SALISBURY TO BEAUDESERT RAIL CORRIDOR STUDY

Review of environmental factors

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Department of Transport and Main Roads

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Executive summary

Introduction

The *South East Queensland Regional Plan 2009–2031* (SEQ Regional Plan) sets out a vision for South East Queensland as ‘a region of interconnected communities, with excellent accessibility and an extensive and efficient public transport system that contributes to reducing greenhouse gas emissions’ (Department of Infrastructure and Planning 2009a). The timely provision of accessible public transport infrastructure is critical to achieving this vision and ensuring that emerging communities have access to employment and services.

Through the Mt Lindesay / Beaudesert Strategic Transport Network Investigation (MLBSTNI), which was released for public comment in mid-2009, state infrastructure planning has identified the need for extensions to existing public transport networks to service future growth areas in the South Western Corridor. In the medium-to-long term, stronger public transport links would also be required to service planned future growth in the Scenic Rim Regional Council area.

The need to identify and preserve a corridor suitable for a future passenger rail service between Salisbury and Beaudesert is specifically identified in the *South East Queensland Infrastructure Plan and Program 2009–2026* (DIP 2009b). It is expected that this passenger rail line would generally follow the alignment of the existing Brisbane–Sydney rail line south to Kagaru; however, a new corridor would be required to connect future passenger services from Kagaru to Beaudesert.

The Department of Transport and Main Roads (DTMR) has engaged Kellogg Brown & Root Pty Ltd (KBR) to prepare a review of environmental factors (REF) which identifies a preferred alignment between Kagaru and Beaudesert township and potential station locations for the passenger rail line from Salisbury to Beaudesert based on the findings of the MLBSTNI.

The primary aim of the REF is to identify potential constraints to the Salisbury to Beaudesert passenger rail line for future investigation and assessment. It summarises the work undertaken to date, the outcomes of the corridor and station selection process, and sets out the actions required for future delivery of a passenger rail line between Kagaru and Beaudesert.
Future passenger rail line

If constructed in the future, the Salisbury to Beaudesert passenger rail line would be operated as an extension of the existing Citytrain network to service future development in the South Western Corridor (in Logan City) and Scenic Rim Regional Council area. It would also provide passenger rail services for established areas and future development in Brisbane City. This would involve the construction of a 53 km double-track, narrow gauge, electrified passenger rail line connecting to the existing Citytrain network near the junction at Salisbury and the construction of new stations as shown in Figure 1.

It is anticipated that development of the passenger rail line would likely be implemented in stages and only commence after 2026 subject to:

- realisation of projected passenger demand in future growth areas under the SEQ Regional Plan
- future infrastructure delivery priorities and funding decisions of the Queensland Government.

Prior to delivery of a passenger rail line, interim public transport solutions would be implemented to service emerging communities in the study area. Potential interim solutions would also be investigated as part of subsequent phases of this study.

Need for the passenger rail line

South East Queensland is one of the fastest growing regions in Australia.

The SEQ Regional Plan identifies a number of local and regional development areas that are anticipated to accommodate future urban development in the SEQ region to 2031. The plan also nominates ‘Identified Growth Areas’ which are capable of supporting growth and development beyond 2031, subject to further investigation.

A significant number of these future growth areas are located in the South Western Corridor in Logan City and the Scenic Rim Regional Council area, which are anticipated to accommodate a significant proportion of the forecast population growth in SEQ to 2031 and beyond.

Regional and local development areas are fundamental to the delivery of dwelling and employment targets in the SEQ Regional Plan. The successful development of these areas as regionally significant centres for growth is dependent on the timely delivery of public transport infrastructure and other services (DIP 2009a).

Development of the Salisbury to Beaudesert passenger rail project would provide essential public transport infrastructure to service future development areas in the South Western Corridor and Scenic Rim Regional Council area. The project would also improve services for established and proposed urban development areas to the south of Brisbane.
Figure 1
Proposed alignment
Protecting the corridor

The coordination of transport and land use planning is a core principle of the SEQ Regional Plan and a core function of the Department of Transport and Main Roads under the Transport Planning and Coordination Act 1994. Early identification of a preferred corridor between Kagaru and Beaudesert will minimise the potential for conflict with surrounding land uses in future.

DTMR proposes to use its powers under the Sustainable Planning Act 2009 and Transport Planning and Coordination Act 1994 to identify this corridor in the local planning scheme for Scenic Rim and other statutory land use planning documents. The Department would then act as a referral agency for development applications under the Sustainable Planning Act 2009 which may impact the future passenger rail line.

DTMR proposes to undertake early concept design and a non-statutory assessment of potential impacts associated with the future passenger rail line to ensure that the corridor protected is feasible with respect to engineering and environmental constraints.

Corridor and station selection

Rail corridor

Between Salisbury and Kagaru, the existing interstate rail corridor aligns with established residential areas and future urban development areas to be serviced by the proposed passenger rail line.

South of Kagaru, the key objective of the corridor development process was to investigate viable options that would enable establishment of an alignment between the existing interstate rail line and Beaudesert township. Two potential options were developed and evaluated in this section. These are described as follows:

- Option A—this alignment option diverted east across the Logan River floodplain from the existing interstate rail corridor at Kagaru and follows the disused Bethania to Beaudesert rail line south to Beaudesert
- Option B—this alignment option followed the existing interstate rail line to Bromelton and then diverted east to Beaudesert.

Option A was selected as the preferred corridor as it:

- integrates with future growth areas identified in the SEQ Regional Plan and local planning instruments
- avoids potential conflict with road and rail freight networks in the Bromelton State Development Area
• minimises the overall length of the alignment, resulting in greater cost efficiency, reduced energy and CO₂ emissions and quicker travel times to Beaudesert

• maximises the extent of the future passenger rail line that generally follows the alignment of the existing interstate rail line between Salisbury and Kagaru, thereby minimising impacts on adjacent freehold properties

• minimises the length of alignment which traverses land below the 100-year average recurrence interval flood level, thereby reducing cost, material inputs and visual impacts associated with elevating the rail line on embankments and structures.

Stations
Potential station locations were initially identified to comply with the following key criteria:

• stations had to be located on the existing interstate line between Salisbury and Kagaru

• stations should maximise potential rail patronage locating them in close proximity to potential catchment/destination areas (i.e. existing or future residential/commercial areas)

Potential station locations were then refined using constraints mapping to identify key constraints, such as the number of potential property requirements based on a typical station footprint or the presence of remnant vegetation, habitat or other environmental values.

Review of environmental factors

The REF summarises the results of a desktop review of the existing natural, social and economic values of the study area to identify where potential impacts on these values would require investigation and assessment should the project proceed in future. The key issues relevant to the study area identified through the REF assessment are discussed below.

Study area sections

Three distinct geographic sections of the study area are recognised for the purpose of the REF, as shown on Figure 1. The northern, central and southern sections are defined largely by the nature and intensity of land use in each section as follows:

• northern section–largely urban land uses between Salisbury and Boronia Heights

• central section–medium-density housing and rural residential uses between Boronia Heights and Undullah

• southern section–generally rural land uses and townships between Undullah and Beaudesert.

Existing environmental values and potential impacts have generally been considered within the context of these sections throughout the REF.
Transport and land use integration

The SEQ Regional Plan identifies future growth areas which are anticipated to accommodate future urban development in the SEQ Region. The study area contains a number of Regional and Local ‘Development Areas’ which will be a focus for accommodating regional dwelling and employment targets to 2031. There are also a number of ‘Identified Growth Areas’, which identify land which is capable of supporting urban growth and development beyond 2031, subject to further investigation. Relevant future growth areas are summarised in Table 1 and are also shown on Figure 2.

Table 1 Future growth areas under the SEQ Regional Plan

<table>
<thead>
<tr>
<th>Growth type</th>
<th>Regional Development Areas (to 2031)</th>
<th>Local Development Areas (to 2031)</th>
<th>Identified Growth Areas (after 2031)</th>
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<tr>
<td>Residential</td>
<td>–</td>
<td>Beaudesert</td>
<td>Beaudesert South</td>
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<td></td>
<td></td>
<td></td>
<td>New Beith–Round Mountain</td>
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<tr>
<td>Residential and</td>
<td>Park Ridge</td>
<td>Greenbank Central</td>
<td>Greater Flagstone</td>
</tr>
<tr>
<td>employment</td>
<td>Flagstone</td>
<td></td>
<td>Greenbank</td>
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<tr>
<td>Employment</td>
<td>Bromelton</td>
<td>–</td>
<td>Greater Bromelton</td>
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<td>North Maclean</td>
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Transit-oriented development involves concentrating a mix of uses, including housing, shops, offices and other facilities such as train and bus stations to encourage a greater proportion of trips by walking, cycling and public transport. Station locations have been selected to maximise opportunities for transit-oriented development by integrating with the proposed future pattern of development in the study area and maximising the residential catchment within walking distance (800 m) of a station.

The development of the proposed passenger rail line also provides opportunities to develop regional cycle networks in accordance with the *South East Queensland Principal Cycle Network Plan* (Queensland Transport 2007). This includes integration with a potential future rail trail along the old Bethania to Beaudesert rail line which was recommended as part of the Mt Lindesay/Beaudesert Strategic Transport Network Investigation.
Figure 2
Future urban development areas
Establishment of a new rail corridor between Kagaru and Beaudesert also has the potential to adversely impact on individual landholders and other parts of the community through land acquisition, road closures and diversions and other disruptions to access and amenity. There are 99 properties located either partially or completely within the preferred corridor footprint in this section, which predominantly comprises rural and agricultural land uses. Of these, 32 properties would be ‘severed’, which involves the physical separation of a single parcel of land into two discrete parcels.

Further consultation with property owners identified as having a potential land requirement and communities is critical to establish the nature and extent of impact associated with the future development of the rail line.

**Noise**

Establishment of a passenger rail line between Salisbury and Beaudesert would increase the frequency of train movements on the future passenger rail line in the northern and central sections of the study area and introduce rail noise to existing rural and agricultural areas in the section between Kagaru and Beaudesert. Operational rail noise for the future passenger rail line would be managed in accordance with Queensland Rail’s *Code of Practice for Railway Noise Management*. Noise modelling would be undertaken as part of subsequent study phases to identify where mitigation measures would be required to address noise-related impacts as part of the future development of the rail line.

**Flora and fauna**

In highly fragmented landscapes such as SEQ, wildlife corridors provide an important link between otherwise isolated habitat areas. Corridors allow plants and animals to move from one area of habitat to another, which is particularly important for rare and less mobile species which rely on specific habitat characteristics. Fencing and electrification associated with the future passenger rail line would create barriers to east-west fauna movement across the corridor which, in turn, has the potential to fragment existing species populations.

Establishment of stations and the rail corridor between Kagaru and Beaudesert also has the potential to affect habitat for threatened species and ecological communities protected under state and Commonwealth environment legislation. As part of subsequent study phases, these potential impacts need to be investigated and assessed with reference to the future rail design having regard to the following flora and fauna values:

- the environment on Commonwealth land where the existing interstate corridor intersects the Greenbank Military Training Area at Boronia Heights
- the regionally significant Flinders–Greenbank/Karawatha biodiversity corridor, which extends between Flinders Peak, the Greenbank Military Training Area and Karawatha Forest, and intersects the existing interstate line at Parkinson
• threatened and migratory species and ecological communities protected under the
  
  *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) that may occur
  within or adjacent to the corridor

• threatened species protected under the *Nature Conservation Act 1992* (Qld).

**Surface water**

The southern section of the study area is generally located on the Logan River floodplain and
the rail alignment would be constructed above ground level for a significant distance to ensure it
remains above the 100-year average recurrence interval flood level. In the northern and central
sections of the study area, the future passenger rail line crosses a number of waterways. Further
assessment of potential impacts associated with waterway crossings would need to be
undertaken as part of subsequent study phases with reference to the future rail design.

**Native title and indigenous cultural heritage values**

The Jagera people were identified as having registered native title claims within the study area.
No significant indigenous cultural heritage values were identified through this assessment;
however, the potential for unrecorded cultural heritage values to exist in the study area is
acknowledged. In future, DTMR would prepare a cultural heritage management plan with the
relevant Aboriginal party or parties for the study area to meet its duty of care requirements
under the *Aboriginal Cultural Heritage Act 2003* (Qld). This process would also be used to
clarify any previously unidentified areas where there is potential to impact on cultural heritage
values.

**Non-indigenous cultural heritage values**

In the southern section of the study area, the rear portion of Enright’s Sawmill would be
potentially required by the preferred corridor. Consultation is required with the landholder
and/or proprietor to assess the nature and extent of the land requirement on this long-standing
sawmill.

**Landscape and visual amenity**

The construction of the future passenger rail line on elevated structures across the Logan River
floodplain would have potential impacts on the existing visual environment in the southern
section of the study area. An assessment of impacts on the existing landscape in this section
would need to be undertaken as part of subsequent study phases. An assessment of the visual
impact in the northern and central sections would also need to be undertaken with reference to
the future rail design; however, as these areas are generally more urbanised, no significant
impacts would be anticipated.
Contaminated land

The REF identified a number of properties listed on the Environmental Management Register as currently or historically supporting ‘notifiable’ (i.e. potentially contaminating) activities. This includes the entire length of the existing interstate rail corridor and disused Bethania to Beaudesert rail line in the section between Kagaru and Beaudesert. Further investigation of the location and nature of any potential contamination on these sites would need to be undertaken as part of subsequent study phases.

Future investigations

The REF has identified a number of further investigations which would be undertaken as part of subsequent study phases. A summary of these investigations is included in Table 2.

<table>
<thead>
<tr>
<th>Category</th>
<th>Future investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail studies</td>
<td>• Concept design development of the rail alignment and preferred station locations</td>
</tr>
<tr>
<td></td>
<td>• Network and patronage modelling</td>
</tr>
<tr>
<td></td>
<td>• Drainage studies</td>
</tr>
<tr>
<td>Community consultation</td>
<td>• Consultation with potential rail users and affected sectors of the community to</td>
</tr>
<tr>
<td></td>
<td>determine the nature and extent of impacts on existing social values in the study</td>
</tr>
<tr>
<td></td>
<td>area</td>
</tr>
<tr>
<td>Noise</td>
<td>• Noise modelling studies</td>
</tr>
<tr>
<td>Social environment</td>
<td>• Socio-demographic analysis</td>
</tr>
<tr>
<td></td>
<td>• Assessment of impacts on agricultural land uses between Kagaru and Beaudesert</td>
</tr>
<tr>
<td>Flora and fauna</td>
<td>• On-ground surveys to verify desktop assessments undertaken for the REF</td>
</tr>
<tr>
<td></td>
<td>• Identification of opportunities for fauna movement across the corridor</td>
</tr>
<tr>
<td></td>
<td>• Preliminary assessment of impacts on matters protected under the Environment</td>
</tr>
<tr>
<td></td>
<td>Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td>Water resources</td>
<td>• Analysis of the hydrological and hydraulic characteristics in the study area</td>
</tr>
<tr>
<td></td>
<td>• Assessment of baseline water quality</td>
</tr>
<tr>
<td></td>
<td>• Identification of significant groundwater resources in the study area</td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>• Consultation to determine the nature and extent of the land requirement on</td>
</tr>
<tr>
<td></td>
<td>Enright’s Sawmill</td>
</tr>
<tr>
<td>Visual amenity</td>
<td>• An assessment of potential impacts on visual amenity and landscape character,</td>
</tr>
<tr>
<td></td>
<td>particularly in the section between Kagaru and Beaudesert</td>
</tr>
<tr>
<td>Climate change</td>
<td>• Preparation of a climate change impact statement in accordance with Queensland</td>
</tr>
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<td>Government requirements</td>
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</table>
1 Introduction

The *South East Queensland Regional Plan 2009–2031* (SEQ Regional Plan) sets out a vision for South East Queensland as ‘a region of interconnected communities, with excellent accessibility and an extensive and efficient public transport system that contributes to reducing greenhouse gas emissions’ (Department of Infrastructure and Planning 2009a).

The timely provision of accessible public transport infrastructure is critical to achieving this vision and ensuring that emerging communities have access to employment and services.

Through the Mt Lindesay / Beaudesert Strategic Transport Network Investigation (MLBSTNI), which was released for public comment in mid-2009, state infrastructure planning has identified the need for extensions to existing public transport networks to service future growth areas in the South Western Corridor. In the medium-to-long term, stronger public transport links would also be required to service planned future growth in the Scenic Rim Regional Council area.

The need to identify and preserve a corridor suitable for a future passenger rail service between Salisbury and Beaudesert is specifically identified in the *South East Queensland Infrastructure Plan and Program 2009–2026* (DIP 2009b). It is expected that this passenger rail line would generally follow the alignment of the existing Brisbane–Sydney rail line; however, a new corridor would be required to connect future passenger services from Kagaru to Beaudesert.

The Department of Transport and Main Roads (DTMR) has engaged Kellogg Brown & Root Pty Ltd (KBR) to prepare a review of environmental factors (REF) which identifies a preferred alignment between Kagaru and Beaudesert township and potential station locations for the passenger rail line from Salisbury to Beaudesert based on the findings of the MLBSTNI.

The primary aim of the REF is to identify potential constraints to the Salisbury to Beaudesert passenger rail line for future investigation and assessment. It summarises the work undertaken to date, the outcomes of the corridor and station selection process, and sets out the actions required for future delivery of a passenger rail line between Salisbury and Beaudesert.

### 1.1 Future passenger rail line

If constructed in the future, the Salisbury to Beaudesert passenger rail line would be operated as an extension of the existing Citytrain network to service future development in the South Western Corridor (in Logan City) and Scenic Rim Regional...
Council area. It would also provide passenger rail services for established areas and future development in Brisbane City.

This would involve the construction of a 53 km double-track, narrow gauge, electrified passenger rail line connecting to the existing Citytrain network near Salisbury Junction and terminating at Beaudesert.

Construction of the passenger rail line would likely be implemented in stages and would only commence after 2026 subject to:

- realisation of projected demand in future growth areas identified under the SEQ Regional Plan
- future infrastructure delivery priorities and funding decisions of the Queensland Government.

Prior to delivery of a passenger rail line, interim public transport solutions would be implemented to service emerging communities in the study area. Potential interim solutions would also be investigated as part of subsequent phases of this study.

1.2 Background

1.2.1 Need for the project

South East Queensland is one of the fastest growing regions in Australia.

The SEQ Regional Plan identifies a number of local and regional development areas that are anticipated to accommodate future urban development in the SEQ region to 2031. The plan also nominates ‘identified growth areas’ which are capable of supporting growth and development beyond 2031, subject to further investigation.

A significant number of these future growth areas are located in the South Western Corridor (Logan City) and the Scenic Rim Regional Council area, which are anticipated to accommodate a significant proportion of the forecast population growth in SEQ to 2031 and beyond (see Figure 1.1).

Regional and local development areas are fundamental to the delivery of dwelling and employment targets in the SEQ Regional Plan. The successful development of these areas as regionally significant centres for growth is dependent on the timely delivery of public transport infrastructure and other services (DIP 2009a).

Development of the Salisbury to Beaudesert passenger rail project would provide essential public transport infrastructure to service future development areas in the South Western Corridor and Scenic Rim Regional Council area. The project would also improve services for established and proposed urban development areas to the south of Brisbane.

A key aim of the project is to ensure the integration of transport and land use to assist in achieving social, economic and environmental sustainability in the SEQ region.

Draft Mt Lindesay / Beaudesert Strategic Transport Network Investigation

Long-term transport needs (to 2056) in the study area have been investigated by the Department of Transport and Main Roads as part of the Mt Lindesay / Beaudesert Strategic Transport Network Investigation.
The study found that future public transport demands are likely to warrant a dedicated passenger rail service to the Bromelton/Beaudesert region 2056 as shown in Figure 1.2, assuming that public transport patronage levels are above the ‘low’ scenario modelled for the study. While demand was higher at Bromelton, the study concluded that it was unlikely that a rail service is the best solution to service the large-scale industrial development within the Bromelton state development area and that it was likely that the rail line was better targeted to Beaudesert township.
Figure 1.1
Overview of passenger rail corridor
Further, the study found that while estimated 2056 demands to Beaudesert were lower than achieved on other components of the rail line, investigation of a rail service was warranted due to the proposed nature of the town as a principal rural activity centre.

The draft report (Cardno Eppell Olsen 2009) released in May 2009 recommended that a detailed corridor planning study was needed to assess the requirements for achieving passenger rail services along the Sydney to Brisbane interstate rail corridor with a view to future corridor preservation needs. The report also recommended that the passenger rail tracks be additional to the existing freight track on this corridor.

1.2.2 Alternatives to the project

The primary objective of a future Salisbury to Beaudesert rail project would be to provide rail transport infrastructure and services for existing communities and future urban communities under the SEQ Regional Plan. This section considers two possible alternatives to the rail project identified in this REF:

- a ‘do nothing’ option which assumes that urban development would proceed in accordance with the SEQ Regional Plan without the provision of additional public transport infrastructure in the study area.
• operating bus services on existing and future road networks as the sole means of public transport within the communities that would otherwise be serviced by the Salisbury to Beaudesert passenger rail service.

‘Do nothing’ option

In future, the population of the study area is expected to grow from approximately 200,000 people in 2006 to around 350,000 in 2031 (PIFU 2009). The majority of this growth would be accommodated within the existing boundary of the urban footprint at Park Ridge, Flagstone and Beaudesert, with further growth anticipated beyond 2031.

A key outcome of the SEQ Regional Plan is the integration of transport and land use planning to encourage a greater proportion of trips by walking, cycling and public transport. Without the provision of additional public transport infrastructure, these communities would be forced to rely on private cars as the primary means of transport to places of work, study and recreation. Therefore, the ‘do nothing’ option is not consistent with the desired outcomes of the SEQ Regional Plan and has not been considered further.

Bus services only

During the initial stages of development in the South Western Corridor and Scenic Rim Regional Council area improved bus infrastructure and services would be used to provide high quality connections to the Brisbane CBD and other major regional destinations such as Logan Central, Browns Plains, Park Ridge and Flagstone. However, once projected passenger demand reaches levels that warrant a train service, it would require very large numbers of buses to carry the same number of passengers. Furthermore, as general traffic levels increase commensurate with the growth in total population, higher levels of bus priority would need to be included on road networks for buses to bypass congestion.

As such, buses are seen as a suitable short–to–medium term solution however, there will be a time when passenger rail would provide higher capacity, high speed public transport and buses would revert to providing local coverage and connectivity, including feeder services to and from rail stations.

1.2.3 Relationship to other projects

There are currently a number of other infrastructure projects (including rail and other services) in varying stages of delivery across SEQ. The following projects in the study area have been deemed relevant due to their proximity to the rail corridor or their potential to influence the project in the future.

Cross River Rail Project

Future capacity on the inner city rail network is a key consideration in determining the nature of the service provided on the Salisbury to Beaudesert passenger rail line. Effective integration of the proposed passenger rail service with the existing Citytrain network also requires consideration of longer-term service requirements for the Gold Coast–Beenleigh rail line and network capacity through the inner city.
Network capacity in the inner city is being addressed by the Cross River Rail Project, which is currently in the early planning phase. This includes the identification of a north–south study corridor, nominally defined by Salisbury at its southern limit. Network integration of the proposed passenger rail line in the vicinity of Salisbury Junction will also be addressed as part of ongoing investigations into the inner city rail network.

Southern Freight Rail Corridor Study

The Southern Freight Rail Corridor Study has identified a future route for a freight rail corridor connecting the western rail line near Rosewood to the existing interstate rail line at Kagaru. This would be operated as a freight-only railway and form a key link from the proposed Melbourne to Brisbane Inland Railway to the existing interstate rail corridor, providing an alternative route to existing freight centres at Acacia Ridge and the Brisbane Multimodal Terminal (Port of Brisbane) (Maunsell 2008). To avoid potential future conflict between freight and passenger rail services, the proposed passenger rail line diverts from the existing interstate line to the north of this connection and follows a route to Beaudesert across the Logan River floodplain.

Mt Lindesay Highway upgrades

Future upgrades to the Mt Lindesay Highway between Brisbane and Beaudesert are planned over the long term. Early concept planning is being undertaken for the Beaudesert bypass and has been considered as part of this study; however, these upgrades would need to be considered further as part of future detailed design.

1.3 Review of Environmental Factors

1.3.1 Purpose

The primary aim of the REF is to summarise the results of a desktop review of the existing natural, social and economic values of the study area, and to identify where potential impacts on these values would require investigation and assessment should the project proceed in future.

1.3.2 Scope

Based on the statement of work provided by DTMR, the aims of the REF were to:

- provide a review of the environmental issues associated with the implementation of a passenger rail line which generally follows the alignment of the existing interstate rail line between Salisbury to Kagaru
- develop and assess potential alignment options to establish a preferred corridor linking the existing interstate rail line near Kagaru and Beaudesert township
- identify preferred station locations for the future passenger rail line between Salisbury and Beaudesert
- identify existing roads or public utilities potentially affected by the future passenger rail line between Kagaru and Beaudesert
• identify environmental, social or economic features or issues requiring consideration as part of any future engineering design, including ‘showstopper’ issues that could significantly constrain the development of the future passenger rail line between Kagaru and Beaudesert

• provide advice with respect to the impact of town planning and legislative requirements on the future development of the passenger rail line

• undertake a preliminary assessment of potential impacts on matters of national environmental significance protected under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).

1.3.3 Study area sections

Three distinct geographic sections of the project area are recognised for the purposes of the REF, as shown on Figure 1.1. The northern, central and southern sections are defined largely by the nature and intensity of land use in each section as follows:

• northern section—largely urban land uses between Salisbury and Boronia Heights

• central section—medium-density housing and rural residential uses between Boronia Heights and Undullah

• southern section—generally rural land uses and townships between Undullah and Beaudesert.

Existing environmental values and potential impacts have generally been considered within the context of these sections which are described in detail in section 2–Project description.

1.3.4 Study team

KBR was commissioned by DTMR to undertake the REF supported by a technical working group consisting of key stakeholder groups who provided advisory inputs to the REF process. A list of those stakeholder groups is provided below.

Technical working group

The technical working group for this study comprised representatives from the following agencies:

• Department of Transport and Main Roads

• Department of Infrastructure and Planning

• Department of Environment and Resource Management

• Brisbane City Council

• Logan City Council

• Queensland Rail Network

• Scenic Rim Regional Council

• Translink Transit Authority
2 Project description

This chapter provides a description of the proposed passenger rail line, including the key design and functional requirements, design criteria and design constraints. Major design features such as bridges, structures and stations are also presented. This chapter also discusses construction matters such as staging and implementation, waste management and construction costs.

2.1 Scope

As stated in Chapter 1, the alignment of the proposed passenger rail line has been assumed to generally follow that of the existing interstate railway between Salisbury and Kagaru. Within these northern and central sections of the study area, this REF has considered engineering issues which will require further investigation in the future. Within the southern section between Kagaru and Beaudesert, the design of the rail alignment has been progressed to a conceptual level. During the detailed impact assessment stage, the design of the overall alignment will be refined to incorporate the findings of subsequent engineering, environmental and demand studies, together with the outcomes of the proposed community consultation program.

2.2 Overview

The following section presents a broad overview of the features of the study area and a summary of the design of the proposed passenger rail line. Further details regarding the design within the southern section are presented in subsequent sections.

2.2.1 General features of the study area

Landforms and topography

The landform of the northern section of the study area is relatively flat from Salisbury to the higher elevations (approximately 40 m Australian Height Datum [AHD]) at Acacia Ridge. From this point, the proposed passenger rail line drops down to and skirts the edge of the Oxley Creek floodplain. South of the Logan Motorway, the elevation of the proposed rail line ranges between 35 m AHD and 70 m AHD, and the surrounding topography consists of undulating hills that continue through the central section of the study area to the point where the proposed rail line intercepts the Logan River floodplain. From here, the topography remains generally flat through to Beaudesert. A series of ridges of up to approximately 250 m AHD run parallel to the west of the corridor from northern Flagstone southwards. More details on the topography of the study area can be found in Chapter 5, together with a description of the underlying geology and soil types.
Water resources

The northern section of the study area is located within the Oxley Creek sub-catchment of the Lower Brisbane River catchment. Oxley Creek runs roughly parallel to the proposed passenger rail line between Salisbury and Hillcrest and the corridor crosses a number of minor, east-to-west draining tributaries of this creek between Salisbury and the Logan River.

The proposed rail line intersects the Logan River catchment at Greenbank and crosses a series of west-to-east draining creeks within the Greater Flagstone area including Abrade, Flagstone and Sandy creeks. The majority of the southern section of the study area falls within the Logan River floodplain. Notable west-to-east draining tributaries of the Logan River within this section of the study area include Teviot Brook and Allan Creek.

Land uses

Notable existing land uses and areas of vegetation within the study area are shown in Figure 2.1 to Figure 2.4 and are summarised below. Detailed land use mapping is presented in Figure 5.27 to Figure 5.29 in Chapter 5.

The northern section of the study area is highly urbanised. The primary land uses from Salisbury to Algester consist of a mix of residential, industrial and commercial activities. Between Algester and the Logan Motorway, the proposed passenger rail line is abutted to the east by residential development and to the west by Paradise Road and areas of non-remnant vegetation associated with Oxley Creek. Between the Logan Motorway and Johnson Road the proposed passenger rail line passes through a large area of remnant vegetation consisting primarily of Eucalyptus species. South of Johnson Road the proposed rail line is bordered by residential development to the east and rural residential properties to the west.

The central section of the study area is dominated by rural and residential land uses. Large, rural residential properties abut the majority of the eastern border of the proposed passenger rail line from Greenbank to southern Flagstone and the western border of the corridor within Greenbank. The Greenbank Military Training Area consists of approximately 45 km² of intact remnant vegetation, formerly widespread throughout the region. The proposed passenger rail line passes through this property from chainage 961.5 km to 956 km between Hillcrest and Greenbank. From southern Greenbank southwards through Greater Flagstone, the proposed rail line is bordered to the west by large areas of relatively intact remnant vegetation in a mosaic of patches together with sections of regrowth vegetation. This mosaic is currently undergoing clearing for urban development.

The southern section of the study area is predominantly rural. This area is dominated by agricultural land uses, including cattle grazing and crop cultivation, with minor, isolated remnant areas of native vegetation scattered across the landscape. Small areas of rural residential properties are located in the eastern portion of the study area along the Mount Lindesay Highway. The town of Beaudesert itself is primarily residential and commercial in nature, and some areas of industrial development are located to the west of Beaudesert at Bromelton.
Figure 2.1
Land use—chainage 975 km to 964 km
Figure 2.2
Land use—chainage 963 km to 950 km
Figure 2.3
Land use—chainage 950 km to 935 km
Figure 2.4
Land use—chainage 935 km to 922 km
2.2.2 Summary of the proposal

As described in Chapter 1, the Salisbury to Beaudesert passenger rail line would consist of approximately 53 km of double-track, narrow gauge, electrified passenger rail line connecting to the existing Citytrain network near Salisbury Junction and terminating at Beaudesert. Both passenger tracks would be dedicated for commuter rail use and would be operated separately from the existing standard and narrow gauge freight lines.

In the northern and central sections of the study area, the Salisbury to Beaudesert passenger rail line is expected to generally follow the alignment of the existing interstate rail corridor. This existing corridor crosses a number of roads and waterways. These crossing points would need to be addressed during future stages of the rail design. Further consideration would also need to be given to the potential interface with the Acacia Ridge intermodal freight terminal.

Based on the assessment undertaken for this REF, new passenger rail stations would be located at Acacia Ridge, Algester, Hillcrest, Boronia Heights, Greenbank, New Beith, Flagstone and Undullah.

The southern section of the conceptual rail alignment would deviate in a south-easterly direction from the interstate rail line at Kagaru to connect with the disused Bethania to Beaudesert rail corridor at the intersection of Hopkins Lane and the Mount Lindesay Highway. From here the corridor would follow the general alignment of the Bethania to Beaudesert rail corridor southwards to Beaudesert. Deviations from this existing corridor would be necessary to accommodate the increased curve radii required to meet the proposed 140 km/h design speed of the alignment through this section. Stations would be located at Gleneagle North and Gleneagle. The terminal station would be situated within Beaudesert town centre.

Additional bridges would be required along the southern section of the alignment to facilitate the crossing of the Logan River and some minor creek systems. Where the proposed alignment traverses the Logan River floodplain, the tracks would be raised above the Q100 flood line by a combination of embankments and viaducts.

Chainages for the proposed alignment have been based on the chainages from Sydney to Brisbane, which run south to north along the existing interstate rail line. Chainages for the alignment commence at 976.825 km (Musgrave Road) and terminate at 922.100 km (Beaudesert town centre).

2.3 Existing transport corridors and service operations

2.3.1 Interstate rail corridor

The existing interstate standard gauge rail line extends 975.8 km between Sydney and Salisbury Junction and was built in the 1920s to connect New South Wales and Queensland. The existing alignment is a non-electrified dual gauge railway from the New South Wales – Queensland border to the northern end of the Acacia Ridge intermodal terminal. From Acacia Ridge to Roma Street the interstate rail line becomes an electrified dual gauge railway. This section of the line shares a ‘two track’ corridor with the Acacia Ridge to Salisbury narrow gauge rail for just over 1 km.
The Queensland section of the interstate rail corridor is currently owned by the Queensland Government, who lease it to DTMR, who sublease it to the Australian Rail Track Corporation (ARTC). ARTC currently manages contracts for infrastructure maintenance and planning. Since 2008 ARTC has been undertaking route improvement works including the installation of signalling systems, lengthening of existing sidings and the installation of dual gauge concrete sleepers and track.

The existing interstate line would remain on its current alignment, and is expected to be minimally impacted by construction of the new commuter tracks.

### 2.3.2 Bethania to Beaudesert rail corridor

This rail line was constructed in 1888 for the purpose of transporting agricultural products and passengers between Bethania and Beaudesert. Due to the low horizontal curve radii, the alignment has very low line speeds (less than 60 km/h). Queensland Rail services ceased in 1996 and the corridor was not used for rail traffic until a six month period in 2002–2003 when the alignment was used by Beaudesert Rail to run a heritage/tourist railway operation. The railway line has not been used since the failure of this operation in 2003. The corridor is therefore mostly unfenced and the remaining rail infrastructure is overgrown and in a state of disrepair.

### 2.3.3 Existing service operations

A single daily passenger train travels each way between Brisbane and Sydney. This Countrylink XPT train travels north from Sydney overnight, arriving at Roma Street station in Brisbane at 6.30 am. The return trip south to Sydney commences an hour later. An additional passenger train travels from Sydney to as far north as Casino in New South Wales before returning to Sydney. Passengers for destinations north of Casino use a bus link between Casino and Brisbane.

Currently an average of five freight trains travel daily each way along the interstate rail line. This number is forecast to almost triple by 2026. The proposed Southern Freight Rail Corridor link from Ipswich will tie into the interstate line near Kagaru, potentially generating additional freight traffic between Kagaru and Acacia Ridge.

### 2.4 Design criteria

Key design parameters are as follows:

- a stand-alone passenger rail line from the interstate rail line to Beaudesert
- the alignment to diverge from the existing interstate line between Kagaru and northern Bromelton, and connect with the disused Bethania to Beaudesert rail corridor before terminating at Beaudesert
- the proposal to consist of a double-track, narrow gauge, electrified rail system
- the alignment to be designed for a desirable minimum speed of 140 km/h
- no new or major at-grade road crossings of the alignment.
2.4.1 Rail formation and corridor width

The corridor within the southern section has been designed for a double-track railway, an access road and an adjacent cycle path. The majority of the design was undertaken using minimum track centres of 6.0 m between the two proposed passenger tracks.

Corridor width is also influenced by the depths of cuts and the heights of embankments. These parameters, coupled with those described above, would result in a proposed corridor width of 45–70 m between Kagaru and Beaudesert.

Overhead clearances have been set at 5.9 m for the proposed passenger rail line in conformance with Queensland Rail standards. Due to the electrified nature of the proposed railway system, the majority of the corridor would be fenced.

The engineering drawings are included within Appendix F for the new corridor between Kagaru and Beaudesert.

Horizontal alignment

South of Kagaru, the alignment traverses relatively flat, predominantly rural land, and the alignment has been generally designed for a speed of 140 km/h. As a consequence, where the existing Bethania to Beaudesert rail corridor is being followed, the proposed alignment would deviate off railway property and onto adjacent land to achieve the design speed. The exception to this is in the vicinity of Beaudesert where the proposed alignment would follow the existing corridor due to constraints such as the location of stations and an adjacent sewerage works. A design speed of 100 km/h was used for this section.

Vertical alignment

The maximum vertical gradient for the future passenger tracks is limited to 1 in 50 (2.00%) on straight track, with allowance for curve compensation on horizontally curved tracks. The maximum grade in stations is 1 in 200 (0.50%), with the majority of stations designed with flatter grades.

Grade separation of any existing road that would cross the finished railway within the southern section has been allowed for. There are several new roads proposed in the Scenic Rim area, and grade separations have been allowed for where the locations of crossings are known. Crossings for these locations, however, are still in the planning phase and could be moved in the future.

2.5 Bridges and structures

It is expected that existing road overbridges within the northern and central sections of the interstate rail corridor between Salisbury and Kagaru would need to be modified to accommodate the additional tracks. It is also expected that existing rail bridges over roads and waterways would require modification or duplication. This would need to be addressed during future stages of the design. Existing road and rail bridges along this section of the alignment are presented in Tables 2.1 and 2.2 below.

