

Nepean River Green Bridge

Transport Study

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Nepean River Green Bridge

Transport Study

Prepared for

Transport for NSW

Prepared by

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DRAFT**Quality Information**

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Executive summary

The NSW Government has committed \$20 million for a new active transport crossing of the Nepean River between Penrith and Emu Plains. The 'Nepean River Green Bridge' will provide for pedestrians and cyclists who currently use the footpath on Victoria Bridge and for any future active transport demand across the Nepean River.

The new pedestrian and cycling bridge will:

- enable safe walking and cycling for commuters, travel to school, leisure opportunities and tourism;
- address a barrier to walking and cycling accessibility; and
- improve the connections between Penrith and Emu Plains.

AECOM has prepared this transport study, which investigates and evaluates different crossing location options to make recommendations for a preferred crossing location. The key outcomes of the study are to identify:

- the best location for a pedestrian and cycle bridge; and
- access options to the bridge from Penrith and Emu Plains.

Victoria Bridge, which forms part of the heavily trafficked Great Western Highway, has a narrow footpath, which does not meet current design guidelines for cyclists.

Significant investment has been made in pedestrian and cycle infrastructure in the form of shared paths leading to the river from Penrith and Emu Plains, and also along the river bank. These facilities support popular local walks such as the *Bridge to Bridge Walk*, and part of the wider Great River Walk, planned to follow the Hawkesbury-Nepean River from Lake Bathurst to Broken Bay. Users of the existing bridge include social walkers, runners and cyclists, children, students and social sporting clubs.

Nepean River has played a key role in the socio/cultural development of the Penrith area. Evidence of the river's historical importance can be traced (and still experienced to an extent) in the activities, memorials and interpretative signage within the study area.

Key non-Aboriginal heritage sites¹ are significant to the interpretation of the crossing within its historical context and in relation to the recommendations for the upgraded bridge locations. Supporting and minimising impact to existing recreational uses is also an important consideration for the crossing location.

Six potential crossing location options were determined through the existing conditions review and feedback from the stakeholder and community workshop. The six potential location options were identified based on project objectives, and also where access points can be made available through publically accessible locations. The six location options identified are as follows:

- Option 1: Emu Ford
- Option 2: North of Rowing Club
- Option 3: North of Victoria Bridge
- Option 4: On Victoria Bridge
- Option 5: Old Punt Road
- Option 6: Regatta Park

Community and stakeholder consultation was undertaken in two workshops held on 4 May and 24 May 2012, at Penrith City Council. The first workshop was intended to provide an overview of the project and gather local knowledge to feed into the preliminary option process. The second and larger workshop was to present the preliminary options to the community and gain their feedback on the options presented.

¹ Specific information relating to local Aboriginal heritage has not been included in this section. Aboriginal participants from the Deerubbin Land Council were approached about attendance at workshops but were not available to attend.

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Stakeholders and community representatives identified current and potential users of the bridge and also community expectations for an upgraded crossing location that is safe, convenient and cost effective.

Community has also placed a high value on the study section of the river in terms of its aesthetic qualities, local identity, heritage, leisure and sporting activities. The river is highly utilised both on the water and its environs, consequently it is important that the preferred location accommodates community activities and has the potential to enhance recreational, economic and social opportunities into the future.

Community and stakeholder feedback generally indicated a preference for the locations near or on the existing bridge, with option five receiving the most positive feedback.

The prioritisation and ranking of options was undertaken through a multi-criteria analysis, with evaluation criteria determined through review of the government planning and policy review, and community and stakeholder input received throughout the project.

The evaluation criteria fit to four broad themes as follows:

<p>Theme: Safety Criteria: Provides for safety in design Criteria: Minimises network conflict</p>	<p>Theme: Community Criteria: Minimises social impacts Criteria: Maximises community benefits</p>
<p>Theme :Function Criteria: Provides efficient access between Penrith and Emu Plains Criteria: Encourages more people to use the crossing</p>	<p>Theme: Cost Criteria: Minimises construction complexity Criteria: Minimises adverse impacts on local heritage and natural environment</p>

Equal weight was given to the criteria to give an unweighted rank. Increased weighting was then applied to criteria associated safety and transport function, in order to identify the preferred crossing location against project objectives.

The results of the unweighted and transport weighted assessment outcomes are summarised below.

Ranking	Unweighted	Weighted to transport criteria
1	Option 5	Option 5
2	Option 4c	Option 4c
3	Option 6	Option 6
3	Option 4a	Option 4a
5	Option 3	Option 3
6	Option 2	Option 2
7	Option 1	Option 4b
8	Option 4b	Option 1

Option 5 – Punt Road alignment is the preferred location based on the analysis undertaken using both the weighted and unweighted criteria and is illustrated in **Figure 1**. This result is consistent with general feedback provided from the community and stakeholders.

Option 4c was found to rank second in the desktop analysis. This option is associated with a cantilever structure on the southern side of the bridge, however heritage and construction complexity would need further investigation if this option considered.

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Figure 1 Nepean River Green Bridge Preferred Bridge Option



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1.0 Introduction to the project

1.1 Background

The NSW Government has committed \$20 million for a new active transport crossing of the Nepean River between Penrith and Emu Plains. The 'Nepean River Green Bridge' will provide for pedestrians and cyclists who currently use the footpath on Victoria Bridge and for any future active transport demand across the Nepean River.

The existing footpath on Victoria Bridge is narrow, requiring cyclists to dismount. Transport for NSW (TfNSW) therefore requires a transport study to investigate location options for a new crossing and selection of a preferred location.

The new pedestrian and cycling crossing will:

- enable safe walking and cycling opportunities for all users and may create leisure and tourism opportunities;
- overcome the walking and cycling connectivity barrier created by the Nepean River; and
- improve connections between Penrith and Emu Plains.

Figure 2 shows the area considered for this study.

Figure 2: Study area



Source: AECOM 2012

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1.2 Scope of study

The scope of this study is to:

- review relevant policy documents, planning guidelines and studies/reports;
- review current crossing locations and options;
- identify current and future pedestrian and cyclist desire lines between Penrith and Emu Plains;
- determine suitable bridge locations;
- list the key impacts and opportunities for each bridge location;
- determine required supporting pedestrian and cycle infrastructure to link the existing path networks to the new crossing location;
- undertake community and stakeholder consultation to ensure all key impacts and opportunities have been identified; and
- recommend a preferred bridge location.

1.3 Report structure

This report outlines the approach, analysis and findings of the study and is presented in the following sections:

- **Section 2** summarises the government policy and planning guidelines that have shaped and influenced the study;
- **Section 3** describes the existing Nepean River crossing locations, existing conditions for pedestrians and cyclists in the study area, existing users of Victoria Bridge and the local features within the study area;
- **Section 4** identifies potential bridge location options meeting study objectives;
- **Section 5** presents the community and stakeholder consultation process and findings;
- **Section 6** presents the evaluation and identification process of the preferred bridge location option; and
- **Section 7** summarises the findings of the study.

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2.0 State and local government policy

2.1 What policy guidelines have shaped the project?

A range of NSW Government planning and policy documents have been reviewed to understand the strategic context and intent for the Nepean River Green Bridge and helped to determine the key evaluation criteria for the assessment of the bridge location options.

The following NSW Government planning and policy documents have been reviewed:

- Metropolitan Plan for Sydney 2036, NSW Government (Department of Planning & Infrastructure), 2010
- Sydney North West Sub-regional Strategy, NSW Government (Department of Planning & Infrastructure), 2007
- NSW BikePlan, Premier's Council for Active Living , 2010
- Sub-regional Bike Planning Study: Penrith, Premier's Council for Active Living, 2009
- NSW 2021 Plan, NSW Government, 2011
- Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River, NSW Government, 2012

Local planning studies have also been reviewed to inform the development of the bridge location options including:

- Victoria Bridge Penrith – Structural Feasibility Study for the Attachment of a Shared Pathway, RMS 2010
- Jane Street Extension, Penrith City Council, 2011
- Penrith Integrated Transport and Land Use Strategy (PITLUS), 2008
- Penrith Accessible Trails Hierarchy System (PATHS), 2011
- Penrith Regional Infrastructure Strategy, 2008
- Penrith Great River Walk, 2011
- Penrith Lakes Development – Russell Street Connection, 2007
- Hawkesbury – Nepean Action Plan, 1997
- Victoria Bridge at Penrith Interim Report, 1989
- Duplication of Victoria Bridge over the Nepean River Environmental Impact Statement, 1991

The Planning Guidelines for Walking and Cycling, the NSW Bicycle Guidelines and the Walking for Travel and Recreation in NSW guidelines have also been reviewed to inform the development of the bridge location options.

Table 1 shows the key messages of relevance to the study arising from the government planning and policy review.

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Table 1: Government planning and policy documents review

Policy document	Key message
Metropolitan Plan for Sydney 2036	<p>The plan aims to promote equity and social inclusion in the Sydney region and to ensure quality of life, health and wellbeing within the city and that its liveability always improves.</p> <p>Penrith will mature and develop a role similar to Parramatta.</p> <p>Penrith Regional City has an employment capacity of 31,000 jobs and to support these jobs, improved liveability and linkages with the Nepean River is required.</p>
Sydney North West Sub-Regional Strategy	<p>Key action to develop Penrith as a regional city. As a river city, Penrith will provide a focus for innovative business environments, jobs and more lifestyle and work opportunities for a growing part of Sydney.</p> <p>A key direction is to improve access to open space and recreation opportunities including parks and public spaces from the regional to the local level.</p> <p>Promoting the riverside location of Penrith and providing open space as a focus of recreation, cultural, entertainment and community facilities will enhance the attractiveness of Penrith to businesses and residents.</p> <p>The strategy confirms that the NSW Government has committed \$20 million for a new active transport crossing of the Nepean River.</p>
NSW 2021 Plan	<p>A key goal of more than doubling the mode share of bicycle trips made in the Greater Sydney region by 2016 and increasing the mode share of walking trips to 25% by 2016.</p>
The NSW Bike Plan	<p>Identifies construction of over 4,000 kilometres of cycle facilities in NSW and investment of \$78 million over 10 years to grow cycling in Penrith, Liverpool and Parramatta.</p> <p>Penrith will see work start on a shared path along the Great Western Highway west of the city centre.</p>
Sub-Regional Bike Planning Study: Penrith	<p>Improvement of the existing crossing over the Nepean River at Victoria Bridge on the Great Western Highway is required as the current bridge width is considered too narrow to accommodate pedestrians or cyclists in a safe manner.</p>
Sydney Regional Environmental Plan No 20—Hawkesbury-Nepean River	<p>Victoria Bridge is noted under legislation as an item of non-Aboriginal heritage and has not been protected under local environmental planning instruments.</p>

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Table 2 shows the key messages of relevance to the study arising from the local policy review.

