Appendix 4 - Value management report (Part 3 long-term study)

RICHMOND BRIDGE AND APPROACHES CONGESTION STUDY

LONGTERM OPTIONS ASSESSMENT
VALUE MANAGEMENT WORKSHOP REPORT

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ABN 36 082 506 171

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Background

The township of Richmond is approximately 65km west of the Sydney CBD. At Richmond, the Richmond Bridge crosses the Hawkesbury River connecting Bells Line of Road to the west with Kurrajong Road to the east.

Urban expansion and land use changes in north-western Sydney are contributing to increased traffic volumes on the existing road network, especially between Richmond and North Richmond and at present there is insufficient capacity for the bridge and its approaches to cope with traffic congestion during peak periods. As a result, during the morning and afternoon peak periods, Richmond Bridge and the approach roads between Gross Vale Road and East Market Street experience traffic congestion. The level of service along this section of Richmond Bridge and its approach roads is well below the expected level for roads of similar classification in Sydney.

To assess this issue and to undertake a process of options development a feasibility study has commenced. The feasibility study is funded by the Federal Government and managed by Roads and Maritime Services (RMS) with SMEC providing consultancy services and advice.

The purpose of this study is to undertake investigations for longer-term solutions to address congestion.

The overall project objectives are:

1. Define the road corridor between Richmond and North Richmond that is required to be reserved for the preferred option.
2. Maintain the operations of Richmond Bridge & its approaches during construction.
3. Reduce traffic congestion to an acceptable level for this classification of road.
4. Maintain and improve accessibility to and across Richmond Bridge.
5. Minimise any environmental impact along the route.
6. Improve safety for all road users.
7. Minimise the project “whole of life cost”.

Short-term strategies are also being developed as part of the study in response to strong community concerns that any extended delay in implementing a long-term solution might see the traffic congestion accentuated, creating a less safe road situation during peak times.

A variety of options were considered to increase the capacity of the existing road network and intersections in order to select a corridor for the future road and bridge works that would be necessary to achieve an acceptable level of functionality – especially during peak periods. These have been refined to establish four (4) principal long-term options:-

- Widening of the existing bridge including possible contra flow options.
- Construction of a new two lane bridge adjacent to the existing bridge
- Construction of a new two lane new bridge (1 in 5 year flood event).
- Construction of a new two lane new bridge (1 in 20 year flood event).

These were recently exhibited for community comment until 17 October 2012. Community submissions will be included in the study report and its recommendations.

An important component of the study report is the qualitative assessment of these principal options in order to determine if a preferred long-term option for the road corridor can be selected. A stakeholder workshop, including community representation was determined as the best means to undertake this qualitative assessment. A Value Management Review Workshop was therefore held at the Sebel Resort and Spa at Windsor on 24 October 2012. The list of participants is included at **Appendix 1**. The agreed workshop purpose was to:

- To assess the principal long-term options for future improvement to the Richmond Bridge and approaches capacity and, if appropriate, to recommend a preferred option for detailed planning.
- The workshop methodology involved the consultant team giving a brief presentation of the project context and of the principal long-term options. Participants were able to seek clarifications so that a shared appreciation was developed about each of the options.
- A draft set of assessment criteria was reviewed and with some minor adjustments was adopted for the assessment process.

These are included at **Appendix 2** together with the workshop assessment comments and relative ratings.

The Study Area

Information Phase

The participants had been provided with some background information prior to the workshop, but the opportunity was given to walk them through the planning and the principal options to be assessed.

Participants were able to ask questions and gain a deeper appreciation of each option, areas of potential benefit and impacts.

The summary information presented at the workshop is included at **Appendix 3**.

Fiona Chan of RMS introduced the workshop and affirmed the purpose of the workshop and the project objectives and highlighted the importance of taking into consideration the issues and concerns of the community and stakeholders.

The community feedback process for the exhibited plans was noted, with submissions having closed on 17 October 2012.

Concern about getting some short-term relief measures in place was also noted and traffic modelling was being undertaken to help in deciding how best to alleviate congestion in the short-term. However, this workshop had to focus on the long-term strategy, so that an appropriate corridor could be determined and thus provide greater certainty for roads and traffic planning. Having the corridor defined would also assist the community implement its development and cultural activities with greater certainty.

Of particular concern is the treatment of Yarramundi Lane and apart form the peak weekday traffic there was also the sporting activities – both evening sports training sessions as well as weekend sports and recreational events – when traffic trying to use the intersection across Kurrajong Road was most problematic.

It was accepted that any short-term strategy must have a workable solution for this intersection.

Transport for NSW highlighted that the opportunity for further community submissions on the draft NSW Transport Masterplan, especially on any short-term fixes remained open until 26 October 2012.

Community Feedback

Jacqui Hyne, of Id Planning advised the workshop on the community consultation process and outcomes to date. Information sessions as well as on-line opportunities have been taken up.

Some 80 people attended the community information sessions and drop-ins.

A total of 56 submissions have been received since July 2012.

The key messages that derive from all of this feedback so far are:-

- Flood immunity
- Key intersections congestion and safety (e.g. Yarramundi Lane)
- Property impacts
- Land use and development
- Project scope
- Timeframes and funding

It was noted that heritage did not come through as a strong issue from the submissions and feedback.

Overall community feedback about the long-term options was for:-

Community Perspectives

The community representatives were asked to share their views about the study and the potential solutions:-

What alternative by-pass options were being considered by RMS?

How further development is occurring in North Richmond and onto Grose Vale Road.

The importance of having an alternative bridge in the event of the existing bridge being cut-off.

Congestion on the two bridges across the river in this area (i.e. Richmond and Windsor) usually occurring at the same time is a serious problem. It needs a global (i.e. strategic) perspective and a third bridge to alleviate the congestion. It would be expected to reduce the need for any expenditure at Windsor or Richmond.
If the focus of the study is just Richmond / North Richmond then its likely that the problems will be exacerbated for the communities. The demographics are changing – no longer a rural area as urban commuters are moving into the area (especially on the western side of the river) – this is bringing significantly higher peak flows through this corridor. Flood immunity is also important – people need to be able to get to work from the North Richmond side so flood free access is needed.
The obvious solution is to have a by-pass – it would be a better long-term solution. Must have all turn options at the Yarramundi Road intersection. Flood free access to the west of the existing bridge is also needed. If we have no growth then the community will stagnate and decline. D and C are the preferred options amongst the community.
The loss of health facilities at Kurrajong will force more traffic through the corridor in seek of medical (and other) service at Windsor.
There is further development occurring and there will no doubt be more over the period that this study is planning for (i.e. up to 2036). Safety is a concern with the current intersections congestion. Access across the river during floods A high level of scepticism that nothing will happen because there is no money – so why not look at a by-pass anyway?
How will the corridor strategy improve public transport – especially in the morning peak periods to and from North Richmond. Introduction of more no-right-turns.

The bridge itself is not the problem – it's the flows to and from Old Kurrajong Road and Yarramundi Lane. A by-pass can have benefits – but it would seriously reduce economic activity in Richmond and North Richmond.
Access to medical services, especially during flooding – its otherwise a 100km road trip to get to Nepean Hospital – with Lithgow too small to cope. Key facilities that are relied upon during flood events – Ambulance Station, Fire Station and Police are all located on the eastern side of the river – so having flood free access is highly critical. Any increased development, especially housing on the western side will exacerbate travel demands through the corridor. A by-pass would be a better value solution. Whatever happens the heritage issues need to be sensitively addressed.
Over investment in short-term and widening of the corridor and adding a bridge crossing may, by the time they are funded and constructed, have less than 15-10 years worth of useful life – a by-pass earlier would give better value-for-money.
Flooding and community development should be the focus of the long-term solution – addressing congestion and intersection treatments are shorter-term considerations.
A third, flood free bridge across the river is already clearly essential with at present the only flood free access being the bridge at Penrith.
The community would be concerned that solving this congestion through one of these options may end up deferring indefinitely the by-pass – a better long-term solution – given any further development on the North Richmond side of the river.