The alignment between Kagaru and Beaudesert passes through a floodplain and would require large openings to accommodate surface water flow. These openings would consist of culverts, bridges and viaducts including a 1.1 km long bridge which would
be required to cross the Logan River and Undullah Road. The locations of bridges and viaducts within this southern section are shown on Drawings BET903-C-DWG-101 to 124 in Appendix F and listed in Tables 2.1 and 2.2.

Table 2.1 Rail bridges

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<th>Section</th>
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<td>969.1</td>
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<td>964.2</td>
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Table 2.2  Road bridges

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<td>Boundary Road overpass</td>
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<tr>
<td></td>
<td>971.3</td>
<td>Learoyd Road overpass</td>
</tr>
<tr>
<td></td>
<td>964.0</td>
<td>Johnson Road overpass</td>
</tr>
<tr>
<td>CENTRAL</td>
<td>956.0</td>
<td>Middle Road overpass</td>
</tr>
<tr>
<td></td>
<td>953.8</td>
<td>Pub Lane overpass</td>
</tr>
<tr>
<td></td>
<td>950.2</td>
<td>Olson Road overpass</td>
</tr>
<tr>
<td></td>
<td>945.1</td>
<td>Homestead Drive overpass</td>
</tr>
<tr>
<td></td>
<td>941.1</td>
<td>Wyatt Road overpass</td>
</tr>
<tr>
<td>SOUTHERN</td>
<td>938.8</td>
<td>Kilmoylar Road overpass</td>
</tr>
<tr>
<td></td>
<td>937.7</td>
<td>Brookland Road overpass</td>
</tr>
<tr>
<td></td>
<td>927.8</td>
<td>Allen Creek Road overpass</td>
</tr>
<tr>
<td></td>
<td>923.3</td>
<td>Road overpass (future bypass)</td>
</tr>
<tr>
<td></td>
<td>923.0</td>
<td>Helen street overpass</td>
</tr>
</tbody>
</table>

2.6  Roads impacted by rail

2.6.1  Northern and central sections

Roads which are crossed by the existing interstate corridor are listed according to their state or local government designation below. Potential impacts on these roads would need to be considered during future stages of the design.

State controlled roads:
- Mount Lindesay Highway
- Brisbane Urban Corridor (Griffith Arterial Road)
- Logan Motorway (adjacent to Paradise Road Interchange).

Brisbane City Council (BCC) arterial roads:
- Beaudesert Road
- Boundary Road
- Learoyd Road.

BCC local roads:
- Musgrave Road
- Johnson Road (on the border of BCC and LCC).

Logan City Council (LCC) arterial roads:
- Middle Road
- Pub Lane
2.6.2 Southern section

The alignment would be crossed by three future arterial roads which are likely to become state controlled:

- Brookland Road (future north–south arterial connecting Flagstone to Bromelton)
- future inner bypass of Beaudesert
- proposed heavy vehicle bypass to Beaudesert business area.

Other local Scenic Rim Regional Council roads which would be affected by the rail alignment within the southern section include Kilmoylar Road, Undullah Road, Hall Road, Hiscock Road, Hopkins Lane, Walker Road, Allan Creek Road and Helen Street.

2.7 Rail systems

2.7.1 Electrification

To enable the running of electric traction rolling stock from Salisbury to Beaudesert, the entire route would be required to be electrified. The proposed electric traction system is a 25 kV overhead wire catenary installation. This would necessitate the installation of vertical steel structures at approximately 60 m intervals along the entire route.

Future design would need to consider the issues associated with the supply of power for this system, potential impacts on surrounding communications networks and the safety considerations surrounding the interface between high voltage electrification and the general public.

2.8 Stations

Following the constraints mapping and options analysis process, which is presented in Chapter 4, the following preferred station locations were identified.

Northern section

- Acacia Ridge
- Algester
- Hillcrest
- Boronia Heights

Central section

- Greenbank
- New Beith (proposed park and ride)
• Flagstone Central
• Undullah

**Southern section**
• Gleneagle North (proposed park and ride)
• Gleneagle
• Beaudesert

2.9 **Public utilities**
Major public utility interfaces with the existing interstate corridor which were identified during the course of this study include:

• high voltage transmission line crossings near Learoyd Road, Logan Motorway, and Pub Lane
• a large diameter water main crossing north of Learoyd Road (see Figure 2.5)
• a transmission pressure gas main along Paradise Road south of Learoyd Road.

![LARGE WATER MAIN CROSSING NORTH OF LEAROYD ROAD](image)

More detailed investigations into public utility locations and interfaces should be undertaken during subsequent phases of this proposal.

2.9.1 **Powerlink**
There are four locations where Powerlink high voltage alignments presently cross the existing interstate corridor. Powerlink is planning additional overhead and underground transmission installations between the Algester and Larapinta substations and thus would be an important future stakeholder.
2.9.2 Telecommunications
Telstra and other telecommunications carriers would have a number of installations across and possibly within the existing interstate corridor, particularly within the more urban parts of the study area. These would need to be identified during subsequent stages of the design.

2.9.3 Electricity reticulation
As in the case of telecommunications, underground and overhead reticulation plant would be identified by the relevant authority during subsequent stages of the design.

2.9.4 Local authority services
Local authority services include water and sewerage reticulation lines. Some of these utilities cross the existing corridor, frequently on overhead structures. The extent of local authority service installations and the managing of any protection or relocation of these services would also form part of the future design process.

2.10 Construction staging
A staged implementation strategy for the construction of the future passenger railway would be developed during subsequent phases of design. Additional construction staging strategies would also need to be developed to address issues such as:

- traffic management
- alternative dry and wet construction programs
- existing rail network access
- temporary works
- accommodation works and access requirements
- construction of rail and road bridges
- construction of new road alignments
- construction of earthworks
- construction of stations and services.

The full implications of any staging options would require careful consideration given the potential construction impacts on local communities resulting from issues such as noise, dust and traffic diversions. Early local consultation would form an integral part of the development of any construction staging strategies.

2.11 Construction activities
Significant levels of construction activity would be required to construct the proposed passenger rail line, stations and associated infrastructure. Currently the construction of the rail line is expected to commence after 2026 (Draft Mt Lindesay/Beaudesert Strategic Transport Network Investigation: Post-2026 Public Transport Connections, DTMR 2009). These timescales will be subject to funding and expected patronage demand.
Given the limitations of the current level of design and the considerable amount of time before construction commences, the likely nature of proposed construction activities is not yet defined in any detail. The following section therefore provides an outline of the construction activities which would potentially be associated with the proposed passenger rail line.

### 2.11.1 Plant and equipment

Typical plant and equipment types for a rail construction project such as the proposed Salisbury to Beaudesert rail line would include:

- light transport vehicles
- excavators
- bulldozers
- wheel loaders
- graders
- scrapers
- backhoes
- heavy trucks
- tip trucks (fill/ballast)
- water trucks
- rollers
- concrete cutting saws
- cranes
- concrete pumps
- concrete trucks
- pile drivers
- wood chippers/mulchers
- track laying machinery
- generators
- compressors
- assorted small items of equipment.

The requirement for the machinery listed would depend on the stage of construction, and not all plant listed would be on site at any given time.

### 2.11.2 Workforce

The construction is likely to be undertaken by private contractors. The number of personnel in the workforce during the peak of construction activities is currently unknown, but is likely to be in the order of hundreds of people. A large proportion of
the workforce is expected to be from the South East Queensland region. Although
parts of the proposed rail line are located in an essentially rural area, the entire
alignment is within easy travelling distance of major towns such as Beaudesert or the
urban areas of Brisbane and Logan. These localities are likely to have ample housing
and facilities to support those workers who do not already live locally.

2.11.3 Associated temporary facilities

A number of construction compounds would be required along the length of the
alignment to secure plant outside hours, to store construction materials, and to house
workforce day facilities such as offices, the mess huts and ablutions facilities. It is also
likely that a number of self-contained portable toilets would be located elsewhere
along the site. Consideration should be given to constraints such as watercourses and
significant vegetation when siting temporary facilities.

2.11.4 Major construction activities

Construction activities would occur in two phases: firstly, the construction of the
earthworks up to the top of formation; and secondly, the construction of the rail
infrastructure.

Formation works

- vegetation clearing and top soil stripping
- preliminary drainage works, including the construction of ‘cutoff’ drains and
  some sedimentation basins
- earthworks
- major drainage works, including the construction of cross-drainage culverts and
  formation of table drains, and construction of remaining sedimentation basins
- installation of drainage and culverts
- trimming and compacting of subgrade
- scour protection works and landscaping

Associated infrastructure works

- realignment of roads and road furniture
- construction of rail/road bridges
- construction of stations and station car parks
- diversion and protection of utilities

Overhead electrification work

- installation of mast foundation, dressing and erection of masts
- installation of balance weights, mid-point anchors and ties
- running of ancillary wires and catenary wires
Track work

- relocating existing tracks where required
- initial ballast laying
- laying of mainline sleepers
- placing continuously welded rail strings on sleepers
- clipping rail to sleepers
- ballast laying and track tamping
- de-stressing of rail strings and final welding
- installation of turnouts and crossovers
- installation of insulated rail joints and other signal system requirements
- final alignment of track

Signalling work

- installation of signal, huts, equipment rooms and automatic warning systems
- installation of mechanical points
- installation of main and local cables

Telecommunication work

- installation of transmission and data networks
- installation of main and local cables
- installation of station services (closed circuit television, public address system, ticket machines and passenger information)

Power distribution work

- installation of track section cabins
- installation of feeder station
- installation of auxiliary and booster transformers
- installation of main and local power cables

2.11.5 Existing rail activities

Approximately 36 km of the construction work would be adjacent to the existing interstate rail line and many activities are likely to be undertaken in close proximity to the operational interstate railway. Construction activities therefore have the potential to impact on the operation of the existing interstate railway. Consultation and careful planning would be required to avoid major disruptions to this service. Furthermore, clear responsibilities would need to be agreed and implemented between the existing interstate rail operators and the principal contractor, to ensure that the necessary safety protocols were followed.
Construction of the line through the existing Acacia Ridge intermodal terminal would require consultation with terminal stakeholders, as this element of works may disrupt terminal operations.

2.12 Demand on resources

The construction of the proposed railway system would require a range of construction material supplies from local and wider regional resources. These resources are likely to include:

- fill
- ballast
- concrete (sleepers and structures such as bridge decks)
- steel
- water
- fuels and oils
- labour resources.

Initial estimates indicate that construction of the rail formation within the southern section would require a volume of excess fill in the order of 75,000 m$^3$. The total cut to fill balance produced by construction of the overall passenger rail line is currently unknown and would need to be investigated in future. This would enable an assessment into the potential impacts on local and regional supplies of fill.

Further studies would need to be undertaken during future design stages to quantify other resource requirements such as the volumes of ballast, concrete and steel required to construct the railway. The impacts of potential resource requirements on local and regional supplies would then need to be assessed following identification of the necessary supply sources.

2.13 Waste management

Waste management issues associated with construction of the proposed passenger line would primarily be linked to the construction phase, and would include:

- handling and disposal of cleared vegetation
- handling and disposal of excess or unsuitable fill and road building materials
- collection and disposal of construction debris and domestic rubbish
- handling and storage of dangerous goods including fuels, oils, greases or other chemicals
- the provision of toilet/washroom facilities, and the collection and disposal of wastewater.

The overriding principles applied to waste management would be to minimise the amount of waste generated, reuse and/or recycle wastes wherever possible, and dispose of the remainder in a responsible manner.
2.14 Cost estimate

The estimated total project development cost of the proposed passenger rail line described in this REF is $1.2–1.8 billion based on today’s values. This has been estimated based on similar constructed projects.
3 Planning background

3.1 Protecting the corridor

The coordination of transport and land use planning is a core principle of the *South East Queensland Regional Plan 2009–2031* (SEQ Regional Plan) and a key function of the Department of Transport and Main Roads (DTMR) under the *Transport Planning and Coordination Act 1994* (TPC Act). Early identification of the preferred corridor between Kagaru and Beaudesert will minimise the potential for conflict with surrounding land uses in the future. There are two main processes available to DTMR for protecting the preferred corridor. These are:

- using powers under the *Sustainable Planning Act 2009* (SPA) and the TPC Act to identify the corridor in statutory land use planning documents
- designating land required for the preferred corridor for community infrastructure under Chapter 5 of the SPA.

DTMR’s preferred approach is to use its powers under the SPA and the TPC Act to identify the preferred corridor in the local planning scheme for the Scenic Rim Regional Council area (which is currently under review) and other land use planning documents, such as the SEQ Regional Plan. The department would then act as a referral agency for development applications under the SPA which may impact the preferred corridor.

Where DTMR is a referral agency or assessment manager for development applications affecting a future public transport corridor or future public passenger transport facility, it must assess the extent to which it meets the land use and transport coordination criteria set out by Part A of the TPC Act.

DTMR proposes to undertake early concept design and a non-statutory assessment of potential impacts associated with the future passenger rail line to ensure that the corridor protected is feasible with respect to engineering and environmental constraints.

3.2 Legislative framework

3.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for matters of national environmental significance (NES). Matters of NES potentially relevant to the proposal include:

- the threatened ecological community of the Swamp Tea-tree (*Melaleuca irbyana*) forests of South East Queensland
An action that has, will have, or is likely to have a significant impact on the environment on Commonwealth land also requires approval from the Australian Government under the EPBC Act. The existing interstate rail corridor bisects the Greenbank Military Training Area, which is a Commonwealth Heritage Place on Commonwealth land.

**Referral decision**

Under the EPBC Act, anyone undertaking an action that may have a significant impact on matters of NES or actions affecting Commonwealth land must submit a referral to the Australian Government Minister for the Environment to determine whether the project requires assessment and approval by the Commonwealth. The Minister may determine that a project is:

- ‘not a controlled action’, where an action is not expected to have a significant impact, and no formal assessment is required for the development to proceed. The minister may also specify that the action is to be undertaken in a ‘particular manner’ to avoid significant impact
- a ‘controlled action’, where potential impacts on matters of NES or Commonwealth land are considered to be significant, and formal assessment and approval under the EPBC Act is required.

### 3.2.2 Native Title Act 1993

The *Native Title Act 1993* (NT Act) provides recognition for the rights and interests over land and water possessed by Australian indigenous people under traditional laws and customs. Native title is generally held to be extinguished on freehold land, but may still exist on lands held in leasehold or other unallocated state land affected by the proposed rail corridor.

The NT Act provides for native title parties to be notified of ‘future acts’ which may affect native rights. Section 24KA of the NT Act contains specific provisions for dealing with future acts involving construction, operation, use, maintenance and repair of public infrastructure and services. These provisions allow public infrastructure projects to proceed insofar as they do not prevent the enjoyment of native title rights under the Act. Figure 3.1 indicates native title claims current for the study area at April 2010.
Figure 3.1
Current native title claims
As shown on Figure 3.1, the Jagera people have a native title claim application over parts of the study area and, in future, would need to be notified of any ‘future acts’ which may affect their native title rights.

3.2.3 State legislation

This section discusses Queensland legislation which needs to be considered as part of the REF. It should be noted that, due to the long time horizons associated with the development of the passenger rail line, these requirements would need to be reviewed in future, should the project proceed.

Sustainable Planning Act 2009

All aspects of development for the maintenance, repair, upgrading, augmentation or duplication of rail transport infrastructure are exempt from assessment against a planning scheme pursuant to Schedule 4, Table 5, Item 8 of the Sustainable Planning Regulation 2009 (SP Regulation). Additional passenger tracks, railway stations and associated facilities may be considered to constitute the ‘augmentation’ of rail transport infrastructure associated with Queensland Rail’s existing Citytrain network; however, this would need to be resolved in consultation with the Department of Infrastructure and Planning or any other relevant authority at the time of application.

Railway lines, stations and associated facilities are also prescribed as community infrastructure under Schedule 2 of the SP Regulation. Under Chapter 5 of the SPA, a minister or local government may designate land for community infrastructure; however, DTMR’s preferred approach is to protect the corridor using powers under the TPC Act as outlined in Section 3.1.

It should be noted that no development approvals would be sought for the passenger rail line at this stage of the study. Development approvals would need to be sought as part of the detailed design process, should the project proceed in future.

Environmental Protection Act 1994

The Environmental Protection Act 1994 aims to protect the environment while still allowing for development that is ecologically sustainable. This Act also regulates environmentally relevant activities (ERAs) prescribed in the Environmental Protection Regulation 2008. ERAs are activities that are considered to have the potential to cause environmental harm. The following ERAs could apply to the project; however, these would need to be reviewed in future:

- ERA 8 – Chemical storage (which includes chemicals used in herbicides and pesticides)
- ERA 16 – Extraction
- ERA 43 – Concrete batching
- ERA 57 – Regulated waste transport (for removing and disposing of industrial waste from construction sites).
Vegetation Management Act 1999

The Vegetation Management Act 1999 protects native vegetation by regulating vegetation clearing in terms of the types and areas of vegetation that can be cleared, and how the clearing may be undertaken. A certification is required under Section 22A of this Act to confirm that any clearing undertaken is for a ‘relevant purpose’. This certification must be obtained before an integrated development assessment system (IDAS) application can be lodged.

Fisheries Act 1994

The Fisheries Act 1994 protects Queensland’s fishery resources by setting out requirements for the use, conservation and enhancement of fishery resources and fish habitat. The proposed railway crosses a number of waterways and so approval may be required under the Fisheries Act for those development activities that would pose a temporary or permanent barrier to fish movement.

Water Act 2000

The Water Act 2000 protects Queensland’s water resources by setting out requirements for development or use of the state’s water resources. Where the railway crosses a waterway, approval may be required under this Act to take or interfere with water, or destroy or remove vegetation within the watercourse.

Nature Conservation Act 1992

The Nature Conservation Act 1992 aims to conserve nature through a comprehensive statewide conservation strategy that includes education and communication, designating and protecting certain areas, and protecting native wildlife and habitat. Recent amendments to this Act mean that permits are now required from the Department of Environment and Resource Management where a proposed activity involves the taking of any native fauna or flora (including vegetation clearing).

In some cases a general permit for the taking of certain species in the wild may be issued to a government agency or government owned corporation. This permit should cover any clearing of such species for this proposal. A separate permit would then be required for taking endangered, rare and vulnerable species if these are present.

Aboriginal Cultural Heritage Act 2003

The Aboriginal Cultural Heritage Act 2003 protects indigenous cultural heritage through duty of care provisions and by setting out requirements for cultural heritage management plans. Section 5.9 of this report discusses the potential cultural heritage impacts of this proposal in detail.

3.2.4 Queensland Government Environmental Offsets Policy

The Queensland Government Environmental Offsets Policy outlines the basic principles and guidelines for applying environmental offsets in Queensland. An environmental offset is defined as an action taken to counterbalance unavoidable negative impacts on the environment resulting from an activity or development.

There are two specific-issue policies that are relevant to this proposal:
• Policy for Vegetation Management Offsets—which sets out specific guidance for
  offsetting impacts on native vegetation
• Offsets for Net Benefit to Koalas and Koala Habitat—which sets out specific
guidance for offsetting impacts on koalas or koala habitat.

The draft Biodiversity Offsets Policy may also need to be considered in future.

3.2.5 State planning policies

In accordance with the SPA, the following state planning policies (SPPs) may be in
effect at the time when development applications are assessed.

SPP 1/03 Mitigating the adverse impacts of flood, bushfire and landslide

SPP 1/03 aims to ensure that development in areas at risk from flood, bushfire and
landslide take appropriate account of these risks to protect property and human life.
Planning scheme overlay maps for Brisbane, Logan and Scenic Rim local government
areas identify a number of locations at risk of natural hazards resulting from flood or
bushfire. While this policy does not impose requirements for any additional approvals,
safety and environmental management plans for the construction and operation of the
railway may need to consider risk from bushfire, flooding or landslide.

SPP 1/92 Development and the conservation of agricultural land

SPP 1/92 aims to protect good quality agricultural land (GQAL) from development
encroachment. This is relevant in the southern section of the study area which
traverses land classified as Class A—arable land, Class B—limited arable land and, in
some cases, Class C1 land that is considered to be GQAL. The government’s policy
position as described in this SPP is that GQAL should not be built on unless there is
an overriding need for the development. Potential impacts on GQAL are discussed in
further detail in Section 5.1.

SPP 2/02 Planning and managing development involving acid sulphate soils

In coastal local government areas (including Brisbane and Logan), SPP 2/02 applies
where disturbance may occur to land, soils and sediment at or below 5 m Australian
Height Datum (AHD) where the natural ground level is less than 20 m AHD.
Preliminary reviews identified that there is no potential for acid sulphate soils to be
affected by the corridor construction (see Section 5.1).

SPP 2/07 Protection of extractive resources

SPP 2/07 identifies extractive resources of state or regional significance (key resource
areas or KRAs) where extractive industry development is appropriate in principle, and
aims to protect these resources from development that might prevent or constrain
extraction when the need for the resource arises. There are no KRAs potentially
affected by the proposed rail corridor.
South East Queensland Koala State Planning Regulatory Provisions

The South East Queensland Koala State Planning Regulatory Provisions place restrictions on the kinds of development occurring in areas of protected koala bushland habitat or the interim koala habitat protection area. These provisions are currently under review and will be superseded by the forthcoming SEQ Koala Conservation State Planning Policy (currently at draft stage) and state planning regulatory provisions in the near future. In the interim, current areas of mapped koala habitat have been noted as part of this study.

3.2.6 Local government

The study area traverses three local government areas: Brisbane City, Logan City and the Scenic Rim Region. Local laws are laws set out by a local government in order to manage locally specific issues. These laws achieve that aim by regulating actions or activities through permitting and licensing requirements. The local laws that are relevant to this proposal are discussed in Chapter 8–Approvals and licensing.
4 Option development and analysis

This chapter provides a description of the process undertaken to identify, develop, evaluate and compare the respective options for a rail alignment between Kagaru and Beaudesert. The chapter also presents the preferred options in regard to station locations, along with a justification of why these options were chosen.

4.1 Study objectives

The overall objective of identifying a suitable alignment for a future passenger rail service between Salisbury and Beaudesert is to support future urban development in Brisbane’s south-western growth corridor through the provision of appropriate public transport infrastructure.

In addition, the following specific aims have been identified for the future railway:

**Transport**
- maximise patronage of the rail system by aligning with future growth areas
- align with future land uses and maximise opportunities for transit-oriented development (TOD)
- maximise the use of the existing interstate rail corridor
- promote pedestrian and cycle activity
- improve travel time to destinations
- promote increased public transport use
- integrate with the existing and proposed transport network structure.

**Cost and engineering**
- incorporate environmental controls within the project design
- provide a realistic and affordable solution
- optimise access and amenity
- achieve a design which enhances the community.

**Natural environment**
- minimise impact on the natural environment
- minimise need for environmental offsets.
Social environment

- minimise impacts on quality of life
- minimise property requirements
- balance stakeholder needs
- provide cohesion within and between suburbs and localities.

Land use planning

- optimise land use patterns
- physically integrate with existing built environment
- achieve consistency with regional, sub-regional and local planning intent.

Specific design and location goals and standards for the rail alignment and stations are summarised in Table 4.1.

**Table 4.1 Design and location goals and standards**

<table>
<thead>
<tr>
<th>Design element</th>
<th>Design and location criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations</td>
<td>• Stations to be located on straight sections</td>
</tr>
<tr>
<td></td>
<td>• Minimum 3 km distance between stations</td>
</tr>
<tr>
<td></td>
<td>• Maximise walking catchment (within 800 m) for all stations</td>
</tr>
<tr>
<td>Track</td>
<td>• Two, narrow gauge passenger rail tracks (one up track, one down track)</td>
</tr>
<tr>
<td></td>
<td>• 25 kV AC overhead electric traction system</td>
</tr>
<tr>
<td>Design speed</td>
<td>• Target design speed of 140 km/h in unconstrained areas</td>
</tr>
<tr>
<td></td>
<td>• Reduced design speed of 70-90 km/h in constrained areas</td>
</tr>
<tr>
<td>Track centres and corridor width</td>
<td>• Accommodate 6 m track centres where reasonable</td>
</tr>
<tr>
<td></td>
<td>• Queensland Rail <em>Standard Track Formation Corridor Widths</em></td>
</tr>
<tr>
<td>Grade</td>
<td>• Maximum vertical grade of 1 in 50 in both directions</td>
</tr>
<tr>
<td></td>
<td>• Maximum vertical grade of 1 in 200 for stations and stabling areas</td>
</tr>
<tr>
<td>Overhead clearance</td>
<td>• 5.9 m for the passenger rail line in accordance with Queensland Rail <em>Standard Clearances for Proposed Structures</em></td>
</tr>
<tr>
<td>Crossings</td>
<td>• No new at-grade (level) crossings; grade separation for all road/rail intersections wherever possible</td>
</tr>
<tr>
<td>Flood immunity</td>
<td>• 100 year average recurrence interval for new railway construction</td>
</tr>
<tr>
<td>Pedestrian and cycle facilities</td>
<td>• Provision for a trunk cycle path adjacent to the rail formation as identified in the Principal Cycle Network Plan</td>
</tr>
</tbody>
</table>

### 4.2 Methodology

#### 4.2.1 Constraints mapping

The first step in the process of identifying potential station locations between Salisbury and Beaudesert and a preferred corridor between Kagaru and Beaudesert was a review of the existing environmental values within the study area. This process included:

- review of the SEQ Regional Plan and local government planning documents
• review of previous technical reports
• site visits
• consultation with state and local government agencies to obtain relevant information including spatial mapping.

This process established existing baseline environmental and social conditions. Existing constraints and issues within the study area were then identified, including those which would have a low, medium or high bearing on the location of stations and alignments. Issues that were considered include:

• identified future growth areas
• existing and future road networks
• property boundaries and property access
• the locations of dwellings and infrastructure
• the locations of community facilities such as schools, places of worship and hospitals
• topography and landform constraints
• good quality agricultural land
• mapped areas of acid sulphate soils
• indigenous and non-indigenous cultural heritage
• the location and value of watercourses
• flooding issues including the known extents of 100 year average recurrence interval (ARI) floods
• locations and depths of groundwater aquifers
• sensitive fauna and flora communities, including koala habitat, remnant vegetation and records of endangered, vulnerable and rare fauna and flora species
• state, regional and locally significant biodiversity corridors
• landscape and visual amenity
• contaminated land.

The process was carried out by KBR with input from DTMR and the technical working group. A comprehensive list of key issues and objectives considered is provided in Appendix A. These objectives were endorsed by the technical working group (TWG). The agencies represented on the TWG are listed in Section 4.2.4.

4.2.2 Alignment option development

Between Salisbury and Kagaru, the existing interstate rail corridor aligns well with the future urban development areas to potentially be serviced by the passenger rail line. It was therefore assumed that the future passenger rail line would generally follow the alignment of the existing interstate rail corridor between Salisbury and Kagaru.
South of Kagaru, the key objective of the corridor development process was to investigate viable options that would enable establishment of an alignment from the existing interstate rail corridor eastwards across the Logan River to connect with the existing disused Bethania to Beaudesert rail corridor. Alignment options would then follow the general alignment of this corridor south into Beaudesert.

Feasible alignment options were identified based on a review of the study objectives and the constraints and issues identified during the constraints mapping process described above.

The process resulted in the identification of two feasible corridor alignment options which are described below and shown spatially in Figure 4.1.

- **Option A**: Option A deviates in a south-easterly direction from the interstate rail line at Kagaru to connect with the disused Bethania to Beaudesert rail corridor at the intersection of Hopkins Lane and the Mount Lindesay Highway. From here, the corridor follows the general alignment of the Bethania to Beaudesert rail corridor south to Beaudesert. Minor deviations from this corridor would be necessary to accommodate the increased curve radii required to meet the proposed 140 km/h design speed of the alignment through this section.

- **Option B**: Option B would continue to follow the alignment of the existing interstate rail line from Kagaru to the point where the corridor crosses Allan Creek, approximately 2 km north of Bromelton. From here Option B would turn in an easterly direction from the interstate rail line to connect with the disused Bethania to Beaudesert rail corridor on the northern outskirts of Beaudesert. Option B would then follow the same alignment as Option A into central Beaudesert.

### 4.2.3 Identification of possible station locations

Possible station locations which integrate with future urban development patterns were identified through an analysis of the SEQ Regional Plan and local planning documents. Aligning the proposed rail system with these future growth areas would maximise rail patronage. This was the principal objective which guided the process of selecting possible station locations.

The possible station locations were then refined based on other study objectives and a review of the constraints and issues identified during the constraints mapping exercise.

A further consideration for station locations was that stations between Salisbury and Kagaru were required to be adjacent to the existing interstate line. Between Kagaru and Beaudesert, station locations were not constrained by the interstate line. Station locations in this part of the study area were selected on the basis of servicing either future residential growth areas north of Beaudesert or future industrial development at Bromelton.
Figure 4.1
Southern corridor alignment options
The constraints mapping exercise identified the following potential locations for stations along the northern and central sections of the proposed passenger rail line (refer to Figures 2.1 to 2.3 and 4.2 and 4.3):

- Acacia Ridge
- Algester Option 1 (Nottingham Road)
- Algester Option 2 (adjacent to Logan Motorway)
- Hillcrest
- Boronia Heights
- Greenbank Option 1 (old station site)
- Greenbank Option 2 (Pub Lane)
- New Beith
- Flagstone Central
- Undullah.

In addition, the following potential station locations were identified for the alternative corridor options within the southern section (refer to Figures 2.4 and 4.1).

**Option A**

- Gleneagle North
- Gleneagle
- Beaudesert.

**Option B**

- Bromelton
- Gleneagle
- Beaudesert.

In order to integrate with the Draft Beaudesert Town Outline Structure Plan City Civic Precinct, the proposed rail alignment and Beaudesert Station location have been shifted to the west of the existing Bethania to Beaudesert rail transport corridor. Further discussions with the Scenic Rim Regional Council are required to determine the optimal station location for Beaudesert.

In most cases, the constraints mapping process resulted in the identification of a single feasible station location. The exceptions to this were station locations within Algester and Greenbank where two feasible station location options were identified. These options were subsequently evaluated in order to define a preferred station location option for each area. The evaluation process is presented in Section 4.3. The Algester and Greenbank station location options are shown on Figures 4.2 and 4.3.
Figure 4.2
Algester station options
Figure 4.3
Greenbank station options
4.2.4 Review and development by technical working group

As part of the southern corridor identification process, a technical working group (TWG) comprising state and local government agency representatives was formed to provide advice with respect to land use planning for the study area, the operational requirements of a passenger rail service and environmental management. The TWG comprised representatives from:

- Department of Transport and Main Roads
- Department of Infrastructure and Planning
- Department of Environment and Resource Management
- Queensland Rail (QR Limited)
- Logan City Council
- Scenic Rim Regional Council
- Brisbane City Council
- TransLink Transit Authority
- KBR.

The TWG provided input and advice on early concept design options to assist with the identification of key issues.

4.2.5 Multi-criteria analysis

A multi-criteria analysis was chosen to evaluate alignment and station location options where the constraints mapping, options development and TWG review did not produce an obvious preferred alignment or station location. Multi-criteria analysis is a decision-making tool developed for complex multi-criteria problems that allows qualitative and/or quantitative aspects of the problem to be included in the decision-making process. Useful attributes of multi-criteria analysis include the following:

- the capability to accommodate multiple criteria in the analysis
- the analysis need not be data intensive and allows for the incorporation of both qualitative and quantitative information
- the analysis is transparent
- it includes mechanisms for feedback concerning the consistency of the judgements made.
Evaluation criteria

In order to evaluate the alignment and station location options, evaluation criteria were developed by KBR, DTMR and the technical working group in three stages:

1. reviewing the key issues and objectives identified during the constraints mapping stage (see Appendix A)
2. sorting and grouping the key issues and objectives
3. developing a criterion, or performance indicator, to measure each grouping of key issues and objectives.

Final evaluation criteria were selected on the basis of meeting the following requirements:

- discerns between options (i.e. criterion is not useful if all options satisfy equally)
- does not highly correlate with other evaluation criteria
- can be used to meaningfully ‘measure’ the acceptability of each of the options
- integrates all points of view expressed by the members of the technical working group.

The final evaluation criteria selected, along with their corresponding measures, are listed in Tables 4.2 and 4.3.

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road access to stations</td>
<td>Potential number of lanes for roads which could access the station</td>
</tr>
<tr>
<td>Integration with existing and proposed land use</td>
<td>Consistency with sub-regional and local planning intent</td>
</tr>
<tr>
<td>Distance to nearest activity hub</td>
<td>Distance to nearest commercial, retail or industry area</td>
</tr>
<tr>
<td>Distance between stations</td>
<td>Distance to the nearest proposed/existing station location</td>
</tr>
<tr>
<td>Catchment population in 2031</td>
<td>Current and projected population to 2031 within 800 m for walk-in and 5 km for park and ride and bus commuters</td>
</tr>
<tr>
<td>Station cost per catchment population</td>
<td>Station cost per catchment population (population within 800 m and 5 km of station)</td>
</tr>
<tr>
<td>Constructability</td>
<td>Ease of construction</td>
</tr>
<tr>
<td>Engineering considerations</td>
<td>Complies with operational design requirements</td>
</tr>
<tr>
<td>Impact on sensitive fauna and flora communities</td>
<td>Area of koala habitat, remnant vegetation and remnant wetlands removed</td>
</tr>
<tr>
<td>Potential property requirements</td>
<td>Number and nature of potential property requirements. To include impacts on access</td>
</tr>
</tbody>
</table>
### Table 4.3  Alignment option evaluation criteria and definition

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact on sensitive fauna and flora communities</td>
<td>Area of koala habitat, remnant vegetation and remnant wetlands removed</td>
</tr>
<tr>
<td>Station location</td>
<td>Contribution to optimal station locations</td>
</tr>
<tr>
<td>Impacts on Good Quality Agricultural Land and disruptions to existing agricultural activities</td>
<td>Area of Good Quality Agricultural Land removed or sterilised</td>
</tr>
<tr>
<td>Alignment cost per catchment population</td>
<td>Cost per catchment population (population within 800 m and 5 km of station)</td>
</tr>
<tr>
<td>CO₂ emissions</td>
<td>Equivalent tonnes of CO₂ produced during construction and operation</td>
</tr>
<tr>
<td>Engineering considerations</td>
<td>Complies with operational design requirements</td>
</tr>
<tr>
<td>Hydrological characteristics</td>
<td>Length of corridor below Q100 line</td>
</tr>
<tr>
<td>Potential property requirements</td>
<td>Number and nature of potential property requirements. To include impacts on access</td>
</tr>
<tr>
<td>Constructability</td>
<td>Ease of construction</td>
</tr>
<tr>
<td>Impact on visual amenity</td>
<td>Vertical alignment of track, views and vistas intersected, natural areas traversed</td>
</tr>
</tbody>
</table>

#### 4.2.6 Pair-wise comparison and weighting

Selection criteria may not be of equal importance and so a pair-wise comparison was undertaken to weight and rank the evaluation criteria. This process involved comparing each evaluation criterion with each other evaluation criterion and recording which was considered to be more important in each pairing. The following guidelines were followed when making each pair-wise comparison:

- each criterion was to be considered in a global and generic context, without considering examples specific to the proposal
- weighting considered what stakeholders generally would consider more important
- in deciding which criterion was most important, it was considered
  - whether or not impacts on one can be avoided, mitigated or minimised through design
  - whether impacts are likely to be short-term, long-term or permanent.

Following the pair-wise comparison, each selection criterion was given a weighting, based upon the number of times that criterion was considered more important than each other criterion. This weighting was then used to rank the criteria from highest to lowest. The pair-wise comparisons were undertaken by DTMR with input from KBR.

#### 4.2.7 Evaluation of options

Each of the station location and alignment options were evaluated by the use of an evaluation matrix. This involved rating each of the options according to each of the evaluation criteria. Each rating was then multiplied by the weighting of the evaluation criterion to obtain weighted evaluation criteria. These were then added for each option to arrive at a total. These value ratios were then used to rank the options in order of preference.
4.2.8 Sensitivity testing

Following completion of the analysis, sensitivity testing was undertaken in order to determine whether changes in the weighting of evaluation criteria had a bearing on the outcome of the assessment. This was done by randomly switching the weightings of some evaluation criteria and rerunning the assessment. In each case, sensitivity testing resulted in the outcome remaining the same.

4.3 Preferred options

4.3.1 Southern alignment

The conclusion of the multi-criteria analysis process was that corridor option A was the preferred corridor to transfer the proposed southern alignment from the interstate rail corridor to Beaudesert. This preferred corridor generally complies with the design goals and objectives of the study and was selected as it:

- integrates with future growth areas identified in the SEQ Regional Plan and local planning instruments
- avoids potential conflict with road and rail freight networks in the Bromelton State Development Area
- is consistent with the planning intent under the SEQ Regional Plan for Beaudesert to act as a Principal Rural Activity Centre
- minimises the overall length of the alignment, resulting in greater cost efficiency, reduced energy usage and CO₂ emissions and quicker travel times to Beaudesert
- minimises the length of alignment which traverses land below the 100 year average recurrence interval (ARI) flood level, thereby reducing cost, material inputs and visual impacts associated with elevating the rail line on embankments and structures.

