Changes in flood behaviour due to the project have the potential to change the frequency of flooding in some locations (ie some locations may flood more regularly than under existing conditions). The project does not change the frequency of flooding for the properties in the vicinity of Tarcutta. Changes in velocity as a result of the project may lead to changes in scour and/or sediment movement within waterways and around structures such as bridge piers and abutments, and levees. Scouring at structures can lead to undermining and failure of structures. High velocities have the potential to move structures in a downstream direction if not properly designed. Sedimentation can lead to a reduction in flow conveyance area within a waterway or through bridge structures by filling of the channel, raising inverts and vegetation growth. This reduction in conveyance area can potentially lead to increases in water levels during storm events.

The project would change the velocity of water flows. Changes to peak velocities at key structures are summarised in Table 9-19. These changes to velocities would not pose a major risk to the operation of the project or to the main channels of Tarcutta and Keajura creeks.

Table 9-19 Changes to peak velocities at key structures

Location	Event (ARI)	Existing (metres per second)[1]	Proposed (metres per second)[1]	Impact (metres per second)
Existing Hume Highway bridge over Tarcutta Creek	1 in 20	3.73	3.69	-0.4
	1 in 100	4.85	4.78	-0.07
	1 in 2000	4.65	4.31	-0.34
Existing Hume Highway bridge over Tarcutta Creek floodway	1 in 20	1.71	1.70	-0.01
	1 in 100	2.40	2.39	-0.01
	1 in 2000	2.80	2.74	-0.06
Existing Hume Highway bridge over Keajura Creek	1 in 20	1.20	1.16	-0.05
	1 in 100	1.92	1.69	-0.24
	1 in 2000	3.75	3.58	-0.18
Proposed bypass bridge over Tarcutta Creek	1 in 20	0.81	0.97	0.17
	1 in 100	0.92	1.26	0.35
	1 in 2000	1.47	2.27	0.80
Proposed bypass bridge over Tarcutta Creek floodway	1 in 20	1.63	1.77	0.14
	1 in 100	2.19	2.47	0.29
	1 in 2000	2.85	3.48	0.63
Proposed bypass bridge over Keajura Creek	1 in 20	0.98	1.52	0.54
	1 in 100	1.41	2.23	0.82
	1 in 2000	1.82	3.59	1.77

Note: 1. While all values are listed to the nearest 0.01 metres, for the purpose of the assessment, the accuracy of the model is within the order of +/- 0.1 metres.

Flood hazard within a floodplain is defined within the *NSW Floodplain Development Manual* (NSW Government 2005) and is based on flood depth and flood velocity and other relevant factors that affect the safety of structures and/or individuals. These other factors include flood warning, flood awareness, flood readiness and evacuation methods.

From a hydraulic perspective, if flood depths are greater than one metre and/or flood velocities are greater than two metres per second then the degree of flood hazard is considered to be high. Velocities noted within Table 9-19 indicate that flood hazard (in terms of flood velocities) at these locations within the Tarcutta Creek floodplain is considered to be high. This is the case under both existing and proposed conditions. However, an assessment of peak velocities at key buildings in the vicinity of the project indicated that only at the Tarcutta Hotel during the 1 in 2000 year ARI flood event would velocities be greater than two metres per second. This would occur during both the existing and proposed conditions, the latter resulting in a predicted 0.24 metres per second reduction in peak velocities. The flood hazard at all other properties is considered to be low under both the existing and proposed conditions for all ARI events modelled. Therefore, the project is not likely to change the existing flood hazard in the vicinity of Tarcutta.

9.4.4 Potential groundwater impacts

Construction

The works associated with the construction of the project would have short-term impacts on ground conditions and, therefore, potentially groundwater flows. Potential impacts would include:

- Potential short-term impact to unconfined alluvial aquifers as a result of aquifer compaction caused by construction of controlled fills, structures and other compaction activities. The effects of ground compaction include the following:
  - Aquifer compaction may result in impediment or prevention of the natural groundwater flow to the north-west. This may cause waterlogging and ponding to the immediate east of the construction site, and may also result in the lowering of the water table to the west and north-west.
  - An existing bore located close to the project, and depending on detailed design, may be damaged or removed.
  - Potential increase in the incidence of dryland salinity may be associated with the changes to flow regime. The disruption to shallow groundwater flow from compaction of the shallow sediments may contribute to water logging and ponding on the up-gradient (eastern) side of the project. Dryland salinity may then be introduced into previously unaffected areas, or the impact of areas currently known to be affected by dryland salinity may increase.
- Potential for excavations into the alluvium that are deeper than approximately two metres to receive groundwater inflow. The groundwater levels within the alluvium are shallow, therefore, excavations for road construction, footings, overburden removal, service trench excavation and other purposes may result in groundwater ingress.
- Potential impacts on surrounding groundwater users through the use of groundwater supplies for construction of the project (eg reduced groundwater levels).

