

- The median island on Thomas Mitchell Drive approach to the intersection with the New England Highway is overgrown with vegetation and partly covered by soil and gravel (refer to Figure 2.35) and a KEEP LEFT sign is missing at the end of the island closer to the intersection (refer to Figure 2.36). All these deficiencies result in poor delineation, with potential of a vehicle striking it especially at night and in adverse weather conditions.



**Figure 2.35** Median island overgrown by vegetation and partly covered by soil and gravel - Thomas Mitchell Drive, on approach to the intersection with the New England Highway

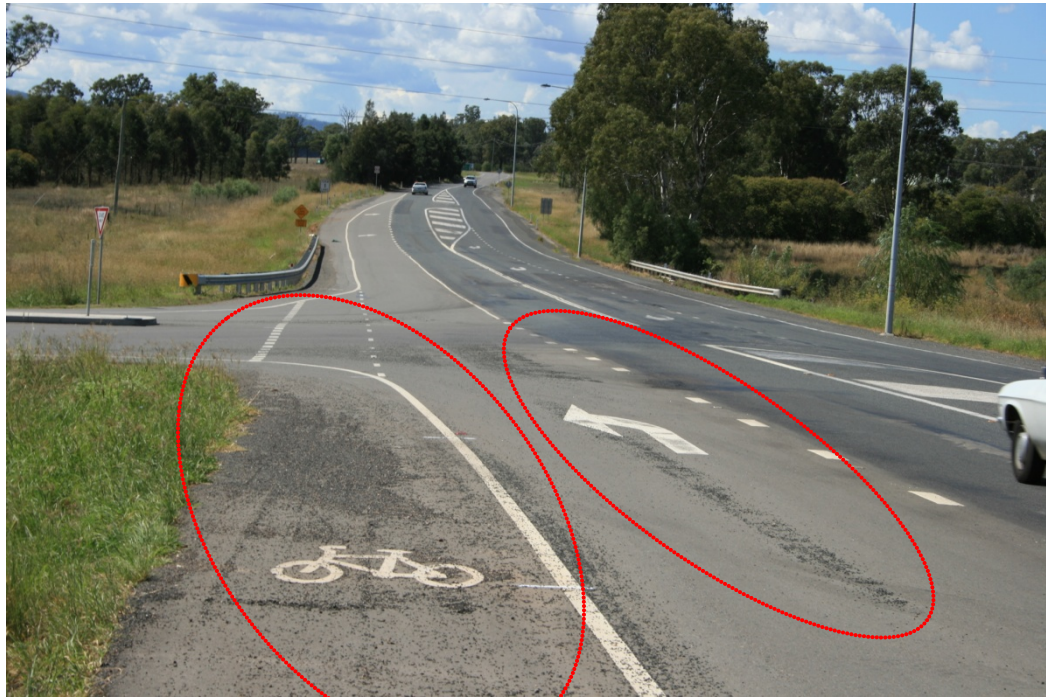


**Figure 2.36** KEEP LEFT sign missing - Thomas Mitchell Drive, looking westbound from its intersection with the New England Highway

#### 2.7.1.4 Denman Road

The following road safety deficiencies were identified along Denman Road during the safety assessment:

- On Denman Road's southern approach to the intersection with Bengalla Link Road, an amount of chipseal covers the cycling lane and partly spread across the adjacent traffic lane (refer to Figure 2.37). This has the potential to adversely affect control of a bicycle or vehicle, increasing a chance for a driver error and potential for a crash to occur.



**Figure 2.37** Chipseal covering dedicated cycling lane - Denman Road, looking northbound on approach to its intersection with Bengalla Link Road

#### 2.7.1.5 Bengalla Link Road

The following road safety deficiencies were identified along Bengalla Link Road during the safety assessment:

- Some of the pavement surface is in poor condition, which may cause problems related to surface roughness, moisture infiltration and further pavement deterioration (refer to Figure 2.38).



**Figure 2.38** Poor pavement condition - Bengalla Link Road, looking eastbound toward its intersection with Denman Road

- Unidirectional Hazard Marker is missing on a safety barrier (refer to Figure 2.39) which results in poor crash barrier delineation at night and in adverse weather conditions.



**Figure 2.39 Unidirectional Hazard Marker is missing on the safety barrier – Bengalla Link Road, looking westbound**

## **2.7.2 Road safety audit – Wybong Road**

An existing roads stage Road Safety Audit of the reconstructed section of Wybong Road between Roxburgh Road and the Mangoola Coal Mine access was undertaken by GHD in September 2010 to assess the safety along this section of the road due to apparent deterioration following its recent upgrade/practical completion.

The audit identified a number of deficiencies including a number of culverts, access headwalls, fences and trees being located within the clear zone; some damaged pavement; some faded pavement markings and a few damaged guideposts and signs.

The amelioration of failed areas along Wybong Road East is complete. A long term strategy/solution will be based upon tests carried out on the road condition in February 2011 and will be required to be agreed with MSC engineers.



### 3. Future traffic demand and assessment of demand impacts

The proposed mine plan modifications and ETL relocation have potential to impact the adjacent road network as a result of:

- increased number of employees
  - ▶ ETL relocation construction – 50 employees for a period of approximately 11 months
  - ▶ operational phase of the mine (including the mine modifications) – 60 employees
- heavy or oversize vehicles associated with the construction of the ETL relocation
- two additional fuel tankers per day, to service the real re-fuelling facility (as part of the modifications to mine plans).

Other impacts assessed are with respect to:

- road closures required for the ETL relocation, decommissioning and stringing of cables and for oversize/overmass vehicles
- heavy or oversize vehicles required for mine operation
- impact on school bus route
- impact on any walking and/or cycling paths, and public transport.

Impacts have been assessed on the adjacent road network, at the intersections and on the mid-block road sections.

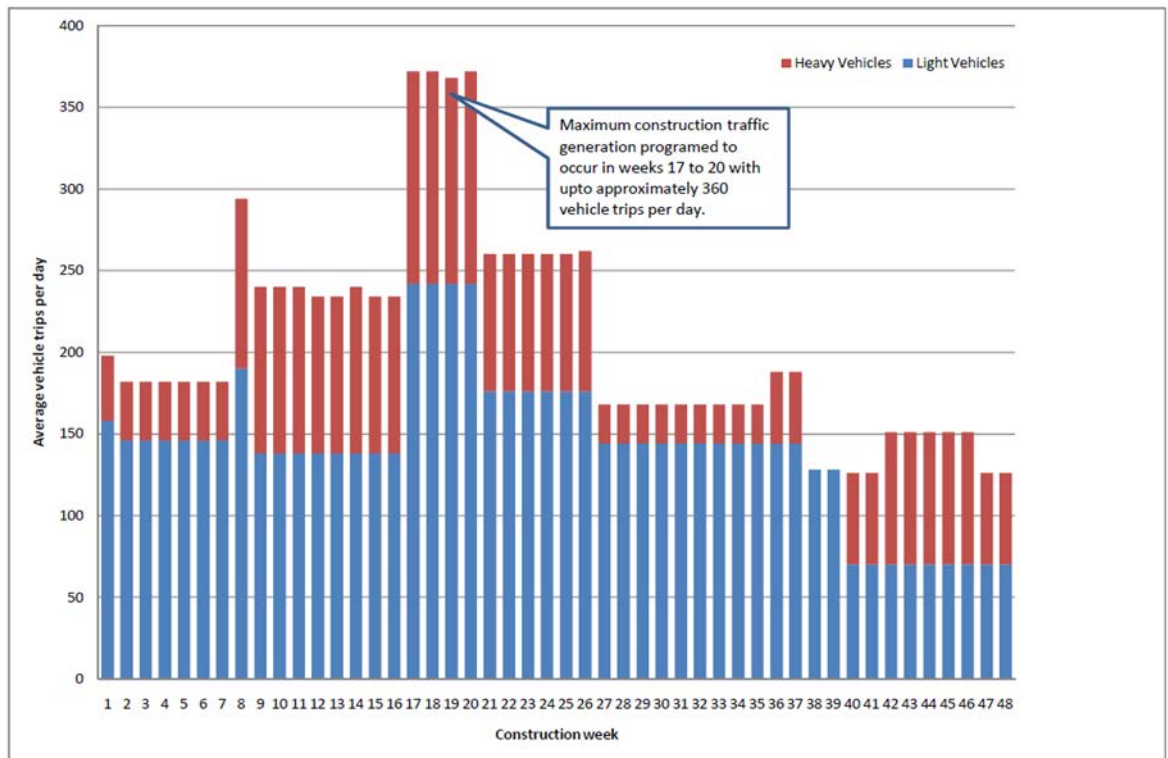
#### 3.1 Predicted background traffic volumes for 2012

The background traffic for 2012 was derived from the 2011 existing traffic flows (indicated in Section 2.6) factored by an annual traffic growth rate of 1% based on historical RTA data.

## 3.2 ETL Relocation traffic demands

### 3.2.1 Construction

A construction program was provided by Downer EDI Engineering, the contractor proposed to undertake the relocation of the ETL. This works program was used to estimate the expected daily vehicle trips for each week of the construction period (shown in Figure 3.1).



**Figure 3.1 Average daily construction traffic by construction week**

From Figure 3.1 it can be seen that the peak traffic generation occurs between weeks 17 and 20, when the total daily traffic is expected to be approximately 360 vehicle trips per day. This equates to:

- AM peak hour traffic volume of 26 vehicles, made up of seven vehicles heading eastbound and 19 vehicles heading westbound
- PM peak hour traffic volume of 29 vehicles, made up of 18 vehicles heading eastbound and 11 vehicles heading westbound
- one third of the estimated number of vehicles during the peak hours are heavy vehicles.

The estimates of daily and peak hour traffic movements assume:

- a vehicle trip is one journey from a destination to the site or from the site to a destination
- approximately 50 staff would be engaged for the relocation of the ETL and each of these staff would make two vehicle trips per day

- the AM and PM peak periods being based on a daily traffic profile similar to the existing profile.

### 3.2.2 Heavy vehicles

The heavy vehicle traffic generation of the ETL relocation has been forecasted for the construction phase by Downer EDI Engineering as follows:

#### Tower foundation stage

- Semi-trailers (mobilisation/demobilisation): *10 trips per day*, in *Week 1* and in *Week 20*
- Agitator - concrete trucks(concrete delivery): *10 trips per day*, from *Week 1* to *Week 20*
- '8x8' trucks (general delivery): *eight trips per day*, from *Week 1* to *Week 20*.

#### Tower assembly stage

- Semi-trailers (mobilisation/demobilisation): *two trips per day*, in *Week 8* and in *Week 26*
- Semi-trailers (tower steel/bolts delivery): *15 trips per day*, from *Week 8* to *Week 11* and in *Week 14*
- '8x8' trucks: *five trips per day*, from *Week 8* to *Week 26*.

#### Stringing stage

- Semi-trailers (mobilisation/demobilisation): *10 trips per day*, in *Week 17* and in *Week 18*
- Semi-trailers (mobilisation/demobilisation): *10 trips per day*, in *Week 17* and in *Week 18*
- Semi-trailers (conductor delivery): *five trips per day*, from *Week 17* to *Week 20*.

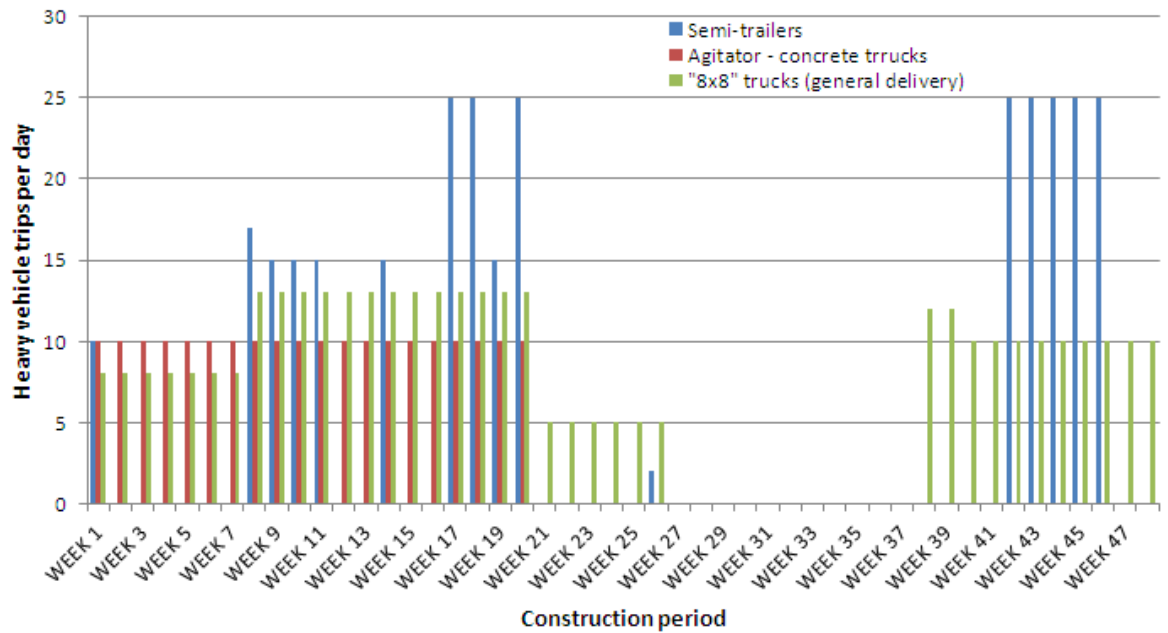
#### Cut-ins stage

- '8x8' trucks (general delivery): *12 trips per day*, *Week 38* and *Week 39*.

#### Dismantling

- Semi-trailers (material removal off site): *25 trips per day*, from *Week 42* to *Week 46*
- '8x8' trucks (delivery and general transport): *10 trips per day*, *Week 40* and *Week 48*.

Figure 3.2 shows the number of heavy vehicles' trips generated per day per week over the construction period.



**Figure 3.2** Number of heavy vehicles' trips generated per day per week over the construction period

The additional volume of heavy vehicles would neither impact the capacity nor significantly impact traffic safety as they would be planned to occur in off peak periods.

### 3.2.3 Operation

Very limited operational traffic will be generated by the ETL relocation. This will relate to maintenance inspections which are normally completed aerially but involve a ground inspection approximately once every three years. Occasionally traffic for maintenance will also be required on an as needs basis.

## 3.3 Mine plan modifications traffic demands

### 3.3.1 Construction

Construction at the mine is substantially complete with no additional construction staff required (previously estimated to increase from 200 to 350).

### 3.3.2 Operation

Employee numbers during the operation phase of Mangoola Coal Mine is proposed to increase from 240 to 300. The impact of these additional 60 employees has been assessed.

The estimates of daily peak hour traffic movements assume:

- a vehicle trip is one journey from a destination to the site or from the site to a destination
- approximately 60 additional employees would be engaged for the mine operation and each of these staff would make two vehicle trips per day

- the AM and PM peak periods being based on a daily traffic profile similar to the existing profile.

It is estimated that an extra 60 employees will generate an additional 120 vehicle trips per day on Wybong Road. The traffic assessment has found that the peak hourly traffic associated with the ongoing operation of the mine is within the LoS A for Wybong Road.

### 3.3.3 Heavy vehicles/Oversize vehicles

Construction at the Mangoola Coal Mine is substantially complete, and for this phase no more heavy or overmass/oversize vehicles are required. For plant construction purposes, soilmec, excavator and dozer at least are required as well as in and out movements for each item resulting in approximately 12 movements for more than 4.5 m wide plants. These activities would result in approximately 30 to 40 minutes of Wybong Road closure, to allow time to setup/shift plant, remove any road protective measure within the nominated timeframe.

#### 3.3.3.1 Fuel tankers

It is proposed that two additional fuel tankers per day, to service the rail-fuelling facility (as part of the modifications to mine plans) would travel to and from the Mangoola Coal Mine, using the route from the New England Highway, via Thomas Mitchell Drive, Bengalla Link Road and Wybong Road to the Mine.

### 3.3.4 Additional trips and their distribution in the peak hours

Figures 3.3 and 3.4 show the additional generated trips and their distribution on the studied network in the peak hours, considering the current traffic distribution and likely traffic dispersion over the road network (based on the proposed cumulative number of additional trips generated by the ETL relocation and mine plan modifications).

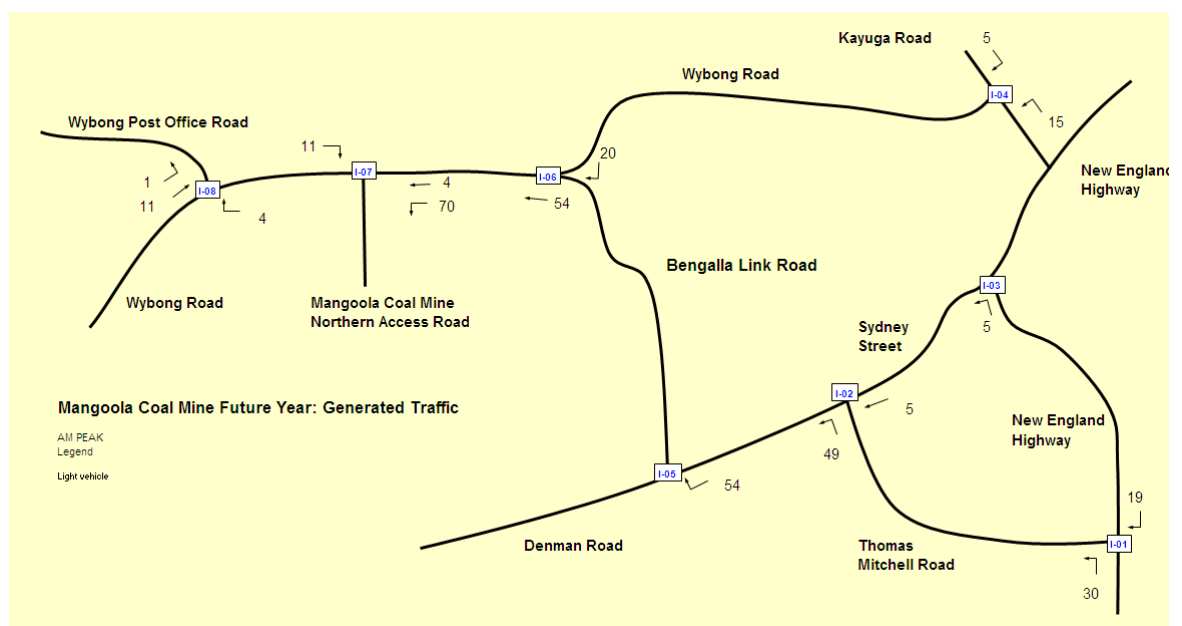
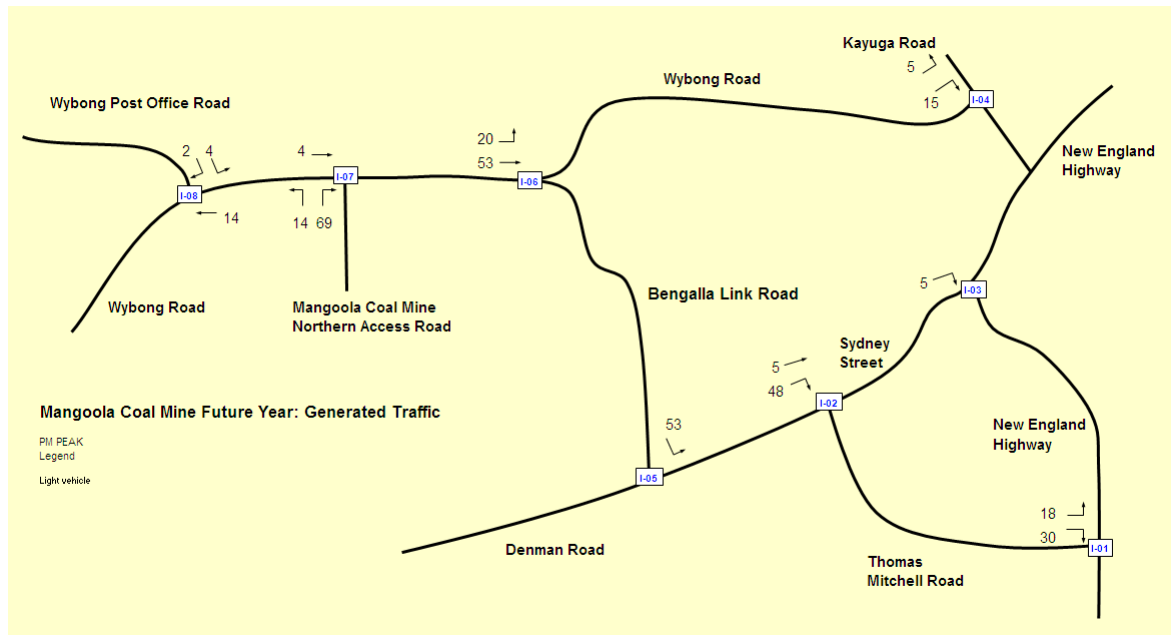


Figure 3.3 Additional trips generated in AM peak hour



**Figure 3.4 Additional trips generated in PM peak hour**

## 3.4 Traffic impacts

### 3.4.1 Construction

#### 3.4.1.1 ETL relocation

Several possible traffic impacts have been identified related to the construction phase for the ETL relocation. These include:

- slightly reduced traffic performance at the interactions and along the roads used for construction access
- delay to traffic during road closures for cable removal during decommissioning and the stringing of power lines across Wybong Road and Wybong Post Office Road
- impact of oversize/overmass vehicles (where required during the ETL relocation construction).

#### **Wybong Road**

The construction of the ETL relocation has the potential to increase on Wybong Road east of the Mangoola Coal Mine Northern Access Road in the PM hour by approximately 29 vehicles. When added to the existing traffic, and traffic forecast for the Mangoola Coal Mine, this has the potential to result in a total PM peak hour traffic volume of 130 vehicles per hour, operating at a LoS A. At this LoS, traffic is able to move without any impediment; therefore impact on traffic will be negligible.

### **Wybong Post Office Road**

The construction works program for the ETL relocation indicates that approximately 20% of the construction traffic for the ETL relocation will require the use of Wybong Post Office Road. Traffic data for this road indicates that its current peak hour traffic volumes are less than 10 vehicles, which is much lower than the traffic volume on Wybong Road. As noted in Section 2.6, the total estimated traffic volume on Wybong Road will be less than 100 vehicles per day (i.e. LoS A), and therefore will not have any impact on the traffic performance of this road.

### **Heavy vehicles and overmass/oversize vehicles**

Based on the construction program supplied by 'Downer EDI Engineering', the contractor proposed to undertake the ETL relocation, up to five oversized/overmass vehicles (10 trips) per day are expected to be needed for the decommissioning and relocation of the ETL.

All of these vehicles would occur in mobilisation/demobilisation stage in Week 1 and Week 20 of the 48 week schedule.

These vehicle types would be routed via Bengalla Link Road and Wybong Road. A separate risk assessment will be required for these types of vehicle as the impact these vehicles cause depends on the nature of the load.

Wybong Road closure will be required for oversized/overmass vehicles. It assumes that MSC will place the same restriction on the ETL relocation construction traffic travelling along Wybong Road as they have done it in the past for oversized/overmass vehicles; i.e. road closures required for vehicles greater than 4.5 m wide. Based on this there will be road closures for wide loads but no detour required.

#### **3.4.1.2 Mine plan modifications**

No additional staff or heavy vehicles are required for the construction phase of the mine plan modifications.

### **3.4.2 Operations**

#### **3.4.2.1 ETL relocation**

The ETL relocation is expected to have no operational impacts on traffic and transport as it will not generate additional traffic following the completion of construction works with the exception of occasional staff employed to conduct inspections of the ETL and associated easement and to conduct maintenance as required.

#### **3.4.2.2 Mine plan modifications**

The additional 60 operational employees generating an additional 120 vehicle trips per day will not have a significant impact on the LoS during peak hour traffic volumes on Wybong Road, Bengalla Link Road or Denman Road.

### **Heavy and overmass/oversize vehicles**

It is estimated that there will be approximately eight heavy vehicles travelling to and from the site every day (16 movements).

It is unlikely that any road closures would be required for trucks travelling to and from the Mangoola Coal Mine site. Mangoola Coal have established a facility on site for the repair/refurbishment of truck bodies which has significantly reduced the number of wide loads required to travel to and from site; i.e. those vehicles which are greater than 4.5 m and require road closure.

### **Fuel Tankers**

The road geometry and the layouts of the key intersections along the route are such that they can accommodate the additional two heavy vehicles/fuel tankers and their turning paths without any operational or safety concerns. There is nothing to indicate that an accident involving a fuel tanker is more likely to occur than accidents involving other vehicles.

## **3.5 Comparison of traffic loads – approved mine plan vs approved mine plan plus modifications and ETL relocation**

The TPK and Associates Traffic Study (2006) completed for the Anvil Hill Project (now known as the Mangoola Coal Mine) reported:

- a total AM peak hour traffic generation of 125 vehicles from 240 operational staff
- a total PM peak hour traffic volume of 106 vehicles from 240 operational staff.

This compares to the following vehicle generation now forecast in this additional assessment:

- AM peak hour traffic of 156 vehicles from 300 mine operations staff and 26 vehicles for the construction of the ETL relocation
- PM peak hour traffic of 135 vehicles from 300 mine operations staff and 29 vehicles for the construction of the ETL relocation.

## **3.6 Cumulative traffic – approved mine, mine plan modifications and ETL relocation**

The maximum cumulative daily traffic including existing traffic, traffic generated by the proposed Mangoola Coal Mine, modifications to mine plans and construction traffic generated by the ETL relocation has the potential, at its peak, to reach:

- AM peak hour traffic volume of approximately 241 vehicles
- PM peak hour traffic volume of 231 vehicles.

This assumes:

- the mine is fully operational, generating approximately 600 vehicle-trips per day
- the weeks of maximum daily traffic of 360 vehicles per day for the construction of the ETL relocation (weeks 17 to 20) occur whilst the mine is fully operational (i.e. mine plan modifications are approved).

### 3.7 Mid-block traffic performance

The RTA, in the Guide to Traffic Generating Developments (RTA, 2002), defines mid-block Levels of Service (LoS) for traffic performance between A and F (with A being good and F being unacceptable). For a rural section of road these LoS are based on the volume of traffic, the type of terrain and the approximate percentage of heavy vehicles within the traffic stream. Generally, a weekday LoS C or better is desirable in the peak hour (refer to Table 3.1)

**Table 3.1 RTA mid-block level of service**

| Terrain     | Level of Service | Precent of Heavy Vehicles |      |      |      |
|-------------|------------------|---------------------------|------|------|------|
|             |                  | 0                         | 5    | 10   | 15   |
| Level       | B                | 630                       | 590  | 560  | 530  |
|             | C                | 1030                      | 970  | 920  | 870  |
|             | D                | 1630                      | 1550 | 1480 | 1410 |
|             | E                | 2630                      | 2500 | 2390 | 2290 |
| Rolling     | B                | 500                       | 420  | 360  | 310  |
|             | C                | 920                       | 760  | 650  | 570  |
|             | D                | 1370                      | 1140 | 970  | 700  |
|             | E                | 2420                      | 2000 | 1720 | 1510 |
| Mountainous | B                | 340                       | 230  | 180  | 150  |
|             | C                | 600                       | 410  | 320  | 260  |
|             | D                | 1050                      | 680  | 500  | 400  |
|             | E                | 2160                      | 1400 | 1040 | 820  |

Source: RTA Guide to Traffic Generating Developments (2002)

For a two lane rural road with rolling terrain and a percentage of heavy vehicles between 10 and 15%, such as Wybong Road, Wybong Post Office Road and Bengalla Link Road, the maximum traffic volume the road should carry to achieve a LoS A is approximately 300 vehicles per hour.

The traffic volume on Wybong Road prior to the enabling works for the Mangoola Coal Mine is approximately 150 vehicle trips per peak hour. The road operates at LoS A.

With the traffic generated by the Mangoola Coal Mine operations and the construction traffic for the ETL relocation during the peak weeks of construction, Wybong Road is estimated to have approximately 241 and 234 vehicles per hour in the AM and PM peak hours respectively, operating at LoS A.

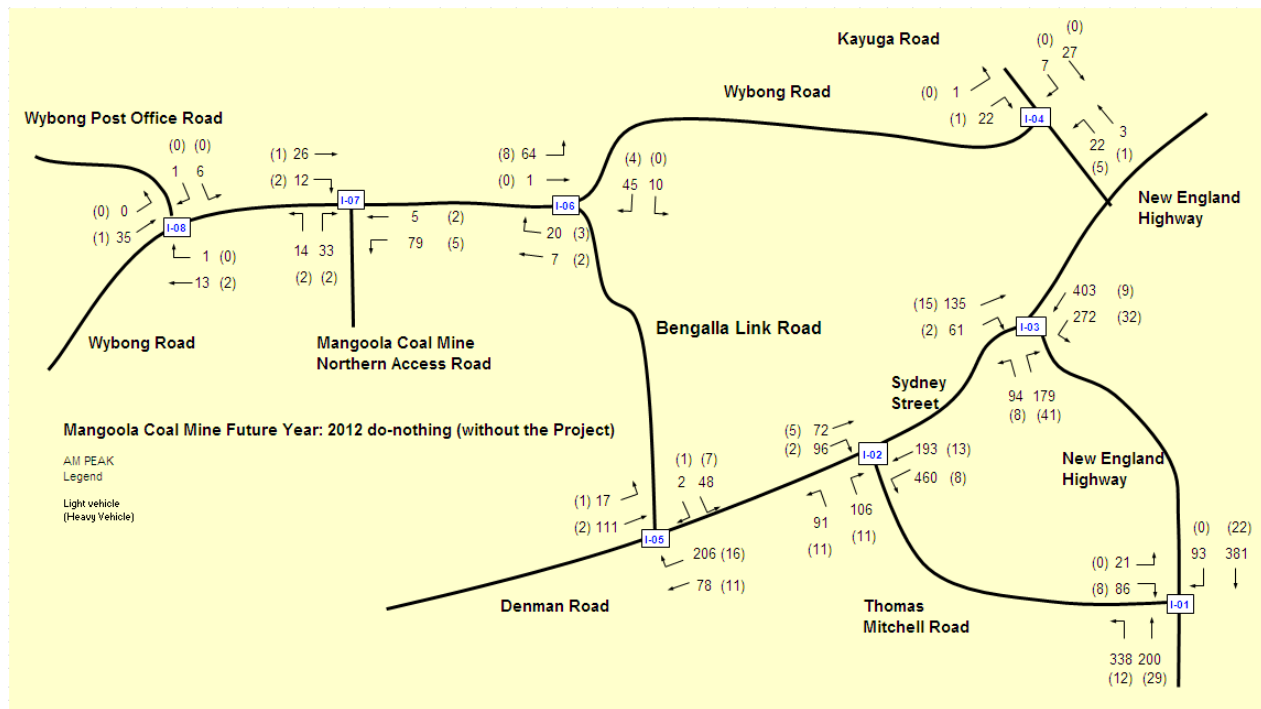
Bengalla Link Road has approximately 350 vehicles per hour in the AM peak hour, operating at LoS B.

Wybong Post Office Road, which has much lower traffic volumes, would operate at LoS A.

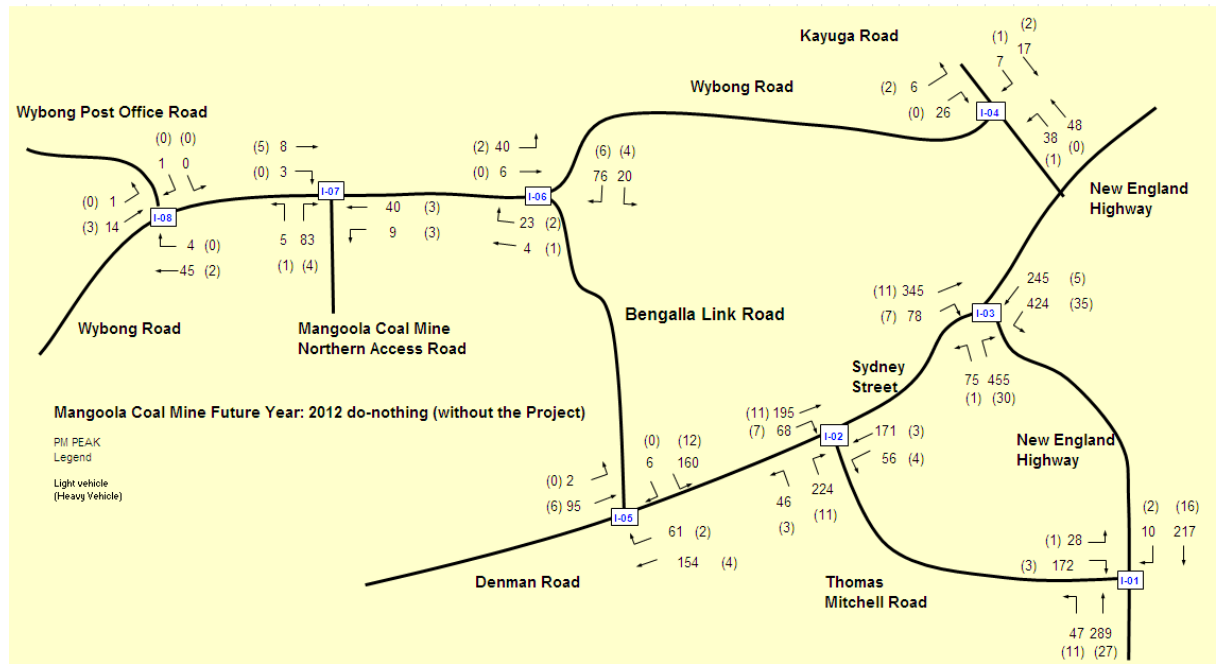
### 3.8 Intersection performance

It is assumed that the ETL relocation construction and mine plan modifications would take the place following approval being granted in 2012. To calculate the background traffic volumes in 2012, a conservative traffic growth of 1% per annum was applied.

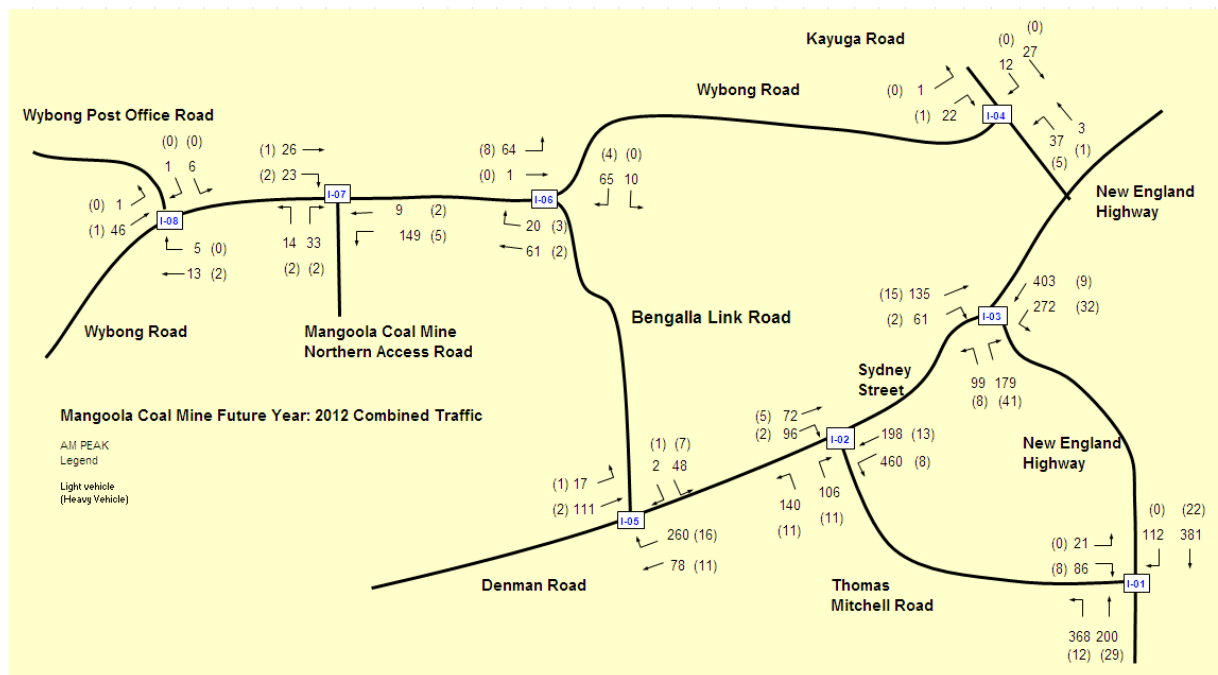
Figures 3.5 and 3.6 show the estimated background turning traffic volumes in 2012 at the key intersections (i.e. without traffic from the ETL relocation and mine plan modification) and Figures 3.7 and 3.8 show the 2012 turning traffic volumes at the same intersections but including the combined peak operational and construction traffic (ETL relocation and mine plan modification).



