

Queensland Transport

Petrie to Kippa-Ring Public Transport Corridor Study

Final Impact Assessment Study Report

October 2003

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E	<i>Air Quality Assessment</i>
F	<i>Detailed Summary of Community Consultation Submissions</i>

Abbreviations





AADT	Annual Average Daily Traffic
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
ANZECC	Australia New Zealand Environment Conservation Council
ARI	Average Recurrence Interval
AS	Australian Standard
ASS	Acid Sulfate Soil
BCR	Benefit Cost Ratio
CBD	Central Business District
CO	Carbon Monoxide
COAR	(Mango Hill/Griffin) Corridor Options Assessment Report
dB(A)	Decibels (A weighted scale)
DLGP	Department of Local Government and Planning
DCP	Development Control Plan
DMR	Department of Main Roads
DPI	Department of Primary Industries
EDR	Environmental Design Report
EMP	Environmental Management Plan
EO	Environmental Officer
EPA	Environmental Protection Agency
EPAct	Environmental Protection Act 1994
EPBC	Environment Protection and Biodiversity Conservation Act (Federal)
EPP (Air)	Environmental Protection (Air) Policy
EPP (Noise)	Environmental Protection (Noise) Policy
ERA	Environmentally Relevant Activity
ESD	Ecologically Sustainable Development
IAS	Impact Assessment Study
IRTP	Integrated Regional Transport Plan
km	kilometres
km/hr	kilometres per metre
L₁₀	A weighted noise level exceeded 10% of the time
L_{max}	Highest momentary sound pressure level from a single noise event
L₉₀	A-weighted noise level exceeded 90% of the time
L_{eq} (24 hour)	A-weighted energy average sound pressure level for 24 hours
LAP	Local Area Plan
LGA	Local Government Area
LRA	Land Resource Area
m	metres
MIBA	Mixed Industry Business Area
mm/s	millimetres per second
NO_x	Oxides of nitrogen
NO	Nitrous oxide
NO₂	Nitrogen dioxide
NRM	Department of Natural Resources and Mines
O₃	Ozone
PASS	Potential Acid Sulfate Soils

Abbreviations continued

pc²	per chord ²
pers. comm.	Personal communication
pers. obs.	Personal observation
PIAS	Preliminary Impact Assessment Study
PIFU	Planning Information Forecast Unit (DLGP)
PM₁₀	Particulate matter less than 10 micrometres in diameter
PRSC	Pine Rivers Shire Council
ppm	parts per million
QASSIT	Queensland Acid Sulfate Soil Investigation Team
QR	Q R
QT	Queensland Transport
RCC	Redcliffe City Council
RFGM	Regional Framework for Growth Management
RL	Reduced Level
rms	root mean squared
SPP	State Planning Policy
ToR	Terms of Reference
TSP	total suspended particles
µg/m³	micrograms per cubic metre
µm	micro metres
VMA	Vegetation Management Act 1999

FIGURE 1
Study Area for the Petrie to Kippa-Ring
Public Transport Corridor Study

TRANSPORT CORRIDOR OPTIONS

- OPTION A 
- OPTION B 
- OPTION C 
- OPTION D 

Note:

Option B and Option C are common between Murrumba Downs and the vicinity where Option B crosses Anzac Avenue in Mango Hill.



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Executive Summary

Background

The Queensland Government's Integrated Regional Transport Plan for South East Queensland (IRTP) proposes investigations for strategic transport corridors which focus heavily on integration of land use and transport planning to be carried out. Corridor Strategies will be developed for those corridors identified as key strategic links needed to meet future travel demands.

The strategies were to be focussed on key elements of transport infrastructure, which have the potential to bring about significant changes in land use and activity patterns and transport networks with resultant social, economic and environmental benefits. The Petrie to Kippa-Ring Public Transport Corridor Study (hereafter referred to as the Study) is aimed at developing one of these integrated land use transport corridor strategies and is being undertaken with the cooperation and assistance of the Queensland Government Departments and Agencies, and the Pine Rivers Shire, Redcliffe City and Caboolture Shire Councils.

The overall aim of the Study is to assess the viability, preferred alignment and social, environmental and economic implications of a public transport corridor between Petrie and Kippa-Ring on the northern outskirts of the Brisbane Metropolitan area (Figure 1).

Study Stages

The Study was carried out in two stages. Stage 1 was completed in June 2000 in order to meet the State's obligations to identify or relinquish any rights to a corridor through the North Lakes development. Stage 1 involved:

- the selection of a preferred mode of transport;
- an initial assessment of the viability of public transport within the corridor; and
- determination of the preferred corridor alignment (Option A, B or C) in the Mango Hill/Griffin Area (Figure 1).

Stage 2 of the Study involved completion of the technical studies including economic modelling, the selection of the preferred alignment between Petrie Station and the proposed Kallangur Station (Option A and D) and the preparation of this Draft Impact Assessment Study (IAS). A detailed implementation strategy has also been prepared including timing and staging of corridor development and recommendations for the integration of public transport and land use.

