TRAFFIC IMPACT ASSESSMENT

58 LOT RESIDENTIAL SUBDIVISION

LOT 682 DP 568678, LOT 705 DP 613881 AND
LOT 810 DP 247285, MANYANA DRIVE, MANYANA

Prepared by:

Watkinson Apperley Pty Ltd

March 2008

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This report has been prepared for JWA Enterprises Pty Ltd, to accompany an Environmental Assessment Report (EPR) under Part 3A (Major Projects) of the EP&A Act 1979, for the 58 Lot Residential Subdivision of Lot 682 DP 568678, Lot 705 DP 613881 and Lot 810 DP 247285, Manyana Drive, Manyana. The report has been prepared in accordance with the scope of services provided by JWA Enterprises Pty Ltd.

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APPENDICES

1 INTRODUCTION

Watkinson Apperley Pty Ltd have been engaged by JWA Enterprises Pty Ltd to prepare a traffic impact assessment for a 58 Lot Residential Subdivision of Lot 682 DP 568678, Lot 705 DP 613881 and Lot 810 DP 247285**,** Manyana Drive, Manyana. The traffic impact assessment has been prepared to accompany an Environmental Assessment Report (EAR) under Part 3A (Major Projects) of the EP&A Act 1979.

As the proposed development is for a subdivision of less than 200 lots it is not affected by Division 17 (Roads and traffic) clause 104 (Traffic-generating development) subcluase (1) of State Environmental Planning Policy (Infrastructure) 2007. The proposal therefore does not need referral to the RTA and a traffic study is not a legal requirement for the development.

The aim of this assessment is to:

- Investigate the existing traffic conditions including current traffic volumes, road widths, and posted speed limit in the vicinity of the proposed development.
- Assess the intersection and traffic requirements for the development.
- Investigate the potential impact the proposed development is likely to have on the existing traffic conditions and recommend methods to minimise that impact if required.

2 SUBJECT SITE

2.1 Location

Manyana is located approximately 210km south of Sydney in the Shoalhaven region. Manyana is a coastal residential village, located approximately 30kms north of Ulladulla, and 11km east of the Princes Highway (**Figure 1**). The subject site is positioned along the eastern edge of the existing residential area of Manyana. Manyana Drive, Sunset Strip, The Palisade, The Barbette, The Bounty and the fore dunes of Manyana Beach generally bound the site. The subject land lies approximately 300 m west of Manyana Beach.

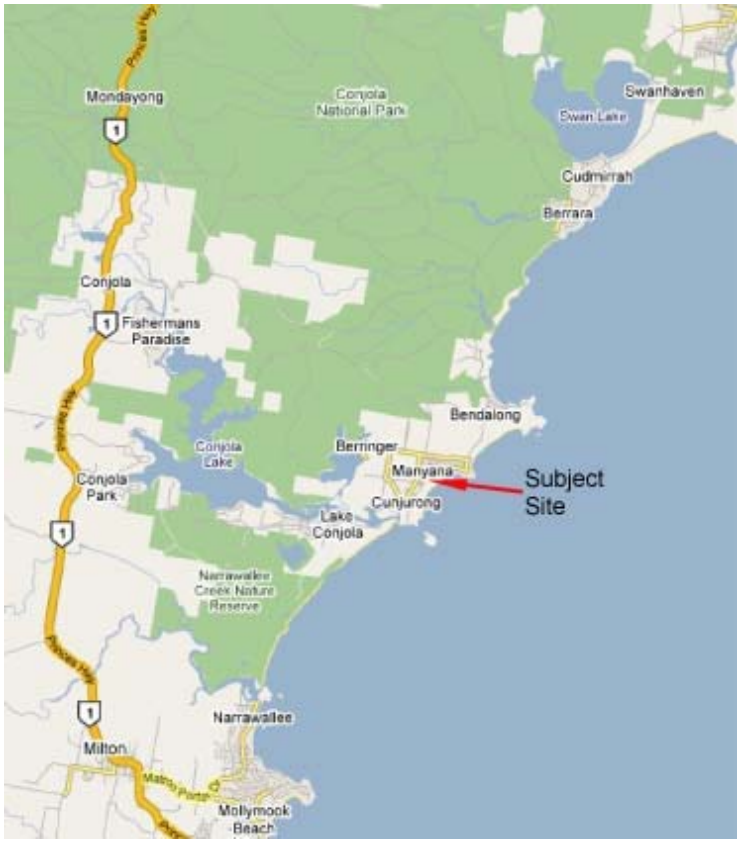


Figure 1: Locality Plan

2.2 Site Description

The subject site, which consists of Lot 682 DP 568678, Lot 705 DP 613881 and Lot 810 DP 247285, comprises an irregular shaped area of some 9.5 ha with maximum north-south and east-west dimensions of 384 m and 530 m respectively (Figure 2).

Lot 682 DP 568678 is located in the northern section of the proposed development, is irregular in shape with a total area of 2.18ha. Lot 682 is proposed to comprise of fifteen (15) Torrens Title lots ranging in size from 742m^2 to 1430m^2, the extension of Sunset Strip and part of proposed Lot 158, which will be dedicated to Shoalhaven City Council (**Attachment 1**).

Lot 810 DP 247285 is located in the southwestern section of the proposed development, is irregular in shape with a total area of 2.11ha. Lot 810 is proposed to comprise of twenty three (23) Torrens Title lots ranging in size from 600m^2 to 993.6m^2 and the extension of Manyana Drive, The Barbette and The Bounty Road (**Attachment 1**).

Lot 705 DP 613881 is located in the south to southeastern section of the proposed development, is irregular in shape and has an area of 5.21ha. Lot 705 is proposed to comprise of nineteen (19) Torrens Title lots ranging in size from 543m^2 to 1466m^2, the creation of a new perimeter loop road off Manyana Drive, the creation of a new road off Manyana Drive to the loop road, and part

of proposed Lot 158 with a proposed artificial wetland to treat stormwater runoff which will be dedicated to Shoalhaven City Council (**Attachment 1**).

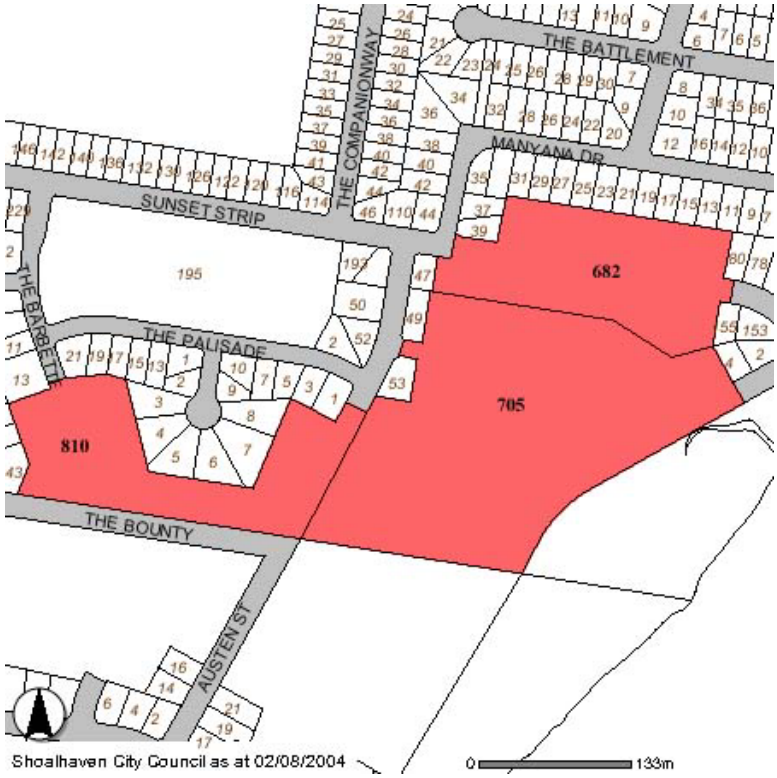


Figure 2: The subject site.

