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# Champions Quarry Consent Modification 4

## Environmental Assessment

Prepared for

**Champions Quarry 2 Pty Ltd**

**June 2018**

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## Commonly Used Acronyms

| Abbreviation | Description |
|---|---|
| ADT | Annual Daily Traffic |
| AUL | Auxiliary Left Turn Lane |
| BAL | Basic Left Turn Lane |
| BAR | Basic Right Turn Lane |
| CHL | Channelised Left Turn Lane |
| CHR | Channelised Right Turn Lane |
| CQ | Champions Quarry |
| DoS | Degree of Saturation |
| DP&E | Department of Planning and Environment |
| EA | Environmental Assessment |
| ENM | Environmental Noise Model |
| ERM | Environmental Resources Management |
| HV | Heavy Vehicle |
| LCC | Lismore City Council |
| LoS | Level of Service |
| LV | Light Vehicle |
| NAL | Noise Assessment Locations |
| PA | Project Approval |
| PSNC | Project Specific Noise Criteria |
| RMS | Roads and Maritime Services |
| TMP | Transport Management Plan |
| VPH | Vehicles per Hour |

# 1 Introduction

## 1.1 Background

Champions Quarry 2 Pty Ltd ("the Proponent") owns and operates the business known as Champions Quarry ("the Quarry"), located at 1668 Wyrallah Road approximately 16 kilometres south of Lismore, within the Lismore local government area (refer **Figure 1**). The Quarry operates under Project Approval (PA) 09_0080 granted by the Planning Assessment Commission on 30 August 2012. The Proponent is approved to extract sandstone at a rate of up to 250,000 tonnes per annum for up to 25 years.

Crushed and screened product is loaded onto trucks for distribution by road. The current approval limits the Quarry to dispatching no more than 5 laden trucks from the site per hour and up to a maximum of 50 trucks per day. There is no limit to the tonnes per day, nor maximum tonnes per truck.

Subsequent to the original 2012 approval, 3 modifications to PA 09_0080 have been approved. These are outlined in **Section 2.**

## 1.2 Scope of Report

This Environmental Assessment (EA) report has been prepared for the Proponent as part of a Modification Application (MOD) to the Department of Planning and Environment (DP&E) to assess potential environmental impacts associated with a proposed increase to the hourly and daily truck movements to and from the Quarry.

The current approval stipulates that extractive material must be transported on 3 designated haulage routes (except in circumstances where the final destination of the transported quarry products can only be accessed by other roads). This report assesses the potential impacts, within the Quarry and on these designated haulage routes, of the proposed increase to hourly and daily truck movements.

Where components of the MOD do not differ from the approved development, they are not detailed within this report as they are considered to have been addressed as part of the original assessment.

## 1.3 The Proponent

The Proponent is a jointly owned family company located in the Far North Coast region of New South Wales. The Proponent services the surrounding areas with quarry and landscapes supplies.

The Proponent has a continued commitment to sustainable development principles in relation to businesses in general, to agriculture and quarrying in particular.

## 1.4 Location

The Quarry is located at 1668 Wyrallah Road in Tuckurimba, approximately 16km south of Lismore in northern NSW (refer **Figure 1**). Access to the site is via an access road from Wyrallah Road.

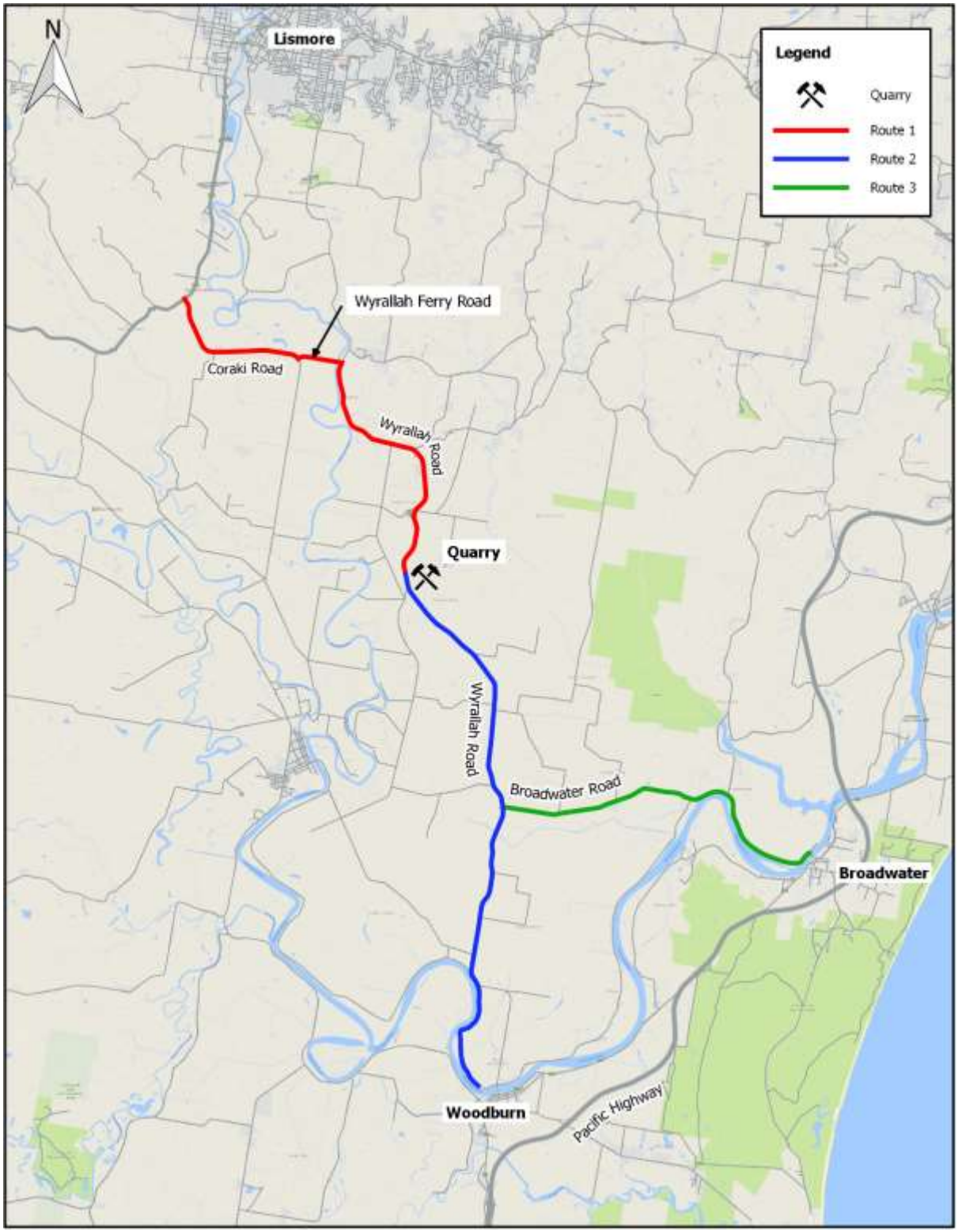


**Figure 1 – Locality Plan and Transport Routes**
(Source: Google – October 2017)

# 2 Project Approval History

A small quarry has been in periodic operation at the site since 1959 and was originally a Local Government pit. Development consent DA 2005/999, granted by Lismore City Council (LCC) in 2006, allowed for the extraction of approximately 29,000 m3 per annum (approximately 64,000 tonnes per annum) of sandstone material for up to 15 years. The Proponent submitted a Development Application (DA) to LCC in May 2008, seeking to expand the Quarry and increase production of crushed sandstone and other products. In February 2009, LCC refused the application for a number of reasons.

Subsequently, an application was made to the DP&E under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). The proposed Quarry expansion was classified as a major project, as it was an extractive industry that extracts from a total resource greater than 5 Mt. Consequently, the Minister for Planning and Infrastructure or delegate became the approval authority for the DA.

In July 2012, DP&E approved the expansion of the Quarry subject to strict conditions of approval including a limit of dispatching no more than 5 laden trucks from the site per hour.

The 2012 approval allowed for extraction of 250,000 tonnes per year for 25 years. The limit of 5 laden trucks per hour was for 11 hours a day Monday to Friday with a maximum of 50 laden trucks per day. There was and still is no limit to export tonnes per day, nor maximum tonnes per truck.

Subsequent to the 2012 approval, 3 Project Approval (PA) modifications have been approved. These are described below.

## 2.1 Modification 1

The first modification (DA 09_0080 MOD1) was approved in October 2013 and was largely of an administrative nature, namely:

- Lot boundary re-alignment so that the Quarry pits and the biodiversity offsets were included within one lot, instead of the biodiversity offset being located across a lot boundary;
- An alternative method to secure the biodiversity offset area; and
- An extension of time to construct the weighbridge within 2 years and the use of weight scales on front end loads in the interim.

## 2.2 Modification 2

Modification 2 (DA 09_0080 MOD2) was approved in September 2016 and involved the following amendments:

- Amendment to allow the use of scales fitted to front end loaders for weighing product as an alternative to the use of a weighbridge;
- Amendment to allow the use of watering of the internal haul road that connects the central and southern extraction areas as an alternative to sealing the road;
- Amendment of the boundaries of the biodiversity offset areas, including clarifying that a tree screen on the northern side of the Quarry access road does not form part of the Biodiversity Offset Strategy; and
- Allowance for reduction to the number of Community Consultative Committee meetings held each year.

## 2.3 Modification 3

Modification 3 (DA 09_0080 MOD3) was approved in August 2017 and included the following amendments:

- Approval for installation of a sand washing plant including the removal of topsoil and overburden from approximately 1 hectare to establish the site;

- Modification of Bund E, a bund adjacent to the sand washing plant to increase its height in order to shield the sand washing plant from sensitive receivers; and
- Installation of additional sedimentation ponds until a filter press is installed.

# 3 Proposed Modification 4 (MOD 4)

Schedule 2, Condition 9 of the PA conditions of approval states:

*The Proponent must not:*

*a) transport more than 250,000 tonnes of extractive material from the site in any calendar year;*

*b) dispatch more than 50 laden trucks from the site on any day; or*

*c) dispatch more than 5 laden trucks from the site in any hour.*

The Proponent is seeking approval to increase the hourly limit from 5 laden trucks per hour to 10 laden trucks per hour, and hence the daily limit from 50 to 100 trucks per day. However, the Proponent does not propose any change to the annual extraction limit. The application for a maximum of 10 trucks per hour is being sort for intermittent periods of high demand to enable the Quarry to supply material to large projects including the Pacific Highway upgrade. The frequency of 10 trucks per hour traveling on any one route will be rare but will enable the Proponent to maintain supply to their regular local customers as well as any intermittent larger supply contracts.

It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall yearly trucks movements will not increase. The Proponent does not propose any change to the annual extraction limit and hence the overall yearly trucks movements will not increase.

## 3.1 Statutory Context

The 2012 major project approval was determined as a transitional project under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act) and met the criteria in Clause 7(1)(b) of Schedule 1 of the then State Environmental Planning Policy (Major Development) 2005.

In accordance with Clause 8J(8) of the Environmental Planning and Assessment Regulation 2000 and the transitional arrangements under Schedule 6A of the EP&A Act, the proposed modification is to be determined under the former section 75W of the EP&A Act. This is consistent with the assessment of the previous 3 project modification applications.

## 3.2 Consultation

### 3.2.1 Department of Planning & Environment

Contact with DP&E was made in October 2017 with details of the proposed modification to seek advice regarding lodgement of a modification application. Due to the nature of the proposed modification, advice received from DP&E was that both a Traffic and Transport Assessment (TIA) as well as a Noise Assessment would be required.

DP&E advised that the TIA should include:

- Accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;
- A detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and state road network, including a road safety audit; and
- A description of the measures that would be implemented to mitigate any impacts, including concept plans of any proposed upgrades, developed in consultation with the relevant road and rail authorities (if required).

Regarding the Noise Assessment, DP&E advised that it should include a quantitative assessment of potential:

- Construction and operational noise and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Industrial Noise Policy and NSW Road Noise Policy;
- Reasonable and feasible mitigation measures to minimise noise emissions; and
- Monitoring and management measures.

### 3.2.2 Department of Roads and Maritime Services (RMS)

A letter of consultation was sent to RMS in November 2017. The letter outlined the proposed modifications and sort comment regarding the proposed increase in heavy vehicles. A response was received from RMS on 21 November 2017. The letter is ATTACHED in **Appendix 1** and details the requirements from RMS for the TIA.

### 3.2.3 Lismore City Council (LCC)

An identical letter of consultation was sent to LCC in November 2017. An email response was received on 14 November 2017 stating that LCC had no additional issues to be addressed at that time. Council's response is ATTACHED in **Appendix 1**.

# 4 Environmental Assessment

The proposed MOD4 will result in an increase of up to 5 additional laden HVs per hour and therefore a potential increase in development traffic numbers and traffic noise. Therefore, these potential traffic and noise impacts require assessment.

All other environmental impacts identified and assessed in the original approved development will remain unchanged by this MOD proposal. No change to the approved working hours is proposed:

- Weekdays - 7:00 am to 6:00 pm;
- Saturdays - 8:00 am to 1:00 pm; and
- Sundays or public holidays - No work.

## 4.1 Traffic Impact Assessment

A TIA was prepared to assess the impact of a proposed increase in truck numbers from 5 to up to 10 laden trucks per hour. A copy of the TIA is provided in **Appendix 2** and a summary is provided below.

### 4.1.1 Transportation Routes

Three approved haulage routes are used to transport quarry products as follows (refer **Figure 1**):

- Transport Route 1 is north from the Quarry to the Bruxner Highway via Wyrallah Road, Wyrallah Ferry Road, and Coraki Road;
- Transport Route 2 is south along Wyrallah Road intersecting with the Pacific Highway at Woodburn; and
- Transport Route 3 is south-east to the Pacific Highway at Broadwater via Wyrallah Road and Broadwater Road.

An inspection of the transportation routes was conducted in 2009 by Roadnet Pty Ltd as part of their TIA for the 2012 development consent. Through consultation with LCC and the Proponent, it is understood that the surrounding road network and transportation routes remain largely unchanged with the exception of the following;

- The speed limit on Wyrallah Road has been reduced from 100km/h to 80km/h from Lismore to just south of the Quarry;
- Several rehabilitation and minor widening projects have been undertaken on both Wyrallah and Broadwater Roads;
- A 40 tonne load limit has been imposed on Broadwater Road;
- The intersection of Wyrallah and Tucki Road has been upgraded to an Auxiliary Right (AUR) type intersection;
- Wyrallah Road and Wyrallah Ferry Road intersection has been widened to cater for the turn movements of HV's travelling to and from the Quarry (as required under the original 2012 PA); and
- Coraki Road and Wyrallah Ferry Road intersection has been widened to cater for the turn movements of HV's travelling to and from the Quarry (as required under the original 2012 PA).

A road safety audit of the transportation routes was previously conducted as part of the original TIA. As the changes to the transportation routes have only improved road conditions it was considered that an additional road safety audit would be unnecessary.

### 4.1.2 Background Traffic Volumes

Historical and current traffic volumes on the transportation routes were obtained from previous TIA reports from the Proponent, RMS and LCC. Values of forecast traffic at a 10 year horizon were calculated using the growth rates as shown in **Table 1.** These values were used to access the future capacity of intersections within the transportation routes. As the future traffic on the Pacific Highway is likely to be significantly reduced in 2020 with the completion of the bypass of Woodburn and Broadwater, current Pacific Highway traffic volumes were used for analysis at the 10 year horizon.

**Table 1 - Existing Traffic Volumes**

| Road | Site of Count | Year of Count | Growth Rate | 2017 ADT | 2027 ADT | %HV |
|---|---|---|---|---|---|---|
| Pacific Highway | 600m east of Norman Street, Woodburn | 2017 | 2.3% | 9,958 | N/A | 5% |
| Wyrallah Road | No.2739 Wyrallah Road | 2015 | 1.4% | 2,014 | 2,384 | 7% |
| Wyrallah Road | West of Leslie Lane | 2015 | 1.4% | 2,481 | 2,936 | 7% |
| Broadwater Road | 50m east of Dungarubba Hall | 2016 | 2.8% | 681 | 927 | 27% |
| Wyrallah Ferry Road | 500m west of Wilsons River Bridge | 2017 | 1.4% | 1,644 | 1,889 | 16% |
| Coraki Road | Pole 33739, between Bruxner Highway and Wyrallah Ferry Road | 2017 | 1.4% | 1,631 | 1,874 | 13% |
| Bruxner Highway | Clovass | 2015 | 2.5% | 5,996 | 8,064 | 11% |

*NB: ADT = Average Daily Traffic; HV = Heavy Vehicles*

### 4.1.3 Development Traffic

The Proponent currently has approval for 5 laden truck movements per hour for 11 hours per day from Monday to Friday (7:00am-6:00pm) and 5 hours on Saturdays (8:00am-1:00pm). The current approval however, has a maximum daily limit of 50 laden trucks.

Truck types used by the Quarry are:

- Single body trucks;
- Truck & Dog (32-34 tonne); and
- HVB (body truck with 4 axle trailer) up to 42 tonne.

The Proponent currently has approval to extract 250,000 tonnes per year however the Proponent does not propose any change to the annual extraction limit and hence the total development generated trucks per year will not change.

The Proponent is seeking approval to increase their hourly limit from 5 laden trucks per hour to 10 laden trucks per hour. It should be noted that the Proponent will not be hauling for extended periods at 10 trucks per hour. The application for a maximum of 10 laden trucks per hour is only being sort for intermittent periods of high demand to enable the Proponent to supply material to large projects including the Pacific Highway upgrade.

The frequency of 10 laden trucks per hour traveling on any one route will be rare as the Proponent will maintain supply to their local customers including concrete and asphalt plants. Furthermore, the new sand washing operation will result in intermittent sand truck movements. These local deliveries and sand truck movements will also fall under the proposed 10 laden trucks per hour limit on any one transport route.

The TIA report considered the worst-case scenario, that being the effect of an additional 5 laden plus 5 return trucks per hour on the affected road network.

The number of light vehicles using the facility will remain unchanged as there will be no increase to the number of employees at the Quarry and therefore no increase to LV traffic movement traffic at the Quarry site.

### 4.1.4 Assessment of Roads

#### 4.1.4.1 Pacific Highway

Upgrade of the Pacific Highway is currently underway and will include a bypass of Woodburn and Broadwater. The works are expected to be completed by 2020. This will significantly reduce traffic volumes on the Pacific Highway through Broadwater and Woodburn and improve the Level of Service (LoS) at the associated Wyrallah and Broadwater Road intersections. The current capacity of these intersections is discussed in more detail below in **Section 4.1.5.**

An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 1% increase to current traffic volumes and is considered to be insignificant. As a result, no mitigation measures are recommended for the Pacific Highway.

#### 4.1.4.2 Wyrallah Road

Wyrallah Road travels in a north/south direction between Lismore and Woodburn. The condition of Wyrallah Road is very similar to that described in the 2009 Roadnet report. LCC has undertaken several rehabilitation projects on Wyrallah Road since then and the intersection of Wyrallah Road and Tucki Road was upgraded in 2016 to an AUR standard.

An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 4% to 5% increase to current traffic volumes and is therefore considered to be minor. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase.

Wyrallah Road is affected by seasonal flows from July to December during the sugar cane season. Procedures to minimise delays and congestion during the sugar cane season are to be implemented as per the Proponent's Transport Management Plan (refer **Section 4.1.8**). Wyrallah Road is currently operating at an acceptable standard and as a result, no further mitigation measures are recommended.

#### 4.1.4.3 Broadwater Road

Broadwater Road links the township of Broadwater to Wyrallah Road. The condition of Broadwater Road is also very similar to that described in the 2009 Roadnet report. LCC has undertaken several rehabilitation projects on Broadwater Road in recent years and another rehabilitation project for a 2 kilometre section of Broadwater Road is planned during 2018. A 40 tonne load limit has also been imposed on Broadwater Road.

A sugar cane mill is located immediately prior to the end of Broadwater Road at the Pacific Highway in Broadwater. Broadwater Road is affected by seasonal flows from July to December during sugar cane season.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 16% increase to current traffic volumes on Broadwater Road and is considered a small increase. It is therefore considered that Broadwater Road will still operate at an acceptable standard with the proposed increased traffic. No improvements are recommended for Broadwater Road.

As the sugar cane mill is located on Broadwater Road, procedures to minimise delays and congestion on Broadwater Road during the sugar cane season are to be implemented as per the Proponent's Transport Management Plan (refer **Section 4.1.8**). In addition, if congestion on Broadwater Road becomes problematic, Transport Route 2 can be used rather than Transport Route 3 to access the Pacific Highway until such time as the congestion eases.

As a 40 tonne load limit has been imposed on Broadwater Road, all laden trucks leaving the Quarry using Transport Route 3 will be limited to 40 tonnes. The weight of each laden truck is controlled during the loading process at the Quarry and this system will be used to ensure no trucks using Transport Route 3 leave the Quarry heavier than 40 tonnes. In addition, the Proponent's Transport Management Plan (refer Section 3.5), will be amended to highlight the load limit on Transport Route 3.

#### 4.1.4.4 Wyrallah Ferry Road

Wyrallah Ferry Road is a short connecting road between Wyrallah Road and Coraki Road. It remains largely unchanged since the 2009 Roadnet report.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 6% increase to current traffic volumes on Wyrallah Ferry Road and is considered to be a minor increase. It is therefore considered that Wyrallah Ferry Road will operate at an acceptable standard with the proposed increased traffic and as a result, no additional mitigation measures are recommended.

#### 4.1.4.5 Coraki Road

The northern end of Coraki Road is used to provide access to the Bruxner Highway for Quarry deliveries either north to Lismore or west in the direction of Casino. There have been no upgrades to Coraki Road in recent years.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 7% increase to current traffic volumes on Coraki Road and is considered to be a minor increase. It is therefore considered that Coraki Road will operate at an acceptable standard with the proposed increased traffic and as a result, no additional mitigation measures are recommended.