Study Area

The Study Area for this IAS includes the Queensland Rail (QR) acquired corridor between Petrie and Kippa-Ring and the surrounding localities which will comprise the public transport catchment for the corridor (Figure 1). The corridor starts in the vicinity of Petrie Rail Station near Anzac Avenue in Petrie, about 23km north of the Brisbane Central Business District. It travels

north-east through the suburbs of Kallangur, Murrumba Downs, Mango Hill and Griffin in Pine Rivers Shire, through Rothwell and then terminating at Kippa-Ring in Redcliffe City. The public transport catchment includes all these suburbs, together with other suburbs on the Redcliffe Peninsula and Deception Bay in Caboolture Shire.

Need for the Proposal

The proposed public transport corridor will link several of the fastest growing suburbs in the Northern Metropolitan area, together with the Redcliffe Peninsula, to the metropolitan rail network. The combined population within the suburbs along the corridor, is expected to double from around 50,000 to around 120,000 by 2025. The recently commenced North Lakes development will alone add some 25,000 residents and somewhere between 6000 – 13000 jobs along the corridor by around 2015.

Parts of the Study Area are characterised by communities with lower than average disposal income and car ownership rates, and they are currently underserved by public transport.

Implementation of the proposed corridor will not only provide an important component of the transport infrastructure to redress currently deficiencies, but also help to establish public transport travel behaviour patterns in the emerging communities along the corridor.

The IRTP identified the Petrie to Kippa-Ring Public Transport Corridor as a Brisbane metropolitan strategic opportunity. Transport 2007, a medium term action plan under the IRTP, has indicated that the rail network will be extended from Petrie to Mango Hill by 2007, and linked by feeder bus services to Redcliffe Peninsula and Deception Bay.

Options Assessment

Mode of Transport

The four alternative modes of transport examined in Stage 1 of the Study were:

- Heavy (Passenger) Rail;
- Buses/Busway;
- Light Rail; and
- Monorail.

A transport model was used to forecast levels of patronage and economic benefits associated with each mode of transport adopting a common corridor option.

Heavy rail was selected as the preferred mode for this corridor on the basis that it is the only mode that provides an acceptable level of economic efficiency. Heavy rail also provided the highest levels of public transport patronage, largely due to better integration with the existing network and absence of any penalties associated with the need to switch modes.

Alternative Corridors

Selection of the preferred corridor option involved a comprehensive evaluation process employing key evaluation criteria based on the Study's technical investigations. The criteria related to the natural environment, the social environment, integrated transport aspects and to costings.

In Stage 1, the alternative corridor options through the Mango Hill/Griffin Area were evaluated, (Options, A, B and C on Figure 1).

Based on the selected evaluation criteria, Option A, the originally preserved corridor, was identified as the preferred corridor through the Mango Hill/Griffin Area. Corridor Option A provides the following benefits over the alternative options:

- the most cost effective option achieving good patronage levels with minimal corridor costs;
- affects fewest landowners as the corridor has already been acquired;
- easier constructability with fewer bridge and retaining structures;
- potentially lower visual impact;
- potentially less impact of water quality in local rivers and waterways; and
- the indicative station sites are accessible to a greater number of future residents.

Stage 2 of the Study evaluated alternative corridor options between the Petrie Station and the proposed Kallangur Station at Goodfellows Road, (Options A or D on Figure 1). The assessment used the same process followed for the Mango Hill/Griffin Area corridor analysis undertaken in Stage 1 and adopted essentially the same evaluation criteria. Based on the evaluation, Options A and D performed similarly overall, although each option has very different characteristics.

In determining a preferred option in this instance, a number of additional factors need to be considered in conjunction with the evaluation matrix. These included:

- the degree of uncertainty associated with the total capital cost involved in resuming the land for Option D;
- the acquisition processes inherently introduces delays and unknown costs which have the potential to frustrate the eventual implementation of the project;
- as Option A is already owned by QR, this option is already preserved and protected for future development as a public transport corridor;
- the greater risks associated with estimating the capital cost of Option D due to a lack of knowledge about the use of the land and the implications of the current land use;

- Option D has fewer ecological impacts but the corridor significantly fragments a large tract of land affecting existing land use and habitat;
- Option D is expected to have significant impacts on the operation of commercial activities in the area, the overall viability of existing and planned operations, and EPA licensing conditions; and
- there are no environmental impacts associated with Option A that cannot be effectively managed through use of appropriate mitigation strategies.

Following full consideration of these factors and the results of the options assessment through the matrix, Option A was identified as the preferred route for the proposed public transport corridor.

Therefore Option A, the existing preserved corridor, is the preferred option along the entire length of the proposed public transport corridor between Petrie and Kippa-Ring.

Project Feasibility

The overall capital cost of the proposed Petrie to Kippa-Ring Corridor is estimated to be \$131M.

The performance of the Petrie to Kippa-Ring Corridor was established by use of a transport model to compare the various alignment and transport mode options with a base case for each of three target years (1999, 2011, and 2025). The base case for each target year was designed to reflect current expectations for transport system development in that year.

