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**APPIN ROAD
KELLERMAN DRIVE TO PRINCES HIGHWAY**

ROAD SAFETY INVESTIGATION REPORT

MARCH 2014



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1. Background

In recent years a spate of high profile fatal crashes triggered a safety route review along Appin Road (B69) from Kellerman Drive, Rosemeadow, to Princes Highway, Bulli Tops. The review was undertaken by the NSW Centre for Road Safety (CRS) in conjunction with NSW Police Force and Roads and Maritime Services.

Following the safety route review, Roads and Maritime has undertaken a more detailed investigation to inform and develop a program of works to improve the safety of all people using Appin Road.

Appin Road is a state road that provides a key link for freight and motorists from the coast at Wollongong to south western Sydney at Campbelltown, via the Appin township. A map of this route is provided overleaf. This section of Appin Road spans three Local Government Areas (LGAs) being Campbelltown City Council, Wollondilly Shire Council and Wollongong City Council, and covers both Sydney and Southern Roads and Maritime Regions (Figure 1).

Key developments along this length of Appin Road include large rural residential properties between Rosemeadow and Appin, the Inghams Chicken Farm, Appin Township, Appin Colliery and West Cliff Colliery. The roadside environment is predominantly bushland between Appin and Bulli. A new residential development is currently under construction on the northern outskirts of the Appin township.

Appin Road is a single carriageway state road and is predominantly one lane in each direction, with sections of two lanes providing overtaking opportunities outside of Appin. There are two significant bridges in the southern section of Appin Road over the Georges River and Loddon Creek.

There are currently four speed limit changes along this 27.2km stretch of Appin Road and a school zone in Appin for Appin Public School. There is also an 80km/h speed limit from Rosemeadow to the outskirts of Appin, a 50km/h area through Appin, a short section of 80km/h south of Appin and 100km/h to Princes Highway at Bulli. These speed limits are shown in Figure 2.

Appin Road through Appin carries about 10,000 vehicles per day based on 2010 data. Two formal rest areas are located on the southern section of Appin Road and these cater for both southbound and northbound light and heavy vehicles.

Appin Road provides a key link for heavy vehicles hauling coal from the West Cliff and Appin Collieries to the coal loading facilities at Wollongong/Port Kembla. Heavy vehicle checking is undertaken in the rest area sites.

Both desktop analysis and on site inspections were undertaken by a project team consisting of Roads and Maritime's Sydney and Southern Region Network and Safety and Network Optimisation teams.

Roads and Maritime has undertaken its crash analysis based on the latest five year crash data period from 1 July 2008 to 30 June 2013. This crash data period differs from the data used in the CRS safety review. It should also be noted that this crash analysis and this report have been produced working from the north/east point on the corridor at Rosemeadow to the south/west at Bulli Tops.

Day time inspections were carried out in late 2013 and early 2014, in fine sunny weather. Detailed crash analysis has been carried out on the latest available five year crash data to ensure Roads and Maritime capture the current trends and issues on Appin Road.

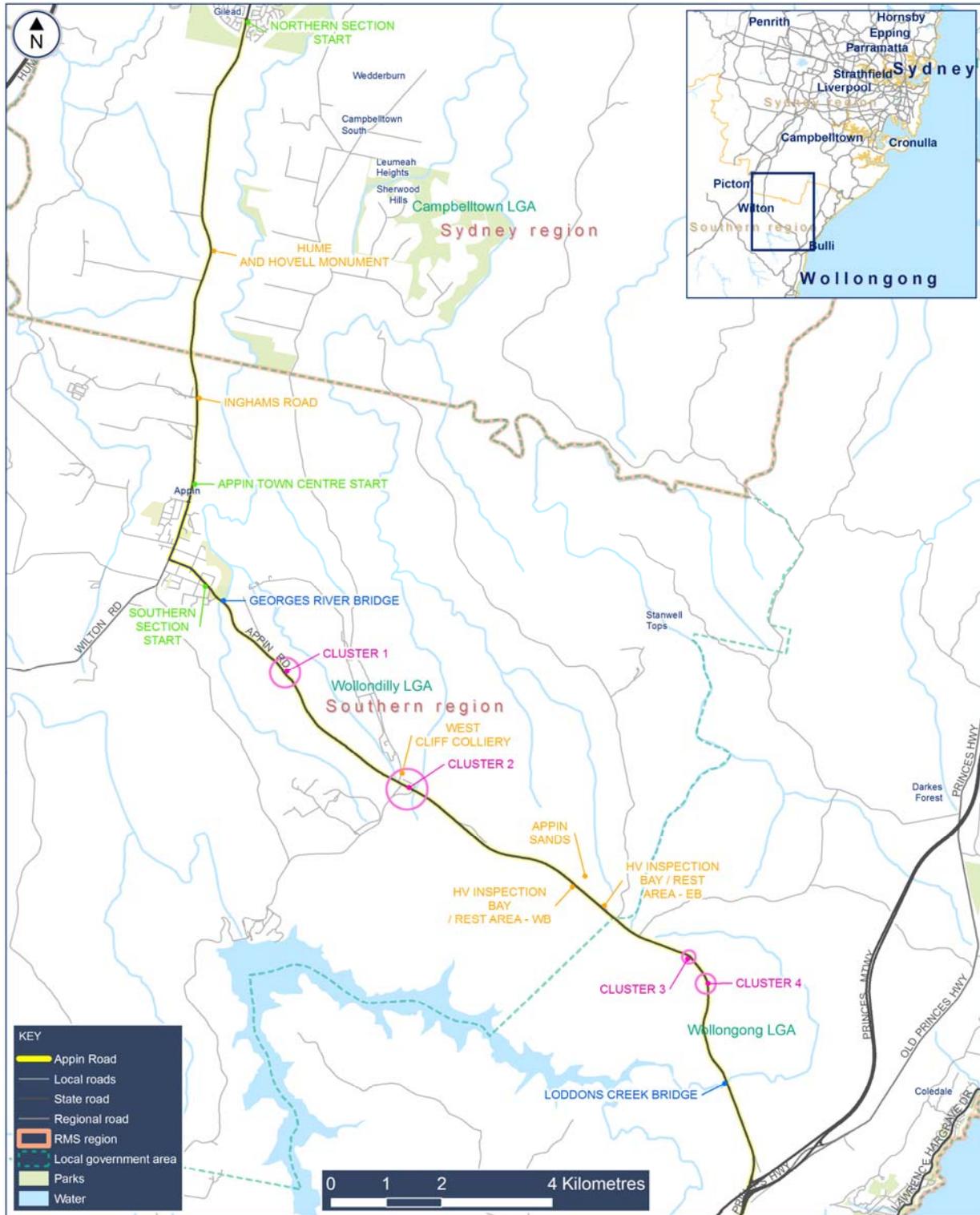
Appin Road

Kellerman Drive to Princes Highway



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LOCATION MAP



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FIGURE 1. APPIN ROAD OVERVIEW

