

**NORTH STREET
NOWRA
TRAFFIC STUDY**

Prepared for

Shoalhaven City Council

November 2004

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1.0 INTRODUCTION

This report outlines the preferred treatment of the North Street traffic corridor in response to the key traffic management objectives from the Nowra CBD Strategy. Connection of east Nowra Sub Arterial (ENSA) to the Princes Highway at North Street is expected to generate major changes to traffic patterns in the northern part of the CBD. This creates the need to understand the long term configuration of North Street and to identify any land requirements arising from road widening and make adequate provision for these. There are also operational problems now at the Bridge/Berry/North intersection and issues for pedestrian crossing facilities along North Street which have been addressed in this study.

The extent of the works considered in this report includes North Street from O’Keefe Avenue to the east and Bridge Road to the west, inclusive of all intersections in between. Modelling of the North Street/Princes Highway is being undertaken as part of the ENSA project although details of requirements have been considered in this project to match requirements along North Street. Road widening west of Bridge Road has not been considered. Issues at Osborne Street have been noted in the report but no recommendations are made.

The analysis in this report has been based on the extension of the existing CBD Paramics model for the 2016 PM peak period. Extensive analysis of intersection options at a detailed operational level has also been undertaken using aaSIDRA.

2.0 BACKGROUND

Strategic modelling indicates that North Street currently services up to 11,500vpd near Bridge Road with projections to increase to 15,000vpd by 2016. Tube counts by Council suggest daily volumes may still be under 10,000vpd. It currently provides a key connection to the Princess Highway to the east via Moss Street and to the north via Bridge Road. Changes to the network in the future will see a more direct connection of North Street to Princes Highway and to ENSA. Previous studies have identified that it is to become an important distributor on the northern edge of the CBD.

The Nowra CBD Strategy identified that the proposed connection of the ENSA through to North Street changed traffic patterns along North Street to the extent that the current two lane cross section would not be sufficient for the expected traffic volumes. Other issues of pedestrian mobility and connectivity, parking provision, network efficiency and intersection alignment issues were also considered with the conclusion that irrespective of provision of ENSA, a four lane cross section would be required prior to or shortly after 2016.

3.0 METHODOLOGY

The following methodology structure was used to complete the study:

1. Extend existing Princes Highway Paramics model network to incorporate North Street extending from Bridge Road (west) to O’Keefe Avenue (east).
2. Develop 2016 peak hour travel demand matrices for the extended area.
3. Assess traffic operations and provide operational review and preliminary options.
4. Finalise network assessment and develop concept plans for North Street showing kerb lines and any property acquisitions where necessary.
5. Develop indicative cost estimates for works and a staged schedule of works based on priority.

4.0 OBJECTIVES

Taken from the previous Nowra CBD Transport Strategy the following objectives have been derived to focus the outcomes of this study.

- **Pedestrian Mobility**

North Street creates a barrier for the major north/south pedestrian movement into and out of the Core CBD area. Any upgrade to North Street should facilitate the safe movement of pedestrians and cyclists across the street;

- **Safety**

The overall safety of motorists, pedestrians and cyclists and their interaction in the road network is crucial to an effective solution. Conflict points should be minimised to reduce the risk of accidents;

- **Network Efficiency**

The primary function of North Street in the overall Road Hierarchy structure is to be reinforced by any ultimate traffic improvements;

- **Parking**

The role of on-street parking in the CBD is to be considered. Any loss of parking due to intersection works should be accommodated elsewhere, preferably in off-street areas;

- **Staged Capital Works Program Based on Priorities**

Priorities should be given to the proposed capital works in order to achieve the maximum benefit for expenditure;

- **Manage the Impacts of Major Network Upgrades Such as ENSA**

The impacts of major road projects such as the ENSA to the network must be considered in the analysis to support the functional road hierarchy and to minimise impacts on the existing network.

5.0 TRAFFIC DATA

5.1 Traffic Modelling

All existing parameters from the previous Paramics model have been applied to the extended model. The model depicts the 2016 PM peak period with volumes extracted from the existing TRACKS model.

Paramics has been used to analyse the performance of the complete network with the ultimate lane and intersection configuration. Quadstone Paramics is a comprehensive vehicle by vehicle microscopic traffic simulation package. The individual vehicles are simulated based on rules relating to gap acceptance, lane changing and other behaviour. Separate vehicle categories allow distinct classes of vehicle, such as buses, to be modelled with different acceleration, deceleration, size and behaviour characteristics.

aaSIDRA has also been used where necessary to examine detailed intersection operational performance and to determine the most suitable signal settings for optimal efficiency.

Traffic counts were collected at the intersection of Bridge Road and North Street to supplement the existing traffic data.

5.2 Pedestrian Desire Lines

An indicative diagram of the pedestrian desire lines created by the local land uses is provided on Figure 1. The primary and secondary routes require various levels of priority to remain accessible and easily negotiable.

As a minimum the primary and secondary routes should be provided with a priority controlled crossing point across major roads where heavy traffic volumes create limited opportunities to cross safely.

North Street currently has no signalised intersections between Bridge Road and the Princes Highway and therefore there are no controlled priority pedestrian crossing locations. At its current cross section of two lanes and with the current peak hour volumes, crossing is possible for mobile pedestrians but difficult for the mobility impaired. A marked foot crossing exists between the staggered T's at Graham Street and the Egan's Lane carpark access. This aligns with the walkway along Graham Street towards the Council Offices and is well used by pedestrians. There is a history of complaint regarding pedestrian safety of this location. The complexity of vehicle movements at the staggered T's adds to the pedestrian safety concerns as drivers are focussed more on other vehicles than pedestrians.

Given the expected traffic growth to the projected design year of 2016 and the identified need for a four lane cross section the signalisation of key intersections along North Street would not only help maintain network efficiency but also provide controlled safe priority crossing points for all pedestrians. Movements north/south and east/west would be facilitated on each signalised intersection for at least three of the four legs.

6.0 TRAFFIC ASSESSMENT

The following section contains an analysis of each intersection in the corridor in terms of its current and ultimate configuration and operational performance. These recommendations are based on the most current predictions for traffic growth and travel patterns available at the time of the study. Further monitoring and investigations into traffic volume growth and changing travel patterns is suggested prior to implementation.

The anticipated traffic volumes predicted for the 2016 PM peak hour (5:00pm to 6:00pm) at each of the intersections analysed are included on Figures 2 and 3.

6.1 North Street/Bridge Road/Berry Street

The intersection of Bridge Road/North Street/Berry Street currently operates as a priority controlled intersection with movements restricted by the ‘Batts Folly’ structure and the extended grassed verge across North Street. The current arrangement creates a number of conflicting irregular traffic movements in particular the right turn from Bridge Road to North Street and the through movement on North Street eastbound.

Due to the high anticipated traffic growth in the area it is expected that the current operation will not be sufficient for a ten year design horizon. The installation of a signalised intersection arrangement will help control conflicting movements and maintain an efficient level of operation. The safety of the intersection will also be improved by limiting the potential conflict points of opposing traffic.

The final recommended option is included on Figure 2. This option is consistent with the four lane cross section of North Street (with restricted parking) and realigns all legs of the intersection to a central point. The area to the west of the ‘Batts Folly’ is used as a left turn slip lane to Bridge Road. The through movement eastbound would be permitted.

The signalised intersection will operate on a 100 second cycle time with a four phase arrangement. Refer Figure 2.

Other alternative options provided by Council (see Appendix 1) were assessed. However they failed to address the potential safety issues created by the poor geometrical alignment at the intersection and the need to control conflicting priority traffic flows. Adequate capacity can be achieved by a more conventional layout.

The queues and delays for each approach under 2016 flows and with ENSA in place are given in Table 6.1. The maximum queue given in the table is the maximum queue length attained during the peak hour simulation. The typical queue is the queue just prior to that movement receiving a green signal that is the typical maximum queue during the cycle.

The assessment in Table 6.1 uses 2016 flows for the intersection. In 2016, major shifts in traffic are anticipated reflecting the opportunities created by ENSA to link to East Nowra using North Street rather than Princes Highway and Kalendar Street. Achievement of the ultimate layout involves considerable road widening in Berry Street south of North Street to accommodate the growth in the movement from Berry Street into North Street towards the east in the PM peak.

**2016 Queues and Delays for Critical Movements
at North Street/Bridge Road/Berry Street Intersection**

Table 6.1

Movement	Maximum Queue (m)	Typical Queue (m)	Average Delay (seconds)
	PM	PM	PM
Berry Street Through	72	48 – 60	20
Berry Street Right Turn	24	12 – 18	1
North Street West all movements	18	6 – 18	45
Bridge Road all movements	36	12 – 24	42
North Street East all movements	66	54 – 60	21

In the longer term, Berry Street approach to the intersection must be widened to allow development of a separate right turn from Berry Street to North Street. Figures 2 and 5 show the implications of widening to the west and east respectively. Data provided on kerb locations shows a wider verge on the eastern side of Berry Street. If in widening one kerb remains as presently located and all works and widening happens to the other side of the roadway, a greater land take is needed for widening to the west.

The choice of widening east or west will need to consider cost and other issues relating to land acquisition. The traffic aspects favour widening to the west as that:

- aligns better with Bridge Road;
- allows potential widening of Bridge Road to the west by reducing the Batts Folly area;
- has greater flexibility for possible controls of the laneway from Woolworths carpark adjacent to the library. Operation of the laneway as left in or left in/left out may be appropriate depending on treatment of right turns west to south at Egan's Lane carpark access off North Street. A median may then be needed in Berry Street. This is a matter for later review.

6.2 North Street/Graham Street/Egan's Lane Carpark Access

The intersection of North Street/Graham Street/Shopping Centre Access currently operates as a priority controlled intersection with all movements allowed. The current alignment of the intersection is such that Graham Street is offset from the Egan's Lane Carpark Access creating a staggered intersection arrangement. This layout is not pedestrian friendly and is restrictive for vehicles entering the shopping centre from the north. A marked foot crossing exists between the T's and has safety issues.

Due to the high anticipated traffic growth in the area it is expected that the current operation will not be sufficient for a ten year design horizon. The installation of a signalised intersection arrangement will help facilitate pedestrian movements and maintain an efficient level of operation into the future.

