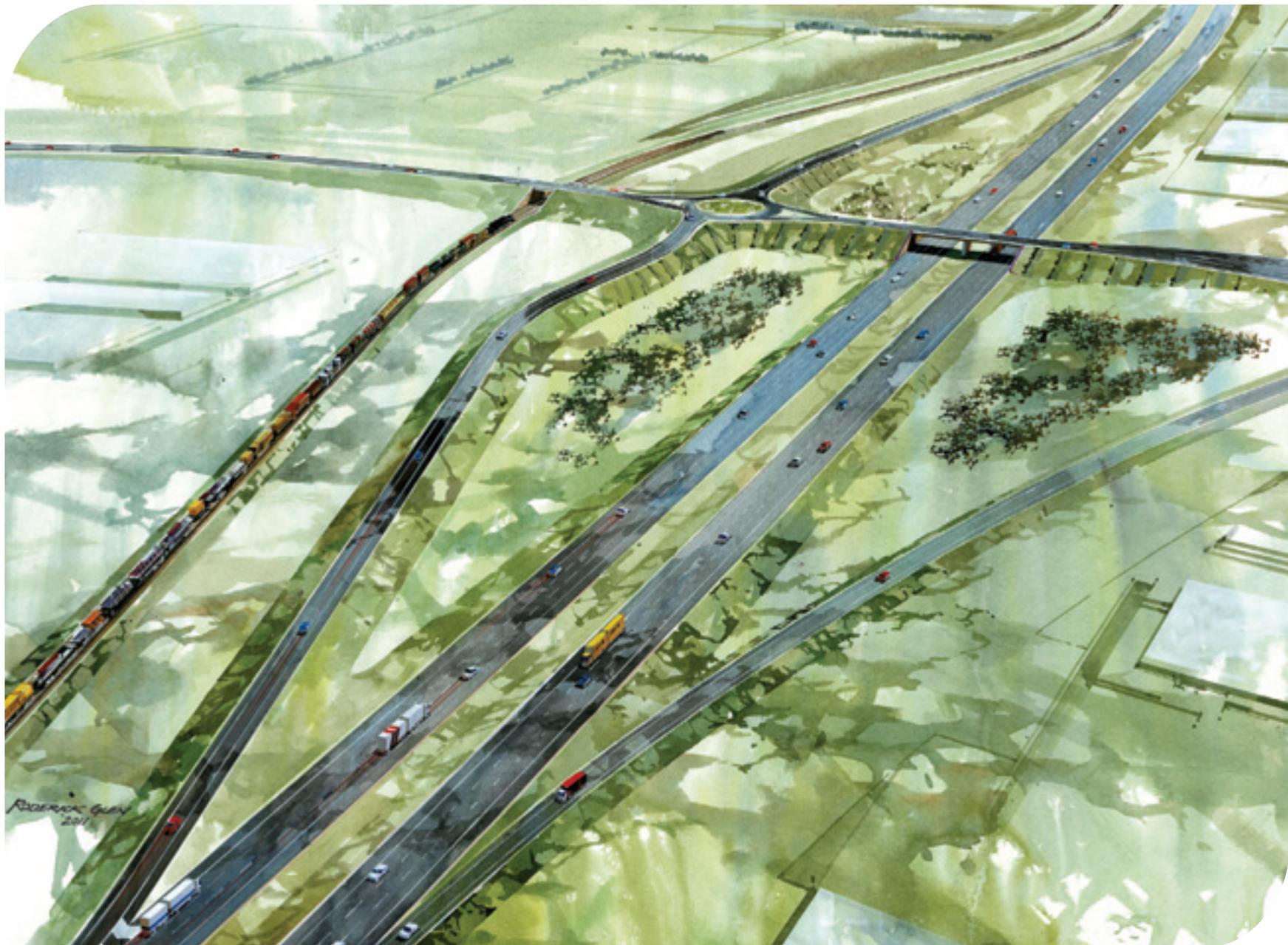


DELIVERING OUR TRANSPORT FUTURE NOW

north-south corridor northern connector



Project Impact Report Volume 1

An environmental, social and economic assessment



Government of South Australia

Department for Transport,
Energy and Infrastructure

DELIVERING OUR TRANSPORT FUTURE NOW

north-south corridor northern connector



Executive Summary

Project Impact Report Volume 1

An environmental, social and economic assessment



Government of South Australia
Department for Transport,
Energy and Infrastructure

DELIVERING OUR TRANSPORT FUTURE NOW

north-south corridor

northern connector



Project Impact Report Executive Summary
An environmental, social and economic assessment



Government of South Australia
Department for Transport,
Energy and Infrastructure

Contents

The Northern Connector	2	Socio-economic	25
The project area	5	Planning, zoning and land use	25
Features of the Northern Connector	5	Traffic and transportation	26
Project timeframes	5	Future traffic demands	26
Strategic importance of the Northern Connector project	10	Arterial roads	26
Need for the project	10	Local roads	26
Benefits of the proposed Northern Connector	12	Aboriginal heritage and Native Title	28
Economic and social	12	Native Title	28
Environmental	12	Aboriginal heritage	28
Development of the Northern Connector project	13	Water quality, drainage and flooding	28
Road and rail route development	13	Air quality	29
Amendments to the preferred road and rail route	13	Non-Aboriginal heritage	30
Proposed route	13	Geology, soils and site contamination	30
Environmental impact assessment process	16	Urban design, landscape and visual assessment	31
Community and stakeholder engagement	16	Greenhouse gas, sustainability and climate change	32
Project Description	17	Sustainability	32
Road corridor, interchanges and local road access	17	Greenhouse gas emissions	32
Rail corridor	18	Climate change	32
Shared-use path	18	Measures to manage and mitigate impacts	33
Stormwater and drainage	18		
Wetland impacts and proposed offset areas	19		
Existing wetland function	19		
Wetland impacts	19		
Wetland impact mitigation	19		
Construction	21		
Operation	21		
Road	21		
Rail	21		
Project Impacts	22		
Flora and fauna	22		
Flora	22		
Fauna	22		
Flora and Fauna impact mitigation	23		
Noise and vibration	24		
Construction noise	24		
Construction vibration	24		
Operational road noise	24		
Operational rail noise	24		
Operational vibration	24		

The Northern Connector Integrated Road and Rail Transport Corridor

The release of the Project Impact Report is a key aspect in determining the appropriate location and extent of the project to enable a corridor to be defined for future construction

The Northern Connector (the project) will be an integrated road and rail transport corridor comprising a new 15.6 km expressway standard road with three lanes in each direction, a 30.9 km single track, national freight rail line, and a shared-use path for cyclists and pedestrians. It will be located in Adelaide's outer northern metropolitan area, about 12 kilometres north of Adelaide's central business district (Figure 1).

The road component will run west of the existing Port Wakefield Road, from the new Northern Expressway interchange with Port Wakefield Road in the north to the Port River Expressway and South Road interchange in the south. The rail component will primarily be located to the western side of the Northern Connector road carriageway, and link with existing rail lines at Virginia to the north, Dry Creek to the south and Port Adelaide to the west (Figure 2).

The project has been developed in response to *South Australia's Strategic Plan* and to *The 30-Year Plan for Greater Adelaide*, which forecasts a significant increase in population growth, road and rail traffic and economic expansion in the northern Adelaide region.

The Northern Connector forms a critical component of Adelaide's North–South Corridor extending from Gawler to Old Noarlunga, as identified in the *Strategic Infrastructure Plan for South Australia: 2010 Discussion Paper*.

The Northern Connector project has also been listed as a 'project with real potential' by the Australian Government. Infrastructure Australia has identified the national significance of the project and the clear and positive

contribution it would make to achieving Australia's policy goals.

The Northern Connector road would form a new link in the Adelaide Urban National Land Transport Network. It would link the Adelaide–Perth/Darwin corridor, mining activity in the states north, the Adelaide–Sydney corridor, areas of the Riverland and Barossa Valley in South Australia, and the Sunraysia area in New South Wales and Victoria, with key freight destinations in Adelaide's north-western suburbs, including the Port of Adelaide, rail terminals, industry zones and Adelaide Airport.

Completion of the road link would enable a largely unimpeded journey from Port Wakefield, the Mid North, Barossa Valley and Riverland to the Port of Adelaide and Adelaide's future non-stop North–South Corridor (incorporating South Road Superway).

The Northern Connector national freight rail line will link the existing freight rail line at Virginia to Dry Creek and Port Adelaide, and make a more efficient north–south link for Perth to Melbourne freight trains and east–west link between Dry Creek and Port Adelaide

The release of this Project Impact Report is part of the project's planning and environmental impact assessment processes. The document is a key aspect in determining the appropriate location and extent of the project to enable a corridor to be defined for future construction of the project.

DTEI is currently seeking and investigating funding for the construction of the Northern Connector project. If approved and funded in the near future, construction could be completed by 2017.



Figure 1. Location Plan



- Northern Connector road
- - - - Northern Connector rail
- Northern Expressway
- - - - South Road Superway
- Road
- - - - Rail
- - - - Existing main roads
- - - - Existing railway line

- ▨ Bolivar Wastewater Treatment Plant
- ▨ Industrial areas
- ▨ Cheetham Salt Ltd salt fields



Source: DEH, DTEI, DPLG

Figure 2 The Northern Connector proposed road and rail route



- Northern Connector road
- Northern Connector rail
- - - Spur line to Port Flat siding
- Northern Expressway
- South Road Superway
- Existing roads
- + + + Existing railway

The project area

The Northern Connector project, located in Adelaide's outer northern metropolitan area (Figure 1), will pass through three council areas — City of Playford, City of Salisbury and City of Port Adelaide Enfield — and the suburbs of Virginia, Waterloo Corner, St Kilda, Bolivar, Globe Derby Park, Dry Creek, Wingfield and Gillman.

The project area has been zoned into

three sections (Figure 2) to facilitate planning, design and assessment of the corridor:

- Northern section (Figure 3a) — relatively low population agricultural land, typically used for horticulture
- Central section (Figure 3b) — adjacent to and immediately east of the SA Water Bolivar Wastewater Treatment Plant

- Southern section (Figure 3c) — incorporates Globe Derby Park, with a small population of residents on semi-rural land holdings used for horse agistment and training facilities; open land primarily used for salt production and Greenfields and Barker Inlet wetlands; vacant land at Gillman; and the more densely populated urban industrial area of Wingfield.

Features of the Northern Connector Integrated Road and Rail Transport Corridor

The Northern Connector project has the following key features:

- a new 15.6-kilometre road, three lanes in each direction, between the Northern Expressway and South Road–Port River Expressway junction
- 120 metre wide corridor enabling future widening of the road carriage ways and duplication of the rail line
- four road interchanges:
 - Northern interchange (Figure 3a)
 - Waterloo Corner interchange (Figure 3a)
 - Bolivar interchange (on-ramp) (Figure 3b)
 - Southern interchange (Figure 3c)
- 1-in-100 year flood immunity
- wide median between the two road

carriageways and outer roadside shoulders

- a system of swales and detention basins to receive and, where appropriate, detain stormwater
- approximately 31 kilometres of standard gauge, single-track freight rail line and a maintenance/access track, generally located to the west of the road carriageways, consisting of a new 24.7 kilometre north–south link for Perth to Melbourne freight trains (from north of Northern Expressway to Dry Creek) and a 11.5 kilometre east–west link between Dry Creek and Port Adelaide
- four rail bridges separating rail freight from road traffic
- two 2-kilometre passing loops at Gillman and north of Waterloo Corner interchange

- a shared-use (pedestrians and cyclists) path
- Barker Inlet north wetland modifications
- wetland offset or rehabilitation areas (for flood storage, water quality treatment and habitat)
- swale drains and detention basins
- landscaping
- Port Wakefield Road–Waterloo Corner and Port Wakefield Road–Bolivar Road intersection upgrades to connect to the Northern Connector interchange ramps.

