Airport Link

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Request for Project Change

MAY 2008

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Queensland Government

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Contents

Executive Summary

Airport Link – EIS & Reference Project

The Coordinator-General's Report on the Environmental Impact Statement for the proposed Airport Link Project was issued in May 2007, in accordance with the requirements of the *State Development and Public Works Organisation Act 1971*. The report presented the findings of the Coordinator-General's evaluation of the EIS and recommended that the Airport Link Project described in the EIS and the Supplementary Report proceed subject to the recommendations and the conditions provided.

The Airport Link Project is a system of road tunnels connecting the Inner City Bypass and North South Bypass Tunnel at Bowen Hills in the south, with Gympie Road and Stafford Road at Lutwyche and Kedron in the north-west, and with Sandgate Road and the East West Arterial at Clayfield in the north-east. The Project would convey three lanes of traffic north-bound from Windsor and three lanes south-bound in parallel tunnels and then two lanes of traffic east-bound from Lutwyche and two lanes west-bound from Clayfield in parallel tunnels. Connections with the surface road network would be established at Windsor and Bowen Hills in the south, at Lutwyche and Kedron in the north-west and at Clayfield in the north-east.

The tunnel system would be supported by an extensive system of integrated measures including in-tunnel safety including fire protection, monitoring systems for incidents and pressurised cross-passage safety exits at 120 metre intervals; smoke extraction; tunnel ventilation and elevated ventilation outlets at Windsor, Kedron and Clayfield; and toll-road control and management. Ancillary facilities include maintenance vehicle facilities, traffic management and air quality management and tolling facilities.

The tollroad control centre would be provided at Kedron, on land bounded by Stafford Road and Clarence Road, and would support project operations for tolling, traffic management, ventilation system management, fire and life safety management, and general maintenance.

Implementation of the Airport Link Project

As recognised in the Coordinator-General's Report, it was intended that the process of delivering the Project in partnership with the private sector would encourage project solutions that are innovative and lead to design improvements over the 'Reference Project' as described in the EIS. The Coordinator-General recommended that the request for tender for the Airport Link Project seek innovation aimed at further mitigation of the risk of impact of the Project in a manner that also complies with the safety, reasonable cost, traffic accessibility and flood impact objectives of the Project.

The Coordinator-General's Report specifically recommended innovation aimed at further mitigating the risk of potential visual, and private property impacts of the ventilation stations and outlets, as well as applying particular criteria in developing the concept design for connections to the road network at the tunnel portals.

City North Infrastructure Pty Ltd is a company, wholly-owned by the Queensland Government, established to manage the procurement of Airport Link and Northern Busway (Windsor to Kedron) on the State's behalf. The Queensland Government, through City North Infrastructure Pty Ltd, issued a Request for Proposals to finance, construct and operate the Airport Link Project and received proposals in December 2007.

Following a process of evaluation, the State has identified a preferred proposal offered by BrisConnections Pty Ltd ("BC") for Airport Link which generally is similar to the Reference Project but incorporates a number of significant improvements or innovations, in response to the request for innovation. This proposal, incorporating the changes to the Reference Project, is referred to in this document as the "Changed Project".

BC has responded to the request for innovation, which has led to improvements in design, which have led to changed impacts both in terms of location and scale. This Request for Project Change identifies the changes from the Reference Project, the reasons for the changes and their effects.

Process for Evaluation of Changed Project

The evaluation for the Reference Project was conducted by the Coordinator-General under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The SDPWO Act provides the process for the Coordinator-General to evaluate changes to significant projects.[1] The State of Queensland, as proponent, has asked the Coordinator-General to evaluate a proposed change to the Airport Link Project in accordance with the SDPWO Act.

Description of the Changed Project

The Changed Project (refer **Figures 1, 2, 3, and 4**) retains the key features and function of the Reference Project, to:

- connect with the Inner City Bypass, North South Bypass Tunnel (NSBT), and with the inner city at Bowen Hills;
- connect with Gympie Road and Stafford Road in Kedron and with Lutwyche Road at Lutwyche in the north-west, and provide some relief to traffic congestion on key roads in the inner northern suburbs;
- connect with Sandgate Road and the East West Arterial, and with the north-eastern suburbs at Clayfield;
- continue to support the implementation of the Northern Busway Project within the same corridor between Windsor and Lutwyche / Kedron and at the same time as Airport Link;
- provide opportunities for pedestrian and cycle connectivity in the inner northern suburbs, and connect with existing pedestrian and cycle facilities as well as those to be delivered as part of the NSBT.

Changes to the project

The changes to the Reference Project are summarised as follows:

- changes in the connections with the surface road network at Windsor / Bowen Hills, Lutwyche / Kedron and at Clayfield to achieve more efficient traffic flows from the surface road network to and through the Changed Project, and to reduce the impacts of the infrastructure on the surface at Kedron and Lutwyche. These changes would result in some of the ramps to the surface road

[1] Part 4 Division 3A *State Development and Public Works Organisation Act 1971*

network being constructed underground beneath Kedron Brook and Lutwyche in the vicinity of the Wooloowin State School and St Andrew's Anglican Church;

- changes in the alignment of the mainline tunnels to accommodate more efficient connections in the north-west, while achieving more efficient and more certain construction conditions in better ground through Lutwyche and Wooloowin. These changes would result in the mainline tunnel alignments moving east and south in a sweeping arc between Lowerson Street Lutwyche and Park Avenue Wooloowin;
- minor changes in the location of the ventilation stations at Kedron and Windsor to reduce the visual impact of the facilities, and the partial burial of the ventilation station at Windsor and complete burial of the ventilation station at Clayfield to reduce the visual impact of each of these buildings;
- relocation of the tunnel control centre to a site at the corner of Stafford Road and Clarence Street, Stafford to allow improved access to the Changed Project tunnel system.

Effects of Changes to the Project

The operating Changed Project would achieve the objectives of the Reference Project while delivering enhancements in network performance, urban amenity at Lutwyche and Kedron, and reduced impacts at Bowen Hills compared to the Reference Project.

Changes in traffic flows on surface roads and in Airport Link

The EIS Airport Link traffic model was updated and used to consider the effects of the Changed Project on the same basis as in the EIS. The updated model, based on updated assumptions about population and demography, employment and network enhancements, shows that the Reference Project would now be predicted to carry more traffic than forecast for the EIS. The updated analysis shows that the "without Airport Link" scenario would result in additional congestion of the road network to that reported in the EIS.

The updated Airport Link traffic model, was applied to consider the effects of the Changed Project. This modelling indicates that the potential traffic flows for the Changed Project are similar to, but higher than, the Reference Project. This is due to the predicted increase in travel demand resulting from the updated demographic forecasts and base network connectivity, as well as the more efficient configuration of the surface connections incorporated into the Changed Project compared to the Reference Project. The strategic network performance benefits of the Changed Project would be similar to the Reference Project.

Urban design and urban amenity

The Changed Project would respond to the Coordinator-General's recommendations at Bowen Hills by a rearrangement of the connections with the Inner City Bypass and the inner city. This design response would relocate the ramps at O'Connell Terrace to a new elevated structure off Bowen Bridge Road north of Butterfield Street.

This change would improve the amenity for residential premises in Bowen Hills, namely The Mews apartments, which would have been adversely affected by the Reference Project.

The Changed Project would lead to changed access arrangements for the residential community of Windsor East. Federation Street would be closed to traffic west of Morris Street, with alternative access being

provided by an extension of Gallway Street to intersect with Lutwyche Road. This intersection would accommodate left-in and left-out manoeuvres as well as right-turns north-bound.

The proposed changes to the Reference Project at Lutwyche and Kedron would result in an enhancement to the urban design outcomes over the Reference Project in that many of the connections with the surface road network would now be provided via a system of underground ramps and less-intrusive portals on Stafford Road and Gympie Road. The Changed Project would result in a reduced impact on the urban amenity for the residents of Lutwyche west of Lutwyche Road.

The ventilation outlet at Clayfield would be reduced in height from 30 metres to 25 metres to address the Coordinator-General's recommendation for reduced visual impact on the surrounding residential area. This change is in response to community concerns expressed in submissions to the Coordinator-General and would assist in reducing the visual impact of the ventilation outlet for nearby residential areas compared with the Reference Project.

The complete burying of the ventilation station and the provision of landscaping across the portals west of Sandgate Road would provide further reduction of impacts compared to the Reference Project. The burying of the ventilation station would avoid the visual impacts imposed by the scale and bulk of the facility described in the Reference Project.

The proposal to partially bury the ventilation station at Windsor would reduce the visual impact of that building on the landscape setting of Windsor East and Mann Park.

Air quality

The proposed change to the location of the Windsor ventilation station and ventilation outlet some 50 metres to the south-east would be of little significance in terms of changed impacts on ambient (outdoor) air quality. The proposed reduction in height of the Clayfield ventilation outlet would result in minor changes in air quality outcomes while remaining well within the goals established in the Coordinator-General's conditions for ambient air quality. The Changed Project would allow for improved air quality outcomes through the innovative use of a variable aperture on the Clayfield ventilation outlet.

There are no changes to the ventilation system which would lead to changes in air quality outcomes in the operation of Airport Link.

The changed traffic flows on major roads in the study corridor also are not expected to lead to significant differences in air quality.

Noise

Acoustic modelling for the changes in the surface connections indicates that:

- in some locations, such as for The Mews apartments and surface roads likely to experience reductions in traffic flows, the acoustic environment would be improved over the Reference Project; and
- in some locations, there would be a need for enhanced acoustic treatments to achieve the environmental objectives established in the Coordinator-General's conditions (e.g. the transition structure from Sandgate Road to the mainline tunnel (west-bound) between Clayfield and Lutwyche).

These local issues would be resolved through detailed design of the connections and the noise barriers to be incorporated into the structures.

There would be no change to the acoustic environment arising from the ventilation stations and ventilation outlets.

Hydrology

The proposed changes to the Reference Project for the crossings of Enoggera Creek are not expected to lead to different outcomes in terms of flood risk upstream of the works. Detailed design and modelling for the bridge structures and supports within the Enoggera Creek floodplain indicate there would be no worsening of impacts from flood events as a consequence of the Changed Project.

There are no changes to the Reference Project proposed in the Kedron Brook catchment which would lead to increased flood risk in the operational phase of the Changed Project. Detailed design for the Changed Project allows the Stafford Road tunnel portal to intercept overland flows in greater than 1 in 100 ARI events to avoid impacts on adjoining properties. Flows entering the tunnel in such circumstances would be managed within the tunnel drainage system.

The proposed changes to the alignment of the mainline tunnels, and the method of construction proposed for the connections with the surface ramps, through Lutwyche, would involve a managed approach to groundwater drawdown. A comprehensive groundwater monitoring system is proposed for these 'drained' sections of tunnel, which when combined with the removal and treatment of drainage waters is considered to be a cost-effective and practical approach for the location.

Cultural heritage

Since the EIS and the Coordinator-General's evaluation report for the Reference Project, Kalinga Park has been listed in the Queensland Heritage Register. A larger area of Kalinga Park would be included in the north-eastern worksite than would have been required for the Reference Project. As a result of the listing, an application for development by the State was made to the Queensland Heritage Council. On 23 January 2008 the Queensland Heritage Council recommended that the proposed works in Kalinga Park proceed, subject to conditions which are achievable for the Changed Project.

In addition to the impacts predicted for the Reference Project, the Changed Project would require the removal of "Nyamber" at Windsor, a place included in BCC's local heritage register. Archival recording of "Nyamber" is recommended prior to the commencement of any works that would affect the premises.

Cumulative effects

The strategic features and functionality of both Airport Link (Changed Project) and Northern Busway in the Changed Project generally would be as described in the EIS. The incremental effects of the Northern Busway, compared to the combined modelling, would be similar to those outlined in the EIS.

The Queensland Government is also procuring from BC a new fly-over road at the East-West Arterial and Gateway intersection ("the Airport Roundabout Upgrade Project"). The Airport Roundabout Upgrade (ARU) Project would provide improved connections to the Airport Precinct, the Gateway Motorway and the local road network and replace the existing intersection with a new four lane overpass and high capacity signalised intersection.

Current project scheduling has the ARU Project delivered in 2011.

Changes in Project Delivery Mode

Whilst the EIS assessed a construction method for the project, it was recognised that construction methods would have the potential to vary depending on detailed design and ground conditions. BC have proposed construction methods that differ from that described in the EIS as follows:

- construction of the mainline tunnels between Chalk Street and Kalinga Park with tunnel boring machines (TBMs) launching from Kalinga Park, Clayfield. Spoil from TBM construction would be transported from the Clayfield worksite by conveyor to a receiving facility at Brisbane Airport;
- a worksite at Chalk Street, to be shared with the Northern Busway Project, would be required for the removal of each of the TBMs in components;
- construction of the connecting ramps from Lutwyche and Kedron by a combination of cut and cover and roadheader methods, including cut and cover construction through and beneath Kedron Brook and beneath Lutwyche;
- construction of the mainline tunnels between Clayfield and Lutwyche at generally increased depths for TBM construction, and between Lutwyche and Windsor at generally reduced depths to facilitate accelerated construction at multiple faces by roadheader equipment;
- for spoil haulage, the use of alternative routes along arterial roads including Gympie Road, Rode Road, Sandgate Road and Toombul Road to form a northern haulage route, in addition to spoil transport by the proposed conveyor system and the use of the southern haulage route identified in the EIS (i.e. south along Lutwyche Road and then across to Kingsford Smith Drive via the local road network or via the Inner City Bypass); and
- the shared use of worksites with Northern Busway Project at Chalk Street and Truro Street to capture potential construction efficiencies and design improvements.

Effects of Changes in Project Delivery Mode

The construction methods for the Changed Project would be the same construction techniques proposed for the Reference Project. The locations in which these various construction techniques would be used is proposed to change in order to address design changes in the infrastructure and to achieve better construction efficiencies and environmental outcomes.

These proposed changes would be undertaken in accordance with the Coordinator-General's conditions for the construction phase including but not limited to those relating to environmental management and community engagement.

The opportunity to transport spoil from the Clayfield worksite by conveyor to the Brisbane Airport would limit increases in the movement of heavy vehicles through the Airport Roundabout and the Nudgee Road – East West Arterial intersection, as well as permitting the construction phase to proceed without undue constraints imposed by traffic congestion at those intersections. . This spoil transport system would also relieve the communities of Clayfield and Hendra of the potential impacts of spoil handling and transport from a road haulage approach to TBM spoil. The design, construction, operation and decommissioning of the conveyor system would require careful management to ensure there would be no impacts on matters of Commonwealth or State interest. The establishment and operation of a conveyor system would require a range of approvals from both the Commonwealth and the State.

Construction worksites

The Changed Project would require changes to the worksites at Windsor, Kedron and Clayfield to achieve efficiencies in construction and overall project delivery over those anticipated for the Reference Project.

The worksite at Windsor would be enlarged to include land north of Federation Street for construction of the southern portals in cut and cover, and to include areas off McDonald Street for workforce car parking. There would also be a increase in the Northern Busway worksite on the western side of Lutwyche Road on Enoggera Creek to accommodate Airport Link works.

A worksite at Truro Street proposed for Northern Busway works would be expanded and shared with Airport Link works to accelerate the construction programme for the mainline tunnels beneath Lutwyche Road. This would result in spoil from Airport Link works being removed by truck from this worksite.

The worksite established at Chalk Street for the Northern Busway would be expanded to receive, disassemble and remove the TBMs, in components, from the mainline tunnels driven from the Clayfield worksite. The scale of the Chalk Street worksite would increase, requiring effective mitigation measures to address the potential impacts of TBM disassembly and removal. There would be a small quantity of spoil removed from this worksite for Airport Link works, arising from TBM break-through and worksite establishment.

The Kedron worksite would be reconfigured by the change in much of the works to underground works. The worksite at the Department of Emergency Services campus north of Gympie Road would be reduced in area and used mostly for workforce car parking and some lay-down of materials and equipment. The worksite along Gympie Road and Lutwyche Road would move more to the west of those roads, towards Kedron Brook. The interface with the Lutwyche residential areas north of Norman Avenue would continue to be managed with a range of effective mitigation measures including physical barriers and construction management procedures.

Traffic management on the surface roads around the worksites at Kedron would continue similar to the Reference Project to ensure daily traffic movements could be maintained with the least disruption possible. The relocation of bus stops to maintain important public transport services through this area would be carefully managed and communicated to commuters.

The Clayfield worksite would be enlarged for the assembly and launching of two TBMs from Kalinga Park, via deep cut and cover chambers constructed beneath Sandgate Road and the North Coast Railway. The worksite east of Sandgate Road would be as for the Reference Project but with increased spoil handling capacity to support the operation of the TBMs linked to the spoil conveyor system extending to the east near the Airtrain to the Brisbane Airport. Surface works in Kalinga Park would be more extensive, but would also be completed with rehabilitation of Kalinga Park commencing approximately two years earlier than for the Reference Project.

Construction noise and vibration

For the Changed Project construction of the mainline tunnels between Lowerson Street Lutwyche and Park Avenue Wooloowin would be generally at greater depths than for the Reference Project. Regenerated noise and vibration impacts from TBM construction of this section are expected to be within the goals established in the Coordinator-General's conditions. However, on-going monitoring would be used to ensure community life can be maintained while construction proceeds.

The construction by a variety of methods of the ramps connecting with the mainline tunnels at Lutwyche would carefully managed to avoid disturbance due to regenerated noise. A range of mitigation measures are available to ensure the Coordinator-General's conditions are satisfied.

The construction of the mainline tunnels between Windsor and Lutwyche generally would be at reduced depths compared with the Reference Project and would still be undertaken primarily by roadheader methods. Again, careful management accompanied by early and on-going consultation with the community would be required to reduce the impacts of regenerated noise in some locations along this section of the route.

The proposed changes to the worksites would require effective mitigation of construction noise from surface works. Predictive modelling indicates that in most cases construction noise would meet the goals. However, for spoil haulage from the Windsor worksite through residential streets, mitigation of noise may be required to meet the goals. Early and on-going consultation with the community would be support the design and implementation of noise mitigation measures.

Spoil handling, management and transport

Construction of the Changed Project would increase the overall quantity of construction spoil by approximately 20% as a consequence of achieving the enhanced urban outcomes on the surface at Kedron and Lutwyche. The Changed Project would bring an innovative response to spoil transport for the TBM spoil with the proposed spoil conveyor from the Clayfield worksite to Brisbane Airport. This conveyor system would handle all spoil from the mainline tunnels constructed by TBM between Chalk Street Lutwyche and Clayfield. Also, some of the cut and cover spoil at Clayfield could be removed by conveyor, with the balance being removed by truck.

The conveyor would be designed to meet the Coordinator-General's conditions with regards noise, dust, night lighting and would be designed and constructed to minimize visual and flooding impacts along the Kedron Brook corridor. The conveyor system would also be designed and constructed to meet community safety needs and project security needs..

The Changed Project would seek to remove some spoil haulage transport from the primary route identified in the Reference Project along Lutwyche Road, Montpelier Road, Breakfast Creek Road and Kingsford Smith Drive to the Brisbane Airport or the Port of Brisbane. An alternative northern route including arterial roads such as Gympie Road, Rode Road, Sandgate Road, Toombul Road would be used to access the Gateway Motorway for either the Brisbane Airport or the Port of Brisbane.

In addition to the sites identified in the Reference Project, there are options to place spoil at a number of sites, including within land controlled by Brisbane Airport Corporation.

Cultural heritage

Cultural Heritage Management Plans ("CHMPs") under the *Aboriginal Cultural Heritage Act 2003* have been signed for the Reference Project. Each CHMP includes a mechanism to enable the area of the CHMP's application to be extended to include any additional areas where surface disturbance may occur (and therefore Aboriginal cultural heritage may be put at risk) arising out of the Changed Project.

With the listing of Kalinga Park on the Queensland heritage register, works in Kalinga Park are subject to the Minister's decision on the recommendations by the Queensland Heritage Council on 23 January 2008.

Also, construction works involving either the Windsor School of Arts or "Nyamber" must be preceded by archival recordings of those places.

Cumulative effects

The Changed Project would be delivered at the time as several major projects in northern Brisbane. Of these projects, the Northern Busway and the upgrade to airport roundabout and Nudgee Road intersections (ARU Project) are most relevant.

As with the Reference Project, the Changed Project would be delivered at the same time as the Northern Busway Project along and beneath Lutwyche Road between Windsor and Kedron. The Changed Project would bring similar benefits to the Reference Project in terms of reduced construction impacts if delivered at the same time.

As Section 1 of the Northern Busway has commenced construction, and the Windsor to Kedron sections are to be delivered simultaneously with Airport Link, the Northern Busway has been included in the transport modelling for the Changed Project. The modelling results have been compared to the cumulative Airport Link and Northern Busway analysis from the EIS.

The cumulative impact of the Changed Project being constructed at the same time as the ARU Project was not considered in the EIS for the Reference Project. The cumulative impact would be managed through the following:

- traffic staging proposed for the ARU Project envisages building outside the existing roadway and once this is complete, switching traffic onto the new works, and building the flyover where the exiting traffic was. A long span bridge structure results in a small surface foot print for the flyover structure, allowing for simpler traffic staging;
- additionally, the majority of works are programmed to occur after completion of the Northern Access Road which is expected to reduce traffic on the Airport Interchange by 40%.

As a result of the above measures, the peak hour capacity of the Airport roundabout would not be affected.

Consultation and Submissions

In addition to any formal notification period of this Request for Project Change required by the Coordinator-General, the proponent proposes to undertake a consultation process consisting of:

- consultations with directly-affected property owners where the extent of the impact and the process for property acquisition, if any is required, is explained;
- consultation with stakeholders in the study corridor to explain the implications of the Changed Project for their interests in land and for their staff;
- community consultation about the Changed Project and the changes proposed, including community information sessions in the study corridor, provision of a visitors' centre from 22 May 2008, maintenance of a 1800 telephone inquiry service, a project website and a project technical website, and an email inquiry service.

The Coordinator-General requires formal public notification of this Request for Project Change, in accordance with the SDPWO Act. Any person may make a submission to the Coordinator-General about

the proposed changes to the approved Airport Link project during the period of public notification. Submissions to the Coordinator-General must:

- be made within the submission period;
- be in writing and signed by each person making the submission;
- state the name and the address of each person making the submission;
- state the grounds for the submission, and the facts and circumstances relied upon in support of those grounds;
- be received by the close of business on 30 June 2008.

The address for the making of submissions is:

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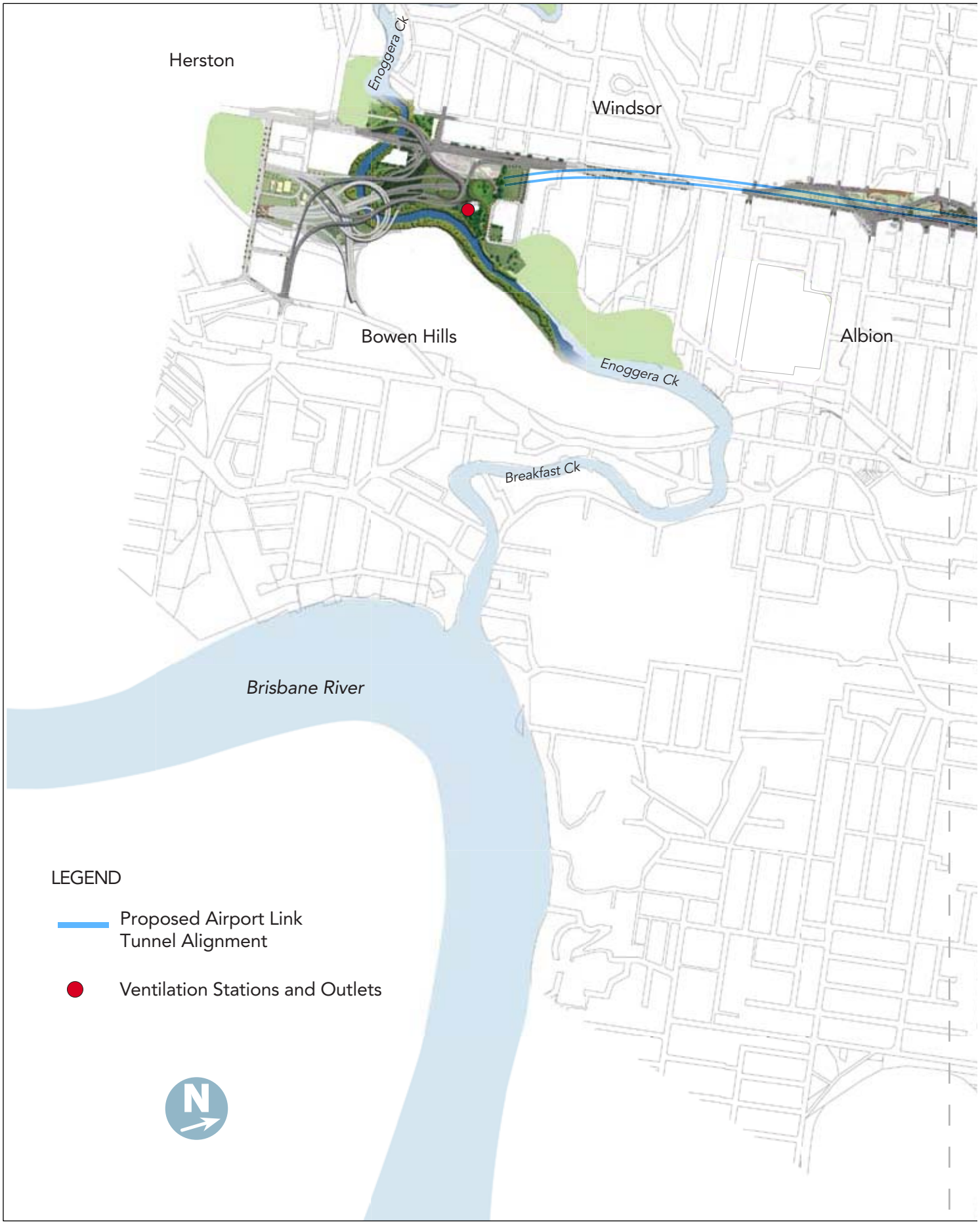
Herston
Enoggera Ck
Windsor
Bowen Hills
Albion
Enoggera Ck
Breakfast Ck
Brisbane River
LEGEND
Proposed Airport Link Tunnel Alignment
Ventilation Stations and Outlets
N

Figure 1

Airport Link Master Plan - **Changed** Project

Figure 2
Southern Connection Master Plan

Figure 3
North Western Connection Master Plan

Figure 4
North Eastern Connection Master Plan

1. Introduction

1.1 Airport Link

In May 2007, the Coordinator-General issued an evaluation report ("Coordinator-General's Report") in accordance with the SDPWO Act, recommending that the Airport Link Project proceed subject to a number of recommendations and conditions. The project to which the Coordinator-General's Report referred was described in detail in the environmental impact statement ("EIS") dated October 2006 and the Supplementary Report dated April 2007 ("the Reference Project").

1.2 Project Implementation and Change

The State of Queensland issued a Request for Proposals ("RFP") in June 2007, to finance, construct and operate the Airport Link Project and to construct and deliver parts of the Northern Busway Project. Proposals were received in December 2007. The State established City North Infrastructure Pty Ltd ("CNI") for the purpose of managing the procurement of both the Airport Link and the Northern Busway Projects.

As recognised in the Coordinator-General's Report, it was intended that the process of delivering the Project in a partnership with the private sector would encourage project solutions that are innovative and lead to design improvements over the 'Reference Project' as described in the EIS. The Coordinator-General recommended that the request for tender for the Airport Link Project seek innovation aimed at further mitigation of the risk of impact of the Project in a manner that also complies with the safety, reasonable cost, traffic accessibility and flood impact objectives of the Project.

Following a process of evaluation, the State has identified a preferred proposal offered by BrisConnections Pty Ltd ("BC") for Airport Link which generally is similar to the Reference Project but incorporates a number of significant improvements or innovations, in response to the request for innovation. This proposal, incorporating the changes to the Reference Project, is referred to in this document as the "Changed Project".

BC has responded to the request for innovation, which has led to improvements in design, which have led to changed impacts both in terms of location and scale. As required by the SDPWO Act, this Request for Project Change identifies the changes from the Reference Project, the reasons for the changes and their effects.

The Coordinator-General's Report specifically recommended innovation aimed at further mitigating the risk of potential visual, and private property impacts of the ventilation stations and outlets, as well as applying particular criteria in developing the concept design for connections to the road network at the tunnel portals.

The following key changes indicate the scope of how the Changed Project responds to the Coordinator-General's recommendations for innovation. Detail of the changes and their effects is provided in chapter 3.

Mitigating the risk of potential visual, and private property impacts of the ventilation stations and outlets.

- The ventilation station and outlet at Windsor would be relocated to the east of the Reference Project location. This enables the station to be partially buried within a hilltop landscaped mound over the cut and cover works and would effectively screen the bulk of the station from view. The smaller sub-station component and the ventilation outlet would be the only visible components.
- The ventilation station and outlet at Kedron Brook would be located to the north of the retained DES building that fronts Gympie Road enabling some integration of the new infrastructure with existing public buildings in this area of a similar scale.
- The ventilation station at Clayfield would be completely below ground level and the ventilation outlet reduced from 30m to 25m in height. The rehabilitated area over the ventilation station would provide parkland and connectivity for pedestrians and cyclists between Clayfield and Toombul.

Mitigating the risk of potential visual, noise, air quality and private property impacts of the construction worksite at Kedron.

- the proposed TBM construction extends further towards Lutwyche, with resulting reduced cut and cover tunnelling impacts at Kedron which would have benefits for Kedron State High School, DES site, St Andrew's Anglican Church, local residential amenity and impacts on the road network;
- the reduction to the surface construction required by the Reference Project along the eastern side of Lutwyche Road, reducing the effects of construction on Wooloowin State School.

Criteria in developing the concept design for connections to the road network at the tunnel portals.

a) Efficient connection to the local road network to provide enhanced access between the city centre and the motorway network, including Airport Link.

- The realignment of the O'Connell Terrace connections to and from Airport Link to Bowen Bridge Road and Lutwyche Road respectively provide for a more direct, efficient and legible connection to and from the city.
- The proposed on-ramp from Bowen Bridge Road would also provide grade separation to the Lutwyche Road northbound connections to the ICB and the NSBT providing greater efficiency than the controlled, at grade intersection in the Reference Project.
- The connecting ramps of the Changed Project would provide for more efficient grade separated access directly to and from Stafford and Gympie Roads.

b) Minimise, where reasonable and practicable, direct impacts (i.e. land resumption) on properties in the vicinity of the connections with the local road network.

- Properties within the Office Park area at the corner of Evans and O'Connell Terrace identified in the Reference Project as possibly being required for the proposed O'Connell Terrace access ramps would not be required by the Changed Project.
- Alignment changes to the ICB and Campbell Street connections from the Airport Link would reuse the NSBT structure and avoid impact on Queensland Rail's (QR) Mayne Rail Yards.
- The innovative approach taken to the Kedron connections replaces significant cut and cover works along Lutwyche Road and through the DES and Kedron State High School properties with driven

tunnelling to minimise direct surface property impacts, particularly to properties along the eastern side of Lutwyche Road and the DES and Kedron State High School lands.

c) *Minimise, or mitigate and manage potential for construction and design-related impacts on the Enoggera Creek, Kedron Brook and Schulz Canal riparian corridors including their ecological, visual and landscape values.*

- The use of the downstream NSBT bridge structure to access the ICB from Lutwyche Road, together with the realignment of the Airport Link connection to the ICB and Campbell Street, results in a significant reduction in the development footprint and the retention of approximately 300m^2 of mature mangroves along both banks of Enoggera Creek.
- The physical mass of the infrastructure proposed in the Reference Project above and across Kedron Brook would be reduced with the Changed Project.

d) *Minimise, or mitigate and manage potential for impacts such as road traffic noise, headlight glare, visual impacts and loss of privacy and aspect on existing sensitive land uses (e.g. The Mews apartments, Tufton Street apartments, Kedron State High School, Wooloowin State School and residences in Clayfield).*

- Alignment changes to the Southern Connection avoids the need for a double-stacked bridge adjacent to The Mews apartments, substantially improving amenity for the residents. The removal of the O'Connell Terrace ramps reduces the traffic and amenity impacts on The Mews.
- the impacts on The Mews apartments would be further reduced by the Changed Project relocating the Campbell Street on-ramp (north-bound) further to the north and east of the ICB.
- The Changed Project would allow for a separate drop off lane for Wooloowin State School and associated median and footpath landscaping which would further mitigate traffic road impacts from Lutwyche Road on the Wooloowin State School, and improve safety compared with the current situation.
- The undergrounding of connections at Kedron reduces the physical impacts on the playing fields at Kedron State High School and reduces the traffic and associated impacts at both Kedron State High School and Wooloowin State School.

e) *Maintain the potential for urban renewal and regeneration in Windsor, Bowen Hills and Kedron, and generally for a number of key sites i.e. Queensland Newspapers, Queensland Rail land at Bowen Hills and Mayne, RNA Showgrounds and Emergency Services at Kedron.*

- Access to the RNA showground (including temporary parking during the Brisbane Exhibition) and businesses on O'Connell Terrace would be maintained by retaining O'Connell Terrace as a suburban route, allowing continued local access for the future development of the RNA, consistent with the Urban Land Development Authority's Interim Land Use Plan for Bowen Hills.
- The removal of the bridge over the QR Mayne Rail Yards as proposed in the Reference Project reduces impacts on this facility.
- Alignment changes for the tunnels and infrastructure in the Kedron area would provide improved network functionality, including improved local network performance and pedestrian and cycle connectivity in this area. Further, the DES building is retained.

f) *Maintain opportunities for high quality urban design outcomes for both the proposed infrastructure and adjacent development sites.*

- The undergrounding of connections to the surface road network at Lutwyche and Kedron maintains the opportunity for surface connectivity between development sites and the proposed Lutwyche Busway station.

A coordinated approach should be taken to delivery of major transport projects in the inner northern suburbs of Brisbane, including the Airport Link, Northern Busway and NSBT projects

- The State has advanced procurement of and coordination with the construction of the Northern Busway to be constructed at the same time as Airport Link, which would minimise the duration of construction impacts over both projects.
- The State has also advanced procurement of the Airport Roundabout Upgrade Project to address traffic congestion at the intersection of the East West Arterial and Gateway Motorway;
- BC are seeking access to NSBT construction areas before NSBT becomes operational to reduce potential construction impacts on the commencement of NSBT operations.

1.3 Airport Link (Reference Project) – Description

The Coordinator-General's Report describes the Reference Project as '*The Airport Link Project comprises two parallel road tunnels and associated surface connections. The Project has a southern connection with the Inner City Bypass, North South Bypass Tunnel (under construction), the City via O'Connell Terrace and Campbell Street between Bowen Hills and Windsor and to Fortitude Valley via Campbell Street. The Project has a north-western connection at Kedron, allowing access to and from Gympie Road and Stafford Road in the north. The Project also has a north-eastern connection at Clayfield where access would be provided to and from Sandgate Road and the East-West Arterial.*

The alignment has a total length of approximately 6.7km, of which approximately 5.7km would be constructed in-tunnel. Between the southern and north-western connections, each tunnel would accommodate three traffic lanes. Between the north-western and north-eastern connections, each tunnel would accommodate two traffic lanes. Dedicated break-down bays would not be provided within the tunnels, as there would be sufficient room to pass a stationary vehicle safely, at an appropriate speed, with the configuration proposed.

Surface road changes will be required to effect transport access in the areas connecting to the tunnel. At the southern portal these connection works will be significant (including elevated structures) to allow for connection to the Inner City Bypass, the North South Bypass Tunnel, Campbell Street and O'Connell Terrace. Surface connection modification and upgrades will also be required at both the north-eastern and north-western connections, principally involving major works to Stafford Road, Gympie Road and Lutwyche Road at Kedron and Sandgate Road and the East-West Arterial at Clayfield.

Supporting infrastructure for tunnel operations will include in-tunnel safety systems (fire protection and monitoring systems and pressurised cross passage safety exits provided at 120 metre intervals which link the main tunnels), a ventilation system that will manage in-tunnel air quality and include elevated ventilation outlets in Bowen Hills, Kedron and Clayfield. This ventilation system seeks to negate release of emissions from the mainline tunnels at the exit portals. Integral components include ventilation stations for the extraction fans and elevated ventilation outlets for high level dispersion of vitiated air from the tunnels.'

The above description applies to the Changed Project with the exception of the removal of the O'Connell Terrace ramps which are replaced by direct connections to Lutwyche Road, and the length of tunnel which, for the Changed Project would be approximately 5.3km, compared with approximately 5.7km for the Reference Project.

A complete description of the Reference Project is available in the Airport Link EIS[2].

1.4 Process for Evaluation of Project Change

The evaluation of the Reference Project by the Coordinator-General was carried out under Part 4 of the *State Development and Public Works Organisation Act 1971* (Qld) ("SDPWO Act"). The Coordinator-General's Report[3] states "*To the extent that a revised design is selected as the preferred configuration through the bidding process, the Proponent will need to provide the Coordinator-General with a Request for Project Change*". The SDPWO Act provides the process for the Coordinator-General to evaluate changes to a significant project, previously the subject of an evaluation report.

The steps to be followed, as set out in Part 4 Division 3A of the SDPWO Act, in identifying, assessing and reporting on the proposed changes to the Reference Project are:

- The Proponent gives the Coordinator-General written notice requesting evaluation of the proposed change. The written notice must include a description of the proposed change and its effects on the project, the reasons for the proposed change and information to allow the Coordinator-General to make the evaluation. This report fulfils that obligation;
- The Coordinator-General may then:
  - refer the details of the proposed change to anyone the Coordinator-General considers may be able to assist in making the evaluation;
  - ask the Proponent for further information about the proposed change, its effects on the project or any other related matter;
  - require the Proponent to publicly notify the proposed change and its effects on the project.
- The Coordinator-General must evaluate the proposed change, considering all properly made submissions, the nature of the change and its effects on the project, the project as evaluated under the Coordinator-General's report for the EIS for the project, the environmental effects of the change and its effect on the project; and
- The Coordinator-General must prepare a 'Change Report' that evaluates the effects of the proposed change and may state such conditions as are necessary to address the impacts of the proposed changes. The Change Report must be given to the Proponent and must be publicly notified.

The Coordinator-General's Evaluation Report for the EIS and the Change Report both have effect for the project, however the Change Report prevails to the extent of any inconsistency.

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[2] www.airportlinkeis.com.au

[3] Coordinator General's Report on the Environmental Impact Statement for the proposed Airport Link Project, May 2007.

1.5 Relationship with other projects

1.5.1 The Northern Busway

Consistent with the Coordinator-General's recommendations to consider opportunities for minimising the impacts of both projects occurring in the same corridor, the State has advanced the procurement of stages of the Northern Busway to be constructed with Airport Link.

The Northern Busway (Herston to Kedron) is being delivered for TransLink as part of Queensland Transport ("QT") and is proceeding through a separate assessment process. The first stage, at Herston (Royal Brisbane Hospital to Windsor), is already under construction.

The State has approved the delivery of the stages of the Northern Busway between Windsor and Kedron to be procured under a design and construct arrangement from BC at the same time as the Airport Link Project.

1.5.2 Airport Roundabout Upgrade Project

The Queensland Government is also procuring from BC a new fly-over road at the East-West Arterial and Gateway intersection ("the Airport Roundabout Upgrade Project"). The main features of the Airport Roundabout Upgrade Project are:

- providing improved connections to the Airport Precinct, the Gateway Motorway and the local road network;
- widening of the East-West Arterial Road to three traffic lanes in each direction to join with the extension of the Changed Project east of Melton Road;
- replacing the existing Gateway Motorway overpass with a new four lane overpass;
- replacing the existing roundabout with a high capacity signalised intersection;
- constructing a new four lane bridge linking the East West Arterial and Airport Drive over the Gateway Motorway overpass; and
- surface road improvements to Airport Drive.

This intersection upgrade would address traffic congestion at the existing Airport Roundabout, and forecast future traffic conditions. It is intended that the Airport Roundabout Upgrade Project would be delivered in parallel with the Changed Project.

The Airport Roundabout Upgrade Project will be subject to a separate assessment and approvals process, consistent with the standard assessment approach to the upgrading of intersection infrastructure on the State road network.

1.6 Consultation

The Coordinator-General found that the public information and consultation undertaken throughout the EIS process for the Reference Project was extensive, and adequate for the purpose of informing the community

about the Reference Project and measures aimed at mitigating the potential impacts of the project[4]. Many of those activities were jointly undertaken or coordinated with public consultation on the Northern Busway project to inform the community about the potential cumulative impacts of both projects in the same corridor.

In support of the Request for Project Change, the proponent is facilitating a range of agency and community information processes on the Changed Project, both before and during any notification period required by the Coordinator-General. Public consultation on the Changed Project would also be coordinated with consultation for the Northern Busway and the Airport Roundabout Upgrade Project.

Consultation has commenced and includes:

- Consultation with property owners who would be directly affected by the Changed Project by either a full or partial acquisition of their land, noting that property owners who would be affected by a volumetric acquisition would be consulted over a period of time extending beyond the Request for Project Change process;
- a series of community and Government Agency information sessions for interested parties to inspect displays and to discuss the proposed changes with project staff;
- visits to directly-affected property owners and residents;
- establishment of a visitor display centre from 22 May 2008.

If the Coordinator-General requires formal public notification of this Request for Project Change, in accordance with the SDPWO Act, any person may make a submission to the Coordinator-General about the proposed changes to the approved Airport Link project during the period of public notification. Submissions to the Coordinator-General must:

- be made within the submission period;
- be in writing and signed by each person making the submission;
- state the name and the address of each person making the submission;
- state the grounds for the submission, and the facts and circumstances relied upon in support of those grounds.

The address for the making of submissions is:

EIS Project Manager–Airport Link Project
Infrastructure and Economic Development Group
Department of Infrastructure and Planning
PO Box 15009 City East QLD 4002
fax +61 7 3225 8282

[4] Coordinator-General's Report, May 2007, p9.

2. Changes to Airport Link Project

The proposed changes to the Reference Project include improvements to the construction methodology, more efficient surface connections, refinement of some aspects of design to coordinate construction with the Northern Busway, and improved traffic performance for the Airport Link and connections with the surrounding network. These project changes are detailed below, together with the reasons for the changes.

2.1 Design Changes

The proposed design changes to the Reference Project **Figure 2-1** are shown generally in Overall Route Plan **Figure 2-2**, and are:

- physical changes to the surface road connections and interchange alignments at Bowen Hills and Windsor to improve their efficiency, reduce impacts on The Mews apartments compared to the Reference Project, provide for better use of existing infrastructure and mitigate impacts on the riparian corridor of Enoggera Creek and the Queensland Rail infrastructure, as follows:
  - relocation of the O'Connell Terrace on-ramps adjacent to The Mews apartments to a ramp structure off the north-bound lanes in Bowen Bridge Road, north of Butterfield Street, providing an elevated crossing over Lutwyche Road to the north bound mainline Airport Link tunnel. The elevated ramp would also provide grade separated access to the NSBT and the ICB replacing the controlled right hand turn movement from Lutwyche Road proposed in the Reference Project and utilising the downstream NSBT bridge to access the ICB;
  - relocation of the O'Connell Terrace off-ramps by a tunnel portal surfacing in the centre of Lutwyche Road to the north of the intersection with Northey Street. The tunnel exit from the southbound lanes of the mainline tunnel crosses over the northbound mainline tunnel near Newmarket Road and requires a consequential extension of the south-bound cut and cover portal through Federation Street to achieve necessary grades. Land would be required between Federation Street to the northern end of Morris Street. Access to Windsor East would be provided through an extension of Gallway Street to Lutwyche Road;
  - realignment of the northbound Campbell Street elevated ramp to the north to provide greater separation from The Mews apartments and to remove the Reference Project requirement for a double stacked crossing of Enoggera Creek with the ICB connection;
  - realignment of the southbound Campbell Street and ICB connection to pass over the circular NSBT elevated connections, immediately downstream of the NSBT bridge across Enoggera Creek. The proposed bridge alignment would replace the downstream crossing of Enoggera Creek near Mann Park and through the Queensland Rail (QR) Mayne Rail Yards proposed in the Reference Project;
  - changes to the connections and lane configurations with the surface road network and with the NSBT;
- changes to the north-south tunnel alignments including a shallower vertical alignment in order to improve tunnel gradients and shorten the construction program by enabling construction access from a new Truro Street worksite to be shared with the Northern Busway;

- relocation of the southern ventilation station to a site approximately 50m to the east of that indicated in the Reference Project, over Byrne Street to accommodate the changed connections described above. The relocation also enables the station to be partially buried into a proposed "landbridge" connecting Mann Park to Lutwyche Road;
- the east-west driven tunnels would be realigned and generally at greater depth than the Reference Project to avoid construction of the mainline tunnel by cut and cover along Lutwyche Road through the DES site and Kedron State High School land as proposed in the Reference Project, and simplify the surface traffic arrangements and improve visual amenity and urban amenity at the surface. The realignment would be in an arc to the east and south of the Reference Project alignment between Lowerson Street Lutwyche and park Avenue Wooloowin, passing at depth beneath Wooloowin State School and Melrose Park;
- elements of the surface infrastructure proposed by the Reference Project at Kedron would be constructed underground to reduce infrastructure at the surface, reduce construction impacts and to improve connectivity to the local road network, and would include:
  - connecting ramps constructed in driven tunnel located under Wooloowin State School and areas between Eveleigh Street and Kedron State High School to link with large Y-junctions with the mainline tunnels and merge with cut and cover works across Lutwyche Road and across Kedron Brook, east of Gympie Road;
  - physical changes to the surface road layout at Kedron with tunnel connections directly from Stafford Road and Gympie Road replacing surface lanes and elevated structures across Kedron Brook. This would improve the efficiency of the intersections, reduce the visual impact and scale of the surface connections, and improve pedestrian and cycle connectivity under the Kedron Brook bridge;
- rearrangement of Lutwyche Road to provide a school drop-off and collection area adjacent to Wooloowin State School to improve safety from the present situation;
- rearrangement of the surface interchange at Clayfield with shorter connection ramps to and from Sandgate Road, an open portal west of Sandgate Road in line with the southern on-ramp, and a land-bridge providing greater pedestrian and cycle connectivity from the south through the rehabilitated parkland;
- reconstruction of Sandgate Road north of the intersection with the East West Arterial to raise the pavement by 600mm to 800mm to improve flood immunity for Sandgate Road;
- in response to the Coordinator-General's conditions to reduce the impact of ventilation outlets, changes to the ventilation station and outlet have been made as follows:
  - the Clayfield ventilation station building would be buried at the same location as in the Reference Project to improve pedestrian and cycle access to the rehabilitated parkland. The electricity sub-station would be an above-ground two-storey structure on additional land to the south of the ventilation station;
  - reduction in the height of the ventilation outlet at Clayfield to 25m compared to the Reference Project height of 30m to reduce the visual impacts. The air quality goals established by the Coordinator-General's conditions would be readily achieved through the innovative use of variable apertures in the lowered ventilation outlet;

- relocation of the Kedron ventilation station to the north of the DES building which would be retained. The ventilation station would be visually screened from the south by the DES building;

- establishment of a fire water compound, including water tanks, pump building and fire truck hardstand on land on the northern side of Wongara Street and its intersection with Sandgate Road;
- relocation of the tollroad control centre to a site at the corner of Stafford Road and Clarence Street, Stafford from the Reference Project site at the DES campus at Kedron, to allow improved access to the Changed Project tunnel system;
- there would be changed requirements for property for both surface and volumetric acquisitions to accommodate the design enhancements for the Changed Project. In some localities, such as Windsor East, Gordon Park and Clayfield, there would be increased surface property acquisitions whereas in other localities such as Lutwyche and Wooloowin, there would be changed volumetric acquisitions.