2.3 Land Use

The subject site is vacant and covered predominately in forest vegetation except for the recently constructed Sewer Pumping Station (north east section of the site) and its associated access from Sunset Strip, which forms part of the Conjola Regional Sewerage Scheme. The site contains a number of informal walking and vehicular tracks, with two formal pedestrian access points to the beach located on the southeastern boundary of the site (one located at the eastern corner and the other located at the southern corner of the southeastern boundary). A number of the walking tracks extend towards these points from the northwest, north, east and west.

Manyana is predominantly a coastal residential village, which includes a general store, caravan parks, holiday rentals and picnic areas with surfing and swimming beaches. The subject site is bounded to the north by existing residential development, to the west by a mixture of existing residential development and vacant undeveloped land, to the east by a mixture of existing residential development and sand dunes associated with Manyana beach reserve and to the south by vacant undeveloped land, crown reserve and sand dunes associated with Manyana beach reserve.

Shoalhaven City Council report “Community Profile” (http://www.shoalhaven.nsw.gov.au/), indicates that the Manyana area has a permanent occupation of 30.6%. The

report also suggests that the Manyana area has an average of 2.33 persons per detached house. Therefore for the majority of the time the proposed subdivision will result in an additional 17 occupied dwellings (30% of 57), with a population increase of 40 people (17 x 2.33). During holiday periods when the occupancy rate is likely to be closer to 100%, the increase in population would be 139 people (57 x 2.33).

2.4 Site Access

Manyana is accessed via Bendalong Road and Inyadda Drive. Once in Manyana there are a number of routes, which can be taken to access different parts of the proposed subdivision. The main access routes are:

- Left from Inyadda Drive onto Curvers Drive, right into The Citadel and right on Sunset Strip;
- Right from Inyadda Drive onto Berringer Road, then left onto The Companionway and left on Sunset Strip;
- Right from Inyadda Drive onto Berringer Road, then left onto The Companionway, left on Sunset Strip and right on Manyana Drive;
- Right from Inyadda Drive onto Berringer Road, then left onto The Companionway, left on Sunset Strip, right on Manyana Drive and right on The Bounty; and
- Right from Inyadda Drive onto Berringer Road, then left onto The Companionway, right on Sunset Strip and left on The Barbette.

The proposed subdivision involves the extension of Sunset Strip, The Barbette, The Bounty, Manyana Drive and the creation of 2 new roads off Manyana Drive one running north-south and the other running east-west (Attachment 2).

3 PROJECT DESCRIPTION

3.1 Proposal

The development provides the opportunity for residential properties to be located in a unique coastal setting within an established coastal village, with good access to urban infrastructure. This proposal is to create a 58-lot residential subdivision of the subject land, with proposed Lot 158 being dedicated to Shoalhaven City Council as public reserve (**Attachment 1**).

This proposal forms infill development of three (3) residue lots from previous subdivision of the area that has been progressively developed in stages over a period of 45 years. The previous subdivisions, the existing road network and the environmental constraints of the site have had a major influence over the final subdivision layout. Therefore while there are other possible subdivision patterns the current proposal is considered the most practical and efficient given the site constraints. The subdivision layout extends Sunset Strip, The Barbette and The Bounty to complete the existing street network. Moreover, the layout has been designed so that the ecologically sensitive parts of the site are protected through their dedication to Shoalhaven City Council (proposed Lot 158) as public land.

4 EXISTING TRAFFIC CONDITIONS

4.1 Road Conditions

The road network in the vicinity of the site includes Princes Highway, Bendalong Road, Inyadda Drive, Berringer Road, Curvers Drive, The Companionway, The Bulwark, Sunset Strip, Manyana Drive, The Rampart, Neptune Place, The Palisade, The Barbette, The Bartizan, The Barbican and Cunjurong Point Road.

- The Princess Highway is the main road in the vicinity of the subject site. The Princes Highway is the only continuous north-south route through the Shoalhaven Region. It links Shoalhaven to Sydney to the north and Batemans Bay and Canberra to the South. The Princes Highway in the vicinity of the turnoff to Manyana (Bendalong Road) comprises one southbound lane and two northbound traffic lanes with a 100 kilometre per hour speed limit. The northbound overtaking lane merges north of Bendalong Road. Access from the Princes Highway onto Bendalong Road is uncontrolled. Although turning lanes are provided on the highway for right and left turns into Bendalong Road. A give way sign controls access to the Princes Highway from Bendalong Road. Furthermore, a short acceleration lane is also provided for left turns from Bendalong Road.

- Bendalong Road runs east from the Princes Highway and provides access to Bendalong, Manyana, Berringer Lake and Cunjurong Point. Bendalong Road comprises two lanes of traffic, one lane in each direction with sealed and unsealed shoulders and a speed limit of 100 kilometres per hour.

- Inyadda Drive runs south from Bendalong Road into the Manyana township, Berringer Lake and Cunjurong Point. The intersection of Inyadda Drive with Bendalong Road is a t-intersection controlled by give way signs, with Bendalong Road having priority. Inyadda comprises two lanes of traffic, one lane in each direction with sealed and unsealed shoulders and a speed limit of 80 kilometres per hour.

- Berringer Road and Curvers Drive form a t-intersection at the southern end of Inyadda Drive. Berringer Road provides access to Berringer Lake residential areas in the west of Manyana. Curvers Drive provides access to residential areas east of Manyana.

- The Companionway, The Bulwark, Sunset Strip, Manyana Drive, The Rampart, Neptune Place, The Palisade, The Barbette, The Bartizan, The Barbican and Cunjurong Point Road are all comprised of two lanes of traffic, one lane in each direction and a speed limit of 50 kilometres per hour. All of the above roads provide access to residential properties. Sunset Strip also provides access to open space and community facilities. The intersections of the majority of these roads are priority controlled except for the intersections of Berringer Road with Cunjurong Point Road and the Companionway, which are controlled by stop signs.

4.2 Existing Traffic Volumes

In order to measure traffic conditions, counts were undertaken during a weekday morning (7:30 - 8:30am) and afternoon period (5:00 – 6:00pm) (during school holidays) on Thursday the 11th October 2007 at the following intersections:

- The Palisade and The Barbette;
- The Barbette and The Bartizan;
- The Barbette and Sunset Strip;
- The Palisade and Manyana Drive;
- Manyana Drive and Sunset Strip; and
- Sunset Strip and The Companionway.