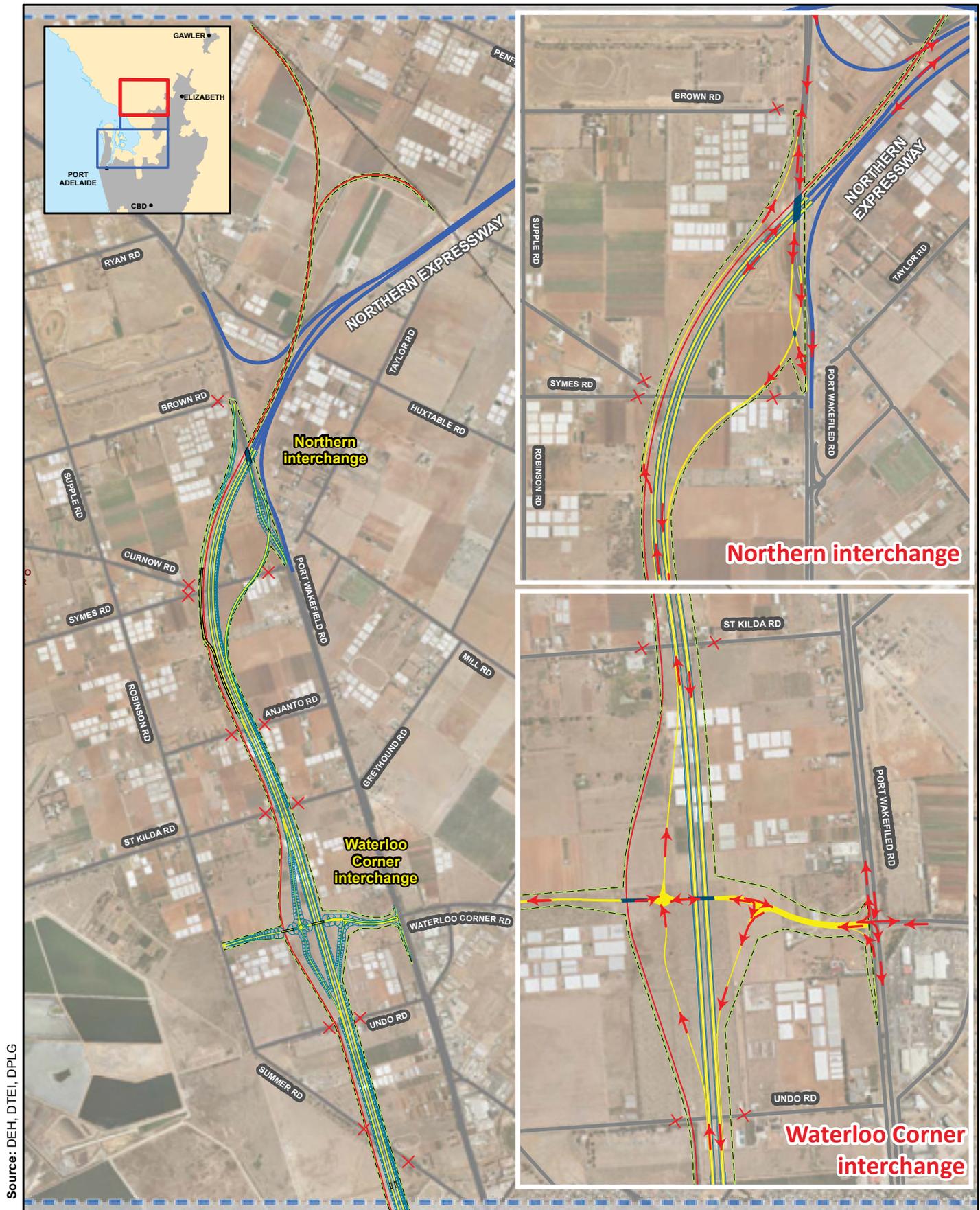
Typical cross-sections for the corridor are shown in Figures 4a and 4b.

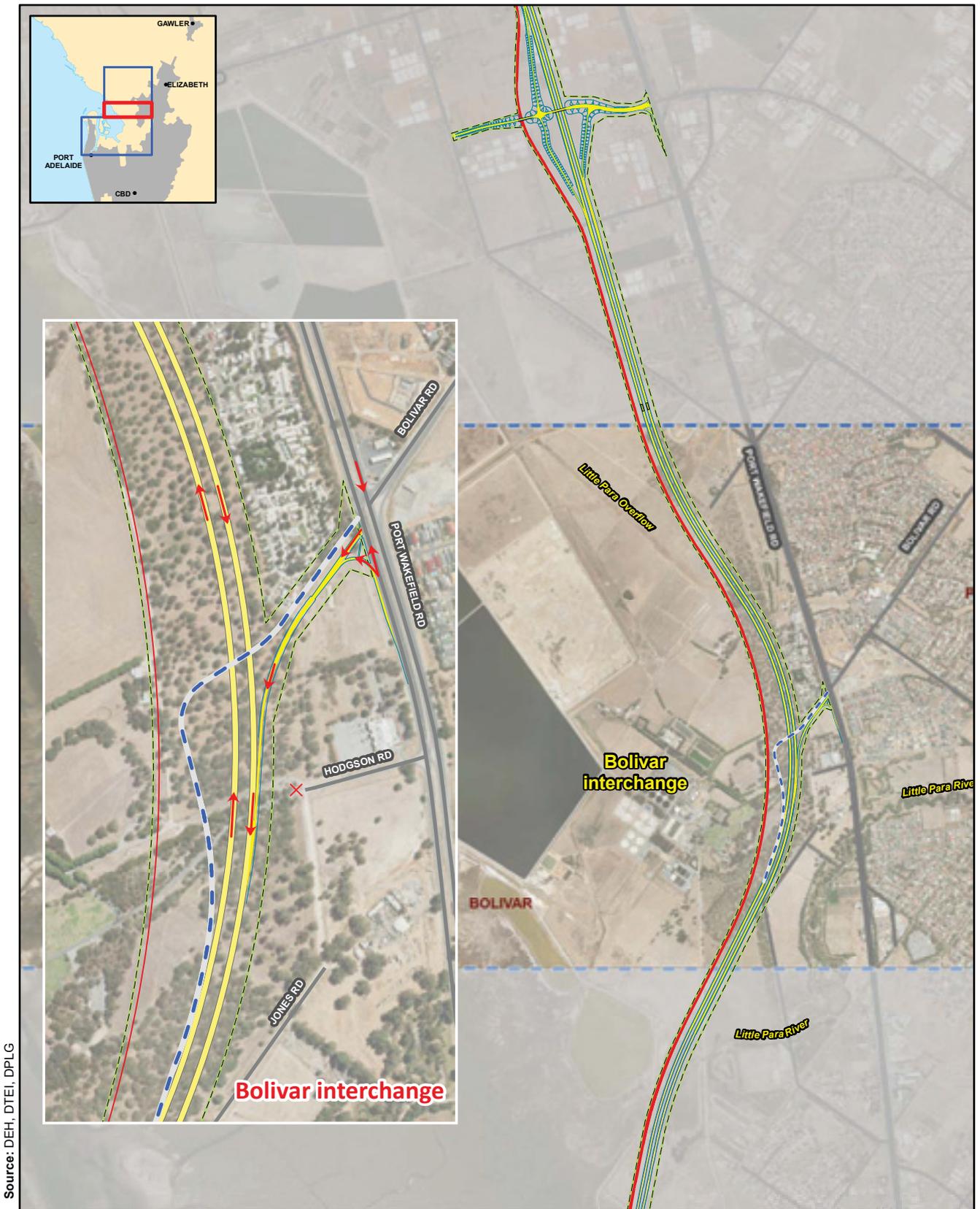
Further details on the project features can be found under the *Project Description* in this document.

Project timeframes

Table 1 outlines the project's indicative timeframes

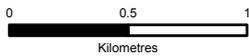
Table 1. Indicative project timeframes	
Concept design (preferred route)	2009
EIA process and finalisation of proposed route	2010–October 2011
Minister approval of proposed route	November 2011
<i>If funding obtained:</i>	
Land acquisition and pre-construction works	2013-14
Detailed design and construction	2014-17
Open Northern Connector	2017





Source: DEH, DTEI, DPLG

Figure 3b Horizontal alignment - Central section



- Northern Connector road
- Northern Connector rail
- Northern Connector boundary
- Existing railway
- Existing roads
- Possible future (post 2031) north bound off ramp for potential new growth area at Bolivar (Currently under investigation) As indicated in 30 year plan for Greater Adelaide Not part of current project scope
- Traffic Direction
- × Roads Closed



Source: DEH, DTEI, DPLG

Figure 3c Horizontal alignment - Southern section



- Northern Connector road
- Northern Connector rail
- - Spur to Port Flat siding
- Northern Connector boundary
- South Road Superway
- Existing roads
- Existing railway
- ← Traffic Direction
- - - Possible future Globe Derby Park interchange

For potential urban growth area
As indicated by 30 Year Plan for Greater Adelaide
Not part of current project scope

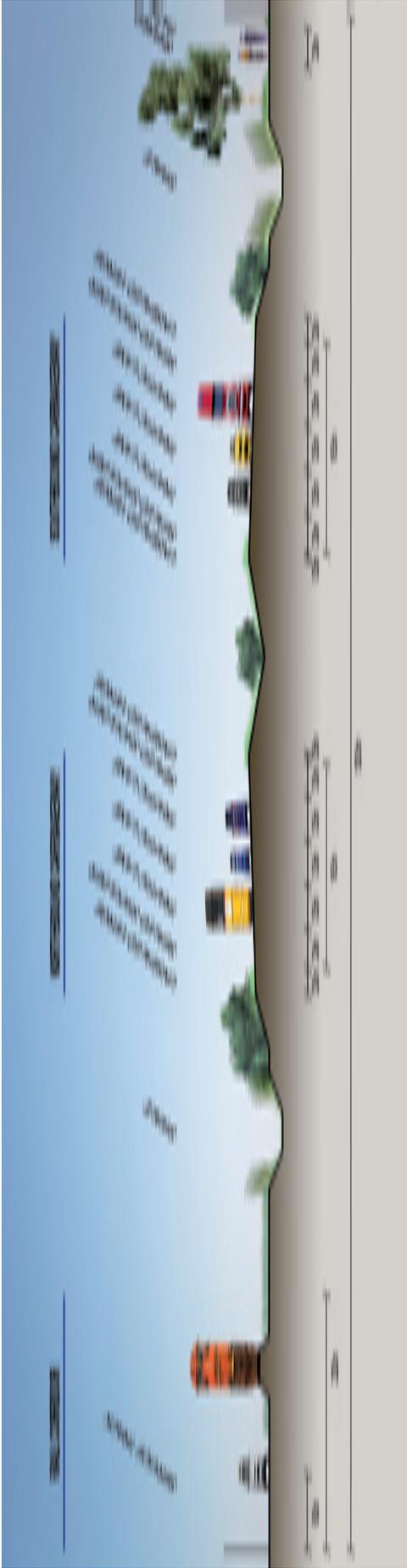


Figure 4a. Typical corridor cross-section north of Dry Creek salt fields (Northern and Central sections)