RMS noted that the traffic modelling has affirmed that this project is needed anyway because a longer-term third crossing of the river does not otherwise relieve the congestion along this corridor between Richmond and North Richmond.

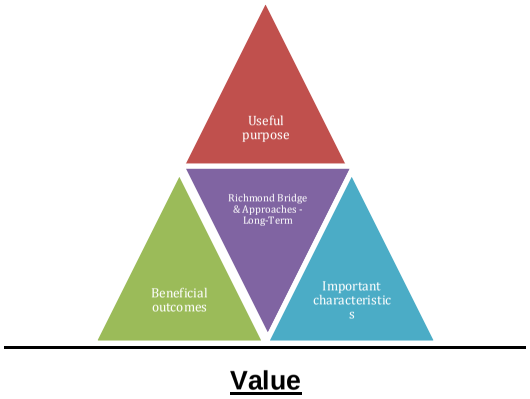
Value Factors

What is it that is valued about the Richmond Bridge and its approaches for the longer-term?

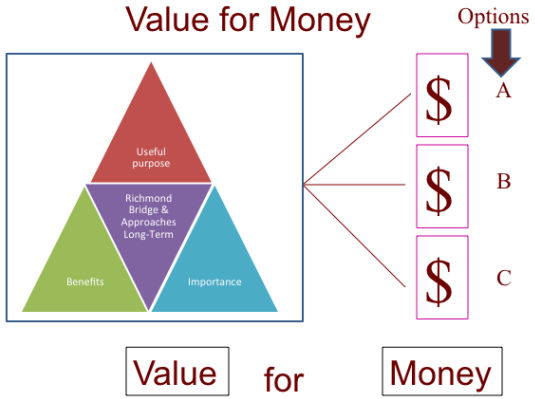
One of the essential elements of the Value Management Process (for example, as defined in the Australian Standard for Value Management - AS 4183-2007) [1]is to identify the 'value factors' of an entity (in this case, the Richmond Bridge and its' approaches).

Value factors are defined as the combination of the useful purposes fulfilled by that entity, the beneficial outcomes from fulfilling those purposes and those other features/characteristics of the entity that are of particular importance or consequence. These three factors – useful purposes, benefits and important characteristics – in combination, determine the value placed on the entity from multiple perspectives.

It is important to recognise that the perceptions of purpose, benefits and importance differ from person to person and, from organisation to organisation and so one task of this workshop will be to capture those perceptions, understand and record them in a structured format. This concept of value is illustrated in the following diagram.



The notion of *value for money* builds on this model of value, and is shown in the following diagram. A distinguishing aspect of this model is the separation of "value" from "money" meaning that a basis is provided to enable comparisons between options to determine which option (or combination of options) will provide the best value for the amount of money to be expended.



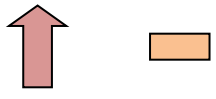
In seeking best *value for money*, the value management workshop-group develops proposals that will fulfil the defined purposes, achieve the desired benefits and incorporate the required important characteristics, all at the lowest total cost (meaning the life cycle costs).

[1] The Australian Standard for Value Management AS4183- 2007 includes an explanation of 'Value' as outlined in this report.

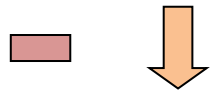
Improvements in value for money may be achieved through various combinations of value and total cost, as shown below.

Increasing the useful purposes, benefits and important characteristics of the *entity* while reducing the *total cost*.

Increasing the useful purposes, benefits and important characteristics of the *entity* without changing the *total cost*.



Maintaining the useful purposes, benefits and important characteristics of the *entity* while reducing the *total cost*.



Marginally reducing the useful purposes, benefits and important characteristics of the *entity* while substantially reducing the *total cost*.

Substantially increasing the useful purposes, benefits and important characteristics of the *entity* while marginally increasing the *total cost*.

Richmond Bridge & Approaches Value Factors

Project Objectives

Improved travel conditions and road safety along the corridor between Richmond and North Richmond

To ensure operation of Richmond Bridge and its approaches can be maintained during construction

To maintain / improve the accessibility on Richmond Bridge

To minimise impacts on the built and natural environment along the route

To minimise the whole-of-life cost

The stakeholder workshop was able to define the following Value Factors:-

NB: These are not listed in any particular order of priority or themed.

Purpose(s)

Establishment of an agreed corridor and strategy for improving travel conditions between Richmond and North Richmond to an acceptable level of service for the period up to 2036

Creation of strategic concept plans and an associated cost plan to inform decision-making by the Commonwealth and NSW Governments.

Intended / Expected Benefits

- reservation of a corridor for the development strategy
- Commonwealth and NSW State Government funding to an agreed program
- fewer accidents and fatalities
- improved journey times along the corridor
- safer conditions and facilities for pedestrians and cyclists along the corridor
- clarity to allow community and commercial developments to be progressed along the corridor
- facilitate public transport options and modal shifts from private vehicles
- improved network connections for the north west growth centre
- improved accessibility along the corridor - including for emergency services
- improved quality of life for the residents - social, cultural and connectivity
- potential improved flood immunity
- facilitate Bells Line of Road as an alternative heavy vehicle route across the Blue Mountains
- potential to allow the expansion of other services infrastructure
- facilitate development / expansion of North Richmond - broader economic spin-offs
- improved real estate values - with increased / improved connectivity of the area to the rest of Sydney

Important Aspects

- having a plan that allows easing the current congestion as quickly as possible - to progress short-term options
- the reliability of the modelling that the strategic concept design is based upon - so that the design solution will meet requirements up to 2036 - picking up on potential future developments and their impacts on traffic
- protection of heritage values along the corridor
- reducing the number of accidents and injuries - including for pedestrians and cyclists
- allowing the community's commercial and employment activities to thrive and not be adversely impacted by the works to improve the travel conditions along the corridor
- avoiding subjecting the community to 'continuous' works along the corridor for an extended period
- improving the level of service along the corridor
- what is done for the short term - integrating with the long-term strategy
- integrating with North West Growth Centre and future connection to the M7 & Bells Line of Road corridor
- reducing social isolation through better public transport connections
- heavy haulage along the corridor - managing increased flows and minimising impacts on the local community - appreciating relationship to other projects along Bells Line of Road
- successfully integrating the ends of the corridor to ensure traffic congestion is not just shifted
- protection of environmental, riverine values of the area
- minimising impact on properties
- retirement village accessibility and quality of life adjacent to the road corridor
- the existing bridge - structural and heritage features
- urban design features and outcomes - visual amenity and character of the area
- the level of flood immunity along the corridor

Options Assessment

The participants were organised into 4 groups to undertake the assessment, ensuring a balance of community representation, key stakeholders, Roads and Maritime Services and the SMEC team.

The members of the SMEC team only provided information for the RMS and community representatives to make their assessments.

Each group took responsibility to assess the 4 options focusing on a particular set of the criteria:

Group 1: Safety and Road Capacity

Group 2: Environment and Cultural Heritage

Group 3: Engineering

Group 4: Visual & Landscape, Noise and Property

The descriptions of the criteria are shown at **Appendix 2,** including the specific qualitative assessment comments.

Each group undertook its assessment and then this was presented to the whole group for clarifications and comments. In this way the whole group had opportunity to raise any queries, suggest any changes and as a whole group affirm the relative assessment.

Once the assessment was done the group was asked to reflect on where the number '1s' were and whether or not this would suggest an overall preferred option.

Workshop Recommendation

Following their further discussions the workshop group was able to make a recommendation as follows.

We recommend Option D corridor because:

It gives superior outcomes for the principal objectives – improved travel conditions and safety outcomes as well as for accessibility during flood events and network integration;

But subject to:

Addressing some of its environmental and possible heritage / cultural impacts and ***potentially*** improving the Yarramundi Lane access / functionality.

Although it was noted that a wider corridor will impact some people once off, but give broader benefits to many more people over a longer period.