This Option A corridor has therefore been adopted as the preferred alignment and is addressed in the remainder of this REF report. Further refinement of the corridor will occur during future stages of the design and environmental impact assessment.

4.3.2 Station locations

The following section provides a brief summary discussion of the two station location options at Greenbank and Algester, within the following contexts:

- biophysical context
- social/community context
- economic context.

Biophysical context

The principal impacts on the natural environment which were considered when selecting the preferred options were the clearing of remnant vegetation communities and of mapped koala habitat. Algester Option 1 would result in more clearing of mapped remnant vegetation than Algester Option 2; however, both options would
result in similar amounts of clearing of mapped koala habitat. Greenbank Option 1 would result in the loss of more remnant vegetation than Greenbank Option 2.

**Social and community context**

Both Greenbank Option 1 and Algester Option 2 had significant shortcomings in the social and community context. For example, Greenbank Option 1 has a much lower population in the catchment area, and is further from the nearest activity hub than Greenbank Option 1. There are also more potential property requirements at this site, with approximately 24 freehold properties potentially being required. These potential property requirements were calculated using an indicative assessment based on a generic station envelope which will be further refined in future. Algester Option 2 had a much lower catchment population and is much further from the nearest activity hub than Algester Option 1.

The selection of the Algester Option 1 and Greenbank Option 2 station locations therefore makes the most efficient use of land, and minimises impacts on the community.

**Economic context**

The economic context of the options was based upon the cost of the station development per head of current (2006) population in the station catchment. This found that Greenbank Option 1 had the highest cost per head of population at $14,350 per head. Greenbank Option 2 was much lower at $6,980 per head. Algester Option 2 was more expensive, at $5060, than Algester Option 1 which was just $1920 per head.

**Conclusion**

The multi-criteria analysis found that the preferred station options were:

- Algester: Option 1 (at Nottingham Road)
- Greenbank: Option 2 (at Pub Lane).

Algester Option 1 represented the preferred station location on the basis of having a greater surrounding catchment population, closer proximity to the nearest activity hub and superior access. The station would also be located with an optimal distance between the adjacent stations of Acacia Ridge and Hillcrest.

Greenbank Option 2 scored substantially higher in the multi-criteria analysis than Option 1. Similar to Algester Option 1, this station would have a greater surrounding catchment population, closer proximity to the nearest activity hub and superior traffic access. Construction of the station at this location would also result in lower impacts on the natural environment and existing properties.
5 Detailed description of the existing environment, impact assessment and proposed mitigation measures

This chapter of the review of environmental factors (REF) provides a general description of the locality surrounding the proposed passenger rail line in terms of its physical geography, vegetation cover, land use and built environment. It discusses the environmental sensitivity of the area surrounding the proposal, noting the proximity of the proposed rail line to native bushland, natural heritage reserves, watercourses, waterbodies, wetlands, noise-sensitive sites, heritage sites, residential areas, shopping centres, or other significant built or natural features. It also outlines actions that may be necessary to minimise the potential impacts of the proposal and recommends future studies where necessary.

5.1 Landforms, geology, soils and good quality agricultural land

5.1.1 Scope

A preliminary assessment of landforms, geological, soil and good quality agricultural land issues was undertaken as part of the REF. This assessment included a review of available published reports and spatial systems data.

5.1.2 Existing environment

Landforms

As described in Chapter 2 and shown in Figure 5.1 to Figure 5.4, the topography of the study area ranges from floodplain to undulating hills and ridges. The landform of the northern section of the study area is relatively flat from Salisbury to higher elevations (approximately 40 m Australian Height Datum (AHD)) of Acacia Ridge. From this point, the proposed passenger rail line drops down to and skirts the edge of the Oxley Creek floodplain at approximately 15 m AHD to 20 m AHD.

South of the Logan Motorway, the topography consists of undulating hills with elevations ranging between approximately 35 m AHD and 70 m AHD. This topography continues through the central section of the study area to the point where the proposed passenger rail line intercepts the Logan River floodplain. From here the topography remains relatively flat through to Beaudesert. A series of ridges of up to 250 m AHD runs parallel to the west of the study area from northern Flagstone southwards.
Geology

A review of mapping in the Geosciences Australia Digital 1:250,000 Geological Data Base indicates that the study area is underlain by numerous geological units. These units are listed in Table 5.1 and shown spatially in Figure 5.5 to Figure 5.7.
Figure 5.1
Topography - 975 km to 964 km
Figure 5.3
Topography - 950 km to 935 km
Figure 5.4
Topography - 935 km to 922 km

Department of Transport and Main Roads, Salisbury to Beaudesert Rail Corridor Study: Review of Environmental Factors, 2010
Figure 5.5
Geology - Northern
Figure 5.6
Geology - Central
Figure 5.7
Geology - Southern
Table 5.1  Geological units within the study area

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit name</th>
<th>Unit age</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rin</td>
<td>Tingalpa Formation</td>
<td>Triassic</td>
<td>Siltstone, shale, thin coal seams</td>
</tr>
<tr>
<td>Qha/2</td>
<td>Qha/2-9543</td>
<td>Holocene</td>
<td>Second river terrace; sand, silt, clay gravel</td>
</tr>
<tr>
<td>Qpa</td>
<td>Qpa-SEQ</td>
<td>Pleistocene</td>
<td>High level alluvium; silt, clay, sand, gravel</td>
</tr>
<tr>
<td>Qhh</td>
<td>Qhh-SEQ</td>
<td>Holocene</td>
<td>Anthropogenic deposits: land fill, mine tailings, rubble</td>
</tr>
<tr>
<td>Qa</td>
<td>Qa-SEQ</td>
<td>Quaternary</td>
<td>Clay, silt, sand, gravel; flood plain alluvium</td>
</tr>
<tr>
<td>RJbw</td>
<td>Woogaroo Subgroup</td>
<td>Triassic–Jurassic</td>
<td>Quartzose sandstone, siltstone, shale conglomerate, coal</td>
</tr>
<tr>
<td>Tos</td>
<td>Sunnybank Formation</td>
<td>Tertiary</td>
<td>Lacustrine and fluviatile quartzose to sublabile sandstone, conglomerate, silty clay, siltstone, clayey mudstone; mildly lateritised</td>
</tr>
<tr>
<td>Tod</td>
<td>Darra Formation</td>
<td>Tertiary</td>
<td>Lacustrine and fluviatile lithic labile sandstone, mudstone, siltstone, shale, minor conglomerate; lateritised</td>
</tr>
<tr>
<td>To</td>
<td>Oxley Group</td>
<td>Tertiary</td>
<td>Claystone, sandstone, shale, basalt, conglomerate, siltstone, limestone</td>
</tr>
<tr>
<td>Jbmg</td>
<td>Gatton Sandstone</td>
<td>Jurassic</td>
<td>Lithic labile and feldspathic labile sandstone</td>
</tr>
<tr>
<td>Jbmk</td>
<td>Koukandowie Formation</td>
<td>Jurassic</td>
<td>Lithofeldspathic labile and sublabile to quartzose sandstone, siltstone, shale, minor coal, ferruginous oolite marker</td>
</tr>
<tr>
<td>Jbmh</td>
<td>Heifer Creek Sandstone</td>
<td>Jurassic</td>
<td>Sublabile to quartzose sandstone, siltstone, shale</td>
</tr>
<tr>
<td>Jw</td>
<td>Walloon Coal Measures</td>
<td>Jurassic</td>
<td>Shale, siltstone, sandstone, coal seams</td>
</tr>
<tr>
<td>Tfa</td>
<td>Albert Basalt</td>
<td>Tertiary</td>
<td>Olivine basalt</td>
</tr>
<tr>
<td>Qha/1</td>
<td>Qha/1-9543</td>
<td>Holocene</td>
<td>Lowest river terrace; gravel, sand, silt, clay</td>
</tr>
<tr>
<td>Te/1</td>
<td>Beaudesert beds-Te1 (basalt)</td>
<td>Tertiary</td>
<td>Basalt, dolerite sills, minor carbonaceous shale</td>
</tr>
<tr>
<td>Td&gt;Te/1</td>
<td>Td-SEQ-Beaudesert beds-Te1 (basalt)</td>
<td>Tertiary</td>
<td>Duricrusted old land surface: ferric ete, silcrete and indurated palaeosols at the top of a deep weathering profile on Beaudesert Beds Unit 1</td>
</tr>
<tr>
<td>Te/3</td>
<td>Beaudesert beds-Te3 (claystone)</td>
<td>Tertiary</td>
<td>Claystone, sandstone, conglomerate, basalt, dolerite sills, minor carbonaceous shale</td>
</tr>
</tbody>
</table>

Soils

Soils investigations

A soils investigation has been undertaken for the study areas. The objectives of the soil assessment were to undertake desktop assessments and reconnaissance field survey to:

- describe and map the physical nature of the soils
• determine the soils susceptibility to erosion, based on previous studies, surface erosion features and the dispersibility of the soil. Areas where soil erosion may potentially affect downstream water quality were to be determined
• determine areas where soil conditions will require specific management during restoration so that it will not degrade the land use
• identify local soil management practices in cropping/grazing areas, areas of good quality agricultural land (GQAL) and areas susceptible to erosion.

Desktop assessments were undertaken mainly using the following publications as a basis:

• *Understanding and Managing Soils in the Moreton Region* (K E Noble (ed) 1996)
• *Soils and Land Suitability – The South Maclean Woodhill Area – South East Queensland* (J K Loi et al. 1997)
• *The Soil Landscapes of Brisbane and South-eastern Environs* (G G Beckmann et al. 1987 [CSIRO Report])
• *Terrain Analysis, Classification, Assessment and Evaluation for Regional Development Purposes in the Moreton Region, Queensland* (K Grant et al. 1982 [CSIRO Report]).

Information on topography and geology to assist in determining landscape erodibility was derived from the relevant publicly available mapping for the area.

The field investigation was conducted over the accessible parts of the existing interstate rail corridor and preferred southern alignment at a reconnaissance level over a one-day period in December 2009.

Soils were not subjected to field sampling or laboratory analysis as it was considered that sufficient information was available for representative soils within the general area of the proposed passenger rail line from previous DERM and CSIRO investigations.

*Existing information review*

As indicated above, the DERM and CSIRO have conducted land resource and soils assessments in the general region of the existing interstate rail corridor and preferred southern alignment. The study by Beckmann et al. (1987) provides soils mapping at a scale of 1:100000 from Brisbane down to the Greenbank area while the study by Loi et al. (1997) provides detailed soils and GQAL mapping between Flagstone and Veresdale at a scale of 1:50000. Information for the remaining areas is covered by the broader studies by DERM and CSIRO.

Table 5.2 presents a summary of the land resource areas (LRAs), landforms, soils and vegetation (addressed in greater detail in a Section 5.6) for the route as interpreted from Noble et al. (1996) as well as an indication of which sections of the future passenger rail line would pass through each of the LRAs.
### Table 5.2  Land resource areas and soils affected by the proposal

<table>
<thead>
<tr>
<th>Land resource area*</th>
<th>LRA description/landform</th>
<th>Soils prevalent along route</th>
<th>Main sections of proposed rail line</th>
<th>Total length impacted (km) (approx)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b (1)</td>
<td>Fine textured Alluvial Plains/Gently undulating to flat plains</td>
<td>Alluvial black earths and alluvial loams/ Black, brown or grey Vertosols and Dermosols</td>
<td>Mainly Logan River floodplain</td>
<td>5.0</td>
</tr>
<tr>
<td>1c (2- a and b)</td>
<td>Mixed Alluvial Plains/ Flat to gently undulating alluvial plains</td>
<td>Sandy alluvial soils, sandy and loamy solodics (Sodosols)</td>
<td>Alluvial terraces and floodplains of streams in central and northern sections</td>
<td>7.6</td>
</tr>
<tr>
<td>2b (minor 5)</td>
<td>Basaltic Uplands/ Gently to steeply undulating rises and hills</td>
<td>Shallow hillside soils and shallow gravelly red/brown earths (Brown Dermosols)</td>
<td>Minor areas in study area, mainly in southern section</td>
<td>Minimal</td>
</tr>
<tr>
<td>6a (4a and b)</td>
<td>Forest Walloons/ Flat to gently undulating plains and rises derived from fine grained sedimentary rocks</td>
<td>Loamy solodics, soloths and red and yellow podzolics (Sodosols); some shallow brown clays (Brown Dermosols) have been included in this category.</td>
<td>Minor areas in proximity to proposed rail line, main section is to the south of the crossing of Teviot Brook</td>
<td>3.7</td>
</tr>
<tr>
<td>7a (3)</td>
<td>Marburg Forest/Rises and undulating plains on sandstone; often laterised</td>
<td>Sandy solodics, soloths and red and yellow podzolics (Sodosols, Chromosols and Tenosols) and shallow gravelly soils (Rudosols)</td>
<td>Major areas within the central and northern sections of the study area</td>
<td>14.9</td>
</tr>
<tr>
<td>T*** (5)</td>
<td>Tertiary sediments (with strong anthropogenic influences)/ Undulating plains and rises</td>
<td>Red and yellow gravelly podzolics and shallow gravelly soils (Chromosols, Kurosols and Rudosols)</td>
<td>Mainly around urbanised area in northern section and to the north of Beaudesert</td>
<td>22.3</td>
</tr>
</tbody>
</table>

* as modified from Noble et al 1996; description of comparable soil unit in this REF in brackets (see below)

** areas for these categories are likely to be significant overestimates as a major proportion of the northern and central sections are expected to be constructed in the existing disturbed interstate rail corridor (refer to text)

*** Undefined – mainly Tertiary sediments and anthropogenic material not defined in documentation as primarily in urbanised setting

### Soil types along proposed passenger rail line

Soils along the proposed rail line can be classified into five different types (as interpreted from the literature described above) as follows:

1. Alluvial cracking clays and non-cracking clays: mainly Grey and Brown Cracking Clays and Dark Cracking Clays (Great Soil Group–GSG: Grey and Brown Clays and Black Earths; Australian Soils Classification–ASC: Black or Brown Vertosol) and Grey and Brown Non-cracking clays (ASC: Black or Brown Dermosol)

2. Sandy/loamy texture contrast soils (2(a)) or deep sands (2(b)) on alluvium (Siliceous sand or Soloth/Podzolic; Arenic Rudosol, Orthic Tenosol or Chromosol)

3. Sandy texture contrast soils on plains and rises – mainly associated with Jurassic Marburg sedimentary parent material (mainly Solodic or Soloth/Brown Sodosols or Chromosol)
4. Loamy texture contrast and shallow clay soils on plains and rises – mainly associated with Jurassic Walloon sedimentary parent material. The texture contrast soils have been mapped as (a) (i.e. mainly Solodic, Soloth or red and yellow Podzolic /Brown Sodosol, Chromosol or Kurosol) while the shallow clays have been mapped and described as (b) (i.e. mainly Brown Clays/Brown Dermosols)

5. Shallow, gravelly texture contrast soils with shallow loamy or gravelly brown topsoil and yellowish brown or red brown gravelly clays (Soloth, Red-Brown Loams, Red and Yellow Podzolics and Lithosols; Leptic Rudosol or Brown Chromosol or Kurosol).

The general location of these soils along the proposed passenger rail line is shown on Figure 5.8 to Figure 5.10.
Figure 5.9
Soil types - Central
Figure 5.10
Soil types - Southern
Soil erodibility

The assessment of erosion potential for an area of land needs to take into account the land slope and landform and other factors but, in particular, the particular soil properties that may induce or inhibit erosion. It is a function of the soils structural stability and its capacity to absorb rainfall and minimise run-off. Considerations include:

- the texture of the surface soil – a sandier surface increases the propensity for sheet erosion while a hard-setting surface increases the potential for run-off and thereby affects lower parts of the landscape
- the texture and structure of the subsoil, taking into account sodicity, dispersibility, clay structure, etc.
- the presence of surface and near-surface stone.

The soil groups described above have the following inherent erodibility:

- Extreme erodibility: Type 4 (a) (Loamy texture contrast soils) – very prone to gully and tunnel erosion
- Very high: Type 3 (Sandy texture contrast soils) and Type 2 (I – Loamy texture contrast soils) – prone to sheet and gully erosion
- High: Type 2 (a – Deep sands), Type 4 (b – Shallow brown clays) and Type 5 (shallow gravelly soils) – prone to sheet erosion
- Low: Moderate: Type 1 (Alluvial clays) – prone to gully erosion adjacent to watercourse.

Overall erosion hazard

The soil erosion potential classification described above has been used to determine the overall erosion risk for the proposed passenger rail line. These are provided in Table 5.3 below and illustrated on Figure 5.8 to Figure 5.10.

This table is based on the principle of the more susceptible a soil is to erosion and the steeper the slope, the greater the overall erosion hazard. In relation to the alluvial soils, consideration has been given to the propensity for streambank erosion.

Table 5.3 Soil group erosion ratings

<table>
<thead>
<tr>
<th>Soil group</th>
<th>Soil erodibility ranking*</th>
<th>Erosion hazard**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (0–2%)</td>
<td>2 (2–5%)</td>
</tr>
<tr>
<td>1</td>
<td>1–2</td>
<td>L</td>
</tr>
<tr>
<td>2(a)</td>
<td>3</td>
<td>M</td>
</tr>
<tr>
<td>2(b)</td>
<td>3</td>
<td>L</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>H</td>
</tr>
<tr>
<td>4(a)</td>
<td>5</td>
<td>H</td>
</tr>
<tr>
<td>4(b)</td>
<td>3</td>
<td>L</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>L</td>
</tr>
</tbody>
</table>

NOTES

*Soil erodibility: 1: low 2: moderate 3: high 4: very high 5: extreme
**Erosion Hazard: L: low M: moderate H: high VH: very high S: severe
n/a: soil group unlikely to occur on such slopes
Based on the erosion hazard ratings, soil groups 3 and 4(a) have the highest potential erosion hazard. Figure 5.8 to Figure 5.10 indicate that:

- 10% of the proposed rail alignment has a very high to severe erosion hazard (VH)
- 30% has a high hazard (H)
- 60% has a low to moderate hazard (L/M).

Drainage lines and watercourses most at risk from elevated erosion and sedimentation levels include Flagstone Creek and Sandy Creek.

Areas of high to severe erosion hazard will need to be the focus of sediment and control measures. Such measures would need to be developed as part of a comprehensive sediment and erosion control plan for the project. General measures are indicated below in Section 5.1.4.

*Acid sulphate soils*

Acid sulphate soils mapping is presented in Figure 5.11. This mapping shows that areas below 5 m AHD with a low probability of acid sulphate soil occurrence are located to the west of the existing interstate line within Salisbury and Coopers Plains. These areas of potential acid sulphate soils are associated with the lower catchments of the Oxley and Stable Swamp creeks. Given the substantial distance between these areas and the proposed passenger rail line, and the fact that the proposed passenger rail line elevation is approximately 12 m AHD in this area, it is highly unlikely that acid sulphate soils would be encountered during construction. Acid sulphate soils have therefore not been considered further as part of this REF.
Figure 5.11
Acid sulphate soils
Good quality agricultural land

For the purposes of implementing State Planning Policy 1/92 Development and the Conservation of Agricultural Land there is a need to identify areas of GQAL. In determining GQAL, land is allocated 1 of 4 classes as summarised in Table 5.4 (from Planning Guidelines, The Identification of Good Quality Agricultural Land, [DHLGP 1993]).

Table 5.4 Description of land classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Crop land</td>
</tr>
<tr>
<td></td>
<td>Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels. There are two sub-classes of crop land:</td>
</tr>
<tr>
<td></td>
<td>A1 – Crop land suitable for rainfed cropping</td>
</tr>
<tr>
<td></td>
<td>A2 – Crop land suitable for horticulture</td>
</tr>
<tr>
<td></td>
<td>All crop land is considered to be GQAL.</td>
</tr>
<tr>
<td>B</td>
<td>Limited crop land</td>
</tr>
<tr>
<td></td>
<td>Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.</td>
</tr>
<tr>
<td></td>
<td>Land marginal for particular crops of local significance is considered to be GQAL.</td>
</tr>
<tr>
<td>C</td>
<td>Pasture land</td>
</tr>
<tr>
<td></td>
<td>Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.</td>
</tr>
<tr>
<td></td>
<td>In areas where pastoral industries are the major primary industry, land suitable for improved or high quality native pastures may be considered to be GQAL. There are three sub-classes of pasture land:</td>
</tr>
<tr>
<td></td>
<td>C1 – Land suitable for sown pastures with moderate limitations</td>
</tr>
<tr>
<td></td>
<td>C2 – Land suitable for sown pastures with severe limitations</td>
</tr>
<tr>
<td></td>
<td>C3 – Land suitable for light grazing for native pastures in inaccessible areas</td>
</tr>
<tr>
<td></td>
<td>C1 is considered to be GQAL.</td>
</tr>
<tr>
<td>D</td>
<td>Non-agricultural land</td>
</tr>
<tr>
<td></td>
<td>Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage. These limitations preclude any interference with land or biological resources for the production of agricultural goods.</td>
</tr>
</tbody>
</table>

Class A land in all areas is considered to be GQAL. In some areas, class B land (where agricultural land is scarce) and better quality class C land (i.e. Class C1– where pastoral industries predominate) are also regarded as GQAL. For the purposes of this REF, GQAL has been determined to be Classes A and B.

Information on GQAL has previously been mapped (as part of general DERM digital data) for the general region with greater detail provided in the report by Loi et al. (1997). GQAL classification presented in this report has been based on an
interpretation of digital data available from DERM with reinterpretation based on the report by Loi et al. (1997) and further field and aerial photo verification.

Figure 5.12 presents an assessment of the GQAL along the proposed passenger rail line where rural industries predominate, i.e. areas to the north of Undullah are not considered in this assessment as this area is predominantly rural residential or urban in character. The assessment findings are shown in Table 5.5.

<table>
<thead>
<tr>
<th>Class</th>
<th>Length occupied along proposed rail line* (km)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.2</td>
<td>10</td>
</tr>
<tr>
<td>B</td>
<td>5.3</td>
<td>26</td>
</tr>
<tr>
<td>C1</td>
<td>10.0</td>
<td>49</td>
</tr>
<tr>
<td>C2, C3, D</td>
<td>3.1</td>
<td>15</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

* as determined for southern section – from Undullah station only – see Figure 5.12

The above assessment indicates that approximately 2.2 km and 5.3 km of the southern section of the proposed rail line will traverse Class A and Class B GQAL respectively.
Figure 5.12
Good quality agricultural land - Southern
5.1.3 Potential impacts

Landforms
The most notable potential impacts on local landforms along the proposed passenger rail line would relate to the requirements for cut and fill along the alignment. These earthworks would generally consist of lateral extensions to existing cuts and embankments and are therefore expected to have a minimal impact on the local topography. The exact nature of earthworks would need to be confirmed during future stages of design.

The existing topography within the southern section of the study area is generally flat and low lying. As described in Chapter 2, the elevation of the track above the Q100 flood line would necessitate the construction of embankments for substantial distances across the both the Teviot Brook and Logan River floodplains. These embankments would be constructed to a height of up to approximately 7 m above the surrounding landscape and may be up to approximately 2.9 km in length.

Two short distances of cut of up to 8 m depth would also be required to traverse two small hills to the south of Kagaru at chainage 938.0 km. An additional cut of approximately 6 m depth would be necessary along Helen Street within the township of Beaudesert.

The proposed earthworks between Kagaru and Beaudesert are shown in longitudinal section on Drawings BET903-C-DWG-101 to 124. The exact magnitude of these earthworks would be refined during subsequent stages of the design.

Soils
As described in Chapter 2 and above, substantial earthworks, including cutting and filling, would be required to construct the proposed passenger rail line.

Areas disturbed by earthworks and other construction activities have the potential to be eroded through the action of rainfall and surface run-off water and may contribute to elevated suspended solids concentrations in receiving waters. Disturbed areas with steeper slopes, such as cut and fill batters in erodible soils, would be particularly susceptible to erosion unless appropriate measures were taken to mitigate these effects.

As described in Section 5.1.2 above, the soil types along much of the proposed passenger rail line can be classified as moderately to highly erodible with areas with a severe erosion risk. Intensive erosion control measures are therefore likely to be required wherever soil with a high to severe erodibility would be disturbed. Further details on possible mitigation measures are provided within Section 5.1.4.

The most significant potential impact associated with soil erosion would be the potential for sedimentation of the numerous drainage paths, creeks and rivers which the proposed alignment would traverse. The highest risk areas would be where significant cuts and fills are required in relatively close proximity to a cross-drainage path or waterway.
Good quality agricultural land

GQAL within the immediate vicinity of the southern section of the proposed rail line is shown on Figure 5.12.

Severance effects

The proposed alignment within the rural southern section of the study area would result in the severance of 24 lots. It is recommended that this should be further investigated in terms of the effects on existing agricultural operations and land management functions. This information would be derived partly through the community consultation program for later stages of the study.

Property level impacts of severance, such as the reduced viability of the current type of agricultural land use, are addressed further in Section 5.8.

Footprint effects

Loss of GQAL would be limited to the footprint effect of the proposed passenger rail line only. Table 5.5 presents the length of the proposed rail line occupied by the various classes of GQAL that would be sterilised by the line. As noted above in Section 5.1.2, no significant areas of GQAL are likely to be affected in the northern and central sections of the proposed passenger rail, given that these sections are highly urbanised or used for non-commercial rural residential activity, with an extremely low potential to be used for agricultural purposes. In addition, many areas adjacent to this section of the proposed passenger rail line, such as Greater Flagstone, have been earmarked for future urban development. The significance of the loss of GQAL through this area of the study area is therefore considered to be negligible.

The southern section of the study area contains extensive areas of GQAL classified as Class A and C. A preliminary assessment of the loss of GQAL concluded that approximately 2.2 km (or approximately 10.2 ha) of Class A GQAL and approximately 5.3 km (or approximately 26.01 ha) of Class B GQAL would be sterilised in the southern section as a result of the direct footprint of the rail infrastructure.

Areas of Class A and Class B GQAL are primarily associated with the alluvial soils of the Logan River floodplain. The permanent loss of this arable land may constitute a significant impact on specific agricultural properties; however, on a regional basis and in terms of overall agricultural productivity in the Beaudesert region, such losses would be very minor. The effects of such losses on individual productive rural enterprises would need to be assessed in later stages of the study.

5.1.4 Mitigation measures

Soil erosion

The mitigation of soil erosion that may result from development of the project in some areas will need to be a significant focus in regard to overall environmental management. Areas of highest risk will be batter slopes in areas of highly erodible soils described above, especially in the Type 3 soils in the central section of the route. Batter slopes should be designed to reduce the potential for erosion, provide stability
and to retain topsoil for landscaping. The design should also include cut-off drains or low bunds to intercept run-off from undisturbed areas upslope of the proposed passenger rail line.

During construction a ‘best practice’ approach to the mitigation of soil erosion and sedimentation would be adopted. The principles that would be applied to the mitigation of erosion and sedimentation of the construction phase of the proposal would be:

- minimise the area of disturbance
- intercept run-off from undisturbed areas and divert it to cross-drainage channels through the use of catch drains
- divert run-off from disturbed areas to sedimentation basins prior to release from the site where catchment sizes are too large to be accommodated by temporary erosion control structures.

Effective erosion control would be achieved through the use of temporary measures such as the following:

- silt fences
- hay bale fences
- protection of drainage structures
- protection and bunding of stockpiled soils
- sediment traps at drainage inlets
- the provision of catch drains to intercept uncontaminated run-off
- the provision of sedimentation basins to treat run-off from disturbed areas
- the progressive revegetation of disturbed areas as soon as practicable.

The requirement for, and location of, more-substantial control measures such as sediment basins would be determined during detailed design phases. Specific areas where sediment basins may potentially be required include those locations where substantial earthworks would occur in highly erosive soils in close proximity to watercourses and drainage lines.

The overriding principle for the placement of temporary erosion control structures would be to retain sediment as close as possible to its origins, and to protect substantial cross-drainage paths.

In the long term, during the operation of the proposal, erosion and sedimentation would be controlled by ongoing monitoring, comprehensive landscaping and through the use of grass-lined table drains. Additionally, in areas where vegetation was not suitable for batter stabilisation a permanent physical treatment such as spray concrete or retaining walls would need to be considered.

5.1.5 **Recommended further studies**

Detailed geotechnical and soils investigations and site surveys will need to be carried out during the detailed design stage of the proposal. These field investigations would
be intended to validate the desk-based information analysed to date and would allow the accurate description of the erosion potential in areas of substantial ground disturbance. This would inform the detailed design phase in terms of engineering controls necessary and provide the basis for site-specific mitigation measures.

5.2 Groundwater

5.2.1 Scope

This section comprises a preliminary desk-based assessment of the existing groundwater environment and the potential impacts of the proposal.

5.2.2 Existing environment

The study area from Salisbury to northern Flagstone falls within the sub-catchment of the lower Brisbane River and groundwater in this area is therefore managed under the Moreton Water Resource Plan (2007). Three groundwater management areas are identified in Schedule 2 of the plan; however, none of these areas are located within the study area.

The study area from Flagstone southwards falls within the area managed under the Logan Basin Water Resource Plan (2007), specifically within the Teviot Brook and Logan River sub-catchments. No groundwater management areas have been designated within the plan.

A review of the Geological Survey of Queensland and Department of Primary Industries Land Resource Area mapping revealed that much of the near-surface geology within the study area consists of alluvium, sandstone, mudstone, siltstone and shale. All of these geological units have the potential to contain aquifers at varying depths. Alluvium in particular has the potential to contain shallow, perched aquifers. As described in Section 5.1 and shown in Figures 5.5 to 5.7, the proposed alignment would traverse minor areas of alluvium associated with Oxley Creek in the Northern Section and more extensive areas of alluvium within the Logan River floodplain.

5.2.3 Potential impacts

While the extent of cutting required within the northern and central sections of the alignment is currently not known, construction of the southern section of the alignment would necessitate the excavation of cuts of up to 8 m depth. Cuttings in general would be intended to accommodate an appropriate grade for the alignment through elevated areas where groundwater is unlikely to be located at shallow depths. No assessment has been made at this time as to whether any of the cuts would intersect with groundwater and it is likely that field investigations would be required to determine this. Pile driving and earthworks within alluvial areas such as the Logan River floodplain have the potential to intersect with shallow, perched aquifers. Again, no assessment has been made at this stage to confirm whether such aquifers exist and whether they are likely to be affected by the proposed works.

5.2.4 Mitigation measures and recommended further studies

A review of the general characteristics of known aquifers within the study area, including groundwater levels, quality and usage should be undertaken as part of
subsequent study phases. It is also recommended that the depth of groundwater should be subsequently confirmed during routine geotechnical investigations. This would inform any specific measures required to mitigate impacts on groundwater.

5.3 Surface water

5.3.1 Scope

This section provides a preliminary assessment of the existing surface water environment and the potential impacts associated with the construction and operation of the proposed passenger rail line. Surface water issues have been considered in the context of both surface water quality and surface water flows. The assessment involved a review of the following sources of information:

- 2009 aerial photography
- South East Queensland Healthy Waterways Report Card 2008 and 2009

5.3.2 Existing environment

Water flow and catchment description

Major catchments within the study area are shown on Figure 5.13. In the northern section, the existing interstate rail corridor runs roughly parallel to Oxley Creek in the eastern part of the Oxley Creek catchment. This approximately 260 km² catchment forms one of the major sub-catchments of the Lower Brisbane River catchment. Stable Swamp Creek is one of the primary tributaries of Oxley Creek and the corridor crosses this highly modified waterway at Acacia Ridge. The corridor also crosses two minor, east-to-west draining, ephemeral tributaries of Oxley Creek at Algester.

The central section of the study area falls generally within the Logan River sub-catchment of the Logan Basin catchment. A very small portion of the interstate corridor between southern Flagstone and Kagaru is located within the Teviot Brook catchment, which also forms a sub-catchment of the Logan Basin catchment. The Logan Basin catchment occupies an area of approximately 3440 km² and extends from the McPherson Ranges to the south of the study area to Moreton Bay in the east.

The existing interstate corridor crosses a series of west-to-east draining, ephemeral tributaries of the Logan River within the Greater Flagstone area. From north to south these include Norris Creek at chainage 951.5 km, Abrade Creek at chainage 948.7 km, Flagstone Creek at chainage 947.2 km, Keith Creek at chainage 945.5 km and Sandy Creek at chainage 944.4 km. When viewed on aerial photographs, these water courses appeared relatively unmodified in the immediate vicinity of the corridor and were all fringed by dense riparian vegetation.

The southern section of the study area falls largely within the Logan River sub-catchment. The exception to this is the extreme northern part of the southern section where the interstate rail corridor crosses the Teviot Brook sub-catchment at Kagaru.
Figure 5.13
Catchment boundaries
The Cedar Grove Weir is located approximately 7 km downstream of the point where the existing interstate corridor crosses Teviot Brook. When the weir is full, its effects are evident at this crossing point, where the waterway consists of a long, narrow body of standing water fringed by sparse patches of riparian vegetation.

South of Kagaru the proposed corridor remains within or immediately adjacent to the Logan River floodplain and crosses the Logan River at chainage 936.5 km. This location is approximately 9 km upstream of Cedar Grove Weir. As in the case of the Teviot Brook crossing, the damming effects of the weir are evident and the river consists of a long narrow body of standing water contained within a deep channel. The channel is fringed by low riparian vegetation and surrounded by grazing lands. From this point southwards to Beaudesert, the corridor runs approximately parallel to the river and crosses a number of minor, east-to-west flowing, ephemeral water courses and drainage lines that form minor tributaries to the river.

**Water quality**

In the absence of in situ baseline water quality data for the study area, the following assessment of existing water quality for the Oxley and Logan Basin catchments has been based on the South East Queensland Healthy Waterways Report Card results for 2008 and 2009.

The section of the Oxley Creek catchment within which the proposed rail line is located is described as a highly modified, urbanised catchment containing sections of both the Ipswich and Logan motorways. The majority of the tributaries within this section of the catchment are abutted by residences and parks. In 2008 and 2009 the South East Queensland Healthy Waterways Project gave the Oxley catchment a report card rating of F (extremely poor). This rating implies that conditions do not meet set ecosystem health values, most key processes are not functional and most critical habitats are severely impacted. The report indicated high scores for nutrient cycling and ecosystem processes indicators but consistently very poor scores for aquatic macroinvertebrate and fish indicators.

The Logan Basin catchment was rated by the Healthy Waterways 2008 and 2009 Report Cards as very poor (rating D). This rating implies that conditions are unlikely to meet set ecosystem health values in most of the reporting region, many key processes are not functional and many critical habitats are impacted. The report indicated a substantial improvement in the ecosystem processes and fish indicator scores, and a slight increase in aquatic macroinvertebrate scores from 2008 to 2009. A substantial decline was recorded over the same period in the physical, chemical and nutrient cycling indicators.

The dominant land uses within the Logan Basin catchment include grazing, native bushland, rural residential and intensive agriculture, with the majority of the upper catchment (southern section of the proposal) extensively cleared for agriculture, grazing and dairying.
5.3.3 Potential impacts

Water flow

Construction

Potential impacts to water flow during construction are not expected to be significant. Minor, localised impacts may occur as a result of the in-stream works necessary to install culverts and bridges. These impacts are expected to be temporary and would be managed to ensure that disturbances to natural water flows are minimised.

Operation

Potential impacts during the operational phase of the project include those related to interference to water flow during periods of normal flow and during floods.

During flood events afflux may occur (alteration to flow due to the presence of structures such as culverts, bridges and embankments). Specific impacts of afflux include:

- water table effects as a result of damming and seepage
- reduced land use while trapped flood waters recede
- reduced structural integrity as a result of damming pressure
- changes to ecology relying on specific stream velocities
- flooding of properties.

As discussed previously, the proposed vertical alignment within the Logan River floodplain would need to be raised above the Q100 flood level by a combination of viaducts and embankments. In addition, a number of culverts, bridges and embankments would be constructed within other sections of the corridor in order to maintain an appropriate grade for the rail tracks. The design of the proposal would be informed by detailed hydrological/hydraulic modelling to ensure that any structures associated with the proposal did not contribute to unacceptable levels of afflux. Details of proposed modelling are provided in Section 5.3.4.

Interference or blockage of water flow during periods of normal flow may also cause negative impacts, including:

- reduction in stream habitat area
- changes to both downstream and upstream ecology
- reduction in water quality if water becomes stagnant for prolonged periods.

Culverts, bridges and embankments would be designed to ensure that the proposal did not negatively affect water flow during periods of normal flow.
Water quality

Construction

The most notable impacts on surface water quality as a result of construction would be associated with sediment laden surface run-off entering a creek or river system.

As described in Section 5.1, soils within the study area are moderately to highly erosive and, without mitigation, the potential for erosion during construction works is significant. Areas particularly prone to erosion include batter slopes of cuttings and fill embankments, and disturbed banks of natural or constructed drainage paths and waterways.

Potential adverse effects associated with elevated sediment loads and turbidity levels on receiving waters include:

• blanketing of bottom substrates with associated impacts on benthic organisms
• changes to the nature of bottom substrates reducing suitable habitat for benthic organisms
• reduced water clarity, which in turn reduces aesthetic qualities and sunlight penetration. Reduced sunlight penetration can have adverse impacts on submerged aquatic plants, and can result in reduced dissolved oxygen concentrations
• the combination of dissolved oxygen depletion at depth and an increased sediment load, resulting in the release of nutrients (nitrogen and phosphorus) from bottom sediments. This can in turn cause increases in planktonic algae populations
• increased growth of emergent macrophytes where sedimentation reduces water depth.