Impacts to groundwater would be minimised through standard design and construction practice.

Water supply impacts

Section 6.3 discusses the water requirements for the project (approximately 200 megalitres over the two year construction period) and the potential sources of that water. Groundwater is likely to be extracted for the project under the existing DECCW (former Department of Water and Energy) issued groundwater extraction licence, issued to the RTA under Part 5 of the *Water Act 1912*. Groundwater extraction may affect access for to local groundwater supplies for adjacent users. A groundwater monitoring program would be implemented to manage potential impacts of groundwater extraction. The monitoring program would consist of the following elements:

- Monitoring of groundwater levels and quality prior to groundwater extraction, monthly during extraction, and for a period after completion of extraction.
- Inspection of groundwater bores for serviceability on a weekly basis.

Groundwater level and quality data would be assessed monthly. Should impacts be detected, steps to minimise the impacts would be implemented. These would include:

- Reduction in the extraction rate.
- Increase in the rest time between pumping intervals.
- Rotation of pumping bores.
- Temporary use of alternative water supplies.
- Investigation of alternative groundwater bores.

Operation

During operation, the ground conditions have the potential to change permanently. These long-term impacts may include:

- Potential long-term impact to unconfined alluvial aquifers as a result of aquifer compaction under the project. The potential consequences of long-term aquifer compaction are the same as those described above for construction impacts.
- Changes to the flow regime induced by the project would increase the risk of the development of dryland salinity. The disruption to shallow groundwater flow from compaction of the shallow sediments may contribute to water logging and ponding on the up gradient (eastern) side of the bypass. Dryland salinity may then be introduced into previously unaffected areas, or the impact of areas affected by dryland salinity may increase.
- Water logging on the eastern side of the project may impact the village of Tarcutta.

Impacts on groundwater would be minimised through standard design and construction practice.

9.4.5 Management of hydrology impacts

Table 9-20 identifies mitigation and management measures that would be implemented for hydrology (surface water and groundwater) impacts. These measures have been incorporated into the draft statement of commitments in Chapter 11.

Table 9-20 Hydrology mitigation and management measures

Potential impact	Mitigation and management measure
Pre-construction	
Ground compaction inducing changes to shallow aquifer conditions and increased incidence of salinity	▪ Consider the impacts of ground compaction on the aquifer conditions through detailed design.
Increased extreme rainfall events due to climate change increasing afflux	▪ As necessary, undertake further flood modelling assessment of potential climate change impacts during the detailed design, in consultation with DECCW.
Construction	
Flooding caused by blockages to flood flow paths during construction	▪ Maintain major flood flow paths during construction activities. ▪ Design temporary creek crossings to overtop in a large flood event. ▪ Locate material stockpiles outside of the 1 in 10 year ARI floodplain. ▪ Use diversion bunds to divert flows around construction works.
Inefficient water use	▪ Implement water efficient work practices, such as water reuse and recycling for road construction and revegetation irrigation.
Interaction with shallow groundwater flows	▪ Develop drainage infrastructure and, as necessary, land management initiatives to manage any groundwater seepage during construction.
Induced localised dryland salinity	▪ Develop strategies to manage groundwater issues associated with surrounding land uses, including management of recharge areas, in consultation with DECCW as necessary.
Impact on groundwater system and users	▪ Undertake groundwater monitoring. Implement mitigation measures where levels indicate that the project is potentially having an adverse impact.
Water extraction boreholes located near proposed alignment	▪ Decommission and relocate boreholes to maintain a reliable water supply for landholders, if required.
Operation	
Afflux and increased inundation time at sensitive receivers	▪ Manage change in peak flood levels (afflux) in the 1 in 100 year ARI event through detailed design. Measures could include: ▸ Additional drainage structures to convey more flow under the bypass in the left overbank. ▸ Treatment to individual properties in consultation with landowners and other relevant stakeholders. ▸ Treatment to the water treatment plant in consultation with Riverina Water County Council.
Potential blockages, diversions or erosion of waterways or drainage lines	▪ Design drainage structures to convey flows under the project. ▪ Implement appropriate scour protection measures at bridge(s) and drainage structures.
Obstruction of groundwater flow	▪ Install appropriate subsurface drainage infrastructure, for example, blind ditches, in areas identified as having shallow groundwater levels.