Two signalisation concepts have been examined:

- offset tee intersections;
- realignment of Graham Street towards the east to create a four way junction.

The restriction of the right turn into the Shopping Centre from the west may be required in the peak periods and should be assessed in greater detail when future volumes are confirmed as it would be preferable to maintain all movements at the intersection.

The realignment of Graham Street to align with the Egan’s Lane Carpark Access would require the resumption of the park land to the east of the intersection and takes away the landscaped walkway north to the Council offices. The pedestrian crossings would not then align with the strongest pedestrian movement line. The analysis shows that better traffic operations are achieved with a single intersection. However the driving force for change is pedestrian provisions. The recommended option – staggered T’s – has adequate traffic operation and a better level of pedestrian provision.

Pedestrians are facilitated by crossing points at three of the four legs, west, east and south. Pedestrian phases are run on demand during the phase sequence and are generally run with an opposing left turn vehicular movement.

The final recommended option is included on Figure 2.

The signalised intersection will operate on a 100 second cycle time with a three phase arrangement. Refer Figure 2.

Queues and Delays for Critical Movements

Table 6.2 *at Graham Road/North Street/Shopping Centre Access*

Movement	Maximum Queue (m)	Typical Queue (m)	Average Delay (seconds)
	PM	PM	PM
Offset Tee Junctions			
North Street East all movements	120	100	
Graham Street all movements	110	75	35.7
North Street West all movements	28	12	18.4
Shopping Centre Access all movements	45	18 - 24	39.3
Realign Graham for Four Way Junction			
North Street East all movements	72	36 - 48	18
Graham Street all movements	42	24 - 36	4
North Street West all movements	18	6 - 12	19
Shopping Centre Access all movements	24	12 - 18	47

6.3 North Street/Kinghorne Street/Moss Street

The intersection of Kinghorne Street/North Street/Moss Street currently operates as a four way priority controlled intersection with restricted movements from the north. The current alignment of the intersection is such that the northern leg is a one way departure from the intersection leading to the Princess Highway. This current layout is not pedestrian friendly.

Due to the high anticipated traffic growth in the area it is expected that the current operation will not be sufficient for a ten year design horizon. The installation of a signalised intersection arrangement will help facilitate pedestrian movements and maintain an efficient level of operation into the future. The closure of the northern leg (Moss Street) has been considered as it offers an opportunity to reduce the number of movements at the intersection. However, this option is not favoured as it makes access into the western end of Moss St difficult and increases flows through the North/O'Keefe intersection.

The final recommended option is included on Figure 3. This option is consistent with the four lane cross section of North Street (with restricted parking). Pedestrian phases are run on demand during the phase sequence and are generally run with an opposing left turn vehicular movement.

The signalised intersection will operate on a 100 second cycle time with a three phase arrangement. Refer Figure 3.

Queues and Delays for Critical Movements at Kinghorne Street/North Street Intersection

Table 6.3

Movement	Maximum Queue (m)	Typical Queue (m)	Average Delay (seconds)
	PM	PM	PM
Kinghorne Street	48	24 - 36	32
North Street East all movements	48	30 - 42	14
North Street West all movements	18	6 - 12	7

6.4 North Street/O’Keefe Avenue

The intersection of O’Keefe Avenue and North Street currently operates as a four way priority controlled roundabout.

The current configuration of the intersection is not pedestrian friendly.

The installation of a signalised intersection arrangement will help facilitate pedestrian movements and maintain an efficient level of operation into the future. The ability to coordinate the signal settings with the movements from the Princes Highway is important to the operation of the network to stop spill back onto the Highway.

The final recommended option is included on Figure 3. This option is consistent with the four lane cross section of North Street (with restricted parking). The restriction of the Right turn into O’Keefe Avenue from the east may be only required in the peak periods and should be assessed in greater detail when future volumes are confirmed as it would be preferable to maintain all movements at the intersection.

Pedestrians are facilitated by crossing points at three of the four legs, west, east and south. Pedestrian phases are run on demand during the phase sequence and are generally run with an opposing left turn vehicular movement.

The signalised intersection will operate on a 100 second cycle time with a four phase arrangement. Refer Figure 3.

*Queues and Delays for Critical Movements
at O’Keefe Avenue/North Street Intersection*

Table 6.4

Movement	Maximum Queue (m)	Typical Queue (m)	Average Delay (seconds)
	PM	PM	PM
O’Keefe Avenue South all movements	84	48 - 60	59
North Street East all movements	48	30 - 42	17
O’Keefe Avenue North all movements	84	48 - 60	40
North Street West all movements	78	42 - 54	19

6.5 Osborne Street/North Street

This section of the network has not been specifically modelled in the study. Options for localised specific treatments have been considered previously by Council and are currently under review. The key issues as discussed with Council are as follows.

The intersection of Osborne and North Streets was previously controlled by Give Way signage (North Street had priority). Due to a minor accident history and increase in traffic volumes, the local traffic committee approved Stop signage and this was introduced in September, 2002. There have been no accidents recorded at the intersection from Police records since that time. Consideration has previously been given to a roundabout at the intersection to control speeds on the approaches to the school in North Street. There have also been suggestions that the intersection be upgraded to signals to enhance pedestrian safety for children crossing. This may not be necessary if the existing children's crossings remain (currently on North Street – 125m west of the intersection, and on Osborne Street – 45m south of the intersection). An issue with a roundabout may be the higher speeds generated for traffic turning left off North Street into Osborne (from east to the south), due to the closer proximity of the existing crossing. However there is opportunity to enhance that crossing by providing blisters, etc. and fencing if necessary. It may also be possible to tighten up that kerb radius to control exit speeds. Regardless of final adopted treatment, an objective of the design would be to improve safe pedestrian crossing opportunity.

The demand for use of this intersection on the periphery of the town centre is expected to be affected by any significant change to travel patterns across the Shoalhaven River in the future (dependant on future bridge/intersection arrangements), increased congestion on Berry Street, and commercial development along Osborne Street. There are matters for specific attention as they arise.

At Collins Way, turning movements out in the PM peak are fewer because of additional exit opportunities to Berry Street and Osborne Street through the adjacent car parks. Capacity is not an issue as the movements are relatively low although sight distance for vehicles exiting this intersection may be affected by adjacent development. If that were to occur it would be possible for vehicles to turn left at this junction and U-turn at the Osborne/North roundabout if that treatment is selected as a preferred treatment.

7.0 INTERIM TREATMENT BRIDGE/NORTH/BERRY

Safety concerns at this intersection make it a high priority for remedial treatment. Until ENSA is in place, current travel patterns will remain largely as existing allowing for general traffic growth. In the short term land acquisition needed long term is not available and consideration of changes within the existing road reserves has also been made.

Assessment of the operation of North/Berry/Bridge layout using 2001 and 2003 traffic counts has been undertaken to indicate operations in the short term.

Peak AM traffic count data from 2001 was factored up to obtain 2004 volumes. Figure 4 shows the lane allocation adopted. The geometry existing will not allow right turns from east to north and west to south to run concurrently as adequate clearance between vehicle paths can not be achieved. As a result the phasing is constrained and additionally an option to ban the right turn from west to south has also been considered.

7.1 aaSIDRA Analysis

Two scenarios were analysed in aaSIDRA using both AM and PM peak volumes for 2004 and 2016. 2016 volumes are based on 3%p.a. growth applied to 2004 flows.

Scenario A – Pedestrians movements were placed on all legs of the intersection and the right turn movement from the North Street west approach to the Berry Street south approach was banned.

Scenario B – Pedestrian movements are provided only on the eastern, western and southern approaches of the intersection.

7.2 Intersection Geometry

The intersection lane configurations for Scenarios A and B are shown on Figures 6 and 7 respectively. The lane configuration for Scenario A illustrates the absence of the right turn lane on the western approach of North Street.

Figure 6 Lane Configurations for Scenario A

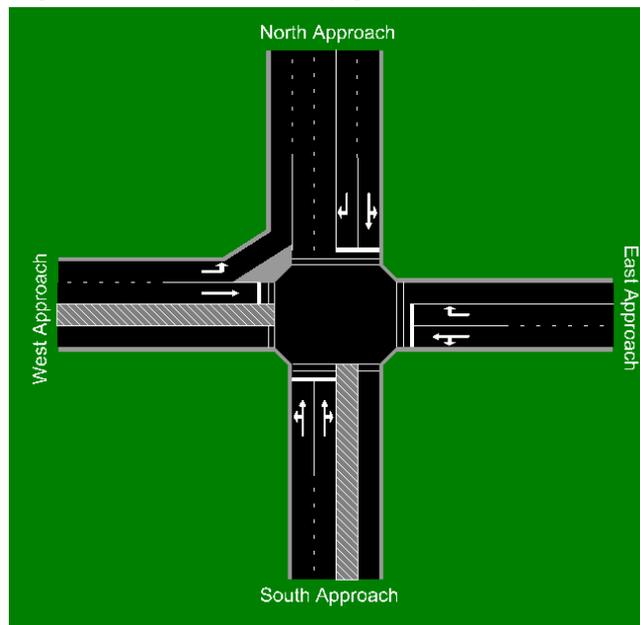
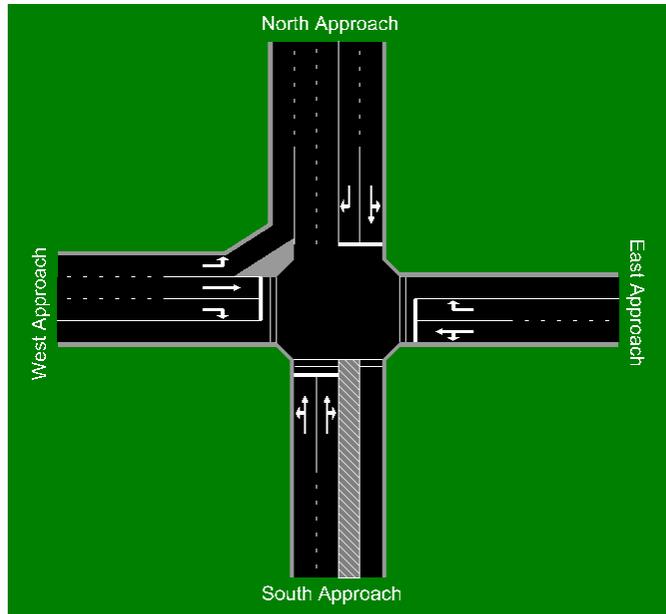


Figure 7 Lane Configurations for Scenario B



7.3 Phasing

The phasing used for the Scenarios A and B are shown on Figures 8 and 9 respectively.