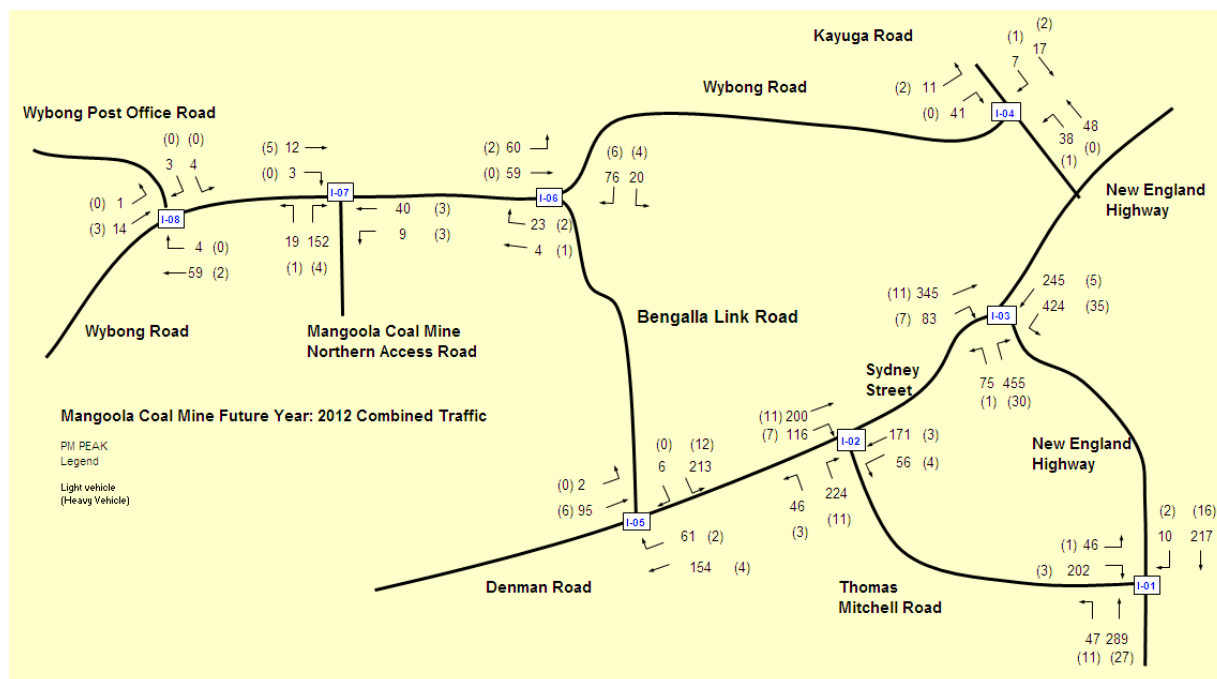
**Figure 3.5 2012 intersection AM peak volumes (6.00 am to 7.00 am) – estimated background traffic volumes**



**Figure 3.6** 2012 intersection PM peak volumes (4.45 pm to 5.45 pm) – estimated background traffic volumes



**Figure 3.7** 2012 intersection AM peak volumes (6.00 am to 7.00 am) – estimated background traffic volumes plus combines operational and construction traffic (ETL relocation and mine plan modifications)



**Figure 3.8 2012 intersection PM peak volumes (4.45 pm to 5.45 pm) – estimated background traffic volumes plus combined operational and construction traffic (ETL relocation and mine plan modification)**

Table 3.2 summarises the SIDRA modelling results of the key intersections in 2012, taking into account estimated background traffic volumes only.

**Table 3.2 2012 do-nothing intersections performance – estimated background traffic volumes**

| Intersection                                   | Peak period | DoS  | Delays (Sec) | LoS | Queue (m) |
|------------------------------------------------|-------------|------|--------------|-----|-----------|
| I-01 New England Highway/Thomas Mitchell Drive | AM          | 0.62 | 50           | D   | 27        |
|                                                | PM          | 0.57 | 28           | C   | 29        |
| I-02 Denman Road/Thomas Mitchell Drive         | AM          | 0.34 | 21           | B   | 13        |
|                                                | PM          | 0.52 | 20           | B   | 26        |
| I-03 New England Highway/Sydney Street         | AM          | 0.44 | 31           | C   | 85        |
|                                                | PM          | 0.72 | 36           | C   | 135       |
| I-04 Kayuga Road/Wybong Road                   | AM          | 0.03 | 13           | A   | 1         |
|                                                | PM          | 0.05 | 14           | A   | 1         |
| I-05 Denman Road/Bengalla Link Road            | AM          | 0.19 | 14           | A   | 8         |
|                                                | PM          | 0.18 | 13           | A   | 7         |
| I-06 Wybong Road/Bengalla Link Road            | AM          | 0.07 | 14           | A   | 2         |
|                                                | PM          | 0.13 | 14           | A   | 4         |
| I-07 Wybong Road/Mangoola Mine Access Road     | AM          | 0.06 | 12           | A   | 2         |
|                                                | PM          | 0.10 | 12           | A   | 3         |
| I-08 Wybong Road/Wybong Post Office Road       | AM          | 0.02 | 13           | A   | 1         |
|                                                | PM          | 0.03 | 13           | A   | 1         |

Table 3.3 summaries the SIDRA modelling results of the key intersections for 2012 which include peak operational and construction traffic associated with the ETL relocation and mine plan modifications, in addition to the estimated background traffic volumes.

**Table 3.3 2012 intersections performance – estimated background traffic volumes plus combined construction and operational traffic (ETL relocation and mine plan modification)**

| Intersection                                   | Peak period | DoS  | Delays (Sec) | LoS | Queue (m) |
|------------------------------------------------|-------------|------|--------------|-----|-----------|
| I-01 New England Highway/Thomas Mitchell Drive | AM          | 0.66 | 55           | D   | 29        |
|                                                | PM          | 0.67 | 31           | C   | 39        |
| I-02 Denman Road/Thomas Mitchell Drive         | AM          | 0.35 | 21           | B   | 13        |
|                                                | PM          | 0.57 | 21           | B   | 29        |
| I-03 New England Highway/Sydney Street         | AM          | 0.44 | 31           | C   | 85        |
|                                                | PM          | 0.72 | 37           | C   | 135       |
| I-04 Kayuga Road/Wybong Road                   | AM          | 0.03 | 13           | A   | 1         |
|                                                | PM          | 0.06 | 13           | A   | 2         |
| I-05 Denman Road/Bengalla Link Road            | AM          | 0.23 | 14           | A   | 10        |
|                                                | PM          | 0.23 | 13           | A   | 9         |
| I-06 Wybong Road/Bengalla Link Road            | AM          | 0.10 | 14           | A   | 3         |
|                                                | PM          | 0.14 | 14           | A   | 5         |
| I-07 Wybong Road/Mangoola Mine Access Road     | AM          | 0.09 | 12           | A   | 2         |
|                                                | PM          | 0.19 | 12           | A   | 7         |
| I-08 Wybong Road/Wybong Post Office Road       | AM          | 0.03 | 13           | A   | 1         |
|                                                | PM          | 0.04 | 13           | A   | 2         |

Analysis of both scenarios indicates that all of the key intersections would operate within their design capacity, with enough spare capacity and with LoS D or better. Furthermore, the layouts of the key intersections are such that they would provide enough space to store the forecast queued vehicles.

The longest queue occurred at the New England Highway/Sydney Street intersection. This traffic comprises non-mine related right turning traffic passing through Muswellbrook or travelling to its CBD. However, the left turning traffic, which may include mine traffic, does not experience significant queuing.

The intersections that carry most of the mine related traffic operate at a good level of service.

Three of the key intersections on the route to Mangoola Mine which have been recently upgraded will operate at a LoS A.

### **3.8.1 Road closures**

#### **3.8.1.1 ETL cable stringing and decommissioning**

The stringing of the ETL cables between towers 27 and 28 and between towers 30 and 31 is likely to require temporary closures of Wybong Road and Wybong Post Office Road.

Hurdles of a timber uprights/crossbeams configuration are intended to be utilised to ensure 6–8 metre clearance over roads for the stringing of cables, with traffic control and authority to stop traffic if required and reduced speeds. When running drawwire/conductor with a helicopter, minor stoppages would be expected lasting 2–5 minutes over a period of 3–4 days for each pull section with road crossings. There are 26 cables in total on the ETL, 24 large and 2 small, which based on a maximum of 5 minutes per cable (assuming one cable strung at a time) would result in total road closure time for stringing of approximately 2 hours 10 minutes over a period of 3–4 days. This would be the case for dismantling, although hurdles are less effective when lowering conductors, with cables cut and removed from the road hurdle each time a phase is lowered so as much risk as possible is mitigated.

Closures are expected to last between 15 to 20 minutes per cable run, pre road crossing over a period of four days. During each of these closures between 20 and 24 vehicles may subsequently incur a delay. Similarly the decommissioning of the existing ETL is likely to require road closures during removal of cables on Wybong Road and Wybong Post Office Road. The location of the ETL crossings of Wybong and Wybong Post Office Roads can be seen in Figure 1.3. During the road closures traffic would not be detoured onto an alternative route.

#### **3.8.1.2 Oversize vehicles**

Road closures of up to 30 to 40 minutes are likely to be required for the movement of oversize vehicles (i.e. vehicles >4.5m in width) used for the delivery of tower materials and equipment being transported for clearing, earthmoving and tower construction. It is estimated that approximately 12 closures for oversize vehicles would be required for the life of the ETL relocation. These road closures will be undertaken during off peak hours. During each of these closures between 40 and 48 vehicles may subsequently incur a delay.

During these road closures traffic would not be detoured onto an alternative route.

Mangoola Coal Mine traffic will generally not use the affected sections of Wybong Road and Wybong Post Office Road as these road sections are west of the Mangoola Project Northern Access Road. Delays or increased journey times are likely to affect existing traffic only, i.e. non-mine related traffic. Based on the traffic count data for Wybong Road/Wybong Post Office Road intersection, closures during off peak periods for ETL stringing and decommissioning and for oversize vehicles, may impact on up to approximately 33 vehicles per hour.

### **3.8.2 School bus operation**

The forecast traffic during the peak weeks of the ETL relocation construction is unlikely to have a significant impact on traffic performance. This coupled with the fact that the school bus operates outside the peak hours for Mangoola Coal Mine related traffic, and no road closures will take place at this time, indicating that the School Bus Service is unlikely to be affected by the construction of the ETL relocation or mine plan modifications.

### **3.8.3 Walking, cycling and public transport**

No cycling, walking or bus services, other than the school bus use Wybong Road and Wybong Post Office Road so no impact on these travel modes will occur because of the construction traffic for the ETL relocation or mine plan modifications.



## **4. Mitigation and management measures**

### **4.1 Minimising traffic delays from road closure**

Road closures of Wybong Road and Wybong Post Office Road, to allow for the stringing of new cables and removal of existing ETL cables, and for the use of roads by overmass/oversize vehicles for the ETL relocation and the construction, commissioning and operation of the mine will almost be negligible. Despite this, the following management measures can be employed to minimise delays to drivers:

- restricting closures to off peak hours
- minimising the number of closures needed
- informing drivers of the days and times of closures in advance.

### **4.2 Managing the safety of the school bus service**

The modest increase of traffic related to the project should not impact on the operation or safety of the school bus service. However, measures to highlight the presence of school buses during the hours of school bus operation could be considered for inclusion within the CTMP. These measures should include:

- reminders of school bus operating times (i.e. from 6.30 am to 8.45 am, and from 3.00 pm to 5.00 pm) during 'Toolbox Talks' for all personnel involved in the ETL relocation
- installation of a variable message signs at the Bengalla Road/Denman Road intersection that activates during school bus operational hours to inform drivers and to make them aware that children may be crossing the road
- excluding the movement of heavy vehicles to and from site during school bus service hours

### **4.3 Address deficiencies listed in the road safety audit**

RTA and MSC should give consideration to shielding or relocating the identified hazards located within the clear zone, proper and timely pavement and road signage maintenance as well as other identified road safety improvements to address the deficiencies mentioned in the Road Safety Audit Report (GHD, 2010) as current road deficiencies adversely affect the safety of the current traffic as well as future proposed increased traffic.

## 4.4 Heavy and oversize/overmass vehicles

Based on the construction program supplied by 'Downer EDI', the contractor proposed to undertake the relocation of the ETL, up to six oversized/overmass vehicles (12 trips) per day are expected to be needed for the relocation and decomposition of the ETL.

As the larger vehicles would occupy most of the width of the roadway, it may increase the risk of the collision, so the following measures should be considered:

- Use of a licenced transport contractor with experience in transporting similar loads, responsible for obtain all required approvals from the RTA and MSC and for complying with the conditions specified in the approvals.
- Development of a CTMP to include scheduling of deliveries, managing timing of transport to avoid peak hours, designing and implementing temporary modifications to intersections and road furniture, restoring all changes to their original condition and managing the transport process.
- Implementation of all aspects of the CTMP in coordination with MSC and the RTA.
- A Transport Code of Conduct be prepared and made available to all contractors and staff detailing traffic routes, behaviour requirements and speed limits. This code of conduct could be included in the CTMP.
- All traffic disruption in the area will be managed in accordance with the CTMP to be approved by MSC.

## **Appendix A**

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SIDRA modelling results



## Existing Traffic

**INTERSECTION SUMMARY**

Site: I-01 EX AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)**Intersection Performance - Hourly Values**

| Performance Measure                       | Vehicles       | Persons          |
|-------------------------------------------|----------------|------------------|
| Demand Flows (Total)                      | 1241 veh/h     | 1489 pers/h      |
| Percent Heavy Vehicles                    | 6.0 %          |                  |
| Degree of Saturation                      | 0.601          |                  |
| Practical Spare Capacity                  | 33.2 %         |                  |
| Effective Intersection Capacity           | 2066 veh/h     |                  |
| Control Delay (Total)                     | 3.07 veh-h/h   | 3.68 pers-h/h    |
| Control Delay (Average)                   | 8.9 sec        | 8.9 sec          |
| Control Delay (Worst Lane)                | 48.2 sec       |                  |
| Control Delay (Worst Movement)            | 48.2 sec       | 48.2 sec         |
| Geometric Delay (Average)                 | 5.8 sec        |                  |
| Stop-Line Delay (Average)                 | 3.1 sec        |                  |
| Level of Service (Aver. Int. Delay)       | NA             |                  |
| Level of Service (Worst Movement)         | LOS D          |                  |
| Level of Service (Worst Lane)             | LOS D          |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 3.4 veh        |                  |
| 95% Back of Queue - Distance (Worst Lane) | 25.8 m         |                  |
| Total Effective Stops                     | 478 veh/h      | 573 pers/h       |
| Effective Stop Rate                       | 0.39 per veh   | 0.39 per pers    |
| Proportion Queued                         | 0.12           | 0.12             |
| Performance Index                         | 16.7           | 16.7             |
| Travel Distance (Total)                   | 933.3 veh-km/h | 1119.9 pers-km/h |
| Travel Distance (Average)                 | 752 m          | 752 m            |
| Travel Time (Total)                       | 12.7 veh-h/h   | 15.2 pers-h/h    |
| Travel Time (Average)                     | 36.7 sec       | 36.7 sec         |
| Travel Speed                              | 73.7 km/h      | 73.7 km/h        |
| Cost (Total)                              | 535.09 \$/h    | 535.09 \$/h      |
| Fuel Consumption (Total)                  | 132.0 L/h      |                  |
| Carbon Dioxide (Total)                    | 330.8 kg/h     |                  |
| Hydrocarbons (Total)                      | 0.470 kg/h     |                  |
| Carbon Monoxide (Total)                   | 19.00 kg/h     |                  |
| NOx (Total)                               | 0.877 kg/h     |                  |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

**Intersection Performance - Annual Values**

| Performance Measure  | Vehicles         | Persons           |
|----------------------|------------------|-------------------|
| Demand Flows (Total) | 595,705 veh/y    | 714,846 pers/y    |
| Delay                | 1,473 veh-h/y    | 1,767 pers-h/y    |
| Effective Stops      | 229,364 veh/y    | 275,237 pers/y    |
| Travel Distance      | 447,973 veh-km/y | 537,568 pers-km/y |
| Travel Time          | 6,080 veh-h/y    | 7,296 pers-h/y    |
| Cost                 | 256,841 \$/y     | 256,841 \$/y      |
| Fuel Consumption     | 63,364 L/y       |                   |
| Carbon Dioxide       | 158,807 kg/y     |                   |
| Hydrocarbons         | 226 kg/y         |                   |
| Carbon Monoxide      | 9,121 kg/y       |                   |
| NOx                  | 421 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 EX AM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 365         | 3.5  | 0.202     | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 239         | 12.8 | 0.066     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 604         | 7.1  | 0.202     | 7.5           | LOS A            | 0.0               | 0.0      | 0.00         | 0.45                | 76.5          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 420         | 5.5  | 0.223     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 97          | 0.0  | 0.125     | 15.4          | LOS B            | 0.6               | 4.3      | 0.55         | 0.83                | 59.7          |
| Approach                        |      | 517         | 4.5  | 0.223     | 2.9           | LOS B            | 0.6               | 4.3      | 0.10         | 0.16                | 90.1          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 22          | 0.0  | 0.029     | 13.6          | LOS A            | 0.1               | 0.9      | 0.44         | 0.74                | 60.1          |
| 12                              | R    | 98          | 8.6  | 0.601     | 48.2          | LOS D            | 3.4               | 25.8     | 0.92         | 1.09                | 34.8          |
| Approach                        |      | 120         | 7.0  | 0.601     | 41.8          | LOS D            | 3.4               | 25.8     | 0.83         | 1.03                | 37.7          |
| All Vehicles                    |      | 1241        | 6.0  | 0.601     | 8.9           | NA               | 3.4               | 25.8     | 0.12         | 0.39                | 73.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-01 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 859 veh/h      | 1031 pers/h     |
| Percent Heavy Vehicles                    | 7.4 %          |                 |
| Degree of Saturation                      | 0.559          |                 |
| Practical Spare Capacity                  | 43.2 %         |                 |
| Effective Intersection Capacity           | 1538 veh/h     |                 |
| Control Delay (Total)                     | 1.80 veh-h/h   | 2.16 pers-h/h   |
| Control Delay (Average)                   | 7.6 sec        | 7.6 sec         |
| Control Delay (Worst Lane)                | 27.9 sec       |                 |
| Control Delay (Worst Movement)            | 27.9 sec       | 27.9 sec        |
| Geometric Delay (Average)                 | 4.0 sec        |                 |
| Stop-Line Delay (Average)                 | 3.6 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 4.0 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 28.4 m         |                 |
| Total Effective Stops                     | 272 veh/h      | 326 pers/h      |
| Effective Stop Rate                       | 0.32 per veh   | 0.32 per pers   |
| Proportion Queued                         | 0.19           | 0.19            |
| Performance Index                         | 11.9           | 11.9            |
| Travel Distance (Total)                   | 673.6 veh-km/h | 808.3 pers-km/h |
| Travel Distance (Average)                 | 784 m          | 784 m           |
| Travel Time (Total)                       | 8.8 veh-h/h    | 10.6 pers-h/h   |
| Travel Time (Average)                     | 37.0 sec       | 37.0 sec        |
| Travel Speed                              | 76.3 km/h      | 76.3 km/h       |
| Cost (Total)                              | 383.35 \$/h    | 383.35 \$/h     |
| Fuel Consumption (Total)                  | 97.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 244.1 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.328 kg/h     |                 |
| Carbon Monoxide (Total)                   | 12.78 kg/h     |                 |
| NOx (Total)                               | 0.637 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 412,295 veh/y    | 494,754 pers/y    |
| Delay                                    | 866 veh-h/y      | 1,039 pers-h/y    |
| Effective Stops                          | 130,331 veh/y    | 156,397 pers/y    |
| Travel Distance                          | 323,314 veh-km/y | 387,977 pers-km/y |
| Travel Time                              | 4,237 veh-h/y    | 5,084 pers-h/y    |
| Cost                                     | 184,007 \$/y     | 184,007 \$/y      |
| Fuel Consumption                         | 46,727 L/y       |                   |
| Carbon Dioxide                           | 117,155 kg/y     |                   |
| Hydrocarbons                             | 158 kg/y         |                   |
| Carbon Monoxide                          | 6,133 kg/y       |                   |
| NOx                                      | 306 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 61          | 19.0 | 0.037     | 13.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 329         | 8.6  | 0.089     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 391         | 10.2 | 0.089     | 2.1           | LOS A            | 0.0               | 0.0      | 0.00         | 0.12                | 93.1          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 243         | 6.9  | 0.130     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 13          | 16.7 | 0.015     | 15.3          | LOS B            | 0.1               | 0.6      | 0.45         | 0.71                | 61.3          |
| Approach                        |      | 256         | 7.4  | 0.130     | 0.8           | LOS B            | 0.1               | 0.6      | 0.02         | 0.03                | 97.4          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 31          | 3.4  | 0.038     | 13.5          | LOS A            | 0.2               | 1.2      | 0.41         | 0.73                | 60.6          |
| 12                              | R    | 182         | 1.7  | 0.559     | 27.9          | LOS B            | 4.0               | 28.4     | 0.80         | 1.07                | 46.2          |
| Approach                        |      | 213         | 2.0  | 0.558     | 25.8          | LOS B            | 4.0               | 28.4     | 0.74         | 1.02                | 47.8          |
| All Vehicles                    |      | 859         | 7.4  | 0.559     | 7.6           | NA               | 4.0               | 28.4     | 0.19         | 0.32                | 76.3          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 EX AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 1113 veh/h     | 1335 pers/h     |
| Percent Heavy Vehicles                    | 4.7 %          |                 |
| Degree of Saturation                      | 0.337          |                 |
| Practical Spare Capacity                  | 137.2 %        |                 |
| Effective Intersection Capacity           | 3299 veh/h     |                 |
| Control Delay (Total)                     | 3.05 veh-h/h   | 3.66 pers-h/h   |
| Control Delay (Average)                   | 9.9 sec        | 9.9 sec         |
| Control Delay (Worst Lane)                | 20.6 sec       |                 |
| Control Delay (Worst Movement)            | 20.6 sec       | 20.6 sec        |
| Geometric Delay (Average)                 | 8.2 sec        |                 |
| Stop-Line Delay (Average)                 | 1.7 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.7 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 12.6 m         |                 |
| Total Effective Stops                     | 649 veh/h      | 779 pers/h      |
| Effective Stop Rate                       | 0.58 per veh   | 0.58 per pers   |
| Proportion Queued                         | 0.18           | 0.18            |
| Performance Index                         | 17.1           | 17.1            |
| Travel Distance (Total)                   | 757.8 veh-km/h | 909.3 pers-km/h |
| Travel Distance (Average)                 | 681 m          | 681 m           |
| Travel Time (Total)                       | 12.5 veh-h/h   | 15.0 pers-h/h   |
| Travel Time (Average)                     | 40.4 sec       | 40.4 sec        |
| Travel Speed                              | 60.7 km/h      | 60.7 km/h       |
| Cost (Total)                              | 486.34 \$/h    | 486.34 \$/h     |
| Fuel Consumption (Total)                  | 108.2 L/h      |                 |
| Carbon Dioxide (Total)                    | 271.1 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.439 kg/h     |                 |
| Carbon Monoxide (Total)                   | 22.94 kg/h     |                 |
| NOx (Total)                               | 0.745 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 534,063 veh/y    | 640,876 pers/y    |
| Delay                                    | 1,465 veh-h/y    | 1,758 pers-h/y    |
| Effective Stops                          | 311,543 veh/y    | 373,851 pers/y    |
| Travel Distance                          | 363,733 veh-km/y | 436,480 pers-km/y |
| Travel Time                              | 5,989 veh-h/y    | 7,187 pers-h/y    |
| Cost                                     | 233,444 \$/y     | 233,444 \$/y      |
| Fuel Consumption                         | 51,958 L/y       |                   |
| Carbon Dioxide                           | 130,150 kg/y     |                   |
| Hydrocarbons                             | 211 kg/y         |                   |
| Carbon Monoxide                          | 11,009 kg/y      |                   |
| NOx                                      | 358 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-02 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                           | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|----------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                  |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Thomas Mitchell Drive (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                                | L    | 106         | 10.9 | 0.161     | 14.8          | LOS B            | 0.7               | 5.7      | 0.51         | 0.82                | 54.5          |
| 3                                | R    | 122         | 9.5  | 0.337     | 20.6          | LOS B            | 1.7               | 12.6     | 0.68         | 0.95                | 48.1          |
| Approach                         |      | 228         | 10.1 | 0.337     | 17.9          | LOS B            | 1.7               | 12.6     | 0.60         | 0.89                | 50.9          |
| East: Denman Road (E)            |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                                | L    | 487         | 1.7  | 0.266     | 11.0          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 58.9          |
| 5                                | T    | 215         | 6.4  | 0.115     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                         |      | 702         | 3.1  | 0.266     | 7.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.51                | 64.2          |
| West: Denman Road (W)            |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                               | T    | 80          | 6.6  | 0.043     | 0.0           | LOS A            | 0.7               | 5.2      | 0.00         | 0.00                | 80.0          |
| 12                               | R    | 102         | 2.1  | 0.152     | 15.1          | LOS B            | 0.7               | 5.2      | 0.59         | 0.88                | 53.6          |
| Approach                         |      | 182         | 4.0  | 0.152     | 8.5           | LOS B            | 0.7               | 5.2      | 0.33         | 0.49                | 62.8          |
| All Vehicles                     |      | 1113        | 4.7  | 0.337     | 9.9           | NA               | 1.7               | 12.6     | 0.18         | 0.58                | 60.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 833 veh/h      | 999 pers/h      |
| Percent Heavy Vehicles                    | 4.9%           |                 |
| Degree of Saturation                      | 0.515          |                 |
| Practical Spare Capacity                  | 55.3%          |                 |
| Effective Intersection Capacity           | 1616 veh/h     |                 |
| Control Delay (Total)                     | 2.00 veh-h/h   | 2.40 pers-h/h   |
| Control Delay (Average)                   | 8.7 sec        | 8.7 sec         |
| Control Delay (Worst Lane)                | 19.3 sec       |                 |
| Control Delay (Worst Movement)            | 19.3 sec       | 19.3 sec        |
| Geometric Delay (Average)                 | 5.9 sec        |                 |
| Stop-Line Delay (Average)                 | 2.8 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 3.5 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 25.4 m         |                 |
| Total Effective Stops                     | 396 veh/h      | 475 pers/h      |
| Effective Stop Rate                       | 0.48 per veh   | 0.48 per pers   |
| Proportion Queued                         | 0.31           | 0.31            |
| Performance Index                         | 12.9           | 12.9            |
| Travel Distance (Total)                   | 569.8 veh-km/h | 683.7 pers-km/h |
| Travel Distance (Average)                 | 684 m          | 684 m           |
| Travel Time (Total)                       | 9.3 veh-h/h    | 11.1 pers-h/h   |
| Travel Time (Average)                     | 40.1 sec       | 40.1 sec        |
| Travel Speed                              | 61.5 km/h      | 61.5 km/h       |
| Cost (Total)                              | 355.75\$/h     | 355.75\$/h      |
| Fuel Consumption (Total)                  | 77.6 L/h       |                 |
| Carbon Dioxide (Total)                    | 194.3 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.301 kg/h     |                 |
| Carbon Monoxide (Total)                   | 14.91 kg/h     |                 |
| NOx (Total)                               | 0.527 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 399,663 veh/y    | 479,596 pers/y    |
| Delay                                    | 961 veh-h/y      | 1,154 pers-h/y    |
| Effective Stops                          | 189,909 veh/y    | 227,890 pers/y    |
| Travel Distance                          | 273,491 veh-km/y | 328,190 pers-km/y |
| Travel Time                              | 4,447 veh-h/y    | 5,337 pers-h/y    |
| Cost                                     | 170,760\$/y      | 170,760\$/y       |
| Fuel Consumption                         | 37,229 L/y       |                   |
| Carbon Dioxide                           | 93,272 kg/y      |                   |
| Hydrocarbons                             | 144 kg/y         |                   |
| Carbon Monoxide                          | 7,158 kg/y       |                   |
| NOx                                      | 253 kg/y         |                   |

# MOVEMENT SUMMARY

Site: I-02 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles  |      |             |     |           |               |                  |                   |          |              |                     |               |
|----------------------------------|------|-------------|-----|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                           | Turn | Demand Flow | HV  | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                  |      | veh/h       | %   | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Thomas Mitchell Drive (S) |      |             |     |           |               |                  |                   |          |              |                     |               |
| 1                                | L    | 52          | 6.1 | 0.054     | 12.3          | LOS A            | 0.2               | 1.8      | 0.31         | 0.69                | 57.1          |
| 3                                | R    | 245         | 4.7 | 0.515     | 19.3          | LOS B            | 3.5               | 25.4     | 0.65         | 1.00                | 49.2          |
| Approach                         |      | 297         | 5.0 | 0.515     | 18.1          | LOS B            | 3.5               | 25.4     | 0.59         | 0.94                | 50.4          |
| East: Denman Road (E)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 4                                | L    | 62          | 6.8 | 0.035     | 11.2          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 58.9          |
| 5                                | T    | 181         | 1.7 | 0.094     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                         |      | 243         | 3.0 | 0.094     | 2.9           | LOS A            | 0.0               | 0.0      | 0.00         | 0.19                | 73.4          |
| West: Denman Road (W)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 11                               | T    | 215         | 5.4 | 0.144     | 0.8           | LOS A            | 1.1               | 8.0      | 0.24         | 0.00                | 70.5          |
| 12                               | R    | 78          | 9.5 | 0.144     | 12.6          | LOS A            | 1.1               | 8.0      | 0.39         | 0.90                | 59.1          |
| Approach                         |      | 293         | 6.5 | 0.144     | 3.9           | LOS A            | 1.1               | 8.0      | 0.28         | 0.24                | 67.1          |
| All Vehicles                     |      | 833         | 4.9 | 0.515     | 8.7           | NA               | 3.5               | 25.4     | 0.31         | 0.48                | 61.5          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

# INTERSECTION SUMMARY

Site: I-03 EX AM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                |              |                 |
|-------------------------------------------|----------------|--------------|-----------------|
| Performance Measure                       | Vehicles       | Pedestrians  | Persons         |
| Demand Flows (Total)                      | 1304 veh/h     | 42 ped/h     | 1607 pers/h     |
| Percent Heavy Vehicles                    | 8.6%           |              |                 |
| Degree of Saturation                      | 0.433          | 0.005        |                 |
| Practical Spare Capacity                  | 107.7%         |              |                 |
| Effective Intersection Capacity           | 3010 veh/h     |              |                 |
| Control Delay (Total)                     | 7.02 veh-h/h   | 0.15 ped-h/h | 8.58 pers-h/h   |
| Control Delay (Average)                   | 19.4 sec       | 13.1 sec     | 19.2 sec        |
| Control Delay (Worst Lane)                | 31.0 sec       |              |                 |
| Control Delay (Worst Movement)            | 31.0 sec       | 17.6 sec     | 31.0 sec        |
| Geometric Delay (Average)                 | 4.4 sec        |              |                 |
| Stop-Line Delay (Average)                 | 14.9 sec       |              |                 |
| Level of Service (Aver. Int. Delay)       | LOS B          | LOS B        |                 |
| Level of Service (Worst Movement)         | LOS C          | LOS B        |                 |
| Level of Service (Worst Lane)             | LOS C          |              |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 11.9 veh       |              |                 |
| 95% Back of Queue - Distance (Worst Lane) | 84.5 m         |              |                 |
| Total Effective Stops                     | 887 veh/h      | 24 ped/h     | 1088 pers/h     |
| Effective Stop Rate                       | 0.68 per veh   | 0.56 per ped | 0.68 per pers   |
| Proportion Queued                         | 0.68           | 0.56         | 0.67            |
| Performance Index                         | 44.6           | 0.7          | 45.3            |
| Travel Distance (Total)                   | 767.4 veh-km/h | 2.0 ped-km/h | 922.9 pers-km/h |
| Travel Distance (Average)                 | 588 m          | 48 m         | 574 m           |
| Travel Time (Total)                       | 20.2 veh-h/h   | 0.6 ped-h/h  | 24.8 pers-h/h   |
| Travel Time (Average)                     | 55.8 sec       | 50.1 sec     | 55.6 sec        |
| Travel Speed                              | 38.0 km/h      | 3.5 km/h     | 37.2 km/h       |
| Cost (Total)                              | 646.58 \$/h    | 11.21 \$/h   | 657.79 \$/h     |
| Fuel Consumption (Total)                  | 100.0 L/h      |              |                 |
| Carbon Dioxide (Total)                    | 251.0 kg/h     |              |                 |
| Hydrocarbons (Total)                      | 0.384 kg/h     |              |                 |
| Carbon Monoxide (Total)                   | 17.04 kg/h     |              |                 |
| NOx (Total)                               | 0.553 kg/h     |              |                 |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 626,021 veh/y    | 20,160 ped/y | 771,385 pers/y    |
| Delay                                    | 3,369 veh-h/y    | 73 ped-h/y   | 4,116 pers-h/y    |
| Effective Stops                          | 425,806 veh/y    | 11,340 ped/y | 522,308 pers/y    |
| Travel Distance                          | 368,340 veh-km/y | 970 ped-km/y | 442,977 pers-km/y |
| Travel Time                              | 9,698 veh-h/y    | 280 ped-h/y  | 11,918 pers-h/y   |
| Cost                                     | 310,359 \$/y     | 5,382 \$/y   | 315,741 \$/y      |
| Fuel Consumption                         | 48,004 L/y       |              |                   |
| Carbon Dioxide                           | 120,460 kg/y     |              |                   |
| Hydrocarbons                             | 184 kg/y         |              |                   |
| Carbon Monoxide                          | 8,177 kg/y       |              |                   |
| NOx                                      | 266 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 EX AM

2112974A Mangoolo TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|--------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                              | L    | 106         | 7.9  | 0.186     | 29.5          | LOS C            | 4.2               | 31.7     | 0.76         | 0.77                | 33.2          |
| 3                              | R    | 229         | 18.8 | 0.431     | 31.0          | LOS C            | 8.9               | 72.0     | 0.83         | 0.80                | 31.5          |
| Approach                       |      | 336         | 15.4 | 0.431     | 30.5          | LOS C            | 8.9               | 72.0     | 0.81         | 0.79                | 32.1          |
| East: New England Highway (E)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                              | L    | 317         | 10.6 | 0.433     | 19.6          | LOS B            | 8.9               | 67.9     | 0.62         | 0.78                | 38.0          |
| 5                              | T    | 429         | 2.2  | 0.426     | 12.5          | LOS A            | 11.9              | 84.5     | 0.65         | 0.57                | 42.7          |
| Approach                       |      | 746         | 5.8  | 0.433     | 15.5          | LOS B            | 11.9              | 84.5     | 0.64         | 0.66                | 40.6          |
| West: Sydney Street (W)        |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                             | T    | 157         | 10.1 | 0.163     | 11.8          | LOS A            | 4.4               | 33.6     | 0.55         | 0.50                | 43.5          |
| 12                             | R    | 65          | 3.2  | 0.208     | 25.0          | LOS B            | 2.6               | 18.5     | 0.69         | 0.75                | 34.5          |
| Approach                       |      | 222         | 8.1  | 0.208     | 15.6          | LOS B            | 4.4               | 33.6     | 0.59         | 0.58                | 40.4          |
| All Vehicles                   |      | 1304        | 8.6  | 0.433     | 19.4          | LOS B            | 11.9              | 84.5     | 0.68         | 0.68                | 38.0          |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

# INTERSECTION SUMMARY

Site: I-03 EX PM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                 |              |                  |
|-------------------------------------------|-----------------|--------------|------------------|
| Performance Measure                       | Vehicles        | Pedestrians  | Persons          |
| Demand Flows (Total)                      | 1784 veh/h      | 42 ped/h     | 2183 pers/h      |
| Percent Heavy Vehicles                    | 5.3%            |              |                  |
| Degree of Saturation                      | 0.710           | 0.004        |                  |
| Practical Spare Capacity                  | 26.7%           |              |                  |
| Effective Intersection Capacity           | 2511 veh/h      |              |                  |
| Control Delay (Total)                     | 11.93 veh-h/h   | 0.15 ped-h/h | 14.47 pers-h/h   |
| Control Delay (Average)                   | 24.1 sec        | 12.7 sec     | 23.9 sec         |
| Control Delay (Worst Lane)                | 36.2 sec        |              |                  |
| Control Delay (Worst Movement)            | 36.2 sec        | 13.8 sec     | 36.2 sec         |
| Geometric Delay (Average)                 | 5.1 sec         |              |                  |
| Stop-Line Delay (Average)                 | 18.9 sec        |              |                  |
| Level of Service (Aver. Int. Delay)       | LOS B           | LOS B        |                  |
| Level of Service (Worst Movement)         | LOS C           | LOS B        |                  |
| Level of Service (Worst Lane)             | LOS C           |              |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 18.0 veh        |              |                  |
| 95% Back of Queue - Distance (Worst Lane) | 132.9 m         |              |                  |
| Total Effective Stops                     | 1361 veh/h      | 24 ped/h     | 1657 pers/h      |
| Effective Stop Rate                       | 0.76 per veh    | 0.56 per ped | 0.76 per pers    |
| Proportion Queued                         | 0.80            | 0.56         | 0.79             |
| Performance Index                         | 69.0            | 0.7          | 69.8             |
| Travel Distance (Total)                   | 1037.9 veh-km/h | 2.0 ped-km/h | 1247.4 pers-km/h |
| Travel Distance (Average)                 | 582 m           | 48 m         | 571 m            |
| Travel Time (Total)                       | 29.7 veh-h/h    | 0.6 ped-h/h  | 36.2 pers-h/h    |
| Travel Time (Average)                     | 60.0 sec        | 49.7 sec     | 59.8 sec         |
| Travel Speed                              | 34.9 km/h       | 3.5 km/h     | 34.4 km/h        |
| Cost (Total)                              | 919.20 \$/h     | 11.13 \$/h   | 930.33 \$/h      |
| Fuel Consumption (Total)                  | 129.1 L/h       |              |                  |
| Carbon Dioxide (Total)                    | 323.5 kg/h      |              |                  |
| Hydrocarbons (Total)                      | 0.524 kg/h      |              |                  |
| Carbon Monoxide (Total)                   | 21.65 kg/h      |              |                  |
| NOx (Total)                               | 0.697 kg/h      |              |                  |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 856,421 veh/y    | 20,160 ped/y | 1,047,865 pers/y  |
| Delay                                    | 5,728 veh-h/y    | 71 ped-h/y   | 6,945 pers-h/y    |
| Effective Stops                          | 653,334 veh/y    | 11,340 ped/y | 795,341 pers/y    |
| Travel Distance                          | 498,169 veh-km/y | 970 ped-km/y | 598,773 pers-km/y |
| Travel Time                              | 14,267 veh-h/y   | 278 ped-h/y  | 17,399 pers-h/y   |
| Cost                                     | 441,215 \$/y     | 5,342 \$/y   | 446,556 \$/y      |
| Fuel Consumption                         | 61,985 L/y       |              |                   |
| Carbon Dioxide                           | 155,299 kg/y     |              |                   |
| Hydrocarbons                             | 252 kg/y         |              |                   |
| Carbon Monoxide                          | 10,392 kg/y      |              |                   |
| NOx                                      | 335 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 EX PM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|--------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                |      |             | %            | v/c   |               |                  | Vehicles          | Distance |              |                     |               |
|                                |      | veh/h       |              |       | sec           |                  | veh               | m        |              | per veh             | km/h          |
| South: New England Highway (S) |      |             |              |       |               |                  |                   |          |              |                     |               |
| 1                              | L    | 79          | 1.3          | 0.107 | 24.4          | LOS B            | 2.8               | 20.0     | 0.66         | 0.75                | 35.9          |
| 3                              | R    | 505         | 6.3          | 0.710 | 29.7          | LOS C            | 18.0              | 132.9    | 0.90         | 0.86                | 32.0          |
| Approach                       |      | 584         | 5.6          | 0.711 | 29.0          | LOS C            | 18.0              | 132.9    | 0.87         | 0.85                | 32.5          |
| East: New England Highway (E)  |      |             |              |       |               |                  |                   |          |              |                     |               |
| 4                              | L    | 479         | 7.7          | 0.703 | 26.0          | LOS B            | 15.7              | 117.2    | 0.81         | 0.84                | 34.0          |
| 5                              | T    | 261         | 2.0          | 0.301 | 15.0          | LOS B            | 8.2               | 58.1     | 0.68         | 0.57                | 40.6          |
| Approach                       |      | 740         | 5.7          | 0.702 | 22.1          | LOS B            | 15.7              | 117.2    | 0.76         | 0.74                | 36.1          |
| West: Sydney Street (W)        |      |             |              |       |               |                  |                   |          |              |                     |               |
| 11                             | T    | 372         | 3.1          | 0.432 | 17.4          | LOS B            | 11.6              | 83.1     | 0.73         | 0.66                | 38.7          |
| 12                             | R    | 88          | 8.3          | 0.410 | 36.2          | LOS C            | 4.3               | 32.4     | 0.88         | 0.79                | 29.1          |
| Approach                       |      | 460         | 4.1          | 0.432 | 21.0          | LOS B            | 11.6              | 83.1     | 0.76         | 0.69                | 36.4          |
| All Vehicles                   |      | 1784        | 5.3          | 0.710 | 24.1          | LOS B            | 18.0              | 132.9    | 0.80         | 0.76                | 34.9          |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