Key Actions Arising

The following key actions were noted to be addressed by the project team:

(They are numbered for reference purposes only)

1.	Option D will need a flood access / major accident contra-flow arrangement for the new carriageway.
2.	Hanna Park access needs to be defined to and from the new roadway, including required signage to direct people to the park.
3.	Intermittent traffic movements associated with sporting and other community events needs to be included in the modelling for any shorter-term solutions to the congestion.
4.	The modelling needs to make sure that the end points of this corridor can cope with the anticipated flows and the current problems are not just being pushed to either end of the corridor.
5.	Accessibility for pedestrians from the retirement village to be clarified.
6.	Council to review the local traffic network for the impacts of the options especially in relation to Yarramundi Lane.
7.	Post on-line the report on the community feedback as well as for the long-term options.

Appendix 1: Workshop Participants

Name	Organisation
Yin Qian	DoIT
Bryan Smith	Community rep
David Marshall	Community rep
Melanie Baurhenn	Community rep
Ricci Green	Community rep
Venecia Wilson	Community rep
Alan Wheen	Community rep
Sean Perry	Hawkesbury City Council
Jeff Organ	Hawkesbury City Council
Jacqui Hyne	Id Planning
Bernie Mills	RMS
Devika Sitinamaluwe	RMS
Fiona Chan	RMS
Greg Upton	RMS
Ian Macleod	RMS
Jennifer Gatt	RMS
Lyndall Thornhill	RMS
Raeburn Chapman	RMS
Brad Hamilton	SMEC
Nicole Vukic	SMEC
Peter Scrivens	SMEC
Rodrigo Estrada	SMEC
Shane Higgins	SMEC
Shaun Nadin	Sydney Water
Joann Tulett	TfNSW
Viv Manwaring	TfNSW
Carl Nugent	Tract

Workshop Facilitator

Mark Neasbey ACVM

Invited but unable to attend:

Lucinda McTaggart	DoIT
Derryn John	DoPI
Chris Amit	HCC
Denise Wilson	Id Planning
Bruce Taggart	RMS
Hilary Johnson	RMS
Ken Lysaught	RMS
Neil Forrest	RMS
Shane Schneider	RMS
Suresh Surendran	RMS
Rolf Lunsmann	TfNSW
Garry Jones	RMS
Rahman Manjur	RMS
Salah Assi	RMS
Allison Flaxman	SES
David Heins	RMS
Joseph Fanous	RMS
Peter Ellis	RMS
Peter Cinque	SES

Appendix 2: Options Assessment Comments

The assessment of the options is reflected in the following table, which also sets out the agreed criteria. The relative rating of the options is reflected by the workshop allocating a number from 1 – being 'the best' to 4 – being 'the worst'. The criteria were not weighted as the assessment was to look at relative merit for each of the options and then to draw any conclusions about the options overall.

Criterion	Criteria Description	Option A	Option B	Option C	Option D
Safety	A qualitative comparison of the overall improvement to safety for each option. Key factors to consider are: Divided carriageways for 80km/h zones, protected turn bays, signal control with pedestrian crossing facilities at intersections, safety barriers, off road shared paths. A higher performing option would be one that provides the greatest improvement to safety.	contra flow system – safety of shared path is also the same; operational risks and OH&S hazards compared to the other options which have dual carriageways 4	2 these could be safer if uncontrolled RT's were removed (and made same as option D) at Yarramundi Lane intersection	2 these could be safer if uncontrolled RT's were removed (and made same as option D) at Yarramundi Lane intersection	1 removes cross-over movements of the carriageway; reduced number of movements of RT's across opposing traffic at Yarramundi Lane; safety at Yarramundi Lane intersection is seen to improve as some of the movements at Yarramundi are removed
	Provision of off road shared path facilities and safer crossing locations (mid block and with signal control at intersections). Safety on the shared pathway. A higher performing option would be one that provides the greatest improvement to safety.	ones over & under existing bridge required 4	1 shared path on downstream side of bridge connects with path on same side of new carriageway	1	1
Overall for Safety		4	2	2	1

Criterion	Criteria Description	Option A	Option B	Option C	Option D
Road capacity	A qualitative assessment of the improvement to congestion provided by the option when compared against a 'Do nothing' scenario. A higher performing option would be one that provides the best possible reduction in traffic congestion. Provides better integration with long-term regional network.	set-up and pull down of contra flow system impacting on travel times; also lane merging an issue; outside of peak periods no contra flow with increased congestion; 4	2	2	1 removes cross-over / right turn movements therefore more control at Yarramundi Lane intersection – leading to less congestion;
	A qualitative assessment of the improvement to travel time provided by the option when compared against a 'Do nothing' scenario. Provides better public transport integration and timetable performance. A higher performing option would be one that provides the best possible improvement to travel time.	set-up and pull down of contra flow system impacting on travel times; also lane merging an issue; 4	2	2	1 improved (marginally) flow compared to B & C due to the restricted movements at Yarramundi Lane intersection;
	Minimising the restriction of turning movements onto and off the corridor and providing safer facilities (TCS or sheltered turning bays). A higher performing option would be one that provides the greatest improvement to safety. A dedicated right turn bay for eastbound traffic on Kurrajong Road to access Old Kurrajong Road / Yarramundi lane will also be provided.	1 no change to current movements at Yarramundi Lane intersection	1 no change to current movements at Yarramundi Lane intersection	1 no change to current movements at Yarramundi Lane intersection	reduced traffic movements at Yarramundi Lane intersection will have a negative impact 4
Regional Network Planning / Integration		Contra flow traffic impacts and no extra flood immunity – so no regional network improvement; 4	No extra flood immunity so no regional network improvement; 3	2 better flood immunity improves regional network connectivity;	1 gives best regional network integration due to improved flood immunity combined with maximum corridor capacity;

Criterion	Criteria Description	Option A	Option B	Option C	Option D
Public Transport Integration		Contra flow off peak only 1 lane therefore higher chances of public transport delays; 4	1 improves ability to maintain and increase public transport services through the corridor including at peak times;	1 improves ability to maintain and increase public transport services through the corridor including at peak times;	1 improves ability to maintain and increase public transport services through the corridor including at peak times;
Overall for Road Capacity		4	3	1 improved safety and capacity; also provide better flood immunity so integrate better with regional network	1 accessibility performs only at 4 - need to get better accessibility at Yarramundi Lane; also provide better flood immunity so integrate better with regional network
Visual and landscape	This measure aims to provide an indication of the visual impact of the proposed bridge options when compared to the current situation. Higher performing options would provide a design that either maintains a view downstream of the river (from the existing bridge) or provides a bridge structure that minimises any disruption of this view. A higher performing option is one that would have the least visual and physical impact on the built and natural values of the corridor. Potential improved vistas - offering better views. A higher performing option is the one that provides the greatest opportunities to strengthen and improve the visual amenity and landscaped values / character of the corridor.	1 least visual impact maintains downstream views; still impacts though on Hanna Park new bridge; extension - would improve overall views of bridge elevation from downstream;	blocks views downstream from existing bridge but creates greater views from the new bridge; maintains a narrow corridor through the community; needs to be designed to be sympathetic to the existing bridge; 4	3 partially blocks views / frames and views under the bridge; gain new views from the existing bridge;	1 frames views downstream (can see under it); greatly improved views from the new bridge (higher level); improved views across the floodplain from the new alignment; visual impacts along flood plain for travellers along the route - blocks views from the existing road; additional vantage points achieved by new bridge;
	NB: the sketches provided are considered misleading in terms of the apparent pylon bulkiness & associated visual impacts;				

Criterion	Criteria Description	Option A	Option B	Option C	Option D
Noise	There is a correlation between this criterion and the occurrence of (Lmax) noise levels due to truck noise compression braking associated with steeper grades. A higher performing option would have a shorter overall length of steep grades. These include schools, places of worship etc. A higher performing option would impact less on community facilities.	Marginal increases in noise only; impacts from trucks and noise from concrete barriers? 3	marginal increases in noise only with acceleration / deceleration on and off the lower bridge; 3	1 more car noise but less truck noise - overall neutral;	2 slightly more noise through the flood plain from the elevated road;
Property	This indicates less economic disruption within the study area. A higher performing option would have a lower number of businesses affected. A higher performing option will have less impact and requirement for property acquisition therefore have a lower area of land acquisition. However, residential/business/ commercial land will be more valuable than rural/ flood plain land. Minimises or avoids properties of community significance. As a result a higher performing option would also have less impact on residential/business/ commercial land. Affect on businesses also in relation to accessibility / disruption in general.	1 maintain narrow corridor - so minimises property impacts;	1 maintain narrow corridor - so minimises property impacts;	increase of footprint - so affects more property; 3	slightly increase of footprint - as it affects more properties than the other options; 4
NB: impacts through Richmond and North Richmond are seen to be the same for all of the options so these have not been considered as a differentiating factor between the options.					