The model provided patronage forecasts and measures of economic benefits for each of the mode options and for two corridor options.

The model predicted that heavy rail attracted the most patronage and at a level sufficient to sustain heavy rail as the preferred transport mode.

The economic benefits include public transport user benefits within the corridor, public transport user benefits beyond the immediate corridor, and road user benefits which accrue as a result of freed road space.

An economic analysis was then carried out which took into account all measurable community benefits, and compared these benefits against the cost of construction, rolling stock acquisition and running costs. A project is considered to be economically viable when the benefit cost ratio (BCR) exceeds one.

Based on the adoption of heavy rail as the preferred transport mode, the BCR of a public transport system along Corridor A was determined to be 1.46. Corridor A also performed best in terms of other measures of economic efficiency, Net Present Value (NPV) and return on the initial capital investment, measured by NPV divided by Capital Costs.

Achieving IRTP Targets

The overall market share of public transport services to/from and within the Study Area is approximately 3.0%. Improvements to existing bus and rail services and the introduction of new bus services to emerging communities which are foreshadowed in the IRTP is expected to increase public transport mode share to approximately 3.8%. The introduction of rail services to the Petrie to Kippa-Ring corridor will further improve mode share to 4.1% by the year 2025. Importantly, the introduction of rail services provides opportunity for more transit supportive development to occur along the corridor, providing further opportunities to increase patronage and public transport mode share.

The Transport 2007 medium term action plan sets a public transport mode share target of 9% across South East Queensland by 2007. The analysis carried out as part of Stage 1 of the Study showed that the IRTP targets for this region may be difficult to achieve through improved public transport services alone. Further improvements to the public transport system, a more transit-supportive land use pattern and disincentives for travel by car may need to be addressed to further increase public transport usage. Other strategies to help achieve this public transport usage target are outlined in Transport 2007.

Description of the Preferred Rail Corridor

In broad terms, the rail line will consist of a single line from Petrie to Kippa-Ring, along the originally preserved corridor (Corridor A), with passing sections at the end stations (Petrie and Kippa-Ring) and at the central Mango Hill Station. This configuration allows for a 15 minute service frequency on the rail corridor extension which would meet future requirements. Embankments will be constructed to provide the option of building a dual track should future patronage levels warrant this. The proposal allows for Stations at Kallangur, Murrumba Downs, Mango Hill, Kinsellas Road, Rothwell and Kippa-Ring. Bus services are assumed to be redirected to provide feeder services to the rail stations, with the Kippa-Ring and Mango Hill stations being of major importance in this regard. Assumed operating scenarios provide for all services to be through running to Central and Roma Street Stations, with 50% express from Petrie.

The alignment is fully grade separated from the local road network. This would require bridges at Dohles Rock Road; the Goodfellows Road deviation; Brays Road; the Bruce Highway; Freshwater Creek Road; and Kinsellas Road (North South Arterial). Major waterway structures are required at Yebri Creek; Black Duck Creek; Freshwater Creek; and Saltwater Creek/Hays Inlet. Bridges will be constructed at three locations between the proposed Rothwell and Petrie stations to allow free fauna movement and to minimise environmental impacts.

Implementation

The introduction of rail to the Petrie to Kippa-Ring Public Transport Corridor has been assessed as economically feasible in the short term. Furthermore, this project currently meets normally accepted thresholds for implementation of this type of public transport service.

The corridor is unencumbered and available for construction. Urban development along the corridor is rapidly proceeding and projections of patronage show that this line is viable. Overall, the project has demonstrated economic viability, and implementation of a rail service has strong public support.

Ideally, implementation should proceed immediately. This would allow the introduction of rail services to match the final sequence of urban development, and encourage further transit supportive development within station surrounds. It would also establish public transport patterns of behaviour amongst the newly developing households prior to the emergence of car dependency, and introduce a clean and environmentally suitable transport service as soon as possible.

In practice, however, the timing of implementation will be more directly influenced by the availability of government funding and/or the attractiveness of the project for private sector investment. To allow for lead times associated with the planning, design, construction and rolling stock requisition, (likely to take 3 or 4 years) a target year for implementation of rail services could be 2007.

Alternative Staging Scenarios

A broad range of staging strategies were considered before short listing three scenarios for detailed analysis. The shortlist scenarios were:

- Scenario A, First Stage Construction to Mango Hill
- Scenario B, First Stage Construction to Kippa-Ring with minimum Station Construction
- Scenario C, Full Construction to Kippa-Ring

Further transport modelling was carried out to determine the likely levels of patronage from each scenario and implications for overall feasibility. The results of the modelling are shown in Table 1, overleaf.

Scenario A provides for stations at Kallangur and Mango Hill. It provides the best return on both ongoing costs and full costs, and yet fails to meet community expectations with respect to delivery of service to the Redcliffe Peninsula.

As depicted in Table 1 transport modelling has shown that boardings at a Mango Hill end station are not significantly higher than boardings at a Mango Hill Station with full construction through to Kippa-Ring. This leads to the conclusion that for much of the Redcliffe Peninsula, the existing Sandgate Station is more accessible than a Mango Hill Station.