These effects are likely to have already occurred to varying degrees in the drainage paths and waterways within the study area as a result of existing land uses (e.g. clearing). The construction of the proposal would need to be managed to ensure that the condition of drainage paths and waterways within the study area was not significantly worsened.

Some sedimentation effects would be expected on the sections of drainage paths and waterways in close proximity to construction areas. This may involve increased turbidity and reduced water clarity following rainfall events however, these impacts would generally be temporary and are not expected to have any significant long-term effect on surface water quality

During construction, chemicals used and stored on site could cause adverse impacts if released into receiving waters. These would include fuels, oils, lubricants and herbicides. If these entered receiving waters, they could have toxic effects on aquatic biota and cause adverse aesthetic effects, such as the formation of surface films.

Construction activities also generate solid wastes including construction debris, packaging, and domestic litter. If these were transported into receiving waters, they could have adverse aesthetic effects and could harm native fauna.
Wastewater would also be produced from toilets and washrooms provided at the construction compounds. If not adequately managed, this has the potential to enter local drainage paths and waterways.

Finally, the construction of the proposal would require clearing of substantial amounts of vegetation. Stockpiled vegetation washed into waterways during rainfall events would have the potential to increase nutrient levels and affect nutrient cycling within the receiving waterways.

**Operation**

During the operational phase, pollutants such as hydraulic fluids and brake pad dust may potentially be transported to waterways from the track formation within surface water run-off. Measures to mitigate this occurrence are described in section 5.3.4. Rainfall events have the potential to cause erosion to exposed ground surfaces. Appropriate design, management and maintenance would need to ensure that impacts on surface water would be limited to the period immediately following construction while stabilising vegetation was becoming established.

5.3.4 Mitigation measures and recommended further studies

**Water flow**

*Construction*

Impacts on water flow during the construction period are expected to be minimal. Mitigation measures to ensure that construction activities do not interfere with existing water flows would include carrying out works outside of the bed of the waterway wherever possible and providing temporary artificial drainage structures where necessary.

*Operation*

The most fundamental mitigation measure to reduce operational impacts to water flow is to ensure that the detailed rail design is informed by the results of comprehensive flood modelling. This would ensure that there would be no significant increase in either flood levels or duration of floodwater inundation.

**Water quality**

*Construction*

Detailed impact and mitigation assessment of water quality issues would be addressed through the development of an environmental management plan. Mitigation measures during the construction phase of the proposal would primarily be associated with the control of sedimentation. Details of these measures are provided in section 5.1. Additional mitigation measures relating to water quality would include:

- separation between the disturbance zone and sensitive receiving waters such as Oxley Creek
• collection and treatment of wastewater via an approved on-site system or removal for off-site disposal
• implementation of sound chemical and fuel storage and handling practices, and the preparation of procedures for the containment and cleanup of accidental spills
• reduced potential for sedimentation through the implementation of the mitigation strategies detailed in Section 5.1.4.

Operation
Impacts to water quality during operation are not expected to be significant. Potential mitigation measures would include:
• maintaining culverts and viaduct structures to prevent the build-up of excess vegetation and rubbish
• establishing and maintaining a diffuse run-off regime using pervious, vegetated areas to reduce run-off volume, speed and pollutant load
• ensuring that trains are well maintained and that any leaks are repaired immediately
• reducing the potential for sedimentation through the implementation of the embankment stabilisation measures detailed in Section 5.1.4.

Recommended further studies
Further studies to define the potential for erosion and identify key sedimentation hazard locations are stipulated in Section 5.1.4.

It is recommended that flood modelling should be undertaken to predict water flow conditions along the length of the proposed corridor during the detailed design stage of the proposal.

A detailed baseline water quality monitoring program is also recommended. This program should be undertaken prior to construction and include sampling both upstream and downstream of each waterway crossing. The Environmental Protection (Water) Policy at the time of development should be used to determine the appropriate parameters and duration of the monitoring program.

5.4 Noise and vibration

5.4.1 Scope
A preliminary assessment of the noise and vibration issues associated with the construction and operation of the proposal was undertaken as part of the REF. This assessment involved a review of the following sources of information:
• Australian Standard AS 1055.2 – 1997: Acoustics – Description and measurement of environmental noise – Application to specific situations
• Australian Standard AS 2436 – 1981: Guide to noise control on construction, maintenance and demolition sites
• Environmental Protection (Noise) Policy 2008
• Code of Practice for Railway Noise Management (Queensland Rail 2007)
• 2009 aerial photography.

5.4.2 Existing environment

Sensitive receptors

As described in Chapter 3, the northern section of the study area is generally highly urbanised and the predominant land use adjacent to the corridor is residential, interspersed with some industrial and commercial activities. As a consequence of these land uses, significant numbers of noise sensitive receptors are located within the immediate vicinity of the proposed rail line. Residences comprise the vast majority of sensitive receptors and these closely abut the corridor within the suburbs of Salisbury, Acacia Ridge, Larapinta, Algester and Hillcrest. Other potentially sensitive receptors in close proximity to the proposed rail line were identified using 2009 aerial photography and include:

• Nyanda State High School at Salisbury
• Trade and Technical Skills Institute at Acacia Ridge
• Brig-o-doone Aged Care Acacia Ridge
• RSL Care Carrington at Algester.

In the central section, there are numerous rural residential properties adjacent to the proposed rail line. The Greenbank Library and Community Preschool and Kindergarten at the Greenbank Community Centre on Teviot Road represent additional sensitive receptors adjacent to the proposed rail line within this part of the study area.

These sensitive receptors would experience some noise impacts as a result of current rail operations on the existing interstate rail corridor however, further investigation would need to be undertaken to determine any additional impacts associated with the proposed passenger rail line, as outlined in section 5.4.5.

The southern section of the study area contains relatively few sensitive receptors in close proximity to the proposed rail corridor. The majority of these are associated with the area of rural residential properties at Gleneagle and the low-to-medium density urban development in the northern part of the town of Beaudesert. In addition to residences, impacts on the following sensitive receptors should be investigated as part of subsequent study phases:

• Gleneagle State School
• St Marys Primary School.

As discussed in Chapter 4, land uses within the areas between Salisbury and Beaudesert are expected to become increasingly more urbanised. The result of this change is likely to be a significant increase in the number of noise sensitive receptors within the study area and potential impacts on these would need to be considered in the future. However, once mitigation measures have been implemented, the residual impact is likely to be negligible or only moderately adverse (the latter at nearby residences).
**Ambient noise levels**

Table 5.6 presents the AS 1055.2 estimated average background A-weighted sound pressure level ($L_{A90,T}$) for different areas containing residences in Australia. In the absence of site-specific baseline noise monitoring data these average sound levels have been used to guide an assessment of the existing ambient noise levels within the study area.

Urban and residential areas adjacent to the existing interstate rail corridor and major roads, including Beaudesert Road and parts of the Mt Lindesay Highway, would be characterised as an R4 environment. Other established residential and rural residential neighbourhoods with local road traffic as the primary noise source would be characterised as an R2 environment, while existing rural and agricultural areas on the Logan River floodplain would be R1 areas.

### Table 5.6 Estimated background noise levels

<table>
<thead>
<tr>
<th>Noise area category</th>
<th>Description of neighbourhood</th>
<th>Average background A-weighted sound pressure level $L_{A90,T}$ (dB(A))</th>
<th>Monday to Saturday</th>
<th>Sundays and public holidays</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Areas with negligible transportation</td>
<td>40 35 30</td>
<td>40 35 30</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>Areas with low density transportation</td>
<td>45 40 35</td>
<td>45 40 35</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>Areas with dense transportation or some commerce industry</td>
<td>55 50 45</td>
<td>55 50 45</td>
<td></td>
</tr>
</tbody>
</table>

### Existing noise attenuation

Existing noise attenuation structures along the interstate rail corridor were identified during site visits and a review of aerial photography. These were limited to the northern section of the corridor and included a concrete wall along the western boundary of the Acacia Ridge inter-modal terminal and intermittent sections of wooden noise barrier walls between Beaudesert Road and the Logan Motorway.

### Vibration

No formal investigations of existing sources of vibration have been undertaken as part of this REF. Potential sources of vibration in the vicinity of the proposed rail line are expected to include the movement of trains and periodic construction activities.

#### 5.4.3 Relevant assessment criteria

### Operational noise criteria

Operational rail noise associated with the future passenger rail line would be managed in accordance with the Queensland Rail *Code of Practice for Railway Noise Management* (2007). These have been sourced from the superseded EPP (Noise) (1999) which specified planning levels for railways to be assessed 1 meter in front of
the most exposed portion of an affected noise-sensitive receptor in terms of 24 hour $L_{Aeq}$ noise level and a maximum pass-by levels ($L_{Amax}$). These criteria are as follows:

- $65 \text{ dB(A)}$ $L_{Aeq(24\text{ hour})}$  
- $87 \text{ dB(A)}$ $L_{Amax}$ (single event maximum sound pressure level).

**Construction noise criteria**

Operational rail noise is excluded from assessment against the criteria prescribed by the Environmental Protection (Noise) Policy 2008 (EPP) under Schedule 1, Part 1 of the *Environmental Protection Act 1998* (EP Act)(Qld). However, any noise associated with construction phase of the project would be subject to the EPP criteria, which specifies that noise that varies over time must not be more than 5 dB(A) greater than the existing acoustic environment.

In addition, Queensland Rail has adopted stringent time constraints for construction for construction activities generating noise that affects neighbouring noise sensitive places. Wherever possible and practicable, these activities should be confined to standard day-time working hours which are:

- Monday–Friday, 0700 – 1800 hours  
- Saturday, 0700 – 1300 hours

Construction noise during these hours would not have noise limits. However, a set of general noise limits would be developed as part of subsequent study phases which would apply to unavoidable construction outside of these hours.

**5.4.4 Potential impacts**

**Operational rail noise**

Operational rail noise would primarily be as a result of train movements along the proposed passenger rail line. Other potential noise sources in the vicinity of commuter stations would include audible train signalling, station announcements, acceleration and braking of trains and traffic around station precincts.

There are a number of existing sensitive receptors in the vicinity of the proposed rail line and noise attenuation would be required avoid unacceptable noise impacts in these locations. There are also a number of future development areas where noise-sensitive receptors may be located in future.

**Construction noise**

Chapter 7 details the typical construction activities associated with this proposal. The most notable of these in terms of noise pollution are discussed below.

- *Site clearance and earth works:* The most significant noise impacts are likely to be generated during site clearance and general earth works. Noise-generating equipment likely to be involved with these activities includes:
  - chain saws  
  - bulldozers
- dump trucks
- scrapers
- graders
- rollers
- compactors
- water carts.

- **Haulage roads:** Large numbers of truck movements would be required to move cleared vegetation, spoil, ballast, rail tracks, water and construction equipment to, from and within the construction site. Where the construction site would be located in close proximity to major roads and urban areas, these vehicle movements would not be expected to generate significant noise impacts beyond those generated by existing traffic. However, concentrations of heavy vehicle movements in more rural areas, on local roads and at site entry and exit points could be a source of noise impacts.

- **Track, sleeper and ballast laying machinery:** The single machine generally used to lay the track, sleepers and ballast would emit considerable levels of noise as it proceeded along the alignment. Noise impacts would, however, be localised and temporary in nature.

- **Station and bridge/viaduct construction:** Station and bridge/viaduct construction would concentrate noise-generating activities in one location for extended periods of time. This has the potential to result in more substantial noise impacts than the alignment construction activities, which would be more transient in nature.

Table 5.7 presents the typical noise levels for equipment likely to be used during the construction of the proposal. These have been obtained from AS 2436. Noise levels generated by construction activities are likely to vary depending on the combination of equipment being operated at any one time.

<table>
<thead>
<tr>
<th>Equipment type</th>
<th>Sound power level (dB(A) at source)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete mixer</td>
<td>107 to 112</td>
</tr>
<tr>
<td>Compactors</td>
<td>117 to 124</td>
</tr>
<tr>
<td>Crane</td>
<td>118 to 120</td>
</tr>
<tr>
<td>Dump trucks</td>
<td>102 to 107</td>
</tr>
<tr>
<td>Dumper</td>
<td>94 to 114</td>
</tr>
<tr>
<td>Excavators</td>
<td>114 to 118</td>
</tr>
<tr>
<td>Graders</td>
<td>114 to 120</td>
</tr>
<tr>
<td>Rock breaker</td>
<td>124 to 140</td>
</tr>
<tr>
<td>Loader</td>
<td>117 to 120</td>
</tr>
<tr>
<td>Welder</td>
<td>Less than 96</td>
</tr>
<tr>
<td>Pile driver</td>
<td>114 to 128</td>
</tr>
<tr>
<td>Rollers</td>
<td>118 to 120</td>
</tr>
<tr>
<td>Saw (cutting equipment)</td>
<td>105 to 126</td>
</tr>
<tr>
<td>Equipment type</td>
<td>Sound power level (dB(A) at source)</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Rotary bored piles</td>
<td>112 to 124</td>
</tr>
<tr>
<td>Scrapers</td>
<td>116 to 121</td>
</tr>
<tr>
<td>Trucks</td>
<td>103 to 120</td>
</tr>
<tr>
<td>Concrete mixer</td>
<td>107 to 116</td>
</tr>
<tr>
<td>Winches</td>
<td>102 to 108</td>
</tr>
</tbody>
</table>

Given the close proximity of many sensitive receptors to the corridor and the nature of the proposed construction activities it is possible that the EPP (Noise) acoustic quality objectives would be temporarily exceeded for a number of sensitive receptors during construction works however, this would need to be assessed as part of subsequent study phases.

**Vibration**

*Construction*

Potential sources of vibration during the construction phase would include activities such as drilling, blasting, rock breaking and pile driving. As there have been no geotechnical investigations undertaken to date, the required level of the above-mentioned activities cannot currently be assessed. Vibration-sensitive receptors could potentially include any structures in the vicinity of the proposed corridors. Community consultation and site-specific surveys would be required to determine the existing condition of structures and the degree to which they would be likely to be affected.

*Operation*

Vibration associated with rail traffic may be generated during the operation of the rail system. Given the nature of the system proposed (electrified), this would not be expected to exceed the existing vibrations generated by train movements on the interstate line.

**5.4.5 Mitigation measures and recommended future studies**

**Operational rail noise**

Examples of possible measures that could be used to mitigate operational noise impacts include:

- construction of noise attenuation barriers and/or application of acoustic treatments to affected buildings where acceptable noise levels would be exceeded in sensitive areas
- regular maintenance of all trains and the fitting of trains with appropriate silencing equipment

Modelling of potential noise impacts associated with proposed future passenger rail operations would be undertaken as part of subsequent study phases to identify any areas where mitigation is required to avoid unacceptable noise impacts on existing sensitive receptors.
With respect to new development, the future rail project and its timing should be taken into consideration as part of planning and assessment of development proposals. Section 9 of the QR Code of Practice refers to DTMR’s ‘Interest in Planning Schemes 3–Planning for Rail Noise’ for assessment of new developments. This document suggests the following examples of planning scheme measures to address noise impacts on new development close to future rail corridors:

- ensuring appropriate buffer distances between the noise source and the noise–sensitive receptor
- locating rooms most sensitive to noise furthest from the noise source
- adopting suitable building design techniques
- use of earth mounds and noise barriers between the noise source and the noise–sensitive receptor.

These measures are suggested with the aim of meeting EPP Planning Levels and a maximum internal noise level (22:00 hrs to 06:00 hrs) no greater than 50dB.

**Construction noise**

Although there are no construction noise limits defined by Queensland legislation, noise mitigation strategies should be implemented where practical to reduce the potential for adverse noise impacts and complaints. Potential strategies for managing construction noise are summarised in Table 5.8. Potential construction noise impacts in noise–sensitive areas would be reviewed as part of subsequent study phases to identify any areas where these mitigation strategies would be required.

<table>
<thead>
<tr>
<th>Table 5.8 Potential mitigation strategies for construction noise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td>Construction noise monitoring</td>
</tr>
</tbody>
</table>
| Source noise control and work practice strategies | Typical mitigation methods employed by Queensland Rail include:  
  - using the quietest equipment available (i.e. using equipment with motor housing)  
  - restricting work hours  
  - fitting construction equipment with effective and properly maintained noise attenuating equipment  
  - alternative processes  
  - silencing or screening equipment where practicable  
  - placement and orientation of equipment to reduce impact at noise sensitive receptors  
  - community notification program outlining the schedule, timeframe and nature of construction activities |
| Community liaison | Direct liaison with affected sectors of the community during construction and implementation of an effective complaints management procedure would be critical to managing potential noise impacts during construction. |
Vibration

Operation

It is unknown at this stage whether mitigation measures would be necessary for operational vibration. However, examples of possible measures include:

- the use of continuous welded rail near sensitive receptors
- the use of rail vibration isolation systems such as resilient rail fastenings, ballast mats and floating slabs
- regular maintenance of trains.

Construction

A review of potential vibration sources during construction and associated levels of vibration should be undertaken as part of subsequent study phases. Where blasting would be employed as a construction method, building condition surveys would need to be undertaken prior to construction so that any adverse impacts as a result of construction works could be identified and rectified.

5.5 Air quality

5.5.1 Scope

A preliminary assessment of the existing air quality and potential impacts associated with the construction and operation of a future passenger railway has been undertaken as part of the REF. This assessment involved a review of the following sources of information:

- 2009 aerial photography
- Australian Bureau of Statistics (census data 2006)
- Bureau of Meteorology Australia (annual rainfall and wind records)
- Environmental Protection Agency air quality monitoring database

5.5.2 Existing environment

Meteorological conditions

The nearest long-term records of climatic conditions are available from the Bureau of Meteorology monitoring stations at Archerfield Airport and Beaudesert. Figure 5.14 and 5.15 illustrate the monthly rainfall averages at these stations, together with an estimate of monthly evaporation. This evaporation estimate has been based on data obtained from the Brisbane Regional monitoring station, which is the closest location for which evaporation data is available.

An analysis of this climatic data determined that the time of year with the highest potential for dust generation would be the months between July and October. This is a result of a combination of low rainfall and high relative evaporation. During these
months, prevailing winds blow predominantly from the south-west in the morning in both Archerfield and Beaudesert. Afternoon winds in Archerfield blow predominantly from the west during July and August and from the north-east in September and October. Wind speed is generally higher in the afternoon.
Figure 5.14
Archerfield mean monthly rainfall and evaporation (Bureau of Meteorology 2009)

Figure 5.15
Beaudesert mean monthly rainfall and evaporation (Bureau of Meteorology 2009)
Sensitive receptors

Receptors that are sensitive to changes in air quality are very similar to those described as being sensitive to noise and vibration in Section 5.4. Most sensitive receptors would be located within residential areas in proximity to the rail corridor. Other sensitive receptor locations would include the educational facilities, RSL care centre and aged care facilities listed in Section 5.4.

Within the southern section of the study area, the preferred corridor would pass adjacent to various areas under cultivation. While the species of crops that are being cultivated are currently not able to be determined, the potential exists that certain species may be sensitive to increased dust levels. This would need to be investigated as part of a community consultation exercise. Community consultation may also reveal other air quality sensitive receptors not identified as part of this desk-based review.

 Ambient air quality

Vehicle emissions are expected to constitute the primary influence on air quality in the wider study area. In the immediate vicinity of the existing interstate rail corridor, air quality would also be influenced by emissions from diesel freight train movements on the interstate rail line. Ambient air quality is expected to be higher in the central and southern sections of the study area as a result of lower traffic levels and less industrial land use. Seasonal sources of dust in the southern section may include agricultural activities such as cultivation.

5.5.3 Assessment criteria

The Environmental Protection (Air) Policy 2008 describes air quality objectives to protect the environmental value of a given site. Table 5.9 presents these objectives for various common pollutants. The air quality objectives are presented as an average over the period stated.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Period</th>
<th>Air quality objective (μg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>1 year</td>
<td>10</td>
</tr>
<tr>
<td>1,3-butadiene</td>
<td>1 year</td>
<td>2.4</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>8 hours</td>
<td>11,000</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>1 hour</td>
<td>250</td>
</tr>
<tr>
<td>Ozone</td>
<td>1 hour</td>
<td>210</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>24 hours</td>
<td>25</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>24 hours</td>
<td>50</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>24 hours</td>
<td>230</td>
</tr>
<tr>
<td>Toluene</td>
<td>24 hours</td>
<td>4,100</td>
</tr>
<tr>
<td>Total suspended particles</td>
<td>1 year</td>
<td>90</td>
</tr>
<tr>
<td>Xylenes</td>
<td>24 hours</td>
<td>1,200</td>
</tr>
</tbody>
</table>
5.5.4 Potential impacts

Construction

Chapter 4 details the typical construction activities associated with this proposal, almost all of which have the potential to generate dust. Specific sources of dust would include:

- newly cleared land
- earthworks
- unloading of spoil and ballast materials
- spoil stockpiles
- track, sleeper and ballast laying
- unsecured truck loads
- movement of vehicles along haulage roads.

Of the above, earthworks and track, sleeper and ballast laying activities in particular have the potential to generate significant levels of dust.

Based on the wind direction and speed patterns described in Section 5.5.2, areas with the highest potential to be affected by dust during the morning hours would be those located to the north-east of construction sites. During the afternoon hours, receptors to the east and south-west are most likely to be affected. However, given the variability of wind direction and the significant potential for dust generation, all areas surrounding construction sites should be considered as susceptible to dust nuisance.

Comprehensive mitigation measures would be necessary to minimise the impacts of dust. These are outlined in Section 5.5.4 below and would need particular investigation during the detailed design phase of the proposal.

Other potential sources of air pollution during the construction stage of the proposal include:

- construction machinery exhaust fumes, both within the construction area and along haulage roads
- traffic disruptions that result in congestion and reduced speeds, which alter emission rates.

Given the relatively flat nature of the topography and the transient nature of the construction sites, the impacts of the above sources of air pollution are not expected to be significant.

Operation

The proposed rail system would be electrically powered and the operation of trains would therefore not result in any direct impacts on air quality within the study area. Increased concentrations of vehicles around commuter stations could, however, have the potential to negatively impact on local air quality.
Development of the proposal has the potential to result in long-term, positive effects on the ambient air quality of the study area. This would be as a result of the reduction in passenger vehicle movements that may result from the implementation of a major public transport system of this type.

5.5.5 Mitigation measures and recommended further studies

Dust suppression would be critical during the construction phase to avoid the potential for dust nuisance. An effective management program for construction would keep dust concentration levels at nearby residences below those known to cause nuisance. In particular, this would require careful planning of earthworks, track laying and other likely dust-generating activities. Examples of dust mitigation strategies would include watering and, in some cases, sealing of roads.

It is not anticipated that modelling would be required to predict and assess potential impacts on air quality as a result of the operation of the rail system.

5.6 Flora and fauna

5.6.1 Scope and methodology

A preliminary assessment of flora and fauna values in the study area was undertaken for the REF, primarily based on a review of available mapping, databases and literature for the study area. The primary aim of this assessment was to identify local and regional conservation values in the study area with particular reference to:

- wildlife corridors and local/regional landscape connectivity values;
- matters of national environmental significance (NES) protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Cwlth) with the potential to be impacted by future development of a passenger rail line;
- endangered, vulnerable or rare (EVR) flora and fauna species protected under the Nature Conservation Act 1992 (Qld);
- areas of remnant and regrowth vegetation protected under the Vegetation Management Act 1999 (VMA)(Qld);
- other areas of ecological significance, including wetland areas and areas of protected koala habitat.

Desktop survey

The following sources were reviewed as the basis for the preliminary desktop assessment of flora and fauna values in the study area:

- Regional ecosystem mapping (version 6.0), regrowth vegetation mapping (version 2.0) and essential habitat mapping (version 2.1) prepared by DERM
- SEQ Koala Habitat Value mapping (version 1.1) prepared by DERM
- the Directory of Important Wetlands mapping
search results from the EPBC Online Protected Matters Search tool, which identifies matters of NES under the EPBC Act

search results from the Wildlife Online, Queensland Herbarium (HERBRECS) and Birds Australia databases

2009 aerial photography

cadastral and topographic data.

The study also included a review of two ecological reports, previously completed for parts of the study area:

- Chenoweth Environmental Planning & Landscape Architecture 2006, ‘Beaudesert LGA Natural Environment Technical Study’

- Chenoweth Environmental Planning & Landscape Architecture 2007, ‘Greater Flagstone Locality Natural Environment Technical Study’.


Field survey

A single-day field inspection was conducted to provide an overview of existing environmental conditions along the corridor; however, no detailed field survey was undertaken for this assessment.

5.6.2 Existing environmental values

Ecological connectivity

In highly fragmented landscapes such as SEQ, wildlife corridors provide an important link between otherwise isolated habitat areas. These links allow plants and animals to disperse or move from one area of habitat to another, which is important for ensuring the continuation of viable wild populations of protected wildlife. This is particularly important for rare and less mobile species which rely on specific habitat characteristics.

Ecological connectivity values in the study area were identified through a review of the Biodiversity Planning Assessment (BPA) mapping in addition to land use planning documents for the study area. This review identified the following key values, which are shown on Figure 5.16:

- the State significant Flinders–Greenbank/Karawatha (FGK) biodiversity corridor, which extends for 40 km from Flinders Peak (south of Ipswich) to Karawatha Forest (in Brisbane City) via the Scenic Rim LGA and Greenbank Military Training Area.

- riparian vegetation which connects habitat patches around waterways, particularly the creeks within the Greater Flagstone area (Abrade Creek, Flagstone Creek and Sandy Creek).

Preliminary field survey confirmed that the existing interstate rail corridor is generally unfenced, as it is only subject to limited train movements each day, and is therefore
largely permeable to fauna movement. The proposed rail line would cross creeks in the Greater Flagstone area on high trestle bridges, which also allow for fauna movement along these waterways.
Figure 5.16
Biodiversity corridors (biodiversity planning assessment)
Vegetation communities

Regional ecosystem (REs) mapping identifies vegetation communities as ‘endangered’, ‘of concern’ or ‘not of concern’ based on the percentage of the pre-clearing extent of that particular community remaining in a bioregion. A total of 14 regional ecosystem types were identified within 1 km of the proposed rail alignment from Salisbury to Kagaru and the preferred corridor between Kagaru and Beaudesert. Table 5.10 provides a description of these RE types and their current status under the VMA, which are also shown on Figure 5.17 to Figure 5.20.

The study area also supports areas of regulated regrowth vegetation, including mapped areas within the proposed rail alignment which are also shown on Figure 5.17 to 5.20. Preliminary surveys have identified that the proposed alignment is substantially clear of regrowth vegetation; however, regrowth vegetation is common in areas adjacent to the proposed rail alignment, particularly in the central section of the study area.

Table 5.10  Regional ecosystem types

<table>
<thead>
<tr>
<th>Regional ecosystem</th>
<th>Short description</th>
<th>VMA status (Dec. 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.3.3</td>
<td>Eucalyptus tereticornis woodland to open forest on alluvial plains</td>
<td>Endangered</td>
</tr>
<tr>
<td>12.3.6</td>
<td>Melaleuca quinquenervia, Eucalyptus tereticornis, Lophostemon suaveolens woodland on coastal alluvial plains</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.3.7</td>
<td>Eucalyptus tereticornis, Melaleuca viminalis, Casuarina cunninghamiana fringing forest</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.3.11</td>
<td>Eucalyptus siderophloia, E. tereticornis, Corymbia intermedia open forest on alluvial plains usually near coast</td>
<td>Of concern</td>
</tr>
<tr>
<td>12.5.2</td>
<td>Eucalyptus tereticornis, Corymbia intermedia on remnant Tertiary surfaces, usually near coast. Usually deep red soils.</td>
<td>Endangered</td>
</tr>
<tr>
<td>12.5.3</td>
<td>Eucalyptus tindaliae and/or E. racemosa open forest on remnant Tertiary surfaces</td>
<td>Endangered</td>
</tr>
<tr>
<td>12.3.11</td>
<td>Eucalyptus siderophloia, E. tereticornis, Corymbia intermedia open forest on alluvial plains usually near coast</td>
<td>Of concern</td>
</tr>
<tr>
<td>12.8.14</td>
<td>Eucalyptus eugenioides, E. biturbinata, E. melliodora open forest on Cainozoic igneous rocks</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.9–10.2</td>
<td>Corymbia citriodora, Eucalyptus crebra open forest on sedimentary rocks</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.9–10.3</td>
<td>Eucalyptus moluccana on sedimentary rocks</td>
<td>Of concern</td>
</tr>
<tr>
<td>12.9–10.4</td>
<td>Eucalyptus racemosa woodland on sedimentary rocks</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.9–10.7</td>
<td>Eucalyptus crebra woodland on sedimentary rocks</td>
<td>Of concern</td>
</tr>
<tr>
<td>12.9–10.12</td>
<td>Eucalyptus seeana, Corymbia intermedia, Angophora leiocarpa woodland on sedimentary rocks</td>
<td>Endangered</td>
</tr>
<tr>
<td>12.9–10.17</td>
<td>Open forest complex often with Eucalyptus acmenoides, E. major, E. siderophloia ± Corymbia citriodora on sedimentary rocks</td>
<td>Not of concern</td>
</tr>
<tr>
<td>12.9–10.19</td>
<td>Eucalyptus fibrosa subsp. fibrosa open forest on sedimentary rocks</td>
<td>Not of concern</td>
</tr>
</tbody>
</table>

Essential habitat

There are a number of areas of Essential Habitat for endangered, vulnerable and rare species located within the study area. These areas are recorded as providing essential habitat for Koala (*Phascolarctos cinereus*) and Wallum Froglet (*Crinia tinnula*). Further investigation would need to be undertaken in these areas to determine actual habitat values as part of subsequent study phases.
Figure 5.17
Regional ecosystems and regrowth vegetation 1
Figure 5.18
Regional ecosystems and regrowth vegetation 2
Figure 5.19
Regional ecosystems and regrowth vegetation 3
Figure 5.20
Regional ecosystems and regrowth vegetation 4
Koala habitat areas

The Queensland Government State Land Freeze Protocol was put in place in December 2008 to protect koala populations in SEQ until such time as an assessment of land in SEQ could be undertaken to determine if it was of value for koala conservation. The koala habitat mapping project has been completed and found that the land of most value to the conservation of koalas is located in seven local government areas (LGA) in SEQ which include Brisbane City Council, Logan City Council, Gold Coast City Council, Moreton Bay Regional Council, Sunshine Coast Regional Council, Redland City Council and Ipswich City Council. The draft SEQ Koala Conservation State Planning Regulatory Provisions (SPRP) will replace the Land Freeze Protocol (scheduled for June 2010) and will only apply to the seven LGAs listed above. The Department of Environment and Resource Management has determined that the Scenic Rim Regional Council will not be included in the draft SEQ Koala SPRP at this time.

Figure 5.21 to Figure 5.23 provide a more detailed overview of koala habitat values in the study area based on this recent mapping project. Based on this mapping, key areas of bushland habitat are located at the Parkinson bushland site, the Greenbank Military Training Area and Greater Flagstone. The section between Greenbank and New Beith also has potential strategic importance for koalas as there are a number of small bushland patches connected by ‘medium-value rehabilitation habitat’.
Figure 5.21
Koala habitat values 1
Figure 5.22
Koala habitat values 2
Figure 5.23
Koala habitat values 3
**Endangered, vulnerable and rare species**

The results of database searches for EVR flora and fauna species are presented in Appendix C. In the absence of site investigations, a preliminary likelihood of occurrence within 300 m of the proposed rail line (‘high’, ‘medium’, ‘low/medium’ or ‘low’) for each fauna species has been assigned based on a desktop review of potential habitat and the age, location and certainty of any records for the species. This desktop review process has also been used to assign a likelihood of occurrence within 100 m of the proposed rail line for flora species.