#### 4.1.4.6 Bruxner Highway

The Bruxner Highway remains largely unchanged since the 2009 Roadnet report in the vicinity of the Coraki Road intersection. An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 2% increase to current traffic volumes and is therefore considered to be insignificant. As a result, no mitigation measures are recommended for the Bruxner Highway.

### 4.1.5 Assessment of Intersections

#### 4.1.5.1 Pacific Highway and Wyrallah Road Intersection

SIDRA analysis of the intersection indicates that the worst hour for the intersection is between 3:00pm and 4:00pm when intersection operates at LoS C. LoS C represents satisfactory operation and as a result crash History for the intersection was reviewed in the TIA. No crashes were reported at this intersection for the past 5 years.

Analysis of the peak traffic volumes resulted in a requirement for Channelised Right Turn Lane (CHR) and Auxiliary Left Turn Lane - short (AUL(s)) turn treatments. The required CHR is already in place however an AUL(s) is not provided. Given that the Pacific Highway bypass is expected to be completed by 2020, construction of an AUL(s) is not considered to be warranted. No other deficiencies at the intersection have been identified and as a result, no additional mitigation measures are recommended.

The intersection is currently operating safety and recommendations for improvements due to crash history and other factors are not necessary. Once the Pacific Highway bypass opens in 2020 it is expected that traffic at the intersection will reduce considerably and that LoS will improve.

#### 4.1.5.2 Pacific Highway and Broadwater Road Intersection

SIDRA analysis indicates that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

Analysis of the peak traffic volumes results in a requirement for a CHR which is already in place. As the intersection already has the required CHR, it is operating well within capacity at LoS A, and all required signage is in place, no additional improvements to the intersection are recommended. Once the Pacific Highway bypass is completed in 2020, it is considered that the performance at the intersection should improve.

As the sugar cane mill is located relatively close to the intersection, if during the sugar cane harvesting season (July to December) congestion at the intersection becomes problematic, Transport Route 2 could be used to access the Pacific Highway rather than Transport Route 3 until such time that congestion eases.

#### 4.1.5.3 Wyrallah Road and Broadwater Road Intersection

SIDRA analysis results indicate that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

Auxiliary turn lane assessment of the intersection revealed that no auxiliary turn lane treatments are required. As no auxiliary turn lanes are required at the intersection, it is operating well within capacity at LoS A, and all required signage is in place, no improvements are recommended.

#### 4.1.5.4 Wyrallah Road and the Quarry Access Road Intersection

Access to the Quarry is via an upgraded intersection including both right and left turn auxiliary lanes (CHR & AUL). Analysis of traffic volumes entering and exiting the Quarry, including the proposed increase, resulted in a requirement for a Basic Right (BAR) turn / Basic Left (BAL) turn configuration for this intersection. As a superior CHR/AUL configuration is already in place, no further recommendations are made.

SIDRA analysis results indicate that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity. As a result, no intersection improvements are recommended.

#### 4.1.5.5 Wyrallah Road and Wyrallah Ferry Road Intersection

As conditioned by the 2012 PA, this intersection has been widened to cater for the turn movements of heavy vehicles (HVs) travelling to and from the Quarry.

SIDRA analysis results indicate that the intersection operates at LoS A at all times without any turn treatments. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

Assessment of auxiliary turn lane requirements at the intersection resulted in a requirement for a CHR(s) and AUL(s), however, there are no existing auxiliary turn lanes at the intersection. It is noted that the requirement for a CHR(s) and AUL(s) stands regardless of the addition of increased Quarry movements.

The SIDRA analysis indicates that the intersection is operating well below capacity without any turn treatments. Whilst a CHR(s) and AUL(s) are recommended for the intersection, these turn treatments are already required without the introduction of additional Quarry movements. As a result, this is an existing deficiency for all road users and it is considered that the Proponent should not be burdened with the construction costs associated with any upgrade.

#### 4.1.5.6 Coraki Road and Wyrallah Ferry Road Intersection

As conditioned by the original 2012 PA, this intersection has been widened to cater for the turn movement of HVs travelling to and from the Quarry.

SIDRA analysis results indicate that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

Warrants for auxiliary turn lanes at the intersection were undertaken resulting in a requirement for a CHR(s) for right turn movements. There are no auxiliary turn lanes at the intersection and it is noted that the requirement for a CHR(s) stands regardless of the addition of increased Quarry movements.

The SIDRA analysis indicates that the intersection is operating well below capacity without any turn treatments. Whilst a CHR(s) is recommended for the intersection, this turn treatment is already required without the introduction of additional Quarry movements. As a result, this is an existing deficiency for all road users and it is considered that the Proponent should not be burdened with the construction costs associated with any upgrade.

#### 4.1.5.7 Bruxner Highway and Coraki Road Intersection

SIDRA analysis reveals that the intersection operates at LoS C on the Coraki Road approach while turning movements from the Bruxner Highway into Coraki Road operate at LoS A.

Peak hour traffic analysis results in a requirement for both CHR and AUL(s) treatments. As these turn treatments are already in place, in addition to a northbound acceleration lane, no further recommendations are made.

Crash History for the intersection of the Bruxner Highway and Coraki Road was reviewed in the TIA. One crash was recorded during the last 5 years which resulted in a non-fatal injury. As no repetitive trends are discernible, no recommendations for improvements due to crash history are warranted.

As the intersection already has the required CHR/AUL turn lane treatments, is operating satisfactorily at LoS C, and all required signage is in place, no additional improvements to the intersection are recommended.

### 4.1.6 Bus Services

Following a bus stop audit conducted by the Proponent, it was found that there are no existing state or local government approved bus stops on the haulage routes. However there a two local bus companies that operate school and private bus services utilising roads that form the haulage routes.

As part of the Proponent's approved Transport Management Plan, haulage of material from the Quarry is minimised or routes altered wherever possible at school bus times. All HVs are fitted with CB radios to enable communication with buses. In addition, truck drivers are trained in staggering vehicle movements to avoid bunching of trucks on the transport routes.

### 4.1.7 Pedestrian and Cyclist Activity

There are currently no dedicated on-road cycleways or off-road shared paths (for cyclists and pedestrians) along the haulage routes. Given the rural environment, it is considered that pedestrian and cyclist activity would be rare, however, there would be some pedestrian activity within Woodburn, and Broadwater. Speed limits within these towns is 50km/h thereby reducing the risk to pedestrians and cyclists.

### 4.1.8 Transport Management Plan

As stipulated by the 2012 PA, a Transport Management Plan (TMP) has been developed and implemented for the Quarry. The TMP is reviewed annually and will be updated to include any additional mitigation measures as a result of this proposed modification.

### 4.1.9 Road Contribution Levies

As stipulated by the 2012 PA, the Proponent must continue to pay Section 94 contributions (now replaced by section 7.11) of the EP&A Act) to LCC in the amount of $0.06442 per tonne per kilometre for every tonne of extractive materials in excess of 8,500 tonnes per annum.

This rate increases over the life of the Quarry in accordance with annual CPI. As there is no proposed increase to the annual development traffic, no increase to this contribution levy is warranted.

### 4.1.10 Conclusions

#### 4.1.10.1 Transportation Route 1

The proposed increase in Quarry traffic results in a maximum of 7% increase to traffic on this transport route for short periods of time. All intersections operate at LoS C (satisfactory) or better. All required intersection auxiliary turn lanes are already in place except at the intersections at both ends of Wyrallah Ferry Road. It is noted that the requirement for auxiliary turn lanes at these two intersections applies regardless of the addition of increased Quarry movements.

#### 4.1.10.2 Transportation Route 2

The proposed increase in Quarry traffic results in a maximum of 5% increase to traffic on this transport route for short periods of time. All intersections operate at LoS C (satisfactory) or better. All required intersection auxiliary turn lanes are already in place except an AUL(s) at the Pacific Highway and Wyrallah Road intersection. Given that the Pacific Highway bypass is expected to be completed by 2020, construction of an AUL(s) is not considered to be warranted.

#### 4.1.10.3 Transportation Route 3

The proposed increase in Quarry traffic results in a maximum of 16% increase (Broadwater Road) to traffic on this transport route for short periods of time. All intersections operate at LoS A (intersection operating well below capacity). All required intersection auxiliary turn lanes are already in place on Transport Route 3.

As a sugar cane mill is located on the eastern end of Broadwater Road, there is potential for traffic congestion during the sugar cane harvesting season (July to December). However, Transport Route 2 could be used to access the Pacific Highway rather than Transport Route 3 until such time that congestion eases.

#### 4.1.10.4 Recommendations

A comprehensive range of mitigation measures have already been implemented as part of the 2012 PA and subsequent MODs. However, two additional measures are recommended below;

- If congestion on Wyrallah Road and Broadwater Road becomes problematic during the sugar cane season (July to December), Transport Route 2 could be used rather than Transport Route 3 to access the Pacific Highway until such time that congestion eases; and
- As a 40 tonne load limit has been imposed on Broadwater Road, all laden trucks leaving the Quarry using Transport Route 3 will be limited to 40 tonnes. The weight of each laden truck is controlled during the loading process at the Quarry and this system will be used to ensure no trucks using Transport Route 3 leave the Quarry heavier than 40 tonnes.

The Proponent shall add these items to their existing Transport Management Plan.

## 4.2 Noise Assessment

A noise assessment was undertaken by Bridges Acoustics to access the potential impacts of an increase in maximum hourly truck movements into and out of the Quarry. The report is ATTACHED as **Appendix 3**.

**Figure 2** shows relevant noise model details including:

- Terrain – 10 m contours in red, 2 m contours over the site in blue;
- Sources and receptors - locations are shown with black symbols; and
- Approved Bunds – represented by toe and crest lines and shown in magenta.

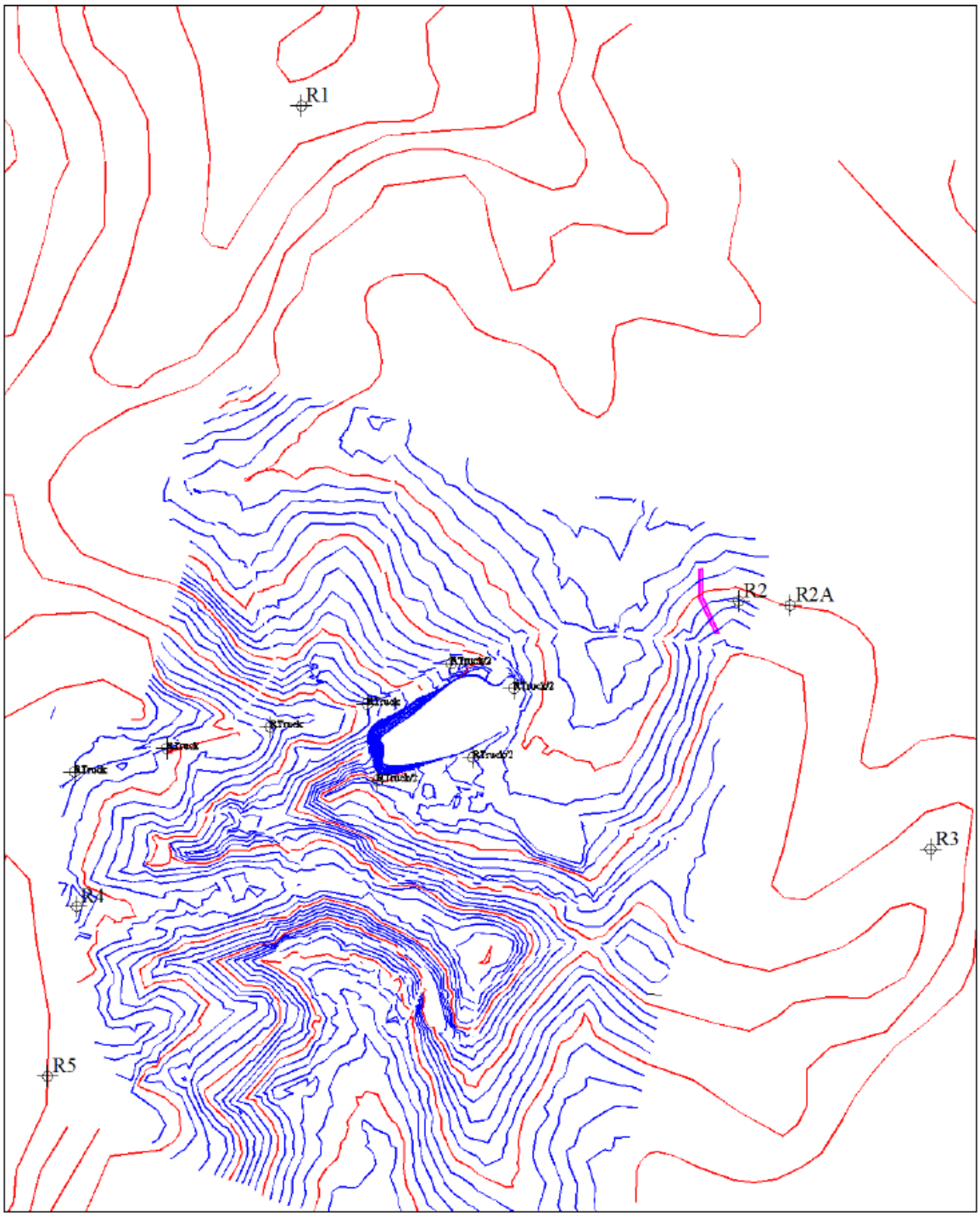


**Figure 2 - Noise Model and Receptor Locations**
(Source: Bridges Acoustics Noise Assessment – April 2018)

### 4.2.1 Existing PA Noise Limits

Current noise limits at sensitive receptors in the vicinity of the Quarry are detailed in the following extract from Schedule 3 Condition 5 of PA 09_0080.

*Table 2: Noise Criteria*

| Receiver | $L_{Aeq\ (15\ min)}$ dB(A) |
|---|---|
| NAL 4 and NAL 5 | 38 |
| NAL 2, NAL 2A, NAL 3 and privately-owned land along the southern end of Hazelmount Lane | 37 |
| NAL 1 and all other receivers | 35 |

### 4.2.2 Existing Noise Levels

The Noise Assessment undertaken as part of the 2009 EA, modelled a range of combinations of noise generating equipment and scenarios. Refer to Table 6.3 of the 2009 Noise Assessment reproduced below.

*Table 6.3 Modelled Scenarios Equipment Used*

| Plant Item | Equipment Used | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | B | C | D | E | F | G | H | I |
| Mobile Crushing Screening Plant | | X | X | | | X | | |
| Washing Plant | | X | | | | X | | |
| Site Truck (Ford L8000) | X | | | | | | | |
| Dump Truck (Cat 35T) | | | | X | X | | X | X |
| Road Truck 1 | X | X | X | | X | X | X | X |
| Road Truck 2 | X | X | X | | X | X | X | X |
| Excavator (20T) | X | | | | | | | |
| Excavator (40T) | | | | X | X | X | X | X |
| Dozer | X | | | X | X | X | X | X |
| Front-End Loader 1 | X | X | X | | X | X | X | X |
| Front-End Loader 2 | | | | | X | X | X | X |
| Rock Hammer | | | | | | | X | |
| Rock Saw | | | | | | | | X |

The Proponent has since committed to operating the rock hammer or rock saw in the absence of other operating plant to minimise noise levels, which requires noise levels for these scenarios H and I to be recalculated. Noise levels from the rock hammer and rock saw operating alone can be determined by subtracting noise levels for Scenario F from the noise levels for Scenarios H and I, respectively.

Table 6.6 of the 2009 Noise Assessment presented predicted receptor noise levels, based on detailed noise modelling, and has been reproduced below including modified values for Scenarios H and I to show noise levels from the rock hammer and rock saw operating alone.

**Table 2** as modified (from Table 6.6 from the 2009 Noise Assessment), indicates predicted noise levels under Scenarios G and H are expected to result in noise levels over the Project Specific Noise Criteria (PSNC) at receptors Noise Assessment Location (NAL) 2 and NAL 3, respectively, by a minor 1 dBA.

**Table 2 - *Project Specific Noise Criteria (PSNC)***

| *Assessment Location* | *Predicted Daytime LAeq,15minute Noise Levels, dBA* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *B* | *C* | *D* | *E* | *F* | *G* | *H* [1] | *I* [2] | *PSNC* |
| *NAL1* | *28* | *26* | *30* | *29* | *30* | *31* | *33* | *27* | *40* |
| *NAL2* | *32* | *35* | *34* | *33* | *34* | ***38*** | *37* | *32* | *37* |
| *NAL3* | *32* | *34* | *34* | *33* | *33* | *37* | ***38*** | *31* | *37* |
| *NAL4* | *37* | *33* | *38* | *36* | *36* | *38* | *36* | *30* | *40* |

*NB: Exceedances of the PSNC are in BOLD*

1. *Modified Scenario H noise levels represent operation of the rock hammer alone*
2. *Modified Scenario I noise levels represent operation of the rock saw alone*

The project approval permits quarry operations as described in the EA, therefore permits the minor 1 dBA exceedances of the PSNC at NAL 2 and NAL 3 under certain operating conditions.

### 4.2.3 Assessment Calculation Details

As MOD4 proposes additional truck movements with no other changes to existing Quarry operations, noise from the additional truck movements has been added to existing noise levels to determine proposed future noise levels from the MOD. Noise levels from the additional truck movements have been calculated as in the 2009 EA, with the following details and input data:

- Environmental Noise Model (ENM) software to calculate noise levels to each receptor;
- Terrain model as used for an early stage of the quarry in the 2009 EA Noise Assessment, in the MOD3 acoustic assessment and as shown in **Figure 2**;
- Truck source locations generally as shown on the source location **Figure 2** for Scenarios B and C and modified to suit the existing entry and exit roads to the Quarry, also shown on **Figure** ;
- Truck sound power levels as reported in the 2009 EA and further described below; and
- Calm daytime weather conditions as reported in Sections 5.1 and 6.3 of the 2009 Noise Assessment.

Table 6.1 of the 2009 Noise Assessment listed modelled sound power levels for each source type, including 103 dBA for a road truck such as a Scania 124L truck and dog trailer as measured by ERM on the Quarry site. This sound power level is typical for a heavy on-road truck in good condition operating at medium engine power and moderate to slow speed such as 20 to 40 km/h.

The modelled source locations are approximately 120 metres apart along the Quarry access road from Wyrallah Road. Assuming a truck speed of 30 km/h (8.3 m/s) results in a truck source including noise from each truck for 14.4 seconds. Currently 5 trucks per hour are approved, which is an average of 1.25 trucks per 15 minute period, however 2 trucks per 15 minute period is likely to occur occasionally and has been assumed. An empty truck entering the Quarry travelling downhill produces significantly less noise than a laden truck travelling up the hill to leave the Quarry, therefore inbound truck movements would be at least 3 dBA quieter than outbound movements.

The above data and assumptions result in a modelled truck source sound power level of 90 LAeq,15min, with effectively 6 sources included along the Quarry access road. The model actually includes full sources along the western section of road and half sources along the separate southern entrance and eastern exit roads where the two are not adjacent.

### 4.2.4 Predicted Noise Levels

Noise levels predicted in previous assessments, and currently approved, are shown in **Table 3** along with predicted noise levels from the proposed additional truck movements. Noise levels in bold font highlight levels over the PSNC.

**Table 3 - Predicted Noise Levels, LAeq,15min**

| Receptor | Predicted Daytime LAeq,15min Noise Level | | | | | | | | PSNC | Project Approval |
|---|---|---|---|---|---|---|---|---|---|---|
| Scenario | B | C | D | E | F | G | H | I | | |
| Approved Project | | | | | | | | | | |
| NAL 1 | 28 | 26 | 30 | 29 | 30 | 31 | 33 | 27 | 40 | 35 |
| NAL 2 | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 2A | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 3 | 32 | 34 | 34 | 33 | 33 | 37 | **38** | 31 | 37 | 37 |
| NAL 4 | 37 | 33 | 38 | 36 | 36 | 38 | 36 | 30 | 40 | 38 |
| NAL 5 | 37 | 33 | 38 | 36 | 36 | 38 | 36 | 30 | 40 | 38 |
| Additional Trucks | | | | | | | | | | |
| NAL 1 | 21 | 21 | 21 | - | 21 | 21 | - | - | 40 | 35 |
| NAL 2 | 19 | 19 | 19 | - | 19 | 19 | - | - | 37 | 37 |
| NAL 2A | 19 | 19 | 19 | - | 19 | 19 | - | - | 37 | 37 |
| NAL 3 | 20 | 20 | 20 | - | 20 | 20 | - | - | 37 | 37 |
| NAL 4 | 35 | 35 | 35 | - | 35 | 35 | - | - | 40 | 38 |
| NAL 5 | 28 | 28 | 28 | - | 28 | 28 | - | - | 40 | 38 |
| Total MOD 4 Noise Level (Approved Project plus Additional Trucks) | | | | | | | | | | |
| NAL 1 | 29 | 27 | 31 | 29 | 31 | 31 | 33 | 27 | 40 | 35 |
| NAL 2 | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 2A | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 3 | 32 | 34 | 34 | 33 | 33 | 37 | **38** | 31 | 37 | 37 |
| NAL 4 | 39 | 37 | 40 | 36 | 39 | 40 | 36 | 30 | 40 | 38 |
| NAL 5 | 38 | 34 | 38 | 36 | 37 | 38 | 36 | 30 | 40 | 38 |

*NB: Exceedances of the PSNC are in BOLD*

**Table 3** shows noise levels from the 2012 PA are expected to exceed the PSNC by a minor 1 dBA at Receptors NAL 2 and NAL 2A for Scenario G and at NAL 3 for Scenario H. These predicted minor exceedances are considered acceptable and approved despite not being reflected in the 2012 PA conditions, as they were clearly presented in the EA and Noise Assessment.