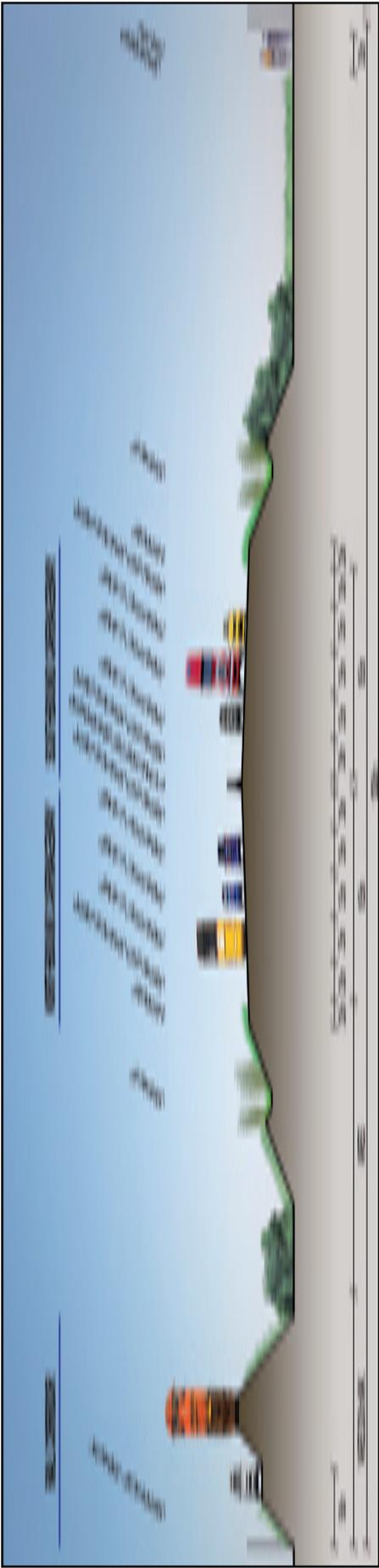


Figure 4b. Typical corridor cross-section in Dry Creek salt fields (Southern section)

Strategic importance of the Northern Connector project

The Northern Connector would create the necessary system-wide accessibility improvements to support major economic activity in the northern and western regions, and also create greater certainty as a catalyst for new investment in the state.

The Northern Connector would also help realise much of the capital and ongoing investment into industry, business and infrastructure in several regions, including the Outer Harbor Osborne Maritime precinct, inner harbour region, north-west industrial crescent, Wingfield Industrial region, Economic Development Precinct in Gillman, Defence SA in Port Adelaide, Greater Edinburgh Parks industrial and commercial region, and Technology Park (Figure 5).

The Northern Connector will contribute to, or facilitate, the achievement

of policy outcomes and objectives for Australian and South Australian Governments, namely:

Australian government policies

- Our Cities, Our Future: A national urban policy for a productive, sustainable and liveable future
- Capital Cities Strategic Planning
- Infrastructure Australia: A Report to the Council of Australian Governments Report
- Infrastructure Australia: Getting the Fundamentals right for Australia's Infrastructure Priorities
- National Land Freight Strategy: Discussion Paper
- National Transport Policy Framework
- Adelaide Urban Corridor Strategy:

Building Our National Transport Future

South Australian government policies

- South Australia's Strategic Plan
- The 30-Year Plan for Greater Adelaide
- Strategic Infrastructure Plan for South Australia
- Economic Statement: South Australia's Prospects for Growth
- 2010 Housing and Employment Land Supply Program
- It will also support a number of regional planning objectives including:
- Housing Plan for South Australia 2005
- Development of Horticultural Industries on the Adelaide Plains: A Blueprint for 2030.

Need for the project

The need for the Northern Connector comes from:

- National and regional economic drivers - the project will facilitate future economic growth and development in the broader Northern Region of Adelaide and the Barossa Region (Figure 5).
- Regional growth - Substantial population and business growth is predicated to occur in the Northern Adelaide region in the near future. The resulting increase in freight and commuter traffic will place additional stress on existing transport infrastructure, which could limit regional and economic growth if not improved.
- Travel efficiency - Forecast population growth, combined with expanding industrial activity in the northern region and increased trade and freight movements to and from the Port of Adelaide, the airport and the

North-South Corridor, will increase traffic delays and congestion, particularly on Port Wakefield Road, if not addressed. Port Wakefield Road is expected to reach its traffic capacity by 2016, resulting in unacceptable congestion and delays for a National Network Link.

- Road safety - With the expected increase in traffic volumes across the Adelaide metropolitan road network, crash rates along Port Wakefield Road are expected to increase. A continuous, uniform standard of road that provides a safe, high quality road environment has been statistically proven to reduce the number of serious road crashes and fatalities.
- Rail and road safety - Freight trains currently operate at high frequencies through densely populated areas like Salisbury, resulting in increased traffic congestion at railway level crossings with arterial roads and increased

potential for traffic accidents. Currently, there are eleven level crossings (to the Port of Adelaide), some of which have been the sites of serious traffic accidents.

- Amenity (road) - As Port Wakefield Road approaches capacity by 2016, it will become increasingly difficult for residents to access. The amenity value for residences adjacent to Port Wakefield Road will decrease with increased noise and air quality impacts.
- Amenity (rail) - Dense residential areas (e.g. Salisbury, Parafield Gardens, Mawson Lakes and Ottoway) adjacent to the existing freight rail line will be exposed to increased noise levels as rail freight frequencies increase.

The benefits of the Northern Connector project addressing these needs are identified on page 12.

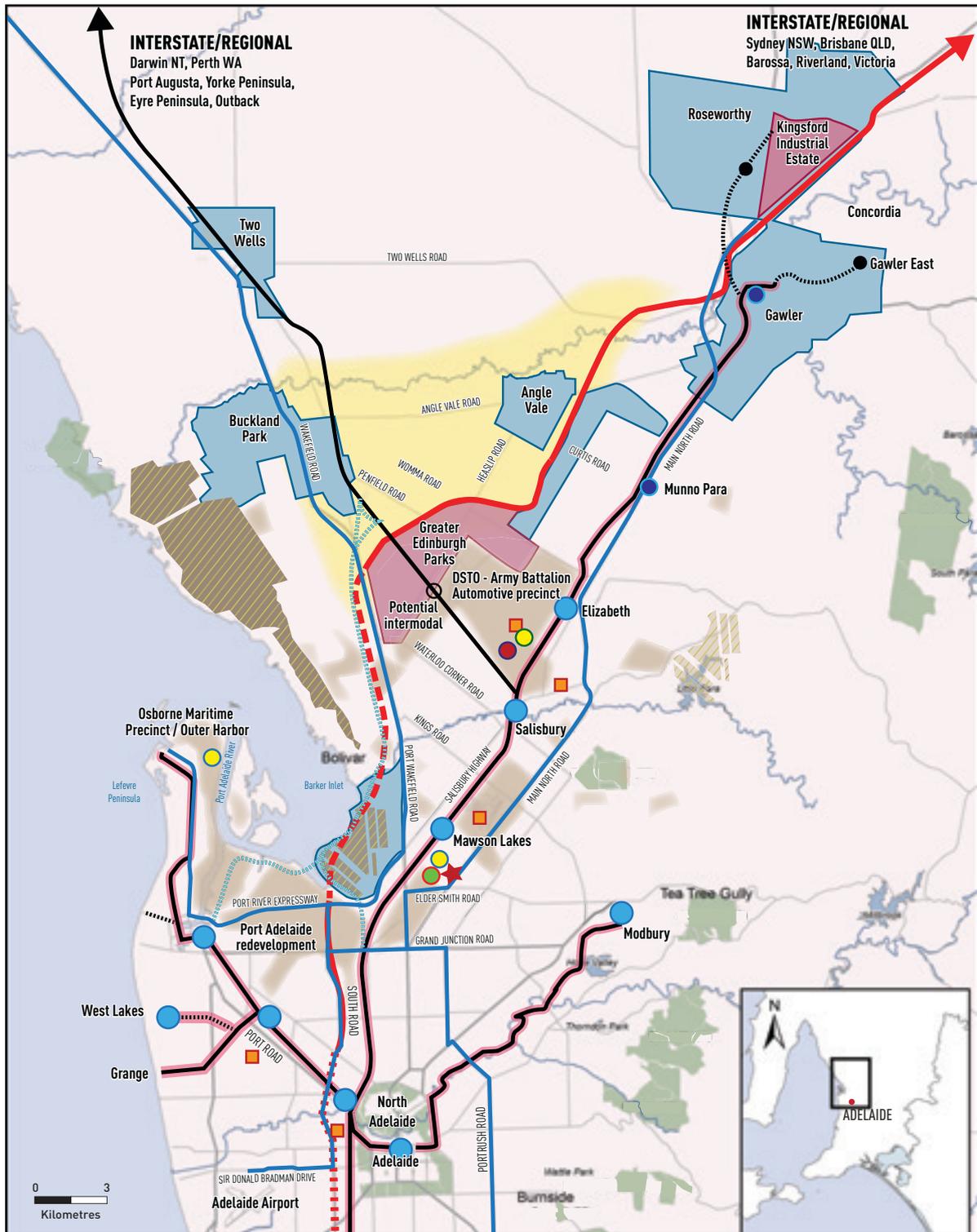


Figure 5 Current and future regional transport and industrial generators

- | | | |
|--|--|---|
| Planned urban land | Transit oriented development | Major road network |
| New strategic employment | Major district centre | Existing mass transit |
| Existing key industry | Planned district centre | Northern Connector rail |
| Adelaide Plains food bowl | Key other employment centre | Major corridor (fixed line) |
| | Science, technology, innovation | Constructed/committed freeway |
| | Manufacturing hub | Northern Connector road |
| | Defence hub | North-South Corridor |
| | University | Wetlands |