Flora and fauna species that were assigned a likelihood of occurrence of ‘low/medium’ to ‘high’ are presented in Table 5.11 to Table 5.13. It should be noted that the majority of database search areas extended for up to approximately 10 km beyond the proposed rail line, with some searches, such as HERBRECS, extending even further. The search area therefore encompassed a wider suite of habitats than would be encountered within 300 m of the proposed rail line.
### Table 5.11 Endangered, vulnerable and rare flora summary table

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC listing</th>
<th>Records</th>
<th>Habitat description</th>
<th>Likelihood of occurrence within 100 m of proposed rail line</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Callitris baileyi</em></td>
<td>–</td>
<td>R</td>
<td>–</td>
<td>–</td>
<td>Upper part of steep slope in dry vine scrub (RE 12.8.16, 12.8.17 and 12.9/10.7), softwood scrub and regrowth and eucalypt forests with scrubby understorey. Rocky, hilly or mountainous areas, usually near creeks, and on shallow and often clay soils.</td>
<td>Medium. Sandstone ridges with RE 12.9/10.7 occur between Parkinson and Undullah.</td>
</tr>
<tr>
<td><em>Eucalyptus curtisii</em></td>
<td>Plunkett mallee</td>
<td>V</td>
<td>–</td>
<td>–</td>
<td>Sandystone ridges. Eucalyptus open forest and woodlands.</td>
<td>Medium. Sandstone ridges occur between Parkinson and Undullah.</td>
</tr>
<tr>
<td><em>Hydrocharis dubia</em></td>
<td>Frogbit</td>
<td>–</td>
<td>R</td>
<td>–</td>
<td>Aquatic herb occurring in small, shallow freshwater bodies or swamps.</td>
<td>Medium. Potential habitat in low-lying areas around Lower Oxley Creek.</td>
</tr>
<tr>
<td><em>Kunzea flavescens</em></td>
<td>–</td>
<td>–</td>
<td>R</td>
<td>–</td>
<td>Dry sclerophyll forest</td>
<td>Medium. Dry sclerophyll is the dominant forest type between Parkinson and Undullah.</td>
</tr>
<tr>
<td><em>Marsdenia coronata</em></td>
<td>Slender Milkvine</td>
<td>–</td>
<td>V</td>
<td>–</td>
<td>Rocky hillsides and ridges in eucalypt forest.</td>
<td>Medium. Previously recorded in Greater Flagstone area. Review potential habitat between Parkinson and Undullah.</td>
</tr>
<tr>
<td><em>Maundia triglochinoides</em></td>
<td>Maundia</td>
<td>–</td>
<td>V</td>
<td>–</td>
<td>Swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.</td>
<td>Medium. Potential habitat in low-lying areas around Lower Oxley Creek.</td>
</tr>
<tr>
<td><em>Melaleuca irbyana</em></td>
<td>Swamp Tea-tree</td>
<td>–</td>
<td>R</td>
<td>–</td>
<td>Poorly drained, low lying heavy dark loams.</td>
<td>Medium. Potential habitat in southern section of study area.</td>
</tr>
<tr>
<td><em>Persicaria elatior</em></td>
<td>Knotweed</td>
<td>V</td>
<td>V</td>
<td>–</td>
<td>Sandy, alluvial soil in swampy areas and riparian herblands along watercourses and lake edges.</td>
<td>Medium. Suitable habitat may occur in low-lying areas around Oxley Creek.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC listing</td>
<td>Records</td>
<td>Habitat description</td>
<td>Likelihood of occurrence within 100 m of proposed rail line</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>---------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Threatened Ecological</td>
<td>Swamp tea-tree (Melaleuca irbyana) forest of</td>
<td>CE</td>
<td>–</td>
<td>–</td>
<td>Open eucalypt forest in poorly drained, usually clay, soils. Associated with</td>
<td>Medium. Closest mapped RE 12.3.3 is approximately 1.5 km</td>
</tr>
<tr>
<td>Communities</td>
<td>south-east Queensland</td>
<td></td>
<td></td>
<td></td>
<td>Regional Ecosystem 12.3.3</td>
<td>from proposed rail line. Examination of 2006 aerial</td>
</tr>
</tbody>
</table>
<pre><code>                                                                                       |             |              |         |                                                                                                                                              |
</code></pre>
<p>|                              |                                                  |             |              |         |                                                                                      | photography shows this to be approximately 4 individual trees |
|             |              |         | of unknown species. The potential exists for isolated individuals or stands elsewhere|
|             |              |         | within the study area.                                                                |                                                             |</p>

*E: endangered; V: vulnerable; R: rare; CE: critically endangered. Where discrepancies occur between schedules, the highest (most endangered) status should be used. EPBC: Environment Protection and Biodiversity Conservation Act; NCA: Nature Conservation Act.*
<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC NCA</th>
<th>EPBC listing</th>
<th>Records</th>
<th>Preferred habitat description</th>
<th>Likelihood of occurrence within 300 m of proposed rail line (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accipiter novaehollandiae</td>
<td>Grey goshawk</td>
<td>– R</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>Tropical rainforest, tall open forests, woodlands, wooded gorges, dense timber along watercourses and farmland.</td>
<td>Medium. Previously recorded in search area. Some potential habitat may be present along watercourses.</td>
</tr>
<tr>
<td>Ephippiorhynchus asiaticus</td>
<td>Black-necked stork</td>
<td>– R</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>Mangroves, inter-tidal wetlands, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewage ponds.</td>
<td>Medium. Previously recorded in search area. Farm dams and marshy areas on Logan River floodplain may contain suitable habitat.</td>
</tr>
<tr>
<td>Erythrotriorchis radiatus</td>
<td>Red goshawk</td>
<td>V E</td>
<td></td>
<td>✓</td>
<td>–</td>
<td>Coastal and sub-coastal tall forests and woodlands, edges of rainforest. Stick nests restricted to tall trees within 1km of a watercourse or wetland</td>
<td>Medium. Not previously recorded although potential habitat may exist along the Logan River and Teviot Brook.</td>
</tr>
<tr>
<td>Ninóx strenua</td>
<td>Powerful owl</td>
<td>– V</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>Tall, open forest and woodland and dense, wet forest along watercourses.</td>
<td>Medium. Previously recorded in search area. Confirm presence of suitable habitat, particularly along waterways.</td>
</tr>
<tr>
<td>Rostratula australis</td>
<td>Australian painted snipe</td>
<td>V V</td>
<td>✓</td>
<td>–</td>
<td>–</td>
<td>Mudflats, shallow, vegetated, freshwater swamps, claypans or inundated grassland (including temporary wetlands).</td>
<td>Low/Medium. May utilise periodically inundated farmland and low lying wet areas within the study area, particularly in the southern section of the study area.</td>
</tr>
<tr>
<td><strong>AMPHIBIANS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adelotus brevis</td>
<td>Tusked frog</td>
<td>– V</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>Rainforest, wet and dry sclerophyll, woodland, vine forest and even in low numbers in open grazing country. Slow moving streams and dams, particularly around accumulated leaves and small woody debris.</td>
<td>Medium. Previously recorded in the search area. Confirm presence of suitable habitat around waterways.</td>
</tr>
</tbody>
</table>
## Designation Records

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC listing</th>
<th>Records</th>
<th>Preferred habitat description</th>
<th>Likelihood of occurrence within 300 m of proposed rail line (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crinia tinnula</strong></td>
<td>Wallum froglet</td>
<td>–</td>
<td>V</td>
<td>–</td>
<td>Low pH freshwater swamps on low nutrient soils, usually deep sands. Organically stained waters of the SEQ coastal lowlands. Heathland, sedgeland, Melaleuca swamp and banksia woodland.</td>
<td>Medium. Previously recorded in the search area. Confirm presence of suitable habitat around waterways.</td>
</tr>
<tr>
<td><strong>Litoria brevipalmata</strong></td>
<td>Green thighed frog</td>
<td>–</td>
<td>R</td>
<td>–</td>
<td>Recorded from a range of habitat types, including wet open forest habitat and streams. Generally in denser vegetation, leaf-litter and ground debris.</td>
<td>Low/Medium. No previous records; however, suitable habitat may exist along streams and in isolated ponds and swamps.</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Neoceratodus forsteri</strong></td>
<td>Australian lungfish</td>
<td>V</td>
<td>–</td>
<td>–</td>
<td>Still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed.</td>
<td>Low. While known to have been translocated from the Mary River in 1889, this species is not regarded as having an established population in the Logan River (Pusey 2004).</td>
</tr>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dasyurus maculatus</strong></td>
<td>Spotted-tailed quoll</td>
<td>E</td>
<td>V</td>
<td>✓</td>
<td>Rainforests, wet and dry sclerophyll forests, coastal heath and scrub from sea-level to sub-alpine regions.</td>
<td>High. Sightings and confirmed scats around Greenbank/Munruben. Potential habitat exists, investigate potential impacts on this species.</td>
</tr>
<tr>
<td><strong>Phascolarctos cinereus</strong></td>
<td>Koala (SEQ bioregion)</td>
<td>–</td>
<td>V</td>
<td>–</td>
<td>Eucalypt woodland and forest habitats. Also modified urban areas including non-eucalypt trees.</td>
<td>High. Known areas of high habitat value for Koala. Investigate potential impacts on this species.</td>
</tr>
<tr>
<td><strong>Pteropus poliocephalus</strong></td>
<td>Grey-headed flying fox</td>
<td>V</td>
<td>–</td>
<td>✓</td>
<td>Rainforests, open eucalypt forests, woodlands, Melaleuca swamps and banksia woodlands.</td>
<td>High. Previously recorded in the search area. Likely to forage in a range of forest types in the study area.</td>
</tr>
</tbody>
</table>

*E: endangered; V: vulnerable; R: rare. Where discrepancies occur between schedules, the highest (most endangered) status should be used.*

### Table 5.13 EPBC-listed migratory and marine species

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>Records</th>
<th>Preferred habitat description</th>
<th>Likelihood of occurrence within 300 m of proposed rail line (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anseranas semipalmata</td>
<td>Magpie goose</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains.</td>
</tr>
<tr>
<td>Apus pacificus</td>
<td>Fork-tailed swift</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>An aerial species</td>
</tr>
<tr>
<td>Ardea alba</td>
<td>Great egret, white egret</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Wide range of aquatic and semi-aquatic habitats.</td>
</tr>
<tr>
<td>Ardea ibis</td>
<td>Cattle egret</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Paddocks and grasslands.</td>
</tr>
<tr>
<td>Ardea intermedia</td>
<td>Intermediate egret</td>
<td>M, OM</td>
<td>–</td>
<td>–</td>
<td>Marshes, cultivated fields, mangroves, mudflats, estuaries.</td>
</tr>
<tr>
<td>Dendrocygna arcuata</td>
<td>Wandering whistling-duck</td>
<td>M</td>
<td>–</td>
<td>–</td>
<td>Deep lagoons, flooded grasslands and dams</td>
</tr>
<tr>
<td>Hirundapus caudacutus</td>
<td>White-throated needletail</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>An aerial species.</td>
</tr>
<tr>
<td>Merops ornatus</td>
<td>Rainbow bee-eater</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>A common species known to occur within numerous habitats including disturbed areas.</td>
</tr>
<tr>
<td>Monarcha melanopsis</td>
<td>Black-faced monarch</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Rainforests, wet sclerophyll forests, denser eucalypt forests, deep gullies, regrowth and mangroves.</td>
</tr>
<tr>
<td>Monarcha trivirgatus</td>
<td>Spectacled monarch</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Low dense vegetation, mainly in rainforests. Also wet and dry sclerophyll forests, woodlands, parks and gardens.</td>
</tr>
<tr>
<td>Myiagra cyanoleuca</td>
<td>Satin flycatcher</td>
<td>M, OM</td>
<td>–</td>
<td>✓</td>
<td>Eucalypt forest, favouring moist gullies and watercourses. Largely absent from regrowth forests.</td>
</tr>
</tbody>
</table>

E: endangered; R: rare; OM: overfly marine; M: migratory. Where discrepancies occur between schedules, the highest (most endangered) status should be used.

5.6.3 Potential impacts

Potential barriers to fauna movement

Fencing and electrification associated with the proposed passenger rail line would create barriers to east–west fauna movement across the corridor. This, in turn, has the potential to fragment existing species populations, particularly for species with large home ranges such as Koala and Spotted–tail Quoll.

There are records for both Koala and Quoll in the central and southern sections of the study area which require further investigation as part of subsequent study phases. Those in the southern section are sparse, however, and the section between Kagaru and Beaudesert is not known to support dense populations of either species. In addition, the central and southern sections potentially support habitat for a number of other species which may be impacted by the proposed rail line.

Potential impacts on fauna movement in other parts of the study area, particularly through the FGK corridor, riparian corridors within Greater Flagstone and potential koala habitat throughout the study area would also need to be assessed in more detail with reference to the future rail design.

Potential impacts on vegetation and habitat

The Logan River floodplain has generally been cleared of native vegetation, and the preferred corridor between Kagaru and Beaudesert has been selected to avoid those patches of remnant vegetation that remain. Aerial photography analysis shows that there are some scattered areas of trees which would require further investigation to confirm whether Melaleuca irbyana occurs in the study area.

Establishment of the passenger rail line between Kagaru and Beaudesert also has the potential to impact on habitats for some EVR frog and bird species; however, the presence of suitable habitat within the corridor has not been confirmed at this stage. Clearing requirements and potential impacts on habitat values in other sections of the corridor would also need to be confirmed with reference to the future rail design.

5.6.4 Impact mitigation and recommended further studies

Providing for fauna movement in rail design

It may be possible to avoid and/or minimise impacts on local species populations, particularly those of recognised conservation significance, by incorporating opportunities for fauna movement into the future rail design. This could involve designing railway structures, such as drainage culverts or rail bridges, to facilitate movement by particular species.

Alternatively, where this would not provide for adequate movement, this could be achieved by designing purpose–built fauna crossing structures. It is recommended that further investigations be undertaken during future stages of the design to confirm the need for, and possible location/s of, these types of structures with reference to the ecological requirements of particular species.
Confirming vegetation and habitat values

The preliminary assessment presented in this REF is based on a review of available information and only limited field inspections. The nature and extent of potential impacts on the vegetation and habitat values should be investigated as part of subsequent study phases, which would involve:

- walkover surveys to:
  - confirm the accuracy of RE mapping and regrowth mapping for the study area
  - identify areas of potential habitat for the EVR flora and fauna species listed in Table 5.11 to Table 5.13
  - identify any occurrences of Swamp Tea-tree (*Melaleuca irbyana*) in the section between Kagaru and Beaudesert.

- identifying opportunities for fauna movement across the corridor, with reference to locations and species of particular conservation significance

- preliminary assessments of potential impacts on species of national environmental significance (NES) to determine the requirement for future referral to the Commonwealth Minister for the Environment under the EPBC Act

- preliminary assessments of potential impacts on species and species breeding habitat protected under the Queensland NCA to determine the need for species management plans in future.

5.7 Land use and land use planning

Land use and land use planning is a key issue for the Salisbury to Beaudesert passenger rail line. Effective integration of station locations with existing and potential or proposed future land uses will maximise rail patronage in the future, and ensure that emerging communities in the study area are provided with high quality, accessible public transport. This section presents a preliminary assessment of land use in the study area based on:

- the *South East Queensland Regional Plan 2009–2031* (DIP 2009a)
- the *South East Queensland Infrastructure Plan and Program 2009–2026* (DIP 2009b)
- Brisbane City Council, Logan City and Scenic Rim Regional Council local planning schemes
- Brisbane City Council, Logan City and Scenic Rim Regional Council local growth management strategies
- 2009 aerial photography supplied by the Department of Transport and Main Roads
- digital cadastral database (DCDB)(cadastre).
5.7.1 Existing land use environment

Land tenure

The predominant land tenure in the study area is freehold land. There are number of reserves adjacent to the proposed rail line, and the existing interstate rail corridor and disused Bethania to Beaudesert railway are generally located on leasehold land as shown in Figure 5.24 to Figure 5.26.
Figure 5.24
Land tenure 1
Figure 5.25
Land tenure 2
Existing land uses

Land uses in the study area are strongly influenced by the proximity to Brisbane CBD. The northern section of the study area is generally highly urbanised and comprises the greatest concentration of residential development and employment nodes. In the central section, existing local centres at Greenbank and Flagstone are generally surrounded by low to medium density residential and rural residential areas separated by significant areas of currently undeveloped land.

In the southern section of the study area, Beaudesert acts as a rural service centre for surrounding settlements and agricultural land uses on the Logan River floodplain.

Three local planning schemes provide guidance about intended land use and development patterns at the local level—Brisbane City Plan 2000, Logan Planning Scheme 2006 and the Beaudesert Shire Planning Scheme. Land use zones are the primary mechanism by which local planning schemes indicate the nature of intended land uses in a particular area. Land use zones in the study area are shown on Figure 5.27 to Figure 5.29, and existing land uses are described below.
Figure 5.27
Land use zones 1
Figure 5.28
Land use zones 2
Figure 5.29
Land use zones 3
Residential

Existing residential precincts adjacent to the existing interstate corridor would form the primary (walking) catchment of the proposed passenger rail line. These are located at Salisbury, Acacia Ridge, Algester, Forestdale, Hillcrest, Boronia Heights, Greenbank, Flagstone and Beaudesert.

The secondary (driving) catchment, which is nominally defined as a 5 km radius around station locations, also includes residential areas at Archerfield, Durack, Doolandella, Sunnybank Hills, Heathwood, Regents Park, Park Ridge, Munruben, North Maclean, South Maclean, Jimboomba, Woodhill and Veresdale. The majority of these residential areas in both catchment areas are characterised by low density housing.

Business and commercial

In the northern section, business and commercial areas are located adjacent to the proposed rail line at Acacia Ridge (Mitchell Street), Sunnybank Hills and Calamvale (Compton Road) and in Algester (Ridgewood/Algester Road). Commercial development in the central section of the study area is located at Greenbank (Teviot Road) and Flagstone (Bushman Drive). In the southern section, the primary business and commercial centres are located in and around the township of Beaudesert.

Open space – recreation and conservation

The largest concentrations of recreational open space adjacent to the proposed rail line are located in the northern and central sections. These include local parks and picnic areas, as well as specific recreation facilities, including Col Bennet Park (pedestrian/cycle path), the Greenbank Showgrounds and James Smith Recreation Area.

The northern and central sections have some open space areas that are protected for various reasons. These include the Parkinson bushland site on the north side of Johnson Road at Parkinson/Heathwood and the Greenbank Military Training Area at Greenbank. Both sites form part of the Flinders–Greenbank/Karawatha regional biodiversity corridor and are discussed further in Section 5.6.

In the southern section there are undeveloped parcels of state land adjacent to the preferred corridor. While this is not formally designated as ‘open space’, land of this nature is often used informally for recreational purposes including horse riding, motorbike riding and mountain biking. There are also parks and picnic areas in close proximity to the corridor, for example Mavor Park on Peterson Street in Beaudesert.

Industry

There are some small pockets zoned for general and light industry in the northern and central sections. Industrial hubs are located at Salisbury, Archerfield, Acacia Ridge and Hillcrest. Industrial land uses in the southern section of the study area are located along the Mt Lindesay Highway between Gleneagle and Beaudesert.
Agricultural

Agricultural uses are the dominant land use type in the southern section of the study area. Rural land on the Logan River floodplain is predominantly used for grazing or cropping.

Community and special uses

In the northern and central sections, community uses in the vicinity of the proposed rail line include the SkillsTech Australia campuses at Salisbury and Acacia Ridge, Nyanda High School, the Greenbank Community Centre, Flagstone State Community College and the Flagstone Primary School.

In the southern section, Gleneagle Primary School is located within 200 m of the preferred corridor, but is separated from the corridor by Mount Lindesay Highway. The Metropolitan South Institute of TAFE Beaudesert Campus is also adjacent to the proposed corridor at Beaudesert. The Beaudesert Public and Private Hospital is located about 1 km east of the proposed corridor at Beaudesert.

5.7.2 Future land use

Short term land use change

In order to determine what land use change is likely to occur in the short-term, data on current development applications or applications that have recently been approved, on land adjacent to the corridor were examined. This study did not find any development applications that would result in a major change in land use adjacent to the corridor. A summary of development applications is shown in Table 5.14.

Table 5.14 Summary of development applications for the study area

<table>
<thead>
<tr>
<th>Local government area</th>
<th>Reconfiguring a lot (subdivision)</th>
<th>Other development applications</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operational Works</td>
<td>Building Works</td>
<td>Material Change of Use</td>
</tr>
<tr>
<td>Brisbane City Council</td>
<td>14.1%</td>
<td>18%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Logan City Council</td>
<td>33.3%</td>
<td>10.4%</td>
<td>-</td>
</tr>
<tr>
<td>Scenic Rim Regional Council</td>
<td>8.3%</td>
<td>6.3%</td>
<td>10.4%</td>
</tr>
</tbody>
</table>

While there were over 540 development applications in the Brisbane City Council area, the majority were for utilities and supporting infrastructure. Applications for subdivisions and multi–unit developments at Rocklea, Salisbury, Coopers Plains and Acacia Ridge are consistent with the infill development anticipated to occur in these areas. It is expected that land use in this area would remain predominantly medium density residential, with pockets of higher density residential areas.

Within the Logan City Council area, there were applications for major low–density residential subdivisions at Flagstone, Teviot Downs and Johnson Road, and significant residential development is expected to occur in these areas over the short term.

The majority of development applications in the Scenic Rim Regional Council area were related to existing rural and agricultural land uses (e.g. poultry farms, etc);
however, there is one application for a residential subdivision adjacent to the preferred corridor at Gleneagle. There were also some boundary realignment applications which indicate the potential for intensified residential development. This part of the study area is expected to remain substantially rural in nature, with some areas of higher intensity residential development in future.

**Long–term land use change**

The SEQ Regional Plan identifies future growth areas which are anticipated to accommodate future urban development in the SEQ region. The study area contains a number of regional and local ‘development areas’ within the current Urban Footprint which will be the focus for accommodating regional dwelling and employment targets to 2031. There are also a number of ‘Identified Growth Areas’, which identify land outside the Urban Footprint which is capable of supporting urban growth and development beyond 2031, subject to further investigation.

Table 5.15 identifies future growth areas in the study area. The current Urban Footprint boundary and future growth areas under the SEQ Regional Plan are also shown on Figure 5.30 to Figure 5.32.

**Table 5.15 Future growth areas in the study area under the SEQ Regional Plan**

<table>
<thead>
<tr>
<th>Growth type</th>
<th>Regional Development Areas (to 2031)</th>
<th>Local Development Areas (to 2031)</th>
<th>Identified Growth Areas (after 2031)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>--</td>
<td>Beaudesert</td>
<td>Beaudesert South</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New Beth–Round Mountain</td>
</tr>
<tr>
<td>Residential and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>employment</td>
<td>Park Ridge</td>
<td>Greenbank Central</td>
<td>Greater Flagstone</td>
</tr>
<tr>
<td>Employment</td>
<td>Flagstone</td>
<td></td>
<td>Greenbank</td>
</tr>
<tr>
<td></td>
<td>Bromelton</td>
<td>--</td>
<td>Greater Bromelton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>North Maclean</td>
</tr>
</tbody>
</table>

*Brisbane CityShape 2026*

The *Brisbane CityShape Implementation Strategy 2026* (CityShape) acts as Brisbane’s local growth management strategy and outlines Brisbane City Council’s preferred strategy for accommodating regional dwelling and employment targets for the Brisbane LGA under the SEQ Regional Plan.

The implementation of CityShape includes undertaking neighbourhood planning for key suburbs in Brisbane City. Neighbourhood plans are currently being prepared for Lower Oxley Creek/Paradise Wetlands and Acacia Ridge/Archerfield which would require review as part of any future rail design. CityShape also identifies Calamvale–Algester and Parkinson–Drewvale as containing greenfield areas for residential development.
Figure 5.30
SEQ Regional Plan 1
Figure 5.31
SEQ Regional Plan 2

Department of Transport and Main Roads, Salisbury to Beaudesert Rail Corridor Study: Review of Environmental Factors, 2010
5-78
Figure 5.32
SEQ Regional Plan 3
Logan Growth Management–Core Matters

Under the SEQ Regional Plan, Logan City will accommodate significant growth to 2031 and beyond. The Logan Growth Management Core Matters (GMCM) – Strategic framework acts as Logan City Council’s local growth management strategy.

Nearly all of the major growth areas identified by the GMCM, with the exception of Beenleigh and Bahrs Scrub, are located within the study area. Logan City Council’s preferred sequencing for planning and development in these areas to 2026 is summarised in Table 5.16.

Table 5.16 Summary of future growth areas in Logan City

<table>
<thead>
<tr>
<th>Area</th>
<th>Sequencing commencement</th>
<th>Planning commencement</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flagstone</td>
<td>2008</td>
<td>2008</td>
<td>Planning being undertaken as part of Greater Flagstone Outline Structure Plan (OSP).</td>
</tr>
<tr>
<td>Flagstone Investigation Areas</td>
<td>2026 +</td>
<td>2008</td>
<td>Planning being undertaken as part of Greater Flagstone OSP. Areas to be included in the Urban Footprint but put on hold.</td>
</tr>
<tr>
<td>Greenbank Central</td>
<td>Not specified</td>
<td>2008</td>
<td>Provides a strategic opportunity for a transit-oriented centre (TOC) supporting a train station. Planning being undertaken as part of Greater Flagstone OSP.</td>
</tr>
<tr>
<td>Greenbank East Investigation Area</td>
<td>2026 +</td>
<td>2008</td>
<td>Planning being undertaken as part of Greater Flagstone OSP. Areas to be included in Urban Footprint but put on hold.</td>
</tr>
<tr>
<td>North Maclean Investigation Area</td>
<td>2026 +</td>
<td>2008</td>
<td>Planning being undertaken as part of Greater Flagstone OSP. Areas to be included in Urban Footprint but put on hold.</td>
</tr>
<tr>
<td>Jimboomba Major Rural Activity Centre</td>
<td>2016</td>
<td>2008</td>
<td>Proposed Master Plan area and planning scheme amendment.</td>
</tr>
</tbody>
</table>

Draft Planning Vision for Beaudesert Shire

The Beaudesert Whole of Shire Planning Project (WOSPP) was undertaken by the former Beaudesert Shire Council to establish a strategy for the future development of land previously contained within the Beaudesert LGA. The outcomes of the WOSPP are summarised in the Draft Planning Vision for Beaudesert Shire released by the former Beaudesert Shire Council in 2007. The key outcomes relevant to this study are summarised in Table 5.17.
Table 5.17 Planning vision for Scenic Rim Regional Council areas

<table>
<thead>
<tr>
<th>Locality</th>
<th>Summary of planning vision</th>
</tr>
</thead>
</table>
| Beaudesert | • Beaudesert will be a significant city which is home to over 30,000 people  
• Beaudesert will be the government and cultural centre of the (Beaudesert) region and a key hub in its transport network  
• Beaudesert will be a centre for the equine industry and be the major rural service centre for the region  
• A new university will be established in the Beaudesert region  
• The town will have all the facilities necessary to ensure a city of this size is socially cohesive |
| Bromelton | • Bromelton will be home to well over 30,000 jobs and provide an intermodal logistics facility for South East Queensland, and provide transport, warehousing and manufacturing as its key industries  
• Bromelton will incorporate a high tech research campus of the new regional university which is allied to its major industries  
• Bromelton’s economic functions will be complemented by facilities such as shopping, child care, sport and recreation, entertainment, hotels/motels and convention facilities |

The Draft Planning Vision included Flagstone and Yarrabilba which are now incorporated into Logan City following local government amalgamations in 2008. As such, planning for these areas has been superseded by Logan City Council’s *Growth Management Core Matters–Strategic Framework* (see above) and is not addressed here.

5.7.3 Land use impacts

A future passenger rail line between Salisbury and Beaudesert would provide essential public transport infrastructure for emerging communities in the South Western Corridor and Scenic Rim Regional Council area. It would also improve travel choice for residents in the northern section of the study area.

Construction of the railway line and associated stations would also create significant opportunities for the application of transit–oriented development (TOD) principles to both established and future communities, based around a high frequency rail service to the Brisbane CBD.

In the section between Kagaru and Beaudesert, the preferred corridor has a potential land requirement from 99 properties. In the long term, these properties would be acquired and developed for the construction of infrastructure associated with the Salisbury to Beaudesert passenger rail service. However, construction of the first stages would not be anticipated to commence until after 2026, with the remaining sections of the corridor likely to be constructed much later.

Prior to this time, development on properties that have been identified as having a potential land requirement for the project between Kagaru and Beaudesert which is assessable under the *Sustainable Planning Act 2009* would be referred to DTMR. DTMR would then assess the extent to which it encourages increased integration between land use and transport in accordance with the *Transport Planning and Coordination Act 1994* (see section 5.3–Planning background).
DTMR would also have similar referral authority for development on land which abuts the corridor and on certain types of development within 400 m of proposed railway stations throughout the study area. The impact of this would need to be considered as part of subsequent project stages.

5.7.4 Mitigation measures and recommended further studies

Station locations

Land use planning documents prepared by local authorities have identified preferred station locations at Acacia Ridge, Greenbank, New Beith, Flagstone, Undullah and Beaudesert which have been considered as part of the station selection process for this REF. A key focus for the next phase of concept design should be on confirming that these locations are feasible from an engineering perspective to inform ongoing land use and planning decisions in these areas.

Transit–oriented development

Transit–oriented development (TOD) involves concentrating a mix of uses, including housing, shops, offices and other facilities such as train and bus stations to encourage a greater proportion of trips by walking, cycling and public transport. Station locations for the Salisbury to Beaudesert passenger rail line have been selected to maximise opportunities for TOD and future design development should focus on incorporating TOD principles for key station locations such as Boronia Heights and Flagstone Central.

Rural/agricultural land uses

The primary impact of the establishment of a new rail corridor between Kagaru and Beaudesert would be on the existing rural and agricultural land uses in the southern section of the study area. The distribution of good quality agricultural land (GQAL) in this section is discussed in Section 5.1 and a review of potential severance impacts associated with the corridor is provided in Section 5.1. Consultation with affected landholders and communities should be undertaken to assist in determining the nature and extent of impact in these areas.

Other land use impacts

Further consideration needs to be given to impacts on other existing and future land uses as the study progresses. The potential impact on residential, community, open space and other land uses in all sections of the study area would need to be assessed based on future rail design.

5.8 Social and economic environment

Public transport connections to social and employment facilities offer an important alternative means of transport to the private vehicle, and form part of an integrated transport system which caters for a range of needs across different sectors of the community.

Overall, the Salisbury to Beaudesert passenger rail line would be expected to have significant beneficial impacts for existing and planned future communities on
Brisbane’s urban and rural fringe. However, establishment of a new rail corridor between Kagaru and Beaudesert also has the potential to adversely impact on individual landholders and other parts of the community through land acquisition, road closures and other disruptions to access and amenity.

The focus of this section is on identifying potential benefits and adverse impacts associated with the passenger rail line for future investigation based on a review of the following:

- SEQ Regional Plan 2009–2031 and SEQIPP 2008–2026
- Population projections for statistical local areas (SLAs) provided by the Queensland Government’s Population Information and Forecasting Unit (PIFU)
- TransLink route and timetable information current at April 2010
- 2002 aerial photography and cadastral information
- available research and literature on the social benefits and impacts of public transport.

No demographic analysis has been undertaken at this stage of the study; however, it is recommended that a detailed assessment of the demographic characteristics in the study area should be conducted as part of subsequent study phases.

5.8.1 Existing social and economic environment

The study area for this assessment was defined by the statistical local areas (SLAs) used by the Australian Bureau of Statistics (ABS) Census of Population and Housing 2006 which fall within a 5 km buffer of the proposed stations along the rail corridor. For the purposes of the analysis, the SLAs have been assigned to one of three study area sections as outlined in Table 5.18.

<table>
<thead>
<tr>
<th>Region</th>
<th>Statistical local areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>Rocklea, Salisbury, Archerfield, Coopers Plains, Acacia Ridge, Sunnybank Hills, Willawong, Algester, Calamvale, Doolandella-Forest Lake, Pallara-Heathwood-Larapinta, Parkinson-Drewvale, Durack, Inala</td>
</tr>
<tr>
<td>Central</td>
<td>Browns Plains, Greenbank-Boronia Heights, Beaudesert (S)–Part A</td>
</tr>
<tr>
<td>Southern</td>
<td>Beaudesert (S)–Part C</td>
</tr>
</tbody>
</table>

In the urban sections of the study area which support more dense residential populations, some SLAs within the 5 km buffer are serviced by existing passenger rail services on the Gold Coast/Beenleigh or Ipswich/Rosewood lines. These SLAs have been excluded from the assessment to ensure the socio-demographic profile which reflects the characteristics of communities in closer proximity to the proposed rail line. The excluded SLAs include Oxley, Corinda, Moorooka, Nathan, Robertson and Sunnybank.

**Population**

The total estimated resident population for the study area at 2006 was 184,777. Approximately half resides in the northern section of the study area, with a further
43% in the central section. The remaining 7% resides in the section between Kagaru and Beaudesert.

Based on the population projections from PIFU shown in Table 5.19, the population of the study area is expected to grow by approximately 77% by 2031 (i.e. from 198,328 persons to 350,090 persons). A significant proportion of this growth would occur in the section between Greenbank and Undullah, which would generally be accommodated by development within the ‘urban footprint’ at Greenbank and Flagstone.

### Table 5.19 Existing and projected population for the study area

<table>
<thead>
<tr>
<th>Section</th>
<th>2006</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
<th>2031</th>
<th>% growth 2006-2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>106,765</td>
<td>119,484</td>
<td>128,076</td>
<td>138,909</td>
<td>143,857</td>
<td>145,230</td>
<td>36%</td>
</tr>
<tr>
<td>Central</td>
<td>79,609</td>
<td>91,353</td>
<td>106,172</td>
<td>126,628</td>
<td>150,318</td>
<td>178,910</td>
<td>124.7%</td>
</tr>
<tr>
<td>Southern</td>
<td>11,954</td>
<td>13,825</td>
<td>16,653</td>
<td>19,620</td>
<td>22,735</td>
<td>25,951</td>
<td>117.1%</td>
</tr>
<tr>
<td>Total</td>
<td>198,328</td>
<td>224,662</td>
<td>250,900</td>
<td>285,157</td>
<td>316,910</td>
<td>350,090</td>
<td>76.5%</td>
</tr>
</tbody>
</table>

Source: ABS Census 2006; PIFU 2006

The population of the southern section would also increase to approximately 26,000 by 2031 or 6.5% of the study area estimated resident population, the majority of which would be accommodated through the development of urban communities in and around Beaudesert. Substantial population growth is also expected in the central and southern sections beyond 2031; however, the projections currently available through PIFU do not extend past this date.

### Existing public transport services

The majority of communities in the study area are serviced by existing bus routes, with the number and frequency of bus services decreasing commensurate with the distance from the CBD (see Table 5.20). Communities in the far northern section of the study area also have access to existing passenger rail services along the Gold Coast/Beenleigh line.

### Table 5.20 Existing public transport services in the study area

<table>
<thead>
<tr>
<th>Service type</th>
<th>Route</th>
<th>Route description</th>
<th>Communities serviced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail</td>
<td>–</td>
<td>Gold Coast/Beenleigh to City</td>
<td>Acacia Ridge, Coopers Plains, Salisbury</td>
</tr>
<tr>
<td>Bus</td>
<td>100</td>
<td>Forest Lake to City</td>
<td>Forest Lake, Inala, Salisbury</td>
</tr>
<tr>
<td>Bus</td>
<td>110</td>
<td>Inala to City (Cityxpress)</td>
<td>Inala, Willawong, Archerfield, Acacia Ridge, Rocklea, Salisbury</td>
</tr>
<tr>
<td>Bus</td>
<td>115</td>
<td>Calamvale to City (Cityxpress)</td>
<td>Calamvale, Sunnybank Hills, Hillcrest, Archerfield, Coopers Plains, Acacia Ridge, Rocklea, Salisbury</td>
</tr>
<tr>
<td>Bus</td>
<td>118</td>
<td>Forest Lake to City (Rocket)</td>
<td>Forest Lake, Heathwood</td>
</tr>
<tr>
<td>Bus</td>
<td>135</td>
<td>Algester to City (Cityxpress)</td>
<td>Parkinson, Algester, Sunnybank Hills, Coopers Plains</td>
</tr>
<tr>
<td>Bus</td>
<td>155</td>
<td>Calamvale to City</td>
<td>Calamvale, Coopers Plains</td>
</tr>
<tr>
<td>Bus</td>
<td>542</td>
<td>Browns Plains to Park Ridge</td>
<td>Park Ridge, Boronia Heights</td>
</tr>
<tr>
<td>Bus</td>
<td>541</td>
<td>Browns Plains to Greenbank</td>
<td>Greenbank, Boronia Heights, Hillcrest</td>
</tr>
<tr>
<td>Bus</td>
<td>540</td>
<td>Beaudesert to Brisbane City</td>
<td>Beaudesert, Glenelg, Veresdale, Maclean, Park Ridge, Greenbank, Acacia Ridge, Coopers Plains</td>
</tr>
</tbody>
</table>
**Social infrastructure**

While there are a number of existing regional health and education facilities in the study area, in most cases residents would need to travel outside the study area to access places of employment, university education, major hospitals and specialist medical facilities.

In future, the development of major employment centres at Park Ridge, Flagstone and Bromelton would also be expected to generate travel by people working at these centres, both from within the study area and from other parts of SEQ. Regional destinations that currently exist or are planned for the study area are summarised in Table 5.21.

| Table 5.21 Regional community facilities and employment nodes in the study area |
|-------------------------------|-------------------|--------------------------------------------------|
| Destination type              | Location          | Description                                      |
| Regional health care facilities| Salisbury         | Queen Elizabeth II Hospital (existing)            |
|                               | Beaudesert        | Beaudesert Public and Private Hospital (existing) |
| Regional education facilities  | Salisbury         | SkillsTech Australia–Salisbury campus (existing) |
|                               | Acacia Ridge      | SkillsTech Australia–Acacia Ridge campus (existing) |
|                               | Beaudesert        | Metropolitan South Institute of TAFE–Beaudesert campus (existing) |
| Regional employment nodes     | Park Ridge        | Estimate 13,000 new jobs when fully developed (planned) |
|                               | Flagstone         | Estimate 9,000–10,000 new jobs to 2026 (planned) |
|                               | Beaudesert        | Estimate 4,000 new jobs by 2026, plus 1,500 additional jobs by 2051 (planned) |
|                               | Bromelton         | Estimate 30,000 new jobs by 2051 (planned) |

There are also a number of local community facilities, such as schools or aged care facilities, in close proximity to the existing interstate rail line or the preferred corridor between Kagaru and Beaudesert. Local facilities adjacent to the existing interstate rail line and the preferred corridor in the southern section are summarised in Table 5.22.

<table>
<thead>
<tr>
<th>Table 5.22 Local community facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section</td>
</tr>
<tr>
<td>Northern</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Central</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Southern</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
5.8.2 Potential impacts

Social benefits of public transport

As discussed above, a future passenger rail line between Salisbury and Beaudesert would be expected to have substantial social benefits for existing and planned future communities on Brisbane’s urban and rural fringe. Some of these benefits include:

- direct benefits to users from increased access to services and activities
- increasing social and economic opportunities for people who cannot drive due to physical, economic or social constraints
- potential health benefits where trips involve walking or cycling to public transport nodes
- reducing the number of private vehicle trips made specifically to carry a passenger (e.g. children to sporting events, etc.)
- potential reductions in the time delay, stress, vehicle operating costs and pollution that each additional vehicle imposes on other road uses.

Economic impacts and benefits

Passenger rail services are a highly efficient mode of moving people between origins and destinations. Development of a passenger rail line between Salisbury and Beaudesert would assist in meeting the demand for transport associated with future urban growth, particularly in the central and southern sections of the study area.

According to Litman (2009), public transport services can increase economic productivity by improving access to education and employment, reducing traffic congestion, roads and parking facility costs, accidents and pollution, by increasing land use efficiencies and supporting certain industries, such as tourism. The future passenger rail line supports the Queensland Government’s preferred pattern of urban growth in the region, and has the potential to support the development of commercial centres and regional employment nodes associated with this growth.

Large scale infrastructure projects of this nature would also be expected to provide an economic stimulus during the construction phase, as a result of the employment opportunities directly related to the construction phase, as well as indirect economic benefits to businesses both locally and nationally. Accommodation of workers and families from regional locations during construction also has the potential to boost local housing and rental markets.

Public transport has also been shown to result in increased property values (Litman 2009). While this may benefit existing property owners, this could also have some effect on housing affordability, particularly in more economically disadvantaged sections of the study area.

Property acquisition and severance

There are 99 properties either partially or completely within the preferred corridor footprint between Kagaru and Beaudesert. In the longer term, affected land would be acquired and developed for the construction of infrastructure associated with the...
passenger rail line. However, construction of the first stage of the project is not anticipated to commence until after 2026, with the section between Kagaru and Beaudesert likely to be constructed much later.

Corridor establishment in the southern section would result in 32 of these affected properties being ‘severed’, which involves the physical separation of a single parcel of land into two discrete parcels. These properties appear to be used predominantly for grazing however, consultation with individual landholders in this section is critical to determine the nature of existing land uses and to establish the precise nature and extent of impact potentially associated with the future development of the rail line.

**Disruptions to access and amenity**

As outlined in Chapter 2, the preferred corridor crosses a number of State–controlled and local roads which may be impacted by the establishment of the passenger rail line. Amenity impacts, such as those arising from noise associated with the new passenger rail operations or dust emissions during construction, may also affect communities and landholders in the vicinity of the future rail line. This is addressed further in Section 5.4 and Section 5.5.

**Perceptions of safety**

Previous studies have found that public transport usage is linked to people’s perception of crime and safety. Improved perceptions of safety can be achieved by appropriate planning and design to enhance surveillance around train stations. The design of any future train station should be undertaken to maximise opportunities for surveillance by authorities and increase community perceptions of safety.

**5.8.3 Impact mitigation and recommended further studies**

Consultation with potential rail users and affected sectors of the community is critical to ensure that social impacts and benefits are accurately identified and managed as part of future project development.

A detailed assessment of existing and potential future demographic characteristics of the communities in the study area should also be undertaken as part of subsequent study phases. The findings of this analysis, combined with the outcomes of the community consultation process, would be used to inform decisions about specific actions or measures required to ensure that the social benefits and potential adverse impacts associated with the future passenger rail line are either ‘captured’ or managed.

