

Appendix B:

Detailed Summary of Network Improvement Options for Shoalhaven River Crossing

Shoalhaven City Council has worked with the RTA over many years to investigate opportunities to improve the road traffic network around Nowra Bomaderry. A report into options for an additional Shoalhaven River crossing was completed in July 2004, and a report subsequent report into options that could extend the life of the existing Shoalhaven River crossing was completed in June 2005. Options for additional river crossings in the vicinity of the existing Princes Highway were identified, however further investigations are necessary prior to a preferred option being selected and this could involve investigation of additional options.

Based on the findings of previous studies the RTA has confirmed that it does not anticipate that an additional crossing of the Shoalhaven River could be justified prior to 2016 however that interim options are being examined that may improve traffic flows on the existing Princes Highway alignment in the short to medium term. It is understood that improving safety and efficiency on the existing Princes Highway through Bomaderry and Nowra will remain the RTA's priority for the foreseeable future.

B.1 Bypass of Nowra

As part of the RTA studies and based on Council's own investigations as part of the Nowra Bomaderry Structure Plan an outer Eastern Bypass route and an Outer Western Bypass route have been investigated. These are considered as Bypass options for Nowra Bomaderry.

As part of its Nowra Bomaderry Structure Plan (NBSP) investigations Shoalhaven City Council found that within the timeframe subject of the NBSP (to 2036) there would be need for substantial upgrade of the existing Princes Highway alignment through Nowra (including additional capacity in vicinity of the existing Shoalhaven River bridges) in addition to a Western Bypass. Council's investigations also revealed that beyond 2036 there may be a need for a further river crossing (in addition to the Western Bypass) subject to the details of the Western Bypass connections to Nowra Bomaderry, and that on this basis a crossing to the far east should not be eliminated from future investigations. There is likely to be significant impacts and costs associated with an outer eastern crossing and accordingly more detailed studies would be required in future to more closely examine potential routes and the benefits, costs, and likely impacts of potential routes.

More details regarding the Western and Eastern Bypass options are provided below in sections B.1.1 and B.1.2.

B.1.1 The Western Bypass

An alignment for a longer term western bypass of Nowra Bomaderry was identified as a corridor in the Illawarra Regional Environmental Plan No. 1, however to date there has been no Western Bypass route adopted in the *Shoalhaven Local Environmental Plan 1985* north of the river (a route has already been adopted in the LEP for the section south of the river). As part of the Nowra Bomaderry Structure Plan investigations the route for the western bypass has been refined from the one adopted by Council in 1992 to avoid sterilising land near Moss Vale Road and to achieve a more appropriate connection for the crossing of the Shoalhaven River. Whilst there have been further minor variations of the corridor in the vicinity of Moss Vale Road in draft form to satisfy flooding accessibility and design constraints, the western bypass alignment between the river and where it reconnects with the existing Highway in Bomaderry (i.e. the full Western Bypass corridor – approximately 16km in total) has been included in the draft Shoalhaven LEP which will soon be on exhibition.

It is proposed to cross the Shoalhaven River approximately 5.5km upstream of the existing bridges at location where the river is approximately 400m wide.

Based on comparable construction costs for the Kiama Bypass and other major regional road projects, it is reasonable to assume that the present day costs of a Western Bypass would be in the range of \$250 Million to as much as \$600 million, and likely to be closer to the higher end of this range when compared to the current cost estimates of the Princes Highway upgrade proposal (Gerringong to Bomaderry).

The scale and cost of the Western Bypass make it a long-term project which will need to be subject to a long term funding commitment from the RTA. Council is having ongoing discussions with the RTA about the Western Bypass which forms part of the Nowra-Bomaderry Structure Plan.