Appin Road

Kellerman Drive to Princes Highway



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SPEED ZONES

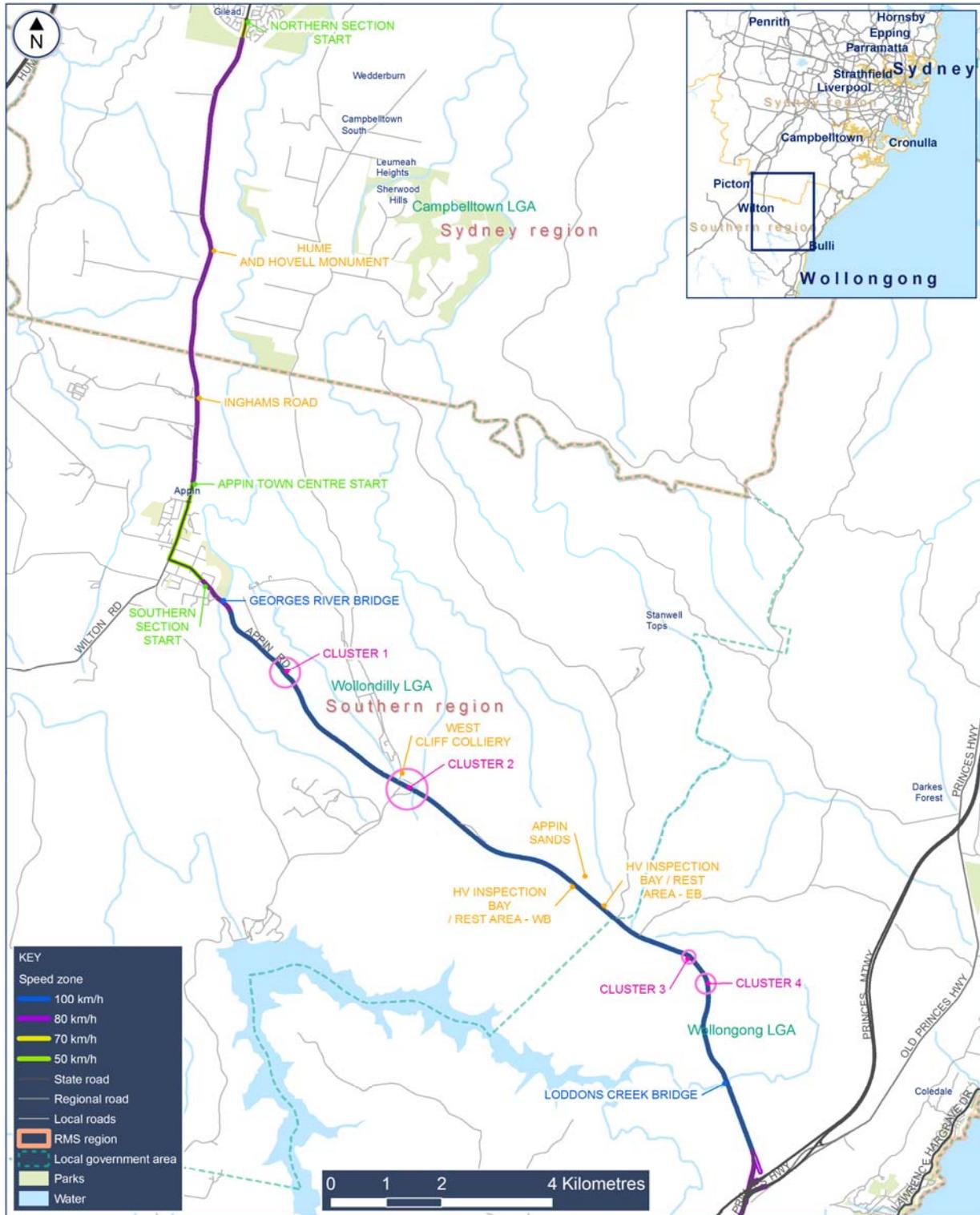


FIGURE 2.

APPIN ROAD SPEED LIMITS

2. Crash Analysis Findings

Roads and Maritime has done a detailed review of the crash history for Appin Road from the intersection of Kellerman Drive, Rosemeadow, to Princes Highway, Bulli. The crash data from 1 July 2008 to 30 June 2013 has been analysed. A summary of the analysis and findings has been provided. The crash data reports and maps can be found in the Appendix.

The crash data for Appin Road between Kellerman Drive, Rosemeadow, and Princes Highway, Bulli, during the five year period showed there had been 154 crashes. Of these there were five fatal crashes, resulting in five fatalities, and 79 injury crashes, resulting in 124 injuries.

An analysis of this crash data shows that 49 (31.8 per cent) crashes were noted with speed and 19 (12.3 per cent) crashes with fatigue as contributing factors. Both of these factors are over represented when compared against the rest of the state.

The five year crash data shows that there were:

- 76 single vehicle crashes (49.4 per cent)
- 35 rear end collisions (22.7 per cent)
- 45 off road/out of control on curve crashes (29.2 per cent)
- 28 off road/out of control on straight crashes (18.1 per cent)
- 15 head-on collisions (9.7 per cent).

In addition, a review of the road environment and conditions showed that there were:

- 52 crashes on a wet road surface (33.8 per cent)
- 58 crashes in darkness (37.7 per cent).

The vehicles involved in crashes included (these fields are not mutually exclusive):

- 134 cars (87 per cent)
- 29 light trucks (18.8 per cent)
- 14 heavy vehicles (9.1 per cent)
- 10 motorcycles (6.5 per cent).

The five fatal crashes occurred one each in 2009, 2010, 2011 and two in 2012. A review of the provisional crash data along this same length of Appin Road showed a further fatal crash occurred in late 2013, resulting in a single fatality.

Although there was one fatal crash in 2013, a review of the most recent crash data (including provisional data) showed a decline in the number and severity of crashes on Appin Road in 2013, compared with the previous four years of crash data.

A further detailed breakdown of the crash data had been carried out to further analyse the trends and types of crashes along Appin Road. For this, Appin Road had been divided into three sections:

- North of Appin township – from 10m south of Kellerman Drive to 315m north of Rixon Road
- Appin township – from 315m north of Rixon Road to Toggerai Street intersection (TCS 3912)
- South of Appin township – from Toggerai Street intersection to Princes Highway.

A summary of the crash data is shown in Table 1.

TABLE 1. CRASH DATA SUMMARY FOR APPIN ROAD FULL LENGTH AND THREE SECTIONS.