Table 2: Local planning studies review

Study	Key message
Victoria Bridge Penrith – Structural Feasibility Study for the Attachment of a Shared Pathway	<p>This study investigates the structural feasibility of attaching a shared pathway onto the southern side of the road bridge over the Nepean River at Penrith, Victoria Bridge.</p> <p>The study considered the feasibility of two structural options:</p> <ul style="list-style-type: none"> - A straight path that requires a structure cantilevered approximately seven metres off the existing bridge; and - A path that curves around the bridge's sandstone pylons. <p>Of the two options considered (straight versus curved alignment), a maximum 2.5metre wide pathway with a curved alignment that follows the profile of the sandstone piers, is:</p> <ul style="list-style-type: none"> - Considered to be structurally feasible. - Cost approximately \$30 to \$35 million in 2010 dollars. <p>A comparison with other possible river crossing options is necessary to determine the optimum solution.</p>
Jane Street Extension, Penrith City Council	<p>An extension from Jane Street to Victoria Bridge has been proposed to relieve the current impacts caused by the congestion on the arterial road network. It is envisaged the extension would improve access into Penrith City Centre.</p>
Penrith Integrated Transport and Land Use Strategy	<p>Proposes improved walking and cycling facilities, especially within 800m of train stations and between pedestrian and cycle traffic generators, e.g. retail and employment zones, schools.</p> <p>Proposes that cycle facilities should be provided on all major residential collector roads in accordance with current standards and guidelines.</p> <p>Identifies a need for a program of road space reallocation on council roads where road space should be reallocated to pedestrians, cyclists and public transport.</p>
Penrith Accessible Trails Hierarchy System	<p>Recommends improved shared path facilities to form a network catering for multiple uses and diverse abilities.</p> <p>Notes that a new shared pathway over Victoria Bridge is part of Council's Vision and Strategic Plan.</p> <p>Recommends a focus on improving cycle connectivity and safety by providing off-road shared paths where possible.</p>
Penrith Regional Infrastructure Strategy	<p>The Physical Public Infrastructure Section identifies that there has been a slight increase in AADT on the Great Western Highway at Victoria Bridge in the 10 years to 2005.</p>
Penrith Great River Walk	<p>There is an opportunity to improve access to Victoria Bridge in order to provide more accessible interpretation and integration into the Great River Walk.</p>
Penrith Lakes Development – Russell Street Connection	<p>Proposed new river crossing (as part of the planned Russell Street link) to link Emu Plains with the Penrith Lakes development via Old Castlereagh Road. The proposed Russell Street link will provide a more direct link with the Penrith Lakes development, ensuring an unsustainable increase in Average Annual Daily Traffic (AADT) does not occur on the existing Victoria Bridge.</p>

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Study	Key message
Hawkesbury –Nepean Action Plan	<p>Identifies the value of the riverine corridor as a significant recreational and tourist asset that must be protected.</p> <p>Strategy is to minimise access points to the river, and minimise the environmental impact of these access points through careful location and design.</p> <p>Plan and manage recreation and tourist developments and associated access points, cycleways and footpaths so as to minimise any adverse environmental impacts on the river.</p>
Victoria Bridge at Penrith – Interim Report	Investigation into ways of increasing capacity of the river crossing and to provide safer conditions for pedestrians and cyclists. Conclusion of report is that a new vehicular crossing (bridge) is recommended to be constructed at the Punt Road site.
Duplication of Victoria Bridge over the Nepean River, Environmental Impact Statement	EIS for a proposal of a new bridge immediately upstream of Victoria Bridge to improve road safety conditions for motorists, pedestrians and cyclists. New bridge to accommodate westbound traffic and to provide a 2.5m shared pedestrian/cycle path. EIS was commissioned by RMS (formerly RTA) in 1991.

Four key criteria for the evaluation of bridge location options have been determined through the review of government planning policies, local planning studies and planning guidelines, namely:

- Safety – ensuring a safe crossing point for pedestrians and cyclists and without conflict with vehicular traffic
- Function –providing access for all transport modes and improved connectivity between Emu Plains and Penrith.
- Community – retaining local values, community culture, providing social benefits and ensuring sustainability.
- Cost – environmental and heritage considerations, and allocated funding for construction.

The key criteria and their role in option assessment are discussed further in **Section 5**.

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3.0 Existing conditions

This section describes the existing conditions in the study area. This includes the existing use of Victoria Bridge, the local features of importance and a transport appraisal of the area that will influence the location and development of the proposed Nepean River Green Bridge.

3.1 Nepean River crossing locations

There are currently two crossings of the Nepean River in the study area; Victoria Bridge (Great Western Highway) and the M4 Western Motorway.

Victoria Bridge (Great Western Highway)

Victoria Bridge is the oldest existing crossing of the Hawkesbury-Nepean River. It was built in 1867 and currently accommodates three transport modes; rail services, vehicle traffic and active transport i.e. pedestrians and cyclists.

The railway corridor is located on the northern side of the bridge and serves the Western Line and Blue Mountains Line. A two-lane, two way carriageway serves vehicular traffic between Penrith and Emu Plains and carries an average daily traffic volume of 24,500 vehicles per day (RMS 2011). A 1.3 metre wide pedestrian and cycle share path is located on the southern side of the bridge.

Victoria Bridge, which forms part of the heavily trafficked Great Western Highway, does not comply with current standards for cycling infrastructure. Community members have campaigned for a safer crossing over the river.

Victoria Bridge is also a tourist attraction and a centrepiece to sporting events along the Nepean River. Consideration has been previously given to upgrading the existing bridge with a separated shared path addition. RMS completed a structural feasibility study into attaching a shared pedestrian/cyclist pathway onto the southern side of Victoria Bridge in November 2010. The study considered the feasibility of two structural options:

- A straight path that requires a structure cantilevered approximately seven metres off the existing bridge; and
- A path that curves around the bridge's sandstone pylons.

Of the two options considered, a maximum 2.5metre wide pathway with a curved alignment that follows the profile of the sandstone piers was:

- Considered to be structurally feasible.
- Cost approximately \$30 to \$35 million in 2010 dollars.

A comparison with other possible river crossing options was considered necessary to determine the optimum solution.

M4 Western Motorway

The M4 Western Motorway (M4) is the most heavily used crossing, by vehicles, over the Nepean River. It carries an average of 55,000 vehicles per day (RMS, 2011). The M4 is a 40 kilometre motorway which extends from Concord in Sydney's inner west to Lapstone at the foothills of the Blue Mountain. It is a strategic route through the inner western and western suburbs of Sydney to the Blue Mountains.

There is a shared path on either side of the bridge for pedestrians and cyclists.

3.2 Transport appraisal

Pedestrian and cycle infrastructure

Great River Walk

The Great River Walk is a recreational trail that is planned to follow the Hawkesbury-Nepean River from its source at Lake Bathurst near Goulburn, to Broken Bay, approximately 570 kilometres north.

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The Penrith section of the Great River Walk is planned between the M4 and Victoria Bridges and will take advantage of the views of the Nepean River and Blue Mountains. It will provide access for walkers, runners, cyclists, mobility impaired, canoeists and horse riders.

The Penrith section of the walk has been jointly funded by Penrith City Council and the NSW Government under the Metropolitan Greenspace Program. Features such as viewing platforms are proposed along the walk.

Bridge to Bridge Walk

The Bridge to Bridge Walk is a seven kilometre recreational trail following the banks of the Nepean River in Penrith and forms part of the Great River Walk. It crosses over the Nepean River using the M4 bridge at the southern end and Victoria Bridge at the northern end.

The trail includes a pedestrian and cycle path, a boardwalk and a bridge which traverse an otherwise inaccessible area.

The walk is a commonly used recreational path for joggers, walkers, families, scooters, bikes, and dog walking. The walk is situated adjacent to picnic areas, children's play equipment, barbeques and gazebos, public toilets and other public amenities.

Local network

A site visit was undertaken in April 2012 to confirm the existing pedestrian and cycle network and infrastructure and to identify issues and opportunities for the Nepean River Green Bridge. Existing and proposed pedestrian/cycle infrastructure was also related to the planned network defined in the Metropolitan Sydney Bike Network.

Existing off road shared use paths are located on:

- High Street, between Memorial Avenue and Station Street;
- Mulgoa Road, between Jane Street and Jamison Road;
- River Road, between Regatta Park and the M4; and
- Along the eastern bank of the Nepean River north of Victoria Bridge to Emu Ford.

The Metropolitan Sydney Bike Network identifies off-road shared use paths for pedestrians and cyclists along key routes within Penrith and Emu Plains. Priority routes identified in proximity to the study area include:

- The Great Western Highway, between Victoria Bridge and Emu Park;
- Nepean Avenue, between Victoria Bridge and the M4;
- Castlereagh Road, between Jane Street and Castlereagh Road;
- Jane Street; and
- River Road, between Punt Road and the southern end of Regatta Park. This section of path has been identified as a key route for the Great River Walk.

The existing and proposed shared paths are shown on **Figure 3**.

Traffic demand

Victoria Bridge is a key link between Penrith and Emu Plains and is an important part of the regional transport network between Sydney and the Blue Mountains. It has a daily traffic volume of approximately 24,500 vehicles (RMS, 2009).

The M4 has replaced Victoria Bridge as the most heavily used vehicle crossing in Penrith with a daily traffic volume of approximately 54,500 vehicles, however Victoria Bridge remains an important facility.

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Figure 3: Existing transport context



Source: AECOM, 2012

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Accident history

Accident data has been obtained for a five year period between 2006 and 2010 for the suburbs of Penrith and Emu Plains.

A total of seven crashes occurred on the eastern approach to Victoria Bridge. Four crashes occurred at the intersection of the Great Western Highway/Ladbury Avenue and three crashes occurred on the Great Western Highway between Ladbury Avenue and Victoria Bridge. One crash involved a pedestrian at the intersection of the Great Western Highway/Bruce Neale Drive.

A total of 20 crashes occurred on the western approach to Victoria Bridge. Sixteen crashes occurred at the intersection of the Great Western Highway/River Road and four crashes occurred on the Great Western Highway between River Road and Victoria Bridge. One crash at the intersection of the Great Western Highway/River Road involved a cyclist.

One crash occurred on Victoria Bridge but this did not involve a pedestrian or cyclist. The data however does not account for near-misses or unreported accidents.

The historical crash data highlights that the majority of vehicle crashes, and the only recorded pedestrian and cyclist crashes, were found to occur at intersection locations. This indicates that the introduction of additional intersections or crossing points as part of the crossing access strategy needs careful consideration with regard to safety. Pedestrian and cyclist crash locations within the study area are shown on [Figure 3](#).

3.3 Local heritage and culture

The city of Penrith is located on the Cumberland Plain, on the western fringe of Sydney. It is located at the foot of the Blue Mountains and is bordered by the Great Western Highway, M4 and the western rail line which runs east/west through the centre of the city towards the Nepean River, crossing via Victoria Bridge.

The city is highly populated with the areas to the north and south mostly used for agricultural purposes. The east and west largely consist of residential development. The study area itself includes residential properties in Penrith on the east bank of the river and Emu Plains on the western bank, parklands, recreational pathways on both sides of the river, and a riparian zone to the north west of the study area.

The Nepean River has played a key role in the socio/cultural development of the Penrith area however it also played a significant role in the economic development and expansion of colonial New South Wales. Evidence of the river's historical importance can be traced (and still experienced to an extent) in the activities, memorials and interpretative signage within the study area.

From the earliest days of the colony Emu Ford and Punt Road have been used as crossings, with Emu Ford being integral to exploration to the west and the crossing of the Blue Mountains by Blaxland, Wentworth and Lawson in 1813. In 1814 William Cox was commissioned by Governor Macquarie to build the first road through the Blue Mountains, commencing their monumental task at Emu Ford. From 1815 a ferry transported people and goods across the river near Punt Road, with a punt constructed by 1823 and used continuously until the 1850s. In 1851 James 'Toby' Ryan, a local businessman and MLA for Nepean in the 1860s, built Emu Hall and subsequently headed a consortium of investors wanting to erect a toll bridge over the Nepean River. The Penrith Nepean Bridge Company was formed and a timber bridge was opened in January 1856. The bridge was destroyed by flood in 1857, reconstructed, and again destroyed in 1860. There is anecdotal evidence that the tollhouse still exists in the grounds of Emu Hall.

