Ramsar wetlands downstream in Moreton Bay and Marine species.

Watercourses and aquatic habitats

The Brisbane River is the only major waterway potentially affected by works, although track upgrade works may occur both to the north and south along existing alignments within the Enoggera Creek, Kedron Brook, Norman Creek and Oxley Creek catchments. Further, local flows may occur in overland flow paths in some areas of the study corridor.

The original waterways in the CBD were moved into lined drains many years ago. Tunnelling will be beneath the bedrock level of the Brisbane River similar to works undertaken by the Clem7 road tunnel.

The CBD is adjacent to the Brisbane River, where there has been flooding under very infrequent extreme events. The hydrographs for similar events have been modified by upstream dams. In addition flooding from overland flow at a number of locations throughout the study corridor has been experienced under extreme rainfall events.

Aquatic habitats along the Brisbane River are dominated by mangroves, with an associated range of fauna. In addition, there are heavily modified parkland environments in the City Botanic Gardens and the Roma Street Parklands that will contain limited aquatic habitat supportive of a range of fauna.

Air and noise

The existing environment is typical of the centre of a large city, with road traffic the dominant air and noise influence. The air and noise characteristics have been extensively monitored as part of ongoing programs and other construction projects.

The existing acoustic environments in the vicinity of the project portals and connections with the surface rail network are influenced by road and rail traffic and other urban activities at both the northern and southern ends of the study corridor.

Social

The study corridor includes the urban areas of Acacia Ridge, Fairfield, Dutton Park, Woolloongabba, CBD Spring Hill and Eagle Junction. These are substantial urban areas that support residential, commercial, industrial and recreational activities. A large number of people from across the South East Queensland region travel to these areas for business, employment, recreation and shopping. In recent times there has been a significant increase in the number of residents as inner city living has resurged in popularity. There is considerable social diversity within these areas, varying both with location and time, both daily and across the week.

Community and tourist facilities

The study corridor includes many features important to both the broader Brisbane and Queensland society, and a number of facilities visited by tourists, mostly in the city centre. These features within or proximate to the study corridor include the Queensland Parliament, Brisbane City Council headquarters and the public library, the City Botanic Gardens, the Roma Street Parklands, the Queen Street Mall and surrounding retail outlets, the Queensland University of Technology, the RNA

Showgrounds, Kangaroo Point Cliffs, the Brisbane Cricket Ground (the Gabba), historic buildings and places, the Treasury Casino, and the focal point for the city busway network.

This area was the centre of initial European development for Brisbane and contains many features of historic interest. There are also a number of restaurants and cafes frequented by visitors and residents.

Cultural heritage

Historic use by indigenous peoples of the area contained within the study corridor is known to have been extensive. The views of indigenous groups with interests in the study corridor will be important inputs to the documentation of the cultural values and significance of the area.

The study corridor has been subjected to extensive waves of development over more than one hundred years that will have already extensively impacted any archaeological materials.

There are also a number of non-indigenous cultural heritage sites within the study corridor that include areas of initial European settlement in Brisbane. These include sites listed on the *Queensland Heritage Register*, Brisbane City Council's local heritage register, the Register of the National Estate and the Commonwealth Heritage List.

Economic characterisation

Brisbane is the capital of the fastest growing state in Australia. Queensland is projected to have the second largest state population by 2030. The Brisbane CBD is the economic centre of both Brisbane and Queensland. The South East Queensland region's transport system is under significant pressure due to rapid population and economic growth, increasing private vehicle use and growing freight movements resulting in worsening peak hour traffic congestion and overcrowding of passenger transport services. Public transport use has grown considerably over the past few years and increased capacity is required to provide adequate public transport access both to the CBD, and between the CBD and major regional hubs across the region.

The cost of road congestion and projected traffic growth for Queensland has been estimated by the Bureau of Infrastructure Transport and Regional Economics (BITRE) to increase from $1.2 billion in 2008 to $3 billion in 2020. The national figure is expected to grow from $9 billion to $20 billion by 2020. Queensland's contribution to national road congestion is expected to rise from around 13 per cent to 15 per cent over this period (BITRE Working Paper 71, 2007).