CRASH SUMMARY	FULL LENGTH	NORTHERN SECTION	APPIN TOWN CENTRE	SOUTHERN SECTION
Total crashes	154	46	24	84
Crashes per km	5.7	5.3	10.4	5.2
Fatal crashes	5	0	0	5
Fatal crashes per km	0.2	0.0	0.0	0.3
Injury crashes	79	25	8	46
Injury crashes per km	2.9	2.9	3.5	2.8
Casualty crashes	84	25	8	51
Casualty crashes per km	3.1	2.9	3.5	3.1
<i>Section length</i>	<i>27.2</i>	<i>8.7</i>	<i>2.3</i>	<i>16.2</i>

Further analysis of the crash data for each section of Appin Road is shown in the following sections of this report. Figures 3, 4 and 5 show an overview of the three sections detailed below.

2.1. Crash Analysis – North of Appin township

The road environment in the North of Appin Township section of Appin Road is an undivided carriageway, with predominantly one lane in each direction which is lined along the majority of this section by mature trees adjacent to the unsealed shoulders. The road is relatively flat with a number of curves along the 8.7km section.

The adjoining land-use is predominantly large rural residential properties with driveway access points along this section. Within this section, there is also the Ingham Chicken Farm and a new residential development that is currently being constructed on the northern outskirts of the Appin township.

During the five year period from 1 July 2008 to 30 June 2013 there had been 46 crashes on this section. There were no fatal crashes and 25 injury crashes resulting in 40 injuries.

An analysis of this crash data showed only five (10.9 per cent) crashes were noted with speed and six (13 percent) crashes with fatigue as contributing factors.

The five year crash data showed there were:

- 19 single vehicle crashes (41.3 percent)
- 19 rear end collisions (41.3 percent)
- Seven off road/out of control on curve crashes (15.2 percent)
- 10 off road/out of control on straight crashes (21.7 percent)
- Four head-on collisions (8.7 percent).

In addition, a review of the road environment and conditions showed there were:

- Nine crashes on a wet road surface (19.6 percent)
- 21 crashes in darkness (45.7 percent).

The vehicles involved in crashes included (these fields are not mutually exclusive):

- 40 cars (87 percent)
- 11 light trucks (23.9 percent)
- Three heavy vehicles (6.5 percent)
- Three motorcycles (6.5 percent).

In summary there were a significant number of rear end crashes along this length of Appin Road. Many of these crashes happened away from intersections and therefore it was assumed

they involved vehicles slowing and turning into the driveways that were situated along this length. There was also a cluster of five northbound rear end crashes approaching the Kellerman Drive roundabout. Only one crash was located at an intersection along this length.

There was a significant trend of out of control, head on and off carriageway crashes along this length of Appin Road with 21 crashes during the five year period. About half of these resulted in an impact with a tree. As noted above, this section of Appin Road has a significant number of trees lining the entire length.

There were six crashes noted with fatigue as a contributing factor, which was about a third of all fatigue crashes along the full analysis length of Appin Road.

Only three crashes involved heavy vehicles and three involved motorcycles in this northern section which was not considered to be significant.

Appin Road

Kellerman Drive to Princes Highway



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NORTHERN SECTION - Kellerman Drive to 315 m north of Rixon Road



FIGURE 3. MAP OF SECTION 1 – APPIN ROAD NORTHERN SECTION

2.2. Crash Analysis – Appin township

The road environment in the Appin township section of Appin Road is a residential road through a rural town. There is an undivided carriageway, with predominantly one wide lane in each direction.

This 2.3km length of Appin Road is relatively flat through town with traffic lights at two intersections being Market Street and Toggerai Street. Outside Appin Public School there is a 480m 40 km/h school zone that operates from 8am to 9:30am and from 2:30pm to 4pm on gazetted school days. The major intersection in the centre of town is at Wilton Road, which is a 90 degree bend and is controlled by stop signs on Wilton Road.

The adjoining land use is predominantly residential with driveway access points along this section of Appin Road. There is a section of shops and commercial properties which are typically separated from Appin Road by a strip of car parking. A service station is located on the north side of the town and bus stops are provided through Appin.

During the five year period from 1 July 2008 to 30 June 2013 there had been 24 crashes on this 2.3km section of Appin Road. Of these there were no fatal crashes and eight injury crashes resulting in eight injuries.

An analysis of this crash data showed that only one (4.2 per cent) crash was noted with speed and four crashes (16.7 per cent) with fatigue as contributing factors.

The five year crash data showed there were:

- 17 multi-vehicle crashes (70.8 per cent)
- 10 rear end collisions (41.7 per cent)
- 12 intersection crashes (50.0 per cent)
- Six off road/out of control on straight crashes (25.0 per cent).

In addition, a review of the road environment and conditions showed there were:

- Three crashes on a wet road surface (12.5 per cent)
- Seven crashes in darkness (29.2 per cent).

The vehicles involved in crashes included (these fields are not mutually exclusive):

- 24 cars (100 per cent)
- Three light trucks (12.5 per cent)
- One heavy vehicle (4.2 per cent)
- Two motorcycles (8.3 per cent)
- Two pedestrians (8.3 per cent).

In summary there were a significant number of rear end crashes along this length of Appin Road, which were typically associated with manoeuvring around a town centre. Due to the low speeds within the township most of the crashes (66.7 per cent) did not result in injuries.

The only two crashes that involved pedestrians along this length of Appin Road occurred within the township, one was a worker on the road and one was a pedestrian crossing Appin Road.

There were four crashes at the intersection of Macquariedale Road and Appin Road which all involved turning vehicles.

There were four crashes noted with fatigue as a contributing factor along this section of Appin Road.

Only one crash involved a heavy vehicle and two involved motorcycles in the town which was not considered to be significant.

Appin Road

Kellerman Drive to Princes Highway



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APPIN TOWN CENTRE - 315 m north of Rixon Road to intersection with Toggerai Street (TCS 3912)