### Movement Performance - Pedestrians

| Mov ID          | Description       | Demand Flow | Average Delay | Level of Service | Average Back of Queue |          | Prop. Queued | Effective Stop Rate |
|-----------------|-------------------|-------------|---------------|------------------|-----------------------|----------|--------------|---------------------|
|                 |                   |             |               |                  | Pedestrian            | Distance |              |                     |
|                 |                   | ped/h       | sec           |                  | ped                   | m        |              | per ped             |
| P1              | Across S approach | 21          | 11.6          | LOS B            | 0.0                   | 0.0      | 0.54         | 0.54                |
| P7              | Across W approach | 21          | 13.8          | LOS B            | 0.0                   | 0.0      | 0.59         | 0.59                |
| All Pedestrians |                   | 42          | 12.7          |                  |                       |          | 0.56         | 0.56                |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

## INTERSECTION SUMMARY

Site: I-04 EX AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 94 veh/h      | 112 pers/h     |
| Percent Heavy Vehicles                    | 7.9%          |                |
| Degree of Saturation                      | 0.026         |                |
| Practical Spare Capacity                  | 2989.6%       |                |
| Effective Intersection Capacity           | 3618 veh/h    |                |
| Control Delay (Total)                     | 0.21 veh-h/h  | 0.26 pers-h/h  |
| Control Delay (Average)                   | 8.2 sec       | 8.2 sec        |
| Control Delay (Worst Lane)                | 11.7 sec      |                |
| Control Delay (Worst Movement)            | 13.3 sec      | 13.3 sec       |
| Geometric Delay (Average)                 | 8.1 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 0.9 m         |                |
| Total Effective Stops                     | 50 veh/h      | 61 pers/h      |
| Effective Stop Rate                       | 0.54 per veh  | 0.54 per pers  |
| Proportion Queued                         | 0.08          | 0.08           |
| Performance Index                         | 1.3           | 1.3            |
| Travel Distance (Total)                   | 70.0 veh-km/h | 84.0 pers-km/h |
| Travel Distance (Average)                 | 748 m         | 748 m          |
| Travel Time (Total)                       | 1.0 veh-h/h   | 1.2 pers-h/h   |
| Travel Time (Average)                     | 37.1 sec      | 37.1 sec       |
| Travel Speed                              | 72.5 km/h     | 72.5 km/h      |
| Cost (Total)                              | 44.05 \$/h    | 44.05 \$/h     |
| Fuel Consumption (Total)                  | 11.8 L/h      |                |
| Carbon Dioxide (Total)                    | 29.6 kg/h     |                |
| Hydrocarbons (Total)                      | 0.046 kg/h    |                |
| Carbon Monoxide (Total)                   | 2.48 kg/h     |                |
| NOx (Total)                               | 0.088 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 44,968 veh/y    | 53,962 pers/y    |
| Delay                                    | 102 veh-h/y     | 123 pers-h/y     |
| Effective Stops                          | 24,203 veh/y    | 29,044 pers/y    |
| Travel Distance                          | 33,616 veh-km/y | 40,339 pers-km/y |
| Travel Time                              | 464 veh-h/y     | 556 pers-h/y     |
| Cost                                     | 21,146 \$/y     | 21,146 \$/y      |
| Fuel Consumption                         | 5,653 L/y       |                  |
| Carbon Dioxide                           | 14,184 kg/y     |                  |
| Hydrocarbons                             | 22 kg/y         |                  |
| Carbon Monoxide                          | 1,191 kg/y      |                  |
| NOx                                      | 42 kg/y         |                  |

# MOVEMENT SUMMARY

Site: I-04 EX AM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |     |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       |      |           |               |                  | %                 | v/c |              |                     |               |
| South: Kayuga Road (S)          |      |             |      |           |               |                  |                   |     |              |                     |               |
| 1                               | L    | 28          | 18.5 | 0.020     | 13.3          | LOS A            | 0.0               | 0.0 | 0.00         | 0.81                | 64.8          |
| 2                               | T    | 4           | 25.0 | 0.020     | 0.0           | LOS A            | 0.0               | 0.0 | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 33          | 19.4 | 0.020     | 11.6          | LOS A            | 0.0               | 0.0 | 0.00         | 0.71                | 68.4          |
| North: Kayuga Road (N)          |      |             |      |           |               |                  |                   |     |              |                     |               |
| 8                               | T    | 28          | 0.0  | 0.020     | 0.1           | LOS A            | 0.1               | 0.9 | 0.12         | 0.00                | 92.7          |
| 9                               | R    | 7           | 0.0  | 0.020     | 12.2          | LOS A            | 0.1               | 0.9 | 0.12         | 1.33                | 65.8          |
| Approach                        |      | 36          | 0.0  | 0.020     | 2.6           | LOS A            | 0.1               | 0.9 | 0.12         | 0.27                | 86.4          |
| West: Wybong Road (W)           |      |             |      |           |               |                  |                   |     |              |                     |               |
| 10                              | L    | 1           | 0.0  | 0.026     | 11.6          | LOS A            | 0.1               | 0.8 | 0.13         | 0.66                | 62.5          |
| 12                              | R    | 24          | 4.3  | 0.026     | 11.8          | LOS A            | 0.1               | 0.8 | 0.13         | 0.69                | 62.8          |
| Approach                        |      | 25          | 4.2  | 0.026     | 11.7          | LOS A            | 0.1               | 0.8 | 0.13         | 0.69                | 62.7          |
| All Vehicles                    |      | 94          | 7.9  | 0.026     | 8.2           | NA               | 0.1               | 0.9 | 0.08         | 0.54                | 72.5          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-04 EX PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 156 veh/h      | 187 pers/h      |
| Percent Heavy Vehicles                    | 4.1 %          |                 |
| Degree of Saturation                      | 0.048          |                 |
| Practical Spare Capacity                  | 1551.4 %       |                 |
| Effective Intersection Capacity           | 3216 veh/h     |                 |
| Control Delay (Total)                     | 0.29 veh-h/h   | 0.35 pers-h/h   |
| Control Delay (Average)                   | 6.8 sec        | 6.8 sec         |
| Control Delay (Worst Lane)                | 12.1 sec       |                 |
| Control Delay (Worst Movement)            | 13.5 sec       | 13.5 sec        |
| Geometric Delay (Average)                 | 6.6 sec        |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.2 m          |                 |
| Total Effective Stops                     | 79 veh/h       | 95 pers/h       |
| Effective Stop Rate                       | 0.51 per veh   | 0.51 per pers   |
| Proportion Queued                         | 0.08           | 0.08            |
| Performance Index                         | 2.1            | 2.1             |
| Travel Distance (Total)                   | 117.8 veh-km/h | 141.4 pers-km/h |
| Travel Distance (Average)                 | 756 m          | 756 m           |
| Travel Time (Total)                       | 1.5 veh-h/h    | 1.9 pers-h/h    |
| Travel Time (Average)                     | 35.8 sec       | 35.8 sec        |
| Travel Speed                              | 76.0 km/h      | 76.0 km/h       |
| Cost (Total)                              | 67.35 \$/h     | 67.35 \$/h      |
| Fuel Consumption (Total)                  | 17.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 43.3 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.067 kg/h     |                 |
| Carbon Monoxide (Total)                   | 3.25 kg/h      |                 |
| NOx (Total)                               | 0.127 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 74,779 veh/y    | 89,735 pers/y    |
| Delay                                    | 141 veh-h/y     | 169 pers-h/y     |
| Effective Stops                          | 38,129 veh/y    | 45,755 pers/y    |
| Travel Distance                          | 56,547 veh-km/y | 67,856 pers-km/y |
| Travel Time                              | 744 veh-h/y     | 893 pers-h/y     |
| Cost                                     | 32,327 \$/y     | 32,327 \$/y      |
| Fuel Consumption                         | 8,295 L/y       |                  |
| Carbon Dioxide                           | 20,788 kg/y     |                  |
| Hydrocarbons                             | 32 kg/y         |                  |
| Carbon Monoxide                          | 1,561 kg/y      |                  |
| NOx                                      | 61 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-04 EX PM

2112974A Mangoola TIA  
 Giveaway / Yield (Two-Way)

| Movement Performance - Vehicles |      |        |              |       |               |                  |                   |          |              |                     |               |
|---------------------------------|------|--------|--------------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | Flow   |              |       |               |                  | Vehicles          | Distance |              |                     |               |
|                                 |      | veh/h  | %            | v/c   | sec           |                  | veh               | m        |              | per veh             | km/h          |
| South: Kayuga Road (S)          |      |        |              |       |               |                  |                   |          |              |                     |               |
| 1                               | L    | 41     | 2.6          | 0.048 | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 1.10                | 64.8          |
| 2                               | T    | 51     | 0.0          | 0.048 | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 92     | 1.1          | 0.048 | 5.5           | LOS A            | 0.0               | 0.0      | 0.00         | 0.49                | 81.9          |
| North: Kayuga Road (N)          |      |        |              |       |               |                  |                   |          |              |                     |               |
| 8                               | T    | 20     | 10.5         | 0.018 | 0.4           | LOS A            | 0.1               | 0.9      | 0.21         | 0.00                | 87.5          |
| 9                               | R    | 8      | 12.5         | 0.018 | 13.2          | LOS A            | 0.1               | 0.9      | 0.21         | 1.17                | 66.0          |
| Approach                        |      | 28     | 11.1         | 0.018 | 4.2           | LOS A            | 0.1               | 0.9      | 0.21         | 0.35                | 80.6          |
| West: Wybong Road (W)           |      |        |              |       |               |                  |                   |          |              |                     |               |
| 10                              | L    | 8      | 25.0         | 0.039 | 13.5          | LOS A            | 0.2               | 1.2      | 0.20         | 0.67                | 62.1          |
| 12                              | R    | 27     | 0.0          | 0.039 | 11.7          | LOS A            | 0.2               | 1.2      | 0.20         | 0.69                | 62.4          |
| Approach                        |      | 36     | 5.9          | 0.039 | 12.1          | LOS A            | 0.2               | 1.2      | 0.20         | 0.69                | 62.4          |
| All Vehicles                    |      | 156    | 4.1          | 0.048 | 6.8           | NA               | 0.2               | 1.2      | 0.08         | 0.51                | 76.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 522 veh/h      | 627 pers/h      |
| Percent Heavy Vehicles                    | 7.7 %          |                 |
| Degree of Saturation                      | 0.188          |                 |
| Practical Spare Capacity                  | 326.3 %        |                 |
| Effective Intersection Capacity           | 2782 veh/h     |                 |
| Control Delay (Total)                     | 1.17 veh-h/h   | 1.41 pers-h/h   |
| Control Delay (Average)                   | 8.1 sec        | 8.1 sec         |
| Control Delay (Worst Lane)                | 13.6 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 7.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.4 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.1 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 7.9 m          |                 |
| Total Effective Stops                     | 234 veh/h      | 280 pers/h      |
| Effective Stop Rate                       | 0.45 per veh   | 0.45 per pers   |
| Proportion Queued                         | 0.15           | 0.15            |
| Performance Index                         | 6.8            | 6.8             |
| Travel Distance (Total)                   | 337.7 veh-km/h | 405.3 pers-km/h |
| Travel Distance (Average)                 | 647 m          | 647 m           |
| Travel Time (Total)                       | 5.0 veh-h/h    | 6.1 pers-h/h    |
| Travel Time (Average)                     | 34.8 sec       | 34.8 sec        |
| Travel Speed                              | 66.9 km/h      | 66.9 km/h       |
| Cost (Total)                              | 193.78 \$/h    | 193.78 \$/h     |
| Fuel Consumption (Total)                  | 41.6 L/h       |                 |
| Carbon Dioxide (Total)                    | 104.4 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.155 kg/h     |                 |
| Carbon Monoxide (Total)                   | 6.74 kg/h      |                 |
| NOx (Total)                               | 0.271 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 250,611 veh/y    | 300,733 pers/y    |
| Delay                                    | 564 veh-h/y      | 677 pers-h/y      |
| Effective Stops                          | 112,104 veh/y    | 134,524 pers/y    |
| Travel Distance                          | 162,108 veh-km/y | 194,529 pers-km/y |
| Travel Time                              | 2,422 veh-h/y    | 2,906 pers-h/y    |
| Cost                                     | 93,017 \$/y      | 93,017 \$/y       |
| Fuel Consumption                         | 19,984 L/y       |                   |
| Carbon Dioxide                           | 50,130 kg/y      |                   |
| Hydrocarbons                             | 74 kg/y          |                   |
| Carbon Monoxide                          | 3,237 kg/y       |                   |
| NOx                                      | 130 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 EX AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |      |       |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. | Satn  | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    |      | v/c   | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Denman Road (E)           |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 5                               | T    | 93          | 12.5 |      | 0.051 | 2.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.16                | 87.5          |
| 6                               | R    | 232         | 7.3  |      | 0.188 | 13.6          | LOS A            | 1.1               | 7.9      | 0.27         | 0.71                | 61.5          |
| Approach                        |      | 324         | 8.8  |      | 0.188 | 10.4          | LOS A            | 1.1               | 7.9      | 0.20         | 0.56                | 67.8          |
| North: Bengalla Link Road (N)   |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 7                               | L    | 58          | 12.7 |      | 0.069 | 10.7          | LOS A            | 0.3               | 2.5      | 0.25         | 0.65                | 50.0          |
| 9                               | R    | 3           | 33.3 |      | 0.069 | 11.6          | LOS A            | 0.3               | 2.5      | 0.25         | 0.78                | 50.0          |
| Approach                        |      | 61          | 13.8 |      | 0.069 | 10.7          | LOS A            | 0.3               | 2.5      | 0.25         | 0.66                | 50.0          |
| West: Denman Road (W)           |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 10                              | L    | 19          | 5.6  |      | 0.011 | 10.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.71                | 57.1          |
| 11                              | T    | 118         | 1.8  |      | 0.061 | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                        |      | 137         | 2.3  |      | 0.061 | 1.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.10                | 76.2          |
| All Vehicles                    |      | 522         | 7.7  |      | 0.188 | 8.1           | NA               | 1.1               | 7.9      | 0.15         | 0.45                | 66.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 EX PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 522 veh/h      | 627 pers/h      |
| Percent Heavy Vehicles                    | 4.8%           |                 |
| Degree of Saturation                      | 0.181          |                 |
| Practical Spare Capacity                  | 343.0%         |                 |
| Effective Intersection Capacity           | 2891 veh/h     |                 |
| Control Delay (Total)                     | 0.87 veh-h/h   | 1.05 pers-h/h   |
| Control Delay (Average)                   | 6.0 sec        | 6.0 sec         |
| Control Delay (Worst Lane)                | 13.2 sec       |                 |
| Control Delay (Worst Movement)            | 13.2 sec       | 13.2 sec        |
| Geometric Delay (Average)                 | 5.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.9 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 6.8 m          |                 |
| Total Effective Stops                     | 197 veh/h      | 237 pers/h      |
| Effective Stop Rate                       | 0.38 per veh   | 0.38 per pers   |
| Proportion Queued                         | 0.11           | 0.11            |
| Performance Index                         | 6.9            | 6.9             |
| Travel Distance (Total)                   | 352.5 veh-km/h | 423.0 pers-km/h |
| Travel Distance (Average)                 | 675 m          | 675 m           |
| Travel Time (Total)                       | 5.4 veh-h/h    | 6.4 pers-h/h    |
| Travel Time (Average)                     | 37.0 sec       | 37.0 sec        |
| Travel Speed                              | 65.6 km/h      | 65.6 km/h       |
| Cost (Total)                              | 201.83 \$/h    | 201.83 \$/h     |
| Fuel Consumption (Total)                  | 42.4 L/h       |                 |
| Carbon Dioxide (Total)                    | 106.3 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.161 kg/h     |                 |
| Carbon Monoxide (Total)                   | 7.14 kg/h      |                 |
| NOx (Total)                               | 0.275 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 250,611 veh/y    | 300,733 pers/y    |
| Delay                                    | 419 veh-h/y      | 503 pers-h/y      |
| Effective Stops                          | 94,610 veh/y     | 113,531 pers/y    |
| Travel Distance                          | 169,215 veh-km/y | 203,058 pers-km/y |
| Travel Time                              | 2,579 veh-h/y    | 3,094 pers-h/y    |
| Cost                                     | 96,879 \$/y      | 96,879 \$/y       |
| Fuel Consumption                         | 20,360 L/y       |                   |
| Carbon Dioxide                           | 51,010 kg/y      |                   |
| Hydrocarbons                             | 77 kg/y          |                   |
| Carbon Monoxide                          | 3,425 kg/y       |                   |
| NOx                                      | 132 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 EX PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
|---------------------------------|------|----------------------|-------------------|-------------|----------------------|------------------|-------------------|---------------|--------------|--------------------------------|-----------------------|
| Mov ID                          | Turn | Demand Flow<br>veh/h | HV Deg. Satn<br>% | Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue |               | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>km/h |
|                                 |      |                      |                   |             |                      |                  | Vehicles<br>veh   | Distance<br>m |              |                                |                       |
| East: Denman Road (E)           |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 5                               | T    | 164                  | 2.6               | 0.086       | 2.4                  | LOS A            | 0.0               | 0.0           | 0.00         | 0.17                           | 87.5                  |
| 6                               | R    | 65                   | 3.2               | 0.050       | 13.2                 | LOS A            | 0.3               | 1.8           | 0.21         | 0.70                           | 61.9                  |
| Approach                        |      | 229                  | 2.8               | 0.086       | 5.4                  | LOS A            | 0.3               | 1.8           | 0.06         | 0.32                           | 79.1                  |
| North: Bengalla Link Road (N)   |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 7                               | L    | 179                  | 7.1               | 0.181       | 10.1                 | LOS A            | 0.9               | 6.8           | 0.24         | 0.65                           | 50.1                  |
| 9                               | R    | 6                    | 0.0               | 0.180       | 9.8                  | LOS A            | 0.9               | 6.8           | 0.24         | 0.75                           | 50.1                  |
| Approach                        |      | 185                  | 6.8               | 0.181       | 10.1                 | LOS A            | 0.9               | 6.8           | 0.24         | 0.66                           | 50.1                  |
| West: Denman Road (W)           |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 10                              | L    | 2                    | 0.0               | 0.001       | 10.1                 | LOS A            | 0.0               | 0.0           | 0.00         | 0.71                           | 57.1                  |
| 11                              | T    | 105                  | 6.0               | 0.056       | 0.0                  | LOS A            | 0.0               | 0.0           | 0.00         | 0.00                           | 80.0                  |
| Approach                        |      | 107                  | 5.9               | 0.056       | 0.2                  | LOS A            | 0.0               | 0.0           | 0.00         | 0.01                           | 79.5                  |
| All Vehicles                    |      | 522                  | 4.8               | 0.181       | 6.0                  | NA               | 0.9               | 6.8           | 0.11         | 0.38                           | 65.6                  |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 EX AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 172 veh/h      | 206 pers/h      |
| Percent Heavy Vehicles                    | 10.4 %         |                 |
| Degree of Saturation                      | 0.074          |                 |
| Practical Spare Capacity                  | 979.2 %        |                 |
| Effective Intersection Capacity           | 2315 veh/h     |                 |
| Control Delay (Total)                     | 0.59 veh-h/h   | 0.71 pers-h/h   |
| Control Delay (Average)                   | 12.5 sec       | 12.5 sec        |
| Control Delay (Worst Lane)                | 13.5 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 12.2 sec       |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.3 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 2.3 m          |                 |
| Total Effective Stops                     | 117 veh/h      | 141 pers/h      |
| Effective Stop Rate                       | 0.68 per veh   | 0.68 per pers   |
| Proportion Queued                         | 0.09           | 0.09            |
| Performance Index                         | 2.8            | 2.8             |
| Travel Distance (Total)                   | 132.9 veh-km/h | 159.5 pers-km/h |
| Travel Distance (Average)                 | 775 m          | 775 m           |
| Travel Time (Total)                       | 1.9 veh-h/h    | 2.3 pers-h/h    |
| Travel Time (Average)                     | 40.8 sec       | 40.8 sec        |
| Travel Speed                              | 68.3 km/h      | 68.3 km/h       |
| Cost (Total)                              | 101.49 \$/h    | 101.49 \$/h     |
| Fuel Consumption (Total)                  | 30.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 76.1 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.123 kg/h     |                 |
| Carbon Monoxide (Total)                   | 7.90 kg/h      |                 |
| NOx (Total)                               | 0.240 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 82,358 veh/y    | 98,829 pers/y    |
| Delay                                    | 285 veh-h/y     | 342 pers-h/y     |
| Effective Stops                          | 56,313 veh/y    | 67,576 pers/y    |
| Travel Distance                          | 63,789 veh-km/y | 76,547 pers-km/y |
| Travel Time                              | 934 veh-h/y     | 1,121 pers-h/y   |
| Cost                                     | 48,713 \$/y     | 48,713 \$/y      |
| Fuel Consumption                         | 14,555 L/y      |                  |
| Carbon Dioxide                           | 36,544 kg/y     |                  |
| Hydrocarbons                             | 59 kg/y         |                  |
| Carbon Monoxide                          | 3,790 kg/y      |                  |
| NOx                                      | 115 kg/y        |                  |

## MOVEMENT SUMMARY

Site: I-06 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                              |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                            | T    | 9           | 22.2 | 0.006     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 85.2          |
| 6                            | R    | 24          | 13.0 | 0.020     | 12.4          | LOS A            | 0.1               | 0.8      | 0.18         | 0.68                | 62.6          |
| Approach                     |      | 34          | 15.6 | 0.020     | 8.9           | LOS A            | 0.1               | 0.8      | 0.13         | 0.49                | 67.7          |
| North: Wybong Road (N)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 7                            | L    | 11          | 0.0  | 0.074     | 12.7          | LOS A            | 0.3               | 2.3      | 0.17         | 0.68                | 63.6          |
| 9                            | R    | 52          | 8.2  | 0.074     | 13.6          | LOS A            | 0.3               | 2.3      | 0.17         | 0.71                | 68.1          |
| Approach                     |      | 62          | 6.8  | 0.074     | 13.5          | LOS A            | 0.3               | 2.3      | 0.17         | 0.71                | 67.4          |
| West: Wybong Road (W)        |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                           | L    | 75          | 11.3 | 0.043     | 13.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.76                | 69.1          |
| 11                           | T    | 1           | 0.0  | 0.001     | 2.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.17                | 87.5          |
| Approach                     |      | 76          | 11.1 | 0.043     | 13.2          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 69.3          |
| All Vehicles                 |      | 172         | 10.4 | 0.074     | 12.5          | NA               | 0.3               | 2.3      | 0.09         | 0.68                | 68.3          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 EX PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 193 veh/h      | 231 pers/h      |
| Percent Heavy Vehicles                    | 8.2%           |                 |
| Degree of Saturation                      | 0.128          |                 |
| Practical Spare Capacity                  | 523.0%         |                 |
| Effective Intersection Capacity           | 1500 veh/h     |                 |
| Control Delay (Total)                     | 0.66 veh-h/h   | 0.80 pers-h/h   |
| Control Delay (Average)                   | 12.4 sec       | 12.4 sec        |
| Control Delay (Worst Lane)                | 13.5 sec       |                 |
| Control Delay (Worst Movement)            | 13.5 sec       | 13.5 sec        |
| Geometric Delay (Average)                 | 12.2 sec       |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.6 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 4.3 m          |                 |
| Total Effective Stops                     | 131 veh/h      | 157 pers/h      |
| Effective Stop Rate                       | 0.68 per veh   | 0.68 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 3.1            | 3.1             |
| Travel Distance (Total)                   | 147.3 veh-km/h | 176.7 pers-km/h |
| Travel Distance (Average)                 | 764 m          | 764 m           |
| Travel Time (Total)                       | 2.2 veh-h/h    | 2.6 pers-h/h    |
| Travel Time (Average)                     | 40.5 sec       | 40.5 sec        |
| Travel Speed                              | 67.9 km/h      | 67.9 km/h       |
| Cost (Total)                              | 106.92 \$/h    | 106.92 \$/h     |
| Fuel Consumption (Total)                  | 30.7 L/h       |                 |
| Carbon Dioxide (Total)                    | 76.9 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.129 kg/h     |                 |
| Carbon Monoxide (Total)                   | 8.03 kg/h      |                 |
| NOx (Total)                               | 0.242 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 92,463 veh/y    | 110,956 pers/y   |
| Delay                                    | 318 veh-h/y     | 382 pers-h/y     |
| Effective Stops                          | 62,992 veh/y    | 75,591 pers/y    |
| Travel Distance                          | 70,685 veh-km/y | 84,822 pers-km/y |
| Travel Time                              | 1,041 veh-h/y   | 1,249 pers-h/y   |
| Cost                                     | 51,324 \$/y     | 51,324 \$/y      |
| Fuel Consumption                         | 14,721 L/y      |                  |
| Carbon Dioxide                           | 36,925 kg/y     |                  |
| Hydrocarbons                             | 62 kg/y         |                  |
| Carbon Monoxide                          | 3,855 kg/y      |                  |
| NOx                                      | 116 kg/y        |                  |

## MOVEMENT SUMMARY

Site: I-06 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                              |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |              |               |                  |                   |     |              |                     |               |
| 5                            | T    | 5           | 20.0         | 0.003         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 85.2          |
| 6                            | R    | 26          | 8.0          | 0.021         | 11.9             | LOS A             | 0.1 | 0.7          | 0.13                | 62.8          |
| Approach                     |      | 32          | 10.0         | 0.021         | 9.9              | LOS A             | 0.1 | 0.7          | 0.11                | 65.8          |
| North: Wybong Road (N)       |      |             |              |               |                  |                   |     |              |                     |               |
| 7                            | L    | 25          | 16.7         | 0.128         | 13.5             | LOS A             | 0.6 | 4.3          | 0.14                | 63.8          |
| 9                            | R    | 85          | 7.4          | 0.128         | 13.5             | LOS A             | 0.6 | 4.3          | 0.14                | 68.2          |
| Approach                     |      | 111         | 9.5          | 0.128         | 13.5             | LOS A             | 0.6 | 4.3          | 0.14                | 67.3          |
| West: Wybong Road (W)        |      |             |              |               |                  |                   |     |              |                     |               |
| 10                           | L    | 44          | 4.8          | 0.025         | 12.9             | LOS A             | 0.0 | 0.0          | 0.00                | 69.1          |
| 11                           | T    | 6           | 0.0          | 0.003         | 2.4              | LOS A             | 0.0 | 0.0          | 0.00                | 87.5          |
| Approach                     |      | 51          | 4.2          | 0.025         | 11.6             | LOS A             | 0.0 | 0.0          | 0.00                | 70.8          |
| All Vehicles                 |      | 193         | 8.2          | 0.128         | 12.4             | NA                | 0.6 | 4.3          | 0.10                | 67.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 192 veh/h      | 230 pers/h      |
| Percent Heavy Vehicles                    | 7.7 %          |                 |
| Degree of Saturation                      | 0.056          |                 |
| Practical Spare Capacity                  | 1325.0 %       |                 |
| Effective Intersection Capacity           | 3413 veh/h     |                 |
| Control Delay (Total)                     | 0.42 veh-h/h   | 0.51 pers-h/h   |
| Control Delay (Average)                   | 7.9 sec        | 7.9 sec         |
| Control Delay (Worst Lane)                | 11.1 sec       |                 |
| Control Delay (Worst Movement)            | 12.1 sec       | 12.1 sec        |
| Geometric Delay (Average)                 | 7.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.8 m          |                 |
| Total Effective Stops                     | 109 veh/h      | 131 pers/h      |
| Effective Stop Rate                       | 0.57 per veh   | 0.57 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 2.7            | 2.7             |
| Travel Distance (Total)                   | 102.7 veh-km/h | 123.2 pers-km/h |
| Travel Distance (Average)                 | 536 m          | 536 m           |
| Travel Time (Total)                       | 1.9 veh-h/h    | 2.2 pers-h/h    |
| Travel Time (Average)                     | 35.1 sec       | 35.1 sec        |
| Travel Speed                              | 55.0 km/h      | 55.0 km/h       |
| Cost (Total)                              | 68.53 \$/h     | 68.53 \$/h      |
| Fuel Consumption (Total)                  | 13.8 L/h       |                 |
| Carbon Dioxide (Total)                    | 34.6 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.052 kg/h     |                 |
| Carbon Monoxide (Total)                   | 2.55 kg/h      |                 |
| NOx (Total)                               | 0.088 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 91,958 veh/y    | 110,350 pers/y   |
| Delay                                    | 203 veh-h/y     | 243 pers-h/y     |
| Effective Stops                          | 52,330 veh/y    | 62,796 pers/y    |
| Travel Distance                          | 49,296 veh-km/y | 59,155 pers-km/y |
| Travel Time                              | 897 veh-h/y     | 1,076 pers-h/y   |
| Cost                                     | 32,894 \$/y     | 32,894 \$/y      |
| Fuel Consumption                         | 6,619 L/y       |                  |
| Carbon Dioxide                           | 16,604 kg/y     |                  |
| Hydrocarbons                             | 25 kg/y         |                  |
| Carbon Monoxide                          | 1,223 kg/y      |                  |
| NOx                                      | 42 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-07 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                      | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|-----------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                             |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| South: Site Access Road (S) |      |             |              |               |                  |                   |     |              |                     |               |
| 1                           | L    | 17          | 12.5         | 0.056         | 6.8              | LOS A             | 0.2 | 1.8          | 0.17                | 39.5          |
| 3                           | R    | 37          | 5.7          | 0.056         | 6.7              | LOS A             | 0.2 | 1.8          | 0.17                | 38.7          |
| Approach                    |      | 54          | 7.8          | 0.056         | 6.7              | LOS A             | 0.2 | 1.8          | 0.17                | 39.1          |
| East: Wybong Road (E)       |      |             |              |               |                  |                   |     |              |                     |               |
| 4                           | L    | 87          | 6.0          | 0.049         | 11.1             | LOS A             | 0.0 | 0.0          | 0.00                | 57.6          |
| 5                           | T    | 7           | 28.6         | 0.004         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 80.0          |
| Approach                    |      | 95          | 7.8          | 0.049         | 10.2             | LOS A             | 0.0 | 0.0          | 0.00                | 59.2          |
| West: Wybong Road (W)       |      |             |              |               |                  |                   |     |              |                     |               |
| 11                          | T    | 28          | 3.7          | 0.027         | 0.4              | LOS A             | 0.2 | 1.3          | 0.22                | 71.5          |
| 12                          | R    | 15          | 14.3         | 0.027         | 12.1             | LOS A             | 0.2 | 1.3          | 0.22                | 57.9          |
| Approach                    |      | 43          | 7.3          | 0.027         | 4.4              | LOS A             | 0.2 | 1.3          | 0.22                | 66.9          |
| All Vehicles                |      | 192         | 7.7          | 0.056         | 7.9              | NA                | 0.2 | 1.8          | 0.10                | 55.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 172 veh/h     | 206 pers/h     |
| Percent Heavy Vehicles                    | 9.8%          |                |
| Degree of Saturation                      | 0.102         |                |
| Practical Spare Capacity                  | 685.3%        |                |
| Effective Intersection Capacity           | 1684 veh/h    |                |
| Control Delay (Total)                     | 0.23 veh-h/h  | 0.28 pers-h/h  |
| Control Delay (Average)                   | 4.8 sec       | 4.8 sec        |
| Control Delay (Worst Lane)                | 11.8 sec      |                |
| Control Delay (Worst Movement)            | 11.8 sec      | 11.8 sec       |
| Geometric Delay (Average)                 | 4.6 sec       |                |
| Stop-Line Delay (Average)                 | 0.3 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.5 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 3.3 m         |                |
| Total Effective Stops                     | 68 veh/h      | 82 pers/h      |
| Effective Stop Rate                       | 0.40 per veh  | 0.40 per pers  |
| Proportion Queued                         | 0.12          | 0.12           |
| Performance Index                         | 2.1           | 2.1            |
| Travel Distance (Total)                   | 78.9 veh-km/h | 94.6 pers-km/h |
| Travel Distance (Average)                 | 460 m         | 460 m          |
| Travel Time (Total)                       | 1.4 veh-h/h   | 1.7 pers-h/h   |
| Travel Time (Average)                     | 29.9 sec      | 29.9 sec       |
| Travel Speed                              | 55.3 km/h     | 55.3 km/h      |
| Cost (Total)                              | 59.51 \$/h    | 59.51 \$/h     |
| Fuel Consumption (Total)                  | 14.3 L/h      |                |
| Carbon Dioxide (Total)                    | 35.9 kg/h     |                |
| Hydrocarbons (Total)                      | 0.053 kg/h    |                |
| Carbon Monoxide (Total)                   | 3.05 kg/h     |                |
| NOx (Total)                               | 0.094 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 82,358 veh/y    | 98,829 pers/y    |
| Delay                                    | 110 veh-h/y     | 133 pers-h/y     |
| Effective Stops                          | 32,783 veh/y    | 39,340 pers/y    |
| Travel Distance                          | 37,853 veh-km/y | 45,424 pers-km/y |
| Travel Time                              | 685 veh-h/y     | 822 pers-h/y     |
| Cost                                     | 28,565 \$/y     | 28,565 \$/y      |
| Fuel Consumption                         | 6,857 L/y       |                  |
| Carbon Dioxide                           | 17,221 kg/y     |                  |
| Hydrocarbons                             | 26 kg/y         |                  |
| Carbon Monoxide                          | 1,462 kg/y      |                  |
| NOx                                      | 45 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-07 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Site Access Road (S)     |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 6           | 16.7 | 0.102     | 6.9           | LOS A            | 0.5               | 3.3      | 0.18         | 0.55                | 39.4          |
| 3                               | R    | 91          | 4.7  | 0.102     | 6.6           | LOS A            | 0.5               | 3.3      | 0.18         | 0.58                | 38.7          |
| Approach                        |      | 97          | 5.4  | 0.102     | 6.6           | LOS A            | 0.5               | 3.3      | 0.18         | 0.58                | 38.8          |
| East: Wybong Road (E)           |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                               | L    | 13          | 25.0 | 0.008     | 11.8          | LOS A            | 0.0               | 0.0      | 0.00         | 0.72                | 57.6          |
| 5                               | T    | 45          | 7.0  | 0.024     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                        |      | 58          | 10.9 | 0.024     | 2.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.16                | 74.7          |
| West: Wybong Road (W)           |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                              | T    | 14          | 38.5 | 0.011     | 0.2           | LOS A            | 0.1               | 0.5      | 0.15         | 0.00                | 74.3          |
| 12                              | R    | 3           | 0.0  | 0.011     | 11.3          | LOS A            | 0.1               | 0.5      | 0.15         | 1.02                | 57.8          |
| Approach                        |      | 17          | 31.3 | 0.011     | 2.3           | LOS A            | 0.1               | 0.5      | 0.15         | 0.19                | 71.1          |
| All Vehicles                    |      | 172         | 9.8  | 0.102     | 4.8           | NA               | 0.5               | 3.3      | 0.12         | 0.40                | 55.3          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-08 EX AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 63 veh/h      | 76 pers/h      |
| Percent Heavy Vehicles                    | 5.0%          |                |
| Degree of Saturation                      | 0.020         |                |
| Practical Spare Capacity                  | 3942.8%       |                |
| Effective Intersection Capacity           | 3192 veh/h    |                |
| Control Delay (Total)                     | 0.03 veh-h/h  | 0.04 pers-h/h  |
| Control Delay (Average)                   | 1.7 sec       | 1.7 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.6 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 0.5 m         |                |
| Total Effective Stops                     | 7 veh/h       | 8 pers/h       |
| Effective Stop Rate                       | 0.11 per veh  | 0.11 per pers  |
| Proportion Queued                         | 0.04          | 0.04           |
| Performance Index                         | 0.6           | 0.6            |
| Travel Distance (Total)                   | 43.6 veh-km/h | 52.3 pers-km/h |
| Travel Distance (Average)                 | 690 m         | 690 m          |
| Travel Time (Total)                       | 0.6 veh-h/h   | 0.7 pers-h/h   |
| Travel Time (Average)                     | 33.2 sec      | 33.2 sec       |
| Travel Speed                              | 74.9 km/h     | 74.9 km/h      |
| Cost (Total)                              | 21.49\$/h     | 21.49\$/h      |
| Fuel Consumption (Total)                  | 4.4 L/h       |                |
| Carbon Dioxide (Total)                    | 11.1 kg/h     |                |
| Hydrocarbons (Total)                      | 0.014 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.42 kg/h     |                |
| NOx (Total)                               | 0.025 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 30,316 veh/y    | 36,379 pers/y    |
| Delay                                    | 14 veh-h/y      | 17 pers-h/y      |
| Effective Stops                          | 3,290 veh/y     | 3,948 pers/y     |
| Travel Distance                          | 20,932 veh-km/y | 25,119 pers-km/y |
| Travel Time                              | 280 veh-h/y     | 335 pers-h/y     |
| Cost                                     | 10,314\$/y      | 10,314\$/y       |
| Fuel Consumption                         | 2,119 L/y       |                  |
| Carbon Dioxide                           | 5,309 kg/y      |                  |
| Hydrocarbons                             | 7 kg/y          |                  |
| Carbon Monoxide                          | 200 kg/y        |                  |
| NOx                                      | 12 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 EX AM