2.2 Delivery Changes

The Changed Project includes a number of innovations in project delivery, including construction of the east-west tunnels by launching two tunnel boring machines (TBMs) from Kalinga Park to an extraction point near the Lutwyche shopping centre at Chalk Street, common with the north-south tunnels constructed with roadheaders. In effect, the mainline tunnels would be a continuous driven tunnel from Bowen Hills to Clayfield, creating a shorter total length of approximately 5.3km compared with the Reference Project of approximately 5.7km.

The Kedron connection is proposed as a cut and cover tunnel under Kedron Brook, with entry and exit ramps constructed underground by roadheader to and from the mainline tunnels.

The changes to project delivery, including construction methodology, would include:

- launching two TBMs from the Clayfield worksite to drive westwards towards an extraction point at Chalk Street Lutwyche. This would extend TBM construction further to Lutwyche, with reduced cut and cover tunnelling impacts at Lutwyche and Kedron. The impacts of the Reference Project on Kedron State High School, DES site, St Andrew's Anglican Church, and the residential area west of Lutwyche Road would be reduced;
- a reduction to the surface construction required by the Reference Project along the eastern side of Lutwyche Road, would reduce the effects of surface construction works on Wooloowin State School;
- spoil from the west-bound TBM tunnel construction to be removed from the Clayfield worksite, with direct access to the arterial road network, resulting in reduced impacts for spoil haulage across the road network;
- the opportunity for spoil haulage from the TBMs to placement sites via a conveyor, which would reduce spoil haulage traffic by about 80,000 spoil haulage truck movements on the road network;
- a reduction in the duration of impacts at Kalinga Park, west of the railway line and the ability to commence rehabilitation within the western part of Kalinga Park earlier than programmed in the Reference Project;

- construction of cut and cover tunnels beneath Kedron Brook to provide connections from the mainline tunnels to Stafford Road and Gympie Road. This would require temporary works, including partial stream diversion, within Kedron Brook;
- changes to construction methodology as a result of design changes to mitigate impacts of ramp connections on The Mews Apartments, leading to a tunnel connection directly to Lutwyche Road.

The proposed changes in delivery mode would lead to some areas being more affected by the Changed Project:

- changes in the alignment of the east-west tunnels would result in similar impacts in different locations compared to the Reference Project. The changed tunnel alignment constructed by TBMs would be at depths ranging between 18 and 40 metres as it moves under properties on the new alignment. There may be vibration and regenerated noise impacts for two to three weeks during construction. There would be a requirement for volumetric acquisition of property to accommodate the changed tunnel alignments. The tunnel infrastructure is not expected to impact on existing or future use of the land, except in areas above the tunnel alignment and areas adjacent to the portals and the ventilation stations. In some circumstances for properties above the tunnel alignments, possible future development may be constrained in terms of limitations upon basement depths. Possible future development incorporating high rise buildings on land adjacent to or within 100 metres, would need to consider the impacts on the performance of the ventilation stations;
- in the Lutwyche area, the connections with the mainline tunnels would be provided by a system of grade-separated ramps constructed in driven tunnels under Lutwyche generally between Lowerson Street Lutwyche and Rose Street Wooloowin. The Reference Project envisaged extensive cut and cover construction for this infrastructure, including works within Lutwyche Road. Construction impacts would likely include regenerated noise and vibration resulting from roadheader construction and possibly drilling and blasting, leading to a potential requirement for advance consultation and effective mitigation during the works in accordance with the Coordinator-General's conditions;
- changes to construction worksite requirements, including:
  - a larger area of land within Kalinga Park, Clayfield necessary to assemble and launch of the TBMs, to service tunnel construction activities, and to construct the realignment of the drainage channel (Eagle Junction Creek) from the end of Jackson Street to join with Schulz Canal. The realignment would remain a permanent feature of the final landscape;
  - expansion of the Windsor worksite, extending between Federation Street and Gallway Street, west of Morris street in order to provide suitable grades for the cut and cover tunnels necessary to construct the Lutwyche Road off-ramp (south-bound);
  - additional worksites in Windsor, on the western side of Bowen Bridge Road south of Northey Street, to provide for the construction of the Bowen Bridge Road on-ramp (north-bound). These worksites would be shared with the Northern Busway to provide for Northern Busway bridging of Lutwyche Road;
  - provision of dedicated car parking for the construction workforce at McDonald Street Windsor, at the DES campus Kedron, and Widdop Street Hendra to manage the potential impacts of workforce car parking in local streets;

- a worksite on the northern side of the Stafford Road - Gympie Road intersection to provide access to the interchange civil works and cut and cover construction in this location;
- worksites to the east of Lutwyche Road, Kedron Brook bridge and Gympie Road to its intersection with Stafford Road construct cut and cover works in addition to the surface and elevated civil works construction identified in the Reference Project. This change would provide underground access to the north-south and east-west tunnel entry ramps from the Stafford Road and Gympie Road portals. The changed construction requirements would include temporary realignment of the low-flow channel of Kedron Brook, sheet piling to protect work areas from flooding and the installation of tunnel floors, walls and decking. Spoil handling and haulage would be required from the cut and cover construction areas;
- expansion and use of the Northern Busway worksite at Truro Street for Airport Link construction, spoil handling and removal; and
- a new worksite would be required at the intersection of Chalk Street and Lutwyche Road for the retrieval of the two TBMs;

Delivery changes also include changes to spoil haulage and placement, including:

- a preferred spoil placement site(s) within the Brisbane Airport on the northern side of Airport Drive in addition to the spoil placement sites identified in the Reference Project. Alternative, additional sites to those approved with the Reference Project would include land controlled by Queensland Recycling, as well as the East Coast Gravel Pit, sites on Gympie Road and adjacent to the Pine River Bridge, and sites at Linkfield Road, Bald Hills and the Narangba Land Remediation Site;
- alternative spoil haulage routes to the Reference Project as a result of additional spoil haulage sites and to address congestion on the road network, including:
  - an alternative extension to the southern spoil haulage route via Sugarmill Road and Lomandra drive to bypass the airport roundabout at peak times; and
  - a new northern haul route using Lutwyche Road, Gympie Road, Rode Road, Sandgate Road, East West Arterial and Airport Drive;
  - an alternative route along Sandgate Road (north of its intersection with Rode Road) to Toombul Road, the Gateway Motorway and Airport Drive via the slip lane in order to bypass the airport roundabout at peak times.

The nature and effect of these, and other project delivery changes, are assessed in Chapter 4.

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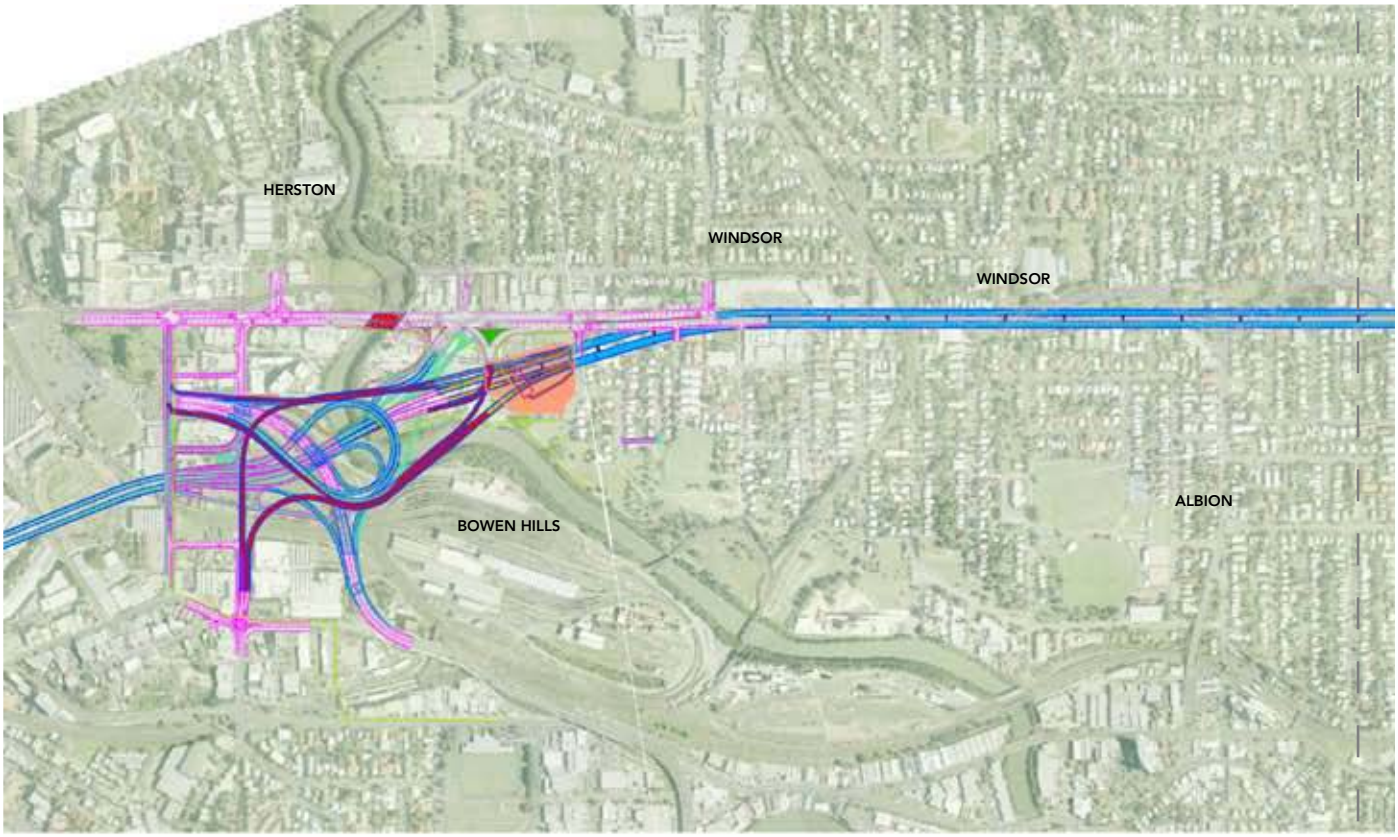

LEGEND

- TRANSITION STRUCTURE
- CUT AND COVER TUNNEL
- DRIVEN TUNNEL - TBM
- DRIVEN TUNNEL - ROAD HEADER
- REINFORCED EARTH STRUCTURE OR FILL EMBANKMENT
- ELEVATED STRUCTURE
- CROSS PASSAGES
- PEDESTRIAN AND CYCLE PATHS
- SURFACE ROADS
- MEDIAN / ISLANDS
- NORTH-SOUTH BYPASS TUNNEL
- WORKSITES
- VENTILATION FAN STATION
- BUSWAY PROJECT

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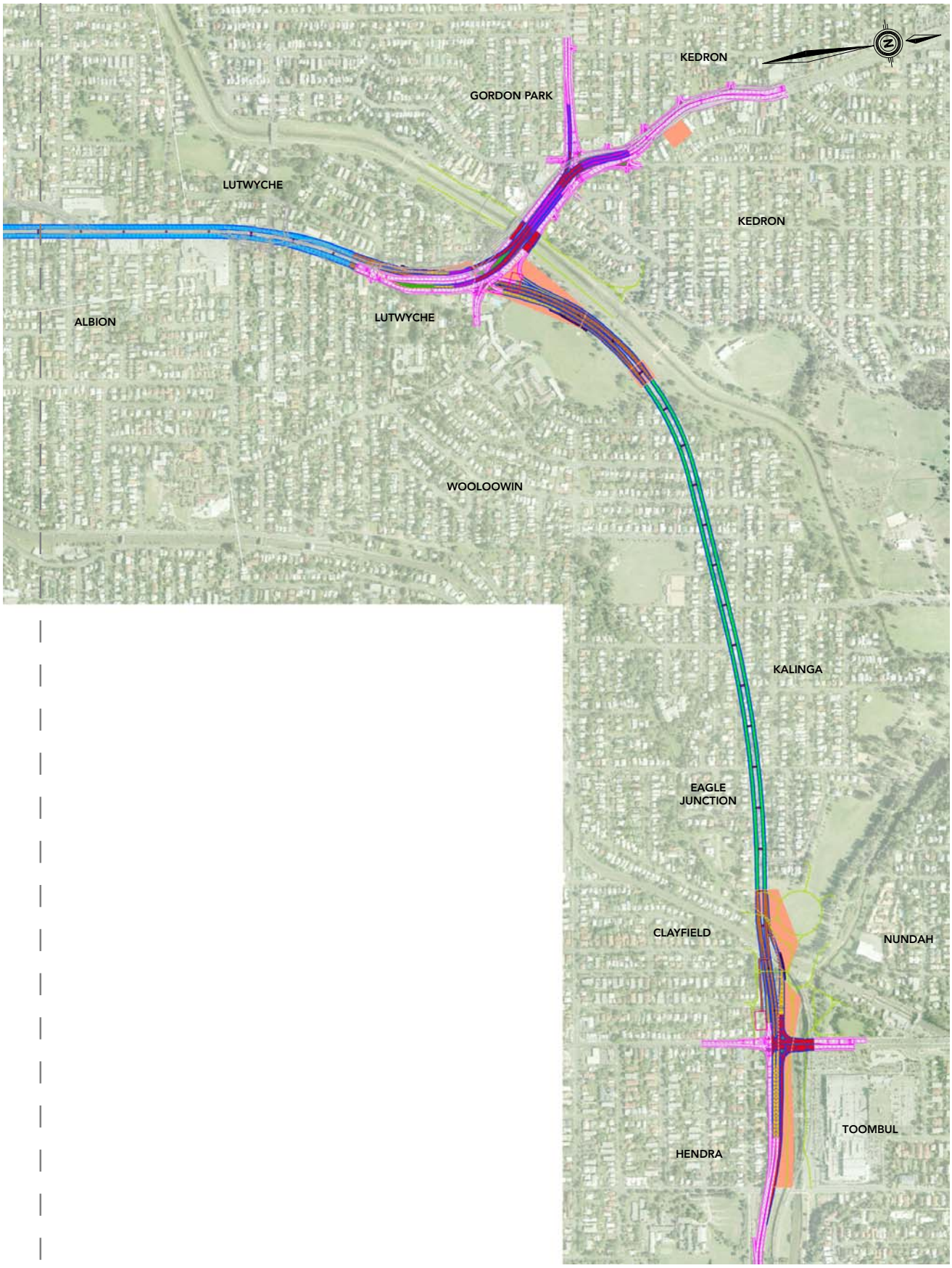
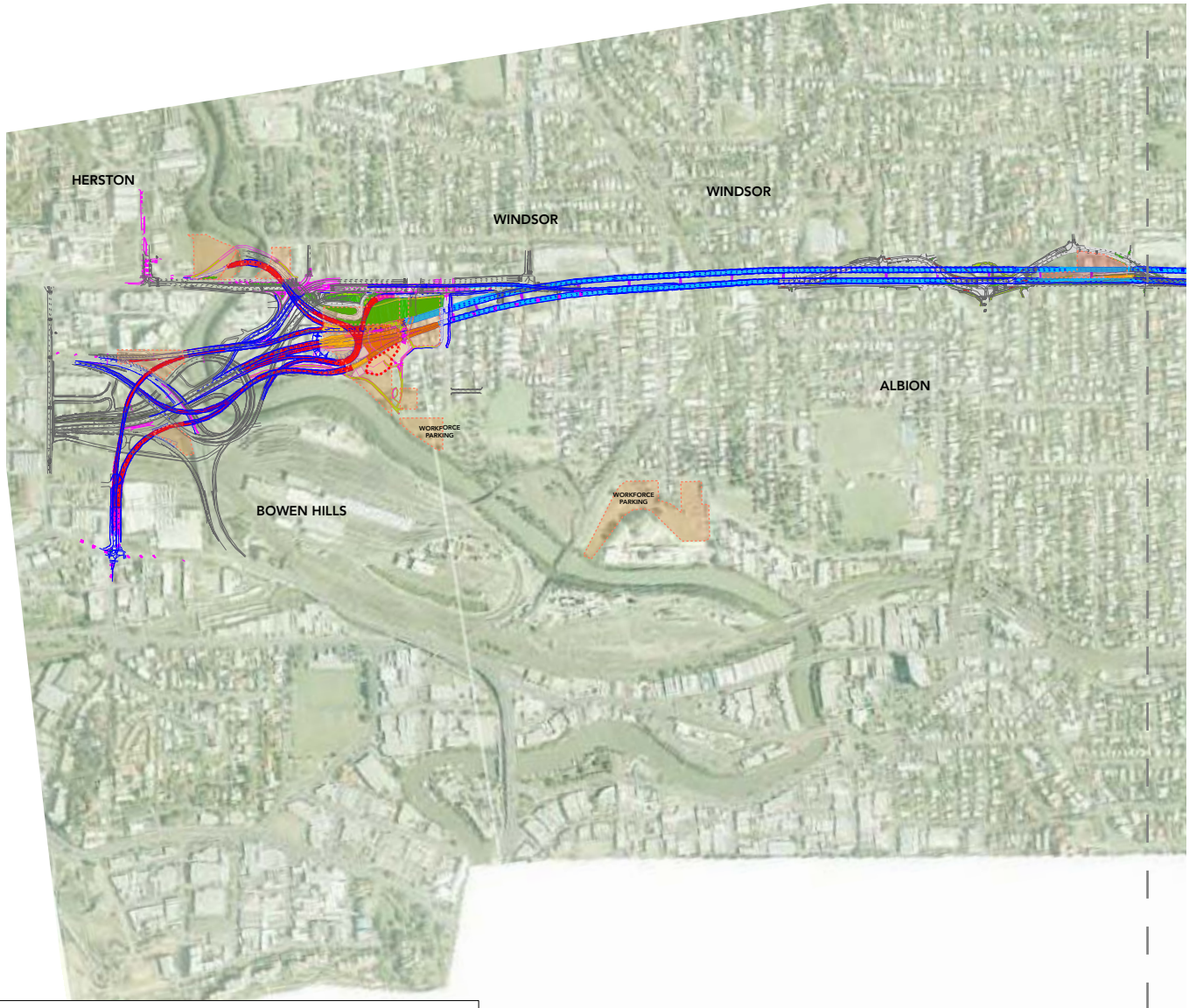


Figure 2-1

Airport Link Overall Route Plan - **Reference** Project



LEGEND

- TRANSITION STRUCTURE
- CUT AND COVER TUNNEL
- DRIVEN TUNNEL - TBM
- DRIVEN TUNNEL - ROAD HEADER
- REINFORCED EARTH STRUCTURE OR FILL EMBANKMENT
- ELEVATED STRUCTURE
- CROSS PASSAGES
- PEDESTRIAN AND CYCLE PATHS
- SURFACE ROADS
- MEDIAN / ISLANDS
- NORTH-SOUTH BYPASS TUNNEL
- WORKSITES AND WORKFORCE PARKING
- VENTILATION FAN STATION
- BUSWAY PROJECT

250 125 0 250 500 750 1000 1250m

SCALE 1:12500

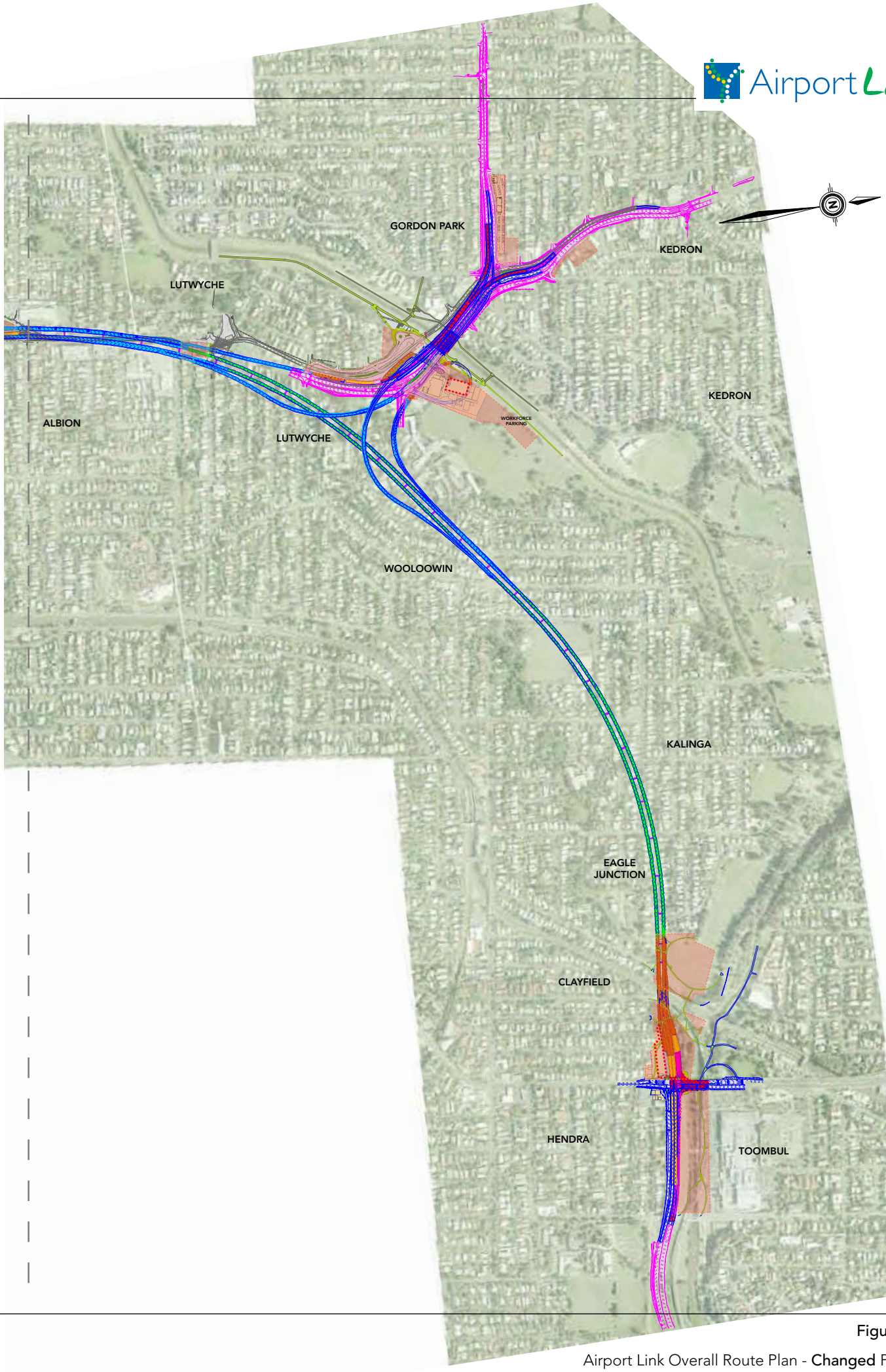


Figure 2-2

Airport Link Overall Route Plan - **Changed** Project

3. Changes to Reference Project - Design and Effects

3.1 Transport Network

3.1.1 Project Changes

The Changed Project would have the same strategic network connectivity and number of traffic lanes as the Reference Project, and provides a connection between key elements of the urban road network managed by the Brisbane City Council (BCC) and the Department of Main Roads (DMR). It would provide for three lanes of general traffic in each direction in the north-south mainline tunnels, and two lanes of general traffic in each direction in the north-east branch tunnels.

The Changed Project would perform the same traffic and transport functions as would the Reference Project in that it would:

- connect with the Inner City Bypass, North-South Bypass Tunnel at Bowen Hills;
- connect with Gympie Road and Stafford Road at Lutwyche and Kedron;
- connect with the East West Arterial and Sandgate Road at Clayfield and Toombul;
- facilitate the implementation of public transport measures, including the Northern Busway project, by relieving traffic congestion on Lutwyche Road; and
- address the project objectives effectively and with potential reductions in above-ground works, would do so with reduced community impacts

The EIS used traffic modelling to replicate the existing traffic environment, to forecast future base traffic conditions, and to assess the effects of the Reference Project on the transport network. The model used to predict traffic and transport demands at the strategic level, the Airport Link Traffic Model, was based upon the Brisbane Strategic Transport Model (BSTM) while detailed local area assessment was undertaken using an intersection analysis model (aaSIDRA).

Key State agencies and the Brisbane City Council undertake periodic modelling of the likely future travel demand upon the regional and metropolitan road network to aid with forward planning and infrastructure development. An accepted tool in this on-going process of review and planning is the BSTM.

The BSTM is continually reviewed and for the modelling for the Changed Project assessment the traffic model has been updated to incorporate the latest available information in three key areas:

Updated demographic projections

New information on population and demographic projections to year 2026 for each traffic zone (over 1 500 in total) within the Brisbane Metropolitan Area has been included in the model. This was sourced from studies commissioned in 2007 by the State's Office of Urban Management (OUM) and the Council of Mayors (SEQ). A summary of the overall demographic forecasts for the EIS and the updated model for the Changed Project assessment is provided in **Table 3-1.**

It is noted that whilst the updated estimates of future population for the Brisbane Metropolitan Area are reasonably similar to the projections used in the EIS, a comparison of the distribution of zonal population

within the Brisbane Metropolitan area indicates a greater concentration of growth expected within the western corridor. The revised employment distribution indicates stronger growth in the Australia TradeCoast area, increasing travel pressures to this area.

Table 3-1 – Population and Employment Projections for Brisbane Metropolitan Area

Year	BSTM Version	Population	Employment
2016	EIS model	2,221,500 (1)	1,130,900 (2)
	Updated model	2,196,800 (3)	1,187,732 (4)
2026	EIS model	2,583,700 (1)	1,320,500 (2)
	Updated model	2,533,400 (3)	1,359,937 (4)

Notes :
(1) Australian Bureau of Statistics (2005/06)
(2) Employment opportunities consistent with relevant ABS population projection.
(3) SEQ Economic and Employment Forecasting Study (PIFU 2007).
(4) SEQ Economic and Employment Forecasting Study (NIEIR 2008).

Updated future transport network

Since the EIS, further planning has also progressed on a number of significant road infrastructure projects that would be likely to interact with travel patterns on Airport Link. The effect of these additional road projects has therefore been incorporated in the traffic model, with the following projects added into the base future networks within the transport model:

- Hale Street Link (as per the Hale Street Link IAS), present at 2012 (opening year of Airport Link).
- a contemporary representation of the Gateway Upgrade Project including Kingsford Smith Drive ramps, by 2012.
- Northern Link (as per TransApex Pre-feasibility Study), by 2016.

As Section 1 of the Northern Busway (Royal Brisbane Hospital) has now commenced construction, and the Northern Busway (Windsor to Kedron) would be delivered at the same time as Airport Link, this key public transport initiative has also been included in the future transport networks.

Updated Airport Link tolls

The Changed Project modelling incorporates a slightly higher toll than that incorporated within the EIS traffic modelling of the Reference Project. The traffic modelling of both the Reference Project and the Changed Project has been undertaken based on a toll for light vehicles (car) of $4.00 for a full north-south journey (i.e. Bowen Hills to Kedron, or Bowen Hills to Toombul) and a toll of $3.00 for an east-west journey (Kedron to Clayfield). The tolls are expressed in June 2006 terms and include GST. In 2008 dollars, these tolls translate to approximately $4.30 north-south and $3.20 east-west.

The toll level for heavy commercial vehicles has also been updated in the traffic model, to reflect a multiplier of 2.65 times the light vehicles (cars) toll level, consistent with the NSBT and the Logan Motorway.

Implications for Traffic Modelling

Traffic modelling indicates that the Reference Project is now predicted to carry more traffic as a result of these updated inputs, particularly updated employment distribution and network assumption, with a corresponding effect on the surface road network. If the Reference Project is not constructed additional congestion of the road network to that reported in the EIS is predicted. This is primarily due to the predicted changed travel demand resulting from the updated demographic projections.

The Airport Link traffic model, based on the BSTM, was used to consider the effects of the Changed Project based on the same assumptions used in the EIS but also incorporating the changes noted above.

This recent traffic modelling indicates that the potential traffic flows for the Changed Project are similar to, but higher than, those estimated in the EIS and slightly higher than the remodelling of the Reference Project using the updated BSTM. This is due to the predicted increase in travel demand resulting from the updated demographic forecasts and base network connectivity, as well as the more efficient configuration of the surface connections incorporated into the Changed Project compared to the Reference Project. The strategic network performance benefits of the Changed Project would be similar to the Reference Project. This is demonstrated in the comparisons presented below in network performance (**Table 3-3**).

3.1.2 Effects on the Project

Demand for Airport Link

The Changed Project would improve the efficiency of Airport Link by enhancing ramp connections at the north-western and southern interchanges. The changes in traffic flows forecast using the updated Airport Link EIS strategic model, compared to the EIS forecasts, are presented in **Table 3-2**. These forecasts indicate that the Changed Project would cater for between 4 and 6% additional vehicles compared to the estimates for the Reference Project in the EIS.

Table 3-2 – Reference Project & Changed Project – changes in Airport Link usage

Location	Change in Average Weekday Traffic (% change from EIS)	
	Reference Project	Changed Project*
2012		
North-South Tunnel	+ 2,200 (3%)	+3,500 (5%)
East-West Tunnel	-3,100 (-13%)	-100 (-1%)
Total Airport Link	-500 (-1%)	+3,700 (4%)
2026		
North-South Tunnel	+5,000 (5%)	+7,600 (8%)
East-West Tunnel	-3,000 (-12%)	-900 (-3%)
Total Airport Link	+2,000 (2%)	+6,700 (6%)

* Change Project forecasts are based on the upgraded Airport Link traffic model derived from the BSTM.

The forecast usage of Airport Link with the increased toll level for heavy commercial vehicles by 2026 would be approximately 4% for the Reference Project and 5% for the Changed Project. The increased toll for commercial vehicles results in a decline from the proportions forecast in the EIS, however the volume of commercial vehicles removed from the surface network remains beneficial.

Network Performance

The impacts of Airport Link on overall Metropolitan area network performance are shown in **Table 3-3**.

Table 3-3 – Reference Project and Changed Project – changes in network-wide benefits

	2012 Average Weekday			2026 Average Weekday		
	EIS	Reference Project[1]	Changed Project[1]	EIS	Reference Project[1]	Changed Project[1]
VKT [Thousands of vehicle-kilometres]						
Motorway	530 (2.4%)	519 (2.3%)	553 (2.5%)	608 (2.0%)	585 (1.9%)	618 (2.0%)
Arterial	-295 (-1.4%)	-290 (-1.4%)	-331 (-1.6%)	-330 (-1.3%)	-298 (-1.2%)	-351 (-1.4%)
Suburban	-96 (-1.2%)	-93 (-1.1%)	-99 (-1.2%)	-131 (-1.3%)	-133 (-1.3%)	-131 (-1.3%)
District	-36 (-1.1%)	-35 (-1.0%)	-34 (-1.0%)	-59 (-1.4%)	-65 (-1.6%)	-56 (-1.3%)
Local	-19 (-1.4%)	-22 (-1.7%)	-22 (-1.7%)	-29 (-1.8%)	-33 (-2.2%)	-31 (-2.0%)
Total Network	84 (0.2%)	79 (0.1%)	67 (0.1%)	59 (0.1%)	56 (0.1%)	48 (0.1%)
VHT [Hundreds of vehicle-hours]						
Motorway	48 (1.8%)	49 (1.8%)	51 (1.9%)	42 (1.0%)	53 (1.3%)	37 (0.9%)
Arterial	-123 (-2.6%)	-150 (-3.2%)	-162 (-3.5%)	-195 (-3.2%)	-202 (-3.5%)	-213 (-3.7%)
Suburban	-40 (-2.4%)	-37 (-2.2%)	-42 (-2.5%)	-65 (-2.9%)	-61 (-2.9%)	-58 (-2.7%)
District	-18 (-1.8%)	-7 (-0.7%)	-5 (-0.5%)	-33 (-2.5%)	-31 (-2.2%)	-25 (-1.8%)
Local	-6 (-1.1%)	-21 (-3.9%)	-27 (-5.0%)	-21 (-2.3%)	-29 (-3.6%)	-31 (-3.9%)
Total Network	-138 (-1.3%)	-167 (-1.6%)	-184 (-1.7%)	-272 (-1.9%)	-270 (-1.9%)	-290 (-2.0%)
Average Trip Speed [Kilometres per hour]						
Total	0.8 (1.5%)	0.9 (1.7%)	1.0 (1.9%)	1.0 (2.1%)	1.0 (2.0%)	1.1 (2.2%)

Notes: (1) From traffic modelling for Reference Project and Changed Project undertaken within updated BSTM-based Airport Link strategic model.

Compared to the Reference Project, the Changed Project would continue to offer traffic congestion relief, with slightly reduced total vehicle travel hours and slightly improved average travel speeds within the overall network. The Changed Project would continue to redistribute travel on lower order roads (local, district and suburban routes) to higher-order roads including motorway routes. The Changed Project would result in a slightly lower impact on overall vehicle kilometres of travel within the network.

Traffic Volume Effects of Airport Link

The effects of Airport Link on key connecting roads are shown in **Table 3-4**. The traffic volume effects of the Changed Project would be generally similar to the Reference Project and the EIS. The improvements proposed for the north-west connection and southern connection would produce some differences:

- the estimated traffic reduction on Bowen Bridge Road south of Butterfield Street would be lower and the reduction in volume on O'Connell Terrace would be higher, due to the modified arrangement with the Bowen Bridge Road on-ramp (north-bound);
- the Changed Project would result in additional traffic (2,000 vpd in 2026) using Stafford Road, principally between Gympie Road and Richmond Street, compared with the Reference Project. The Changed Project incorporates upgrading the Stafford Road/Richmond Street intersection to accommodate traffic increases.

Table 3-4 – Reference Project and Changed Project – comparison of project effects on key connecting roads

Location	Change in Average Weekday Traffic – 2012 (% change from Do Minimum)			Change in Average Weekday Traffic – 2026 (% change from Do Minimum)		
	EIS	Reference Project[1]	Changed Project[1]	EIS	Reference Project[1]	Changed Project[1]
Southern Connections						
NSBT (Brisbane River)	2,400 (3%)	4,900 (7%)	4,100 (6%)	8,000 (9%)	11,400 (15%)	11,400 (15%)
ICB (West of Bowen Bridge Road)	2,300 (2%)	2,500 (2%)	3,900 (4%)	2,300 (2%)	-500 (-0%)	-800 (-1%)
Hale Street (North of Milton Road)	200 (0%)	1,000 (1%)	400 (0%)	-700 (-1%)	-700 (-1%)	-700 (-1%)
Bowen Bridge Road (South of O'Connell Terrace)	800 (2%)	-2,500 (-5%)	-4,300 (-9%)	5,400 (10%)	1,200 (2%)	-1,800 (-3%)
Bowen Bridge Road (South of Butterfield Street)	-21,800 (-33%)	-11,700 (-20%)	-6,700 (-11%)	-23,500 (-31%)	-13,200 (-20%)	-5,600 (-8%)
Campbell Street (East of Mayne Road)	4,400 (20%)	8,100 (49%)	7,800 (47%)	5,800 (20%)	9,100 (39%)	7,500 (32%)
O'Connell Terrace (East of Bowen Bridge Road)	-1,700 (-11%)	-900 (-8%)	-2,000 (-18%)	-700 (-4%)	-1,800 (-12%)	-2,300 (-15%)
Brookes Street (South of St Pauls Terrace)	2,700 (13%)	2,900 (15%)	3,000 (16%)	2,400 (10%)	1,000 (4%)	1,600 (7%)
St Pauls Terrace (South of Brookes Street)	1,600 (12%)	600 (4%)	200 (1%)	800 (4%)	1,000 (6%)	400 (2%)
Gregory Terrace (West of Brookes Street)	-800 (-7%)	-200 (-2%)	0 (0%)	-1,800 (-12%)	-400 (-3%)	-300 (-2%)
Wickham Street (West of Brookes Street)	1,600 (5%)	1,700 (6%)	2,200 (8%)	1,500 (4%)	2,000 (7%)	2,500 (8%)
Ann Street (West of Brookes Street)	3,800 (12%)	3,300 (11%)	1,700 (6%)	3,800 (10%)	4,600 (13%)	2,700 (8%)
Montpelier Road (West of Breakfast Creek Road)	3,300 (12%)	3,700 (13%)	2,200 (8%)	2,900 (8%)	2,900 (9%)	1,600 (5%)
Gipps Street (North of Wickham Street)	-2,600 (-6%)	-3,100 (-8%)	-3,300 (-8%)	-2,200 (-5%)	-1,100 (-2%)	-2,100 (-5%)
Northern Connections						
Stafford Road (East of Richmond Street)	14,300 (56%)	13,300 (54%)	15,100 (61%)	17,400 (62%)	16,700 (62%)	18,700 (69%)
Stafford Road (West of Richmond Street)	13,000 (49%)	11,900 (46%)	12,400 (48%)	16,100 (55%)	15,700 (57%)	16,300 (59%)
Stafford Road (West of Webster Road)	6,200 (25%)	5,800 (24%)	5,700 (23%)	9,300 (37%)	8,900 (38%)	8,800 (37%)
Gympie Road (North of Broughton Road)	17,000 (22%)	17,000 (22%)	16,100 (21%)	21,800 (26%)	19,700 (23%)	19,400 (23%)
Gympie Road (South of Kitchener Road)	11,900 (16%)	12,300 (17%)	13,700 (18%)	14,600 (18%)	14,600 (18%)	16,300 (20%)
Gympie Road (North of Rode Road)	4,400 (6%)	4,000 (5%)	4,200 (5%)	8,300 (10%)	6,800 (8%)	6,900 (8%)
Rode Road (West of Gympie Road)	900 (3%)	1,300 (4%)	1,200 (4%)	-600 (-2%)	-100 (-0%)	-100 (-0%)
Sandgate Road (North of Schulz Canal)	-5,800 (-9%)	-4,900 (-7%)	-5,400 (-8%)	-6,400 (-9%)	-1,900 (-3%)	-2,400 (-3%)
East West Arterial (East of Widdop Street)	15,900 (27%)	16,500 (30%)	17,100 (31%)	10,400 (14%)	9,200 (12%)	8,800 (12%)

Notes : (1) From traffic modelling for Reference Project and Changed Project undertaken within updated BSTM-based Airport Link strategic model.

(2) Volumes shown are Do Something (with Airport Link) minus Do Minimum (without Airport Link).

Effects on Local Area Traffic Volumes

The likely effects of the Changed Project on roads in the local area are shown in **Table 3-5**.

The Changed Project effects on local surface roads compared to the Reference Project would be:

- increased benefits such as relieved congestion and relieved amenity on Lutwyche Road, as traffic volumes would be reduced by a further 2,000 to 3,000 vpd from the Reference Project;
- increased traffic reduction benefits on key east-west surface routes such as Kedron Park Road-Rose Street-Junction Road and Rode Road;
- use of Richmond Street by some traffic destined for Lutwyche, due to the revised arrangements connecting west-bound traffic from the east-west tunnels to Stafford Road. The anticipated effects of the Changed Project on Richmond Street would be a small increase in traffic (up to 5%).
- the anticipated effect on Butterfield Street would continue to be a small decrease in traffic, despite the more direct access to the Airport Link offered by the Bowen Bridge Road on-ramp.
- effects on other local roads would be generally similar to the Reference Project.

Table 3-5 – Reference Project and Changed Project – comparison of project effects on surface roads within the Inner North Area

Location	Change in Average Weekday Traffic – 2012 (% change from Do Minimum)			Change in Average Weekday Traffic – 2026 (% change from Do Minimum)		
	EIS	Reference Project[1]	Changed Project[1]	EIS	Reference Project[1]	Changed Project[1]
Arterial Roads						
Lutwyche Road (South of Kedron Park Road, Kedron)	-24,800 (-36%)	-23,300 (-35%)	-26,000 (-39%)	-26,000 (-36%)	-26,200 (-36%)	-29,300 (-40%)
Lutwyche Road (North of Stoneleigh Street, Lutwyche)	-28,900 (-39%)	-26,800 (-37%)	-28,800 (-40%)	-30,100 (-39%)	-30,400 (-39%)	-32,600 (-42%)
Lutwyche Road (South of Newmarket Road, Windsor)	-36,600 (-35%)	-36,700 (-35%)	-38,500 (-37%)	-41,600 (-36%)	-45,300 (-38%)	-47,400 (-40%)
Sandgate Road (South of Junction Road, Clayfield)	-12,700 (-25%)	-11,600 (-23%)	-11,400 (-23%)	-15,400 (-25%)	-14,700 (-24%)	-14,400 (-23%)
Sandgate Road (South of Bonney Avenue, Albion)	-14,300 (-25%)	-13,800 (-25%)	-13,700 (-24%)	-19,500 (-27%)	-19,400 (-27%)	-19,300 (-27%)
Kedron Park Road (East of Lutwyche Road, Kedron)	-5,300 (-15%)	-5,400 (-16%)	-6,800 (-20%)	-6,200 (-16%)	-6,300 (-16%)	-7,800 (-20%)
Junction Road (West of Sandgate Road, Clayfield)	-8,100 (-27%)	-6,900 (-24%)	-7,600 (-26%)	-7,400 (-23%)	-6,700 (-21%)	-6,700 (-21%)
Rode Road (West of Sandgate Road, Wavell Heights)	-5,600 (-23%)	-5,200 (-21%)	-6,100 (-25%)	-6,700 (-24%)	-6,900 (-25%)	-8,000 (-29%)
Nudgee Road (North of E-W Arterial, Hendra)	1,600 (19%)	1,100 (12%)	1,100 (12%)	2,700 (21%)	2,700 (19%)	2,600 (19%)
Nudgee Road (South of E-W Arterial, Hendra)	-4,000 (-18%)	-3,900 (-19%)	-3,900 (-19%)	-4,300 (-17%)	-4,500 (-18%)	-3,700 (-15%)
Kingsford Smith Drive (East of Cooksley Street, Hamilton)	-6,600 (-9%)	-7,500 (-10%)	-7,600 (-11%)	-2,100 (-3%)	-4,500 (-6%)	-4,600 (-6%)
South Pine Road (Kedron Brook, Everton Park)	-6,300 (-13%)	-6,000 (-12%)	-6,100 (-12%)	-6,600 (-11%)	-6,900 (-12%)	-7,100 (-12%)
Enoggera Road (South of South Pine Road, Alderley)	-5,500 (-9%)	-4,400 (-7%)	-4,600 (-8%)	-8,800 (-12%)	-9,200 (-12%)	-9,400 (-13%)
Suburban Roads						
Butterfield Street (West of Bowen Bridge Road, Herston)	400 (4%)	-1,000 (-10%)	-500 (-5%)	-700 (-4%)	-1,400 (-10%)	-1,400 (-10%)
Newmarket Road (West of Lutwyche Road, Windsor)	-8,400 (-25%)	-9,200 (-30%)	-10,300 (-33%)	-9,700 (-23%)	-11,000 (-29%)	-11,500 (-30%)
Hamilton Road (West of Sandgate Road, Wavell Heights)	-3,200 (-15%)	-2,600 (-12%)	-3,500 (-17%)	-4,000 (-17%)	-3,900 (-17%)	-4,300 (-18%)
Kedron Park Road (South of Park Road, Wooloowin)	1,400 (12%)	-100 (-1%)	-400 (-3%)	100 (1%)	-2,400 (-15%)	-2,900 (-19%)
Albion Road (East of Lutwyche Road, Windsor)	-4,300 (-22%)	-5,600 (-29%)	-5,600 (-29%)	-3,000 (-13%)	-5,700 (-22%)	-6,800 (-27%)
Shaw Road (Kedron Brook, Wooloowin)	-1,600 (-10%)	-1,800 (-11%)	-2,100 (-13%)	-2,800 (-15%)	-3,500 (-19%)	-3,900 (-22%)
Chalk Street (West of Bridge Street, Wooloowin)	200 (1%)	-1,500 (-10%)	-1,700 (-11%)	-1,900 (-10%)	-3,900 (-21%)	-4,100 (-22%)
Maygar Street (West of Lutwyche Road, Windsor)	-900 (-11%)	-1,400 (-16%)	-2,200 (-25%)	-700 (-7%)	-1,300 (-12%)	-2,400 (-22%)
District Roads						
Richmond Street (South of Stafford Road, Kedron)	-900 (-15%)	-800 (-13%)	200 (3%)	-1,200 (-19%)	-1,000 (-17%)	300 (5%)
Edinburgh Castle Road (North of Leckie Road, Kedron)	-1,600 (-21%)	-1,300 (-18%)	-1,100 (-15%)	-2,300 (-25%)	-2,500 (-28%)	-2,000 (-22%)
Dickson Street (North of Wride Street, Wooloowin)	-2,300 (-20%)	-2,500 (-21%)	-2,400 (-20%)	-3,500 (-27%)	-3,400 (-26%)	-3,500 (-27%)

Notes : (1) From traffic modelling for Reference Project and Changed Project undertaken within updated BSTM-based Airport Link strategic model.