The date of the survey was chosen to capture the school holiday period when the permanent occupancy rate in Manyana is likely to be closer to 100%, compared to the normal 30%. The time periods were selected because they allow for a 30 to 45 min travel time for residents who are working in the Nowra and Ulladulla area. The six intersections were chosen because they are directly affected by the proposed subdivision (**Attachment 3**). The Princess Highway/Bendalong Road and Bendalong Road/Inyadda Drive intersections were not surveyed as it is considered that as the subject land is zoned for residential development Shoalhaven City Council and the RTA should have taken the future development of the subject land into consideration in their capacity analysis for these intersections.

Table 1 provides a breakdown of the movements at each intersection during the survey period. It should be noted that Manyana Drive is not a continuous road and is offset in a westerly direction at the intersection with Sunset Strip (Figure 2 & 3). Therefore there are two intersections between Manyana Drive and Sunset Strip as indicated in Figure 3.

Intersection	AM	PM
Right from The Palisade onto The Barbette	8	1
Right from The Bartizan onto The Barbette	1	3
Left from The Bartizan onto The Barbette	3	4
Right from The Barbette onto Sunset Strip	0	4
Left from The Barbette onto Sunset Strip	5	0
Left from The Barbette onto The Palisade	1	2
Left from The Barbette onto The Bartizan	6	0
Right from The Barbette onto The Bartizan	0	9
Left from Sunset Strip onto The Barbette	0	9
Right from Sunset Strip onto The Barbette	0	0
Right from Manyana Drive (1) onto Sunset Strip	12	7
Left from The Palisade onto Manyana Drive (2)	3	0
Left from Manyana Drive (2) onto Sunset Strip	2	0
Right from Manyana Drive (2) onto Sunset Strip	1	0
Right from Sunset Strip onto The Companionway	5	2
Left from Sunset Strip onto The Companionway	0	5
Left from Sunset Strip onto Manyana Drive (1)	5	14
Right from Manyana Drive (2) onto The Palisade	5	1
Right from Sunset Strip onto Manyana Drive (2)	2	1
Left from Sunset Strip onto Manyana Drive (2)	6	1
Left from The Companionway onto Sunset Strip	4	5
Right from The Companionway onto Sunset Strip	4	13
Total Movements	**73**	**81**

Table 1: A breakdown of the movements at each of the intersections during the survey period.

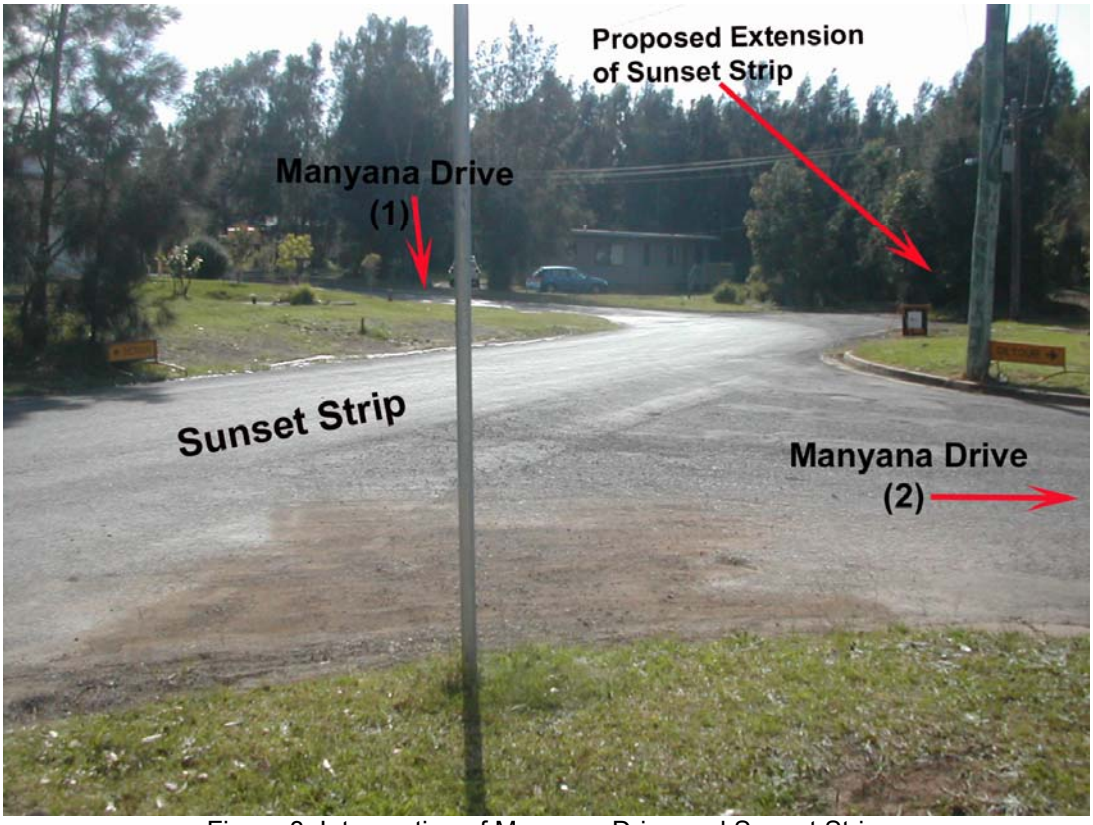


Figure 3: Intersection of Manyana Drive and Sunset Strip.

Table 2 provides a breakdown of the total number of vehicles using The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway during the survey period.

Existing two-way streets (sum of both directions) peak hour traffic flows		
Road	***AM (peak hour)***	***PM (peak hour)***
The Palisade	11	1
The Barbette	4	7
The Bartizan	12	15
Sunset Strip	18	32
Manyana Drive	20	8
The Companionway	8	18
Total Movements	**73**	**81**

Table 2: A breakdown of the total number of vehicles using The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway during the survey period.

Typically, peak hour flows represent between 8% and 12% of daily traffic flows. Using this assumption, daily traffic flows along The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway was calculated using 10% of peak hour flows (Table 3).

Road	Average Peak Vehicle Movements Per Hour	TDT
The Palisade	6	60
The Barbette	5.5	55
The Bartizan	14.5	145
Sunset Strip	25	250
Manyana Drive	14	140
The Companionway	13	130
Total Movements	**78**	**780**

Table 3: The average peak vehicle movements per hour and the Total Daily Traffic (TDT) flows along The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway.

4.3 Road Classification

Roads are classified according to the role they fulfil and the corresponding volume of traffic they should carry. The RTA identifies the following guidelines for the functional classification of roads:

Arterial Road
Typically a main road carrying over 15,000 vehicles per day and fulfilling a role as a major inter-regional link with over 1500 vehicles per hour during the peak hours.

Sub-arterial Road
Defined as secondary inter-regional links, typically carrying volumes between 5000 and 20000 vehicles per day with between 500 and 2000 vehicles per hour during the peak hours.

Collector Road
Provides a link between local areas and regional roads, typically carrying between 2,000 and 10,000 vehicles per day. At volumes greater than 5,000 vehicles per day, residential amenity begins to decline noticeably. Peak hour flows would be between 250 to 1000 vehicles per hour.

Local Road
Provides access to individual allotments, carrying low volumes typically less than 2,000 vehicles per day with peak hour flows up to 250 vehicles per hour.