2112974A Mangoolia TIA  
Giveaway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                                   | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                                          |      | veh/h       | %            | v/c   |               |                  | sec               | veh |              |                     |               |
| East: Wybong Road (E)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 5                                        | T    | 16          | 13.3         | 0.010 | 0.1           | LOS A            | 0.1               | 0.5 | 0.12         | 0.00                | 75.7          |
| 6                                        | R    | 1           | 0.0          | 0.010 | 10.3          | LOS A            | 0.1               | 0.5 | 0.12         | 0.96                | 60.0          |
| Approach                                 |      | 17          | 12.5         | 0.010 | 0.8           | LOS A            | 0.1               | 0.5 | 0.12         | 0.06                | 74.5          |
| North West: Wybong Post Office Road (NW) |      |             |              |       |               |                  |                   |     |              |                     |               |
| 27                                       | L    | 6           | 0.0          | 0.007 | 10.8          | LOS A            | 0.0               | 0.2 | 0.11         | 0.69                | 58.7          |
| 29                                       | R    | 1           | 0.0          | 0.007 | 11.8          | LOS A            | 0.0               | 0.2 | 0.11         | 0.71                | 57.5          |
| Approach                                 |      | 7           | 0.0          | 0.007 | 10.9          | LOS A            | 0.0               | 0.2 | 0.11         | 0.69                | 58.5          |
| West: Wybong Road (W)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 10                                       | L    | 1           | 0.0          | 0.002 | 12.5          | LOS A            | 0.0               | 0.0 | 0.00         | 0.71                | 57.3          |
| 11                                       | T    | 38          | 2.8          | 0.020 | 0.0           | LOS A            | 0.0               | 0.0 | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 39          | 2.7          | 0.020 | 0.3           | LOS A            | 0.0               | 0.0 | 0.00         | 0.02                | 79.1          |
| All Vehicles                             |      | 63          | 5.0          | 0.020 | 1.7           | NA               | 0.1               | 0.5 | 0.04         | 0.11                | 74.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

# INTERSECTION SUMMARY

Site: I-08 EX PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 75 veh/h      | 90 pers/h      |
| Percent Heavy Vehicles                    | 7.0 %         |                |
| Degree of Saturation                      | 0.029         |                |
| Practical Spare Capacity                  | 2653.8 %      |                |
| Effective Intersection Capacity           | 2573 veh/h    |                |
| Control Delay (Total)                     | 0.02 veh-h/h  | 0.03 pers-h/h  |
| Control Delay (Average)                   | 1.1 sec       | 1.1 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.1 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 1.4 m         |                |
| Total Effective Stops                     | 6 veh/h       | 8 pers/h       |
| Effective Stop Rate                       | 0.08 per veh  | 0.08 per pers  |
| Proportion Queued                         | 0.06          | 0.06           |
| Performance Index                         | 0.8           | 0.8            |
| Travel Distance (Total)                   | 51.7 veh-km/h | 62.0 pers-km/h |
| Travel Distance (Average)                 | 691 m         | 691 m          |
| Travel Time (Total)                       | 0.7 veh-h/h   | 0.8 pers-h/h   |
| Travel Time (Average)                     | 33.0 sec      | 33.0 sec       |
| Travel Speed                              | 75.4 km/h     | 75.4 km/h      |
| Cost (Total)                              | 25.59 \$/h    | 25.59 \$/h     |
| Fuel Consumption (Total)                  | 5.3 L/h       |                |
| Carbon Dioxide (Total)                    | 13.4 kg/h     |                |
| Hydrocarbons (Total)                      | 0.016 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.44 kg/h     |                |
| NOx (Total)                               | 0.029 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 35,874 veh/y    | 43,048 pers/y    |
| Delay                                    | 11 veh-h/y      | 13 pers-h/y      |
| Effective Stops                          | 3,037 veh/y     | 3,644 pers/y     |
| Travel Distance                          | 24,794 veh-km/y | 29,752 pers-km/y |
| Travel Time                              | 329 veh-h/y     | 395 pers-h/y     |
| Cost                                     | 12,282 \$/y     | 12,282 \$/y      |
| Fuel Consumption                         | 2,568 L/y       |                  |
| Carbon Dioxide                           | 6,438 kg/y      |                  |
| Hydrocarbons                             | 8 kg/y          |                  |
| Carbon Monoxide                          | 209 kg/y        |                  |
| NOx                                      | 14 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 EX PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles          |      |             |      |           |               |                  |                   |          |              |                     |               |
|------------------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                                   | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                          |      | veh/h       | %    | v/c       | sec           |                  | vehicles          | Distance |              | per veh             | km/h          |
| East: Wybong Road (E)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                                        | T    | 49          | 4.3  | 0.029     | 0.1           | LOS A            | 0.2               | 1.4      | 0.08         | 0.00                | 76.9          |
| 6                                        | R    | 4           | 0.0  | 0.029     | 10.2          | LOS A            | 0.2               | 1.4      | 0.08         | 0.97                | 60.0          |
| Approach                                 |      | 54          | 3.9  | 0.029     | 0.9           | LOS A            | 0.2               | 1.4      | 0.08         | 0.08                | 75.2          |
| North West: Wybong Post Office Road (NW) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 27                                       | L    | 1           | 0.0  | 0.002     | 10.8          | LOS A            | 0.0               | 0.1      | 0.09         | 0.69                | 58.8          |
| 29                                       | R    | 1           | 0.0  | 0.002     | 11.8          | LOS A            | 0.0               | 0.1      | 0.09         | 0.72                | 57.6          |
| Approach                                 |      | 2           | 0.0  | 0.002     | 11.3          | LOS A            | 0.0               | 0.1      | 0.09         | 0.71                | 58.2          |
| West: Wybong Road (W)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                                       | L    | 1           | 0.0  | 0.002     | 12.5          | LOS A            | 0.0               | 0.0      | 0.03         | 0.70                | 57.1          |
| 11                                       | T    | 18          | 17.6 | 0.010     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 19          | 16.7 | 0.010     | 0.7           | LOS A            | 0.0               | 0.0      | 0.00         | 0.04                | 78.2          |
| All Vehicles                             |      | 75          | 7.0  | 0.029     | 1.1           | NA               | 0.2               | 1.4      | 0.06         | 0.08                | 75.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## Future 2012 Do-nothing

### INTERSECTION SUMMARY

Site: I-01 FU DN AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

#### Intersection Performance - Hourly Values

| Performance Measure                       | Vehicles       | Persons          |
|-------------------------------------------|----------------|------------------|
| Demand Flows (Total)                      | 1253 veh/h     | 1503 pers/h      |
| Percent Heavy Vehicles                    | 6.0 %          |                  |
| Degree of Saturation                      | 0.618          |                  |
| Practical Spare Capacity                  | 29.4 %         |                  |
| Effective Intersection Capacity           | 2026 veh/h     |                  |
| Control Delay (Total)                     | 3.14 veh-h/h   | 3.76 pers-h/h    |
| Control Delay (Average)                   | 9.0 sec        | 9.0 sec          |
| Control Delay (Worst Lane)                | 49.6 sec       |                  |
| Control Delay (Worst Movement)            | 49.6 sec       | 49.6 sec         |
| Geometric Delay (Average)                 | 5.8 sec        |                  |
| Stop-Line Delay (Average)                 | 3.3 sec        |                  |
| Level of Service (Aver. Int. Delay)       | NA             |                  |
| Level of Service (Worst Movement)         | LOS D          |                  |
| Level of Service (Worst Lane)             | LOS D          |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 3.6 veh        |                  |
| 95% Back of Queue - Distance (Worst Lane) | 26.7 m         |                  |
| Total Effective Stops                     | 483 veh/h      | 580 pers/h       |
| Effective Stop Rate                       | 0.39 per veh   | 0.39 per pers    |
| Proportion Queued                         | 0.12           | 0.12             |
| Performance Index                         | 16.9           | 16.9             |
| Travel Distance (Total)                   | 942.0 veh-km/h | 1130.4 pers-km/h |
| Travel Distance (Average)                 | 752 m          | 752 m            |
| Travel Time (Total)                       | 12.8 veh-h/h   | 15.4 pers-h/h    |
| Travel Time (Average)                     | 36.9 sec       | 36.9 sec         |
| Travel Speed                              | 73.4 km/h      | 73.4 km/h        |
| Cost (Total)                              | 540.73 \$/h    | 540.73 \$/h      |
| Fuel Consumption (Total)                  | 133.1 L/h      |                  |
| Carbon Dioxide (Total)                    | 333.6 kg/h     |                  |
| Hydrocarbons (Total)                      | 0.474 kg/h     |                  |
| Carbon Monoxide (Total)                   | 19.16 kg/h     |                  |
| NOx (Total)                               | 0.885 kg/h     |                  |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

#### Intersection Performance - Annual Values

| Performance Measure  | Vehicles         | Persons           |
|----------------------|------------------|-------------------|
| Demand Flows (Total) | 601,263 veh/y    | 721,516 pers/y    |
| Delay                | 1,506 veh-h/y    | 1,807 pers-h/y    |
| Effective Stops      | 231,958 veh/y    | 278,350 pers/y    |
| Travel Distance      | 452,159 veh-km/y | 542,591 pers-km/y |
| Travel Time          | 6,157 veh-h/y    | 7,388 pers-h/y    |
| Cost                 | 259,549 \$/y     | 259,549 \$/y      |
| Fuel Consumption     | 63,887 L/y       |                   |
| Carbon Dioxide       | 160,114 kg/y     |                   |
| Hydrocarbons         | 228 kg/y         |                   |
| Carbon Monoxide      | 9,198 kg/y       |                   |
| NOx                  | 425 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 368         | 3.4  | 0.203     | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 241         | 12.7 | 0.067     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 609         | 7.1  | 0.203     | 7.5           | LOS A            | 0.0               | 0.0      | 0.00         | 0.45                | 76.5          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 424         | 5.5  | 0.225     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 98          | 0.0  | 0.127     | 15.5          | LOS B            | 0.6               | 4.4      | 0.55         | 0.84                | 59.6          |
| Approach                        |      | 522         | 4.4  | 0.225     | 2.9           | LOS B            | 0.6               | 4.4      | 0.10         | 0.16                | 90.0          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 22          | 0.0  | 0.029     | 13.6          | LOS A            | 0.1               | 0.9      | 0.45         | 0.74                | 60.1          |
| 12                              | R    | 99          | 8.5  | 0.618     | 49.6          | LOS D            | 3.6               | 26.7     | 0.92         | 1.10                | 34.2          |
| Approach                        |      | 121         | 7.0  | 0.617     | 43.0          | LOS D            | 3.6               | 26.7     | 0.83         | 1.03                | 37.1          |
| All Vehicles                    |      | 1253        | 6.0  | 0.618     | 9.0           | NA               | 3.6               | 26.7     | 0.12         | 0.39                | 73.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-01 FU DN PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 866 veh/h      | 1040 pers/h     |
| Percent Heavy Vehicles                    | 7.3%           |                 |
| Degree of Saturation                      | 0.570          |                 |
| Practical Spare Capacity                  | 40.3%          |                 |
| Effective Intersection Capacity           | 1519 veh/h     |                 |
| Control Delay (Total)                     | 1.84 veh-h/h   | 2.21 pers-h/h   |
| Control Delay (Average)                   | 7.7 sec        | 7.7 sec         |
| Control Delay (Worst Lane)                | 28.3 sec       |                 |
| Control Delay (Worst Movement)            | 28.3 sec       | 28.3 sec        |
| Geometric Delay (Average)                 | 4.0 sec        |                 |
| Stop-Line Delay (Average)                 | 3.7 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 4.1 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 29.3 m         |                 |
| Total Effective Stops                     | 275 veh/h      | 330 pers/h      |
| Effective Stop Rate                       | 0.32 per veh   | 0.32 per pers   |
| Proportion Queued                         | 0.19           | 0.19            |
| Performance Index                         | 12.0           | 12.0            |
| Travel Distance (Total)                   | 679.4 veh-km/h | 815.3 pers-km/h |
| Travel Distance (Average)                 | 784 m          | 784 m           |
| Travel Time (Total)                       | 8.9 veh-h/h    | 10.7 pers-h/h   |
| Travel Time (Average)                     | 37.1 sec       | 37.1 sec        |
| Travel Speed                              | 76.1 km/h      | 76.1 km/h       |
| Cost (Total)                              | 387.03 \$/h    | 387.03 \$/h     |
| Fuel Consumption (Total)                  | 98.1 L/h       |                 |
| Carbon Dioxide (Total)                    | 245.9 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.331 kg/h     |                 |
| Carbon Monoxide (Total)                   | 12.88 kg/h     |                 |
| NOx (Total)                               | 0.642 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 415,832 veh/y    | 498,998 pers/y    |
| Delay                                    | 885 veh-h/y      | 1,062 pers-h/y    |
| Effective Stops                          | 132,074 veh/y    | 158,489 pers/y    |
| Travel Distance                          | 326,122 veh-km/y | 391,347 pers-km/y |
| Travel Time                              | 4,286 veh-h/y    | 5,143 pers-h/y    |
| Cost                                     | 185,772 \$/y     | 185,772 \$/y      |
| Fuel Consumption                         | 47,080 L/y       |                   |
| Carbon Dioxide                           | 118,035 kg/y     |                   |
| Hydrocarbons                             | 159 kg/y         |                   |
| Carbon Monoxide                          | 6,181 kg/y       |                   |
| NOx                                      | 308 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 FU DN PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 61          | 19.0 | 0.037     | 13.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 333         | 8.5  | 0.090     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 394         | 10.2 | 0.090     | 2.1           | LOS A            | 0.0               | 0.0      | 0.00         | 0.12                | 93.2          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 245         | 6.9  | 0.131     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 13          | 16.7 | 0.015     | 15.3          | LOS B            | 0.1               | 0.6      | 0.45         | 0.71                | 61.2          |
| Approach                        |      | 258         | 7.3  | 0.131     | 0.7           | LOS B            | 0.1               | 0.6      | 0.02         | 0.03                | 97.4          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 31          | 3.4  | 0.038     | 13.5          | LOS A            | 0.2               | 1.2      | 0.42         | 0.73                | 60.6          |
| 12                              | R    | 184         | 1.7  | 0.570     | 28.3          | LOS B            | 4.1               | 29.3     | 0.81         | 1.08                | 45.8          |
| Approach                        |      | 215         | 2.0  | 0.570     | 26.2          | LOS B            | 4.1               | 29.3     | 0.75         | 1.03                | 47.5          |
| All Vehicles                    |      | 866         | 7.3  | 0.570     | 7.7           | NA               | 4.1               | 29.3     | 0.19         | 0.32                | 76.1          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 1124 veh/h     | 1349 pers/h     |
| Percent Heavy Vehicles                    | 4.7%           |                 |
| Degree of Saturation                      | 0.343          |                 |
| Practical Spare Capacity                  | 133.2%         |                 |
| Effective Intersection Capacity           | 3277 veh/h     |                 |
| Control Delay (Total)                     | 3.09 veh-h/h   | 3.71 pers-h/h   |
| Control Delay (Average)                   | 9.9 sec        | 9.9 sec         |
| Control Delay (Worst Lane)                | 20.8 sec       |                 |
| Control Delay (Worst Movement)            | 20.8 sec       | 20.8 sec        |
| Geometric Delay (Average)                 | 8.2 sec        |                 |
| Stop-Line Delay (Average)                 | 1.7 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.7 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 12.9 m         |                 |
| Total Effective Stops                     | 657 veh/h      | 788 pers/h      |
| Effective Stop Rate                       | 0.58 per veh   | 0.58 per pers   |
| Proportion Queued                         | 0.18           | 0.18            |
| Performance Index                         | 17.3           | 17.3            |
| Travel Distance (Total)                   | 765.7 veh-km/h | 918.8 pers-km/h |
| Travel Distance (Average)                 | 681 m          | 681 m           |
| Travel Time (Total)                       | 12.6 veh-h/h   | 15.1 pers-h/h   |
| Travel Time (Average)                     | 40.4 sec       | 40.4 sec        |
| Travel Speed                              | 60.7 km/h      | 60.7 km/h       |
| Cost (Total)                              | 491.35\$/h     | 491.35\$/h      |
| Fuel Consumption (Total)                  | 109.2 L/h      |                 |
| Carbon Dioxide (Total)                    | 273.6 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.443 kg/h     |                 |
| Carbon Monoxide (Total)                   | 23.15 kg/h     |                 |
| NOx (Total)                               | 0.752 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 539,621 veh/y    | 647,545 pers/y    |
| Delay                                    | 1,484 veh-h/y    | 1,781 pers-h/y    |
| Effective Stops                          | 315,266 veh/y    | 378,319 pers/y    |
| Travel Distance                          | 367,519 veh-km/y | 441,023 pers-km/y |
| Travel Time                              | 6,056 veh-h/y    | 7,267 pers-h/y    |
| Cost                                     | 235,846\$/y      | 235,846\$/y       |
| Fuel Consumption                         | 52,436 L/y       |                   |
| Carbon Dioxide                           | 131,346 kg/y     |                   |
| Hydrocarbons                             | 213 kg/y         |                   |
| Carbon Monoxide                          | 11,111 kg/y      |                   |
| NOx                                      | 361 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-02 FU DN AM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Movement Performance - Vehicles  |      |             |      |           |               |                  |                   |          |              |                     |               |
|----------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                           | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                  |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Thomas Mitchell Drive (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                                | L    | 107         | 10.8 | 0.163     | 14.8          | LOS B            | 0.8               | 5.8      | 0.51         | 0.83                | 54.5          |
| 3                                | R    | 123         | 9.4  | 0.343     | 20.8          | LOS B            | 1.7               | 12.9     | 0.68         | 0.96                | 48.0          |
| Approach                         |      | 231         | 10.0 | 0.343     | 18.0          | LOS B            | 1.7               | 12.9     | 0.60         | 0.90                | 50.8          |
| East: Denman Road (E)            |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                                | L    | 493         | 1.7  | 0.268     | 11.0          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 58.9          |
| 5                                | T    | 217         | 6.3  | 0.116     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                         |      | 709         | 3.1  | 0.269     | 7.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.51                | 64.2          |
| West: Denman Road (W)            |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                               | T    | 81          | 6.5  | 0.043     | 0.0           | LOS A            | 0.7               | 5.3      | 0.00         | 0.00                | 80.0          |
| 12                               | R    | 103         | 2.0  | 0.155     | 15.2          | LOS B            | 0.7               | 5.3      | 0.59         | 0.89                | 53.5          |
| Approach                         |      | 184         | 4.0  | 0.155     | 8.5           | LOS B            | 0.7               | 5.3      | 0.33         | 0.50                | 62.8          |
| All Vehicles                     |      | 1124        | 4.7  | 0.343     | 9.9           | NA               | 1.7               | 12.9     | 0.18         | 0.58                | 60.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 841 veh/h      | 1009 pers/h     |
| Percent Heavy Vehicles                    | 4.9%           |                 |
| Degree of Saturation                      | 0.524          |                 |
| Practical Spare Capacity                  | 52.6%          |                 |
| Effective Intersection Capacity           | 1605 veh/h     |                 |
| Control Delay (Total)                     | 2.04 veh-h/h   | 2.44 pers-h/h   |
| Control Delay (Average)                   | 8.7 sec        | 8.7 sec         |
| Control Delay (Worst Lane)                | 19.5 sec       |                 |
| Control Delay (Worst Movement)            | 19.5 sec       | 19.5 sec        |
| Geometric Delay (Average)                 | 5.9 sec        |                 |
| Stop-Line Delay (Average)                 | 2.9 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 3.6 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 26.1 m         |                 |
| Total Effective Stops                     | 401 veh/h      | 481 pers/h      |
| Effective Stop Rate                       | 0.48 per veh   | 0.48 per pers   |
| Proportion Queued                         | 0.31           | 0.31            |
| Performance Index                         | 13.1           | 13.1            |
| Travel Distance (Total)                   | 575.5 veh-km/h | 690.6 pers-km/h |
| Travel Distance (Average)                 | 684 m          | 684 m           |
| Travel Time (Total)                       | 9.4 veh-h/h    | 11.2 pers-h/h   |
| Travel Time (Average)                     | 40.1 sec       | 40.1 sec        |
| Travel Speed                              | 61.4 km/h      | 61.4 km/h       |
| Cost (Total)                              | 359.52 \$/h    | 359.52 \$/h     |
| Fuel Consumption (Total)                  | 78.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 196.1 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.304 kg/h     |                 |
| Carbon Monoxide (Total)                   | 15.05 kg/h     |                 |
| NOx (Total)                               | 0.531 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 403,705 veh/y    | 484,446 pers/y    |
| Delay                                    | 978 veh-h/y      | 1,173 pers-h/y    |
| Effective Stops                          | 192,425 veh/y    | 230,910 pers/y    |
| Travel Distance                          | 276,259 veh-km/y | 331,511 pers-km/y |
| Travel Time                              | 4,499 veh-h/y    | 5,399 pers-h/y    |
| Cost                                     | 172,571 \$/y     | 172,571 \$/y      |
| Fuel Consumption                         | 37,568 L/y       |                   |
| Carbon Dioxide                           | 94,119 kg/y      |                   |
| Hydrocarbons                             | 146 kg/y         |                   |
| Carbon Monoxide                          | 7,223 kg/y       |                   |
| NOx                                      | 255 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-02 FU DN PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Movement Performance - Vehicles  |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
|----------------------------------|------|----------------------|-------------------|-------------|----------------------|------------------|-------------------|---------------|--------------|--------------------------------|-----------------------|
| Mov ID                           | Turn | Demand Flow<br>veh/h | HV Deg. Satn<br>% | Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue |               | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>km/h |
|                                  |      |                      |                   |             |                      |                  | Vehicles<br>veh   | Distance<br>m |              |                                |                       |
| South: Thomas Mitchell Drive (S) |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 1                                | L    | 52                   | 6.1               | 0.054       | 12.3                 | LOS A            | 0.2               | 1.8           | 0.32         | 0.69                           | 57.1                  |
| 3                                | R    | 247                  | 4.7               | 0.524       | 19.5                 | LOS B            | 3.6               | 26.1          | 0.65         | 1.00                           | 49.0                  |
| Approach                         |      | 299                  | 4.9               | 0.524       | 18.3                 | LOS B            | 3.6               | 26.1          | 0.60         | 0.95                           | 50.2                  |
| East: Denman Road (E)            |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 4                                | L    | 63                   | 6.7               | 0.036       | 11.2                 | LOS A            | 0.0               | 0.0           | 0.00         | 0.73                           | 58.9                  |
| 5                                | T    | 183                  | 1.7               | 0.095       | 0.0                  | LOS A            | 0.0               | 0.0           | 0.00         | 0.00                           | 80.0                  |
| Approach                         |      | 246                  | 3.0               | 0.095       | 2.9                  | LOS A            | 0.0               | 0.0           | 0.00         | 0.19                           | 73.4                  |
| West: Denman Road (W)            |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 11                               | T    | 217                  | 5.3               | 0.145       | 0.8                  | LOS A            | 1.1               | 8.1           | 0.24         | 0.00                           | 70.5                  |
| 12                               | R    | 79                   | 9.3               | 0.145       | 12.6                 | LOS A            | 1.1               | 8.1           | 0.39         | 0.90                           | 59.1                  |
| Approach                         |      | 296                  | 6.4               | 0.145       | 3.9                  | LOS A            | 1.1               | 8.1           | 0.28         | 0.24                           | 67.1                  |
| All Vehicles                     |      | 841                  | 4.9               | 0.524       | 8.7                  | NA               | 3.6               | 26.1          | 0.31         | 0.48                           | 61.4                  |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

# INTERSECTION SUMMARY

Site: I-03 FU DN AM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                |              |                 |
|-------------------------------------------|----------------|--------------|-----------------|
| Performance Measure                       | Vehicles       | Pedestrians  | Persons         |
| Demand Flows (Total)                      | 1317 veh/h     | 42 ped/h     | 1622 pers/h     |
| Percent Heavy Vehicles                    | 8.6%           |              |                 |
| Degree of Saturation                      | 0.437          | 0.005        |                 |
| Practical Spare Capacity                  | 105.8%         |              |                 |
| Effective Intersection Capacity           | 3012 veh/h     |              |                 |
| Control Delay (Total)                     | 7.11 veh-h/h   | 0.15 ped-h/h | 8.69 pers-h/h   |
| Control Delay (Average)                   | 19.4 sec       | 13.1 sec     | 19.3 sec        |
| Control Delay (Worst Lane)                | 31.0 sec       |              |                 |
| Control Delay (Worst Movement)            | 31.0 sec       | 17.6 sec     | 31.0 sec        |
| Geometric Delay (Average)                 | 4.4 sec        |              |                 |
| Stop-Line Delay (Average)                 | 15.0 sec       |              |                 |
| Level of Service (Aver. Int. Delay)       | LOS B          | LOS B        |                 |
| Level of Service (Worst Movement)         | LOS C          | LOS B        |                 |
| Level of Service (Worst Lane)             | LOS C          |              |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 12.0 veh       |              |                 |
| 95% Back of Queue - Distance (Worst Lane) | 85.4 m         |              |                 |
| Total Effective Stops                     | 897 veh/h      | 24 ped/h     | 1100 pers/h     |
| Effective Stop Rate                       | 0.68 per veh   | 0.56 per ped | 0.68 per pers   |
| Proportion Queued                         | 0.68           | 0.56         | 0.67            |
| Performance Index                         | 45.1           | 0.7          | 45.9            |
| Travel Distance (Total)                   | 774.8 veh-km/h | 2.0 ped-km/h | 931.8 pers-km/h |
| Travel Distance (Average)                 | 588 m          | 48 m         | 574 m           |
| Travel Time (Total)                       | 20.4 veh-h/h   | 0.6 ped-h/h  | 25.1 pers-h/h   |
| Travel Time (Average)                     | 55.8 sec       | 50.1 sec     | 55.7 sec        |
| Travel Speed                              | 37.9 km/h      | 3.5 km/h     | 37.1 km/h       |
| Cost (Total)                              | 653.15 \$/h    | 11.21 \$/h   | 664.37 \$/h     |
| Fuel Consumption (Total)                  | 100.9 L/h      |              |                 |
| Carbon Dioxide (Total)                    | 253.1 kg/h     |              |                 |
| Hydrocarbons (Total)                      | 0.388 kg/h     |              |                 |
| Carbon Monoxide (Total)                   | 17.18 kg/h     |              |                 |
| NOx (Total)                               | 0.558 kg/h     |              |                 |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 632,084 veh/y    | 20,160 ped/y | 778,661 pers/y    |
| Delay                                    | 3,413 veh-h/y    | 73 ped-h/y   | 4,169 pers-h/y    |
| Effective Stops                          | 430,681 veh/y    | 11,340 ped/y | 528,157 pers/y    |
| Travel Distance                          | 371,909 veh-km/y | 970 ped-km/y | 447,260 pers-km/y |
| Travel Time                              | 9,804 veh-h/y    | 280 ped-h/y  | 12,045 pers-h/y   |
| Cost                                     | 313,514 \$/y     | 5,382 \$/y   | 318,896 \$/y      |
| Fuel Consumption                         | 48,416 L/y       |              |                   |
| Carbon Dioxide                           | 121,490 kg/y     |              |                   |
| Hydrocarbons                             | 186 kg/y         |              |                   |
| Carbon Monoxide                          | 8,248 kg/y       |              |                   |
| NOx                                      | 268 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 FU DN AM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow<br>veh/h | HV Deg. Satn<br>% | Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue |               | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>km/h |
|--------------------------------|------|----------------------|-------------------|-------------|----------------------|------------------|-------------------|---------------|--------------|--------------------------------|-----------------------|
|                                |      |                      |                   |             |                      |                  | Vehicles<br>veh   | Distance<br>m |              |                                |                       |
| South: New England Highway (S) |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 1                              | L    | 107                  | 7.8               | 0.188       | 29.5                 | LOS C            | 4.3               | 31.9          | 0.76         | 0.77                           | 33.2                  |
| 3                              | R    | 232                  | 18.6              | 0.435       | 31.0                 | LOS C            | 8.9               | 72.6          | 0.83         | 0.81                           | 31.5                  |
| Approach                       |      | 339                  | 15.2              | 0.435       | 30.5                 | LOS C            | 8.9               | 72.6          | 0.81         | 0.79                           | 32.1                  |
| East: New England Highway (E)  |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 4                              | L    | 320                  | 10.5              | 0.437       | 19.6                 | LOS B            | 9.0               | 68.5          | 0.62         | 0.78                           | 38.0                  |
| 5                              | T    | 434                  | 2.2               | 0.430       | 12.5                 | LOS A            | 12.0              | 85.4          | 0.66         | 0.58                           | 42.6                  |
| Approach                       |      | 754                  | 5.7               | 0.437       | 15.5                 | LOS B            | 12.0              | 85.4          | 0.64         | 0.66                           | 40.6                  |
| West: Sydney Street (W)        |      |                      |                   |             |                      |                  |                   |               |              |                                |                       |
| 11                             | T    | 158                  | 10.0              | 0.164       | 11.8                 | LOS A            | 4.4               | 33.8          | 0.55         | 0.50                           | 43.5                  |
| 12                             | R    | 66                   | 3.2               | 0.214       | 25.7                 | LOS B            | 2.7               | 19.1          | 0.70         | 0.75                           | 34.1                  |
| Approach                       |      | 224                  | 8.0               | 0.214       | 15.9                 | LOS B            | 4.4               | 33.8          | 0.60         | 0.58                           | 40.2                  |
| All Vehicles                   |      | 1317                 | 8.6               | 0.437       | 19.4                 | LOS B            | 12.0              | 85.4          | 0.68         | 0.68                           | 37.9                  |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

### Movement Performance - Pedestrians

| Mov ID          | Description       | Demand Flow | Average Delay | Level of Service | Average Back of Queue |               | Prop. Queued | Effective Stop Rate |
|-----------------|-------------------|-------------|---------------|------------------|-----------------------|---------------|--------------|---------------------|
|                 |                   | ped/h       | sec           |                  | Pedestrian<br>ped     | Distance<br>m |              |                     |
| P1              | Across S approach | 21          | 8.6           | LOS A            | 0.0                   | 0.0           | 0.46         | 0.46                |
| P7              | Across W approach | 21          | 17.6          | LOS B            | 0.0                   | 0.0           | 0.66         | 0.66                |
| All Pedestrians |                   | 42          | 13.1          |                  |                       |               | 0.56         | 0.56                |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

## INTERSECTION SUMMARY

Site: I-03 FU DN PM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                 |              |                  |
|-------------------------------------------|-----------------|--------------|------------------|
| Performance Measure                       | Vehicles        | Pedestrians  | Persons          |
| Demand Flows (Total)                      | 1801 veh/h      | 42 ped/h     | 2203 pers/h      |
| Percent Heavy Vehicles                    | 5.2%            |              |                  |
| Degree of Saturation                      | 0.717           | 0.004        |                  |
| Practical Spare Capacity                  | 25.4%           |              |                  |
| Effective Intersection Capacity           | 2510 veh/h      |              |                  |
| Control Delay (Total)                     | 12.12 veh-h/h   | 0.15 ped-h/h | 14.69 pers-h/h   |
| Control Delay (Average)                   | 24.2 sec        | 12.7 sec     | 24.0 sec         |
| Control Delay (Worst Lane)                | 36.3 sec        |              |                  |
| Control Delay (Worst Movement)            | 36.3 sec        | 13.8 sec     | 36.3 sec         |
| Geometric Delay (Average)                 | 5.2 sec         |              |                  |
| Stop-Line Delay (Average)                 | 19.1 sec        |              |                  |
| Level of Service (Aver. Int. Delay)       | LOS B           | LOS B        |                  |
| Level of Service (Worst Movement)         | LOS C           | LOS B        |                  |
| Level of Service (Worst Lane)             | LOS C           |              |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 18.3 veh        |              |                  |
| 95% Back of Queue - Distance (Worst Lane) | 135.0 m         |              |                  |
| Total Effective Stops                     | 1378 veh/h      | 24 ped/h     | 1678 pers/h      |
| Effective Stop Rate                       | 0.77 per veh    | 0.56 per ped | 0.76 per pers    |
| Proportion Queued                         | 0.80            | 0.56         | 0.79             |
| Performance Index                         | 70.0            | 0.7          | 70.7             |
| Travel Distance (Total)                   | 1047.6 veh-km/h | 2.0 ped-km/h | 1259.2 pers-km/h |
| Travel Distance (Average)                 | 582 m           | 48 m         | 572 m            |
| Travel Time (Total)                       | 30.1 veh-h/h    | 0.6 ped-h/h  | 36.7 pers-h/h    |
| Travel Time (Average)                     | 60.1 sec        | 49.7 sec     | 59.9 sec         |
| Travel Speed                              | 34.8 km/h       | 3.5 km/h     | 34.3 km/h        |
| Cost (Total)                              | 930.14 \$/h     | 11.13 \$/h   | 941.27 \$/h      |
| Fuel Consumption (Total)                  | 130.4 L/h       |              |                  |
| Carbon Dioxide (Total)                    | 326.7 kg/h      |              |                  |
| Hydrocarbons (Total)                      | 0.530 kg/h      |              |                  |
| Carbon Monoxide (Total)                   | 21.86 kg/h      |              |                  |
| NOx (Total)                               | 0.703 kg/h      |              |                  |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 864,505 veh/y    | 20,160 ped/y | 1,057,567 pers/y  |
| Delay                                    | 5,818 veh-h/y    | 71 ped-h/y   | 7,052 pers-h/y    |
| Effective Stops                          | 661,614 veh/y    | 11,340 ped/y | 805,276 pers/y    |
| Travel Distance                          | 502,872 veh-km/y | 970 ped-km/y | 604,416 pers-km/y |
| Travel Time                              | 14,438 veh-h/y   | 278 ped-h/y  | 17,603 pers-h/y   |
| Cost                                     | 446,469 \$/y     | 5,342 \$/y   | 451,810 \$/y      |
| Fuel Consumption                         | 62,590 L/y       |              |                   |
| Carbon Dioxide                           | 156,811 kg/y     |              |                   |
| Hydrocarbons                             | 254 kg/y         |              |                   |
| Carbon Monoxide                          | 10,491 kg/y      |              |                   |
| NOx                                      | 338 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 FU DN PM

2112974A Mangoolia TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|--------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                |      |             | %            | v/c   |               |                  | Vehicles          | Distance |              |                     |               |
|                                |      | veh/h       |              |       | sec           |                  | veh               | m        |              | per veh             | km/h          |
| South: New England Highway (S) |      |             |              |       |               |                  |                   |          |              |                     |               |
| 1                              | L    | 80          | 1.3          | 0.109 | 24.4          | LOS B            | 2.9               | 20.3     | 0.66         | 0.75                | 35.9          |
| 3                              | R    | 511         | 6.2          | 0.717 | 30.0          | LOS C            | 18.3              | 135.0    | 0.90         | 0.87                | 31.9          |
| Approach                       |      | 591         | 5.5          | 0.718 | 29.2          | LOS C            | 18.3              | 135.0    | 0.87         | 0.85                | 32.4          |
| East: New England Highway (E)  |      |             |              |       |               |                  |                   |          |              |                     |               |
| 4                              | L    | 483         | 7.6          | 0.708 | 26.2          | LOS B            | 15.9              | 118.8    | 0.81         | 0.84                | 33.9          |
| 5                              | T    | 263         | 2.0          | 0.304 | 15.1          | LOS B            | 8.2               | 58.5     | 0.68         | 0.57                | 40.5          |
| Approach                       |      | 746         | 5.6          | 0.708 | 22.2          | LOS B            | 15.9              | 118.8    | 0.76         | 0.75                | 36.0          |
| West: Sydney Street (W)        |      |             |              |       |               |                  |                   |          |              |                     |               |
| 11                             | T    | 375         | 3.1          | 0.436 | 17.4          | LOS B            | 11.7              | 83.8     | 0.73         | 0.66                | 38.7          |
| 12                             | R    | 89          | 8.2          | 0.419 | 36.3          | LOS C            | 4.4               | 32.8     | 0.88         | 0.79                | 29.1          |
| Approach                       |      | 464         | 4.1          | 0.436 | 21.1          | LOS B            | 11.7              | 83.8     | 0.76         | 0.69                | 36.3          |
| All Vehicles                   |      | 1801        | 5.2          | 0.717 | 24.2          | LOS B            | 18.3              | 135.0    | 0.80         | 0.77                | 34.8          |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

### Movement Performance - Pedestrians

| Mov ID          | Description       | Demand Flow | Average Delay | Level of Service | Average Back of Queue |          | Prop. Queued | Effective Stop Rate |
|-----------------|-------------------|-------------|---------------|------------------|-----------------------|----------|--------------|---------------------|
|                 |                   |             |               |                  | Pedestrian            | Distance |              |                     |
|                 |                   | ped/h       | sec           |                  | ped                   | m        |              | per ped             |
| P1              | Across S approach | 21          | 11.6          | LOS B            | 0.0                   | 0.0      | 0.54         | 0.54                |
| P7              | Across W approach | 21          | 13.8          | LOS B            | 0.0                   | 0.0      | 0.59         | 0.59                |
| All Pedestrians |                   | 42          | 12.7          |                  |                       |          | 0.56         | 0.56                |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