As outlined in Chapter 3, any land required to secure the corridor in the future would be acquired in accordance with the procedures governing land acquisition and compensation under the *Acquisition of Land Act 1967*. Other actions or mitigation measures which may be applied in particular sections of the study area, or to particular communities include:

- further investigation of engineering solutions which maximise benefits and/or minimise impacts on rail users and affected communities
- integrating passenger rail services with more flexible forms of transport, such as buses or other transport feeder services, particularly for those without access to a private vehicle
• designing stations to maximise accessibility through walking or cycling, and
catering appropriately for disabled access

• maximising opportunities to link with existing and future pedestrian and cycle
networks

• designing station precincts which maximise surveillance by authorities and
community perceptions of safety.

Further assessment of potential amenity impacts would also need to be undertaken, as
outlined in Section 5.4 with respect to noise and vibration and Section 5.5 with respect
to air quality. Assessment of the potential impacts on the economic environment
would also need to be assessed as part of subsequent project stages.

5.9 Cultural heritage

Information about indigenous and non-indigenous cultural heritage values in the study
area was collated by reviewing relevant heritage databases and local government
planning schemes, including the:

• EPBC Online Protected Matters Search tool, which identifies heritage values of
Commonwealth significance protected under the EPBC Act

• Aboriginal and Torres Strait Island Cultural Heritage Database, which identifies
recorded sites of Aboriginal cultural heritage significance

• Queensland Heritage Register, which identifies sites recognised by the State as
having heritage significance under the Heritage Act 1992 (Qld)

• Brisbane City Plan Heritage Register, which identifies sites of local significance
protected under Brisbane City Plan 2000

• Logan Overlay Map 8–map and assessment provision for the Heritage Places
Overlay Area identifies sites of local significance protected under the Logan
Planning Scheme 2006

• Beaudesert Shire Cultural Heritage Overlay, which identifies sites of local
significance in the Scenic Rim and Logan local government areas protected under
the Beaudesert Shire Planning Scheme.

Consultation was also undertaken with representatives of the Cultural Heritage
Coordination Unit (CHCU) within the Department of Environment and Resource
Management (DERM) to identify Aboriginal parties that may have an interest in the
study area.

Identification of cultural heritage values for this REF is limited to places and objects
of known, recorded cultural heritage value and no additional field investigations have
been undertaken as part of the study. It is anticipated that other cultural heritage values
would be identified through consultation with the community and relevant Aboriginal
parties for the study area.
5.9.1 Existing environment

Indigenous cultural heritage values

Recorded sites identified by the Aboriginal and Torres Strait Islander Cultural Heritage Register, provided by DERM are listed in Table 5.23. Of these, only one site is located in close proximity to the corridor. There is also potential for other unrecorded places and sites of cultural heritage value to occur in the study area.

Table 5.23 Registered indigenous cultural heritage sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Attribute</th>
<th>Site</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>KB:D13</td>
<td>Artefact</td>
<td>LB:F41</td>
<td>Artefact</td>
</tr>
<tr>
<td>LB:F39</td>
<td>Artefact</td>
<td>LB:O22</td>
<td>Earthen, destroyed</td>
</tr>
<tr>
<td>LB:F40</td>
<td>Artefact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Aboriginal parties

For the purposes of the Aboriginal Cultural Heritage Act 2003 (Qld) (ACH Act), ‘Aboriginal parties’ that may have an interest in the project may include native title claimants or other Aboriginal people with particular knowledge about Aboriginal cultural beliefs and practices associated with an area.

The Jagera and Turrbal people both have registered native title claims within the broad study area. In addition to these groups, DERM recognises both the Munujali People and the Ugarapul People as Aboriginal parties with a particular interest in the study area. This list is not intended to be exhaustive, and it is acknowledged that other Aboriginal persons may assert an interest in accordance with section 35(7) of the ACH Act.

5.9.2 Non–indigenous cultural heritage values

Database searches identified five sites of non-indigenous cultural heritage significance within 1 km of the proposed rail line. These are summarised in Table 5.24. In addition, a tourist railway was operated along the now–disused Bethania to Beaudesert rail line however, these services ceased in 2003 and would not be impacted by the proposed passenger rail line.

Table 5.24 Non-indigenous cultural heritage sites in the study area

<table>
<thead>
<tr>
<th>Significance</th>
<th>Place</th>
<th>Statutory protection</th>
<th>Heritage attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTHERN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Archerfield Second World War Igloos Complex</td>
<td>Queensland Heritage Register</td>
<td>WWII relic</td>
</tr>
<tr>
<td>State</td>
<td>Acacia Ridge Air Raid Shelter</td>
<td>Queensland Heritage Register</td>
<td>WWII relic</td>
</tr>
<tr>
<td>CENTRAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commonwealth</td>
<td>Greenbank Military Training Area (part)</td>
<td>Listed place–Commonwealth Heritage Register</td>
<td>Natural systems–conservation refuge for native species containing large areas of endangered vegetation communities.</td>
</tr>
</tbody>
</table>
### Potential impacts

#### Indigenous cultural heritage

There is one recorded indigenous cultural heritage site within 120 m of the rail corridor between Kagaru and Beaudesert. Database search records identify that this is an artefact site. Any potential for impact on the cultural significance of the site would need to be determined in consultation with the appropriate Aboriginal party. It is also possible that other, previously unrecorded, heritage values occur in the study area; however, this would also need to be confirmed through consultation with the relevant Aboriginal parties in the future.

#### Non-indigenous cultural heritage

The majority of the sites listed in Table 5.24 are a substantial distance from the proposed rail line and would be unlikely to be impacted by establishment of the passenger rail line in the future.

In the southern section, the rear portion of Enright’s Sawmill would be required for the preferred corridor. This would affect the existing timber storage area; however, consultation would be required to determine whether this would adversely affect the viability of existing sawmill operations. As the cultural heritage value of the site relates to the longevity of the sawmill operation, no significant cultural heritage impacts would be anticipated provided the business can continue in this location.

### Mitigation measures and recommended further studies

#### Indigenous cultural heritage

Under Queensland’s *Aboriginal Cultural Heritage Act 2003*, all persons undertaking an activity have a ‘duty of care’ to ensure that no harm is caused to Aboriginal cultural heritage. Activities undertaken in accordance with an approved cultural heritage management plan (CHMP) are considered to meet the duty of care requirements under the Act. Should the project proceed in future, DTMR would enter into a voluntary CHMP with the appropriate Aboriginal party or parties. This process would also be used to clarify any previously unrecorded areas where there is potential to impact on cultural heritage significance.

#### Non-indigenous cultural heritage

Consultation with the proprietors of Enright’s Sawmill should be undertaken as part of community consultation on the REF to determine the nature and extent of impact on the site. Potential impacts on the heritage values associated with the Greenbank
Military Training Area would also need to be considered with reference to the future rail design in the central section of the study area.

5.10 Landscape and visual amenity

A desktop assessment has been undertaken in order to determine the scenic value of the study area and the potential landscape and visual impacts that may result from the implementation of the proposed passenger rail line. As there is no standard methodology or guideline for assessing the visual impact of railway development in Queensland, this desktop assessment has been based upon the methodology presented in the Department of Transport and Main Roads’ *Road landscape manual* (2004).

The assessment only considers issues relating to the rail line and associated infrastructure (e.g. overhead lines). It does not include a detailed assessment of the short-term impacts arising from construction activities, as these are not yet fully defined.

The general landscape character of the study area, including the natural and built environment, was observed during a number of site visits undertaken during 2009. The detail noted was used to inform the desktop assessment.

The data sources used in undertaking this desktop assessment included the following:

- tourist maps and information (Brisbane Tourism Information Centre and <http://www.ourbrisbane.com>)
- street maps (http://www.whereis.com)
- 2009 aerial photography
- Brisbane City Plan 2000, Logan City Planning Scheme 2006 and Scenic Rim Regional Council Planning Scheme (Beaudesert Shire Planning Scheme 2007)
- South East Queensland Regional Plan 2009–2031
- Department of Infrastructure and Planning’s South East Queensland Regional Scenic Amenity Study public preference survey 2004
- Brisbane City Council’s Scenic Amenity Study survey feedback summary 2004.

5.10.1 Existing environment

Regional landscape setting

The DTMR *Road landscape manual* divides Queensland into landscape regions, classifying and describing each landscape region. According to the *Road landscape manual*’s classification, the study area is located within the South East landscape region, which is characterised by:

- a high population
- gently undulating river valleys and the coastal plain
- coastal hinterland and ranges
• a variety of rural and semi-natural areas.

Elements of the landscape that contribute to landscape and visual amenity include land use patterns, areas of cultural heritage (both indigenous and non-indigenous), regionally significant geological formations, waterbodies and waterways, as well as vistas and views. The landscape elements relevant to the scenic amenity of the study area are described below.

**Northern section**

The topography of the northern section of the study area is relatively flat from Salisbury to the elevated areas of Acacia Ridge. South of Acacia Ridge the proposed passenger rail line moves down onto the Oxley Creek floodplain and from here the topography remains generally flat, with very minor undulations. Visual catchments within the northern section are therefore relatively small with no long distance views within or around the study area.

The northern section is dominated by low to medium density residential land uses, together with areas of commercial and light industrial activities. This section of the study area also contains some areas of open space, including local parks and patches of both remnant and non-remnant vegetation. These areas are generally located to the south of Learoyd Road. Of note are the patches of vegetation along Paradise Road in the vicinity of Oxley Creek, the Parkinson Bushland to the south of the Logan Motorway and the Greenbank Military Training Area.

**Central section**

The topography of the central section is minor to moderately undulating between Greenbank and the start of the Teviot Brook and Logan River floodplains at Undullah. Visual catchments are generally limited.

Land uses within the central section consist of low density, rural residential properties interspersed with substantial areas of open space. Notable areas of vegetation include the southern part of the Greenbank Military Training Area and the vast areas of remnant and regrowth vegetation to the west of the existing interstate corridor within Flagstone. The latter is currently undergoing extensive clearing for urban development. This section of the study area also contains recreational facilities such as local parks, picnic spots and sporting fields.

**Southern section**

Between Kagaru and Beaudesert, the preferred corridor crosses or passes along the edge of the Teviot Brook and Logan River floodplains. The topography in the vicinity of the corridor is therefore generally flat and visual catchments are large. A series of ridges is located to the west of the corridor, the closest of which is approximately 5 km distant. Some areas of slightly more elevated terrain are also located at Woodhill and Gleaneagle to the east of the preferred corridor.

Land uses within the southern section are generally rural with isolated pockets of vegetation and agricultural infrastructure scattered across substantial areas of open grazing country. Some areas of rural residential properties are located to the east of the...
preferred corridor at Gleneagle. These residential land uses increase in density as the corridor approaches the township of Beaudesert.

**Landscape character types and landscape value**

A correlation generally exists between the level of development and the level of scenic amenity, as natural features are considered to be of higher scenic value than built features.

Appendix E outlines the dominant landscape character of each section of the study area, broken down further into summaries of the character between each of the proposed stations. This outline gives a brief description of the natural landscape, built landscape and open space features. The quality of the landscape is also indicated based on the following measures:

- **low**—landscape is highly developed with little cultural heritage value, no observable landforms, no natural waterways and no vegetated open space
- **medium**—some areas of development, some cultural heritage value, some observable landforms, some natural waterways and little to no vegetated open space
- **high**—little to no development, high cultural heritage value, observable landforms, natural waterways and much vegetated open space.

**Sensitive landscape receptors**

Sensitive landscape receptors are generally places that are enjoyed by the public for their high levels of scenic amenity. They include areas such as national parks, conservation reserves, scenic lookouts and other public places. Residential areas are also sensitive to landscape alterations and impacts on visual amenity. Residents usually expect that the existing scenic amenity or character surrounding their property will continue.

The following list of potentially sensitive receptors was identified during a review of aerial photography along the proposed passenger rail line alignment.

**Northern and central sections**

- Residential areas between Salisbury and Greenbank, and small pockets of residences at Flagstone
- Recreational areas which adjoin the existing interstate corridor such as Algester Park at Algester, Seaton Park at Hillcrest and the Greenbank and James Smith recreational areas at Greenbank
- The Parkinson Bushland and Glider Forest Conservation Area at Parkinson
- Areas of remnant and non-remnant vegetation along Paradise Road
- Greenbank Military Training Area

**Southern section**

- Scattered rural residences between Kagaru and Gleneagle
• Residential areas at Gleneagle and Beaudesert
• Recreational area on the corner of Hall Road and the Mount Lindsay Highway

Common perceptions and values

Scenic amenity is a subjective value that can vary throughout and within communities. It is therefore important to understand what the communities within the study area consider to be of ‘high value’ in terms of landscape and scenic amenity.

Surveys have been undertaken in the study area to determine the public’s perception regarding appealing and unappealing scenic attributes. A public preference survey undertaken as part of the South East Queensland Regional Scenic Amenity Study in 2004 used 440 photos from four main domains—bush, rural, urban and coastal—to determine attributes that contribute to high and low scenic amenity. Brisbane City Council also undertook a public preference survey identifying views and viewing locations that the public would like preserved throughout the area. None of the viewing locations identified in the survey would be affected by the proposed passenger rail line.

The feedback obtained through both these surveys is useful in identifying attributes that local communities consider to enhance amenity and those they consider degrade it.

The feedback summaries concluded that communities in the study area believe:

• natural areas are generally higher in scenic amenity
• built environment areas can be high in scenic amenity where the built elements are balanced with natural elements
• vegetated open space is more appealing than unvegetated open space
• views of observable landforms (i.e. rivers, mountains and the coastline) are of high scenic amenity.

The surveys also found that people were unlikely to find a view appealing if there was no opportunity to rest and look at it. This is an important consideration for the proposal, as transport infrastructure can often contribute to scenic amenity by providing access to viewpoints.

5.10.2 Potential impacts

Change to landscape value

While the future construction activities are not yet fully defined, it is expected that works associated with the proposed passenger rail line would include activities such as vegetation clearing and earthworks (refer to Chapter 2 for an outline of the expected construction activities). These activities have the potential to impact on the existing landscape value throughout the study area in the short term.

Along the northern and central sections of the proposed passenger rail line, the most notable changes to the existing landscape would be extensions to existing cut and fill embankments. The extent of these changes would need to be quantified during future stages of the design.
Within the southern section, the tracks would need to be elevated above the Q100 flood line within the Teviot Brook and Logan River floodplains. This would require the construction of embankments and viaducts for substantial distances across what is currently a relatively flat landscape. The extent of these embankments is shown on Drawings BET903-C-DWG-101 to 124 and described in Section 5.1.3 of this chapter.

**Change to visual character**

Changes to visual character may be assessed as low, medium or high:

- **Low** is where the railway and associated infrastructure would result in little or no contrast with the visual quality of the surrounding area.
- **Medium** is where the railway and associated infrastructure may pose a moderate contrast with the existing landscape.
- **High** is where the railway and associated infrastructure may cause a major visual contrast with the visual setting of the landscape.

Using these criteria, the changes to visual character within the northern section would be expected to generally be low. This is because the proposed passenger rail line is expected to generally follow the alignment of the existing interstate rail corridor, with its associated rail infrastructure, and would traverse developed urban areas. The visual impacts of electrification masts and associated rail infrastructure such as stations would need to be investigated further during future stages of the design.

Within the central section of the study area, the proposed passenger rail line would be expected to result in a low to moderate contrast with the existing landscape. Here the alignment would follow that of the existing rail corridor but would traverse less developed rural residential areas.

Visual amenity issues would be highest in the southern section where the rail infrastructure would result in a medium to high contrast with the existing rural setting. The majority of the area is flat, sparsely vegetated, grazing land and the proposed passenger rail line would therefore be visible from substantial distances away. The extent of changes to the visual character of the area would progressively decrease between Gleneagle and Beaudesert as the proposed passenger rail line passed through increasingly developed areas.

**5.10.3 Mitigation measures and recommended further studies**

Sections 5.10.1 and 5.10.2 offer a preliminary assessment of scenic amenity values that may be impacted by the proposed passenger rail line. It is recommended that further detailed studies be undertaken to assess the potential issues which have been raised. These future studies should include a detailed landscape and visual assessment of a design which has been progressed beyond the conceptual level. This should be supported by a community consultation exercise which involves local residents, landowners and other stakeholders who would potentially be affected by the visual aspects of the proposed passenger rail line.

Impacts on landscape and scenic amenity should be managed via landscaping and urban design treatments focusing on:

- preserving open space
- protecting waterways
- preserving vegetation
- maintaining the rural character through the southern section
- creating buffers between the proposed passenger rail line and surrounding landscape using measures such as appropriate landscaping, retaining walls, screening and fencing.

5.11 Greenhouse gas emissions

5.11.1 Scope

This section provides a preliminary assessment of the greenhouse gas emission issues associated with the construction and operation of the proposed passenger rail line described in Chapter 2. Specifically, the assessment is intended to identify notable sources of greenhouse gas emissions and to provide an outline of the future greenhouse gas assessment that would need to be undertaken during subsequent stages of design.

5.11.2 Background

Anthropogenic pollutants that are of importance to global warming potential include the following greenhouse gases: carbon dioxide (CO$_2$), methane (CH$_4$), nitrous dioxide (N$_2$O) and synthetic gases (hydrofluorocarbons [HFCs], sulphur hexafluoride [SF$_6$], tetrafluoromethane [CF$_4$], hexafluoroethane [C$_2$F$_6$]). CO$_2$ is considered to be the most common and important form of anthropogenic greenhouse gas and is the common unit by which other greenhouse gases are expressed.

Emission factors for different activities and energy uses have been standardised as per the National Greenhouse Accounts (NGA) Factors, June 2009 (Department of Climate Change 2009). Under the NGA factors, the global warming potential of emissions from specific facilities/developments is expressed in terms of carbon dioxide equivalents (CO$_2$-e), with other greenhouse gases having different global warming potentials also expressed as CO$_2$-e units.

5.11.3 Emission scope identification

Greenhouse gas emissions would be associated with the planning, construction and operation of the proposed passenger rail line. The two main types of emissions are classified as either direct (or point-source) or indirect. Greenhouse gas emissions are further classified under the NGA factors into three scopes:

- **Scope 1**: Scope 1 emissions consist of direct or point-source emissions produced from sources within the boundary of an organisation or site as a direct result of operations. They are generally emitted per unit of activity at the point of emission release. In the context of the Salisbury to Beaudesert railway, emissions that would be generated from fuel used by earthmoving equipment during construction are an example of Scope 1 emissions.
• **Scope 2**: Scope 2 emissions consist of indirect emissions generated in the wider economy as a result of an organisation’s activity. Electricity used in the operation of passenger train services and stations would constitute Scope 2 emissions.

• **Scope 3**: Scope 3 covers all other indirect or life-cycle emissions. These would consist primarily of the indirect or embodied emissions associated with the manufacture of materials which would be used in construction.

### 5.11.4 Potential emissions

**Construction**

During construction of the proposed passenger rail line, emissions would be generated by construction-related fuel and electricity use as well as the embedded manufacturing and transportation emissions associated with the materials used in the construction.

While the required cut and fill volumes have not been finalised, it is expected that mass haulage of fill during construction would result in significant volumes of CO₂ emissions within the study area and surrounds.

**Operation**

Electricity usage during railway and station operations would constitute the primary source of greenhouse gas emissions during the operational phase. Table 5.25 presents the expected emissions generated per rail passenger per trip. This has been calculated by using the average of 30.3 g CO₂ emitted per passenger kilometre as per the Queensland Rail carbon calculation tool (QR 2009).

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Approximate length of alignment (km)</th>
<th>Emissions (per passenger trip) (kg CO₂-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail</td>
<td>54.5</td>
<td>1.65</td>
</tr>
</tbody>
</table>

These emissions are approximate estimates only and have been calculated using the following assumptions:

- The distance travelled would be approximately 54.5 km from Salisbury to Beaudesert.
- A six-car passenger train holds 600 passengers at full capacity peak usage (as per Queensland Rail calculation tool (QR 2009))
- This calculation does not take parameters such as gradients, curvatures, speed and number of stops into consideration.

Table 5.26 presents the CO₂ emissions associated with transporting a passenger from Salisbury to Beaudesert station via road in an average passenger vehicle. This has been calculated by using the average of 200 g CO₂ emitted by an average passenger vehicle per kilometre as per the Australian Government green vehicle guide (Department of Infrastructure, Transport, Regional Development and Local Government 2008). Although the estimated CO₂ emissions of train and road vehicle
passengers have been estimated using some broad assumptions, a comparison of the two reveals that rail transport is approximately five times more efficient than road vehicle transport.
<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Approx. length of journey (km)</th>
<th>Emissions (per passenger trip) (kg CO₂-e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road vehicle</td>
<td>55</td>
<td>9.17</td>
</tr>
</tbody>
</table>

These emissions have been calculated using the following assumptions:

- The distance travelled from Salisbury station to Beaudesert station via road is approximately 55 km.
- An average passenger vehicle carries 1.2 passengers.

5.11.5 **Mitigation measures and proposed future studies**

The next stage of the climate change assessment would involve the further optimisation of the design to minimise greenhouse gas emissions followed by an assessment of the greenhouse gas emissions during the construction and operational phases of the future passenger railway. These steps are discussed below.

**Optimisation**

During the evolving conceptual design of the southern section of the proposed passenger rail line, specific consideration has been given to the optimisation of the alignment with regard to fuel efficiency. This has included consideration of issues such as rail gradients, radial curves, minimisation of the length of track and optimising the number of stations. The output of this initial optimisation process is not only fuel efficiency, but also transport efficiency, reduced life-cycle emissions, and overall reduced greenhouse gas generation.

During the future stages of the design, further consideration should be given to the identification of ways to optimise the overall efficiency of the rail alignment and railway service operations. Identification of potential innovations and methods of value management should be encouraged.

Variables that relate to the train energy consumption, and therefore emissions, would influence the design process, rail line optimisation and overall project life-cycle costs. The following general rail freight modal energy efficiency formula (Parajuli, Ferreira and Bunker, 2009) identifies some of the key issues that require consideration during future track design:

\[
\text{Energy consumption} = (\text{speed term}) + (a. \times \text{travel distance/no of stops}) + (b. \times \text{grade and term curvature}) + (c. \times \text{train length/term mass}).
\]

Ensuring that greenhouse gas emissions and also sustainability issues are considered during future design stages could make a significant impact in terms of the life-cycle costs associated with the operation of the proposed passenger rail line.

An assessment of the greenhouse gas emissions should be carried out parallel to the design optimisation stage. This would involve the identification of an interim emissions profile for the operation of the railway system and would form part of the patronage and transport model outputs.
**Assessment**

A formal analysis of the greenhouse gas emissions associated with the construction and operational phases of the proposed passenger rail line would need to be carried out during future stages of the design and include the identification of the following:

- fuel use of construction equipment and vehicles during construction works (e.g. the use of bulldozers during earthworks operations)
- electricity usage during construction and the design process (e.g. electricity used by the design and construction offices)
- embedded emissions associated with the materials used for the construction of the proposal (e.g. the embedded energy of concrete and steel)
- electricity usage relating to passenger and train operations as well as station operation
- operational and construction emissions profiles for the three different NGA scopes.

**5.12 Contaminated land**

For the purposes of the *Environmental Protection Act 1994*, contaminated land refers to land contaminated by hazardous substances which may pose a threat to human health or the environment. The Department of Environment and Resource Management (DERM) maintains two public access registers that contain land use planning information with respect to contaminated lands:

- Environmental Management Register, which records properties that have been or are being used for a ‘notifiable activity’ under the *Environmental Protection Act 1998*
- Contaminated Land Register, which records sites proven to contain contamination which may cause, or is causing, serious environmental harm. This register also records known sites of unexploded ordnances (UXOs).

Searches of both registers were undertaken using lot and real property (RP) descriptions of properties located within approximately 100 m of the proposed passenger rail line.

Hazardous substances can also take the form of unexploded ordinance. In addition, to records held on the Contaminated Land Register, the Australian Government Department of Defence maintains an online UXO mapping tool that assigns one of the following three categories to areas with the potential to contain UXO:

- Substantial – a history of numerous UXO finds or heavy residual fragmentation. Areas likely to be assessed as substantial include impact areas, demolition sites and areas of heavy explosive ordnance dumping.
- Slight – areas with a confirmed history of military activities that have resulted in residual UXOs, but which the Department of Defence considers it inappropriate to assess as ‘substantial’.
- Other – a site that Department of Defence records do not confirm as having been used for live firing. UXOs or explosive ordnance fragments or components have
not been recovered from the site. The Department of Defence opinion is that it would be inappropriate to assess as either ‘slight’ or ‘substantial’.

Given the proximity of the proposed passenger rail line to the Greenbank Military Training Area, a review of this the Department of Defence UXO mapping was undertaken.

5.12.1 Existing environment

Potentially contaminated land

Searches of the Contaminated Land Register returned no results for the study area. However, there are 27 potentially contaminated sites listed on the Environmental Management Register (EMR) within 100 m of the proposed passenger rail line. In addition to these properties, the existing interstate rail corridor and disused Bethania to Beaudesert rail line are included on the EMR based on the potential for contamination from past and current railway operations. Land in the study area which is recorded on the EMR is shown on Figure 5.33 to Figure 5.35.
Figure 5.33
Environmental Management Register 1
Figure 5.34
Environmental Management Register 2
Figure 5.35
Environmental Management Register 3
The nature of potential contamination varies throughout the study area. In the northern section, registered sites are concentrated in the industrial areas of Acacia Ridge and Coopers Plains with a large number listed as storage areas for oil or petroleum products and hazardous contaminants.

In the central and southern sections, registered sites are generally associated with livestock dips or spray races consistent with the dominant agricultural land uses. Sites associated with industrial contaminants are concentrated in the more urbanised areas around Beaudesert.

**Unexploded ordnance (UXO)**

Nine properties between Flagstone and Kagaru were also identified as having ‘slight’ potential to contain UXO based on mapping provided by the Department of Defence, as shown on Figure 5.33 to Figure 5.35.

### 5.12.2 Potential impacts

Sites on the EMR generally pose a low risk to human health and the environment under the current land use. Further, sites are listed based on their real property description (i.e. lot on plan). However, only a small portion of the site may have been used for potentially contaminating activities. Depending on the location and nature of contamination, excavation and soil displacement activities have the potential to mobilise soil contaminants, thereby resulting in the spread of contamination beyond a contained location. If not properly identified and managed, this may result in adverse environmental effects (e.g. on waterways, etc).

Alternatively, UXOs represent a potential risk to workers during construction, with the potential to cause injury or death if detonated as a result of construction activities.

The location and nature of UXOs and any potential contamination on registered sites would need to be established as part of subsequent study phases to determine whether the future passenger rail line would be likely to disturb areas containing environmentally significant levels of contaminants.

### 5.12.3 Mitigation measures and recommended further studies

It is recommended that a preliminary assessment of potential contamination on the sites shown in Figure 5.33 to Figure 5.35 should be undertaken as part of subsequent study phases. This would involve a review of historical site information and aerial photography to identify potential sources of contamination with the potential to be disturbed by construction activities, should the project proceed in future.

On sites where disturbance of contaminated soil is likely to be required, further detailed assessment would need to be undertaken and appropriate management measures devised in accordance with DERM’s requirements should the project proceed in future.
5.13 Hazards and risks

5.13.1 Scope

This section provides a preliminary assessment of the hazards and risks associated with the construction of the future passenger rail line. This assessment has been undertaken as a desk-based exercise and is intended to identify potential risks, quantify those risks where possible, identify potential controls, and outline possible mitigation strategies. When undertaking risk management, it is not always appropriate to base the analysis of risk on a worst case scenario as this may lead to inappropriate resource allocation. The following analysis therefore adopts a conservative estimate as a method of producing a realistic assessment.

5.13.2 Potential hazards and risks and mitigation measures

Handling or storage of hazardous materials

Hazardous materials stored on site are likely to be restricted to diesel fuels, machine and vehicle oils and hydraulic fluids. These materials would be stored in appropriate containers within bunded locations in accordance with Schedule 2 of the Environmental Protection Regulation 2008. Spill prevention measures together with incident response plans would be set out in an environmental management plan.

Public utilities

During construction, the potential exists for personnel and machinery to come into contact with high-voltage electricity power lines when work is occurring within or adjacent to existing or future services easements. Services of particular note are the high-voltage electricity lines that cross the existing interstate corridor at Greenbank. Work method statements would be developed to address potential safety issues and construction personnel would be provided with specific training when working in proximity to potentially dangerous electricity or gas infrastructure.

The potential also exists for construction works to intersect other public utilities such as water mains and fibre optic cables. While these do not pose a threat to health and safety, the cost implications of accidental damage can be considerable. It is recommended that relevant services authorities be contacted prior to any excavation works in addition to the standard practice of conducting a ‘dial before you dig’ search of below-ground utility locations.

Bushfires

Large areas classed as having medium bushfire risk were identified in the vicinity of the proposed passenger rail line during a review of the Queensland Government’s bushfire risk mapping. These areas of medium risk are generally located between the Logan Motorway and Kagaru. Of particular note are the areas between the Logan Motorway and Johnson Road, the Greenbank Military Training Area and Greater Flagstone. Communication would be maintained with the Queensland Government Department of Community Safety to provide for early warning of any potential bushfire hazards.
In addition, construction activities such as welding have the potential to start bushfires. Appropriate management plans would be implemented to prevent bushfires occurring, and construction personnel would be specifically briefed on bushfire prevention.

**Operating under rail traffic**

As described in Chapter 2, the alignment of the northern and central sections of the proposed passenger rail line would generally follow that of the existing interstate rail line. This line currently experiences approximately 65 train movements per week. Train movements along the existing interstate rail line are likely to be maintained throughout the construction of the future passenger rail lines and the risk would therefore exist for personnel and equipment to be struck by passing freight trains.

The issue of working within an operational rail corridor would be subject to detailed and thorough safety risk assessment prior to the construction phase. Specific work method statements would be developed to address potential trackside safety issues, and all construction personnel would be provided with specific training when working in proximity to moving trains.

**5.13.3 Recommended further studies**

A comprehensive risk assessment would be undertaken prior to the construction phase which would cover natural or accidental hazards, such as flooding, together with other health, safety and environmental risks. This risk assessment would be undertaken in accordance with Australian Standard *AS/NZS 4360: 2004 – Risk management* and would be incorporated in the future risk management and incident response plans.
6 Cumulative environmental effects

This assessment has identified a number of potential impacts associated with the development of the passenger rail line that could potentially interact with impacts associated with other future projects in the study area to produce a cumulative effect on particular environmental values in the study area.

Conversely, impacts associated with the passenger rail project may combine to produce a more noticeable effect than is evident when they are assessed in isolation (e.g. the combined effect of noise and dust generated during construction rather than one or the other on its own).

At this stage of the study, it is difficult to estimate the cumulative potential of project impacts without first assessing in detail the nature and extent of impact likely to be generated by the project itself. However, the following should be considered when assessing the cumulative impacts of the proposal as part of subsequent study phases.

**Essential infrastructure provision and transport efficiency**

The proposed Salisbury to Beaudesert passenger rail line would be developed as part of proposed significant land use change in the South Western Corridor and central Scenic Rim region. The Salisbury to Beaudesert passenger rail line would most likely be delivered as part of an integrated transport network, comprising additional roads as well as fixed rail infrastructure and feeder bus services. The cumulative benefit of these extensions of the existing transport network would contribute to the development of the appropriately provisioned, ‘strong communities’ envisioned by the SEQ Regional Plan.

The addition of a new passenger service on the existing Citytrain network also has the potential to result in an increased number of trains through the inner city. Future network capacity on the inner city network is being investigated as part of the Cross River Rail project, which will also be a key consideration in determining the nature of the service which can be provided on the Salisbury to Beaudesert line.

**Noise**

Passenger rail services between Salisbury and Beaudesert would be expected to result in a significant increase in the number of train movements in the existing interstate rail corridor from Salisbury to Kagaru, where the proposed passenger line is envisaged to run alongside the existing freight line. The cumulative impact of these train movements on the ambient noise environment would need to be considered as part of subsequent study phases. This is typically achieved by modelling noise impacts using the $L_{Aeq24hour}$ as a measure of the noise levels over a 24-hour period.
In future, consideration would also need to be given to the potential for increased freight movements along the existing interstate rail line associated with the development of the Southern Freight Rail Corridor.

**Koala conservation**

Koala populations in South East Queensland are under serious threat from a combination of factors, including the progressive loss of habitat due to development, domestic animals and disease. Due to critical declines in recent years, further loss of useable habitat or impacts on koala dispersal patterns and movement has the potential to significantly impact these populations. Future assessment of the impacts associated with the development of the proposed passenger rail line needs to be conducted with reference to the conservation status of koalas in the SEQ region as a whole.

**Threatened species and communities**

In addition to koalas, this assessment has also identified one threatened ecological community (the Swamp Tea-tree Forests of South East Queensland) and a number of threatened species potentially found in the study area. Habitat loss and fragmentation through urban development is often a critical factor in the decline of species and communities, particularly within the study area and the SEQ region as a whole, and this needs to be further investigated as part of subsequent study phases.

**Good quality agricultural land**

The progressive development of agricultural land for urban purposes has resulted in reductions in the amount of land available for rural and agricultural land uses in SEQ. The impacts associated with sterilisation of good quality agricultural land in the section between Kagaru and Beaudesert need to be assessed in light of these regional reductions.
7 Summary of benefits and impacts for future investigation

This chapter provides a summary of the major benefits and potential adverse impacts of the proposal that have been identified during the course of this study. These benefits and adverse impacts will need to be re-evaluated and further quantified during the subsequent detailed impact assessment stage of the proposal. The chapter also provides a summary of the key possible mitigation measures.

### 7.1 Major benefits

A future passenger rail line between Salisbury and Beaudesert would provide essential public transport infrastructure for emerging communities identified in the SEQ Regional Plan, linking residential growth areas with places of employment and education. It would also improve travel choice for residents in established urban areas and create significant opportunities for transit–oriented development (TOD) in existing and future communities, based around a rail service to the Brisbane CBD.

Public transport connections to social and employment facilities offer an important alternative means of transport to the private vehicle, and form part of an integrated transport system which caters for a range of needs across different sectors of the community. Rail services are a highly efficient mode of moving large numbers of people and are well suited to major regional destinations and greenfield residential development (Buffini 2000).

As outlined in Section 5.8, a future passenger rail line between Salisbury and Beaudesert would be expected to have substantial social benefits for existing and planned future communities on Brisbane’s urban and rural fringe. Some of these benefits include:

- direct benefits to users from increased access to services and activities
- increased social and economic opportunities for people who cannot drive due to physical, economic or social constraints
- potential health benefits where trips involve walking or cycling to public transport nodes
- reduced number of private vehicle trips made specifically to carry a passenger (e.g. children to sporting events, etc)
- potential reductions in the time delay, stress, vehicle operating costs and pollution that each additional vehicle imposes on other road users
- reductions in the CO₂ emissions generated by transport activities within the study area.
Further assessment would be required as part of subsequent study phases to ensure the potential benefits associated with a passenger rail line are adequately identified and ‘captured’.

7.2 Potential adverse impacts

The primary impact associated with the protection and establishment of a passenger rail corridor is the effect on existing land uses in the section between Kagaru and Beaudesert. Ninty-nine properties have been identified as having a potential requirement for the rail corridor in this section, and further consultation with individual landholders and communities would be required to determine the precise nature and extent of requirements from these properties.

The passenger rail line also has the potential to result in other adverse impacts on the social, economic and natural environmental values of the study area. Further investigation is required to determine the likelihood and extent of impact and to identify where particular actions or measures would be required to avoid, minimise or mitigate these impacts.

Based on the assessment in this REF, the potential impacts summarised below require further investigation and consideration as part of subsequent study phases.