(2) Volumes shown are Do Something (with Airport Link) minus Do Minimum (without Airport Link).

Effect on Intersection Performance

The Changed Project would improve the efficiency of traffic operations at several intersections in the vicinity of the north-west connection. It would also include a new signalised intersection at Lutwyche Road/ Gallway Street for local access, and improvements at Stafford Road / Richmond Street.

The results of SIDRA intersection analyses at these locations are summarised in **Table 3-6**. Peak period volumes from the updated Airport Link strategic transport model have been applied.

Key measures of intersection operation include the Level of Service (LOS) and the Degree of Saturation (DOS). These provide an assessment of the operation of the road network in terms of conditions experienced by drivers and range from A (free flow conditions) to F (severely congested).

As noted in the EIS, these analyses are based upon conservative assumptions. No effects of the future potential spreading of the peak period demands beyond a two hour period in the morning and evening have been incorporated.

Table 3-6 – EIS and Changed Project – comparison of key intersection performance forecasts (2022)

Intersection	AM Peak Hour				PM Peak Hour			
	EIS		Changed Project		EIS		Changed Project	
	Max DOS (X)	LOS	Max DOS (X)	LOS	Max DOS (X)	LOS	Max DOS (X)	LOS
Gympie Road / Stafford Road	1.07	F	0.65	C	1.04	F	0.95	D
Stafford Road / Richmond Street	0.87	C	0.76	B	1.00	E	0.91	C
Lutwyche Road / Kedron Park Road	1.08	F	0.73	C	1.32	F	0.75	D
Lutwyche Road / Gallway Street	N/A	N/A	0.93	B	N/A	N/A	0.88	B
Lutwyche Road / Northey Street	1.00	D	1.01	E	1.03	F	1.12	F
Bowen Bridge Road / Butterfield Street	0.77	C	0.87	C	1.00	D	0.93	C
Campbell Street / Mayne Road / Hamilton Place	0.95	E	1.21	F	0.93	E	1.18	F
Sandgate Road / East-West Arterial Road	1.04	F	1.07	F	1.30	F	1.14	F

Key observations from this assessment of the effects of the Changed Project are:

- performance at most locations would be similar to, or better than, forecast in the EIS for the Reference Project, with improvements in traffic operations in particular around the north-west connections;
- the new Lutwyche Road / Gallway Street intersection would operate within capacity, however queues in the right-turn pocket for movements from the south would be likely to overflow into the adjacent lane during peak periods. The demand for this movement would need to be monitored and if necessary, a right-turn ban would need to be implemented during peak periods to ensure safety and network efficiency for north-bound traffic on Lutwyche Road;

- although the Changed Project does not substantially alter the layout of the Campbell Street/Mayne Road/Hamilton Place intersection where the Airport Link off-ramp (south-bound) connects, a lower level of service of operation would be forecast than for the Reference Project. This is partially attributable to revised expectations of land-use growth in the Bowen Hills area. Changes to the local traffic network accompanying more intense development are still under investigation by others and are not incorporated in the strategic model. Further refinement of the local network would be expected to re-distribute traffic, lowering the pressure at this location. It is noted the strategic model forecasts indicate that the PM peak volumes at this intersection for the Changed Project would be 3% higher than for the Reference Project;
- while the forecast Level of Service (LOS) at Sandgate Road would remain "F", the total peak period delay would be lower with the Changed Project than in the Reference Project.

Effect on Local Access

The effects of the Changed Project on local access generally would be similar for those described in the EIS for the Reference Project, with a small number of variations in the connections at Bowen Hills and Kedron. The anticipated traffic effects are summarised below:

- the modified ramp arrangements, connecting to Bowen Bridge Road north of Butterfield Street and Lutwyche Road north of Northey Street, would remove the need to change traffic operations and local access on O'Connell Street, Campbell Street or Sneyd Street. These changes would reduce the effects on the local area;
- a new link extending Gallway Street to Lutwyche Road would replace Federation Street, providing signalised access to and from the major road for the local catchment including Bryden Street. No right-turn into Gallway Street would be provided from Lutwyche Road, however a right turn from Gallway Street to Lutwyche Road would be provided. Analysis of the new intersection, shown in **Table 3-6**, indicates that it would provide acceptable traffic performance;
- a pick-up/set-down area would be provided in Lutwyche Road at Wooloowin State School, improving accessibility for students and reducing demands on surrounding local streets; and
- reconfiguration of the Leckie Road/Gympie Road intersection would necessitate the closure of the western end of Arnott Street. Access would be accommodated satisfactorily via Fifth Avenue, while the simplified intersection layout would enhance safety.

Public Transport

The connectivity and features of the Northern Busway would remain generally as identified in the Northern Busway concept design and impact management plan (CDIMP) and described briefly in the Airport Link EIS. The additional impact on public transport operations arising from the Changed Project would be expected to be minimal.

During construction, the Changed Project may require temporary relocation of up to four bus stops in addition to those required for the reference project and described in the EIS. Three of these would be located on the eastern side of Lutwyche Road to the north of Federation Street, north of Annie Street, and north of Chalk Street. One would be on the southern side of Kedron Park Road adjacent to the Kedron Park Hotel. In all these cases, the temporary bus stops should be located as close as possible to the original bus stop location and with convenient pedestrian access.

On completion of the Changed Project, the bus stops in the Kedron and Lutwyche area would be replaced by high quality busway facilities.

Pedestrians and Cyclists

The Changed Project would provide for essentially the same pedestrian and cycle movements as described in the EIS for the Reference Project, with some enhancements particularly in Lutwyche and Kedron.

The modifications to Airport Link accesses in Windsor and Bowen Hills would result in a number of changes in the way these movements, as summarised below:

- the new Gallway Street signals on Lutwyche Road would provide local access and a convenient alternative route from the northern Enoggera Creek bikeway to the western side of Lutwyche Road.
- Federation Street would be closed to vehicles at Lutwyche Road, but pedestrian access would be retained, connecting to the ultimate busway station at Federation Street Windsor.
- the simplified configuration of the Northey Street intersection would include a wide median on Lutwyche Road, allowing the pedestrian crossing on the southern side of the intersection to be safely staged.
- extending the pathway through Flynn Oval to Mann Park.[5]
- enhanced pedestrian and cycle routes from Mann Park to Lutwyche Road through the hilltop landscaped mound over the partially buried ventilation station.

Compared with the Reference Project, proposed changes at the connections in Lutwyche and Kedron would include:

- simplification of the Gympie Road pedestrian crossings at Kedron Park Road and Stafford Road, made possible by the improved grade separation in the Changed Project over the Reference Project;
- connection of the path system near the Fifth Street bridge to the local street network via Brook Street, and provision of a new pedestrian and cycle bridge over Kedron Brook in the vicinity of Park Terrace to link with the path system on the eastern side of Kedron Brook.

Compared with the Reference Project, proposed changes in the pedestrian and cycle connections in Clayfield and Toombul would be:

- relocation of the main east-west pedestrian and cycle path linking Kedron Brook with the Boondall Wetlands to the northern side of Schulz Canal between Melton Road and Sandgate Road. A new pedestrian and cycle bridge over Schulz Canal would be provided between Melton Road and Schulz Canal. All existing routes would be progressively reinstated during construction;
- additional pedestrian crossing at the East West Arterial/Sandgate Road intersection, providing continuous pedestrian routes along both sides of Sandgate Road;
- the landbridge at Clayfield over the vent station building provides enhanced local pedestrian and cycle access and amenity.

[5] Note this path would be closed during construction, with pedestrian and cycle traffic diverted along Somerset Street

3.1.3 BC Traffic Estimates

BC also used the BSTM as the basis for traffic forecasts, using their own research on input assumptions and assessment of future traffic demand. BC predicted higher AADT traffic levels due to a range of factors including assumptions on stronger population and employment growth, forecasts of buoyant economic activity and its influence on travel, overall increased travel demand within Brisbane, network enhancements such as the ARU Project, and users' increased recognition of reliability and travel quality benefits offered by Brisbane's expanding toll road network.

If BC's expectations regarding travel demand and the attractiveness of Airport Link are realised, then the following transport effects are possible:

- more traffic would be concentrated on Airport Link and the motorway-standard road links, such as NSBT and future proposed links such as Northern Link and East-West Link;
- more traffic would travel in the non-peak periods, partly in response to more flexible working-hours and practices;
- traffic demand on Airport Link would be balanced in both directions throughout the day, due in part to greater diversity in cross-city demand as a result of increasing dispersal of employment and major activity centres in the metropolitan area[6];
- stronger demands for cross-river vehicle travel within Brisbane, arising from economic activity and changes in population and demography would be expected to deliver increased traffic to Airport Link;
- higher use of the East West Arterial as a feeder route to Airport Link would be expected, aligned to accelerated growth in Australia TradeCoast and the upgrading of the East West Arterial/Gateway Motorway interchange. This would result in consequential benefits for traffic relief on Kingsford Smith Drive, due to traffic redistributing within the network to use Airport Link. BC forecasts that daily traffic volumes on Kingsford Smith Drive would be lower than current traffic volumes after Airport Link is opened;
- benefits to the surface roads such as Lutwyche Road and Sandgate Road are forecast to occur, with forecast traffic levels similar to the EIS, after Airport Link is opened; and
- without the Airport Link Project, substantial increased congestion would be evident in the transport network.

3.1.4 Conclusions

The Changed Project includes a number of design changes to improve road network performance. Overall, its connectivity and function would remain similar to the Reference Project as described in the EIS. The Changed Project would continue to meet the project objectives of providing a sound basis for future traffic management by allowing cross-city travel movements to bypass the Central Business District and inner suburbs, connecting activity centres, and relieving congested roads in Brisbane's northern suburbs.

[6] This effect currently occurs on the Gateway Motorway south of Airport Drive where there is no marked divide between peak and non-peak operations.

The Changed Project incorporates improved connections, particularly at Kedron, which improves traffic flow, reducing delay for Airport Link users and other surface traffic. This would increase the efficiency of the facility, and would result in:

- improved overall network performance and congestion reduction – greater savings in vehicle hours travelled, improved overall travel speed and reduced impacts of vehicle-kilometres of travel within the network;
- higher forecast usage of Airport Link (6% more users in 2026 than the EIS forecast for the Reference Project);
- expected greater reduction in through traffic using key north-south and east-west surface routes through the inner northern suburbs;
- increased traffic volumes on some arterial connecting roads in close proximity to the project such as Gympie Road and Stafford Road;
- an increase in traffic on Richmond Street at Kedron, rather than the reduction previously forecast in the EIS.

The Changed Project would also:

- maintain local accessibility generally - with reduced impacts in the O'Connell Terrace area, and suitable alternatives for the Arnott Street catchment affected by a new road closure and left in only access from Gympie Road to Leckie Road;
- in response to requirements from BCC and DMR, access from Homebush Road and Broughton Road to Gympie Road would be closed to through traffic, and each of those roads would be terminated in a cul-de-sac arrangement. Satisfactory alternative access would be available from Brookfield Road or Somerset Road via Clarence Road or Mitchell Street;
- change local accessibility in Windsor East through the proposed closure of Federation Street and the extension of Gallway Street through to connect with Lutwyche Road, resulting in a viable albeit less convenient route from the south to Windsor East catchment;
- provide similar benefits to public transport as envisaged in the EIS, in conjunction with the Northern Busway.

The difference in traffic forecasts in the analysis undertaken indicates that the Changed Project offers greater benefits than the Reference Project for the functioning of both the metropolitan and local road networks, with improved capability to relieve present and future surface congestion.

3.2 Bowen Hills – Windsor (Southern Connection)

3.2.1 Project Changes

The Changed Project proposes changes to the Windsor – Bowen Hills interchange to achieve more efficient traffic flows from the surface road network to and through the Changed Project and improved urban amenity outcomes, a change in the location of the southern ventilation station and ventilation outlet to reduce visual impacts and to enable improved pedestrian and cycle connectivity, and changes in the urban design treatments for the infrastructure to provide a sense of place, way-finding and enhanced urban amenity outcomes.

The Changed Project would relocate the city connections at O'Connell Terrace to Bowen Bridge Road and Lutwyche Road. No local traffic network alterations would be required to the intersection of O'Connell Terrace and Bowen Bridge Road to provide access to the O'Connell Terrace ramps. The Changed Project would remove the double-stacked ramps adjacent to The Mews apartments required by the Reference Project's combination of the O'Connell Terrace connection with the ICB off-ramp (north-bound) over Enoggera Creek. To mitigate further the Reference Project's impacts on The Mews apartments, the Changed Project would relocate the Campbell Street on-ramp (north-bound) further to the north and east of the ICB.

In the Changed Project, the city connections would be from Bowen Bridge Road. The Bowen Bridge Road to the Airport Link mainline (north-bound) tunnel would be via a grade-separated ramp adjacent to the Northern Busway ramp over Enoggera Creek and Lutwyche Road, south of Northey Street. This connection also provides access to the NSBT (south-bound) and the ICB (west-bound). The Reference Project provided this connection via a controlled intersection at Lutwyche Road and Northey Street.

The connection from the Airport Link mainline (south-bound) tunnel would be from a portal in the middle of Lutwyche Road, south of the Newmarket Road intersection.

The connections from the Changed Project (south-bound) to Campbell Street and ICB would be realigned to pass over the NSBT connections, to the east of the NSBT bridge across Enoggera Creek. The proposed bridge alignment would be three metres higher than the Reference Project. The structure would be located near the centre of the existing NSBT loop area which would mitigate the visual impact of the structure. Compared with the Reference Project, this solution provides for a smaller footprint that avoids the crossing of Enoggera Creek near Mann Park. Consequently, associated mangrove and property impacts on the Queensland Rail (QR) Mayne Rail Yards would be avoided.

The Lutwyche Road connection (southbound) to the NSBT and the ICB would be relocated to a position further north off Lutwyche Road to take into account the interim Northern Busway's Federation Street bus stop. This connection would join with the Lutwyche Road (north-bound) elevated ramp, to NSBT and ICB at a signalised intersection over the mainline tunnel portals. The ICB connection west-bound would utilise the downstream NSBT bridge to join with the NSBT connection from Lutwyche Road to the ICB.

The main features of the new interchange at Windsor and Bowen Hills are:

- the right-turn (south-bound) entry to the ICB and NSBT from the Lutwyche Road / Northey Street intersection would be relocated to join with the Bowen Bridge Road ramp (north-bound);
- the south-bound approach of Lutwyche Road to the Northey Street intersection would be widened to four lanes to accommodate an off-ramp for Airport Link;
- a new road connection from the northern end of Morris Street to Lutwyche Road, in effect extending Gallway Street, would connect with Lutwyche Road via a controlled intersection;
- no right turn would be available from Lutwyche Road into the new Gallway Street to service Windsor East. Gallway Street would be provided with left-in and left-out manoeuvres to and from Lutwyche Road, with a right-turn to the north;
- the south-bound connection from Lutwyche Road to the ICB and NSBT would be relocated further north, diverging from Lutwyche Road just south of the Gallway Street extension;

- pedestrian and cycle access to Windsor East including the Federation Street Busway Station, would be integrated into the Northey Street intersection;
- the Airport Link connections to and from the NSBT would be provided as single lanes, with sufficient flexibility in the layout, with line-marking changes, to operate with two lanes in each direction subject to traffic demands;
- Federation Street between Lutwyche Road and Morris Street would be closed permanently.

The proposed change in location of the ventilation station and ventilation outlet would be sited and realigned on land fronting Byrne Street Windsor, to the east of the south-bound connections. This would be a change from the location proposed in the Reference Project.

Detailed urban design features are:

- the ventilation outlet would be illuminated and would adopt a slimline profile aligned roughly on a north-south axis. The ventilation station would be partially buried in a landscaped setting to off-set the impact of the scale and bulk of the building;
- the provision of a landscaped space sitting above the portals to the mainline tunnel lanes in the position that would have been occupied by the ventilation station in the Reference Project.

A comparison of the Reference Project and Changed Project at Bowen Hills and Windsor is provided in **Figure 3-1** and **Figure 3-2**.

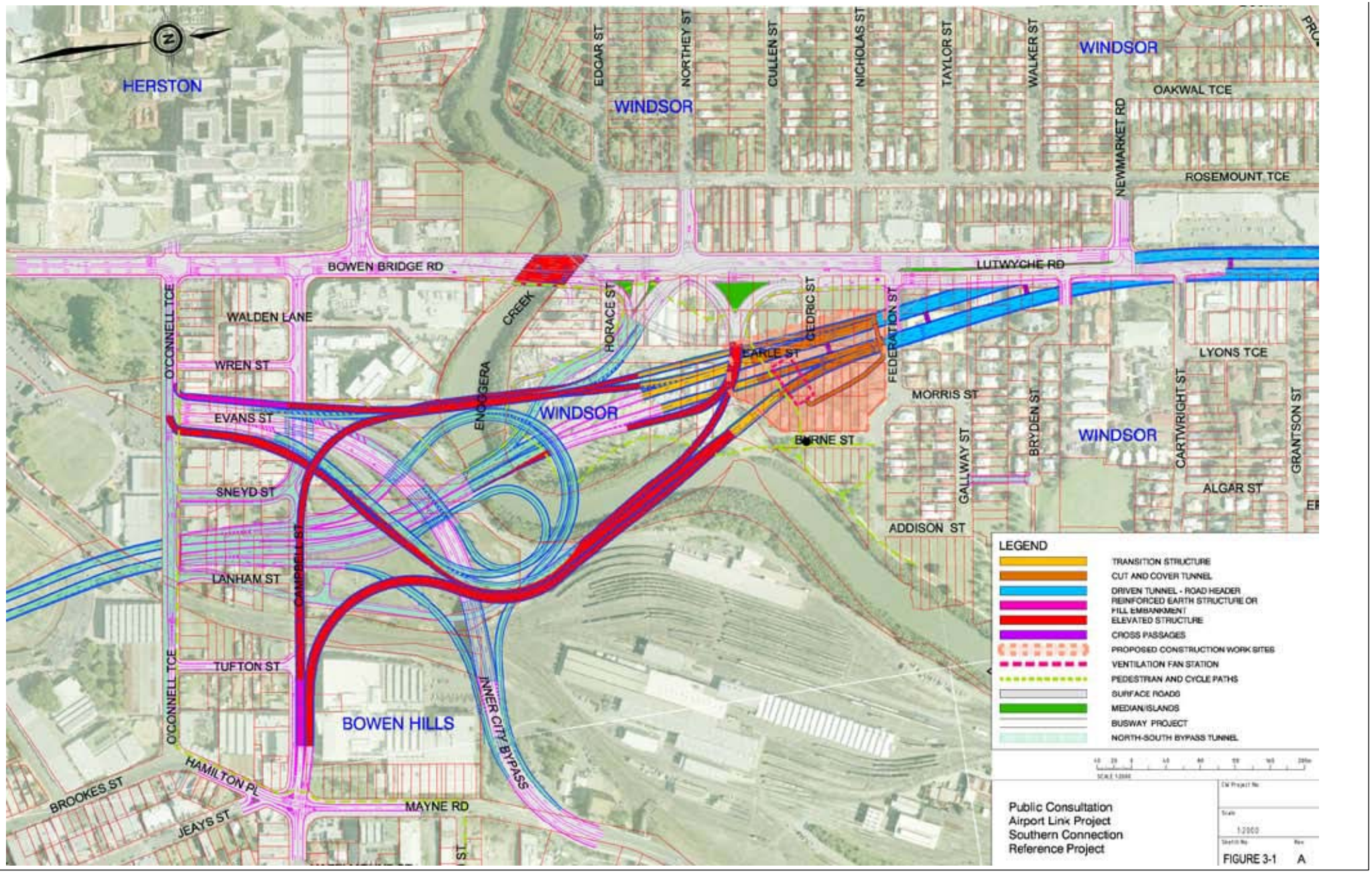


Figure 3-1
Southern Connection **Reference** Project

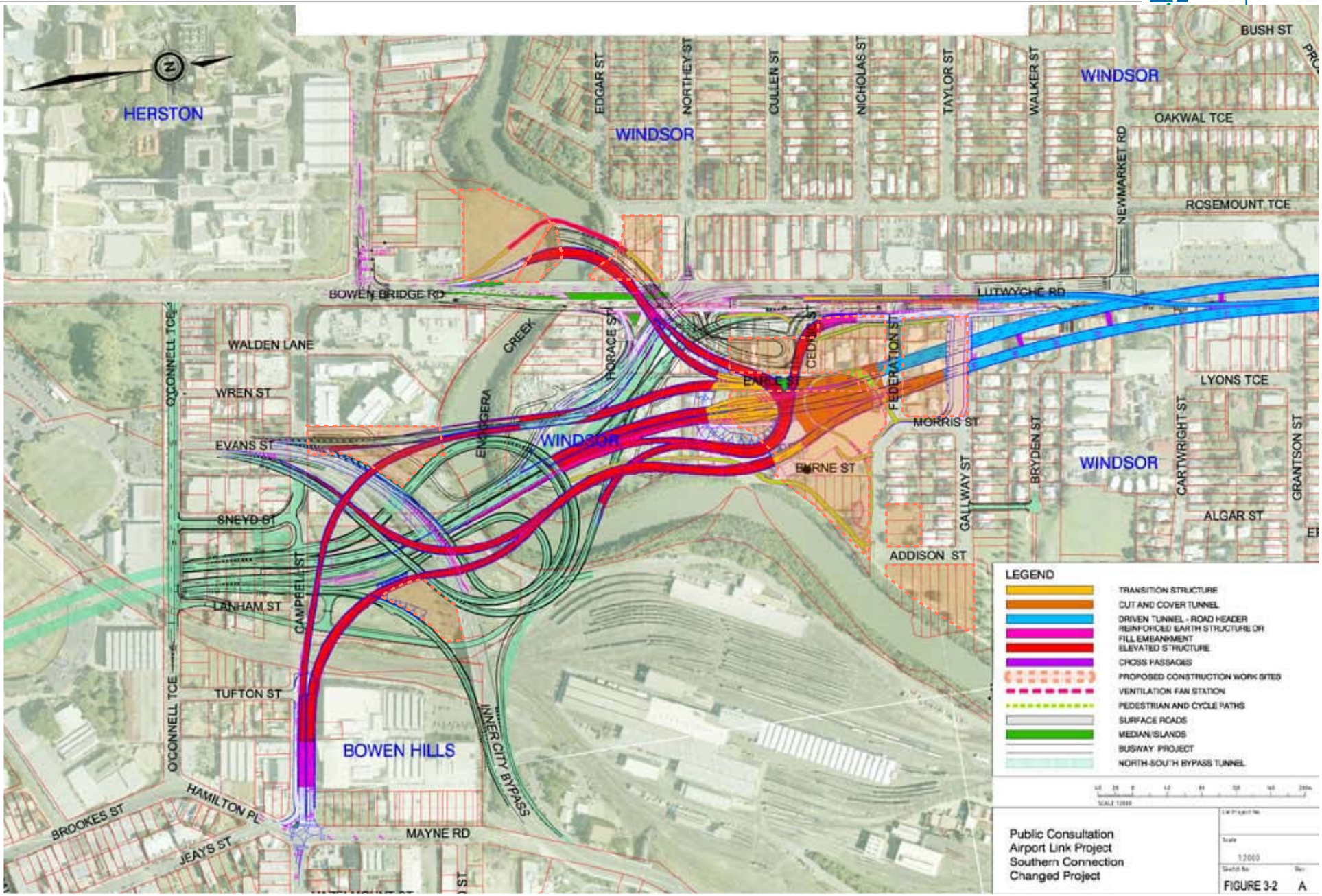


Figure 3-2
Southern Connection **Changed** Project

3.2.2 Effects on the Project

The primary effect of the proposed changes to the surface connections at Bowen Hills and Windsor is to improve the connectivity between the Changed Project and the surface network. This is described in more detail at **Section 3.2**.

Emergency vehicle access to and from Royal Brisbane Hospital (RBH) is maintained.

Environmental Effects

Table 3-7 below examines the potential environmental effects in the order presented in the EIS.

Table 3-7 - Environmental Effects - Southern Connection Changes

EIS aspect	Potential impact	Likely changed environmental effect
Traffic and Transport	Refer to 3.2	
Topography, Geology, Geomorphology and Soils	No changed effect	
Hydrology and Groundwater Quality	No changed effect	
Surface Water Quality	No changed effect	
Air Quality	Refer below	✓
Noise and Vibration	Refer below	✓
Flora and Fauna	Refer below	✓
Land Use and Planning	Refer below	✓
Cultural Heritage	Refer below	✓
Social environment	No changed effect	
Urban Design and Visual Environment	Refer below	✓
Economic and Financial Environment	No changed effect	
Hazard and Risk	Refer below	✓
Waste Management	No changed effect	
Urban Regeneration	No changed effect	

Air Quality Effects

In the EIS, air quality was assessed by modelling:

- the emissions from the ventilation outlets with and without the Reference Project, taking into account other contributors such as the ventilation outlet for the NSBT project;
- the emissions from motor vehicles around surface roads with and without the Reference Project; and
- the existing environment for a wide range of meteorological conditions.

Impacts from changes to traffic on surface roads were assessed in detail in the Reference Project, both for air quality and health impacts. The air quality impacts were generally proportionate to the volume of traffic on the road. The changes in air quality impacts for the Changed Project have been assessed by comparing changes in traffic numbers on surface roads with the Reference Project.

Traffic flows, from the updated traffic model (refer Section 3.2), have been examined for surface roads in the Bowen Hills and Windsor area. The difference between the "Do Minimal" or no tunnel option and the "Do Something" option for the Reference project and for the Changed Project were calculated.

The most likely surface road locations with air quality impacts for the Reference Project were Bowen Bridge Road and Newmarket Road. For these roads air quality was forecast to be within the goals for ambient air. For the Changed Project, traffic flows on the modelled roads in 2012 and 2026 in this section of the route, namely Bowen Bridge Road and Newmarket Road are forecast to decrease compared to the Reference Project. The EIS conclusions for health impacts remain valid for the Changed Project.

Noise and Vibration

Operational road traffic noise impacts were reviewed taking into account:

- revised road layouts and preliminary roadside noise barrier design for each of the connections with the surface road network; and
- impacts on the greater road network given revised traffic forecasts.

As with the Reference Project, no noise or vibration operational impacts are predicted for traffic flows within the tunnel sections of the Changed Project. The findings of the assessments are presented below, whereas the noise and vibration reports prepared on behalf of CNI by Heggies Australia and on behalf of BC by Air Noise and Environment are attached respectively.

Portal Road Traffic Noise

The LA10(18hr) noise predictions for the Changed Project were examined at the nearest noise sensitive locations. The planning goal of 63 dBA LA10(18hr) was used to assess the effect of the Changed Project[7], except for south of Enoggera Creek where the "status-quo" planning level was used due to high existing noise levels in this area.

Road traffic noise modelling has been undertaken for the Changed Project. Compliance with the Coordinator-General's conditions of 63 dBA LA10(18hr) and "status quo" noise levels would be achieved in the Windsor-Bowen Hills area with noise mitigation either through reasonable and feasible mitigation measures such as noise barriers and the opportunity through normal planning processes for redevelopment to introduce new buildings that act as noise barriers.

In particular, modelling has shown that:

- the Changed Project design would reduce noise-related impacts on The Mews apartments, as recommended in the Coordinator-General's Report[8], by relocating the O'Connell Terrace connections as a grade-separated connection with Bowen Bridge Road, north of Butterfield Street. There is a consequential reduction in the noise mitigation required (no barrier required for O'Connell Terrace ramps) compared to the Reference Project. Barriers are already provided for the NSBT -

[7] This goal is adopted at the Windsor – Bowen Hills portals for non State-controlled roads.

[8] Recommendation 7(e) - Road Network Connections

ICB connection. Status quo noise levels can be reasonably and feasibly achieved for the Changed Project;

- there are no significant changes from the Reference Project to noise barriers required to achieve "status quo" noise levels at the Tufton Street apartments;
- with appropriate mitigation measures the Changed Project would achieve the planning noise levels for residences in Northey and Victoria Streets Road affected by traffic noise emanating from the elevated on-ramp (north-bound) from Bowen Bridge Road;
- as for the Reference Project, the Changed Project would achieve the 63 dBA LA10(18hr) for the residential places of Windsor East, including for residences along the proposed extension of Gallway Street with relocation of the proposed noise barriers for the Reference Project.

Road Network Traffic Noise (Remote from Portals)

Noise predictions showing the upper limit of likely (operational) noise changes arising from the Changed Project are set out in **Table 3-8**.

Table 3-8 - Effect of 2022 Tunnel Traffic on Noise from Major Southern Surface Connecting Routes

Roadway	Change in LA10 (18hr) Traffic Noise Level Due to Tunnel 2022 (with Northern Busway)
Bradfield Hwy	-0.2
Herston Rd	-1.2
Brunswick St	-5.3
Bowen Bridge Rd	-3.7
Inner City Bypass	1.4
Breakfast Creek Rd	0.2
Kingsford Smith Rd	0.4
Albion Rd/Albion Bypass	-1.0
Northey St	1.2
Newmarket Rd	-1.1

Table 3-8 indicates that the expected operational noise changes on the wider road network due to the Changed Project would be negligible and would likely be unnoticed by most people. Changes in noise levels of 2 dBA or less are generally considered to be undetectable to the human ear. The decrease on Bowen Bridge Rd (-3.7 dBA) and Brunswick (-5.3 dBA) for the Changed Project would generally be considered a "noticeable" positive change as a result of the Changed Project.

Flora and Fauna

The new alignment over Enoggera Creek reduces the infrastructure footprint resulting in the retention of 300m^2 of mature mangroves downstream. The loss of mangroves associated with the additional crossing of Enoggera Creek for the Bowen Bridge Road on-ramp (north-bound) and associated overhead pedestrian bridge crossing of Enoggera Creek, is more than compensated by avoiding the extensive area of mangroves within and adjacent to the QR land. Refer to **Figure 3-4**.

Indication of **Reference** Project with O'Connell Terrace ramps

Indication of **Changed** Project without O'Connell Terrace ramps

Figure 3-3
View North from O'Connell Terrace - Artists Impression

Indication of **Reference** Project downstream bridge crossing of Enoggera Creek

Changed Project no longer requires this crossing and retains mangroves

Figure 3-4
Downstream Enoggera Creek - Artists Impression

Where mangrove removal cannot be avoided, stream banks would be re-profiled and root mass remained intact to allow for re-colonisation. Supplementary mangrove planting would also be provided adjacent to construction works.

The removal of mangroves would require development approval under the *Integrated Planning Act 1997* (Qld) for operational works, being the removal, destruction or damage of a marine plant. The existing Coordinator-General's conditions require that this development application must include information identifying:

- the areas likely to be disturbed by such work;
- any species of marine plants likely to be affected by the works;
- any potential changes to tidal flows likely to affect a marine plant resulting from that work; and
- where mangrove removal cannot be avoided, site conditions suitable for the re-colonisation of mangroves once construction is completed, in accordance with *Fish Habitat Guideline 002 – Restoration of Fish Habitat, Guidelines for Marine Areas, DPI, 1998*.

Land Use and Planning

The Changed Project would provide safer and more efficient traffic operations, as well as a significantly improved urban outcome for the Bowen Hills business and residential communities.

The area south of Enoggera Creek and to the east of the Mayne rail yards is contained within the new Bowen Hills Urban Development Area (UDA) under the control of the Urban Land Development Authority (ULDA). The ULDA is undertaking a Development Scheme for the area that will outline the types of housing, land uses, the provision of community and recreational facilities, and an integrated transport network. The Changed Project forecasts some increase in traffic associated with the Campbell Street ramps but equally opens greater opportunity for local connectivity by relocating the O'Connell Terrace ramps to Lutwyche Road.

O'Connell Terrace would be retained as a suburban road and would not be used as a connection for city traffic, maintaining its essential function for local businesses and the RNA grounds. Consequently, access to the RNA Showground including temporary parking during the Brisbane Exhibition, and businesses on O'Connell Terrace would be maintained by retaining O'Connell Terrace. Future development of the RNA would not be constrained by the Changed Project. As a result of improved traffic flows with the Changed Project, access to the RBH from Bowen Bridge Road would also be improved compared with the Reference Project.

The Changed Project would impact on twenty eight additional properties, seventeen of which are government-owned, in the Windsor and Bowen Hills area than the Reference Project.

Table 3-9: Changes in property impacts (Southern Connections), Reference Project and Changed Project

Ownership	Reference Project	Additional Property Requirements	Changed project
Residential	22	5	27
Commercial	1	6	7
Government	11	17	28
Total	34	28	62

Premises within the Office Park identified for resumption in the Reference Project at the corner of Evans Street and O'Connell Terrace would not be required by the Changed Project as they are no longer affected by ramps in O'Connell Terrace. Only urban mitigation works would be undertaken in Campbell Street and O'Connell Terrace.

An additional six properties would be required to the north of Federation Street to accommodate the design changes brought by the innovative approach to the Windsor - Bowen Hills connection. The Changed Project removes the connection to O'Connell Terrace, but requires a ramp connection up onto Lutwyche Road from the north south tunnel. This requires a shallower alignment for the south bound tunnel with construction required north of Federation Street. This area would be returned following completion of construction for future development.

The Changed Project would occupy land to the west of Lutwyche Road and south of Northey Street in conjunction with the Northern Busway Project works. The Bowen Bridge Road on-ramp (north-bound) to Airport Link would involve a widening along Bowen Bridge Road requiring a small area of frontage of the Hungry Jack's fast food premises. Consultation with the property owner would be required to accompany detailed planning and delivery of this road widening to ensure access could be maintained during the works.

Three commercial properties on Lutwyche Road, north of Bowen Bridge would be permanently required to allow for the Bowen Bridge Road on-ramp (north-bound) crossing Lutwyche Road. Access would also be required to vacant BCC owned land fronting Victoria Street, south of Northey Street for the pedestrian crossing of Enoggera Creek.

Cultural Heritage

The Changed Project, at Windsor, would result in the removal of buildings at 12 Federation Street identified as "Nyamber", or the former Marooma Nursing Home. This is one of the six (6) properties required for the Changed Project referred above. This property is identified in the Brisbane City Council schedule of local heritage significance in the Brisbane City Plan 2000. The property is not listed on either the Queensland Heritage Register or the Register of the National Estate. "Nyamber" is considered to be of local heritage significance because it is one of a group of houses along Lutwyche Road providing evidence of the development of this area in Windsor as a residential suburb during the second half of the 19th century.

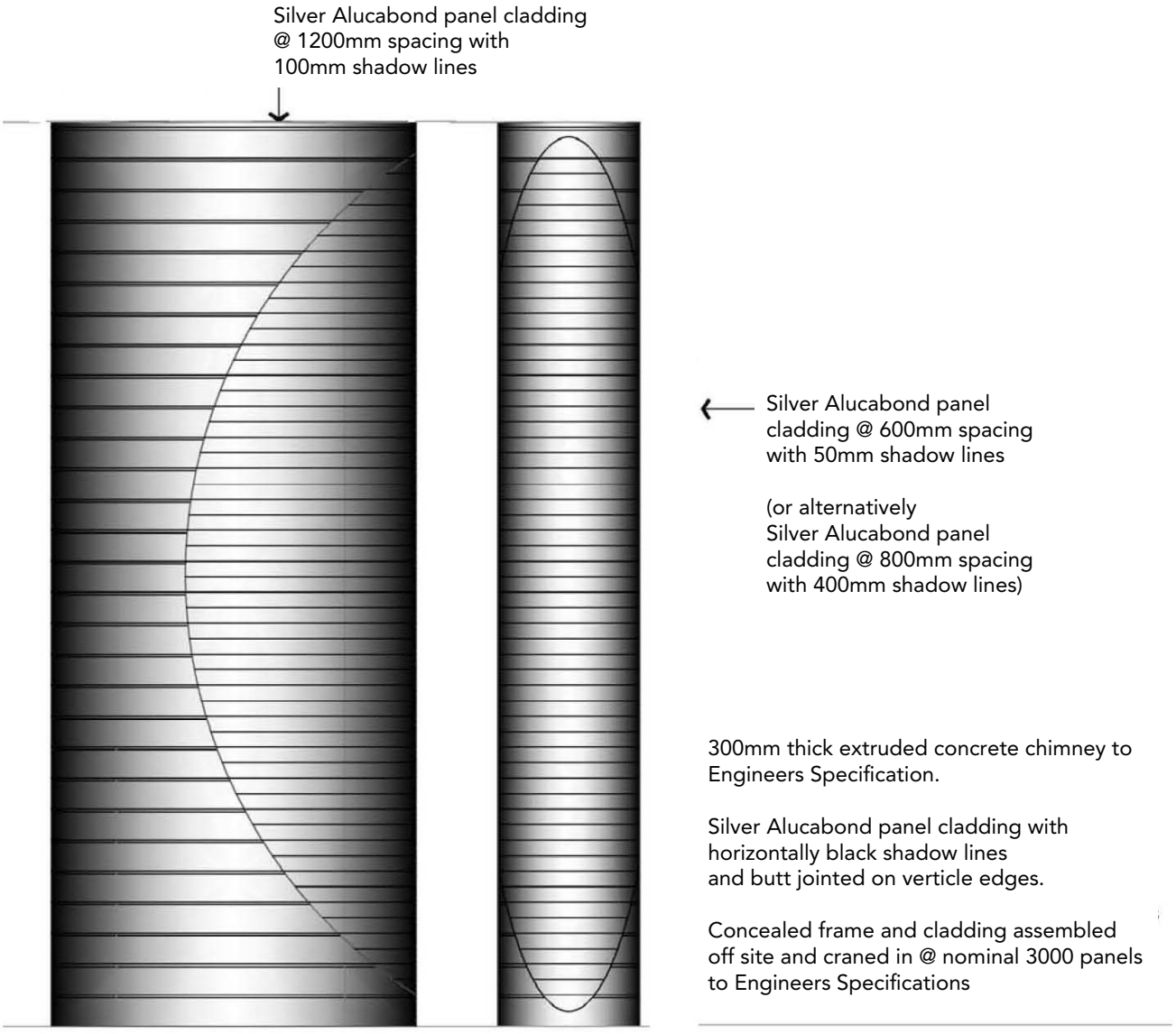
The Changed Project would increase the impact on the area formerly known as the Swan Hill Residential Estate by extending the land required for works and infrastructure development. This estate is considered to have included the area between Federation Street and the line between Gallway Street to Lutwyche Road, including the "Nyamber" property.

The Coordinator-General's conditions require archival quality photographic recording of sites of cultural heritage significance impacted by the Project. It is recommended that this requirement be extended to include the "Nyamber" property prior to carrying out relevant construction works.

Urban Design and Visual Environment

Compared with the Reference Project, the Changed Project would move the ventilation station and ventilation outlet further east adjacent to Byrne Street. The ventilation station would be partially buried and screened behind a landscape feature created over the Airport Link portals (**Figures 3-5 and 3-6**).

Partial burial of Windsor ventilation station within the hilltop park south of Federation Street



Ventilation outlet typical elevation and design elements

Figure 3-5
Windsor Ventilation Station and Outlet - Artists Impression

Lutwyche Road and Horace Street intersection looking east - existing view

Reference Project indicating ventilation station and outlet - Artists Impression

Changed Project with ventilation station buried and outlet located further to the east - Artists Impression

Figure 3-6
View of Windsor ventilation station and outlet looking east from Lutwyche Road

This landscape feature would provide space for passive recreation while also concealing plant and equipment (e.g. water fire tank, pump room), lessening the building footprint from the Reference Project. The current concept design for the ventilation outlet is as a 'blade' or slender oblong structural element presenting a slender profile to the north and the south and an increased profile to the east and the west. Architectural treatments in addition to the changed location of the ventilation outlet would serve to mitigate the visual impact of the structure.

The Changed Project would relieve the urban amenity impacts on O'Connell Terrace Bowen Hills by moving the on-ramp (north-bound) from O'Connell Terrace to Bowen Bridge Road. The proposed change to the O'Connell Terrace connections would also relieve the urban amenity impacts of the Reference Project upon The Mews apartments in Campbell Street by removing the need for a double-stacked road structure adjacent to their eastern boundary.

The Changed Project would maintain the pedestrian connections from Bowen Hills station to the Royal Brisbane Hospital.

The infrastructure included within the Changed Project would have an increased visual complexity compared to the Reference Project due to the height and location of the various elevated roadways. In particular, there would be:

- increased complexity to the visual environment by introducing:
  - an additional elevated structure over Lutwyche Road adjacent to the Northern Busway connection;
  - an additional elevated structure, when compared with the Reference Project, over the portals to the mainline tunnels south of Federation Street;
  - an additional elevated structure, when compared with the Reference Project, connecting the mainline tunnel south-bound to the Inner City Bypass west-bound, above the NSBT infrastructure;
  - a four-level elevated structure for the Campbell Street off-ramp (south-bound) over the Inner City Bypass;
- increased perception of width on Lutwyche Road near Federation Street with the addition of the off-ramp (south-bound).

Design mitigations for the Changed Project include:

- locating the highest of the elevated road structures towards the middle of the Bowen Hills interchange, thereby increasing the separation between this element and vantage points and sensitive places;
- a comprehensive approach to landscaping and structural elements, such as the coloured monoliths proposed as a southern gateway to the Changed Project, the partially-buried ventilation station and the design and orientation of the ventilation outlet at Windsor.

Hazard and Risk

The Changed Project would include a range of flood mitigation works and tunnel portal protection measures, such as extensive local earthworks along the banks of Enoggera Creek lowering the ground level

to RL1.6m AHD to provide for increased hydraulic capacity through this section of Enoggera Creek. The tunnel infrastructure would be protected through:

- the construction of an earth levee around the majority of the tunnel portal area east of Lutwyche Road and north of the creek;
- provision of flood walls around the eastern Campbell/ICB ramps;
- using the structure of the partially-buried ventilation station off Byrne Street adjacent to Enoggera Creek as an additional flood protection measure.

Flood investigations for the Changed Project have adopted a comprehensive approach to hydraulic modelling which shows that with proposed mitigation methods described above, there would be no increase in flooding upstream for events up to 10,000 year ARI.

3.3 Kedron

3.3.1 Project Changes

The Reference Project included road connections to Gympie Road and Stafford Road from the north-south tunnels and from the east-west tunnels of Airport Link. The Changed Project design would place the northern connections from Gympie and Stafford Road underground, resulting in less surface infrastructure, particularly across Kedron Brook. The connections for the Changed Project are:

- as with the Reference Project, the north-bound connections at Kedron would have an elevated structure over Kedron Brook. The east-west tunnel connection to Gympie Road and Stafford Road would have more efficient grade separated connections. The two left-hand lanes from the north-bound tunnel would ramp up and over Kedron Brook, to be joined by one lane on the left side and one on the right from the west-bound tunnel connection, destined for Stafford Road and Gympie Road respectively. The resulting four-lane, elevated structure would then divide with two lanes connecting to Stafford Road west-bound near Clarence Road and two to Gympie Road north-bound near Broughton Road;
- access from Gympie Road and Stafford Road south-bound and east-bound would be in fully grade-separated cut and cover tunnel. Gympie Road traffic would ramp down in two lanes into cut and cover tunnel north of Stafford Road. A third lane would develop on the left and diverge towards the east-west tunnel, with two lanes continuing towards the south-bound tunnel. Stafford Road traffic would enter cut and cover tunnel in one lane near Clarence Street, widening to two lanes before diverging left for the east-west tunnel and right for the south-bound tunnel;
- an on-ramp for north-bound traffic from Lutwyche Road via a double right turn at the Lutwyche Road / Kedron Brook Road intersection. This would merge from two lanes to one and loop around the Department of Emergency Services (DES) building, descending into cut and cover tunnel to merge with the east-bound ramp from Gympie Road and Stafford Road;
- the mainline tunnels between Lowerson Street, Lutwyche and Park Avenue, Wooloowin would be realigned. Generally, the mainline tunnels would be relocated, in an arc between these locations, to the east and south of the alignment of the Reference Project. The system of underground ramps provided for the above connections are generally above and across the mainline tunnels between Lowerson Street and Rose Street;

- the tollroad control centre would be relocated to a site at the corner of Stafford Road and Clarence Street, Stafford to allow improved access to the Changed Project tunnel system.