Environment and cultural heritage	A higher performing option would have a lower impact on the archaeology. Presence of archaeology adjacent to the road.	1 as above plus even though greater impact on wooden bridge there is potential to mitigate impacts on existing wooden bridge	1 as above plus even though greater impact on wooden bridge there is potential to mitigate impacts on existing wooden bridge	3	larger footprint so potentially a broader effect 4
	This criterion accounts for potential affects to flora and fauna including threatened species and territorial animals. Where riparian flora and fauna has been mapped, this will also be included. A higher performing option would have a lower number and area (ha) impacted.	1	1	3	potential impacts on frogs and Hanna Park 4
	The cultural heritage evaluation includes Aboriginal and non- Aboriginal sites. A higher performing option would have a lower number and therefore indicate a lower disturbance of cultural heritage sites.	Non-Aboriginal 2 based on information currently available (further surveys are needed) Aboriginal 4	Non-Aboriginal / Built Heritage 3 based on information currently available (further surveys are needed) Aboriginal 4	Non-Aboriginal / Built Heritage 3 based on information currently available (further surveys are needed) Aboriginal 4	based on information currently available (further surveys are needed) attract greater traffic volumes particularly heavy vehicles Aboriginal 4 Non-Aboriginal / Built Heritage 4
Overall for Environment and Heritage		1 lesser footprint; less traffic due to contra flow arrangement (3 lanes vs. 4)	2	3	largest footprint; likely to have greatest impact on environmental values; largest footprint across the river; effects on Hanna Park 4

Engineering	This criterion needs to be assessed qualitatively. It includes aspects of construction techniques including traffic management, movement of construction materials through the study area, ease of bridge construction, noise, dust, environmental management strategies, geological considerations and construction program. A higher performing option would be one that is perceived to be a more constructible design.	impacts on traffic management; increased construction within waterway; building adjacent to existing structure; already constrained location to build in; overall build time may be 1-2 years; more difficult to construct compared to the other options; modifications necessary to the existing structure - relocation of the water main also a disadvantage; possibly the cheapest to build; dustiest affecting traffic adjacent; increased piling in the river; safety of existing structure during construction - piling activities; any problems with the existing bridge would have to be addressed with new bridge construction alongside; 4	a bigger structure compared to option A; tie-ins - congestion caused by close proximity - impacts on local community 3	1 slightly shorter bridge; less material required to be used (brought into the corridor); potential site storage areas away from the corridor and so less construction traffic impact;	2 more space and larger structures for options C&D; greater impacts on the whole of the alignment; separation and working off-line is a benefit for options C&D; approach roads on northern side will have an impact on existing property and park - south side not such a big issue; access from existing properties during construction will be an issue; options C&D involve less work within the river which is a bonus; canoe launching wharf may need to be relocated to facilitate options C&D; access to the park would be worst with options C&D; easier future construction of another bridge in options C&D;
Engineering	Improving the flood immunity and maintaining flood access along the corridor for a 1:5yr ARI flood event. A higher performing option would improve access during flood events and minimise the social and economic impacts.	3 existing bridge level below the 1:5	3	1 above the 1:5	1 above the 1:5
	Improving the flood immunity and maintaining flood access along the corridor for a 1:20yr ARI flood event. A higher performing option would improve access during flood events and minimise the social and economic impacts.	3	3	2	1 only option that achieves 1:20

Engineering (cont.)	This is a qualitative assessment for each option against the degree and ease of maintenance of bridge structures. A higher performing option would be one that would be easier to maintain and minimises long-term road operating costs.	adding complication to maintenance of existing structure; most difficult with addition of a longitudinal joint; height access to deck and piers for maintenance not really any difference across the options; access to A though would be an ongoing issue 4	3	1 bridge length a bit shorter than for option D	2
	This is a qualitative assessment for each option against the degree and ease of maintenance of the road carriageway and associated structures. A higher performing option will be one that would be easier to maintain and minimises long-term road operating costs.	lack of flexibility with this alignment 3	1 new bridge new alignment - smallest additional new structural elements	2	largest scheme with most infrastructure to be maintained 3
	Long-term operational cost	cost of doing the contra-flow system 4	1	1	1
Overall for engineering		4	3	1	2
Project Capital Cost	Route options costs will represent the likely total project cost for each option, including allowances for design, project development costs incurred by RMS, land acquisition, litigation measures etc. A higher performing option would have a lower capital cost.	1 base case	1 1.05Xbasecase	3 1.6xbasecase	3 1.7xbasecase

Appendix 3: Background Information & The Principal Options

The 'Richmond Bridge and Approaches Congestion Study' is a corridor options study funded by the Australian Government to address traffic congestion on Richmond Bridge and its approach roads and to reserve a road corridor for future traffic needs.

Richmond Bridge and its approach roads comprise a two-lane (one lane in each direction) configuration. Richmond Bridge is listed on the RMS S170 Heritage and Conservation Register as an item of significant state heritage. The town of Richmond is also a Macquarie town important for its streetscapes and heritage character. The corridor comprising March Street, Kurrajong Road, and Bells Line of Road, between East Market Street, Richmond and Grose Vale Road, North Richmond currently experiences traffic congestion issues eastbound in the morning (AM) peak period and westbound in the afternoon/evening (PM) peak period. The Richmond Bridge is located to the western end of the study area and is the only Hawkesbury River crossing serving the residential areas of North Richmond, Kurrajong, Bilpin and Bell. The roads approaching the bridge comprise a two-way, two-lane configuration.

The Australian Government has provided funding to RMS to undertake a strategic concept options study to develop suitable options that address the traffic congestion issue in order to reserve a road corridor for future traffic needs in the vicinity of the existing bridge. The study has been split into two stages. Stage 1 was completed by Hyder Consulting Pty Ltd (Hyder) and identified short-term strategies to address the congestion issue (up to 2021). Stage 2 currently being undertaken by SMEC (Australia) Pty Ltd (SMEC) on behalf of RMS identifies long-term options to address congestion (beyond 2021 to 2036).

As part of reviewing and addressing the congestion issue, Hyder assessed the performance of Richmond Bridge and its approaches and developed short-term (up to 2021) solutions to traffic congestion along the corridor. The Stage 1 proposals developed included intersection treatments and localised measures such as the removal of on-street parking during peak periods.

In July 2012 a consultation workshop was held with members of the public to present the Stage 1 proposals.

This forum was also used to gather information from the public with regard to long-term solutions. This information has been considered in the refinement of the strategic concept options developed for the long-term measures for Stage 2. Figure 1 on the following page shows the location of Richmond.

Project Justification

Urban expansion and land use changes in north-western Sydney have contributed to the traffic growth on the existing road network. Consequently, during morning and afternoon peak periods, Richmond Bridge and its approach roads between East Market Street, Richmond and Grose Vale Road, North Richmond experience traffic congestion.

The Level of Service along this section of road is below the average for similar roads in Sydney and will worsen without increases in the capacity of the corridor to address projected future development in the area. In addition consideration has been given to the opportunity to develop options that provide a higher level of flood immunity thereby reducing the impact of floods and associated access restriction on the local community.

Project Overview

Richmond is a town about 65 kilometres north west of the Sydney CBD and located in the Hawkesbury City Council local government area. Richmond Bridge spans the Hawkesbury River connecting the towns of Richmond to the east and North Richmond to the west. The corridor comprising March Street, Kurrajong Road, and Bells Line of Road (Bells Line of Road) between eastbound in the morning (AM) peak period and westbound in the afternoon/evening (PM) peak period.

The Australian Government has provided funding to Roads and Maritime Services (RMS) to undertake a study to investigate the traffic congestion issue in the short and long terms.