9.5 Noise and vibration

A detailed noise and vibration assessment has been undertaken for the project and is presented below. This is supported by *Technical Paper 6 — Noise and Vibration* (Volume 2).

DGRs	Where addressed
Noise and vibration (including but not limited to):	
Construction noise and vibration, including construction traffic noise.	Section 9.5.5 Technical Paper 6 (Volume 2)
Operational road traffic noise impacts, including consideration of local meteorological conditions (as relevant).	Section 9.5.4 Technical Paper 6 (Volume 2)
The assessment must take into account the following guidelines as relevant: *Environmental Criteria for Road Traffic Noise* (EPA 1999), *Environmental Noise Management Manual* (RTA 2001), *Draft New South Wales Construction Noise Guideline* (DECC 2008c) (formerly published as chapter 171 of the EPA's *Environmental Noise Control Manual* (EPA 1994)), *Assessing Vibration: A Technical Guideline* (DEC 2006), and *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC 1990).	Sections 9.5.1, 9.5.2, 9.5.3 Technical Paper 6 (Volume 2)

During preparation of this environmental assessment, the Director-General of the Department of Planning issued a clarification relating to the construction noise assessment DGRs. The Director-General advised that, since the *Draft New South Wales Construction Noise Guideline* (DECC 2008c) has not been finalised, the construction noise assessment is to take into account chapter 171 of the *Environmental Noise Control Manual* (ENCM) (EPA 1994). This is addressed in Sections 9.5.3 and 9.5.5.

9.5.1 Assessment approach

Technical Paper 6 (Volume 2) details the approach taken for the noise and vibration assessment. This involved noise monitoring (see Figure 9-9) and noise modelling. For the purposes of the assessment, receivers have been identified within three zones (see Figure 9-9):

- Zone 1: west of the project. Includes four rural residences.
- Zone 2: between the project and the existing highway. Includes:
  - Approximately 30 residences in Tarcutta.
  - Tarcutta Hotel.
  - St Marks Anglican Church and Church Hall.
  - Tarcutta Memorial Hall.
  - Tarcutta Cemetery.
- Zone 3: east of the existing highway. Includes:
  - Approximately 80 residences in Tarcutta.
  - Tarcutta Public School.
  - St Frances Xavier Church.
  - The Truck Drivers Memorial Park.
  - Approximately five rural residences.

The predicted noise levels are based on traffic predictions cited in *Technical Paper 7 — Traffic and Transport* (Volume 2) (see Section 9.7). The traffic and transport assessment predicted that during the night-time (in a 'high diversion' scenario), approximately 64 per cent of traffic would use the project instead of the existing highway through Tarcutta.