Employment in the CBD is forecast to grow from approximately 140 000 jobs in 2006 to 260 000 jobs by 2026, based on National Institute of Economic and Industry Research forecasts. The rail system delivers a significant number of the highly skilled workforce to the Brisbane CBD.

4.2 Built environment

The built environment within the study corridor is dominated by urban development.

Brisbane is the capital of Queensland and its business and administration centre. It has been extensively developed for commercial, institutional, cultural, educational, religious, recreational and residential uses.

The southern areas of Fairfield, Park Road and Dutton Park contain a mix of residential, commercial and light industrial uses and much of the residential precincts are dominated by character housing within a development control precinct of Brisbane City Council's *City Plan*.

The suburb of Woolloongabba, about one kilometre south of the Brisbane CBD, contains a mix of retail, commercial, industrial and residential uses, and residential dwellings range from character housing to modern residential towers. Woolloongabba contains the Brisbane Cricket Ground ('the Gabba'), the Mater hospital complex and the South Brisbane dental hospital. The state government owns a large site housing Go Print and the Land Centre.

The built form within the Brisbane CBD is characteristic of a city centre, with many tall buildings and deep basements. The detailed feasibility studies will address and locate building basements, together with the use of such buildings as part of the design and impact assessment studies. The location of proposed stations in the CBD will also be determined in relation to the existing and planned future built form controlled by *City Plan*.

Spring Hill was one of the first parts of Brisbane to be settled, around the 1850s and contains some of the city's oldest buildings. The area has undergone substantial redevelopment for commercial, institutional and residential uses. Major developments include St Joseph's College, Centenary Aquatic Centre, St Andrews War Memorial Hospital, Brisbane Central Primary School, Brisbane Grammar Schools and Victoria Parkland.

Bowen Hills was declared an Urban Development Area on 27 March 2008 and the *Bowen Hills Development Scheme* came into effect on the 3 July 2009. Future development within walking distance of the Bowen Hills railway station will promote inner city transit oriented development (TOD).

Throughout the study corridor, especially in the CBD, there are older buildings with heritage value.

4.3 Land tenure and ownership

Land tenure within the study corridor is held under a variety of tenure arrangements including freehold, reserve or leasehold tenure, as well as unallocated state land.

State and Council controlled land within the study corridor may include:

- parklands, including the City Botanic Gardens, Kangaroo Point cliffs, Roma Street Parkland and Victoria Park
- council, state and commonwealth owned buildings
- roads
- existing rail corridors.

4.4 Planning schemes and government policies

The Queensland Government *South East Queensland Regional Plan 2009-2031* provides a framework for managing population growth and development in the region to 2031. The *South East Queensland Infrastructure Plan and Program 2009-2026* outlines the Queensland Government's infrastructure priorities for the South East Queensland region to support the *South East Queensland Regional Plan 2009-2031*. The plan identifies $124 billion in estimated infrastructure investment (inclusive of federal government contributions and other revenue sources), which is expected to create 900 000 jobs through to 2026. The *South East Queensland Infrastructure Plan and Program 2009-*

2026 supports TOD outcomes at major public transport nodes, public transport corridors, existing activity centres and state landholdings within a 10-kilometre radius of the CBD, including Bowen Hills and Woolloongabba.

The *SEQ Regional Plan* is supported by the draft regional transport plan called *Connecting SEQ 2031: An Integrated Regional Transport Plan.* This draft plan, due to be finalised in 2010, outlines the transport response to the framework for managing growth in the region outlined in the *SEQ Regional Plan*.

Brisbane's CBD will be developed according to the provisions of the *City Centre Neighbourhood Plan*. The *City Centre Neighbourhood Plan* became effective on 1 January 2009 following extensive public consultation and state government approval. The plan is based on the principles of the *City Centre Master Plan*. The Master Plan was released in August 2006 to provide a 20-year blueprint for the development of Brisbane's city centre. The *Neighbourhood Plan* is the statutory document that manages development of land in the city centre. The vision for the city centre included in the plan includes:

- the further development of the city centre in its role as Queensland's principal centre for business and administration
- a reduced dependence on private vehicle usage and increased reliance on public transport, cycling and walking.