Benefits of the proposed Northern Connector

Economic and social

- Provide the critical link in a free flowing strategic Adelaide North–South Corridor from Gawler to Old Noarlunga
- Improve freight connections between the Port of Adelaide and the Riverland and Barossa Valley to the east, Perth to the west, and Darwin, Olympic Dam and other significant mining operations to the north
- Improve safety for road users by reducing freight traffic and conflicts at at-grade intersections, particularly from Port Wakefield Road
- Improve traffic conditions and access for road users and local communities along Port Wakefield Road and Main North Road
- Improve freight efficiency and export opportunities
- Provide a safer, faster road connection to suburban destinations such as Adelaide Airport, sporting venues, beaches and businesses in the southern and western suburbs
- Reduce travel times for commuters travelling to and from the northern suburbs
- Improve safety for pedestrians and road users, by reducing freight rail traffic through suburban areas east of Port Wakefield Road
- Improve amenity and environmental sustainability, by reducing traffic congestion, there would be reduced travel times, and improved fuel efficiency, local air quality conditions and noise for residents living adjacent to Port Wakefield, including the suburbs of Paralowie and Parafield Gardens
- Improve amenity for residents living adjacent the existing rail freight corridor in the suburbs of Salisbury North and South, Parafield Gardens, Mawson Lakes and Ottoway
- Improve traffic conditions and reduce delays for road users through the reduced numbers of freight trains and passenger trains using the existing line
- ‘Unlock’ commercial and industrial development opportunities along the corridor, including the Economic Development Precinct in Gillman and Defence SA in Port Adelaide
- Support nationally significant industry sectors in the Northern Adelaide region and beyond – agribusiness, manufacturing, automotive, defence, transport and storage, mining and energy production – with an efficient transport network to deliver exportable goods to South Australia’s transport hubs
- Facilitate a freight transport mode shift from road freight to rail freight
- Rail freight transport efficiencies through higher speed and shorter connection to port and intermodal facilities
- Improved access to Adelaide and the Port of Adelaide for rail freight transport travelling from the north and west of country South Australia
- Provide a benefit cost ratio of 5.2 and a net present value (NPV) of \$1678.0 million (see Chapter 5 of the Project Impact Report for more information)
- Create approximately 1662 jobs per year, for a construction period of 3 years (see Chapter 5 of the Project Impact Report for more information)

Environmental

- Reduce the environmental impact of heavy rail freight transport through suburban communities
- Increase the area of wetland habitat in the northern Adelaide region through wetland offset development
- Improve stormwater treatment through modifications to existing wetlands and wetland offset development
- Enhance biodiversity of the northern Adelaide region through rehabilitation of existing wetlands and construction of new wetlands
- Enhance biodiversity of the region by landscape planting using indigenous species
- Improve visual amenity with landscaping and urban design opportunities
- Reduce overall vehicle emissions due to smoother traffic flow
- Reduce greenhouse gas emissions from the ‘do nothing’ scenario

Development of the Northern Connector project

A number of environmental, social, economic and engineering assessments and investigations have been undertaken to determine the appropriate location and extent of the Northern Connector project.

Preliminary planning assessments before 2008 investigated a number of options including the upgrading of Port Wakefield Road to an expressway standard and the development of a new road corridor for a future expressway to the west of Port Wakefield Road between the Northern Expressway and Salisbury Highway. No provisions were made for a new rail line at that time.

Initial assessments of these two options determined that the environmental, community and business impacts, as well as engineering issues, made a route to the west of Port Wakefield Road preferable. The route was further modified to include twin rail tracks along the central median of the road corridor.

The Strategic Road/Rail Link Planning Study together with the road-rail reference concept was publicly announced by the Minister for Transport in 2008 to enable the community and stakeholders, including local councils and affected landowners, to assess and contribute to the concept.

Road and rail route development and selection of the preferred route

The information gathered from the community, and from further investigations on traffic volumes, engineering, safety and environmental issues, led to the development of three to four corridor options in each of the three project sections (Northern, Central and Southern) (Figure 2). At this time the Southern section was significantly changed, to link more directly to the Port River Expressway and South Road interchange and include more lanes in each direction.

A number of different road route Options (Figure 6) were further

developed and assessed by key project stakeholders, including councils, government agencies and other technical specialists, such as a wetlands designer. The assessment identified a preferred option for each section of the project (Figure 6; route 1A, 2D and 3B); they were further investigated and developed as were a number of interchange options, sited at Northern Expressway–Port Wakefield Road, Waterloo Corner, Bolivar, Globe Derby Park and South Road–Port River Expressway.

The assessment also identified a rail freight route in the Southern section (Figure 6, rail option B) that would connect to the existing rail freight line at Kings Road, Virginia and the Outer Harbor line turnout at Dry Creek south rail yards.

The preferred (selected) road and rail route was announced by the Minister for Transport in July 2009, to enable further community input to the planning process.

Amendments to the preferred road and rail route

After this announcement, outcomes of detailed environmental, social, economic and engineering investigations prompted further modifications to the road and rail route and interchange layouts:

Road and interchange

Reduction from four lanes to three lanes in each direction. Upon further analysis and assessment it was determined that three lanes in each direction provides adequate functionality to meet the needs of long distance trips whilst Port Wakefield Road will provide for efficient movement of local trips. The corridor width will enable further road widening/upgrades when required in the future

Route shifted further to the east through SA Water Bolivar Wastewater Treatment Plant

Globe Derby Park interchange removed from the scope of the project (provision

made for it if required for future urban expansion as identified in the 30 Year Plan for Greater Adelaide)

Modified layout of Bolivar and Southern interchanges

Rail

Reduction from dual rail line to a single rail line with two passing loops

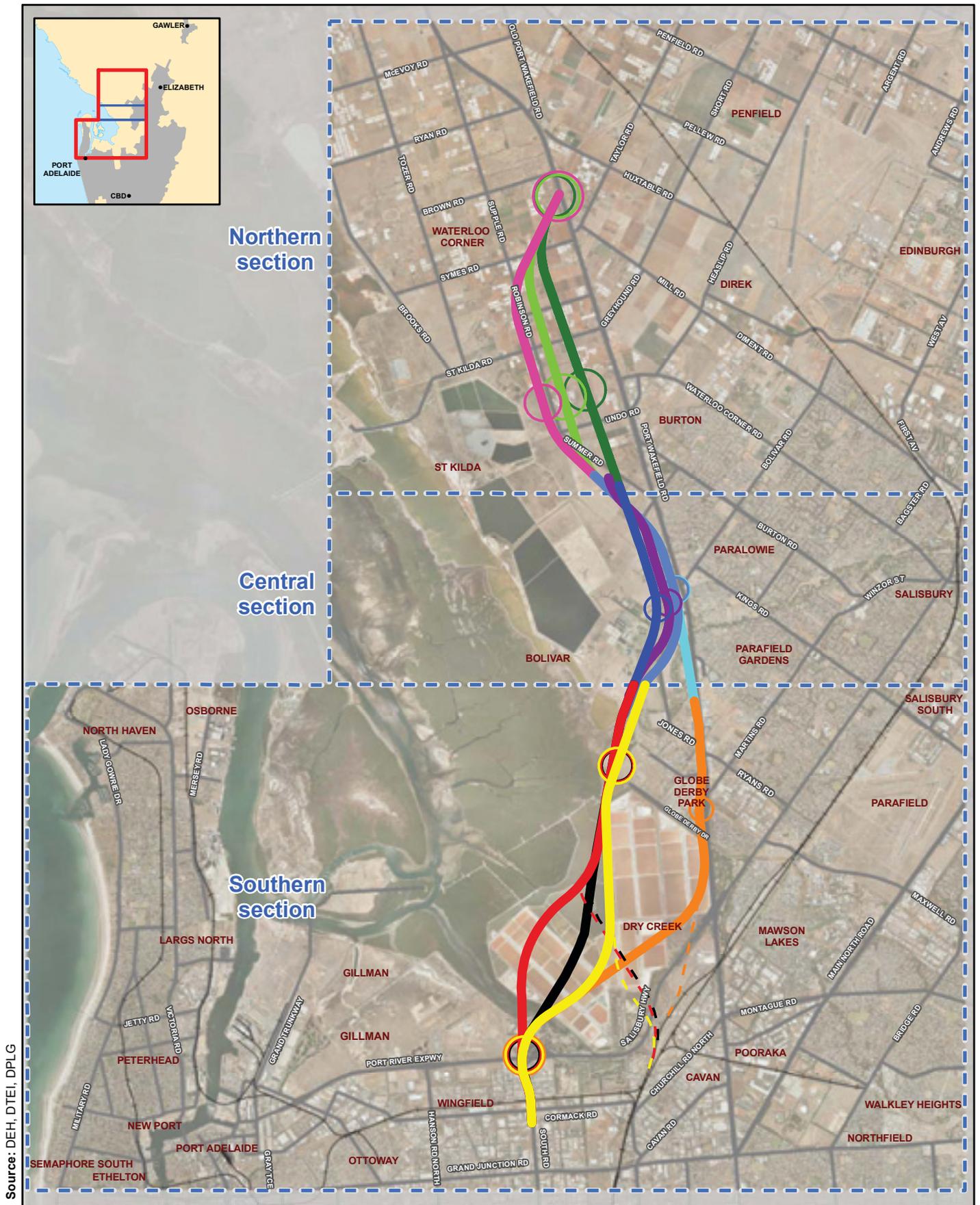
Relocation and redesign of the rail line to run entirely to the western side of the road carriageways with the benefits in the Southern section (Figure 7) of:

- rail corridor acting as a sea wall thereby reducing height and fill requirements for the road corridor
- more direct connections to the Port of Adelaide and the Adelaide rail freight line
- avoiding direct impacts on Greenfields Stage 3 wetlands and the threatened birds and their habitats in that wetland
- minimising impacts on the operation of the Dry Creek salt fields (previous rail route bisected the salt fields)
- maximising land available for possible urban expansion area in Dry Creek salt fields (identified in The 30-Year Plan for Greater Adelaide)

Northern Connector Integrated Road and Rail Transport Corridor - proposed route

Figure 2 shows the proposed road and rail route for the Northern Connector Integrated Road and Rail Transport Corridor, with these amendments. It is described and assessed in the Project Impact Report.

Throughout the design phase, modifications will continue to be made to the road route, interchanges and rail route in response to community feedback and well as engineering, safety, social, environmental and economic considerations. Any modifications requiring additional investigations and assessment will be presented in a Supplement Report.



Source: DEH, DTEI, DPLG

Figure 6 Alternative routes considered



Interchange location
 NB: colours of interchange circle corresponds to the colour of its option(s)

- | Road: | | | Rail: | | |
|-------|-----------|--|-----------|--|-----------|
| | Option 3A | | Option 2A | | Option 1A |
| | Option 3B | | Option 2B | | Option 1B |
| | Option 3C | | Option 2C | | Option 1C |
| | Option 3D | | Option 2D | | Option A |
| | | | | | Option B |
| | | | | | Option C |
| | | | | | Option D |



Source: DEH, DTET, DPLG



Figure 7 Alternative rail options considered Southern section

- Northern Connector road
- Northern Connector rail
- - - Spur line to Port Flat siding
- +— Existing railway
- Existing roads

Environmental impact assessment process

The Northern Connector project will not be assessed under the Development Act 1993, as the required land would be acquired under the Highways Act 1926. However, the Department for Transport, Energy and Infrastructure (DTEI) is following an environmental impact assessment process similar to Major Projects processes under the Development Act.

DTEI has prepared a Project Impact Report, essentially an environmental, social and economic assessment, and is engaging the community and stakeholders, holding public displays and encouraging public comment. The subsequent Supplement Report will

address issues raised during the public comment period.

A referral for the project will be submitted, under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), to the Department of Sustainability, Environment, Water, Population and Communities as the project has the potential to impact on Threatened and Migratory species. Should the Australian Government determine that the project has significant impacts on Matters of National Environmental Significance, assessment and approval under the EPBC Act would be required.