Hence while Scenario A performs with economic efficiency, it is ineffective in meeting an overall strategic objective for this project of providing a service to the Redcliffe Peninsula.

Table 1
Project Year 2011 Station Boardings / Alightings

Rail Station		Scenario A	Scenario B	Scenario C
Petrie	All	1,233	1,333	1,232
	Ex	703	704	1,805
	<i>Total</i>	<i>1,936</i>	<i>2,037</i>	<i>3,037</i>
Kallangur	All	1,739	1,773	1,180
	Ex	584	613	1,536
	<i>Total</i>	<i>2,323</i>	<i>2,386</i>	<i>2,716</i>
Murrumba Downs	All	--	--	726
	Ex	--	--	1,066
	<i>Total</i>	<i>--</i>	<i>--</i>	<i>1,792</i>
Mango Hill	All	1,455	1,346	1,013
	Ex	800	605	1,505
	<i>Total</i>	<i>2,255</i>	<i>1,951</i>	<i>2,518</i>
Kinsellas Road	All	--	--	329
	Ex	--	--	497
	<i>Total</i>	<i>--</i>	<i>--</i>	<i>826</i>
Rothwell	All	--	--	366
	Ex	--	--	472
	<i>Total</i>	<i>--</i>	<i>--</i>	<i>838</i>
Kippa-Ring	All	--	1,318	1,018
	Ex	--	630	1,631
	<i>Total</i>	<i>--</i>	<i>1,948</i>	<i>2,649</i>
Petrie to Kippa Ring	All	4,427	5,770	5,864
	Ex	2,087	2,552	8,512
	<i>Total</i>	<i>6,514</i>	<i>8,322</i>	<i>14,376</i>

All denotes all stops; Ex denotes express services

Scenario B provides for stations at Kallangur, Mango Hill, and Kippa-Ring. It meets the overall strategic objectives of the project in that it provides a high standard of public transport service to the full corridor, and it reduces initial cost through the construction of selected stations and reduced service frequency in off peak periods.

However, while station construction is a relatively small portion of the total construction cost, reducing the number of stations generally has a large effect on patronage. Detailed analysis has shown that in the case of Scenario B the reduction in initial cost is insufficient to warrant the reduction in the level of service provided to the community.

Scenario C provides for stations at Kallangur, Murrumba Downs, Mango Hill, Kinsellas Road, Rothwell and Kippa-Ring. It provides the highest standard of service to the corridor and was shown to meet normal target fare box recovery targets and the broad community expectations for this project.

Recommended Staging Scenario

It is recommended that Scenario C be adopted with the exclusion of Kinsellas Road Station and with qualifications on the implementation of Rothwell Station.

As shown in Table 1, the proposed Kinsellas Road and Rothwell Stations are low activity stations, receiving significantly lower patronage than the remaining stations. Kinsellas Road Station is to supplement the park and ride capacity of the Mango Hill Station, and as such this station is not initially required to be constructed.

The Rothwell Station is sited within a largely undeveloped, but ecologically sensitive area and there is an opportunity to influence the development of surrounding land through the early implementation of this station. However, the early implementation of the Rothwell Stations would be conditional upon appropriate planning and development initiatives by statutory agencies to encourage transit supportive development around the station. Also, Rothwell Station provides a supplementary park and ride station for the Deception Bay community, and it is recommended that, subject to the above this station proceed with first stage implementation at year 2007.

A Rothwell Station passing loop may also be required to improve service flexibility and reliability and remove constraints on time tabling for the main north coast line in general. This issue can also be addressed through detailed operational analysis of the complete Citytrain network closer to the year of implementation.

Public Transport Integration

The need for additional bus routes largely reflects the need to service newly developing areas together with service areas as part of the future vision for public transport services encapsulated in Transport 2007.

Key bus service and transport infrastructure elements needed to support and integrate with the Petrie to Kippa-Ring Public Transport Corridor include:

- additional express rail services added to the Caboolture rail lines. The effect of this is to increase rail service frequencies to approximately 10 minutes in the peak and 15 minutes in the off peak with the additional express services operating throughout the day;
- Lawnton Station to Petrie Station third track construction;
- premium stations/interchanges at Petrie as per Transport 2007;
- service frequencies on existing (i.e. 1999) bus services enhanced to 30 minutes throughout the day;
- new bus services to integrate with proposed rail services in the proposed corridor especially servicing those suburbs experiencing strong growth and other suburbs under-serviced by public transport to occur (North Lakes, Caboolture, Pine Rivers Shire);
- the South East Transit Project (SET);

- the Inner Northern Busway project (INB);
- associated bus priority measures (e.g. in Gympie/Lutwyche Road, Kelvin Grove Road etc);
- associated bus operating strategies associated with INB and SET (which mainly affect Brisbane Transport services but with marginal impacts on Hornibrook and Brisbane Bus Lines services); and
- provision of bus priority facilities linking INB to Chermside, Carseldine and North South Arterial to Anzac Avenue.