Figure 8

Phasing for Scenario A

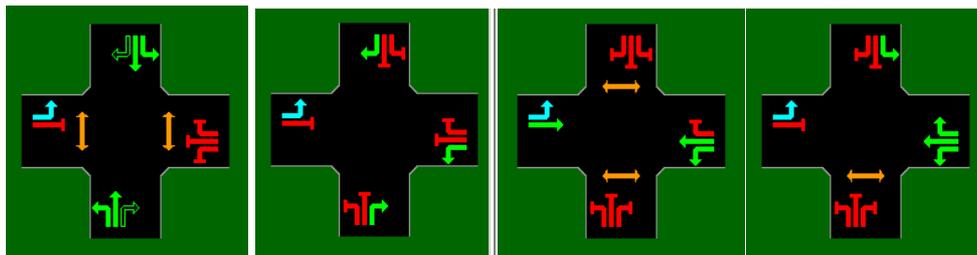
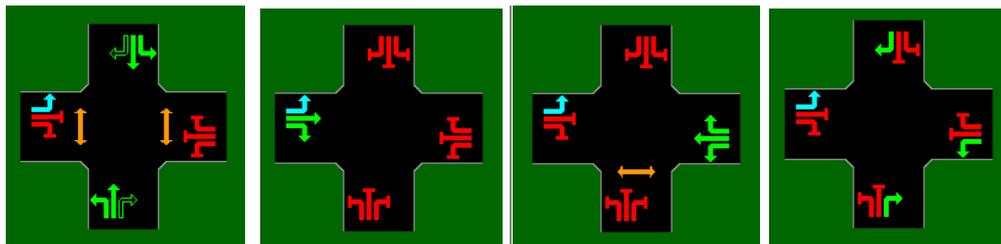


Figure 9

Phasing for Scenario B



7.4 Results

Table 7.1 illustrates the DOS for both the 2004 and 2016 AM and PM peak volumes. The AM and PM DOS for Scenario A in 2004 are 0.58 and 0.90 respectively. Scenario B AM and PM yield similar results of 0.64 and 0.61 respectively. This analysis makes provision for pedestrians. In phases when no pedestrian demands occur better performance can be achieved. Even in 2004 the provision for pedestrians brings the PM operating characteristic to the maximum desirable level (DOS of 0.90). Significantly better operating conditions are achieved if pedestrians are not provided for across the northern leg. This situation arises as the phasing is constrained by the geometry for right turns from North Street, and there is a big imbalance in the right turn volumes. The only phase in which the pedestrians can cross the northern leg is the one with the lightest traffic demands creating inefficiency reflected in Table 7.1 below.

The AM and PM DOS for Scenario A in 2016 are 0.77 and 0.99 respectively. Scenario B for the 2016 AM and PM yield the same DOS of 0.68.

Table 7.1 *Degree of Saturation Results for 2004 and 2016*

Scenario	DOS 2004		DOS 2016	
	AM	PM	AM	PM
A	0.58	0.90	0.77	0.99
B	0.64	0.61	0.86	0.86

7.5 Conclusions

- Scenario A has insufficient capacity in the PM peak if pedestrian demands are allowed for on all legs;
- prior to widening of the intersection, pedestrian movements should only be allowed on the eastern, western and southern approaches of the intersection.

It appears therefore that upgrading at North/Berry/Bridge can occur in two stages:

1. Stage 1 is signalisation as per Figure 7 which could happen as soon as funds permit.
2. Stage 2, as per Figure 2, which requires widening of the road reserve in Berry Street south of North Street and would be needed soon after the ENSA connections are made to the Princes Highway.

8.0 NORTH STREET CROSS SECTIONS

8.1 West of Princes Highway

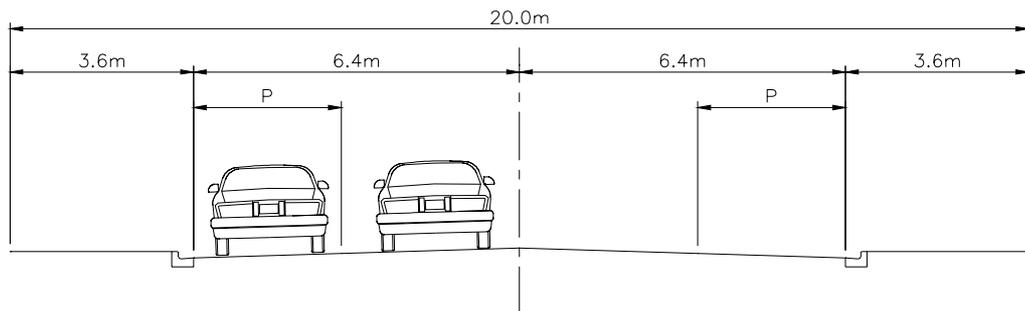


Figure 10

Existing Cross Section (West of O'Keefe Street)

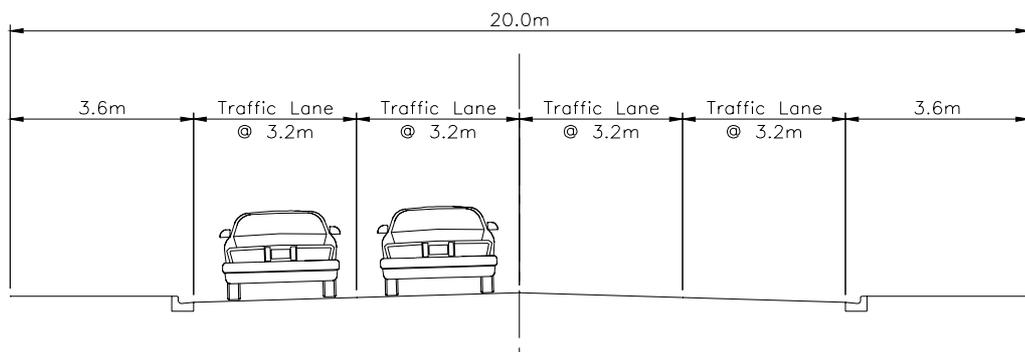


Figure 11

Minimum Cross Section A-A (West of Kinghorne Street)

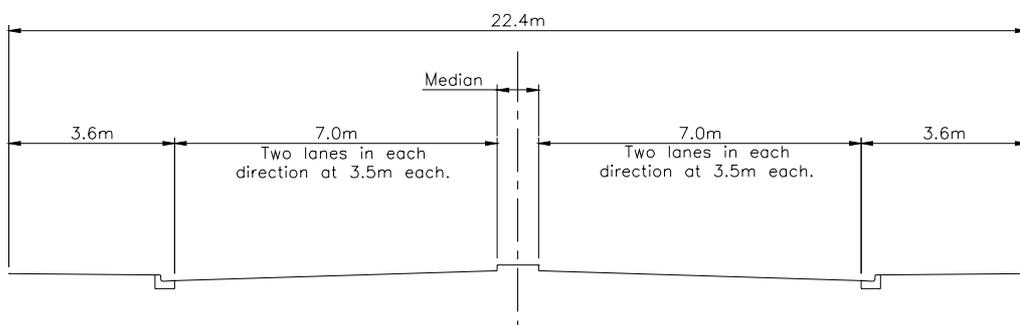


Figure 12

Council Earlier Proposal for Widening

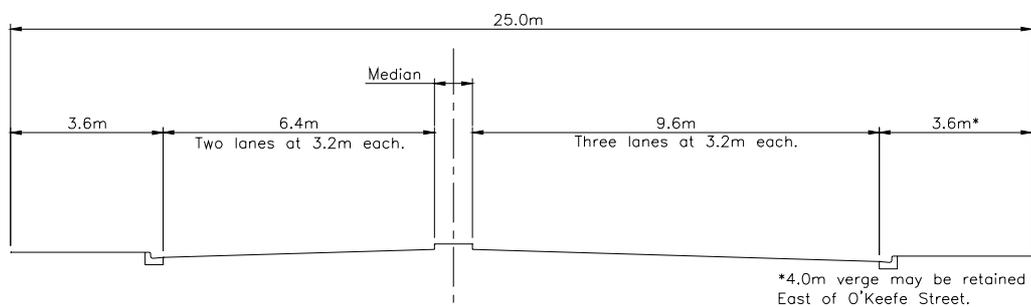
Issues

Costs of minor widening to both sides (Figure 12 concept) make that option difficult to support:

- median would not be a safe refuge;
- utilities costs are potentially doubled;
- stormwater costs are high;
- with several existing buildings built to the front boundary, achievement of widening will be delayed until all are secured;
- traffic demands are not so high that the capacity advantage of more generous lanes needs to be procured when costs are high.

Recommended Cross Sections:

- Figure 11 above i.e. minimum change west of Kinghorne Street;
- Figure 13 below east of Kinghorne Street.

**Figure 13****Recommended Cross Section**

8.2 North Street - Princes Highway and East

The separate East Nowra Sub Arterial (ENSA) project has examined the requirements for connection of ENSA to the Princes Highway at North Street including the signalisation of the North Street/Princes Highway intersections and the associated road widening. While the analysis has been undertaken in a separate project, the findings of that separate project in relation to road widening are reported here for completeness.

The road widening requirements in the sections approaching the Princes Highway from both the west and east are dictated by the need for capacity to be developed at the Princes Highway intersections at Moss and North/ENSA. Because of the proximity of these two intersections on Princes Highway a complex layout and phasing is needed with co-ordination of phasing at the two junctions. Further, the intersections of North/O'Keefe and North/ENSA/Brereton are also relatively close to the Princes Highway. Signalisation of these locations and management of queues between them and Princes Highway also dictates the number of approach lanes, median provision, and consequently road widening needed.

Analysis of the operation has been undertaken in the ENSA analysis using the Paramics model. The proposed layouts of the intersections are attached and the key intersection performance indicators are included in Table 1.