Community and stakeholder engagement

The two main community and stakeholder engagement processes undertaken are:

- communication — activities focused on delivering factual information about the project to all interested parties, including local residents, businesses and stakeholder groups, to increase awareness and understanding of the project
- consultation — discussions between the project team and interested parties to gain detailed information and feedback that enable project impacts and route selection to be assessed.

Community engagement techniques used to date include:

- project information telephone line
- email and website
- one-to-one meetings with property owners
- meetings with local and state government agencies and industry groups
- community forums
- letters and feedback forms.

Overall, most feedback has been positive and identified the benefits of:

- increased safety and reduced traffic congestion on Port Wakefield Road
- travel time savings — faster route between Adelaide's north and the Port of Adelaide
- diverting freight traffic away from local suburban roads
- removing freight trains from suburban rail lines
- possible future land zoning changes.

The most common concerns raised were:

- social and economic impacts of property acquisition
- safety in a multiple use transport corridor
- possible future land zoning changes
- changes to local road access
- community severance
- perceived effect on property values from the proximity of a transport corridor.

The release of the Northern Connector Project Impact Report is a major step in the community engagement process.

The release of the Northern Connector Project Impact Report is a major step in the community engagement process.

Project Description

The key features of the Northern Connector Integrated Road and Rail Transport Corridor are outlined on page 5 of this document. This section provides further details on these features.

Road corridor, interchanges and local road access

The Northern interchange (Figure 3a), in the suburb of Virginia, connects the Northern Connector with Port Wakefield Road and the Northern Expressway.

The main through route (direct and high speed) will be between the Northern Expressway and Northern Connector for vehicles travelling to or from Gawler using the existing bridge at the intersection of the Northern Expressway and Port Wakefield Road. The existing road layout will be modified by taking traffic travelling to and from the Northern Expressway through the central and south spans (openings) of the existing bridge; the freight rail line will use the northern span.

In addition, the Northern interchange will:

- provide a northbound off-ramp from the Northern Connector to Port Wakefield Road for vehicles travelling north to Port Wakefield and beyond
- provide a south bound on-ramp from Port Wakefield Road to the Northern Connector for vehicles travelling to Adelaide
- enable vehicles travelling north and south along Port Wakefield Road to continue using the existing overpass bridge
- retain the southbound off-ramp from the Northern Expressway to Port Wakefield Road.

Road users travelling south from Port Wakefield Road, north of the Northern interchange, and from the Northern Expressway wanting access to Port Wakefield Road and the local road network (including Waterloo Corner Road and Bolivar Road) between this interchange and Salisbury Highway will continue along Port Wakefield Road.

Heading south, the corridor would pass across and thus close:

- Curnow Road
- Symes Road
- Anjanto Road
- St Kilda Road.

Alternative access for these roads would be provided at the Waterloo Corner interchange.

The Northern Connector will connect with Waterloo Corner Road (Figure 3a) at Waterloo Corner interchange to provide a:

- northbound off-ramp from the Northern Connector to the new Waterloo Corner Road extension for vehicles access to Robinson Road, St Kilda, Port Wakefield Road and Waterloo Corner Road
- northbound on-ramp to the Northern Connector for vehicles coming from Robinson Road, St Kilda, Port Wakefield Road and Waterloo Corner Road
- southbound on-ramp to the Northern Connector for vehicles travelling from Port Wakefield Road, Waterloo Corner Road and Robinson Road.

Southbound vehicles for Waterloo Corner Road or Robinson Road will need to access Port Wakefield Road at the Northern interchange.

Continuing south, the corridor will pass across and close:

- Undo Road
- Summer Road
- Hodgson Road.

Alternative access for these roads would be provided at the Waterloo Corner interchange.

The Bolivar interchange (Figure 3b) will have an on-ramp for southbound traffic from Port Wakefield Road and Bolivar Road on to the Northern Connector.

Southbound vehicles for Bolivar Road or the stretch of Port Wakefield Road to Salisbury Highway will need to access Port Wakefield Road at the Northern interchange. Provision for construction of a possible future northbound off-ramp has been allowed for in the corridor, although this is not part of the current project scope.

Motorists wanting to access Bolivar Road and Port Wakefield Road will need to travel from Salisbury Highway along Port Wakefield Road or exit at Waterloo Corner interchange.

Heading south, to the west of the suburb of Globe Derby Park, the corridor enters Dry Creek salt fields. Room has been allowed for in the corridor for the construction of a future Globe Derby Park interchange, should the salt fields change to an urban expansions area (see The 30-Year Plan for Greater Adelaide), just south of Dry Creek (Figure 3c).

Further south, the Southern interchange (Figure 3c), in the Barker Inlet interchange at Wingfield, will connect the Northern Connector with South Road, the Port River Expressway and Salisbury Highway.

The Southern interchange will provide:

- for northbound and southbound traffic flow to and from the Northern Connector and South Road Superway
- a westbound off-ramp from the Northern Connector to Port River Expressway
- a northbound on-ramp from the Port River Expressway to Northern Connector
- an eastbound ramp from South Road Superway to Salisbury Highway
- a southbound ramp from the Salisbury Highway to South Road Superway.

Rail corridor

East of Port Wakefield Road at Virginia, the new standard gauge, single-track freight rail track will start at a turn-out from the existing freight rail line, about 2 kilometres north-east of the Northern interchange. A spur for heading south on the existing rail line from the Northern Connector rail line will be provided and the existing King Road level crossing realigned to allow connection with the existing rail line.

Heading south, the rail line would run to the west of the northbound carriageway of the Northern Expressway and then pass under the Northern interchange bridge (Figure 7a) and continue in a southerly direction to the west of the Northern Connector road carriageway.

The rail corridor would then follow the same route as the road carriageways for the next 12 kilometres (Figure 3a and 3b).

In Dry Creek salt fields, the rail corridor would remain on the western side of the road corridor and act as a sea wall to protect the road from any future sea level rise.

In the south-western extent of the salt fields, the rail line will diverge. One rail line heads south over the Northern



Connector road corridor, passing over Salisbury Highway via a bridge through Barker Inlet South wetland and joining with the existing freight rail line to Adelaide to form an east-west rail corridor connection (Melbourne to Perth via Adelaide).

The second rail line, in the salt fields, heads west, crossing North Arm Creek and skirting the future Gillman industry lands, following the sea wall and connecting with the existing rail line just

south of the Eastern Parade–Grand Trunkway–Perkins Street intersection. The rail line then runs to the Port of Adelaide across the newly constructed Port River Expressway rail bridge over the Port River. This rail line completes an efficient link from northern areas of the state to the Port of Adelaide.

A spur line to the Port Flat siding would also be provided at this location (Figure 3c).

Shared-use path

A three metre wide shared-use path (Figure 4a and 4b) along the corridor will connect the Northern Expressway shared-used path to the cycle/pedestrian facilities along

South Road Superway. It would generally be located to the east of the road carriageways, safely separating pedestrian and cycling activities from road and rail.

At Waterloo Corner the shared-use path would follow the exit ramps to allow cyclists and pedestrians to access local roads without crossing ramps.

Stormwater and drainage

The Northern Connector road and rail corridor will be raised on an embankment for flood protection. A drainage system, constructed in the project corridor, will consist of detention basins, open channels or vegetated swales (drainage lines) and cross culverts.

Side swale lines with vegetation running parallel to the road carriageways would collect runoff from the road pavement and treat the water before discharging to the detention basins.

Bridges and culverts at a number of locations such as Helps Road

drain, Little Para River, Little Para overflow, Dry Creek, North Arm Creek and in Barker Inlet wetlands will maintain stormwater drainage and/or tidal flows.

Wetland impacts and proposed offset areas

Existing wetland function

A number of sensitive environmental areas in the Southern section would be affected by the project, in particular: marine intertidal and freshwater Barker Inlet north wetlands (affected by the road corridor) and freshwater Barker Inlet south wetlands (affected by the rail corridor). Barker Inlet wetlands, together with the adjacent Greenfields wetlands, form a constructed wetland system that has an important role in flood storage, water quality treatment and habitat provision for many threatened and non-threatened fauna species. They are also an area for other activities such as stormwater reuse, environmental tourism and education.



Wetland impacts

The extent to which the Barker Inlet wetland system would be directly affected by the project (based on the current proposed route) is shown in Table 1. These wetland loss areas are based on concept design only and are likely to be refined during the detailed design phase of the project.

Through a relocation of the rail corridor in the Southern section (Figure 7), the important bird (avifauna) habitat areas of Greenfields Stage 3 wetlands are not directly impacted by the project.

existing wetlands are proposed to be offset through a combination of modifications, rehabilitation and revegetation to existing wetlands and/or creation of new wetland offset areas – at a wetland loss to offset ratio of 1:1.5 (each 1 ha impact to the wetlands from the project (Table 2) is offset by 1.5 ha).

Areas of Barker Inlet north wetlands would require modification/reconstruction to allow water flow to continue through the wetland to compensate for the construction impact of the Southern interchange.

Rehabilitation and revegetation

works in Barker Inlet north and south wetlands, Range wetlands and Magazine wetlands would aim to improve their biodiversity and habitat value.

Areas under consideration for construction of new offset wetlands (Figure 9) may consist of marine intertidal and/or freshwater wetlands, and replicate habitat and vegetation types in Barker Inlet and Greenfields wetlands. As well as enhancing biodiversity in the region the new wetlands would provide additional flood storage and improve the quality of water discharged to Barker Inlet.