The purpose of the study is to develop suitable options to address the traffic congestion issue in the short (2016-2021) term (Stage 1) and the long (2021-2036) term (Stage 2).

Project objectives

The objectives of the study are to improve travel conditions and road safety along the corridor between Richmond and North Richmond. To support these objectives, the following additional objectives also need to be satisfied by the study:

- Ensure the operation of Richmond Bridge and its approaches can be maintained during construction.
- Maintain/improve the accessibility of Richmond Bridge.
- Minimise the impacts on the built and natural environment along the route.
- Minimise the project whole of life cost.

Study Area

The study area includes the corridor comprising March Street, Kurrajong Road, and Bells Line of Road and extends from East Market Street, Richmond to Grose Vale Road, North Richmond including the Richmond Bridge. The Richmond Bridge is located to the western end of the study area and is the only Hawkesbury River crossing serving the residential areas of North Richmond, Kurrajong, Bilpin and Bell. The roads approaching the bridge comprise a two-way, two-lane configuration.

The study area was divided into four distinct sections in as part of the initial option development process. These sections were:

Section 1: Richmond area

Section 2: Kurrajong Road

Section 3: Richmond Bridge

Section 4: North Richmond

Technical Investigations

A series of technical investigations (listed below) provide the basis for the assessment of the route options. These studies aim to inform the project objectives and allow assessment of the route options against the criteria. The key outcomes in the form of issues and opportunities associated with each route option are presented in this background paper.

The technical studies commissioned to inform the Stage 2 study include:

Traffic modelling and transport assessment.

Flood modelling.

Environmental studies (including biodiversity and heritage).

Urban and landscape design study including visual assessment.

Constraints mapping (based on outputs from the Environmental studies).

Review of utility services.

Strategic concept designs (road and bridge).

Preliminary geotechnical investigations.

Design objectives and criteria

Design objectives

The primary objective of the study is to alleviate traffic congestion along the corridor between Richmond and North

Richmond. The secondary objective of the study is to provide an improved level of flood immunity for the corridor.

To support these key objectives, the following additional objectives also need to be satisfied by the study:

Ensure the operations of Richmond Bridge and its approaches can be maintained during construction.

Maintain/Improve the accessibility of Richmond Bridge.

Minimise the impacts on the built and natural environment along the route.

Improve safety for pedestrians, cyclist and motorists.

Minimise the project whole of life cost.

Engineering standards

The following Engineering Standards have been used in the development of the strategic concept options:

- AUSTROADS (previously NAASRA) Guidelines and publications.
- RMS Supplements and Technical Directions.
- Australian Standards

Road design criteria

The following road design criteria have been adopted in the development of the options:

- The provision of the necessary number of travel lanes along the corridor and with suitable intersection treatments to provide an acceptable Level of Service to manage traffic congestion in 2036.
- Design speed – urban section 70km/h
- Design speed – rural section 90km/h
- Sign posted speed limit – urban and rural sections 10km/h less than the design speed
- Stopping Sight Distance (SSD) – rural section 120 metres with a reaction time of 1.5 seconds
- Stopping Sight Distance (SSD) – urban section 80 metres with a reaction time of 1.5 seconds

Typical cross section and clearances

- Cross section element Minimum values (and range)
- Lane width Existing carriageway: 2.9 - 3.2 metres
- New carriageway: 3.0 - 3.5 metres
- Typical median width Minimum width = 4.2 metres (where applicable)
- Typical verge width 2.0 metres or retaining existing width
- Shoulder width Existing carriageway - 0.5 metres
- New carriageway: 1.5 - 2.0 metres (where applicable)
- Shared use path width 3 metres
- Footpath width (existing) 1.2 metres
- Vertical clearance 5.3 metres

Bridge design criteria

The following bridge design criteria have been adopted in the development of the options:

- Australian Standard 5100 (Bridge Design Code).
- RMS Supplements and Technical Directions.
- 100 year design life.
- Lane width 3.25 metres for Option A
- 3.5 metres for Options B, C, D
- Shoulder width 2.0 metres for Option A
- 1.5 – 2.0 metres for Options B,C and D
- Footpath width Existing width of footpath (2.1 metres) for Option A
- 3 metre wide shared use path for Options B, C, D
- Contra flow barrier width 0.6 metres (Option A only)
- Longitudinal grade To match the road alignment
- Crossfall 3 percent to match the road alignment
- Superstructure classified as partially submerged as closed cell structures are considered unsuitable
- Design loads theoretical design loads to model traffic loadings (SM1600 and HLP400).

Road design constraints

The road design constraints along the corridor include the following:

- The existing Richmond Bridge.
- Existing property boundaries.
- The existing alignment through a built up urban area with mixed land uses in Richmond from East Market Street to Chapel Street (along March Street and Kurrajong Road) and in North Richmond, Bells Line of Road from the Hannapak industrial complex to Grose Vale Road/Terrace Road.
- Sensitive heritage (Aboriginal and non-Aboriginal) elements.
- Flora and fauna habitats and species.
- Conflict with utility services.

Consideration of flood immunity

Consultation with the State Emergency Service (SES) and Hawkesbury City Council (HCC) considered the impacts of a 1:5 year, 1:10 year and 1:20 year ARI flood event and the flood access issues that need to be addressed with regard to the bridge and approaches. Through this process it was established that the routes considered are not flood evacuation routes for either the SES or HCC.

Consideration of grade separation intersection treatments

Options that involved full grade separation of the existing intersections such as Grose Vale Road/Bells Line of Road were not considered further due to the following issues:

- Traffic volumes were capable of being catered for by at grade intersections and can still provide an adequate level of service.
- The preliminary economic assessment of the capital cost of grade separation interchanges indicated that these options were not economically justifiable.

Environmental Considerations

In conjunction with the development of options, preliminary environmental investigations were undertaken for the study area. The results of these were used to identify the existing environment in the area and any potential constraints for the options being considered. As part of this investigation, desktop environmental searches were undertaken for the study area. This was followed by a field investigation through the study area, however it was limited to public spaces, such as the road corridor and river bank. No field investigations were undertaken on private land.

In general, because all options are the same through the townships of Richmond and North Richmond, the environmental constraints in these areas would be consistent for all options. In addition, options across the flood plain and Hawkesbury River all occur within about a 50 metre corridor, therefore the environmental constraints in these areas would also be similar for all options.

The main distinctions between the constraints are:

- The options closest to the existing road corridor (options A and B) may have higher Aboriginal and non-Aboriginal constraints through the flood plain and across the river.
- Options C and D would require more property acquisition as they have a wider road corridor.
- Option C and D may require more flood and hydrology management due to the height of the new road embankment across the flood plain. However these options would also provide a higher level of flood immunity for the local community.

Biodiversity constraints

Low quality River-flat eucalypt forest on coastal floodplains (of the NSW North Coast, Sydney Basin and South East Corner bioregions) endangered ecological community exists within the study area along the banks of the Hawkesbury River. This constraint is common for all options.

Freshwater wetlands on coastal floodplains (of the NSW North Coast, Sydney Basin and South East Corner bioregions) endangered ecological community exists around the Pugh's Lagoon wetland. This constraint is common for all options.

There is potential for Green and Golden Bell Frogs to exist within Pugh's Lagoon. This constraint would be common for all options.

Hollow bearing trees exist within the riparian forest on the southern bank of the Hawkesbury River along the banks of the river adjacent to the existing bridge.

Options A and B have more potential to impact these, therefore this is a common for these options. Noxious weeds in the area are common for all options.

Aboriginal Heritage Constraints

There are known Aboriginal sites close to the existing bridge alignment. This would be a greater constraint to options A and B.

There is a potential for further unrecorded Aboriginal heritage and cultural sites to occur within the local landscape. This constraint would be common to all options.

Non-Aboriginal Heritage constraints

Within or adjacent to the study area 10 items listed on the State Heritage Register occur within the Richmond township, some immediately adjacent to the road corridor. As all options through the township are the same, this constraint is common for all options.

Three items listed on Section 170 Registers, including Richmond Bridge in the RMS register, occur within the study area. The constraint within Richmond is the same for all options.