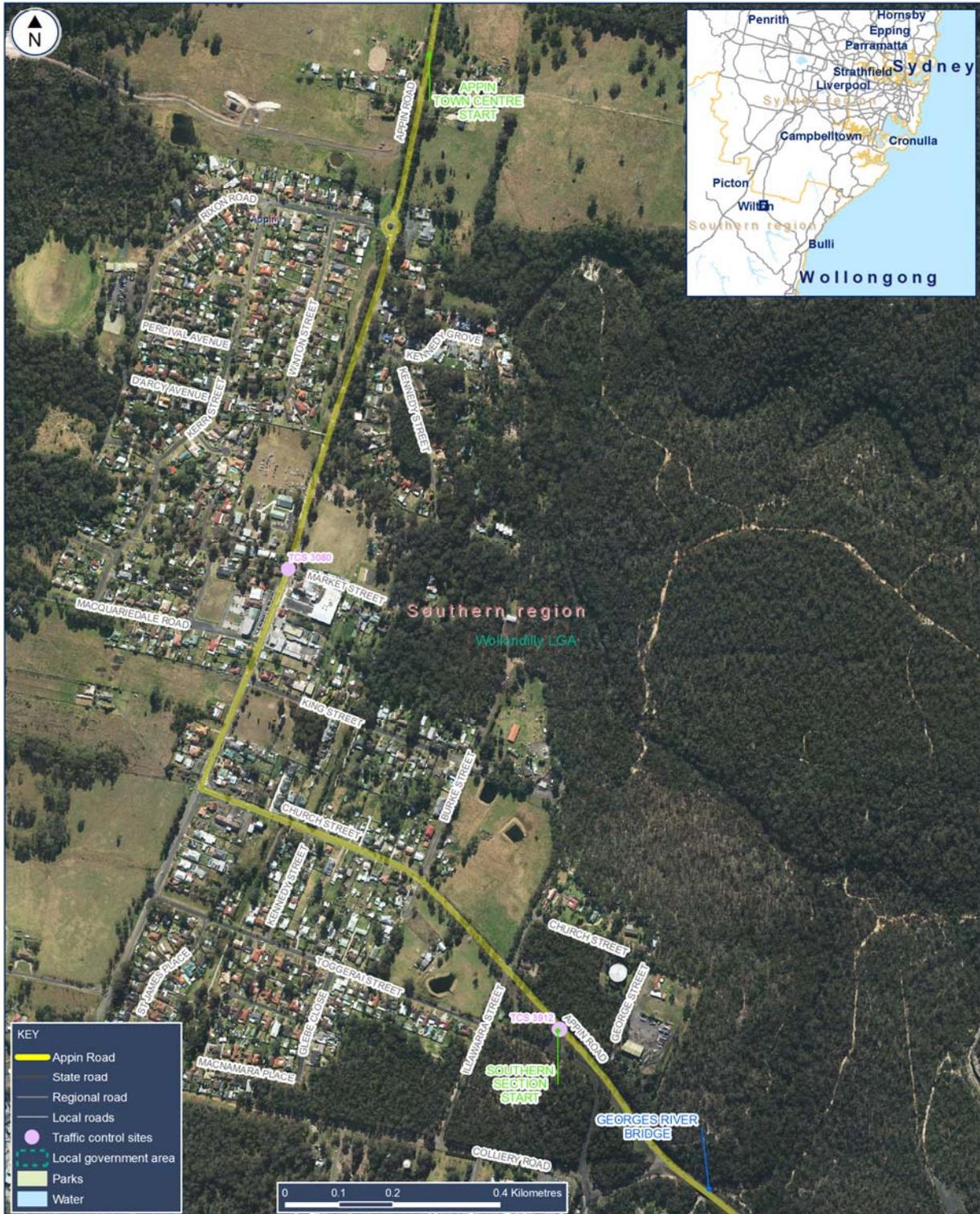


FIGURE 4. MAP OF SECTION 2 – APPIN TOWNSHIP

2.3. Crash Analysis – South of Appin township

The road environment in the South of Appin township section of Appin Road is predominantly bushland with coal mining operations and is 16.2km in length.

Along this length, Appin Road is an undivided carriageway, with predominantly one lane in each direction and sections of overtaking lanes provided over approximately 10km of to service both north and southbound vehicles.

The road has a number of significant curves along this section particularly around the waterway crossings which are undulating. There are two bridges crossing the Loddon Creek and the Georges River.

The West Cliff Colliery is located on the eastern side of Appin Road, just south of Appin township which results in a high proportion of heavy vehicles hauling coal on Appin Road.

There are two rest areas / heavy vehicle inspection areas that service both northbound and southbound light and heavy vehicle traffic on this section of Appin Road. The main intersection along this length is at the southern end, where Appin Road joins the Princes Motorway and Princes Highway.

During the five year period from 1 July 2008 to 30 June 2013 there had been 84 crashes on this section. There were five fatal crashes resulting in five fatalities and 46 injury crashes resulting in 76 injuries.

An analysis of this crash data showed 43 (51.2 per cent) crashes were noted with speed and nine crashes (10.7 per cent) with fatigue as contributing factors. The proportion of crashes with speed as a contributing factor was high, when compared to the other sections and the NSW averages.

The five year crash data showed there were:

- 50 single vehicle crashes (59.5 per cent)
- 38 off road/out of control on curve crashes (45.2 per cent)
- 12 off road/out of control on straight crashes (14.3 per cent)
- 11 head-on collisions (13.1 per cent). In addition, a review of the road environment and conditions showed there were:
 - 40 crashes on a wet road surface (47.6 per cent)
 - 30 crashes in darkness (35.7 per cent)
 - 11 intersection crashes (13.1 per cent).

The vehicles involved in crashes included (these fields are not mutually exclusive):

- 70 cars (83.3 per cent)
- 15 light trucks (17.9 per cent)
- 10 heavy vehicles (11.9 per cent)
- Five motorcycles (6.0 per cent).

In summary there was a significant trend of out of control, head on and off carriageway crashes along this length of Appin Road with 61 crashes during the five year period. A large proportion of these had occurred on curves along Appin Road. Additionally there were 40 crashes that occurred on a wet road surface and 43 crashes had speed noted as a contributing factor in this southern section.

There were 11 crashes at intersections, with most of these (eight crashes) at the on and off ramps to the Princes Motorway.

Four crashes occurred in fog or mist. This area at the top of the escarpment is prone to fog, which may limit a driver's visibility.

There were nine crashes noted with fatigue as a contributing factor, which was more than half of the fatigue crashes along the full analysis length of Appin Road.

There were 10 heavy vehicles involved in crashes along this southern section of Appin Road. This was a significant issue and given the use of this road by fully laden coal trucks was an area of concern.

There were five crashes that involved motorcycles.

Five of the 84 crashes resulted in fatalities in this section of Appin Road. Further detailed analysis of these fatal crashes and the four clusters of crashes in these areas had been undertaken.

The four identified crash clusters were located:

- **Cluster 1:** 1.6km to 2km south-east of Georges River
- **Cluster 2:** 400m west to 200m east of Baden Powell Drive
- **Cluster 3:** 2.4km to 2.6km north-west of Loddons Creek
- **Cluster 4:** 1.8km to 2km north-west of Loddons Creek.