Changes to the surface roads at Kedron for the Changed Project would be:

- removal of additional entry ramps from Stafford Road into the south-bound tunnel;
- no exit from the east-west tunnel to the Lutwyche Road south at the intersection with Kedron Park Road. Access to Lutwyche Road south would be via Stafford Road and Richmond Street;
- a dedicated and separated drop-off lane on Lutwyche Road for safe student access to Wooloowin State School;
- the bridges crossing Kedron Brook reducing in width to ten lanes from the thirteen proposed in the Reference Project, due to the shorter left-turn lanes for Kedron Park Road and the undergrounding of the east-bound and south-bound ramps for Airport Link;
- widening of Gympie Road between Kedron Brook and Broughton Road, with similar allowance for surface traffic as in the Reference Project, and four lanes of ramps for Airport Link. The extent of eight lanes on Gympie Road north of the ramps would be slightly longer than in the Reference Project, returning to six lanes north of Broughton Road;
- the Gympie Road/Leckie Road intersection moved slightly northward to suit the changed alignment of Gympie Road and operating as a left-in connection only. As a result the western end of Arnott Street would be closed;
- in response to requirements from BCC and DMR, access from Homebush Road and Broughton Road to Gympie Road would be closed to through traffic, and each of those roads would be terminated in a cul-de-sac arrangement;
- access to Swan Street Gordon Park would be signalised as part of the Gympie Road-Stafford Road intersection;
- lane arrangements at the Gympie Road-Stafford Road intersection would be similar to the Reference Project, except no left-turn slip lane into Stafford Road would be provided;
- widening of Stafford Road to provide three west-bound lanes west of Gordon Street, with one lane for surface traffic and two lanes from the Airport Link off-ramp, and up to four east-bound lanes at the intersection with Gympie Road. East of Clarence Road, the Airport Link on-ramp would go underground down from the right-hand lane, with two lanes past the diverge for surface traffic.

The design of the Kedron connection in the Changed Project also provides for the retention of the DES building south of Kedron Brook with access similar to the existing access from Lutwyche Road. This entry and exit would also provide access to the ventilation station.

A comparison of the Reference Project and Changed Project at Kedron is provided in **Figures 3-7, 3-8A, 3-8B, 3-8C, 3-8D** and **Figure 3-9**.

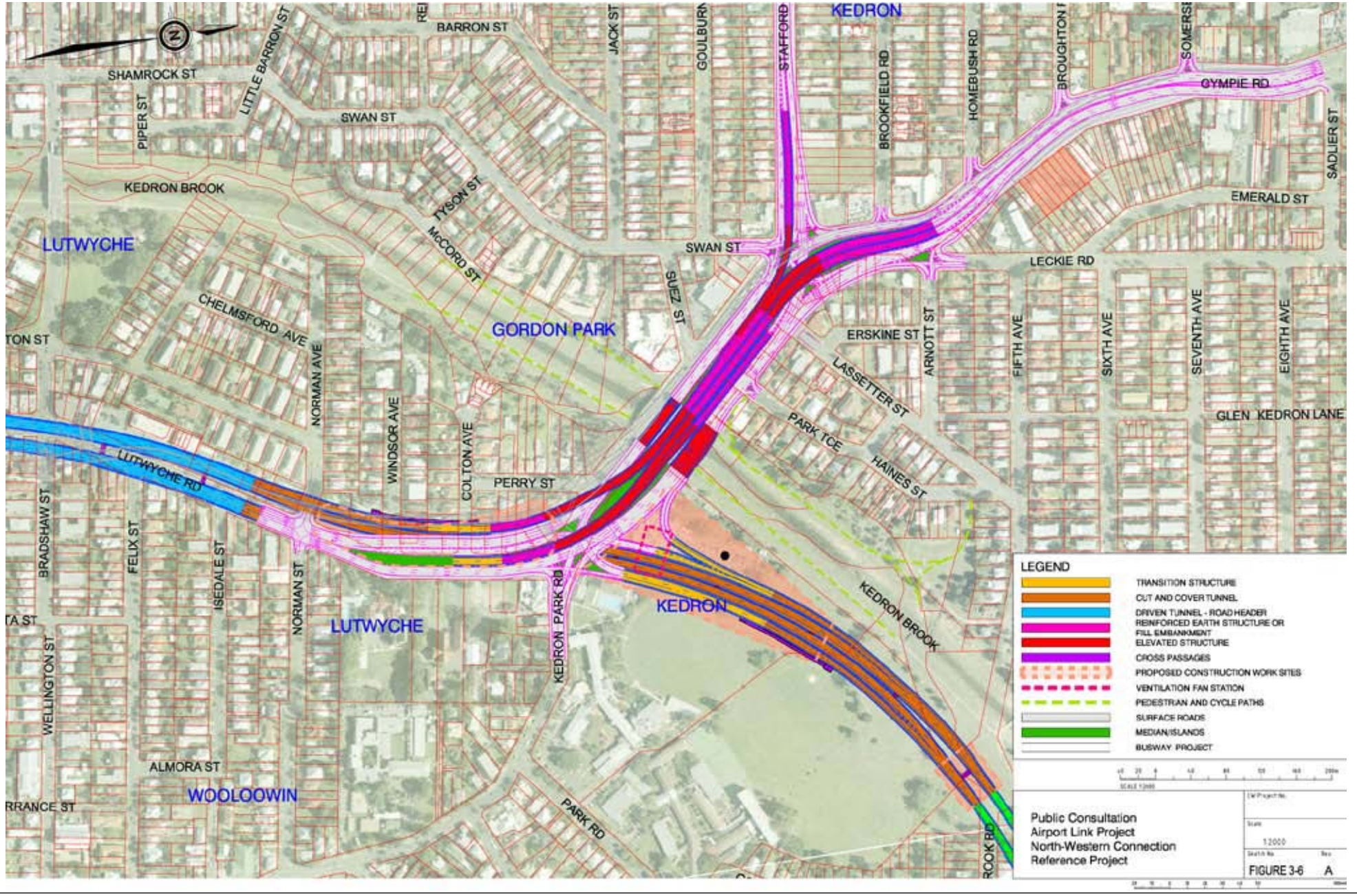


Figure 3-7
North-Western Connection **Reference** Project

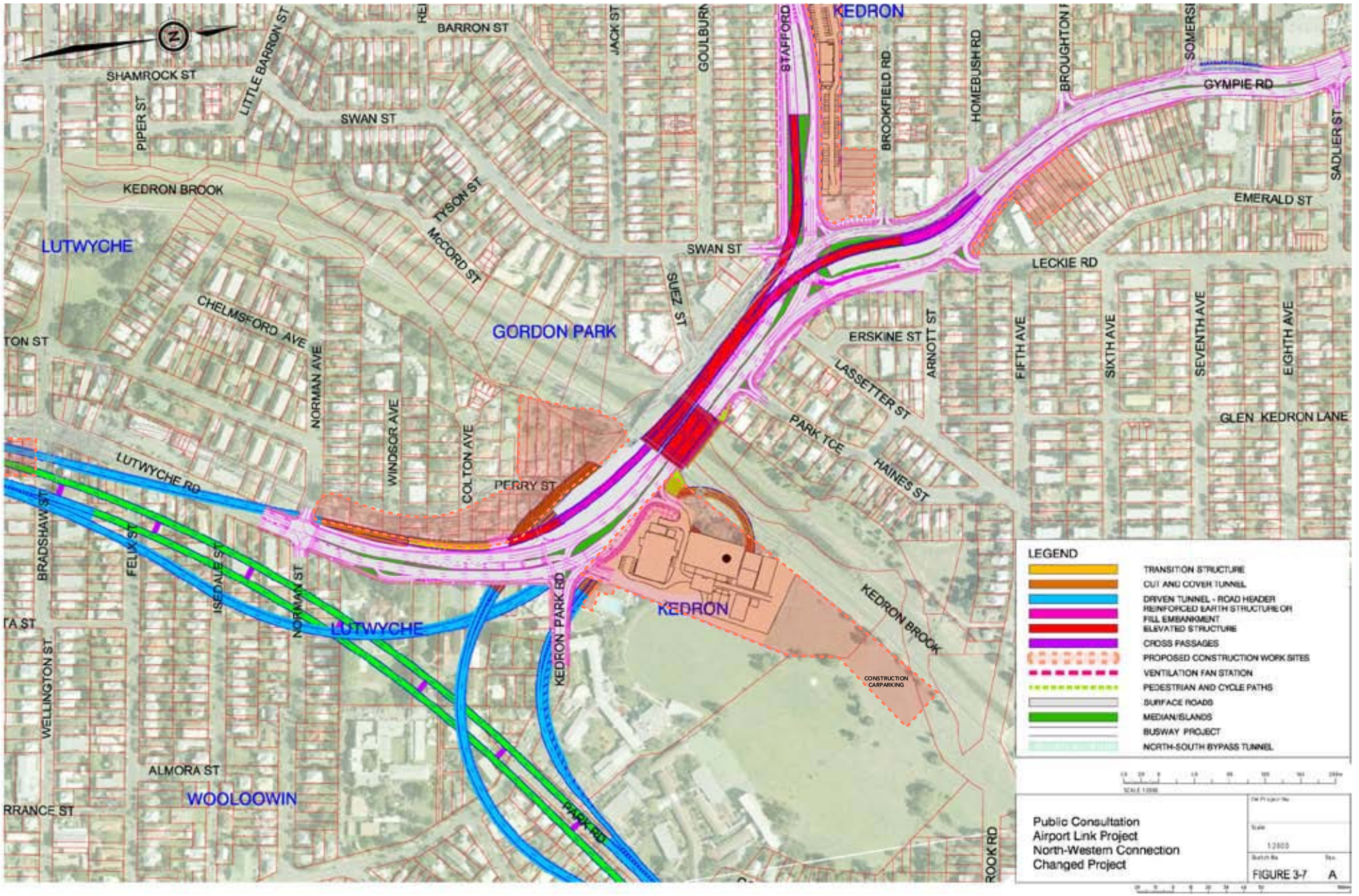


Figure 3-8A
North Western Connection **Changed** Project Surface Works and Elevated Structure

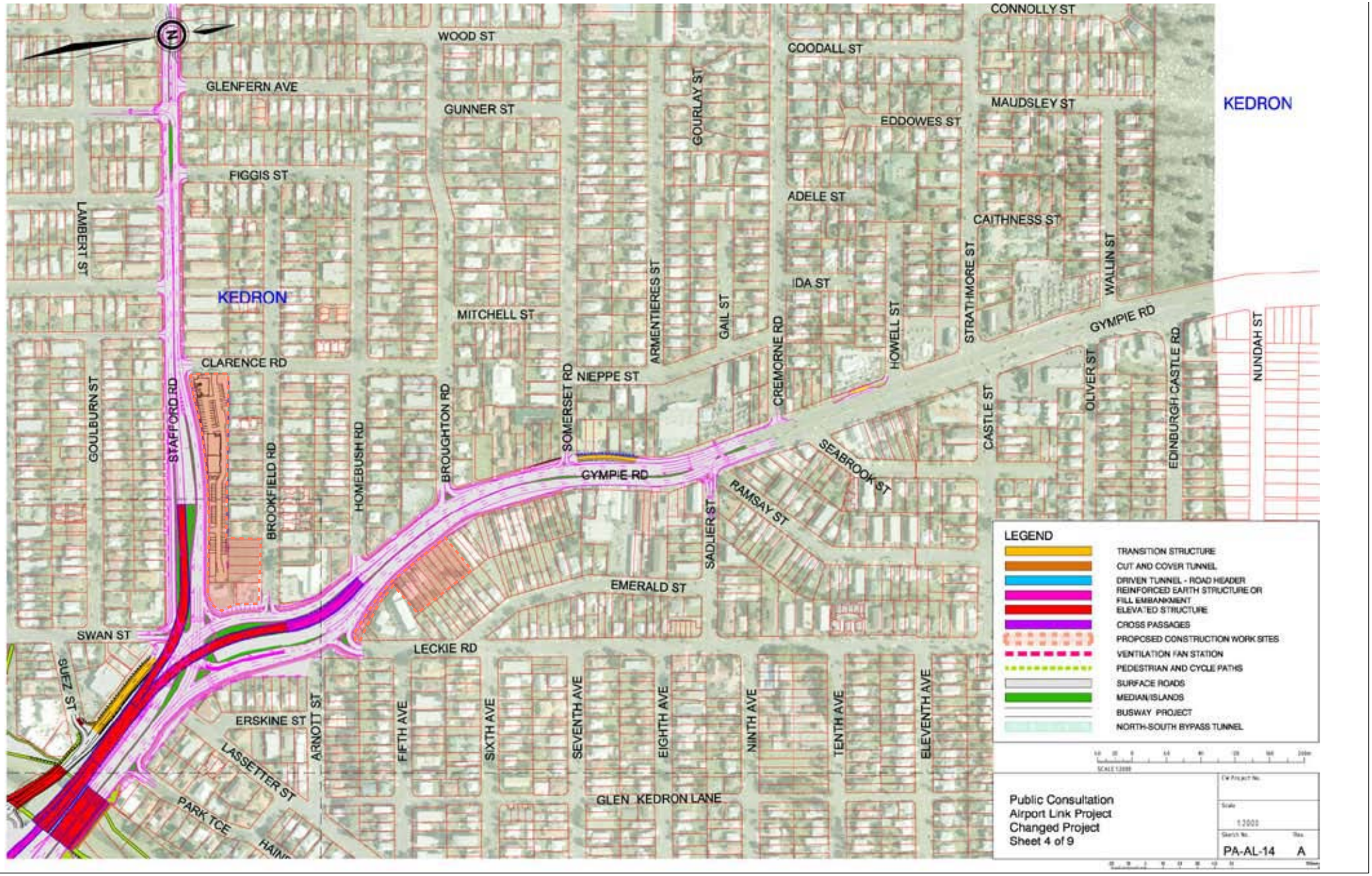


Figure 3-8B
North Western Connection **Changed** Project Surface Works Gympie and Stafford Roads

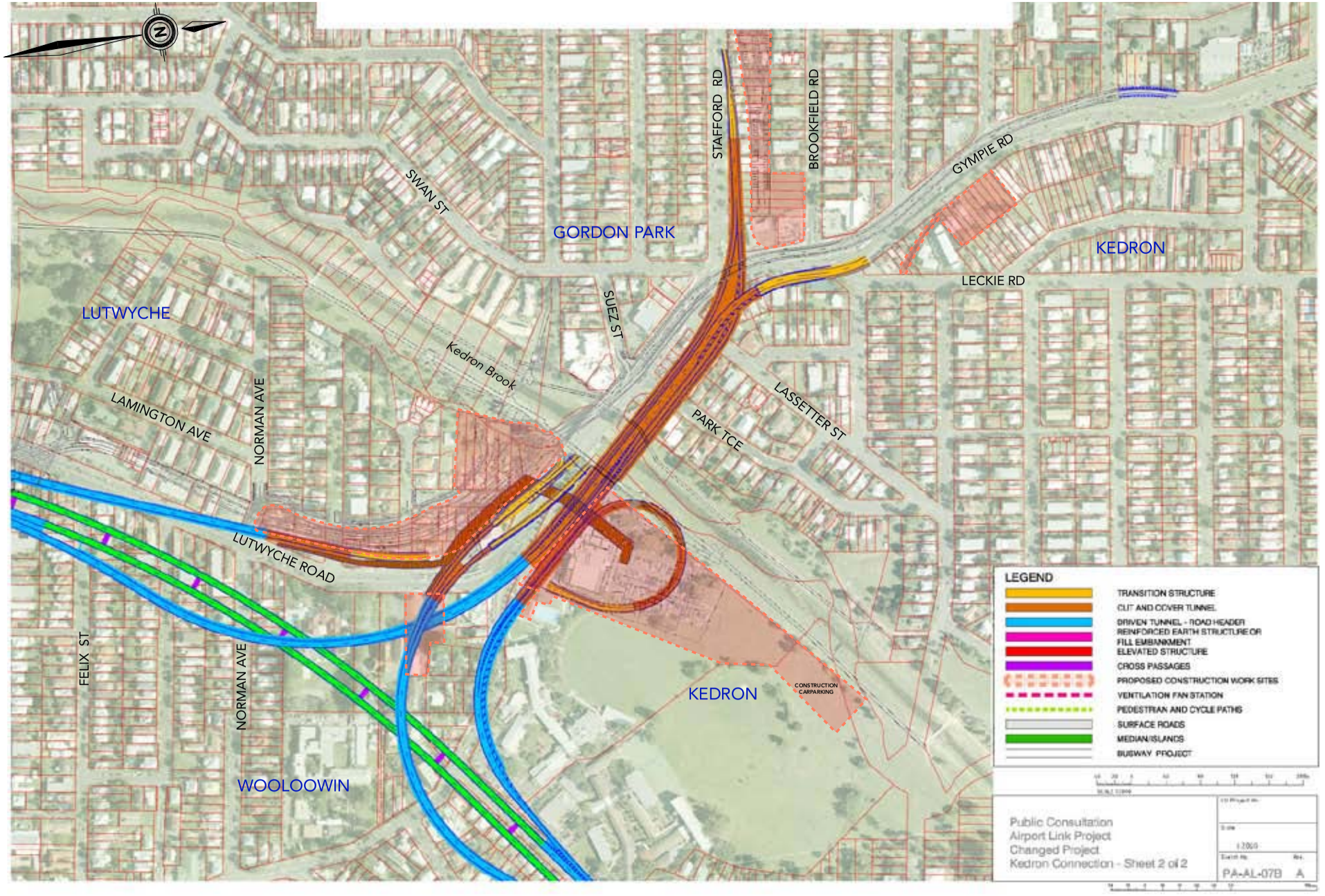


Figure 3-8C
North Western Connection **Changed** Project Cut and Cover Works

Figure 3-8D
North Western Connection **Changed** Project Tunnel Connecting Ramps

Kedron connection indication of **Reference** Project surface elevated road structures

Kedron connection **Changed** Project

Figure 3-9
NorthWestern Kedron Connection View to the South - Artists Impression

3.3.2 Effects

The primary effects of the proposed changes to the surface connections at Lutwyche and Kedron are to reduce the surface footprint of the road network over Kedron Brook and the extent and bulk of the elevated structures through the area between the Kedron Park Road intersection and the Gympie Road intersection with Stafford Road. More efficient grade separation would be provided to key intersections particularly for traffic from the east-west tunnel, although the direct access to Lutwyche Road south would be removed, requiring access to the south via Stafford Road. The Changed Project intersection arrangement provides improved performance for the intersection of Gympie Road with Stafford Road as can be seen in the improved Level of Service (LOS) in table 3.6.

Environmental Effects

Table 3-10 below examines the potential environmental effects in the order presented in the EIS.

Table 3-10 - Environmental Effects - Northern Connection Changes

EIS aspect	Potential impact	Likely changed environmental effect
Traffic and Transport	Refer to 3.2	
Topography, Geology, Geomorphology and Soils	No changed effect	
Hydrology and Groundwater Quality	Refer below	✓
Surface Water Quality	No changed effect	
Air Quality	Refer below	✓
Noise and Vibration	Refer below	✓
Flora and Fauna	No changed effect	
Land Use and Planning	Refer below	✓
Cultural Heritage	No changed effect	
Social environment	No changed effect	
Urban Design and Visual Environment	Refer below	✓
Economic and Financial Environment	No changed effect	
Hazard and Risk	Refer below	✓
Waste Management	No changed effect	
Urban Regeneration	No changed effect	

Hydrology and Groundwater Quality

The principal differences between the Reference Project and the Changed Project that have potential impacts on the hydrology and groundwater environment of the Project are the following:

- cut and cover tunnels across Kedron Brook have been designed to avoid groundwater impacts on Kedron Brook or its alluvial aquifer;
- drained Y-junctions at Kedron may result in minimal but variable settlements, due to the nature of the overlying stiff to very stiff clays. The deeper alignment of the tunnels in this vicinity is expected to diminish the risk of settlement from groundwater drawdown.

Air Quality

Traffic flows, from the updated traffic model (refer Section 3.2), have been examined for surface roads in the Kedron area. The difference between the "no Airport Link" option and the Reference Project and the Changed Project were calculated. For both the Reference Project and the Changed Project, impacts on ambient air quality from surface traffic on Stafford Road east of Webster Road would be within the goals established by the Coordinator-General and would not change the forecast with regards to community health outcomes presented in the EIS.

For the Reference Project, traffic flows forecast for Gympie Road, south of Rode Road, indicate significant changes to annual average concentrations of NO_2. For the Changed Project, the predicted traffic flows would decrease slightly. Consequently, the potential health outcomes for the Changed Project would be similarly improved compared to the Reference Project along this section of the route.

An increase in traffic flows is predicted at the intersection of Lutwyche Road and Gympie Road where there would be a convergence of surface traffic and emerging tunnel traffic. In the Reference Project, the total traffic flows at this intersection were similar to the total traffic numbers on Gympie Road, but would be spread over double the number of lanes at this intersection, compared to the continuing section of Gympie Road to the north.

With the revised traffic forecasts for the Reference Project, there would be approximately 50% more traffic at the intersection of Gympie Road and Lutwyche Road both with and without Airport Link. Traffic forecasts for the Changed Project at this location, indicate there would be about 4% more traffic than the Reference Project. The forecast increased traffic flows along this section would result in long-term concentrations of NO_2 less than the air quality goal, but higher than presented in the EIS for both the Changed Project and the Reference Project.

Similarly for Stafford Road, traffic flows for the Changed project would result in increases ranging from 2% to 7% east of Webster Road. The changes in average annual concentrations of NO_2 likely to arise as a consequence of the changes in traffic would be higher than predicted for the Reference Project but would be within the ambient air quality goals.

Noise and Vibration

Operational road traffic noise impacts were reviewed taking into account:

- revised portal area road layouts and preliminary roadside noise barrier design; and
- impacts on the greater road network given revised traffic forecasts.

As with the Reference Project, no noise or vibration operational impacts are predicted for the tunnel sections of the Changed Project.

Portal Road Traffic Noise

The revised LA10(18hr) noise predictions were examined at the nearest noise sensitive locations with the proposed noise barriers in place for the Changed Project. The planning goal of 63 dBA LA10(18hr) was used to assess the effect of the Changed Project for non State-controlled roads south of Kedron Brook. The 68 dBA LA10(18hr) planning goal applies to State-controlled roads north of Kedron Brook.

Revised road traffic noise modelling has been undertaken for the Changed Project design both north and south of Kedron Brook to give confidence that the 63 dBA and 68 dBA $L_{A10(18hr)}$ criteria respectively

could be achieved. The Coordinator-General's conditions of 63 dBA LA10(18hr) and 68 dBA LA10(18hr) noise goals (south and north of Kedron Brook respectively) would be achieved in the Kedron area for the Changed Project with reasonable and feasible noise barriers or the use of architectural treatments at particular residences in this area.

The revised modelling has shown that for the Changed Project:

- as for the Reference Project, noise barriers in the order of 6m high would be required to achieve the 63 dBA LA10(18hr) criterion for the residential area south of Kedron Brook and west of Lutwyche Road (e.g. Perry Street, Windsor Avenue, Norman Avenue area);
- as for the Reference Project, noise barriers in the order of 3m to 6m high would be required to achieve the 68 dBA LA10(18hr) criterion for the residential area north of Kedron Brook, east of Gympie Rd and south of Leckie Road (e.g. Park Terrace, Lasseter Street and Erskine Avenue area);
- noise barrier requirements may be reduced from the Reference Project to a noise barrier in the order of 6m high to achieve the 68 dBA LA10(18hr) criterion for the residential area north of Kedron Brook, east of Gympie Road and north of Leckie Road .

Road Network Traffic Noise (Remote from Portals)

Noise predictions showing the upper limit of likely (operational) noise changes arising from the Changed Project are set out in **Table** 3-11**.**

Table 3-11 - Effect of 2022 Tunnel Traffic on Noise from Major Northern Surface Connecting Routes

Roadway	Change in LA10 (18hr) Traffic Noise Level Due to Tunnel 2022 (with Northern Busway)
Stafford Road	1.7
Webster Road	-0.6
Gympie Rd (North of Stafford Rd)	0.8
Leckie Rd	-1.0
Rode Rd (West of Gympie Rd)	0.5
Rode Rd (East of Gympie Rd)	0.2
Lutwyche Rd	-0.2
Park Rd	-1.1
Maygar St	-0.7

Table 3-11 indicates that the expected operational noise changes (both increases and decreases) on the wider road network due to the Changed Project would be negligible and unlikely to be noticed by most persons. Changes in noise levels of 2 dBA or less are generally considered to be undetectable to the human ear.

Land Use and Planning

The Changed Project would relocate the tollroad control centre from a site adjacent to the present location of the DES building to a site on the corner of Clarence Road and Stafford Road. The tollroad control centre in combination with widenings of Stafford Road for future road network enhancements would require eight additional properties to the requirements of the Reference Project.

The tollroad control centre would accommodate a range of administrative and maintenance activities. Some maintenance vehicle parking would be involved, in addition to the staff car parking normally associated with this type of activity.

The tollroad control centre would share its rear boundary with residential properties fronting Brookfield Street. The building would be two storeys in height, standing above a ground level of car parking. The premises would be landscaped to mitigate the impact of the building bulk and the likely presence of security and night lighting of the staff car park.

The Changed Project would impact on eight (8) additional residential properties in the Kedron area to the Reference Project. Apart from the residential properties described above, the Changed project would also impact upon a commercial property for the establishment of one of the Kedron worksites and two government owned sites in Lutwyche.

Table 3-12: Changes in property impacts (North-west Connections), Reference Project and Changed Project

Ownership	Reference Project	Additional Property Requirements	Changed project
Residential	44	8 (full take)	52
Commercial	13	1	14
Government	12	2 (Ozcare and YMCA)	14
Total	69	11	80

The Changed Project would retain a number of land uses free from the impacts of surface works that would have arisen with the Reference Project. In particular, the Kedron State High School would not be impacted, beyond an area required nearby for construction worker car parking. Construction impacts from surface works adjacent to the Wooloowin State School also would be reduced as a consequence of the Changed Project design and delivery methods.

Urban Design and Visual Environment

The Changed Project design in this location would lessen the physical and visual impacts of the Project in the Lutwyche and Kedron area.

The Changed Project provides for a more open landscape with the elimination of the reinforced earth walls of the Reference Project along Gympie Road and the provision of lighter elevated structures using a limited number of supporting structures. The width of the elevated structures would be reduced across Kedron Brook and up Gympie Road because of the under-grounding of the access to the tunnels from Stafford Road and Gympie Road.

The area around the south-bound portal on Stafford Road would provide opportunity for open space and a landscape buffer for residents to the north of the portal.

The location of the ventilation station behind the partially retained DES building, **Figure 3-10**, would reduce the visual impact of the ventilation infrastructure from Lutwyche Road, compared with the Reference Project.

Lutwyche Road looking north towards Emergency Services Complex - existing view

Reference Project indication of ventilation station, outlet and additional elevated road structure - Artists Impression

Changed Project with ventilation station behind retained DES building - Artists Impression

Figure 3-10
Lutwyche Road looking north towards Emergency Services Complex

The design for pedestrian and cycle management for the Changed Project would provide positive improvements for access and mobility around the area. High quality urban design treatments are proposed to the underpass at Kedron Brook incorporating CPTED measures, such as lighting, low planting and clear sight lines. During construction the Kedron Brook recreational and commuter pathway would remain open with temporary bridges constructed north and south of Kedron Brook. This is an important community and transport link. In response to consultation inputs during the EIS and the recommendations of the Coordinator-General, a school drop-off zone at the Wooloowin Primary School would be provided to improve safety for students accessing this facility.

The Reference Project proposed boulevard treatments to Gympie Road north of Kedron Brook Bridge and Stafford Road. The Changed Project would provide median planting to the middle of both roads.

Hazard and Risk

The Changed Project, like the Reference Project, is designed to achieve protection of tunnel infrastructure in a 10,000 ARI river flood event. Detailed design for the Changed Project allows the Stafford Road tunnel portal to intercept overland flows in infrequent, high intensity rainfall events (more than 1 in 100 year) to avoid impacts on adjoining properties. Flows entering the tunnel would be managed within the tunnel drainage system.

The Changed Project removes additional infrastructure through Kedron Brook as proposed in the Reference Project to support the additional three lanes and therefore would achieve a lesser impact to upstream properties compared to the Reference Project.

3.4 Clayfield

3.4.1 Project Changes

The changes proposed would improve the efficiency of the traffic connections and the operation of the tunnel system, and minimise the visual impact of the ventilation station in relation to the surrounding residential area. The proposed changes are:

- the on-ramp (west-bound) transition from Sandgate Road would be significantly shortened from the Reference Project from 180m to 85m;
- the portal to the mainline tunnels would be located 70m to the west of Sandgate Road, approximately in-line with the Sandgate Road on-ramp (west-bound);
- the off-ramp (east-bound) transition from the mainline tunnel to Sandgate Road would be shortened from Reference Project from 180m to 140m;
- the lane arrangement from the off-ramp to Sandgate Road would be changed to provide three left-turn lanes to Sandgate Road north and one right-turn lane to Sandgate Road south;
- the surface road alignment of Sandgate Road north of the intersection with the East West Arterial would be raised by some 600mm to 800mm to improve flood immunity of Sandgate Road;
- the main structure of the ventilation station would be fully buried with provision for public access and landscape treatment on a surface “land bridge”;

- the sub-station for the ventilation station would be situated on land between Alma Road and Sandgate Road (i.e. opposite the intersection with Wongara Street) to the south of the main structure of the ventilation station;
- the ventilation outlet would be reduced in height from 30m to 25m.

A comparison of the Reference Project and Changed Project at Kedron is provided in **Figures 3-11** and **3-12**. Two indicative views of this connection are shown in **Figure 3-13.**

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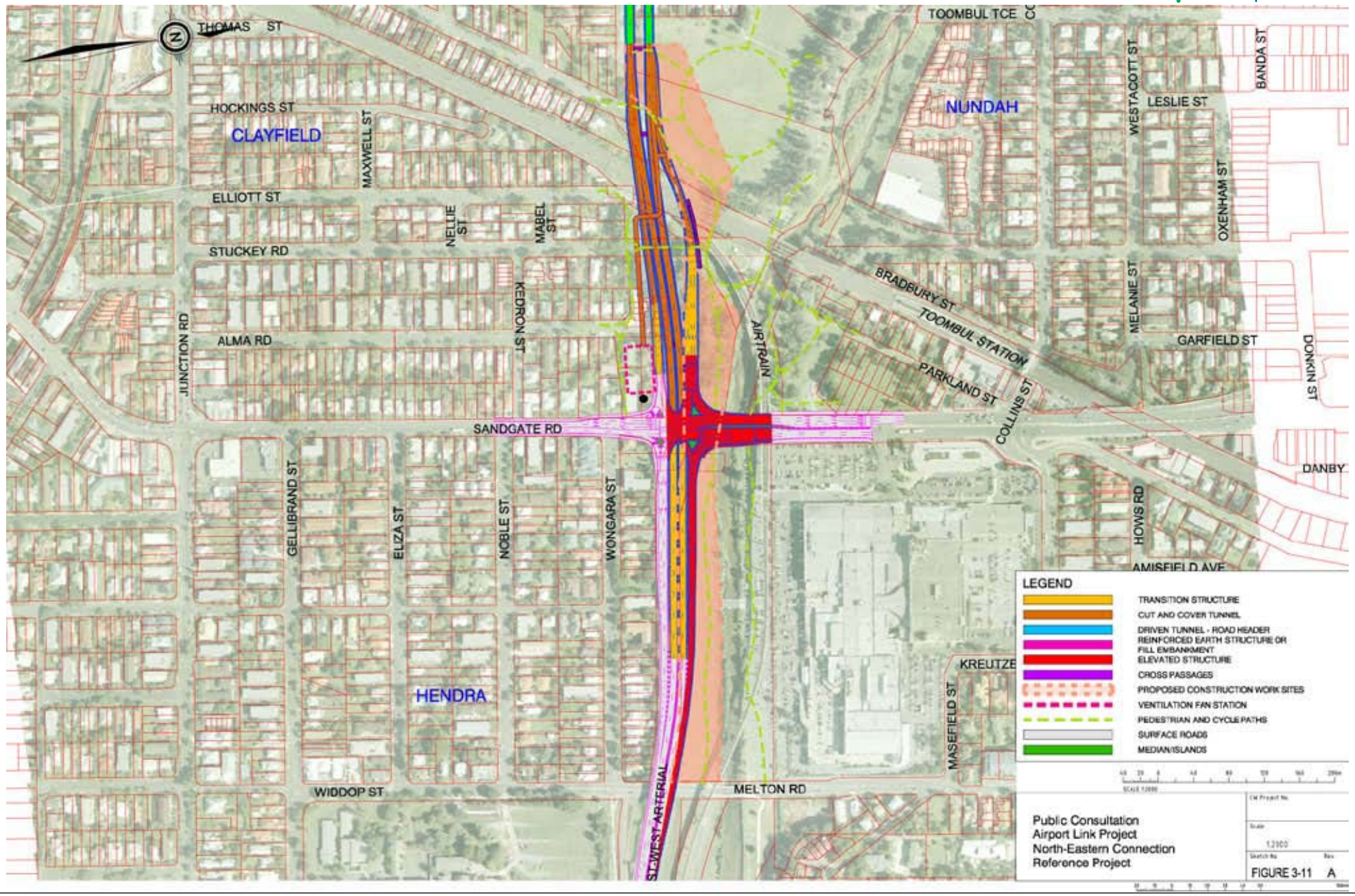


Figure 3-11
North Eastern Connection **Reference** Project

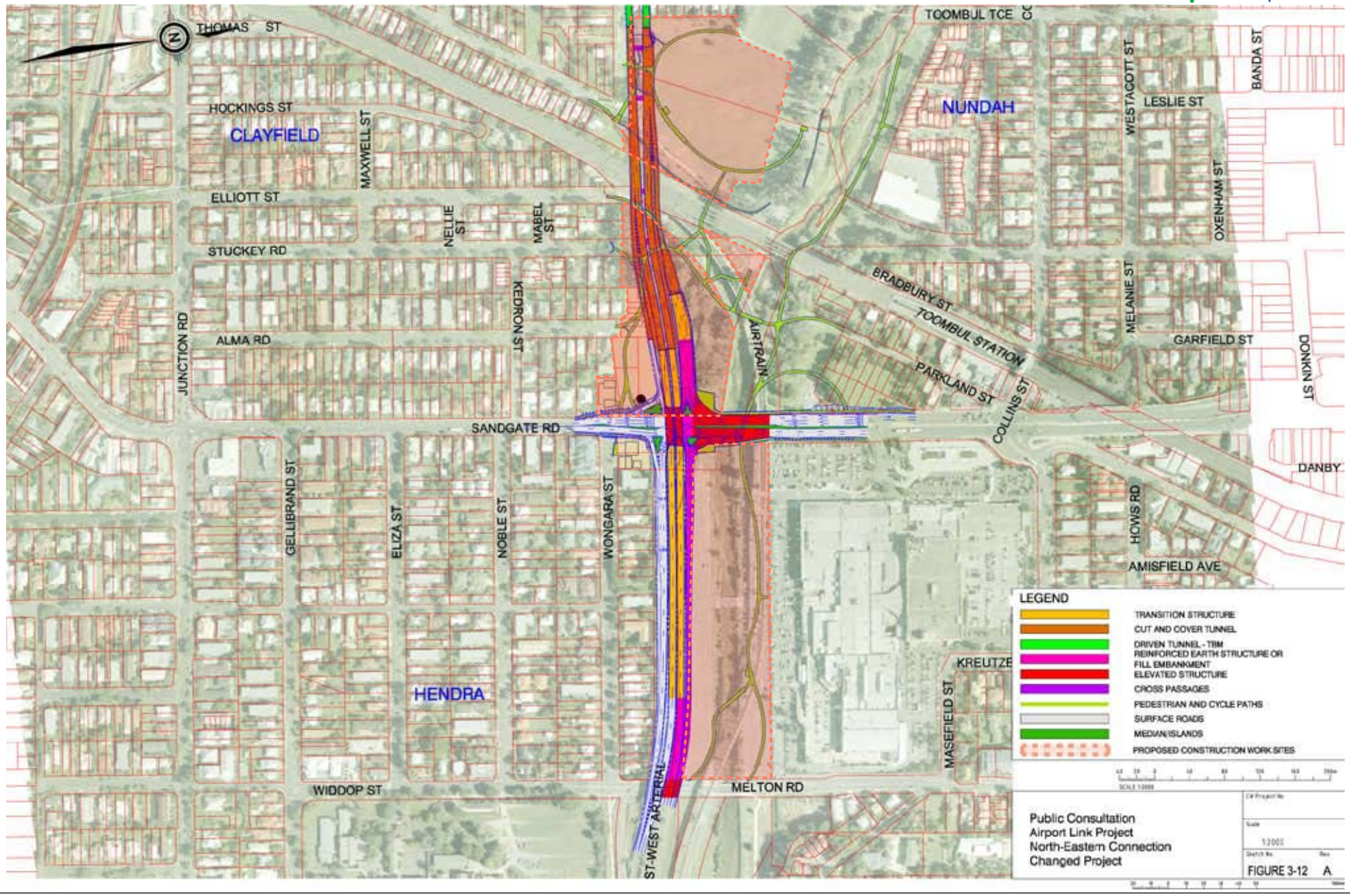
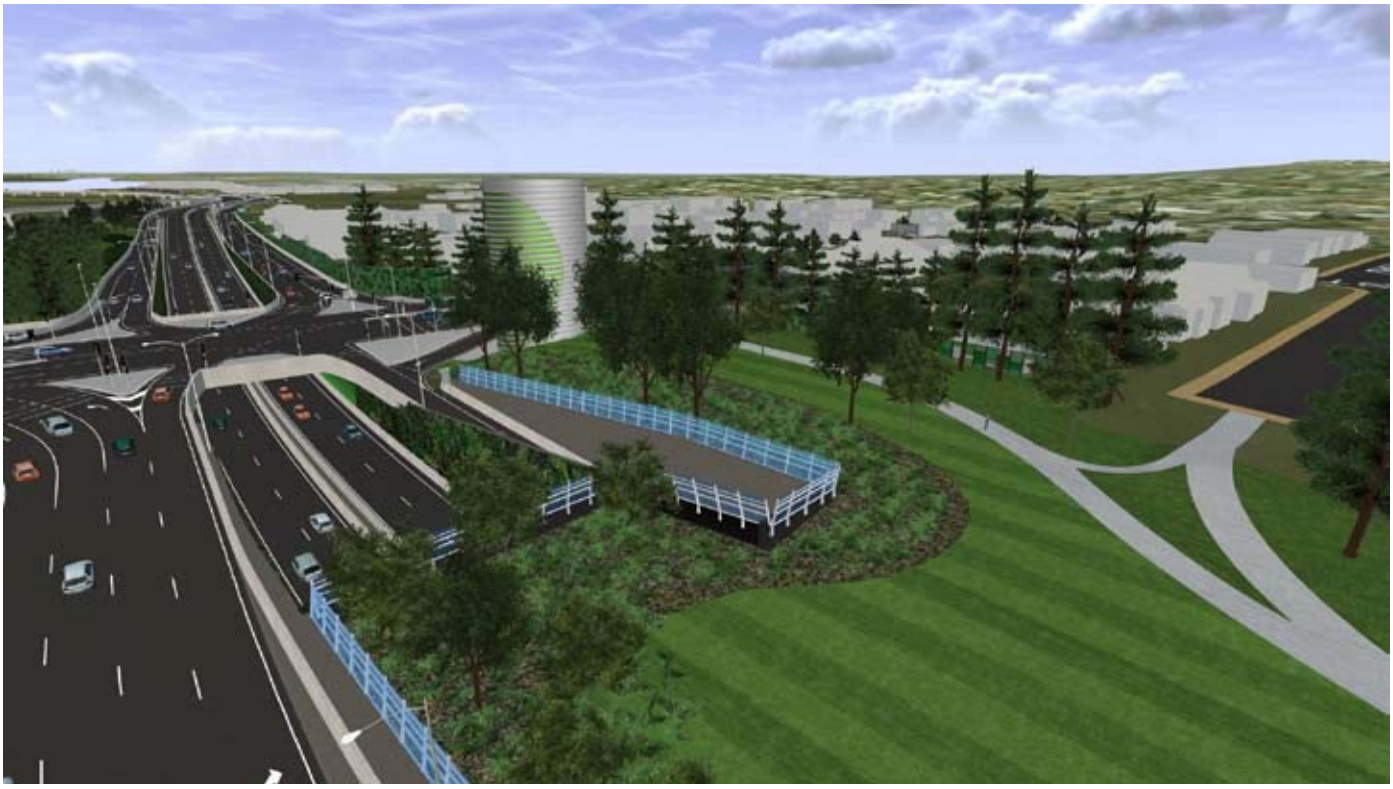


Figure 3-12
North Eastern Connection **Changed** Project



View looking east over open portal and buried ventilation station

View looking north to Toombul Shopping Centre

Figure 3-13
North Eastern Clayfield Connection - Artists Impressions

3.4.2 Effects of the Changed Project

The primary effects of the proposed surface interchange at Clayfield would be:

- for the relocation of the mainline tunnel portal to the west of Sandgate Road, there would be potential traffic noise, and landscape and open space impacts;
- for the relocation of the ventilation sub-station further south, there would be property and potential amenity impacts for the adjoining lots in Alma Road.

Environmental Effects

Table 3-13 below examines the potential environmental effects in the order presented in the EIS.

Table 3-13 - Environmental Effects - Clayfield Connection Changes

EIS aspect	Potential impact	Likely changed environmental effect
Traffic and Transport	Refer to 3.1	
Topography, Geology, Geomorphology and Soils	No changed effect	
Hydrology and Groundwater Quality	No changed effect	
Surface Water Quality	No changed effect	
Air Quality	Refer below	✓
Noise and Vibration	Refer below	✓
Flora and Fauna	No changed effect	
Land Use and Planning	Refer below	✓
Cultural Heritage	Refer below	✓
Social environment	No changed effect	
Urban Design and Visual Environment	Refer below	✓
Economic and Financial Environment	No changed effect	
Hazard and Risk	No changed effect	
Waste Management	No changed effect	
Urban Regeneration	No changed effect	

Air Quality

The surface roads in this location would experience the most changes to air quality due to changes in traffic flows. Traffic flows are predicted to decrease by about 7-20% on Sandgate Road for both the Reference Project and the Changed Project.

Traffic flows are also predicted to decrease on the Gateway Motorway by a similar extent for both the Reference Project and the Changed Project. The extent of the traffic impact on the Gateway Motorway for the Changed Project would be approximately 17% decrease in 2012 compared to a predicted 28% decrease in the EIS.

Traffic flows on both the East West Arterial and Airport Drive would increase by a similar amount for both the Reference Project and the Changed Project. For the Changed Project, the traffic impact would be an increase of approximately 30% in 2012 for the East West Arterial and approximately 4% in 2012 for Airport Drive. Similar increases were reported in the EIS for the Reference Project.

In summary there would be no significant changes in air quality along the major surface roads in this section of the route for the Changed Project compared to the Reference Project.

The reduction in height from 30 metres to 25 metres for the ventilation outlet was modelled for possible implications for ambient air quality outcomes. The option of a lower height at Clayfield was investigated in accordance with the Coordinator-General's recommendations. The predicted ground level concentrations for a ventilation outlet of 25 metres would still be significantly below air quality goals. This lower height was adopted for the Changed Project.

Noise and Vibration

Operational road traffic noise impacts were reviewed taking into account:

- revised portal area road layouts and preliminary roadside noise barrier design, and
- impacts on the greater road network given revised traffic forecasts.

As for the Reference Project, no noise or vibration operational impacts are predicted for the tunnel sections of the Changed Project.

Portal Road Traffic Noise

Potential changes in traffic flows arising from the proposed change to the infrastructure were examined for changes in LA10(18hr) noise predictions at the nearest noise sensitive locations with the proposed noise barriers in place.

The modelling and assessment of road traffic noise east of Sandgate Road did not highlight any significant differences from the Reference Project to the Changed Project. The Changed Project would achieve the 68 dBA LA10(18hr) goal applying to State-controlled roads in this area.

West of Sandgate Road, the main line tunnels of the Changed Project would be open to the air for a distance of approximately 70m. The extent of the open connecting ramps from Sandgate Road however, would be reduced from 180m identified in the Reference Project to approximately 130m for the northern off-ramp (east-bound) and 80m for the southern on-ramp (west-bound).

Road traffic noise modelling has been undertaken for the Changed Project west of Sandgate Road to ascertain whether the goal of 63 dBA LA10(18hr) for new roads can be achieved around the Clayfield connection given the design changes identified above and with reasonable and practicable noise mitigation. This modelling has not taken into account the above ground sub-station proposed in this area. The sub-station would assist in further reducing noise levels from the tunnel portal area as it is located between the portals and some of the nearest residences. Predictive modelling required to support detailed design would determine the extent and height of noise barriers with the sub-station in place.