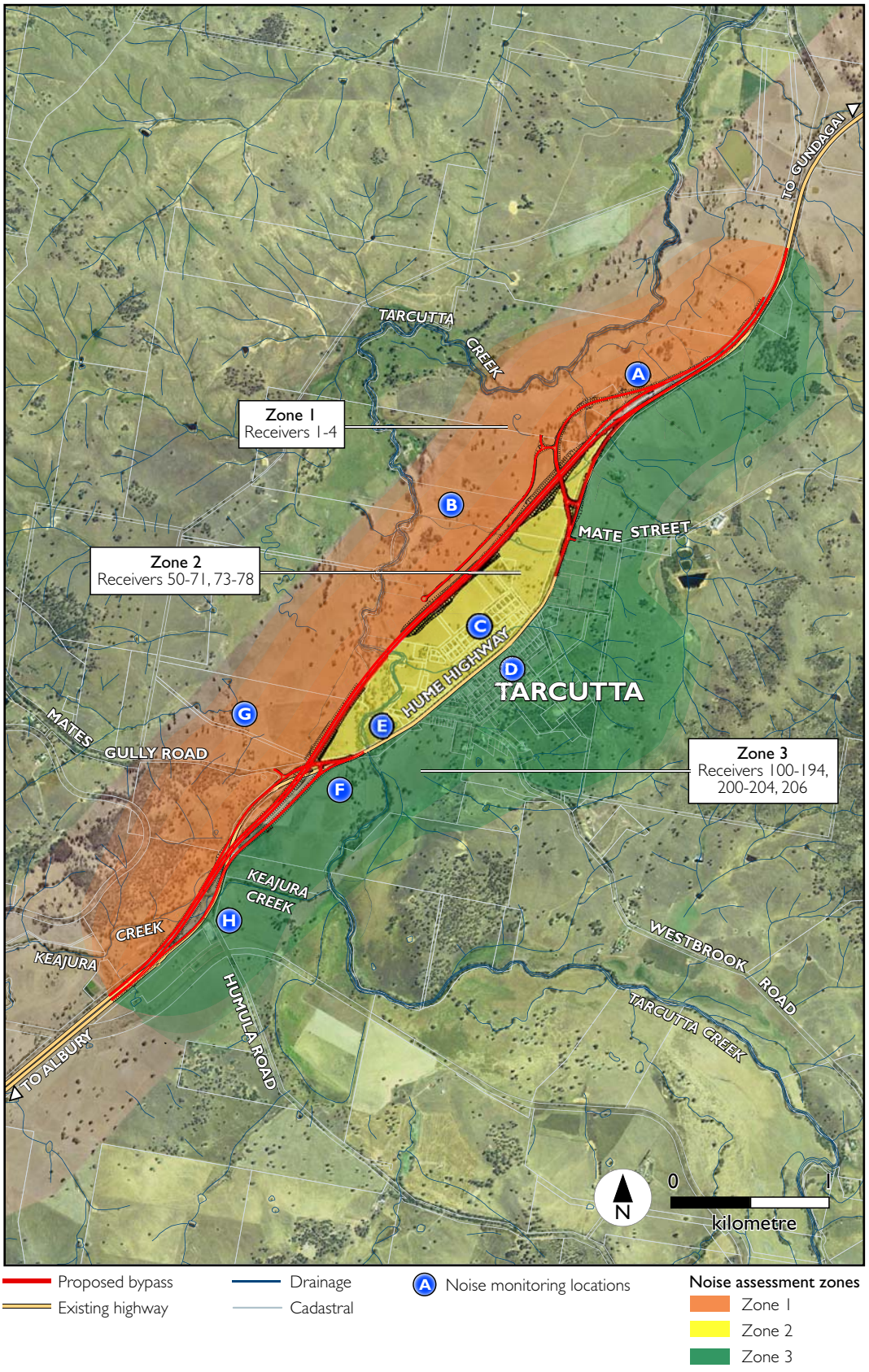

Figure 9-9 **Noise monitoring locations and noise zones**

9.5.2 Existing noise environment

Noise monitoring was conducted to provide background noise levels to set appropriate criteria for the construction noise assessment, and to allow validation of the noise model used to determine existing traffic noise levels at receivers.

The long-term background noise levels, in terms of rating background level, are provided in Table 9-21. The time periods are as defined in the *NSW Industrial Noise Policy* (EPA 2000).

Table 9-21 Measured background noise levels

Monitoring location	Rating background level (dBA)		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
Tarcutta village			
C	35	41	37
D	43	47	42
E	44	47	41
Isolated receivers			
A	37	37	36
B	38	41	35
F	40	44	40
G	40	41	38
H	42	44	38

The *NSW Industrial Noise Policy* recommends that, unless there is a specific cause for evening and night-time levels to be higher than daytime, the lowest rating background level measured throughout a 24 hour period should be used. In this case, the traffic counts in Tarcutta show a marked increase in heavy vehicle traffic during the evening period (see Section 9.6), and the evening rating background levels are higher than those for the daytime and night-time periods. Accordingly, the rating background levels as measured have been used to set construction noise criteria.

L_{Aeq} is the standard descriptor of traffic noise. The measured L_{Aeq} levels over the periods used for assessing traffic noise are given in Table 9-22. Locations B, C and G were too distant from the highway for traffic noise to be dominant, with other noise sources dominating background noise.

Table 9-22 Measured L_{Aeq}

Location	L_{Aeq} (dBA)	
	Daytime (7am to 6pm)	Night-time (10pm to 7am)
Tarcutta village		
D	61	63
E	57	57
Isolated receivers		
A	55	56
F	61	60
H	56	58

9.5.3 Assessment criteria

Construction noise and vibration

The ENCM provides construction noise objectives. It is considered that for construction periods longer than 26 weeks, as for this project, the L_{A10} noise level should not exceed the background (L_{A10}) level by more than 5 dBA.