The plan anticipates an underground heavy rail link to connect Spring Hill with the city core.

The *City Centre Master Plan* includes transport strategies to service the busiest parts of the city centre. The strategies link key generators and attractors in the city frame, and look at introducing new bus and train routes and stations, ferries and mass transit options. The *Master Plan* identifies the need to improve public transport provision to and within the CBD and surrounding areas. It proposed key transport elements:

- an underground heavy rail link between Woolloongabba and Bowen Hills via Eagle Street and Parliament House to serve the eastern sector of the CBD and provide increased river crossing and city station capacity
- an accessible and recognisable mass transit service linking West End, South Brisbane, CBD, Fortitude Valley, Teneriffe and New Farm to cater for the high growth and urban renewal.

The *Master Plan* does not specify the mode to provide the mass transit service but indicates that it should be a 'highly visible, extremely accessible high-capacity mode' and be integrated with other public transport services to provide a circulation system to enliven the city and connect key attractions.

Brisbane City Council's *Transport Plan for Brisbane 2008–2026* has been developed as an Integrated Local Transport Plan under the objectives of the *South East Queensland Regional Plan 2009-2031*. The *Transport Plan* notes that the Queensland Government is undertaking studies into options for future capacity upgrading of inner city rail and bus systems, and that council planning and projects will be aligned with these study findings as they are made available. The *Transport Plan* also notes that Brisbane City Council will be undertaking studies to determine what steps need to be taken to achieve the projected public transport mode share target in an earlier timeframe than 2026, and that the necessary conditions to achieve this would include a significant increase in rail capacity, making full use of rail corridors to move more than 30 000 passengers per hour which should include serious consideration of an inner Brisbane metro system.

The *Transport Plan* notes as a key driver that by 2016, almost 50 per cent of Brisbane's population is expected to live in outer suburbs. Further pressure is also expected from people commuting to Brisbane from surrounding local areas like Logan, Ipswich, Redland, Beaudesert, Redcliffe, Caboolture and Pine Rivers. By 2016, it is projected that more than one million people will live in these areas and by 2026 1.2 million. At the same time, employment is expected to increase in Brisbane by 55 per cent but in these surrounding areas by only 35 per cent.

Brisbane City Council, in partnership with the Queensland Government, has started developing an overarching plan to guide development of the inner city – the *River City Blueprint.* The River City Blueprint will draw together all existing plans, studies and strategies for suburbs within a five kilometre radius of the CBD to generate a single, consolidated vision for the area. It will create a cohesive framework to manage growth and infrastructure delivery to 2031 and beyond. The draft River City Blueprint is expected by mid 2010 with a final release in late 2010.

5 Potential environmental impacts

5.1 Potential environmental impact studies

Investigations completed to date have been aimed at identifying the optimal corridor for the north-south Cross River Rail connection. Detailed investigations, preliminary design and community and stakeholder engagement will be undertaken as part of the EIS process. The studies required to support and complete the EIS may include, but are not limited to:

- preliminary project design, including urban design and landscape design, and construction planning
- traffic and transport, including railway operations, pedestrian and cycle access, road network impacts and other public transport
- land use, planning scheme provisions and urban renewal opportunities
- studies of potential bio-physical impacts (eg ecology, groundwater, contaminated land, surface water, noise, vibration and air quality)
- studies of potential socio-economic impacts (eg visual, cultural heritage, social, economic including cost-benefit analysis, construction effects)
- waste management
- hazards and risks.

5.2 Transport system

Cross River Rail will provide opportunities for improved performance across the South East Queensland regional rail network with corresponding benefits to road transport networks and especially road-based public transport.

Cross River Rail will help transform South East Queensland's rail system by providing new inner city rail infrastructure that will deliver benefits to not only inner city travel, but the wider South East Queensland rail network.