For the residential areas directly south and west of the Sandgate Road portal (e.g. Alma Road, Stuckey Road, Elliott Street and Kalinga Street), noise barriers in the order of 2m to 5m high would be required to achieve the 63 dBA LA10(18hr) criterion for road traffic noise. This would achieve a reduction to the noise barriers required for the Reference Project of 4m to 8m high. The changed requirements for noise mitigation in this area would be due to:

- the predicted reductions in traffic flows for the Changed Project on Sandgate Road north and south of the connections; and

- the increased separation distance between sensitive receptors (e.g. dwellings) and the changed infrastructure compared with the Reference Project.

The design of the Changed Project at the Sandgate Road portals would comply with the conservative 63 dBA $L_{A10(18hr)}$ criterion west of Sandgate Road and with the 68 dBA $L_{A10(18hr)}$ criterion east of Sandgate Road with reasonable and feasible noise barriers.

Provided the sub-station is designed appropriately, nuisance from operational noise emissions would not likely exceed the goals. As with the ventilation stations, high levels of noise reduction are readily achieved for such facilities through the use of design and mitigation measures.

Road Network Traffic Noise (Remote from Portals)

Noise predictions showing the upper limit of likely (operational) noise changes arising from the Changed Project are set out in **Table 3-14**.

Table 3-14 - Effect of 2022 Tunnel Traffic on Noise from Major Eastern Surface Connecting Routes

Roadway	Change in LA10 (18hr) Traffic Noise Level Due to Tunnel 2022 (with Northern Busway)
Sandgate Rd (North of East/West Arterial Rd)	-0.3
Sandgate Rd (South of East/West Arterial Rd - North of Junction Rd	-1.2
Sandgate Rd (South of Junction Rd)	-1.2
Melton Rd	-0.9
East-West Arterial Rd	1.5
Nudgee Rd (North of East/West Arterial Rd)	-1.2
Nudgee Rd (South of East/West Arterial Rd)	1.5
Zillman Road	-0.4
Junction Rd/Rose St	-0.9

Table 3-14 indicates that the expected operational noise changes, both increases and decreases, on the wider road network due to the Changed Project would be negligible and unlikely to be noticed by most people. Changes in noise levels of 2 dBA or less are generally considered to be undetectable to the human ear.

Land Use and Planning

The Changed Project would require additional properties in Clayfield to accommodate the infrastructure and to facilitate the proposed change in construction method. Many of the newly-required properties would be government-owned, while nine additional residential properties would be required. Of these, two would be partly acquired (refer **Table 3-15**).

Table 3-15: Changes in property impacts (North-east Connections), Reference Project and Changed Project

Ownership	Reference Project	Additional Property Requirements	Changed project
Residential	34	9	43
Commercial	1		1
Government	8	12 (park, vacant land)	20
Total	43		64

As with the other changes in property requirements, consultation with the affected owners commenced with the announcement of the outcome of the tender process leading to the Changed Project. Consultation with these people will be on-going through the acquisition process.

Cultural Heritage

As with the Reference Project, there would be project works in the State Heritage listed, Kalinga Park An application was made by the State to the Queensland Heritage Council (QHC) on 22 October, 2007, for development in Kalinga Park based on the Reference Project approved by the Coordinator-General and a Preliminary Conservation Management Plan.

A Notice of Recommendation was made by the QHC that the works may proceed generally in accordance with the drawings, policies and guidelines specified in the Reference Project as submitted together with the Preliminary Conservation Management Plan.

The Changed Project would include the following design changes in the area of Kalinga Park;

- the portal to the mainline tunnels would be located 70m to the west of Sandgate Road, approximately inline with the Sandgate Road on-ramp (west-bound);
- the off-ramp (east-bound) transition from the mainline tunnel to Sandgate Road would be shortened from Reference Project from 180m to 140m.

Also the ventilation station and outlet adjoining the Park would have a lower profile and reduced building mass. The relocation of the portal west of Sandgate Road would remove the "urban forest" proposed in the Reference Project. However, the shortening of the Sandgate Road ramps and the burial of the main components of the ventilation station would provide additional opportunities for landscape rehabilitation and improved pedestrian and cycle opportunities through this section of Kalinga Park.

The design modifications of the Changed Project within Kalinga Park are considered to be generally in accordance with the Reference Project. Detailed development proposals for Kalinga Park would be referred to the QHC for its review and comment in respect of the landscape and building works for the Changed Project.

Urban Design and Visual Environment

Urban design measures for the Changed Project in this location would mitigate a number of potential physical and visual impacts, due to the burying of the ventilation station, and the reduced length of the Sandgate Road on-ramp (west-bound) transition into Kalinga Park. These two design outcomes would allow for enhanced open space connections and an improved visual environment compared with the Reference Project, especially for surrounding residents of Alma Road and Stuckey Street (refer **Figure**

3-14). Some of these benefits would be offset by the location, height and bulk of the proposed sub-station proposed next to residential premises in Alma Road, opposite the intersection of Wongara Street and Sandgate Road.

The ventilation outlet at Clayfield would replicate the design of the ventilation outlets at Windsor. The narrow side of the structure would be presented to views from the south, such as Sandgate Road. The broad side of the structure would present to views from the east along the East West Arterial and elevated vantage points in Hendra, and west from streets east of the North Coast Railway. The ventilation outlet would also present to views from some properties in Clayfield west of the railway and from elevated vantage points in Nundah.

Where the Reference Project provided an opportunity for a pocket park in between Wongara Street and the East West Arterial, the Changed Project would establish a Fire and Water compound.

The pedestrian and cycle management of the Changed Project around the Sandgate Road portals would provide connections to all key destinations in accordance with the Reference Project. An extensive system of boardwalks is provided around the vicinity of the North Coast Railway due to the realignment of Eagle Junction Creek which runs along its western edge into Schulz Canal. A pedestrian and cycle bridge over Schulz Canal between Melton Street and Sandgate Road would also be provided as part of the urban mitigations for the Changed Project. This bridge would be integrated with a landscaped approach to re-establishing a riparian ecology in this part of Schulz Canal. Two (2) views over the proposed landscape treatment of the Clayfield connection are shown in **Figure 3-15**.

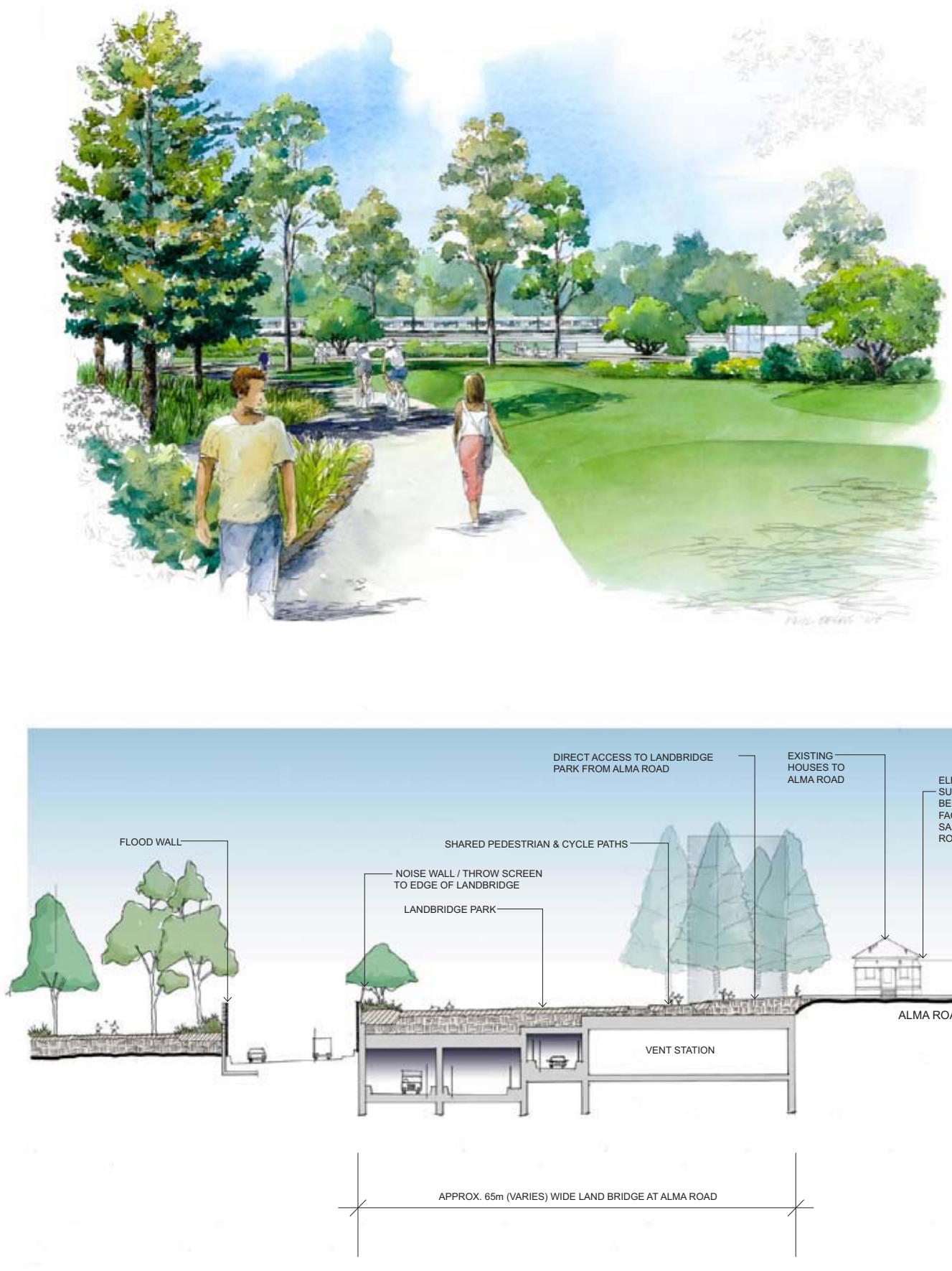


Figure 3-14

Changed Project Landscape View and Section Through Buried Ventilation Station North of Alma Road - Artists Impression

View from East-West Arterial to tunnel entrance indicating proposed noise barrier design and landscape treatment to the portal

View to the East over Kalinga Park and the north eastern connection

Figure 3-15
Landscape Treament of North Eastern Connection Changed Project - Artists Impressions

3.5 Tunnel Ventilation System

There is no change proposed to the ventilation system described in the Reference Project in that it would be a longitudinal ventilation system operated with jet fans in the tunnel roofs and extraction points and ventilation outlets near the three main surface connections. There would be minor changes to the location and heights of the ventilation outlets.

An assessment of the Changed Project, including modification to the ventilation outlet locations and heights, as well as the anticipated load, indicate that ambient air quality would remain well within the goals established for ambient air quality in the Coordinator-General's conditions.

The southern ventilation station at Windsor and ventilation outlet would be relocated by approximately 50m to the east of the location identified in the Reference Project. The relocation of the ventilation outlet accommodates the ability to partially bury the ventilation station within the proposed landscape works covering the cut and cover of the tunnel portals. A 6m high electricity sub-station would then be located on top of the ventilation station.

The proposed height of the ventilation outlet would be 36.5m above natural ground level at this location but approximately the same elevation as for the Reference Project (refer to **Figure 3-16**). The ventilation outlet has been structurally designed to be extended an additional 10m in the future, if required to remain clear above the heights of adjacent buildings. Development controls on the heights of adjacent buildings would be required to maintain the operational efficiency of the ventilation outlet in this location.

The Kedron ventilation station would be moved to the north of the DES building. The height of the proposed ventilation outlet would be 35m, being 11m higher than the ventilation station rooftop. The ventilation outlet has been structurally designed to be extended an additional 5m in the future, if necessary. Indicative elevations of the Kedron ventilation station from the south and from the east are provided in **Figure 3-17**.

The Clayfield ventilation station would be buried at the same location as the Reference Project. The ventilation outlet would be reduced in height from 30m to 25m in response to community concerns about visual impact and urban amenity. An above-ground electricity sub-station would occupy land south of the below-ground ventilation station. Indicative views of the Clayfield ventilation outlet from surrounding areas are provided in **Figure 3-18**.

The heights of the ventilation outlets would satisfy the Coordinator-General's conditions for at least 30 metres in height above ground level, or no less than 10 metres higher than the highest exiting building within 100 metres of the outlet.[9] This condition also included the Clayfield ventilation outlet may be less than 30m in height where visual impact analysis and predictive modelling indicate that a lesser height would not prevent achievement of the ambient air goals.

[9] Coordinator-General's report on the Environmental Impact Statement for the Proposed Airport Link Project, May 2007, Schedule 3, 19(e) Air Quality

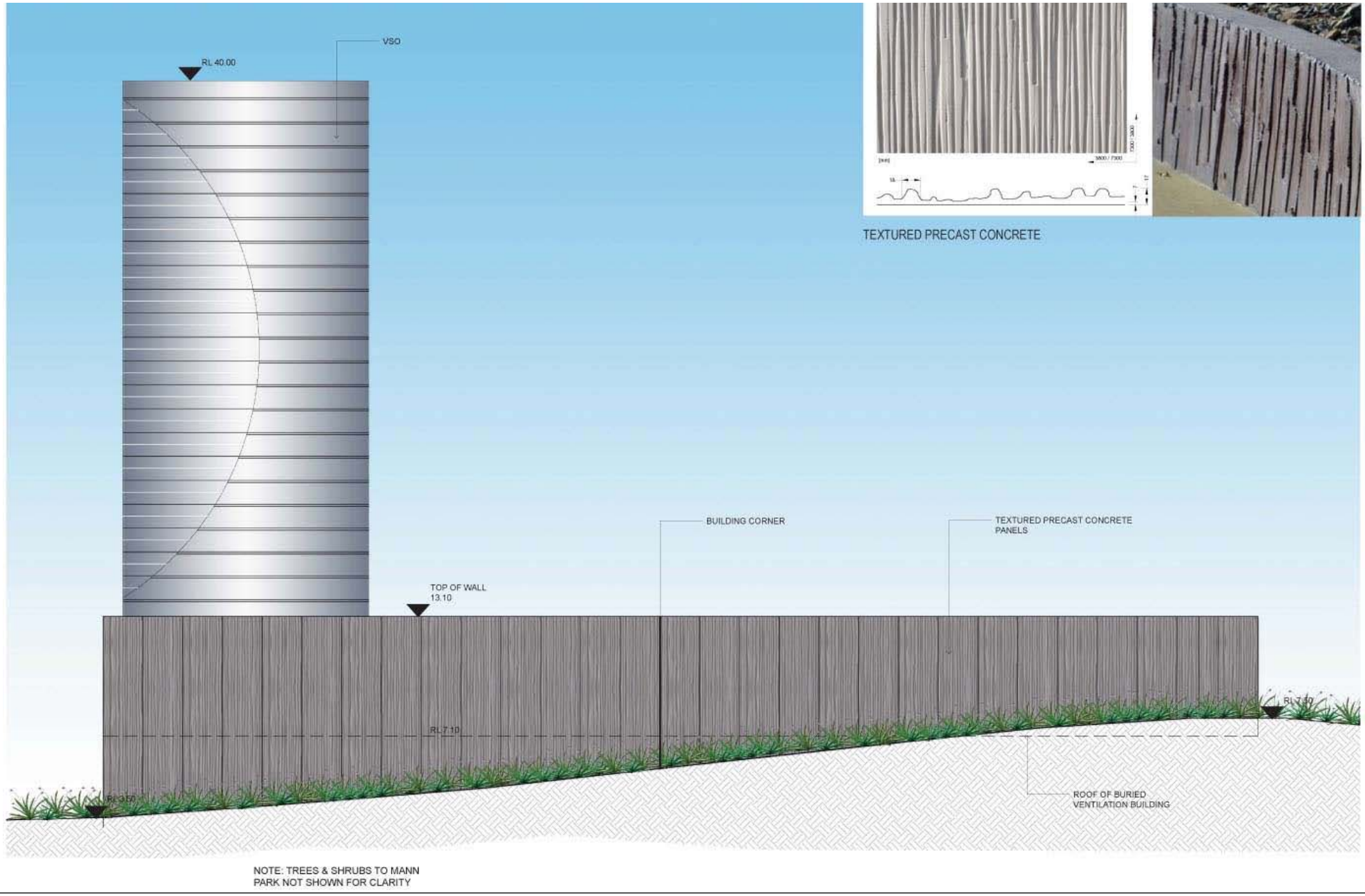
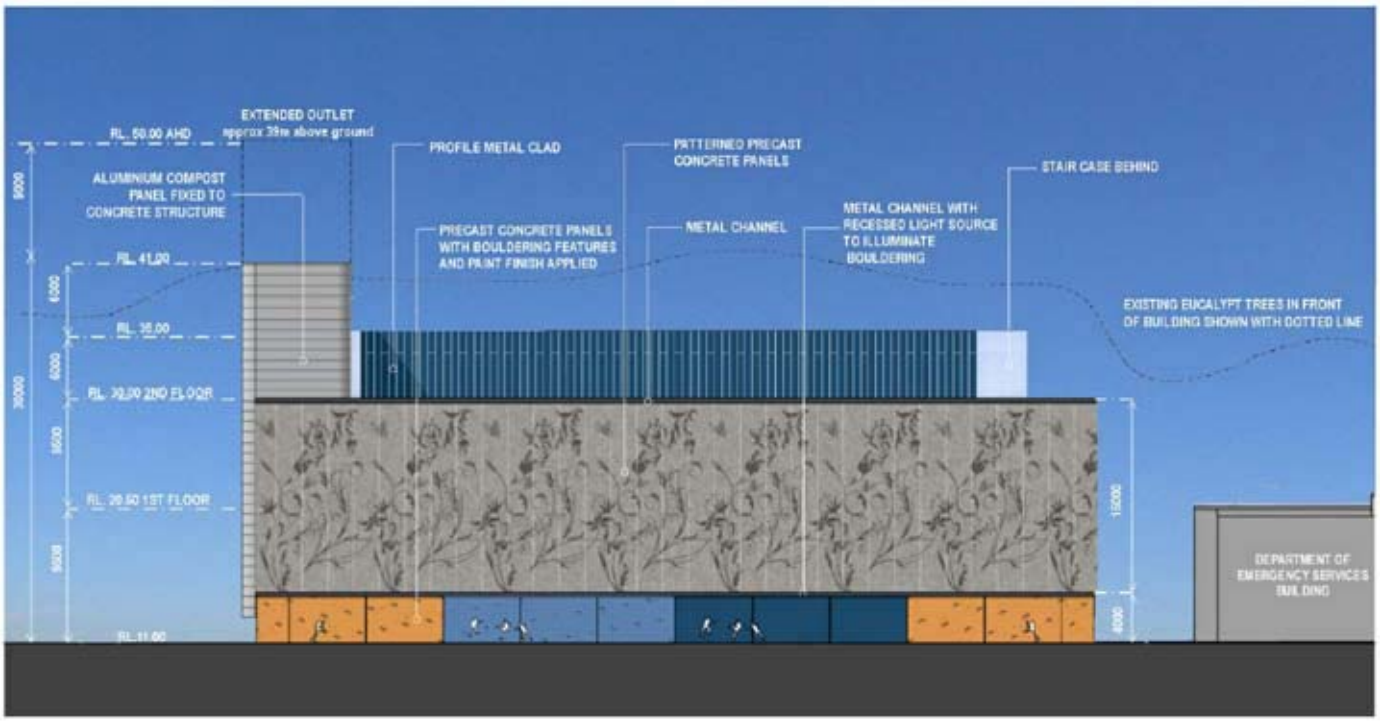


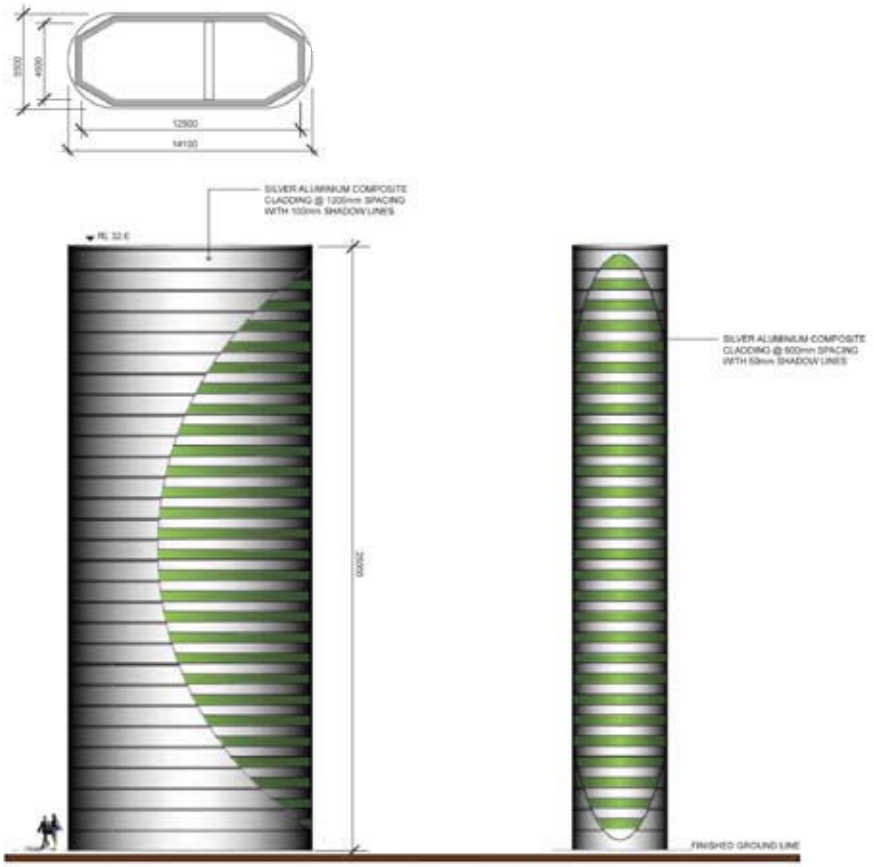
Figure 3-16
Southern Ventilation Station and Outlet - East Elevation View from Mann Park



Elevation North

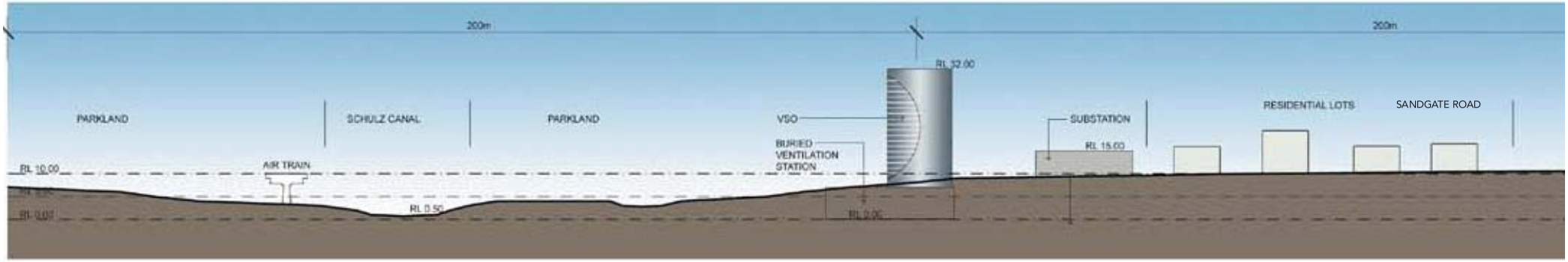
View from East - Kedron State High School

Figure 3-17
North Western Ventilation Station - Kedron - Artists Impressions



Typical Elevations and Plan

Location



Cross Setion

Figure 3-18
Clayfield Ventilation Station and Outlet

Air Quality Effects of the Changes to the Ventilation System

An assessment of the potential impacts on ambient air quality of the Changed Project was undertaken by Air Noise Environment on behalf of BC and presented in the attached report. Emission estimates from the ventilation outlets were undertaken at the three sites proposed in the EIS for a range of in-tunnel traffic scenarios. These results were then compared with the results from the modelling undertaken for the Reference Project. The Changed Project model included the differences to the height and location of the ventilation outlets and traffic numbers in the tunnel.

The emission rates are summarised below in **Table 3-16** for the Changed Project and the Reference Project. The emissions for the Reference Project are taken from the EIS. The emissions for the Changed Project are based on the higher BC traffic forecasts. The modelling for the EIS examined an extreme congestion case to assess the air quality outcomes. It was assumed that this case occurred every day and the numbers in **Table 3-16** for the Reference Project relate to this.

Table 3-16- Estimated Ventilation Outlet Emissions for Changed Project and Reference Project - 2012

	Reference Project		Changed Project		
Windsor Emissions	**Daily (kg) Congested**	**Peak (g/s) Congested**	**Daily (kg) Normal**	**Daily (kg) Congested**	**Peak (g/s) Congested**
CO	1352	42.74	1261	3302	49.59
NO_x	296	7.58	291	326	4.92
PM_{10}	9	0.43	13	29	0.44
Kedron Emissions	**Daily (kg) Congested**	**Peak (g/s) Congested**	**Daily (kg) Normal**	**Daily (kg) Congested**	**Peak (g/s) Congested**
CO	2172	60.45	1064	2814	41.24
NO_x	327	10.55	215	276	4.06
PM_{10}	14	0.49	10	25	0.38
Clayfield Emissions	**Daily (kg) Congested**	**Peak (g/s) Congested**	**Daily (kg) Normal**	**Daily (kg) Congested**	**Peak (g/s) Congested**
CO	1095	42.63	870	1440	22.37
NO_x	172	5.84	161	165	2.53
PM_{10}	8	0.32	6	16	0.26

Table 3-16 shows the total daily emissions and peak hour emissions for the Reference Project as well as the total daily emissions for the Changed Project under congested operating conditions and the peak hour emissions for congested mode. The total daily emissions in congested mode for the Changed Project were similar to or higher than the total daily emissions for the Reference Project. However, the congested emissions were used to estimate the short-term impacts only for the Changed Project.

BC modelled 'normal' tunnel operating conditions. In addition, an 'extreme congestion' case was also modelled in relation to short-term goals only for this case, on the basis that modelling long-term goals with

congested emission rates would over-estimate long-term concentrations. This is a reasonable but less conservative approach than that taken the EIS assessment.

Emission rates were calculated based on BC's traffic modelling for the Changed Project. While the EIS had a fixed stack diameter, the ventilation outlets for the Changed Project would have a variable diameter which could be adjusted to optimise the exit velocity for more effective plume dispersion for the lower outlet height of 25 metres. Estimated emission rates for the Windsor ventilation outlet generally would be higher under congested conditions for the Changed Project than for the Reference Project although the maximum NO_x would be higher for the Reference Project.

The cumulative impact of the Windsor ventilation outlet operating with BC's traffic forecasts and the NSBT ventilation outlet at Sneyd Street, Bowen Hills, would not result in exceedences of the goals for ambient air quality in this locality, including at the Royal Brisbane Hospital.

There would be some sustained periods when the emission rate of PM_{10} under congested conditions would be higher for the Changed Project than the maximum emissions assumed in the EIS. Generally emissions of NOx and PM_{10} from the Kedron ventilation outlet would be less than the maximum emissions assumed in the EIS. The predicted impacts of the emissions for both the Reference Project and the Changed Project would be well below the air quality goals at Kedron.

There would be sustained periods where the estimated emissions under congested flow would be higher than the maximum emissions assumed in the EIS for the calculated NO_x and PM_{10} emissions from the Clayfield ventilation stations. The option of a lower outlet height at Clayfield was investigated. The predicted ground level concentrations would be significantly below air quality goals with an outlet height of 25 metres compared to the Reference Project height of 30 metres. This lower height was adopted for the Changed Project.

In practice, the impacts of the ventilation outlets would be minor both in terms of compliance with air quality goals and health risks. Changes in the tunnel ventilation would be unlikely to result in significant changes to impacts on ambient air quality.

The EIS estimates of daily emissions in 2016 and 2026 were higher than in 2012, however the impacts were low in all cases and not substantially different from year to year. For the Changed Project, it is not anticipated that the impacts in 2026 would be significantly different from the impacts in 2012. The EIS was conservative in presenting a 'worst case' scenario for its estimates of future emission loads. It did not assume any further improvement in vehicle technology or fuel standards. In practice, emissions per vehicle would be likely to decrease rather than remain constant as assumed for the EIS 'worst case' scenario. BC anticipates that improvements in vehicle technology and fuel standards will continue over the life of the Changed Project and would off-set increases in traffic flows and emission rates.

Table 3-17 shows the highest ground-level pollutant concentrations that are predicted in the study area due only to the emissions from the tunnel ventilation outlets. The results for the Reference Project are compared with those for the Changed Project. These are the highest concentrations due to the ventilation outlets, predicted in the study area. In most areas the concentrations due to ventilation outlets would be much lower than these concentrations.

Despite the differences in the modelling approaches and the resulting differences in calculated emission rates between the Reference Project and the Changed Project, the predicted ground-level concentrations would be well below the air quality goals established by the Coordinator-General's conditions. The data

also show that the contribution from ventilation outlet emissions to the total concentration in the ambient air is a small fraction of the air quality goal.

Table 3-17 - Highest Modelled Ground-Level Concentrations due to Ventilation Outlets

Pollutant and averaging time	2012	Relevant air quality goal
Reference Project EIS maximum GLC		
Maximum 8-hour average CO (mg/m^3)	0.1	10
Maximum 1-hour average NO_2 ($\mu g/m^3$)	15	246
Annual average NO_2 ($\mu g/m^3$)	0.5	62
Maximum 24-hour average PM_{10}($\mu g/m^3$)	0.5	50
Annual average PM_{10} ($\mu g/m^3$)	0.1	30
Changed Project Bowen Hills @ 30m		
Maximum 8-hour average CO (mg/m^3)	0.09	10
Maximum 8-hour average CO (mg/m^3) congested	0.24	10
Maximum 1-hour average NO_2 ($\mu g/m^3$)	18.15	246
Maximum 1-hour average NO_2 ($\mu g/m^3$) congested	29.75	246
Annual average NO_2 ($\mu g/m^3$)	0.27	62
Maximum 24-hour average PM_{10}($\mu g/m^3$)	0.47	50
Annual average PM_{10} ($\mu g/m^3$)	0.06	30
Changed Project Kedron @ 30m		
Maximum 8-hour average CO (mg/m^3)	0.068	10
Maximum 8-hour average CO (mg/m^3) congested	0.15	10
Maximum 1-hour average NO_2 ($\mu g/m^3$)	6.01	246
Maximum 1-hour average NO_2 ($\mu g/m^3$) congested	7.52	246
Annual average NO_2 ($\mu g/m^3$)	0.14	62
Maximum 24-hour average PM_{10}($\mu g/m^3$)	0.37	50
Annual average PM_{10} ($\mu g/m^3$)	0.03	30
Changed Project Clayfield @ 30m		
Maximum 8-hour average CO (mg/m^3)	0.15	10
Maximum 1-hour average NO_2 ($\mu g/m^3$)	36.42	246
Annual average NO_2 ($\mu g/m^3$)	0.15	62
Maximum 24-hour average PM_{10}($\mu g/m^3$)	0.34	50
Annual average PM_{10} ($\mu g/m^3$)	0.03	30
Changed Project Clayfield @ 25m		
Maximum 8-hour average CO (mg/m^3)	0.16	10
Maximum 8-hour average CO (mg/m^3) congested	0.37	10
Maximum 1-hour average NO_2 ($\mu g/m^3$)	45.53	246
Maximum 1-hour average NO_2 ($\mu g/m^3$) congested	64.9	246
Annual average NO_2 ($\mu g/m^3$)	0.19	62
Maximum 24-hour average PM_{10}($\mu g/m^3$)	0.41	50
Annual average PM_{10} ($\mu g/m^3$)	0.03	30

Modelling undertaken for the Changed Project also included a reduction in the height of the Clayfield ventilation structure from 30m in the Reference Project to 25m in the Changed Project. Overall, the results indicate that the change in design and reduction in the height of the Clayfield ventilation outlet would not substantially affect the air quality impacts. While he maximum contributions to ground-level concentrations from the lower outlet height would be higher than for the 30 metre height, they would remain well below the goals for ambient air quality.

Greenhouse

A greenhouse gas inventory has been prepared for the Changed Project and is attached.

3.6 Aboriginal Cultural Heritage

The project works for the Changed Project lie substantially within the area described as the study area for the Coordinator-General's terms of reference, with the exception of the proposed conveyor.

A comprehensive Aboriginal cultural heritage study was undertaken over the general project area pursuant to the EIS. As required by the EIS terms of reference, the study was undertaken by the relevant Aboriginal parties for the project area, as identified pursuant to the *Aboriginal Cultural Heritage Act 2003* (Qld) ("ACHA"), assisted by suitably qualified archaeological experts.

Each Aboriginal party identified that the project area had general cultural heritage significance to them, however no "objects" or "places" of particular significance, as defined under the ACHA, were identified. The Coordinator-General's Report required that ongoing management of the cultural heritage values of the project area be under the provisions of a cultural heritage management plan ("CHMP") developed in accordance with the Aboriginal parties for the project area and approved pursuant to the provisions of Part 7 of the ACHA.

CHMPs have been signed by both Aboriginal parties. Each CHMP includes a mechanism to enable the area of the CHMP's application to be extended to include any additional areas where surface disturbance may occur (and therefore Aboriginal cultural heritage may be put at risk) arising out of the Changed Project.

Each CHMP establishes a comprehensive process for management of cultural heritage values that may exist in the project area and may be affected by surface disturbance caused by the Project. Additional management measures are in accordance with the existing CHMPs.

The CHMPs make provision for:

- monitoring of construction (surface works) including ground-breaking for areas of potential cultural heritage significance;
- on-going liaison with the relevant native title claimants about construction aspects relating to places of indigenous cultural heritage significance identified in the Cultural Heritage Study included in the EIS.

3.7 Cumulative Effects

The cumulative effects of the Changed Project are generally as reported in Chapter 21 of the Airport Link EIS for the Reference Project. More specific local cumulative effects would be generated from changes to the design and delivery of the Changed Project, particularly in regard to its interaction with the Northern

Busway. The relative impact of identified project changes and their cumulative effect with the wider road transport works, as well as on going land use change and development within the Airport Link corridor, is reported below.

3.7.1 Northern Busway

Construction of Stage 1 of the Northern Busway at Herston has commenced. Consistent with the Coordinator-General's recommendations, the procurement process sought to reduce the predicted cumulative impacts associated with works for the Northern Busway, including busway stations, sections of driven tunnel, cut and cover tunnel and associated surface works being constructed at the same time and in the same corridor as Airport Link.

As a consequence of the design requirements for the Airport Link Project, the following impacts and benefits that this would create for both the Changed Project and the Northern Busway Project include:

- access for buses to and from the east-west tunnel to the Kedron Brook Bus Station would be improved over the Reference Project;
- the co-location of infrastructure over Lutwyche Road at Enoggera Creek to address visual impacts and provide for shared worksites;
- the co-location and sympathetic design of noise barriers on the western side of the busway structure to meet noise goals.

The Airport Link on-ramp (north-bound) from Bowen Bridge Road would impact on the access to Bowen Bridge Road from Stage 1 of the Northern Busway. Stage 1 of the busway was designed to provide an access ramp off the busway to Bowen Bridge Road, south of Enoggera Creek. The effect of the Changed Project would require the busway to avoid the Changed Project by returning the busway to access Butterfield Street and Bowen Bridge Road, south of the Airport Link ramp. A turn-around within the area of Bowen Bridge Road park adjacent to Enoggera Creek, would be required. This would also avoid the need for a further bridge crossing by the busway of Enoggera Creek.

The Airport Link ramp would also require the Northern Busway bridge over Enoggera Creek and Lutwyche Road to be relocated further to the west and north over Lutwyche Road. The Bowen Bridge Road on-ramp (north-bound) for the Changed Project would also provide grade-separated access to the ICB (west-bound) and the NSBT (south-bound), requiring a different alignment for the Northern Busway crossing of Lutwyche Road. This would affect a different group of landowners between Enoggera Creek and Northey Street.

The traffic and transport analysis presented for the Changed Project includes the impact of the Northern Busway Project.

3.7.2 Airport Roundabout Upgrade Project

The main features of Airport Roundabout Upgrade (ARU) Project are:

- a new four-lane fly-over linking the East West Arterial Road with Airport Drive;
- the existing roundabout is replaced by a signalised intersection;
- widening of the East West Arterial Road from two to three lanes each way;

- lane widening and surface road improvements to Airport Drive.

The impact of the Changed Project on the East West Arterial / Gateway Motorway/Airport Drive roundabout and the related East West Arterial / Nudgee Road intersection would be very similar to the impact of the Reference Project. In a scenario without upgrading, at both locations, forecast peak hour total intersection volumes for the Changed Project in 2012 are within 1% of the Reference Project.

With the Airport Roundabout Upgrade (ARU) Project in place, east-west accessibility would be improved and additional traffic would be expected to use Airport Link. Traffic modelling of both the Reference Project and the Changed Project with the ARU project has been undertaken using the updated BSTM based Airport Link model. Results are summarised in **Table 3-18.**

Table 3-18 Effect of Airport Roundabout Upgrade Project on Reference Project and Changed Project

Location	Change in Average Weekday Traffic due to ARU Project	
	Reference Project	Changed Project
2012		
North-South Tunnel	+1,700 (2%)	+3,500 (4%)
East-West Ramps	+1,200 (6%)	+1,700 (7%)
Total Airport Link	+2,900 (3%)	+5,200 (5%)
2026		
North-South Tunnel	+7,500 (7%)	+7,900 (8%)
East-West Ramps	+8,900 (39%)	+9,700 (39%)
Total Airport Link	+16,400 (13%)	+17,600 (14%)

Table Note:

(1) These comparisons show the difference between the forecast Airport Link volumes with and without the proposed Airport Roundabout Upgrade (ARU) project.

The ARU Project would result in a similar uplift in traffic volumes using Airport Link for both the Reference Project and the Changed Project. With the ARU Project, additional network performance benefits in terms of travel distance and time savings, and congestion relief, are forecast. The quantum of these benefits would be similar for the Reference Project and the Changed Project.

The ARU Project would provide a suitable traffic management solution to relieve congestion forecast at the East-West Arterial/Gateway Motorway/Airport Drive roundabout either without or with Airport Link.

4. Changes to Project Delivery and Effects

4.1 Construction Methodology

4.1.1 Project Delivery Changes

The construction method for the Changed Project would use the same construction techniques as the Reference Project, namely:

- "cut and cover" construction for tunnel entrances and exits;
- the use of "drill and blast" for tunnel excavation;
- tunnel construction using roadheader machinery; and
- tunnel construction using earth-pressure-balance tunnel boring machines (TBMs) particularly in poor ground.

The locations in which these various techniques would be used has been changed in order to address changes in the infrastructure and to achieve better construction efficiencies and environmental outcomes. The EIS[10], indicated that the actual construction methods adopted for project delivery would be determined having regard to the environmental, commercial and construction factors, in addition to requirements of the Coordinator-General's Conditions.

Construction methods would be adapted to changes proposed to the alignment of the mainline tunnels further south and east and at a greater depth at Lutwyche and Wooloowin through the north-western connection. The increased length of driven tunnel through the Kedron connections would result in a reduced amount of cut and cover construction and a consequential reduction in the potential for environmental effects on the surface environment.

The east-west section of the mainline tunnels would be constructed as driven tunnel from the eastern connection at Sandgate Road through the north-western connection and as far as Chalk Street along the north-south tunnel. Two earth pressure balance tunnel boring machines (TBMs) would be launched from the Clayfield construction worksite, east of Sandgate Road, to drive west under Wooloowin and Lutwyche, before being removed at the Chalk Street worksite to be shared with Northern Busway works.

The option of constructing tunnels with TBMs launching from the east was investigated in the EIS but was not adopted on the bases of:

- the difficulty of transporting the TBM through local streets in Wooloowin to place it in its starting position in Kalinga Park; and
- difficulties in scheduling construction of the cut and cover tunnel and other advance works with the arrival of the TBM.

The perceived constraints on construction outlined in the EIS section 3.6.1 have been resolved through more detailed investigations supporting construction planning such that it would now be feasible to

[10] Section 36.1 Environmental Impact Statement

assemble and launch two TBMs from a launch chamber constructed beneath the North Coast Railway and Kalinga Park. This would allow access from the East West Arterial and would avoid the use of local streets for transporting major construction machinery and equipment.

Greater efficiencies in design, such as the realignment of the mainline (TBM) tunnels through Lutwyche and Wooloowin, would minimise the extent of impacts associated with surface works including cut and cover works adjacent to Kedron Brook by the removal of the TBM components from the dedicated shaft at Chalk Street, Lutwyche. This would also lead to greater efficiencies in construction by extending the TBM construction beyond the difficult ground conditions in Wooloowin and Lutwyche.

Spoil would be transported from the TBMs via the in-tunnel conveyors under Sandgate Road to a transfer location within the transition trough from the tunnels to the East West Arterial, east of Sandgate Road. There would be an opportunity to transfer spoil from this location to an external conveyor to a spoil placement site on the northern side of Airport Drive, within Brisbane Airport.

Should all necessary approvals for the external conveyor and preferred spoil placement site not be obtained within the required timeframe, two feasible alternatives would be available. They would include transporting spoil by a shortened conveyor to a spoil receiving depot west of Nudgee Road and adjacent to the Airtrain, and transporting the spoil by road via the East West Arterial to spoil placement sites. The 'shortened conveyor' alternative would rely on road haulage from the Nudgee Road receiving depot but would relieve the residential communities of Hendra and Clayfield of the impacts of spoil handling at the Clayfield worksite. The 'road haulage' option would satisfy the Coordinator-General's conditions with regards to haulage on the arterial road network and would avoid the use of local streets. However, this alternative as with the shortened conveyor alternative, would impact on traffic flows on the East West Arterial and Gateway Motorway.

The Changed Project would not require the cut and cover connection proposed in the Reference Project between the north-south and the east-west driven tunnels along Lutwyche Road and the southern side of Kedron Brook.

For the Changed Project, the connections between the mainline tunnels and Lutwyche Road, Gympie Road and Stafford Road would be provided by underground ramps, constructed by roadheader methods. Roadheaders would also construct the Y-junctions in which these ramps merge with the mainline tunnel. The connections from the north would be from cut and cover portals in new locations from Stafford Road, Gympie Road and under Kedron Brook. These cut and cover connections would then link with the driven tunnel ramps at the Kedron worksite near the intersection of Lutwyche Road and Kedron Park Road.

Construction of the connection from the north-south tunnel to Kedron would be similar to the Reference Project along the western side of Lutwyche Road, north of Norman Avenue. The connection to Kedron from the east-west tunnel and its connecting ramp would be via cut and cover construction under Lutwyche Road. Entry to the east-west tunnel from Lutwyche Road would be as described in the Reference Project but with changes to the location of the surface transition structure and cut and cover tunnel to a circular ramp around the retained DES building, joining with the northern entry ramp prior to its junction with the mainline tunnel.

Detailed design and actual construction methods would need to vary from that shown in response to ground conditions, and the on-going need to achieve efficiencies in construction and effectiveness in mitigating the potential impacts. The consultation process supporting the construction program includes a comprehensive

information stream, including advanced notification of construction techniques and timeframes for local areas and sensitive stakeholders.

The depth and alignment of the tunnels for the Changed Project would vary from the Reference Project as identified in **Table 4-19** below. Along the north-south tunnels the depth would be generally shallower with moderate gradients, apart from the initial decline (up to 6.5%) from the tunnel portals south of Gallway Street to just south of Newmarket Road where the tunnels would reach a depth of some 32 metres. While the Reference Project tunnels continued to descend from this point, being some 29 metres below the surface, to a low point under the Windsor Memorial Park some 48 metres below the surface, the Changed Project would ascend at a 1% grade to a crest underneath the new Truro Street worksite near Ada Street, at a depth of 19 metres .

Table 4-19 - Comparision of Tunnel Depths

Location	Reference Project Indicative depth (metres) North bound carriageway	Changed Project Indicative depth (metres) North bound carriageway
Federation Street – Gallway Street	10	13
Newmarket Road	29	29
Lutwyche Road (@ Freedom Furniture)	32	31
Ferny Grove Railway	30	19
Grafton Street	32	16
Windsor Memorial Park	48	28
Ada Street	41	19
Lutwyche Road (between Fuller St & Chapel St)	48	27
Lutwyche Shopping Centre	35	26
Felix Street	24	29
Wooloowin State School	12	40
Park Road	27	36
Roseleigh Street	29	31
Dawson Ave	28	25
Park Ave	24	18
West of Kalinga Street	19	14

Depths taken from land surface to crown of constructed tunnel

The Changed Project would proceed entirely as a driven tunnel along a more southerly and easterly alignment from Park Avenue Wooloowin to rejoin with the Reference Project alignment near Felix Street Lutwyche. This changed alignment would be relatively deep between Felix Street and Roseleigh Street, compared with the Reference Project, to obtain more solid ground for the construction of the east-west tunnels. From Roseleigh Street to Kalinga Street the alignment of the Changed Project is marginally shallower than the Reference Project.

The changes proposed to the construction methodology with increased driven tunnel and less cut and cover would deliver the Changed Project within a 45 month construction program, compared with the 51 month program for the Reference Project. This reduced program would minimise the duration of exposure to potential construction impacts for residents and businesses along the alignment. The Changed Project would commence in late 2008 with completion by 2012.

4.1.2 Effects of Changes

The changes proposed to the construction methodology change the relative environmental and community effects of the Reference Project.