However, the existing Richmond Bridge is only a constraint for option A as it would require modifications to the bridge structure.

105 local heritage items listed on the current and draft Hawkesbury City Council Local Environment Plans occur within the study area. These are predominantly within townships and would be a common constraint for all options.

There is potential for archaeological remains of the old river crossing, including the punt wharf and former timber bridge to exist adjacent to the current road corridor. This is a higher constraint for options A and B as they are closer to the existing road alignment at the river.

There is potential for archaeological remains of the former railway line to North Richmond to exist within the study area. This would be a common constraint for all options.

Landform, geology and soils constraints

Potential to expose acid sulphate soils at various locations across the proposal site. This constraint would be fairly common for all options.

Given the close proximity of the options, the soil type constraints would be similar for all options.

Water quality and hydrology constraints

The Hawkesbury River is a common constraint for all options.

Pugh's Lagoon on the northern side of the existing road corridor would provide a constraint for all options as a widening road corridor would be required in this area.

Managing hydrology across the flood plain would be a constraint for all options.

However option C and D would require additional consideration for flood mitigation underneath the new road alignments due to the potential height of the embankments. These options would also provide a higher level of flood immunity for the local communities.

Noise constraints

Sensitive receivers within the Richmond and North Richmond areas would be a noise constraint for all options.

Heritage buildings that may be affected by an increase in vibration from the operation of the road would be a common constraint for all options.

Shortlisted options for development

The final short list of strategic options for the Richmond Bridge are:

Option A; Option B; Option C; Option D

Common to the four options is the provision of:

- Two lanes in the peak direction during peak periods between Richmond and North Richmond. This would be achieved through a mix of peak hour on-street parking restrictions and the provision of a new two lane carriageway between Chapel Street and Old Kurrajong Road/Yarramundi Lane.
- Signalised intersections with right turn bays and pedestrian crossing facilities, except at West Market Street and Old Kurrajong Road/Yarramundi Lane.
- A three metre wide shared use path between Richmond and North Richmond.

Option A – Three-lane contra flow traffic management option to provide two lanes in the peak direction. This would involve:

Widening of the existing bridge downstream to accommodate three travel lanes across the bridge.

An additional two lanes for the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road/Yarramundi Lane to provide four lanes (two lanes in each direction).

Contra flow traffic management from approximately 50 metres west of Old Kurrajong Road/Yarramundi Lane to approximately 120 metres east of Pitt Lane including across the bridge.

No change to the current level of flood immunity.

Option B - Provide a total of four lanes, two in each direction, with no change to the current level of flood immunity. This would involve:

A new two lane bridge five metres downstream from the existing bridge constructed at the same level as the existing bridge.

Retaining the existing bridge.

An additional two lanes for the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road/Yarramundi Lane which will provide four lanes (two lanes in each direction).

Option C - Provide a total of four lanes, two in each direction, with the bridge and additional eastbound carriageway constructed at a level to provide 1:5 year ARI flood immunity. This would involve:

A new two lane bridge provided 25-50 metres downstream from the existing bridge.

Retaining the existing bridge.

An additional two lanes for the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road/Yarramundi Lane which will provide four lanes (two lanes in each direction).

Option D - Provide a total of four lanes, two in each direction, with the bridge and additional eastbound carriageway constructed at a level to provide 1:20 year ARI flood immunity. This would involve:

A new two-lane bridge provided 25-50 metres downstream from the existing bridge.

Retaining the existing bridge.

An additional two lanes for the Kurrajong Road eastbound carriageway between Chapel Street and Old Kurrajong Road/Yarramundi Lane which will provide four lanes (two lanes in each direction).

Removal of some turning movements at Old Kurrajong Road / Yarramundi Lane.

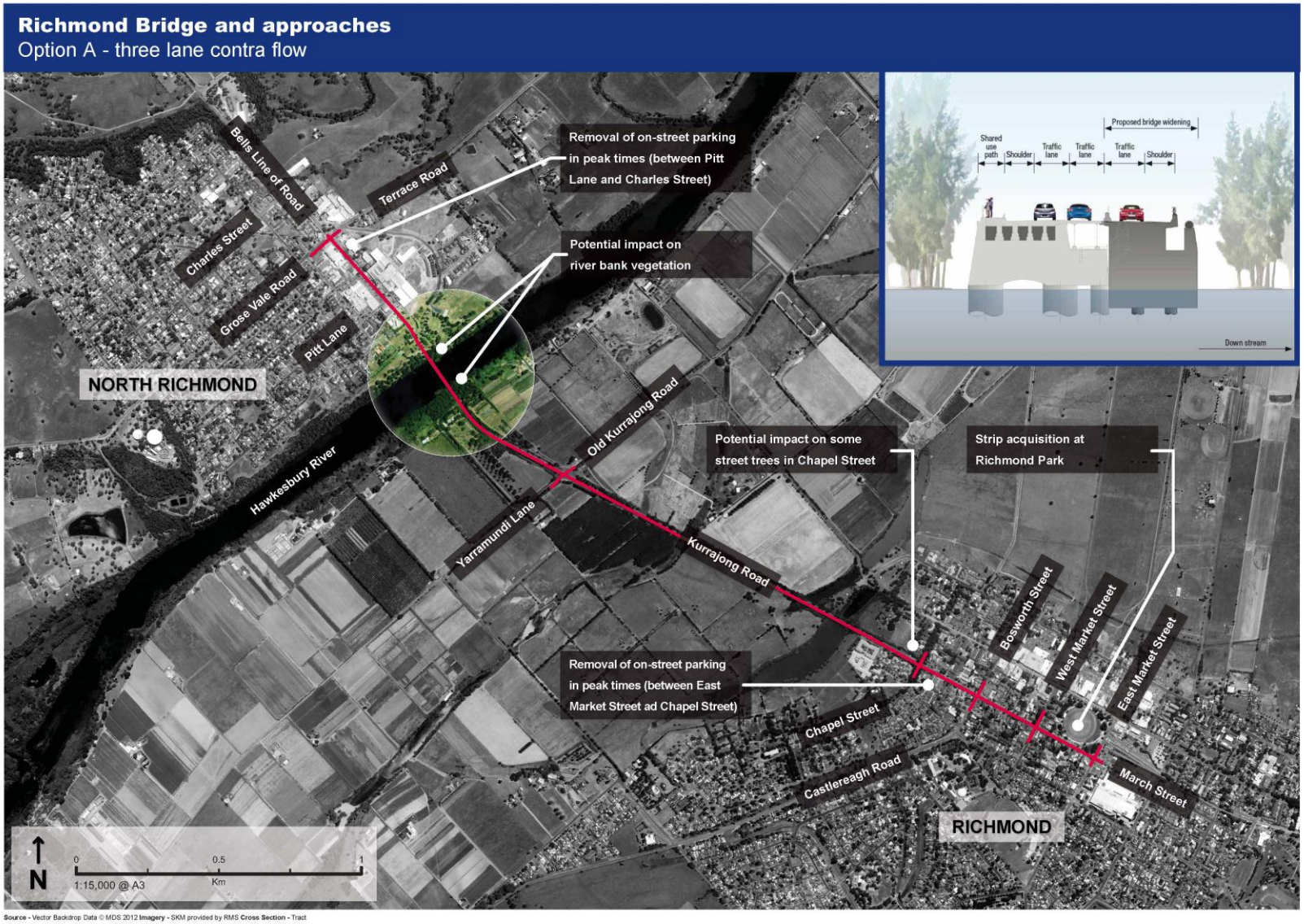
In all the four options, parking along the corridor would be restricted to off peak hours in Richmond and North Richmond, to provide for four lanes during the morning and afternoon peaks.

Consideration of a new four-lane bridge

A sub-option of Options C and D consisting of a new four-lane bridge on the downstream side of the existing bridge and with the same level of flood immunity as Options C and D has also been considered. This alternative bridge option would provide two lanes in each direction across a single bridge and could allow the existing bridge to be used for recreational purposes such as a green link pedestrian and cycle route across the river.