Based on the outcomes of these consultations it is agreed between Council and the RTA that:

- A Western Bypass is not economically feasible in the short or medium term, priority and extensive funding by the NSW State Government is unlikely in the short to medium term and the RTA has no plans to become involved in the Western Bypass for the foreseeable future.
- As most of the existing traffic across the Shoalhaven River has an origin or destination in Nowra Bomaderry, even when a Western Bypass becomes viable in the longer term a significant investment by the State Government would be required in any event along the existing Princes Highway alignment prior to and in addition to a Western Bypass and other important local road upgrade projects such as the North Nowra Link Road and the Illaroo Road to Moss Vale Road Link.

The proposed alignment for a possible future Western Bypass is shown below in **Figure B1**.

In addition to the obvious benefits to the Princes Highway by removal of direct through traffic; dependent on the connections ultimately agreed, the Western Bypass assists to alleviate the impacts of future growth on existing roads to the west of the Princes Highway including their intersections with the Princes Highway and provides the necessary capacity to accommodate growth in through traffic, including seasonal through traffic which has a substantial impact on the Highway.

B.1.2 The Eastern Bypass

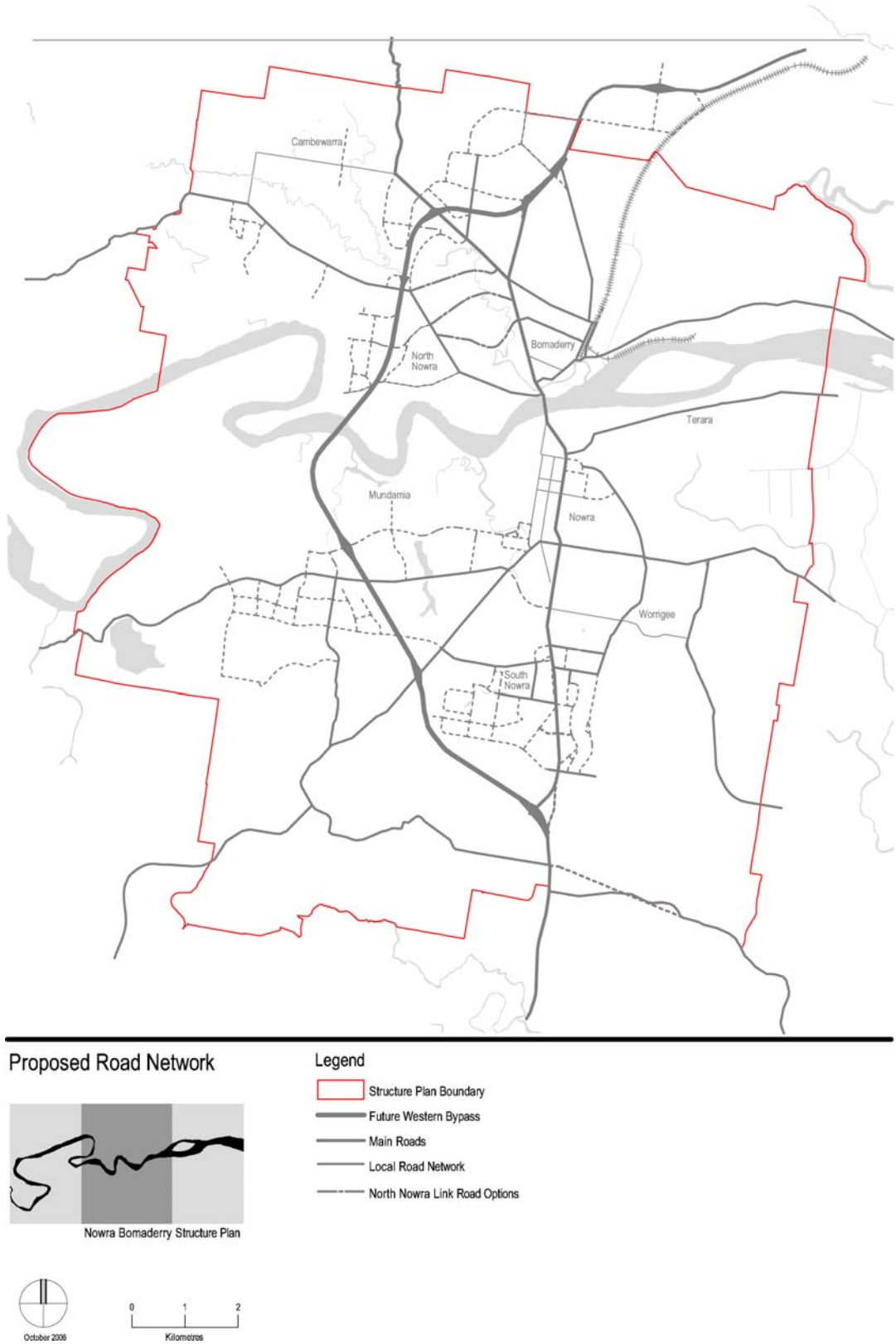
Because of the significant expansion of residential development in the Worrigee area to the east of Nowra, to avoid the residential expansion area an alignment for an Eastern Bypass of Nowra Bomaderry would be significantly longer than a Western Bypass and be constructed for the most part over the Shoalhaven river flood plain.