## INTERSECTION SUMMARY

Site: I-04 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 94 veh/h      | 112 pers/h     |
| Percent Heavy Vehicles                    | 7.9%          |                |
| Degree of Saturation                      | 0.026         |                |
| Practical Spare Capacity                  | 2989.6%       |                |
| Effective Intersection Capacity           | 3618 veh/h    |                |
| Control Delay (Total)                     | 0.21 veh-h/h  | 0.26 pers-h/h  |
| Control Delay (Average)                   | 8.2 sec       | 8.2 sec        |
| Control Delay (Worst Lane)                | 11.7 sec      |                |
| Control Delay (Worst Movement)            | 13.3 sec      | 13.3 sec       |
| Geometric Delay (Average)                 | 8.1 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 0.9 m         |                |
| Total Effective Stops                     | 50 veh/h      | 61 pers/h      |
| Effective Stop Rate                       | 0.54 per veh  | 0.54 per pers  |
| Proportion Queued                         | 0.08          | 0.08           |
| Performance Index                         | 1.3           | 1.3            |
| Travel Distance (Total)                   | 70.0 veh-km/h | 84.0 pers-km/h |
| Travel Distance (Average)                 | 748 m         | 748 m          |
| Travel Time (Total)                       | 1.0 veh-h/h   | 1.2 pers-h/h   |
| Travel Time (Average)                     | 37.1 sec      | 37.1 sec       |
| Travel Speed                              | 72.5 km/h     | 72.5 km/h      |
| Cost (Total)                              | 44.05 \$/h    | 44.05 \$/h     |
| Fuel Consumption (Total)                  | 11.8 L/h      |                |
| Carbon Dioxide (Total)                    | 29.6 kg/h     |                |
| Hydrocarbons (Total)                      | 0.046 kg/h    |                |
| Carbon Monoxide (Total)                   | 2.48 kg/h     |                |
| NOx (Total)                               | 0.088 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 44,968 veh/y    | 53,962 pers/y    |
| Delay                                    | 102 veh-h/y     | 123 pers-h/y     |
| Effective Stops                          | 24,203 veh/y    | 29,044 pers/y    |
| Travel Distance                          | 33,616 veh-km/y | 40,339 pers-km/y |
| Travel Time                              | 464 veh-h/y     | 556 pers-h/y     |
| Cost                                     | 21,146 \$/y     | 21,146 \$/y      |
| Fuel Consumption                         | 5,653 L/y       |                  |
| Carbon Dioxide                           | 14,184 kg/y     |                  |
| Hydrocarbons                             | 22 kg/y         |                  |
| Carbon Monoxide                          | 1,191 kg/y      |                  |
| NOx                                      | 42 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-04 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Kayuga Road (S)          |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 28          | 18.5 | 0.020     | 13.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.81                | 64.8          |
| 2                               | T    | 4           | 25.0 | 0.020     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 33          | 19.4 | 0.020     | 11.6          | LOS A            | 0.0               | 0.0      | 0.00         | 0.71                | 68.4          |
| North: Kayuga Road (N)          |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 28          | 0.0  | 0.020     | 0.1           | LOS A            | 0.1               | 0.9      | 0.12         | 0.00                | 92.7          |
| 9                               | R    | 7           | 0.0  | 0.020     | 12.2          | LOS A            | 0.1               | 0.9      | 0.12         | 1.33                | 65.8          |
| Approach                        |      | 36          | 0.0  | 0.020     | 2.6           | LOS A            | 0.1               | 0.9      | 0.12         | 0.27                | 86.4          |
| West: Wybong Road (W)           |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 1           | 0.0  | 0.026     | 11.6          | LOS A            | 0.1               | 0.8      | 0.13         | 0.66                | 62.5          |
| 12                              | R    | 24          | 4.3  | 0.026     | 11.8          | LOS A            | 0.1               | 0.8      | 0.13         | 0.69                | 62.8          |
| Approach                        |      | 25          | 4.2  | 0.026     | 11.7          | LOS A            | 0.1               | 0.8      | 0.13         | 0.69                | 62.7          |
| All Vehicles                    |      | 94          | 7.9  | 0.026     | 8.2           | NA               | 0.1               | 0.9      | 0.08         | 0.54                | 72.5          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-04 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 156 veh/h      | 187 pers/h      |
| Percent Heavy Vehicles                    | 4.1 %          |                 |
| Degree of Saturation                      | 0.048          |                 |
| Practical Spare Capacity                  | 1551.4 %       |                 |
| Effective Intersection Capacity           | 3216 veh/h     |                 |
| Control Delay (Total)                     | 0.29 veh-h/h   | 0.35 pers-h/h   |
| Control Delay (Average)                   | 6.8 sec        | 6.8 sec         |
| Control Delay (Worst Lane)                | 12.1 sec       |                 |
| Control Delay (Worst Movement)            | 13.5 sec       | 13.5 sec        |
| Geometric Delay (Average)                 | 6.6 sec        |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.2 m          |                 |
| Total Effective Stops                     | 79 veh/h       | 95 pers/h       |
| Effective Stop Rate                       | 0.51 per veh   | 0.51 per pers   |
| Proportion Queued                         | 0.08           | 0.08            |
| Performance Index                         | 2.1            | 2.1             |
| Travel Distance (Total)                   | 117.8 veh-km/h | 141.4 pers-km/h |
| Travel Distance (Average)                 | 756 m          | 756 m           |
| Travel Time (Total)                       | 1.5 veh-h/h    | 1.9 pers-h/h    |
| Travel Time (Average)                     | 35.8 sec       | 35.8 sec        |
| Travel Speed                              | 76.0 km/h      | 76.0 km/h       |
| Cost (Total)                              | 67.35 \$/h     | 67.35 \$/h      |
| Fuel Consumption (Total)                  | 17.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 43.3 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.067 kg/h     |                 |
| Carbon Monoxide (Total)                   | 3.25 kg/h      |                 |
| NOx (Total)                               | 0.127 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 74,779 veh/y    | 89,735 pers/y    |
| Delay                                    | 141 veh-h/y     | 169 pers-h/y     |
| Effective Stops                          | 38,129 veh/y    | 45,755 pers/y    |
| Travel Distance                          | 56,547 veh-km/y | 67,856 pers-km/y |
| Travel Time                              | 744 veh-h/y     | 893 pers-h/y     |
| Cost                                     | 32,327 \$/y     | 32,327 \$/y      |
| Fuel Consumption                         | 8,295 L/y       |                  |
| Carbon Dioxide                           | 20,788 kg/y     |                  |
| Hydrocarbons                             | 32 kg/y         |                  |
| Carbon Monoxide                          | 1,561 kg/y      |                  |
| NOx                                      | 61 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-04 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Kayuga Road (S)          |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 41          | 2.6  | 0.048     | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 1.10                | 64.8          |
| 2                               | T    | 51          | 0.0  | 0.048     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 92          | 1.1  | 0.048     | 5.5           | LOS A            | 0.0               | 0.0      | 0.00         | 0.49                | 81.9          |
| North: Kayuga Road (N)          |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 20          | 10.5 | 0.018     | 0.4           | LOS A            | 0.1               | 0.9      | 0.21         | 0.00                | 87.5          |
| 9                               | R    | 8           | 12.5 | 0.018     | 13.2          | LOS A            | 0.1               | 0.9      | 0.21         | 1.17                | 66.0          |
| Approach                        |      | 28          | 11.1 | 0.018     | 4.2           | LOS A            | 0.1               | 0.9      | 0.21         | 0.35                | 80.6          |
| West: Wybong Road (W)           |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 8           | 25.0 | 0.039     | 13.5          | LOS A            | 0.2               | 1.2      | 0.20         | 0.67                | 62.1          |
| 12                              | R    | 27          | 0.0  | 0.039     | 11.7          | LOS A            | 0.2               | 1.2      | 0.20         | 0.69                | 62.4          |
| Approach                        |      | 36          | 5.9  | 0.039     | 12.1          | LOS A            | 0.2               | 1.2      | 0.20         | 0.69                | 62.4          |
| All Vehicles                    |      | 156         | 4.1  | 0.048     | 6.8           | NA               | 0.2               | 1.2      | 0.08         | 0.51                | 76.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 FU DN AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 526 veh/h      | 632 pers/h      |
| Percent Heavy Vehicles                    | 7.6%           |                 |
| Degree of Saturation                      | 0.189          |                 |
| Practical Spare Capacity                  | 322.5%         |                 |
| Effective Intersection Capacity           | 2779 veh/h     |                 |
| Control Delay (Total)                     | 1.18 veh-h/h   | 1.42 pers-h/h   |
| Control Delay (Average)                   | 8.1 sec        | 8.1 sec         |
| Control Delay (Worst Lane)                | 13.6 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 7.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.4 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.1 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 7.9 m          |                 |
| Total Effective Stops                     | 235 veh/h      | 282 pers/h      |
| Effective Stop Rate                       | 0.45 per veh   | 0.45 per pers   |
| Proportion Queued                         | 0.15           | 0.15            |
| Performance Index                         | 6.8            | 6.8             |
| Travel Distance (Total)                   | 340.4 veh-km/h | 408.5 pers-km/h |
| Travel Distance (Average)                 | 647 m          | 647 m           |
| Travel Time (Total)                       | 5.1 veh-h/h    | 6.1 pers-h/h    |
| Travel Time (Average)                     | 34.8 sec       | 34.8 sec        |
| Travel Speed                              | 67.0 km/h      | 67.0 km/h       |
| Cost (Total)                              | 195.13 \$/h    | 195.13 \$/h     |
| Fuel Consumption (Total)                  | 41.9 L/h       |                 |
| Carbon Dioxide (Total)                    | 105.1 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.156 kg/h     |                 |
| Carbon Monoxide (Total)                   | 6.78 kg/h      |                 |
| NOx (Total)                               | 0.273 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 252,632 veh/y    | 303,158 pers/y    |
| Delay                                    | 568 veh-h/y      | 682 pers-h/y      |
| Effective Stops                          | 112,943 veh/y    | 135,531 pers/y    |
| Travel Distance                          | 163,415 veh-km/y | 196,098 pers-km/y |
| Travel Time                              | 2,440 veh-h/y    | 2,928 pers-h/y    |
| Cost                                     | 93,661 \$/y      | 93,661 \$/y       |
| Fuel Consumption                         | 20,105 L/y       |                   |
| Carbon Dioxide                           | 50,433 kg/y      |                   |
| Hydrocarbons                             | 75 kg/y          |                   |
| Carbon Monoxide                          | 3,253 kg/y       |                   |
| NOx                                      | 131 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 FU DN AM

2112974A Mangoolia TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |              |               |                  |                   |     |              |                     |               |
|---------------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| East: Denman Road (E)           |      |             |              |               |                  |                   |     |              |                     |               |
| 5                               | T    | 94          | 12.4         | 0.052         | 2.4              | LOS A             | 0.0 | 0.0          | 0.00                | 87.5          |
| 6                               | R    | 234         | 7.2          | 0.189         | 13.6             | LOS A             | 1.1 | 7.9          | 0.28                | 61.4          |
| Approach                        |      | 327         | 8.7          | 0.189         | 10.4             | LOS A             | 1.1 | 7.9          | 0.20                | 67.8          |
| North: Bengalla Link Road (N)   |      |             |              |               |                  |                   |     |              |                     |               |
| 7                               | L    | 58          | 12.7         | 0.069         | 10.7             | LOS A             | 0.3 | 2.5          | 0.25                | 50.0          |
| 9                               | R    | 3           | 33.3         | 0.069         | 11.6             | LOS A             | 0.3 | 2.5          | 0.25                | 50.0          |
| Approach                        |      | 61          | 13.8         | 0.069         | 10.8             | LOS A             | 0.3 | 2.5          | 0.25                | 50.0          |
| West: Denman Road (W)           |      |             |              |               |                  |                   |     |              |                     |               |
| 10                              | L    | 19          | 5.6          | 0.011         | 10.3             | LOS A             | 0.0 | 0.0          | 0.00                | 57.1          |
| 11                              | T    | 119         | 1.8          | 0.062         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 80.0          |
| Approach                        |      | 138         | 2.3          | 0.062         | 1.4              | LOS A             | 0.0 | 0.0          | 0.00                | 76.3          |
| All Vehicles                    |      | 526         | 7.6          | 0.189         | 8.1              | NA                | 1.1 | 7.9          | 0.15                | 67.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 528 veh/h      | 634 pers/h      |
| Percent Heavy Vehicles                    | 4.8%           |                 |
| Degree of Saturation                      | 0.183          |                 |
| Practical Spare Capacity                  | 337.9%         |                 |
| Effective Intersection Capacity           | 2892 veh/h     |                 |
| Control Delay (Total)                     | 0.88 veh-h/h   | 1.06 pers-h/h   |
| Control Delay (Average)                   | 6.0 sec        | 6.0 sec         |
| Control Delay (Worst Lane)                | 13.2 sec       |                 |
| Control Delay (Worst Movement)            | 13.2 sec       | 13.2 sec        |
| Geometric Delay (Average)                 | 5.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.9 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 6.8 m          |                 |
| Total Effective Stops                     | 200 veh/h      | 240 pers/h      |
| Effective Stop Rate                       | 0.38 per veh   | 0.38 per pers   |
| Proportion Queued                         | 0.11           | 0.11            |
| Performance Index                         | 7.0            | 7.0             |
| Travel Distance (Total)                   | 356.8 veh-km/h | 428.1 pers-km/h |
| Travel Distance (Average)                 | 675 m          | 675 m           |
| Travel Time (Total)                       | 5.4 veh-h/h    | 6.5 pers-h/h    |
| Travel Time (Average)                     | 37.0 sec       | 37.0 sec        |
| Travel Speed                              | 65.6 km/h      | 65.6 km/h       |
| Cost (Total)                              | 204.12 \$/h    | 204.12 \$/h     |
| Fuel Consumption (Total)                  | 42.9 L/h       |                 |
| Carbon Dioxide (Total)                    | 107.4 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.163 kg/h     |                 |
| Carbon Monoxide (Total)                   | 7.21 kg/h      |                 |
| NOx (Total)                               | 0.278 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 253,642 veh/y    | 304,371 pers/y    |
| Delay                                    | 425 veh-h/y      | 510 pers-h/y      |
| Effective Stops                          | 95,833 veh/y     | 115,000 pers/y    |
| Travel Distance                          | 171,252 veh-km/y | 205,503 pers-km/y |
| Travel Time                              | 2,610 veh-h/y    | 3,132 pers-h/y    |
| Cost                                     | 97,976 \$/y      | 97,976 \$/y       |
| Fuel Consumption                         | 20,571 L/y       |                   |
| Carbon Dioxide                           | 51,536 kg/y      |                   |
| Hydrocarbons                             | 78 kg/y          |                   |
| Carbon Monoxide                          | 3,460 kg/y       |                   |
| NOx                                      | 133 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                        | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|-------------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                               |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| East: Denman Road (E)         |      |             |              |               |                  |                   |     |              |                     |               |
| 5                             | T    | 166         | 2.5          | 0.087         | 2.4              | LOS A             | 0.0 | 0.0          | 0.00                | 87.5          |
| 6                             | R    | 66          | 3.2          | 0.051         | 13.2             | LOS A             | 0.3 | 1.9          | 0.21                | 61.9          |
| Approach                      |      | 233         | 2.7          | 0.087         | 5.5              | LOS A             | 0.3 | 1.9          | 0.06                | 79.1          |
| North: Bengalla Link Road (N) |      |             |              |               |                  |                   |     |              |                     |               |
| 7                             | L    | 181         | 7.0          | 0.183         | 10.1             | LOS A             | 0.9 | 6.8          | 0.24                | 50.0          |
| 9                             | R    | 6           | 0.0          | 0.180         | 9.8              | LOS A             | 0.9 | 6.8          | 0.24                | 50.1          |
| Approach                      |      | 187         | 6.7          | 0.183         | 10.1             | LOS A             | 0.9 | 6.8          | 0.24                | 50.1          |
| West: Denman Road (W)         |      |             |              |               |                  |                   |     |              |                     |               |
| 10                            | L    | 2           | 0.0          | 0.001         | 10.1             | LOS A             | 0.0 | 0.0          | 0.00                | 57.1          |
| 11                            | T    | 106         | 5.9          | 0.057         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 80.0          |
| Approach                      |      | 108         | 5.8          | 0.057         | 0.2              | LOS A             | 0.0 | 0.0          | 0.00                | 79.5          |
| All Vehicles                  |      | 528         | 4.8          | 0.183         | 6.0              | NA                | 0.9 | 6.8          | 0.11                | 65.6          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 FU DN AM

2112974A Mangoolia TIA  
 Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 173 veh/h      | 207 pers/h      |
| Percent Heavy Vehicles                    | 10.4%          |                 |
| Degree of Saturation                      | 0.074          |                 |
| Practical Spare Capacity                  | 979.2%         |                 |
| Effective Intersection Capacity           | 2329 veh/h     |                 |
| Control Delay (Total)                     | 0.60 veh-h/h   | 0.72 pers-h/h   |
| Control Delay (Average)                   | 12.5 sec       | 12.5 sec        |
| Control Delay (Worst Lane)                | 13.5 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 12.2 sec       |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.3 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 2.3 m          |                 |
| Total Effective Stops                     | 118 veh/h      | 142 pers/h      |
| Effective Stop Rate                       | 0.68 per veh   | 0.68 per pers   |
| Proportion Queued                         | 0.09           | 0.09            |
| Performance Index                         | 2.8            | 2.8             |
| Travel Distance (Total)                   | 133.7 veh-km/h | 160.5 pers-km/h |
| Travel Distance (Average)                 | 775 m          | 775 m           |
| Travel Time (Total)                       | 2.0 veh-h/h    | 2.3 pers-h/h    |
| Travel Time (Average)                     | 40.8 sec       | 40.8 sec        |
| Travel Speed                              | 68.3 km/h      | 68.3 km/h       |
| Cost (Total)                              | 102.01 \$/h    | 102.01 \$/h     |
| Fuel Consumption (Total)                  | 30.5 L/h       |                 |
| Carbon Dioxide (Total)                    | 76.5 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.123 kg/h     |                 |
| Carbon Monoxide (Total)                   | 7.93 kg/h      |                 |
| NOx (Total)                               | 0.241 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 82,863 veh/y    | 99,436 pers/y    |
| Delay                                    | 287 veh-h/y     | 345 pers-h/y     |
| Effective Stops                          | 56,691 veh/y    | 68,029 pers/y    |
| Travel Distance                          | 64,183 veh-km/y | 77,020 pers-km/y |
| Travel Time                              | 940 veh-h/y     | 1,128 pers-h/y   |
| Cost                                     | 48,966 \$/y     | 48,966 \$/y      |
| Fuel Consumption                         | 14,621 L/y      |                  |
| Carbon Dioxide                           | 36,711 kg/y     |                  |
| Hydrocarbons                             | 59 kg/y         |                  |
| Carbon Monoxide                          | 3,809 kg/y      |                  |
| NOx                                      | 116 kg/y        |                  |

## MOVEMENT SUMMARY

Site: I-06 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                              |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                            | T    | 9           | 22.2 | 0.006     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 85.2          |
| 6                            | R    | 24          | 13.0 | 0.020     | 12.4          | LOS A            | 0.1               | 0.8      | 0.18         | 0.68                | 62.6          |
| Approach                     |      | 34          | 15.6 | 0.020     | 8.9           | LOS A            | 0.1               | 0.8      | 0.13         | 0.49                | 67.7          |
| North: Wybong Road (N)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 7                            | L    | 11          | 0.0  | 0.074     | 12.7          | LOS A            | 0.3               | 2.3      | 0.17         | 0.68                | 63.6          |
| 9                            | R    | 52          | 8.2  | 0.074     | 13.6          | LOS A            | 0.3               | 2.3      | 0.17         | 0.71                | 68.1          |
| Approach                     |      | 62          | 6.8  | 0.074     | 13.5          | LOS A            | 0.3               | 2.3      | 0.17         | 0.71                | 67.4          |
| West: Wybong Road (W)        |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                           | L    | 76          | 11.1 | 0.044     | 13.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.76                | 69.1          |
| 11                           | T    | 1           | 0.0  | 0.001     | 2.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.17                | 87.5          |
| Approach                     |      | 77          | 11.0 | 0.044     | 13.2          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 69.3          |
| All Vehicles                 |      | 173         | 10.4 | 0.074     | 12.5          | NA               | 0.3               | 2.3      | 0.09         | 0.68                | 68.3          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 FU DN PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 194 veh/h      | 232 pers/h      |
| Percent Heavy Vehicles                    | 8.2%           |                 |
| Degree of Saturation                      | 0.130          |                 |
| Practical Spare Capacity                  | 517.3%         |                 |
| Effective Intersection Capacity           | 1494 veh/h     |                 |
| Control Delay (Total)                     | 0.67 veh-h/h   | 0.80 pers-h/h   |
| Control Delay (Average)                   | 12.4 sec       | 12.4 sec        |
| Control Delay (Worst Lane)                | 13.5 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 12.2 sec       |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.6 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 4.3 m          |                 |
| Total Effective Stops                     | 132 veh/h      | 158 pers/h      |
| Effective Stop Rate                       | 0.68 per veh   | 0.68 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 3.2            | 3.2             |
| Travel Distance (Total)                   | 148.1 veh-km/h | 177.7 pers-km/h |
| Travel Distance (Average)                 | 765 m          | 765 m           |
| Travel Time (Total)                       | 2.2 veh-h/h    | 2.6 pers-h/h    |
| Travel Time (Average)                     | 40.5 sec       | 40.5 sec        |
| Travel Speed                              | 67.9 km/h      | 67.9 km/h       |
| Cost (Total)                              | 107.45 \$/h    | 107.45 \$/h     |
| Fuel Consumption (Total)                  | 30.8 L/h       |                 |
| Carbon Dioxide (Total)                    | 77.3 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.129 kg/h     |                 |
| Carbon Monoxide (Total)                   | 8.07 kg/h      |                 |
| NOx (Total)                               | 0.243 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 92,968 veh/y    | 111,562 pers/y   |
| Delay                                    | 320 veh-h/y     | 384 pers-h/y     |
| Effective Stops                          | 63,350 veh/y    | 76,020 pers/y    |
| Travel Distance                          | 71,079 veh-km/y | 85,295 pers-km/y |
| Travel Time                              | 1,047 veh-h/y   | 1,256 pers-h/y   |
| Cost                                     | 51,578 \$/y     | 51,578 \$/y      |
| Fuel Consumption                         | 14,788 L/y      |                  |
| Carbon Dioxide                           | 37,092 kg/y     |                  |
| Hydrocarbons                             | 62 kg/y         |                  |
| Carbon Monoxide                          | 3,873 kg/y      |                  |
| NOx                                      | 117 kg/y        |                  |

## MOVEMENT SUMMARY

Site: I-06 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                              |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                            | T    | 5           | 20.0 | 0.003     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 85.2          |
| 6                            | R    | 26          | 8.0  | 0.021     | 11.9          | LOS A            | 0.1               | 0.7      | 0.13         | 0.69                | 62.8          |
| Approach                     |      | 32          | 10.0 | 0.021     | 9.9           | LOS A            | 0.1               | 0.7      | 0.11         | 0.58                | 65.8          |
| North: Wybong Road (N)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 7                            | L    | 25          | 16.7 | 0.130     | 13.6          | LOS A            | 0.6               | 4.3      | 0.14         | 0.69                | 63.8          |
| 9                            | R    | 86          | 7.3  | 0.130     | 13.5          | LOS A            | 0.6               | 4.3      | 0.14         | 0.72                | 68.2          |
| Approach                     |      | 112         | 9.4  | 0.130     | 13.5          | LOS A            | 0.6               | 4.3      | 0.14         | 0.71                | 67.3          |
| West: Wybong Road (W)        |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                           | L    | 44          | 4.8  | 0.025     | 12.9          | LOS A            | 0.0               | 0.0      | 0.00         | 0.76                | 69.1          |
| 11                           | T    | 6           | 0.0  | 0.003     | 2.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.17                | 87.5          |
| Approach                     |      | 51          | 4.2  | 0.025     | 11.6          | LOS A            | 0.0               | 0.0      | 0.00         | 0.68                | 70.8          |
| All Vehicles                 |      | 194         | 8.2  | 0.130     | 12.4          | NA               | 0.6               | 4.3      | 0.10         | 0.68                | 67.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 193 veh/h      | 231 pers/h      |
| Percent Heavy Vehicles                    | 7.7 %          |                 |
| Degree of Saturation                      | 0.056          |                 |
| Practical Spare Capacity                  | 1324.5 %       |                 |
| Effective Intersection Capacity           | 3430 veh/h     |                 |
| Control Delay (Total)                     | 0.43 veh-h/h   | 0.51 pers-h/h   |
| Control Delay (Average)                   | 8.0 sec        | 8.0 sec         |
| Control Delay (Worst Lane)                | 11.1 sec       |                 |
| Control Delay (Worst Movement)            | 12.1 sec       | 12.1 sec        |
| Geometric Delay (Average)                 | 7.7 sec        |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.8 m          |                 |
| Total Effective Stops                     | 110 veh/h      | 132 pers/h      |
| Effective Stop Rate                       | 0.57 per veh   | 0.57 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 2.7            | 2.7             |
| Travel Distance (Total)                   | 103.3 veh-km/h | 123.9 pers-km/h |
| Travel Distance (Average)                 | 536 m          | 536 m           |
| Travel Time (Total)                       | 1.9 veh-h/h    | 2.3 pers-h/h    |
| Travel Time (Average)                     | 35.1 sec       | 35.1 sec        |
| Travel Speed                              | 55.0 km/h      | 55.0 km/h       |
| Cost (Total)                              | 68.86 \$/h     | 68.86 \$/h      |
| Fuel Consumption (Total)                  | 13.8 L/h       |                 |
| Carbon Dioxide (Total)                    | 34.7 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.052 kg/h     |                 |
| Carbon Monoxide (Total)                   | 2.55 kg/h      |                 |
| NOx (Total)                               | 0.088 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 92,463 veh/y    | 110,956 pers/y   |
| Delay                                    | 204 veh-h/y     | 245 pers-h/y     |
| Effective Stops                          | 52,695 veh/y    | 63,234 pers/y    |
| Travel Distance                          | 49,574 veh-km/y | 59,489 pers-km/y |
| Travel Time                              | 902 veh-h/y     | 1,082 pers-h/y   |
| Cost                                     | 33,051 \$/y     | 33,051 \$/y      |
| Fuel Consumption                         | 6,644 L/y       |                  |
| Carbon Dioxide                           | 16,665 kg/y     |                  |
| Hydrocarbons                             | 25 kg/y         |                  |
| Carbon Monoxide                          | 1,226 kg/y      |                  |
| NOx                                      | 42 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-07 FU DN AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                      | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|-----------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                             |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Site Access Road (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                           | L    | 17          | 12.5 | 0.056     | 6.8           | LOS A            | 0.2               | 1.8      | 0.18         | 0.55                | 39.5          |
| 3                           | R    | 37          | 5.7  | 0.056     | 6.7           | LOS A            | 0.2               | 1.8      | 0.18         | 0.59                | 38.7          |
| Approach                    |      | 54          | 7.8  | 0.056     | 6.7           | LOS A            | 0.2               | 1.8      | 0.18         | 0.58                | 39.1          |
| East: Wybong Road (E)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                           | L    | 88          | 6.0  | 0.050     | 11.1          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 57.6          |
| 5                           | T    | 7           | 28.6 | 0.004     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                    |      | 96          | 7.7  | 0.050     | 10.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.67                | 59.2          |
| West: Wybong Road (W)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                          | T    | 28          | 3.7  | 0.027     | 0.4           | LOS A            | 0.2               | 1.3      | 0.22         | 0.00                | 71.4          |
| 12                          | R    | 15          | 14.3 | 0.027     | 12.1          | LOS A            | 0.2               | 1.3      | 0.22         | 1.00                | 57.9          |
| Approach                    |      | 43          | 7.3  | 0.027     | 4.4           | LOS A            | 0.2               | 1.3      | 0.22         | 0.34                | 66.9          |
| All Vehicles                |      | 193         | 7.7  | 0.056     | 8.0           | NA               | 0.2               | 1.8      | 0.10         | 0.57                | 55.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 FU DN PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 173 veh/h     | 207 pers/h     |
| Percent Heavy Vehicles                    | 9.8%          |                |
| Degree of Saturation                      | 0.104         |                |
| Practical Spare Capacity                  | 672.7%        |                |
| Effective Intersection Capacity           | 1667 veh/h    |                |
| Control Delay (Total)                     | 0.23 veh-h/h  | 0.28 pers-h/h  |
| Control Delay (Average)                   | 4.8 sec       | 4.8 sec        |
| Control Delay (Worst Lane)                | 11.8 sec      |                |
| Control Delay (Worst Movement)            | 11.8 sec      | 11.8 sec       |
| Geometric Delay (Average)                 | 4.6 sec       |                |
| Stop-Line Delay (Average)                 | 0.3 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.5 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 3.3 m         |                |
| Total Effective Stops                     | 69 veh/h      | 83 pers/h      |
| Effective Stop Rate                       | 0.40 per veh  | 0.40 per pers  |
| Proportion Queued                         | 0.12          | 0.12           |
| Performance Index                         | 2.1           | 2.1            |
| Travel Distance (Total)                   | 79.2 veh-km/h | 95.0 pers-km/h |
| Travel Distance (Average)                 | 459 m         | 459 m          |
| Travel Time (Total)                       | 1.4 veh-h/h   | 1.7 pers-h/h   |
| Travel Time (Average)                     | 29.9 sec      | 29.9 sec       |
| Travel Speed                              | 55.2 km/h     | 55.2 km/h      |
| Cost (Total)                              | 59.82 \$/h    | 59.82 \$/h     |
| Fuel Consumption (Total)                  | 14.4 L/h      |                |
| Carbon Dioxide (Total)                    | 36.1 kg/h     |                |
| Hydrocarbons (Total)                      | 0.054 kg/h    |                |
| Carbon Monoxide (Total)                   | 3.07 kg/h     |                |
| NOx (Total)                               | 0.095 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 82,863 veh/y    | 99,436 pers/y    |
| Delay                                    | 111 veh-h/y     | 134 pers-h/y     |
| Effective Stops                          | 33,078 veh/y    | 39,693 pers/y    |
| Travel Distance                          | 37,993 veh-km/y | 45,592 pers-km/y |
| Travel Time                              | 688 veh-h/y     | 826 pers-h/y     |
| Cost                                     | 28,712 \$/y     | 28,712 \$/y      |
| Fuel Consumption                         | 6,892 L/y       |                  |
| Carbon Dioxide                           | 17,309 kg/y     |                  |
| Hydrocarbons                             | 26 kg/y         |                  |
| Carbon Monoxide                          | 1,474 kg/y      |                  |
| NOx                                      | 46 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-07 FU DN PM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |      |       |               |                  |                   |          |              |                     |               |
|---------------------------------|------|-------------|------|------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. | Satn  | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | veh/h       | %    |      | v/c   | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Site Access Road (S)     |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 1                               | L    | 6           | 16.7 |      | 0.104 | 6.9           | LOS A            | 0.5               | 3.3      | 0.18         | 0.55                | 39.4          |
| 3                               | R    | 92          | 4.6  |      | 0.103 | 6.6           | LOS A            | 0.5               | 3.3      | 0.18         | 0.58                | 38.7          |
| Approach                        |      | 98          | 5.4  |      | 0.103 | 6.6           | LOS A            | 0.5               | 3.3      | 0.18         | 0.58                | 38.8          |
| East: Wybong Road (E)           |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 4                               | L    | 13          | 25.0 |      | 0.008 | 11.8          | LOS A            | 0.0               | 0.0      | 0.00         | 0.72                | 57.6          |
| 5                               | T    | 45          | 7.0  |      | 0.024 | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                        |      | 58          | 10.9 |      | 0.024 | 2.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.16                | 74.7          |
| West: Wybong Road (W)           |      |             |      |      |       |               |                  |                   |          |              |                     |               |
| 11                              | T    | 14          | 38.5 |      | 0.011 | 0.2           | LOS A            | 0.1               | 0.5      | 0.15         | 0.00                | 74.3          |
| 12                              | R    | 3           | 0.0  |      | 0.011 | 11.3          | LOS A            | 0.1               | 0.5      | 0.15         | 1.02                | 57.8          |
| Approach                        |      | 17          | 31.3 |      | 0.011 | 2.3           | LOS A            | 0.1               | 0.5      | 0.15         | 0.19                | 71.1          |
| All Vehicles                    |      | 173         | 9.8  |      | 0.104 | 4.8           | NA               | 0.5               | 3.3      | 0.12         | 0.40                | 55.2          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-08 FU DN AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 63 veh/h      | 76 pers/h      |
| Percent Heavy Vehicles                    | 5.0 %         |                |
| Degree of Saturation                      | 0.020         |                |
| Practical Spare Capacity                  | 3942.8 %      |                |
| Effective Intersection Capacity           | 3192 veh/h    |                |
| Control Delay (Total)                     | 0.03 veh-h/h  | 0.04 pers-h/h  |
| Control Delay (Average)                   | 1.7 sec       | 1.7 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.6 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 0.5 m         |                |
| Total Effective Stops                     | 7 veh/h       | 8 pers/h       |
| Effective Stop Rate                       | 0.11 per veh  | 0.11 per pers  |
| Proportion Queued                         | 0.04          | 0.04           |
| Performance Index                         | 0.6           | 0.6            |
| Travel Distance (Total)                   | 43.6 veh-km/h | 52.3 pers-km/h |
| Travel Distance (Average)                 | 690 m         | 690 m          |
| Travel Time (Total)                       | 0.6 veh-h/h   | 0.7 pers-h/h   |
| Travel Time (Average)                     | 33.2 sec      | 33.2 sec       |
| Travel Speed                              | 74.9 km/h     | 74.9 km/h      |
| Cost (Total)                              | 21.49 \$/h    | 21.49 \$/h     |
| Fuel Consumption (Total)                  | 4.4 L/h       |                |
| Carbon Dioxide (Total)                    | 11.1 kg/h     |                |
| Hydrocarbons (Total)                      | 0.014 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.42 kg/h     |                |
| NOx (Total)                               | 0.025 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 30,316 veh/y    | 36,379 pers/y    |
| Delay                                    | 14 veh-h/y      | 17 pers-h/y      |
| Effective Stops                          | 3,290 veh/y     | 3,948 pers/y     |
| Travel Distance                          | 20,932 veh-km/y | 25,119 pers-km/y |
| Travel Time                              | 280 veh-h/y     | 335 pers-h/y     |
| Cost                                     | 10,314 \$/y     | 10,314 \$/y      |
| Fuel Consumption                         | 2,119 L/y       |                  |
| Carbon Dioxide                           | 5,309 kg/y      |                  |
| Hydrocarbons                             | 7 kg/y          |                  |
| Carbon Monoxide                          | 200 kg/y        |                  |
| NOx                                      | 12 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 FU DN AM

2112974A Mangoolia TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                                   | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                                          |      | veh/h       | %            | v/c   |               |                  | sec               | veh |              |                     |               |
| East: Wybong Road (E)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 5                                        | T    | 16          | 13.3         | 0.010 | 0.1           | LOS A            | 0.1               | 0.5 | 0.12         | 0.00                | 75.7          |
| 6                                        | R    | 1           | 0.0          | 0.010 | 10.3          | LOS A            | 0.1               | 0.5 | 0.12         | 0.96                | 60.0          |
| Approach                                 |      | 17          | 12.5         | 0.010 | 0.8           | LOS A            | 0.1               | 0.5 | 0.12         | 0.06                | 74.5          |
| North West: Wybong Post Office Road (NW) |      |             |              |       |               |                  |                   |     |              |                     |               |
| 27                                       | L    | 6           | 0.0          | 0.007 | 10.8          | LOS A            | 0.0               | 0.2 | 0.11         | 0.69                | 58.7          |
| 29                                       | R    | 1           | 0.0          | 0.007 | 11.8          | LOS A            | 0.0               | 0.2 | 0.11         | 0.71                | 57.5          |
| Approach                                 |      | 7           | 0.0          | 0.007 | 10.9          | LOS A            | 0.0               | 0.2 | 0.11         | 0.69                | 58.5          |
| West: Wybong Road (W)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 10                                       | L    | 1           | 0.0          | 0.002 | 12.5          | LOS A            | 0.0               | 0.0 | 0.00         | 0.71                | 57.3          |
| 11                                       | T    | 38          | 2.8          | 0.020 | 0.0           | LOS A            | 0.0               | 0.0 | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 39          | 2.7          | 0.020 | 0.3           | LOS A            | 0.0               | 0.0 | 0.00         | 0.02                | 79.1          |
| All Vehicles                             |      | 63          | 5.0          | 0.020 | 1.7           | NA               | 0.1               | 0.5 | 0.04         | 0.11                | 74.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-08 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 75 veh/h      | 90 pers/h      |
| Percent Heavy Vehicles                    | 7.0 %         |                |
| Degree of Saturation                      | 0.029         |                |
| Practical Spare Capacity                  | 2653.8 %      |                |
| Effective Intersection Capacity           | 2573 veh/h    |                |
| Control Delay (Total)                     | 0.02 veh-h/h  | 0.03 pers-h/h  |
| Control Delay (Average)                   | 1.1 sec       | 1.1 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.1 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 1.4 m         |                |
| Total Effective Stops                     | 6 veh/h       | 8 pers/h       |
| Effective Stop Rate                       | 0.08 per veh  | 0.08 per pers  |
| Proportion Queued                         | 0.06          | 0.06           |
| Performance Index                         | 0.8           | 0.8            |
| Travel Distance (Total)                   | 51.7 veh-km/h | 62.0 pers-km/h |
| Travel Distance (Average)                 | 691 m         | 691 m          |
| Travel Time (Total)                       | 0.7 veh-h/h   | 0.8 pers-h/h   |
| Travel Time (Average)                     | 33.0 sec      | 33.0 sec       |
| Travel Speed                              | 75.4 km/h     | 75.4 km/h      |
| Cost (Total)                              | 25.59 \$/h    | 25.59 \$/h     |
| Fuel Consumption (Total)                  | 5.3 L/h       |                |
| Carbon Dioxide (Total)                    | 13.4 kg/h     |                |
| Hydrocarbons (Total)                      | 0.016 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.44 kg/h     |                |
| NOx (Total)                               | 0.029 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 35,874 veh/y    | 43,048 pers/y    |
| Delay                                    | 11 veh-h/y      | 13 pers-h/y      |
| Effective Stops                          | 3,037 veh/y     | 3,644 pers/y     |
| Travel Distance                          | 24,794 veh-km/y | 29,752 pers-km/y |
| Travel Time                              | 329 veh-h/y     | 395 pers-h/y     |
| Cost                                     | 12,282 \$/y     | 12,282 \$/y      |
| Fuel Consumption                         | 2,568 L/y       |                  |
| Carbon Dioxide                           | 6,438 kg/y      |                  |
| Hydrocarbons                             | 8 kg/y          |                  |
| Carbon Monoxide                          | 209 kg/y        |                  |
| NOx                                      | 14 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 FU DN PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles          |      |             |      |           |               |                  |                   |          |              |                     |               |
|------------------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
| Mov ID                                   | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|                                          |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Wybong Road (E)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                                        | T    | 49          | 4.3  | 0.029     | 0.1           | LOS A            | 0.2               | 1.4      | 0.08         | 0.00                | 76.9          |
| 6                                        | R    | 4           | 0.0  | 0.029     | 10.2          | LOS A            | 0.2               | 1.4      | 0.08         | 0.97                | 60.0          |
| Approach                                 |      | 54          | 3.9  | 0.029     | 0.9           | LOS A            | 0.2               | 1.4      | 0.08         | 0.08                | 75.2          |
| North West: Wybong Post Office Road (NW) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 27                                       | L    | 1           | 0.0  | 0.002     | 10.8          | LOS A            | 0.0               | 0.1      | 0.09         | 0.69                | 58.8          |
| 29                                       | R    | 1           | 0.0  | 0.002     | 11.8          | LOS A            | 0.0               | 0.1      | 0.09         | 0.72                | 57.6          |
| Approach                                 |      | 2           | 0.0  | 0.002     | 11.3          | LOS A            | 0.0               | 0.1      | 0.09         | 0.71                | 58.2          |
| West: Wybong Road (W)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                                       | L    | 1           | 0.0  | 0.002     | 12.5          | LOS A            | 0.0               | 0.0      | 0.03         | 0.70                | 57.1          |
| 11                                       | T    | 18          | 17.6 | 0.010     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 19          | 16.7 | 0.010     | 0.7           | LOS A            | 0.0               | 0.0      | 0.00         | 0.04                | 78.2          |
| All Vehicles                             |      | 75          | 7.0  | 0.029     | 1.1           | NA               | 0.2               | 1.4      | 0.06         | 0.08                | 75.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## 2012 – Cumulative Traffic INTERSECTION SUMMARY