Table 1 *Princes Highway/North Street Intersection Operation*

Southbound	100*	100*	93.2
Eastbound	60 - 70	105*	134.7
Northbound	90 - 100	225*	109.2
Westbound	110 - 120	125*	112.3

* in some instances queues form back to and beyond upstream intersection or zone.

The intersection concepts involve road widening along the northern side of North Street as follows:

- Kinghorne Street to Princes Highway 5.0m;
- Princes Highway to Brereton Street 5.6m.

In addition the provision of a left turn lane from Princes Highway (north) into North Street (east) requires widening of the Princes Highway extending from North Street towards Moss Street.

These details are shown on Figure 3 and the figures at Appendix 2 (Cardno MBK 7583/01/1-00C, F, G).

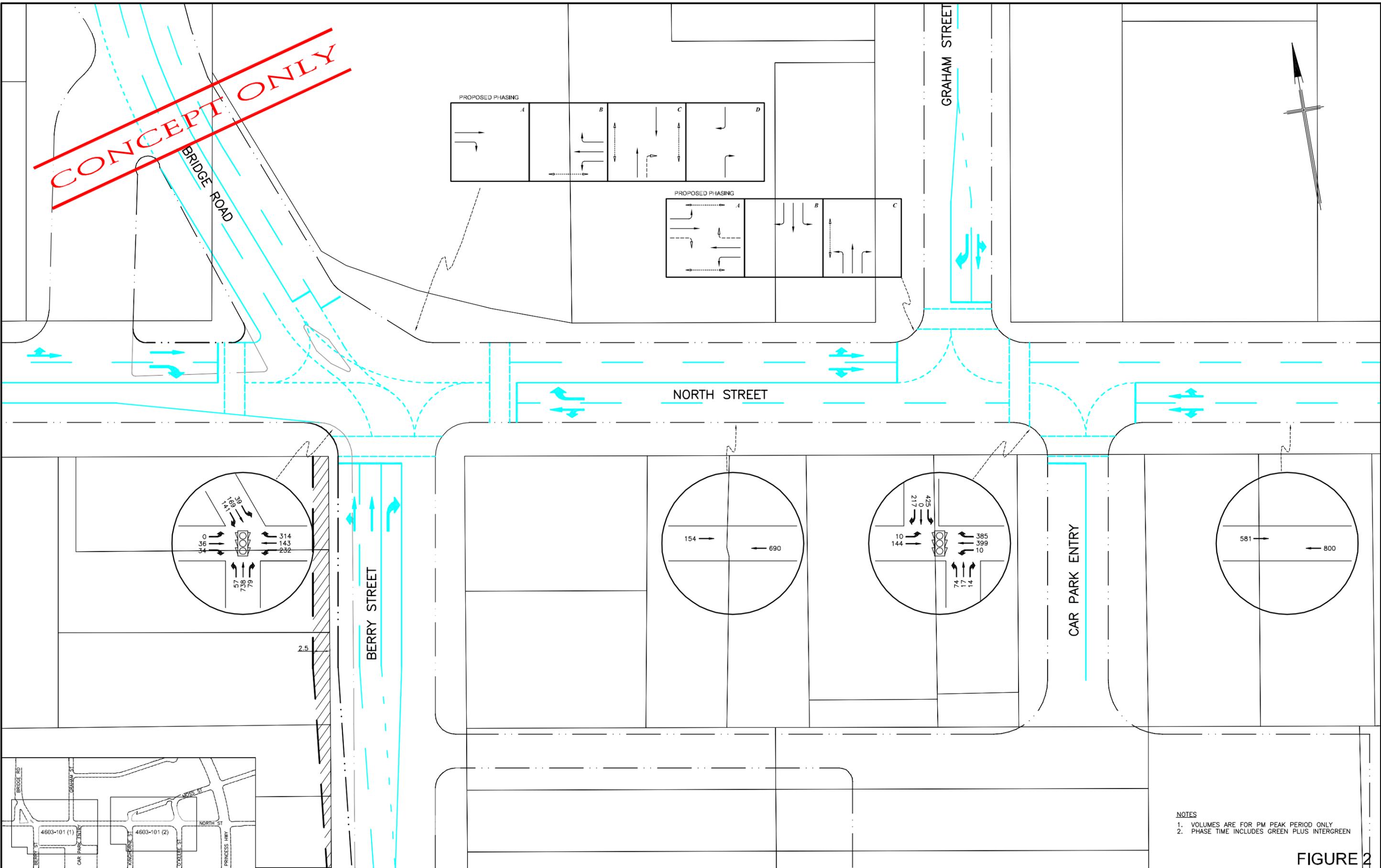
9.0 SUMMARY OF CONCLUSIONS

1. The layout shown on Figures 2 and 3 should be adopted as the general arrangement plan for North Street.
2. Signalisation of the intersections along the entire length will be needed to provide adequate capacity and allow primary pedestrian movements to be achieved as follows:
 - a. The O’Keefe Street roundabout needs to be converted to signalisation to co-ordinate with signals at North/Princes Highway, and facilitate pedestrian movements.
 - b. The Graham Street/Egan’s Lane carpark access signalisation primarily facilitates pedestrian movements north to south. It can be achieved as a single intersection controlling staggered T-junctions.
 - c. North Street/Bridge/Berry intersection is the highest priority for signalisation and is recommended as two stages. The ultimate form requires road widening and should be planned to follow soon after the ENSA link to North Street occurs.
 - d. The Kinghorne Street signalisation is seen as the lowest priority but will be needed prior to 2016.
3. Road widening is necessary as follows:
 - a. 5m widening on the northern side of North Street east of Kinghorne Street to Princes Highway and 5.6m east of Princes Highway.
 - b. Truncation on Princes Highway alignment on east side between Moss and North Streets.
 - c. Widening in Berry Street south of North Street is needed. Council needs to examine implications of two widening options presented on Figures 2 and 5 to finalise their approach.
4. In the short term, signalisation of the North/Bridge/Berry intersection can proceed within existing road reserves allowing for kerb relocations on the western leg only.

5. Timing for works is indicated as follows:
 - a. Short term
 - i. Stage 1 works at Bridge/North/Berry to deal with immediate capacity issues;
 - ii. Signalisation of North/Graham/Egan’s to improve pedestrian safety.
 - b. Medium term
 - i. Signalisation at Kinghorne/North to improve pedestrian safety;
 - ii. Signalisation at O’Keefe/North would be needed when the northern section of ENSA connects to Princes Highway.
 - c. Longer term
 - i. Stage 2 works at North/Berry/Bridge including road widening following land acquisition.

Figures 1 - 5

CONCEPT ONLY



NOTES
 1. VOLUMES ARE FOR PM PEAK PERIOD ONLY
 2. PHASE TIME INCLUDES GREEN PLUS INTERGREEN

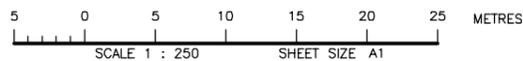
FIGURE 2

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 South Brisbane Q 4101



Issue	Description	Date	Auth.
A	ISSUE FOR COMMENT	29.03.04	J.M.
B	SOME LANE REALIGNMENTS	27.05.04	J.M.

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Design	Drawn	Checked
J.X.Z.	J.M.	J.O.
MAR'04	MAR'04	MAR'04
Scale	Sheet Size	
AS SHOWN	A1	
Authorised for Issue	Client	
Signed:	SHOALHAVEN CITY COUNCIL	
RPEQ No:		

Project Title
NOWRA NORTH STREET CONCEPTS

Drawing Title
INTERSECTION CONCEPTS

Drawing no	4603-101	
Sheet	1 of 2	Project no. 4603
CAD files	Issue	
x:\4603_Base.dwg	B	