Two options would be possible for an eastern Bypass with local variations. This includes a 20 km "far east" option which could cross the Shoalhaven River to the east of Pig Island. It would be approximately 4km downstream of the existing bridges at location where the river is approximately 500m wide. This would include some 13km of construction over the Shoalhaven river flood plain.

An alternative crossing location closer to Nowra with the benefit of connecting with the proposed East Nowra Sub-Arterial Road (described in Section 2.2.5 of the EAR) is longer. It would involve a 22 km Bypass route which could cross the Shoalhaven River at the western end of Pig Island, approximately 2km downstream of the existing bridges at location where the river is substantially wider (approximately 1500m). This would include some 15km of construction over the Shoalhaven river flood plain.

Both options would cross Bolong Road, Greenwell Point Road and Forest Road. The longer option closer to Nowra would also cross Millbank Road."

Figure B1 – Proposed Alignment of the Nowra Bomaderry Western Bypass



East of the existing bridges the topography consists of a very wide, low lying flood plain besides a wide river channel. So apart from the longer length, and associated construction costs, to eliminate possible flooding impacts on existing development, consideration would have to be given to bridging the flood plain with significant additional cost implications.

Similar to the Western Bypass, an Eastern Bypass is unlikely to attract enough local and regional traffic to eliminate the need to substantially upgrade the existing Highway alignment including at the Shoalhaven River.

Because of the limited growth potential in the eastern villages east of Nowra, the Eastern Bypass does not eliminate the impacts of future growth on existing roads like the Western Bypass, however it is evident from the analysis that the eastern Bypass corridor has a very strong demand for traffic and Council believes it will need to be further investigated in detail post construction of the Western Bypass.

B.2 New Local River Crossing

Because of the long time frames involved, and the inability of a bypass to address local traffic issues, Council and the RTA also investigated options closer to the existing river crossings to augment the existing bridges across the Shoalhaven River.

The following new river crossing alignment options have been investigated:

- Local Eastern Connection: A local river crossing east of the Highway connecting Bolong Road to Moss Street in the vicinity of Railway Street and Ferry Lane.
- Bridge Duplication: A new Highway bridge adjacent to the existing bridges or the possible relocation of the existing steel bridge and addition of a new Highway bridge. These options would provide new bridge infrastructure that would tie-in with the existing Princes Highway alignment. However, providing additional crossing structures would not address the critical traffic capacity problems at the approach intersections, including at Illaroo Road and Bridge Road (without grade separation of those intersections). In addition to possible short term works to optimise capacity of the existing bridges, options for grade separation of the intersections is also still being further investigated and is likely to be required in the medium to longer term. At the southern end grade separation of Bridge Road may be avoided if a direct connection to Bridge Road could be achieved by a local western river connection however this can not be guaranteed.
- Local Western Connection: A local road crossing west of the Highway connecting Nowra and Bomaderry and providing grade-separation of Princes Highway and Illaroo Rd. This option would provide improved access between all three of the main population centres of North Nowra, Bomaderry and the Nowra CBD. At grade options on Illaroo Road may not have sufficient capacity and would require a significantly higher bridge than the current bridges. Grade separation of Illaroo Road would allow an additional bridge to be constructed at the same level as the existing concrete bridge. However the connection to Bridge Road would directly impact land being investigated for development potential on the southern bank of the Shoalhaven River which if supported could jeopardise this option irrespective of optimum connections on the northern side.
- Intermediate Local Western Connection: A local road crossing further to the west of the local Western Connection. This option would be unlikely to attract local traffic from the Princes Highway or from Bolong Road (it is too far to the west for a direct connection) and would cross through the middle of Nowra Golf Course and so was not considered in further detail.

Key issues that were identified with each of these 3 options were:

- East of the existing bridges the topography consists of a very wide, low lying flood plain besides a wide river channel. A long bridge with raised approaches on embankments would be required, including designing to account for sailing on Shoalhaven River (the sailing club is located immediately to the east of the existing bridges) and significant land acquisition.
The effectiveness of the local eastern connection would be significantly affected by flooding (dependent on the actual location there would possible issues accessing the bridge in times of high flood levels), and could cause flooding impacts on surrounding development from the afflux of the new bridge and embankments. As with the Outer Eastern Bypass option this option would require a long bridge with high construction costs and would provide for direct connection from Illaroo Road.
- West of the existing bridges the topography consists of narrower river flats between a narrower river channel and high sandstone cliffs. As such a significantly shorter bridge could be realised, however it would still need to be longer than the existing bridges, or any new bridge located adjacent to the existing bridges. Grades on Illaroo Road make it difficult for a new bridge immediately adjacent the existing concrete bridge to allow continued connection to Illaroo Road. This means a local western crossing would need to be offset sufficiently from the Highway to allow a new crossing under Illaroo Road (and over to Bolong Road with connection back to Illaroo Road presumably via Walsh Crescent). An offset further to the west is likely to be required to allow an at grade intersection on Illaroo Road and this is likely to impact the access to the Nowra Golf Club and Greys Beach on the northern side of the river.
- There are many sensitive land uses near the existing bridges north and south of the river including the Shoalhaven Hospital, Nowra Golf Course, the Civic Centre precinct including the Nowra administration centre and the Shoalhaven Entertainment Centre, Shoalhaven River precinct, parks and community facilities and being the major gateway entrance to Nowra presents visual impact issues for all local river crossing options.
- At the time of the assessment in 2005 there were 19 non-indigenous heritage items identified in the vicinity of the existing river crossings. These included Graham Lodge and Greenhills (the original town of Nowra), the Old Nowra Bridge, the Bomaderry Railway Station, railway yards and railwayman's barracks, structures at the Nowra Showground, Nowra Wharf, and houses, constraining local crossing options.
- Visual and Aesthetics: East of the Princes Highway, a new bridge would have a high visual impact on views over the flood plain, due to the intrusion of the high approach embankments and the elevated bridge contrasting with the surrounding topography.
Dependent on options for connections back to Illaroo Road (at grade or grade separated) a landmark design could enable the new bridge to be a significant architectural feature of the landscape which could mitigate inevitable high visual impacts.

There are major constraints to any alignment in these locations, but notwithstanding those constraints, the medium to long term strategy is to build another crossing before the Western Bypass. A probable timeframe of twenty to thirty years could be involved if based on traffic congestion alone, however the structural integrity of the existing wrought iron bridge and the associated maintenance costs are becoming of increasing concern to RTA. Accordingly replacement options for the southbound bridge are also currently being investigated by the RTA for the short to medium term. That is the safety and economic aspects of the current maintenance activities could substantially bring forward an upgrade which (subject to options being investigated) is likely to also include capacity improvements.