By the 1860s planning was underway for the western rail line and a combined rail and road bridge was to be constructed as part of the Penrith to Weatherboard (Wentworth Falls) rail line. Designed by Engineer-in-Chief of Railways, John Whitton, Victoria Bridge was constructed between 1864 and 1867. It is an important part of the history of the state's transport technology, being the first successful bridge crossing of the Nepean River at Penrith and one of the earliest metal bridges constructed in NSW. Since it was originally constructed, Victoria Bridge has undergone various modifications but remains the oldest surviving bridge on the NSW rail system.

It is the rowing tradition of Penrith, however, which currently tends to dominate the broader sporting/cultural activities of the area and for which Penrith and the Nepean River are internationally recognised. The first recorded boat race was said to have occurred in the early 1850s, with the Penrith Rowing Club opening in 1888 followed by the Nepean Rowing Club in 1928. The Commonwealth Games (then Empire Games) were held on the river in

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1938. Penrith's first Olympic rower competed in the Rome Olympics in 1960. Since then there have been numerous state and international competitions held on the river, including the 2000 Olympic rowing events. The study area also includes residential properties in Penrith on the east bank of the river and Emu Plains on the western bank, parklands, recreational pathways on both sides of the river, and a riparian zone to the north west of the study area.

The following table describes the key non-Aboriginal heritage sites² identified as part of the study. These features are highly significant to the interpretation of the crossing within its historical context and their importance in relation to the recommendations for the upgraded bridge locations cannot be underestimated.

The local heritage and cultural features are described in **Table 3** and the location of these features are shown in **Figure 4**.

Table 3: Local heritage and culture

Heritage feature	Significance	National and NSW interpretation themes	Associations
Emu Ford (in use before 1813)	Historical significance: First crossing of the Nepean River	3. Developing regional and national economies/exploration	Early explorers from early 19 th century Coxs Road construction 1814 Macquarie era economic expansion and settlement of the colony
Punt Road road reserve	Historical significance Remnants of linkage to earliest ferry and punt crossings of the river	3. Developing regional and national economies/transport	Earliest movement of goods and livestock across the river, in continuous use from 1815 to 1867 with the construction of Victoria Bridge.
Emu Hall (1851)	Historical, social and associative significance Early residence built by local businessman who financed first bridge crossings of the Nepean River. Residence is bounded by the former punt crossing and the 1867 alignment of the Great Western Highway	4. Settlement – Building settlements, towns and cities/accommodation	James Tobias Ryan, (1818-1899) businessman, entrepreneur and MLA for Nepean 1860-72. Visiting politicians and dignitaries
Old police station memorial – mid 19th century construction, in use as a police station 1891-1908. Burnt down in 1996.	Historical and social significance in the location and style of building of the early police station.	7. Governing/law and order	1891-1908, occupied as residence and police station by 1 st Class Police Constable William Bressington. Memorial within the Punt Road area amongst other heritage features and proposed public art installation.
Near Punt Road			

² Specific information relating to local Aboriginal heritage has not been included in this section. Aboriginal participants from the Deerubbin Land Council were approached about attendance at workshops but were not available to attend.

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Heritage feature	Significance	National and NSW interpretation themes	Associations
Victoria Bridge (cons. 1864-67) Oldest surviving bridge on the NSW rail system	State level historical, associative, aesthetic, social, research, rarity, representativeness significance.	3. Developing regional and national economies/transport	John Whitton, 'Father of Australian Railways' Early rail line development, Penrith to Weatherboard (Wentworth Falls) 'cutting edge' British technology in construction
Penrith Rowing Club 1888 Nepean Rowing Club 1928	Social significance: Boat racing and rowing on the river continuously since 1850s State, national and international competitions	3. Developing regional and national economies/events 8. Developing Australia's cultural life/ sport/leisure	Calendar of significant events - rowing competitions at local, state, national and international levels Local sporting champions, Olympic athletes, training and recreational activities
Weir and pumping station Sandbag weir 1902 Present concrete weir 1908	Technological significance: Essential to the early water supply for the township of Penrith Social significance: Popular boating and swimming location	4. Building settlements, towns and cities/utilities 8. Developing Australia's cultural life/ sport and leisure	Water supply to support growing population Water sports as an important part of the local culture and economic development
Site of the Log Cabin	Social and historical significance in the continuous use of site as an inn since early 19 th century. Current Log Cabin Inn is a local landmark, capturing excellent views of the bridge and river within the study area.	3. Developing regional and national economies/commerce 4. Building settlements, towns and cities/transport	Early staging location and accommodation More recently associated with economic and social life of the area due to location on the river. It sits between the original crossing locations of Emu Ford to the north and the ferry/punt to the south.
Emu Ford (in use before 1813)	Historical significance: First crossing of the Nepean River	3. Developing regional and national economies/exploration	Early explorers from early 19 th century Coxs Road construction 1814 Macquarie era economic expansion and settlement of the colony

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Figure 4: Local features



Source: AECOM, 2012

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3.4 Victoria Bridge users

Current users of Victoria Bridge include walkers, cyclists and school groups.

Cyclists vary from children and the elderly, commuters and social riders to racers and fitness riders. Pedestrian users include children, the elderly, parents with prams, commuters and social walkers, dog walkers, fitness walkers/runners and triathletes.

The bridge is used by students from McCarthy College to access sporting facilities and to access Penrith City Centre. Students particularly use the crossing on Thursdays to get to the train station as school closes early at 2.30pm.

In 2011, Nepean High School organised regular 'river circuit' runs utilising Victoria Bridge as a crossing point. However, some organised extracurricular activities avoid the existing crossing due to prevalent safety concerns. Consequently, students are directed to the M4 bridge crossing, organised walkathon as an example.

Victoria Bridge is also in use by social clubs such as the Penrith Cycle Club and Nepean Triathlon Club, with regular rides and running courses crossing the Nepean River at this location.

Information relating to current users of the existing Victoria bridge was primarily attained through the community and stakeholder consultation activities undertaken, described in **Section 5**.

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4.0 Bridge location options

Six potential bridge locations have been determined through the existing conditions review and feedback from the stakeholder and community workshop. The six potential location options are based on the items of consideration identified in **Section 3**, and where access points can be made available through publically accessible locations. The six locations identified are as follows:

- Option 1: Emu Ford
- Option 2: North of Rowing Club
- Option 3: North of Victoria Bridge
- Option 4: Victoria Bridge
- Option 5: Old Punt Road
- Option 6: Regatta Park

An additional option was also identified during Workshop 2 by participants, which was located south of the existing Victoria Bridge crossing and required access through private property. This option is acknowledged, however cannot be considered further at this stage because it requires resolution of access through private property, and could not be implemented within the study timeframe.

4.1 Option 1: Emu Ford

Option 1 proposes a new crossing at Emu Ford as shown in **Figure 5**. Potential connections to the Option 1 crossing location from the wider network are via High Street, Bruce Neale Drive and Old Ferry Road to the east and Great Western Highway and Punt Road to the west. Potential access strategies through use of existing network links and potential upgrades to the Option 1 bridge location include:

Penrith City to bridge

Route 1 Via Bruce Neale Drive	<ul style="list-style-type: none"> - Use existing shared path on the south side of High Street to Bruce Neal Drive. - Crossing facility required to allow access to Bruce Neale Drive. - Existing path under railway line may require upgrade or widening to allow pedestrians and cyclists to be separated from vehicle traffic. - Approximately 550m of shared path may be required, following Bruce Neale Drive alignment to existing shared path on eastern bank of river, and to bridge location ramps providing access to bridge. - Ramp to provide connection from path on river bank to bridge.
Route 2 Under existing Victoria Bridge	<ul style="list-style-type: none"> - Use existing shared path on the south side of High Street to Bruce Neal Drive. - Continue on existing High Street shared paths to Ferry Road access. - Ramp may be required to allow access for all users to the shared path on the river bank. - Continue on shared path (approximately 770m) to ramps providing access to bridge location.

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Emu Plains to bridge

- Route 1**
- Existing path available on southern side of the Great Western Highway however may require widening.
- Via Great Western Highway**
- Crossing of rail line required via overpass¹, with connections provided from Great Western Highway either from the intersection with River Road or via an additional crossing facility to the north of Stanton Place.
 - From the overbridge approximately 580m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option 1 Bridge.

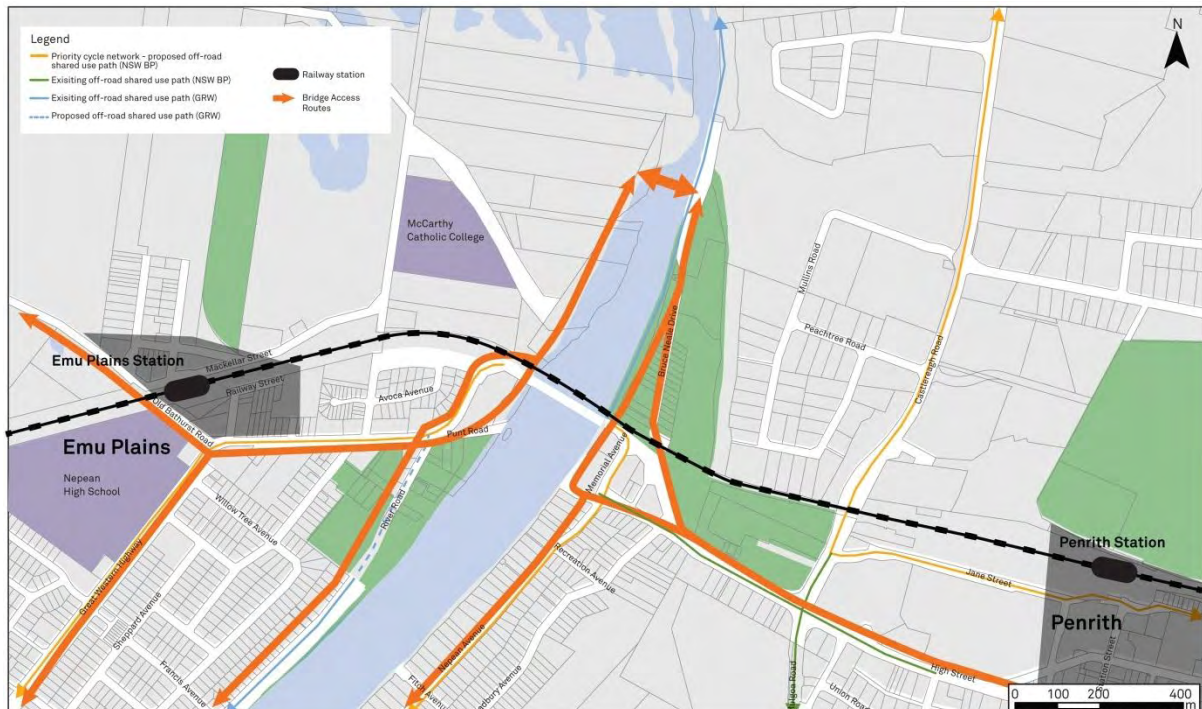
- Route 1**
- Use of existing paths on Great Western Highway to Punt Road (widening may be required).
- Via Punt Road**
- Provision of a shared path following Punt Road alignment, and then continuing to a widened Victoria Bridge underpass (approximately 220m)
 - From the underbridge approximately 580m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option 1 Bridge.