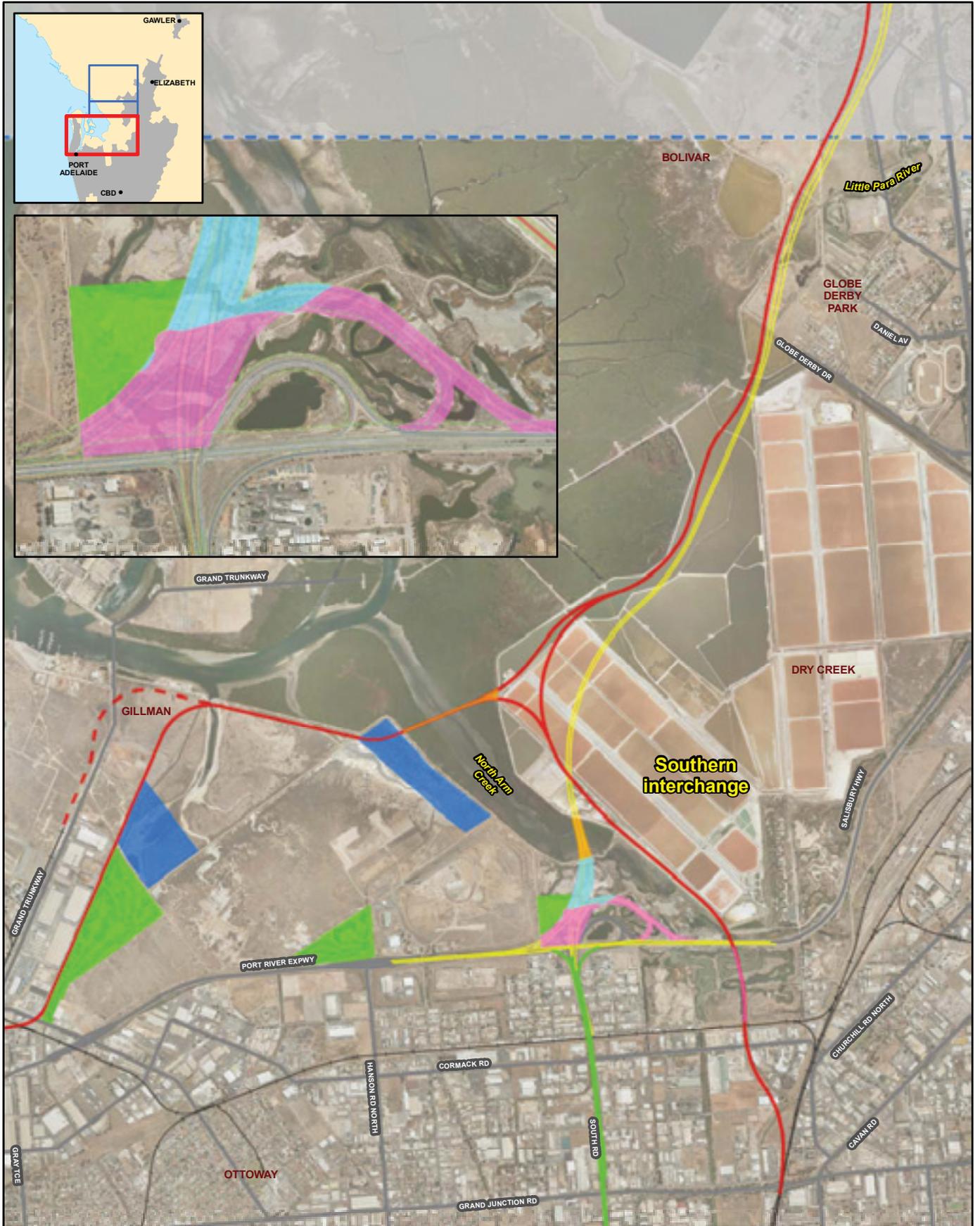
Wetland impact mitigation

The impacts of the project on

Table 2

Area of Barker Inlet wetlands directly impacted by the Northern Connector project

Wetlands	Wetland loss (hectares)
Marine intertidal (Barker Inlet north wetlands)	5.9
Freshwater (Barker Inlet north and south wetlands)	11.7
Total	17.6



Source: DEH, DTEI, DPLG



Figure 8 Areas of potential wetland habitat offsets and or rehabilitation Southern section

- Loss areas:
- Freshwater wetlands (11.7 Ha)
 - Mangroves (4.6 Ha)
 - Marine intertidal wetlands (5.9 Ha)

- Potential offsets areas,
Combination of (loss to offset ratio 1:1.5):
- New freshwater / marine intertidal wetlands
 - Wetland modification / rehabilitation

- Northern Connector road
- Spur line to Port Flat siding
- Northern Connector rail
- South Road Superway
- Existing railway
- Existing roads

Construction

Due to the flat topography of the project area, the road and rail corridor of the Northern Connector would be formed by an earth embankment of imported and recycled fill materials, founded on the existing ground profile, ranging from one metre above ground level in the Northern section to about 3.5 metres above in the south. Construction would generally use conventional methods employed on most similar major projects, adapted to account for the various engineering and environmental constraints (e.g. poor ground conditions and potential acid sulfate soils in the south).

The only cuttings (excavations) likely for the project would be for

drainage swales adjacent to the road carriageways and for a ramp at the Southern interchange, adjacent to the Port River Expressway. Suitable fill options are currently being investigated and would likely be sourced from excavations within the corridor, recycled soil material from other DTEI projects, nearby sources (borrow pits) or existing commercial quarries.

Construction over the wetlands and mangroves in the Southern section would require methods such as rock end tipping, to form a solid base from which to construct the embankment fills and minimise the impact on mangroves and wetlands.

Operation

Road

The posted speed on the Northern Connector will be 110 kilometres per hour, with reduced speeds for entering and exiting at interchanges.

Operation of the Northern Connector road will be monitored and managed remotely through DTEI's Traffic Management Centre.

Managed motorway

The Northern Connector road component would be a managed motorway. Managed motorways use Intelligent Transport Systems (ITS) to improve access to, and the safe and efficient management of traffic flow along, urban motorways. The following measures would be employed on the Northern Connector (including the Port Wakefield Road Corridor).

Primary measures:

- Lane use management systems (LUMS) - manages lane use around incidents without total loss of motorway capacity
- Hard shoulder running where emergency break down lanes are used as supplementary lanes during peak periods
- Ramp metering - coordinated use of traffic lights on motorway on-ramps

to control the rate at which vehicles merge with the main motorway traffic stream (ramp signals). Vehicles generally proceed individually on a green light

- Variable speed limits (VSL) - supported by variable message signs to prevent the occurrence of further (secondary) incidents after an initial crash, to improve safety during hard shoulder running, and/or during extreme weather events
- Freight and public transport priority typically at ramps in conjunction with ramp metering for general vehicles

Secondary measures:

- Incident detection using closed circuit television (CCTV) cameras, webcams, weather monitoring stations and emergency telephones
- Automatic number plate recognition (ANPR) to monitor freight movements
- Traffic and traveller information services, such as Variable Message Signs (VMS) with real-time advice about travel times and/or current speed
- Speed enforcement using speed cameras

Other supporting ITS equipments used on the Northern Connector will include high speed tele-communications, smart lighting, vehicle detectors and sustainable energy/power supply.

Maintenance

Maintenance (including road pavement, line marking, reflective pavement markers, kerbing, tree pruning, signs, barriers, stormwater pits and small culverts) would remain the responsibility of DTEI, which would regularly inspect large culverts and bridges.

The local road network and associated ongoing maintenance would be managed by the relevant local council.

Rail

The Northern Connector rail, used for freight trains and interstate passenger trains, will have a maximum speed for freight trains of 115 kilometres per hour.

No visual surveillance is proposed for the rail line, although train operations are monitored and controlled remotely by Australian Rail Track Corporation, which will also be responsible for maintenance of the rail corridor.

Project Impacts

Construction and operation of the Northern Connector project would bring significant environmental, social and economic benefits.

The project area has a complex combination of sensitive environmental features, large industrial and business operations, and communities. In developing the Northern Connector

route to achieve the project objectives, many, often competing, environmental, social, economic and engineering issues have had to be balanced.

The scale, nature and location of the project, make some adverse impacts inevitable. Where possible, measures will be put in place to minimise and/or offset these impacts.

The construction and operation of the Northern Connector project would bring significant environmental, social and economic benefits.

Flora and fauna

Flora

Seven native vegetation associations (communities) and five planted exotic or native areas of vegetation are found in the Northern Connector corridor. Native vegetation (as defined by the Native Vegetation Act 1991) totals 49.79 hectares in the corridor and varies greatly in condition from very poor (e.g. degraded samphire areas) to excellent (e.g. remnant mangrove forest).

Two threatened flora species of state conservation significance, under the National Parks and Wildlife Act 1972, were found to occur in the project area: Hoary rush (*Juncus radula*) and Black Cotton-bush (*Maireana decalvans*). Both species are located in the chenopod shrubland in the SA Water revegetation area near Jobson and Summer roads.

No flora species of national conservation significance (i.e. listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)) were located, or are known to occur, in the project area.

Fauna

Avifauna (birds), mammal, reptiles, amphibians and fish species have been assessed for the project area. The most recent surveys in the summer of 2010–11, focused on avifauna investigations supplementing fauna surveys commissioned by DTEI in 2004

(as part of the Port River Expressway project), 2008 and 2009.

Determining the effect of the Northern Connector project on faunal groups of conservation significance, especially bird species, and their habitat, considered alternative suitable habitats in the project region and wider region. Species of national conservation significance were assessed for likely impacts of the project in line with the EPBC Act Significant Impact Guidelines.

About 200 bird species have been recorded in the wider region, 128 of them in the project area in surveys since the 1980s. Of these, 65 species of national (44) and/or State (11) significance were recorded or identified as potentially occurring in the project area.

A total of 44 threatened bird species listed under the EPBC Act occur in or adjacent to the project area. All are migratory and/or marine species and five are threatened species listed under Schedules of the EPBC Act. Also recorded in the project area or region in varying numbers are 25 species of international migratory shorebirds. Some of these species have not been recorded in surveys of the project area and the remainder occur in small numbers not exceeding the international flyway (seasonal migrating) population thresholds. All would

experience few to minimal adverse effects from the removal of small areas of habitat by the project.

The investigations determined:

- within the project area, the most important areas of bird habitat, including Greenfields Stage 3 (often referred to as Magazine Road Wetlands), the northern section of the marine shallow water and intertidal samphire shrubland in the Barker Inlet Wetlands north and the roosting areas in Barker Inlet Wetlands south will not be affected
- most adverse effects to birds will be direct and associated with habitat removal plus temporary impacts during construction in Barker Inlet wetlands and potentially in North Arm Creek
- a relatively low risk of a significant impact (as defined by the EPBC Act Significant Impact Guidelines) on a few species including the Orange-bellied Parrot (OBP) (*Neophema chrysogaster*), Australian Painted Snipe (*Rostratula australis*) and White-bellied Sea-eagle (*Haliaeetus leucogaster*), plus small numbers of migratory shorebirds and aquatic bird species.
- the project may affect small areas of potential foraging habitat (most of which is heavily damaged and degraded and unlikely to be suitable as feeding habitat for the species) of the critically endangered Orange-



bellied Parrot. Population numbers of this species in the wild are currently low, estimated at about 50 birds, with limited chance of recovery. Part of the project area, as a component of the wider coastal part of the region, was part of the parrot's traditional foraging range. However, very few sightings of the species have been recorded in the past 20 years, with the most recent being at Chapman Creek in 2006 well to the north of the north-most section of the project area. It is unlikely that any Orange-bellied Parrots will be seen this far north in South Australia, if at all, due to their very low population numbers in the State

- one breeding pair of birds White-bellied Sea-Eagle (*Haliaeetus leucogaster*) is reported to be resident in the region, possibly the wider region, although their nest and roost locations are unknown. However, they are known to forage in the region and the southern part of the project area. It is considered that any impact on this species will be confined to the construction phase of the project and that this would be relatively small due to the very large range and large area of foraging habitat available to and used by the species. It is considered very unlikely that the project would create a long term or significant impact (as defined by the EPBC Act Significant Impact Guidelines (DEH 2006) impact on the species.

- additional species will lose small areas of habitat, primarily through direct impacts and fragmentation, but not enough to significantly affect their population or abundance; some of these species use more than one habitat type, so they can move to other preferred or similar sites in the area less or not affected by the development; species include: Long-toed Stint, Australian Painted Snipe, Australasian Bittern, Pectoral Sandpiper, Latham's Snipe, Wood Sandpiper, Marsh Sandpiper, Broad-billed Sandpiper, White-winged Black Tern, Glossy Ibis, Cattle Egret, Great Egret, Little Egret, Intermediate Egret, Sharp-tailed Sandpiper, Common Sandpiper and Black-tailed Godwit; the risk of a significant impact (as defined by the EPBC Act Significant Impact Guidelines) on these species is considered to be relatively low
- for species of State conservation significance the loss and/or degradation of habitat and hence feeding, roosting and or breeding grounds will impact the local population, but will not adversely impact on the regional or State population.
- no frogs, mammals, reptiles or fish known to occur in the project area are listed as state or national significance, and no significant impacts are expected.