The project will increase the capacity of the rail network with more frequent services and easier interchange between trains and other transport. Building new inner city rail infrastructure will cater for the growing number of rail passengers in both the CBD and the wider South East Queensland rail network. The new rail tracks provided by Cross River Rail will provide future opportunities for changes to the way the greater South East Queensland rail network is operated providing greater flexibility and capacity across the entire network. Cross River Rail is anticipated to provide the ability to move up to 120 000 people in the morning peak period into the inner city.

When completed Cross River Rail will provide substantial environmental, social and economic benefits at the regional, city and local scales through improvements to the rail network with corresponding benefits to the road network. During construction there is the potential at the local level for some adverse impacts to local road traffic, which will need to be carefully considered and mitigated against through considered design and management approaches.

A more detailed assessment of these benefits and impacts will be undertaken as part of the EIS.

5.3 Biophysical environment impacts

Flora, fauna and aquatic habitats

The biophysical environment of the study corridor has been heavily modified over many years, particularly since European settlement. The preparation of the EIS and selection of the final project alignment within the study corridor will allow any potential impacts to flora, fauna and aquatic habitats to be identified and assessed. Significant impacts to flora, fauna and aquatic habitats are not anticipated due to the highly urbanised environment within the project corridor and recent experience on other major transport tunnel projects in Brisbane.

Ecological studies will be undertaken to determine the presence, if any, of significant species and the current ecological conditions. Such studies will inform the scope of possible mitigation measures to ensure the existing environmental values are protected from potential adverse effects.

No adverse impacts are anticipated on the Brisbane River or the Ramsar wetlands downstream, principally because much of Cross River Rail is expected to be constructed underground, mostly in bedrock and beneath the Brisbane River.

Predicted impacts will be minimised through sensitive planning and design development. An environmental management plan will be developed to assist in mitigating impacts as part of the EIS.

Geology and groundwater

Construction of the Cross River Rail tunnel has potential to impact the groundwater regime along the corridor.

Potential impacts that will be considered include:

- the potential to intersect open fractures and joints
- consolidation and settlement where the tunnel passes under and drains saturated alluvial sediments
- reduction of available water for groundwater dependant ecosystems due to lowering of the groundwater table
- mobilisation of contaminated groundwater to “drained” sections of the tunnel
- the potential occurrence of acid sulphate soils in low-lying alluvial areas where there is potential for tunnel construction to lower water table levels
- groundwater impacting on or ‘attacking’ concrete and steel
- disposal of inflows to the tunnels during and post construction.

Hydrogeological investigations involving drilling and testing will be undertaken during the detailed feasibility studies to inform the EIS process.

Flooding, water quality and sediment control

Tunnelling will be beneath the bed level of the Brisbane River, greatly reducing the potential for impact on the Brisbane River. The findings from this approach with the Clem7 road tunnel are that impacts on the river system are very unlikely.

Construction works near overland flow paths or smaller local waterways will need to be appropriately managed to ensure that they are protected and that no adverse impacts result in the Brisbane River.

The management of construction water quality and sediment control for major building excavations is well established in the Brisbane City area and will be appropriately assessed and documented as part of the construction planning informing the EIS.

The design of the project will need to achieve design objectives with regards an acceptable flood immunity, and that any works associated with the project do not have adverse effects on existing flood regimes in any of the local catchments.

Any construction work involving excavation has the potential for water quality and sediment impacts if not appropriately managed. Recent experience on other major transport tunnel projects in Brisbane indicates that these potential impacts can be mitigated through the provision of enclosed construction portals, routine controls on surface works and water treatment if necessary before discharge to any waterways. Groundwater discharges may be required at times during underground excavation and any discharges will need to be appropriately treated, and the potential impacts of groundwater drawdown and the induced movement of any existing contamination understood. The EIS will assess these issues.

Spoil and waste management

There is the potential for a significant amount of waste to be generated during construction of the project including demolition materials and construction waste.