**Table 3** also shows noise levels from the additional trucks alone are expected to the meet the PSNC and, more importantly, total noise levels from MOD4 are predicted to meet the PSNC (except where the PSNC are already exceeded by the 2012 PA). Predicted noise levels from MOD4 are not expected to meet the 2012 PA conditions for all combinations of scenario and receptor, however an amendment to the 2012 PA conditions is recommended where the condition requires noise criteria below the PSNC.

### 4.2.5 Recommendation

Given that MOD4 noise levels are predicted to meet the PSNC, no additional noise mitigation measures are required or have been recommended beyond those previously recommended in the 2009 Noise Assessment and those currently approved. Quarterly noise surveys previously completed by Quarry employees and more recently by Bridges Acoustics indicate the existing Quarry noise levels meet the current noise criteria under normal Quarry operating conditions. Therefore, the existing noise mitigation measures appear effective in maintaining acceptable noise levels at all receptors.

An amendment to PA 09_0080 Schedule 3 Condition 5 is recommended to address the predicted noise levels for this modification without permitting further exceedances of the PSNC beyond those currently approved, as follows. Text in bold type highlights proposed amendments to this condition.

**Noise Criteria**

5 *Except for times during which Bunds A, C (stage 3 only) and D and the water re-use and water supply dams are being actively constructed, the Proponent shall ensure that the noise generated on site does not exceed the criteria in Table 2 at any residence on privately-owned land.*

*Table 2: Noise Criteria*

| *Receiver* | *LAeq (15 min) dB(A)* |
|---|---|
| ***NAL 4*** | ***40*** |
| *NAL 2, NAL 2A, NAL 3,* ***NAL 5*** *and privately-owned land along the southern end of Hazelmount Lane* | ***38*** |
| *NAL 1 and all other receivers* | *35* |

The recommended amendment to Condition 5 above addresses the minor (maximum 2 dBA) increase in noise level predicted for the Modification and the predicted noise levels of 38 LAeq,15min at NAL 2, NAL 2A and NAL 3 in the Noise Assessment that were not reflected in the existing condition.

## 4.3 Dust and Air Quality

Dust and air quality is managed by the Proponent's Air Quality Management Plan which is available on the Proponent's website (https://championsquarry.com.au/environmental-assessment/). As there is no proposed increase to the annual output at the Quarry, there is no expected increase in dust generated by extraction activities at the Quarry.

All roads along the approved transportation routes are sealed as is the main access road from Wyrallah Road to the Quarry. All trucks leaving the Quarry have covers which are in place prior to leaving the operational area to mitigate dust leaving the truck during transportation.

Temporary haul roads within the Quarry are not sealed, however dust generated on these roads and from other sources within the Quarry are managed as detailed in the Air Quality Management Plan. Dust from on site vehicles is mitigated by the following:

- Routine inspections of work areas, stockpile sites and haulage routes within the Quarry are undertaken as well as daily visual monitoring of air quality during quarrying operations;
- All unsealed Quarry haulage roads are watered, as required, at the rate of 2L/m2/hour;
- Water sprays are used on all mobile processing equipment and stockpiles, as required, to minimise airborne particulate matter;
- All trucks leaving the Quarry have covers in place prior to leaving the operational area;
- A dust deposition gauge is located at Receiver 2 (refer **Figure 2**) and is monitored each month; and

- Stockpiles of overburden and topsoil that are to be used in rehabilitation activities at the Quarry are seeded to minimise potential for fugitive dust.

Results from the dust deposition gauge are kept and published on the Proponent's website as well as records of any complaints received. The Air Quality Management Plan is also reviewed annually, revised as necessary, and published online.

# 5 Conclusion

The proposed MOD4 to permit an increase in maximum hourly and daily truck numbers entering and leaving the Quarry will not significantly change the overall nature of the development nor the associated impacts. As the modification does not propose an increase in maximum annual production from the Quarry, no increase in long term average traffic or noise levels from the Quarry is proposed. The minor increase in traffic and noise levels will be offset by longer or more frequent periods of little or no truck activity.

## 5.1 Proposed Amendments to PA 09_0080

The proposed MOD4 would require the following amendment to Schedule 2 Condition 9 of the 2012 PA conditions (proposed amendments shown in bold type):

*9. The Proponent must not:*

*(a) transport more than 250,000 tonnes of extractive material from the site in any calendar year;*

*(b) dispatch more than **100** laden trucks from the site on any day; or*

*(c) dispatch more than **10** laden trucks from the site in any hour.*

*Note: In this condition, 'per hour' means the 60 minutes following the change of hour.*

As outlined in **Section 4.2.5,** an amendment to PA 09_0080 Schedule 3 Condition 5 is recommended to address the predicted noise levels for this modification as follows (proposed amendments shown in bold type):

**Noise Criteria**

*5 Except for times during which Bunds A, C (stage 3 only) and D and the water re-use and water supply dams are being actively constructed, the Proponent shall ensure that the noise generated on site does not exceed the criteria in Table 2 at any residence on privately-owned land.*

*Table 2: Noise Criteria*

| *Receiver* | *LAeq (15 min) dB(A)* |
|---|---|
| ***NAL 4*** | ***40*** |
| *NAL 2, NAL 2A, NAL 3, **NAL 5** and privately-owned land along the southern end of Hazelmount Lane* | ***38*** |
| *NAL 1 and all other receivers* | *35* |

## 5.2 Proposed Amendments to the TMP

Two additional mitigation measures are recommended for the existing TMP, specifically;

- If congestion on Wyrallah Road and Broadwater Road becomes problematic during the sugar cane season (July to December), Transport Route 2 may be used rather than Transport Route 3 to access the Pacific Highway until such time that congestion eases; and
- The weight of each truck leaving the Quarry using Transport Route 3 is to be limited to 40 tonnes.

### 5.3 Recommendation

It is therefore requested that DP&E support the proposed modification subject to the amendments to the PA conditions and Transport Management Plan as recommended above.

# Appendix 1: Responses to Letter of Consultation

File No: NTH09/01607/07
Your Ref:

The Director
Constructive Solutions
PO Box 1498
TAMWORTH NSW 2340

Attention: Michael Bloem

Dear Sir / Madam,

**Proposed modification - Project 09_0080 - Champions Quarry, 1668 Wyrallah Road, Tuckurimba**

I refer to your letter of 1 November 2017 requesting comments from Roads and Maritime in relation to the proposed modification of consent conditions for the subject quarry.

**Roles and Responsibilities**

The key interests for Roads and Maritime Services are the safety and efficiency of the road network, traffic management, the integrity of infrastructure assets and the integration of land use and transport.

Roads and Maritime is given the opportunity to review and provide comment on the subject development under Clause 16 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

It is emphasised that the comments provided below are based on the current proposal and the information provided at this time. They are not to be interpreted as binding upon Roads and Maritime and may change following formal assessment of any application referred by the relevant consent authority.

**Roads and Maritime Response**

Roads and Maritime request that a Traffic Impact Assessment (TIA) be prepared by suitably qualified person/s in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Roads and Maritime Supplement and RTA Guide to Traffic Generating Developments. The TIA should include, but not be limited to, the following;

- The total impact of existing and proposed development on the road network with consideration for a 10 year horizon.
- The volume and distribution of traffic generated by the proposed development.
- Existing traffic volumes and background traffic growth expected along the proposed haulage routes.
- Identification of impacted intersections along the proposed haulage routes; including the intersections with the classified (State) road network (Pacific Highway and Bruxner Highway).

- Consideration of turning lane warrants and identification of appropriate intersection treatments for the identified intersections along the proposed haulage routes, based on Austroads Guide to Traffic Management Part 6 and Austroads Guide to Road Design Part 4A.
- Capacity analysis using Sidra or similar, if required, to identify Level of Service (LOS) at identified intersections along the proposed haulage routes. Intersections with Pacific Highway and Bruxner Highway must be modelled.
- Swept path analysis for the largest design vehicle at identified intersections along the proposed haulage routes.
- Available sight distances at identified intersections along the proposed haulage routes.
- Details of proposed improvements required at identified intersections to mitigate impacts on safety and capacity.
- Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.
- Impacts of road traffic noise and dust generated along the proposed haulage routes.
- Consideration for Clause 16(1) of the Mining SEPP regarding;
    - Impact on school zones and residential areas.
    - Code of Conduct for haulage operators
    - Road safety assessment of approved haulage routes

Where road safety concerns are identified at a specific location along the proposed haulage routes, Roads and Maritime suggests that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.

The current Austroads Guidelines, Australian Standards and Roads and Maritime Supplements are to be adopted for any proposed works on the classified road network.

The Developer would be required to enter into a Works Authorisation Deed (WAD) with Roads and Maritime for any works deemed necessary on the classified (State) road network. The developer would be responsible for all costs associated with the works and administration for the WAD.

Further information on undertaking private developments adjacent to classified roads can be accessed at:

http://www.rms.nsw.gov.au/projects/planning-principles/index.html

If you have any further enquiries regarding the above comments please contact Liz Smith, Manager Land Use Assessment on (02) 6640 1362 or via email at: development.northern@rms.nsw.gov.au

Yours faithfully

for Monica Sirol
Network & Safety Manager, Northern Region
Date: 21/11/2017

**From:** Peter Jeuken [mailto:Peter.Jeuken@lismore.nsw.gov.au]
**Sent:** Tuesday, 14 November 2017 9:20 AM
**To:** Michael Bloem <mick@constructivesolutions.com.au>
**Subject:** Champions Quarry - increase in hourly trucks

Hi,

I refer to your letter dated 1 November 2017 regarding the proposed Modification to Consent for Champions Quarry, and have noted the contents therein.

I wish to advise that having noted the matters you have intended to cover, Council has no additional issues to be addressed at this time.

Regards,

---

**Peter Jeuken |** Manager - Development & Compliance **| Lismore City Council**

PO Box 23A, Lismore, 2480 **| T** (02) 6625 0410 **| F** (02) 6625 0400 **|** M 0427 299814| **www.lismore.nsw.gov.au**

Lismore City Council acknowledges the people of the Bundjalung Nation, traditional custodians of the land on which we work.

# Appendix 2: Traffic Impact Assessment

constructive solutions

providing total solutions

# Champions Quarry Consent Modification

## Traffic and Transport Assessment

Prepared for

**Champions Quarry 2 Pty Ltd**

**June 2018**

Report prepared by Constructive Solutions Pty Ltd

PO Box 1498
TAMWORTH NSW 2340

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**DOCUMENT HISTORY AND STATUS**

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| | |
|---|---|
| Author: | Doug Seymour |
| Project Manager: | Michael Bloem |
| Project Name: | Champions Quarry Consent Modification |
| Project Number: | 201740 |
| Name of Client: | Champions Quarry 2 Pty Ltd |

## Table of Contents

## Commonly Used Acronyms

| Abbreviation | Description |
|---|---|
| ADT | Annual Daily Traffic |
| AUL | Auxiliary Left Turn Lane |
| BAL | Basic Left Turn Lane |
| BAR | Basic Right Turn Lane |
| CHL | Channelised Left Turn Lane |
| CHR | Channelised Right Turn Lane |
| CQ | Champions Quarry |
| DoS | Degree of Saturation |
| DP&E | Department of Planning and Environment's |
| HV | Heavy Vehicle |
| LCC | Lismore City Council |
| LoS | Level of Service |
| LV | Light Vehicle |
| RMS | Roads and Maritime Services |
| TMP | Transport Management Plan |
| VPH | Vehicles per Hour |

# 1 Introduction

## 1.1 Background

Champions Quarry (CQ) operates a sandstone quarry ("the Quarry) located approximately 16km south of Lismore in northern NSW. The original development consent was granted in 2012 to increase the overall extraction limit to 6.25 million tonnes at a rate of 250,000 tonnes per annum over a period of 25 years.

The current approval also limits the Quarry to dispatching no more than 5 laden trucks from the site per hour and up to a maximum of 50 trucks per day. There is no limit to the tonnes per day, nor maximum tonnes per truck.

CQ is seeking approval under Part 3A of the Environmental Planning and Assessment Act-1979 to increase the hourly outbound laden truck limit of 5 trucks per hour to 10 trucks per hour. CQ does not propose any change to the yearly extraction rate of 250,000 tonnes per annum and as a result, the current annual number of trucks used by the Quarry will not increase.

## 1.2 Scope of Report

This traffic and transport assessment has been prepared for CQ to assess potential traffic and transport impacts on the surrounding road network associated with the proposed increase to the hourly truck movements to and from the Quarry. The report has been prepared with reference to the RMS Guide to Traffic Generating Developments and Austroads Guides to assess traffic-related impacts of the Proposal.

The current approval stipulates that extractive material must be transported on three designated haulage routes (except in circumstances where the final destination of the transported quarry products can only be accessed by other roads), and this report assesses the potential impacts on these designated haulage routes.

No assessment of the structural capacity of bridges or other drainage structures within the haulage routes has been made. As the Proposal does not include an increase to the mass limit of existing haulage vehicles it is considered that a structural assessment is not required.

## 1.3 Location

The Quarry is located at 1668 Wyrallah Road in Tuckurimba, approximately 16km south of Lismore in northern NSW (refer **Figure 1**).

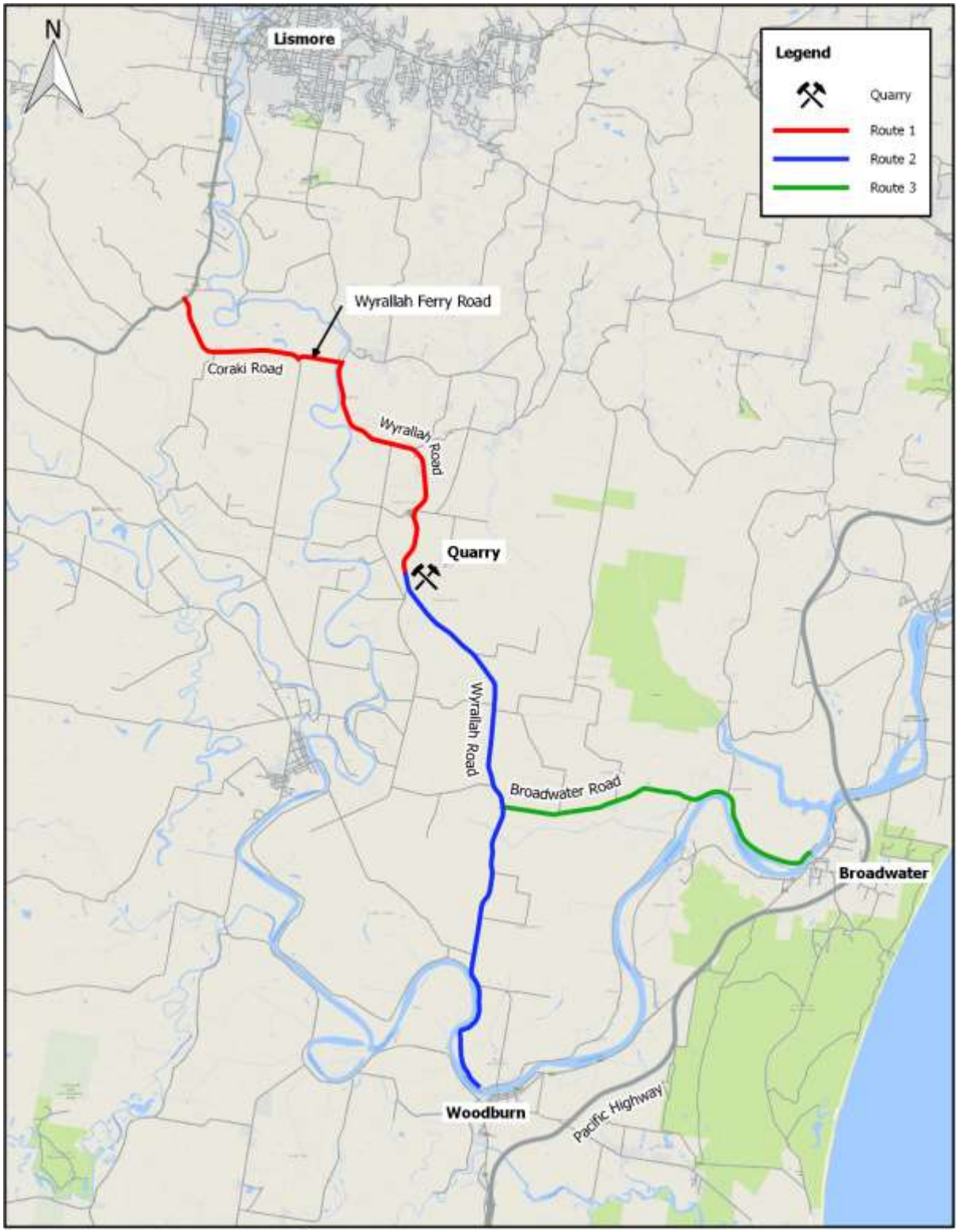



**Figure 1 – Locality Plan and Transport Routes**
(Source: Google – May 2018)

# 2 The Surrounding Road Network

## 2.1 Transportation Routes

Three approved haulage routes are used to transport quarry products as follows (refer **Figure 1**):

- Transport Route 1 is north from the Quarry to the Bruxner Highway via Wyrallah Road, Wyrallah Ferry Road, and Coraki Road;
- Transport Route 2 is south along Wyrallah Road intersecting with the Pacific Highway at Woodburn; and
- Transport Route 3 is south-east to the Pacific Highway at Broadwater via Wyrallah Road and Broadwater Road.

## 2.2 Roads

An inspection of the transportation routes was conducted in 2009 by Roadnet Pty Ltd as part of their Traffic Impact Assessment (TIA) for the 2012 development consent. Through consultation with Lismore City Council (LCC) and the Quarry operators it is understood that the surrounding road network and transportation routes remain largely unchanged with the exception of the following;

- The speed limit on Wyrallah Road has been reduced from 100km/h to 80km/h from Lismore to just south of the Quarry;
- Several rehabilitation and minor widening projects have been undertaken on both Wyrallah and Broadwater Roads;
- A 40 tonne load limit has been imposed on Broadwater Road; and
- The intersection of Wyrallah and Tucki Road has been upgraded to an Auxiliary Right (AUR) type intersection;

LCC also advised that a rehabilitation project for a 2km section of Broadwater Road is planned for 2018.

A Road Safety Audit of the transportation route was previously conducted as part of the original TIA. As changes to the transportation routes have improved road conditions, it is considered that an additional RSA is unnecessary.

## 2.3 Traffic Volumes

### 2.3.1 Current and Forecast Background Traffic Volumes

The 2017 traffic data for the Pacific Highway was obtained from the RMS website[1] and data for other roads was provided by LCC (refer **Appendix 1**).

An analysis of the available data was undertaken to compare the background traffic volumes with the additional traffic proposed by the Quarry. **Table 1** provides a summary of the current 2017 traffic levels for the transportation routes. Where traffic counts were greater than 1 year old, a growth rate was calculated using historical data. Where no historical data was available a growth rate of 2.5% was applied. It should be noted that this background data includes the existing CQ heavy vehicle (HV) traffic of up to 50 one-way trips per day.

Values of forecast traffic at a 10 year horizon were also calculated using the growth rates as shown in **Table 1.** These values were used to access the capacity of intersections within the transportation routes.

[1] RMS Website – Traffic Volume Viewer – 3/10/2017

As the future traffic on the Pacific Highway is likely to be significantly reduced in 2020 with the completion of the bypass of Woodburn and Broadwater, current Pacific Highway traffic volumes were used for analysis at the 10 year horizon.

**Table 1 – Existing Traffic Volumes**

| Road | Site of Count | Year of Count | Growth Rate | 2017 ADT | 2027 ADT | %HV |
|---|---|---|---|---|---|---|
| Pacific Highway | 600m east of Norman Street, Woodburn | 2017 | 2.3% | 9,958 | N/A | 5% |
| Wyrallah Road | No.2739 Wyrallah Road | 2015 | 1.4% | 2,014 | 2,384 | 7% |
| Wyrallah Road | West of Leslie Lane | 2015 | 1.4% | 2,481 | 2,936 | 7% |
| Broadwater Road | 50m east of Dungarubba Hall | 2016 | 2.8% | 681 | 927 | 27% |
| Wyrallah Ferry Road | 500m west of Wilsons River Bridge | 2017 | 1.4% | 1,644 | 1,889 | 16% |
| Coraki Road | Pole 33739, between Bruxner Highway and Wyrallah Ferry Road | 2017 | 1.4% | 1,631 | 1,874 | 13% |
| Bruxner Highway | Clovass | 2015 | 2.5% | 5,996 | 8,064 | 11% |

*NB: ADT = Average Daily Traffic; HV = Heavy Vehicles*

Peak hours and 2017 peak hourly traffic volumes for the roads are outlined in T**able 2**. This data is also used in **Section 3** for the analysis of each intersection. Peak hour traffic volumes for the Bruxner Highway were not available, therefore as recommended by Austroads, a value of 10% of the ADT was used.

**Table 2 – Peak Volumes**

| Road | AM Peak | | PM Peak | |
|---|---|---|---|---|
| | Hour | VPH (2017) | Hour | VPH (2017) |
| Pacific Highway | - | - | 12-1pm | 823 |
| Wyrallah Road (West of Leslie Lane) | 8-9am | 189 | 3-4pm | 195 |
| Wyrallah Road (No.2739 Wyrallah Road) | 8-9am | 261 | 4-5pm | 249 |
| Broadwater Road | 6-7am | 62 | 3-4pm | 61 |
| Wyrallah Ferry Road | 8-9am | 147 | 4-5pm | 155 |
| Coraki Road | 8-9am | 151 | 4-5pm | 147 |
| Bruxner Highway | 10% ADT | 630 | 10% ADT | 630 |

*NB: VPH = Vehicles per Hour*

### 2.3.2 Development Traffic

CQ currently has approval for 5 laden truck movements per hour for 11 hours per day from Monday to Friday (7:00am-6:00pm) and 5 hours on Saturdays (8:00am-1:00pm). The current approval however, has a maximum daily limit of 50 laden trucks.