A full network of feeder bus routes have also been planned for the Deception Bay/North Lakes / Mango Hill area to provide feeder services through the North lakes Town Centre to the Mango Hill Station.

Land Use Transport Integration

The Mango Hill / North Lakes development offers significant opportunity for integration of land use and transport planning. All levels of government are currently engaged in the process of maximising the potential for integration of land use and transport planning in these key sites.

Opportunities for transit supportive development have been identified around proposed station locations, introduction of which will enhance the overall economic performance of the public transport corridor. Specific integration issues have also been identified with respect to each station and with Deception Bay.

There is currently a high degree of cooperation and coordination on the part of all of the relevant planning agencies acting within this corridor. It is recommended that Queensland Transport be responsible for harnessing this considerable goodwill for the purpose of integrating all aspects of planning affecting this corridor.





Existing Environment and Assessment of Impacts

The preferred public transport corridor follows the currently preserved alignment which was identified in the 1970s and purchased in the 1980s. Land use planning in the Study Area has recognised the existence of this proposed corridor and allowed for its integration. While introduction of the corridor is expected to have significantly overall benefits to the community, a number of adverse impacts on the existing environment have been identified. In most cases, these impacts can be partly or completely mitigated by the implementation of management measures.

Table 2 summarises the potential impacts of the development of the proposed public transport corridor and mitigation measures proposed in response to these.

FIGURE 1.2.1
Study Area for the Petrie to Kippa-Ring
Public Transport Corridor Study

TRANSPORT CORRIDOR OPTIONS

- OPTION A 
- OPTION B 
- OPTION C 
- OPTION D 

Note:

Option B and Option C are common between Murrumba Downs and the vicinity where Option B crosses Anzac Avenue in Mango Hill.



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FIGURE 1.2.2
Location of photos
illustrating the IAS corridor



Transport corridor



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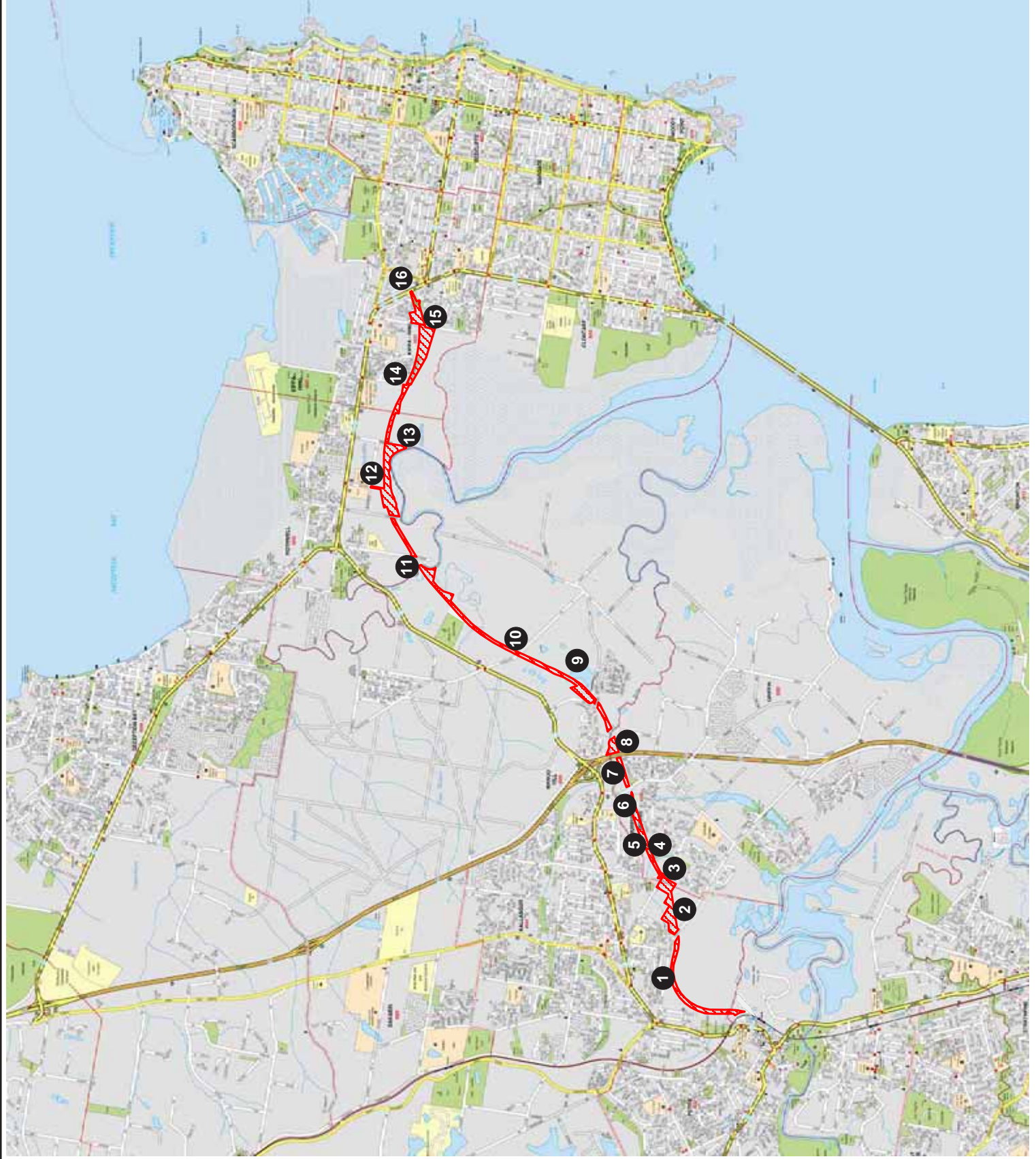