CONCEPT ONLY

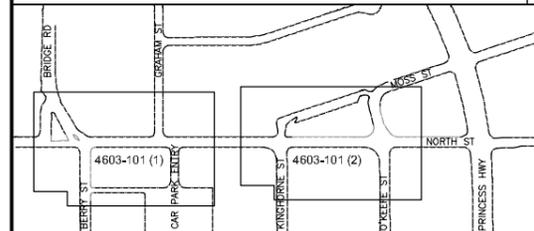
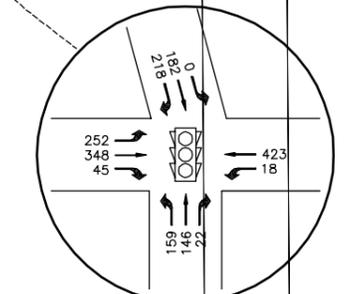
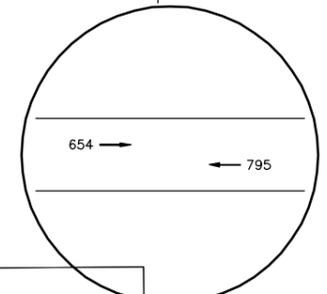
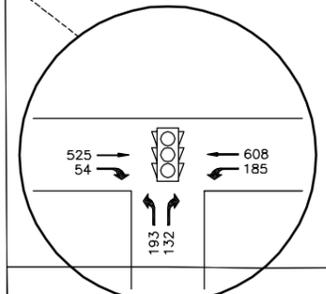
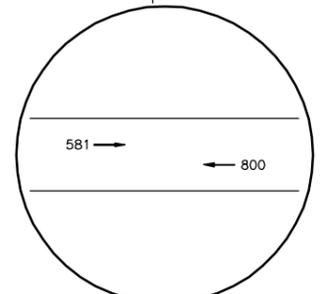
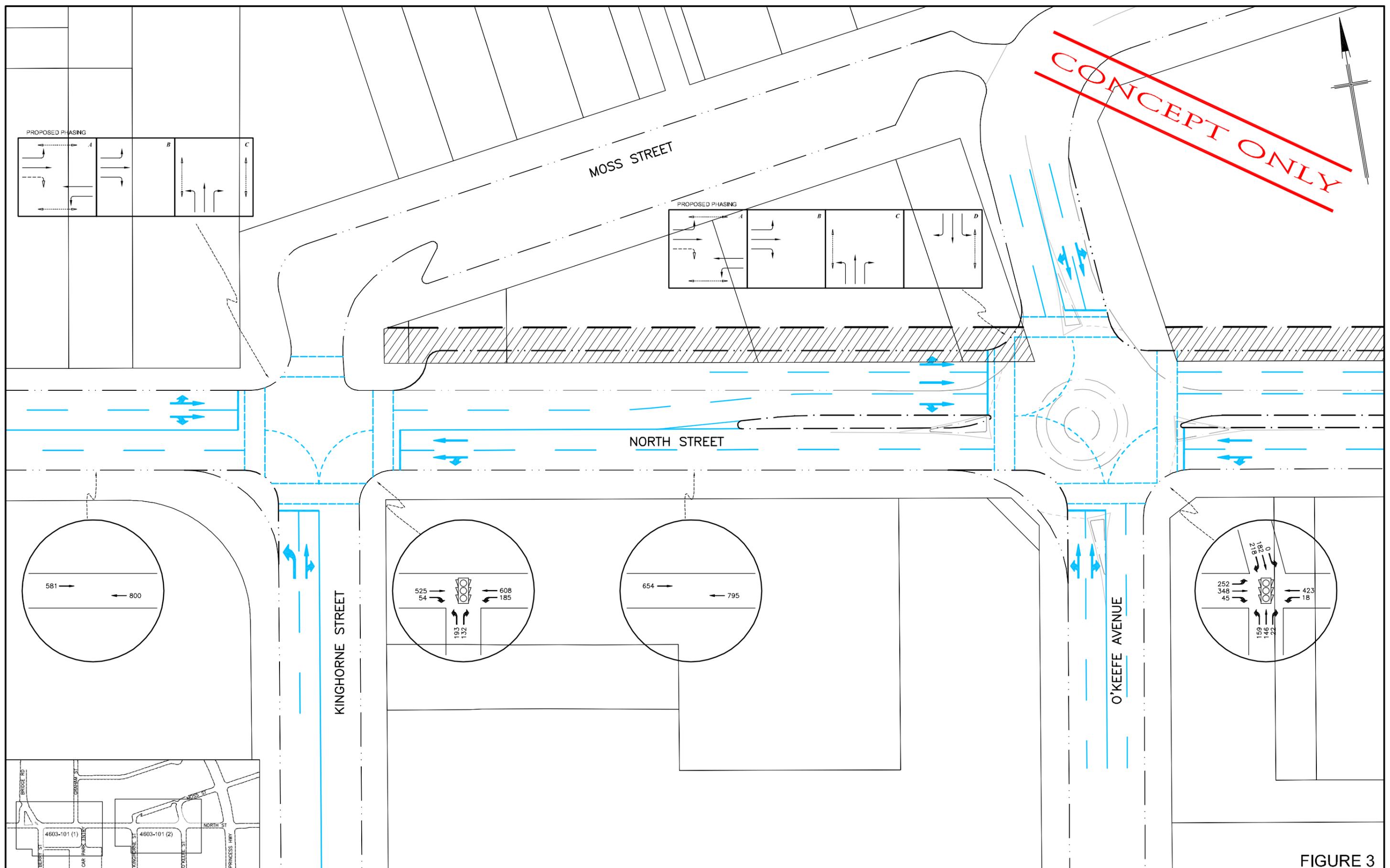
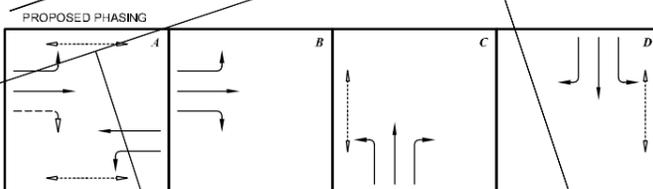
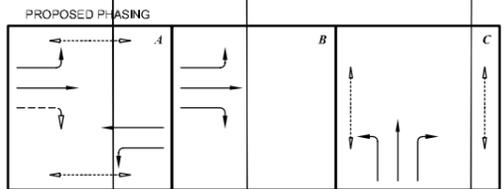


FIGURE 3

EPPELL OLSEN & PARTNERS
 Transportation & Traffic Engineering & Planning
 Telephone : (07) 3846 3600
 Facsimile : (07) 3846 3611
 Email : eop@eo.com.au
 243 Riverside Drive
 P.O. Box 3873
 South Brisbane Q 4101



Issue	Description	Date	Auth.
A	ISSUE FOR COMMENT	29.03.04	J.M.
B	SOME LANE REALIGNMENTS	27.05.04	J.M.
C	MOSS/NORTH INTERSECTION REDESIGN	12.11.04	J.M.

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SCALE 1 : 250 SHEET SIZE A1

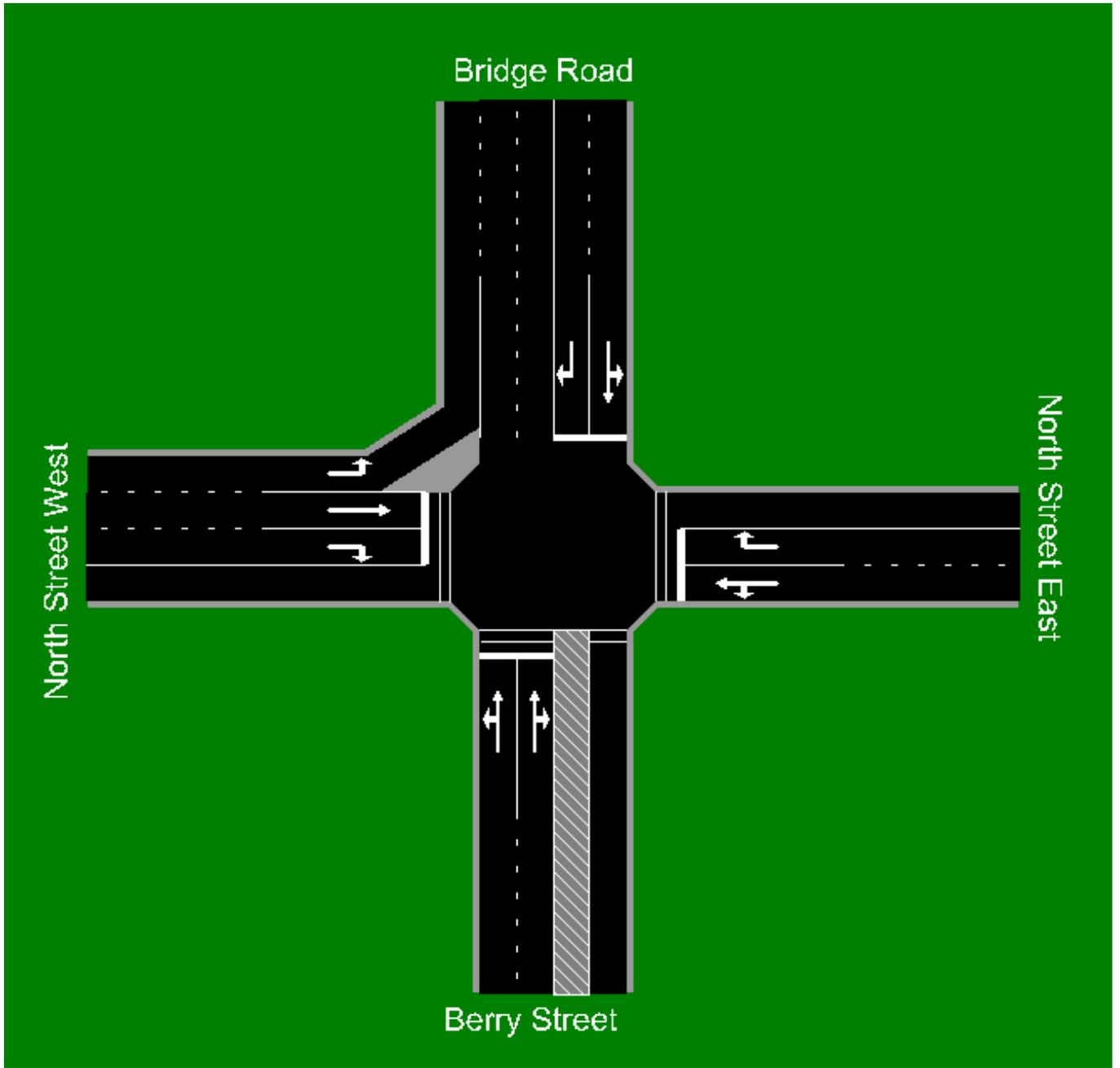
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Design	Drawn	Checked
J.X.Z.	J.M.	J.O.
MAR'04	MAR'04	MAR'04
Scale	Sheet Size	
AS SHOWN	A1	
Authorised for Issue	Client	
Signed:	SHOALHAVEN CITY COUNCIL	
RPEQ No:		