Truck types used by the Quarry are:

- Single body trucks;
- Truck & Dog (32-34 tonne); and
- HVB (body truck with 4 axle trailer) up to 42 tonne.

The Quarry currently has approval to extract 250,000 tonnes per year. Working within this annual limit, if the Quarry was hauling material for the full 11 hours per day between Monday and Friday and 5 hours on Saturdays, the average hourly rate of extraction would be 80 tonnes or 2.4 truck and trailers per hour. CQ does not propose any change to the annual extraction limit and hence the average development generated trucks of 2.4 per hour per hour will not change.

CQ are seeking approval to increase their hourly limit from 5 laden trucks per hour to 10 laden trucks per hour. It should be noted that CQ will not be hauling for extended periods at 10 trucks per hour. The application for a maximum of 10 trucks per hour is only being sort for intermittent periods of high demand to enable the Quarry to supply material to large projects including the Pacific Highway upgrade.

The frequency of 10 trucks per hour traveling on any one route will be rare as QC will maintain supply to their local customers including concrete and asphalt plants. Furthermore, the new sand washing operation will result in intermittent sand truck movements. These local deliveries and sand truck movements will also fall under the proposed 10 truck movements per hour limit on any one transport route.

CQ currently has approval to operate 5 laden trucks per hour on the transport routes. Even though the average hourly haulage rate of 2.4 trucks per hour will not change, this report will consider the worst-case scenario, that being the effect of an additional 5 laden plus 5 return trucks per hour on the affected road network (refer to **Section 3**).

The number of light vehicles using the facility will remain unchanged as there will be no increase to the number of QC employees and therefore no increase to LV traffic movement traffic at the Quarry site.

## 2.4 Accident (Crash) Data

Crash data for the surrounding road network was obtained from the NSW Government Centre for Road Safety website[2]. The available data lists crashes from 2012 to 2016 and the source data is provided in **Appendix 2.**

A total of 58 crashes occurred between 2012 to 2016. There were no fatalities, 32 crashes resulting in injuries, and the remaining 26 resulted in no injuries. 32 accidents occurred at night, 24 during the day, 1 at dawn and 1 at dusk. 72% of crashes were single vehicle accidents. 40% of crashes occurred on a curve and 24% occurred at an intersection. **Tables 3 & 4** detail the number of accidents for each road and intersection.

**Table 3 – Transport Route Crash Data (2012 to 2016)**

| Road | Extent | Fatal | Injury | Non-Casualty |
|---|---|---|---|---|
| Wyrallah Road | Wyrallah Ferry Road to CQ | 0 | 9 | 11 |
| Wyrallah Road | CQ to Pacific Highway | 0 | 15 | 9 |
| Broadwater Road | Full extent | 0 | 2 | 3 |
| Wyrallah Ferry Road | Full extent | 0 | 0 | 0 |
| Coraki Road | Wyrallah Ferry Road to Bruxner Highway | 0 | 1 | 3 |

[2] RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017

**Table 4 – Intersection Crash Data (2012 to 2016)**

| Intersection | Fatal | Injury | Non-Casualty |
|---|---|---|---|
| Pacific Highway and Wyrallah Road | 0 | 0 | 0 |
| Pacific Highway and Broadwater Road | 0 | 0 | 0 |
| Wyrallah Road and Broadwater Road | 0 | 1 | 0 |
| Wyrallah Road and Champions Quarry Access Road | 0 | 0 | 0 |
| Wyrallah Road and Wyrallah Ferry Road | 0 | 1 | 0 |
| Coraki Road and Wyrallah Ferry Road | 0 | 2 | 0 |
| Bruxner Highway and Coraki Road | 0 | 1 | 0 |

The accidents were reasonably evenly distributed along the transport routes and the number of accidents on each road is proportional to the volume of traffic on the road. The number of accidents at intersections is minor and no repetitive or reoccurring accident patterns were identified.

# 3 Assessment and Recommendations

The following subsections review the anticipated impacts of the consent modification on the road network. Discussions relevant to the recommendations for impact mitigation or other controls are also included, where appropriate.

## 3.1 Roads

### 3.1.1 Pacific Highway

Upgrade of the Pacific Highway is currently underway and will include a bypass of Woodburn and Broadwater. The works are expected to be completed by 2020. This will significantly reduce traffic volumes on the Pacific Highway through Broadwater and Woodburn and improve the Level of Service (LoS) at the associated Wyrallah and Broadwater Road intersections. The current capacity of these intersections is discussed in more detail below in **Section 3.2.**

An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 1% increase to current traffic volumes and is considered to be insignificant and as a result, no mitigation measures are recommended for the Pacific Highway.

### 3.1.2 Wyrallah Road

Wyrallah Road travels north/south between Lismore and Woodburn. The condition of Wyrallah Road is very similar to that described in the 2009 Roadnet report. LCC has undertaken several rehabilitation projects on Wyrallah Road since then and the intersection of Wyrallah Road and Tucki Road has also been upgraded in 2016 to an AUR standard.

Other changes include a reduction of the speed limit on Wyrallah Road from 100km/h to 80km/h from Lismore to south of the Quarry access. This addressed deficiencies in the winding and undulating alignment that did not meet road design guidelines for 100km/h as well as a minor approach sight distance deficiency to the Quarry access road intersection.

Traffic volumes on Wyrallah Road have remained largely unchanged for the past 18 years. A traffic count from 1998 returned a higher figure than recent count in 2015. Traffic counts on Wyrallah Road however, are likely to be affected by seasonal sugar cane heavy haulage vehicles that typically operate from July to December. A growth rate of 1.4% was adopted for the purposes of estimating future growth for this report calculated by comparing 2002 data to 2015 data.

An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 4% to 5% increase to current traffic volumes and is therefore considered to be minor. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase.

Procedures to minimise delays and congestion on Wyrallah Road and Broadwater Road during the cane season are to be implemented as per the Proponent's Transport Management Plan (refer **Section 3.5).** Wyrallah Road is currently operating at an acceptable standard and as a result, no further mitigation measures are recommended.

### 3.1.3 Broadwater Road

Broadwater Road links the township of Broadwater to Wyrallah Road. The condition of Broadwater Road is also very similar to that described in the 2009 Roadnet report. LCC has undertaken several rehabilitation projects on Broadwater Road in recent years and another rehabilitation project for a 2km section of Broadwater Road is planned during 2018. A 40 tonne load limit has been imposed on Broadwater Road.

Traffic volumes have increased at a rate of 2.8% per annum since 2003. A sugar cane mill is located immediately prior to the end of Broadwater Road at the Pacific Highway in Broadwater. Broadwater Road is affected by seasonal flows from July to December during sugar cane season.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 16% increase to current traffic volumes on Broadwater Road and is considered a small increase. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase. It is therefore considered that Broadwater Road will still operate at an acceptable standard with the proposed increased traffic. No improvements are recommended for Broadwater Road.

As the sugar cane mill is located on Broadwater Road, procedures to minimise delays and congestion on Broadwater Road during the cane season are to be implemented as per the Proponent's Transport Management Plan (refer **Section 3.5).** In addition, if congestion on Broadwater Road becomes problematic, Transport Route 2 can be used rather than Transport Route 3 to access the Pacific Highway until such time that congestion eases.

As a 40 tonne load limit has been imposed on Broadwater Road, all laden trucks leaving the Quarry using Transport Route 3 will be limited to 40 tonnes. The weight of each laden truck is controlled during the loading process at the Quarry and this system will be used to ensure no trucks using Transport Route 3 leave the Quarry heavier than 40 tonnes. In addition, the Proponent's Transport Management Plan (refer **Section 3.5)**, will be amended to highlight the Transport Route 3 load limit.

### 3.1.4 Wyrallah Ferry Road

Wyrallah Ferry Road is a short connecting road between Wyrallah Road and Coraki Road. It remains largely unchanged since the 2009 Roadnet report. Both Wyrallah Road and Coraki Road inspections have been widened as discussed in more detail in **Section 3.2.** No other deficiencies have been identified.

The traffic volume on Wyrallah Ferry Road has marginally decreased from 1,670 vehicles per day (vpd) in 2009 (Roadnet report) to 1,644vpd in 2017. The same growth rate as Wyrallah Road of 1.4% has been conservatively adopted for the purposes of estimating future growth for this report.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 6% increase to current traffic volumes on Wyrallah Ferry Road and is considered to be a minor increase. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase. It is therefore considered that Wyrallah Ferry Road will operate at an acceptable standard with the proposed increased traffic and as a result, no additional mitigation measures are recommended.

### 3.1.5 Coraki Road

The northern end of Coraki Road is used to provide access to the Bruxner Highway for Quarry deliveries either north to Lismore or west in the direction of Casino. Coraki Road and has not undergone any significant changes in recent years.

Previous traffic counts on Coraki Road from 2002 and 2007 indicate that traffic has decreased to 1,631vpd as measured in 2017. A 2010 count by LCC in 2010 returned a result of 1,424vpd however the location of the count was outside the transportation route. The same growth rate as Wyrallah Road of 1.4% has been conservatively adopted for the purposes of estimating future growth for this report.

The proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 7% increase to current traffic volumes on Coraki Road and is considered to be a minor increase. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase. It is therefore considered that Coraki Road will operate at an acceptable standard with the proposed increased traffic and as a result, no additional mitigation measures are recommended.

### 3.1.6 Bruxner Highway

The Bruxner Highway remains largely unchanged since the 2009 Roadnet report in the vicinity of the Coraki Road intersection. LCC provided traffic volume data within the southern outskirts of Lismore however the actual volumes at the Coraki Road intersection are likely to be significantly less.

Never the less, as the intersection is configured with multiple auxiliary turning lanes it is operating within capacity as discussed in **Section 3.2.**

An increase of up to 10 truck movements per hour (5 laden plus 5 return trips) represents a 2% increase to current traffic volumes and is therefore considered to be insignificant. It is important to note that the proposed increase to truck movements would only be for intermittent periods as the overall annual truck movements will not increase. As a result, no mitigation measures are recommended for the Bruxner Highway.

## 3.2 Intersections

### 3.2.1 Pacific Highway and Wyrallah Road Intersection

The intersection of the Pacific Highway and Wyrallah Road is a 4-way intersection with Cedar Street to the south. Stop control is in place on Wyrallah Road, and give way control on Cedar Street. Existing Channelised Right (CHR) turn lanes are provided for right turns into both Wyrallah Road and Cedar Street, however there are no left turn auxiliary lanes. Speed limit at the intersection is 50km/h.

#### 3.2.1.1 Warrants for Turn Treatments

Figure 4.9(b) of *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections,* specifies warrants for providing basic, auxiliary and channelised left and right turn treatments at unsignalised intersections. The graph is reproduced below as **Figures 2 and 3** and shows hourly volumes of traffic at an intersection subject to a speed limits less than 100km/h.

The intersection was analysed for the Pacific Highway peak hour of 12:00pm to 1:00pm and the Wyrallah Road peak hours at 8:00am to 9:00am and 3:00pm to 4:00pm.

Analysis of the 8:00am to 9:00am peak on Wyrallah Road with volumes on the Pacific Highway at the same time requires a CHR (refer **Figure 2**) and this turn treatment is already in place. Other peak hour volumes on the Pacific Highway between 12:00pm and 1:00pm and Wyrallah Road between 3:00pm and 4:00pm indicate that an Auxiliary Left short (AUL(s)) is required (refer **Figure 3**). It is noted that the requirement for an AUL(s) stands regardless of the maximum 10 Quarry haulage movements per hour.

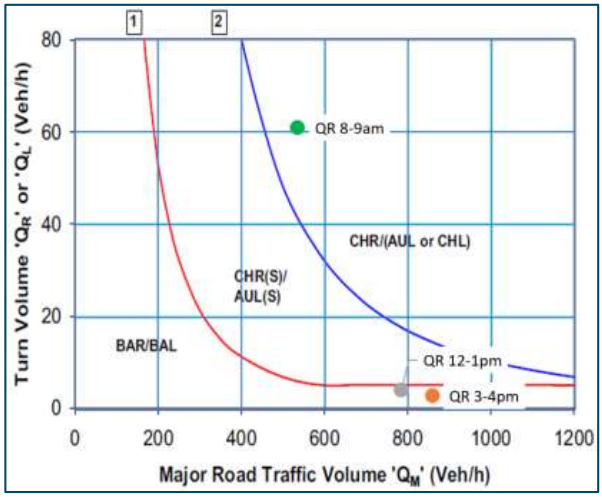



**Figure 2 – Warrant for right turn treatment**

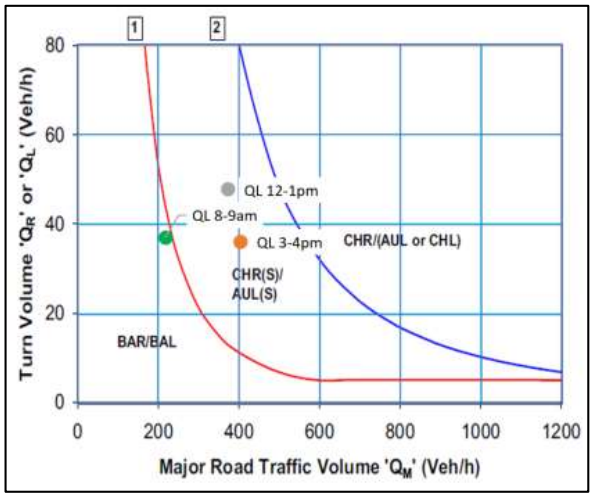



**Figure 3 – Warrant for left turn treatment**

#### 3.2.1.2 SIDRA Analysis

The intersections within the transportation routes were modelled using SIDRA, an intersection performance simulation software package. SIDRA simulates the performance of each intersection based upon the traffic volumes of each turning movement, approach speed limits and geometric properties of the intersection. The performance of the intersection is summarised by four performance indicators:

- Level of Service (LoS);
- Degree of Saturation (DoS);
- Queue length; and
- Average delay per vehicle.

LoS is a qualitative measure describing operational conditions within a traffic stream and takes into account service measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, safety, comfort and convenience. There are six levels of service, designated A (best – free flow) to F (worst – breakdown in flow).

DoS is defined as the ratio of demand flow to capacity. As it approaches 1, extensive delays and queues would be expected. For a satisfactory situation, the DoS should be less than the nominated practical degree of saturation, usually 0.9.

Queue length is the number of vehicles waiting at the hold line and is usually quoted as the 95$^{th}$ percentile back of the queue, which is the value below which 95% of all observed queue lengths fall.

Delay is the difference between interrupted and uninterrupted travel times through the intersection and is measured in seconds per vehicle. The delays include queued vehicles decelerating and accelerating to and/or from the stop, as well as delays experienced by all vehicles negotiating the intersection. At sign controlled intersections the average delay for the worst movement is reported.

The performance of the Pacific Highway and Wyrallah Road intersection for the above indicators is summarised in **Table 1.** Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 1 – SIDRA Analysis of Pacific Highway and Wyrallah Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to – 9:00am | 0.47 | 18.5 | B | 19.8 |
| 12:00pm to 1:00pm | 0.37 | 23.5 | B | 11.6 |
| 3:00pm to 4:00pm | 0.78 | 40.6 | C | 44.8 |

SIDRA analysis reveals that the worst hour for the intersection is between 3:00pm and 4:00pm when intersection operates at LoS C. LoS C represents satisfactory operation however a review of accident history at the intersection is recommended for intersections operating at LoS C.

Crash History for the intersection of the Pacific Highway and Wyrallah Road was reviewed in **Section 2.4**. No crashes were reported at this intersection for the past 5 years. Therefore, the intersection is operating safety and recommendations for improvements due to crash history are not considered necessary as a result of this Proposal.

It should be noted that the intersection is currently operating at LoS C with existing traffic volumes without the proposed additional CQ traffic. Once the Pacific Highway bypass opens in 2020 it is expected that traffic at the intersection will reduce considerably and that LoS will improve.

#### 3.2.1.3 Recommendations

The intersection is operating satisfactorily. The required CHR is already in place however an AUL(s) is not provided. Given that the Pacific Highway is to be bypassed in approximately 2 years' time which will result in a significant reduction in traffic at the intersection, construction of an AUL(s) is not considered to be warranted. No other deficiencies at the intersection have been identified and as a result, no additional mitigation measures are recommended.

### 3.2.2 Pacific Highway and Broadwater Road Intersection

The intersection of the Pacific Highway and Broadwater Road is a T-junction with give way control on Broadwater Road. A CHR is in place for right turns from the Pacific Highway into Broadwater Road. There is no left turn auxiliary lane. Traffic is limited to 50km/h at the intersection. A sugar cane mill is located immediately to the north-west of the intersection off Broadwater Road.

#### 3.2.2.1 Warrants for Turn Treatments

Peak hours occur between 12:00pm and 1:00pm on the Pacific Highway and 6:00am to 7:00am and 3:00pm to 4:00pm on Broadwater Road. As the Quarry does not commence operations until 7:00am, the 7:00am to 8:00am hourly data from the Pacific Highway was combined with 6:00am to 7:00am data from Broadwater Road to enable conservative estimation of the effect of increased Quarry traffic at the intersection.

Analysis of the peak traffic volumes results in a requirement for a CHR (refer **Figure 4**) and this turn treatment is already in place. With regard to left turn treatments, although it is close for the Pacific Highway peak hour at 12:00pm to 1:00pm, the data indicates that no auxiliary turn lane is required (refer **Figure 5**).

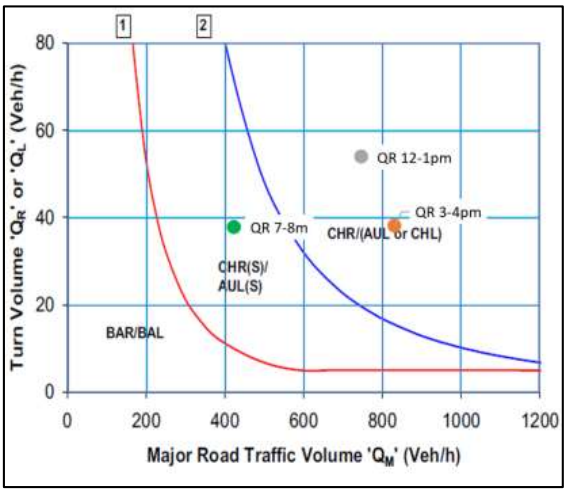



**Figure 4 – Warrant for right turn treatment**

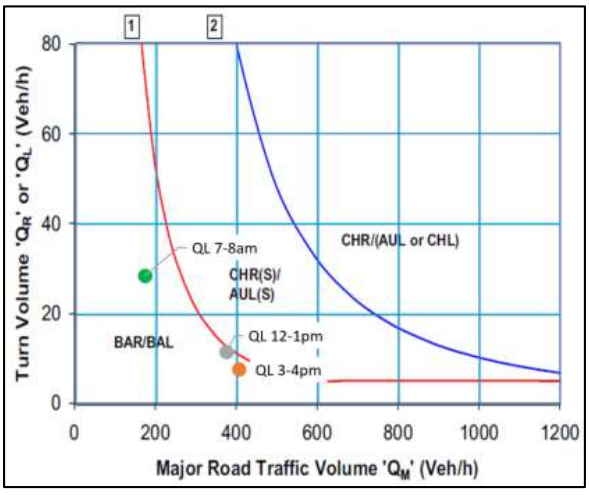



**Figure 5 – Warrant for left turn treatment**

#### 3.2.2.2 SIDRA Analysis

Performance of the Pacific Highway and Broadwater Road intersection is summarised in **Table 6**. Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 6 – SIDRA Analysis of Pacific Highway and Broadwater Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 7:00am to – 8:00am | 0.12 | 1.3 | A | 2.1 |
| 12:00pm to 1:00pm | 0.22 | 12.3 | A | 3.4 |
| 3:00pm to 4:00pm | 0.21 | 1.3 | A | 4.7 |

SIDRA analysis reveals that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity. Once the Pacific Highway bypass is completed in 2020 these results will further reduce.

#### 3.2.2.3 Recommendations

As the intersection already has the required CHR, it is operating well within capacity at LoS A. All required signage is in place and no additional improvements to the intersection are recommended. With the sugar cane mill located so close to the intersection, if during cane harvesting season (July to December) congestion at the intersection becomes problematic, Transport Route 2 could be used to access the Pacific Highway rather than Transport Route 3 until such time that congestion eases.

### 3.2.3 Wyrallah Road and Broadwater Road Intersection

The intersection of Wyrallah Road and Broadwater Road is a basic T-junction with give way control on Broadwater Road. There are no auxiliary turn lanes and the speed limit at the intersection is 100km/h.

#### 3.2.3.1 Warrants for Turn Treatments

The intersection was analysed for the Wyrallah Road peak hours of 8:00am to 9:00am and 3:00pm to 4:00pm. AM peak hour on Broadwater Road occurs between 6:00am and 7:00am which is prior to Quarry haulage operations and the PM peak hour coincides with PM peak hour on Wyrallah Road.

As the speed limit on Wyrallah Road is 100km/h at this intersection, Figure 4.9(a) of *AUSTROADS Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections,* was used to assess the warrants for turn treatments. Analysis reveals that no auxiliary turn lane treatments are required as shown in **Figure 6**.