In addition, the ENCM recommends the following time restrictions for the construction activities where noise is audible at residential premises:

- 7am to 6pm Monday to Friday.
- 8am to 1pm if audible on residential premises, otherwise 7am to 1pm Saturday.
- No work on Sundays and public holidays.

If night-time construction is required for a project, it is recommended that the L_{A10} level should not exceed the existing night-time background (L_{A10}) level by more than 5 dBA.

In addition to those criteria, where any work is conducted during the night-time period 10pm to 7am, the ENCM recommends that, to protect against sleep disturbance, the L_{A1} noise levels should not exceed the background level by more than 15 dBA at any sensitive receiver. While there are no specific criteria relating to sleep disturbance in the NSW Government's *Environmental Criteria for Road Traffic Noise* (ECRTN) (EPA 1999), the document advises that maximum internal noise levels below 50 to 55 dBA are unlikely to cause awakening reactions.

Section 6.5 identifies that the majority of construction activities would take place between 6am and 7pm Monday to Friday and 7am and 4pm Saturday. The proposed working hours between 6am and 7am, and 6pm and 7pm are outside the standard construction hours in the ENCM. Background noise level surveys (provided in Appendix D of Technical Paper 6 (Volume 2)) indicate that noise levels in these hours are very similar to the daytime background levels (refer Table 9-21). Hence, the criterion for L_{A10} construction in the 6am to 7am and 6pm to 7pm periods has been included with the daytime criterion. Sleep disturbance criteria have been determined for the early morning and night-time periods. Table 9-23 shows the project-specific construction noise criteria for sensitive receivers in the village and isolated receivers. The latter criteria are based on the minimum level measured at any of the isolated receivers.

Table 9-23 Project-specific construction noise criteria

Receiver location	L_{A10} construction noise criteria (dBA)			Sleep disturbance (L_{A1} (dBA))	
	Daytime (6am to 7pm)[1]	Evening (7pm to 10pm)	Night-time (10pm to 6am)	Early morning (6am to 7am)	Night-time (10pm to 6am)
Tarcutta village[2]	40	46	42	50	50
Isolated receivers[3]	42	42	40	52	50

Notes: 1. Includes early morning (6am to 7am) and early evening (6pm to 7pm).

2. Includes receivers 50 to 71, 73 to 78, 104 to 192, 194, 200 to 204.

3. Includes receivers 1 to 4, 100, 101, 102, 103, 171, 193, 206 (see Figures 14-1 and 14-2 in Technical Paper 6 (Volume 2)).

Blasting

For assessment of annoyance due to blasting, the *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC 1990) sets out the following criteria for any sensitive receiver:

- The maximum overpressure due to blasting should not exceed 115 dB for more than five per cent of blasts in any year and should not exceed 120 dB for any blast.
- The maximum peak particle ground velocity should not exceed five millimetres per second for more than five per cent of blasts in any year and should not exceed 10 millimetres per second for any blast.

At sufficiently high levels, blasting may in itself cause structural damage to some building elements such as windows. However, this occurs at peak overpressure levels of about 133 dB and above, which is well in excess of the criteria for annoyance.

Vibration

Chapter 16 of Technical Paper 6 (Volume 2) identifies the vibration criteria for blasting activities, which are established in accordance with Australian Standard *AS2187.2-1993 Explosives — Storage, Transport and Use*. Section 15.1 of Technical Paper 6 (Volume 2) identifies the vibration criteria for other construction activities, which are established in accordance with *Assessing Vibration: A Technical Guideline* (DEC 2006).

In regard to potential building damage, the recommended vibration level for sensitive heritage buildings ranges from 3.0 to 10.0 millimetres per second and 5.0 to 20.0 millimetres per second for dwellings.

Operational traffic noise

Criteria for assessment of road traffic noise are set out in the ECRTN. The RTA has also published the *Environmental Noise Management Manual* (ENMM) to assist in implementing the ECRTN.

The ECRTN classifies various road developments depending on the type of road and nature of the development. Practice note (i) of the ENMM describes when each of these classifications applies. The project is considered a 'new freeway or arterial road corridor' ('new road') except for approximately one kilometre at the northern end of the project, where it is considered a 'redevelopment of existing freeway/arterial road' ('redevelopment') for two receivers (4 and 204). Table 9-24 lists the relevant ECRTN daytime and night-time criteria for different receiver types.