Project Title
NOWRA NORTH STREET CONCEPTS

Drawing Title
INTERSECTION CONCEPTS

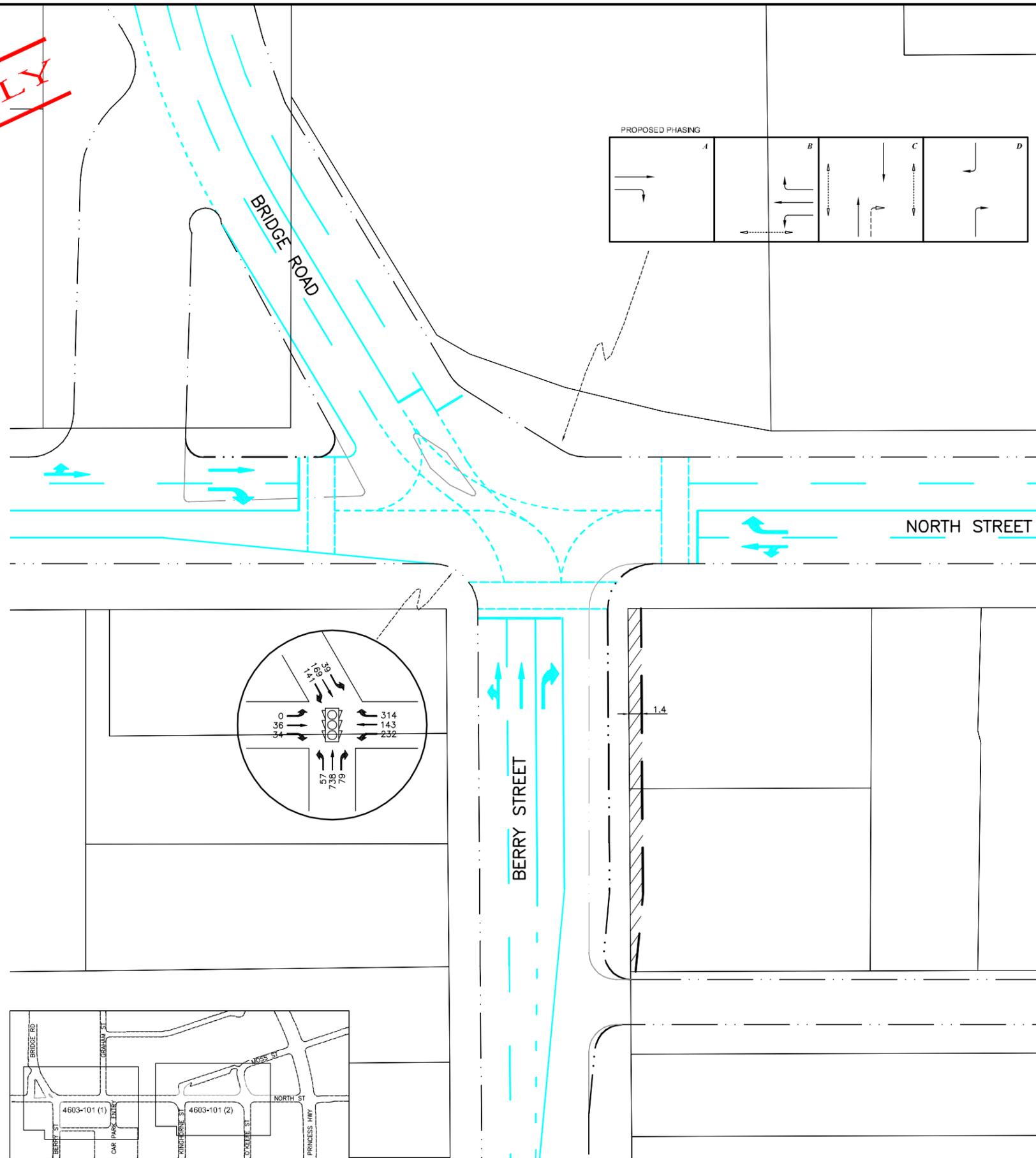
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Sheet	2 of 2
Project no.	4603
Issue	C
CAD files	x:\4603_Base.dwg
Xref n	



DRAWING TITLE:
**LANE CONFIGURATION
BRIDGE RD/NORTH ST/
BERRY ST**

FIGURE No.	4
PROJECT No.	4603
DATE	24.08.04

CONCEPT ONLY



- NOTES**
- VOLUMES ARE FOR PM PEAK PERIOD ONLY
 - PHASE TIME INCLUDES GREEN PLUS INTERGREEN

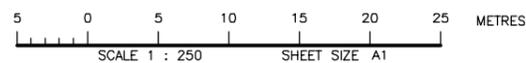
FIGURE 5

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Issue	Description	Date	Auth.
A	ISSUE FOR COMMENT	29.03.04	J.M.
B	SOME LANE REALIGNMENTS	27.05.04	J.M.

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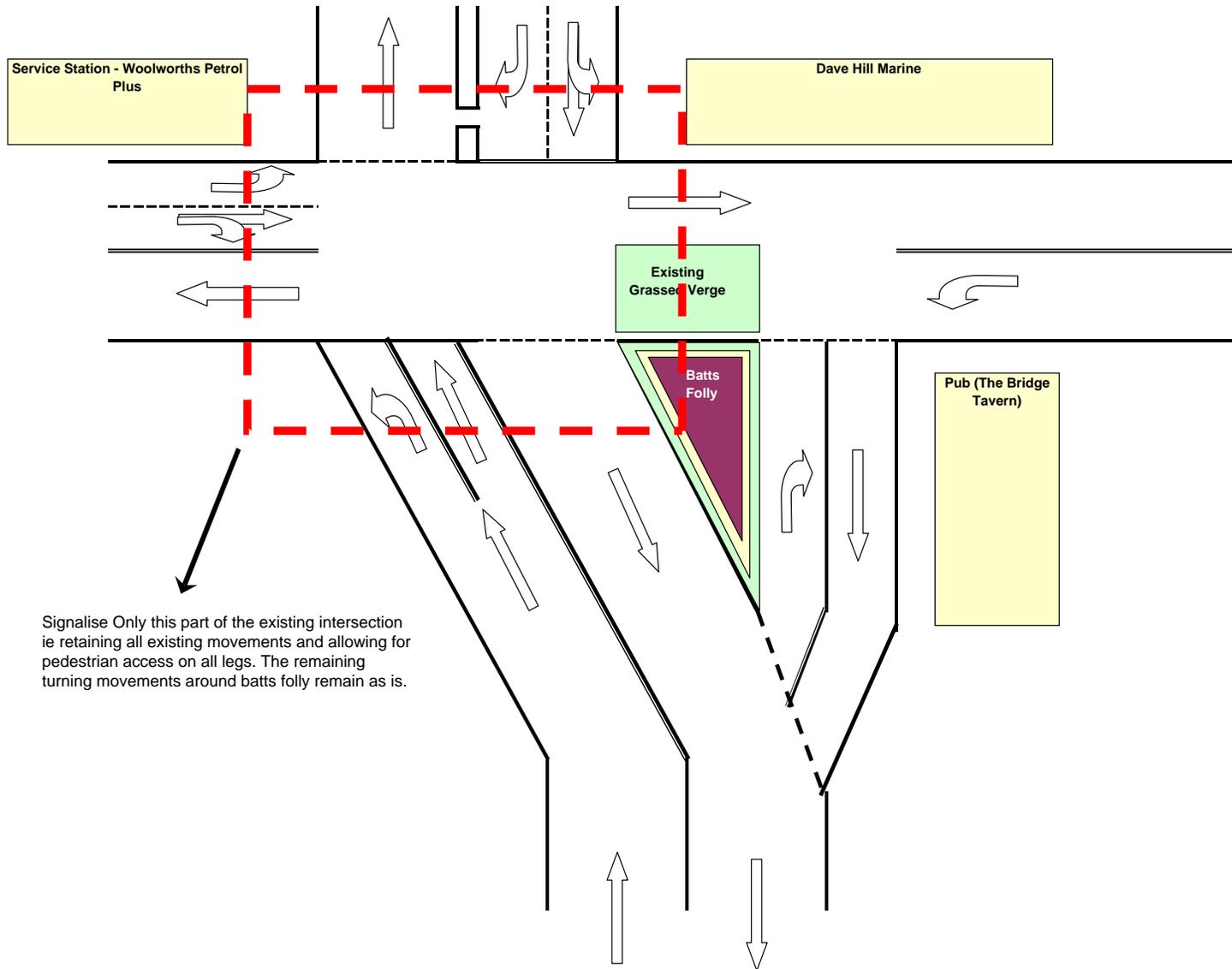
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J.X.Z.	J.M.	J.O.
MAR'04	MAR'04	MAR'04
Scale	Sheet Size	
AS SHOWN	A1	
Authorised for Issue	Client	
Signed:	SHOALHAVEN CITY COUNCIL	
RPEQ No:		

Project Title	Drawing Title
NOWRA NORTH STREET CONCEPTS	INTERSECTION CONCEPTS
Client	
SHOALHAVEN CITY COUNCIL	