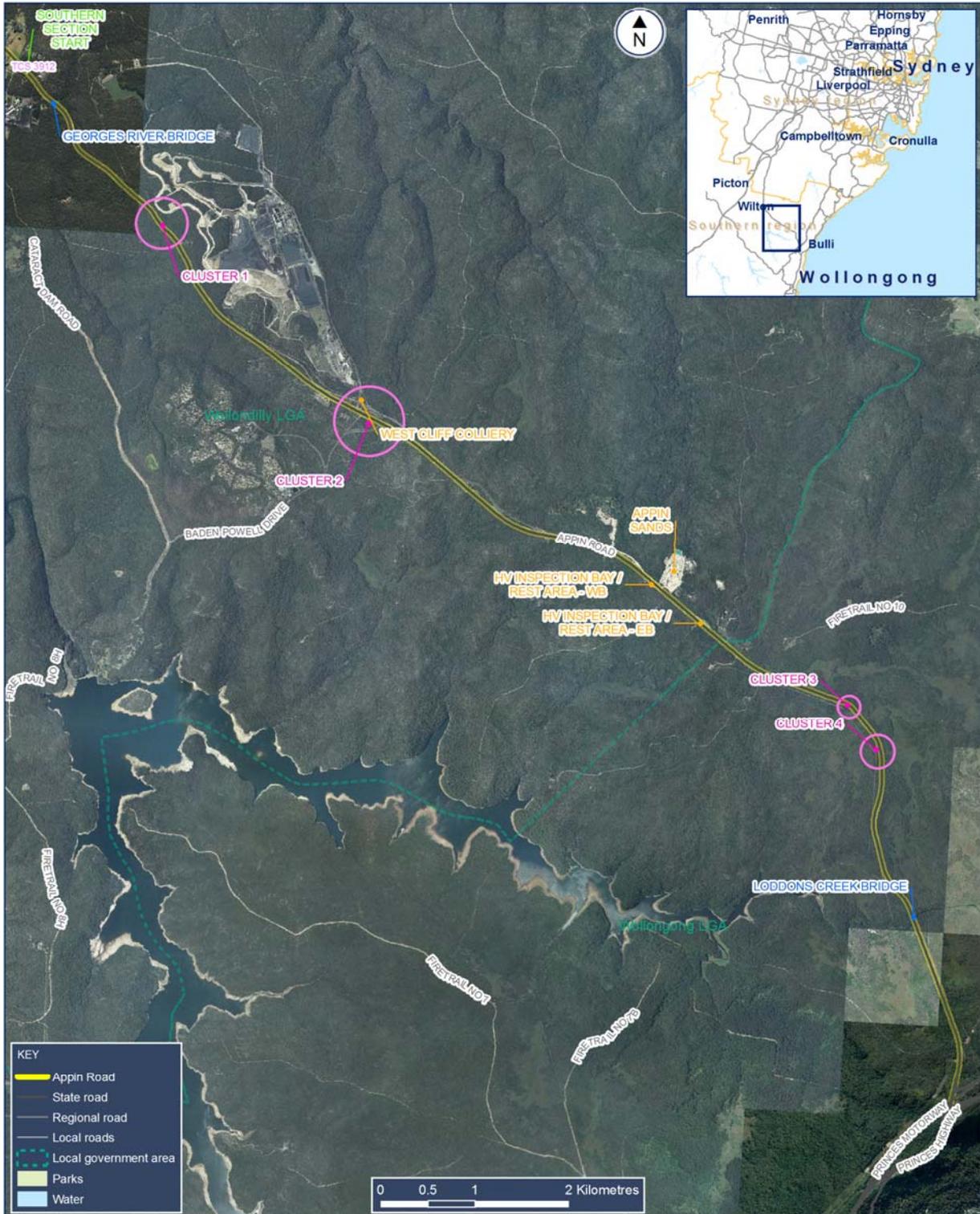
Appin Road

Kellerman Drive to Princes Highway



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SOUTHERN SECTION - Intersection with Toggerai Street (TCS 3912) to interchange with Princes Highway



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FIGURE 5. MAP OF SECTION 3 – APPIN ROAD SOUTHERN SECTION

2.3.1. Crash Cluster One

Crash cluster one is a 400m length of Appin Road 1.6km to 2.0km south-east of the Georges River. This location has an overtaking lane in the southbound direction and a speed limit of 100km/h. At this location there were seven reported crashes in the latest five year period. Of these crashes, one was a fatal crash and five were injury crashes. Six of the crashes involved speed as a factor and four crashes occurred on a wet surface.

The fatal crash was a head-on collision involving speed as a factor. This crash occurred on a dry surface in daylight. The remaining six crashes were all off road crashes, three crashes to the left and three crashes to the right. Four of these off road crashes occurred on a wet surface. Two of the crashes involved the primary vehicle travelling southbound and the remaining five crashes, including the fatal crash, were northbound.

2.3.2. Crash Cluster Two

Crash cluster two is a 600m length of Appin Road around the intersection with Baden Powell Drive (400m west and 200m east of this intersection). This length also contains the entry to the West Cliff Colliery on the northern side of Appin Road. The northbound section of Appin Road at this location has a left-turn slip lane into Baden Powell Drive and a right-turn lane for the colliery entrance. The northbound through lane is a single lane. Southbound is two lanes with a left-turn slip lane into the colliery and a right-turn lane into Baden Powell Drive. The speed limit at this location is 100km/h.

There were 11 reported crashes within this cluster for the latest five year period. One of these crashes was a fatal crash and five were injury crashes. One crash occurred at the intersection with Baden Powell Drive and three crashes involved vehicles exiting the colliery.

The fatal crash involved a vehicle travelling off road into a drain or culvert northbound on Appin Road. Alcohol and fatigue were factors in this single vehicle crash. In addition to this fatal off road crash, there were a further five off road crashes and one head-on crash. Five of the off road or head-on crashes involved vehicles travelling north on Appin Road.

Seven of the 11 crashes within this cluster occurred on a wet surface (64 per cent). Crashes are increasing at this location with two crashes in 2011, three in 2012 and two crashes in 2013 (half year).

Note three of the crashes were coded as 5km south of Appin township so the precise location of these crashes is not clear.

2.3.3. Crash Cluster Three

Crash cluster three is a 200m section of Appin Road located on a curve 2.4km to 2.6km north-west of Loddons Creek. At this location there are two lanes northbound and one lane southbound. The speed limit at this location is 100km/h.

There were eight reported crashes at this location for the latest five year period. Two of these crashes were injury crashes. Six of the eight crashes (75 per cent) occurred on a wet surface and seven crashes involved speed as a factor. Seven crashes were off-road and one crash was a head-on crash. Four crashes occurred in the southbound direction and four in the northbound direction. Four crashes occurred in darkness.

2.3.4. Crash Cluster Four

Crash cluster four is a 200m length of Appin Road located 1.8km to 2km north-west of Loddons Creek. This location is curved with two lanes travelling northbound and a single lane southbound. The speed limit at this location is 100km/h.

For the latest five year period, there were 10 reported crashes at this location. Two of the crashes were fatal crashes and four were injury crashes. Eight of the 10 crashes involved vehicles travelling southbound. Of the 10 crashes, eight were off road crashes, with six off to the left and two crashes to the right. In addition there was one head-on crash and one overtaking

crash. Four crashes in this cluster occurred on a wet surface and three occurred in darkness. Seven of the 10 crashes reported for this cluster had speed as a contributing factor. There was one crash involving a heavy vehicle. Eight of the crashes involved only a single vehicle.