The Shoalhaven City Council DCP 100 has identifies the following guidelines for the functional classification of roads:

Local Distributor

The highest order road within a residential development should have as its main function the convenient and of traffic generated by the development. The local distributor typically carries between 3,000 and 6,000 vehicles per day.

Collector Streets
Have a residential function but also carries higher volumes of traffic collected from lower order streets. A reasonable level of residential amenity and safety

is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority and access place or street. The collector street typically carries up to 3,000 vehicles per day with access to residential allotments.

Local Street
Are a local residential street should provide a balance between the status of that street in terms of its access and residential amenity functions. Residential safety and amenity are dominant but to a lesser degree than access streets. The local street typically carries up to 2,000 vehicles per day.

Access Street
Has a primary function, residential space – amenity features that facilitate pedestrian and cycle movements, and where vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. The access street typically carries up to 500 vehicles per day.

Table 4 provides a summary of the classification of the existing roads in the vicinity of the proposed subdivision in accordance with the RTA Guidelines and the Shoalhaven City Council DCP100.

Road Name	Approx. Carriage Width (m)	Speed limit	Road Hierarchy (RTA)	Road Hierarchy (DCP 100)
The Palisade	8.2	50	Local	Local Street
The Barbette	7.8	50	Local	Local Street
The Bartizan	8.14	50	Local	Local Street
Sunset Strip	8.5	50	Local	Local Street
Manyana Drive	9	50	Local	Local Street
The Companionway	7.3	50	Local	Collector

Table 4: The classification of the roads within the existing subdivision in accordance with the RTA Guidelines and the Shoalhaven City Council DCP100.

Adopting the above classification, it can be seen that the existing traffic volumes of all the surveyed roads (Table 3) are well below the limits for a local road under the RTA road classification of 2,000 vehicles per day (TDT) and peak hour flows of 250 vehicles per hour. The Companionway currently carries up to around 125 vehicles per day, well within the limits of a collector street (3,000 VPD) under the Shoalhaven City Council DCP 100 classification. The Palisade, The Bartizan, The Barbette, Sunset Strip, and Manyana Drive currently carries between 60 and 290 vehicles per day, well within the limits of a local road (2,000 TDT) under the Shoalhaven City Council DCP 100 classification. During the peak periods the surveyed roads are carrying a maximum of 12.5% of their theoretical capacity.

The desirable maximum capacity of a road section is determined from AUSTROAD's "*Guide to Traffic Engineering Practice: Part 2 - Roadway Capacity*", by the Level of Service (LoS). A basic Level of Service (LoS) may be equated to a particular Volume/Capacity by considering a range of LoS from A through F with A representing a very good LoS through F which represents an unacceptable LoS. These ranges are shown in Table 5. Typically, roads with LoS worse than D will require remedial works to improve the LoS.

Level of Service	Volume/capacity (V/C) Range
A	<0.65
B	0.65 to 0.75
C	0.75 to 0.85
D	0.85 to 0.95
E	0.95 to 1.05
F	>1.05

Table 5: The range of LoS according to the AUSTROAD's "*Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity*"

For The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway, using the assumed desirable maximum hourly flow of 250 and the data from Table 2, the volume to capacity ratio and the level of service are shown in Table 6. As indicated in Table 6 the roads are all operating at a level of service of A. This confirms the observations during the traffic survey, when there was no congestion or delays experienced by the existing road users.

	V/C	LoS	V/C	LoS
	AM		PM	
The Palisade	0.044	A	0.004	A
The Barbette	0.016	A	0.028	A
The Bartizan	0.048	A	0.06	A
Sunset Strip	0.072	A	0.128	A
Manyana Drive	0.08	A	0.032	A
The Companionway	0.032	A	0.072	A

Table 6: The LoS for surveyed roads.

4.4 Intersection Operation

The main intersections in the vicinity of the site are:

- The Palisade and The Barbette;
- The Barbette and The Bartizan;
- The Barbette and Sunset Strip;
- The Palisade and Manyana Drive;
- Manyana Drive and Sunset Strip; and
- Sunset Strip and The Companionway.

All these intersections are unsignalised intersections with minor roads. As the roads involved in the intersection contain relatively low volumes of cross and turning traffic, when compared to the figures provided in the AUSTROAD's Roadway Capacity guidelines (Table 7), capacity analysis is considered unnecessary and thus not required.

Type of Road	Light cross and Turning Volumes Maximum Design Hour Volumes Vehicles per hour (two way)		
Two lane major road	400	500	650
Cross road	250	200	100

Table 7: Intersection volumes which capacity Analysis is unnecessary (AUSTROAD's "*Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity)*.

4.5 Road Safety

The roads associated with the existing subdivision all have relatively well defined carriageways with speed limits of 50km/h. During the survey period the majority of vehicles appeared to comply with the posted speed limits. The roads contain good lines of sight for all the intersections and the roads themselves contain no major obstacles.

4.6 Public Transport

Public transport is available to the site and is provided by:

Nowra Coaches:

- Nowra to Lake Conjola, Fishermans Paradise, Manyana and Bendalong
  - Tuesday to Thursday: 1 service each day.
  - School days Mon - Fri 1 service each way.
- The services operate along Berringer Road, Curvers Drive, Cunjurong Point Road and Sunset Strip.

Kellam Bus Lines:

- Ulladulla to Lake Conjola, Fishermans Paradise and Bendalong
  - School Days: 1 service each way.
- The public can use this service.

4.7 Pedestrian Access

There are no formal footpaths along the roads within the existing subdivision streets.

5 TRAFFIC IMPACT

5.1 Predicted Traffic Generation

The impact of the traffic associated with the proposed development has been assessed with regard to the RTA Guide to Traffic Generating Developments. This is the standard document used to assess the impact of traffic associated with developments. The typical generation rates for residential dwelling houses are provided in Table 8. Note that a trip is defined as one-way vehicle movement from one point to another. Therefore, a return trip to and from a land use is counted as two trips.

Daily vehicle trips	9.0 per dwelling
Weekday peak hour vehicle trips	0.85 per dwelling

Table 8: Typical generation rates for residential dwelling houses (RTA Guide).

Using the above rates, the future increase in traffic volumes associated with the proposed subdivision and the creation of an additional 57 residential lots (proposed Lot 158 contains an endangered ecological community and is proposed to be dedicated to Shoalhaven Council and thus will not have a dwelling entitlement) are summarised in Table 9. As can be seen from Table 9, the future increase in traffic flow associated with the proposed subdivision is relatively low.

Number of proposed dwellings	Daily vehicle trips	Weekday peak hour vehicle trips
57	513	48

Table 9: Future traffic flows due to the proposed subdivision.

Table 10 shows the predicted increase in traffic movements resulting from the proposed 57 residential lots all using Sunset Strip. Sunset Strip has been chosen, as it will provide a link between the proposed and existing development in the west of Manyana and the public facility located at Manyana Beach. Furthermore, Sunset Strip overall recorded the highest vehicles movements of the roads surveyed. As can be see from Table 10, even when assuming as a worst case that all additional traffic movement uses Sunset Strip the future peak traffic flows are well below the acceptable limit of 250 vehicles per hour. As a result the volume to capacity ratio would range between 0.268 and 0.324 resulting in a Level of Service of A, which would indicate a good level of service for future road users.