This four-lane bridge could be accommodated within the proposed corridor. Due to the height difference in the approach alignment for the sub Option D, the new four lane bridge option would have impacts on turning movements at Old Kurrajong Road / Yarramundi Lane that would require adjustments to be made at Bosworth Street to cater for the additional traffic.

Option A


Richmond Bridge and approaches
Option A - three lane contra flow
Bells Line of Road
Terrace Road
Charles Street
Grose Vale Road
Pitt Lane
NORTH RICHMOND
Hawkesbury River
Old Kurrajong Road
Yarramundi Lane
Kurrajong Road
Chapel Street
Castlereagh Road
March Street
RICHMOND
Bosworth Street
West Market Street
East Market Street
Removal of on-street parking in peak times (between Pitt Lane and Charles Street)
Potential impact on river bank vegetation
Potential impact on some street trees in Chapel Street
Strip acquisition at Richmond Park
Removal of on-street parking in peak times (between East Market Street ad Chapel Street)
Proposed bridge widening
Shared use path
Shoulder
Traffic lane
Traffic lane
Traffic lane
Shoulder
Down stream
N
0
0.5
1
1:15,000 @ A3
Km
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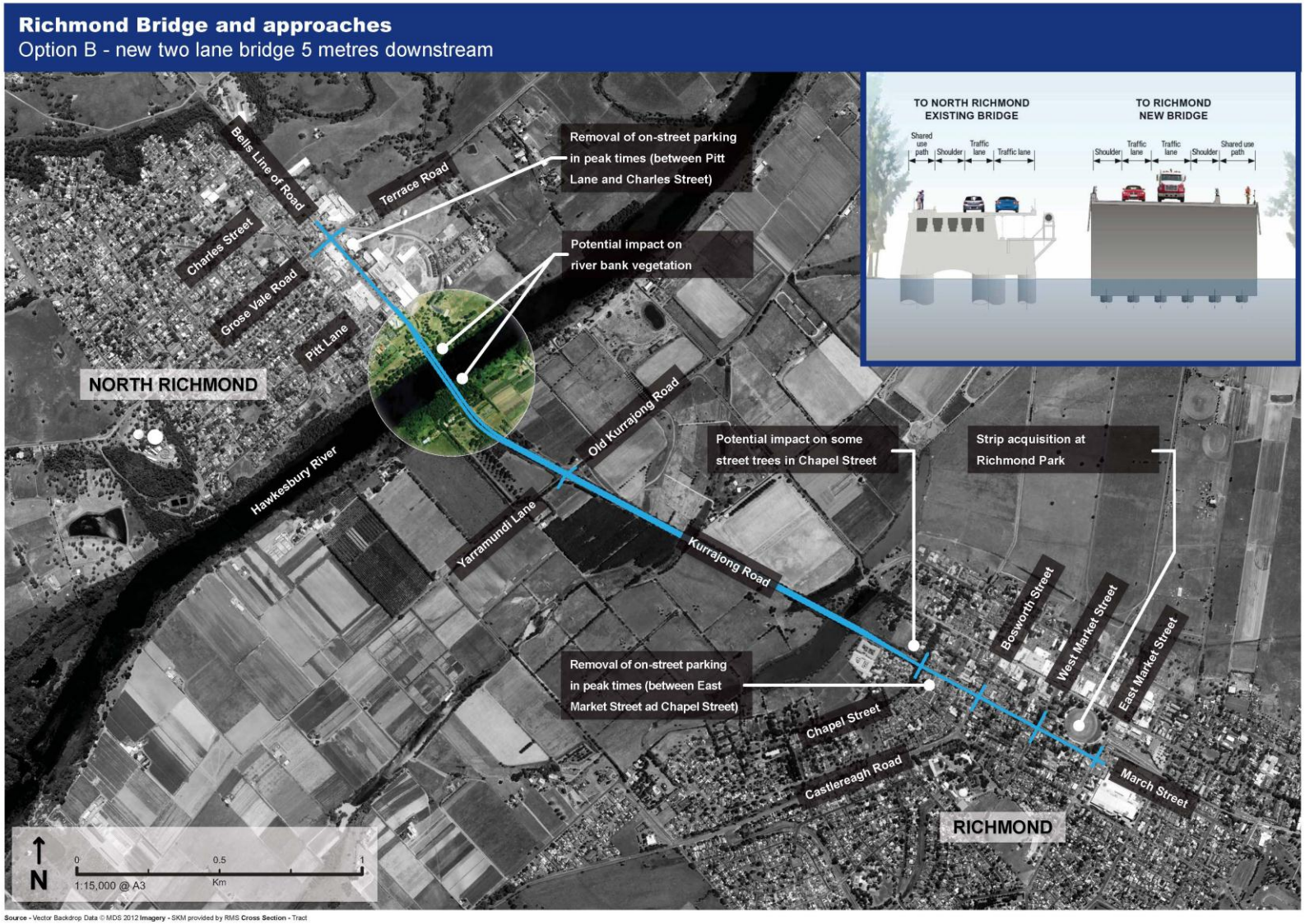
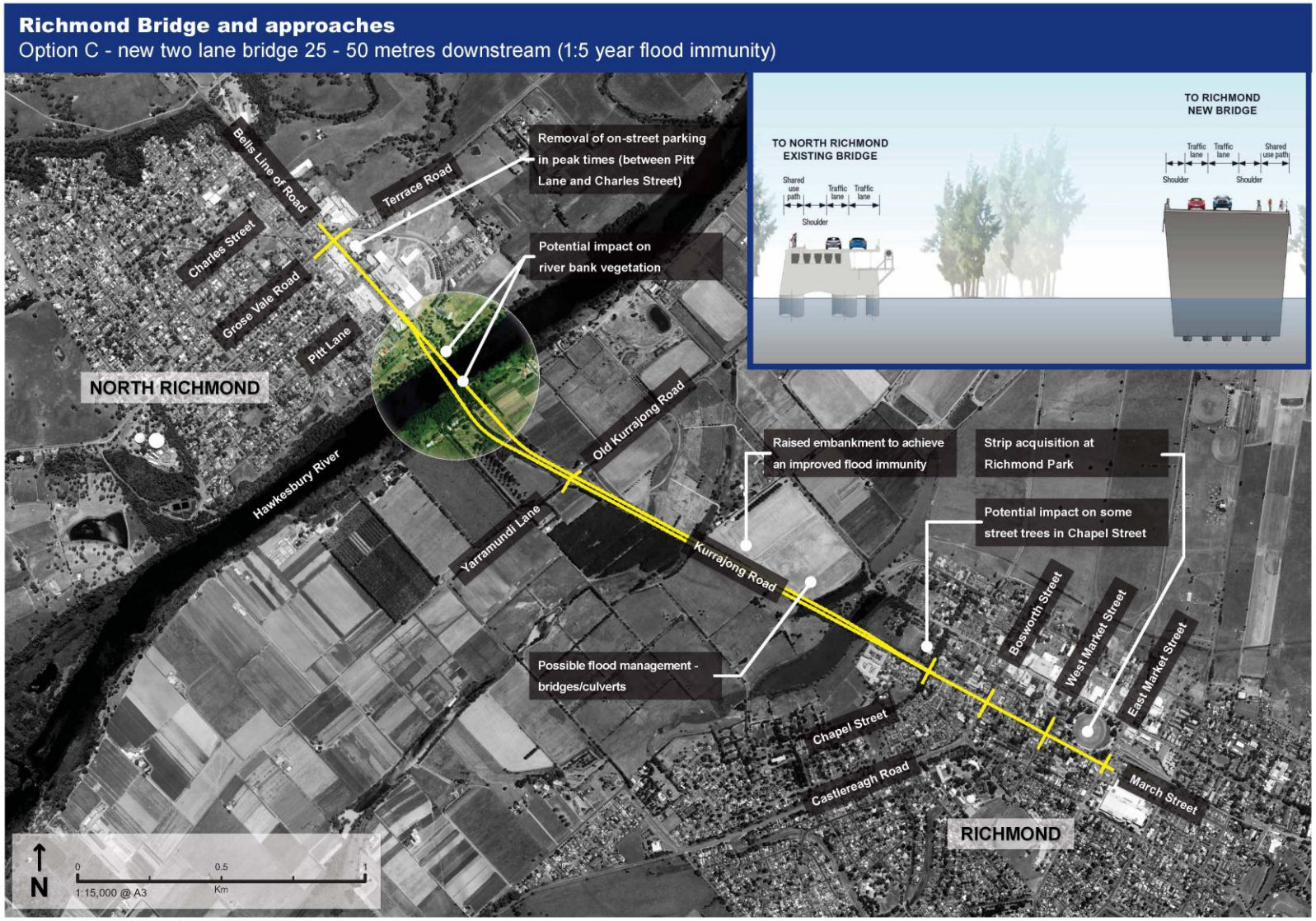
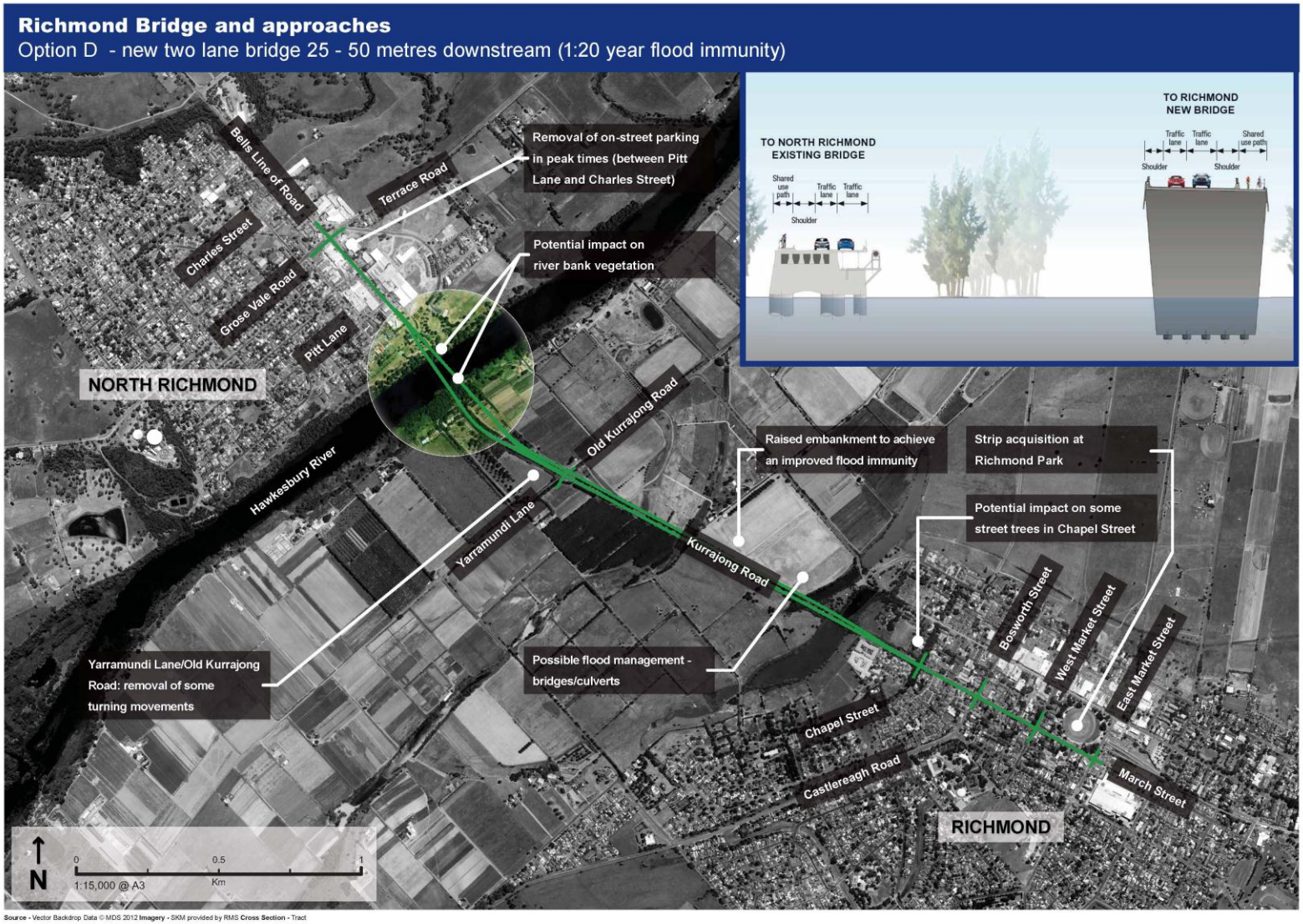
Option B