Site: I-01 FU CT AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                  |
|-------------------------------------------|----------------|------------------|
| Performance Measure                       | Vehicles       | Persons          |
| Demand Flows (Total)                      | 1304 veh/h     | 1565 pers/h      |
| Percent Heavy Vehicles                    | 5.7 %          |                  |
| Degree of Saturation                      | 0.664          |                  |
| Practical Spare Capacity                  | 20.5 %         |                  |
| Effective Intersection Capacity           | 1964 veh/h     |                  |
| Control Delay (Total)                     | 3.50 veh-h/h   | 4.20 pers-h/h    |
| Control Delay (Average)                   | 9.7 sec        | 9.7 sec          |
| Control Delay (Worst Lane)                | 55.4 sec       |                  |
| Control Delay (Worst Movement)            | 55.4 sec       | 55.4 sec         |
| Geometric Delay (Average)                 | 6.0 sec        |                  |
| Stop-Line Delay (Average)                 | 3.7 sec        |                  |
| Level of Service (Aver. Int. Delay)       | NA             |                  |
| Level of Service (Worst Movement)         | LOS D          |                  |
| Level of Service (Worst Lane)             | LOS D          |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 3.9 veh        |                  |
| 95% Back of Queue - Distance (Worst Lane) | 29.3 m         |                  |
| Total Effective Stops                     | 529 veh/h      | 634 pers/h       |
| Effective Stop Rate                       | 0.41 per veh   | 0.41 per pers    |
| Proportion Queued                         | 0.13           | 0.13             |
| Performance Index                         | 18.0           | 18.0             |
| Travel Distance (Total)                   | 976.9 veh-km/h | 1172.3 pers-km/h |
| Travel Distance (Average)                 | 749 m          | 749 m            |
| Travel Time (Total)                       | 13.6 veh-h/h   | 16.3 pers-h/h    |
| Travel Time (Average)                     | 37.4 sec       | 37.4 sec         |
| Travel Speed                              | 72.1 km/h      | 72.1 km/h        |
| Cost (Total)                              | 566.70 \$/h    | 566.70 \$/h      |
| Fuel Consumption (Total)                  | 138.2 L/h      |                  |
| Carbon Dioxide (Total)                    | 346.4 kg/h     |                  |
| Hydrocarbons (Total)                      | 0.499 kg/h     |                  |
| Carbon Monoxide (Total)                   | 20.39 kg/h     |                  |
| NOx (Total)                               | 0.922 kg/h     |                  |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 626,021 veh/y    | 751,225 pers/y    |
| Delay                                    | 1,680 veh-h/y    | 2,016 pers-h/y    |
| Effective Stops                          | 253,756 veh/y    | 304,507 pers/y    |
| Travel Distance                          | 468,922 veh-km/y | 562,707 pers-km/y |
| Travel Time                              | 6,505 veh-h/y    | 7,807 pers-h/y    |
| Cost                                     | 272,017 \$/y     | 272,017 \$/y      |
| Fuel Consumption                         | 66,346 L/y       |                   |
| Carbon Dioxide                           | 166,260 kg/y     |                   |
| Hydrocarbons                             | 239 kg/y         |                   |
| Carbon Monoxide                          | 9,785 kg/y       |                   |
| NOx                                      | 442 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 400         | 3.2  | 0.220     | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 241         | 12.7 | 0.067     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 641         | 6.7  | 0.220     | 7.7           | LOS A            | 0.0               | 0.0      | 0.00         | 0.47                | 75.9          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 424         | 5.5  | 0.225     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 118         | 0.0  | 0.159     | 15.7          | LOS B            | 0.8               | 5.5      | 0.57         | 0.86                | 59.2          |
| Approach                        |      | 542         | 4.3  | 0.225     | 3.4           | LOS B            | 0.8               | 5.5      | 0.12         | 0.19                | 88.4          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 22          | 0.0  | 0.030     | 13.8          | LOS A            | 0.1               | 0.9      | 0.45         | 0.74                | 60.0          |
| 12                              | R    | 99          | 8.5  | 0.664     | 55.4          | LOS D            | 3.9               | 29.3     | 0.93         | 1.12                | 31.9          |
| Approach                        |      | 121         | 7.0  | 0.663     | 47.8          | LOS D            | 3.9               | 29.3     | 0.85         | 1.05                | 34.9          |
| All Vehicles                    |      | 1304        | 5.7  | 0.664     | 9.7           | NA               | 3.9               | 29.3     | 0.13         | 0.41                | 72.1          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS D. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-01 FU CT PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 917 veh/h      | 1100 pers/h     |
| Percent Heavy Vehicles                    | 6.9%           |                 |
| Degree of Saturation                      | 0.668          |                 |
| Practical Spare Capacity                  | 19.7%          |                 |
| Effective Intersection Capacity           | 1372 veh/h     |                 |
| Control Delay (Total)                     | 2.34 veh-h/h   | 2.81 pers-h/h   |
| Control Delay (Average)                   | 9.2 sec        | 9.2 sec         |
| Control Delay (Worst Lane)                | 31.4 sec       |                 |
| Control Delay (Worst Movement)            | 31.4 sec       | 31.4 sec        |
| Geometric Delay (Average)                 | 4.4 sec        |                 |
| Stop-Line Delay (Average)                 | 4.8 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS C          |                 |
| Level of Service (Worst Lane)             | LOS C          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 5.5 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 39.3 m         |                 |
| Total Effective Stops                     | 339 veh/h      | 407 pers/h      |
| Effective Stop Rate                       | 0.37 per veh   | 0.37 per pers   |
| Proportion Queued                         | 0.23           | 0.23            |
| Performance Index                         | 13.9           | 13.9            |
| Travel Distance (Total)                   | 718.8 veh-km/h | 862.6 pers-km/h |
| Travel Distance (Average)                 | 784 m          | 784 m           |
| Travel Time (Total)                       | 9.9 veh-h/h    | 11.9 pers-h/h   |
| Travel Time (Average)                     | 38.8 sec       | 38.8 sec        |
| Travel Speed                              | 72.7 km/h      | 72.7 km/h       |
| Cost (Total)                              | 422.67 \$/h    | 422.67 \$/h     |
| Fuel Consumption (Total)                  | 105.4 L/h      |                 |
| Carbon Dioxide (Total)                    | 264.3 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.367 kg/h     |                 |
| Carbon Monoxide (Total)                   | 14.84 kg/h     |                 |
| NOx (Total)                               | 0.696 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 440,084 veh/y    | 528,101 pers/y    |
| Delay                                    | 1,126 veh-h/y    | 1,351 pers-h/y    |
| Effective Stops                          | 162,687 veh/y    | 195,225 pers/y    |
| Travel Distance                          | 345,046 veh-km/y | 414,055 pers-km/y |
| Travel Time                              | 4,749 veh-h/y    | 5,699 pers-h/y    |
| Cost                                     | 202,880 \$/y     | 202,880 \$/y      |
| Fuel Consumption                         | 50,608 L/y       |                   |
| Carbon Dioxide                           | 126,854 kg/y     |                   |
| Hydrocarbons                             | 176 kg/y         |                   |
| Carbon Monoxide                          | 7,123 kg/y       |                   |
| NOx                                      | 334 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-01 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                 |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: New England Highway (S)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                               | L    | 61          | 19.0 | 0.037     | 13.3          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 64.8          |
| 2                               | T    | 333         | 8.5  | 0.090     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach                        |      | 394         | 10.2 | 0.090     | 2.1           | LOS A            | 0.0               | 0.0      | 0.00         | 0.12                | 93.2          |
| North: New England Highway (N)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                               | T    | 245         | 6.9  | 0.131     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| 9                               | R    | 13          | 16.7 | 0.015     | 15.3          | LOS B            | 0.1               | 0.6      | 0.45         | 0.71                | 61.2          |
| Approach                        |      | 258         | 7.3  | 0.131     | 0.7           | LOS B            | 0.1               | 0.6      | 0.02         | 0.03                | 97.4          |
| West: Thomas Mitchell Drive (W) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                              | L    | 49          | 2.1  | 0.061     | 13.5          | LOS A            | 0.3               | 2.0      | 0.42         | 0.74                | 60.5          |
| 12                              | R    | 216         | 1.5  | 0.668     | 31.4          | LOS C            | 5.5               | 39.3     | 0.84         | 1.15                | 43.6          |
| Approach                        |      | 265         | 1.6  | 0.667     | 28.0          | LOS C            | 5.5               | 39.3     | 0.76         | 1.07                | 46.0          |
| All Vehicles                    |      | 917         | 6.9  | 0.668     | 9.2           | NA               | 5.5               | 39.3     | 0.23         | 0.37                | 72.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 FU CT AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 1181 veh/h     | 1417 pers/h     |
| Percent Heavy Vehicles                    | 4.5%           |                 |
| Degree of Saturation                      | 0.346          |                 |
| Practical Spare Capacity                  | 131.2%         |                 |
| Effective Intersection Capacity           | 3414 veh/h     |                 |
| Control Delay (Total)                     | 3.30 veh-h/h   | 3.96 pers-h/h   |
| Control Delay (Average)                   | 10.1 sec       | 10.1 sec        |
| Control Delay (Worst Lane)                | 21.0 sec       |                 |
| Control Delay (Worst Movement)            | 21.0 sec       | 21.0 sec        |
| Geometric Delay (Average)                 | 8.2 sec        |                 |
| Stop-Line Delay (Average)                 | 1.8 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.7 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 13.0 m         |                 |
| Total Effective Stops                     | 703 veh/h      | 843 pers/h      |
| Effective Stop Rate                       | 0.59 per veh   | 0.59 per pers   |
| Proportion Queued                         | 0.19           | 0.19            |
| Performance Index                         | 18.4           | 18.4            |
| Travel Distance (Total)                   | 804.2 veh-km/h | 965.1 pers-km/h |
| Travel Distance (Average)                 | 681 m          | 681 m           |
| Travel Time (Total)                       | 13.3 veh-h/h   | 16.0 pers-h/h   |
| Travel Time (Average)                     | 40.6 sec       | 40.6 sec        |
| Travel Speed                              | 60.4 km/h      | 60.4 km/h       |
| Cost (Total)                              | 516.84\$/h     | 516.84\$/h      |
| Fuel Consumption (Total)                  | 114.5 L/h      |                 |
| Carbon Dioxide (Total)                    | 286.9 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.467 kg/h     |                 |
| Carbon Monoxide (Total)                   | 24.41 kg/h     |                 |
| NOx (Total)                               | 0.789 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 566,905 veh/y    | 680,286 pers/y    |
| Delay                                    | 1,585 veh-h/y    | 1,902 pers-h/y    |
| Effective Stops                          | 337,272 veh/y    | 404,727 pers/y    |
| Travel Distance                          | 386,030 veh-km/y | 463,235 pers-km/y |
| Travel Time                              | 6,388 veh-h/y    | 7,666 pers-h/y    |
| Cost                                     | 248,082\$/y      | 248,082\$/y       |
| Fuel Consumption                         | 54,979 L/y       |                   |
| Carbon Dioxide                           | 137,696 kg/y     |                   |
| Hydrocarbons                             | 224 kg/y         |                   |
| Carbon Monoxide                          | 11,717 kg/y      |                   |
| NOx                                      | 379 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-02 FU CT AM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                           | Turn | Demand Flow | HV  | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|----------------------------------|------|-------------|-----|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                  |      | veh/h       | %   | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Thomas Mitchell Drive (S) |      |             |     |           |               |                  |                   |          |              |                     |               |
| 1                                | L    | 159         | 7.3 | 0.231     | 14.6          | LOS B            | 1.1               | 8.3      | 0.53         | 0.84                | 54.5          |
| 3                                | R    | 123         | 9.4 | 0.346     | 21.0          | LOS B            | 1.7               | 13.0     | 0.68         | 0.96                | 47.8          |
| Approach                         |      | 282         | 8.2 | 0.346     | 17.4          | LOS B            | 1.7               | 13.0     | 0.60         | 0.89                | 51.4          |
| East: Denman Road (E)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 4                                | L    | 493         | 1.7 | 0.268     | 11.0          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 58.9          |
| 5                                | T    | 222         | 6.2 | 0.118     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                         |      | 715         | 3.1 | 0.269     | 7.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.50                | 64.2          |
| West: Denman Road (W)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 11                               | T    | 81          | 6.5 | 0.043     | 0.0           | LOS A            | 0.7               | 5.3      | 0.00         | 0.00                | 80.0          |
| 12                               | R    | 103         | 2.0 | 0.156     | 15.2          | LOS B            | 0.7               | 5.3      | 0.59         | 0.89                | 53.5          |
| Approach                         |      | 184         | 4.0 | 0.156     | 8.5           | LOS B            | 0.7               | 5.3      | 0.33         | 0.50                | 62.8          |
| All Vehicles                     |      | 1181        | 4.5 | 0.346     | 10.1          | NA               | 1.7               | 13.0     | 0.19         | 0.59                | 60.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-02 FU CT PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 897 veh/h      | 1076 pers/h     |
| Percent Heavy Vehicles                    | 4.6%           |                 |
| Degree of Saturation                      | 0.566          |                 |
| Practical Spare Capacity                  | 41.3%          |                 |
| Effective Intersection Capacity           | 1584 veh/h     |                 |
| Control Delay (Total)                     | 2.31 veh-h/h   | 2.78 pers-h/h   |
| Control Delay (Average)                   | 9.3 sec        | 9.3 sec         |
| Control Delay (Worst Lane)                | 21.2 sec       |                 |
| Control Delay (Worst Movement)            | 21.2 sec       | 21.2 sec        |
| Geometric Delay (Average)                 | 6.1 sec        |                 |
| Stop-Line Delay (Average)                 | 3.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS B          |                 |
| Level of Service (Worst Lane)             | LOS B          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 4.0 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 28.8 m         |                 |
| Total Effective Stops                     | 447 veh/h      | 537 pers/h      |
| Effective Stop Rate                       | 0.50 per veh   | 0.50 per pers   |
| Proportion Queued                         | 0.32           | 0.32            |
| Performance Index                         | 14.3           | 14.3            |
| Travel Distance (Total)                   | 613.4 veh-km/h | 736.1 pers-km/h |
| Travel Distance (Average)                 | 684 m          | 684 m           |
| Travel Time (Total)                       | 10.1 veh-h/h   | 12.1 pers-h/h   |
| Travel Time (Average)                     | 40.6 sec       | 40.6 sec        |
| Travel Speed                              | 60.7 km/h      | 60.7 km/h       |
| Cost (Total)                              | 385.76 \$/h    | 385.76 \$/h     |
| Fuel Consumption (Total)                  | 83.3 L/h       |                 |
| Carbon Dioxide (Total)                    | 208.7 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.327 kg/h     |                 |
| Carbon Monoxide (Total)                   | 16.16 kg/h     |                 |
| NOx (Total)                               | 0.565 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 430,484 veh/y    | 516,581 pers/y    |
| Delay                                    | 1,111 veh-h/y    | 1,333 pers-h/y    |
| Effective Stops                          | 214,753 veh/y    | 257,704 pers/y    |
| Travel Distance                          | 294,422 veh-km/y | 353,306 pers-km/y |
| Travel Time                              | 4,854 veh-h/y    | 5,824 pers-h/y    |
| Cost                                     | 185,165 \$/y     | 185,165 \$/y      |
| Fuel Consumption                         | 39,984 L/y       |                   |
| Carbon Dioxide                           | 100,156 kg/y     |                   |
| Hydrocarbons                             | 157 kg/y         |                   |
| Carbon Monoxide                          | 7,758 kg/y       |                   |
| NOx                                      | 271 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-02 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                           | Turn | Demand Flow | HV  | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|----------------------------------|------|-------------|-----|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                  |      | veh/h       | %   | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Thomas Mitchell Drive (S) |      |             |     |           |               |                  |                   |          |              |                     |               |
| 1                                | L    | 52          | 6.1 | 0.054     | 12.3          | LOS A            | 0.2               | 1.8      | 0.32         | 0.69                | 57.1          |
| 3                                | R    | 247         | 4.7 | 0.566     | 21.2          | LOS B            | 4.0               | 28.8     | 0.71         | 1.04                | 47.4          |
| Approach                         |      | 299         | 4.9 | 0.566     | 19.6          | LOS B            | 4.0               | 28.8     | 0.64         | 0.98                | 48.8          |
| East: Denman Road (E)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 4                                | L    | 63          | 6.7 | 0.036     | 11.2          | LOS A            | 0.0               | 0.0      | 0.00         | 0.73                | 58.9          |
| 5                                | T    | 183         | 1.7 | 0.095     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                         |      | 246         | 3.0 | 0.095     | 2.9           | LOS A            | 0.0               | 0.0      | 0.00         | 0.19                | 73.4          |
| West: Denman Road (W)            |      |             |     |           |               |                  |                   |          |              |                     |               |
| 11                               | T    | 222         | 5.2 | 0.180     | 0.7           | LOS A            | 1.3               | 9.3      | 0.21         | 0.00                | 71.2          |
| 12                               | R    | 129         | 5.7 | 0.180     | 12.4          | LOS A            | 1.3               | 9.3      | 0.38         | 0.84                | 58.5          |
| Approach                         |      | 352         | 5.4 | 0.180     | 5.0           | LOS A            | 1.3               | 9.3      | 0.27         | 0.31                | 66.0          |
| All Vehicles                     |      | 897         | 4.6 | 0.566     | 9.3           | NA               | 4.0               | 28.8     | 0.32         | 0.50                | 60.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-03 FU CT AM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                |              |                 |
|-------------------------------------------|----------------|--------------|-----------------|
| Performance Measure                       | Vehicles       | Pedestrians  | Persons         |
| Demand Flows (Total)                      | 1322 veh/h     | 42 ped/h     | 1629 pers/h     |
| Percent Heavy Vehicles                    | 8.5%           |              |                 |
| Degree of Saturation                      | 0.437          | 0.005        |                 |
| Practical Spare Capacity                  | 105.8%         |              |                 |
| Effective Intersection Capacity           | 3024 veh/h     |              |                 |
| Control Delay (Total)                     | 7.16 veh-h/h   | 0.15 ped-h/h | 8.74 pers-h/h   |
| Control Delay (Average)                   | 19.5 sec       | 13.1 sec     | 19.3 sec        |
| Control Delay (Worst Lane)                | 31.0 sec       |              |                 |
| Control Delay (Worst Movement)            | 31.0 sec       | 17.6 sec     | 31.0 sec        |
| Geometric Delay (Average)                 | 4.5 sec        |              |                 |
| Stop-Line Delay (Average)                 | 15.0 sec       |              |                 |
| Level of Service (Aver. Int. Delay)       | LOS B          | LOS B        |                 |
| Level of Service (Worst Movement)         | LOS C          | LOS B        |                 |
| Level of Service (Worst Lane)             | LOS C          |              |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 12.0 veh       |              |                 |
| 95% Back of Queue - Distance (Worst Lane) | 85.4 m         |              |                 |
| Total Effective Stops                     | 902 veh/h      | 24 ped/h     | 1105 pers/h     |
| Effective Stop Rate                       | 0.68 per veh   | 0.56 per ped | 0.68 per pers   |
| Proportion Queued                         | 0.68           | 0.56         | 0.67            |
| Performance Index                         | 45.4           | 0.7          | 46.1            |
| Travel Distance (Total)                   | 778.0 veh-km/h | 2.0 ped-km/h | 935.6 pers-km/h |
| Travel Distance (Average)                 | 588 m          | 48 m         | 575 m           |
| Travel Time (Total)                       | 20.5 veh-h/h   | 0.6 ped-h/h  | 25.2 pers-h/h   |
| Travel Time (Average)                     | 55.9 sec       | 50.1 sec     | 55.7 sec        |
| Travel Speed                              | 37.9 km/h      | 3.5 km/h     | 37.1 km/h       |
| Cost (Total)                              | 656.14 \$/h    | 11.21 \$/h   | 667.35 \$/h     |
| Fuel Consumption (Total)                  | 101.3 L/h      |              |                 |
| Carbon Dioxide (Total)                    | 254.1 kg/h     |              |                 |
| Hydrocarbons (Total)                      | 0.390 kg/h     |              |                 |
| Carbon Monoxide (Total)                   | 17.26 kg/h     |              |                 |
| NOx (Total)                               | 0.560 kg/h     |              |                 |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 634,611 veh/y    | 20,160 ped/y | 781,693 pers/y    |
| Delay                                    | 3,435 veh-h/y    | 73 ped-h/y   | 4,195 pers-h/y    |
| Effective Stops                          | 432,732 veh/y    | 11,340 ped/y | 530,618 pers/y    |
| Travel Distance                          | 373,436 veh-km/y | 970 ped-km/y | 449,092 pers-km/y |
| Travel Time                              | 9,851 veh-h/y    | 280 ped-h/y  | 12,101 pers-h/y   |
| Cost                                     | 314,947 \$/y     | 5,382 \$/y   | 320,329 \$/y      |
| Fuel Consumption                         | 48,610 L/y       |              |                   |
| Carbon Dioxide                           | 121,975 kg/y     |              |                   |
| Hydrocarbons                             | 187 kg/y         |              |                   |
| Carbon Monoxide                          | 8,285 kg/y       |              |                   |
| NOx                                      | 269 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 FU CT AM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |               | Prop. Queued | Effective Stop Rate | Average Speed |
|--------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|---------------|--------------|---------------------|---------------|
|                                |      | veh/h       | %            | v/c   | sec           |                  | veh               | Distance<br>m |              | per veh             | km/h          |
| South: New England Highway (S) |      |             |              |       |               |                  |                   |               |              |                     |               |
| 1                              | L    | 113         | 7.5          | 0.197 | 29.5          | LOS C            | 4.5               | 33.3          | 0.76         | 0.77                | 33.2          |
| 3                              | R    | 232         | 18.6         | 0.435 | 31.0          | LOS C            | 8.9               | 72.6          | 0.83         | 0.81                | 31.5          |
| Approach                       |      | 344         | 15.0         | 0.435 | 30.5          | LOS C            | 8.9               | 72.6          | 0.81         | 0.79                | 32.1          |
| East: New England Highway (E)  |      |             |              |       |               |                  |                   |               |              |                     |               |
| 4                              | L    | 320         | 10.5         | 0.437 | 19.6          | LOS B            | 9.0               | 68.5          | 0.62         | 0.78                | 38.0          |
| 5                              | T    | 434         | 2.2          | 0.430 | 12.5          | LOS A            | 12.0              | 85.4          | 0.66         | 0.58                | 42.6          |
| Approach                       |      | 754         | 5.7          | 0.437 | 15.5          | LOS B            | 12.0              | 85.4          | 0.64         | 0.66                | 40.6          |
| West: Sydney Street (W)        |      |             |              |       |               |                  |                   |               |              |                     |               |
| 11                             | T    | 158         | 10.0         | 0.164 | 11.8          | LOS A            | 4.4               | 33.8          | 0.55         | 0.50                | 43.5          |
| 12                             | R    | 66          | 3.2          | 0.214 | 25.7          | LOS B            | 2.7               | 19.1          | 0.70         | 0.75                | 34.1          |
| Approach                       |      | 224         | 8.0          | 0.214 | 15.9          | LOS B            | 4.4               | 33.8          | 0.60         | 0.58                | 40.2          |
| All Vehicles                   |      | 1322        | 8.5          | 0.437 | 19.5          | LOS B            | 12.0              | 85.4          | 0.68         | 0.68                | 37.9          |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

### Movement Performance - Pedestrians

| Mov ID          | Description       | Demand Flow | Average Delay | Level of Service | Average Back of Queue |          | Prop. Queued | Effective Stop Rate |
|-----------------|-------------------|-------------|---------------|------------------|-----------------------|----------|--------------|---------------------|
|                 |                   | ped/h       | sec           |                  | Pedestrian            | Distance |              |                     |
|                 |                   | ped/h       | sec           |                  | ped                   | m        |              | per ped             |
| P1              | Across S approach | 21          | 8.6           | LOS A            | 0.0                   | 0.0      | 0.46         | 0.46                |
| P7              | Across W approach | 21          | 17.6          | LOS B            | 0.0                   | 0.0      | 0.66         | 0.66                |
| All Pedestrians |                   | 42          | 13.1          |                  |                       |          | 0.56         | 0.56                |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

## INTERSECTION SUMMARY

Site: I-03 FU CT PM

2112974A Mangoola TIA

Signals - Fixed Time Cycle Time = 80 seconds

| Intersection Performance - Hourly Values  |                 |              |                  |
|-------------------------------------------|-----------------|--------------|------------------|
| Performance Measure                       | Vehicles        | Pedestrians  | Persons          |
| Demand Flows (Total)                      | 1806 veh/h      | 42 ped/h     | 2210 pers/h      |
| Percent Heavy Vehicles                    | 5.2%            |              |                  |
| Degree of Saturation                      | 0.717           | 0.004        |                  |
| Practical Spare Capacity                  | 25.4%           |              |                  |
| Effective Intersection Capacity           | 2518 veh/h      |              |                  |
| Control Delay (Total)                     | 12.18 veh-h/h   | 0.15 ped-h/h | 14.76 pers-h/h   |
| Control Delay (Average)                   | 24.3 sec        | 12.7 sec     | 24.1 sec         |
| Control Delay (Worst Lane)                | 36.5 sec        |              |                  |
| Control Delay (Worst Movement)            | 36.5 sec        | 13.8 sec     | 36.5 sec         |
| Geometric Delay (Average)                 | 5.2 sec         |              |                  |
| Stop-Line Delay (Average)                 | 19.1 sec        |              |                  |
| Level of Service (Aver. Int. Delay)       | LOS B           | LOS B        |                  |
| Level of Service (Worst Movement)         | LOS C           | LOS B        |                  |
| Level of Service (Worst Lane)             | LOS C           |              |                  |
| 95% Back of Queue - Vehicles (Worst Lane) | 18.3 veh        |              |                  |
| 95% Back of Queue - Distance (Worst Lane) | 135.0 m         |              |                  |
| Total Effective Stops                     | 1383 veh/h      | 24 ped/h     | 1683 pers/h      |
| Effective Stop Rate                       | 0.77 per veh    | 0.56 per ped | 0.76 per pers    |
| Proportion Queued                         | 0.80            | 0.56         | 0.79             |
| Performance Index                         | 70.2            | 0.7          | 71.0             |
| Travel Distance (Total)                   | 1050.7 veh-km/h | 2.0 ped-km/h | 1262.8 pers-km/h |
| Travel Distance (Average)                 | 582 m           | 48 m         | 572 m            |
| Travel Time (Total)                       | 30.2 veh-h/h    | 0.6 ped-h/h  | 36.8 pers-h/h    |
| Travel Time (Average)                     | 60.2 sec        | 49.7 sec     | 60.0 sec         |
| Travel Speed                              | 34.8 km/h       | 3.5 km/h     | 34.3 km/h        |
| Cost (Total)                              | 933.33 \$/h     | 11.13 \$/h   | 944.45 \$/h      |
| Fuel Consumption (Total)                  | 130.8 L/h       |              |                  |
| Carbon Dioxide (Total)                    | 327.6 kg/h      |              |                  |
| Hydrocarbons (Total)                      | 0.532 kg/h      |              |                  |
| Carbon Monoxide (Total)                   | 21.92 kg/h      |              |                  |
| NOx (Total)                               | 0.705 kg/h      |              |                  |

LOS (Aver. Int. Delay) for Vehicles is based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

LOS (Aver. Int. Delay) for Pedestrians is based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

LOS Method for individual pedestrian movements: Delay (HCM).

| Intersection Performance - Annual Values |                  |              |                   |
|------------------------------------------|------------------|--------------|-------------------|
| Performance Measure                      | Vehicles         | Pedestrians  | Persons           |
| Demand Flows (Total)                     | 867,032 veh/y    | 20,160 ped/y | 1,060,598 pers/y  |
| Delay                                    | 5,845 veh-h/y    | 71 ped-h/y   | 7,086 pers-h/y    |
| Effective Stops                          | 663,761 veh/y    | 11,340 ped/y | 807,853 pers/y    |
| Travel Distance                          | 504,330 veh-km/y | 970 ped-km/y | 606,166 pers-km/y |
| Travel Time                              | 14,490 veh-h/y   | 278 ped-h/y  | 17,666 pers-h/y   |
| Cost                                     | 447,996 \$/y     | 5,342 \$/y   | 453,338 \$/y      |
| Fuel Consumption                         | 62,767 L/y       |              |                   |
| Carbon Dioxide                           | 157,253 kg/y     |              |                   |
| Hydrocarbons                             | 255 kg/y         |              |                   |
| Carbon Monoxide                          | 10,519 kg/y      |              |                   |
| NOx                                      | 339 kg/y         |              |                   |

## MOVEMENT SUMMARY

Site: I-03 FU CT PM

2112974A Mangoolia TIA

Signals - Fixed Time Cycle Time = 80 seconds

### Movement Performance - Vehicles

| Mov ID                         | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|--------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                |      |             | %            | v/c   |               |                  | Vehicles          | Distance |              |                     |               |
|                                |      | veh/h       |              |       | sec           |                  | veh               | m        |              | per veh             | km/h          |
| South: New England Highway (S) |      |             |              |       |               |                  |                   |          |              |                     |               |
| 1                              | L    | 80          | 1.3          | 0.109 | 24.4          | LOS B            | 2.9               | 20.3     | 0.66         | 0.75                | 35.9          |
| 3                              | R    | 511         | 6.2          | 0.717 | 30.0          | LOS C            | 18.3              | 135.0    | 0.90         | 0.87                | 31.9          |
| Approach                       |      | 591         | 5.5          | 0.718 | 29.2          | LOS C            | 18.3              | 135.0    | 0.87         | 0.85                | 32.4          |
| East: New England Highway (E)  |      |             |              |       |               |                  |                   |          |              |                     |               |
| 4                              | L    | 483         | 7.6          | 0.708 | 26.2          | LOS B            | 15.9              | 118.8    | 0.81         | 0.84                | 33.9          |
| 5                              | T    | 263         | 2.0          | 0.304 | 15.1          | LOS B            | 8.2               | 58.5     | 0.68         | 0.57                | 40.5          |
| Approach                       |      | 746         | 5.6          | 0.708 | 22.2          | LOS B            | 15.9              | 118.8    | 0.76         | 0.75                | 36.0          |
| West: Sydney Street (W)        |      |             |              |       |               |                  |                   |          |              |                     |               |
| 11                             | T    | 375         | 3.1          | 0.436 | 17.4          | LOS B            | 11.7              | 83.8     | 0.73         | 0.66                | 38.7          |
| 12                             | R    | 95          | 7.8          | 0.441 | 36.5          | LOS C            | 4.6               | 34.5     | 0.89         | 0.79                | 29.0          |
| Approach                       |      | 469         | 4.0          | 0.441 | 21.3          | LOS B            | 11.7              | 83.8     | 0.76         | 0.69                | 36.2          |
| All Vehicles                   |      | 1806        | 5.2          | 0.717 | 24.3          | LOS B            | 18.3              | 135.0    | 0.80         | 0.77                | 34.8          |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on average delay for all vehicle movements.