	Existing traffic flow from survey	Future traffic flow due to proposed subdivision	Total future traffic flow	Volume to capacity ratio	LoS
AM Peak Traffic Flow (veh/hr)	18	48	66	0.264	A
PM Peak Traffic Flow (veh/hr)	32	48	80	0.32	A
Total Traffic	250	513	763		

Table 10: Shows the predicted increase in traffic flow on Sunset Strip as a result of the proposed subdivision.

5.2 Proposed New Roads

There are a number of physical or design-based mechanisms and operational mechanisms, which can be employed to calm and manage traffic and to ensure safe pedestrian access. Selection of the appropriate mechanisms or group of mechanisms depends on the type and location of the road being designed.

The proposed subdivision layout represents an integrated street design approach that incorporates physical and operational mechanisms to manage traffic and pedestrian movement. The choice of the street type and layout as well as the mechanisms employed was influenced by several factors:

- the functional class of the road;
- the average and peak traffic volumes;
- the existing road network;
- the environmental constraints (Flora and Fauna, Bushfire, Stormwater management); and
- the activity/ land use on the affected land and adjoining public open spaces.

The proposal involves the extension of The Barbette, The Bounty, Manyana Drive, Sunset Strip, the construction of a new perimeter loop road off Manyana Drive, and the construction of a new road off Manyana Drive to the loop road. Attachment 2 shows the proposed road to be created as part of this subdivision.

The extension of The Barbette, The Bounty and Manyana Drive will be designed and constructed to match the carriageway of the existing roads in accordance with the principles of a local road as defined in Council's Subdivision Code (DCP 100). The Barbette is proposed to have a 15.24 metre reserve, with approximately 3.7 metre verges and a 7.8 metre carriageway. The Bounty and Manyana Drive are proposed to have a 20.115 metre reserve, with 6.5 metre verges and a 7 metre carriageway. All three roads will be designed to accommodate the swept paths of garbage trucks and furniture delivery vans.

The extension of Sunset Strip will be designed and constructed generally in accordance with the principles of an access street as defined in Council's Subdivision Code (DCP 100). Sunset Strip is proposed to have a 12 metre reserve, with a 4 metre verge on the northern side and a 2 metre verge on the southern side of the street with a 6 metre carriageway. A typical cross-section of a 12m wide road reserve has been provided in Attachment 4 to show the general location of services. It is also proposed to contain a bio-retention system within the verge and carriageway, reducing the road carriageway width to 5m at one point. The bio-retention system will have the dual purpose of managing stormwater flows and providing a traffic calming device similar to a chicane.

The proposed perimeter loop road off Manyana Drive will be designed and constructed generally in accordance with the principles of an access street as defined in Council's Subdivision Code (DCP 100). The loop road will be located off Manyana Drive approximately 20m north of The Palisade and approximately 40m north of The Bounty. Furthermore it is proposed that an 80m long road from Manyana Drive to the loop road be constructed. The proposed connecting road will be located approximately 20m south of The Palisade and will service 7 lots (Attachment 2).

The perimeter loop road is proposed to have a variable road reserve ranging from 12 to 13 metres. The northern and eastern sections of the loop road are proposed to have a 12m road reserve, with a 4 metre verge on the western side and a 2 metre verge on the eastern side of the street with a 6 metre carriageway. A typical cross-section of a 12m wide road reserve has been provided in Attachment 4 to show the general location of services. The southern section of the loop road and the connecting road are proposed to have a road reserve of 13m, with 3.5 metre verges and a 6 metre carriageway. A typical cross-section of a 13m wide road reserve has been provided in Attachment 4 to show the general location of services.

As part of the Environmental Assessment for the proposed subdivision an endangered ecological community ('*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'*) was identified on the subject land resulting in the proposed subdivision being reduced from 71 lots to 58 lots.

The proposed reduction in width of the road reserve, and verges for Sunset Strip, the loop road and the connecting road has been proposed as a design solution to overcome the following environmental and economic constraints of the site:

- The subject land on the southern side and adjacent to the proposed extension of Sunset Strip contains an endangered ecological community ('*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'*), which limits the ability to create lots along that southern side of the road frontage. As result the number of lots proposed along the southern side of the Sunset Strip extension has been reduced from 9 in the original subdivision layout to 4 lots.
- The total number of lots having direct street frontage to the Sunset Strip extension has been reduced from 19 in the original subdivision layout to 14 lots. Furthermore, majority of the extension will be singly loaded According to the RTA guidelines discussed in Section 5.1 this will result in 126 direct traffic movements per day (during peak holiday period when the occupation rate is at 100%), which is considered to be a low number of traffic movements.
- The land to the east of proposed perimeter loop road (lots 119,120 and 126) comprises endangered ecological community *('Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'*), which provides a limited depth of land between the EEC on Lot 158 and the proposed connecting extension to Manyana Drive. Furthermore, the layout must provide for a 16 - 20m APZ adjacent to Lot 158.
- The total number of lots proposed to be serviced from the loop road has been reduced from 20 in the original subdivision layout to 14 lots. Furthermore, majority of the loop road will be singly loaded. According to the RTA guidelines discussed in Section 5.1 this would result in 136 direct traffic movements per day (during peak holiday period when the occupation rate is at 100%), which is considered to be low amount of traffic movements.

It is considered that the proposed reduction in the road reserve, carriageway and verges will provide an enhanced environmental outcome, while providing adequate space for services and a safe road environment for both vehicle and pedestrians. The proposed reductions in the road reserve, and verges are justified for the following reasons:

- The reduction in the reserve width will reduce the impact of civil construction required within the endangered ecological community *('Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'*).
- The loop road and the extension to Sunset Strip is virtually a single loaded street, therefore it makes good design sense to maintain a narrow road reserve to manage driver behaviour and limit the opportunity for speeding. Furthermore the single side roads provide a buffer between residential development and the endangered ecological community.
- The proposed carriageway width satisfies Shoalhaven Council requirements.
- The proposed 4m wide verge as part of a 12m wide road reserve (Attachment 4) is adequate to accommodate all services and the 2m wide verge will provide sufficient space for pedestrian movements.
- The proposed 3.5m wide verges as part of a 13m wide road reserve (Attachment 4) are adequate to accommodate all services and pedestrian movements.
- Given the location of the extension to Sunset Strip and position of the loop road vehicular traffic will be subservient in terms of volume to those elements of public amenity, pedestrians and cyclists. Therefore the primary functions of this section of the Sunset Strip will be to provide a link between the public open space provided at Manyana Beach and the existing and proposed residential development and to encourage pedestrian/cycle movements.
- We are of the opinion that with the use of appropriate pavement treatment to inform road user that they are entering different road conditions the proposed road widths are adequate in this location given the low traffic volumes and the short distance required to travel to entry and exit points of the roads. Furthermore, the introduction of the pavement thresholds will provide a safe shared environment for pedestrians.
- The roads in question are relatively flat and contain good sight distances in all directions.
- The proposed road widths satisfies the bushfire requirements and will allow fire trucks direct access to the public reserve from Sunset Strip and the loop road in the event of an emergency.