Table 2
Summary of Potential Key Impacts or Benefits and Proposed Mitigation Measures

Aspect of the Environment	Potential Impacts or Benefits of Proposal <i>Proposed Mitigation Measures (in Italics)</i>
Geology and Soils	<ul style="list-style-type: none"> Disturbance of acid sulfate soils <p><i>Soil sampling, minimising earthworks and implementation of ASS management plan</i></p> <p>Overall: Minor impact</p>
Hydrology and Water Quality	<p><i>Hydrology</i></p> <ul style="list-style-type: none"> Potential for alteration of surface flows due to construction of rail infrastructure <p><i>Detailed hydrological assessment prior to design and use of best practice during design</i></p> <p>Overall: Minor impact</p>
	<p><i>Surface water</i></p> <ul style="list-style-type: none"> Potential increase in runoff and pollution during construction and operation <p><i>Employ permanent and temporary sediment and pollution control structures</i></p> <p>Overall: Minor impact</p>
	<p><i>Groundwater</i></p> <ul style="list-style-type: none"> No direct impact on groundwater Slight potential for indirect impact through impact on surface water flows <p><i>Use of best practice during detailed design to minimise alterations to surface flows</i></p> <p>Overall: Minor impact</p>
Climate	<ul style="list-style-type: none"> Benefit to climate through reduction in greenhouse gases and other pollutants through reduction in motor vehicle usage <p>Overall: Minor benefit</p>
Flora and Fauna	<ul style="list-style-type: none"> Proposed public transport corridor contains terrestrial, fresh and saltwater vegetation Minimum of 207 species of vertebrates indicated by the surveys undertaken in this study. 19 species of mammals, 138 of birds, 26 of reptiles, 11 of frogs and 13 of fish. Birds listed under international agreements are present in the Study Area. Loss of areas floral communities, weed invasion and fragmentation of habitat Potential impacts on listed species (Wallum froglet and Little corellas); Potential increase in artificial barriers to movement; and <p>Potential impact on matters of national environmental significance triggering EPBC.</p> <p><i>Implement best practice design including fauna crossings, buffer sensitive areas during construction and operation, reduce footprint of proposed stations (particularly Rothwell Station), fencing of corridor, baseline monitoring, development and implementation of an EMP and monitoring the effectiveness of mitigation measures.</i></p> <p><i>Referral under Commonwealth Environmental Protection and Biodiversity Conservation Act 1999</i></p> <p>Overall: Moderate to major impact</p>

Aspect of the Environment	Potential Impacts or Benefits of Proposal <i>Proposed Mitigation Measures (in Italics)</i>
Land Use Planning	<ul style="list-style-type: none"> • The Petrie end of the proposed corridor west of the Highway is largely urbanized. • East of the highway, the corridor passes largely through greenfield areas and the developing Mango Hill Estate. This provides opportunity to integrate the corridor in future land use planning in this area. • No significant impact on land use planning in the Study Area • Development of corridor achieves regional land use planning objectives • Could lead to transport supportive development. <p>Overall: Minor to moderate benefit</p>
Social and Community Issues	<ul style="list-style-type: none"> • Community well informed about the project and have been expecting it to be developed. • Corridor was acquired over 20 years ago. • Rapid population growth within Pine Rivers Shire. • Substantial growth within the Mango Hill/Griffin Area <p><i>Benefits</i></p> <ul style="list-style-type: none"> • Fast and efficient rail service between the Brisbane CBD and Redcliffe • Improved/alternative access to employment opportunities, services and networks <p><i>Impacts</i></p> <ul style="list-style-type: none"> • Reduced amenity, noise and visual intrusion for some residences near the corridor • Increased concern for personal and property safety from residents • Temporary impacts during construction e.g. traffic, noise and dust generation <p><i>Mitigation of environmental impacts relating to noise, amenity and traffic as recommended in the project EMP. Best practice planning and urban design of rail stations. Planned implementation of the proposal should also return a considerable benefit to the community.</i></p> <p>Overall: Moderate to major benefit</p>
Noise and Vibration	<ul style="list-style-type: none"> • Background noise sampling indicates typical urban levels • Significant background noise associated with the Bruce Highway • Noise levels expected to meet criteria at most noise sensitive locations • A number of locations identified as requiring noise amelioration measures <p><i>Construction of recommended noise amelioration measures. Implementation of a noise and vibration monitoring program during construction. Follow recommended standards for equipment, work practices and hours of operation</i></p> <p>Overall: Minor impact</p>
Cultural Heritage	<ul style="list-style-type: none"> • Four indigenous sites were identified in the Study Area (only one within the corridor) including artefact scatters, middens and one isolated tool. • Any earthworks in the vicinity may unearth other cultural heritage material, including burials • The historical site of Cunningham’s campsite will be possibly impacted <p><i>Preparation of a Cultural Heritage Management Plan. Monitoring by an archaeologist and cultural heritage Indigenous field workers should occur during initial earthworks in areas most likely to contain further cultural heritage material. The area around Mango Hill Golf Course requires further archaeological study and possible artefact collection and recording</i></p> <p>Overall: Minor impact</p>