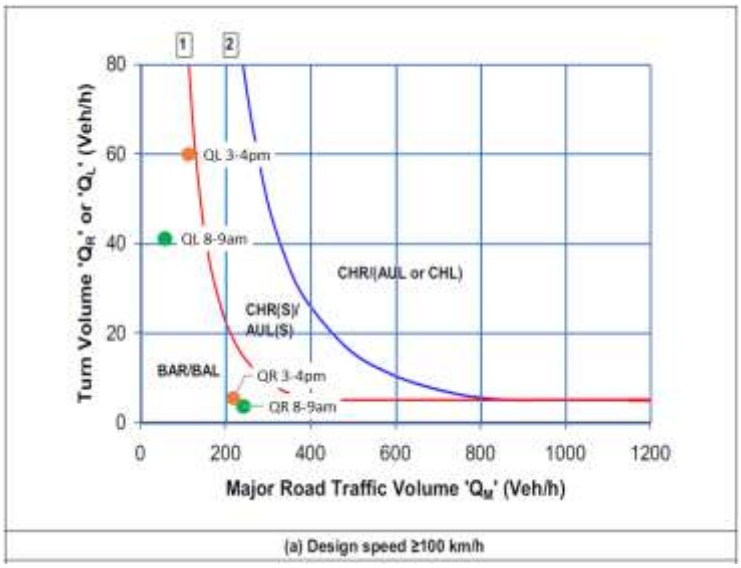



**Figure 6 – Warrant for turn treatments**

#### 3.2.3.2 SIDRA Analysis

Performance of the Wyrallah and Broadwater Road intersection is summarised in **Table 7.** Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 7 – SIDRA Analysis of Wyrallah Road and Broadwater Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to 9:00am | 0.09 | 9.4 | A | 1.9 |
| 3:00pm to 4:00pm | 0.12 | 9.3 | A | 2.7 |

SIDRA analysis results show that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

#### 3.2.3.3 Recommendations

No auxiliary turn lanes are required at the intersection, it is operating well within capacity at LoS A, and all required signage is in place. As a result, no improvements are recommended.

### 3.2.4 Wyrallah Road and the Quarry Access Road Intersection

Access to the Quarry is via an upgraded intersection including both right and left turn auxiliary lanes (CHR & AUL). Traffic leaving the Quarry is controlled by a stop sign prior to entering Wyrallah Road.

As discussed in **Section 3.1.2,** the speed limit of Wyrallah Road at this intersection has been reduced to 80km/h. This resolved a minor approach sight distance deficiency at the intersection when the previously posted speed limit was 100km/h.

#### 3.2.4.1 Warrants for Turn Treatments

Analysis of traffic volumes entering and exiting the Quarry including the proposed increase by up to 10 movements per hour resulted in a requirement for a Basic Right (BAR) / Basic Left (BAL) configuration for the intersection. As a superior CHR/AUL configuration is already in place, no further recommendations are made.

#### 3.2.4.2 SIDRA Analysis

Performance of the Wyrallah Road and Quarry Access Road intersection is summarised in **Table 8**. Only the worst case was modelled, that being the AM peak hour between 8:00am and 9:00am. Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 8 – SIDRA Analysis of Wyrallah Road and Broadwater Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to 9:00am | 0.08 | 15.6 | B | 2.1 |

SIDRA analysis results show that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

#### 3.2.4.3 Recommendations

Increasing Quarry traffic entering Wyrallah Road from a maximum of 5 to 10 laden trucks per hour will not adversely affect the capacity of the intersection. The intersection is operating at LoS A and will continue to do so for the next 10 years. As a result, no intersection improvements are recommended.

### 3.2.5 Wyrallah Road and Wyrallah Ferry Road Intersection

The intersection of Wyrallah Road and Wyrallah Ferry Road is a basic T-junction with give way control on Wyrallah Ferry Road. There are no existing auxiliary turn lanes and the speed limit at the intersection is 50km/h. As conditioned by the previous project approval, this intersection has been widened to cater for the turn movements of HVs travelling to and from the Quarry.

#### 3.2.5.1 Warrants for Turn Treatments

Peak hours occur between 8:00am to 9:00am and 4:00pm to 5:00pm on both Wyrallah Road and Wyrallah Ferry Road. Analysis of the peak traffic volumes results in a requirement for a CHR(s) and AUL(s) as shown in **Figure 7**. It is noted that the requirement for a CHR(s) and AUL(s) stands regardless of the addition of increased Quarry movements.

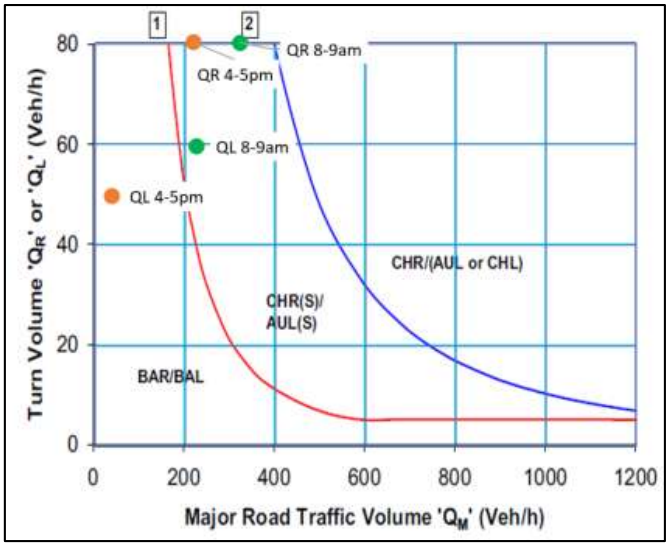



**Figure 7 – Warrant for turn treatments**

### 3.2.5.2 SIDRA Analysis

Performance of the Wyrallah Road and Wyrallah Ferry Road intersection is summarised in **Table 9**. Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 9 – SIDRA Analysis of Wyrallah Road and Wyrallah Ferry Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to 9:00am | 0.18 | 6.3 | A | 5.4 |
| 4:00pm to 5:00pm | 0.17 | 5.7 | A | 5.9 |

SIDRA analysis results show that the intersection operates at LoS A at all times without any turn treatments. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

### 3.2.5.3 Recommendations

The SIDRA analysis indicates that the intersection is operating well below capacity without any turn treatments. Whilst a CHR(s) and AUL(s) has been identified for the intersection from Austroads, these turn treatments are already required without the introduction of additional Quarry movements. As a result, this is an existing deficiency for all road users and it is considered that CQ should not be burdened with the construction costs associated with any upgrade.

### 3.2.6 Coraki Road and Wyrallah Ferry Road Intersection

The intersection of Coraki Road and Wyrallah Ferry Road is a basic T-junction with give way control on Wyrallah Ferry Road. There are no auxiliary turn lanes and the speed limit at the intersection is 80km/h. As conditioned by the original 2012 project approval, this intersection has been widened to cater for the turn movement of HVs travelling to and from the Quarry.

### 3.2.6.1 Warrants for Turn Treatments

Peak hours occur between 8:00am to 9:00am and 4:00pm to 5:00pm on both Coraki Road and Wyrallah Ferry Road. Analysis of the peak traffic volumes results in a requirement for a CHR(s) for right turn movements during the morning and afternoon peak hours (refer **Figure 8**). It is noted that the requirement for a CHR(s) stands regardless of the addition of increased Quarry movements.

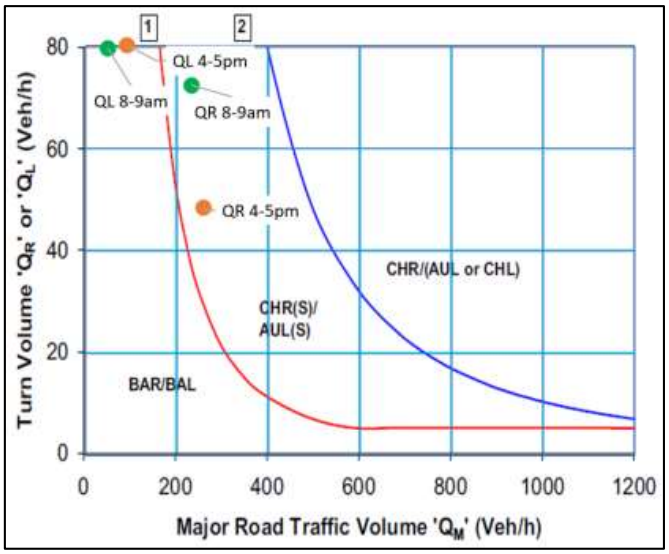



**Figure 8 – Warrant for turn treatments**

### 3.2.6.2 SIDRA Analysis

Performance of the Coraki Road and Wyrallah Ferry Road intersection is summarised in **Table 10**. Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 10 – SIDRA Analysis of Coraki Road and Wyrallah Ferry Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to 9:00am | 0.17 | 6.6 | A | 4.9 |
| 4:00pm to 5:00pm | 0.16 | 6.3 | A | 5.1 |

SIDRA analysis results show that the intersection operates at LoS A at all times. LoS A represents the minimal delay condition and that the intersection is operating well below capacity.

### 3.2.6.3 Recommendations

The SIDRA analysis indicates that the intersection is operating well below capacity without any turn treatments. Whilst a CHR(s) has been identified for the intersection from Austroads, this turn treatment is already required without the introduction of additional Quarry movements. As a result, this is an existing deficiency for all road users and it is considered that CQ should not be burdened with the construction costs associated with any upgrade.

### 3.2.7 Bruxner Highway and Coraki Road Intersection

The intersection of the Bruxner Highway and Coraki Road is a T-junction with stop control on Coraki Road. A CHR and AUL are in place for traffic turning in and out of Broadwater Road. There is also a north-bound acceleration lane for traffic heading towards Lismore and a short west-bound widening towards Casino. The speed limit is 80km/h at the intersection.

#### 3.2.7.1 Warrants for Turn Treatments

Peak hours on the Bruxner Highway and Coraki Road occur between 8:00am to 9:00am and 4:00pm to 5:00pm. Analysis results in a requirement for both CHR and AUL(s) treatments (refer **Figure 9**). As these turn treatments are already in place, including the acceleration lane, no further recommendations are made.

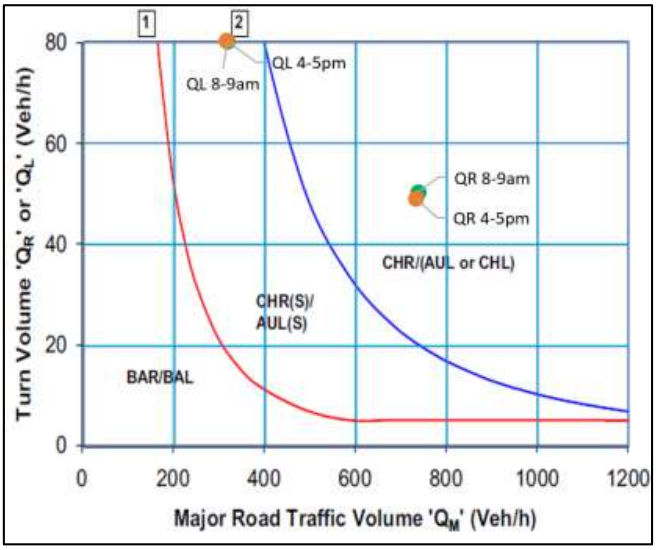



**Figure 9 – Warrant for turn treatments**

#### 3.2.7.2 SIDRA Analysis

Performance of the Bruxner Highway and Coraki Road intersection is summarised in **Table 11**. Detailed SIDRA outputs for the intersection are provided in **Appendix 3.**

**Table 11 – SIDRA Analysis of Bruxner Highway and Coraki Road intersection**

| Peak Hour | DoS | Delays (Sec) | LoS | Queue (m) |
|---|---|---|---|---|
| 8:00am to 9:00am | 0.73 | 41.3 | C | 37.1 |
| 4:00pm to 5:00pm | 0.71 | 39.4 | C | 34.5 |

SIDRA analysis reveals that the intersection operates at LoS C on the Coraki Road approach while turning movements from the Bruxner Highway into Coraki Road operate at LoS A. LoS C represents satisfactory operation however a review of accident history at the intersection is recommended for intersections operating at LoS C. Crash History for the intersection of the Bruxner Highway and Coraki Road was reviewed in **Section 2.4**. One crash was recorded during the last 5 years of available data which resulted in a non-fatal injury. As no repetitive trends are discernible, no recommendations for improvements due to crash history are considered necessary as a result of this Proposal.

#### 3.2.7.3 Recommendations

As the intersection already has the required CHR/AUL turn lane treatments, is operating satisfactorily at LoS C, and all required signage is in place, no additional improvements to the intersection are recommended.

### 3.3 Bus Services

The findings of a bus stop audit conducted by CQ indicate there are no existing state or local government approved bus stops on the haulage routes. However, there are two local bus companies that operate school and private bus services which utilise roads that form the haulage routes.

Rivers Bus Line conduct school bus services on the southern end of Wyrallah Road at morning and afternoon school times (8:00am to 9:15am and 3:00pm to 4:15pm). They also run a public bus route from Lismore to Woodburn and return however this service uses Coraki Road rather than Wyrallah Road.

Quinn's Busses also operate school bus services along Wyrallah Road and Broadwater Road from the Lismore end between the hours of 7:15am to 9:00am and 3.00pm to 5.15pm on school days.

As part of the Proponent's approved Transport Management Plan (refer **Section 3.5)**, haulage of material from the Quarry is minimised or routes altered wherever possible at school bus times. All HVs are fitted with CB radios to enable communication with buses. Drivers are trained in staggering vehicle movements to avoid bunching of trucks on the transport routes.

### 3.4 Pedestrian and Cyclist Activity

There are currently no dedicated on-road cycleways or off-road shared paths (for cyclists and pedestrians) along the haulage routes. Given the rural environment, it is considered that pedestrian and cyclist activity would be rare. There would be some pedestrian activity within Woodburn, and Broadwater. Speed limits within these towns is 50km/h thereby reducing the risk to pedestrians and cyclists.

### 3.5 Transport Management Plan

As stipulated by the original project approval, a Transport Management Plan (TMP) has been developed and implemented for the Quarry. The TMP includes a drivers' code of conduct which includes mitigation measures such as:

- Minimisation of transportation or use of alternate routes during school bus times where possible;
- Avoidance of bunching of Quarry vehicles along the transport routes – staggering of vehicles leaving or returning to the Quarry;
- Covering of all loaded vehicles entering or leaving the Quarry and installation of CB radios in all HVs;
- CB radio communication with buses and cane trucks;
- Use of CB radios to determine how many vehicles are on/about to enter the transport routes;
- Limiting HVs movements to the approved maximum trucks per hour; and
- Driving in a considerate manner at all times and respecting the rights of others to use and share the road space.

All employees and contractors that operate HVs are trained in and must comply with the drivers code of conduct. Adherence to the code of conduct minimises the potential traffic and transport impacts.

### 3.6 Road Contribution Levies

As stipulated by the original project approval, the Proponent must pay Section 94 contributions (now replaced by section 7.11) of the EP&A Act) to LCC in the amount of $0.06442 per tonne per kilometre for every tonne of extractive materials in excess of 8,500 tonnes per annum transported from the Quarry on roads for which LCC is liable for road maintenance funding. (This rate increased over the life of the project in accordance with annual CPI.)

While CQ proposes to increase the maximum allowable laden trucks per hour, as previously discussed, there is no proposal to increase the annual truck movements or overall extraction limit. Therefore, the cost to the Proponent per year will not increase. All loads leaving the Quarry will still be measured and reported to DPE as per current practice.

# 4 Conclusion

The road transport routes have been assessed in respect to the proposed increase of up to 10 truck movements per hour (5 laden plus 5 return trips) in accordance with the RTA Guide to Traffic Generating Developments and Austroads Guides.

The analysis and discussions presented in this report can be summarised as follows:

- Roads that form the three transport routes have sufficient capacity for the cumulative 10 year background traffic and the increased Quarry traffic;
- The three transport routes for the Quarry have existing approval for HV access and are currently used by HVs. The HV traffic impacts of the Quarry are small due to the comparatively low traffic numbers generated from the Quarry;
- All affected intersections will operate satisfactorily and have sufficient capacity for the cumulative 10 year background traffic and the proposed daily increased Quarry traffic with the exception of Wyrallah Road and Wyrallah Ferry Road and the intersection of Coraki Road and Wyrallah Ferry Road. (It is important to note that the overall annual truck movements will not increase. The proposed increase to truck movements would only be for intermittent periods.);
- With respect to LV traffic impacts of the proposed modification, these are considered negligible because there is no increase of LV traffic;
- Upgrade of the Pacific Highway is planned for completion by 2020 which will bypass Woodburn and Broadwater and significantly reduce traffic volumes at the transport route intersections with the Pacific Highway;
- Mitigation measures have been identified where required; and
- The Proponent intends to continue the Section 94 contribution payments to LCC to contribute to road maintenance along the transportation routes.

It should be noted that the investigations associated with this assessment indicate that the intersection of Wyrallah Road and Wyrallah Ferry Road requires an upgrade to a CHR(s) and AUL(s) standard and the intersection of Coraki Road and Wyrallah Ferry Road requires an upgrade to a CHR(s) standard. These intersection upgrades are required irrespective of the introduction of additional Quarry movements. As a result, the current configuration of these intersections are considered to be existing deficiencies for all road users and CQ should not be burdened with the construction costs associated with any upgrades.

## 4.1 Summary of Recommendations

A comprehensive range of mitigation measures have already been implemented as part of the existing project approval. However, two additional measures are recommended below:

- If congestion on Wyrallah Road and Broadwater Road becomes problematic during the sugar cane season (July to December), Transport Route 2 could be used rather than Transport Route 3 to access the Pacific Highway until such time that congestion eases; and
- As a 40 tonne load limit has been imposed on Broadwater Road, all laden trucks leaving the Quarry using Transport Route 3 will be limited to 40 tonnes. The weight of each laden truck is controlled during the loading process at the Quarry and this system will be used to ensure no trucks using Transport Route 3 leave the Quarry heavier than 40 tonnes.

The Proponent shall add this information to their existing Transport Management Plan.

# 5 References


- RTA Publication (2002), 'Guide to Traffic Generating Developments'.
- AUSTROADS (2010), 'Guide to Traffic Management Part 3: Traffic Studies and Analysis'.
- AUSTROADS (2009), 'Guide to Road Design – Part 4A: Un-signalised and Signalised Intersections'.
- RTA Publication 20 October 2012 (RMS Publication Number: 12.450) NSW Route Assessment Guide for Restricted Access Vehicles October 2012.
- Roadnet (2009), 'Traffic Impact study – Proposed Expansion of Champions Quarry Operation'
- NSW Department of Planning and Infrastructure (2012), Notice of approval of amended development consent - Champions Quarry Project'
- Champions Quarry Expansion (March 2017), 'Transport Management Plan' version 2.1.