5.3 Future Traffic Generation

Having considered the subject site and its location within the Manyana village area, it is considered that the majority of the traffic flow along the proposed new roads will be generated by the proposed subdivision. Out of the proposed new roads Sunset Strip will be the most likely road to experience additional traffic movements in the future as it will create the link to the public facility and beach access located to the east at Manyana Beach. Table 10 demonstrates that both the total traffic movements and peak hourly movements predicted for Sunset Strip as the result of the proposed subdivision are well below the RTA guideline for a local road. Therefore, given the limited supply of developable land available in Manyana it is considered that the proposed road network will have sufficient capacity to manage the anticipated increase in traffic within the Manyana area.

5.4 Pedestrian Access

Pedestrian connections will be provided via street access through the subdivision to areas of public open space and community facilities including Manyana Beach and Yulunga Reserve. Furthermore, an additional public access point is proposed to be provided to Manyana Beach through an access track located to the north of proposed Lot 131 and through the southern part of proposed lot 158. It is foreseen that due to the small amount of traffic predicted on the proposed new roads there will be no need to provide formal footpaths or cycleway.

6 CONCLUSIONS

Based on the findings of this assessment, it is unlikely that the proposed development will have a detrimental effect on the local traffic and driver safety on The Palisade, The Bartizan, The Barbette, Sunset Strip, Manyana Drive and The Companionway or the surrounding streets in the Manyana area. The estimated additional traffic generated as a result of the proposal is 513 vehicle movements per day (during peak holiday period when the occupation rate is 100%), which is well within the capacity of the existing road network as demonstrated in this report. Furthermore all the intersections within and adjoining the proposed subdivision are below the requirements for a capacity analysis and therefore can adequately manage the predicted increase in traffic flow.

7 REFERENCES

AUSTROADS. 2004. Guide to Traffic Engineering Practice - Part 3: Traffic Studies

AUSTROADS. 1998. Guide to Traffic Engineering Practice - Part 2: Roadway Capacity

NSW Government. 2007. State Environmental Planning Policy (Infrastructure). http://www.legislation.nsw.gov.au/.

Roads Transport Authority (RTA). 2002. Guide to Traffic Generating Developments (Version 2.2).

Shoalhaven City Council. 1999. Development Control Plan No. 100 – Engineering Design Specifications. www.shoalhaven.nsw.gov.au/.

ATTACHMENT 1

PROPOSED SUBDIVISION LAYOUT

N

W E

S

KEY

DENOTES ASSET PROTECTION ZONE
AS DETERMINED BY BUSHFIRE ASSESSMENT

CREEK

PADMOUNT

END OF EXISTING ROADS

DRIVE

MANYANA

SUNSET

SUNSET STRIP

STRIP

THE BULWARK

DRIVE

PROPOSED WETLANDS

ZONE BOUNDARY

DEFERRED FROM AMENDMENT No. 62 GAZETTED 5/2/99

158
3.97 ha
(3.07 ha Deferred Lot 2(e) Village)
(0.90 ha 2(a1) Residential)

THE PALISADE

THE BARBICAN

THE BARBETTE (15.24 WIDE)

THE BOUNTY (20.115 WIDE)

AUSTEN STREET

ROAD (2) 13 WIDE

ROAD (1) 13 WIDE

ROAD (1) 12 WIDE BOUNDARY

ZONE BOUNDARY

REDUCTION RATIO	DATUM	SURVEY	0	AMENDMENTS	BY	DATE	NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO FINAL SURVEY
1:1000 A1 1:2000 A3	AHD	DESIGN	TW	0. ORIGINAL PLAN 1. AMEND LOT BOUNDARIES & ADD SCC SEWER PUMPING STATION 2. AMEND LOT BOUNDARIES 725–730, PATHWAY & SCC SEWER PUMPING STATION 3. AMEND LOT BOUNDARIES, ADD SEWER PUMPING STATION & PERIMETER FIRE TRAIL 4. REMOVE 14 LOTS, AMEND LOT BOUNDARIES, REDUCE ROAD WIDTH & CHANGING APZs 5. AMEND LOT BOUNDARIES	BP TW/VI TW/VI TW/VI DCA DMC	22/8/03 16/12/03 18/2/04 31/3/05 20/12/07 24/04/08	
		DRAWN	BP				
		CHECKED	TW				
		APPROV'D					

WATKINSON APPERLEY PTY LIMITED
SURVEYORS & ENGINEERS
51 GRAHAM STREET NOWRA 2541
PH: (02) 4421 4500 FAX : (02) 4423 1496
EMAIL: mail@watapp.com.au

DATE: 26 MARCH 2008

PROPOSED SUBDIVISION LAYOUT
LOT 682 DP 568678, LOT 705 DP 613881
AND LOT 810 DP 247285
MANYANA DRIVE, MANYANA
FOR JWA ENTERPRISES PTY LIMITED

SHEET 1 OF 1 SHEETS

REF. No. 101662

PLAN No. 03/141

101662 PROP SUBD.DWG

ATTACHMENT 2

PROPOSED ROAD NETWORK

N

W E

S

KEY

CURRENT ROAD NETWORK

ROADS TO BE CREATED FOR THE PROPOSED DEVELOPMENT

CREEK

PADMOUNT

END OF EXISTING ROADS

DENOTES 6m WIDE FIRE TRAIL

MANYANA DRIVE

SUNSET STRIP

THE BULWARK

PROPOSED WETLANDS

6m ACCESS TRACK

ACCESS TO PUMPING STATION

ZONE BOUNDARY

DEFERRED FROM AMENDMENT No. 62 GAZETTED 5/2/99

158
3.97 ha
(3.07 ha Deferred Lot 2(e) Village)
(0.90 ha 2(a1) Residential)

THE PALISADE

THE BARBICAN

THE BARBETTE

THE BOUNTY

AUSTEN STREET

ROAD (1) 13 WIDE

ROAD (2) 13 WIDE

(20.115 WIDE)

(15.24 WIDE)

(12 WIDE)

REDUCTION RATIO	DATUM	SURVEY	0	AMENDMENTS	BY	DATE	NOTE: DIMENSIONS AND AREAS ARE SUBJECT TO FINAL SURVEY
1:1000 A1 1:2000 A3	AHD	DESIGN	TW	0. ORIGINAL PLAN	BP	22/8/03	
		DRAWN	BP	1. AMEND LOT BOUNDARIES & ADD SCC SEWER PUMPING STATION	TW/VI	16/12/03	
		CHECKED	TW	2. AMEND LOT BOUNDARIES 725–730, PATHWAY & SCC SEWER PUMPING STATION	TW/VI	18/2/04	
		APPROV'D		3. AMEND LOT BOUNDARIES, ADD SEWER PUMPING STATION & PERIMETER FIRE TRAIL	TW/VI	31/3/05	
				4. REMOVE 14 LOTS, AMEND LOT BOUNDARIES, REDUCE ROAD WIDTH & CHANGING APZs	DCA	20/12/07	
				5. AMEND LOT BOUNDARIES	DMC	24/04/08	

WATKINSON APPERLEY PTY LIMITED
SURVEYORS & ENGINEERS
51 GRAHAM STREET NOWRA 2541
PH: (02) 4421 4500 FAX : (02) 4423 1496
EMAIL: mail@watapp.com.au