The location for the disposal of material excavated from the tunnel has not been selected. Similarly, the method of transporting construction spoil has yet to be determined and will be the subject of feasibility studies informing the EIS. Depending on the nature of the excavated material, there may be an opportunity to exploit a proportion of the spoil as a valuable construction resource.

Studies of the nature and volume of waste materials and spoil will be undertaken as part of the design and construction planning studies informing EIS. The proposal for spoil and waste management will be described and assessed.

Contaminated land investigations will be undertaken as part of the EIS and management procedures developed. The removal of soil from sites registered on the Environmental Management Register will require the approval from the Department of Environment and Resource Management.

Strategies will be developed, in accordance with the waste hierarchy, to avoid where possible, and then reuse, recycle and appropriately dispose of the remainder.

Air quality, noise and vibration

By increasing the use of electric powered public rail transport, it is expected that Cross River Rail will help reduce air quality emissions and road traffic noise across Brisbane into the future, compared to the 'do-nothing' case. This would result in a reduction in the number of motor vehicles that otherwise would use the road network with a corresponding reduction in vehicle exhaust and noise emissions. The potential for corresponding greenhouse and health benefits will be assessed.

The existing residential amenity for individuals along the corridor will need to be understood and protected. Further assessment of the current air and noise conditions will be undertaken as part of the EIS to inform requirements for air and noise migrations during project construction.

Construction experience on other major tunnels and building excavations in Brisbane indicates that potential adverse air quality, noise and vibration impacts can be managed with appropriate and carefully managed mitigation measures. Potential air quality impacts may arise from dust generation during excavation and construction activities, dust released during spoil removal, the distribution of dust by wind, and exhaust emissions from increased traffic and machinery use on site. Noise impacts can result from construction activities and indirectly from regenerated noise due to vibration. Vibration can affect individual amenity, buildings (especially heritage sites due to construction techniques and finishes) and sensitive equipment.

Potential impacts on properties and people near the project sites will be assessed as part of the EIS including the development of predictive models where necessary. Appropriate construction site management practices will be developed to mitigate predicted impacts and monitoring programs set out to ensure required outcomes are achieved. These management programs will be linked with consultation requirements to ensure businesses and residents are kept informed and problems are identified.

It is likely that underground stations and tunnels will have some ventilation requirements to provide fresh air, but in the absence of emissions of pollutants in large quantities, the potential impact on the ambient air quality will be very low. Potential effects of ventilation outlets on the surrounding community and changes in air quality resulting from reduced traffic volumes will be assessed as part of the EIS.

In areas where surface traffic volumes are significantly reduced, it is expected that air quality adjacent to benefited roads will be improved.

There is limited risk of long-term noise or vibration impact since most of the project will be underground. A noise and vibration assessment will be undertaken to determine impacts and any required mitigation measures, especially in areas where the project operational works are on or close to the surface.

5.4 Socio-economic impacts

The project is expected to deliver strong social outcomes at a regional and local level, providing people with a choice of transport mode and improved lifestyles compared to the situation if the project did not proceed. Positive social outcomes expected to result from the project include:

- improved access to services and public transport
- improved amenity, especially in terms of air quality, noise, visual effects and urban renewal
- reduced severance of communities by road traffic
- greater choice and availability of employment opportunities
- improved economic well-being.

There are also a number of potentially adverse effects that may occur in the project corridor, during both construction and operation. These may include:

- land acquisition and potential displacement
- disruption of local access during construction
- effects on community structure and functioning, including severance
- adverse impacts on residential and workplace amenity.

A social impact assessment will be undertaken as part of the EIS and include consultation with the community to identify issues, both positive and negative, and the development of appropriate measures to address these.

The economic impacts, both positive and negative, will also be evaluated, and the impacts of and opportunities for the project on local businesses and urban renewal will be considered.

Property impacts and severance

The construction and delivery of Cross River Rail will involve the acquisition of properties in the vicinity of the portals and the stations. Some land acquired for construction will also be required to support the operation of Cross River Rail. Land will also be acquired volumetrically to support the passage of the project beneath the surface.