The anticipated effects of the Changed Project in tunnel construction are:

- exposure of different properties to construction and property impacts associated with tunnel works due to the realignment of the mainline tunnels and connecting ramps, however such impacts would be similar to those for the Reference Project;
- introduction of new elements for construction and spoil handling works, such as the opportunity for the use of a conveyor for spoil transport from the Clayfield worksite to external spoil placement facilities;
- cut and cover construction in Kedron Brook for the Gympie Road connections, including potential for night works within Kedron Brook and in accordance with the Coordinator-General's conditions for general construction;
- additional works in Enoggera Creek to the west of Bowen Bridge Road at Herston;
- options for alternative spoil placement sites, additional to those identified for the Reference Project;
- potential to start rehabilitation of Kalinga Park, west of the North Coast Railway, within 2 years of construction commencement from the eastern worksite;
- the reduction in the extent of cut and cover along Lutwyche Road, through the DES site and alongside Kedron Brook behind the Kedron State High School, resulting in mitigation of associated impacts;
- the relocation of the worksites at Lutwyche and Kedron would reduce the potential impact of spoil haul traffic and other construction traffic accessing the worksite in the middle of Lutwyche Road proposed in the Reference Project;
- the change in the design for the connections to Stafford Road would lead to more extensive works (cut and cover works, surface road works and elevated structure works) with potential traffic and environmental impacts;
- the use of the worksite at Truro Street, shared with Northern Busway, for construction and spoil handling for Airport Link would extend the duration and the scale and intensity of construction activity in this location;
- the extension of cut and cover construction northwards from Federation Street would also extend potential cut and cover construction impacts further into the residential areas of Windsor East, as far north as the proposed extension of Gallway Street. The extension of Gallway Street would also introduce construction impacts for adjoining properties (e.g. potential noise, vibration and dust impacts).

The proposed change in alignment for the mainline tunnels may result in noise and vibration impacts for new residences and other sensitive receivers, such as the Wooloowin State School. Potential effects may also occur on hydrology and flooding in Kedron Brook due to cut and cover works. In addition to the project approvals identified in chapter 4 of the EIS, the cut and cover works in Kedron Brook at the north-western connection may also trigger the requirement for a riverine protection permit under the *Water Act*

2000. Such an application would need to be accompanied by the information set out in Part 8 of the *Water Act 2000*. The potential for these environmental impacts is addressed below.

Noise and Vibration

Goals for noise and vibration to guide construction planning and management were established in the Coordinator-General's conditions. The Coordinator-General's conditions also provide that where the goals are predicted to be exceeded, the Proponent is required to implement mitigation measures and consultation to manage the impact on potentially-affected residents. These goals and triggers for additional mitigation measures and consultation remain relevant and necessary for the Changed Project.

Potential noise and vibration impacts along the north-south alignment would increase due to the shallower construction of the Changed Project. The Coordinator-General's conditions require a comprehensive Construction EMP, including sub-plans for the effective management of noise and vibration.

Roadheader construction at the shallower, southern end of the north-south alignment from Cedric Street to Felix Street may result in higher levels of vibration, potentially above the 'threshold of perception' but 'barely noticeable'. As for the Reference Project, blasting impacts would require careful management to ensure compliance with the Coordinator General's conditions.

For possible night work to construct the cut and cover tunnels beneath Kedron Brook, effective mitigation measures would likely be required to achieve the environmental objectives and performance criteria specified in the Coordinator-General's Conditions for general construction and for the management of noise and vibration effects of construction.

Regenerated noise levels for the Reference Project were expected to be low except at residences at either end of the tunnels, the Rosemount Hospital and some residences located between Somerset Street and Hadfield Street. Regenerated noise levels for the Changed Project are predicted to be higher for most residences along the north-south alignment if tunnelling works continue at night. If regenerated noise is predicted to exceed the goals, then mitigation measures and advance consultation would be required as identified in the EIS. Impacts at the Rosemont Hospital may also require mitigation during tunnelling in this area. Only some commercial properties may require mitigation measures.

The Changed Project would include tunnelling works (roadheader and TBM) under Wooloowin State School and in close proximity to the Kedron State High School. Regenerated noise and vibration levels at these two schools may result in detectable regenerated noise and possibly just detectable vibration within classrooms, although levels are likely to be compliant with the relevant Australian Standards[11]. The Changed Project would reduce the surface works and associated noise impacts at both schools compared to the Reference Project.

The noise and vibration predicted for the construction of the ramps at Kedron would be significantly lower than for the cut and cover works proposed in the Reference Project even though mitigation measures may need to be employed, particularly for night-time tunnelling. There would be potential for vibration and

[11] Predicted vibration levels would be below the range of "low probability of reaction" recommendations in AS2670 *Evaluation of Human Exposure to Whole Body Vibration - Continuous and Shock-induced Vibration in Buildings (1 to 80 Hz)*. Regenerated noise levels comply with internal noise level recommendations in AS2107 *Acoustics - Recommended design sound levels and reverberation times for building interiors.*

regenerated noise impacts at residences in this area, if tunnelling works continued at night. Should further predictive modelling, supported by construction monitoring data, indicate such impacts, then mitigation measures and advance consultation with potentially-affected people would be required in accordance with the Coordinator-General's conditions. Only some commercial properties may require mitigation measures. For the Changed Project construction works, acceptable noise levels are predicted for the two schools in this area.

Potential noise and vibration impacts along the east-west alignment would be reduced by constructing a deeper tunnel in this area and utilising improved rock strata found at depth except for the shallow works at the eastern end of the tunnel where predicted impacts are higher than for the Reference Project.

The east-west tunnels from Kalinga Street to Felix Street would be constructed by EPB[12] TBM. Vibration impacts for the Reference Project were predicted to exceed the threshold of perception but be barely noticeable. This would also be the case for the Changed Project except for the section of the tunnel below Kalinga Street to Park Avenue where vibration levels are predicted to exceed the 0.5 mm/s goal for sleep disturbance established in the Coordinator Generals conditions. Effective mitigation measures and advance consultation would be required in this area to achieve the environmental objectives for construction. The construction contractor would be required to address potential impacts with the occupants of properties along this section of the construction works.

Regenerated noise impacts were predicted for the Reference Project at night-time for residences at either end of the east-west tunnels, while for the Changed Project potential impacts are predicted only at the eastern end. Predicted regenerated noise in this area would likely be higher than the Reference Project due to the Changed Project having shallower tunnels in this area. A comprehensive approach to mitigation of both regenerated noise and vibration impacts would be required to achieve the environmental objectives for construction and to address and satisfy the Coordinator-General's conditions.

Consistent with the Coordinator-General's Conditions, a comprehensive construction noise and vibration management plan would be implemented including the design of construction approaches to achieve the environmental objectives and performance criteria. The Construction EMP noise and vibration sub-plan would address:

- predicted noise and vibration levels;
- assessment of the likely response to adjacent buildings and their inhabitants/contents to noise and vibration;
- required measures to prevent damage from vibration;
- noise and vibration monitoring, where appropriate;
- property condition monitoring, where appropriate, before, during and after construction;
- liaison with potentially affected, and affected property owners;
- community awareness programs; and
- a comprehensive and documented complaints system.

[12] EPB: earth-pressure balance TBM – for use in variable ground conditions such as those likely to be encountered between Clayfield and Lutwyche.

Flood Effects from works in Kedron Brook

Construction of the north-west connection for the Changed Project would involve cut and cover works through Kedron Brook, to be undertaken in two parts.

When cut and cover works occur in the southern half of Kedron Brook, the low flow channel would be diverted to the northern side of the stream. The temporary diversion channel would be designed to maintain the pedestrian access beneath the bridge. The diversion channel would be 15m wide and 150m long constructed at the level of the existing low flow channel. The working area on the southern side would be protected from flooding with sheet piling forming a coffer dam arrangement. The sheet piling to isolate the cut and cover works would be up to 1500mm above the level of the main flow channel. This would give relatively low flood immunity to the works area and any overflow water from a flood event subsequently would be pumped from the excavation back into Kedron Brook.

Once the limit of the working area is reached, the roof of the tunnel would be installed and the flow would be reinstated before the northern side of the creek is similarly isolated for construction.

The effect of the Changed Project works through Kedron Brook would be to increase flooding risk upstream effectively halving the conveyance of the channel during construction. Flood modelling indicates that, without mitigation measures during construction, two (2) residential properties upstream of the construction site would have an increased level of inundation in a 100 year flood event, due to the restricted capacity for flood flows through the construction area. This impact could be mitigated with short term, temporary measures, such as a temporary levee bank on a short section of Kedron Brook during construction.

The Draft Outline Construction EMP requires as performance criteria that the project be designed and constructed to avoid adverse impacts on flood levels for an ARI 100yr storm event in Enoggera Creek and Kedron Brook, upstream of the project works. In accordance with the Coordinator-General's conditions, the performance criteria must be adopted and incorporated into the Construction EMP for the project.[13] Those performance criteria include identifying measures for managing flooding impacts on identified upstream properties and also downstream water quality impacts to Kedron Brook from the escape of flood waters from the construction site. The Coordinator-General's conditions require the Construction Hazard and Risk EMP Sub-plan to consider the potential risks from inundation in consultation with relevant emergency services.

Flora and Fauna

The Kedron Brook catchment covers over 110km^2 and extends into the Pine Rivers Shire in its upper section. It is dominated by urban land use, but includes large areas of remnant waterway vegetation in areas upstream of the proposed Airport Link works.

In the vicinity of the north-west connection at Kedron, the stream has been straightened and contained in channelling as flood mitigation measures.

Water quality results derived from previous studies (EPA 2000) were evaluated against:

[13] Coordinator-General's Report, Appendix 1, Schedule 3, Condition 4

- the BCC Water Quality Objectives (WQOs), and indicated overall compliance with BCC WQOs and good level of water quality. The median values for all parameters are met at most sites.
- the Queensland WQOs and indicated overall compliance and good level of water quality. The median values for all parameters are met at most sites.
- the ANZECC Guidelines and indicated overall compliance with ANZECC Guidelines (2000) WQOs. The median values for all parameters are met at most sites.

In comparison with the BCC WQOs, the QWQG and the ANZECC guidelines, the water quality in Kedron Brook is average. Most parameters at the monitored sites were within the relevant guideline objectives.

Habitat assessments undertaken showed that the value of instream habitat along Kedron Brook varied between Gympie Road, Kalinga Park and Sandgate Road. The site at Gympie Road had poor habitat value due to the total removal of riparian vegetation for flood mitigation. Consequently, no overhanging vegetation is present, shrub and ground layers are sparse and banks are dominated by exotic grasses Nevertheless, the site provides some value to aquatic organisms through the creation of small pools and riffles. The absence of riparian vegetation provides no corridor for wildlife.

Kedron Brook at Gympie Road was dominated by exotic grasses on the banks. Aquatic vegetation was dominated by dense waterweed (*Egeria densa*), bulrushes (*Typha* sp.), milfoil (*Myriophyllum* sp.), water primrose (*Ludwigia peploides*) and para grass (*Brachiaria mutica*).

Under the Brisbane City Council Natural Assets Local Law 2002, waterway and wetland vegetation is protected. This includes vegetation along Kedron Brook. No land in the area is subject to the Wetlands code.

The fish communities of Kedron Brook are dominated by hardy, common native species and introduced species that are common pests in urban streams in South-east Queensland. Fish most likely to survive in Kedron Brook are those able to utilise a number of habitats, adapt to change and tolerate the fluctuating pollution and nutrient levels. No threatened fish species are likely to occur in the study area.

In Kedron Brook, the invertebrate fauna present are considered representative of a degraded urban waterbody. Freshwater turtles are common in the deeper pools along Kedron Brook. The Saw shelled turtle (*Elseya latisternum*) and Brisbane long-necked turtle (*Chelodina longicollis*) are reported as the most common species.

Information regarding amphibians in Enoggera Creek and Kedron Brook is relatively limited. A search of the BCC's database listed the following frog species to occur within two kilometres of the centre of the study corridor: Eastern sedgefrog (*Litoria fallax*); Common green treefrog (*Litoria caerulea*); Striped marshfrog (*Limnodynastes peronii*); and Emerald spotted treefrog (*Litoria peronii*). The Southern Barred Frog (*Mixophyes iteratus*) was listed under the EPBC Act database as in the general area, but is regarded as not likely to occur in the study corridor. This species is known to occur in uplands and lowlands in rainforest and wet sclerophyll forest, including farmland. Populations have been found in disturbed areas with vegetated riparian strips in cattle farms and regenerating logged areas.

Potential Impacts and Mitigation Measures

The Changed Project, as did the Reference Project, proposes extensive rehabilitation of Kedron Brook between Gympie Road and Shaw Road. The Northern Busway works would extend the rehabilitation treatment upstream to Bradshaw Street.

Kedron Brook has been straightened and contained in a low flow constructed channel for flood mitigation purposes. The rehabilitation works are proposed to restore habitat to a more natural state while still retaining hydraulic capacity. The ecology of Kedron Brook would be in an improved state once construction works are complete, leading to enhanced recreational and community values. The focus during construction would be to mitigate potential impacts on the existing habitat.

Potential impacts on receiving waterways may be either direct or indirect. Direct impacts would result from the excavation for cut and cover road structures, vegetation removal and erosion and sedimentation associated with the construction. Indirect impacts include water contamination or degradation due to sedimentation and erosion and effects on vegetation and fauna inhabiting surface water environments, including freshwater ecosystems.

The potential sources of water contamination requiring mitigation during construction are:

- disturbance of acid sulphate soils;
- sediment from disturbed areas;
- disturbance of instream sediments;
- hydrocarbon or chemical leaks and small scale spill from vehicles;
- hydrocarbon or chemical spills from storage areas;
- discharges from temporary sewerage and site facilities; and
- storage and disposal of waste material including spoil placement.

The potential for soil erosion and sedimentation is the main construction related water quality impact. Potentially, this would occur after vegetation removal and/or during excavation and earthworks. Sediment may be transported offsite by runoff into the drainage network, into receiving waters and onto adjacent properties.

Increased sedimentation from earthworks, hazardous/chemical substances (e.g. hydrocarbons from oil spills, asphalt prime, solvents, cement slurry and wash waters) and litter are potential pollutants if not managed properly. Eutrophication (the process of excessive nutrient enrichment) of receiving waters often stems from nitrogen and/or phosphorus bound to the surface of deposited soil particles. This over-enrichment of a water body with nutrients can result in excessive growth of blue/green algae, which leads to depletion of oxygen within the water column. This can impact upon waterways by increasing turbidity, reducing aesthetics and amenity of an area, altering water quality due to increased nutrients or pollutants associated with sediment and affecting floral and faunal communities. Acid drainage (from acid sulphate soils) is a potential impact that can affect groundwater and surface water.

Potential impacts on aquatic flora and fauna may occur at the area of cut and cover across Kedron Brook, and construction may have minor local impacts on aquatic flora and fauna through disturbance to small pools and riffles. No significant ecological impacts are expected. The area would recolonise rapidly after the project works were completed.

Removal of vegetation for construction would have little impact on aquatic flora at Kedron Brook, as remnant riparian vegetation has already been removed, and banks are dominated by exotic grasses.

During construction of the cut and cover a range of erosion and sediment control devices would be considered for use, especially in higher risk areas such as creek crossings. Piling operations present challenges for sediment erosion and control due to the limited space available for removal and/or containment of excavated materials. In such instances, the isolation of the working area by temporary fencing, bunding, or sheetpiling to prevent the loss of erodible soils to surrounding receiving waters or drains would be considered.

A water quality monitoring program during construction would be established to measure compliance with water quality objectives and to enable potential impacts to water quality to be assessed and mitigated. Monitoring is required under the Coordinator-General's Conditions.[14]

4.2 Spoil Handling, Haulage and Placement

4.2.1 Spoil Placement

In addition to the possible spoil placement locations assessed in the EIS, and subject to any necessary approvals, additional options for spoil placement considered for the Changed Project include:

- within the Export Park West precinct east of the construction of the new Gateway Upgrade Project (GUP) and south of the approved Northern Access Road Project (NARP);
- within the Banksia Place precinct, opposite the existing International Terminal;
- delivery to the approved Queensland Recycling land development works for BAC off Lomandra Drive and/or their Nudgee Road construction materials handling facility;
- East Coast Gravel Pit, Gympie Road, Pine River Bridge;
- a sand and gravel operation at Linkfield Road, Bald Hills;
- Narangba Land Remediation Site.

In addition, alternative suitable and viable sites may become available before the spoil operation commences.

Contaminated spoil would be sorted from the spoil stream and transported directly to the Swanbank Waste Management Facility.

Identified spoil placement sites on land controlled by Brisbane Airport Corporation would need to be assessed in accordance with the *Airports Act 1996* and referrals if necessary made under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth)("EPBC Act").

As spoil placement on the Export Park West site was previously withdrawn from the Reference Project under the EPBC Act, it would be appropriate to refer the placement of spoil on Export Park West to the Commonwealth Minister for the Environment, Heritage and the Arts for a determination as to whether it is a controlled action.

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[14] Coordinator-General's Report, Appendix 1, Schedule 3, Condition 10

4.2.2 Estimates of Spoil Volume

The estimate of spoil that would be produced by the Changed Project is approximately 2.8 million m^3 of bank material[15], as distinct from the Reference Project estimate of 1.6 million m^3. A breakdown of total spoil estimates generated at the three board worksite locations identified in the Reference Project and as estimated for the Changed Project is identified in **Table 4-20** below.

Table 4-20 - Estimates of Total Spoil

	Reference Project Spoil (bcm)	Changed Project Spoil generated (bcm)	Changed Project Spoil removed (bcm)
Southern worksite*	450,000	1,010,000*	870,000
North-western worksites	975,000	1,003,300	803,300
North-eastern worksite	185,000	803,000	803,000
Total	**1,610,000**	**2,816,300**	**2,473,300**

* For the Changed Project, the southern worksite includes the proposed Truro Street worksite which would be shared with the construction of the Northern Busway. Truro Street would be used to remove spoil from the northern section of the north-south tunnels, accounting for the increase in spoil generated for the southern worksites.

The Reference Project estimated that some 1 million bank cubic metres (bcm) would be generated from the driven north-south and east-west tunnels. The Changed Project would increase the length of the east-west tunnels, to join with the north-south tunnels, and would include increased lengths of driven tunnel ramps for the Lutwyche and Kedron interchange. The total estimate of driven tunnel spoil from the Changed Project is about 1.7 million bcm.

The total cut and cover spoil would increase for the Changed Project from about 0.6 million bcm to about 1.1 million bcm. This increase is due to the more extensive cut and cover proposed for the southern connection, including the burial of the southern and the north-eastern ventilation stations and the deeper cut and cover through Kedron Brook to Stafford Road and Gympie Road required to avoid the overhead bridging structures proposed in the Reference Project. Some 340,000 bcm of spoil would be returned to the surface worksites and tunnels constructed by TBM as fill, with approximately 2.47 million bcm to be taken to the proposed spoil placement sites.

4.2.3 Spoil Transport

Truck Haulage Routes

Access from construction sites onto the road network is addressed in the consideration of worksites in Sections 4.2.4 to 4.2.7.

Spoil haulage routes would be nominated in the Construction Traffic EMP Sub-Plan as required by the Coordinator-General's condition 5(c)(i) with minor roads only to be used where they are required for the most direct access to motorway and arterial routes.

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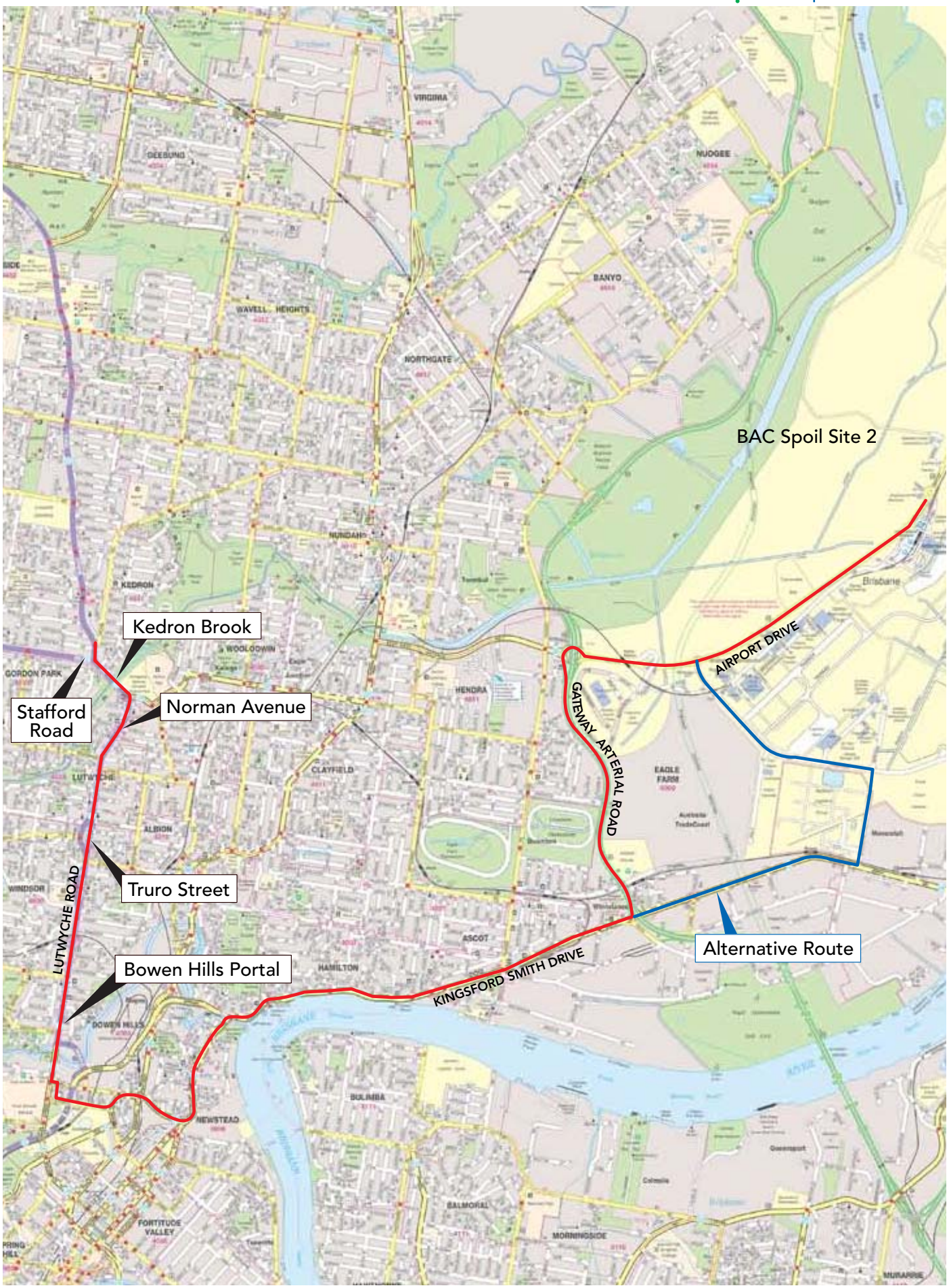
[15] Bank material is *in situ* material and does not include a 'bulking' factor used for post-excavation calculations. The bulking factor varies depending on the density of the bank material. The Changed Project has assumed that 1 bcm = 2.4 tonnes.

If spoil placement at Brisbane Airport is advanced, the access route would be via Kingsford Smith Drive and would include the Gateway Motorway and Airport Drive, with an alternative route via Sugarmill Road and Lomandra Drive to bypass the Airport Roundabout at peak times (refer to **Figure 4-1**).

The Changed Project also identifies a possible northern haul route (refer to **Figure 4-2**) which would provide a shorter haulage distance from the Kedron sites to the Brisbane Airport using Lutwyche Road, Gympie Road, Rode Road, Sandgate Road, East West Arterial and Airport Drive. This route would avoid the use of local roads and would not use Albion Road, Park Road and Junction Road as required by the Coordinator-General's conditions. To bypass the Airport Roundabout at peak times, the Changed Project has also identified an alternative route along Sandgate Road north of its intersection with Rode Road to Toombul Road, the Gateway Motorway and Airport Drive via the slip lane.



Basemap - Universal Copyright UBD 2006

Figure 4-1
Truck Haulage Routes - Southern Haul Route

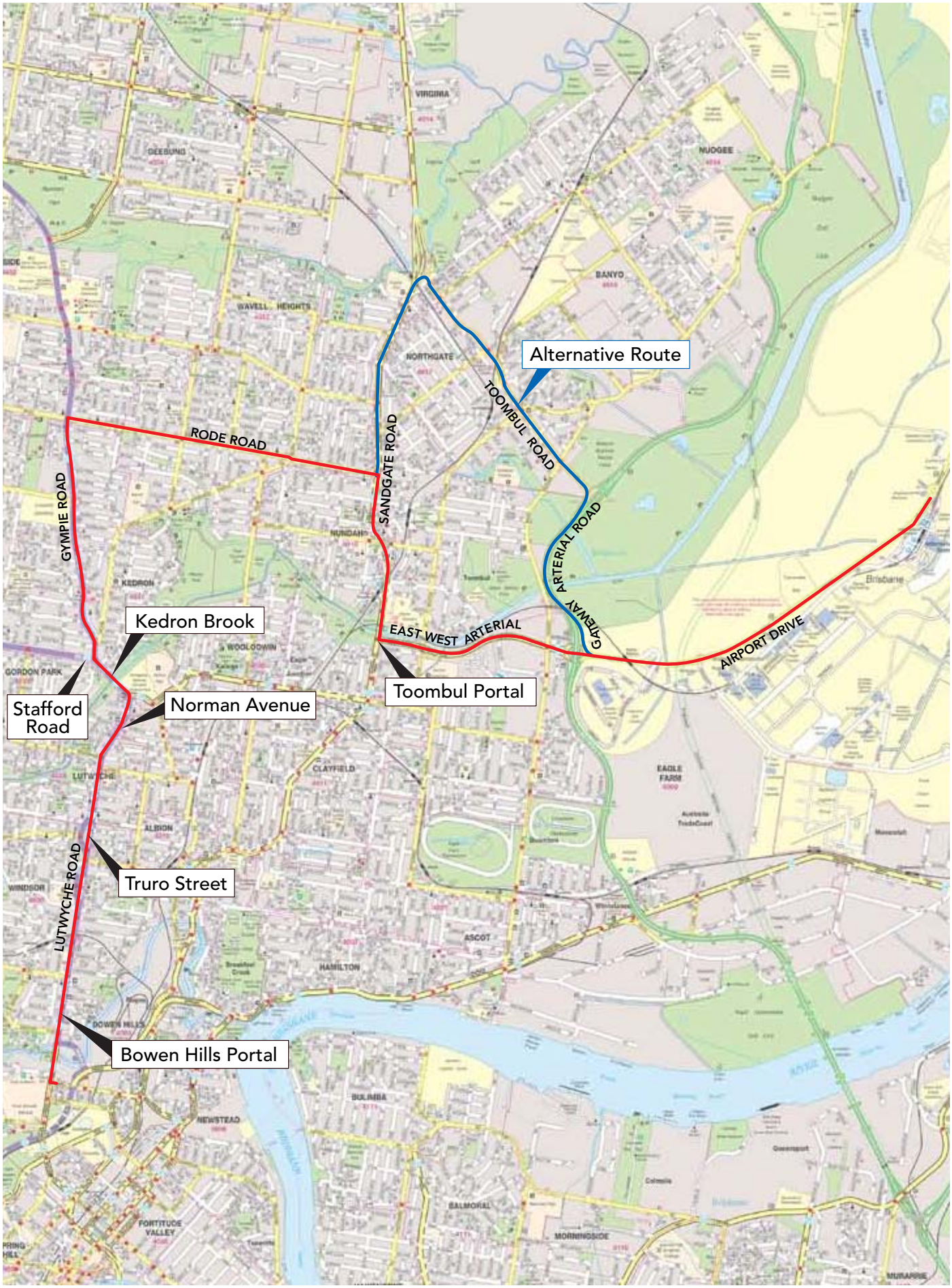


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Figure 4-2
Truck Haulage Routes - Northern Haul Route

Conveyor spoil from Clayfield worksite

To handle TBM spoil from the north-eastern worksite, the Changed Project would provide the opportunity for the use of a spoil conveyor to carry spoil from the eastern side of Sandgate Road to the Brisbane Airport. This external conveyor would collect the spoil material from the TBMs' internal conveyors, passing from the tunnels, beneath Sandgate Road, to a transfer point with the external conveyor within the constructed transition trough in the middle of the East West Arterial. **Figure 4-3A** shows the indicative alignment of the proposed conveyor.

The Changed Project's spoil conveyor would transport an estimated 520,000 bcm of spoil from the TBMs for the construction of the east-west driven tunnel directly to the preferred spoil placement site. This would occur over a 10 month period, commencing in 2010.

Although the conveyor is yet to proceed through detailed design, it would most likely comprise a conveyor belt of about 1.2 m width, housed within a lightweight support structure of about 2m width. The support system would be fixed to foundations typically spaced at 3m intervals. The support system would minimise the size and visual impacts of the structure, to provide minimal flood impedance and to simplify construction, operation and removal of the structure. A suitable cover would be provided to minimise and manage dust movement, acoustic impacts, and prevent rainfall onto the spoil. Noise attenuation would be provided to meet the noise goals in the Coordinator-General's Condition for noise sensitive places.

An access road would be required alongside the conveyor, resulting in a 5m corridor, or nearby with spur road access.

If approvals for the conveyor and associated spoil placement site are not obtained within the required construction timeframe, there are two alternative methods for spoil transport from the Clayfield worksite.

One alternative would entail a shortened conveyor system, that would still relieve the residential communities of Hendra and Clayfield of the potential impacts of spoil handling and haulage by truck but would still have the impact of additional trucks on the arterial road networks otherwise avoided by the full conveyor proposal. The shortened conveyor would be terminated at an enclosed spoil handling facility at the western side of Nudgee Road, south of Airtrain. The shortened conveyor would follow a similar alignment as the full spoil conveyor east to the enclosed spoil handling facility on vacant land to the south of Airtrain (refer to **Figure 4-3B**). Haulage trucks would enter and exit the enclosed spoil handling facility from Nudgee Road. The spoil would be loaded to the trucks within the enclosed facility by conventional front end loaders.

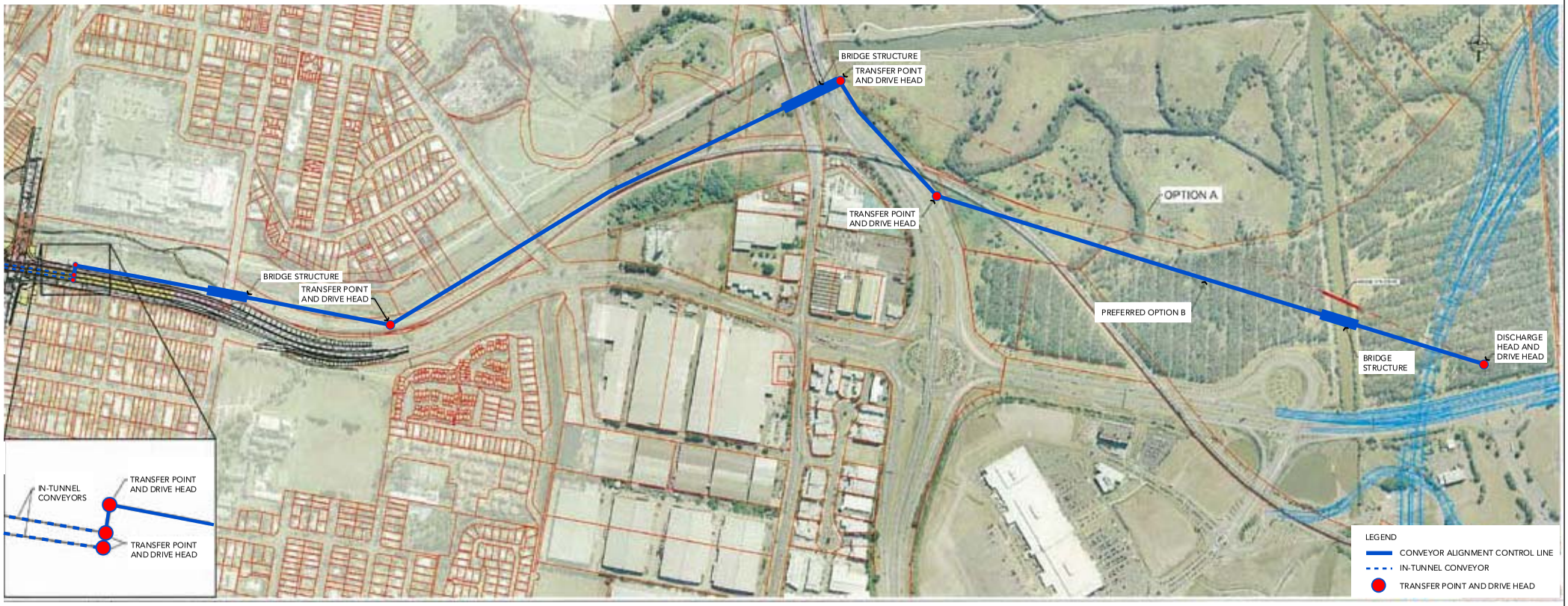


Figure 4-3A
Airport Link Proposed Full Conveyor Alignment

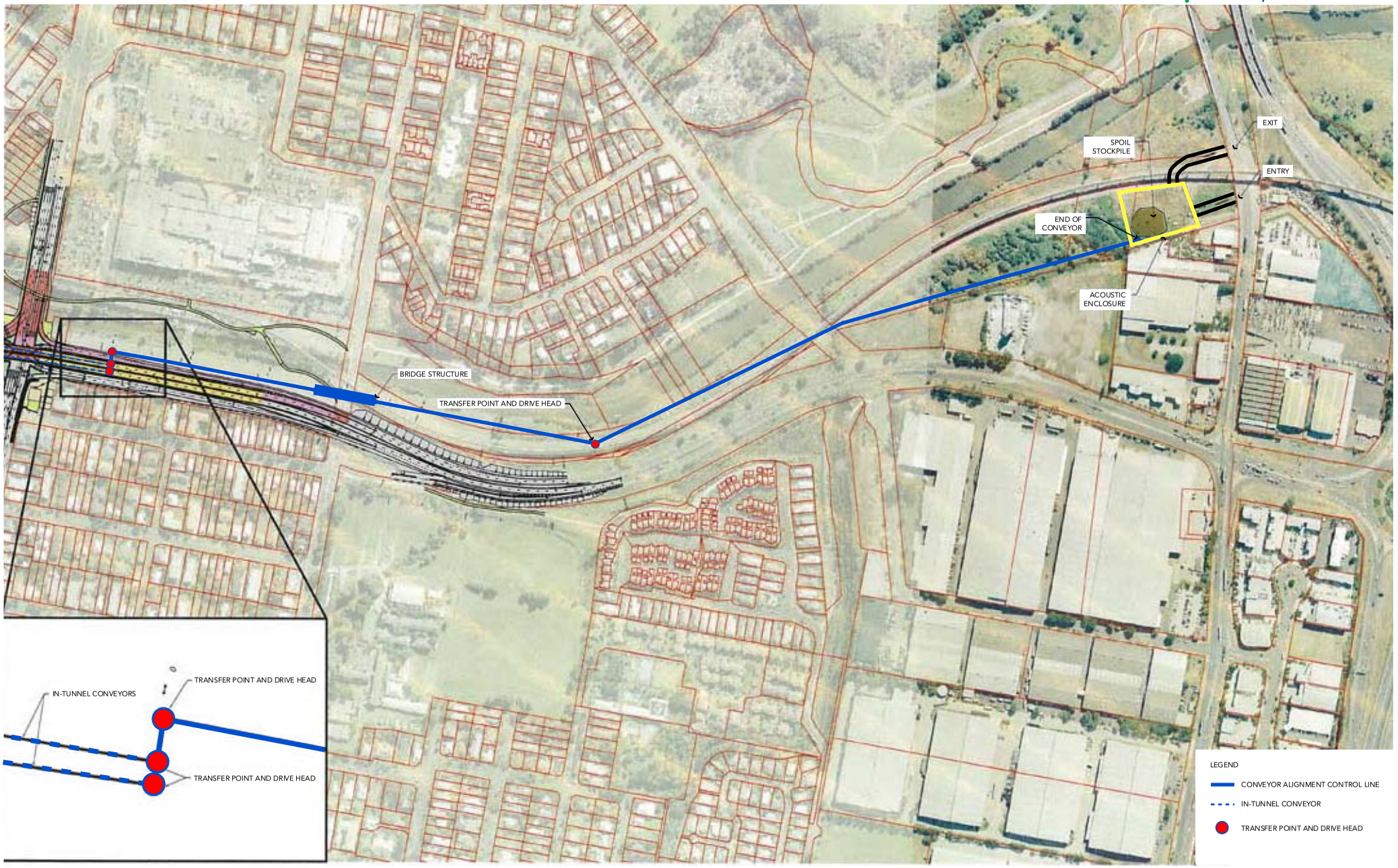


Figure 4-3B
Airport Link Proposed Shortened Conveyor Alignment

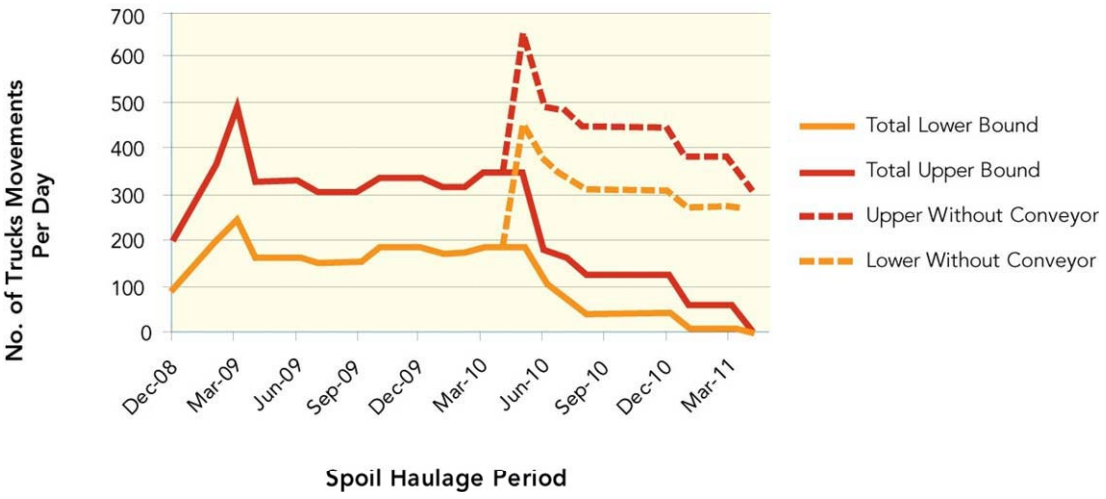
A second alternative would entail truck haulage operating directly from a spoil handling facility east of Sandgate Road, designed within the permanent trough structure of the mainline Airport Link tunnels where they merge with the East West Arterial. Spoil would be transported from the tunnels to the spoil handling facility via the twin in-tunnel conveyors under Sandgate Road. They would discharge to the trough ground surface via two small stacking conveyors. The spoil handling facility would be about 20m wide or the width of the trough, roofed with side walls 10m above road level at the eastern end and 6m at the western end where the trough is some 4m lower, and up to 150m long. The spoil handling facility would be operated in accordance with the Coordinator-General's conditions, including being enclosed, ventilated and acoustically-lined.

Truck Haulage Trips

As noted in Section 4.2.2 the estimated volume of spoil to be removed in the Changed Project is approximately 2,816,300 bcm minus approximately 340,000 bcm of spoil to be returned as fill, equalling approximately 2,476,300 bcm. If the conveyor were to be used from the Clayfield site, the spoil to be removed by truck would be approximately 1,956,300 bcm, with approximately 520,000 bcm being sent by conveyor. Assuming truck volumes of 13 bcm (30-32 tonnes) per truck, the numbers of extra truck movements (i.e. full trucks to placement sites and empty trucks returning) on the road network during excavation works would be about 301,000 with the conveyor and about 381,000 without the conveyor.

The Reference Project calculated spoil volumes for the Airport Link project to be approximately 1,610,000 bcm. Using the same truck volume assumption, this would represent about 124,000 return truck trips or 248,000 truck movements. On this basis, the increased spoil volume and truck trips would be about 20% higher than in the Reference Project with the conveyor and about 50% higher without the conveyor. The total truck movements per day over the duration of the Changed Project are shown in **Figure 4-4**.

Figure 4-4 Summary of truck movements per day throughout construction of project



Comparison of Spoil Haulage Traffic Volumes

Traffic generation from spoil haulage for the Changed Project and the Reference Project are summarised in **Table 4-21**.

Table 4-21 Comparison of Spoil Haulage Traffic Volumes (without conveyor)

Location	Estimated Volume of Spoil Hauled	Overall Duration of Operation	Estimated Average Truck Loads per Day(1)
Reference Project (EIS)			
Southern Connection	450,000 m^3	32 months	50
North-Western Connection	975,000 m^3	30 months	115
North-Eastern Connection	185,000 m^3	16 months	40
Changed Project			
Southern Connection	450,000 m^3	18 months	170
Lutwyche Road Worksites	420,000 m^3	24 months	66
North-Western Connection	803,000 m^3	26 months	131
North-Eastern Connection- Tunnel Boring Machines	520,000 m^3	10 months	295(2)
North-Eastern Connection- Other Works	283,000 m^3	16 months	40

Notes : (1) Average across the total period of operations in each area. Actual traffic volumes will vary during the project depending on activities at the time.

(2) Anticipated maximum daily haulage traffic with both TBMs in full operation. This will only occur if the conveyor operation is not undertaken.

4.2.4 Effects of Spoil Handling and Haulage

The potential impacts associated with the proposed changes in spoil management relate to possible effects on:

- the operation of the traffic network;
- the social environment through noise and other amenity effects due to increased truck movements; and
- the environment through the construction of the conveyor to the spoil placement sites, especially across 'sensitive' lands owned by Council and BAC.

These effects are described below.

Effects on the operation of the traffic network

The Changed Project would have higher hourly haulage traffic movements than the Reference Project due to various factors including higher total spoil haulage volumes and reduced duration of works in some locations (e.g. Kalinga Park).

The number of trucks per hour shown in **Table 4-21** represents only a small increase in the background traffic volumes on the spoil haulage routes.

The Changed Project identifies new measures that would reduce impacts on congested areas, including:

- use of a proposed northern haul route via Rode Road, reducing construction traffic volumes on Lutwyche Road, Bowen Bridge Road and Kingsford Smith Drive;

- use of alternative peak period routes via Toombul Road and via Sugarmill Road, minimising impacts on the East West Arterial/Gateway Motorway interchange.

The impact of haulage traffic on the northern haul route would be expected to be minor, adding an average of less than 0.5% to expected daily and peak hour traffic on most roads along the route. Daily heavy vehicle volumes would increase by about 20% on Rode Road, and by less than 5% in most other areas. Although the greatest proportional influence would occur on Rode Road, this would be less than 1.5 % of daily traffic volumes and less than 1% of peak hour flows. This would have minimal impacts on average travel times, overall and in peak conditions.

An average of 10 trucks per hour would pass through the East West Arterial/Gateway Motorway/Airport Drive interchange in each direction, rising to 15 per hour in periods of peak work activity. This represents well under 0.5% of background peak hour flow.

Operational conditions at this interchange would be improved by the opening of an alternative access to Brisbane Airport to supplement the existing Airport Drive connection from the Gateway Motorway. The Airport Northern Access Road Project is currently under construction, in conjunction with the Gateway Upgrade (GUP). The Northern Access is planned to open in mid-2009, close to the scheduled time for the spoil haulage for tunnel boring operations to begin at the Clayfield worksite. Combined with the proposed haulage hours, this would minimise the potential impact on the airport roundabout. The new Northern Access to the Airport would also reduce the operational effects of other haulage traffic, and any peak period restrictions adopted may be able to be relaxed.

A construction traffic EMP Sub-Plan for each major spoil haulage route would be prepared in accordance with Coordinator-General's conditions to ensure acceptable operating conditions are maintained.

Environmental Effects of Traffic and Truck Haulage

Overall truck usage for spoil transport

As noted in Section 4.3.3 the volume of spoil to be removed by truck represents about 301,000 truck movements with use of the conveyor from the Clayfield worksite and about 381,000 truck movements if the conveyor is not used. The truck haulage would be about 20% higher than projected in the Reference Project with the conveyor and 50% higher without the conveyor.

The EIS for the Reference Project found that spoil traffic generally would not increase average traffic noise levels (LA_{10} (18 hr) on spoil routes by more than about 0.5 dBA along major road corridors and would not present an acoustic impact, except at O'Connell Terrace and Montpelier Road where the increase may be up to 5.2 dB(A) higher.

An assessment of the spoil truck movements for the Changed Project has shown that there would be an increase by 20-50% in loaded trips compared with the Reference Project. This represents a minor increase in noise levels of (approximately) 1 dBA for the 20% increase and (approximately) 2 dBA for the 50% increase over the predictions for the Reference Project. With such increases, it is likely that for most haulage routes on arterial roads, the impacts would remain undetectable and insignificant. It is noted that heavy vehicles already travel along all the arterial roads nominated as the haul routes both day and night and that the maximum pass-by noise levels would not increase above those levels that already exist.

As the frequency of truck pass-bys would be greater (than existing) during construction, some arterial roads may have an increase such that mitigation measures would be required and would be negotiated with land owners. As proposed for the Reference Project, these would be assessed on a case by case basis.