Note:

¹ An overpass is proposed as it is understood that provision of a widened shared path on the south side of Great Western Highway, connecting to an underpass would require land resumption from Emu Hall. This input was provided at the community workshop and is due to existing utilities. It therefore cannot be considered as an access strategy without further investigation.

Ramps would be required for access onto the new bridge from the western and eastern banks of the river. The bridge would need to be built above the 1 in 100 year flood level. The bridge however would not need to allow clearance for river traffic, as commercial fleet and the rowing club do not travel on this section of the river.

Figure 5: Option 1 – Emu Ford



Source: AECOM, 2012

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4.2 Option 2: North of the Rowing Club

The Option 2 crossing is located at a point north of the Rowing Club as shown in **Figure 6**. Connections to the proposed crossing location would be similar to Option 1, with access via High Street, Bruce Neale Drive and Old Ferry Road to the east and Great Western Highway and Punt Road to the west.

Penrith City to bridge

- | | |
|---------------------------------------|---|
| Route 1 | - Use existing shared path on High Street to Bruce Neal Drive. |
| Via Bruce Neale Drive | <ul style="list-style-type: none"> - Crossing facility required to allow access to Bruce Neale Drive. - Existing path under railway line may require upgrade or widening to allow pedestrians and cyclists to be separated from vehicle traffic. - Approximately 350m of shared path may be required, following Bruce Neale Drive alignment to existing shared path on eastern bank of river, and to bridge location ramps providing access to bridge. - Ramp to provide connection from path on river bank to bridge |
| Route 2 | - Use existing shared path on High Street to Bruce Neal Drive. |
| Under existing Victoria Bridge | <ul style="list-style-type: none"> - Continue on existing High Street shared paths to Ferry Road access. - Ramp may be required for access to the shared path on the river bank. - Continue on shared path (approximately 450m) to ramps providing access to bridge location. |

Emu Plains to bridge

- | | |
|----------------------------------|---|
| Route 1 | - Existing path available on southern side of the Great Western Highway however may require widening. |
| Via Great Western Highway | <ul style="list-style-type: none"> - Crossing of rail line required via overpass¹, with connections provided from Great Western Highway either from the intersection with River Road or via an additional crossing facility to the north of Stanton Place. - From the overbridge approximately 220m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option 2 Bridge. |
| Route 1 | - Use of existing paths on Great Western Highway to Punt Road (widening may be required). |
| Via Punt Road | <ul style="list-style-type: none"> - Provision of a shared path following Punt Road alignment, and then continuing to a widened Victoria Bridge underpass (approximately 220m) - From the underbridge approximately 390m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option 2 Bridge. |

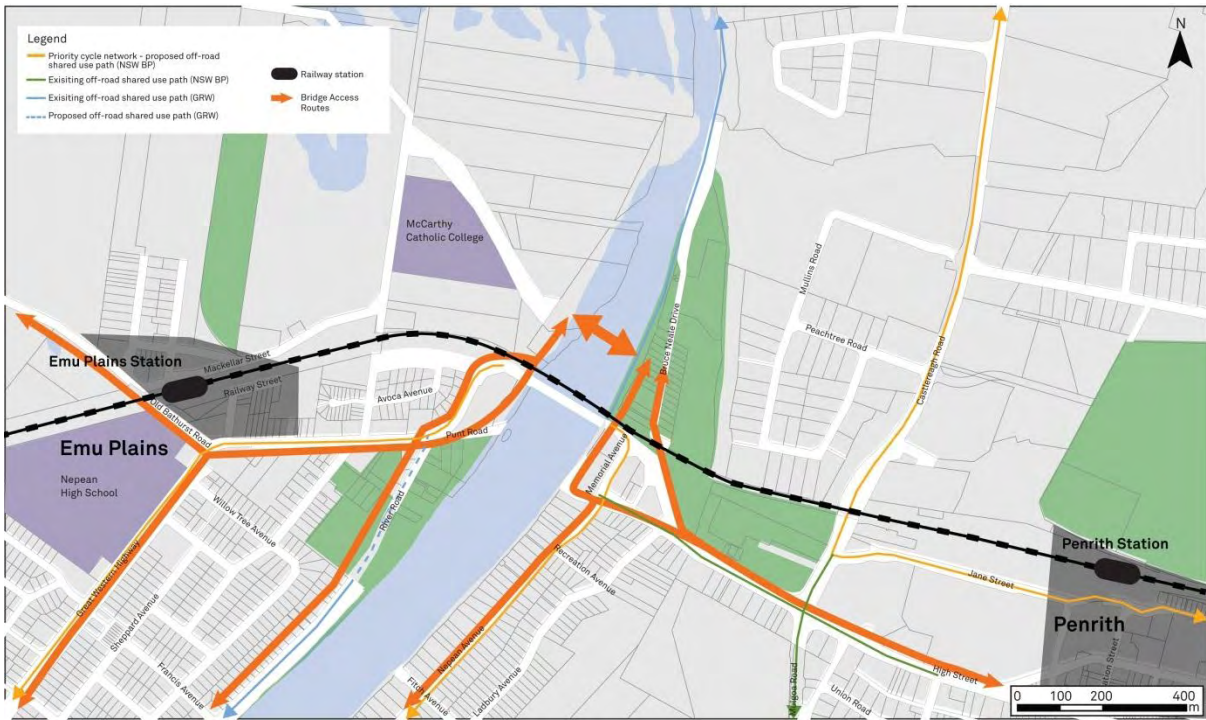
Note:

¹ An overpass is proposed as it is understood that provision of a widened shared path on the south side of Great Western Highway, connecting to an underpass would require land resumption from Emu Hall. It therefore cannot be considered as an access strategy without further investigation.

Ramps would be required for access onto the new bridge from paths located on the river bank. The bridge height would need to meet vertical clearance requirements for canoes, and rowing boats and be built above the 1 in 100 year flood level. The bridge may need to be as high as the existing Victoria Bridge (10m) if it is located within the path of commercial boats such as the Nepean Belle and Platypus.

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Figure 6: Option 2 – North of Rowing Club



Source: AECOM, 2012

4.3 Option 3: North of Victoria Bridge

Option 3 proposes a new crossing at a point north of Victoria bridge, but south of the Rowing Club as shown in **Figure 7**. Connections to the proposed crossing location are via High Street, Bruce Neale Drive and Old Ferry Road to the east and Great Western Highway and Punt Road to the west.

Penrith City to bridge	
Route 1	- Use existing shared path on High Street to Bruce Neal Drive.
Via Bruce Neale Drive	- Crossing facility required to allow access to Bruce Neale Drive.
	- Existing path under railway line may require upgrade or widening to allow pedestrians and cyclists to be separated from vehicle traffic.
	- Approximately 250m of shared path may be required, following Bruce Neale Drive alignment to existing shared path on eastern bank of river, and to bridge location ramps providing access to bridge.
	- Ramp to provide connection from path on river bank to Option 3 bridge
Route 2	- Use existing shared path on High Street to Bruce Neal Drive.
Under existing Victoria Bridge	- Continue on existing High Street shared paths to Ferry Road access.
	- Ramp may be required for access to the shared path on the river bank.
	- Continue on shared path (approximately 270m) to ramps providing access to Option 3 bridge.

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Emu Plains to bridge

- Route 1**
- Via Great Western Highway**
- Existing path available on southern side of the Great Western Highway however may require widening.
 - Crossing of rail line required via overpass¹, with connections provided from Great Western Highway either from the intersection with River Road or via an additional crossing facility to the north of Stanton Place.
 - From the overbridge approximately 100m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option 3 Bridge.

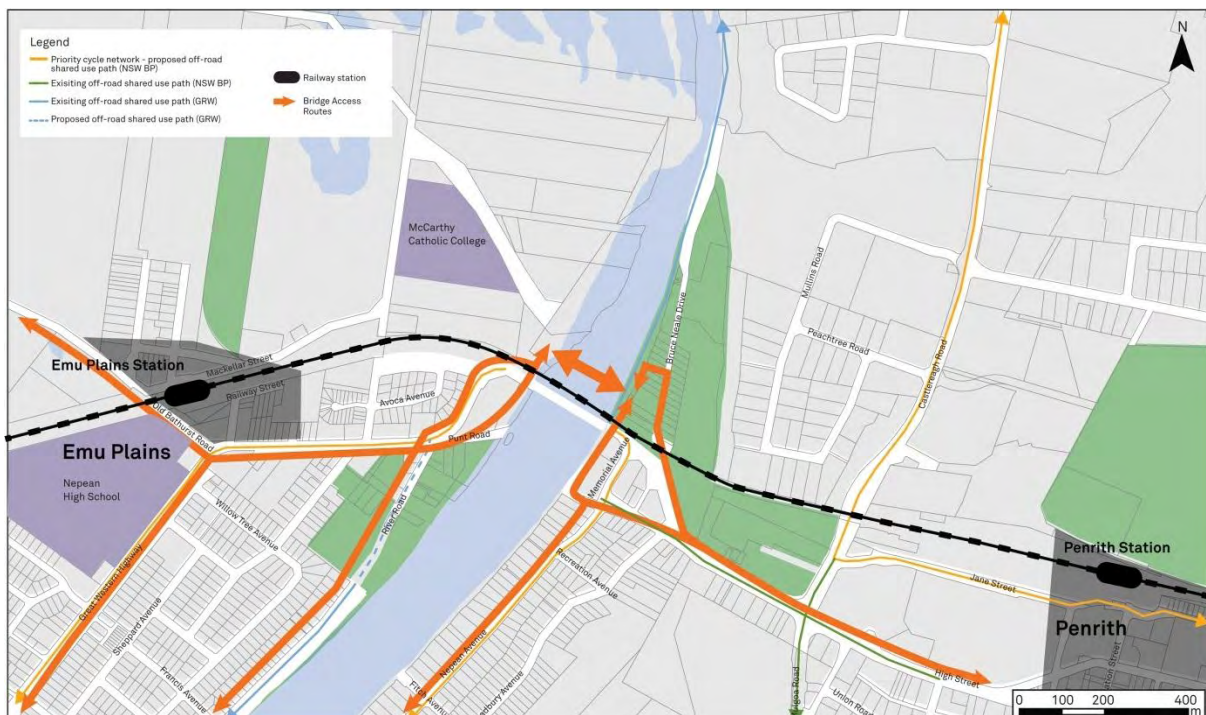
- Route 1**
- Via Punt Road**
- Use of existing paths on Great Western Highway to Punt Road (widening may be required).
 - Provision of a shared path following Punt Road alignment, and then continuing to a widened Victoria Bridge underpass (approximately 220m)
 - From the underbridge approximately 100m of shared path is required along the western bank of the river to the bridge location ramps providing access to the Option3 Bridge.

Note:

¹ An overpass is proposed as it is understood that provision of a widened shared path on the south side of Great Western Highway, connecting to an underpass would require land resumption from Emu Hall. It therefore cannot be considered as an access strategy without further investigation.

Ramps would be required for access onto the new bridge and the bridge would need to be built above the 1 in 100 year flood level. The bridge would need to be as high as the existing Victoria Bridge (10m) as river traffic would need access under the bridge at this section of the river.

Figure 7: Option 3 – North of Victoria Bridge



Source: AECOM, 2012

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4.4 Option 4: Victoria Bridge

Option 4 proposes a new crossing on or immediately adjacent to Victoria Bridge. There are three possibilities for Option 4 as follows:

- Option 4a – a shared pedestrian and cyclist facility on the northern side of the bridge;
- Option 4b – located between the road and rail bridge, above the existing utility pipeline; and
- Option 4c – a shared pedestrian and cyclist facility on the southern side of the bridge.