7.2.1 Landforms, geology and soil

- sterilisation of areas of good quality agricultural land (GQAL) in the southern section and effects of severance on agricultural management

7.2.2 Surface water

- potential erosion risk during both the construction and operational phases
- increased turbidity in localised sections of waterways and cross-drainage paths following run-off from disturbed areas
- potential disruptions to surface water flows within the Teviot Brook and Logan River floodplains resulting from the construction of rail embankments

7.2.3 Noise and vibration

- increased frequency of train movements along the existing interstate rail line
- increased traffic around station locations
- temporary noise nuisance at numerous sensitive receptors along the alignment resulting from construction activities such as ballast and track laying

7.2.4 Air quality

- temporary dust nuisance at numerous sensitive receptors along the alignment resulting from construction activities such as earthworks and ballast laying
7.2.5 Flora and fauna

- potential impacts on the conservation and connectivity values of the Flinders – Greenbank/Karawatha biodiversity corridor, particularly where the proposed passenger rail line directly intersects the corridor at the Parkinson bushland site
- potential impacts on fauna movement associated with fencing and electrification
- the potential for impact on the environment on Commonwealth land contained within the Greenbank Military Training Area
- potential impacts on threatened species and communities and migratory species of national environmental significance protected under the Environment Protection and Biodiversity Conservation Act 1999
- potential impacts on endangered, vulnerable and rare (EVR) flora and fauna protected under the Nature Conservation Act 1992
- potential impacts on koala populations and habitat in the study area with reference to the conservation status of koalas in the SEQ region
- clearing in areas of remnant and regrowth vegetation protected under the Vegetation Management Act 1999

7.2.6 Cultural heritage

- potential impacts on the cultural heritage values associated with Enright’s Sawmill
- potential impacts on indigenous cultural heritage values that may be present in the study area

7.2.7 Socio-economic

- impacts on individual landholders of the 99 properties located within the preferred corridor between Kagaru and Beaudesert associated with statutory protection of the corridor and future acquisition
- impacts on landholders associated with property severance in the section between Kagaru and Beaudesert
- effects of increased activity around proposed station locations
- potential changes to existing access and traffic arrangements

7.2.8 Landscape and visual

- visual impacts created by the contrast of a raised rail line and associated infrastructure against the existing visual quality of the rural areas within the southern section of the study area

7.2.9 Greenhouse gas emissions

- emissions generated by construction-related fuel and electricity use as well as the embedded manufacturing and transportation emissions associated with the materials used in the construction
7.3 Future studies

Engineering and design

- conceptual corridor and alignment design in the northern and central sections
- conceptual design of stations
- survey of key structures and constrained locations
- investigation of utility services requiring relocation
- refinement of the proposed rail alignment
- drainage studies
- patronage modelling
- network planning

Soils

- assessment of high risk areas for soil erosion

Groundwater

- identification of any significant groundwater resources in the study area

Surface water

- further analysis of the hydraulic characteristics of the study area
- assessment of baseline water quality within the study area

Noise

- assessment of the ambient noise levels within the study area
- preliminary modelling of noise impacts and comparison of results against the criteria in Queensland Rail’s Code of Practice for Rail Noise

Flora and fauna

- walkover surveys to:
  - confirm the accuracy of regional ecosystem and regrowth vegetation mapping for the study area
  - identify areas of potential habitat for threatened flora and fauna species
  - identify any occurrences of Swamp Tea-tree (*Melaleuca irbyana*), particularly in the section between Kagaru and Beaudesert
- identification of opportunities for fauna movement across the corridor, with reference to locations and species of particular conservation significance
- preliminary assessment of impacts on matters of national environmental significance to determine the requirement for future referral to the Commonwealth Minister for the Environment under the EPBC Act
Socio-economics

- undertaking consultation with potential rail users and affected sectors of the community to inform an assessment of impacts on social environmental values
- assessment of the socio-demographic characteristics in the study area

Cultural heritage

- further assessment of the cultural heritage values of the study area and consultation with relevant stakeholders where necessary

Visual amenity

- visual amenity and landscape impact assessment
- consultation with local residents, landowners and other stakeholders

Climate change

- preparation of a climate change impact statement in accordance with Queensland Government requirements
8 Approvals and licensing

A preliminary assessment of the types of statutory approvals required for a project of this nature was undertaken to inform the scope of the REF and subsequent study phases. Due to the long-term nature of the study, these are highly likely to change over the life of the project and would require review in the future. It should be noted that no development approvals are being sought for the proposed passenger rail line at this stage of the study. Development approvals would need to be sought should development of the project be proposed to proceed (see Chapter 3 Planning background).

8.1 Project scope for approvals consideration

In determining approval requirements, specific construction activities and additional provisions must be considered.

Construction activities are described in Chapter 2 and include:

- rail line construction, upgrade and maintenance
- access to construction sites
- water sources (for construction purposes)
- works within watercourses (i.e. river and creek crossings)
- vegetation clearing
- cut and fill works.

Additional provisions include:

- maintenance of access roads
- land acquisitions
- road closures
- cycleways
- infrastructure and access requirements related to new stations as well as additional pedestrian and vehicle overpasses
- ancillary works to relocate and reinstate public utility plant and roads affected by construction of the proposed passenger rail line.

These activities require development permits under the Integrated Development Assessment Scheme (IDAS) set out under the Sustainable Planning Act 2009 (SPA) and other state legislation. Activities may also require local law approvals for actions on council lands or roads, and approvals for modifying public utility plant.
This chapter discusses the need for these approvals based on the current known scope of the future project. All these approvals need to have at least a preliminary design completed to support the application. For example, a vegetation clearing application needs to describe what part of a site will be affected, and additional areas needed for construction of the works, to then define the extent of clearing that will need approval.

### 8.2 Environment Protection and Biodiversity Conservation Act 1999

This assessment has identified a number of potential matters of national environmental significance (NES) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which may be relevant to the Salisbury to Beaudesert passenger rail line. These include:

- threatened and migratory species as identified in Section 5.6—Flora and fauna
- the threatened ecological community, Swamp Tea-tree (*Melaleuca irbyana*)
- Forests of South East Queensland.

The proposed passenger rail line also bisects Commonwealth land where it traverses the Greenbank Military Training Area. Consideration of the likelihood and significance of impact on these features should be undertaken as part of subsequent study phases to determine whether a proposal to construct a future passenger rail line should be referred to the Commonwealth Minister for the Environment as outlined in Section 3.2.1.

### 8.3 IDAS approvals

For the purposes of this assessment, it is assumed that the development of the future passenger rail line would be exempt from assessment against a planning scheme as outlined in Section 3.2.3 of this report. However, under the *Sustainable Planning Act 2009*, there are a number of facets of the development that would trigger the requirement to obtain approval for a material change of use (MCU) or operational works through the Integrated Development Assessment System (IDAS). As outlined above, these requirements would require review in future to account for any changes in legislation and policy.

#### 8.3.1 Resource allocations or entitlements / owner’s consent

For a development application to be considered ‘properly made’ under the SPA, it must be accompanied by the written consent of the landowner on which the development is proposed. Where the proposal affects state land, the owner’s consent is in the form of a ‘resource allocation’ where an actual part of the land would be taken or, where land is to be used for a particular purpose (e.g. a railway), as a ‘resource entitlement’.

#### 8.3.2 Material change of use

**Environmentally relevant activities**

Environmental impacts associated with business and industrial activities are primarily managed through development approval under IDAS and licensing the operator undertaking environmentally relevant activities (ERAs) under the *Environmental Protection Act 1994* (EP Act). Schedule 2 of the Environmental Protection Regulation
2008 lists and describes the activities that are ERAs. The Department of Environment and Resource Management (DERM) assesses most ERA applications, but the assessment of some is devolved to the relevant local government.

The following have been identified as potential ERAs for the project:

- **ERA 8**—Chemical storage (which includes chemicals used in herbicides and pesticides). A minimum storage applies of 50 tonnes of Class 1, Class 2.3 or Class 6.1 dangerous goods; 10 m³ of Class C1 or C2 combustible liquids under AS1940 or dangerous goods Class 3; or 200 m³ or 200 tonnes for other chemicals.

- **ERA 16**—Extraction and screening (which includes dredging, where the amount removed exceeds 1000 tonnes per year). Queensland Rail has an exemption from ERA 16 where the extraction is part of a cut and fill process. Dredging will apply where more than 1000 tonnes of material is excavated from the bed or banks of a watercourse where the rail line is bridged over a stream. The extraction includes material removed for piles, or to create piling pads and crane pads and access tracks across the stream bed.

- **ERA 43**—Concrete batching

- **ERA 57**—Regulated waste transport (for removing and disposing of industrial waste from construction sites).

**Contaminated land**

The majority of the existing interstate rail corridor and disused Bethania to Beaudesert rail line, as well as a number of adjacent lots, are listed on the Environmental Management Register (EMR) as outlined in Section 5.12. Making a material change of use on a property which is wholly or partially on the EMR (or Contaminated Land Register) is assessable development under Schedule 3 of the Sustainable Planning Regulation 2009 (SP Regulation). Any removal of contaminated soil off-site would also trigger the need for a disposal permit as outlined in Section 8.4.6 below.

**8.3.3 Operational works**

**Works within watercourses**

As part of the construction of the proposed passenger rail line there are a number of waterway crossings where construction is likely to take place. Under Schedule 3, Table 4, Item 3 of the SP Regulation, operational works approval would be required for taking or interfering with water that would be required where a watercourse is realigned or changed or where the flow of water is impeded by the works and the cross-sectional area of the watercourse is reduced to less than 50 per cent of its prior cross-section.

**Waterway barriers**

The *Fisheries Act 1994* may be triggered where there is a need to construct temporary barriers as part of construction within watercourses. Operational works approval may be required for the construction or raising of waterway barrier works as required under Schedule 3, Table 4, Item 6 of the SP Regulation.
Vegetation clearing

The *Vegetation Management Act 1999* (VMA) applies to any vegetation clearing associated with regional ecosystems within the corridor or potentially native woody vegetation and regional ecosystems on areas outside the corridor, depending on the tenure or lease type of the property.

The clearing must be certified by the chief executive of DERM as being for a relevant purpose under Section 22A of the VMA. Relevant purpose includes clearing for a significant project or for constructing necessary infrastructure. The proposed project would satisfy the latter requirement as it is part of a project nominated as part of the *South East Queensland Infrastructure Plan and Program 2009–2026* (DIP 2009b).

Once certification is received, an application can be made for a development permit for operational works for clearing native vegetation under Schedule 3, Table 4, Item 1 of the SP Regulation depending on the tenure of the land.

Clearing is sometimes assessable against the relevant local government’s planning scheme. However, as discussed in Chapter 5, exemptions under Schedule 9 of the IP Act mean that the proposal would not be assessed against the local government planning scheme. Clearing may still require approval under relevant local laws.

The VMA does not apply to clearing on:

- a forest reserve under the *Nature Conservation Act 1992*
- a protected area under the *Nature Conservation Act*, s. 28
- an area declared as a state forest or timber reserve under the *Forestry Act 1959*
- a forest entitlement area under the *Land Act 1994*.

Vegetation on these areas is excluded from regulation under the VMA because it is adequately regulated and protected under the relevant Acts mentioned. If there are any areas of vegetation to be cleared on these excluded areas, an approval would need to be obtained through the relevant legislation. Clearing of native vegetation controlled under the Nature Conservation Act is discussed in Section 8.4.3.

8.4 Non-IDAS permits

As with the EPBC Act and IDAS approval requirements, the necessity for the various non-IDAS permits will become apparent following field investigations and the completion of the detailed design. The approvals matrix and summary should then be updated accordingly.

8.4.1 Riverine protection permits

As a government department declared under the *Public Service Act 1966*, DTMR may carry out certain activities in accordance with the *Guideline—Activities in a watercourse, lake or spring carried out by an entity*. Insofar as the destruction of vegetation, excavation and placement of fill within watercourses associated with waterway crossings for the future passenger rail line is carried out in accordance with this guideline, no approval (i.e. Riverine Protection Permits) would be required to undertake these activities under current legislation.
8.4.2 Approvals under the Transport Infrastructure Act

Chapter 7 part 2 of the *Transport Infrastructure Act 1994* outlines the process for investigating potential rail corridors. The purpose of this section of the Act is to allow for entry to land to determine its potential and suitability for railway construction, as well as to protect the interests of the landowners or occupiers.

In order to gain access to land, the parties interested in investigating certain land must apply for a rail feasibility investigator’s authority from the chief executive responsible for administering the Transport Infrastructure Act (DTMR), in accordance with s. 110 of the Transport Infrastructure Act. This authority allows the investigator and associates to enter and re-enter land, do anything on that land, bring anything onto that land and leave machinery or equipment on that land (subject to conditions that may be imposed by the chief executive).

In order to protect the interests of landowners and occupiers, the Transport Infrastructure Act includes strict provisions relating to giving notice of entry (s. 114), and also allows for landowners to seek compensation where damage to land occurs (s. 118).

This authority does not indicate approval or commitment from the state to provide the corridor or rail development.

If the project involves works in a state-controlled road, either to provide a point of access into the rail corridor or if the corridor crosses a state-controlled road, approval may be needed for roadworks under s. 33 of the Transport Infrastructure Act or for ancillary works and encroachments under s. 50 of the Transport Infrastructure Act.

DTMR will be the assessment manager for these applications and will be responsible for issuing any resource allocations for works on state-controlled roads and any other lands under the control of DTMR.

8.4.3 Nature Conservation Act 1992

Under the *Nature Conservation Act 1992*, permits are required from DERM where a proposed activity involves the taking of ‘endangered’, ‘rare’, ‘threatened’ and ‘of least concern’ native plants in the wild. Where the clearing is of vegetation ‘of least concern’ on freehold land (by the landholder or contractor) or the clearing is undertaken under an approval from the Governor in Council then a permit is not required under the Nature Conservation Act. DERM should be consulted to determine whether or not a permit is required under the Nature Conservation Act.

Queensland Rail is currently seeking a general permit under the Nature Conservation Act from DERM for the clearing of ‘of least concern’ native plants for railway purposes. If this is granted, the project may be covered by that permit.

8.4.4 Native Title Act 1993 (QLD)

Native title is normally resolved before commencing works, by suppression or by resumption processes under the *Native Title Act 1993*.

If geotechnical or other investigations that will impact on the land are needed before native title assessment or clearance is completed, then the proponent must first demonstrate that the work is low impact clearing and excavation works, and that it is
reasonably needed action for public safety. The actions may then be taken under s. 24LA of the Native Title Act.

Resolution of native title is separate to managing impacts on cultural heritage which are discussed in relation to the *Aboriginal Cultural Heritage Act 2003* (see Section 8.4.5).

### 8.4.5 Aboriginal Cultural Heritage Act 2003

The *Aboriginal Cultural Heritage Act 2003* (ACH Act) provides for Aboriginal persons or groups to act as ‘Aboriginal parties’ for an area. Under the ACH Act, all persons undertaking an activity have a ‘duty of care’ to ensure that no harm is caused to Aboriginal cultural heritage. Activities undertaken in accordance with an approved cultural heritage management plan (CHMP) are considered to meet these duty of care requirements. Should the project proceed in future, DTMR would enter into a voluntary CHMP with the appropriate Aboriginal party or parties in accordance with DERM’s *Cultural Heritage Management Plan Guidelines* (2005).

### 8.4.6 Disposal permits for contaminated spoil

Under Section 424 of the EP Act, a disposal permit is required to remove and treat or dispose of contaminated soil from land listed on the EMR. Should subsequent investigations confirm the presence of contaminated soil within the corridor, disposal permits would need to be sought in future.

### 8.5 Assessment manager

As outlined above, it is assumed that the development of the passenger rail line would be exempt from assessment against local planning schemes, should the project proceed in future. Schedule 6 of the SP Regulation sets out the relevant assessment manager for development applications made under IDAS. This includes provision for applications involving multiple jurisdictions. Assessment managers for the relevant approvals identified above are summarised in Table 8.1; however, these would need to be confirmed with reference to approvals required based on future rail design.

**Table 8.1 Relevant assessment managers for individual development applications**

<table>
<thead>
<tr>
<th>Aspect of development</th>
<th>Assessment manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmentally relevant activities</td>
<td>DERM (as the chief executive administering the EP Act)</td>
</tr>
<tr>
<td>Vegetation clearing</td>
<td>DERM (as the chief executive administering the VMA)</td>
</tr>
<tr>
<td>Taking or interfering with water</td>
<td>DERM (as the chief executive administering the Water Act)</td>
</tr>
<tr>
<td>Contaminated land management</td>
<td>DERM (as the chief executive administering the EP Act)</td>
</tr>
</tbody>
</table>

### 8.6 Referral agencies

Referral agencies for particular aspects of development are nominated under Schedule 7 of the SP Regulation. Nominated referral agencies for the assessable aspects of development for the future passenger rail line are summarised in Table 8.2. As outlined above, these would need to be reviewed and confirmed at a time closer to construction.
### Table 8.2 Relevant referral agencies for individual development applications

<table>
<thead>
<tr>
<th>Aspect of development</th>
<th>Referral agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land relating to a state-controlled road</td>
<td>DTMR (as the chief executive administering the TI Act)</td>
</tr>
<tr>
<td>Constructing or raising of waterway barrier</td>
<td>Department of Employment, Economic Development and Innovation (Fisheries Queensland) as the chief executive administering the Fisheries Act</td>
</tr>
<tr>
<td>Environmentally relevant activities</td>
<td>DERM (as the chief executive administering the EP Act)</td>
</tr>
<tr>
<td>Vegetation clearing</td>
<td>DERM (as the chief executive administering the VMA)</td>
</tr>
<tr>
<td>Taking or interfering with water</td>
<td>DERM (as the chief executive administering the Water Act)</td>
</tr>
<tr>
<td>Contaminated land management</td>
<td>DERM (as the chief executive administering the EP Act)</td>
</tr>
</tbody>
</table>

### 8.7 Applicable local laws

While exempt from assessment against local planning schemes, local laws made under the *Local Government Act 1993* would apply to the proposed passenger rail line. Potentially applicable local laws are summarised in Table 8.3; however, these would need to be reviewed should the project proceed in future.

### Table 8.3 Potentially applicable local laws

<table>
<thead>
<tr>
<th>Local government</th>
<th>Local law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRISBANE CITY COUNCIL</strong></td>
<td>00–Heavy and Long Vehicle Parking 1999</td>
</tr>
<tr>
<td></td>
<td>00–Natural Assets Local Law 2003</td>
</tr>
<tr>
<td></td>
<td>06–Streets, Bridges, Culverts, etc</td>
</tr>
<tr>
<td></td>
<td>11–Sundry Matters relating to Structures</td>
</tr>
<tr>
<td></td>
<td>14–Parking and Control of Traffic</td>
</tr>
<tr>
<td><strong>LOGAN CITY COUNCIL</strong></td>
<td>08–Environmental Management 1999</td>
</tr>
<tr>
<td></td>
<td>11–Roads 1999</td>
</tr>
<tr>
<td></td>
<td>11.01–Interference with Local Government Roads 2003</td>
</tr>
<tr>
<td></td>
<td>12–Council Property and Other Public Places 2003</td>
</tr>
<tr>
<td></td>
<td>07.15–Blasting Operation*</td>
</tr>
<tr>
<td></td>
<td>08–Parks and Reserves*</td>
</tr>
<tr>
<td></td>
<td>10–Roads*</td>
</tr>
</tbody>
</table>

*pre–amalgamation Beaudesert Shire Council local law*
References


Beckmann GG et al. 1987, *The soil landscapes of Brisbane and south-eastern environs* CSIRO Soils and Land Use Series Report No. 60

Brisbane City Council (BCC) 2006, *Brisbane CityShape 2026*, Brisbane.


Department of Environment and Resource Management (DERM) 2009, Regional ecosystem description database (REDD), Version 6.0b Updated November 2009, Queensland Herbarium, Brisbane.

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Grant K et al. 1982, *Terrain analysis, classification, assessment and evaluation for regional development purposes in the Moreton Region, Queensland*; CSIRO Report Applied Geomechanics No. 23


Noble KE (ed) 1996, *Understanding and managing soils in the Moreton Region* Department of Primary Industries Report No. QE 96003


Planning Information and Forecasting Unit (PIFU) 2009, *Office of Economic and Statistical Research*, Queensland Government


Appendix A

CONSTRAINTS MAPPING - LIST OF KEY ISSUES AND OBJECTIVES
## List of key issues and objectives

<table>
<thead>
<tr>
<th>Key issues</th>
<th>Objectives</th>
</tr>
</thead>
</table>
| Physical access                 | Provide for road access to stations  
Provide for pedestrian access to stations  
Provide for cycle access to stations |
| Land use integration            | Facilitate and integrate with transit-orientated development (TOD) opportunities  
Maintain compatibility with existing land use of adjacent areas  
Ensure consistency with existing strategic planning, at local and regional levels  
Optimise access to nearest activity ‘hub’  
Ensure the most efficient and appropriate use of land tenure  
Potential for land use change |
| Patronage                       | Optimise distance between stations  
Service surrounding catchment (population within 800 m of potential/proposed station locations)  
Capacity to meet demand  
Consideration of travel time to and from destination  
Efficiency of services |
| Transport network integration   | Consequential impacts on related infrastructure (e.g. roads)  
Adequate road networks to stations  
Stations support of proposed network structure (i.e. future roads, bus routes)  
Adequate supporting facilities to stations (e.g. shops)  
Maximise pedestrian and cycle catchment areas  
Increase use of public transport |
| Cost and engineering            | Ensure cost effectiveness in both construction and operation  
Provide for efficient construction  
Reduce need for engineering mitigation  
Maintain required design speed |
<table>
<thead>
<tr>
<th>Key issues</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain minimum curve radii</td>
<td></td>
</tr>
<tr>
<td>Consider gradients</td>
<td></td>
</tr>
<tr>
<td>Ensure most appropriate structure types</td>
<td></td>
</tr>
<tr>
<td>Natural environment</td>
<td></td>
</tr>
<tr>
<td>Contaminated land and geotechnical conditions</td>
<td>Maximise geotechnical stability</td>
</tr>
<tr>
<td>and impacts</td>
<td>Limit impacts on acid sulphate soils</td>
</tr>
<tr>
<td></td>
<td>Manage contaminated land issues</td>
</tr>
<tr>
<td>Hydrological characteristics</td>
<td>Minimise flooding impacts on infrastructure</td>
</tr>
<tr>
<td></td>
<td>Minimise infrastructure contribution to afflux</td>
</tr>
<tr>
<td>Sensitive habitats and species</td>
<td>Avoid protected areas (conservation reserves etc.)</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on EVR species of significance protected under the Queensland Nature Conservation Act 1992</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on significant species protected under the Environmental Protection and Biodiversity Conservation Act 1999</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on remnant vegetation</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on essential habitat</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on regional wetlands</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on koala habitat</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on state and regional wildlife corridors</td>
</tr>
<tr>
<td></td>
<td>Minimise the need for environmental offsetting</td>
</tr>
<tr>
<td>Climate change</td>
<td>Consider the impacts of climate change, for example increased flooding and storm events</td>
</tr>
<tr>
<td></td>
<td>Consider potential greenhouse gas emissions</td>
</tr>
<tr>
<td>Social environment</td>
<td></td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>Consideration of cultural heritage places</td>
</tr>
<tr>
<td></td>
<td>Consideration of native title</td>
</tr>
<tr>
<td></td>
<td>Consideration of the need for indigenous land use agreement (ILUA)</td>
</tr>
<tr>
<td>Directly affected landholders</td>
<td>Minimise property severance</td>
</tr>
<tr>
<td>Key issues</td>
<td>Objectives</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Minimise resumptions</td>
</tr>
<tr>
<td></td>
<td>Balance stakeholder needs</td>
</tr>
<tr>
<td></td>
<td>Consideration of local industry</td>
</tr>
<tr>
<td></td>
<td>Determine community acceptance</td>
</tr>
<tr>
<td>Agricultural land</td>
<td>Minimise impacts on good quality agricultural land</td>
</tr>
<tr>
<td>Quality of life</td>
<td>Minimise noise pollution</td>
</tr>
<tr>
<td></td>
<td>Minimise impacts on air quality</td>
</tr>
<tr>
<td>Visual impact</td>
<td>Visual amenity</td>
</tr>
</tbody>
</table>
Appendix B

REVIEW OF ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999
1 Introduction

A preliminary assessment of the potential to impact matters protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) was conducted as part of this study. This assessment identified a number of relevant protected matters; however, at this stage of the study there is insufficient information to determine whether a referral to the Commonwealth Minister for the Environment would be warranted, should it be proposed that the project proceed in the future.

EPBC Act

Chapter 2, Part 3 (12–25) and Division 2 subdivision A (26(3)) of the Act outline the triggers for requirements for approval under the Act. In accordance with these triggers, an action would require approval from the federal Minister for Environment, Heritage and the Arts if:

- the action has, would have, or is likely to have a significant impact on a matter of national environmental significance (NES) or
- the action proposed is on, or will affect, Commonwealth land and where Commonwealth agencies are proposing to take action and
- the action is not subject to one of the exceptions identified within the Act.

None of the exceptions listed within the Act are relevant to the proposal. Therefore, the proposal needs to be assessed in consideration of potential impacts upon Commonwealth land and the potential impacts on matters of NES.

The significance of potential impacts on matters protected under the EPBC Act should be determined with reference to the requirements of the Act and the significant impact criteria nominated in the following documents:

- EPBC Act Policy Statement 1.1—Matters of National Environmental Significance (DEH 2005)
- EPBC Act Policy Statement 1.2—Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies (DEH 2006).
Matters of national environmental significance

Matters of national environmental significance (NES) in the study area were identified by searching the EPBC Online Protected Matters Search Tool. These results were used to identify matters of NES potentially relevant to the proposal which are discussed below.

Wetlands of international importance

Search results identified the Moreton Bay Ramsar site as a wetland of international importance potentially relevant to the passenger rail line. An action would have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it would result in:

- areas of the wetland being destroyed or substantially modified
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- a substantial and measurable change in the water quality of the wetland, for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

Assessment

No wetlands of international importance are located in close proximity to the proposed corridor. The Moreton Bay Ramsar-listed wetland is approximately 10 km away at the closest point. Although the proposed corridor would cross a number of waterways within the catchment of the Moreton Bay wetland, the distance is sufficient that impacts on this wetland are not anticipated.

Listed threatened species and ecological communities

Search results identified one critically endangered ecological community and several threatened and migratory species as potentially relevant to the future passenger rail line. These search results were reviewed against other environmental data, such as the results of preliminary survey and regional ecosystem mapping, to determine the species likely to occur in the study area. Those species considered relevant to the study area are summarised in Tables B1–B3.

A full list of the listed species and communities identified by the database search is included at Appendix C.
<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC listing</th>
<th>Records</th>
<th>Habitat description</th>
<th>Likelihood of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FLORA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hydrocharis dubia</em></td>
<td>Frogbit</td>
<td>EPBC V</td>
<td>NCA V</td>
<td>WNet ✓</td>
<td>Herb ✓</td>
<td>Small, shallow freshwater bodies or swamps.</td>
</tr>
<tr>
<td><em>Paspalidium grandispiculatum</em></td>
<td></td>
<td>EPBC V</td>
<td>NCA V</td>
<td>WNet –</td>
<td>Herb –</td>
<td>Mixed eucalypt forest, mixed open forest, and native pasture.</td>
</tr>
<tr>
<td><em>Persicaria elatior</em></td>
<td>Knotweed</td>
<td>EPBC V</td>
<td>NCA V</td>
<td>WNet –</td>
<td>Herb –</td>
<td>Sandy, alluvial soil in swampy areas and riparian herblands along watercourses and lake edges.</td>
</tr>
<tr>
<td><strong>THREATENED ECOLOGICAL COMMUNITIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swamp tea-tree forest of south-east Queensland (<em>Melaleuca irbyana</em>)</td>
<td>CE</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Open eucalypt forest in poorly drained, usually clay, soils. Associated with RE 12.3.3</td>
<td>Medium. No mapped areas of RE 12.3.3 within the preferred corridor between Kagaru and Beaudesert; however, there is potential for isolated stands to occur on open paddocks in southern section of the study area.</td>
</tr>
</tbody>
</table>

*E: endangered; V: vulnerable; R: rare; CE: critically endangered. Where discrepancies occur between schedules, the highest (most endangered) status should be used.*

### Table B2 Endangered, vulnerable and rare fauna summary table

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>WildNet</th>
<th>Birds Aust</th>
<th>Preferred habitat description</th>
<th>Likelihood of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Erythrotriorchis radiatus</em></td>
<td>Red Goshawk</td>
<td>V</td>
<td>–</td>
<td>–</td>
<td>Tall open forest, woodland, lightly tree'd savannah and the edge of rainforest.</td>
<td>Low/medium. Suitable habitat exists in the study area.</td>
</tr>
<tr>
<td><em>Rostratula australis</em></td>
<td>Australian Painted Snipe</td>
<td>V</td>
<td>–</td>
<td>–</td>
<td>Mudflats, shallow, vegetated, freshwater swamps, claypans or inundated grassland (including temporary wetlands).</td>
<td>Low/medium. May use inundated farmland and low lying wet areas within the study area.</td>
</tr>
<tr>
<td><em>Turnix melanogaster</em></td>
<td>Black-breasted Button-quail</td>
<td>V</td>
<td>–</td>
<td>–</td>
<td>Fragments of vine forest and thickets that are periodically water-stressed and coastal scrubs. Also low thickets or woodlands, <em>Lantana camara</em> patches and wetter subtropical rainforest in NSW. Hoop pine plantations.</td>
<td>Low/medium. No records within search area. Potential habitat within study area.</td>
</tr>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dasyurus maculatus maculatus</em></td>
<td>Spotted-tailed Quoll</td>
<td>E</td>
<td>✓</td>
<td>–</td>
<td>Rainforests, wet and dry sclerophyll forests, coastal heath and scrub from sea-level to sub-alpine regions. This species has a large home range and can travel distances of up to 8 km overnight.</td>
<td>High. Known to occur in central section of study area and previously recorded from section between Kagaru and Beaudesert.</td>
</tr>
<tr>
<td><em>Pteropus poliocephalus</em></td>
<td>Grey-headed Flying fox</td>
<td>V</td>
<td>✓</td>
<td>–</td>
<td>Rainforests, open eucalypt forests, woodlands, melaleuca swamps and banksia woodlands. This species forages widely but roosts seasonally in ‘camps’.</td>
<td>High. No known camps in the vicinity but highly likely to encounter foraging individuals in eucalypt forests throughout the study area.</td>
</tr>
</tbody>
</table>

E: endangered; V: vulnerable; R: rare. Where discrepancies occur between schedules, the highest (most endangered) status should be used.

**Table B3  EPBC-listed migratory and marine overfly species**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>Records</th>
<th>Preferred habitat description</th>
<th>Likelihood of occurrence within 300 m of corridor (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anseranas semipalmata</td>
<td>Magpie Goose</td>
<td>M, OM</td>
<td>✓</td>
<td>Shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains.</td>
<td>Medium. Various records from Oxley area. Potential habitat within 300 m of alignment.</td>
</tr>
<tr>
<td>Apus pacificus</td>
<td>Fork-tailed Swift</td>
<td>M, OM</td>
<td>✓</td>
<td>An aerial species.</td>
<td>Medium. May overfly the study area.</td>
</tr>
<tr>
<td>Ardea alba</td>
<td>Great Egret, White Egret</td>
<td>M, OM</td>
<td>✓</td>
<td>Wide range of aquatic and semi-aquatic habitats.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td>Ardea ibis</td>
<td>Cattle Egret</td>
<td>M, OM</td>
<td>✓</td>
<td>Paddocks and grasslands.</td>
<td>High. Records and potential habitat within the study area.</td>
</tr>
<tr>
<td>Ardea intermedia</td>
<td>Intermediate Egret</td>
<td>M, OM</td>
<td>–</td>
<td>Marshes, cultivated fields, mangroves, mudflats, estuaries.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td>Dendrocygna arcuata</td>
<td>Wandering Whistling-duck</td>
<td>M</td>
<td>–</td>
<td>Deep lagoons, flooded grasslands and dams.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td>Hirundapus caudacutus</td>
<td>White-throated Needletail</td>
<td>M, OM</td>
<td>✓</td>
<td>An aerial species.</td>
<td>Medium. May overfly the study area.</td>
</tr>
<tr>
<td>Merops ornatus</td>
<td>Rainbow Bee-eater</td>
<td>M, OM</td>
<td>✓</td>
<td>A common species known to occur within numerous habitats including disturbed areas.</td>
<td>High. Records and potential habitat within search and study area.</td>
</tr>
<tr>
<td>Monarcha melanopsis</td>
<td>Black-faced Monarch</td>
<td>M, OM</td>
<td>✓</td>
<td>Rainforests, wet sclerophyll forests, denser eucalypt forests, deep gullies, regrowth and mangroves.</td>
<td>Medium. Records within search area and potential habitat within the study area.</td>
</tr>
<tr>
<td>Monarcha trivirgatus</td>
<td>Spectacled Monarch</td>
<td>M, OM</td>
<td>✓</td>
<td>Low dense vegetation, mainly in rainforests. Also wet and dry sclerophyll forests, woodlands, parks and gardens.</td>
<td>Medium. Records within search area and potential habitat within the study area.</td>
</tr>
<tr>
<td>Myiagra cyanoleuca</td>
<td>Satin Flycatcher</td>
<td>M, OM</td>
<td>✓</td>
<td>Eucalypt forest, favouring moist gullies and watercourses. Largely absent from regrowth forests.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
</tbody>
</table>

E: endangered; R: rare; OM: overfly marine; M: migratory. Where discrepancies occur between schedules, the highest (most endangered) status should be used.

Threatened ecological communities

The southern section of the study area may contain areas of the critically endangered ecological community, Swamp Tea-tree (Melaleuca irbyana) Forests of South East Queensland. This community is associated with seasonally cracking clay soils on level ground and slightly elevated areas on alluvial plains and their edges. It does not grow along watercourses or permanent water bodies but is more commonly associated with areas that experience periods of inundation several weeks after rainfall. On the margins of alluvial plains, Swamp Tea-tree forest may grade into open forest or woodlands dominated by Eucalyptus moluccana, E. tereticornis, E. crebra, E. siderophloia and Corymbia intermedia, which is mapped as RE 12.3.3b for the purposes of Queensland regional ecosystem mapping (DEWHA 2010).

The features described above are generally associated with the section between Kagaru and Beaudesert. While there are no mapped areas of RE 12.3.3b within the preferred corridor, a number of isolated vegetation patches occur on agricultural lands in this section and it is possible that previously unrecorded patches of Swamp Tea-tree forest do occur. On-ground surveys of these areas should be undertaken to confirm whether this community is present in the study area and whether there would be any impact associated with future development of the passenger rail line.

There are known occurrences of this community in the central section of the study area; however, initial surveys indicate that the existing corridor generally traverses sandstone ridge and gully areas which are not considered suitable habitat.

Endangered species

The Spotted-tail Quoll is listed as endangered under the EPBC Act. A number of sightings of this species have been recorded around Greenbank and Munruben, which generally corresponds to the central section of the study area. There are also previous records for Quoll in the southern section of the study area; however, these are sparse and this section is not known to support dense populations of this species. Based on the large home range and habitat requirements of this species, it is possible that a number of individual animals occupy the study area. Further assessment of potential impacts on this species should be undertaken as part of subsequent study phases.

Vulnerable species

There are three plants, one mammal and three bird species listed as vulnerable under the EPBC Act considered potentially relevant to the proposal. Frogbit (Hydrocharis dubia) and Knotweed (Persicaria elatior) are both associated with freshwater swamps and may be associated with low-lying inundated areas around Lower Oxley Creek, while Paspalidium gradispiculatum is associated with the type of mixed eucalypt forest characteristic of the central section of the study area. Further investigations of potential impacts on these species should be assessed as part of subsequent study phases. Further investigation is also required to determine the location of any potential habitat for the three bird species.

Grey-headed Flying-fox is likely to use a range of forest types in the area for foraging; however, no significant impacts on this species would be expected to result from the development of a future passenger rail line.
Migratory species

The migratory species listed in Table B3 are highly mobile bird species which would be likely to occur in a range of habitats across the study area. While some habitat loss could result from the development of the proposed rail line, this would not be expected to result in a significant impact on these species. However, this would need to be reviewed with reference to the future rail design, particularly in the northern and central sections of the study area.

3 The environment on Commonwealth land

Potential impacts upon Commonwealth land must be considered within the context of ‘whole of environment’ impacts, including (as relevant to this proposal) impacts on landscapes, soils, water resources, plants, animals and heritage features, people and communities and pollutants, chemicals and toxic substances.

Greenbank Military Training Area

The existing interstate corridor bisects Commonwealth land where it traverses the Greenbank Military Training Area (GMTA) at Boronia Heights. The GMTA comprises approximately 4500 ha containing eucalypt forest and woodland important for maintaining a range of old growth forest types now rare in South East Queensland. It includes three endangered regional ecosystems and is recognised as an important contemporary refuge for species threatened by land clearing in the Brisbane region.

The GMTA is known to support Koala and Tusked Frog, which are both listed as vulnerable under the Nature Conservation Act 1992 and a number of locally significant glider species. It is also listed on Queensland’s Directory of Important Wetlands as:

- a good example of a wetland type occurring within a biogeographic region in Australia
- a wetland supporting native plant or animal taxa or communities that are considered endangered or vulnerable at the national level.