Trucking from Clayfield work site to Spoil Placement Sites

The use of the conveyor would have potential community benefits for spoil haulage from the Clayfield worksite, where the combined volume of spoil, when operating at peak capacity, would be approximately 4,850 bcm per day. The use of a conveyor system would result in fewer trucks on the road network than would otherwise occur with the Changed Project. If trucks were used instead of the conveyor, this would result in up to 295 return truck trips per day over a proposed 18hr haulage time or equivalent to 16 return truck trips or 32 truck movements per hour. This operation would occur for a period of about 12 months.

The increased truck movements on the East West Arterial would represent less than 0.5% increase on all vehicle trips such that the consequential noise increases would not be detectable. While the trips by spoil trucks would increase at night on the East West Arterial, the consequences for road traffic noise would be minimal and still unlikely to be detectable.

Use of Alternative Northern Spoil Haulage Route

Under City Plan, arterial roads are identified in the Transport and Traffic Facilities Planning Scheme Policy and Planning Scheme Map 1, Area Classifications and Proposed Road Hierarchy to 2011.

Rode Road is identified in City Plan as an arterial road. Whilst there are a number of residences along Rode Road, use of this road as an arterial road, including for the haulage of spoil, is within its intended function. The noise (amenity) increase and hence level of impact on the residents would be small. This is especially so at night when construction traffic management would control increased truck numbers to low levels.

Daytime (LA10(12hour)) and night-time (LA10(1hr)) noise predictions have been undertaken for the alternative northern spoil haulage routes based on the above truck movements. Predicted changes in noise levels (above existing) for all roads along these two routes, either daytime or night-time, would be 1 dBA or less and therefore considered negligible.

Effects of Conveyor

Effects of conveyor on ecology

The conveyor would be located on a modified landscape, with the primary communities being un-managed grasslands and saltmarsh areas, sparse mangroves along drainage lines and monoculture plantations of Swamp She-oak (*Casuarina glauca)*.

The grasslands include the exotic Rhodes Grass (*Chloris gayana*) as a dominant in the drier areas with other exotic grasses and herbs in lesser numbers. The open grassland habitat is unlikely to sustain populations of rare or threatened fauna species. Birds recorded within the grassland habitat are all common species which occur widely within the region. Given the simple structure of the habitat and the relatively impoverished species diversity of overall fauna assemblages likely to be present, the grassland has a low habitat value. Grasslands and associated freshwater wetlands and sedge communities within the BAC land were found to contain potential habitat for Lewins Rail (*Rallus pectoralis pectoralis*) which is listed as "rare" under the *Nature Conservation Act 1992*. Locations of known or probable Lewins Rail habitat are generally found to the east of the proposed conveyor alignment.[16] One small area of probable habitat was adjacent to the proposed conveyor alignment.

[16] Gateway Upgrade Project EIS (DMR 2004)

The saltmarsh areas are dominated by Marine Couch (*Sporobolus virginicus*), with Seablite (*Suaeda australis*), Berry Saltbush, (*Einadia hastata*), Ruby Saltbush (*Enchylaena tomentosa*), Samphire (*Sarcocornia quinqueflora*) and Sea Purslane (*Sesuvium portulacastrum*) also present. The mangrove channels in the area support Grey Mangrove (*Avicennia marina*), River Mangrove (*Aegiceras corniculatum*) and Milky Mangrove (*Excoecaria agallocha*). The mangrove / saltmarsh areas within the BAC land are regarded as an important habitat (roosting and foraging) for various shorebirds.

An extensive area of Casuarina plantation on BAC land lies adjacent to the floodplain area north of Airport Drive. The Casuarina plantation consists of a monoculture of Swamp She-oak trees (*Casuarina glauca*) with an understorey of weeds and, in some places, Marine Couch. Microchiropteran bats were found to use the plantations, but introduced mammals dominated on the ground. This area has a relatively low conservation and habitat value and is unlikely to sustain populations of rare or threatened fauna.

The construction and temporary use of the corridor for the conveyor would have a relatively low environmental risk, if carefully designed, implemented and managed. The management would include a detailed survey of the ecological values of the alignment, and the design to minimise any potential impacts identified. This would include ensuring the clearing along the alignment and road access to the minimum required. Construction measures would include the management of surface water regimes, dust, vehicle movements and the introduction of weed species and contaminants to maintain habitat values.

Effects of conveyor on erosion control and surface water quality

The area over which the conveyor would pass is likely to be comprised of land below 5 m AHD and, given its "swampy" nature, is likely to contain Acid Sulphate Soils (ASS). The potential exists for any excavation activity to disturb ASS and provide the conditions for "acid runoff" from the site, unless properly managed.

There would be some limited excavation to provide for footings. The management of acid sulphate soils (ASS) and sediment runoff would be addressed during the detailed design phase of the conveyor and incorporated into EMPs prepared for the construction and operation of the works in accordance with the Coordinator-General's Conditions[17].

Effects of conveyor on flooding

A hydraulic model was prepared for the north east connection of the Changed Project. The model included the impacts of the conveyor structure. The operational parts of the conveyor system would be located above a designed flood level. The design flood level was determined in a risk assessment-based approach, taking into account the short operational period of the conveyor operation (up to 10 months). The hydraulic effects of the conveyor were considered by BC in the flood modelling to ensure that the conveyor would not have any adverse upstream effects during a 100 year ARI flood event.

During detailed design, the conveyor system would be constructed to avoid inundation of additional properties due to afflux and the program of works for the conveyor construction, operation and maintenance would be designed and constructed to avoid impoundment of overland flow resulting in inundation on adjoining property.

[17] Coordinator-General's conditions, Appendix 1, Schedule 3, Condition 11

Effects from conveyor noise

Noise impacts from the conveyor operation, especially the cross conveyor at Toombul, transfer points and drive head locations, would be unlikely, due to the location of the conveyor on the northern side of the East West Arterial and adjacent to the Airtrain.

Noise modelling, developed for the EIS, has been undertaken and updated to include the proposed conveyor as a 'line noise source', to assess the likely noise levels at residences adjacent the proposed conveyor route. The modelling indicates that compliance with the Coordinator-General's Conditions regarding construction noise goals[18] could be achieved at all neighbouring noise sensitive locations through appropriate mitigations such as the use of:

- "low" noise or "super low" noise idlers; and/or
- partial or full enclosure of the conveyor system where required to meet the noise goals for sensitive locations - only partial enclosure is predicted to be required for the "low" and "super low" noise idlers and full enclosure is predicted to be required should conventional idlers be utilised.

As part of the Construction Noise and Vibration EMP Sub-Plan an acoustic study would identify the extent of any possible impact in the context of any residential or other sensitive sites in the locality and mitigation measures would be designed in response to that impact.

Visual impacts of conveyor

The location, design and size of the conveyor would make it visible to motorists, commuters, cyclists and pedestrians along its route near the East West Arterial and Air Train. The visibility of the conveyor and the landscape context would contribute to a moderate to high visual impact in the local setting. This impact would be short-term, due to the temporary nature of the facility and could be mitigated through the use of appropriate materials and colours in design and construction.

The conveyor would be very obvious and would have a high visual impact on an arterial road where it crosses above over the Gateway Motorway. The crossing of the Gateway Motorway by the Airtrain would aid in mitigating this impact. The impact would be a temporary impact.

Mitigation measures for conveyor

Potential impacts from the construction and operation of the conveyor would be minimised by:

- refining the alignment to avoid areas of higher ecological value;
- appropriate mitigation to reduce noise impacts, which may include the use of idlers and/or enclosure of the structure where necessary, and on-going management to ensure the effectiveness of such mitigation measures;
- management of ground works to ensure potential runoff from the excavation activities is minimised, in accordance with the existing Coordinator-General's conditions. This would include erosion and sediment control and management of ASS, and restoration of disturbed areas following the closure of conveyor;
- management of any existing weed problems and any new weed growth in disturbed areas;

[18] Coordinator-General's conditions, schedule 3, condition 9 (Table 3: Internal Noise Goals - Night Time Construction)

- elevation of the structure to ensure flooding is able to be managed and to avoid conveyor operations during major flood events;
- use of materials and colours in design and construction to mitigate visual impacts for the locality and at the Gateway Motorway; and
- decommissioning and rehabilitation of the corridor as soon as practicable upon completion of the spoil transport task for the conveyor.

4.2.5 Cumulative Effects

Other projects being undertaken during the construction of the Airport Link include the Northern Busway, Gateway Upgrade, North-South Bypass Tunnel and the Airport Roundabout Upgrade Project. All of these projects would require the removal of spoil. There is potential for cumulative impacts associated with the transportation and disposal of spoil.

Spoil haulage for the Northern Busway is estimated to generate an average of 2 truck loads per hour from the Lutwyche Road worksites and 3 truck loads per hour from the north-west worksites. These truck movements would follow the same haulage routes as the Airport Link haulage vehicles. The cumulative effect of Northern Busway spoil trips with the Changed Project would be minor and would have little or no consequence on the performance of the road network and negligible difference in the environmental impacts.

The cumulative impact of the Changed Project being constructed at the same time as the ARU Project was not considered in the EIS for the Reference Project. The cumulative impact would be managed through the following:

- traffic staging proposed for the ARU Project envisages building outside the existing roadway and once this is complete, switching traffic onto the new works, and building the flyover where the exiting traffic was. A long-span bridge structure results in a small surface footprint for the flyover structure, allowing for simpler traffic staging;
- additionally, the ARU Project works are programmed to occur after completion of the Northern Access Road which is expected to reduce traffic on the Airport Interchange by 40%.

As a result of the above measures, the peak hour capacity of the Airport roundabout would not be affected.

Further analysis for the spoil haulage traffic would be required in the preparation of the Construction Traffic EMP Sub-Plan required by the Coordinator-General's conditions to address the cumulative effect on traffic performance of Airport Link works and concurrent Northern Busway spoil haulage. Other projects under construction at the same time, such as the NSBT and Gateway Upgrade Project (GUP) would also need to be considered in the development of the Construction Traffic EMP Sub-Plan.

4.3 Windsor Worksites and Construction

4.3.1 Worksite Locations

The southern worksite at Windsor East would be expanded from that described in the Reference Project to include land between Federation Street and Gallway Street and east to Morris Street. The worksite would also be expanded as shown on **Figure 4-5** to include:

- Byrne Street and Mann Park for general equipment laydown and storage, establishment of primary offices;
- workforce facilities at Federation Street on the three vacant house blocks at the corner of Federation Street and Addison Road; and
- workforce parking east of Addison Street.

The main worksite would include noise barriers with initial access from Federation Street as identified in the Reference Project until later stages when access would be from the newly opened extension of Gallway Street, Morris Street and the remaining section of Federation Street.

The main site office for the Windsor worksite would be established on vacant land situated on the corner of Federation Street and Addison Street. Access to the staff parking for the main office would be from Gallway Street. Local traffic would exit the area via Addison Street, Gallway Street, Morris Street and Federation Street until the Gallway Street extension is completed.

New southern worksites, coordinated with the construction of the Northern Busway and the Bowen Bridge Road on-ramp (north-bound) over Lutwyche Road, include land to the north and south of Enoggera Creek on the western side of Bowen Bridge Road. Subject to agreement with the NSBT, satellite offices and workforce facilities also would be established adjacent to the Queensland Rail access road south of the ICB and also east of The Mews apartments.

Access to the worksite on the western side of Bowen Bridge Road would be via the Northern Busway Stage 1 access on Butterfield Street, with left-in access from Bowen Bridge Road in some stages of the works.

Sections of the Airport Link / ICB / NSBT interchange works, including the satellite site offices south of Enoggera Creek, would be accessible from Campbell Street or Lanham Street. The worksite area between the ICB and the Exhibition rail line would have access from the ICB, while the central section between Cedric Street and Enoggera Creek would have access from Lutwyche Road via the 'Horace St' connection as well as via the main Federation Street worksite.

Workforce parking would be provided on vacant land north of the Ferny Grove Railway with access off Albion Road and along McDonald Road. Shared pedestrian and cycle access to the southern worksites would be via the existing shared path along Enoggera Creek. This path may be realigned in some locations.

Dedicated transport would be provided to shuttle workers from this car park to the southern worksites and to other worksites such as Truro Street and Lutwyche.

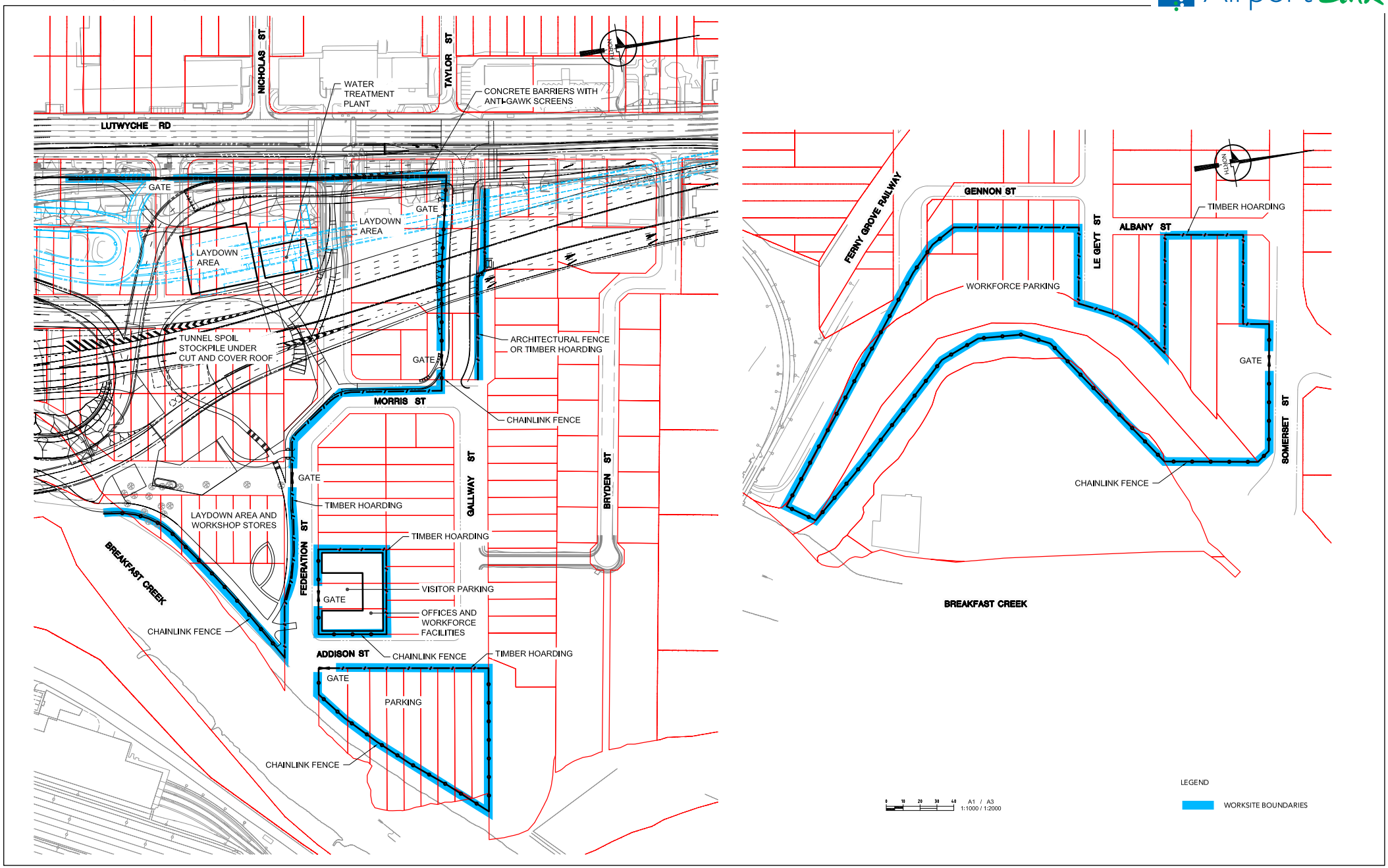


Figure 4-5
Windsor Worksites and Workforce Parking

Traffic diversions for the Changed Project as compared with the Reference Project, resulting in changes to public transport and pedestrian and cycle access during construction, would be required as follows:

- construction of bridges would require night-time closures of several links in the NSBT/ICB interchange. Diversion routes would maintain connectivity during these closures. Identified diversion routes typically include Bowen Bridge Road, Campbell Street and O'Connell Terrace;
- the temporary closure of Campbell Street for the O'Connell Terrace on-ramp bridge construction in the Reference Project would not be required with the Changed Project;
- progressive traffic diversions and lane realignments would be required on Lutwyche Road and Bowen Bridge Road for the changed off-ramp construction;
- Federation Street would be closed to local traffic during construction. Access to the Federation Street catchment would be via Bryden Street, as it is at present during construction of the NSBT, until the connection of Gallway Street to Lutwyche Road is opened in mid-2009;
- the shared pedestrian/cycle paths along Breakfast Creek would be closed through Mann Park during construction. Alternative access to Lutwyche Road would be available via Bryden Street, with a pedestrian crossing at Newmarket Road, and via Federation Street or via the Gallway Street Extension;
- temporary footpath closures would occur on the western side of Lutwyche Road between Butterfield Street and Northey Street;
- pedestrian and cyclist access on Campbell Street would be closed in some sections, with diversions via O'Connell Terrace;
- two bus stops, inbound north of Federation Street and outbound near Taylor Street, may need to be temporarily relocated.

4.3.2 Effects of changes to worksites

The potential environmental effects of the changes to worksite arrangements in the Windsor area are:

- a change in the land area required, including the acquisition of additional properties;
- changes in amenity – especially from noise effects due to the change in work site boundaries and truck movements into and out of the site; and
- impacts on community due to changes in access arrangements and the requirements for parking in the vicinity.

The possible environmental and social impacts are discussed below.

Land Use

The changes in the configuration of the Windsor worksite would require the acquisition of extra properties including six (6) additional properties between Federation Street, Gallway Street and Morris Street over the requirement for the Reference Project. Three vacant lots on the corner of Federation Street and Addison Street would be used for the main site office.

The proposed changes would also result in the use of vacant land north of the Ferny Grove Railway for workforce car parking during the construction phase of the Changed Project. At present, this vacant land

contributes to the open space values of the area. Effective and early site rehabilitation and landscaping would assist in recovering such values upon completion of the construction programme.

Traffic and Parking

Access to worksites for the Changed Project would generally occur from major roads.

Access to the Windsor worksite for spoil haulage would be via Federation Street and Morris Street.

The main workforce car park would be accessed from McDonald Street and would ensure local streets are not parked out by workers' vehicles. The construction workforce also would be encouraged to use public transport where possible or use this temporary car park. The footpath along Enoggera Creek would be used for access from the car park to the worksite.

Pedestrian and cyclist connectivity in the areas around the worksite would be maintained, with some temporary route changes. Bus operations would not be adversely affected by the bus stop relocations.

A Construction Traffic EMP Sub-Plan would be prepared before each construction phase in accordance with the Coordinator-General's Conditions to ensure acceptable operating conditions are maintained with the proposed temporary arrangements.

Amenity

The extension of the Windsor worksite would result in increased exposure of the residents on Gallway Street and nearby areas to amenity impacts from the works, including from spoil haulage at night. For spoil haulage from the Windsor worksite through residential streets, mitigation of noise may be required to meet the goals as well as early and on-going consultation with the community.

Noise barriers are proposed along the northern side of Gallway Street as extended to Lutwyche Road. Property treatments may be required on a case by case basis in this area to achieve acceptable internal noise levels for sleeping. As in the Reference Project, any such measures would be managed by consultation with the community and responding to identified community issues.

Conclusion

The proposed changes to the Windsor worksite would be managed in response to technical requirements and community expectations and in accordance with the Construction EMP and sub-plans required by the Coordinator-General's conditions. The Construction EMP and sub-plans would be developed in step with detailed design development and prior to relevant construction. The consultation process proposed includes a comprehensive information stream, including advanced notification of construction techniques and timeframes for local areas and sensitive stakeholders.

4.4 Kedron Worksites and Construction

4.4.1 Worksite Locations

Lutwyche Road worksite

The revised design of the mainline tunnels under Lutwyche allows for the reduction in size of the Norman Avenue to Colton Avenue worksite (**Figure 4-6**) compared with the Reference Project. The Changed Project no longer requires the worksite to be within Lutwyche Road and, as a consequence, the worksite and associated facilities, including spoil handling within the acoustic shed, would be on the western side of Lutwyche Road between Norman Avenue and Perry Street. This worksite is required for the construction of the Airport Link off-ramp (north-bound) and transition structure. The portal to the tunnel off-ramp would be relocated north of the intersection of Norman Avenue with Lutwyche Road, and would be within the worksite. There would be no cut and cover works south of Norman Avenue or within Lutwyche Road as proposed in the Reference Project. Truck access to this worksite would be from Lutwyche Road.

Kedron Park worksite

The construction requirements through the DES and Kedron Park High School areas at Kedron (refer **Figure 4-7**) would change significantly from the Reference Project. The Kedron worksite would be confined largely to the DES site. There would not be a worksite and associated tunnel workshed for the launching of the TBMs on the Kedron State High School land, as was required for the Reference Project.

For the Changed Project, the area required in the Reference Project for cut and cover works along Kedron Brook, would be required for construction workforce parking. Access to the car park would be restricted to light vehicles, via Gympie Road east of Kedron Brook.

The Kedron worksite at DES would extend along the southern bank of Kedron Brook to allow construction of the connection to the east-west tunnel. The worksite would also increase in area to the south to allow construction of a shaft to gain early access to the driven tunnels and associated ramps. An acoustic enclosure would be provided over this Kedron shaft and would include the spoil stockpile and handling facility to the north of the DES building.

The Kedron worksite would provide Airport Link office and site facilities within the retained DES office building.

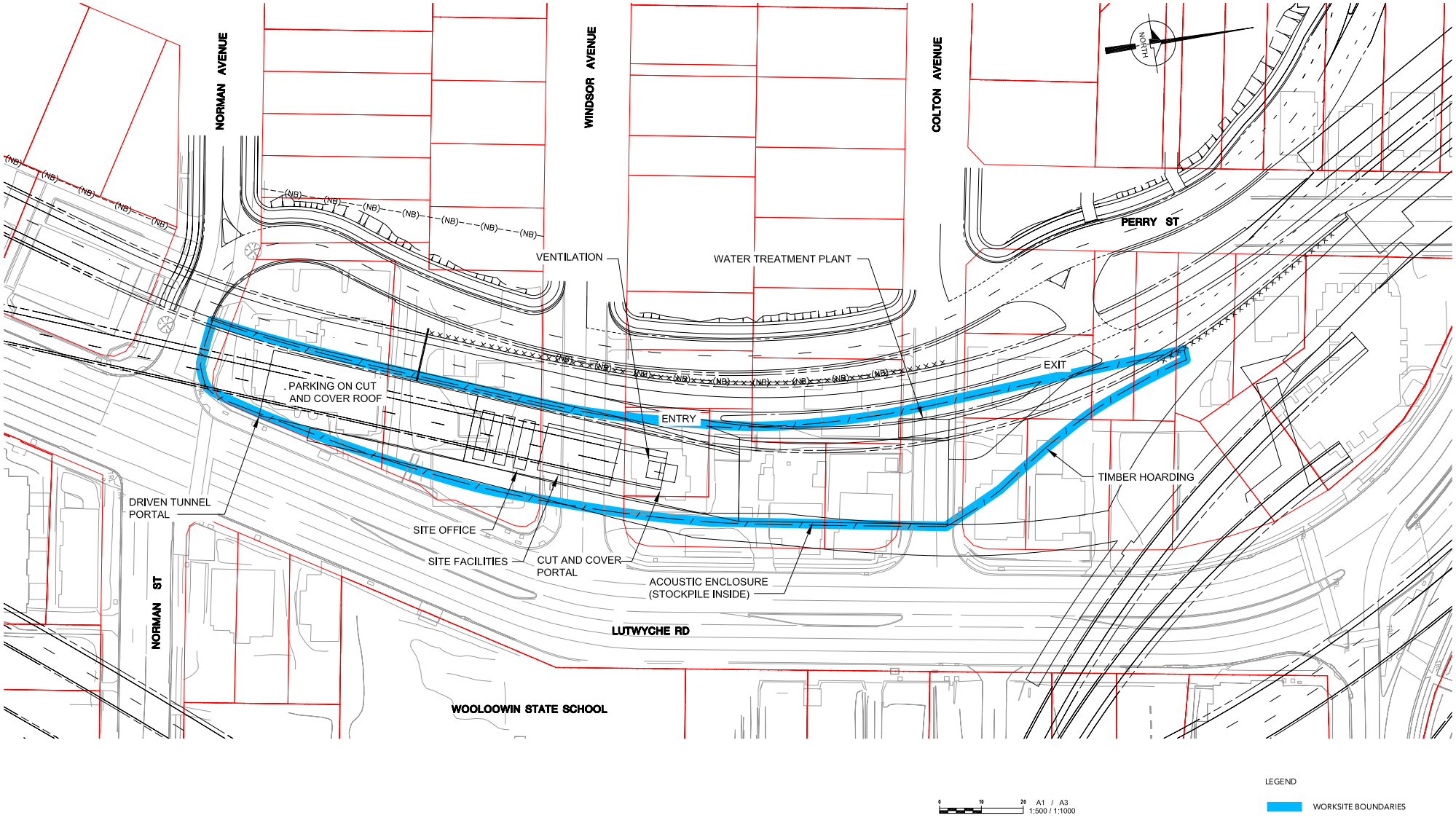


Figure 4-6
Lutwyche Road Worksite

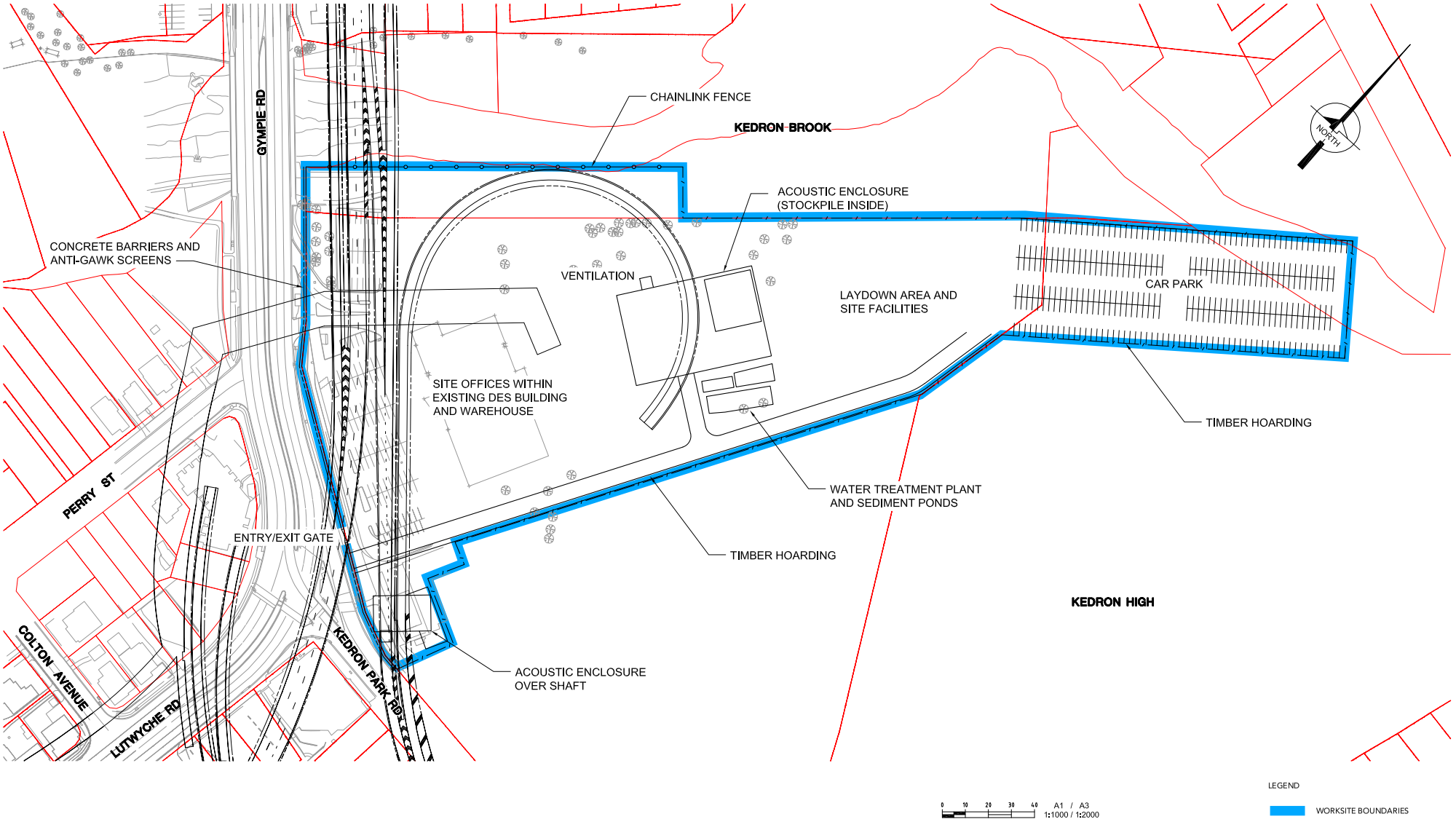


Figure 4-7
Kedron Park Worksite

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Gympie Road Sites

The Changed Project would include a new worksite located on the northern side of the Gympie and Stafford Road intersection, between Stafford Road and Brookfield Road (**Figure 4-8**). The site would provide access to the Stafford and Gympie Road interchange civil works. Spoil haulage from this cut and cover would exit onto Gympie Road to the northern haulage route. The worksite also would provide access for spoil haulage from the proposed transition trough located in the middle of Gympie Road. Access to this new worksite would from arterial roads.

Diversions and changes for pedestrians and public transport

Diversions during construction would be required for the Kedron and Gympie Road worksites, as follows:

- Brookfield Road, Homebush Road, Broughton Road and Somerset Road would each be temporarily closed at Gympie Road. Only one of these streets would be closed at any time, with access available to Gympie Road via Clarence Rd, Mitchell St or Nieppe St.
- Lasseter Street and Park Street would be closed at the boundary of the worksite during construction, with access to Gympie Road available via Sadlier Street, Leckie Road, Fifth Avenue and Erksine Avenue. The provision of more direct access to Gympie Road for this catchment would be investigated during construction.
- the service road on the eastern side of Gympie Road north of Leckie Road would be closed for pavement reconstruction. Access to Gympie Road would be available via Sadlier Street and Leckie Road.
- progressive alignment changes would be required, principally on Lutwyche Road and Gympie Road, but also on Kedron Park Road and Stafford Road.
- daytime tidal flow arrangements with 3 lanes in the peak and 2 in the off-peak direction would be used on Gympie Road north of Leckie Road.
- a temporary route for the Kedron Brook shared pedestrian/cycle path would be provided on the northern side of Kedron Brook, including 2 temporary bridges.

Pedestrian and cycle access to Kedron State High School from the Kedron Brook shared path on the western side of the playing fields would be maintained.

Some footpath closures would be required during the works, with alternative footpath routes provided. These would include the western footpath on Lutwyche Road between Norman Street and Kedron Park Road, and the footpath along the service road east of Gympie Road north of Leckie Road. The pedestrian crossing of Gympie Road at Leckie Road would also be closed, with pedestrians diverted to the crossing at Stafford Road.

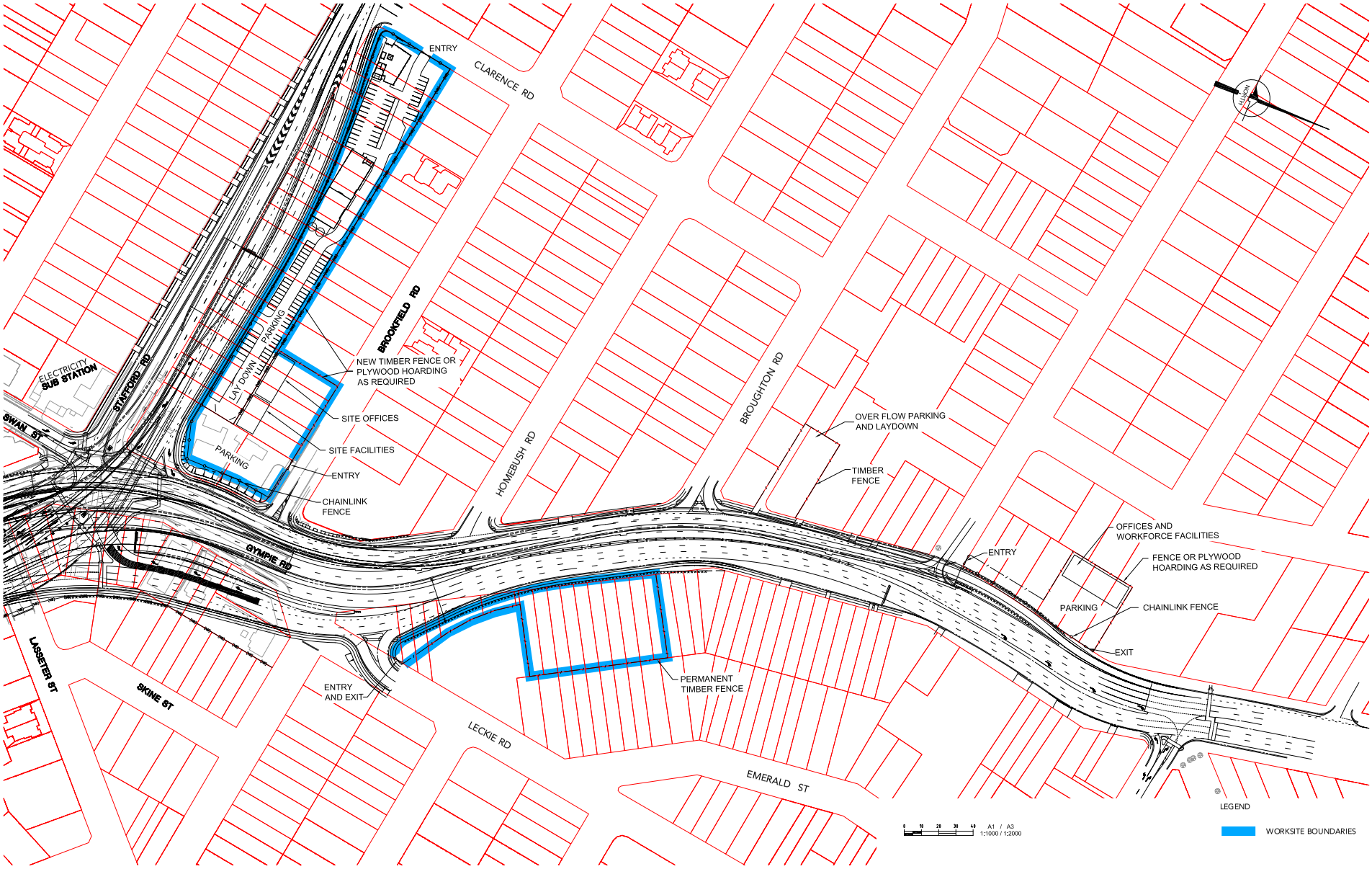

Figure 4-8
Stafford Interchange Worksite and Gympie Road Worksite

4.4.2 Effects of Worksite Changes

The potential environmental effects of the changes to worksite arrangements in the Kedron area are:

- a change in the land area required, including reduced impacts on the lands adjacent to Kedron Park High School and around Norman Avenue;
- changes in amenity – especially noise – due to the change in work site boundaries and truck movements into and out of the sites.

The possible environmental and social impacts are discussed below.

Traffic and access

Pedestrian and cyclist connectivity in the areas surrounding the worksites would be maintained, with some temporary route changes. Bus operations would not be adversely affected by the bus stop relocation.

A Construction Traffic EMP Sub-Plan for this area would be prepared before each relevant construction phase in accordance with the Coordinator-General's conditions to ensure acceptable operating conditions are maintained with the proposed temporary arrangements.

Amenity

Compared to the Reference Project, the Changed Project worksite configurations allow the retention of the Kedron State High School playing fields, access to Kedron Brook and significantly reduced amenity impacts on Kedron State High School and Wooloowin State School.

By relocating the construction worksite to the western side of Lutwyche Road, the potential for any effects on Wooloowin State School would be reduced. The extension to Perry Road would still be required for access to Windsor Avenue and Colton Avenue. Consequently, there would be no change in the proximity of residences in the streets on the western side of Lutwyche Road to the construction site.

Conclusion

The proposed changes to the Kedron and Lutwyche worksites would allow impacts to be managed in response to technical requirements and community expectations and in accordance with the Construction EMP and sub-plans required by the Coordinator-General's conditions. The Construction EMP and sub-plans would be developed in step with detailed design development and during construction. The consultation process supporting the construction program would include a comprehensive information stream, including advanced notification of construction techniques and timeframes for local areas and sensitive stakeholders.

4.5 Clayfield & Toombul Worksites and Construction

4.5.1 Worksite Locations

The Clayfield worksite within Kalinga Park (**Figure 4-9**) would increase in size from the Reference Project to accommodate the launching of the two TBMs. The enlarged worksite in Kalinga Park would extend to the property boundaries along the full length of Kalinga Street. The worksite would then extend from the northern end of Kalinga Street generally eastwards to the northern abutment of the North Coast Railway,

consistent with the Reference Project boundary in order to avoid Diggers Drive. From there, the northern extent of the worksite would follow Kedron Brook / Schulz Canal to Melton Road.

The southern boundary of the worksite in Kalinga Park would extend from Kalinga Street to the east along Lewis Street to meet with the land identified in the Reference Project for the worksite between the North Coast Railway and Sandgate Road.

The worksite east of Sandgate Road would be extended north of Schulz Canal to include the area of car park south of the Airtrain alignment.

The TBMs would be assembled and launched within the cut and cover, which would operate as the acoustic enclosure. The cut and cover works to the mainline tunnel within Kalinga Park, would consist of a trough roof slab and side retaining walls, forming an acoustic structure for TBM assembly and launching. At the eastern end of the cut and cover structure, acoustic doors would be installed to ensure that construction noise is contained. The structure would be completed prior to the TBM tunnelling operations commencing.

Kalinga Park would be available for the commencement of rehabilitation works within two years of construction commencing apart from the tunnel roof openings.

Access to the Clayfield worksite (**Figure 4-10**) would be generally as envisaged in the Reference Project, with an access route under Sandgate Road linking to the western section of the site. This would remove the need for access from the East-West Arterial-Sandgate Road intersection.

Workforce car parking would be provided within the worksite as envisaged in the Reference Project, with overflow parking available on the southern side of Schulz Canal east of Melton Road.

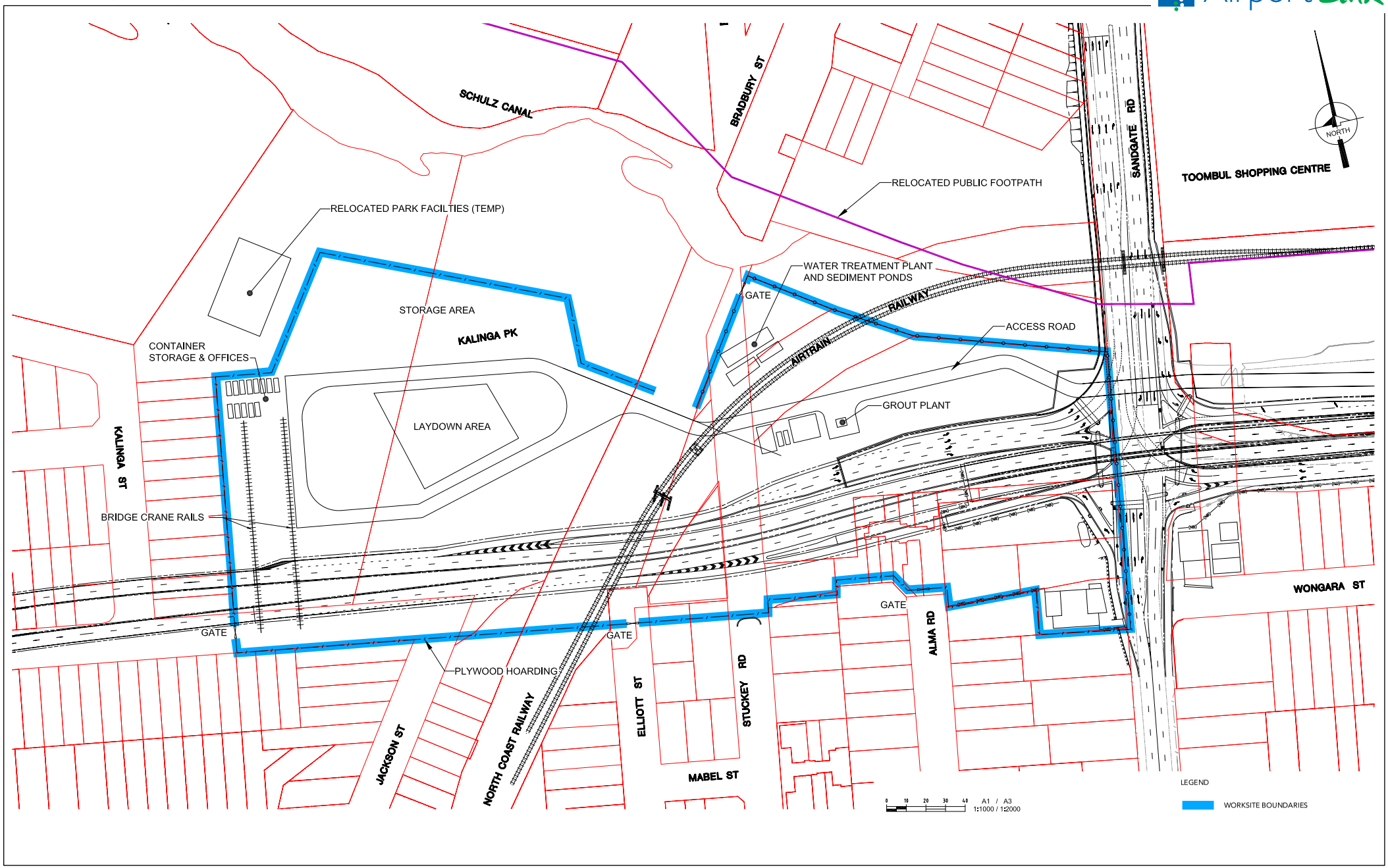

Figure 4-9
Clayfield / Kalinga Park Worksite

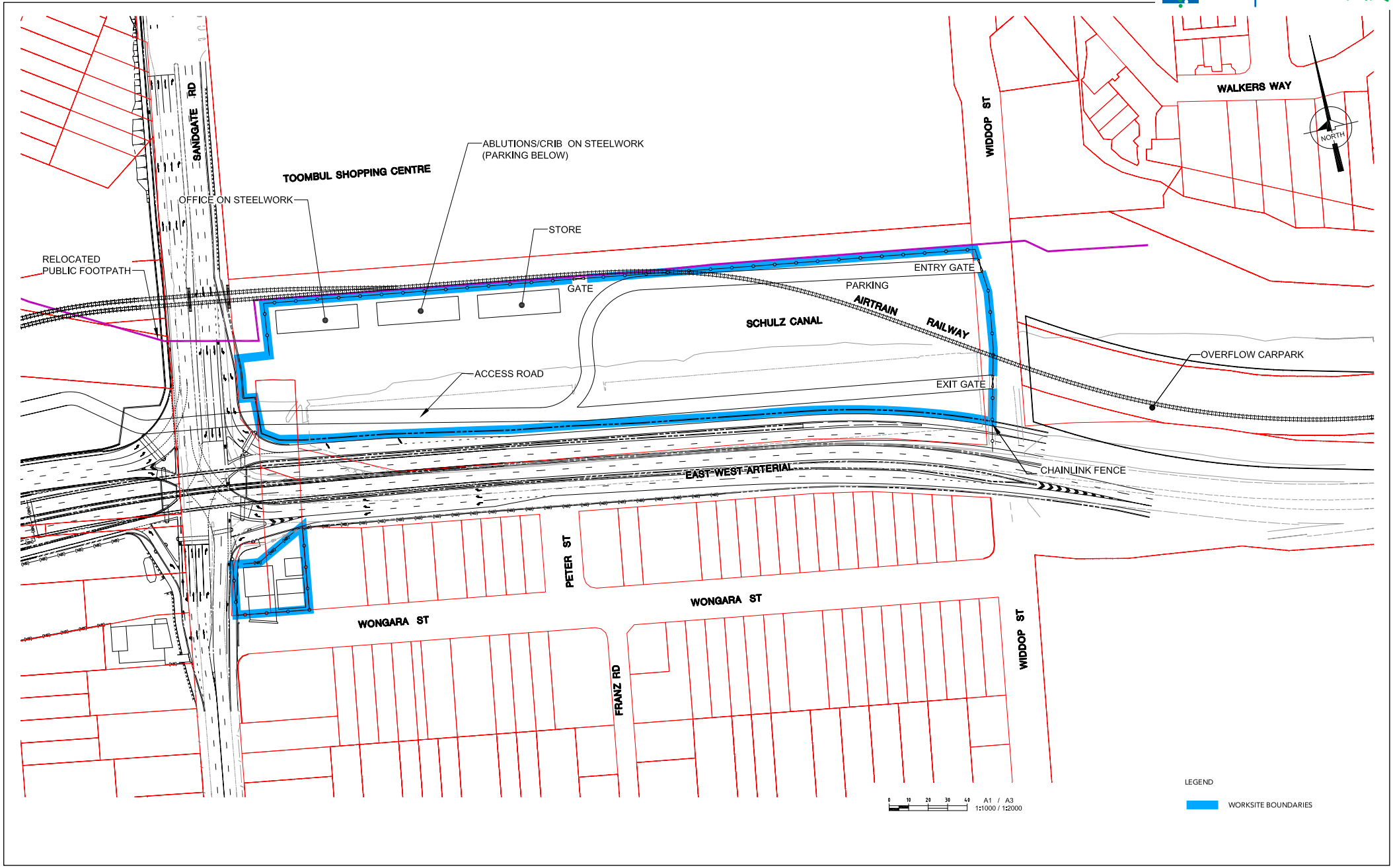

Figure 4-10
Clayfield / Toombul Worksite

4.5.2 Effects of Worksite Changes

The potential environmental effects of the proposed changes to worksite arrangements in the Clayfield / Toombul area comprise:

- a change in the land area required, including increased land area in Kalinga Park, although for a shorter time;
- changes in amenity – especially construction noise due to the change in work site boundaries and TBM activities in the Kalinga Park area.