Flora and Fauna impact mitigation

Impacts on vegetation and fauna in the project area have been avoided and/or minimised by the corridor selection process and development of the proposed alignment. Initial environmental studies helped guide the corridor alignment through the project area, in particular designing the road and rail corridor to avoid some higher value sections of Barker Inlet north wetlands and avoid the habitat-valuable Greenfields Stage 3 wetlands. Project impacts would be mitigated and offset by:

- ensuring that a significant environmental benefit (SEB) is achieved for removal of native vegetation, in line with the requirements of the Native Vegetation Act. It would include on-ground rehabilitation and revegetation
- offsetting non-native vegetation requiring removal through on-ground landscaping and revegetation works
- providing compensatory habitats at a greater rate to offset those lost, by modifying, rehabilitating and revegetating existing wetlands and/or creating new freshwater/marine intertidal wetland areas.

Noise and vibration

Construction noise

Assessment of construction noise indicates that some degree of impact on residences during construction is likely. Night time construction works near residences would be avoided or minimised where possible.

Construction noise management and mitigation measures will be implemented to minimise the impact. They may include locating noisy machinery away from residential properties, avoiding truck movements on local roads where possible, and installing temporary noise barriers around stationary equipment.

Construction vibration

During construction, residents near the works may perceive vibration and there may be some vibration effects on building contents for residences closest to the works. Structural damage is not expected.

Construction vibration management and mitigation measures may include minimising vibration energy as necessary, undertaking vibration monitoring as required, and informing the community about when and where construction activities that may generate vibration effects will happen.

Operational road noise

Noise assessment for the project determined that traffic noise levels would increase at residential properties adjacent to the Northern Connector. Road traffic noise levels at properties adjacent to Port Wakefield Road are predicted to significantly decrease. Across the project area the predicted number of properties exposed to high levels of road traffic noise would decrease following the opening of the Northern Connector.

Methods to mitigate road traffic noise would be determined during the detailed design phase of the project and could include use of 'low noise' road surfaces, roadside noise barriers and a range of treatment measures for eligible properties.

Operational rail noise

The rail noise assessment determined that residents living adjacent to the Northern Connector would hear new rail noise. Mitigation would likely include a range of treatment measures for eligible properties.

Diverting rail freight to the Northern Connector integrated rail transport corridor would considerably reduce the rail noise impact on properties

There would be considerable reductions in noise for residences adjacent to Port Wakefield Road and the existing Salisbury freight rail line

adjacent to the existing rail freight line in Parafield Gardens, Salisbury Downs, Salisbury, Salisbury North and Ottoway. Across the study area there would be an overall improvement in rail noise for residents. Any noise treatments for those residents adjacent to the Northern Connector would be similar to those provided for operation road noise and would be determined during the detailed design phase of the project.

Operational vibration

Operational vibration assessment determined that during operation, vibration levels at residences are expected to comply with both structural damage and nuisance guideline levels.



Socio-economic

The socio-economic benefits and impacts that could arise from construction and operation of the Northern Connector include state-wide and regional economic benefits and impacts on the local community and economy.

The principal socio-economic benefits of the project would be:

- reduced truck and freight movements on Port Wakefield Road, Salisbury Highway and local roads and communities, improving amenity and safety for residents in these areas
- improved access (including reduced travel times) to Adelaide for northern Adelaide residents
- improved safety for commuters at existing rail crossings
- improved amenity for dense residential areas adjacent to Port Wakefield Road and the existing rail line through the relocation of disruptive heavy freight trucks and trains.

Potential local impacts on the community and economy in the project area, during both construction and operation, would include:

- severance and reduced social cohesion, particularly for the

community to the west of the Northern Connector

- reduced environmental amenity for relatively sparse residential premises adjacent to the Northern Connector corridor
- property acquisition (more than 60% of the land required for the Northern Connector is in the ownership of local, state and Commonwealth government; less than 40% of the land to be acquired is held in private ownership)
- property access
- social fabric
- horticultural impacts.

Measures to mitigate these impacts include the construction of Waterloo Corner interchange to allow for access to local roads and residential areas, improvements to environmental amenity in the area with significant landscaping and planting schemes, and upgrade of local roads to improve local conditions and accessibility.

Ongoing community consultation will be essential to address community concerns and queries during the detailed design and construction phases of the project.

Planning, zoning and land use

The planning phase of the project has taken into consideration Australian, South Australian and local government strategic objectives.

Land acquisition, construction and ongoing operations of the Northern Connector would have both positive and negative impacts on existing land uses in the area and the wider region of metropolitan Adelaide (and beyond).

The Northern Connector project could have many benefits, some of

which are listed in the other impact sections.

Specific mitigation measures have been considered for these impacts, for example providing wetland offset areas, implementing air quality and noise management measures during construction, improving local amenity with intensive landscaping and local road upgrades, and providing continued access to Port Wakefield Road through strategically located interchanges.

Traffic and transportation

The Northern Connector road corridor would receive traffic from Port Wakefield Road and the Northern Expressway, and significant volumes of traffic (including heavy vehicles) that formerly used the Angle Vale Road–Heaslip Road route and Main North Road, on to Port Wakefield Road. Ultimately, the Northern Connector will be a more efficient route for this traffic and significantly reduce traffic volumes on Port Wakefield Road.

The rail route would be a faster and more efficient route for freight trains that currently travel through northern urban areas and the Wingfield industrial area. The new route would substantially reduce safety concerns associated with the current 12 level crossings.

Future traffic demands

Future population and employment estimates to 2031 for the Northern Adelaide region have been used to forecast traffic volumes on the Northern Connector and thus determine the number of lanes required on carriageways and at interchanges.

Forecast daily traffic volumes (2031) for the Northern Connector range from 55,000 vehicles per day (vpd) north of Waterloo Corner interchange to 78,700 vpd south of Globe Derby Park (Figure 10). Peak hour, peak direction traffic volumes range from 6,100 to 8,600 vehicles per hour at the same locations.

At Waterloo Corner and Bolivar interchanges, a single lane only would be required on each on-ramp and off-ramp. Roundabouts or T-junctions will control traffic at the junction of ramps with local roads.

Arterial roads

The Northern Connector would significantly change travel patterns in the northern area and result in changes in traffic volumes on all arterial roads in the immediate vicinity.

With the operation of the Northern Connector, traffic volumes on Port Wakefield Road (south of Waterloo Corner Road to Salisbury Highway) by 2031 are predicted to reduce to levels well below current (2010) volumes (Figure 10). Other arterial roads (e.g. Heaslip and Bolivar roads) would have similar traffic volumes to their current (2010) volumes with the Northern Connector in operation in 2031.

Local roads

The Northern Connector route would pass through established residential and commercial areas and affect access to varying degrees.

The impacts would be most evident in the section north of Bolivar, where the route would sever east–west movements at five local roads: Symes Road, Anjanto Road, St Kilda Road,

Undo Road and Summer Road, which provide access to residences, horticulture, aquaculture and agriculture businesses, and recreation areas.

Alternative access to Port Wakefield Road would be provided at Waterloo Corner interchange, which would extend Waterloo Corner Road from Port Wakefield Road over the Northern Connector to link into Robinson Road. The extent of traffic diversion would be significantly less on other roads. Various local roads will be upgraded to cater for the changed travel patterns.

In the Central section, only the existing access road (Hodgson Road) to SA Water's Bolivar Wastewater Treatment Plant would be severed; access will be provided through Waterloo Corner interchange.

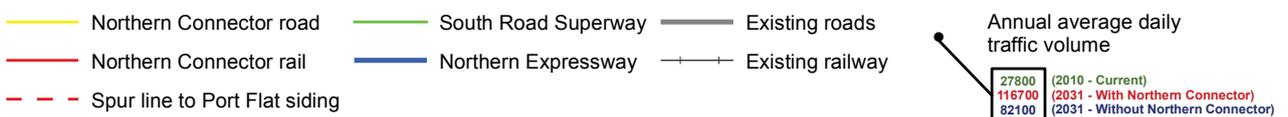
In the Southern section, the route will pass to the west of Globe Derby Park and across the salt fields towards the interchange at South Road. Access into Globe Derby Park will remain unchanged.

The removal of current access restrictions on to and from Port Wakefield Road at Symes Road, Anjanto Road, St Kilda Road, Undo Road, Summer Road, Victoria Drive, Daniel Avenue and Ryans Road may also be investigated.





Figure 9 Current (2010) and forecast (2031) annual average daily traffic volumes



Aboriginal heritage and Native Title

Native Title

The project area is located in the native title claim area of the native title applicants, the Kaurna Peoples (SAD6001/00) and is adjacent to the native title claim area of the native title applicants, the Ramindjeri (SAD162/10).

DTEI has been advised by the Crown Solicitor's Office that native title has not been extinguished in some of the areas of land identified to be affected by the project, and as such DTEI will consult with the Native Title Claim Representatives as required by the Native Title Act 1993.

Aboriginal heritage

A search of Aboriginal Affairs and Reconciliation Division, Department of the Premier and Cabinet, records and previous heritage assessments for the project area indicated a number of registered and unregistered sites, objects or remains in the vicinity of the project). A heritage survey of the corridor will likely be undertaken to determine

possible locations of other sites, objects and remains

There is the potential that during construction of the road and rail corridor, damage, disturbance or interference with Aboriginal sites, objects and remains could occur.

A Section 23 authorisation will be sought under the Aboriginal Heritage Act 1988 to authorise damage, disturbance and interference with Aboriginal sites, objects and remains (as applicable) located in the project area.

The Minister for Aboriginal Affairs and Reconciliation, as bound by Section 13 of the Aboriginal Heritage Act, will take all reasonable steps to consult with the Aboriginal Heritage Committee and any traditional owners and other Aboriginal persons who, in the opinion of the Minister, have a particular interest in the matter. It is the Minister's decision whether or not to authorise under Section 23 of the Act, and DTEI will abide by the Minister's decision.

Water quality, drainage and flooding

The main drainage systems and surface waterbodies potentially impacted by the project are constructed stormwater systems (Helps Road drain, Dry Creek), constructed wetlands (Barker Inlet north and south wetlands) and natural surface water or tidal flow flows (Little Para River, North Arm Creek, Magazine Creek).

A qualitative assessment of the likely risks to water quality, flooding and drainage associated with the project considered planning and design, construction and operational phases of the project. Key issues that will need to be addressed during the design phase are:

- management of flooding at various locations in the project corridor (e.g.

Barker Inlet wetlands, Dry Creek, Little Para overflow)

- impacts to wetland function and design (capacity and water quality treatment functions) specifically Barker Inlet north and south wetlands
- water quality impacts during construction:
 - » associated with erosion, sedimentation and poor site management practices
 - » potential pollutants during construction including sediment, hydrocarbons and toxicants from spills, and pH altering substances from acid sulphate oil disturbance



- water quality impacts during operation associated with runoff from impervious surfaces
- water quality impacts during operation associated with runoff from impervious surfaces containing sediment, gross pollutants, oils and surfactants, and heavy metals
- accidental spills during construction and operations, which may result in toxic effects on the receiving environment.