One fatal crash (CrashID 752342 in 2011) occurred in the darkness and rain with the vehicle travelling off road to the right into a tree. Speed was considered a factor in this crash. The second fatal crash (CrashID 805692 in 2012) involved a head-on with a vehicle travelling east impacting with a westbound light truck. Speed was a factor in this crash which occurred in daylight on a dry surface.

3. Site investigations and identification of issues

Roads and Maritime has carried out a number of inspections along Appin Road, since the completion of the safety review to determine and assess the road environment and road conditions. In collaboration with the crash analysis, these inspections and assessments, , have helped identify issues and informed the program of works.

The identified issues have been broken up into the three sections (as per the crash analysis) and also a section of general issues that are present along the entire corridor.

As a result the following general issues have been identified:

- Delineation along the length of Appin Road appears to be reasonable when viewed in daylight conditions, however there are a couple of sections where guideposts/reflectors appear to be missing and the profile edge and centre lines have not been replaced after heavy patching.



- Maintenance of vegetation along the length of Appin Road needs to be reviewed. There are a number of locations where vegetation on the inside of curves is limiting the sight distance available for road users.



- The advance and intersection warning signage and road name signage is not consistently applied along the route.



- Curve warning and advisory speed signs are to be reviewed for accuracy along the entire route, to ensure consistency along Appin Road. This review will also include the review of speed limit signs.



- Centre line marking along the route provides a number of short overtaking opportunities and some of these are adjacent to overtaking lanes and merges. A review of the centreline marking should be undertaken along the entire route.



- Speed surveys have been collected along Appin Road which show that there is some non-compliance with the sign posted speed limits. NSW Police are responsible for the enforcement of the NSW Road Rules which include the enforcement of the speed limits and drink driving.



3.1. Issues – North of Appin township

A review of the crash history and an inspection of this section have identified the following issues along Appin Road between 10m south of Kellerman Drive and 315m north of Rixon Road:

- There are very narrow sealed and often unsealed shoulders along much of this section of Appin Road. There is no opportunity to regain control of an errant vehicle in these narrow and predominantly unsealed shoulders. The lane widths in this area are around 3.5m, which are acceptable for this 80km/h speed limit.



- Approximately 600m south of Kellerman Drive there are two sections of swale style drain that cover about 1km on the eastern side of Appin Road. This style of drain is in close proximity to the travel lane and poses a safety risk for errant vehicles.



- Driveways to large rural residential properties line this length of Appin Road. Many of these driveways are concealed and there is a significant rear end crash history involving vehicles decelerating or stationary waiting to turn into these properties. Due to the narrow road configuration there is no opportunity to pass these slowing or stopped vehicles. As these rural residential houses are well set back from Appin Road it is likely road users do not expect to find propped or slower moving vehicles in this length of Appin Road.



- A large commercial farm facility for Inghams Chickens is located on the western side of Appin Road. Access to this facility is provided at a large uncontrolled driveway access, to the north of Appin township. This intersection has only minimal signage and requires improvements to the line marking.



- There was a cluster of rear end collisions heading northbound on Appin Road on approach to the Kellerman Drive roundabout. There is no advance warning that you are approaching a roundabout or that there may be a queue of vehicles.



- Mature trees line much of this length of Appin Road and they are often located quite close to the travel lanes. In recent years two lengths of wire rope barrier were installed to protect errant vehicles from hitting some of these trees. Additionally profile edge lines and additional Raised Reflective Pavement Markers (RRPM) have been installed along the northern most 6km of this section to warn motorists if they leave their travel lane.



- A review of the driveway of 880 Appin Road has identified that the sight distance of approaching southbound vehicles, when turning onto Appin Road, was obscured by a large tree adjacent to Appin Road.



- Profile line marking is provided through much of this length of Appin Road, however there is a 3km section on approach to the Appin township that requires further investigation into the provision of profile edge and centre line markings.



- As this is a rural section of road there is no street light provided, so at night road users rely on the line marking and delineation along the route, which includes RRPMs, centre and edge lines, guideposts and warning signs. During the daytime inspection the line marking generally appeared to be in a satisfactory condition, however further enhancement of the delineation, such as guideposts, should be considered.



- There are a number of sections where the road surface has been heavily patched to repair potholes. As a result the ride quality is poor in some areas.



- Due to the proximity of longwall coal mining in the vicinity of Appin Road there is a significant risk of pavement damage due to mining subsidence. A regular inspection program exists and repairs to the pavement are made when necessary to address these issues. A length of 1.6km of pavement is due to be reviewed and repaired as needed. This work is planned in coming months to address subsidence from 1.2km to 2.8km north of Rixon Road.
- Speed was noted as a factor in 10.9 per cent of the crashes along this length of Appin Road. The speed limit on the section of Appin Road to the north of Appin township was reduced from 100km/h to 80km/h in mid-2002 to reduce vehicle speeds and the incidence of crashes. The incidence of serious and fatal crashes has reduced significantly along this length of Appin Road post speed reduction. Although the NSW Police regularly enforce the speed limits on Appin Road, there is a need to investigate vehicle speeds in this area.



- A significant residential development is currently under construction adjacent to Appin Road on the northern outskirts of Appin township between Brian Road and Rixon Road. Access to this development is from a new roundabout on Appin Road which is being built. The speed limit in this area is currently 80km/h.



3.2. Issues – Appin township

A review of the crash history and an inspection of this section have identified the following issues along Appin Road through the town from 315m north of Rixon Road to Toggerai Street:

- Inconsistencies exist in the pavement through the Appin township due to the history of unrelated minor works and patching.



- Many of the local roads within the Appin township are poorly signposted. As this is the responsibility of Wollondilly Council it is appropriate to request Council to carry out a review.



- There is a pinch point within the Appin township on Appin Road outside the petrol station (located on the eastern side). The entry and exit driveways are provided on to Appin Road adjacent to a stand of trees (which narrows the road shoulder) and an adjoining north and southbound pair of bus stops. There is a cluster of crashes in this area and the bus stops and the trees limit the opportunity to pass stopped or turning vehicles.



- A pair of kerb blisters were provided outside of Appin Public School to provide protection for pedestrians waiting to cross the road and to minimise the crossing length. The kerb blisters have an incorrect hazard marker board sign on both approaches.



- Line marking at the intersection of Wilton Road and Appin Road (stop signs on Wilton Road only) is confusing, particularly the lane designation for northbound traffic on Appin Road. Further improvements to the delineation at this intersection and the approaches would further enhance safety at this site.



- Within the residential area there are two sections of overtaking permitted to the south and north of the Wilton Road junction. This overtaking falls within a 50km/h speed limit and may encourage unsafe manoeuvres adjacent to residential properties and near the school.



- The intersection of Illawarra Street (northern leg) at Appin Road is currently unsealed (gravel). As a result the gravel has been pulled into the intersection. Additionally the line marking at this intersection is poor and the creation of the two southbound lanes on Appin Road occurs immediately after this intersection.