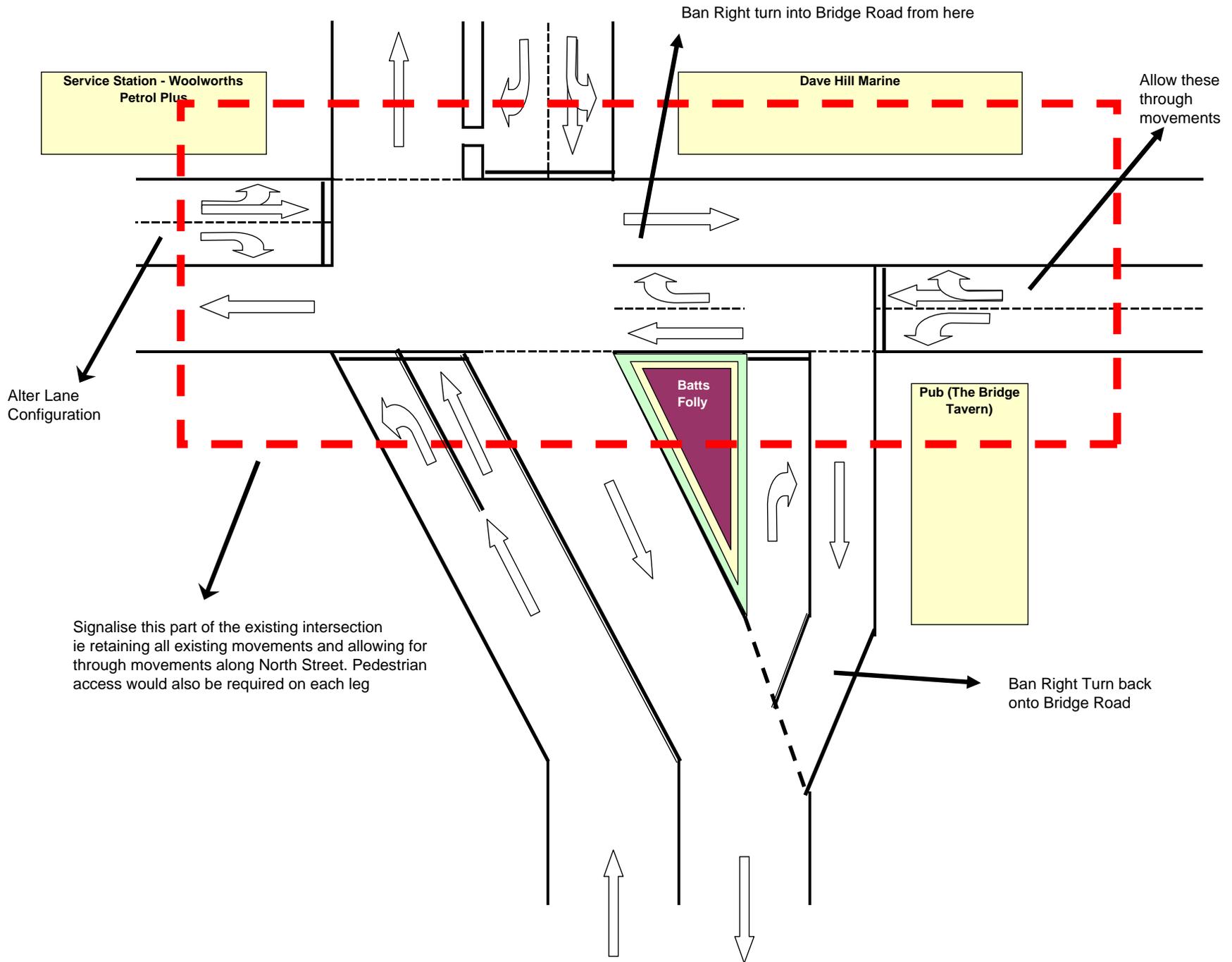
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Sheet	Issue
1 of 1	B
CAD files	Xref n#
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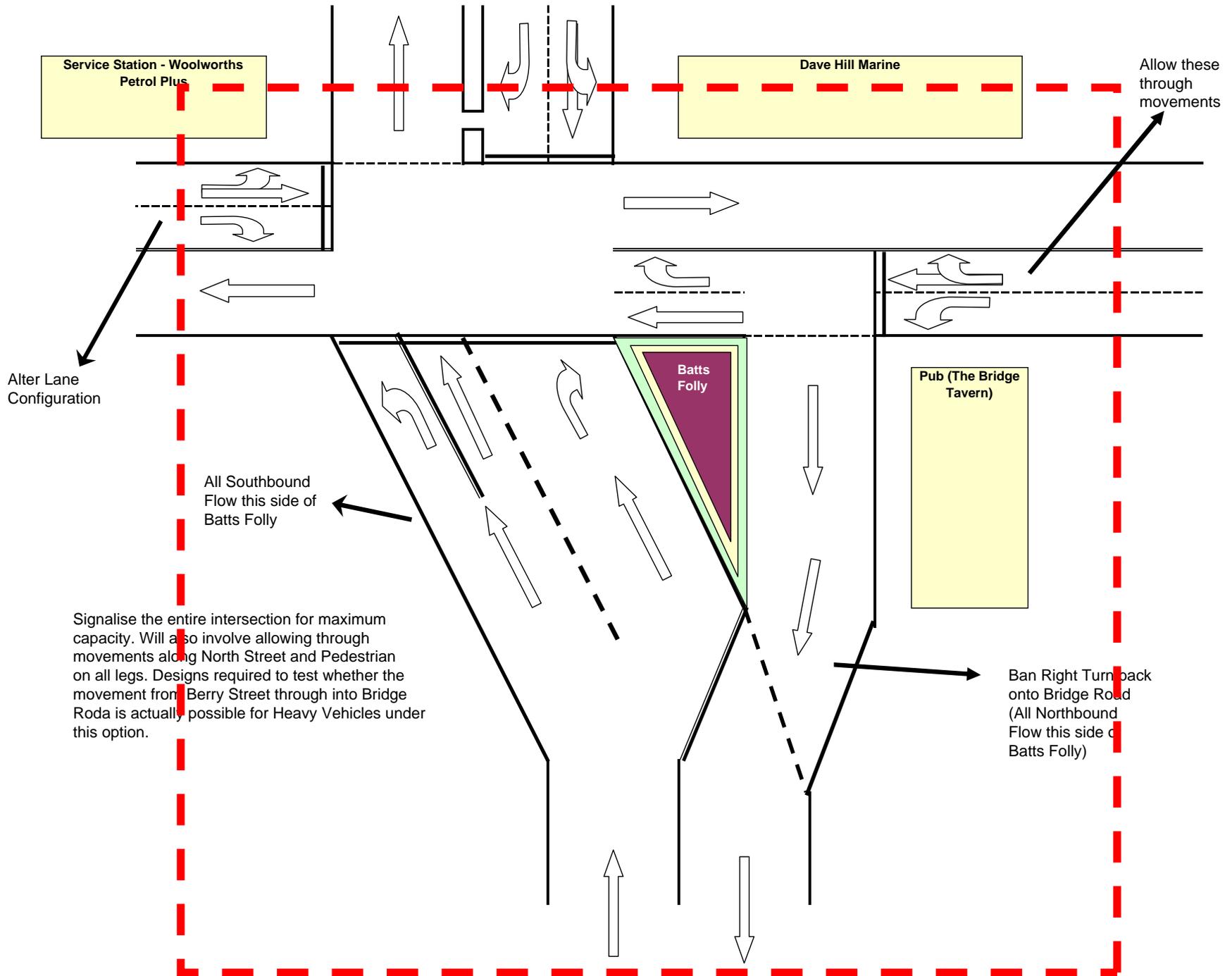
APPENDIX 1

North Street/Bridge Road/Berry Street Initial "Options for Discussion" from Council



Signalise Only this part of the existing intersection ie retaining all existing movements and allowing for pedestrian access on all legs. The remaining turning movements around batts folly remain as is.





Service Station - Woolworths
Petrol Plus

Dave Hill Marine

Allow these
through
movements

Alter Lane
Configuration

All Southbound
Flow this side of
Batts Folly

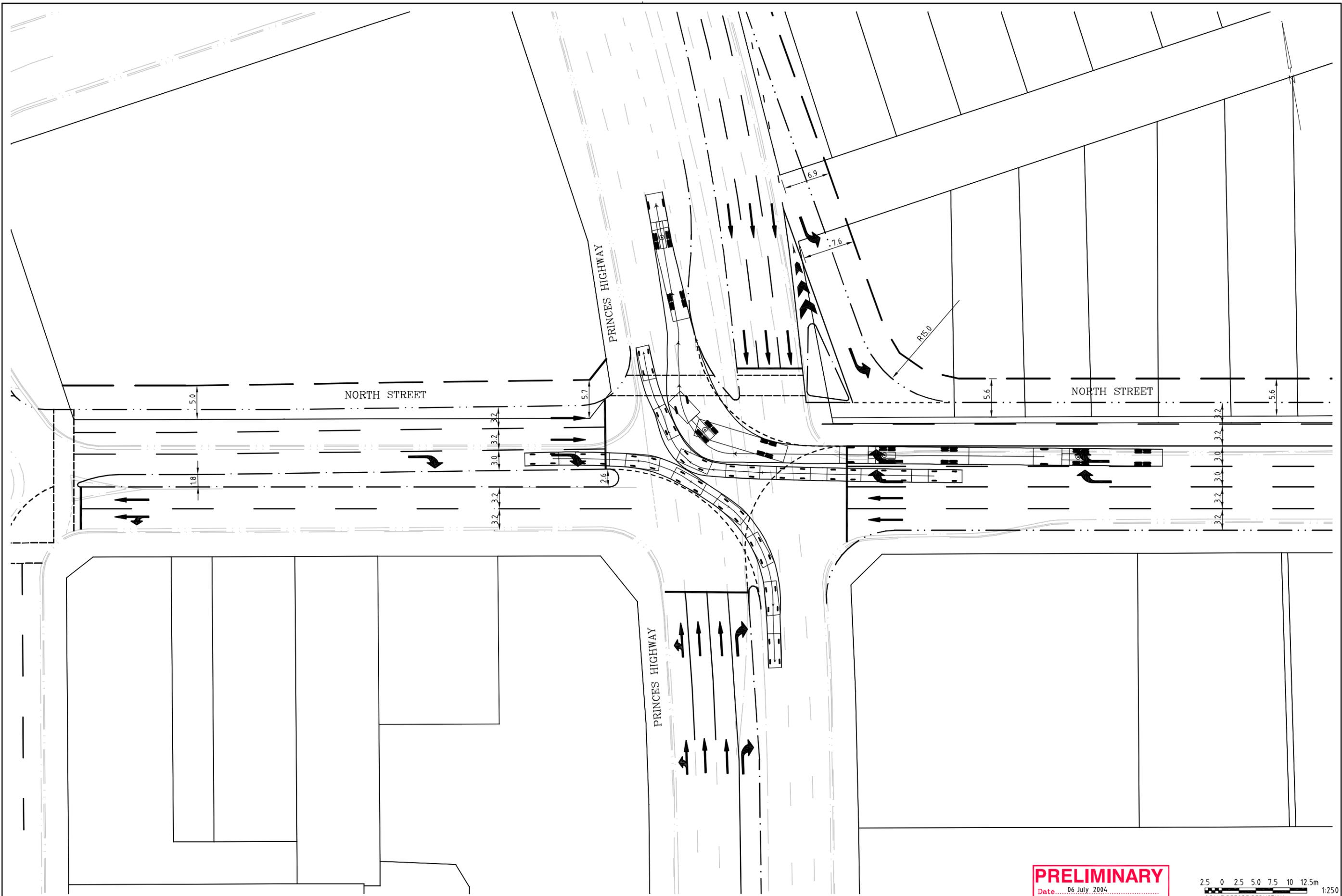
Signalise the entire intersection for maximum
capacity. Will also involve allowing through
movements along North Street and Pedestrian
on all legs. Designs required to test whether the
movement from Berry Street through into Bridge
Roda is actually possible for Heavy Vehicles under
this option.

Pub (The Bridge
Tavern)

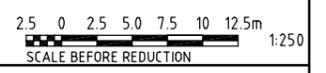
Ban Right Turn back
onto Bridge Road
(All Northbound
Flow this side of
Batts Folly)

APPENDIX 2

North Street - Princes Highway & Brereton Street Concepts (from ENSA Study)



PRELIMINARY
Date: 06 July 2004



Rv.	DATE	REVISIONS	REC.	APPR.	Rv.	DATE	REVISIONS	REC.	APPR.