Richmond Bridge and approaches
Option B - new two lane bridge 5 metres downstream
TO NORTH RICHMOND EXISTING BRIDGE
TO RICHMOND NEW BRIDGE
Shared use path
Shoulder
Traffic lane
Traffic lane
Shoulder
Traffic lane
Traffic lane
Shoulder
Shared use path
Removal of on-street parking in peak times (between Pitt Lane and Charles Street)
Potential impact on river bank vegetation
Potential impact on some street trees in Chapel Street
Strip acquisition at Richmond Park
Removal of on-street parking in peak times (between East Market Street ad Chapel Street)
Bells Line of Road
Terrace Road
Charles Street
Grose Vale Road
Pitt Lane
NORTH RICHMOND
Hawkesbury River
Old Kurrajong Road
Yarramundi Lane
Kurrajong Road
Bosworth Street
West Market Street
East Market Street
Chapel Street
Castlereagh Road
March Street
RICHMOND
N
0
0.5
1
Km
1:15,000 @ A3
Source - Vector Backdrop Data © MDS 2012 Imagery - SKM provided by RMS Cross Section - Tract

Option C


Richmond Bridge and approaches
Option C - new two lane bridge 25 - 50 metres downstream (1:5 year flood immunity)
TO NORTH RICHMOND EXISTING BRIDGE
TO RICHMOND NEW BRIDGE
Shared use path
Traffic lane
Traffic lane
Shoulder
Traffic lane
Traffic lane
Shared use path
Shoulder
Bells Line of Road
Terrace Road
Charles Street
Grose Vale Road
Pitt Lane
NORTH RICHMOND
Hawkesbury River
Removal of on-street parking in peak times (between Pitt Lane and Charles Street)
Potential impact on river bank vegetation
Old Kurrajong Road
Yarramundi Lane
Kurrajong Road
Raised embankment to achieve an improved flood immunity
Strip acquisition at Richmond Park
Potential impact on some street trees in Chapel Street
Possible flood management - bridges/culverts
Bosworth Street
West Market Street
East Market Street
Chapel Street
Castlereagh Road
March Street
RICHMOND
N
0
0.5
1
1:15,000 @ A3
Km
Source - Vector Backdrop Data © MDS 2012 Imagery - SKM provided by RMS Cross Section - Tract

Option **D**


Richmond Bridge and approaches
Option D - new two lane bridge 25 - 50 metres downstream (1:20 year flood immunity)
TO NORTH RICHMOND EXISTING BRIDGE
TO RICHMOND NEW BRIDGE
Shared use path
Traffic lane
Traffic lane
Shoulder
Traffic lane
Traffic lane
Shared use path
Shoulder
Shoulder
Bells Line of Road
Terrace Road
Charles Street
Grose Vale Road
Pitt Lane
NORTH RICHMOND
Hawkesbury River
Removal of on-street parking in peak times (between Pitt Lane and Charles Street)
Potential impact on river bank vegetation
Old Kurrajong Road
Raised embankment to achieve an improved flood immunity
Strip acquisition at Richmond Park
Potential impact on some street trees in Chapel Street
Yarramundi Lane
Kurrajong Road
Bosworth Street
West Market Street
East Market Street
Yarramundi Lane/Old Kurrajong Road: removal of some turning movements
Possible flood management - bridges/culverts
Chapel Street
Castlereagh Road
March Street
RICHMOND
N
0
0.5
1
1:15,000 @ A3
Km
Source - Vector Backdrop Data © MDS 2012 Imagery - SKM provided by RMS Cross Section - Tract