- A non-standard 'No Right Turn' sign is incorrectly installed on Appin Road southbound at the Toggerai Street intersection.



- Currently the 80km/h speed limit on the southern outskirts of Appin township starts 120m north of the traffic signals at Toggerai Street resulting in vehicles accelerating on the southbound approach to an intersection with traffic lights. In this area there is also a short merging lane for northbound traffic within an 80km/h zone.



- A southbound overtaking lane starts just before the intersection with Toggerai Street which has traffic lights and this encourages road users to accelerate approaching intersection. Additionally the overtaking lane is on the left hand side of the approach lane, which is not standard as it promotes road users to undertake turning vehicles.



3.3. Issues – South of Appin township

A review of the crash history and an inspection of this section have identified the following issues along Appin Road from Toggerai Street intersection to the Princes Highway:

- There is an identified pattern of wet surface crashes on this southern section of Appin Road. In 2012 there were 11 crashes on a wet surface resulting in 16 casualties. In the first half of 2013 there were a further five crashes resulting in three casualties. A significant resurfacing program has been carried out on this stretch of Appin Road and a visual inspection of the pavement and review of the surface friction results did not identify any specific areas of concern. It's therefore necessary to determine if pavement geometry is contributing to wet weather crashes due to poor drainage of the road surface. An inspection during a rain event will be carried out to determine if detailed survey of the road geometry is needed.
- In 2012 on the approaches to Loddons Creek Bridge two sections of overtaking opportunity (370m southbound and 1.3km northbound) were identified on Appin Road in close proximity to overtaking lanes. Overtaking lanes provide a safer environment.



- Speed is noted as a factor in 43 crashes along this southern section of Appin Road. In January 2013, a review of the 100km/h speed limit on Appin Road was undertaken, which found the current 100km/h speed limit on Appin Road between Appin township and Princes Highway interchange to be appropriate.
- Speed surveys undertaken in 2012 at the boundary between Wollondilly and Wollongong council's areas showed the 85th percentile speeds to be 109.8km/h westbound and 106.9km/h eastbound. Although NSW Police regularly carry out speed enforcement in this area, the speed survey data could be used to better target speed enforcement activities on Appin Road.

- Eastbound and westbound combined rest areas for light and heavy vehicles are provided along this length of Appin Road to manage driver fatigue and provide an opportunity for a rest break. Roads and Maritime is currently investigating the placement of mobile vendors in these rest areas. It is expected that mobile vending in rest areas will increase the number of road users stopping at this facility and may reduce the incidence of fatigue related crashes.



- Around the exit from the West Cliff and Appin colliery's there is a visible impact of coal dust falling on the road from vehicles. The line marking in this area is grey in colour and appears quite dull. The effect of coal on the road and line marking needs to be better understood.



- A Firewise advertising billboard is located facing southbound traffic on approach to the bend near crash cluster four. A driver's attention should be focussed on the driving task at this point in time and not on reading a billboard sign.



- The safety review suggested the use of vehicle activated signs (VAS) around crash cluster four. VAS are most effectively used to warn drivers of a specific hazard, rather than a length of road, and so would not appear to be warranted in this location. A review of the curve advisory markers, curve warning and advisory speed signs is planned to be undertaken.
- At the southern end of Appin Road there is a large and very deep drain on the western side of Appin Road, set back around three to five metres from the travel lanes. This unprotected drainage channel may pose a hazard for errant motorists.



- The analysis indicated that four crashes occurred during fog or misty conditions. As with a number of roads in this area at the top of the escarpment the weather conditions can change quickly and a heavy fog or mist may restrict a driver's visibility. Signage is provided to warn motorists.



- There were eight reported crashes at the intersection of Appin Road and Princes Motorway. Four of these were right turn/through traffic crashes which involved vehicles crossing two southbound lanes on Appin Road to make a right turn. A further detailed review of sight distance and vehicle manoeuvres at this intersection should be looked at, with consideration of a single southbound lane through this intersection and the addition of left turn lanes. A short merge is provided on the southern side of this intersection.



4. Program of Works

There is an ongoing program of maintenance work along the Appin Road corridor that is carried out predominantly by Roads and Maritime. In addition to this maintenance program, Roads and Maritime has carried out a number of specific projects on Appin Road to improve the safety of road users in recent years.

4.1. Completed Works

In June 2002 Roads and Maritime reduced the speed limit on Appin Road from 100km/h to 80km/h in the northern section from south of Kellerman Drive to Brians Road.

In 2007, Roads and Maritime installed profile line markings on the edges of Appin Road to the south of Kellerman Drive.

In 2008, two sections of wire rope fencing were installed along Appin Road to protect errant vehicles from impacting the mature trees along this northern section of Appin Road. One barrier is 100m long and is located on the eastern side of Appin Road, approximately 700m south of Kellerman Drive. The other barrier is 110metres long and located on the western side of Appin Road, approximately 3.7km south of Kellerman Drive.

In 2012/2013, Roads and Maritime removed two sections of overtaking opportunity from Appin Road, on the approaches to Loddons Creek Bridge, 370m eastbound and 1.3km westbound, to encourage drivers to use the overtaking lanes on the departure side of the bridge in each direction, which provide safer overtaking.

In 2013, Roads and Maritime upgraded the directional sign posting along Appin Road to include the new route marking system, consistent with the national standard.

Recent activity in the longwall mines that pass under Appin Road has led to some deformation in the road pavement along Appin Road. This is closely monitored and repairs are made to the surface to ensure the safety of road users. It is expected that further longwall mining will be done in this area (to the north of Appin township). Any related impacts on the road surface will be repaired.

Roads and Maritime has undertaken two pavement maintenance projects in the northern section of Appin Road between 2004 and 2006. This work included:

- Re-surfacing of a 3km length, from 3.3km to 6.3km south of Kellerman Drive
- Pavement rehabilitation from Kellerman Drive to the Campbelltown LGA boundary.

More recently Roads and Maritime has undertaken a resurfacing program on Appin Road from 2011 to 2013 to provide a consistent asphalt surface on the southern section and into Appin township. In 2013 this work included:

- From Illawarra Street to Wilton Road
- A 3km length from 730m to 3.8km west of Loddon Creek Bridge
- A section at the eastern end of Appin Road at Bulli Tops
- A length from the West Cliff Colliery junction west for 1.2km.

In 2011-2012, Roads and Maritime investigated installing a road side wire rope barrier about 2km south of Kellerman Drive to protect errant road users from crashing into the mature trees. The existing trees are located very close to the travel lane, the installation did not go ahead because there was not enough land area to meet minimum requirements.

4.2. Early Works (funded)

Roads and Maritime has a program of ongoing surveillance and maintenance activities within the Appin Road corridor including vegetation trimming, signage, line marking and cleaning of rest areas.

Roads and Maritime has programmed \$745,000 of surface rehabilitation on the following two sections of Appin Road during the next six months:

- 3.8km west of Loddon Creek adjacent to the two rest areas
- 1.2km west of Wedderburn Road.