Potential connections to the proposed crossing location are described as follows:

Penrith City to bridge

Option 4a	- Use existing shared path on High Street to Bruce Neal Drive.
Northern side of Victoria Bridge	<ul style="list-style-type: none"> - Follow High Street to Old Ferry Road access and via ramp to the existing shared path on the river bank. - Continue on shared path under the existing bridge, and through to a new graded ramp connecting to the new cantilevered bridge.
Option 4b	- Use existing shared path on High Street to Bruce Neal Drive.
Between Victoria road and rail bridge	<ul style="list-style-type: none"> - Crossing facility required to allow access to northern side of the Great Western Highway from the shared path located on the southern side of the Great Western Highway. - Shared path and ramp continue from this crossing, between the Great Western Highway and the Railway Line to connect to the bridge located above the utilities pipeline.
Option 4c	- Use existing shared path on Street to Bruce Neal Drive.
Southern side of Victoria Bridge	- Continue on shared path along the southern side of the Great Western Highway to connect to the bridge location.

Emu Plains to bridge

Option 4a	- Route 1 via Punt Road:
Northern side of Victoria Bridge	<ul style="list-style-type: none"> • Use of existing paths on Great Western Highway to Punt Road (widening may be required). • Provision of a shared path following Punt Road alignment, and then continuing to a widened Victoria Bridge underpass (approx. 220m) • Provision of a new ramp connecting to the Option 4a bridge
	- Route 2 via Great Western Highway
	<ul style="list-style-type: none"> • Use of existing paths available on southern side of the Great Western Highway, however may require widening. • Crossing of rail line required via overpass and connecting to Option 4a Bridge. Connections can be provided from Great Western Highway either from the intersection with River Road or via an additional crossing facility to the north of Stanton Place.
Option 4b	- Use of existing paths available on southern side of the Great Western Highway, however may require widening.
Between Victoria road and rail bridge	<ul style="list-style-type: none"> - Connections can be provided from Great Western Highway either from the intersection with River Road or via an additional crossing facility to the north of Stanton Place. - A new shared path would be then be provided between the Great Western

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Highway and rail line, continuing to a ramp connecting to Option 4b.

Emu Plains to bridge (cont.)

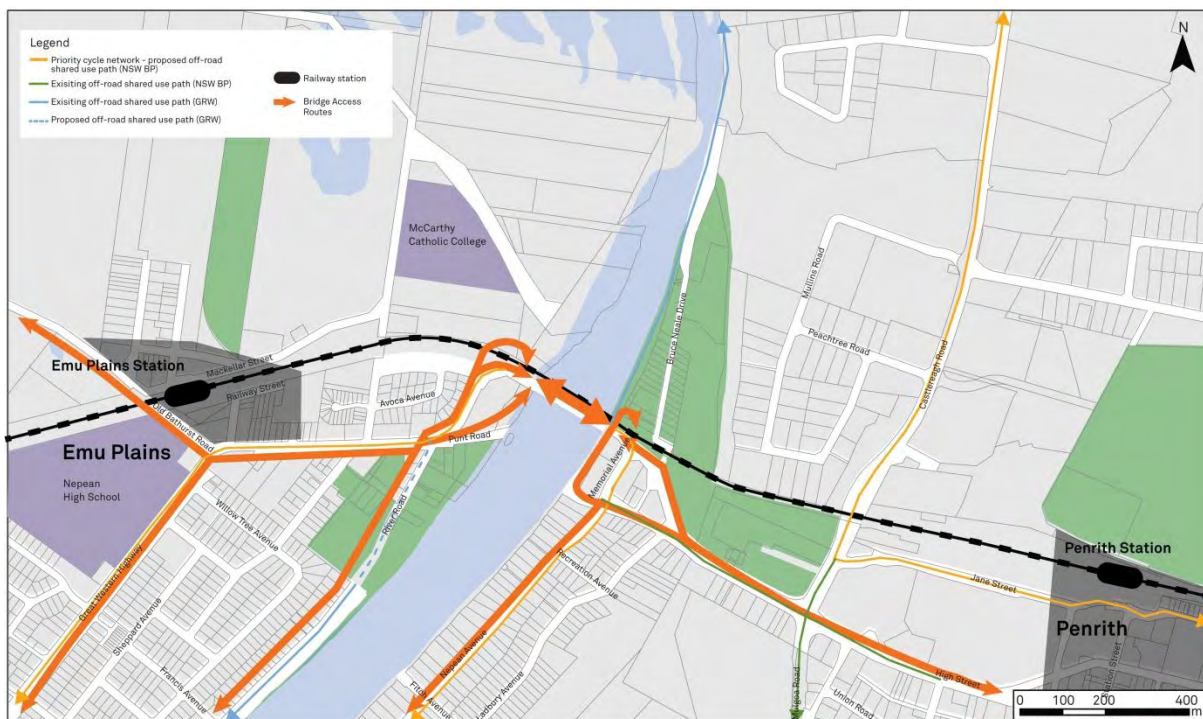
- | | |
|--|--|
| <p>Option 4c</p> <p>Southern side of Victoria Bridge</p> | <ul style="list-style-type: none"> - Use of existing paths on Great Western Highway to Punt Road (widening may be required). - Provision of a shared path following Punt Road alignment, connecting to the ramps onto Option 4c Bridge. The shared path length would be approximately 220m from Punt Road. |
|--|--|

Note:

¹ An overpass is proposed as it is understood that provision of a widened shared path on the south side of Great Western Highway, connecting to an underpass would require land resumption from Emu Hall. It therefore cannot be considered as an access strategy without further investigation.

The bridge would need to be built above the 1 in 100 year flood level. The bridge would need to be as high as the existing Victoria Bridge (10m) as river traffic would need access under the bridge at this section of the river.

Figure 8: Option 4 – Victoria Bridge



Source: AECOM, 2012

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4.5 Option 5: Punt Road

Option 5 proposes a new crossing at Punt Road as shown in **Figure 9**. Connections to the proposed crossing location are via High Street, Memorial Avenue, Nepean Avenue and Old Ferry Road to the east and Great Western Highway, Old Bathurst Road, River Road and Punt Road to the west.

Penrith City to bridge

- Route 1**
- Follow High Street to Old Ferry Road access and bridge location.
 - Ramp may be required to provide connection from Old Ferry Road to bridge (gradient may be required depending on bridge height).

Emu Plain to bridge

- Route**
- Use of existing paths on Great Western Highway to Punt Road (widening may be required).
 - Provision of a shared path following Punt Road alignment, connecting to ramps onto Option 5 Bridge.

Ramps would be required for access onto the new bridge and the bridge would need to be built above the 1 in 100 year flood level. The bridge would need to be as high as the existing Victoria Bridge (10m) as river traffic would need access under the bridge at this section of the river.

Figure 9: Option 5 – Punt Road



Source: AECOM, 2012

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4.6 Option 6: Regatta Park

Option 6 is located south of Regatta Park as shown in **Figure 10**. Connections to the proposed crossing location are via High Street, Memorial Avenue, Nepean Avenue and Fitch Avenue to the east and Great Western Highway and River Road to the west.

Penrith City to bridge

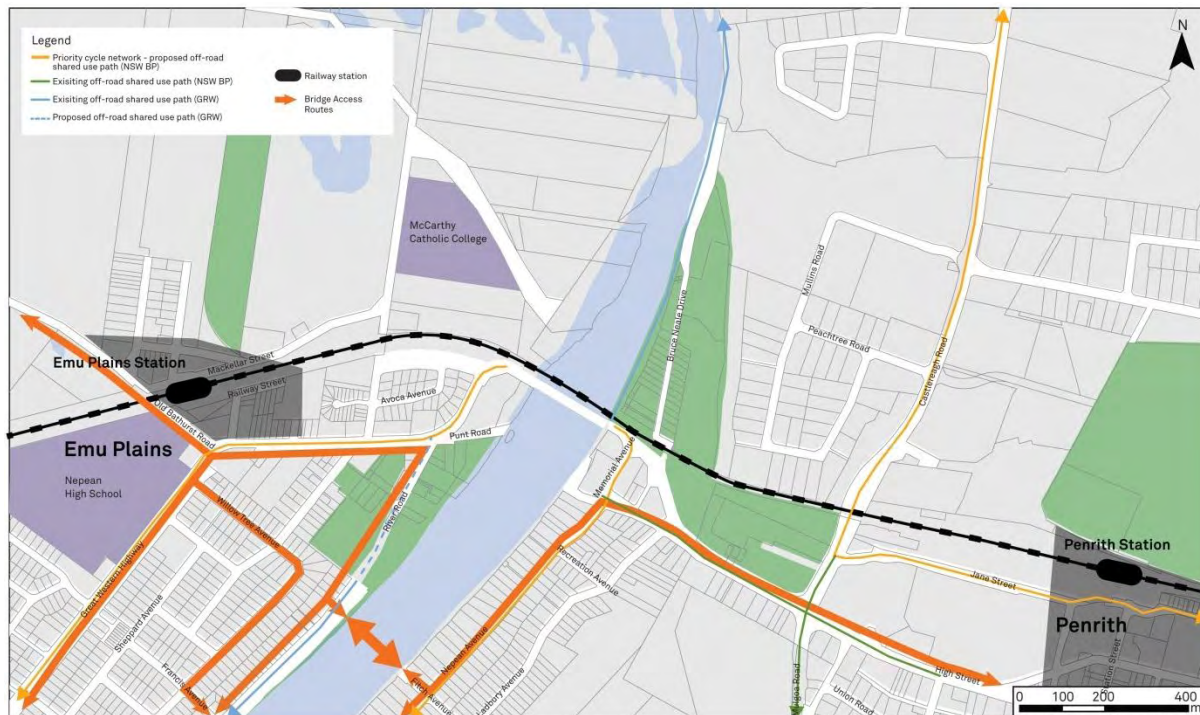
- Route 1**
- Follow High Street to Old Ferry Road using existing shared path.
 - Shared path may be required along the alignment of Nepean Avenue to access the bridge location at Fitch Avenue.
 - Ramp may be required to provide connection from Fitch Avenue to bridge (gradient may be required depending on bridge height).

Emu Plain to bridge

- Route**
- Upgrade of existing footpath along River Road (between Great Western Highway and south of Regatta Park) may be required to accommodate pedestrians and cyclists.
 - Provision of new ramp to Option 6 bridge.

Ramps would be required for access onto the new bridge and the bridge would need to be built above the 1 in 100 year flood level. The bridge would need to be as high as the existing Victoria Bridge (10m) as river traffic would need access under the bridge at this section of the river.