Based on the traffic analysis if the existing southbound bridge is replaced with a higher capacity bridge this would add considerable benefits to the local road network.

B.3 Upgrading the Approach Intersections

The investigations into options that could extend the life of the existing Shoalhaven River Crossing (completed in June 2005) identified options for additional river crossings in the vicinity of the existing Princes Highway but also examined a range of non-bridge options to relieve traffic on the Princes Highway between Bridge Road and Bolong Road. Further investigations are necessary prior to a preferred option being selected and this could involve investigation of additional options by the RTA.

The investigations were limited to options for possible capacity improvement measures at the existing bridges, including the approaches. The report focused on options to improve the traffic capacity of the intersections at Bolong Road, Illaroo Road and Bridge Road.

North of the existing crossings the options examined included the following:

- An additional left-turn only lane at the Illaroo Road intersection.
- Converting the Illaroo Road intersection to a flyover and connecting into the existing Princes Highway river crossing infrastructure, but without a new river crossing.
- Integrating the Bolong Road and Illaroo Road intersections with the Princes Highway into a major grade separated interchange, but without a new river crossing.

In addition to options north of the river, the following options to the south of the river were also considered.

- Upgrade Bridge Road
- New connection under bridge between Pleasant Way and Scenic Drive.
- New T-junction south of Bridge Road
- New 4-way junction south of Bridge Road
- Grade-separation of Bridge Road
- Additional bridge between existing bridges
- Southern Interchange

A description and the outcomes from the investigations of these options, specifically those options that relate to Illaroo Road, are summarised below.

B.3.1 Additional Lane in Illaroo Road

The proposal is to improve the capacity of the intersection by separating the left and right movements in Illaroo Road. Several schemes were investigated. One possible short term improvement is to widen on the northern side to provide a separate left turn lane. This would involve property acquisition. The results indicate that widening Illaroo Road generates an improvement in intersection capacity by allowing (for the same green time in Illaroo Road) a significant increase in the amount of traffic that could be released from Illaroo Road on to the Highway. However the extent of this improvement is impacted by the limited capacity for the Highway to absorb an increase in traffic discharge based on the constraints of the existing bridges and associated intersections. Accordingly it is a more likely outcome that this option would allow green time to be reduced on Illaroo Road whilst still providing for the same extent of traffic release, and as a consequence the additional green time can be reallocated to the Highway resulting in a marked improvement to overall intersection capacity..

Expensive due to land acquisition and impacts on services, but is complimentary to all future options being investigated.

Would have immediate benefits; with benefits increased significantly in conjunction with any increase in the capacity of the Shoalhaven River bridges.

B.3.2 Illaroo Road Flyover

This option proposes the construction of a two-lane one-way ramp, grade-separated over the Highway and on a viaduct over dairy property to the east of the Highway. No right turn would be permitted from Illaroo Road at the existing intersection. The ramp junction with the Highway would be controlled by two-phase traffic signals. Several properties would be affected in Illaroo Road.

The analysis shows that the ramp/Highway intersection limits the southbound capacity. No significant increase in southbound capacity can be achieved over existing operation of the Highway while there are only two lanes southbound on the bridge. However, the work could be compatible with the construction of a new southbound with increased land capacity.

B.3.3 Illaroo Road/Bolong Road Interchange

This option considers a new two-way link road to connect Illaroo Road and Bolong Road incorporating a viaduct over Bombaderry Creek and grade-separation with the Highway. South facing ramps would form a half-diamond interchange with the Highway. The new road could connect to Illaroo Road via a roundabout of traffic signals, however at grade options on Illaroo Road may not have sufficient capacity and would require a significantly higher bridge than the current bridges if in conjunction with a new local western crossing. Grade separation of Illaroo Road on the other hand would allow increased capacity and an additional bridge to be constructed at the same level as the existing concrete bridge (under Illaroo Road and over to Bolong Road with connection back to Illaroo Road presumably via Walsh Crescent). However the local western connection to Bridge Road associated with a local western option would directly impact land being investigated for development potential on the southern bank of the Shoalhaven River.