Further assessment of potential impacts on these and other environmental values associated with the future passenger rail line would need to be assessed with reference to the future rail design in this section. In the future, a referral would need to be lodged with the Department of Environment, Water, Heritage and the Arts should there be potential for impact on Commonwealth land.
Appendix C

ENDANGERED, VULNERABLE
AND RARE FLORA AND
FAUNA SPECIES
### Endangered, vulnerable and rare flora summary table

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC Listing</th>
<th>Records</th>
<th>Habitat Description</th>
<th>Likelihood of Occurrence within 100m of corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia acrionastes</em></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Lower slopes and rocky upper slopes and mountain tops on rhyolite. Eucalyptus forest and mountain heathlands.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Acacia saxicola</em></td>
<td>Mt Maroon Wattle</td>
<td>- E</td>
<td>✓</td>
<td>-</td>
<td>Rocky upper slopes and mountain tops on rhyolite. Eucalyptus forest and mountain heathlands.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Agrotia cicatricata</em></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Sparse shrubby vegetation in rock crevices and on exposed plateaus on skeletal sandy soil over granite. Recorded at altitudes of 1350–1500 m in NSW.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Arundinella grevillensis</em></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Eucalyptus forest and montane heathlands on rocky upper slopes, cliff lines and rock pavements of mountain tops on rhyolite.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Banksia conferta subsp. conferta</em></td>
<td>- V</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Eucalyptus forest and montane heathlands on rocky upper slopes, cliff lines and rock pavements of mountain tops on rhyolite.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Bosistoa selwynii</em></td>
<td>Heart-leaved Bosistoa</td>
<td>V</td>
<td>- ✓</td>
<td>- ✓</td>
<td>Riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 &amp; RE 12.11.11).</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Bosistoa transversa</em></td>
<td>Three-leaved Bosistoa</td>
<td>V</td>
<td>- ✓</td>
<td>- ✓</td>
<td>Occurs in riparian rainforest (RE 12.3.1) and Araucarian vine forest (RE 12.11.10 &amp; RE 12.11.11)</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Brasenia schreberi</em></td>
<td>- R</td>
<td>-</td>
<td>- ✓</td>
<td>✓</td>
<td>RE 12.3.8 and other wetland areas</td>
<td>Low. No RE 12.3.8 within study area. Single record 8 km from corridor</td>
</tr>
<tr>
<td><em>Bulbophyllum globuliforme</em></td>
<td>Miniature Moss-orchid</td>
<td>V</td>
<td>R ✓</td>
<td>- ✓</td>
<td>Occurs in Araucarian vine forest (RE 12.11.10 &amp; RE 12.11.11) on the upper branches of Hoop Pine.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC</td>
<td>NCA</td>
<td>EPBC Listing</td>
<td>Records</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------</td>
<td>-------------</td>
<td>------</td>
<td>-----</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td><em>Callitris baileyi</em></td>
<td></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td><em>Clematis fawcettii</em></td>
<td></td>
<td>V</td>
<td>V</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td><em>Comesperma breviflorum</em></td>
<td></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td><em>Coopernookia scabridiaca</em></td>
<td>Coopernookia</td>
<td>V</td>
<td>V</td>
<td>-</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td><em>Corchorus cunninghamii</em></td>
<td>Native Jute</td>
<td>V</td>
<td>E</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td><em>Cryptocarya foetida</em></td>
<td>Stinking</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Cryptostylis hunteriana</em></td>
<td>Leafless Tongue-orchid</td>
<td>V</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Cycas megacarpa</em></td>
<td></td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC Listing</td>
<td>Records</td>
<td>Habitat Description</td>
<td>Likelihood of Occurrence within 100m of corridor</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>---------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Eucalyptus curtisii</td>
<td>Plunkett Mallee</td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Sandstone ridges. Eucalyptus open forest and woodlands.</td>
<td>Medium. Potential habitat within study area</td>
</tr>
<tr>
<td>Eucalyptus michaeliana</td>
<td>Hillgrove Gum</td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Tall open forests on foothills and valleys on rhyolite.</td>
<td>Low. Low potential for habitat within study area</td>
</tr>
<tr>
<td>Fatoua villosa</td>
<td></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Description of preferred habitat not readily available.</td>
<td>Low. Single record 5.5 km west of corridor</td>
</tr>
<tr>
<td>Fontainea venosa</td>
<td>Silky Frankenia</td>
<td>V</td>
<td>V</td>
<td>-</td>
<td>Subcoastal rainforest complex.</td>
<td>Low. No potential habitat within study area</td>
</tr>
<tr>
<td>Gahnia insignis</td>
<td></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Slopes in eucalyptus tall open forests and woodlands and montane heathland.</td>
<td>Low. Low potential for habitat within study area</td>
</tr>
<tr>
<td>Gossia gonoclada</td>
<td>Angle-Stemmed Myrtle</td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>Lowland riparian rainforest, below the peak flood level, along permanent watercourses subject to tidal influence.</td>
<td>Low. No potential habitat within study area</td>
</tr>
<tr>
<td>Hakea maconochieana</td>
<td></td>
<td>V</td>
<td>V</td>
<td>-</td>
<td>Shallow clay soils on the tops of stony tablelands.</td>
<td>Low. No potential habitat within study area</td>
</tr>
<tr>
<td>Hibbertia hexandra</td>
<td></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Understory shrub in wet eucalypt and rainforest and adjoining heath.</td>
<td>Low. No potential habitat within study area</td>
</tr>
<tr>
<td>Hibbertia monticola</td>
<td>Mountain Guinea Flower</td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>Mountainous areas above 300m. Eucalyptus tall open forests and woodlands, rainforest margins and montane heathland.</td>
<td>Low. No potential habitat within study area</td>
</tr>
<tr>
<td>Hydrocharis dubia</td>
<td>Frogbit</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>Small, shallow freshwater bodies or swamps.</td>
<td>Medium. Potential habitat within study area. Single record (1971) east of corridor.</td>
</tr>
</tbody>
</table>

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C-3
<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common name</th>
<th>Designation</th>
<th>EPBC Listing</th>
<th>Records</th>
<th>Habitat Description</th>
<th>Likelihood of Occurrence within 100m of corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Indigofera baileyi</em></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Open woodlands on granite or basalt soils.</td>
<td>Low. Low potential for habitat within study area. Two records 15 km from corridor.</td>
</tr>
<tr>
<td><em>Kunzea flavescens</em></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Dry Sclerophyll Forest</td>
<td>Medium. Potential habitat within study area.</td>
</tr>
<tr>
<td><em>Leionema elatius subsp. beckleri</em></td>
<td>-</td>
<td>E</td>
<td>-</td>
<td>✓</td>
<td>Shrublands of exposed rock pavements &amp; cliffs.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Lenwebbia prominens</em></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>✓</td>
<td>Subtropical rainforest, often on stream banks</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Leucopogon recurvisepalus</em></td>
<td>-</td>
<td>E</td>
<td>-</td>
<td>-</td>
<td>Dry sclerophyll forest, heath, dunes, at no particular altitude.</td>
<td>Low. Potential habitat within study area. Single record (1923).</td>
</tr>
<tr>
<td><em>Marsdenia coronata</em></td>
<td>-</td>
<td>V</td>
<td>-</td>
<td>✓</td>
<td>Rocky hillsides and ridges in Eucalypt forest.</td>
<td>Low/Medium. Potential habitat within study area. Recorded within 4 km of corridor.</td>
</tr>
<tr>
<td><em>Marsdenia longiloba</em></td>
<td>Clear Milkvine</td>
<td>V</td>
<td>V</td>
<td>-</td>
<td>Rainforest margins and Eucalyptus tall open forest/woodland.</td>
<td>Low. Low potential for habitat within study area.</td>
</tr>
<tr>
<td><em>Maundia triglochinoides</em></td>
<td>-</td>
<td>V</td>
<td>-</td>
<td>-</td>
<td>Swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients</td>
<td>Medium. Potential habitat within study area.</td>
</tr>
<tr>
<td><em>Melaleuca irbyana</em></td>
<td>-</td>
<td>R</td>
<td>-</td>
<td>-</td>
<td>Poorly drained, low lying heavy dark loams.</td>
<td>Medium. Potential habitat within study area.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC</td>
<td>NCA</td>
<td>Records</td>
<td>Habitat Description</td>
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</tr>
<tr>
<td><em>Notelaea ipsiciensis</em></td>
<td>Cooneana Olive</td>
<td>CE</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Known from only three closely clustered sub-populations in the Ipswich area. Total extent of occurrence is less than 2 km², and total number of specimens is 17 (all mature). Eucalypt-dominated dry sclerophyll communities situated on poor, sandstone-based soils.</td>
</tr>
<tr>
<td><em>Notelaea lloydii</em></td>
<td>Native olive</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>-</td>
<td>Open eucalypt forest, often near the margins of vine thickets, vine forests and soilwood scrub at altitudes between 80 and 480 m. Usually on stony, shallow and rocky soils derived from sandstone or acid volcanic rocks, often on steep slopes, or near drainage lines</td>
</tr>
<tr>
<td><em>Ozothamnus whitei</em></td>
<td></td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>Upland rainforest and tall Eucalyptus open forest.</td>
</tr>
<tr>
<td><em>Pandorea baileyana</em></td>
<td>Large-leaved Wonga Vine</td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>Rainforest</td>
</tr>
<tr>
<td><em>Parsonia tenuis</em></td>
<td>Slender Silkpod</td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>Rainforest</td>
</tr>
<tr>
<td><em>Paspalidium grandispiculatum</em></td>
<td></td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>-</td>
<td>Mixed Eucalyptus forest, mixed open forest, and native pasture.</td>
</tr>
<tr>
<td><em>Persicaria elatior</em></td>
<td>Knotweed</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>-</td>
<td>Sandy, alluvial soil in swampy areas and riparian herblands along watercourses and lake edges.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC</td>
<td>EPBC Listing</td>
<td>Records</td>
<td>Habitat Description</td>
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</tr>
<tr>
<td><em>Phebalium distans</em></td>
<td>Mt Berryman Phebalium</td>
<td>CE</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>Semi-evergreen vine thicket on red volcanic soils, or in communities adjacent to this vegetation type. Deeply weathered basalt with undulating to hilly terrain. Red-brown earths to brown clays (derived from siltstone and mudstones), and lithosols to shallow, gravelly krasnozems</td>
</tr>
<tr>
<td><em>Planchonella eerwah</em></td>
<td></td>
<td>-</td>
<td>E</td>
<td>-</td>
<td>✓</td>
<td>Rainforest. Ridges and ridge slopes light loams overlying stony clays.</td>
</tr>
<tr>
<td><em>Plectranthus alloplectus</em></td>
<td></td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>On rock pavements generally on rhyolite.</td>
</tr>
<tr>
<td><em>Plectranthus habrophyllus</em></td>
<td></td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>-</td>
<td>Known from only six locations between Ipswich and Ormeau. Rock outcrops of sandstone or chert in shaded situations in eucalypt woodland often close to vine forest.</td>
</tr>
<tr>
<td><em>Pultenaea pycnocephala</em></td>
<td></td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>Montane shrublands &amp; tall open forests on trachyte.</td>
</tr>
<tr>
<td><em>Pultenaea whiteana</em></td>
<td>Mt Barney Bush Pea</td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>-</td>
<td>Montane shrublands &amp; gully forests on trachyte.</td>
</tr>
<tr>
<td><em>Randia moorei</em></td>
<td>Spiny Gardenia</td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>-</td>
<td>Subtropical, riverine, littoral and dry stunted rainforests along moist scrubby water courses at altitudes up to 360 m.</td>
</tr>
<tr>
<td><em>Rhodamnia maideniana</em></td>
<td>Smooth Scrub Turpentine</td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>✓</td>
<td>Wet sclerophyll forest</td>
</tr>
<tr>
<td><em>Ricinocarpos speciosus</em></td>
<td></td>
<td>-</td>
<td>V</td>
<td>✓</td>
<td>✓</td>
<td>Damp areas in vine forest margins, eucalypt open forest and near rainforest.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
<td>EPBC Listing</td>
<td>EPBC Records</td>
<td>Habitat Description</td>
<td>Likelihood of Occurrence within 100m of corridor</td>
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</tr>
<tr>
<td><em>Rulingia salviifolia</em></td>
<td>Sage-leaved Rulingia</td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Montane shrublands, open and tall open forests. High altitude on ranges</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Senna acclinis</em></td>
<td></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Edges of subtropical and dry rainforest.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Solanum callium</em></td>
<td>Brush Nightshade</td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Description of preferred habitat not readily available.</td>
<td>Low. Single record from Mt Barney.</td>
</tr>
<tr>
<td><em>Sophora fraseri</em></td>
<td>Brush Sophora</td>
<td>V V</td>
<td>✓</td>
<td>-</td>
<td>Moist habitats, often in hilly terrain at altitudes from 60–660 m on basalt derived shallow soils along rainforest margins, tall open forests, Araucarian vine forest, vine forest regrowth margins.</td>
<td>Low. Low potential for habitat within study area.</td>
</tr>
<tr>
<td><em>Taeniophyllum muelleri</em></td>
<td>Minute Orchid,</td>
<td>V</td>
<td>✓</td>
<td>-</td>
<td>Littoral rainforest, wet sclerophyll and riparian areas.</td>
<td>Low. Low potential for habitat within study area.</td>
</tr>
<tr>
<td></td>
<td>Ribbon-root Orchid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Thelionema grande</em></td>
<td></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Dry sclerophyll forests, woodlands or heathlands at altitudes greater than 800 metres. Upland rock pavements of trachyte and granite pavements.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Wahlenbergia scopulicola</em></td>
<td></td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Montane heathlands on rock pavements and cliffs of trachyte, very tall woodlands on rhyolite. Potentially Regional Ecosystems 12.3.3, 12.3.11, 12.8.14, 12.8.17 and 12.8.19</td>
<td>Low. No potential habitat within study area. RE’s present within 100 m of corridor. Records from Mt Barney</td>
</tr>
<tr>
<td><em>Westringia blakeana</em></td>
<td>Slender Westringia</td>
<td>- R</td>
<td>-</td>
<td>✓</td>
<td>Montane heathlands on rock pavements of trachyte, tall open forests on rhyolite.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common name</td>
<td>Designation</td>
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<td></td>
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<td>EPBC</td>
<td>NCA</td>
<td>WNet</td>
<td>Herb</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Listing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fertile lower footslopes and flats. Restricted to the southern Darling Downs within Queensland</td>
</tr>
<tr>
<td></td>
<td>White Box-Yellow Box-Blacley’s Red Gum Grassy Woodland and Derived Native Grassland</td>
<td>CE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fertile lower footslopes and flats. Restricted to the southern Darling Downs within Queensland</td>
</tr>
<tr>
<td></td>
<td>Swamp Tea-tree (Melaleuca irbyana) Forest of South-east Queensland</td>
<td>CE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Open eucalypt forest in poorly drained, usually clay, soils. Associated with Regional Ecosystem 12.3.3</td>
</tr>
</tbody>
</table>

*E: Endangered  
V: Vulnerable  
R: Rare  
CE: Critically endangered  

Where discrepancies occur between schedules, the highest (most endangered) status should be used.
## Endangered, vulnerable and rare fauna summary table

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common Name</th>
<th>Designation</th>
<th>EPBC Listing</th>
<th>Records</th>
<th>Preferred Habitat Description</th>
<th>Likelihood of Occurrence within 300 m of corridor (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Accipiter novaehollandiae</em></td>
<td>Grey goshawk</td>
<td>R</td>
<td>-</td>
<td>✓</td>
<td>Tropical rainforest, tall open forests, woodlands, wooded gorges, dense timber along watercourses and farmland.</td>
<td>Medium. Potential habitat present. Recorded in search area.</td>
</tr>
<tr>
<td><em>Anthochaera phygia</em></td>
<td>Regent Honeyeater</td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>Dry eucalypt woodland and open forest, woodland, rural and urban areas with mature eucalypts. Favours ironbark-box associations, including <em>Eucalyptus sideroxylon</em> (white box), <em>E. albens</em>, <em>E. meliodora</em> (yellow box), <em>E. robusta</em> (swamp mahogany), and <em>Casuarina cunninghamiana</em> in riparian forest, which generally comprise large trees that are reliable nectar producers with a tall shrub layer.</td>
<td>Low. Potential habitat present. No records from search area.</td>
</tr>
<tr>
<td><em>Calyptorhynchus lathami</em></td>
<td>Glossy Black-cockatoo</td>
<td>-</td>
<td>V</td>
<td>✓</td>
<td>Range of forests and woodlands with suitable hollows in dead or senescent trees. Feeds almost exclusively on the seeds of Allocasuarina spp. Including <em>A. littoralis</em> (Black She-oak), <em>A. torulosa</em> (Forest She-oak), <em>Casuarina cunninghamiana</em> (River She-oak) and <em>C.equistefolia</em> (Beach She-oak).</td>
<td>Low. Extremely limited areas of habitat in the vicinity of the proposed alignment.</td>
</tr>
<tr>
<td><em>Cyclopsitta diophthalma coxeni</em></td>
<td>Coxen's Fig-Parrot</td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>Dry/cool subtropical rainforest. Also thin strips of gallery rainforest, littoral rainforest and coastal eucalypt/melaleuca forest where fig densities are high.</td>
<td>Low. No potential habitat and no records within search area.</td>
</tr>
<tr>
<td><em>Ephippiorhynchus asiaticus</em></td>
<td>Black-necked Stork</td>
<td>R</td>
<td>-</td>
<td>✓</td>
<td>Mangroves, inter-tidal wetlands, floodplains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewage ponds.</td>
<td>Medium. Recorded in search area. Areas of potential habitat present.</td>
</tr>
<tr>
<td><em>Erythrotriorchis radiatus</em></td>
<td>Red Goshawk</td>
<td>V</td>
<td>E</td>
<td>✓</td>
<td>Tall open forest, woodland, lightly treed savannah and the edge of rainforest.</td>
<td>Low/Medium. Not recorded in study area. Some potential habitat.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common Name</td>
<td>Designation</td>
<td>EPBC Listing</td>
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<td>Likelihood of Occurrence within 300 m of corridor (study area)</td>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Falco hypoleucos</td>
<td>Grey Falcon</td>
<td>- R</td>
<td></td>
<td></td>
<td>Dry, lightly timbered plains and eucalypt lined river channels. Nomadic.</td>
<td>Low. Single, unconfirmed record approximately 5 km west of proposed alignment. Potential habitat within Logan River floodplain.</td>
</tr>
<tr>
<td>Geophaps scripta scripta</td>
<td>Squatter Pigeon (southern)</td>
<td>V V</td>
<td>✓</td>
<td>-</td>
<td>Near water in grassed woodlands; foothills, watercourses, riverflats and grassy plains.</td>
<td>Low. Not recorded in search area. Potential habitat exists.</td>
</tr>
<tr>
<td>Lophoictinia isura</td>
<td>Square Tailed Kite</td>
<td>- R</td>
<td></td>
<td>✓</td>
<td>Heathland, woodlands, forests, rainforests, timbered water courses, hills and gorges.</td>
<td>Low. Single, unconfirmed record 10 km from corridor.</td>
</tr>
<tr>
<td>Melithreptus gularis</td>
<td>Black-chinned Honeyeater</td>
<td>- R</td>
<td></td>
<td>✓</td>
<td>Drier eucalypt forests, woodlands, timber on watercourses, often with no understorey and scrubs.</td>
<td>Medium. Records within search area. Potential habitat near corridor.</td>
</tr>
<tr>
<td>Numenius madagascariensis</td>
<td>Eastern Curlew</td>
<td>- R</td>
<td></td>
<td>✓</td>
<td>Mudflats and sandflats on sheltered coasts, mangrove swamps, bays, harbours and lagoons.</td>
<td>Low. Minimal potential habitat within study area</td>
</tr>
<tr>
<td>Neochmia phaeton</td>
<td>Crimson Finch (White Bellied)</td>
<td>V V</td>
<td>-</td>
<td>✓</td>
<td>Pandanus (swampy grasslands with scattered Pandanus spiralis) and Canegrass (open forest with a thick grassy understorey)</td>
<td>Low. Minimal potential habitat within study area. Single record 5km from corridor.</td>
</tr>
<tr>
<td>Nettapus coromandelianus</td>
<td>Cotton Pygmy-goose</td>
<td>- R</td>
<td></td>
<td>✓</td>
<td>Deeper freshwater swamps, lagoons and dams with waterlilies and other semi-emergent water plants.</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
<tr>
<td>Ninox strenua</td>
<td>Powerful owl</td>
<td>- V</td>
<td></td>
<td>✓</td>
<td>Tall, open forest and woodland and dense, wet forest along watercourses.</td>
<td>Medium. Recorded within search area. Potential habitat within study area.</td>
</tr>
<tr>
<td>Rostratula australis</td>
<td>Australian Painted Snipe</td>
<td>V V</td>
<td>✓</td>
<td>-</td>
<td>Mudflats, shallow, vegetated, freshwater swamps, claypans or inundated grassland (including temporary wetlands).</td>
<td>Low/Medium. May utilise inundated farmland and low lying wet areas within the study area.</td>
</tr>
<tr>
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<td>Common Name</td>
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</tr>
<tr>
<td><em>Turnix melanogaster</em></td>
<td>Black-breasted Button-quail</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>Fragments of vine forest and thickets that are periodically water-stressed and coastal scrubs. Also low thickets or woodlands, acacia thickets, <em>Lantana camara</em> patches and wetter subtropical rainforest in NSW. Hoop pine plantations.</td>
<td>Low/Medium. No records within search area. Potential habitat within study area.</td>
</tr>
<tr>
<td><strong>AMPHIBIANS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Adelotus brevis</em></td>
<td>Tusked Frog</td>
<td>-</td>
<td>V</td>
<td>✓</td>
<td>Rainforest, wet and dry sclerophyll, woodland, vine forest and even in low numbers in open grazing country. Slow moving streams and dams, particularly around accumulated leaves and small woody debris.</td>
<td>Medium. Records within search area and potential habitat within study area.</td>
</tr>
<tr>
<td><em>Crinia tinnula</em></td>
<td>Wallum Froglet</td>
<td>-</td>
<td>V</td>
<td>✓</td>
<td>Low pH freshwater swamps on low nutrient soils, usually deep sands. Organically stained waters of the SEQ coastal lowlands. Heathland, sedgeland, Melaleuca swamp and Banksia woodland.</td>
<td>Medium. Records within search area and potential habitat within study area.</td>
</tr>
<tr>
<td><em>Litoria brevipalmata</em></td>
<td>Green Thighed Frog</td>
<td>-</td>
<td>R</td>
<td>✓</td>
<td>Rainforest and wet sclerophyll forest. Flooded areas bordering forest. Generally in denser vegetation, leaf-litter and ground debris.</td>
<td>Low/Medium. Limited potential habitat within study area. Records within search area.</td>
</tr>
<tr>
<td><em>Mixophyes iteratus</em></td>
<td>Southern Barred Frog, Giant Barred Frog</td>
<td>E</td>
<td>E</td>
<td>✓</td>
<td>Shallow rocky streams in rainforest, wet sclerophyll forest and farmland from 100 to 1000 m or deep, slow moving streams with steep banks in the lowlands.</td>
<td>Low. No records in search area. Potential habitat at Teviot Brook and Logan River.</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Neoceratodus forsteri</em></td>
<td>Australian Lungfish</td>
<td>V</td>
<td>-</td>
<td>✓</td>
<td>Still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed.</td>
<td>Medium. Recorded within Logan River.</td>
</tr>
<tr>
<td><em>Pseudomugil mellis</em></td>
<td>Honey Blue-eye</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>Slightly acidic, tannin-stained lakes and streams in coastal heath (wallum).</td>
<td>Low. Single record south west of Beaudesert. No potential habitat in study area.</td>
</tr>
<tr>
<td><strong>INSECTS</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Taxa</td>
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</tr>
<tr>
<td><strong>Phyllodes imperialis</strong></td>
<td>A moth</td>
<td>E -</td>
<td>✓ -</td>
<td>- -</td>
<td>Thick primary lower montane rainforests. Associated with the vine Carronia multisepalea.</td>
<td>Low. No records within search area. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Phyllodes imperialis</em></td>
<td>(southern subsp. ANIC 3333)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chalinolobus dwyeri</td>
<td>Large-eared Pied Bat, Large Pied Bat</td>
<td>V R</td>
<td>✓ -</td>
<td>- -</td>
<td>Roosts in disused mine tunnels, rock overhangs, caves and fairy martin nests. Utilises forest habitat for foraging. More associated with higher altitude moist forests and adjacent rainforest.</td>
<td>Low. No records within search area. No potential habitat within study area.</td>
</tr>
<tr>
<td>Dasyurus maculatus maculatus</td>
<td>Spotted-tailed Quoll</td>
<td>E V</td>
<td>✓ ✓ -</td>
<td></td>
<td>Rainforests, wet and dry sclerophyll forests, coastal heath and scrub from sea-level to sub-alpine regions.</td>
<td>Medium. Records and potential habitat within study area.</td>
</tr>
<tr>
<td>Petrogale pinicillata</td>
<td>Brush Tailed Rock Wallaby</td>
<td>V V</td>
<td>✓ ✓ -</td>
<td></td>
<td>Rocky terrain such as escarpments, boulder piles and rocky pinnacles in a variety of habitats such as rainforest and woodlands. Generally prefer sites that are north-facing and contain numerous ledges and crevices.</td>
<td>Low. No potential habitat within the study area.</td>
</tr>
<tr>
<td>Phascolarctos cinereus</td>
<td>Koala (SEQ Bioregion)</td>
<td>- V</td>
<td>✓ -</td>
<td>- -</td>
<td>Eucalypt woodland and forest habitats. Also modified urban areas including non-eucalypt trees.</td>
<td>High. Records and potential habitat within the study area.</td>
</tr>
<tr>
<td>Potorous tridactylus tridactylus</td>
<td>Long-nosed Potoroo (SE mainland)</td>
<td>V V</td>
<td>✓ -</td>
<td>- -</td>
<td>Subtropical and warm temperate rainforest through tall open forest with dense understorey to dense coastal heaths. Requires thick groundcover and light soils.</td>
<td>Low. No records within search area. Minimal areas of potential habitat in study area.</td>
</tr>
<tr>
<td>Pteropus poliocephalus</td>
<td>Grey-headed Flying Fox</td>
<td>V -</td>
<td>✓ ✓ -</td>
<td></td>
<td>Rainforests, open eucalypt forests, woodlands, Melaleuca swamps and Banksia woodlands.</td>
<td>Medium. Records within search area and potential foraging habitat within study area.</td>
</tr>
<tr>
<td>Vombatus ursinus</td>
<td>Common Wombat</td>
<td>- R</td>
<td>✓ -</td>
<td>- -</td>
<td>Variety of habitats ranging from dry forests and woodlands to grasslands.</td>
<td>Low. Single record near Goodna (1993). Potential habitat within the study area.</td>
</tr>
<tr>
<td><strong>REPTILES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Taxa</td>
<td>Common Name</td>
<td>Designation</td>
<td>EPBC NCA</td>
<td>Records</td>
<td>Preferred Habitat Description</td>
<td>Likelihood of Occurrence within 300 m of corridor (study area)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------</td>
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<td>----------</td>
<td>---------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Coeranoscincus reticulatus</em></td>
<td>Three-toed Snake-tooth Skink</td>
<td>V</td>
<td>R</td>
<td>✓</td>
<td>Subtropical rainforest and nearby wet sclerophyll forests.</td>
<td>Low. No records within search area. Potential habitat near Greenbank.</td>
</tr>
<tr>
<td><em>Delma torquate</em></td>
<td>Collared Delma</td>
<td>V</td>
<td>V</td>
<td>✓</td>
<td>Rocky hillsides on basalt and lateritic soils supporting open eucalypt and Acacia woodland with a sparse understorey of shrubs and tussocks or semi-evergreen vine thicket. Also recorded from areas without significant rock.</td>
<td>Low. No records from study area. No potential habitat within study area.</td>
</tr>
</tbody>
</table>

_E: Endangered  
_V: Vulnerable  
_R: Rare  

*Where discrepancies occur between schedules, the highest (most endangered) status should be used.*
### EPBC listed migratory and marine overfly species

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Common Name</th>
<th>Designation</th>
<th>Records</th>
<th>Preferred Habitat Description</th>
<th>Likelihood of Occurrence within 300 m of corridor (study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BIRDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Anthochaera phrygia</em></td>
<td>Regent Honeyeater</td>
<td>M, E</td>
<td>✓</td>
<td>Discussed previously.</td>
<td>Low. Discussed previously.</td>
</tr>
<tr>
<td><em>Anseranas semipalmata</em></td>
<td>Magpie Goose</td>
<td>M, OM</td>
<td>✓</td>
<td>Shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains.</td>
<td>Medium. Various records from Oxley area. Potential habitat within 300 m of alignment.</td>
</tr>
<tr>
<td><em>Apus pacificus</em></td>
<td>Fork-tailed Swift</td>
<td>M, OM</td>
<td>✓ ✓</td>
<td>An aerial species</td>
<td>Medium. May overfly the study area.</td>
</tr>
<tr>
<td><em>Ardea alba</em></td>
<td>Great Egret, White Egret</td>
<td>M, OM</td>
<td>✓ ✓</td>
<td>Wide range of aquatic and semi-aquatic habitats.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Ardea ibis</em></td>
<td>Cattle Egret</td>
<td>M, OM</td>
<td>✓</td>
<td>Paddocks and grasslands.</td>
<td>High. Records and potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Ardea intermedia</em></td>
<td>Intermediate Egret</td>
<td>M, OM</td>
<td>✓</td>
<td>Marshes, cultivated fields, mangroves, mudflats, estuaries.</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Cyclopsitta diophthalma coxeni</em></td>
<td>Coxen's Fig-Parrot</td>
<td>M, E</td>
<td>✓</td>
<td>Discussed previously.</td>
<td>Low. Discussed previously.</td>
</tr>
<tr>
<td><em>Dendrocygna arcuata</em></td>
<td>Wandering Whistling-Duck</td>
<td>M</td>
<td>✓ ✓</td>
<td>Deep lagoons, flooded grasslands and dams</td>
<td>Medium. Potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Egretta garzetta</em></td>
<td>Little Egret</td>
<td>M, OM</td>
<td>✓ ✓</td>
<td>Generally coastal and inland mudflats. Less likely to enter pastures and wetlands than other egret species.</td>
<td>Low. No preferred habitat within study area.</td>
</tr>
<tr>
<td><em>Eurostopodus mystacalis</em></td>
<td>White-throated Nightjar</td>
<td>M</td>
<td>✓ ✓</td>
<td>Dry eucalypt forest with dense leaf little and sparse under-storey. Often on ridge tops.</td>
<td>Low. Single record within search area.</td>
</tr>
<tr>
<td><em>Gallinago hardwickii</em></td>
<td>Latham's Snipe, Japanese Snipe</td>
<td>M, OM</td>
<td>✓ ✓</td>
<td>Freshwater and brackish swamps, marshes and flooded paddocks.</td>
<td>Low. No records within search area. Potential habitat within study area.</td>
</tr>
<tr>
<td><em>Gallinago hardwickii</em></td>
<td>Latham's Snipe, Japanese Snipe</td>
<td>M, OM</td>
<td>✓ ✓</td>
<td>Freshwater and brackish swamps, marshes and flooded paddocks.</td>
<td>Low. No records within search area. Potential habitat within study area.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common Name</td>
<td>Designation</td>
<td>Records</td>
<td>Preferred Habitat Description</td>
<td>Likelihood of Occurrence within 300 m of corridor (study area)</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Haliaeetus leucogaster</em></td>
<td>White-bellied Sea-Eagle</td>
<td>M, OM</td>
<td>✓</td>
<td>Marine and estuarine habitats and larger wetland areas.</td>
<td>Low. No records within search area or potential habitat within study area.</td>
</tr>
<tr>
<td><em>Hirundapus caudacutus</em></td>
<td>White-throated Needletail</td>
<td>M, OM</td>
<td>✓</td>
<td>An aerial species.</td>
<td>Medium. May overfly the study area.</td>
</tr>
<tr>
<td><em>Lathamus discolor</em></td>
<td>Swift Parrot</td>
<td>OM E</td>
<td>✓</td>
<td>Discussed previously.</td>
<td>Low. Discussed previously.</td>
</tr>
<tr>
<td><em>Merops ornatus</em></td>
<td>Rainbow Bee-eater</td>
<td>M, OM</td>
<td>✓</td>
<td>A common species known to occur within numerous habitats including disturbed areas.</td>
<td>High. Records and potential habitat within search and study area.</td>
</tr>
<tr>
<td><em>Monarcha melanopsis</em></td>
<td>Black-faced Monarch</td>
<td>M, OM</td>
<td>✓</td>
<td>Rainforests, wet sclerophyll forests, denser eucalypt forests, deep gullies, regrowth and mangroves.</td>
<td>Medium. Records within search area and potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Monarcha trivirgatus</em></td>
<td>Spectacled Monarch</td>
<td>M, OM</td>
<td>✓</td>
<td>Low dense vegetation, mainly in rainforests. Also wet and dry sclerophyll forests, woodlands, parks and gardens.</td>
<td>Medium. Records within search area and potential habitat within the study area.</td>
</tr>
<tr>
<td><em>Biziura lobata</em></td>
<td>Musk Duck</td>
<td>M</td>
<td>✓</td>
<td>Deep freshwater lagoons, with dense reed beds.</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Pelecanus conspicillatus</em></td>
<td>Australian Pelican</td>
<td>M</td>
<td>✓</td>
<td>Large bodies of standing water</td>
<td>Low. No potential habitat within study area.</td>
</tr>
<tr>
<td><em>Myiagra cyanoleuca</em></td>
<td>Satin Flycatcher</td>
<td>M, OM</td>
<td>✓</td>
<td>Eucalypt forest, favouring moist gullies and watercourses. Largely absent from regrowth forests.</td>
<td>Medium. Potential habitat within study area.</td>
</tr>
<tr>
<td><em>Nettapus coromandelianus albipennis</em></td>
<td>Australian Cotton Pygmy-goose</td>
<td>M, OM</td>
<td>✓</td>
<td>Discussed previously.</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
<tr>
<td><em>Nettapus pulchellus</em></td>
<td>Green Pygmy-goose</td>
<td>M</td>
<td>✓</td>
<td>Well vegetated lowland lagoons and other permanent fresh water.</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
<tr>
<td><em>Numenius madagascariensis</em></td>
<td>Eastern Curlew</td>
<td>M R</td>
<td>✓</td>
<td>Discussed previously</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
<tr>
<td><em>Rhipidura rufifrons</em></td>
<td>Rufous Fantail</td>
<td>M, OM</td>
<td>✓</td>
<td>Rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
<tr>
<td>Taxa</td>
<td>Common Name</td>
<td>Designation</td>
<td>Records</td>
<td>Preferred Habitat Description</td>
<td>Likelihood of Occurrence within 300 m of corridor (study area)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>---------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Rostratula benghalensis</em> s. lat.</td>
<td>Painted Snipe</td>
<td>M</td>
<td>-</td>
<td>Shallow, freshwater wetlands with a thick cover of low vegetation.</td>
<td>Low. Minimal potential habitat within study area.</td>
</tr>
</tbody>
</table>

E: Endangered  
R: Rare  
OM: Overfly Marine  
M: Migratory  

Where discrepancies occur between schedules, the highest (most endangered) status should be used.
Appendix D

EXTRACTS FROM DRAFT
BEAudesert LOCALITY
NATURAL ENVIRONMENT
TECHNICAL STUDY
APPENDIX

B

Koala Habitat Matrix – MLNBLA Koala Habitat Assessment Study Landscape Stratification Table & Figure

Extracted from

Figure 6. Landscape Stratification
APPENDIX

C

Quoll Sightings as of 23/8/06 in the northern Beaudesert LGA
REPORTED SIGHTINGS – SPOTTED-TAILED QUOLL
SOUTH MACLEAN TO CAROLE PARK

Key to sightings
Live sighting 2004-2006
Roadkill 2004-2005
Live sighting pre-2004
Roadkill pre-2004
Appendix E

DESCRIPTION OF LANDSCAPE CHARACTER (BY SECTION)
<table>
<thead>
<tr>
<th>Zone</th>
<th>Dominant landscape character</th>
<th>Description of landscape character</th>
<th>Landscape quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern Section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musgrave Road to Acacia Ridge Terminal</td>
<td>Urban residential</td>
<td>Minimal natural features</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Commercial development</td>
<td>Residential development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial use area</td>
<td>Commercial/industrial properties</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimal open space (unvegetated)</td>
<td></td>
</tr>
<tr>
<td>Acacia Ridge Terminal to Algester Station</td>
<td>Urban residential</td>
<td>Within Oxley Creek catchment, otherwise minimal natural features</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Commercial development</td>
<td>Residential development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial use area</td>
<td>Commercial/industrial properties</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimal open space (unvegetated)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logan Motorway</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residential development</td>
<td></td>
</tr>
<tr>
<td>Algester Station to Hillcrest Station</td>
<td>Urban residential</td>
<td>Large unvegetated open space between Logan Motorway and Johnson Road</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Major roads</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Central Section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hillcrest Station to Greenbank Station</td>
<td>Urban residential</td>
<td>Wetland area (Greenbank Training Military Area)</td>
<td>Medium to High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residential development</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some unvegetated open space</td>
<td></td>
</tr>
<tr>
<td>Greenbank Station to New Beith Station</td>
<td>Rural residential</td>
<td>Residential development</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some vegetated open space</td>
<td></td>
</tr>
<tr>
<td>Flagstone North Station to Flagstone Central Station</td>
<td>Rural residential</td>
<td>Residential development</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some vegetated open space</td>
<td></td>
</tr>
<tr>
<td>Flagstone Central Station to Undullah Station</td>
<td>Rural residential</td>
<td>Low density housing</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open space (vegetated and unvegetated)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industrial areas - waste</td>
<td></td>
</tr>
<tr>
<td>Zone</td>
<td>Dominant landscape character</td>
<td>Description of landscape character</td>
<td>Landscape quality</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><strong>SOUTHERN SECTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undullah Station to Gleneagle North Station</td>
<td>Rural Residential</td>
<td>Some farm houses, Teviot Brook and Logan River</td>
<td>Medium to High</td>
</tr>
<tr>
<td></td>
<td>Rural use area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some farm houses and rural residential development, Cyrus Creek</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and unnamed gullies and creeks</td>
<td></td>
</tr>
<tr>
<td>Gleneagle North Station to Gleneagle</td>
<td>Rural Residential</td>
<td>Logan River, Farm houses and slightly more dense</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Station</td>
<td>Rural use area</td>
<td>residential development at Gleneagle and Beaudesert</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commerical development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gleneagle Station to Beaudesert Station</td>
<td>Rural Residential</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural use area</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commercial development</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>