Figure 10: Option 6 – Regatta Park



Source: AECOM, 2012

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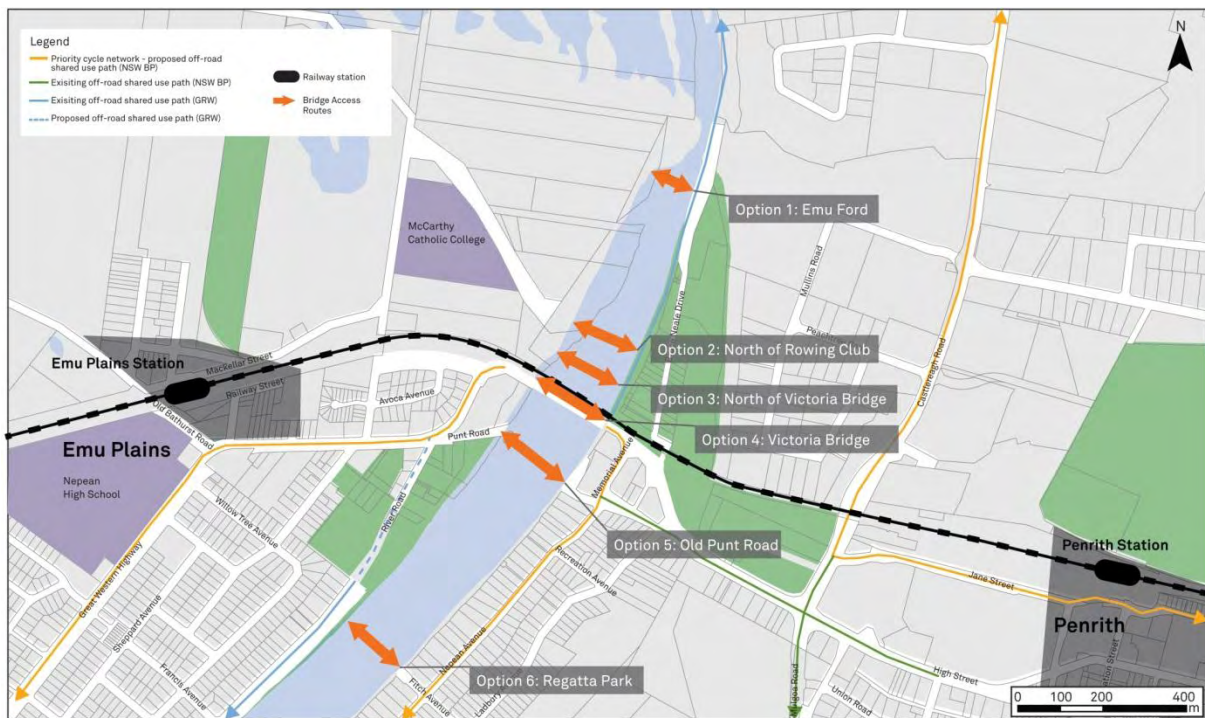
4.7 Summary of bridge location options

Six potential locations for the Nepean River Green Bridge have been determined and are shown on Figure 10.

Connections to the potential bridge locations have been identified and with access strategies capitalising on existing and proposed cycle and pedestrian linkages where possible. Where this is not possible, supporting infrastructure has been identified to provide access connections to the proposed bridge locations.

The options in the vicinity of the existing Victoria Bridge and south of Victoria Bridge would need to be in line with the existing height of Victoria Bridge to accommodate river traffic passing underneath them.

Figure 11: Potential bridge locations



Source: AECOM, 2012

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5.0 Community and stakeholder consultation

5.1 Background and consultation approach

Community interest in an upgraded pedestrian crossing of the Nepean River has been high for several years with users of Victoria Bridge pedestrian access dissatisfied with the level of safety currently existing on the bridge. Consequently the allocation of funding as part of the NSW Government's election commitment to improve cycling and walking connections between Emu Plains and Penrith has been well received by community and stakeholder representatives.

The current study, to investigate and evaluate different crossing locations and options, has a significant community engagement component due to the amount of interest in the project and the number of groups and individuals who would directly benefit from an upgraded crossing. These include leisure and recreational users (walking, running and cycling), students from Nepean and McCarthy high schools, cycle commuters and residents wanting to access Penrith for shopping and business activities, among a range of potential and actual users of the crossing.

5.2 Stakeholder and community consultation methodology

Community and stakeholder consultation was undertaken in two workshops held on 4 May and 24 May 2012 at Penrith City Council. The first workshop provided an overview of the project and gathered local knowledge to feed into the preliminary option process. The second larger workshop presented the preliminary options to the community to gain their input to a multi-criteria analysis.

5.3 Outcomes of Workshop 1

Workshop 1 - Penrith City Council 4 May 2012, 3.00-5.00pm

Identified stakeholders were invited by letter (Appendix A) and a follow up phone call, however the availability of stakeholders was relatively low due to the daytime meeting time, which wasn't well suited for business stakeholders. This was remediated by an evening timeslot for workshop 2.

Workshop 1 content consisted of an introduction and a slide presentation by the project team followed by a facilitated discussion. Feedback forms were provided and notes were taken during the discussion. Stakeholders included representatives from Penrith City Council, Roads and Maritime Services (RMS) and community representatives from the Penrith Cycle Club and Nepean and District Historical Society. While the community representation was low, the information provided by Council, RMS and the community representatives who did attend was of a high quality and gave the project team a detailed overview of the constraints and opportunities from technical and user group perspectives.

Workshop 1 gathered local information and opportunities and constraints across the entire study area. At this stage no crossing options were presented - it was open to participants to comment on any aspect of the project.

The following points were raised during Workshop 1.

Safety

- Ensure safety and wellbeing for existing users (pedestrian/cyclist and vehicle conflicts and pedestrian and cyclist conflicts);
- Improve access and safety for students from local schools such as McCarthy College and Nepean High School to sporting facilities and activities, and to Penrith City Centre;
- Ensure the proposed Nepean River Green Bridge is strategically located to assist with crime prevention.

Access

- Consider that the proposal should be easily accessible, away from vehicle traffic and wide enough to be able to accommodate prams, runners, cyclists comfortably;
- The need to maintain access under the existing Victoria Bridge for local users;

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- Maintain access points to Victoria Bridge, including informal pathways under the bridge, that link well with the proposal to maintain the level of connectivity between Penrith and Emu Plains;
- Consider spatial requirements to accommodate for varying pedestrian and cycle skill levels and reaction time;
- Importance of maintaining access for organised events by social clubs such as Penrith Cycle Club and Nepean Tri Club who hold regular rides and running courses across the existing crossing.

Consideration of different users and activities

- Ensure bridge location does not impose on the existing uses and recreational activities of the river;
- Consider all different user groups and user types;
- Maintain existing uses and recreational activities on the river;
- Retain a clearance zone for boat use on the Nepean River (to the north of Victoria Bridge);
- Consider the operating characteristics to accommodate these users with respect to travelling speeds – ranging from 2km/h to over 30km/h.

Maintain local identity

- The importance of protecting the identity of the Bridge to Bridge Walk as it has been in operation for over 25 years and continues to be used daily;
- The heritage significance of the Old Punt Road alignment;
- Ensure minimal impacts to local features and heritage items (Log Cabin, Emu Hall, Old Punt Road and the view corridor between Victoria Bridge and the M4);
- Raise awareness of the proposed Nepean River Green Bridge.

Summary

Safety and access, as expected, were major considerations in the location of an upgraded bridge, particularly the need to provide safe access for all user types. Issues included visibility, separation from traffic and accommodating diverse groups. In terms of how the bridge and river is used, there is considerable activity in the study area, including a number of social groups and individuals who take advantage of the locale and facilities provided, such as walking and cycling paths along the river banks, particularly the popular *Bridge to Bridge Walk*. Local identity is also valued as are the heritage and environmental features of the area.

5.4 Outcomes of Workshop 2

Workshop 2 - Penrith Library Theatre 24 May 2012, 6.00-8.00pm

The project team presented six preliminary options, taking into consideration feedback received from Workshop 1.

The workshop was held at an evening timeslot in response to community requests, with a broad range of community members from within the study and adjacent areas invited via a letterbox drop. Approximately 800 householder letters were distributed (Appendix B) and 40 stakeholder invitations.

Workshop content and running order consisted of a slide presentation of the six preliminary options and the evaluation criteria or 'themes' that the community was asked to consider for each option.

The themes included:

- Safety – if the crossing location provides safety in design and minimises network conflict.
- Function – providing efficient access between Penrith and Emu Plains and if the crossing would encourage more people to use the crossing.
- Community – Minimises social impacts, maximises community benefits.
- Cost – Minimises construction complexity and adverse impacts on local heritage and natural environment.

This was followed by a facilitated evaluation and discussion as follows:

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Community members, who were grouped into six tables, were asked to consider the options with the aid of feedback sheets. Each option was evaluated by the groups according to the four themes. A group leader was chosen to represent the views of each table and make a short presentation at the end of each round.

Key issues

Safety

Safety received the greatest input with a number of key issues/constraints raised against the options. Themes raised against each of the options included:

Safety	
Option 1	<p>This option was considered to be isolated and secluded, especially at night. Concerns were raised about crime and fear for personal safety. Crossing of the Great Western Highway and the railway were also considered to be safety issues. These safety concerns were related to changes in grade, if steps or steep ramps were required (trip hazard and isolation) and also with regard to exposure to additional traffic on the route to the location.</p> <p>Flooding was identified as an issue, presenting a safety hazard if users were stranded. Lighting was also identified as a design consideration.</p>
Option 2	<p>Similar to Option 1, the majority of responses also considered Option 2 to be isolated and secluded, potentially exposed to crime with a fear for personal safety.</p> <p>Crossing of the Great Western Highway and the railway were again considered to be safety issues with regard to potential changes in grade and increased exposure/conflict with traffic. Option 2 was considered to present safety and security issues for the rowing club.</p>
Option 3	<p>The majority of responses considered Option 3 to be isolated and secluded. It was considered that users of the bridge in this location would be exposed to crime. Flooding and changes in grade and the requirement for steep ramps were also seen as a safety concern at this location.</p> <p>Conflict with traffic for access was identified as a concern as per Option 1 and Option 2. Option 3 was also considered to present safety and security issues for the rowing club.</p>
Option 4	<p>The majority of responses considered Option 4 to be unsafe due to the need for high and enclosed walls and enclosure of shared path on the bridge to protect users from the vehicle and railway traffic and noise, leading to personal security issues.</p> <p>The option however was also considered to be safe due to potential of no change in grade, being in a central location and visible.</p>
Option 5	<p>The majority of responses considered Option 5 to be safe due to the central location of the bridge..</p>
Option 6	<p>The majority of responses considered Option 6 to be safe, in a central location and visible. However a large proportion of responses also considered the bridge location to be isolated and secluded and would produce security issues for local residents.</p>

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Function

The following opportunities and constraints were raised in relation to function:

Function	
Option 1	<p>Most respondents considered Option 1 to be inconvenient for commuters, people with disabilities and school students. It is inconvenient, indirect and too long a distance to travel.</p> <p>The location involved changes in grade and the need for ramps, which would present difficulty for some users.</p>
Option 2	<p>Similar to Option 1, Option 2 is again considered to be inconvenient, indirect and too far away by most respondents.</p> <p>Changes in grade would be required with the need for ramps and the option had no views.</p>
Option 3	<p>Respondents generally thought that Option 3 was inconvenient, indirect and too far to travel, and had no views. There is poor access to the location.</p> <p>Changes in level and the need for ramps were also raised as a concern.</p>
Option 4	<p>The majority of respondents considered this option to have good connections as it follows existing pathways and has direct access between Penrith and Emu Plains.</p> <p>Changes in level, and the need for ramps, were raised as concerns.</p>
Option 5	<p>As with Option 4, this option was considered to have good connections and direct access between Emu Plains and Penrith for the majority of users. It was considered to be convenient and offer a shorter commute and also provide connections between existing pedestrian and cycle links.</p> <p>This crossing location was considered indirect for students from McCarthy college, however provides views of the river.</p>
Option 6	<p>The majority of respondents thought that this option was inconvenient, indirect, too far away and too long a distance to travel for commuters. Option 6 would provide easy access to Regatta Park and the River Walk, however it would provide use for a limited number of users.</p> <p>This crossing location also significantly reduces the <i>Bridge to Bridge Walk</i>.</p>

Community

The following opportunities and constraints were raised in relation to community expectations, impacts and benefits associated with the crossing location.