More investigation and detailed analysis may inform a solution to the complex problem of providing a feasible connection to Illaroo Road, however, the analysis results indicate that the limiting element of this scheme is the capacity of the on-ramp merge where the two lane ramp would be controlled by traffic signals until three southbound lane were provided over the river in a similar way to the flyover option described above.

Because of the limited capacity of the bridges to accommodate such an option, because more detailed investigations are required to determine appropriate connections, and because of the likely impact on land acquisition and significant costs associated, an interchange of this nature to resolve the bridges capacity problem can be more appropriately considered as a medium – long term solution, for all intents and purposes a scheme to this effect is not a short term option.

B.3.4 Intersection Improvements South of the River

The intersection improvements south of the river listed above were investigated in the context of providing solutions that extend the life of the existing Shoalhaven River crossings.

However these options can assist to address current and future traffic problems on Illaroo Road by improving the absorption capacity on the Highway (improving the flow of traffic on the Highway at both ends of the bridges means that during the allocation of green time to Illaroo Road more traffic can exit Illaroo Road to the Highway).

Of the options investigated on the south of the river that could improve river capacity including capacity of Princes Highway / Bridge Road intersection; grade separation of Bridge Road would work well however would require significant land acquisition and this would be impacted by on going investigations into potential gateway developments. Only the option to extend Hawthorne Avenue to provide a new set of traffic signals on the Highway (relocate those phases associated with Pleasant Way) could be provided without major constraints and this would have an immediate impact although being an at grade solution only has short term benefits and is not complimentary to longer term options.

B.3.5 River Crossing Relief Options

The AECOM study describes what is referred to as River Crossing Relief Options (or “RCR”). The RCR option included on the north side of the Shoalhaven River the additional lane on Illaroo Road on the approach to the Princes Highway, and on the south side of the Shoalhaven River the extension of Hawthorne Avenue and associated relocation of phase associated with Pleasant Way at the Highway/Bridge Road intersection (involves part closure of Pleasant Way to prevent vehicle access to/from the south, with those movements relocated to the new junction).

The AECOM North Nowra Link Road study found that whilst the benefits of the North Nowra Link Road were obvious when considering the positive impact on the Princes Highway / Illaroo Road intersection, the overall reduction in network wide VHT parameter (for Central and Southern options), and the calculated benefit cost ratios (for Central and Southern options), that the benefits of the North Nowra Link Road were clearly constrained by congestion on the Princes Highway during the analysed critical peak periods.

The technical aspects of the (AECOM) North Nowra Link Road study were subject of review which was a collaborative effort of Council, RTA, and AECOM staff in a workshop environment. With reference to the reports into options for an additional Shoalhaven River Crossing and options that could extend the life of the existing Shoalhaven River Crossing, the working party gave consideration to those few options that may be both feasible and affordable in the short term and agreed to test possible improvements to the Highway on both sides of the existing bridges (against the best performing link road option in isolation) to ascertain whether additional network benefits would be likely to stem from improvements to Highway capacity.

The AECOM North Nowra Link Road study found that in conjunction with the NNLR Central Option, the results if the RCR analysis demonstrated that the benefit cost ratios would be approximately double that compared to the benefits of the NNLR in isolation. This confirms the impact the Highway was having on the NNLR performance and also gives clues as to the potential benefits of the NNLR outside of peak periods when there is less congestion on the Highway (noting that in excess of 80% of traffic on Illaroo Road occurs outside of peak periods). In essence by improving capacity on the Highway this allows greater traffic release from North Nowra in the critical peak periods and allows motorists to take advantage of the significant improvement to accessibility and travel time savings.

The RTA is continuing to investigate the RCR options as well as other possible short term solutions to improving safety and efficiency on the existing Princes Highway at the bridges.