A 1.6km length of pavement is due to be reviewed and repaired, as needed, following recent mining activity. This surface repair work is planned in coming months to address subsidence from 1.2km to 2.8km north of Rixon Road.

Night time inspections will be undertaken to review the effectiveness of the existing signage and delineation along the length of Appin Road. Any deficiencies will be addressed.

Roads and Maritime has carried out a review of the existing delineation and signage along Appin Road. General improvements will be made to the following signs and lines in coming months:

- Advance intersection warning signs
- Curve warning and advisory speed signs
- Curve alignment markers
- Guide posts
- Sections of profile edge and centre line marking
- Raised reflective pavement markers.

Specific signage upgrades and improvements include:

- Replacement of the non standard no right turn sign at Toggerai Street
- Replacement of the non standard hazard marker boards on the kerb extensions in front of Appin Public School.
- Advance roundabout ahead/reduce speed warning signs northbound on Appin Road approaching the Kellerman Drive roundabout
- Concealed driveway warning signage on the northern section of Appin Road.

Review of all overtaking opportunities then adjustments, if required. Particular sites that should be investigated include:

- Overtaking opportunity south of Kellerman Drive
- Overtaking through the Brians Road intersection
- Overtaking opportunity south and north of Wilton Road intersection
- Southbound overtaking lane across Toggerai Street
- Southbound overtaking lane across the Princes Highway interchange.

The Firewise advertising sign will be relocated, away from the bends on Appin Road.

Roads and Maritime will undertake a speed zone review to relocate the 50km/h speed limit on the southern side of Appin township 120m further south of its existing location, to include the intersection with traffic lights at Toggerai Street.

Additional speed surveys will be carried out in early 2014 to inform enforcement activities along the northern section of Appin Road. Roads and Maritime will meet with NSW Police to provide data and work with them to better target enforcement activities.

Roads and Maritime will carry out mobile speed camera site assessments to identify places that could enhance the current NSW Police enforcement of the speed limits on Appin Road.

Roads and Maritime is moving forward with negotiations to use the existing rest area facilities on Appin Road for mobile vendors. Should this be successful, it is expected to increase the attractiveness of stopping within the rest areas and improve the management of fatigue related crashes.

Wet surface inspections will be carried out on the southern section of Appin Road to identify any areas where drainage and water sheeting may be an issue.

4.3. Works for further investigation

A detailed investigation of the clear zone along the northern section of Appin Road is currently being carried out by an independent consultant. An environmental assessment will need to be done as it is understood there may be an ecologically sensitive habitat in this area. If there are no environmental issues, then a hazard removal program will be developed in consultation with Council and the community.

The cause of crashes at crash cluster four requires further investigation beyond the initial SCRIM and pavement inspections which have been carried out. Other work includes:

- Wet weather inspection to investigate possible sheeting of water on the road surface
- If sheeting is occurring, a detailed survey of the road geometry will be required to identify what redesign is necessary
- If sheeting is not occurring, further work to make this section of road more forgiving, such as clear zone improvements and safety barrier, will be investigated.

Roads and Maritime will do a speed limit review and consider the starting point of the 80km/h speed limit on the northern side of Appin township, after the current redevelopment and roundabout construction work in this area is done.

A review of the drainage systems in both the northern and southern sections of Appin Road will be carried out to determine if any works are required.

Should the colliery make any changes to its operation or submit a Development Application, Roads and Maritime will review the access arrangements from Appin Road.

Roads and Maritime will hold a discussion with the colliery regarding the coal dust, which accumulates on the road surface and line marking along Appin Road. During inspections it was also noted that coal from vehicles was deposited in the rest areas.

Roads and Maritime will review the road layout and vehicle manoeuvres in the vicinity of the petrol station and adjoining bus stops within the Appin township.

Street blade signposting within Appin township can be difficult to locate and read, so Roads and Maritime will contact Wollondilly Council to request a review of this signage.

Improvements to the road shoulders may be considered in conjunction with maintenance activities, if there is a demonstrated crash history.

Maintenance of the pavement along Appin Road is an ongoing program. Funding for maintenance activities along Appin Road, will be prioritised against other maintenance projects across NSW. Providing a sealed surface at the intersection of Illawarra Street will be considered when resurfacing work is carried out in this area.

5. Recommendation

It is recommended that Roads and Maritime continue to implement the early works identified in this report in 2014. These works are funded under existing Road Safety programs.

These funded works are currently being carried out and most are expected to be implemented in coming months. The estimated cost of the funded works for the signage, line marking and delineation improvements is about \$100,000. The upcoming maintenance works have an estimated cost of \$745,000.

Further investigation and planning will be undertaken in regard to the remaining works identified in this report. Detailed investigations and survey will inform the development of these projects. The progress of these works is dependent upon identifying suitable funding sources and prioritising works on a state wide basis.

6. Appendix

Maps

- Appin Road finalised crashes, map 1 to 5

Full Length

- Appin Road full length finalised SCR, DCR, RUM
- Appin Road full length provisional SCR, DCR, RUM
- Appin Road full length finalised darkness SCR
- Appin Road full length finalised fatigue SCR
- Appin Road full length finalised speed SCR
- Appin Road full length finalised heavy vehicles SCR, DCR, RUM
- Appin Road full length finalised intersections SCR, DCR, RUM
- Appin Road full length finalised wet surface SCR, DCR, RUM
- Appin Road full length provisional wet surface SCR, DCR, RUM

Cluster Crash Data

- Cluster one finalised SCR, DCR, RUM
- Cluster one finalised wet surface SCR
- Cluster two finalised SCR, DCR, RUM
- Cluster two finalised wet surface SCR
- Cluster three finalised SCR, DCR, RUM
- Cluster three finalised wet surface SCR
- Cluster four finalised SCR, DCR, RUM
- Cluster four finalised wet surface SCR
- Cluster four provisional SCR, DCR, RUM

Fatal Crash Data

- Fatal CrashID 678066 finalised SCR, DCR
- Fatal CrashID 701201 finalised SCR, DCR
- Fatal CrashID 752342 finalised SCR, DCR
- Fatal CrashID 804379 finalised SCR, DCR
- Fatal CrashID 805692 finalised SCR, DCR
- Fatal CrashID 854421 provisional SCR, DCR

Northern Section

- Finalised SCR, DCR, RUM
- Provisional SCR, DCR, RUM
- Rear end finalised SCR, DCR
- Wet Surface finalised SCR, DCR, RUM

Town Centre

- Finalised SCR, DCR, RUM
- Provisional SCR, DCR, RUM

Southern Section

- Finalised SCR, DCR, RUM
- Provisional SCR, DCR, RUM
- Wet Surface finalised SCR, DCR, RUM

Intersection

- Appin Road and Princes Highway finalised DCR, Crash Diagram