DATE: 26 MARCH 2008

PROPOSED ROAD NETWORK
LOT 682 DP 568678, LOT 705 DP 613881 AND LOT 810 DP 247285
MANYANA DRIVE, MANYANA
FOR JWA ENTERPRISES PTY LIMITED

SHEET 1 OF 1 SHEETS

REF. No. 101662

PLAN No. 03/141

101662 PROP SUBD.DWG

ATTACHMENT 3

PHOTOMONTAGE

ATTACHMENT 3 - PHOTOMONTAGE

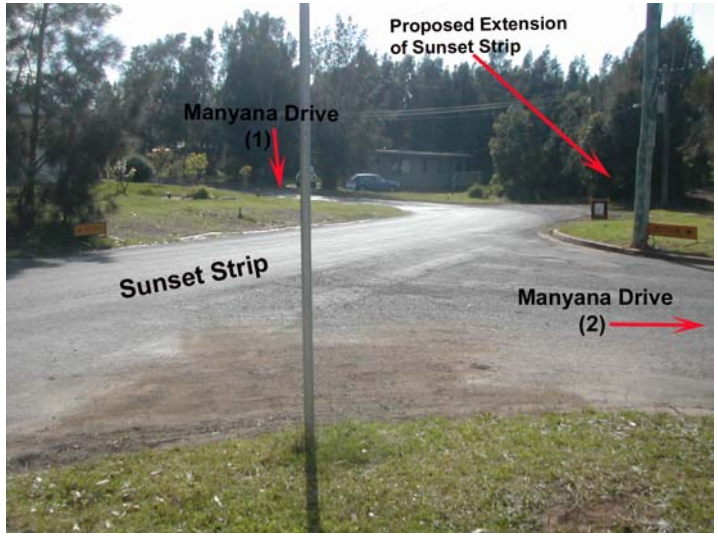


Photo 1 - Intersection of Sunset Strip and Manyana Drive

Photo 2 - Intersection of The Barbette and The Bartizan

Photo 3 - Intersection of The Palisade and Manyana Drive

Photo 4 – View in a northerly direction along The Barbette

ATTACHMENT 3 - PHOTOMONTAGE

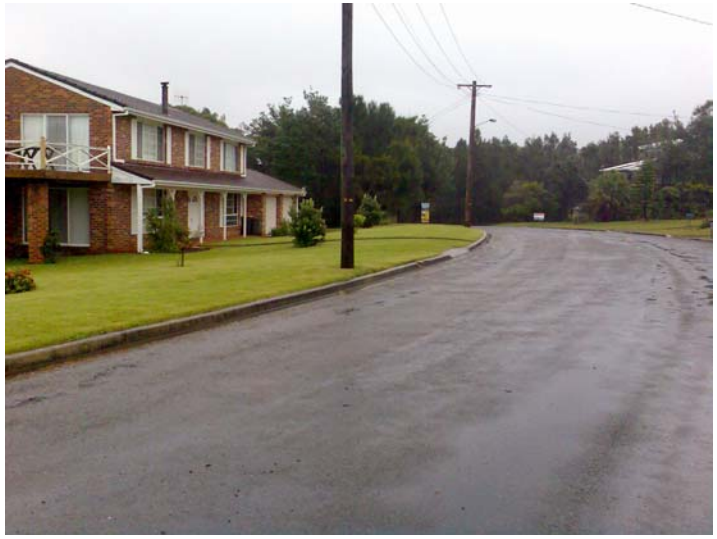


Photo 5 – View west along Sunset Strip from The Bulwark

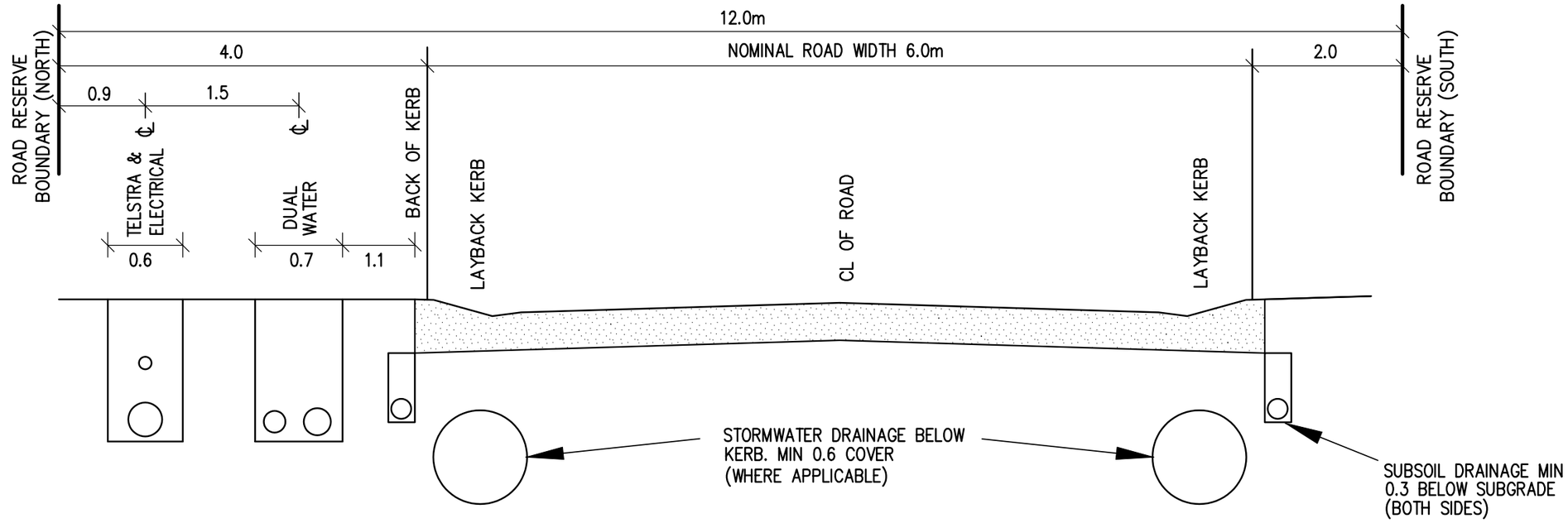
Photo 6 – View in an easterly direction along Manyana Drive from the Intersection with Sunset Strip