Community	
Option 1	<p>Respondents generally thought that this option was unsuitable, inconvenient and unlikely to be used by the community. It was also identified to not meet community expectations "too far off the track".</p> <p>The crossing location was not seen to support business opportunities, and seen to be too remote to offer community benefit.</p>
Option 2	<p>As above, this option was considered to be unsuitable, inconvenient, too far away, no views and generally doesn't meet community needs and expectations.</p> <p>Option 2 is likely to adversely impact on the rowing club, in terms of activities and security associated with increase in pedestrian activity. The views from the rowing club would also be compromised.</p>
Option 3	<p>This option is considered to potentially interfere with local rowing club, canoe club and navel cadet activities. It is also likely to compromise the Sandy Brennan Memorial Reserve.</p> <p>It is also considered to have less impact on the local environment.</p>

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Community

- Option 4** This option was considered to have little impact on the local environment, to be a positive option for some users however it does not satisfy all user groups.
- The location was found to not support any business opportunities, meet community expectations, and be strongly impacted by noise from the rail way and road traffic. It was acknowledged that this option would have minimal impact on neighbouring residents.
- Potential access and graffiti of Victoria Bridge was raised as a concern. This was also raised as concern for Emu Hall, as direct access to the Great Western Highway would require land resumption due to existing utilities.
- Option 5** Respondents were generally satisfied with this option however there are concerns about impacts to heritage items, as well as a view that heritage items would be enhanced.
- Option 5 was identified as potentially compromising river views from the Log Cabin Motor Inn, and concern was raised over impacts to the rowing course and residential amenity.
- The opportunity for an “iconic structure”/“community asset”/attraction was raised, together with business and tourism opportunities, and enhanced experience of the river.
- Option 6** This option was considered unsuitable as it has the potential to impact residential areas and significantly reduce the distance of the *Bridge to Bridge Walk*. It was also likely to interfere with local street parking and impact on the Nepean River view corridor.
- Limited commercial benefit was identified at this location.

Cost

The following key issues were raised in relation to the potential financial cost of the crossing and environmental and heritage impacts.

Cost

- Option 1** Most respondents considered the cost of option 1 to be high in terms of construction, additional structures and shared path connections. Flooding and maintenance requirements (vegetation) are also likely to increase cost.
- It was also considered to have the biggest environmental impact, in terms of vegetation removal.
- Option 2** Option 2 received similar comments to Option 1, respondents considered this option to be high cost in relation to construction, additional structures, cost of upgrading existing infrastructure and shared path connections.
- The need for car park and security upgrade in proximity to the rowing club was also identified.
- Option 3** As above, Option 3 was considered to be high in construction costs and additional structures. The need for additional access paths was also identified to increase cost.
- Option 4** This option was considered to have less construction costs by some respondents, although the majority considered it to be high cost in terms of linkages, heritage impacts, upgrades to existing infrastructure and construction of additional structures.
- Perceived value for money was identified by one respondent.
- Option 5** Respondents generally considered the cost of this option lower in terms of the construction of associated infrastructure. In terms of the bridge structure, the option was considered comparable to other options identified. The potential for heritage impacts was identified.
- Option 6** This option was considered to have generally lower costs associated with construction and additional infrastructure, connections and linkages, than other options.

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5.5 Summary of community feedback

Community and stakeholder feedback generally indicated a preference for the locations near or on the existing bridge, with option five receiving the most positive feedback.

It is clear from comments received that community expectation is for an upgraded crossing location that is safe, convenient and cost effective. Community has also placed a high value on the study section of the river in terms of its aesthetic qualities, local identity, heritage, leisure and sporting activities. The river is highly utilised both on the water and its environs, consequently it is important that the preferred location accommodates community activities and has the potential to enhance recreational, economic and social opportunities into the future.

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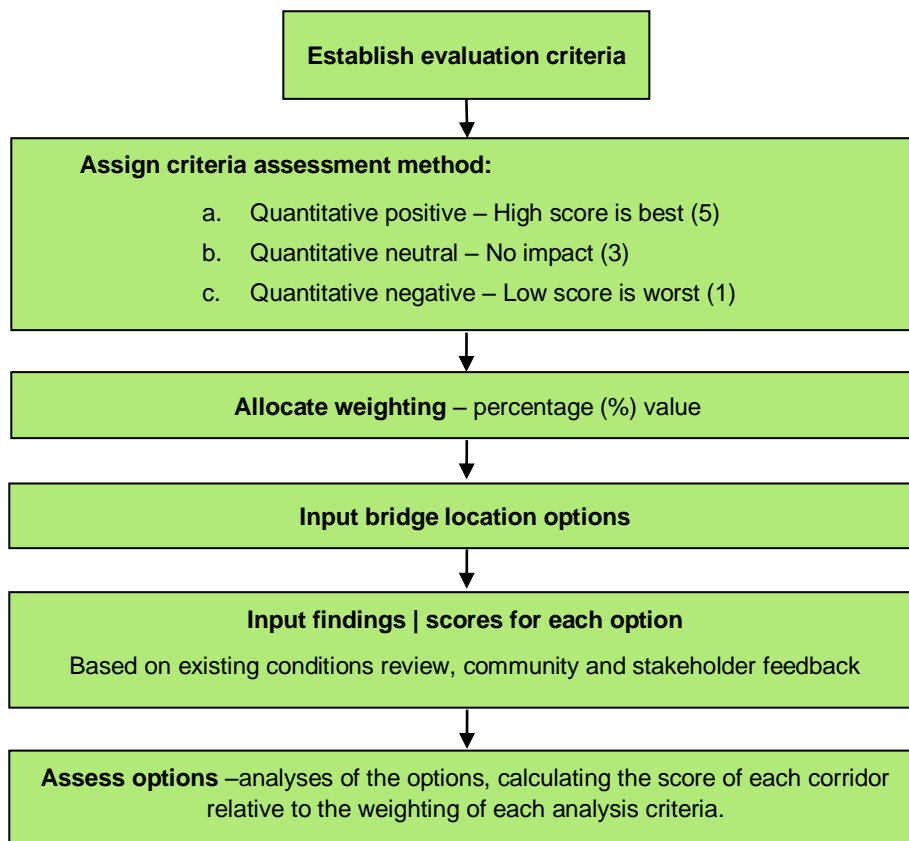
6.0 Options analysis

6.1 Overview

A multi-criteria analysis has been used to rank options across evaluation criteria, with sensitivity tests to consider the importance of the criteria. This multi-criteria analysis considers a range of factors derived from the overarching project objectives, the policy review and community/stakeholder input.

A flow chart summary of the multi-criteria analysis method adopted for this study is shown in **Figure 12**.

Figure 12 Multi-criteria analysis framework



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6.2 Bridge location evaluation criteria

The evaluation criteria fit to four broad themes as follows:

Theme: Safety Criteria: Provides for safety in design Criteria: Minimises network conflict	Theme: Community Criteria: Minimises social impacts Criteria: Maximises community benefits
Theme :Function Criteria: Provides efficient access between Penrith and Emu Plains Criteria: Encourages more people to use the crossing	Theme: Cost Criteria: Minimises construction complexity Criteria: Minimises adverse impacts on local heritage and natural environment

Equal weight was given to the criteria to give an unweighted rank. Increased weighting was then applied to criteria associated with traffic and transport elements, in line with the study focus.

The evaluation criteria and their relative assessment weightings are summarised in **Table 4**.

Table 4 Overview of evaluation criteria

Key issues	Assessment weighting	
	Base weighting	Transport assessment weighting
Criterion 1 – Safety		
A. Does the location provide for safety in design?	25%	33%
B. Does the location minimise network conflict?		
Criterion 2 – Function		
A. Does the location provide efficient access between Penrith and Emu Plains	25%	33%
B. Does the location encourage more people to use the crossing?		
Criterion 3 – Community		
A. Does the location minimise adverse social impacts?	25%	17%
B. Does the location maximise community benefit?		
Criterion 4 – Cost		
A. Does the location minimise construction complexity?	25%	17%
B. Does the location minimise adverse impacts on local heritage and natural environment?		

A score out of 5 (low =1, medium =3, high =5) was given to each sub-criterion for each crossing location option. The score was informed by the background review, site inspection and community/stakeholder feedback.

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6.3 Crossing location assessment outcomes

6.3.1 Unweighted assessment outcomes

The results of the un-weighted assessment are summarised in **Table 5**, followed by key considerations that give rise to the ranking of crossing locations in the multi-criteria analysis.

Table 5 Highest ranked bridge locations (equal weighting across criteria)

Crossing location	Ranking				
	Safety	Function	Community	Cost	Overall
Option 1	8	8	1	5	7
Option 2	3	4	6	4	6
Option 3	3	4	6	2	5
Option 4a	3	3	1	6	4
Option 4b	3	4	5	6	7
Option 4c	1	2	3	6	2
Option 5	1	1	3	2	1
Option 6	3	4	6	1	3

Note: where cells span across multiple ranks, the options have been ranked equally.

Safety

Option 5 and Option 4c scored highest in relation to safety in design. These options were considered to provide the most opportunity for passive surveillance being in proximity to potential places of activity such as Regatta Park. Viewing platforms are proposed as part of the Great River Walk on the river bank, which would increase the perceived safety of the crossing at this location.

Option 1 received the lowest score in relation to safety in design, low scores were also assigned to options located north of the bridge and between the rail and road bridge. These options presented varying degrees of isolation and associated with the remoteness of the bridge location, or need to potentially travel in underpasses or enclosed paths, where it would be difficult to be seen and potentially cause fear about safety, particularly associated with assault.

Option 4c and Option 5 scored highest with regard to minimising network conflict. The access strategies for these crossing are able to capitalise on existing network links and crossings, minimising conflict between pedestrians, cyclists and vehicles. These existing linkages include the shared path on the south of High Street, existing path on River Road and existing signalised intersection at the Great Western Highway and River Road.

Options 1, 2, 3, 4a and 4b scored lower in this category as users may be required to cross the Great Western Highway in order to access the crossing from Penrith. Crossing would also potentially be required on the western side, in order to access a potential rail and road overbridge. Option 6 was also ranked lower as users are potentially directed into residential areas.

Function

The Nepean River Green Bridge is a key element of the NSW Government's election commitment to improve cycling and walking connections between Emu Plains and Penrith. The optimal crossing location aims to meet existing and forecast user desire lines and demand, in order to meet strategic policy goals and sustainable transport and urban objectives.

Option 5 was found to provide the most efficient access between Penrith and Emu Plains, providing a direct linkage between High Street (eastern bank) and onto the Great Western Highway (western bank), receiving the highest score of the options assessed. Options north of the bridge (1, 2 and 3) together with Option 6, were

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ranked lower due to deviation required from user desire lines. This deviation is greater than 1km for Options 1 and 6, and approximately 900m and 500m for Option 2 and Option 3.

The needs and characteristics of the different user groups identified through the community and stakeholder workshops were a key consideration in the scoring of options in relation to whether the crossing location was likely to encourage usage. Option 5 and Option 4c were scored highest, considered to attract some if not the majority of user groups. These options were considered attractive in relation to user experience, such as view corridors, potential ease of access and meeting potential desire lines.