### Movement Performance - Pedestrians

| Mov ID          | Description       | Demand Flow | Average Delay | Level of Service | Average Back of Queue |          | Prop. Queued | Effective Stop Rate |
|-----------------|-------------------|-------------|---------------|------------------|-----------------------|----------|--------------|---------------------|
|                 |                   |             |               |                  | Pedestrian            | Distance |              |                     |
|                 |                   | ped/h       | sec           |                  | ped                   | m        |              | per ped             |
| P1              | Across S approach | 21          | 11.6          | LOS B            | 0.0                   | 0.0      | 0.54         | 0.54                |
| P7              | Across W approach | 21          | 13.8          | LOS B            | 0.0                   | 0.0      | 0.59         | 0.59                |
| All Pedestrians |                   | 42          | 12.7          |                  |                       |          | 0.56         | 0.56                |

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

## INTERSECTION SUMMARY

Site: I-04 FU CT AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                 |
|-------------------------------------------|---------------|-----------------|
| Performance Measure                       | Vehicles      | Persons         |
| Demand Flows (Total)                      | 115 veh/h     | 138 pers/h      |
| Percent Heavy Vehicles                    | 6.4 %         |                 |
| Degree of Saturation                      | 0.028         |                 |
| Practical Spare Capacity                  | 2722.9 %      |                 |
| Effective Intersection Capacity           | 4049 veh/h    |                 |
| Control Delay (Total)                     | 0.29 veh-h/h  | 0.34 pers-h/h   |
| Control Delay (Average)                   | 9.0 sec       | 9.0 sec         |
| Control Delay (Worst Lane)                | 11.8 sec      |                 |
| Control Delay (Worst Movement)            | 12.9 sec      | 12.9 sec        |
| Geometric Delay (Average)                 | 8.8 sec       |                 |
| Stop-Line Delay (Average)                 | 0.1 sec       |                 |
| Level of Service (Aver. Int. Delay)       | NA            |                 |
| Level of Service (Worst Movement)         | LOS A         |                 |
| Level of Service (Worst Lane)             | LOS A         |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.0 m         |                 |
| Total Effective Stops                     | 67 veh/h      | 80 pers/h       |
| Effective Stop Rate                       | 0.58 per veh  | 0.58 per pers   |
| Proportion Queued                         | 0.08          | 0.08            |
| Performance Index                         | 1.6           | 1.6             |
| Travel Distance (Total)                   | 84.3 veh-km/h | 101.1 pers-km/h |
| Travel Distance (Average)                 | 735 m         | 735 m           |
| Travel Time (Total)                       | 1.2 veh-h/h   | 1.4 pers-h/h    |
| Travel Time (Average)                     | 37.4 sec      | 37.4 sec        |
| Travel Speed                              | 70.8 km/h     | 70.8 km/h       |
| Cost (Total)                              | 52.83 \$/h    | 52.83 \$/h      |
| Fuel Consumption (Total)                  | 13.8 L/h      |                 |
| Carbon Dioxide (Total)                    | 34.6 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.055 kg/h    |                 |
| Carbon Monoxide (Total)                   | 2.99 kg/h     |                 |
| NOx (Total)                               | 0.103 kg/h    |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 55,074 veh/y    | 66,088 pers/y    |
| Delay                                    | 137 veh-h/y     | 165 pers-h/y     |
| Effective Stops                          | 32,130 veh/y    | 38,555 pers/y    |
| Travel Distance                          | 40,457 veh-km/y | 48,548 pers-km/y |
| Travel Time                              | 571 veh-h/y     | 686 pers-h/y     |
| Cost                                     | 25,358 \$/y     | 25,358 \$/y      |
| Fuel Consumption                         | 6,616 L/y       |                  |
| Carbon Dioxide                           | 16,588 kg/y     |                  |
| Hydrocarbons                             | 27 kg/y         |                  |
| Carbon Monoxide                          | 1,436 kg/y      |                  |
| NOx                                      | 50 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-04 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                 | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                        |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Kayuga Road (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                      | L    | 44          | 11.9 | 0.028     | 12.9          | LOS A            | 0.0               | 0.0      | 0.00         | 0.79                | 64.8          |
| 2                      | T    | 4           | 25.0 | 0.028     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach               |      | 48          | 13.0 | 0.028     | 11.8          | LOS A            | 0.0               | 0.0      | 0.00         | 0.72                | 67.2          |
| North: Kayuga Road (N) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                      | T    | 28          | 0.0  | 0.024     | 0.2           | LOS A            | 0.1               | 1.0      | 0.14         | 0.00                | 91.0          |
| 9                      | R    | 13          | 0.0  | 0.024     | 12.3          | LOS A            | 0.1               | 1.0      | 0.14         | 1.15                | 65.7          |
| Approach               |      | 41          | 0.0  | 0.024     | 3.9           | LOS A            | 0.1               | 1.0      | 0.14         | 0.35                | 82.3          |
| West: Wybong Road (W)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                     | L    | 1           | 0.0  | 0.026     | 11.7          | LOS A            | 0.1               | 0.8      | 0.15         | 0.65                | 62.3          |
| 12                     | R    | 24          | 4.3  | 0.026     | 11.8          | LOS A            | 0.1               | 0.8      | 0.15         | 0.69                | 62.7          |
| Approach               |      | 25          | 4.2  | 0.026     | 11.8          | LOS A            | 0.1               | 0.8      | 0.15         | 0.69                | 62.6          |
| All Vehicles           |      | 115         | 6.4  | 0.028     | 9.0           | NA               | 0.1               | 1.0      | 0.08         | 0.58                | 70.8          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-04 FU CT PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 177 veh/h      | 212 pers/h      |
| Percent Heavy Vehicles                    | 3.6%           |                 |
| Degree of Saturation                      | 0.060          |                 |
| Practical Spare Capacity                  | 1227.1%        |                 |
| Effective Intersection Capacity           | 2934 veh/h     |                 |
| Control Delay (Total)                     | 0.36 veh-h/h   | 0.44 pers-h/h   |
| Control Delay (Average)                   | 7.4 sec        | 7.4 sec         |
| Control Delay (Worst Lane)                | 12.0 sec       |                 |
| Control Delay (Worst Movement)            | 13.2 sec       | 13.2 sec        |
| Geometric Delay (Average)                 | 7.2 sec        |                 |
| Stop-Line Delay (Average)                 | 0.2 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.3 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.9 m          |                 |
| Total Effective Stops                     | 94 veh/h       | 113 pers/h      |
| Effective Stop Rate                       | 0.53 per veh   | 0.53 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 2.5            | 2.5             |
| Travel Distance (Total)                   | 134.2 veh-km/h | 161.1 pers-km/h |
| Travel Distance (Average)                 | 759 m          | 759 m           |
| Travel Time (Total)                       | 1.8 veh-h/h    | 2.2 pers-h/h    |
| Travel Time (Average)                     | 36.9 sec       | 36.9 sec        |
| Travel Speed                              | 74.0 km/h      | 74.0 km/h       |
| Cost (Total)                              | 78.49 \$/h     | 78.49 \$/h      |
| Fuel Consumption (Total)                  | 20.1 L/h       |                 |
| Carbon Dioxide (Total)                    | 50.3 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.080 kg/h     |                 |
| Carbon Monoxide (Total)                   | 4.03 kg/h      |                 |
| NOx (Total)                               | 0.149 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 84,884 veh/y    | 101,861 pers/y   |
| Delay                                    | 174 veh-h/y     | 209 pers-h/y     |
| Effective Stops                          | 45,143 veh/y    | 54,172 pers/y    |
| Travel Distance                          | 64,434 veh-km/y | 77,321 pers-km/y |
| Travel Time                              | 870 veh-h/y     | 1,045 pers-h/y   |
| Cost                                     | 37,674 \$/y     | 37,674 \$/y      |
| Fuel Consumption                         | 9,646 L/y       |                  |
| Carbon Dioxide                           | 24,161 kg/y     |                  |
| Hydrocarbons                             | 39 kg/y         |                  |
| Carbon Monoxide                          | 1,934 kg/y      |                  |
| NOx                                      | 71 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-04 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                 | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                        |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Kayuga Road (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                      | L    | 41          | 2.6  | 0.048     | 12.4          | LOS A            | 0.0               | 0.0      | 0.00         | 1.10                | 64.8          |
| 2                      | T    | 51          | 0.0  | 0.048     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 100.0         |
| Approach               |      | 92          | 1.1  | 0.048     | 5.5           | LOS A            | 0.0               | 0.0      | 0.00         | 0.49                | 81.9          |
| North: Kayuga Road (N) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 8                      | T    | 20          | 10.5 | 0.018     | 0.4           | LOS A            | 0.1               | 0.9      | 0.21         | 0.00                | 87.5          |
| 9                      | R    | 8           | 12.5 | 0.018     | 13.2          | LOS A            | 0.1               | 0.9      | 0.21         | 1.17                | 66.0          |
| Approach               |      | 28          | 11.1 | 0.018     | 4.2           | LOS A            | 0.1               | 0.9      | 0.21         | 0.35                | 80.6          |
| West: Wybong Road (W)  |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                     | L    | 14          | 15.4 | 0.060     | 12.8          | LOS A            | 0.3               | 1.9      | 0.20         | 0.67                | 62.1          |
| 12                     | R    | 43          | 0.0  | 0.060     | 11.7          | LOS A            | 0.3               | 1.9      | 0.20         | 0.70                | 62.4          |
| Approach               |      | 57          | 3.7  | 0.060     | 12.0          | LOS A            | 0.3               | 1.9      | 0.20         | 0.69                | 62.4          |
| All Vehicles           |      | 177         | 3.6  | 0.060     | 7.4           | NA               | 0.3               | 1.9      | 0.10         | 0.53                | 74.0          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 FU CT AM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 583 veh/h      | 700 pers/h      |
| Percent Heavy Vehicles                    | 6.9%           |                 |
| Degree of Saturation                      | 0.232          |                 |
| Practical Spare Capacity                  | 244.8%         |                 |
| Effective Intersection Capacity           | 2513 veh/h     |                 |
| Control Delay (Total)                     | 1.39 veh-h/h   | 1.67 pers-h/h   |
| Control Delay (Average)                   | 8.6 sec        | 8.6 sec         |
| Control Delay (Worst Lane)                | 13.6 sec       |                 |
| Control Delay (Worst Movement)            | 13.6 sec       | 13.6 sec        |
| Geometric Delay (Average)                 | 8.2 sec        |                 |
| Stop-Line Delay (Average)                 | 0.4 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.4 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 10.0 m         |                 |
| Total Effective Stops                     | 276 veh/h      | 331 pers/h      |
| Effective Stop Rate                       | 0.47 per veh   | 0.47 per pers   |
| Proportion Queued                         | 0.17           | 0.17            |
| Performance Index                         | 7.7            | 7.7             |
| Travel Distance (Total)                   | 374.6 veh-km/h | 449.5 pers-km/h |
| Travel Distance (Average)                 | 642 m          | 642 m           |
| Travel Time (Total)                       | 5.6 veh-h/h    | 6.8 pers-h/h    |
| Travel Time (Average)                     | 34.8 sec       | 34.8 sec        |
| Travel Speed                              | 66.4 km/h      | 66.4 km/h       |
| Cost (Total)                              | 214.82 \$/h    | 214.82 \$/h     |
| Fuel Consumption (Total)                  | 45.7 L/h       |                 |
| Carbon Dioxide (Total)                    | 114.5 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.173 kg/h     |                 |
| Carbon Monoxide (Total)                   | 7.53 kg/h      |                 |
| NOx (Total)                               | 0.300 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 279,916 veh/y    | 335,899 pers/y    |
| Delay                                    | 670 veh-h/y      | 804 pers-h/y      |
| Effective Stops                          | 132,450 veh/y    | 158,939 pers/y    |
| Travel Distance                          | 179,808 veh-km/y | 215,770 pers-km/y |
| Travel Time                              | 2,709 veh-h/y    | 3,250 pers-h/y    |
| Cost                                     | 103,112 \$/y     | 103,112 \$/y      |
| Fuel Consumption                         | 21,916 L/y       |                   |
| Carbon Dioxide                           | 54,960 kg/y      |                   |
| Hydrocarbons                             | 83 kg/y          |                   |
| Carbon Monoxide                          | 3,615 kg/y       |                   |
| NOx                                      | 144 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 FU CT AM

2112974A Mangoola TIA  
 Giveaway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                        | Turn | Demand Flow<br>veh/h | HV Deg. Satn<br>% | Satn<br>v/c | Average Delay<br>sec | Level of Service | 95% Back of Queue<br>Vehicles<br>veh | Distance<br>m | Prop. Queued | Effective Stop Rate<br>per veh | Average Speed<br>km/h |
|-------------------------------|------|----------------------|-------------------|-------------|----------------------|------------------|--------------------------------------|---------------|--------------|--------------------------------|-----------------------|
| East: Denman Road (E)         |      |                      |                   |             |                      |                  |                                      |               |              |                                |                       |
| 5                             | T    | 94                   | 12.4              | 0.052       | 2.4                  | LOS A            | 0.0                                  | 0.0           | 0.00         | 0.16                           | 87.5                  |
| 6                             | R    | 291                  | 5.8               | 0.232       | 13.6                 | LOS A            | 1.4                                  | 10.0          | 0.29         | 0.71                           | 61.4                  |
| Approach                      |      | 384                  | 7.4               | 0.232       | 10.8                 | LOS A            | 1.4                                  | 10.0          | 0.22         | 0.58                           | 66.8                  |
| North: Bengalla Link Road (N) |      |                      |                   |             |                      |                  |                                      |               |              |                                |                       |
| 7                             | L    | 58                   | 12.7              | 0.070       | 10.8                 | LOS A            | 0.3                                  | 2.5           | 0.26         | 0.65                           | 49.9                  |
| 9                             | R    | 3                    | 33.3              | 0.070       | 11.7                 | LOS A            | 0.3                                  | 2.5           | 0.26         | 0.79                           | 49.9                  |
| Approach                      |      | 61                   | 13.8              | 0.070       | 10.8                 | LOS A            | 0.3                                  | 2.5           | 0.26         | 0.66                           | 49.9                  |
| West: Denman Road (W)         |      |                      |                   |             |                      |                  |                                      |               |              |                                |                       |
| 10                            | L    | 19                   | 5.6               | 0.011       | 10.3                 | LOS A            | 0.0                                  | 0.0           | 0.00         | 0.71                           | 57.1                  |
| 11                            | T    | 119                  | 1.8               | 0.062       | 0.0                  | LOS A            | 0.0                                  | 0.0           | 0.00         | 0.00                           | 80.0                  |
| Approach                      |      | 138                  | 2.3               | 0.062       | 1.4                  | LOS A            | 0.0                                  | 0.0           | 0.00         | 0.10                           | 76.3                  |
| All Vehicles                  |      | 583                  | 6.9               | 0.232       | 8.6                  | NA               | 1.4                                  | 10.0          | 0.17         | 0.47                           | 66.4                  |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-05 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 584 veh/h      | 701 pers/h      |
| Percent Heavy Vehicles                    | 4.3%           |                 |
| Degree of Saturation                      | 0.234          |                 |
| Practical Spare Capacity                  | 242.0%         |                 |
| Effective Intersection Capacity           | 2498 veh/h     |                 |
| Control Delay (Total)                     | 1.04 veh-h/h   | 1.25 pers-h/h   |
| Control Delay (Average)                   | 6.4 sec        | 6.4 sec         |
| Control Delay (Worst Lane)                | 13.2 sec       |                 |
| Control Delay (Worst Movement)            | 13.2 sec       | 13.2 sec        |
| Geometric Delay (Average)                 | 6.1 sec        |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 1.2 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 9.0 m          |                 |
| Total Effective Stops                     | 236 veh/h      | 284 pers/h      |
| Effective Stop Rate                       | 0.40 per veh   | 0.40 per pers   |
| Proportion Queued                         | 0.13           | 0.13            |
| Performance Index                         | 8.1            | 8.1             |
| Travel Distance (Total)                   | 394.5 veh-km/h | 473.5 pers-km/h |
| Travel Distance (Average)                 | 675 m          | 675 m           |
| Travel Time (Total)                       | 6.2 veh-h/h    | 7.4 pers-h/h    |
| Travel Time (Average)                     | 38.2 sec       | 38.2 sec        |
| Travel Speed                              | 63.7 km/h      | 63.7 km/h       |
| Cost (Total)                              | 231.24\$/h     | 231.24\$/h      |
| Fuel Consumption (Total)                  | 48.2 L/h       |                 |
| Carbon Dioxide (Total)                    | 120.8 kg/h     |                 |
| Hydrocarbons (Total)                      | 0.188 kg/h     |                 |
| Carbon Monoxide (Total)                   | 8.58 kg/h      |                 |
| NOx (Total)                               | 0.314 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                  |                   |
|------------------------------------------|------------------|-------------------|
| Performance Measure                      | Vehicles         | Persons           |
| Demand Flows (Total)                     | 280,421 veh/y    | 336,505 pers/y    |
| Delay                                    | 498 veh-h/y      | 598 pers-h/y      |
| Effective Stops                          | 113,448 veh/y    | 136,137 pers/y    |
| Travel Distance                          | 189,381 veh-km/y | 227,257 pers-km/y |
| Travel Time                              | 2,973 veh-h/y    | 3,568 pers-h/y    |
| Cost                                     | 110,993\$/y      | 110,993\$/y       |
| Fuel Consumption                         | 23,150 L/y       |                   |
| Carbon Dioxide                           | 57,980 kg/y      |                   |
| Hydrocarbons                             | 90 kg/y          |                   |
| Carbon Monoxide                          | 4,120 kg/y       |                   |
| NOx                                      | 151 kg/y         |                   |

## MOVEMENT SUMMARY

Site: I-05 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                        | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|-------------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                               |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| East: Denman Road (E)         |      |             |              |               |                  |                   |     |              |                     |               |
| 5                             | T    | 166         | 2.5          | 0.087         | 2.4              | LOS A             | 0.0 | 0.0          | 0.00                | 87.5          |
| 6                             | R    | 66          | 3.2          | 0.051         | 13.2             | LOS A             | 0.3 | 1.9          | 0.21                | 61.9          |
| Approach                      |      | 233         | 2.7          | 0.087         | 5.5              | LOS A             | 0.3 | 1.9          | 0.06                | 79.1          |
| North: Bengalla Link Road (N) |      |             |              |               |                  |                   |     |              |                     |               |
| 7                             | L    | 237         | 5.3          | 0.232         | 10.1             | LOS A             | 1.2 | 9.0          | 0.25                | 50.0          |
| 9                             | R    | 6           | 0.0          | 0.234         | 9.9              | LOS A             | 1.2 | 9.0          | 0.25                | 50.1          |
| Approach                      |      | 243         | 5.2          | 0.232         | 10.1             | LOS A             | 1.2 | 9.0          | 0.25                | 50.0          |
| West: Denman Road (W)         |      |             |              |               |                  |                   |     |              |                     |               |
| 10                            | L    | 2           | 0.0          | 0.001         | 10.1             | LOS A             | 0.0 | 0.0          | 0.00                | 57.1          |
| 11                            | T    | 106         | 5.9          | 0.057         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 80.0          |
| Approach                      |      | 108         | 5.8          | 0.057         | 0.2              | LOS A             | 0.0 | 0.0          | 0.00                | 79.5          |
| All Vehicles                  |      | 584         | 4.3          | 0.234         | 6.4              | NA                | 1.2 | 9.0          | 0.13                | 63.7          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 251 veh/h      | 301 pers/h      |
| Percent Heavy Vehicles                    | 7.1 %          |                 |
| Degree of Saturation                      | 0.104          |                 |
| Practical Spare Capacity                  | 667.6 %        |                 |
| Effective Intersection Capacity           | 2404 veh/h     |                 |
| Control Delay (Total)                     | 0.68 veh-h/h   | 0.82 pers-h/h   |
| Control Delay (Average)                   | 9.8 sec        | 9.8 sec         |
| Control Delay (Worst Lane)                | 13.7 sec       |                 |
| Control Delay (Worst Movement)            | 13.8 sec       | 13.8 sec        |
| Geometric Delay (Average)                 | 9.5 sec        |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.4 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 3.2 m          |                 |
| Total Effective Stops                     | 134 veh/h      | 161 pers/h      |
| Effective Stop Rate                       | 0.53 per veh   | 0.53 per pers   |
| Proportion Queued                         | 0.09           | 0.09            |
| Performance Index                         | 3.7            | 3.7             |
| Travel Distance (Total)                   | 195.6 veh-km/h | 234.7 pers-km/h |
| Travel Distance (Average)                 | 781 m          | 781 m           |
| Travel Time (Total)                       | 2.7 veh-h/h    | 3.3 pers-h/h    |
| Travel Time (Average)                     | 39.3 sec       | 39.3 sec        |
| Travel Speed                              | 71.5 km/h      | 71.5 km/h       |
| Cost (Total)                              | 134.32 \$/h    | 134.32 \$/h     |
| Fuel Consumption (Total)                  | 38.4 L/h       |                 |
| Carbon Dioxide (Total)                    | 96.4 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.154 kg/h     |                 |
| Carbon Monoxide (Total)                   | 9.38 kg/h      |                 |
| NOx (Total)                               | 0.300 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                   |
|------------------------------------------|-----------------|-------------------|
| Performance Measure                      | Vehicles        | Persons           |
| Demand Flows (Total)                     | 120,253 veh/y   | 144,303 pers/y    |
| Delay                                    | 328 veh-h/y     | 393 pers-h/y      |
| Effective Stops                          | 64,251 veh/y    | 77,101 pers/y     |
| Travel Distance                          | 93,880 veh-km/y | 112,656 pers-km/y |
| Travel Time                              | 1,314 veh-h/y   | 1,577 pers-h/y    |
| Cost                                     | 64,473 \$/y     | 64,473 \$/y       |
| Fuel Consumption                         | 18,449 L/y      |                   |
| Carbon Dioxide                           | 46,271 kg/y     |                   |
| Hydrocarbons                             | 74 kg/y         |                   |
| Carbon Monoxide                          | 4,501 kg/y      |                   |
| NOx                                      | 144 kg/y        |                   |

## MOVEMENT SUMMARY

Site: I-06 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                              |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                            | T    | 66          | 3.2  | 0.035     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 85.2          |
| 6                            | R    | 24          | 13.0 | 0.020     | 12.4          | LOS A            | 0.1               | 0.8      | 0.18         | 0.68                | 62.6          |
| Approach                     |      | 91          | 5.8  | 0.035     | 3.3           | LOS A            | 0.1               | 0.8      | 0.05         | 0.18                | 77.8          |
| North: Wybong Road (N)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 7                            | L    | 11          | 0.0  | 0.104     | 13.1          | LOS A            | 0.4               | 3.2      | 0.21         | 0.66                | 63.3          |
| 9                            | R    | 73          | 5.8  | 0.104     | 13.8          | LOS A            | 0.4               | 3.2      | 0.21         | 0.73                | 67.8          |
| Approach                     |      | 83          | 5.1  | 0.104     | 13.7          | LOS A            | 0.4               | 3.2      | 0.21         | 0.72                | 67.2          |
| West: Wybong Road (W)        |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                           | L    | 76          | 11.1 | 0.044     | 13.4          | LOS A            | 0.0               | 0.0      | 0.00         | 0.76                | 69.1          |
| 11                           | T    | 1           | 0.0  | 0.001     | 2.4           | LOS A            | 0.0               | 0.0      | 0.00         | 0.17                | 87.5          |
| Approach                     |      | 77          | 11.0 | 0.044     | 13.2          | LOS A            | 0.0               | 0.0      | 0.00         | 0.75                | 69.3          |
| All Vehicles                 |      | 251         | 7.1  | 0.104     | 9.8           | NA               | 0.4               | 3.2      | 0.09         | 0.53                | 71.5          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-06 FU CT PM

2112974A Mangoola TIA  
Giveaway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 271 veh/h      | 325 pers/h      |
| Percent Heavy Vehicles                    | 5.8%           |                 |
| Degree of Saturation                      | 0.140          |                 |
| Practical Spare Capacity                  | 470.0%         |                 |
| Effective Intersection Capacity           | 1928 veh/h     |                 |
| Control Delay (Total)                     | 0.80 veh-h/h   | 0.95 pers-h/h   |
| Control Delay (Average)                   | 10.6 sec       | 10.6 sec        |
| Control Delay (Worst Lane)                | 14.0 sec       |                 |
| Control Delay (Worst Movement)            | 14.1 sec       | 14.1 sec        |
| Geometric Delay (Average)                 | 10.2 sec       |                 |
| Stop-Line Delay (Average)                 | 0.4 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.6 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 4.7 m          |                 |
| Total Effective Stops                     | 158 veh/h      | 189 pers/h      |
| Effective Stop Rate                       | 0.58 per veh   | 0.58 per pers   |
| Proportion Queued                         | 0.12           | 0.12            |
| Performance Index                         | 4.0            | 4.0             |
| Travel Distance (Total)                   | 203.1 veh-km/h | 243.8 pers-km/h |
| Travel Distance (Average)                 | 751 m          | 751 m           |
| Travel Time (Total)                       | 2.9 veh-h/h    | 3.5 pers-h/h    |
| Travel Time (Average)                     | 38.3 sec       | 38.3 sec        |
| Travel Speed                              | 70.6 km/h      | 70.6 km/h       |
| Cost (Total)                              | 133.72 \$/h    | 133.72 \$/h     |
| Fuel Consumption (Total)                  | 36.5 L/h       |                 |
| Carbon Dioxide (Total)                    | 91.5 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.153 kg/h     |                 |
| Carbon Monoxide (Total)                   | 8.97 kg/h      |                 |
| NOx (Total)                               | 0.283 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                   |
|------------------------------------------|-----------------|-------------------|
| Performance Measure                      | Vehicles        | Persons           |
| Demand Flows (Total)                     | 129,853 veh/y   | 155,823 pers/y    |
| Delay                                    | 382 veh-h/y     | 458 pers-h/y      |
| Effective Stops                          | 75,745 veh/y    | 90,894 pers/y     |
| Travel Distance                          | 97,510 veh-km/y | 117,012 pers-km/y |
| Travel Time                              | 1,380 veh-h/y   | 1,656 pers-h/y    |
| Cost                                     | 64,183 \$/y     | 64,183 \$/y       |
| Fuel Consumption                         | 17,518 L/y      |                   |
| Carbon Dioxide                           | 43,916 kg/y     |                   |
| Hydrocarbons                             | 73 kg/y         |                   |
| Carbon Monoxide                          | 4,306 kg/y      |                   |
| NOx                                      | 136 kg/y        |                   |

## MOVEMENT SUMMARY

Site: I-06 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                       | Turn | Demand Flow | HV Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------|------|-------------|--------------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                              |      | veh/h       | %            | v/c           | sec              |                   |     |              | per veh             | km/h          |
| East: Bengalla Link Road (E) |      |             |              |               |                  |                   |     |              |                     |               |
| 5                            | T    | 5           | 20.0         | 0.003         | 0.0              | LOS A             | 0.0 | 0.0          | 0.00                | 85.2          |
| 6                            | R    | 26          | 8.0          | 0.021         | 12.2             | LOS A             | 0.1 | 0.8          | 0.23                | 62.3          |
| Approach                     |      | 32          | 10.0         | 0.021         | 10.2             | LOS A             | 0.1 | 0.8          | 0.19                | 65.3          |
| North: Wybong Road (N)       |      |             |              |               |                  |                   |     |              |                     |               |
| 7                            | L    | 25          | 16.7         | 0.140         | 14.1             | LOS A             | 0.6 | 4.7          | 0.25                | 63.0          |
| 9                            | R    | 86          | 7.3          | 0.140         | 14.0             | LOS A             | 0.6 | 4.7          | 0.25                | 67.6          |
| Approach                     |      | 112         | 9.4          | 0.140         | 14.0             | LOS A             | 0.6 | 4.7          | 0.25                | 66.6          |
| West: Wybong Road (W)        |      |             |              |               |                  |                   |     |              |                     |               |
| 10                           | L    | 65          | 3.2          | 0.036         | 12.8             | LOS A             | 0.0 | 0.0          | 0.00                | 69.1          |
| 11                           | T    | 62          | 0.0          | 0.032         | 2.4              | LOS A             | 0.0 | 0.0          | 0.00                | 87.5          |
| Approach                     |      | 127         | 1.7          | 0.036         | 7.7              | LOS A             | 0.0 | 0.0          | 0.00                | 76.5          |
| All Vehicles                 |      | 271         | 5.8          | 0.140         | 10.6             | NA                | 0.6 | 4.7          | 0.12                | 70.6          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 282 veh/h      | 339 pers/h      |
| Percent Heavy Vehicles                    | 5.2%           |                 |
| Degree of Saturation                      | 0.089          |                 |
| Practical Spare Capacity                  | 795.7%         |                 |
| Effective Intersection Capacity           | 3159 veh/h     |                 |
| Control Delay (Total)                     | 0.69 veh-h/h   | 0.83 pers-h/h   |
| Control Delay (Average)                   | 8.9 sec        | 8.9 sec         |
| Control Delay (Worst Lane)                | 11.0 sec       |                 |
| Control Delay (Worst Movement)            | 12.1 sec       | 12.1 sec        |
| Geometric Delay (Average)                 | 8.6 sec        |                 |
| Stop-Line Delay (Average)                 | 0.3 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.3 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 1.9 m          |                 |
| Total Effective Stops                     | 175 veh/h      | 209 pers/h      |
| Effective Stop Rate                       | 0.62 per veh   | 0.62 per pers   |
| Proportion Queued                         | 0.10           | 0.10            |
| Performance Index                         | 4.0            | 4.0             |
| Travel Distance (Total)                   | 153.2 veh-km/h | 183.9 pers-km/h |
| Travel Distance (Average)                 | 543 m          | 543 m           |
| Travel Time (Total)                       | 2.7 veh-h/h    | 3.3 pers-h/h    |
| Travel Time (Average)                     | 35.0 sec       | 35.0 sec        |
| Travel Speed                              | 55.8 km/h      | 55.8 km/h       |
| Cost (Total)                              | 96.43 \$/h     | 96.43 \$/h      |
| Fuel Consumption (Total)                  | 18.1 L/h       |                 |
| Carbon Dioxide (Total)                    | 45.3 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.069 kg/h     |                 |
| Carbon Monoxide (Total)                   | 3.09 kg/h      |                 |
| NOx (Total)                               | 0.113 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 135,411 veh/y   | 162,493 pers/y   |
| Delay                                    | 333 veh-h/y     | 400 pers-h/y     |
| Effective Stops                          | 83,772 veh/y    | 100,526 pers/y   |
| Travel Distance                          | 73,547 veh-km/y | 88,256 pers-km/y |
| Travel Time                              | 1,318 veh-h/y   | 1,581 pers-h/y   |
| Cost                                     | 46,288 \$/y     | 46,288 \$/y      |
| Fuel Consumption                         | 8,680 L/y       |                  |
| Carbon Dioxide                           | 21,753 kg/y     |                  |
| Hydrocarbons                             | 33 kg/y         |                  |
| Carbon Monoxide                          | 1,484 kg/y      |                  |
| NOx                                      | 54 kg/y         |                  |

# MOVEMENT SUMMARY

Site: I-07 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Movement Performance - Vehicles |      |             |      |           |               |                  |                   |     |              |                     |               |
|---------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
| Mov ID                          | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|                                 |      | Vehicles    |      |           |               |                  | Distance          | veh |              |                     |               |
| veh/h                           |      |             |      |           |               |                  |                   |     |              |                     |               |
| %                               |      |             |      |           |               |                  |                   |     |              |                     |               |
| v/c                             |      |             |      |           |               |                  |                   |     |              |                     |               |
| sec                             |      |             |      |           |               |                  |                   |     |              |                     |               |
| veh                             |      |             |      |           |               |                  |                   |     |              |                     |               |
| m                               |      |             |      |           |               |                  |                   |     |              |                     |               |
| per veh                         |      |             |      |           |               |                  |                   |     |              |                     |               |
| km/h                            |      |             |      |           |               |                  |                   |     |              |                     |               |
| South: Site Access Road (S)     |      |             |      |           |               |                  |                   |     |              |                     |               |
| 1                               | L    | 17          | 12.5 | 0.059     | 7.1           | LOS A            | 0.3               | 1.9 | 0.23         | 0.56                | 39.3          |
| 3                               | R    | 37          | 5.7  | 0.059     | 6.9           | LOS A            | 0.3               | 1.9 | 0.23         | 0.60                | 38.4          |
| Approach                        |      | 54          | 7.8  | 0.059     | 7.0           | LOS A            | 0.3               | 1.9 | 0.23         | 0.59                | 38.9          |
| East: Wybong Road (E)           |      |             |      |           |               |                  |                   |     |              |                     |               |
| 4                               | L    | 162         | 3.2  | 0.089     | 11.0          | LOS A            | 0.0               | 0.0 | 0.00         | 0.73                | 57.6          |
| 5                               | T    | 12          | 18.2 | 0.007     | 0.0           | LOS A            | 0.0               | 0.0 | 0.00         | 0.00                | 80.0          |
| Approach                        |      | 174         | 4.2  | 0.089     | 10.3          | LOS A            | 0.0               | 0.0 | 0.00         | 0.68                | 59.0          |
| West: Wybong Road (W)           |      |             |      |           |               |                  |                   |     |              |                     |               |
| 11                              | T    | 28          | 3.7  | 0.037     | 0.7           | LOS A            | 0.2               | 1.7 | 0.28         | 0.00                | 68.7          |
| 12                              | R    | 26          | 8.0  | 0.037     | 12.1          | LOS A            | 0.2               | 1.7 | 0.28         | 0.96                | 58.0          |
| Approach                        |      | 55          | 5.8  | 0.037     | 6.2           | LOS A            | 0.2               | 1.7 | 0.28         | 0.46                | 63.7          |
| All Vehicles                    |      | 282         | 5.2  | 0.089     | 8.9           | NA               | 0.3               | 1.9 | 0.10         | 0.62                | 55.8          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-07 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |                |                 |
|-------------------------------------------|----------------|-----------------|
| Performance Measure                       | Vehicles       | Persons         |
| Demand Flows (Total)                      | 264 veh/h      | 317 pers/h      |
| Percent Heavy Vehicles                    | 6.4 %          |                 |
| Degree of Saturation                      | 0.192          |                 |
| Practical Spare Capacity                  | 316.1 %        |                 |
| Effective Intersection Capacity           | 1374 veh/h     |                 |
| Control Delay (Total)                     | 0.39 veh-h/h   | 0.47 pers-h/h   |
| Control Delay (Average)                   | 5.3 sec        | 5.3 sec         |
| Control Delay (Worst Lane)                | 11.8 sec       |                 |
| Control Delay (Worst Movement)            | 11.8 sec       | 11.8 sec        |
| Geometric Delay (Average)                 | 5.0 sec        |                 |
| Stop-Line Delay (Average)                 | 0.4 sec        |                 |
| Level of Service (Aver. Int. Delay)       | NA             |                 |
| Level of Service (Worst Movement)         | LOS A          |                 |
| Level of Service (Worst Lane)             | LOS A          |                 |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.9 veh        |                 |
| 95% Back of Queue - Distance (Worst Lane) | 6.7 m          |                 |
| Total Effective Stops                     | 120 veh/h      | 144 pers/h      |
| Effective Stop Rate                       | 0.45 per veh   | 0.45 per pers   |
| Proportion Queued                         | 0.15           | 0.15            |
| Performance Index                         | 3.5            | 3.5             |
| Travel Distance (Total)                   | 112.1 veh-km/h | 134.6 pers-km/h |
| Travel Distance (Average)                 | 424 m          | 424 m           |
| Travel Time (Total)                       | 2.2 veh-h/h    | 2.7 pers-h/h    |
| Travel Time (Average)                     | 30.6 sec       | 30.6 sec        |
| Travel Speed                              | 49.9 km/h      | 49.9 km/h       |
| Cost (Total)                              | 90.89 \$/h     | 90.89 \$/h      |
| Fuel Consumption (Total)                  | 21.2 L/h       |                 |
| Carbon Dioxide (Total)                    | 53.1 kg/h      |                 |
| Hydrocarbons (Total)                      | 0.087 kg/h     |                 |
| Carbon Monoxide (Total)                   | 5.14 kg/h      |                 |
| NOx (Total)                               | 0.145 kg/h     |                 |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 126,821 veh/y   | 152,185 pers/y   |
| Delay                                    | 188 veh-h/y     | 226 pers-h/y     |
| Effective Stops                          | 57,573 veh/y    | 69,088 pers/y    |
| Travel Distance                          | 53,831 veh-km/y | 64,597 pers-km/y |
| Travel Time                              | 1,080 veh-h/y   | 1,296 pers-h/y   |
| Cost                                     | 43,626 \$/y     | 43,626 \$/y      |
| Fuel Consumption                         | 10,172 L/y      |                  |
| Carbon Dioxide                           | 25,501 kg/y     |                  |
| Hydrocarbons                             | 42 kg/y         |                  |
| Carbon Monoxide                          | 2,467 kg/y      |                  |
| NOx                                      | 70 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-07 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                      | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|-----------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                             |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| South: Site Access Road (S) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 1                           | L    | 21          | 5.0  | 0.191     | 6.6           | LOS A            | 0.9               | 6.7      | 0.20         | 0.55                | 39.4          |
| 3                           | R    | 164         | 2.6  | 0.192     | 6.6           | LOS A            | 0.9               | 6.7      | 0.20         | 0.58                | 38.6          |
| Approach                    |      | 185         | 2.8  | 0.192     | 6.6           | LOS A            | 0.9               | 6.7      | 0.20         | 0.58                | 38.8          |
| East: Wybong Road (E)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 4                           | L    | 13          | 25.0 | 0.008     | 11.8          | LOS A            | 0.0               | 0.0      | 0.00         | 0.72                | 57.6          |
| 5                           | T    | 45          | 7.0  | 0.024     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                    |      | 58          | 10.9 | 0.024     | 2.6           | LOS A            | 0.0               | 0.0      | 0.00         | 0.16                | 74.7          |
| West: Wybong Road (W)       |      |             |      |           |               |                  |                   |          |              |                     |               |
| 11                          | T    | 18          | 29.4 | 0.013     | 0.2           | LOS A            | 0.1               | 0.6      | 0.15         | 0.00                | 74.3          |
| 12                          | R    | 3           | 0.0  | 0.013     | 11.3          | LOS A            | 0.1               | 0.6      | 0.15         | 1.01                | 57.8          |
| Approach                    |      | 21          | 25.0 | 0.013     | 1.9           | LOS A            | 0.1               | 0.6      | 0.15         | 0.15                | 71.8          |
| All Vehicles                |      | 264         | 6.4  | 0.192     | 5.3           | NA               | 0.9               | 6.7      | 0.15         | 0.45                | 49.9          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-08 FU CT AM

2112974A Mangoola TIA  
 Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 79 veh/h      | 95 pers/h      |
| Percent Heavy Vehicles                    | 4.0 %         |                |
| Degree of Saturation                      | 0.026         |                |
| Practical Spare Capacity                  | 3009.5 %      |                |
| Effective Intersection Capacity           | 3069 veh/h    |                |
| Control Delay (Total)                     | 0.04 veh-h/h  | 0.05 pers-h/h  |
| Control Delay (Average)                   | 1.9 sec       | 1.9 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.8 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.1 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 0.6 m         |                |
| Total Effective Stops                     | 10 veh/h      | 12 pers/h      |
| Effective Stop Rate                       | 0.13 per veh  | 0.13 per pers  |
| Proportion Queued                         | 0.05          | 0.05           |
| Performance Index                         | 0.8           | 0.8            |
| Travel Distance (Total)                   | 54.5 veh-km/h | 65.4 pers-km/h |
| Travel Distance (Average)                 | 690 m         | 690 m          |
| Travel Time (Total)                       | 0.7 veh-h/h   | 0.9 pers-h/h   |
| Travel Time (Average)                     | 33.4 sec      | 33.4 sec       |
| Travel Speed                              | 74.4 km/h     | 74.4 km/h      |
| Cost (Total)                              | 26.79 \$/h    | 26.79 \$/h     |
| Fuel Consumption (Total)                  | 5.4 L/h       |                |
| Carbon Dioxide (Total)                    | 13.6 kg/h     |                |
| Hydrocarbons (Total)                      | 0.018 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.55 kg/h     |                |
| NOx (Total)                               | 0.032 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 37,895 veh/y    | 45,474 pers/y    |
| Delay                                    | 20 veh-h/y      | 24 pers-h/y      |
| Effective Stops                          | 4,918 veh/y     | 5,902 pers/y     |
| Travel Distance                          | 26,140 veh-km/y | 31,368 pers-km/y |
| Travel Time                              | 351 veh-h/y     | 422 pers-h/y     |
| Cost                                     | 12,861 \$/y     | 12,861 \$/y      |
| Fuel Consumption                         | 2,615 L/y       |                  |
| Carbon Dioxide                           | 6,550 kg/y      |                  |
| Hydrocarbons                             | 9 kg/y          |                  |
| Carbon Monoxide                          | 264 kg/y        |                  |
| NOx                                      | 15 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 FU CT AM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                                   | Turn | Demand Flow | HV Deg. Satn |       | Average Delay | Level of Service | 95% Back of Queue |     | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------------------|------|-------------|--------------|-------|---------------|------------------|-------------------|-----|--------------|---------------------|---------------|
|                                          |      | veh/h       | %            | v/c   |               |                  | sec               | veh |              |                     |               |
| East: Wybong Road (E)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 5                                        | T    | 16          | 13.3         | 0.013 | 0.2           | LOS A            | 0.1               | 0.6 | 0.14         | 0.00                | 74.7          |
| 6                                        | R    | 5           | 0.0          | 0.013 | 10.3          | LOS A            | 0.1               | 0.6 | 0.14         | 0.85                | 59.8          |
| Approach                                 |      | 21          | 10.0         | 0.013 | 2.7           | LOS A            | 0.1               | 0.6 | 0.14         | 0.21                | 70.4          |
| North West: Wybong Post Office Road (NW) |      |             |              |       |               |                  |                   |     |              |                     |               |
| 27                                       | L    | 6           | 0.0          | 0.007 | 10.8          | LOS A            | 0.0               | 0.2 | 0.13         | 0.68                | 58.6          |
| 29                                       | R    | 1           | 0.0          | 0.007 | 11.8          | LOS A            | 0.0               | 0.2 | 0.13         | 0.71                | 57.4          |
| Approach                                 |      | 7           | 0.0          | 0.007 | 11.0          | LOS A            | 0.0               | 0.2 | 0.13         | 0.69                | 58.4          |
| West: Wybong Road (W)                    |      |             |              |       |               |                  |                   |     |              |                     |               |
| 10                                       | L    | 1           | 0.0          | 0.002 | 12.5          | LOS A            | 0.0               | 0.0 | 0.03         | 0.69                | 57.1          |
| 11                                       | T    | 49          | 2.1          | 0.026 | 0.0           | LOS A            | 0.0               | 0.0 | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 51          | 2.1          | 0.026 | 0.3           | LOS A            | 0.0               | 0.0 | 0.00         | 0.01                | 79.3          |
| All Vehicles                             |      | 79          | 4.0          | 0.026 | 1.9           | NA               | 0.1               | 0.6 | 0.05         | 0.13                | 74.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

## INTERSECTION SUMMARY

Site: I-08 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

| Intersection Performance - Hourly Values  |               |                |
|-------------------------------------------|---------------|----------------|
| Performance Measure                       | Vehicles      | Persons        |
| Demand Flows (Total)                      | 95 veh/h      | 114 pers/h     |
| Percent Heavy Vehicles                    | 5.6 %         |                |
| Degree of Saturation                      | 0.037         |                |
| Practical Spare Capacity                  | 2085.0 %      |                |
| Effective Intersection Capacity           | 2588 veh/h    |                |
| Control Delay (Total)                     | 0.04 veh-h/h  | 0.05 pers-h/h  |
| Control Delay (Average)                   | 1.5 sec       | 1.5 sec        |
| Control Delay (Worst Lane)                | 12.5 sec      |                |
| Control Delay (Worst Movement)            | 12.5 sec      | 12.5 sec       |
| Geometric Delay (Average)                 | 1.4 sec       |                |
| Stop-Line Delay (Average)                 | 0.1 sec       |                |
| Level of Service (Aver. Int. Delay)       | NA            |                |
| Level of Service (Worst Movement)         | LOS A         |                |
| Level of Service (Worst Lane)             | LOS A         |                |
| 95% Back of Queue - Vehicles (Worst Lane) | 0.2 veh       |                |
| 95% Back of Queue - Distance (Worst Lane) | 1.7 m         |                |
| Total Effective Stops                     | 10 veh/h      | 12 pers/h      |
| Effective Stop Rate                       | 0.11 per veh  | 0.11 per pers  |
| Proportion Queued                         | 0.07          | 0.07           |
| Performance Index                         | 1.0           | 1.0            |
| Travel Distance (Total)                   | 65.4 veh-km/h | 78.5 pers-km/h |
| Travel Distance (Average)                 | 691 m         | 691 m          |
| Travel Time (Total)                       | 0.9 veh-h/h   | 1.1 pers-h/h   |
| Travel Time (Average)                     | 33.4 sec      | 33.4 sec       |
| Travel Speed                              | 74.4 km/h     | 74.4 km/h      |
| Cost (Total)                              | 32.47 \$/h    | 32.47 \$/h     |
| Fuel Consumption (Total)                  | 6.7 L/h       |                |
| Carbon Dioxide (Total)                    | 16.8 kg/h     |                |
| Hydrocarbons (Total)                      | 0.021 kg/h    |                |
| Carbon Monoxide (Total)                   | 0.62 kg/h     |                |
| NOx (Total)                               | 0.037 kg/h    |                |

LOS (Aver. Int. Delay) for Vehicles is not applicable since the average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

LOS Method for individual vehicle movements and lanes: Delay (RTA NSW).

| Intersection Performance - Annual Values |                 |                  |
|------------------------------------------|-----------------|------------------|
| Performance Measure                      | Vehicles        | Persons          |
| Demand Flows (Total)                     | 45,474 veh/y    | 54,568 pers/y    |
| Delay                                    | 19 veh-h/y      | 23 pers-h/y      |
| Effective Stops                          | 4,863 veh/y     | 5,836 pers/y     |
| Travel Distance                          | 31,406 veh-km/y | 37,687 pers-km/y |
| Travel Time                              | 422 veh-h/y     | 507 pers-h/y     |
| Cost                                     | 15,586 \$/y     | 15,586 \$/y      |
| Fuel Consumption                         | 3,218 L/y       |                  |
| Carbon Dioxide                           | 8,063 kg/y      |                  |
| Hydrocarbons                             | 10 kg/y         |                  |
| Carbon Monoxide                          | 300 kg/y        |                  |
| NOx                                      | 18 kg/y         |                  |

## MOVEMENT SUMMARY

Site: I-08 FU CT PM

2112974A Mangoola TIA  
Giveway / Yield (Two-Way)

### Movement Performance - Vehicles

| Mov ID                                   | Turn | Demand Flow | HV   | Deg. Satn | Average Delay | Level of Service | 95% Back of Queue |          | Prop. Queued | Effective Stop Rate | Average Speed |
|------------------------------------------|------|-------------|------|-----------|---------------|------------------|-------------------|----------|--------------|---------------------|---------------|
|                                          |      | veh/h       | %    | v/c       | sec           |                  | Vehicles          | Distance |              | per veh             | km/h          |
| East: Wybong Road (E)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 5                                        | T    | 64          | 3.3  | 0.037     | 0.1           | LOS A            | 0.2               | 1.7      | 0.09         | 0.00                | 76.8          |
| 6                                        | R    | 4           | 0.0  | 0.037     | 10.2          | LOS A            | 0.2               | 1.7      | 0.09         | 0.98                | 60.0          |
| Approach                                 |      | 68          | 3.1  | 0.037     | 0.7           | LOS A            | 0.2               | 1.7      | 0.09         | 0.06                | 75.6          |
| North West: Wybong Post Office Road (NW) |      |             |      |           |               |                  |                   |          |              |                     |               |
| 27                                       | L    | 4           | 0.0  | 0.007     | 10.9          | LOS A            | 0.0               | 0.2      | 0.08         | 0.70                | 58.9          |
| 29                                       | R    | 3           | 0.0  | 0.007     | 11.9          | LOS A            | 0.0               | 0.2      | 0.08         | 0.73                | 57.6          |
| Approach                                 |      | 7           | 0.0  | 0.007     | 11.3          | LOS A            | 0.0               | 0.2      | 0.08         | 0.71                | 58.3          |
| West: Wybong Road (W)                    |      |             |      |           |               |                  |                   |          |              |                     |               |
| 10                                       | L    | 1           | 0.0  | 0.002     | 12.5          | LOS A            | 0.0               | 0.0      | 0.03         | 0.70                | 57.1          |
| 11                                       | T    | 18          | 17.6 | 0.010     | 0.0           | LOS A            | 0.0               | 0.0      | 0.00         | 0.00                | 80.0          |
| Approach                                 |      | 19          | 16.7 | 0.010     | 0.7           | LOS A            | 0.0               | 0.0      | 0.00         | 0.04                | 78.2          |
| All Vehicles                             |      | 95          | 5.6  | 0.037     | 1.5           | NA               | 0.2               | 1.7      | 0.07         | 0.11                | 74.4          |

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.