The process of acquiring interests in land on the surface and in strata may be undertaken through the provisions of the *Acquisition of Land Act 1967* and the *Transport Planning and Coordination Act 1994*. Any future acts on land on which native title has not been extinguished will need to be consistent with the *Native Title Act 1993 (Commonwealth)* and the *Native Title (Queensland) Act 1993*.

Impacts on properties directly affected by construction will be assessed and may include redevelopment of some properties directly above station locations, or cut and cover works near tunnel portals. Properties immediately adjacent to construction areas may experience some construction impacts such as vibration and the EIS will assess these potential impacts and develop appropriate mitigations.

Property severance, if any, as a result of the project is expected to be minor given that most of the project will be constructed in tunnel and stations underground. There may be impacts on future development above and immediately adjacent to the underground sections of the project. This will be assessed during the EIS including related issues associated with the acquisition of volumetric title required for the underground sections of the works.

Changes in the tenure of affected land may occur, and the rationalisation of final tenure arrangements will be considered as the project progresses.

As a consequence of the proposed investment and benefits delivered by Cross River Rail, changes in land use are expected to occur, over time, at key locations along the project alignment.

The conversion of land usage along the route may be required at proposed stations, portals and ventilations outlets, with current land usage (residential, commercial, industry, exhibition land) replaced by rail transport infrastructure and facilities. Some of these locations are governed by specific legislation (primarily the RNA Exhibition Grounds) or are under a planning regime administered other than by Brisbane City Council (Bowen Hills Urban Land Development Area). The process of dealing with land use changes will be developed throughout the EIS.

Cultural heritage

Consultation with local indigenous groups and the Cultural Heritage Branch of the Department of Environment and Resource Management will be undertaken to determine if there are any sites of indigenous significance within the project corridor. It is possible that there are sites of significance to

the indigenous people of the area. Their input will be sought as part of an indigenous cultural heritage study will be undertaken across the project corridor as part of the EIS.

Cross River Rail is very likely to pass by or beneath a number of listed heritage sites and the potential exists for direct or indirect (vibration) effects to occur during construction. A detailed assessment of the potential impacts of the proposed works on all buildings along the final route will be undertaken during the EIS, especially heritage-listed structures or other buildings of historic interest.

The project is not anticipated to have any adverse impacts on cultural heritage but will enable greater access to buildings and places with cultural heritage values in inner Brisbane and throughout South East Queensland. Assessments will be undertaken as part of the EIS of all matters relevant to cultural heritage to ensure that any potential impacts are predicted and mitigations provided to ensure no discernable adverse impacts occur. This will include the assessment of the potential effects of construction on all adjacent structures, with particular attention to the potential effects of vibration.

Urban design, landscape and visual effects

Most of the project is anticipated to be underground and accordingly there will be relatively low impacts on the landscape, with any minor impacts related to portal areas, underground station access points and temporary construction sites. Above ground station components will be designed to complement and enhance the local urban design environment. The assessment of visual impacts is often subjective and consultation will be undertaken as part of the EIS to identify preferred visual approaches.

Economic

Traffic congestion is a growing problem in South East Queensland, and as the region continues to grow, congestion will worsen. Congestion stifles productivity and bears a significant economic cost. By 2020, it is expected that congestion will cost the Brisbane economy around $3 billion per annum if current trends continue (Urban Transport Challenge, p.3). In the longer term and if the whole of South East Queensland is considered, this cost will be substantially higher. Cross River Rail will provide vital public transport to cut congestion, providing access to job markets and remove cars from the roads, helping to maintain highway capacity for the shipment of goods and services (APTA, 2003). High quality public transport reduces traffic congestion by attracting travellers who would otherwise drive. Studies show that as public transport services improve, congestion levels on parallel roadways tend to decline (Litman 2009, p11).

The project will strongly influence the shape, economic diversification, and accessibility of the city over the next 30 years, and support future employment and population growth and distribution in the Brisbane CBD and broader inner city area. The project is a key component of an inner city transport and land use strategy, currently being jointly developed by the state government and Brisbane City Council. Without the increase in capacity to that network that will be delivered by the project the future productive output of the capital would be significantly diminished.