The risk assessment also identified measures to mitigate potential impacts

of the project. A range of engineering measures and site management techniques have been proposed including cross drains and equalising culverts enabling continued flow of stormwater, flood gates and spillways, and swales to reduce flood risk.

A soil erosion and drainage management plan would be developed and implemented before construction. Erosion and sediment control during construction would include installation of temporary sedimentation basins and ponds, and sediment fencing; and developing

and implementing a water quality monitoring program.

These measures would reduce potential water quality, drainage and flooding impacts of the project.

Air quality

An air quality study and monitoring program to understand the existing environment examined the ambient air impact of two sources: current background level of pollutants in the atmosphere; and emissions from a diesel locomotive. Emissions from Port Wakefield Road were also measured to calibrate the air dispersion model.

Air dispersion modelling was then carried out for predicted traffic flow scenarios for 2016 and 2031 for the Northern Connector. The cumulative air quality impact of emissions from both

traffic and diesel locomotives would meet Ambient Air Quality National Environment Protection Measure guidelines in both years in the Northern Connector corridor.

The assessment also demonstrated that air quality impact on residences along Port Wakefield Road would be significantly reduced with the lower traffic volumes.

The main air quality issue during construction would be dust, which would require management.



Non-Aboriginal heritage

Only one heritage place was identified in the vicinity of the proposed Northern Connector project – the state listed Dry Creek Explosives Magazine and Earth Mounds, north of Magazine Road and south-west of Cheetham Salt Ltd salt fields.

The Dry Creek Explosives Magazine and Earth Mounds site is located approximately 1.2 km to the east of the Northern Connector road corridor; and 300 m to the east of the rail corridor. Given these distances, structural damage to the heritage place during construction and operation is not probable.

The following places are not formally listed on any of the heritage databases

searched; their current legal status is identified below. Should these or other places become listed and protected, appropriate approvals for affecting the heritage places would be sought:

- Penrice Area (Register of national Estate – indicative place)
- Port Adelaide and Gawler Reach (National Heritage List – nominated place)
- Port Adelaide, Port Adelaide River, Waterfront, and Adelaide Dolphin Sanctuary (National Heritage List – nomination now ineligible for proposed priority assessment list).

No local heritage listed places would be affected by the project.

Geology, soils and site contamination

The main soil and geological hazards that may affect or be affected by the Northern Connector project are erosion and acid sulphate soils, particularly during the construction phase of the project.

Erosion related impacts may be controlled by:

- using erosion resistant materials in earthworks, and avoiding erosion prone materials such as dispersive soils, silts and fine sands
- adequately protecting soil surfaces otherwise exposed to erosive actions, for example a vegetative cover
- minimising the extent and degree of disturbance of existing soil surfaces
- minimising contact time and/or area between the erosive agent and soil surface, providing control structures or measures for eroded material
- using water trucks to minimise dust generation from work areas.

- Acid sulfate soils, associated with marine and estuarine soils south of Bolivar Wastewater Treatment Plant, cause problems only if the soil is disturbed by excavation or dewatering. The resultant generation of sulfuric acid and leaching of heavy metals from the soil matrix could have significant adverse effects on flora and fauna, and on any surface or subsurface steel or concrete infrastructure.
- Acid sulfate soil-related impacts are preferably controlled by avoiding the soils or, at least, minimising their disturbance. A thorough acid sulfate soil site investigation and risk assessment would be part of the detailed design phase of the Northern Connector project. Construction phase measures for managing impacts are likely to include:
 - stockpiling excavated soil in a manner that minimises the generation and spread of acidity
 - neutralising the excavated material,

by mixing in a sufficient amount of a reducing agent

- strategically re-burying disturbed material below the watertable
- maintaining tidal flushing where it currently occurs.

DTEI has gained experience in assessment, management and mitigation of acid sulfate soils from construction of the Port River Expressway in 2004–2005 and currently on the South Road Superway project. A soil erosion and drainage management plan would be prepared and implemented before earthworks began on the site.

Other specific areas of site contamination risks in the project area are documented in the Project Impact Report. These areas are generally linked to past and present land uses such as waste disposal areas, service stations, groundwater plumes, railway infrastructure and drainage channels.

Urban design, landscape and visual assessment

The project area is predominantly flat and low-lying, although there are a number of important visual elements in and around the corridor.

The Northern section of the project area is predominantly a developed landscape of farms and greenhouses.

The Central section includes Bolivar Wastewater Treatment Plant. Visually significant elements include the tree belt, boulevards of exotic tree species, areas of remnant open woodland, and views to the west over the treatment ponds.

In the Southern section, the marine waters, mangroves and coastal shrublands of Barker Inlet and the Port River Estuary, on the eastern side of Gulf St Vincent, make up one of South Australia's largest estuaries. The wetlands are a very important visual component of the character of this area. The Southern section is also visually dominated by the shaped forms

of the salt piles and salt fields.

The Northern Connector, in particular the interchanges and bridges, would become a dominant landscape feature.

Landscaping and revegetation with indigenous species throughout the project area would include:

- landscape plantings at targeted locations along the route to minimise visual exposure to residential properties
- plantings within interchanges to minimise the visual appearance of the infrastructure
- strengthening and formalising plantings along existing roads and in the existing Bolivar Wastewater Treatment Plant buffer area
- remediation plantings in areas such as Little Para River, Barker Inlet wetlands and various other landscape treatments.

Landscaping and revegetation will use indigenous species



Greenhouse gas, sustainability and climate change

Sustainability

DTEI's sustainability vision for development of the Northern Connector will ensure that the project integrates with the existing environment, is environmentally responsible, highlights the natural features of the landscape, and acknowledges natural land patterns. This vision would be achieved by applying sustainable design objectives and principles.

Greenhouse gas emissions

A quantitative assessment has estimated the greenhouse gas emissions associated with vegetation clearance and construction activities at approximately 187 kilotonnes CO₂-e (equivalent of carbon dioxide).

Measures to minimise greenhouse gas emissions will be implemented during the construction phase.

With traffic volumes across the Adelaide metropolitan network expected to increase, the operating road component of the Northern Connector, is predicted to reduce greenhouse gas emissions by 37 kilotonnes CO₂-e in 2017 (compared to no Northern Connector). By 2031, the predicted annual reduction in greenhouse gas emissions is 105.5 kilotonnes CO₂-e.

Total greenhouse emission savings in the 30 years from the start of construction through to operation and use of the road and rail corridor are summarised in Table 3.

Table 3.

Total greenhouse gas emission savings over a 30 year timeframe

Project Aspect	Greenhouse Gas Emissions (Kt CO ₂ -e)
Northern connector construction related GHG emissions	+187 (increase)
30 Year GHG Emissions Savings for operation of rail	-28.3 (saving)
30 Year GHG Emission Savings for operation of the road	-2,409 (saving)
Northern Connector maintenance emissions (30-year estimate)	+222.6 (increase)
Total 30 Year Emission Savings Based on construction and operation of the project	-2027.7 (saving)*

*(i.e. a saving in GHG emissions compared to no Northern Connector being built)

Climate change

The predominantly flat, low-lying Northern Connector project area would be subject to the effects of climate change and sea level rise, particularly in the coastal areas of the Southern section.

A qualitative climate change risk assessment has suggested a number of adaptation strategies that may help reduce the impact of climate change on the project.

To accommodate the estimated sea level rise by 2050 of 3.45 metres Australian Height Datum (AHD) and 4.1 AHD to 2100 (as recommended by the South Australian Coast Protection Board), in the Southern section the westerly rail embankment height will be higher than the easterly road embankment height allowing for use of the rail embankment as a sea wall.

Measures to manage and mitigate impacts

A project environmental management plan would be developed.

This project-specific source document details the environmental protection measures required to mitigate and minimise environmental effects.

Environmental management, mitigation and monitoring measures have been identified for the three phases of the project: planning and design, construction and operation.

DTEI has an environmental management framework for its construction projects that includes implementation of an environmental management system and development of environmental documentation (including procedures and manuals) to help manage planning, construction, operation and maintenance activities.

A project environmental management plan would be developed. This project-specific source document details the environmental protection measures required to mitigate and minimise environmental effects. Its primary purpose is to ensure that the environmental requirements and commitments for the project are carried forward into the construction and operation phases, and that project impacts are effectively managed.

The project environmental management plan forms part of the environmental specification in the construction contract. The construction contractor will be required to develop and document a contractor's environmental management plan, which outlines how environmental management and mitigation measures would be implemented on-site during construction. The contractor's plan would incorporate subplans such as:

- noise and vibration management
- Aboriginal cultural heritage management
- vegetation management
- surface water quality monitoring
- vegetation management
- weed management
- soil erosion and drainage management
- contamination and acid sulphate soils management.

Have your say by making a submission

Making a submission

You can comment on any aspect of the project. All comments must be received in writing – formal written submissions – and may include:

- your opinion, suggestion or opposition to the project
- additional elements that you believe would make the project better
- any errors or omissions in the report, plus any extra factual information you have, and its source
- any other aspect that you would like to make comment on, question or propose.

Importantly, providing a written submission, be it a question or comment, contributes to the planning process. To have your say please make a submission.

Written submissions are public documents with responses to the raised issues, included in the *Supplement Report*. The South Australian Minister for Transport in releasing the *Supplement Report* will define the corridor and project scope.

The Northern Connector *Project Impact Report*, including the Executive Summary, plus four technical Reports comprises the suite of documents that detail the project. All of these will be on public display until Friday 9 September

2011. During this time you can read the documents as well as attend an information session to better understand the project's objectives and impacts.

All of these reports are readily available during the exhibition period, with hard copies available at the City of Salisbury, City of Port Adelaide Enfield and the City of Playford libraries as well as online at www.infrastructure.sa.gov.au. For a CD containing all of the reports, or just a printed copy of the *Executive Summary*, please call 1300 793 458.

The closing date for submission is Friday 9 September 2011

Tips for making a written submission

Include your full name, address and day time contact telephone number

Clearly identify your issue/s and refer to the appropriate section/s of the report

If you hand write your submission, please ensure it is legible.

Lodge your submission by post, email or by using the online form by Friday 9 September 2011.

* All submissions will be public documents unless confidentiality is requested however, through the *Freedom of Information Act 1991* the department can be challenged on this.

For more information

For more information, to make an enquiry or join the mailing list contact the Northern Connector project team.

Phone: 1300 793 458 (interpreter service available)

Email: dtei.northernconnector@sa.gov.au

Visit the website: www.infrastructure.sa.gov.au and then follow the prompts.

Για περισσότερες πληροφορίες γι' αυτό το πρόγραμμα οδοποιίας τηλεφωνήστε στο **1300 793 458**. Διαθέτουμε και διερμηνείς.

Se desiderate altre informazioni su questo progetto stradale telefonate al **1300 793 458**. Ci sono interpreti a disposizione.

Để có thêm thông tin về công trình đường bộ này xin hãy gọi điện thoại số **1300 793 458**. Sẽ có phiên dịch viên.

លើចំណុចសំណង់មានបន្ថែមទៀតអំពីគម្រោងផ្លូវថ្នល់នេះ សូមទូរស័ព្ទមកលេខ **1300 793 458** មានអ្នកបកប្រែភាសាផង។

www.infrastructure.sa.gov.au | 1300 793 458