Options such as Option 4b and Option 1 were scored lowest, with changes in grade requiring steps or ramps, increased distance and isolation likely to detract vulnerable users such as the elderly, women and children.

Community

Implications to the community, or 'non-users', of the crossing were considered on two fronts. The first being if any adverse social impacts were associated with the crossing location, and secondly if there were any benefits that could be achieved through the crossing location.

In regard to adverse social impacts, this theme considers adverse impacts to current activities on the river and residential amenity (noise, light and visual intrusion). Option 1 was found to score highest in relation to minimising potential for adverse social impacts. The crossing at this location will have minimal impact to existing residents, and river activities. Options 2, Option 3 and Option 6 were the lowest scoring in this category. Option 2 and Option 3 for the potential impacts to the rowing club operations, this was highlighted during the community workshop where concern was raised in regard to conflict with rowers and also increased activity in proximity to the rowing club shed. Option 6 and Option 5 were ranked lower due to increased exposure to surrounding residents.

Community benefits were identified as opportunities for increasing connection and experience of the river, and potential for social or business opportunities. All options, excluding Option 4b, were seen to provide some community benefit – especially in regard to increased connection and access to the river and view corridors. Option 5 was ranked highest as it also presented opportunities for social activity and small business development.

Cost

With regard to cost, each option was considered with respect to additional infrastructure and maintenance requirements. Potential impacts to heritage, landform, embankments and vegetation were also considered.

Option 1 was scored low in regard to construction complexity due to the additional requirements for shared paths, underpasses and maintenance requirements through vegetated and flood prone land. Options 2 and 3 were ranked low due to similar factors, but with a lesser severity.

Options 4a, 4b and 4c were also ranked low, due to the potential complexity in constructing the bridge on the existing heritage listed Victoria Bridge. All options require changes in level, and also careful construction in order to minimise impact to the heritage listed structure.

Heritage considerations were also taken into account in regard to the low scoring of Option 5, with the landform identified as a heritage constraint.

DRAFT**6.3.2 Sensitivity test outcomes**

The results of the weighted assessment outcomes are provided in **Table 6**. This assessment gives more weight to transport related criteria to reflect the project objectives.

Table 6 Highest ranked bridge locations (equal weighting across criteria)

Ranking	Overall
1	Option 5
2	Option 4c
3	Option 6
3	Option 4a
5	Option 3
6	Option 2
7	Option 4b
8	Option 1

The sensitivity test confirms that Option 5 is the preferred location option, and that similar results are obtained for the ranking of remaining options.

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7.0 Summary and next steps

7.1 Transport assessment

This study has identified and evaluated different crossing location options to recommend a preferred crossing location. Six potential location options were determined through a review of opportunities and constraints and feedback from stakeholders and community workshops. The six locations are:

- Option 1: Emu Ford
- Option 2: North of Rowing Club
- Option 3: North of Victoria Bridge
- Option 4: On Victoria Bridge
- Option 5: Old Punt Road
- Option 6: Regatta Park

Community and stakeholder consultation was undertaken in two workshops held on 4 May and 24 May 2012, at Penrith City Council. Stakeholders and community representatives identified current and potential users of the bridge and also community expectations for an upgraded crossing location that is safe, convenient and cost effective.

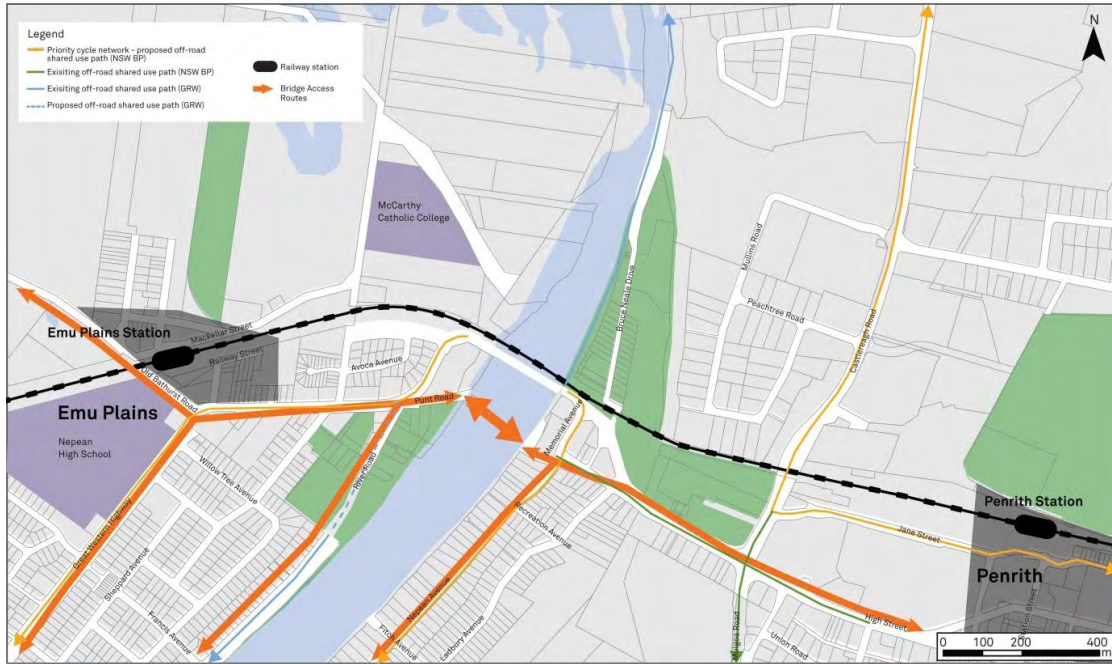
Community has also placed a high value on the study section of the river in terms of its aesthetic qualities, local identity, heritage, leisure and sporting activities. The river is highly utilised both on the water and its environs, consequently it is important that the preferred location accommodates community activities and has the potential to enhance recreational, economic and social opportunities into the future.

Community and stakeholder feedback generally indicated a preference for the locations near or on the existing bridge, with option five receiving the most positive feedback.

A similar conclusion was drawn from an unweighted multi-criteria analysis, and weighted analysis focussing on transport related elements. The analysis indicated that *Option 5 - Punt Road alignment* ranked first of the options assessed, aligning most closely with project objectives and community values. The Option 5 alignment, together with potential access strategies is illustrated in **Figure 13**.

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Figure 13: Option 5 – Punt Road

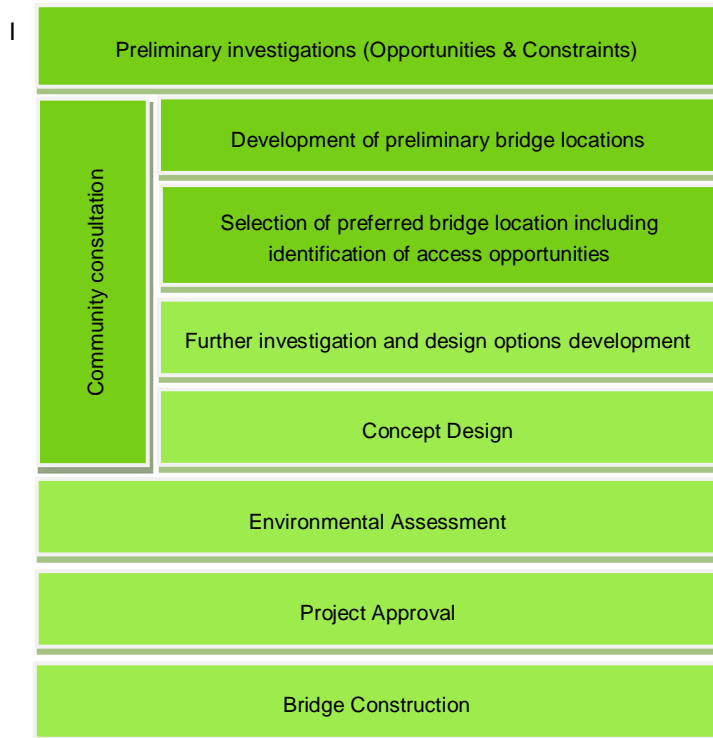


Source: AECOM, 2012

7.2 Next steps

An outline of the Nepean River Green Bridge planning process is illustrated in **Figure 14**, with completed elements of the transport assessment highlighted.

Figure 14 Nepean River Green Bridge **Transport Assessment** and Next Steps



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Appendix A

Invitation letter to workshop 1

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Appendix A Invitation letter to workshop 1

26 April 2012

Name
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Stakeholder Workshop - Nepean River Green Bridge Transport Study

Transport for NSW has engaged AECOM to conduct a study into the location and access options for the Nepean River Green Bridge - a pedestrian and cycle path across the Nepean River. The Nepean River Green Bridge will improve walking and cycling connections between Penrith and Emu Plains.

The study will determine and evaluate options for the crossing location, taking into consideration the needs and concerns of the community and other key stakeholders. The study will consider both commuting and leisure activities, recognising the Nepean River bridge to bridge walk and the local and regional cycle network.

Community feedback is an important part of the study, and any advice from the community will feed directly into the assessment of location options for the crossing.

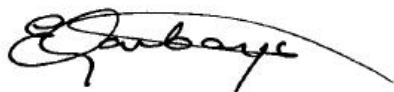
You are invited to participate in a stakeholder workshop. This workshop will introduce the project and give all stakeholders the opportunity to provide input on opportunities and constraints for the location and access options for the Nepean River Green Bridge.

The workshop will be held from 2:00 – 5:00pm on Friday 4 May 2012 at Penrith City Council Chambers, 601 High Street, Penrith.

If you have any questions or would like to RSVP to attend the stakeholder workshop, please contact Wendy Carlson of the Nepean River Green Bridge project team, phone 8934 0653 during business hours or email Wendy.Carlson@aecom.com by Wednesday 2 May 2012.

I look forward to meeting you.

Yours sincerely



Erika Garbayo

Nepean River Green Bridge Transport Study Project Manager, AECOM
T. 8934 0277
E. Erika.Garbayo@aecom.com

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Appendix B

Invitation letter to workshop 2

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16 May 2012

Dear Resident

Community Workshop - Nepean River Green Bridge Transport Study

Transport for NSW has engaged AECOM to conduct a study into the location and access options for the Nepean River Green Bridge - a pedestrian and cycle path across the Nepean River. The Nepean River Green Bridge will improve walking and cycling connections between Penrith and Emu Plains.

This study will determine and evaluate options for the crossing location, taking into consideration the needs and concerns of the community and other key stakeholders. This study will consider both commuting and leisure activities, recognising the Nepean River bridge to bridge walk and the local and regional cycle network.

Community feedback is an important part of this study, and any advice from the community will feed directly into the assessment of location options for the crossing.

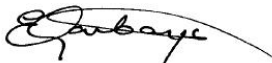
You are invited to participate in a community workshop. This workshop will build on previous input from stakeholders on opportunities and constraints for the location and access options for the Nepean River Green Bridge. We would now like to present the preliminary location options for community comment.

The workshop will be held from 6:00 – 8:00pm on Thursday 24 May 2012 at Penrith City Library Theatre, 601 High Street, Penrith, 2750. Refreshments will be served from 5.30pm, for a 6.00pm start.

If you have any questions or would like to RSVP to attend this community workshop, please contact Wendy Carlson of the Nepean River Green Bridge project team, phone 8934 0653 during business hours or email Wendy.Carlson@aecom.com by Tuesday 22 May 2012.

I look forward to meeting you.

Yours sincerely

**Erika Garbayo**

Nepean River Green Bridge Transport Study Project Manager, AECOM

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