Good public transport is vital to successful urban areas, enabling people to access jobs and services, employers to access labour markets, and businesses to reach customers for their services. There are well-established links between improved transport efficiency and economic growth. Maintaining adequate rail service and access is vital for the economic well-being of Queensland's largest city.

Further benefits will be derived for rail freight movements across the Brisbane urban area, providing improved access to the Port of Brisbane and support for the Australian Trade Coast industry base.

Preliminary economic assessment undertaken has indicated substantial benefits available from the Cross River Rail investment. Environmental impact studies will include comprehensive cost benefit assessments as part of a wider economic assessment that will include all significant economic benefits and impacts of the project.

5.5 Built environment

The project will have a positive impact on the built environment within the project corridor through the provision of an underground public rail transport facility, hence reducing the impact of motor vehicles on the city and reducing the need for surface road transport infrastructure and parking.

The impact of construction on building, especially from vibration, will be assessed and mitigations determined as part of the EIS.

The project may enable significant urban renewal opportunities at stations and nearby areas in the CBD and at other locations along the project corridor including Woolloongabba and Bowen Hills. High quality public transport can help reduce social disadvantage by providing opportunities for affordable housing at transit oriented developments and access from more remote cheaper housing areas. The new rail corridor would promote sites for infill development, and activate a range of land use opportunities at locations along the corridor, both large and small in scale.

5.6 Hazard, risk and health and safety

There are a number of potential hazards, risk and health and safety issues that may occur during Cross River Rail. The project may also provide health and safety benefits including improved separation of passenger and freight services, improved station facilities and accessibility, and resulting improved rail passenger safety.

Construction activities that may generate a hazard include:

- operation of vehicles and construction equipment in the confined tunnel space with resulting increased risk levels from spillages, fire and poor air quality
- operation of vehicles and construction equipment, and the storage of dangerous goods in relatively compact construction sites
- construction failures and accidents including tunnel collapse or subsidence, flooding and worker injuries and death
- the use of oils, fuels and other dangerous goods including explosives, and their transport to construction areas
- increased traffic risks as a result of the transport of excavated materials to disposal areas.

Operation activities that may generate a hazard include:

- passenger safety incidents including personal safety and injury
- staff accidents and incidents in the tunnel during maintenance works
- major train incidents including derailment and fire
- acts of terrorism leading to major fires and explosions resulting in injury to passengers and staff

- tunnel and other structural components collapse, subsidence or failure
- flooding and inundation from both surface and groundwater sources.

Further risk studies will be undertaken during the EIS and effective mitigations developed and documented. Consultation will be undertaken with relevant government agencies on issues such as fire and life safety, disability access and personal safety through design.

6 Environmental management

An environmental management plan will be developed as part of the EIS. The environmental management plan will seek to address the full range of aspects related to the project including design, construction, operation and maintenance. The intent of the environmental management plan is to outline the measures that are proposed to be implemented to manage the impacts of the project on the environment.

The environmental management plan will be used to assist in the compliance to applicable environmental legislation, best practise environmental management and local authority requirements. Throughout the project the plan shall be reviewed and updated periodically to reflect the knowledge gained and experiences encountered.

The environmental management plan would address:

- design requirements
- pre-construction activities
- construction/ commissioning
- operation.

7 References

The following documents or studies are referred to within the Cross River Rail IAS:

- South East Queensland Regional Plan 2009-2031
- South East Queensland Infrastructure Plan and Program 2009-2026 (Litman 2009, p11)
- Transport Plan for Brisbane 2008–2026
- Draft Connecting SEQ 2031: An Integrated Regional Transport Plan for South East Queensland
- City Centre Master Plan
- City Centre Neighbourhood Plan
- CityShape Implementation Strategy
- Bowen Hills Development Scheme
- BITRE Working Paper 71, 2007
- National Institute of Economic and Industry Research
- Department of Environment and Resource Management Wildlife online database
- City Plan
- Inner City Rail Capacity Study (2008).