The possible environmental and social impacts are discussed below.

Land Use and Cultural Heritage

The extended area required in Kalinga Park would result in an impact on community use of the park, although specific uses would be provided for elsewhere in the park boundaries.

The Clayfield worksite west of Sandgate Road is largely within the State Heritage listed, Kalinga Park. An application was made by the State to the Queensland Heritage Council (QHC) on 22 October 2007, for development in Kalinga Park based on the Reference Project approved by the Coordinator-General and a Preliminary Conservation Management Plan.

A Notice of Recommendation was made by the QHC on 23 January 2008 that the works may proceed generally in accordance with the drawings, policies and guidelines specified as submitted together with the Preliminary Conservation Management Plan.

The Changed Project has increased the area of land required for the construction worksite within Kalinga Park. The worksite area does not include the area of Diggers Drive West identified in the Preliminary Conservation Management Plan as being of high cultural heritage significance. The changed area does include the area of land occupied by the Queensland Miniature Race Car Club and the 300 year old ironbark in the Kedron Brook and Pathway precinct. The 300 year old ironbark is identified as an item of high cultural heritage significance and would be retained by the Changed Project.

The drainage channel (Eagle Junction Creek) through the Clayfield worksite from the end of Jackson Street, would also be permanently realigned to join with Schulz Canal and passing under Diggers Drive West. The construction would require the excavation of a trench for the culvert under the Drive which would require the removal of a single mature Eucalyptus tree. This tree was part of the 1950's program of planting a new avenue along Diggers Drive by Brisbane City Council. The loss of this tree would have a minimal impact on the significance of the place. There would be no alteration to the alignment of Diggers Drive West, and reinstatement of the Drive to its current condition, following the trenching for the culverts, would have no impact on the cultural heritage significance of the place.

The change to the construction worksite area within Kalinga Park is considered to be generally in accordance with the Reference Project. The removal of the tree associated with the realignment of the drainage channel is considered to be a minor variation to the work and would be undertaken with the approval of the Cultural Heritage Section of the EPA in accordance with the Recommendations from the Queensland Heritage Council. Detailed plans of the construction area within Kalinga Park would be required to be referred to the Queensland Heritage Council for its review and comment in respect of the

landscape and building works for the Changed Project. The 300 year old ironbark would be retained and protected during construction.

Traffic

The Changed Project does not require access from the Sandgate Road-East-West Arterial intersection, which would reduce the impact of the works on network traffic performance in the area. Other regular access points are as envisaged in the Reference Project. The traffic effects of transporting the TBM spoil from this worksite by conveyor are discussed in section 4.2.3 of this report.

Pedestrian and cyclist connectivity in the areas surrounding the works would be maintained, with some temporary route changes.

A Construction Traffic Management EMP Sub-Plan for this area would be prepared before each relevant construction phase in accordance with the Coordinator-General's conditions to ensure acceptable operating conditions are maintained with the proposed temporary arrangements.

Amenity

Without adequate mitigation, the proposed changes to the worksite layout and the proposal to launch two TBMs from Kalinga Park would impact on the amenity of the adjacent residential area, especially due to worksite establishment, and to noise associated with TBM assembly and launching. The use of the cut and cover works, equipped with acoustic doors, would provide an effective mitigation measure for the TBM assembly and launching. Construction noise barriers are proposed to the north, west and south of this construction site to attenuate construction noise generally.

The conveyor running from the acoustic enclosure (cut and cover construction) to the spoil shed on the eastern side of Sandgate Road would be enclosed, screened and equipped with "low noise" idlers to mitigate potential impacts of conveyor operation.

As for each of the worksites for both the Reference Project and the Changed Project, night lighting would need to be designed, installed and operated so as to avoid, or mitigate and manage the impacts of intrusive glare for adjacent residential areas and roads.

Conclusion

The proposed changes to the Clayfield and Toombul worksites would allow impacts to be managed in response to technical requirements and community expectations and in accordance with the Construction EMP and sub-plans required by the Coordinator-General's conditions.

Certain aspects of worksite set-up and operation, such as the enlarged worksite, TBM launching and spoil conveyor, would require careful design, operation and management to avoid, or mitigate and manage potential construction impact such as noise, dust, intrusive night lighting and diminished recreation and amenity values for the adjacent residential area.

The Construction EMP and sub-plans would be developed in step with detailed design development and during construction. The consultation process supporting the construction program would include a comprehensive information stream, including advanced notification of construction techniques and timeframes for local areas and sensitive stakeholders.

4.6 Truro and Chalk Street Worksites

4.6.1 Worksite Locations

Additional Airport Link worksites are proposed at Truro Street and Chalk Street, Lutwyche and would be shared by the Changed Project with worksites proposed for the Northern Busway Project.

Truro Street

Mid-tunnel access for construction works for the Changed Project would be provided at the Northern Busway worksite (**Figure 4-11**) at Truro Street. Construction works for the Changed Project would utilise this worksite to gain access to the north-south tunnels of Airport Link, and would provide a single site for spoil handling and haulage for both projects.

The Changed Project would need to expand the proposed Northern Busway worksite to coordinate construction access and spoil handling, site amenities and materials and equipment storage between both projects. The shared Truro Street worksite would occupy land on the western side of Truro Street between Stoneleigh Street and Fosbery Street.

The worksite would require the relocation of the Windsor School of Arts which has local heritage value. The existing YMCA building would be retained on-site for use as a construction site office.

Access to this worksite would be off Truro Street and Lutwyche Road. Spoil haulage would be actively managed so that the travel of returning empty trucks would be managed to optimise space on site. Staff parking would be available on site and dedicated transport would also be provided to and from the temporary carpark on McDonald Road.

Chalk Street

The Changed Project would also require an additional worksite on the eastern side of Lutwyche Road between Chalk Street and Bradshaw Street (**Figure 4-12**). This worksite would be shared with the Northern Busway Project. The establishment of this worksite would include two large vertical shafts for the extraction of the TBMs arriving from the Clayfield worksite.

A large bridge crane would be installed over the shafts to lift out the disassembled TBM components. This worksite would be critical to the successful implementation of the TBM construction method launching from the Clayfield worksite, and would require careful site management during the dismantling of each of the TBMs to avoid impacting on Northern Busway works and impacting on local communities. TBM components would need to be removed from this site at night to permit the use of the requisite heavy vehicles and to avoid traffic disruptions.

There would be no spoil, other than minor quantities of spoil derived from tunnel break-through and site establishment works, including excavation of the access shafts, to be removed from the Airport Link works at Chalk Street. However there would be spoil, plant and equipment from Northern Busway works leaving the worksite.

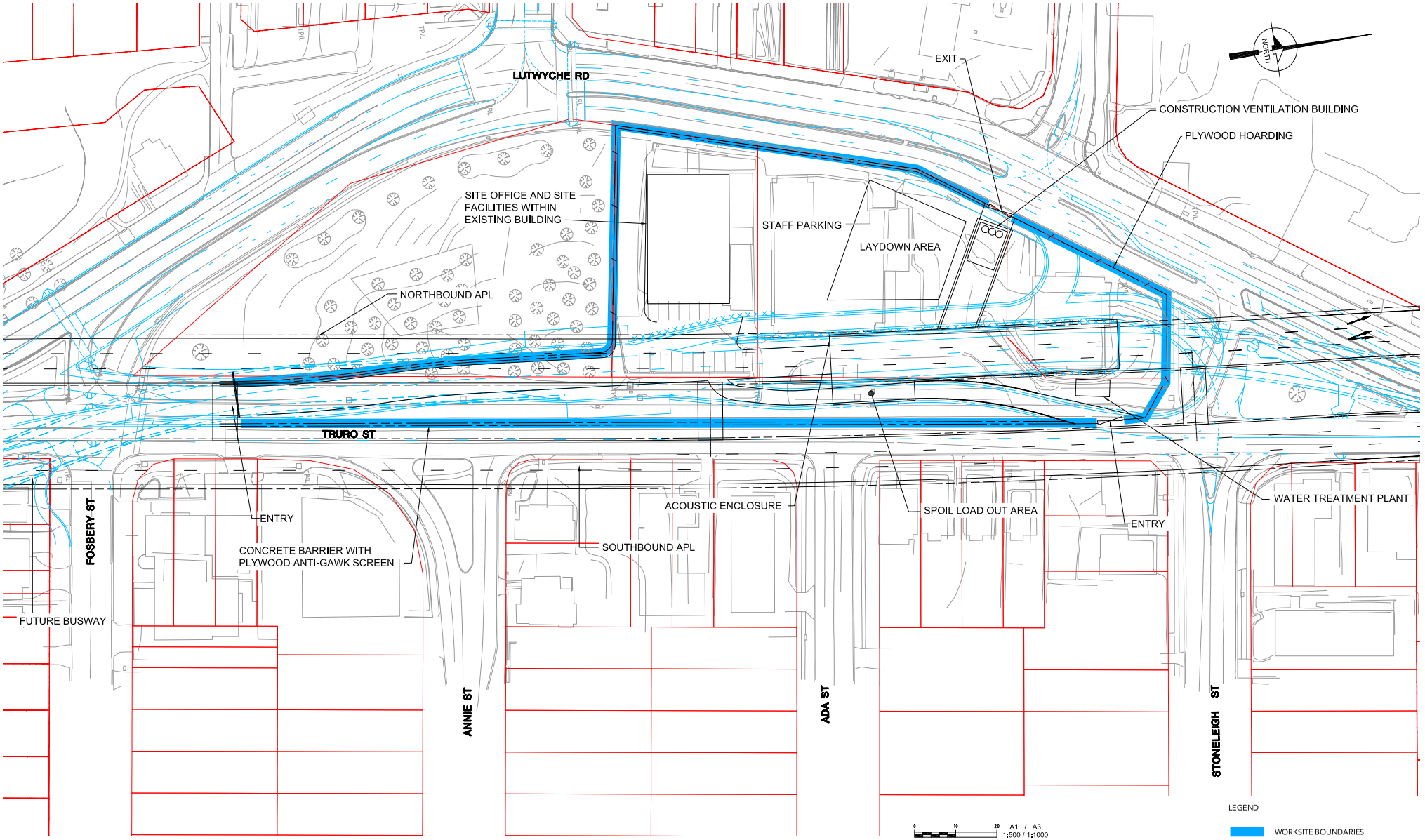

Figure 4-11
Truro Street Worksite

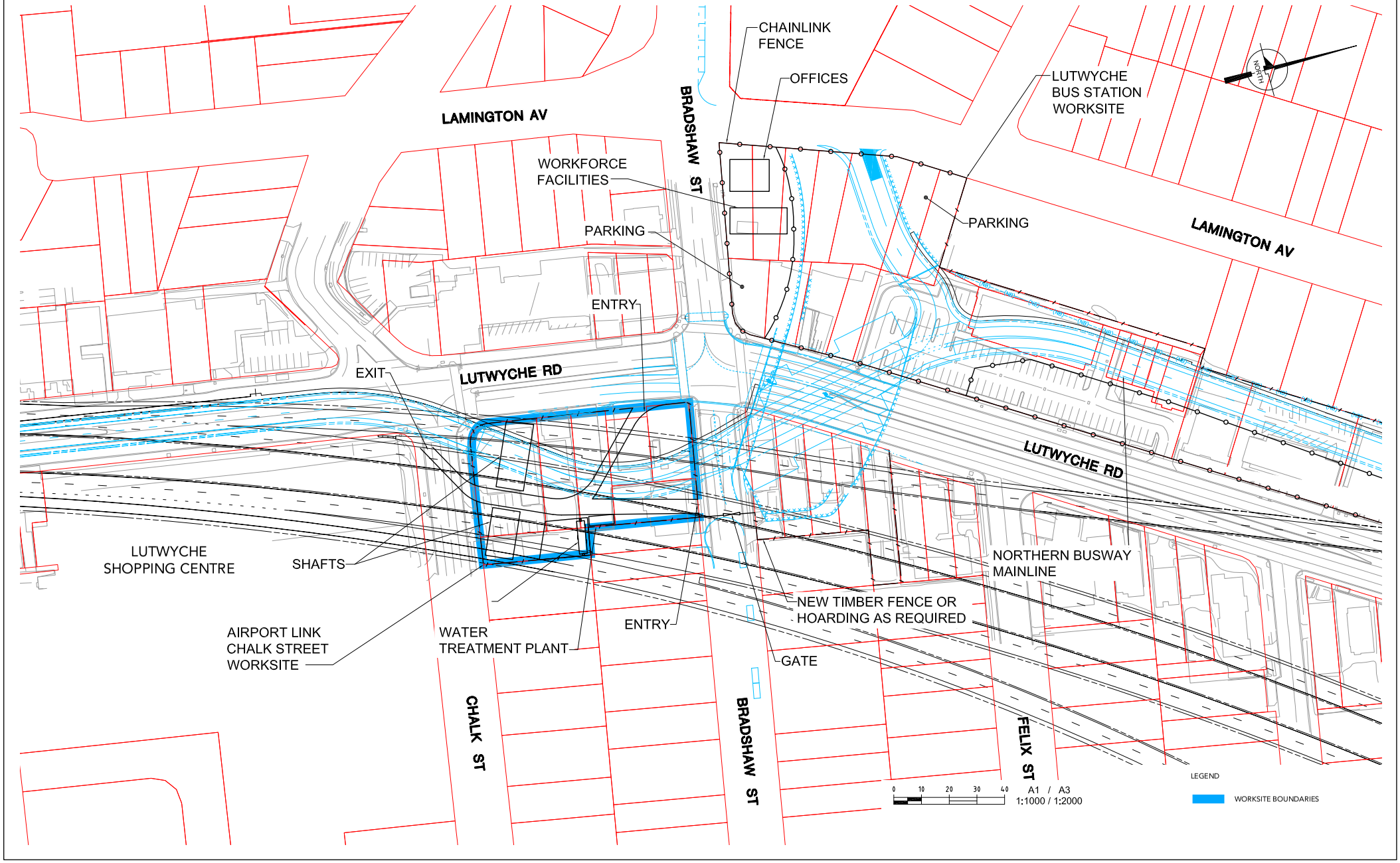

Figure 4-12
Chalk Street Worksite

During construction the western side of Truro Street would be partially closed to traffic to be incorporated into the worksite. Several temporary pedestrian route changes would be required.

The existing bus stop on Truro Street may need to be relocated, possibly to a location close to Fosbery Street providing pedestrian access to and from the west. The in-bound bus stop on Lutwyche Road north of Chalk Street would need to be relocated while the adjacent footpath is closed.

4.6.2 Effects of Worksite Changes

The potential environmental effects of the changes to worksite arrangements for the Changed Project, to be shared with the Northern Busway, comprise:

- changes in amenity – especially noise due to the location of the worksites in relation to nearby residential land, and possible impacts on convenience due to changes in pedestrian access; and
- changes in construction access and spoil haulage requirements.

The possible environmental and social impacts are discussed below.

Traffic

Access to these worksites would occur generally from major roads. The Chalk Street site would be used in the delivery of the Changed Project, for the removal of the two TBMs in components and other plant and equipment. There would be no spoil, other than minor quantities of spoil derived from tunnel break-through and site establishment works, to be removed from the Airport Link works at Chalk Street.

Pedestrian and cycle access to community facilities, including the Lutwyche shopping centre, would be maintained.

At the Truro Street worksite, spoil truck access would be via Lutwyche Road (in-bound to worksite) and Truro Street (out-bound from worksite). Queuing space outside the Truro Street worksite for empty spoil trucks would be addressed through active haulage management to ensure that vehicles are not kept waiting to enter the site, particularly in peak traffic periods.

Pedestrian and cyclist connectivity in the areas surrounding the Truro Street worksite would be maintained, with some temporary route changes. The alternative crossing points for Lutwyche Road while the Albion Road crossing is closed, at Harris Street and Maygar Street, are each over 200 m from Albion Road. Pedestrians would need to be notified of the closure as far as possible in advance. Bus operations would not be adversely affected by the bus stop relocation.

A Construction Traffic Management EMP Sub-Plan for this area would be prepared before each relevant construction phase in accordance with the Coordinator-General's conditions to ensure acceptable operating conditions are maintained with the proposed temporary arrangements.

Amenity

The Chalk Street worksite for the Changed Project, for dismantling and removing each of the TBMs has the potential for impacts on amenity of nearby residents, due to the need for drill and blast to construct the shafts. Due to the proximity of the worksite to the residential properties, effective mitigation measures for construction noise and vibration would be required.

The existing Coordinator-General's conditions include limitations on the hours during which blasts could occur, monitoring and reporting on blast noise and vibration levels, requirements to undertake building condition surveys, and extensive community consultation and/or temporary relocations to achieve an acceptable outcome.

Removal of the TBM sections would be required at night so that road closures can be arranged with minimal impact on the operation of Lutwyche Road and other roads during peak traffic periods.

The Truro Street worksite would be managed in accordance with the Coordinator-General's conditions for the Airport Link Project. In particular, night time spoil haulage would be managed by the use of an acoustic shed on the site and spoil handling within that shed. Furthermore, construction noise barriers are proposed around the entire worksite to attenuate construction noise generally.

Conclusion

The proposed changes to the construction worksites, with the shared use of Northern Busway worksites at Chalk Street Lutwyche and Truro Street Lutwyche would:

- in the case of the Chalk Street worksite, allow the removal of the two TBMs driving the mainline tunnels from Clayfield and bring construction efficiencies and design enhancements to the Changed Project, particularly with regards minimising the extent of surface infrastructure at the Kedron and Lutwyche connections;
- in the case of the Truro Street worksite, allow multiple work faces to be established in the construction of the north-south mainline tunnels, again bringing construction efficiencies to the Changed Project;
- allow impacts to be managed in response to technical requirements and community expectations and in accordance with the Construction EMP and sub-plans required by the Coordinator-General's conditions.

Aspects of worksite set-up and operation at Chalk Street, such as the removal of TBM components, would require careful design, operation and management to avoid, or mitigate and manage potential construction impact such as noise, dust, intrusive night lighting and diminished amenity values for the adjacent residential area due to night works. The cartage required for TBM removal would need to be designed and assembled to avoid impacts on adjoining or adjacent residential properties.

Aspects of worksite set-up and operation at Truro Street, such as the removal of spoil on a 24-hour basis, would require careful management to avoid traffic impacts during peak periods and other environmental impacts such as noise, dust and night lighting associated with spoil handling and removal. The design and siting of the workshed at Truro Street would need to be sensitive to the scale and setting of nearby residential dwellings.

For the establishment and operation of these additional worksites for the Changed Project, the Construction EMP and sub-plans would need to be developed in step with detailed design development and during construction. The Construction EMP would need also to integrate with the environmental management measures applying to the delivery of the Northern Busway Project.

The consultation process supporting the construction program would include a comprehensive information stream, including advanced notification of construction techniques and timeframes for local areas and sensitive stakeholders.

5. Recommendations and Conclusions

The need and justification for the Airport Link Project was established when the Coordinator-General recommended that the Airport Link project proceed in May 2007. This assessment addresses the approved Airport Link project to the extent that it is proposed to be changed.

The State has accepted a proposal offered by BC for Airport Link which is generally comparable to the Reference Project but incorporates a number of significant improvements or innovations, in response to the Coordinator-General's request for innovation. BC's response incorporates improvements in design, which would result in changed impacts both in terms of location, timing and scale. The Changed Project would achieve the objectives of the Reference Project while delivering enhancements in network performance and urban amenity at Lutwyche and Kedron, while addressing the impacts of concern to the Coordinator-General in the Reference Project at Bowen Hills.

It is recommended that the Changed Project proceed, subject to the conditions of the Coordinator-General's Report on the Environmental Impact Statement for the proposed Airport Link Project dated May 2007, except where varied by the conditions described below and subject to relevant conditions that address the following issues:

- management of spoil placement sites;
- spoil haulage, including by conveyor;
- management of worksites;
- construction car parking;
- works in Kalinga Park;
- other changes/amendments to conditions necessary because of the Changed Project.

5.1 Mitigation of impacts on urban amenity and visual environment

As with the Reference Project, the Changed Project would impact on urban amenity and the visual environment during both the construction and operational phases. The impacts would be evident upon the residential communities of Windsor East, Lutwyche north of Bradshaw Street and west of Lutwyche Road, Kedron around the intersection of Gympie Road and Stafford Road, at Clayfield around Kalinga Park and at Toombul overlooking Schulz Canal.

During project delivery mode, or construction, the impacts of the works must be managed in accordance with the Construction EMP and the Coordinator-General's conditions. The interface between the worksites and the residential communities must be established and managed to avoid the distribution of impacts beyond the worksite boundaries to the extent reasonable and practicable. For nearby or adjoining residents, the interface should present a low-impact but effective edge to the worksites. The use of materials, colours and the positioning of buildings, night-lighting, ventilation and other plant and equipment with continuous motor noise, workers' car parking and site offices must be sensitive to the nature and scale of the adjoining and adjacent land uses, and where necessary, must include mitigation measures to ensure the utility of such premises is maintained.

During detailed design development, consideration must given to the impacts of the Changed Project in its operational mode. Such impacts and urban amenity and the visual environment would include:

- increases in road traffic noise arising from changes in the design arrangements for the surface connections at Windsor, Bowen Hills, Lutwyche, Kedron and Clayfield - environmental objectives and goals addressed by the Coordinator-General's conditions;
- changes in accessibility to Windsor East arising from changes to intersection arrangements along Lutwyche Road and changes to the local road network within Windsor East, changes in the local road network in Lutwyche north of Bradshaw Street, and changes to the road network in Kedron north and east of Gympie Road.

The impacts upon urban amenity and visual environment of the Changed Project would be addressed through the implementation of the urban design master plan required by the Coordinator-General's conditions.

5.2 Spoil haulage

The Changed Project embodies innovation in its design and alignment reducing the extent of surface works at Lutwyche and Kedron in response to the Coordinator-General's recommendation to reduce impacts on the community and in particular, upon the schools adjacent to the surface connections. One consequence of this realignment and changed approach to construction of the mainline tunnels between Lutwyche and Clayfield is an increase in the quantity of spoil to be removed from a number of worksites including the southern worksite at Windsor, the north-western worksites at Lutwyche and Kedron, the north-eastern worksite at Clayfield, and the central worksites at Truro Street Lutwyche. Small quantities of spoil would be removed from another central worksite at Chalk Street.

For the Changed Project, spoil haulage routes would be as proposed in the Reference Project, supplemented as required by a northern haulage route, and supplemented further by the use of a purpose-built conveyor system for TBM spoil emanating from the Clayfield worksite. The TBM spoil would be transported by conveyor to a receiving depot within the Brisbane Airport known as Export Park West.

The northern haulage route would include the use of Gympie Road, Rode Road, Sandgate Road, and possibly Toombul Road and the Gateway Motorway to access the nominated spoil placement sites within Brisbane Airport. While this route was not anticipated in the EIS for the Reference Project, it would follow arterial roads within Brisbane and would be subject to the relevant conditions in the Coordinator-General's conditions[19]. A suggested amendment to Appendix 1, Schedule 3, condition 5(c) is provided below to ensure the impacts of spoil haulage are confined to the major road corridors within the city:

> "5 (c)(i) *Spoil haulage is permitted only on motorways, and arterial roads and suburban routes as defined in City Plan 2000 (Transport and Traffic Facilities Planning Scheme Policy and Planning Scheme Map 1, Area Classifications and Proposed Road Hierarchy to 2011) with no spoil being hauled along Junction Road, Clayfield or Albion Road, Lutwyche or Albion Road, Albion. Spoil haulage is permitted on other roads only where necessary for the most direct access to worksites and spoil placement sites to and from motorways and arterial roads.*"

[19] Coordinator-General's Conditions, Schedule 3, conditions 5 and 6

Appropriate early and on-going consultation, again in accordance with the Coordinator-General's conditions[20] would be necessary to support the use of this route for spoil haulage.

The spoil conveyor system would extend from a transfer station to be established to the east of Sandgate Road in the Clayfield worksite, through a number of transport points, to the receiving depot at Export Park West. Some spoil would be placed at this location, while other over-flow material would be transported further, by road vehicles, to Banksia Place and other locations within the Brisbane Airport. While the spoil conveyor system would relieve traffic related impacts of road transport, the conveyor system itself has the potential to impact on the environment.

The construction, operation and decommissioning of the spoil conveyor would need to be undertaken in accordance with the Coordinator-General's conditions. In addition it is recommended that the conveyor be constructed, operated and decommissioned in accordance with the following:

1. *The spoil handling facilities including the spoil conveyor must be designed, routed and sited to avoid where practicable or minimise and mitigate impacts on:*

    a) *existing infrastructure such as but not limited to Brisbane Airport, North Coast Railway, Airtrain, the Gateway Motorway, the East West Arterial and the local road network including Nudgee Road;*

    b) *sensitive places;*

2. *sensitive environments including matters of national environmental significance, watercourses, wetlands, areas below HAT, conservation areas and areas of protected habitat, and places of cultural heritage significance;*

    a) *existing trunk infrastructure and local services.*

3. *Spoil handling facilities, including the conveyor system must be designed, constructed and operated to satisfy the following requirements:*

    a) *the facility must be safe and secure, such that unauthorised access to any part of it is not available, directional night lighting is provided to all access points and hazard areas, and facility operations are capable of remote surveillance by worksite staff;*

    b) *the facility must not impede existing public access to community facilities, recreation areas and open space, or if access would be constrained as a consequence of the facilities, only with the prior agreement of the Brisbane City Council and in consultation with local and potential affected communities;*

    c) *the facility must present the minimum visual and landscape impact practicable, having regard for its scale, character of construction and construction materials, location relative to sensitive land uses, and the likely duration of its use.*

    d) *contaminants, including sediments, are not released from the Brisbane Airport as a consequence of the Project that could cause an adverse effect to surface waters as described in the Airports (Environment Protection) Regulations 1997.*

4. *The design, construction and operation of spoil handling facilities, including the conveyor system, must comply with Appendix 1, Schedule 3, Condition 7(c)(i) to (v) of the Coordinator-General's Conditions.*

5. *Construction of spoil handling facilities including the conveyor system must avoid where practicable, or minimise and mitigate the potential invasion or colonisation of areas disturbed by*

[20] Coordinator-General's Conditions, Schedule 3, conditions 1 and 4

construction activities by introduced plant and animal pests such as, but not limited to, fire ants, birds and weeds.

6. *Upon completion of the spoil handling and transport task, the conveyor system must be decommissioned as soon as practicable and the conveyor corridor rehabilitated to a condition suitable for use for the preferred purposes under the area's designation in City Plan 2000.*

   Such rehabilitation must include:

   a) remediation of any land contaminated by either the construction or use of the conveyor system;

   b) rehabilitating the corridor to an approximation of the pre-existing ground form, providing such rehabilitation works would not cause significant changes in surface drainage patterns or flood levels;

   c) landscaping works generally consistent with a landscape master plan to be prepared and provided to the Coordinator-General in consultation with the Brisbane City Council at least 30 days prior to decommissioning works commencing; and

   d) reinstatement of any pedestrian and cycle paths to their former location.

   e) Operation and use of the spoil handling facilities, must not exceed the noise goals established in the EIS (Chp 19 – draft Outline Construction EMP) and in the Coordinator-General's conditions21 for steady-state construction activities for both internal and external settings;

7. *Access to the conveyor system for maintenance purposes must be provided within the conveyor corridor and as close as practicable to the conveyor system.*

8. *Develop and implement a surface water quality monitoring program for receiving waters adjoining the conveyor on the Brisbane Airport, including Schulz Canal and Kedron Brook."*

5.3 Management of spoil placement sites

The Changed Project would involve the placement of spoil at sites within the Brisbane Airport, namely at Export Park West and at Banksia Place, with additional sites including those identified in the EIS for the Reference Project, such as the old Brisbane Airport and the Port of Brisbane. There may be other sites approved for receiving construction spoil situated elsewhere within metropolitan Brisbane which would be suitable and available for spoil placement from Airport Link should the need arise. Such sites could be accessed from Airport Link worksites via the arterial road and motorway network.

Placement of spoil within the Brisbane Airport, especially on sites north of Airport Drive, would require careful management so as to avoid impacting on Commonwealth interests or matters of national environmental significance. Commonwealth interests would extend but not be limited to:

- the relevant development objectives for Brisbane Airport, established by the Airport master plan for land use and related development of the airport site, and BAC's environmental management plans and systems;
- implementation of the Brisbane Airport Environment Strategy.

The matters of national environmental significance likely to be relevant to an assessment of the placement of spoil within the Brisbane Airport, or on adjacent lands likely to affect Commonwealth land would include wetlands of international importance.

[21] Coordinator-General's Evaluation of the Airport Link EIS, Schedule 3

While the draft Outline Environmental Management Plan presented in the EIS for the Reference Project established environmental objectives and performance criteria for the placement of spoil, there would be a need to detailed Construction EMP Sub-plans for the placement of spoil within the Brisbane Airport. Detailed measures for spoil placement would need to be consistent with the Brisbane Airport Environment Strategy, the airport master plan and environmental management plans and systems.

Prior to the commencement of spoil placement within Brisbane Airport, BC would need to develop detailed plans for such placement and for an appropriate level of environmental management. It is considered that with this approach, the placement of spoil as proposed in the Changed Project would not have a detrimental impact on matters of national environmental significance nor upon the Commonwealth interests inherent in Brisbane Airport.

Until such time as detailed management plans have been developed and agreed with the Commonwealth, the other spoil placement sites proposed for the Reference Project would be available for use.

5.4 Construction car parking

For the Changed Project, a number of external, dedicated car parking areas are proposed as a means for managing the potentially adverse effects of uncontrolled workforce car parking in local streets. Workforce car parking, other than that included within the designated worksites, is proposed at:

- Windsor, off McDonald Road;
- Kedron, off Gympie Road, on the southern side of Kedron Brook adjacent to DES and the Kedron High School; and
- Hendra, as overflow car parking to the Clayfield worksite the east of Widdop Street south of Schulz Canal.

While the Coordinator-General's conditions would apply to the establishment, operation and maintenance of these car parking areas, there would be a need for additional conditions to ensure careful design, operation and management is achieved to avoid, or mitigate and manage potential impacts on adjacent residential areas. It is recommended that the following condition be included in the Coordinator-General's Change Report:

"Construction car parking sites must be designed, constructed and operated to provide for the management and mitigation of impacts by:

- *incorporating acoustic screening, dust control, water quality control and community safety measures to achieve the environmental objectives and performance criteria set out in the EIS Chapter 19 Draft Outline EMP (Construction);*
- *installing and positioning night lighting, including security lighting to avoid light spill onto adjoining land that is a Sensitive Place (as defined by the Coordinator-General's Conditions), at intensities exceeding 8 lux measured at the common boundary;*
- *designing the construction car park so that headlight glare from the construction car park is less than 8 lux at the boundary of a Sensitive Place as defined in the Coordinator-General's Conditions;*
- *landscaping and urban design of the Project avoids the potential for loss of privacy of adjacent dwellings and buildings;*

- *rehabilitating the construction car parks as quickly as is reasonable and practicable to a standard suitable for future use of a purpose preferred in this location under the Area designation in City Plan 2000."*

5.5 Cultural Heritage

Since the EIS and the Coordinator-General's evaluation report was completed for the Reference Project, Kalinga Park which would be partially included in the north-eastern worksite, has been listed in the Queensland Heritage Register. As a result of the listing, an application for development by the State was made to the Queensland Heritage Council. On 23 January 2008 the Queensland Heritage Council recommended that the proposed works in Kalinga Park proceed, subject to conditions.

It is recommended that a condition be included in the Change Report that:

"The proponent must undertake works to rehabilitate and regenerate Kalinga Park in the vicinity of the project works to reinstate the heritage and community values of the place. Such works must be designed and delivered in accordance with a landscape master plan consistent with the Preliminary Conservation Management Plan for Kalinga Park, Clayfield prepared by Archaeo Cultural Heritage Services Pty Ltd and dated October 2007."

The Changed Project would require the removal of "Nyamber", a place included in BCC's local heritage register and the Windsor School of Arts. In order to provide for archival recording of Nyamber and the Windsor School of Arts prior to removal, it is recommended that the Coordinator-General's existing condition in Schedule 3, Condition 15(a) be amended to include a new sub condition (iv) to read:

"Windsor East, to include Nyamber and in Lutwyche to include the Windsor School of Arts".

5.6 Environmental Management Plans

The Coordinator-General's Conditions require the preparation and implementation of a comprehensive Construction EMP and Operation EMP for the Project which are to be developed generally in accordance with the Draft Outline Construction EMP and Draft Outline Operation EMP in Chapter 19 of the EIS and the recommendations of the Coordinator-General's Report. The Changed Project includes a number of additional or revised mitigation measures designed to reduce the environmental effects of the changes. Where appropriate, the Construction EMP and Operation EMP should be updated to reflect the Changed Project and any additional or revised mitigation measures.

It is recommended that a condition be included in the Coordinator-General's Change Report that required:

"The Construction EMP and Operation EMP for the Project are to be updated to reflect the Changed Project".

5.7 Miscellaneous Conditions

There are a number of miscellaneous matters arising from the Changed Project which would need to be addressed by conditions in the Change Report. Such matters, and the recommendations with regards possible additional conditions, include:

With regards student access for Wooloowin State School, insert in Appendix 1, Schedule 3 of the Coordinator-General's conditions:

During construction, provide an alternative drop off zone for Wooloowin State School that is safe and adjacent to the School and east of Lutwyche Road.

Other amendments or additions to existing conditions in Appendix 1, Schedule 3 include:

1. *The transport and movement of heavy plant, machinery and other equipment, must not occur on minor roads except where such transport or movement is in accordance with relevant local laws, or as otherwise approved by the Brisbane City Council or other relevant authorities and following consultation with residents in such roads.*
2. *Any water supply or other infrastructure services required to be extended to a worksite to support construction activities must be designed and constructed to achieve the environmental objectives and performance criteria set out in the EIS Chapter 19 Draft Outline EMP (Construction), and including but not limited to flood management.*
3. *Replace Schedule 3, condition 9(i)(iii) with "where predictive modelling predicts the goals will be exceeded, notify occupants of premises of the range of works proposed, their planned duration, the possible effects and predicted levels of vibration, and what measures would be taken to permit normal daily business to continue."*
4. *Add to Schedule 3, condition 9(m)(i) - the words - "and sensitive education establishments (e.g. Wooloowin State School, Kedron State High School, Windsor State School and the Holy Rosary School)" at the end of condition 9(m)(i).*

5.8 Conclusions

The Changed Project would not affect the strategic function of the Airport Link project described in the EIS, in that it would:

- connect with the Inner City Bypass, NSBT, and with the inner city at Bowen Hills;
- connect with Gympie Road and Stafford Road in Kedron and with Lutwyche Road at Lutwyche in the north-west, and would provide some relief to traffic congestion on key roads in the inner northern suburbs;
- connect with Sandgate Road and the East West Arterial, and with the north-eastern suburbs at Clayfield;
- continue to support the implementation of the Northern Busway Project within the same corridor between Windsor and Lutwyche / Kedron and at the same time as Airport Link;
- provide opportunities for pedestrian and cycle connectivity in the inner northern suburbs, and would connect with existing pedestrian and cycle facilities as well as those to be delivered as part of the NSBT.

The Changed Project would achieve the objectives established for the Airport Link Project, as documented in the EIS and evaluated in the Coordinator-General's evaluation of the EIS. That is, the Changed Project would "*... provide relief to congested roads in Brisbane's northern suburbs, connect activity centres and provide a sound basis for future traffic management by linking to strategic road connections allowing cross-city travel movements to bypass the Central Business District and inner suburbs.*"[22]

[22] *Coordinator-General's Report on the Environmental Impact Statement for the proposed Airport Link Project, May 2007*

In its design, the Changed Project is the same as the Reference Project in that there would be two tunnels with mono-directional traffic flow between the major connections in Windsor, Lutwyche and Clayfield. The Changed Project would provide three traffic lanes in each of the north-south tunnels between Windsor and Lutwyche, and two traffic lanes in each of the east-west tunnels between Lutwyche and Clayfield.

The changes to the Reference Project in its design and operational mode and also in its delivery mode are summarised generally as follows:

- changes in the alignment of the mainline tunnels to accommodate more efficient connections in the north-west, while achieving more efficient and more certain construction conditions in better ground through Lutwyche and Wooloowin;
- changes in the connections with the surface road network at Windsor / Bowen Hills, Lutwyche / Kedron and at Clayfield to achieve more efficient traffic flows from the surface road network to and through the Changed Project, and to reduce the impacts of the infrastructure on the surface at Kedron and Lutwyche;
- minor changes in the location of the ventilation stations at Kedron and Windsor to reduce the visual impact of the facilities;
- delivery changes in terms of tunnel construction, spoil handling and spoil transportation (including opportunities for a spoil conveyor), changes to the extent of particular forms of tunnel construction, changes to the arrangement of some of the worksites, and changes by way of addition of worksites along Lutwyche Road;
- consequential changes in traffic flows in the surface road network although still consistent with the overall outcomes anticipated for the Reference Project.

Changes in mainline tunnel alignment

The Changed Project has addressed the recommendations of the Coordinator-General in seeking innovative methods for project delivery to avoid or mitigate the impacts of construction upon the Kedron State High School and other sensitive receptors in the vicinity of the Lutwyche and Kedron connections.

The proposed changes in the alignment of the mainline tunnels between Lowerson Street Lutwyche and Park Avenue Wooloowin would permit the Changed Project to deliver more efficient connections with the surface road network. The proposed change would reduce construction impacts on the Kedron State High School and the Wooloowin State School compared to the Reference Project.

The potential construction impacts from surface works on the Wooloowin State School would be reduced as, although reduced, may still occur from underground or tunnel construction works as the surface works would be relocated to the western side of Lutwyche Road. Construction impacts upon the Wooloowin State School and on other sensitive receptors along the alignment would still require careful management and possibly mitigation, in accordance with the existing Coordinator-General's conditions.

The proposed changes in alignment would have volumetric title impacts on properties in Lutwyche and Wooloowin.

The proposal to construct the mainline tunnels from Clayfield to Lutwyche by TBM methods would result in the production of greater quantities of spoil, and with an increase the quantity of spoil reporting back to the Clayfield worksite. The Changed Project creates the opportunity for spoil to be removed by way of a conveyor system generally following the alignment of the Airtrain for much of its route.

Changes in the connections to the surface road network

The proposed changes in the arrangement of the connections to the surface road network at Bowen Hills respond to the Coordinator-General's recommendation to seek innovative responses in design to mitigate the impacts of project delivery and operation upon the sensitive receptors in and around the connections at Bowen Hills (eg The Mews apartments, the Tufton Street apartments).

The proposed changes to the surface road network at Bowen Hills would relocate the Airport Link (north-bound) connections, together with the NSBT (south-bound) and ICB (west-bound) connections into a single elevated system of roads and ramps commencing on the out-bound (west) side of Bowen Bridge Road. A further change would result in the Airport Link (south-bound) city ramp emerging in a portal in Lutwyche Road south of Newmarket Road. These changes would relieve the pressure on O'Connell Terrace and would remove the double-stacked ramps which would have been constructed in close proximity to The Mews apartments.

The proposed changes to the surface network at Lutwyche and Kedron would place the connections with Gympie Road and Stafford Road on the northern (western) side of Kedron Brook and the Lutwcyhe Road connection further west of the Wooloowin State School. This latter connection would remain buffered from the residential area by the infrastructure and noise barriers associated with the Northern Busway. The changes proposed to the Gympie Road and Stafford Road connections would permit a more efficient use of Airport Link, while separating potentially conflicting traffic movements at the intersection of those two arterial roads. The connections with the mainline tunnels would be provided by a system of grade-separated ramps constructed in driven tunnels under Lutwyche generally between Lowerson Street Lutwyche and Rose Street Wooloowin.

An additional benefit of these proposed changes would be in the reduction of the above-ground infrastructure required for the various connections with the surface road network.

The changes to the connections with Sandgate Road are considered to be minor and would promote more efficient traffic flows through the intersection with the East West Arterial and with the connections to the Airport Link mainline tunnels.

The portals to the mainline tunnels would move to the west of Sandgate Road, requiring careful detailed design to ensure road traffic noise meets the environmental objectives and goals established in the EIS and the Coordinator-General's conditions.

Changes in the ventilation stations and ventilation outlets

The proposed changes at Windsor include a partial burying of the ventilation station and a relocation of the ventilation outlet to a position closer to the western alignment of Byrne Street Windsor. This is a move of about 50 metres. The proposed change would reduce the visual impact of the ventilation station and would further separate the ventilation outlet from the residential properties in Federation Street. No change in air quality outcomes is expected as a consequence of this change.

The proposed change at Kedron would relocate and partially bury the ventilation station and relocate the ventilation outlet to a position just to the north of the existing DES building adjacent to Kedron Brook. The change would reduce the visual impact of the Kedron ventilation station. No change in air quality outcomes is expected as a consequence of this change.

The proposed change at Clayfield would bury the ventilation station generally in the same location as proposed for the Reference Project. The sub-station for the ventilation station would be located on land in

Alma Road and Sandgate Road, opposite the intersection of Wongarra Street. This would reduce the visual impact of the ventilation station in Clayfield but would also reduce the acoustic screening offered to that structure to residents of Alma Road and Stuckey Street. Acoustic barriers would be required to compensate for this change.

Changes in delivery mode of Airport Link

The changes in delivery mode of Airport Link include:

- construction of the mainline tunnels between Chalk Street and Kalinga Park with TBMs launching from Kalinga Park, Sandgate;
- construction of the connecting ramps from Lutwyche and Kedron by a combination of cut and cover and roadheader methods, including a cut and cover construction through and beneath Kedron Brook;
- construction of the mainline tunnels between Clayfield and Lutwyche at generally increased depths and between Lutwyche and Windsor at generally reduced depths;
- the opportunity for removal of spoil from TBM construction from the Clayfield worksite via a proposed conveyor system to a receiving depot and placement sites within Brisbane Airport, or if approvals for the full conveyor and associated spoil placement site are not obtained within the required construction timeframe, a shortened conveyor terminating at an enclosed spoil handling facility at the western side of Nudgee Road. If neither of the conveyor options are advanced, spoil haulage by truck from the Clayfield worksite is proposed;
- for spoil haulage, the use of alternative routes along arterial roads including Gympie Road, Rode Road, Sandgate Road and Toombul Road to form the northern haulage route, in addition to spoil transport by the conveyor system; and
- the shared use of worksites with the Northern Busway Project at Chalk Street and Truro Street to capture potential construction efficiencies and design improvements.

These proposed changes would be undertaken in accordance with the Coordinator-General's conditions for the construction phase including but not limited to those relating to environmental management and community engagement.

The proposal to transport spoil from the Clayfield worksite by conveyor to the Brisbane Airport would avoid potential increases in the movement of heavy vehicles through the airport roundabout and the Nudgee Road – East West Arterial intersection, as well as permitting the construction phase to proceed without undue constraints imposed by traffic congestion at those intersections. The design, construction, operation and decommissioning of the conveyor system would require careful management to ensure there would be no impacts on matters of Commonwealth or State interest. Should the conveyor not proceed, spoil would be transported by road.

Consequential changes in traffic flows on surface roads and in Airport Link

The EIS Airport Link traffic model was updated and used to consider the effects of the Changed Project on the same basis as in the EIS. The updated model, based on updated assumptions about population and demography, employment and network enhancements, shows that the Reference Project would now be predicted to carry more traffic than forecast for the EIS. The updated analysis shows that the "without Airport Link" scenario would result in additional congestion of the road network to that reported in the EIS.

The updated Airport Link traffic model, was used to consider the effects of the Changed Project. This modelling indicates that the potential traffic flows for the Changed Project are similar to, but higher than, the Reference Project. This is due to the predicted increase in travel demand resulting from the updated demographic forecasts and base network connectivity, as well as the improved, more efficient configuration of the surface connections incorporated into the Changed Project compared to the Reference Project. The strategic network performance benefits of the Changed Project would be similar to the Reference Project.

Most of the changes to the Reference Project can be accommodated through implementation of the Coordinator-General's conditions dated May 2007. Some changes to conditions are required to provide effective management of project delivery aspects such as spoil haulage, worksite management and workforce car parking.

The Changed Project would achieve the objectives of the Reference Project while delivering enhancements in network performance, urban amenity at Lutwyche and Kedron, and reduced impacts compared to the Reference Project at Bowen Hills.