# Appendix 1: Traffic Data

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Bruxner Highway - 0.7km South of Three Chain Rd

**TRAFFIC DIRECTION**

North - South

**DATA COLLECTION INTERVAL DATE**

From: 17/8/14 To: 11/3/14

**AVERAGE DAILY TRAFFIC (ADT)**

| | |
|---|---|
| Entire Week = | 10,007 |
| Weekdays = | 10,925 |
| Weekends = | 7,559 |

**PEAK TIME TRAFFIC (ADT)**

| | |
|---|---|
| AM Peak (8-9am) = | 949 |
| PM Peak (4-5pm) = | 957 |

**POSTED SPEED**

100 Km/h

**85th PERCENTIL SPEED**

90 Km/h

**HEAVY VEHICLE %**

| | |
|---|---|
| Entire Week = | 10.2 |
| Weekdays = | 10.8 |
| Weekends = | 7.2 |

**AERIAL IMAGE**

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Wyrallah Road - No.2739 Wyrallah Road

**TRAFFIC DIRECTION**

East - West

**DATA COLLECTION INTERVAL DATE**

From: 1/12/15 To: 14/12/15

**AVERAGE DAILY TRAFFIC (ADT)**

| | |
|---|---|
| Entire Week = | 2,014 |
| Weekdays = | 2,209 |
| Weekends = | 1,575 |

**PEAK TIME TRAFFIC (ADT)**

| | |
|---|---|
| AM Peak (8-9am) = | 184 |
| PM Peak (3-4pm) = | 195 |

**POSTED SPEED**

100 Km/h

**85th PERCENTIL SPEED**

90 Km/h

**HEAVY VEHICLE %**

| | |
|---|---|
| Entire Week = | 7.0 |
| Weekdays = | 7.7 |
| Weekends = | 4.4 |

**AERIAL IMAGE**

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Wyrallah Road - West of Leslie Lane

**TRAFFIC DIRECTION**

East - West

**DATA COLLECTION INTERVAL DATE**

From: 19/5/15 To: 16/5/15

**AVERAGE DAILY TRAFFIC (ADT)**

| | |
|---|---|
| Entire Week = | 2,481 |
| Weekdays = | 2,706 |
| Weekends = | 1,918 |

**PEAK TIME TRAFFIC (ADT)**

| | |
|---|---|
| AM Peak (8-9am) = | 254 |
| PM Peak (4-5pm) = | 249 |

**POSTED SPEED**

80 Km/h

**85th PERCENTIL SPEED**

93 Km/h

**HEAVY VEHICLE %**

| | |
|---|---|
| Entire Week = | 8.5 |
| Weekdays = | 9.4 |
| Weekends = | 5.5 |

**AERIAL IMAGE**

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Broadwater Rd - 50m East of Dungarubba Hall

**TRAFFIC DIRECTION**

East - West

**DATA COLLECTION INTERVAL DATE**

From: 27/8/16 To: 31/10/16

**AVERAGE DAILY TRAFFIC (ADT)**

| | |
|---|---|
| Entire Week = | 681 |
| Weekdays = | 723 |
| Weekends = | 579 |

**PEAK TIME TRAFFIC (ADT)**

| | |
|---|---|
| AM Peak (6-7am) = | 60 |
| PM Peak (3-4pm) = | 59 |

**POSTED SPEED**

100 Km/h

**85th PERCENTIL SPEED**

102 Km/h

**HEAVY VEHICLE %**

| | |
|---|---|
| Entire Week = | 27.3 |
| Weekdays = | 26.6 |
| Weekends = | 29.2 |

**AERIAL IMAGE**

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Coraki Rd - Pole 33739

**TRAFFIC DIRECTION**

North - South

**DATA COLLECTION INTERVAL DATE**

From: 13/10/17 To: 30/10/17

**AVERAGE DAILY TRAFFIC (ADT)**

Entire Week = 1,631
Weekdays = 1,927
Weekends = 1,089

**PEAK TIME TRAFFIC (ADT)**

AM Peak (8-9am) = 151
PM Peak (4-5pm) = 147

**POSTED SPEED**

80 Km/h

**85th PERCENTIL SPEED**

95 Km/h

**HEAVY VEHICLE %**

Entire Week = 13.3
Weekdays = 14.4
Weekends = 8.6

**AERIAL IMAGE**

# TRAFFIC COUNT REPORT

**LOCATION OF WORKS: Road Name & Description**

Wyrallah Ferry Road - 500m West of Bridge

**TRAFFIC DIRECTION**

East - West

**DATA COLLECTION INTERVAL DATE**

From: 13/10/17 To: 30/10/17

**AVERAGE DAILY TRAFFIC (ADT)**

Entire Week = 1,644
Weekdays = 1,932
Weekends = 1,116

**PEAK TIME TRAFFIC (ADT)**

AM Peak (8-9am) = 147
PM Peak (4-5pm) = 155

**POSTED SPEED**

80 Km/h

**85th PERCENTIL SPEED**

94 Km/h

**HEAVY VEHICLE %**

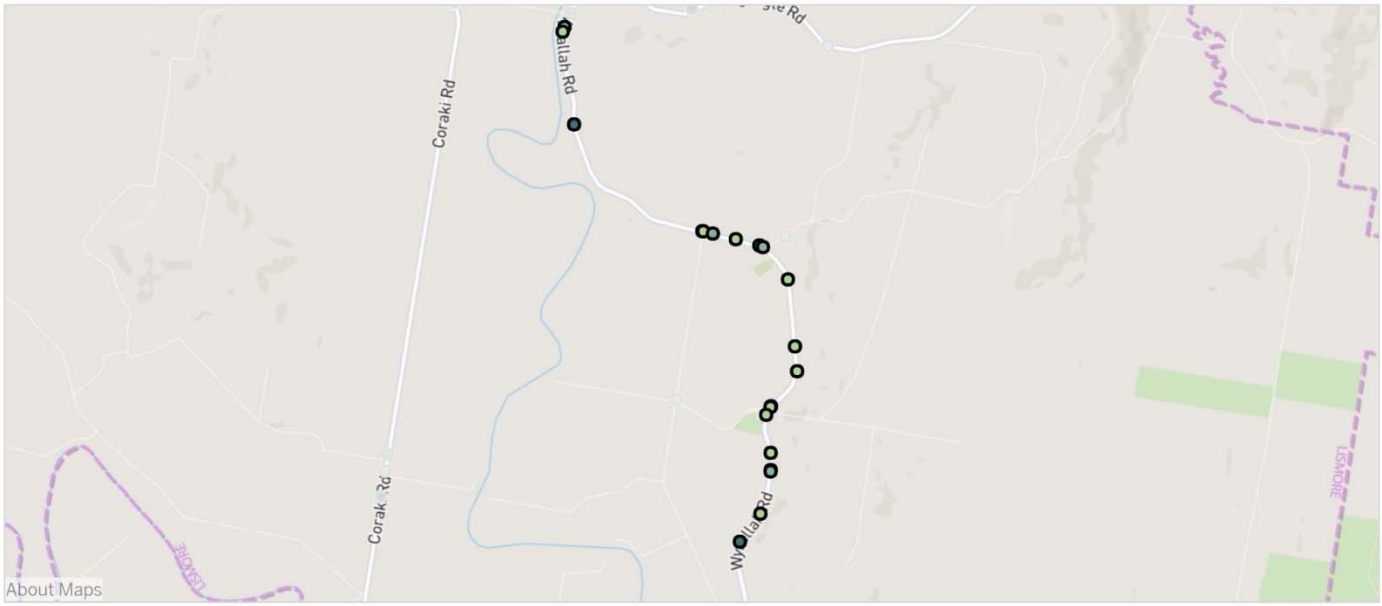
Entire Week = 15.5
Weekdays = 16.6
Weekends = 11.2

**AERIAL IMAGE**

# Appendix 2: Crash Data

# Wyrallah Road

(North of Quarry)




Degree of crash

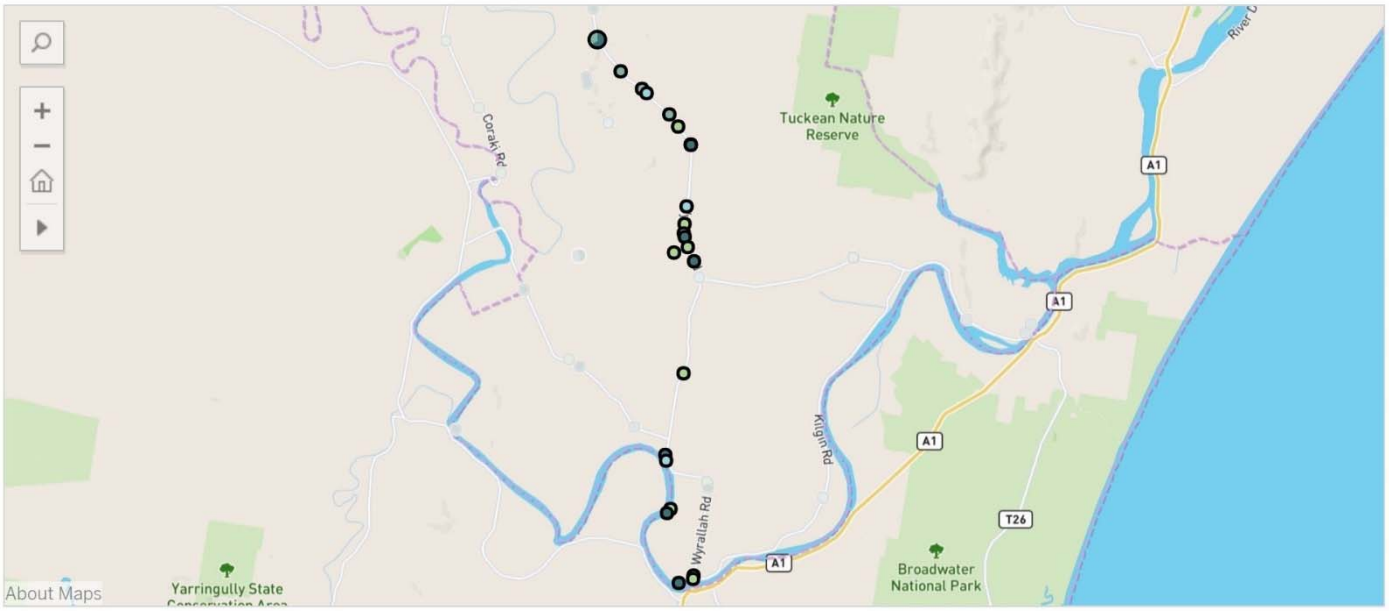
Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 782976 | Non-casualty (t.. | 86 | Off left/left bend | 2-way undivided | Daylight | 153.321667 | -28.924367 | - | - |
| | 785325 | Non-casualty (t.. | 87 | Off lft/lft bnd=>obj | 2-way undivided | Daylight | 153.320708 | -28.915956 | - | - |
| | 786542 | Non-casualty (t.. | 31 | Left rear | 2-way undivided | Daylight | 153.32144 | -28.92209 | - | - |
| | 797431 | Non-casualty (t.. | 70 | Off road to left | 2-way undivided | Daylight | 153.297137 | -28.893268 | - | - |
| | 802103 | Non-casualty (t.. | 53 | Overtake turning | T-junction | Daylight | 153.311848 | -28.911555 | - | - |
| | 802137 | Non-casualty (t.. | 80 | Off left/right bend | 2-way undivided | Daylight | 153.318432 | -28.928354 | - | - |
| 2013 | 828268 | Non-casualty (t.. | 89 | Other curve | 2-way undivided | Darkness | 153.31891 | -28.933417 | - | - |
| | 834035 | Moderate Injury | 87 | Off lft/lft bnd=>obj | X-intersection | Daylight | 153.318938 | -28.927576 | - | 1 |
| | 839183 | Moderate Injury | 70 | Off road to left | 2-way undivided | Dawn | 153.312846 | -28.911757 | - | 1 |
| | 843404 | Non-casualty (t.. | 82 | Off right/right bend | 2-way undivided | Daylight | 153.317826 | -28.93741 | - | - |
| | 846092 | Non-casualty (t.. | 71 | Off rd left => obj | 2-way undivided | Darkness | 153.315252 | -28.912273 | - | - |
| | 849902 | Serious Injury | 86 | Off left/left bend | 2-way undivided | Darkness | 153.29833 | -28.901758 | - | 1 |
| | 849907 | Moderate Injury | 72 | Off road to right | 2-way undivided | Darkness | 153.318887 | -28.933534 | - | 1 |
| | 853687 | Non-casualty (t.. | 81 | Off left/rt bnd=>obj | 2-way undivided | Darkness | 153.318899 | -28.93184 | - | - |
| 2014 | 1046710 | Non-casualty (t.. | 20 | Head on | T-junction | Darkness | 153.318879 | -28.927649 | - | - |
| | 1046917 | Moderate Injury | 30 | Rear end | T-junction | Daylight | 153.311749 | -28.911534 | - | 2 |
| 2015 | 1071062 | Serious Injury | 86 | Off left/left bend | 2-way undivided | Daylight | 153.317725 | -28.912842 | - | 1 |
| | 1085430 | Moderate Injury | 71 | Off rd left => obj | 2-way undivided | Daylight | 153.297325 | -28.892846 | - | 3 |
| | 1085630 | Moderate Injury | 20 | Head on | T-junction | Daylight | 153.318094 | -28.912996 | - | 1 |
| 2016 | 1112349 | Serious Injury | 88 | Out of cont on bend | 2-way undivided | Daylight | 153.315679 | -28.93998 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Wyrallah Road

(South of Quarry)



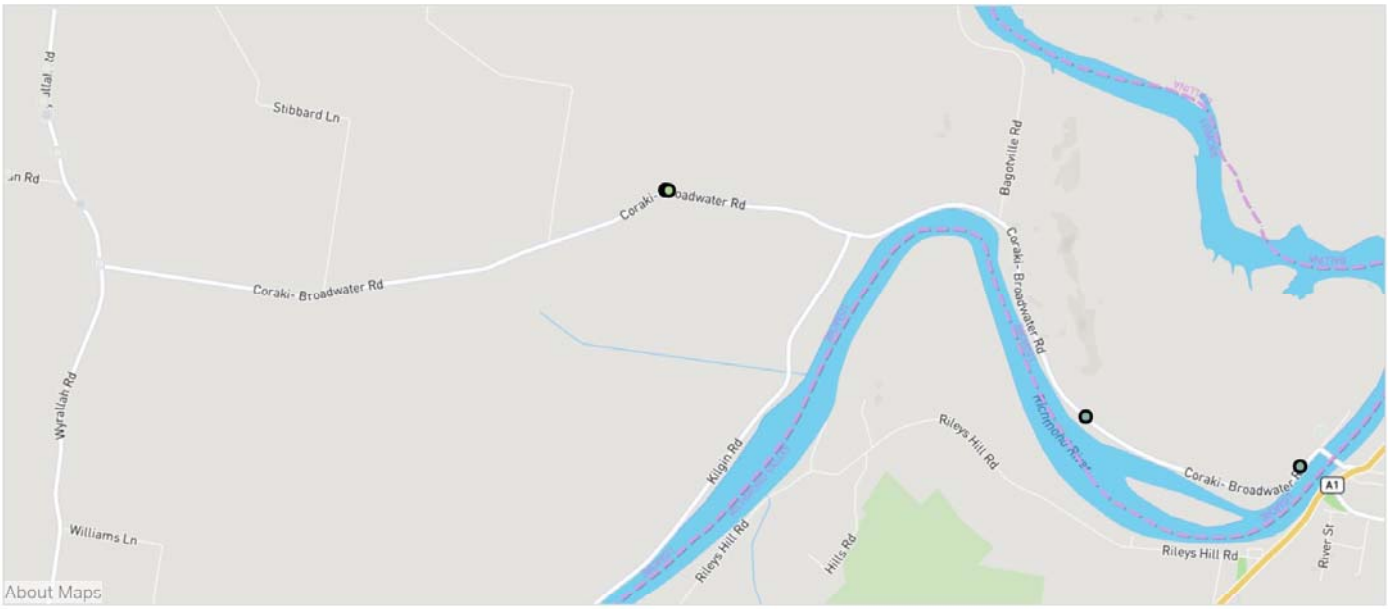

Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 781425 | Minor/Other Inj.. | 87 | Off lft/lft bnd=>obj | 2-way undivided | Daylight | 153.334551 | -29.042539 | - | 1 |
| | 786601 | Non-casualty (t.. | 84 | Off right/left bend | 2-way undivided | Dusk | 153.340963 | -28.970796 | - | - |
| | 796987 | Moderate Injury | 80 | Off left/right bend | 2-way undivided | Darkness | 153.328296 | -28.958188 | - | 1 |
| | 797042 | Non-casualty (t.. | 85 | Off rt/lft bnd=>obj | 2-way undivided | Daylight | 153.339088 | -29.022741 | - | - |
| | 797400 | Non-casualty (t.. | 10 | Cross traffic | X-intersection | Darkness | 153.341567 | -29.069385 | - | - |
| | 801929 | Non-casualty (t.. | 87 | Off lft/lft bnd=>obj | 2-way undivided | Darkness | 153.335712 | -29.053501 | - | - |
| | 811255 | Moderate Injury | 70 | Off road to left | 2-way undivided | Daylight | 153.335398 | -28.963981 | - | 1 |
| | 822819 | Non-casualty (t.. | 20 | Head on | 2-way undivided | Daylight | 153.336599 | -28.995341 | - | - |
| 2013 | 830396 | Non-casualty (t.. | 80 | Off left/right bend | 2-way undivided | Daylight | 153.339155 | -28.990953 | - | - |
| | 833607 | Minor/Other Inj.. | 67 | Struck animal | 2-way undivided | Darkness | 153.329484 | -28.959156 | - | 1 |
| | 836316 | Non-casualty (t.. | 83 | Off rt/rt bnd=>obj | 2-way undivided | Darkness | 153.340183 | -28.9941 | - | - |
| | 848748 | Moderate Injury | 73 | Off rd rght => obj | 2-way undivided | Daylight | 153.322736 | -28.954209 | - | 1 |
| | 850896 | Serious Injury | 10 | Cross traffic | T-junction | Daylight | 153.316671 | -28.947 | - | 4 |
| | 1005108 | Non-casualty (t.. | 71 | Off rd left => obj | 2-way undivided | Darkness | 153.339359 | -28.988847 | - | - |
| | 1005785 | Serious Injury | 75 | Off end of road | T-junction | Darkness | 153.316671 | -28.947 | - | 1 |
| | 1006660 | Serious Injury | 73 | Off rd rght => obj | 2-way undivided | Daylight | 153.33434 | -29.041238 | - | 1 |
| 2014 | 1020990 | Serious Injury | 87 | Off lft/lft bnd=>obj | 2-way undivided | Darkness | 153.340993 | -28.970903 | - | 3 |
| 2015 | 1061606 | Moderate Injury | 32 | Right rear | T-junction | Daylight | 153.316671 | -28.947 | - | 1 |
| | 1067659 | Minor/Other Inj.. | 30 | Rear end | 2-way undivided | Darkness | 153.339874 | -28.984863 | - | 1 |
| | 1083714 | Serious Injury | 4 | Ped walk with | 2-way undivided | Darkness | 153.337832 | -29.070298 | - | 1 |
| 2016 | 1097423 | Serious Injury | 81 | Off left/rt bnd=>obj | 2-way undivided | Daylight | 153.341815 | -28.997317 | - | 1 |
| | 1115906 | Serious Injury | 81 | Off left/rt bnd=>obj | 2-way undivided | Darkness | 153.334776 | -29.054439 | - | 1 |
| | 1116364 | Serious Injury | 71 | Off rd left => obj | 2-way undivided | Darkness | 153.3394 | -28.991778 | - | 1 |
| | 1122375 | Non-casualty (t.. | 71 | Off rd left => obj | 2-way undivided | Daylight | 153.337683 | -28.966731 | - | - |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Broadwater Road



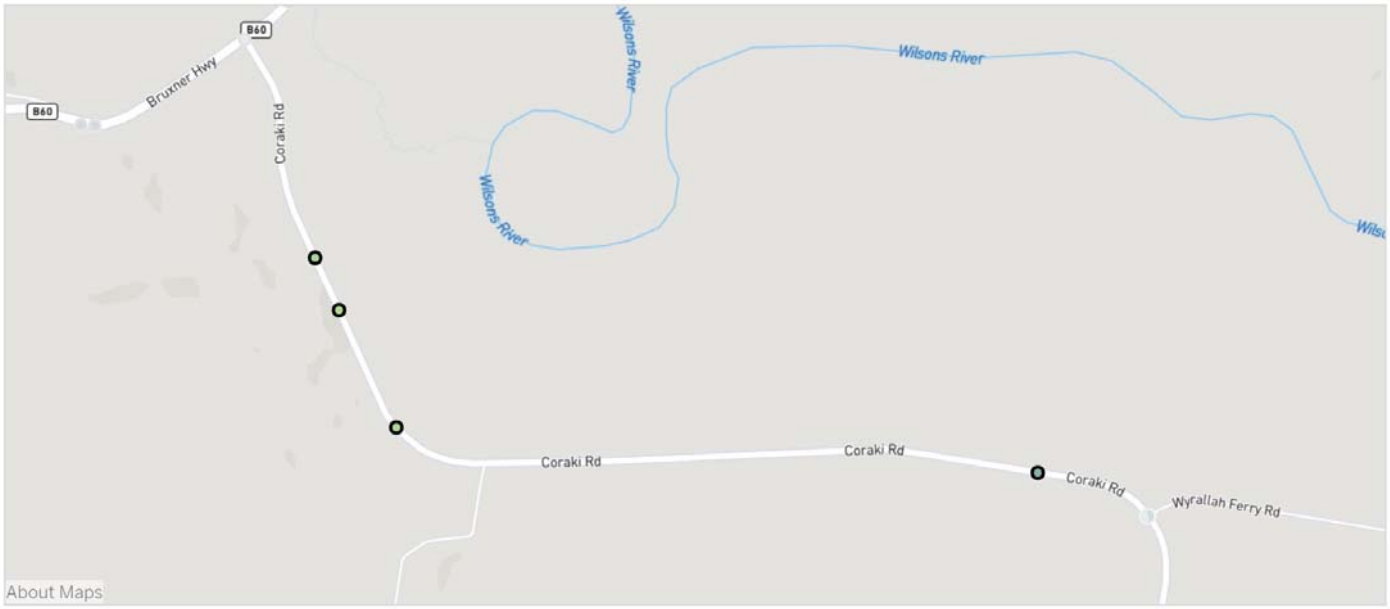

Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 812250 | Non-casualty (t.. | 82 | Off right/right bend | 2-way undivided | Darkness | 153.383358 | -28.996455 | - | - |
| 2013 | 853618 | Moderate Injury | 71 | Off rd left => obj | 2-way undivided | Darkness | 153.427967 | -29.013539 | - | 1 |
| 2014 | 1011054 | Non-casualty (t.. | 81 | Off left/rt bnd=>obj | 2-way undivided | Darkness | 153.383176 | -28.996443 | - | - |
| 2016 | 1100194 | Non-casualty (t.. | 81 | Off left/rt bnd=>obj | 2-way undivided | Daylight | 153.383122 | -28.996431 | - | - |
| | 1119727 | Moderate Injury | 20 | Head on | 2-way undivided | Daylight | 153.412822 | -29.010472 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Coraki Road




Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 794076 | Non-casualty (t.. | 87 | Off lft/lft bnd=>obj | 2-way undivided | Darkness | 153.259092 | -28.887846 | - | - |
| | 815488 | Non-casualty (t.. | 73 | Off rd rght => obj | 2-way undivided | Darkness | 153.256222 | -28.88258 | - | - |
| 2014 | 1037465 | Non-casualty (t.. | 67 | Struck animal | 2-way undivided | Darkness | 153.257066 | -28.884221 | - | - |
| 2015 | 1089208 | Moderate Injury | 73 | Off rd rght => obj | 2-way undivided | Daylight | 153.281762 | -28.88925 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Intersection of Wyrallah Road and Broadwater Road


Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 800659 | Minor/Other Inj.. | 32 | Right rear | T-junction | Daylight | 153.343117 | -29.000963 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Intersection of Wyrallah Road and Wyrallah Ferry Road