## **APPENDIX 4**

Mangoola Coal Response to Letter from Wybong  
Action Group - RE: ETL Alignment (14 August 2009)



14 August 2009

Mr John Shewan  
President  
Wybong Action Group  
C/O 740 Ridgелands Road  
Manobalai NSW 2333

Dear Mr Shewan

**RE: Information Requests from Mangoola Coal Community Information Session**

Thank you for your letter provided to Mangoola Coal personnel on 22 July 2009 regarding suggestions for the 500 kV proposal. We have reviewed the Wybong Action Groups comments and will take these into consideration whilst preparing the Environmental Assessment for this proposal.

Mr Morgan also communicated to Scott Elliott (Senior Project Manager) and Jane Yelland (HSEC Manager) several questions the group would like answered. These questions and responses are provided in **Table 1** below.

**Table 1**

| Question                                                                                                                                             | Mangoola Coal Response                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Query regarding location of noise monitoring stations.                                                                                               | These locations are specified in the Mangoola Coal Noise Monitoring Program, Figure 2 and 3. This is available at the following website <a href="http://www.xstrata.com/operation/mangoola/publications/">http://www.xstrata.com/operation/mangoola/publications/</a> Mobile monitoring equipment is detailed in the Mangoola Coal Noise Monitoring Program in Section 7.2.2 and Table 6. |
| Question asked regarding compensation for people who receive damage to their vehicles as a result of increased wildlife due to biodiversity offsets. | This has not been considered as part of the Biodiversity Strategy.                                                                                                                                                                                                                                                                                                                        |
| What is Xstrata's intent with Ridgелands Road Exploration Lease?                                                                                     | The DPI first placed the Ridgелands lease out for expressions of interest (EOI) in 2008. The EOI was public & anyone had the right to apply. Xstrata submitted                                                                                                                                                                                                                            |

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|                                                                                                                        |                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                        | <p>an EOI in accordance with the DPI process (which required addressing a number of criteria) and were subsequently informed that they had not been successful.</p> <p>The DPI has re-released this area for EOI's closing in October 2009. Xstrata is yet to make a decision as to whether they will participate in this process.</p> |
| 500 kV Relocation Proposed Modification Fact Sheet is not working on the internet site.                                | This has been tested and is currently working.                                                                                                                                                                                                                                                                                         |
| WAG have concerns regarding dust and noise from changed mine plans associated with the 500 kV relocation modification. | The environmental assessment will include assessments of noise and dust impacts associated with mine plan changes.                                                                                                                                                                                                                     |

If you have any further comments please contact through any of the following methods:

- the Community Response Line [mangoolaenquiries@xstratacoal.com.au](mailto:mangoolaenquiries@xstratacoal.com.au),
- Free call number 1800 014 339
- Office contact during business hours on 6542 6600.

Yours sincerely,

Xstrata Mangoola Pty Limited



Scott Elliott

Project Manager

## APPENDIX 5

## CSI Contributions

## 2010/2011 CSI

### HEALTH

#### ***Humpty Dumpty Foundation***

Continuing its long-term support of the Humpty Dumpty Foundation, in 2010 XC donated \$50,000 and in 2011 will donate another \$50,000, which will be used to purchase priority items for children's hospitals and health services across Australia. The commitment will also include a further \$23,000 contribution to the Foundation's Balmoral Burn event, a high-profile, annual corporate charity fun run being held for the 11th consecutive year in 2011.

The Humpty Dumpty Foundation has been providing support for children's services since 1996. It buys essential and often life-saving medical equipment for neonatal units (newborn care) and paediatric wards (for toddlers and children up to 16 years old) in hospitals and health service centres across the country. It also provides funding for special projects in hospitals, including magical fairy gardens, paediatric fellowships for graduate doctor training and weekly visits by the much-loved Clown Doctors. In the last five years alone, the Foundation has bought more than 1,000 pieces of medical equipment, which have helped save the lives of sick and injured babies and children.

#### ***Hunter Medical Research Institute (HMRI) – Asthma Fellowship***

As part of a \$300,000 commitment to the HMRI to establish the XCN Research Fellowship in Asthma (XCN provided a further \$100,000 in 2010).

#### ***Hunter Medical Research Institute – Depression Fellowship***

One in five people in Australia will experience depression at some stage in their life and while not all depression leads to suicide, this is a major risk factor if the illness is left untreated.

In 2010 XCN contributed \$100,000 and will contribute an additional \$100,000 in 2011 to the HMRI, as part of a three-year commitment to a Post-Doctoral Research Fellowship awarded to Dr Kerry Inder, who is examining ways to reduce depression and male suicide in rural communities.

The project, known as xTEND: eXtending Treatments, Education and Networks for Depression, is helping specialists develop a greater understanding of the role of social and family factors in depression, as a basis for improving interventions and suicide prevention programs.

XCN's contribution has also enabled HMRI to enter into a national partnership with beyondblue: the national depression initiative.

#### ***John Hunter Children's Hospital Neonatal Unit***

With one of the largest neonatal intensive care units in New South Wales, the John Hunter Children's Hospital provides highly skilled care to more than 1,100 critically ill newborn babies each year. Over the past five years, XCN has funded the purchase of new equipment and the refurbishment of hospital facilities for the benefit of patients and their families.

In 2010 XCN continued its long-term support of the John Hunter Children's Hospital with a \$200,000 funding commitment to purchase 10 cardiovascular monitors costing \$20,000 each update ageing equipment improving care.

In 2011, XCN is continuing its long-term support of the hospital with a \$200,000 funding commitment to purchase a further 10 *Philips* cardiovascular monitors, to monitor the heart rate, breath, temperature and blood pressure of babies in the intensive care unit. The new

monitors, costing more than \$20,000 each, will update ageing equipment and will help the hospital improve the care it provides to the most fragile members of society. Throughout the past four years, XCN has funded both the purchase of new equipment and the refurbishment of hospital facilities for the benefit of patients and their families.

### ***Westpac Rescue Helicopter Service***

The Westpac Rescue Helicopter Service is a community-owned and operated medical search and rescue service that serves the Hunter, Central Coast, Mid North Coast, New England and North West regions, completing over 1,200 missions each year.

Rescuing people from accident scenes and transporting critically ill patients from small, rural hospitals to large tertiary hospitals – primarily the John Hunter Hospital in Newcastle and the Base Hospital in Tamworth – this free service benefits over 1 million people, covering a region of 132,000 square kilometres.

In 2010, XCN committed \$120,000 and in 2011 is committing a further \$130,000 to support this critical care service that benefits the wider community in each of the regions in which XCN operates within New South Wales.

### ***John Hunter Hospital Trauma Unit***

As the only major trauma service outside metropolitan Sydney, the John Hunter Hospital Trauma Unit services a wide geographic area and plays a vital role in nearby rural and remote areas.

XCN first established a relationship with the John Hunter Hospital Trauma Unit in 2010, and in 2011 will further its support, giving \$200,000 to fund a trauma education and research program.

XCN's funding covers three related projects: the expansion of the John Hunter Hospital Trauma Unit's Trauma Education Program into additional regional and rural areas of NSW; improvements to the Trauma Hotline Service; and the enhancement of the existing Trauma Research Program, which underpins the continued improvement of trauma service delivery and education.

### ***HIMH's Foundations Magazine***

As part of an ongoing commitment since 2009, XCN continues to fund The Hunter Institute of Mental Health to produce *Foundations*, an innovative magazine providing a valuable professional mental health development resource for staff in early-childhood.

Based on the success of the magazine to date, XCN will extend its funding in 2011 to increase distribution to three issues for every staff member in long day care and preschool services across the Hunter, Manning, Mudgee and Taree areas.

The magazine has also been made available free of charge via the website, allowing children's services, other professionals and individuals around Australia and overseas to tap into an important hub of information, connections and resources contained within each issue.

### ***Starlight Children's Foundation***

A national organisation with local representation in each state, the Starlight Children's Foundation's mission is to brighten the lives of seriously ill and hospitalised children and their families. The foundation's primary focus is children and young people from 4 to 18 years old, who have a serious or chronic illness and are long-term in-patients or frequent visitors to hospitals or specialist care visitors. Starlight Express Rooms, hosted by Captain Starlight, provide a medical-free haven where hospitalised children and their siblings can play video games, explore art and crafts, tell jokes, sing, dance and be fun-loving kids again.

XCN has pledged \$250,000 in 2011 to become the exclusive sponsor of the Starlight Express Room at the John Hunter Hospital, which is used by over 13,000 child patients each year. XCN's sponsorship will cover the annual cost of running the Starlight Express Room and the associated Starlight Ward Program, which includes the cost of equipping and running the room; keeping abreast of innovations in technology; and recruiting, training and employing a program manager and several Captain Starlights.

## **ARTS AND CULTURE**

### ***Newcastle Regional Museum***

XCN is a significant employer in – and an integral part of – the Hunter Valley region, and in 2010 and 2011 continues its funding commitment with \$325,000, part of a \$1 million sponsorship for the development of the Newcastle Museum.

Opening in 2011, the \$23.5 million Newcastle Museum will be housed in the refurbished heritage railway workshops in Newcastle's Honeysuckle precinct.

XCN is sponsoring the redevelopment of the iconic Locomotive Boiler Shop, which will become a venue for the Supernova Interactive Science Centre, themed events, conferences, exhibitions and community activities. In keeping with XCN's strong presence in the Hunter region, the building will also incorporate an underground mining exhibition.

### ***The Power of Music Program***

In 2010, XCN committed \$100,000 and this year, 2011, XCN will commit a further \$115,000 to the Power of Music Program will help expand the program further into the Mudgee, Kandos and Gulgong areas, as well as further promoting existing programs in the Kirkton, Singleton, Muswellbrook, Aberdeen and Scone regions.

The program will deliver three major musical productions involving several hundred children; develop an exciting drama production; direct a youth choir; run an adult late-starters band; and teach up to 45 young musicians individually in the XCN Rising Stars Program.

The annual end-of-year Musical Spectacular will take place in September 2011, showcasing members of all of the bands and choirs from participating schools as well as emerging musicians from across the regions. By raising the standard and awareness of music performances in the Upper Hunter area, the program aims to raise the self-esteem of young people and support community musicianship.

### ***Minimbah Teaching Place***

As part of its two year commitment to developing a new Indigenous cultural centre in the Hunter Valley, XCN, in 2010, provided \$300,000 to an Indigenous teaching and Keeping Place. The Teaching and Keeping Place will be developed in the Broke area, and will be unique to the Hunter Valley.

### ***Sydney Symphony Regional Tour***

In 2011, XC is once again proud to continue supporting the Sydney Symphony Orchestra's Regional Tour series, sharing its world-class performance, flair and style with rural New South Wales.

Bringing joy and inspiration to regional centres such as Albury, Broken Hill, Griffith, Tamworth and Wagga Wagga, the annual Sydney Symphony Orchestra Regional Tour continues to reach new generations of rural families who may otherwise never have the opportunity to experience a live orchestral performance.

XC contributed \$30,000 in 2010 and is contributing a further \$30,000 to this year's Sydney Symphony Regional Tour. Since 1932, the Sydney Symphony Orchestra has grown to include more than 100 musicians giving over 200 performances each year to an annual audience of over 400,000.

### ***The Song Room***

The Song Room develops and implements tailored, high-quality music and arts-based programs for children, to enhance the learning, personal development and community involvement of those who would otherwise miss out, such as children living in areas of socio-economic disadvantage or in marginalised communities, and those with special needs.

XC is continuing its three-year partnership with The Song Room, having already helped more than 3,000 disadvantaged children across the Mudgee, Rockhampton and Hunter Valley regions since 2007.

In 2010 XC contributed \$105,000 and this year will deliver \$115,000 to fund a new initiative focusing on disadvantaged schools in the Wallsend region of the Hunter Valley in New South Wales, and the Rockhampton and Emerald regions of Queensland. This innovative program will deliver 10 six-month workshop programs in the target regions, help with the recruitment of local teaching artists, and provide teaching and learning resources at participating schools.

## **ENTERPRISE AND JOB CREATION**

### ***Hunter Valley Training Company***

The Xstrata External Apprentice Program has involved 65 apprentices since 2006, 18 of whom are now working tradesmen. The program has engaged 24 XCN suppliers as host employers, involving a commitment by XCN of more than \$1.5 million to date.

In partnership with the Hunter Valley Training Company (HVTC), in 2010 XCN invested \$280,000, and in 2011 is investing a further \$320,000 to help fund the introduction of 14 new apprentices to the program. XCN's funding sponsors apprentices' skills training costs, TAFE fees and wage offset for TAFE training days, providing security to apprentices as well as to host employers. The initiative is being expanded in 2011 to include Mudgee and Picton areas.

XCN has a strong commitment to reducing skills shortages in areas related to the mining sector. The partnership between XCN and HVTC includes apprentices employed by HVTC who are then aligned with host employers selected from XCN's medium-sized suppliers. HVTC now has more than 1,400 apprentices in training with 800 companies, across a wide range of vocations including business, community services, construction, horticulture, information technology, manufacturing, telecommunications and tourism.

## **EDUCATION**

### ***New South Wales Premier's Education Scholarships***

For the eighth consecutive year, XCN is helping to provide an opportunity for four outstanding teachers working in rural and remote communities to travel overseas to extend their professional knowledge.

The New South Wales Premier's XCN Rural and Remote Education Scholarships have a total value of \$62,500 and are open to all New South Wales school and TAFE teachers working in non-metropolitan areas.

The scholarships give teachers – particularly those working in small schools – the opportunity to explore new ideas, undertake research on world's-best educational practices and implement their findings for the ultimate benefit of young people in New South Wales. This international initiative further supports the outstanding work done by schools in remote areas to provide the same opportunities for quality education as are available in urban schools.

#### ***University of Newcastle – Indigenous Scholarships***

XCN's Indigenous Scholarships for students at the University of Newcastle build on XCN's longstanding commitment to helping young people from disadvantaged backgrounds pursue higher education.

In 2010, XCN invested \$20,000 and in 2011 will increase its funding for this program with a further \$30,000 in Indigenous scholarships for mining-related disciplines at the University of Newcastle. Each scholarship is worth \$10,000 per year and will be awarded to students demonstrating strong academic performance and a commitment to pursuing a career in mining.

#### ***University of New South Wales – Scholarship Program***

The University of New South Wales (UNSW) is one of Australia's leading research and teaching universities, and its Faculty of Engineering is the largest and most comprehensive in Australia. It is also ranked as one of the best in the world, and has produced a large number of Australia's top mining engineers over the past six decades.

XCN has supported UNSW scholarship initiatives since 2002, investing \$180,000 in 2010, and will invest a further \$200,000 in 2011 for the education of future engineers, surveyors and environmental professionals.

XCN's ongoing support also includes providing funds for student field trips to mining operations; support for recruitment initiatives to attract school leavers to pursue careers in the mining industry; and support for other marketing and recruitment resources to assist in attracting new students.

#### ***University of Sydney –Scholarship Program***

Rapid growth in Australia's resources sector means the demand for qualified engineers has never been greater. In 2011, XCN is offering \$30,000 to sponsor three scholarships for University of Sydney students wishing to study mining-related disciplines, such as electrical, mechanical and civil engineering. By encouraging young people to study resources-related subjects and consider careers in the mining industry, the scholarships aim to address current skills shortages and encourage future innovation.

XCN scholarships will open up a new world of study and research for the next generation of mining professionals – those who will design, develop and implement cutting-edge technology to improve the safety, productivity and environmental standards of mining worldwide.

#### ***University of Newcastle – Scholarship Program***

XCN is pleased to continue its financial support for training mining professionals at the University of Newcastle. XCN's scholarship donation of \$270,000 in both 2010 and 2011 will provide undergraduate scholarships in the disciplines of civil, electrical and mechanical engineering; environmental management; geology; surveying; and occupational health and safety.

With more than 33,000 students, 5,000 postgraduate coursework students and 1,300 postgraduate research students, the University of Newcastle is ranked in Australia's top 10 research universities. Supported by XCN, it is also part of national and international research programs and initiatives dedicated to investigating ways to further improve mining processes.

The University of Newcastle is an important and valuable contributor to the Hunter Valley region, home to XCN's most extensive Australian mining operations.

#### ***Galuwa – A Pathway Program for Aboriginal Youth***

The NSW Department of Education and Training's *Galuwa* Scholarship Program supports Aboriginal students in NSW government schools throughout the broader Hunter region to help them complete their secondary education and develop future career pathways. *Galuwa* is a Sydney-area Aboriginal language word meaning 'to climb'. The scholarship initiative is aimed at the transition to high school, and is delivered through extracurricular activities such as tutoring and mentoring, literacy and numeracy support, and concentrated learning hubs.

In its second year of sponsorship, XCN will provide \$270,000 to the *Galuwa* Program in 2011, and has pledged to continue its funding commitment for five years, for a total of \$1.26 million. Over the five-year period, a total of 60 three-year scholarships will be offered to eligible Year 6 students.

As part of the scholarship, students will work with tutors on a weekly basis and will also participate in two Career Aspiration Hubs each year, where they will focus on educational needs, core skills, leadership, career development and goal-setting activities. The project also involves an Ambassador Program, where high-profile Aboriginal leaders from the community or from fields such as education, sports and the arts participate in the Career Aspiration Hubs.

#### ***KIDS Foundation – School Injury Prevention Program***

Founded in 1993, the KIDS Foundation is a non-profit organisation that runs annual interactive safety education programs for preschool, primary and secondary students.

The KIDS Foundation's School Injury Prevention Program aims to increase safety awareness, knowledge and problem-solving skills to help students better manage their own safety. Injury prevention programs will be introduced across 30 preschools, primary schools and high schools (10 of each), encompassing three program areas, through which children progress as they mature: the See More Safety Program, an early education program to help teachers and children identify hazards in the everyday environment; the Safety Club, a primary-school program designed to guide school communities on issues of child safety and injury prevention; and TeenSafe, aimed at helping school communities address safety and injury prevention among secondary-school students.

The KIDS Foundation School Injury Prevention Program is closely aligned to XCN's core values and commitment to safety, and will operate in many schools attended by the children of XCN employees. XCN will provide \$350,000 in seed funding to establish the program over three years (2011 to 2013), helping schools embed the program in their curricula.

## ENVIRONMENT

### ***Myriver Hunter***

Young people across the Hunter Valley will continue to play a critical role in the restoration of the mighty Hunter River, via a further funding boost from XCN of \$50,000 in 2010 to OzGREEN. XCN is sponsoring a section of the river around Singleton/Muswellbrook, supporting OzGREEN to develop regional school workshops, community environment forums and school and youth eco-projects.

### ***Singleton Indigenous Regeneration Support Team***

Commencing in 2009, the Singleton Indigenous Bush Regeneration Training Program provides training and employment opportunities for local Indigenous people working on the existing Hunter River Rehabilitation Project, developing skills among Indigenous people so they can participate in future employment opportunities in the field of conservation and land management.

The program delivers the accredited Certificate 2 in Conservation and Land Management in an experiential manner – on ground and on country – while facilitating partnerships between diverse organisations to support the participants under the guidance of Conservation Volunteers Australia (CVA).

XCN provided \$150,000 in 2010 and will provide \$150,000 in 2011 to enable CVA to continue the successful program in 2011. A further six local Indigenous people will be trained this year, in addition to the seven graduates from the 2009 program who have completed their certificates. Another six participants will graduate in March 2011, including a trainee from the 2009 program who is completing a Certificate 4 in Conservation and Land Management, and supervisor training from CVA.

### ***Hunter Central Rivers Catchment Management Authority (HCRCMA)***

XCN has pledged \$1.5 million over the next three years to help The Wybong Catchment Health Improvement Project address priority natural resource management issues in the Wybong catchment.

The HCRCMA CAP views the Wybong Catchment as a priority saline catchment area and has identified several important areas requiring programs to ensure the health and sustainability of the catchment. In addition, the Wybong catchment has been identified as a critical biodiversity corridor in the NSW Government's Great Eastern Ranges Project.

Funding will be allocated to several on-the-ground works programs on non-Xstrata-owned land to address key targets identified within the CAP, including regenerating native vegetation, stabilising stream channels, restoring in-stream habitats and stabilising salt-affected areas.

Landholders within the project area will be invited to apply for grants for on-ground works through the HCRCMA, which will employ a full-time Project Officer based in Muswellbrook. The specific works program for each property will be developed with landowners in close consultation with key stakeholders such as the Department of Environment, Climate Change and Water. A landholder extension and training program will complement and support the delivery and maintenance of on-ground works.

## COMMUNITIES

### ***Singleton and Mudgee Dads Take Home Reading Program***

The Dads Take Home Reading Program continues to make a significant difference to the reading and interaction behaviours of children and their fathers in the Hunter Valley and mid-west regions. Part of a \$300,000 four-year partnership, the Mudgee Dads Take Home Reading Program is based on the successful Singleton Take Home Reading Program which received \$105,000 from XCN in its fourth and final year.

### ***Maitland Neighbourhood Centre***

XCN will increase its support in 2011 for the residents of Maitland and surrounding districts, with an \$80,000 grant to expand the services offered by the Maitland Neighbourhood Centre. In 2010, XCN provided a grant of \$70,000.

The centre is a vital part of the community, providing services and support to marginalised families and individuals, coordinating community-based groups that offer a range of programs catering for individuals from children to the frail and aged. A vital part of the centre's work involves administering an Emergency Relief Program to assist community members who are experiencing financial hardship.

Specific new initiatives to be introduced in 2011 include a series of community events to acknowledge and celebrate significant days, and a weekly breakfast program. Events will focus on raising awareness and education around important social issues and will coincide with key dates such as Homelessness Week, Domestic Violence Week and Seniors Week. The breakfast program aims to bring together a range of people from across the community, to develop positive nutritional habits and build connections, understanding and communication.

### ***Wesley Newcastle Youth Service***

Newcastle Youth Service (NYS) provides a safe and supportive drop-in centre and a range of services for young people aged 12 to 25 years, their families and the communities of the Newcastle and Hunter regions.

As part of a three-year commitment, XCN's \$60,000 grant in 2011 will enable Wesley NYS to employ a Youth Outreach Worker. This will increase its capacity to provide additional outreach services and one-on-one counselling to the Hunter region's youth in crisis, as part of its continuing Youth Harm Minimisation Outreach Initiative (YHMOI). Funding will also include a one-off capital contribution of \$75,000 to purchase a new Street Smart Van to target hot spots around Newcastle and provide a base from which to connect with young people at risk of isolation, homelessness and other impending crises. The van will provide additional direct support and counselling to an estimated 30 people each month.

XCN's \$60,000 grant in 2010 enabled NYS to employ a counsellor to increase its capacity to provide additional outreach services and one-on-one counselling to the Hunter region's youth in crisis, as part of its continuing YHMOI.;

### ***Carrie's Place***

Over the last 30 years, Carrie's Place in the Maitland area has provided a range of support services for women and children who are victims of domestic violence in the Lower Hunter Valley.

In 2011, XCN is committing \$125,000 to fund the work of a Project Education Worker and an Intake Worker. The Education Worker will work with women recovering from the trauma of domestic abuse, and will help women establish positive pathways to independent living. The role will improve awareness and education within the community about the impact of, and issues relating to, domestic violence.

The Intake Worker will provide critical support to the Carrie's Place team and will be the first point of contact in relation to early intervention or post-crisis work and accommodation needs.

In 2010, XCN committed \$150,000 to fund the work of an outreach centre to provide support and education programs to prevent homelessness caused by domestic violence. \$25,000 will be used to assist in renovating the centre.

#### ***Hunter Support Program, Lifeline (Newcastle and Hunter)***

The Hunter Support Program will provide personal, relationship and suicide-prevention counselling for men and their families across the Singleton and Muswellbrook regions. The program will specifically target men experiencing personal emotional difficulty and family members affected by problems with male relatives, by providing general counselling services, as well as suicide awareness, intervention and prevention training. The program complements existing Lifeline programs including the Hunter Valley Men's Program (HVMP), Financial Counselling Service and the Life Matters Program (suicide intervention, prevention and 'postvention').

XCN is furthering its support of Lifeline in 2011 with a \$150,000 grant to help ensure the continuation of these critical services in the Upper Hunter region.

XCN continued its support with an \$80,000 grant (2010) to help ensure the continuation of this critical service to reduce domestic violence and family breakdown in the Upper Hunter.

#### ***Crisis Intervention Response Service, Lifeline***

The Crisis Intervention Response Service was coordinated by Lifeline in 2009 and developed in collaboration with local police to provide support, information, referral and follow-up counselling for family, friends, bystanders, witnesses and the wider community following involvement in or witness to a traumatic event. With XCN's continued commitment of \$75,000 in 2010, qualified Lifeline counsellors offer immediate support following such events.

#### ***Young Driver Awareness Program***

Based upon safety learnings from the mining industry, the Young Driver Awareness Program was conceived by two XCN employees to raise awareness and help change behaviour among Year 11 high school students in the Singleton region as they prepare to apply for a driver's licence. With more than 250 Year 11 students at Singleton High School having completed the program in 2008 and 2009, XCN's contribution of \$120,000 in 2010 was used to further develop the initiative and contract a program co-ordinator. The funding will also assist the implementation of the course at other high schools across the Newcastle and Hunter Region.

#### ***Muswellbrook Women's and Children's Refuge***

For more than 25 years the Muswellbrook Women's and Children's Refuge has offered crisis accommodation for women and children escaping domestic violence.

A \$70,000 funding boost in 2010 enabled the Refuge to assist women within the local community and surrounding areas by providing information, support and advocating on their behalf.

XCN is pleased to increase its commitment to the refuge in 2011, helping to provide support and assistance for women and children in the community through continued funding for an Outreach Worker, and funding for a newly appointed part-time Child Support Worker. The \$80,000 funding boost in 2011 will enable the refuge to assist women within the local community and surrounding areas by providing information and support, and advocating on their behalf.

The refuge will also focus on preventing further domestic violence through early intervention and group programs aimed at promoting women's self-esteem, assertiveness, confidence and social networks.

### ***All Abilities Playgrounds – Singleton and Tahmoor***

In 2010, XCN committed a further \$200,000 towards the development of All Abilities Playgrounds in Singleton and Tahmoor. The All Abilities Playgrounds will be a boost to their local areas, which currently lack any play facilities specifically catering for kids with disabilities.

### ***Community Links Wollondilly***

Community Links operates out of the Tahmoor Community Centre and provides community support, referral, activities and other programs across the Wollondilly Council area. XCN is supporting Community Links by providing \$200,000 over two years for a new program, the Back on Track Crisis Support Project, which will offer short-term crisis support in the Wollondilly area. The program will help local people with accommodation, food supplies, transport and electricity, as well as referrals to specialist support services such as financial, legal and mental healthcare providers.

XCN's donation will help Community Links develop a strategic plan and a more streamlined service, with a view to attracting long-term government funding. The donation will also make it possible to employ a new Crisis Caseworker and will fund a range of project administration and other resources, such as brokerage fees to source accommodation and other services.

### ***Dads in Distress Support Services***

Dads in Distress Support Services (DIDSS) are is a non-profit organisation dedicated to helping fathers who face difficulties as a result of separating from their partner and/or children. The organisation's primary goal is to stem the present trend of male suicide resulting from the emotional trauma of divorce or separation, by providing counselling and other support services. In 2011, XCN will provide \$40,000 to fund temporary accommodation in the Maitland and Hunter area for men, with or without their children, who need to leave their home due to a family breakdown.

### ***Hunter Prelude Early Intervention Centre***

The Hunter Prelude Early Intervention Centre provides services to the families of children with a diagnosed disability or at risk of developmental delay. Aimed at children from birth to six years old, Hunter Prelude's programs recognise that the first few years are crucial in setting the foundation for successful learning, behaviour and health outcomes later in life.

These programs currently support 120 children, with services provided at Singleton and Kurri Kurri centres, families' homes, mainstream preschools and child-care centres. Staff members, including teachers, child-care workers, speech pathologists and occupational therapists, support the children and their families through a range of specialised intervention programs. XCN is a long-term supporter of the Centre and will contribute \$10,000 to help cover the centre's annual operating costs.

In 2011 XCN will also extend its commitment by providing a one-off capital contribution of \$170,000 to Singleton Council to upgrade the facility and purchase new equipment. The money will be used to upgrade both the indoor and outdoor areas, and purchase equipment suitable for children of varying abilities.

## **APPENDIX 6**

Mangoola Coal Response to Letter from Wybong  
Action Group - RE: Various Issues



14 December 2010

Mr John Shewan  
President  
Wybong Action Group  
740 Ridgeland Rd  
Manobalai  
NSW 2333

Dear Mr Shewan,

We would like to respond to your letter to Evelina Hendry dated 24 October 2010 which detailed your concerns regarding the posting of documentation on the Mangoola Coal website and other matters relating to the Mangoola Mine.

As required by Schedule 5 Conditions 10 and 11 of the Project Approval, Mangoola has supplied documentation and information regarding each required strategy, plan, program and revision to the relevant agency and to the Community Consultation Committee (CCC). Copies of relevant documentation were posted on the Mangoola website but unfortunately as a consequence of Information Technology (IT) maintenance carried out by Xstrata PLC in September 2010 the website reverted to an earlier 2009 version and many of these documents were unavailable from September onward. When it occurred this error was completely beyond the control of Mangoola Coal.

This error has since been corrected and the Mangoola website can now be maintained by Mangoola Coal directly which will enable timely posting of information.

To respond to your particular concerns in the order raised by you in your letter, under the heading Strategy/Plan/Program –

- Mine Operations Plan Points a,b,c and d refer to the Mangoola Approval and Modifications 3,4 and 5. This information is currently available on the Mangoola Coal website via the link to the NSW Department of Planning webpage under the Approvals tab.
- Appendix 2 (Project Layout Plan) and Appendix 6 (Conceptual Rehabilitation Plan), are also accessible via the NSW Department of Planning webpage link.
- Appendix 3, 6.6.13 Spontaneous Combustion Management Strategy. A draft strategy has been prepared and is currently the subject of internal review. When finalised it will be uploaded to the Mangoola Coal website.

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- Appendix 4 General Terms of the Planning Agreement. Mangoola has been in lengthy negotiation with relevant Stakeholders, principally Muswellbrook Council, to finalise the Education and Training Strategy and Wybong Uplands Management Strategy. Funds have been paid to Muswellbrook Shire Council since January 2009 to initiate these projects and Mangoola Coal is keen to proceed with these projects. Once these Strategies are finalised they will be posted on the Mangoola Coal website.
- Schedule 5 Environmental Management, Monitoring. Details of the Environmental Management Plan and Monitoring program are available on the Mangoola Coal website under Publications>Other Publications. Similarly minutes of recent CCC meetings are now available on the website.
- Schedule 3 Specific Environmental Conditions. A draft Road Closure Management Plan has been prepared. Once approved and prior to blasting within 500m of Wybong Rd it will be uploaded on the website. The Landscape Management Plan, the Rehabilitation and Offset Management Plan, the Final Void Plan, the Mine Closure Plan, the Conservation Management Strategy and the Construction Traffic Management Plan are all now available on the website. The Energy Savings Action Plan is currently subject to internal review for submission to the Dept. of Planning and will be made available when approved.

In response to your question on Community Information Sessions, we are pleased to report that 68 neighbours and other interested persons have accepted our invitation to tour the mine site in recent months. This number compares to 19 at the last Wybong Hall CIS. We intend to continue our programme of direct community contact throughout 2011.

With respect to the last Community Information Session at Wybong Hall, no "acute community concerns" were raised with us on the day but in any case we respond to the points you raise as follows: -

- a) With respect to your question on 'best endeavours', Mangoola Coal in accordance with the requirements of the Project Approval has submitted it's report regarding acquisition of affected properties to the Director General of the Department of Planning.
- b) Our Compliance noise monitoring programme has identified no exceedance of Project Approval conditions. We are mindful of noise impact on our neighbours and are committed to continuously improving our performance, an example being trialling of new, less obtrusive reversing alarms for mining equipment.
- c) Offers of noise mitigation were sent to eligible residences in July. The final responses were received in November and we have been in contact to update neighbours on progress.
- d) Wybong Road haulage related closure was agreed by Muswellbrook Council and Mangoola Coal as an additional control for the safety of all road users during the current Construction Phase.
- e) Wybong Rd East including the Castlerock and Ridgeland Road intersections were recently the subject of a third party safety audit for Muswellbrook Council. It was concluded the upgraded road and intersection complied with all applicable standards. Wybong Road west of the mine entrance is not a Mangoola Coal heavy haulage route.

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- f) As noted previously, recent problems with the Mangoola Coal website were the result of Information Technology issues not a change in address as you suggest. These issues have now been resolved which I expect will result in improved site information in future for the general public and any other interested stakeholders.
- g) The inability to access information for a brief period was unintended and as I have stated above is now resolved. As has already been explained to the CCC, this documentation has been available at all times on request.

Should you have any further questions, please contact our Environment and Community Co-ordinator Ben de Somer on 65495500.

Regards,



Geoff Kelly

Operations Manager

Mangoola Coal Pty Limited

**Cc: Ben Harrison, Senior Compliance Officer, NSW Department of Planning**

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