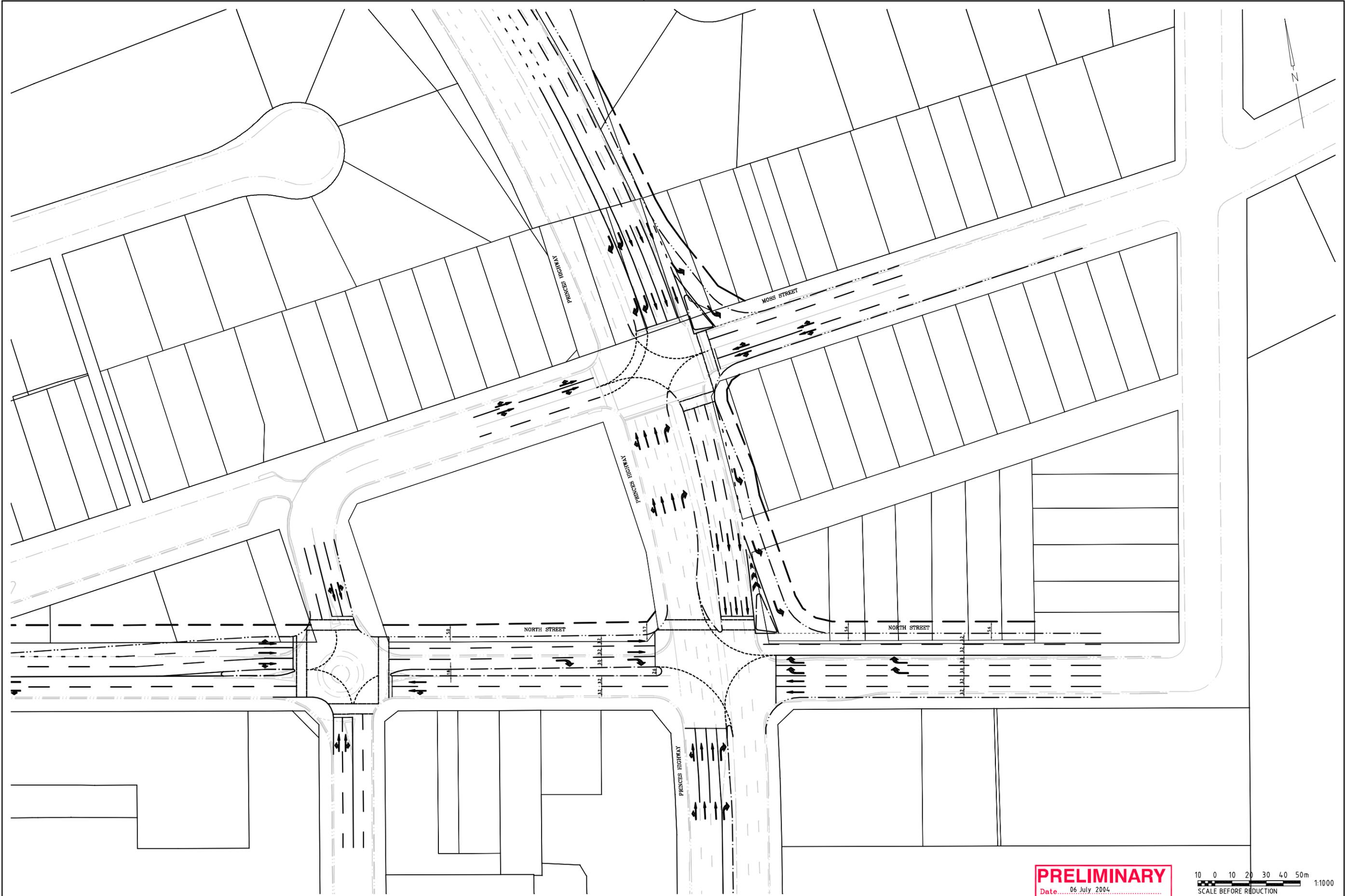
DESIGNED:	A3	DATUM:
DRAWN:		
CHECKED:		
RECOMMENDED: PROJ. MAN.		APPROVED: PROJ. DIR.

Cardno MBK
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P.O. Box 368, Toowoomba 4066
Email: cardno@cardno.com.au
ACN: 051 074 992

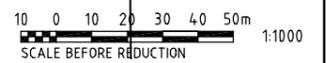
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Gold Coast	(07) 5539 9333	(07) 5536 4647
Sunshine Coast	(07) 5443 2555	(07) 5443 5642
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Central Coast	(02) 4323 2558	(02) 4324 3251
Port Moresby	(0011875) 325 2322	(0011875) 325 0951
Philippines	(0011632) 910 5146	(0011632) 910 5146

SHOALHAVEN SHIRE COUNCIL
EAST NOWRA SUB-ARTERIAL
PRINCES HIGHWAY AND NORTH STREET INTERSECTION
PROPOSED LAYOUT - OPTION 1

DATE: JUNE 2004
DRAWING No: **7583/01/1-00C**
Rv.



PRELIMINARY
Date: 06 July 2004



Rv.	DATE	REVISIONS	REC.	APPR.	Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED: _____
 DRAWN: _____
 CHECKED: _____
 RECOMMENDED: PROJ. MAN. _____
 APPROVED: PROJ. DIR. _____

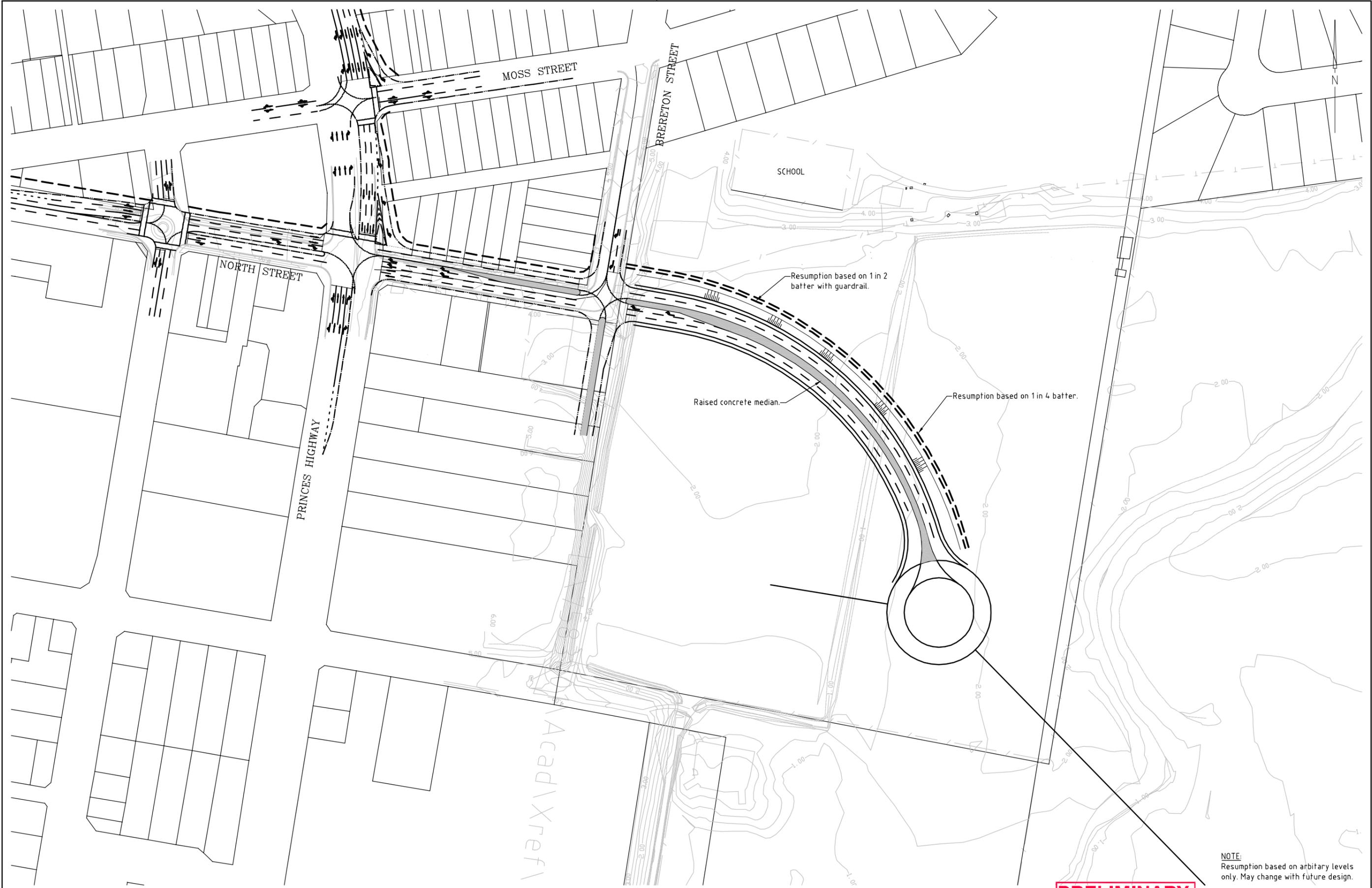
A3 DATUM: _____

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 Central Coast (02) 4323 2558 (02) 4324 3251
 Port Moresby (0011675) 325 2322 (0011675) 325 0951
 Philippines (0011632) 910 5146 (0011632) 910 5146

SHOALHAVEN SHIRE COUNCIL
 EAST NOWRA SUB-ARTERIAL
 PRINCES HIGHWAY AND NORTH STREET INTERSECTION
 PROPOSED LAYOUT - OPTION 2

DATE: JUNE 2004
 DRAWING No: 7583/01/1-00F
 Rv. _____



NOTE:
Resumption based on arbitrary levels only. May change with future design.

PRELIMINARY
Date: 07 July 2004

10 0 10 20 30 40 50m
SCALE BEFORE REDUCTION 1:1000

DESIGNED:	
DRAWN:	
CHECKED:	
RECOMMENDED: PROJ. MAN.	
APPROVED: PROJ. DIR.	
DATE:	
REVISIONS:	
REC. APPR.	

DESIGNED:		DATUM:	
DRAWN:	A3		
CHECKED:			
RECOMMENDED: PROJ. MAN.		APPROVED: PROJ. DIR.	

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Philippines	(0011632) 910 5146	(0011632) 910 5146

SHOALHAVEN SHIRE COUNCIL
EAST NOWRA SUB-ARTERIAL
PRELIMINARY ROAD ALIGNMENT

DATE:	JUNE 2004	Rv.	
DRAWING No:	7583/01/1-00G		