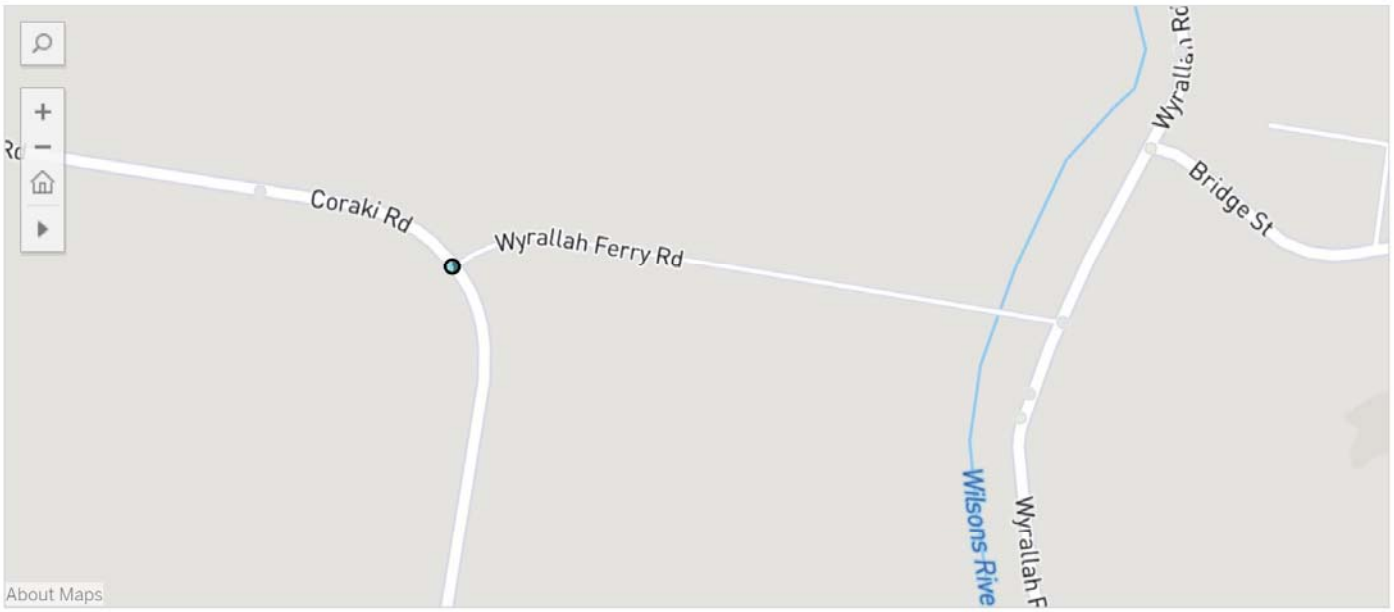

Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | 1007487 | Moderate Injury | 32 | Right rear | T-junction | Daylight | 153.297994 | -28.89158 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Intersection of Coraki Road and Wyrallah Ferry Road




Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 813914 | Minor/Other Inj.. | 13 | Right near | T-junction | Daylight | 153.285648 | -28.890586 | - | 1 |
| 2013 | 838557 | Serious Injury | 30 | Rear end | T-junction | Daylight | 153.285648 | -28.890586 | - | 2 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Intersection of Bruxner Hwy & Coraki Road


Degree of crash

Fatal | Serious Injury | Moderate Injury | Minor/Other Injury | Non-casualty (towaway)

| Reporti.. | Crash ID | Degree of crash | RUM - code | RUM - description | Type of location | Natural ligh.. | Longitude | Lattitude | No Kill.. | No Injured |
|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 1115214 | Minor/Other Inj.. | 30 | Rear end | T-junction | Daylight | 153.253729 | -28.87585 | - | 1 |

Source: RMS Centre for Road Safety Website – Interactive crash statistics – 24/10/2017
http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

# Appendix 3: SIDRA Data

# LANE SUMMARY

## Site: 101 [Pacific Highway and Wyrallah Road Intersection (2017, 8-9am)]

New Site
Stop (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| South: Cedar Street | | | | | | | | | | | | | |
| Lane 1 | 27 | 0.0 | 520 | 0.052 | 100 | 9.2 | LOS A | 0.2 | 1.3 | Full | 500 | 0.0 | 0.0 |
| Approach | 27 | 0.0 | | 0.052 | | 9.2 | LOS A | 0.2 | 1.3 | | | | |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 288 | 4.4 | 1912 | 0.151 | 100 | 0.2 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 61 | 7.0 | 1356 | 0.045 | 100 | 5.5 | LOS A | 0.2 | 1.5 | Short | 52 | 0.0 | NA |
| Approach | 349 | 4.9 | | 0.151 | | 1.1 | NA | 0.2 | 1.5 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 194 | 5.8 | 415 | 0.468 | 100 | 18.5 | LOS B | 2.7 | 19.8 | Full | 500 | 0.0 | 0.0 |
| Approach | 194 | 5.8 | | 0.468 | | 18.5 | LOS B | 2.7 | 19.8 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 255 | 4.9 | 1894 | 0.135 | 100 | 0.7 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 15 | 0.0 | 1368 | 0.011 | 100 | 5.5 | LOS A | 0.0 | 0.3 | Short | 45 | 0.0 | NA |
| Approach | 270 | 4.7 | | 0.135 | | 0.9 | NA | 0.0 | 0.3 | | | | |
| Intersection | 840 | 4.9 | | 0.468 | | 5.3 | NA | 2.7 | 19.8 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Pacific Highway and Wyrallah Road Intersection (2017, 12-1pm)]

New Site
Stop (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| South: Cedar Street | | | | | | | | | | | | | |
| Lane 1 | 27 | 0.0 | 347 | 0.078 | 100 | 13.2 | LOS A | 0.3 | 1.9 | Full | 500 | 0.0 | 0.0 |
| Approach | 27 | 0.0 | | 0.078 | | 13.2 | LOS A | 0.3 | 1.9 | | | | |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 429 | 4.5 | 1912 | 0.224 | 100 | 0.1 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 3 | 7.0 | 1090 | 0.003 | 100 | 6.3 | LOS A | 0.0 | 0.1 | Short | 52 | 0.0 | NA |
| Approach | 432 | 4.5 | | 0.224 | | 0.2 | NA | 0.0 | 0.1 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 100 | 6.6 | 271 | 0.369 | 100 | 23.5 | LOS B | 1.6 | 11.6 | Full | 500 | 0.0 | 0.0 |
| Approach | 100 | 6.6 | | 0.369 | | 23.5 | LOS B | 1.6 | 11.6 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 441 | 4.8 | 1902 | 0.232 | 100 | 0.4 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 11 | 0.0 | 1165 | 0.009 | 100 | 6.1 | LOS A | 0.0 | 0.3 | Short | 45 | 0.0 | NA |
| Approach | 452 | 4.7 | | 0.232 | | 0.5 | NA | 0.0 | 0.3 | | | | |
| Intersection | 1011 | 4.7 | | 0.369 | | 3.0 | NA | 1.6 | 11.6 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Pacific Highway and Wyrallah Road Intersection (2017, 3-4pm)]

New Site
Stop (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| South: Cedar Street | | | | | | | | | | | | | |
| Lane 1 | 27 | 0.0 | 394 | 0.068 | 100 | 11.8 | LOS A | 0.2 | 1.7 | Full | 500 | 0.0 | 0.0 |
| Approach | 27 | 0.0 | | 0.068 | | 11.8 | LOS A | 0.2 | 1.7 | | | | |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 373 | 4.5 | 1912 | 0.195 | 100 | 0.2 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 4 | 7.0 | 1116 | 0.004 | 100 | 6.2 | LOS A | 0.0 | 0.1 | Short | 52 | 0.0 | NA |
| Approach | 377 | 4.5 | | 0.195 | | 0.2 | NA | 0.0 | 0.1 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 206 | 6.7 | 265 | 0.777 | 100 | 40.6 | LOS C | 6.0 | 44.8 | Full | 500 | 0.0 | 0.0 |
| Approach | 206 | 6.7 | | 0.777 | | 40.6 | LOS C | 6.0 | 44.8 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 422 | 4.9 | 1898 | 0.222 | 100 | 0.5 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 11 | 0.0 | 1245 | 0.009 | 100 | 5.8 | LOS A | 0.0 | 0.3 | Short | 45 | 0.0 | NA |
| Approach | 433 | 4.7 | | 0.222 | | 0.7 | NA | 0.0 | 0.3 | | | | |
| Intersection | 1043 | 4.9 | | 0.777 | | 8.7 | NA | 6.0 | 44.8 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Pacific Highway and Broadwater Road Intersection (2017, 7-8am)]

Pacific Highway and Broadwater Road Intersection
Giveway / Yield (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 221 | 4.6 | 1893 | 0.117 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 40 | 0.0 | 0.0 |
| Lane 2 | 38 | 27.3 | 1281 | 0.030 | 100 | 4.2 | LOS A | 0.1 | 1.1 | Short | 37 | 0.0 | NA |
| Approach | 259 | 7.9 | | 0.117 | | 0.6 | NA | 0.1 | 1.1 | | | | |
| North: Broadwater Road | | | | | | | | | | | | | |
| Lane 1 | 66 | 27.3 | 1084 | 0.061 | 100 | 5.9 | LOS A | 0.2 | 2.1 | Full | 500 | 0.0 | 0.0 |
| Approach | 66 | 27.3 | | 0.061 | | 5.9 | LOS A | 0.2 | 2.1 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 199 | 7.9 | 1835 | 0.108 | 100 | 0.7 | LOS A | 0.0 | 0.0 | Full | 90 | 0.0 | 0.0 |
| Approach | 199 | 7.9 | | 0.108 | | 0.7 | NA | 0.0 | 0.0 | | | | |
| Intersection | 524 | 10.4 | | 0.117 | | 1.3 | NA | 0.2 | 2.1 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Pacific Highway and Broadwater Road Intersection (2017, 12-1pm)]

Pacific Highway and Broadwater Road Intersection
Giveway / Yield (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 418 | 4.6 | 1893 | 0.221 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 40 | 0.0 | 0.0 |
| Lane 2 | 38 | 27.3 | 983 | 0.039 | 100 | 5.4 | LOS A | 0.2 | 1.4 | Short | 37 | 0.0 | NA |
| Approach | 456 | 6.5 | | 0.221 | | 0.4 | NA | 0.2 | 1.4 | | | | |
| North: Broadwater Road | | | | | | | | | | | | | |
| Lane 1 | 46 | 27.3 | 408 | 0.113 | 100 | 12.3 | LOS A | 0.4 | 3.4 | Full | 500 | 0.0 | 0.0 |
| Approach | 46 | 27.3 | | 0.113 | | 12.3 | LOS A | 0.4 | 3.4 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 413 | 5.0 | 1885 | 0.219 | 100 | 0.1 | LOS A | 0.0 | 0.0 | Full | 90 | 0.0 | 0.0 |
| Approach | 413 | 5.0 | | 0.219 | | 0.1 | NA | 0.0 | 0.0 | | | | |
| Intersection | 915 | 6.9 | | 0.221 | | 0.9 | NA | 0.4 | 3.4 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Pacific Highway and Broadwater Road Intersection (2017, 3-4pm)]

Pacific Highway and Broadwater Road Intersection
Giveway / Yield (Two-Way)

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| East: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 362 | 4.6 | 1893 | 0.191 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 40 | 0.0 | 0.0 |
| Lane 2 | 55 | 27.3 | 1019 | 0.054 | 100 | 5.2 | LOS A | 0.2 | 2.0 | Short | 37 | 0.0 | NA |
| Approach | 417 | 7.6 | | 0.191 | | 0.7 | NA | 0.2 | 2.0 | | | | |
| North: Broadwater Road | | | | | | | | | | | | | |
| Lane 1 | 67 | 27.3 | 445 | 0.151 | 100 | 11.7 | LOS A | 0.5 | 4.7 | Full | 500 | 0.0 | 0.0 |
| Approach | 67 | 27.3 | | 0.151 | | 11.7 | LOS A | 0.5 | 4.7 | | | | |
| West: Pacific Highway | | | | | | | | | | | | | |
| Lane 1 | 386 | 5.3 | 1881 | 0.205 | 100 | 0.2 | LOS A | 0.0 | 0.0 | Full | 90 | 0.0 | 0.0 |
| Approach | 386 | 5.3 | | 0.205 | | 0.2 | NA | 0.0 | 0.0 | | | | |
| Intersection | 870 | 8.1 | | 0.205 | | 1.3 | NA | 0.5 | 4.7 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Wyrallah Road & Broadwater Road Intersection (2017, 8-9am, 10yr)]

Wyrallah Road & Broadwater Road Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| South: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 169 | 7.6 | 1808 | 0.094 | 100 | 0.3 | LOS A | 0.0 | 0.3 | Full | 500 | 0.0 | 0.0 |
| Approach | 169 | 7.6 | | 0.094 | | 0.3 | NA | 0.0 | 0.3 | | | | |
| East: Broadwater Road | | | | | | | | | | | | | |
| Lane 1 | 58 | 27.3 | 885 | 0.065 | 100 | 9.4 | LOS A | 0.2 | 1.9 | Full | 500 | 0.0 | 0.0 |
| Approach | 58 | 27.3 | | 0.065 | | 9.4 | LOS A | 0.2 | 1.9 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 115 | 16.2 | 1710 | 0.067 | 100 | 3.9 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 115 | 16.2 | | 0.067 | | 3.9 | NA | 0.0 | 0.0 | | | | |
| Intersection | 342 | 13.8 | | 0.094 | | 3.0 | NA | 0.2 | 1.9 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Wyrallah Road & Broadwater Road Intersection (2017, 3-4pm, 10yr)]

Wyrallah Road & Broadwater Road Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| South: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 59 | 9.6 | 1698 | 0.035 | 100 | 1.3 | LOS A | 0.1 | 0.5 | Full | 500 | 0.0 | 0.0 |
| Approach | 59 | 9.6 | | 0.035 | | 1.3 | NA | 0.1 | 0.5 | | | | |
| East: Broadwater Road | | | | | | | | | | | | | |
| Lane 1 | 84 | 27.3 | 928 | 0.091 | 100 | 9.3 | LOS A | 0.3 | 2.7 | Full | 500 | 0.0 | 0.0 |
| Approach | 84 | 27.3 | | 0.091 | | 9.3 | LOS A | 0.3 | 2.7 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 203 | 14.7 | 1734 | 0.117 | 100 | 3.2 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 203 | 14.7 | | 0.117 | | 3.2 | NA | 0.0 | 0.0 | | | | |
| Intersection | 347 | 16.9 | | 0.117 | | 4.4 | NA | 0.3 | 2.7 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101v [Wyrallah Rd & Champions Quarry Access Rd Intersection (2017, 8-9am, 10 year)]

Wyrallah Rd & Champions Quarry Access Rd
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| South: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 149 | 7.0 | 1885 | 0.079 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 370 | 0.0 | 0.0 |
| Lane 2 | 10 | 100.0 | 751 | 0.013 | 100 | 9.3 | LOS A | 0.1 | 0.7 | Short | 170 | 0.0 | NA |
| Approach | 159 | 12.8 | | 0.079 | | 0.6 | NA | 0.1 | 0.7 | | | | |
| East: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 20 | 100.0 | 437 | 0.046 | 100 | 15.6 | LOS B | 0.2 | 2.1 | Full | 500 | 0.0 | 0.0 |
| Approach | 20 | 100.0 | | 0.046 | | 15.6 | LOS B | 0.2 | 2.1 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 10 | 100.0 | 1079 | 0.009 | 100 | 7.5 | LOS A | 0.0 | 0.0 | Short | 130 | 0.0 | NA |
| Lane 2 | 149 | 7.0 | 1856 | 0.080 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 159 | 12.8 | | 0.080 | | 0.5 | NA | 0.0 | 0.0 | | | | |
| Intersection | 339 | 18.0 | | 0.080 | | 1.4 | NA | 0.2 | 2.1 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Wyrallah Rd & Wyrallah Ferry Rd Intersection (2017, 8-9am, 10 year)]

Wyrallah Rd & Wyrallah Ferry Rd Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| South: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 324 | 8.8 | 1803 | 0.180 | 100 | 1.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 324 | 8.8 | | 0.180 | | 1.0 | NA | 0.0 | 0.0 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 147 | 13.1 | 1298 | 0.113 | 100 | 4.8 | LOS A | 0.6 | 4.3 | Full | 380 | 0.0 | 0.0 |
| Approach | 147 | 13.1 | | 0.113 | | 4.8 | NA | 0.6 | 4.3 | | | | |
| West: Wyrallah Ferry Road | | | | | | | | | | | | | |
| Lane 1 | 173 | 15.5 | 989 | 0.175 | 100 | 6.3 | LOS A | 0.7 | 5.4 | Full | 500 | 0.0 | 0.0 |
| Approach | 173 | 15.5 | | 0.175 | | 6.3 | LOS A | 0.7 | 5.4 | | | | |
| Intersection | 644 | 11.6 | | 0.180 | | 3.3 | NA | 0.7 | 5.4 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Wyrallah Rd & Wyrallah Ferry Rd Intersection (2017, 4-5pm, 10 year)]

Wyrallah Rd & Wyrallah Ferry Rd Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| South: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 99 | 11.9 | 1732 | 0.057 | 100 | 2.7 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 99 | 11.9 | | 0.057 | | 2.7 | NA | 0.0 | 0.0 | | | | |
| North: Wyrallah Road | | | | | | | | | | | | | |
| Lane 1 | 277 | 10.8 | 1646 | 0.168 | 100 | 2.5 | LOS A | 0.8 | 5.9 | Full | 380 | 0.0 | 0.0 |
| Approach | 277 | 10.8 | | 0.168 | | 2.5 | NA | 0.8 | 5.9 | | | | |
| West: Wyrallah Ferry Road | | | | | | | | | | | | | |
| Lane 1 | 182 | 15.5 | 1085 | 0.168 | 100 | 5.7 | LOS A | 0.7 | 5.2 | Full | 500 | 0.0 | 0.0 |
| Approach | 182 | 15.5 | | 0.168 | | 5.7 | LOS A | 0.7 | 5.2 | | | | |
| Intersection | 559 | 12.6 | | 0.168 | | 3.6 | NA | 0.8 | 5.9 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Coraki Rd & Wyrallah Ferry Rd Intersection (2017, 8-9am, 10 year)]

Coraki Rd & Wyrallah Ferry Rd Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| South: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 200 | 14.2 | 1590 | 0.126 | 100 | 3.3 | LOS A | 0.5 | 4.1 | Full | 500 | 0.0 | 0.0 |
| Approach | 200 | 14.2 | | 0.126 | | 3.3 | NA | 0.5 | 4.1 | | | | |
| East: Wyrallah Ferry Road | | | | | | | | | | | | | |
| Lane 1 | 162 | 15.5 | 967 | 0.167 | 100 | 6.6 | LOS A | 0.6 | 4.9 | Full | 106 | 0.0 | 0.0 |
| Approach | 162 | 15.5 | | 0.167 | | 6.6 | LOS A | 0.6 | 4.9 | | | | |
| North: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 146 | 14.7 | 1690 | 0.086 | 100 | 4.5 | LOS A | 0.0 | 0.0 | Full | 319 | 0.0 | 0.0 |
| Approach | 146 | 14.7 | | 0.086 | | 4.5 | NA | 0.0 | 0.0 | | | | |
| Intersection | 507 | 14.8 | | 0.167 | | 4.7 | NA | 0.6 | 4.9 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Coraki Rd & Wyrallah Ferry Rd Intersection (2017, 4-5pm, 10 year)]

Coraki Rd & Wyrallah Ferry Rd Intersection
Giveway / Yield (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| South: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 119 | 14.3 | 1497 | 0.079 | 100 | 4.0 | LOS A | 0.3 | 2.7 | Full | 500 | 0.0 | 0.0 |
| Approach | 119 | 14.3 | | 0.079 | | 4.0 | NA | 0.3 | 2.7 | | | | |
| East: Wyrallah Ferry Road | | | | | | | | | | | | | |
| Lane 1 | 182 | 15.5 | 1111 | 0.164 | 100 | 6.3 | LOS A | 0.6 | 5.1 | Full | 106 | 0.0 | 0.0 |
| Approach | 182 | 15.5 | | 0.164 | | 6.3 | LOS A | 0.6 | 5.1 | | | | |
| North: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 231 | 14.5 | 1698 | 0.136 | 100 | 4.0 | LOS A | 0.0 | 0.0 | Full | 319 | 0.0 | 0.0 |
| Approach | 231 | 14.5 | | 0.136 | | 4.0 | NA | 0.0 | 0.0 | | | | |
| Intersection | 532 | 14.8 | | 0.164 | | 4.8 | NA | 0.6 | 5.1 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Bruxner Hwy & Coraki Rd Intersection (2017, 8-9am, 10 year)]

Bruxner Hwy & Coraki Rd Intersection
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total veh/h | HV % | veh/h | v/c | % | sec | | Veh | Dist m | | m | % | % |
| SouthEast: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 178 | 13.3 | 242 | 0.734 | 100 | 41.3 | LOS C | 4.8 | 37.1 | Full | 500 | 0.0 | 0.0 |
| Approach | 178 | 13.3 | | 0.734 | | 41.3 | LOS C | 4.8 | 37.1 | | | | |
| NorthEast: Bruxner Highway | | | | | | | | | | | | | |
| Lane 1 | 121 | 13.3 | 1705 | 0.071 | 100 | 7.2 | LOS A | 0.0 | 0.0 | Short | 75 | 0.0 | NA |
| Lane 2 | 394 | 10.2 | 1839 | 0.214 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 515 | 10.9 | | 0.214 | | 1.7 | NA | 0.0 | 0.0 | | | | |
| SouthWest: Bruxner Highway | | | | | | | | | | | | | |
| Lane 1 | 394 | 10.2 | 1848 | 0.213 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 57 | 13.3 | 722 | 0.079 | 100 | 10.1 | LOS A | 0.3 | 2.3 | Short | 130 | 0.0 | NA |
| Approach | 451 | 10.6 | | 0.213 | | 1.3 | NA | 0.3 | 2.3 | | | | |
| Intersection | 1143 | 11.2 | | 0.734 | | 7.7 | NA | 4.8 | 37.1 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# LANE SUMMARY

## Site: 101 [Bruxner Hwy & Coraki Rd Intersection (2017, 4-5pm, 10 year)]

Bruxner Hwy & Coraki Rd Intersection
Stop (Two-Way)
Design Life Analysis (Practical Capacity): Results for 10 years

**Lane Use and Performance**

| | Demand Flows | | Cap. | Deg. Satn | Lane Util. | Average Delay | Level of Service | 95% Back of Queue | | Lane Config | Lane Length | Cap. Adj. | Prob. Block. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | HV | | | | | | Veh | Dist | | | | |
| | veh/h | % | veh/h | v/c | % | sec | | | m | | m | % | % |
| SouthEast: Coraki Road | | | | | | | | | | | | | |
| Lane 1 | 173 | 13.3 | 244 | 0.710 | 100 | 39.4 | LOS C | 4.4 | 34.5 | Full | 500 | 0.0 | 0.0 |
| Approach | 173 | 13.3 | | 0.710 | | 39.4 | LOS C | 4.4 | 34.5 | | | | |
| NorthEast: Bruxner Highway | | | | | | | | | | | | | |
| Lane 1 | 117 | 13.3 | 1705 | 0.069 | 100 | 7.2 | LOS A | 0.0 | 0.0 | Short | 75 | 0.0 | NA |
| Lane 2 | 394 | 10.2 | 1839 | 0.214 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Approach | 511 | 10.9 | | 0.214 | | 1.7 | NA | 0.0 | 0.0 | | | | |
| SouthWest: Bruxner Highway | | | | | | | | | | | | | |
| Lane 1 | 394 | 10.2 | 1848 | 0.213 | 100 | 0.0 | LOS A | 0.0 | 0.0 | Full | 500 | 0.0 | 0.0 |
| Lane 2 | 56 | 13.3 | 726 | 0.077 | 100 | 10.1 | LOS A | 0.3 | 2.3 | Short | 130 | 0.0 | NA |
| Approach | 450 | 10.6 | | 0.213 | | 1.3 | NA | 0.3 | 2.3 | | | | |
| Intersection | 1134 | 11.1 | | 0.710 | | 7.3 | NA | 4.4 | 34.5 | | | | |

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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# Appendix 3: Noise Assessment

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11 April 2018
Ref: J0180-04-L1

Champions Quarry
P.O. Box 5261
EAST LISMORE NSW 2480

**Attn: Ms Cath Champion**

Dear Cath,

**RE: CHAMPIONS QUARRY – MODIFICATION TO PROJECT APPROVAL – PROPOSED HOURLY TRUCK LIMIT INCREASE**

## 1. INTRODUCTION

This report has been prepared for Champions Quarry to assess environmental noise emissions associated with a proposed Modification to permit an increase in maximum hourly truck movements into and out of the quarry which is located off Wyrallah Road Tuckurimba approximately 16 km south of Lismore, NSW. The Modification is required due to the campaign nature of quarry sales, where customer demand tends to be concentrated in defined time periods depending on the progress of the roadwork or other construction project, rather than consistently from day to day. The Modification would therefore not affect quarry plans or equipment and would not change the current production limit of 250,000 tonnes per annum.