Table 9-24 Daytime and night-time criteria for receivers

Receiver type	Daytime criterion	Night-time criterion	Where criteria are already exceeded
Residential receivers			
'New road'	55($L_{Aeq,15hr}$)	50 ($L_{Aeq,9hr}$)	The new road should be designed so as not to increase existing noise levels by more than 0.5 dB.
'Redevelopment of an existing road' (receivers 4 and 204)	60 ($L_{Aeq,15hr}$)	55 ($L_{Aeq,9hr}$)	In all cases, the redevelopment should be designed so as to not increase existing noise levels by more than 2 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances, this may be achievable only through long term strategies.
Non-residential receivers			
School	45 ($L_{Aeq,1hr}$) — Internal during school hours 55 ($L_{Aeq,15hr}$) — External	-	-
Place of worship (including the Memorial Hall)	40 ($L_{Aeq,1hr}$) — Internal while place is in use	40 ($L_{Aeq,1hr}$) — Internal while place is in use	-
Hospital	35 ($L_{Aeq,1hr}$) — Internal at any time	35 ($L_{Aeq,1hr}$) — Internal at any time	-
Passive recreation (eg Truck Drivers' Memorial Park)	55 ($L_{Aeq,15hr}$)	-	-
Active recreation (eg sports field)	60 ($L_{Aeq,15hr}$)		-
Cemetery	55 ($L_{Aeq,15hr}$)		-

The traffic assessment for the project (see Section 9.7 and Technical Paper 7 (Volume 2)) predicts that many heavy vehicles would continue to use the existing highway through Tarcutta. This would mean that noise from the existing highway alone could still be above the noise criterion for a new road at many receivers in Tarcutta.

The ECRTN guidelines require consideration of combined noise (from the existing highway and project) against the base criteria. Where these criteria cannot be met, reasonable and feasible mitigation should be considered. Practice Note (iv) of the ENMM provides discussion of where additional controls would be 'reasonable and feasible'.

For road upgrades, the ECRTN and ENMM provide guidance on the likelihood of sleep disturbance. This is discussed in Section 13.1 of Technical Paper 6 (Volume 2). The ENMM suggests that the nominated noise levels and guidelines should be taken into consideration when determining noise mitigation measures to address general road traffic noise.

The quoted noise levels (of 50 to 55 dBA internal noise) are not intended as specific criteria for the purpose of implementing mitigation measures, but to highlight the potential for awakening reactions and the consideration of this in the design of noise mitigation, where this is considered to be necessary to reduce overall noise levels.

Acute noise levels

Noise levels above $L_{Aeq,9hr}$ 60 dBA or $L_{Aeq,15hr}$ 65 dBA are considered 'acute' and would be considered for noise mitigation as part of the project, even if noise from the project complies with the allowance criterion.

9.5.4 Operational road traffic noise impacts

Predicted operational road traffic noise

Residential receivers in Tarcutta

Most of the residential receivers in Tarcutta currently experience noise from the existing highway above the ECRTN criteria for new roads. By 2022, if the project is not built, noise levels would exceed the ECRTN criteria at more than half the residential receivers in Tarcutta. If the project is built, most residential receivers are predicted to experience a reduction in noise level as traffic moves from the existing highway to the project.

An assessment against the ECRTN criteria has predicted that in 2022 the combined noise from the project and the existing highway would exceed the base criterion at approximately 110 residential receivers. Most of these residential receivers are located on the eastern side of the existing highway. Because the project would reduce noise levels at these residential receivers, it would not be considered reasonable and feasible to provide further mitigation unless the noise levels were acute.

Because the bypass is considered a new road, the initial application of the ECRTN is to consider all noise against the 'new road' criterion (except at receivers 4 and 204, for which the project is considered a 'redevelopment'). The receivers located between the existing highway and the project (in Zone 2; refer Figure 9-9) would be exposed to noise from both roads. In following the ENMM, the intention is to reduce the combined level of all road noise sources to the criterion. However, for many of these residential receivers, the noise from the existing highway is predicted to be above the base criterion, so it is not considered reasonable and feasible to further reduce the noise from the existing highway unless the noise levels were acute. In these cases, it was considered more appropriate to apply mitigation to the project (that is, noise from a new direction) so the noise at residential receivers would meet the criterion from the new road. This means:

- For receivers where the existing noise is not significant, the proposed bypass would meet the ECRTN base criterion.