Photo 7 – View in an easterly direction along The Palisade

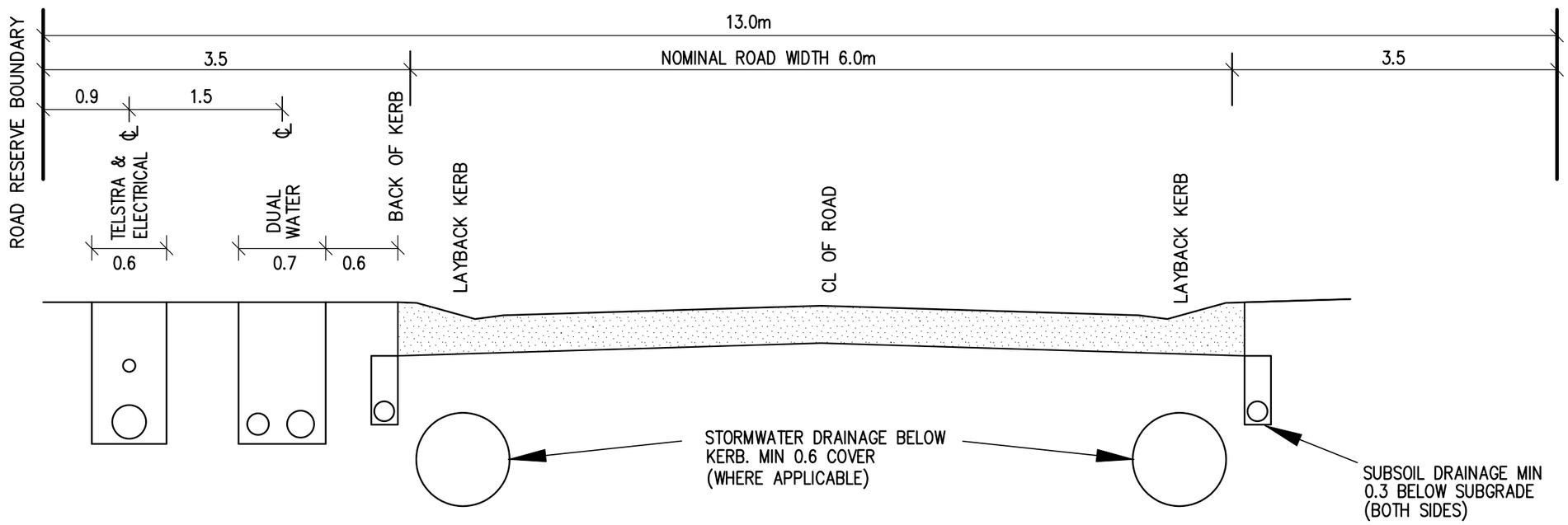
Photo 8 – View in an easterly direction along Sunset Strip

ATTACHMENT 4

TYPICAL CROSS-SECTION AND SERVICE LOCATION



TYPICAL CROSS SECTION
AND SERVICE LOCATION
FOR A 12M WIDE ROAD RESERVE



AND SERVICE LOCATION
FOR A 13M WIDE ROAD RESERVE

APPENDIX 1

TRAFFIC COUNT SHEETS

LEFT FROM BARB ONTO BART

Traffic Count Field Sheets

|||| |

Location: The Barbette at Manyana (Figure 3).

Date: 11 th Time: 7:30 TO 8:30 (AM)/PM

LEFT FROM BARB ONTO PAL

Observers Names: Liam Egan

|

Observers Signatures: Liam Egan

Vehicle Type	Right from Pal onto Barb (A)	Right from Bart onto Barb (B)	Left from Bart onto Barb (C)	Right from Barb onto ST (D)	Left from Barb onto ST (E)
Car	|||| |||	|	|||		||||
Bus					
Motor Cycle					
Truck					
Total					

NO BUSES MOTOCYCLES TRUCKS

Traffic Count Field Sheets

Location: The Barbette at Manyana (Figure 4).

Date: 11-10-07 Time: 7:30 TO 8:30 AM/PM

Observers Names: Liam Egan

Observers Signatures: _____

Vehicle Type	Left from Barb onto Pal (F)	Left from Barb onto Bart (G)	Right from Barb onto Bart (H)	Left from ST onto Barb (I)	Right from ST onto Barb (J)
Car	1	𝍸 1			
Bus					
Motor Cycle					
Truck					
Total					

7:30 8:30

Traffic Count Field Sheets

Location: The intersection of Manyana Drive and Sunset Strip at Manyana (Figure 1).

Date: 11-10-2007 Time: 7:30 TO 8:30 AM/PM

Observers Names: Glen Mitchell

Observers Signatures: [signature]

Vehicle Type	Right from MD(1) on to ST (A)	Left from Pal on to MD(2) (B)	Left from MD(2) on to ST (C)	Right from MD(2) on to ST (D)	Right from ST on to Com (E)	Left from ST on to Com (F)
Car	~~IIII~~ ~~III~~ I	III	II	I	~~IIII~~	
Bus						
Motor Cycle						
Truck	I					
Total						

Traffic Count Field Sheets

Location: The intersection of Manyana Drive and Sunset Strip at Manyana (Figure 2).

Date: 11/10/07 Time: 7:30 TO 8:30 AM/~~PM~~

Observers Names: Glen Mitchell

Observers Signatures: _____

Vehicle Type	Left from ST on to MD(1) (G)	Right from MD(2) on to Pal (H)	Right from ST on to MD(2) (I)	Left from ST on MD(2) (J)	Left from Com on to ST (K)	Right from Com on to ST (L)
Car	~~IIII~~	~~IIII~~	II	~~IIII~~ I	IIII	IIII
Bus						
Motor Cycle						
Truck						
Total						

CARS = 𝍸 𝍸 𝍸 ||

Traffic Count Field Sheets

Location: The Barbette at Manyana (Figure 3).

Date: 11-10-07 Time: 5:00 TO 6:00 AM/PM

Observers Names: Liam Egan

Observers Signatures: Liam Egan

Vehicle Type	Right from Pal onto Barb (A)	Right from Bart onto Barb (B)	Left from Bart onto Barb (C)	Right from Barb onto ST (D)	Left from Barb onto ST (E)
Car	/	111	1111	1111	
Bus					
Motor Cycle					
Truck					
Total					

Traffic Count Field Sheets

Location: The Barbette at Manyana (Figure 4).

Date: 11-10-07 Time: 5:00 TO 6:00 AM/PM

Observers Names: Liam Egan

Observers Signatures: Liam Egan

Vehicle Type	Left from Barb onto Pal (F)	Left from Barb onto Bart (G)	Right from Barb onto Bart (H)	Left from ST onto Barb (I)	Right from ST onto Barb (J)
Car	11		𝍸 1111	𝍸 1111	
Bus					
Motor Cycle					
Truck					
Total					

Traffic Count Field Sheets

4 - 6

Location: The intersection of Manyana Drive and Sunset Strip at Manyana (Figure 1).

Date: 11-10-07 Time: 5:00 TO 6:00 AM/PM

Observers Names: Glen Mitchell

Observers Signatures: [signature]

Vehicle Type	Right from MD(1) on to ST (A)	Left from Pal on to MD(2) (B)	Left from MD(2) on to ST (C)	Right from MD(2) on to ST (D)	Right from ST on to Com (E)	Left from ST on to Com (F)
Car	𝍸 II				II	𝍸
Bus						
Motor Cycle						
Truck						
Total						

Traffic Count Field Sheets

Location: The intersection of Manyana Drive and Sunset Strip at Manyana (Figure 2).

Date: 11-10-07 Time: 5:00 TO 6:00 AM/PM

Observers Names: Glen Mitchell

Observers Signatures: _____

Right from MDL to St

Vehicle Type	Left from ST on to MD(1) (G)	Right from MD(2) on to Pal (H)	Right from ST on to MD(2) (I)	~~Left~~ from ST on MD(2) (J)	Left from Com on to ST (K)	Right from Com on to ST (L)
Car	~~HHT~~ ~~HHT~~ III	I	I	I	IIII	~~HHT~~ ~~HHT~~ III
Bus						
Motor Cycle						
Truck	I				I	
Total						

Traffic Count Field Sheets

Traffic Count Field Sheets