Schedule 2 Condition 9 of Project Approval 09_0080 as modified in August 2017 requires:

***Extractive Material Transport***

*9. The Proponent must not:*
- *(a) transport more than 250,000 tonnes of extractive material from the site in any calendar year;*
- *(b) dispatch more than 50 laden trucks from the site on any day; or*
- *(c) dispatch more than 5 laden trucks from the site in any hour.*

The proposed Modification includes the following amendment to Schedule 2 Condition 9 (with proposed amendments in bold type):

*9. The Proponent shall not:*
- *(a) transport more than 250,000 tonnes of extractive material from the site in any calendar year;*
- *(b) dispatch more than **100** laden trucks from the site on any day; or*
- *(c) dispatch more than **10** laden trucks from the site in any hour.*

The Modification therefore seeks to double the maximum number of trucks per hour and per day. More intensive product transport on busy days would be offset by less intense transport on other days.

Bridges Acoustics was engaged by Champions Quarry to determine whether the proposed increase in hourly and daily truck movements would result in significant acoustic impacts to any noise sensitive receptor and, if so, to recommend practical and cost effective mitigation measures to reduce predicted impacts and continue to meet relevant noise limits.

## 2. NOISE LIMITS

Following is an extract from Schedule 3 Condition 5 of PA 09_0080 containing the noise limits applied to sensitive receptors.

**Noise Criteria**

*5 Except for times during which Bunds A, C (stage 3 only) and D and the water re-use and water supply dams are being actively constructed, the Proponent shall ensure that the noise generated on site does not exceed the criteria in Table 2 at any residence on privately-owned land.*

*Table 2: Noise Criteria*

| ***Receiver*** | ***LAeq (15 min) dB(A)*** |
|---|---|
| *NAL 4 and NAL 5* | *38* |
| *NAL 2, NAL 2A, NAL 3 and privately-owned land along the southern end of Hazelmount Lane* | *37* |
| *NAL 1 and all other receivers* | *35* |

Development Application 09_0080 was supported by *Champions Quarry Expansion Environmental Assessment* (ERM, February 2010) including *Appendix D Noise Assessment* (ERM, December 2009). Table 4.1 of the Noise Assessment presented Project Specific Noise Criteria (PSNC) determined from measured background noise levels and the requirements of the *NSW Industrial Noise Policy* (INP) and is reproduced below.

***Table 4.1 Project Specific Noise Criteria (PSNC)***

| ***Location*** | ***Period*** | ***Intrusiveness Criteria LAeq,15minute*** | ***Amenity Criteria LAeq,period*** |
|---|---|---|---|
| *NAL1* | *Day* | *40* | *50* |
| *NAL2* | | *37* | *50* |
| *NAL3* | | *37* | *50* |
| *NAL4* | | *40* | *50* |

The PA 09_0080 noise criteria are therefore lower than the PSNC at NAL 1, 4 and 5, on the basis that background noise levels and resulting PSNC at NAL 5 would be the same as at the nearby NAL 4.

## 3. EXISTING NOISE LEVELS

### 3.1 Reported in the Environmental Assessment

The Noise Assessment presented calculated noise levels for Scenarios B to I which cover various operating scenarios and combinations of operating plant. However, Scenarios H and I are a combination of Scenario F and operation of a rock hammer and rock saw, respectively, as shown in Table 6.3 of the Noise Assessment which is reproduced below.

Champions Quarry have since committed to operating the rock hammer or rock saw in the absence of other operating plant to minimise noise levels, which requires noise levels for these scenarios to be recalculated. Noise levels from the rock hammer and rock saw operating alone can be determined by subtracting noise levels for Scenario F from the noise levels for Scenarios H and I, respectively.

***Table 6.3 Modelled Scenarios Equipment Used***

| ***Plant Item*** | ***Equipment Used*** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ***B*** | ***C*** | ***D*** | ***E*** | ***F*** | ***G*** | ***H*** | ***I*** |
| *Mobile Crushing Screening Plant* | | *X* | *X* | | | *X* | | |
| *Washing Plant* | | *X* | | | | *X* | | |
| *Site Truck (Ford L8000)* | *X* | | | | | | | |
| *Dump Truck (Cat 35T)* | | | | *X* | *X* | | *X* | *X* |
| *Road Truck 1* | *X* | *X* | *X* | | *X* | *X* | *X* | *X* |
| *Road Truck 2* | *X* | *X* | *X* | | *X* | *X* | *X* | *X* |
| *Excavator (20T)* | *X* | | | | | | | |
| *Excavator (40T)* | | | | *X* | *X* | *X* | *X* | *X* |
| *Dozer* | *X* | | | *X* | *X* | *X* | *X* | *X* |
| *Front-End Loader 1* | *X* | *X* | *X* | | *X* | *X* | *X* | *X* |
| *Front-End Loader 2* | | | | | *X* | *X* | *X* | *X* |
| *Rock Hammer* | | | | | | | *X* | |
| *Rock Saw* | | | | | | | | *X* |

Table 6.6 of the Noise Assessment presented predicted receptor noise levels, based on detailed noise modelling, and has been reproduced below including modified values for Scenarios H and I to show noise levels from the rock hammer and rock saw operating alone.

***Table 6.6 Project Specific Noise Criteria (PSNC)***

| ***Assessment Location*** | ***Predicted Daytime LAeq,15minute Noise Levels, dBA*** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***B*** | ***C*** | ***D*** | ***E*** | ***F*** | ***G*** | ***H*** [1] | ***I*** [2] | ***PSNC*** |
| *NAL1* | *28* | *26* | *30* | *29* | *30* | *31* | *33* | *27* | *40* |
| *NAL2* | *32* | *35* | *34* | *33* | *34* | ***38*** | *37* | *32* | *37* |
| *NAL3* | *32* | *34* | *34* | *33* | *33* | *37* | ***38*** | *31* | *37* |
| *NAL4* | *37* | *33* | *38* | *36* | *36* | *38* | *36* | *30* | *40* |

*Note: Exceedances of the PSNC are in BOLD*

1 Modified Scenario H noise levels represent operation of the rock hammer alone

2 Modified Scenario I noise levels represent operation of the rock saw alone

Table 6.6 from the Noise Assessment, as modified, indicates predicted noise levels under Scenarios G and H are expected to result in noise levels over the PSNC at receptors NAL 2 and NAL 3, respectively, by a minor 1 dBA.

The Project Approval permits quarry operations as described in the Environmental Assessment, therefore permits the minor 1 dBA exceedances of the PSNC at NAL 2 and NAL 3 under certain operating conditions.

## 3.2 Modification 3

The Project Approval has previously been modified, with the latest Modification 3 including installation of the approved sand washing plant in a different location from that originally approved. An acoustic assessment *Champions Quarry, Modification to Development Consent, Proposed Sand Washing Plant* (Bridges Acoustics, May 2017) was included in the Modification 3 Environmental Assessment as Attachment E. The Acoustic Assessment presented a table of noise levels to receptors with the relocated sand washing plant, which indicated no significant change to predicted noise levels.

# 4. ASSESSMENT

## 4.1 Calculation Details

As the Modification includes additional truck movements with no other changes to quarry operations, noise from the additional truck movements has been added to existing noise levels to determine proposed future noise levels from the Modification. Noise levels from the additional truck movements have been calculated as in the EA, with the following details and input data:

- Environmental Noise Model (ENM) software to calculate noise levels to each receptor;
- Terrain model as used for an early stage of the quarry in the EA Noise Assessment, in the Modification 3 acoustic assessment and as shown in the figure appended to this report;
- Truck source locations generally as shown on the source location figures in Annex C to the Noise Assessment for Scenarios B and C and modified to suit the existing entry and exit roads to the quarry, also shown on the figure appended to this report;
- Truck sound power levels as reported in the EA and further described below; and
- Calm daytime weather conditions as reported in Sections 5.1 and 6.3 of the Noise Assessment.

Table 6.1 of the Noise Assessment listed modelled sound power levels for each source type, including 103 dBA for a road truck such as a Scania 124L truck and dog trailer as measured by ERM on the quarry site. This sound power level is typical for a heavy on-road truck in good condition operating at medium engine power and moderate to slow speed such as 20 to 40 km/hr.

The modelled source locations are approximately 120 m apart along the quarry access road from Wyrallah Road. Assuming a truck speed of 30 km/hr (8.3 m/s) results in a truck source including noise from each truck for 14.4 seconds. Currently 5 trucks per hour are approved, which is an average of 1.25 trucks per 15 minute period, however 2 trucks per 15 minute period is likely to occur occasionally and has been assumed. An empty truck entering the quarry travelling downhill produces significantly less noise than a laden truck travelliing up the hill to leave the quarry, therefore inbound truck movements would be at least 3 dBA quieter than outbound movements.

The above data and assumptions result in a modelled truck source sound power level of 90 LAeq,15min, with effectively 6 sources included along the access road. The model actually includes full sources along the western section of road and half sources along the separate southern entrance and eastern exit roads where the two are not adjacent.

The Noise Assessment does not present equivalent assumptions to calculate the source sound power level, however Annex D to the Noise Assessment includes a ‘Road Truck 1’ source with a sound power level of 103 dBA and a ‘Road Truck 2’ source with a sound power level of 90 dBA. Detailed noise model data prepared by ERM for the Noise Assessment included sound power levels of 90 dBA for each road truck source, therefore this assessment is consistent with the EA.

## 4.1 Predicted Noise Levels

Noise levels predicted in previous assessments, and currently approved, are shown in Table 1 along with predicted noise levels from the proposed additional truck movements. Noise levels in bold font highlight levels over the PSNC.

**Table 1: Predicted Noise Levels, LAeq,15min.**

| Receptor | Predicted Daytime LAeq,15min Noise Level | | | | | | | | PSNC | Project Approval |
|---|---|---|---|---|---|---|---|---|---|---|
| Scenario | B | C | D | E | F | G | H | I | | |
| Approved Project | | | | | | | | | | |
| NAL 1 | 28 | 26 | 30 | 29 | 30 | 31 | 33 | 27 | 40 | 35 |
| NAL 2 | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 2A | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 3 | 32 | 34 | 34 | 33 | 33 | 37 | **38** | 31 | 37 | 37 |
| NAL 4 | 37 | 33 | 38 | 36 | 36 | 38 | 36 | 30 | 40 | 38 |
| NAL 5 | 37 | 33 | 38 | 36 | 36 | 38 | 36 | 30 | 40 | 38 |
| Additional Trucks | | | | | | | | | | |
| NAL 1 | 21 | 21 | 21 | - | 21 | 21 | - | - | 40 | 35 |
| NAL 2 | 19 | 19 | 19 | - | 19 | 19 | - | - | 37 | 37 |
| NAL 2A | 19 | 19 | 19 | - | 19 | 19 | - | - | 37 | 37 |
| NAL 3 | 20 | 20 | 20 | - | 20 | 20 | - | - | 37 | 37 |
| NAL 4 | 35 | 35 | 35 | - | 35 | 35 | - | - | 40 | 38 |
| NAL 5 | 28 | 28 | 28 | - | 28 | 28 | - | - | 40 | 38 |
| Total Modification Noise Level (Approved Project plus Additional Trucks) | | | | | | | | | | |
| NAL 1 | 29 | 27 | 31 | 29 | 31 | 31 | 33 | 27 | 40 | 35 |
| NAL 2 | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 2A | 32 | 35 | 34 | 33 | 34 | **38** | 37 | 32 | 37 | 37 |
| NAL 3 | 32 | 34 | 34 | 33 | 33 | 37 | **38** | 31 | 37 | 37 |
| NAL 4 | 39 | 37 | 40 | 36 | 39 | 40 | 36 | 30 | 40 | 38 |
| NAL 5 | 38 | 34 | 38 | 36 | 37 | 38 | 36 | 30 | 40 | 38 |

Table 1 shows noise levels from the currently approved project are expected to exceed the PSNC by a minor 1 dBA at Receptors NAL 2 and NAL 2A for Scenario G and at NAL 3 for Scenario H. These predicted minor exceedances are considered acceptable and approved despite not being reflected in the current Project Approval conditions, as they were clearly presented in the EA and Noise Assessment.

Table 1 also shows noise levels from the additional trucks alone are expected to the meet the PSNC and, more importantly, total noise levels from Modification are predicted to meet the PSNC (except where the PSNC are already exceeded by the existing approved project). Predicted noise levels from the Modification are not expected to meet the existing Project Approval conditions for all combinations of scenario and receptor, however a modification to the Project Approval condition is recommended where the condition requires noise criteria below the PSNC.

### 4.1 Recommendation

Given the Modification noise levels are predicted to meet the PSNC, no additional noise mitigation measures are required or have been recommended beyond those previously recommended in the Noise Assessment and currently approved. Quarterly noise surveys previously completed by Champions Quarry staff and more recently by Bridges Acoustics indicate the existing quarry noise levels meet the PA noise criteria under normal quarry operating conditions, therefore the existing noise mitigation measures appear effective in maintaining acceptable noise levels at all receptors.

An amendment to PA 09_0080 Schedule 3 Condition 5 is recommended to address the predicted noise levels for the Modification without permitting further exceedances of the PSNC beyond those currently approved, as follows. Text in bold type highlights proposed amendments to this condition.

**Noise Criteria**

*5 Except for times during which Bunds A, C (stage 3 only) and D and the water re-use and water supply dams are being actively constructed, the Proponent shall ensure that the noise generated on site does not exceed the criteria in Table 2 at any residence on privately-owned land.*

*Table 2: Noise Criteria*

| *Receiver* | *LAeq (15 min) dB(A)* |
|---|---|
| ***NAL 4*** | ***40*** |
| *NAL 2, NAL 2A, NAL 3,* ***NAL 5*** *and privately-owned land along the southern end of Hazelmount Lane* | ***38*** |
| *NAL 1 and all other receivers* | *35* |

The recommended amendment to Condition 5 above addresses the minor (maximum 2 dBA) increase in noise level predicted for the Modification and the predicted noise levels of 38 LAeq,15min at NAL 2, NAL 2A and NAL 3 in the Noise Assessment that were not reflected in the existing condition.

## 4. CONCLUSION

The proposed Modification to permit an increase in maximum hourly and daily truck numbers entering and leaving the quarry would not result in exceedances of the relevant Project Specific Noise Criteria developed according to the INP and more recent NPI. As the Modification does not propose an increase in maximum annual production from the quarry, no increase in long term average noise levels from the quarry is proposed. The minor predicted increase in average 15 minute noise levels reported in this assessment, due to the proposed increase in maximum hourly truck numbers, would be offset by longer or more frequent periods of little or no truck noise.

An amendment to PA Schedule 3 Condition 5 is recommended to ensure the noise criteria reflect the predicted noise levels from the existing and modified quarry.

Yours faithfully,

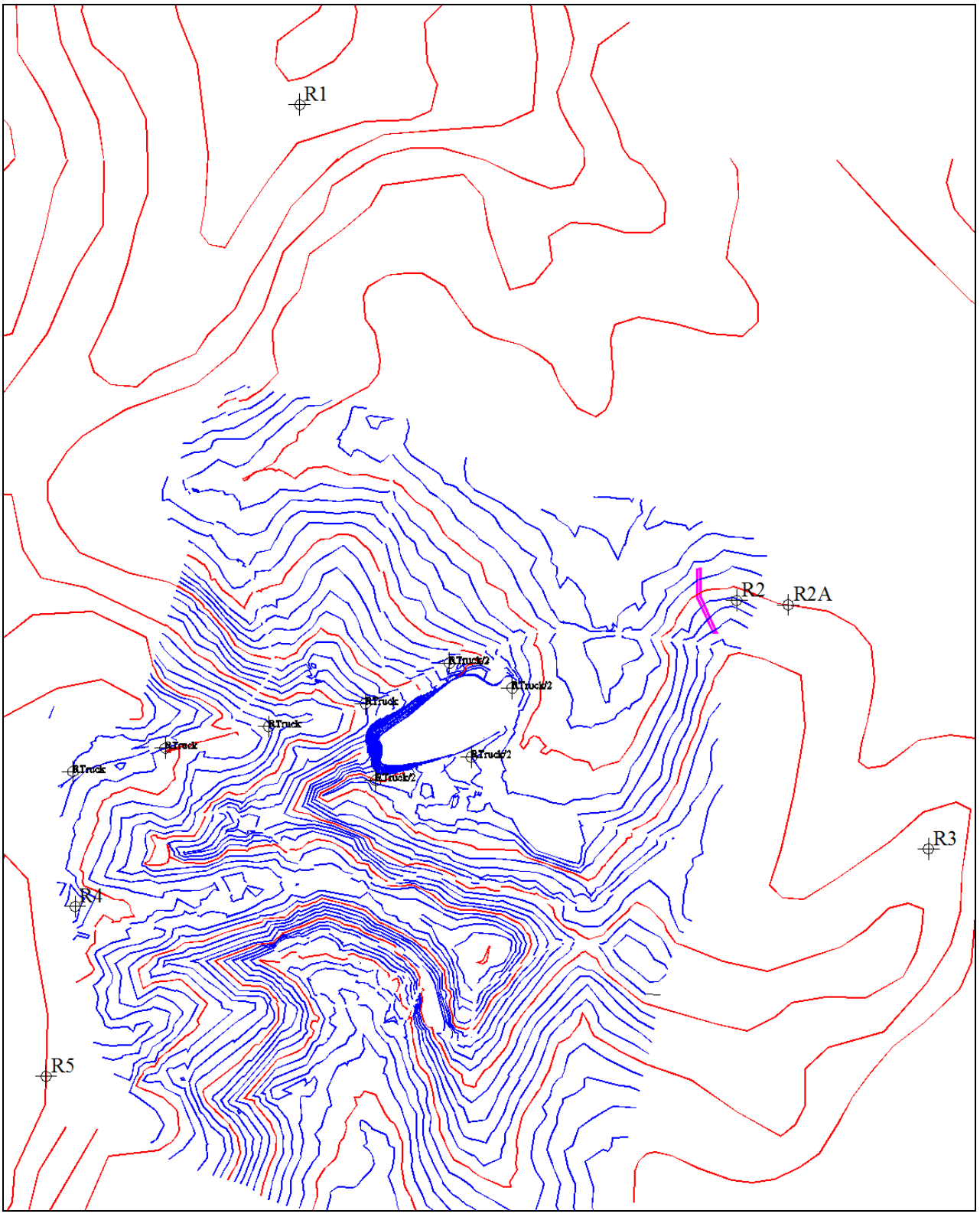
**BRIDGES ACOUSTICS**

**MARK BRIDGES BE Mech (Hons) MAAS**
**Principal Consultant**

## APPENDIX A – NOISE MODEL SOURCE AND RECEPTOR LOCATIONS

The figure below shows relevant noise model details including:

- Terrain – 10 m contours in red, 2 m contours over the site in blue;
- Sources and Receptors - locations are shown with black symbols; and
- Approved Bunds – represented by toe and crest lines and shown in magenta.



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