- For receivers where the existing highway noise is significant (houses on the highway), the noise at the façade facing the proposed bypass would not increase by more than 0.5 dBA.

Table 9-25 shows the total number of receivers in Tarcutta where the base ECRTN noise criterion of 50 dBA is predicted to be exceeded as a result of the project alone, and compares these with the predicted noise levels of the existing highway with no project as well as predicted noise levels from the combined project and existing highway (all in 2022). The table does not include isolated receivers or non-residential receivers.

The results are all predicted to the façade of the receivers facing the project (the western façade). At the eastern facades, all receivers would experience a decrease in noise level of approximately 2 dBA with the project.

Table 9-25 Predicted night-time noise, $L_{Aeq,9hr}$ at receivers between the existing highway and the project (Zone 2), western façade

Receiver[1]	Predicted night-time noise level $L_{Aeq,9hr}$ (dBA)[2,3]			
	Existing highway 2012 (no project)	Combined project and existing highway 2012	Project 2022	Combined project and existing highway 2022
50	49.5	49	***55.5***	***56***
51	***60***	***56***	***53***	***58***
63	45.5	47	***50.5***	***51***
64	44.5	49.5	***53.5***	***54***
65	46	47	***51***	***52***
66	***50.5***	48	***51***	***53***
67	***56***	***52***	50	***55***
68	43.5	***51.5***	***55***	***55.5***
69	***58***	***54***	***51.5***	***57***
70	52.5	***50.5***	***52***	***53***
71	***54***	***50.5***	***50.5***	***54***

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.
2. All results are predicted to the western façade.
3. ***Bold italic*** numbers indicate an exceedance of the 50 dB night-time noise criterion.
4. Refer to Table 9-24 for the application of criterion when existing highway noise already exceeds.

The predictions in Table 9-25 indicate that the combined project and existing highway noise in 2022 would exceed the night-time noise criterion at all receivers. The results provide the following further information on noise levels in 2022:

- Three receivers (51, 67 and 69) would experience decreased noise levels as a result of the project (compared with no project).
- One receiver (71) would experience the same noise level from the project as it would if there was no project.
- Seven receivers (50, 63, 64, 65, 66, 68 and 70) would experience increased noise levels as a result of the project.

Table 9-26 shows the predicted noise levels on the eastern façade of receivers located in Tarcutta between the existing highway and the project (Zone 2).

Table 9-26 Predicted acute night-time noise, $L_{Aeq,9hr}$ at receivers between the existing highway and the project (Zone 2), eastern façade

Receiver[1]	Predicted night-time noise level $L_{Aeq,9hr}$ (dBA)[2,3]		
	Existing highway 2012 (no project)	Combined project and existing highway 2012	Combined project and existing highway 2022
51	***68***	***64***	***65***
67	***64***	***60***	***61***
69	***66***	***62***	***63***

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.
2. All results are predicted to the eastern façade.
3. ***Bold italic*** numbers indicate an exceedance of the 60 dB night-time noise criterion for acute noise levels.

The results in Table 9-26 indicate that all residential receivers would experience acute noise levels (above 60 dBA) in 2012 if the project did not proceed. While the project would reduce these noise levels, they are still predicted to be acute.

Isolated residential receivers

The predicted noise levels at isolated residential receivers are shown in Table 9-27.

Table 9-27 Predicted night time noise levels, $L_{Aeq,9hr}$ at isolated residential receivers (Zones 1 and 3)

Receiver[1,2]	Zone[3]	Predicted night-time noise level $L_{Aeq,9hr}$ (dBA)[4]					Criterion $L_{Aeq,9hr}$ (dBA)[5]
		Highway 2012 (no project)	Combined project and existing highway 2012	Highway 2022 (with project)	Project 2022	Combined project and existing highway 2022	
'Redevelopment'							
4	1	***56.5***	***61***	***59***	***59***	***62***	55
204	1	***56.5***	***60***	***58.5***	***58***	***61***	
'New road'							
1	1	50	***53***	47	***53***	***54***	50
2	1	47	***51***	44	***51.5***	***52***	
3	1	44	50	41	***51***	***51***	
102	3	***56***	***56.5***	***53***	***56***	***58***	
103	3	***57.5***	***59***	***54.5***	***58.5***	***60***	
206	3	***57***	***59***	***54***	***58.5***	***60***	

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.
2. Results are predicted to the eastern façade for receivers 4, 1, 2 and 3. Results are predicted to the western façade for receivers 102, 103, 204 and 206.
3. Refer to Figure 9-9.
4. ***Bold italic*** numbers indicate an exceedance of the 50 dB night-time noise criterion for 'new road' receivers and the 55 dBA night-time noise criterion for 'redevelopment' receivers.
5. Refer to Table 9-24 for the application of criteria when existing highway noise already exceeds.