Aspect of the Environment	Potential Impacts or Benefits of Proposal <i>Proposed Mitigation Measures (in Italics)</i>
Landscape and Visual	<ul style="list-style-type: none"> • Area west of the Bruce Highway dominated by established residential suburbs (Petrie, Kallangur and Murrumba Downs) which are of an urban character punctuated by open space pockets • Land use east of the Bruce Highway characterised by development of greenfield sites, agricultural activities and low density residential uses in a rural setting • Vegetation or topographic screening of much of the corridor • Presence of infrastructure will create significant visual impact for small numbers of residents along some sections of the corridor <p><i>Appropriate best practice urban design of station and landscaping of infrastructure to minimise visual impacts</i></p> <p>Overall: Minor impact</p>
Air Quality	<p><i>Construction</i></p> <ul style="list-style-type: none"> • Temporary local increase in dust and vehicle emissions <p><i>Implementation of a construction phase Air Quality Management Plan</i></p> <p>Overall: Minor impact</p> <p><i>Operation</i></p> <ul style="list-style-type: none"> • Slight reduction of ground level concentrations of pollutants modelled • Overall, no adverse impacts on local or regional air quality are expected; slight improvement possible for some parameters, depending on other factors <p>Overall: Minor benefit</p>

Consultation

The key purpose of the consultation process was to provide the opportunity for community input. This has enhanced the quality of the background information on which key decisions have been made. Increasing public awareness of the Study was also a focus of the consultation process.

During Stage 1 of the Study, Corridor Options Assessment, consultation activities focused on raising public awareness of the project, the scope of work to be carried out and the issues to be addressed. Subsequent phases also focused on receiving community input on the evaluation criteria, corridor options assessment and station locations.

In Stage 2, preparation of the Impact Assessment Study, consultations involved exhibition of the draft IAS and review of submissions and comments received on the draft document.

The community were informed about the study via Newsletters, a Community Information Session, the project website, Community Open Days and the Freecall information line. Community feedback was obtained via written submissions, the Freecall information line, meetings, and Community Open Days.

Overall, there was a good response to the consultation process demonstrated by the following responses to each of the contact activities:

- 577 entries on the mailing list;

- 11 meetings and briefings with potentially directly affected land owners and local stakeholders, during Stage 1, Corridor Option Assessment;
- attendance by approximately 150 persons at the Community Information Sessions at the commencement of Stage 1;
- 116 attendees at two Open Days at Petrie and 85 attendees at two Open Days at Redcliffe during Stage 1;
- 33 registered attendees at the Petrie Open Day and 54 at Redcliffe Open Day during Stage 2;
- 103 calls made to the Freecall hotline;
- 8 written submissions on the draft Terms of Reference;
- 13 written submissions on the corridor options report; and
- 72 written submissions on the draft IAS report; and
- 1,927 hits on the Study website.

Table 3 summarises the key issues raised as part of the consultation process and the response of the consultant to these issues.

**Table 3
Summary of Key Issues Raised During Consultation and Response**

Category	Key Issues	Response	See Chapter
Social	<ul style="list-style-type: none"> • Concern about property acquisition. • Concern about property devaluation. • Concern about impact on Mango Hill Estate 	<ul style="list-style-type: none"> • The chosen corridor is largely confined to the existing rail easement, eliminating the social impacts associated with land acquisition. • Difficult to quantify impacts on property values. Similar projects show that properties within walking distance to rail stations may increase in value. Noise, visual and other amenity impacts on some properties will be mitigated through the EMP. 	2
Visual Amenity and Noise	<ul style="list-style-type: none"> • Reduced amenity of nearby residences and businesses resulting from noise and visual intrusion of corridor infrastructure and operation. • Potential noise around stations 	<ul style="list-style-type: none"> • Noise mitigation has been incorporated into the corridor preliminary design to reduce noise impacts. Best urban design of stations to blend with surrounding urban environment. Landscaping to reduce some visual elements. • Issue to be addressed during detailed design. 	6 & 9 3
Transport	<ul style="list-style-type: none"> • Increased public transport opportunities and integration with other modes of transport is likely to improve accessibility to services, places of employment and recreation. 	<ul style="list-style-type: none"> • Integrated Transport Implementation Strategy has been prepared to maximise the potential for land use and transport integration. • Station layout and design as well as local signposting may reduce the potential for local traffic and parking problems. This will have to be monitored and reviewed. 	3, 4, 6 & 8

Category	Key Issues	Response	See Chapter
	<ul style="list-style-type: none"> • Parking needs and possible congestion in the vicinity of the stations. • Accessibility to stations, particularly Kippa-Ring. • Rothwell Station should be included in Stage 2 implementation to service surrounding schools and for Deception Bay residents. 	<ul style="list-style-type: none"> • Issues of parking, security and noise around stations need to be addressed at detailed design stage. • Rothwell station may be required to improve service flexibility and reliability and needs to be considered as part of operational analysis prior to implementation. Also, development of Rothwell Station in Stage 2 could lead to transport supportive development in the area being promoted by Redcliffe City Council. 	
Environmental	<ul style="list-style-type: none"> • the potential impacts on waterways including: <ul style="list-style-type: none"> – Black Duck Creek; – Freshwater Creek; – Hays Inlet; and – Kangaroo Waterholes. • the potential impacts on aquatic and terrestrial flora and fauna, in the above mentioned areas. 	<ul style="list-style-type: none"> • EMP prepared to minimise water quality and flora and fauna impacts. • Reduced station and corridor footprint at Hays Inlet (Rothwell Station). • Fauna bridges to allow movement under the corridor at Kippa-Ring, Kallangur and all creek crossings. • Avoid Kangaroo Waterholes • Single span bridges to reduce in-stream impacts 	6 & 9
Security	<ul style="list-style-type: none"> • Personal and property safety in close proximity to the corridor, stations and parking facilities. • Increased pedestrian movement within and around local residential streets thus creating safety concerns. • Concern in relation to privacy and security around stations and in residential areas in closest proximity. 	<ul style="list-style-type: none"> • Stations and pedestrian and cycle paths will be designed and located where practicable to minimise potential nuisance generated from pedestrian, cycle and vehicle movement in local residential areas neighbouring stations. • Issues of security, accessibility and privacy to be addressed during detailed design stage. Crime Prevention Through Environmental Design (CPTED) principles will be used during the detailed design stage which will address issues of security and accessibility. 	3
Economic	<ul style="list-style-type: none"> • Flow on effects from the corridor may include new and improved residential, business and employment development. • Cost of fares should be capped if Private Sector involved. 	<ul style="list-style-type: none"> • Integrated Transport Implementation Strategy has been prepared to maximise the potential for land use and transport integration. • Corridor will be part of Citytrain network and fares will be commensurate with other services. 	4

Environmental Management

An Environmental Management Plan (EMP) was prepared in response to the potential impacts that were identified through the environmental assessment. It is intended that this EMP(Planning) provide an indication of the types of mitigation measures to be undertaken to minimise the identified environmental impacts and to guide the production of more detailed EMPs for the detailed design, construction and operation phases of the project.

Conclusions and Recommendations

The Petrie to Kippa-Ring Public Transport Corridor was identified in the IRTP as a Brisbane Metropolitan strategic opportunity to improve public transport services in this rapidly growing part of the northern metropolitan area.

Detailed analysis has indicated that a rail corridor following the original preserved alignment has been demonstrated as economically viable if implemented immediately. Viability of the corridor is expected to improve over time as further population growth in the area occurs.

Construction and operation of the proposed heavy rail line along the Petrie to Kippa-Ring Public Transport Corridor has a number of potential environmental, social and economic impacts. These impacts can be mitigated through addressing the issues and strategies identified.

On the basis of these investigations, the primary conclusions and recommendations of this study are that:

1. *The existing, preserved corridor (Option A) should be developed for heavy rail and should include six stations at the nominated locations;*
2. *Implementation of the corridor should occur in three stages as follows:*
 - Stage 1: Immediate commencement of enhancements to the existing public transport line haul service, during the 3 to 4 year lead time required for the detailed design and construction of the corridor.*
 - Stage 2: Implementation of the corridor by Year 2007, through introduction of a single track (with passing loops) between Petrie and Kippa-Ring.*

All Station except Kinsellas Road to be provided as part of Stage 2, with the introduction of the Rothwell Station conditional upon planning and development initiatives for transit supportive development in the area.
 - Stage 3: Upgrade of the Corridor by Year 2025 by duplication of the track, addition of the Kinsellas Road Station and additional service enhancements.*
3. *The detailed design stage of the project should proceed.*
4. *The development of the Petrie to Kippa-Ring Public Transport Corridor will have manageable environmental, social and economic impacts.*
5. *Mitigation measures and additional studies identified in Section 8 and the preparation of comprehensive EMPs for design, construction and operation based on the recommendations in the EMP (Planning) (Section 9) should be implemented in full.*

It should be noted that the cost estimates used will be reviewed by Queensland Transport and may be subject to change. Any changes in the estimated costs for the project may also influence recommendations related to the staging and timing of the project.