Table 9-27 shows that noise from the project alone is predicted to exceed the night-time criteria at all isolated residential receivers identified, and that the combined noise from the existing highway and the project would be louder than the project alone.

Non-residential receivers

Noise levels at non-residential receivers are given in Table 9-28. The noise level is the $L_{Aeq,1hr}$ during the busiest hour of use. For some receivers, the criterion is based on internal noise. For most buildings, if the windows are open, then the internal noise level is approximately 10 dBA less than the external noise level. Hence, for the buildings with predicted external noise levels more than 10 dBA above the internal noise criterion, a possible exceedance is noted.

Table 9-28 Predicted noise levels at non-residential receivers

Receiver[1]	External noise levels $L_{Aeq,1hr}$ (dBA)					Comment (combined noise)	Change from existing
	Hume Highway 2012 (no project)	Hume Highway 2022 (with project)	Combined project and existing highway 2022	Estimated internal noise level with windows open	Criterion		
61. St Marks Church Hall	53	51	54	44	40 (internal)	Exceeds	Increase
62. St Marks Church	55	53	55	45	40 (internal)	Exceeds	No change
73. Tarcutta Memorial Hall	70	68	68	58	40 (internal)	Exceeds	Decrease
74, 75. Tarcutta General Cemetery	52	50	53 to 56	-	55	Might exceed	Increase
154. St Francis Xaviers Church	61	59	59	49	40 (internal)	Exceeds	Decrease
183-185. Tarcutta Hospital	49	47	50	40	35 (internal)	Exceeds	Increase
187. Tarcutta Public School	53	51	53	43	45 (internal)	Complies	No change
194. Truckers Memorial	60	58	58	48	55	Exceeds	Decrease

Note: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

Impact on maximum noise levels

Section 13.2 of Technical Paper 6 (Volume 2) estimates maximum noise levels from the existing highway. The results show that the levels exceed the threshold at residential receivers and isolated residential receivers. As the Hume Highway will continue to be used after opening of the project, the analysis would change only by the number of vehicles using the existing highway. This means there could still be up to 100 events per hour with maximum noise levels above the threshold.

In general, the maximum noise levels from the project would be much less in Tarcutta, but would increase at some isolated residential receivers.

Meteorological effects

Neither the ECRTN nor the ENMM discuss assessment of traffic noise under changing meteorological conditions. Following advice from DECCW, the *NSW Industrial Noise Policy* has been used to make and ensure qualitative assessment of meteorological effects.

The *NSW Industrial Noise Policy* discusses the effect of temperature inversions and wind; both can enhance noise propagation from a source to a receiver. The *NSW Industrial Noise Policy* discusses that, for the best confidence in an assessment of meteorological effects on noise, meteorological data for the assessment area is required. In this case, meteorological data for Tarcutta was unavailable. In such cases, the default conditions are the temperature inversions of three degrees per 100 metres in combination with a drainage wind of two metres per second from source to receiver, where the receiver is below the noise source. In this case, the receivers are typically above the height of the project, hence the drainage wind has not been considered.

Limited data is available to accurately predict traffic noise under different meteorological conditions. The following procedure was used to estimate the effect of these conditions for the project.

Noise propagation from the project was predicted using the RTA environmental noise model. A line source (to simulate the flow of traffic) representing the project was used and noise was predicted at all receivers under various meteorological conditions. The model resulted in the prediction of the noise level at any receiver from the project under isothermal still conditions and under a temperature inversion of three degrees per 100 metres. The difference in these two levels is typically 1 to 4 dBA, depending on the location of the receiver with respect to the highway. This difference was then added to the predicted traffic noise level.

The analysis shows that the temperature inversion increases noise level by up to 3 dBA at any receiver. This increase in noise level exists only for the time of the temperature inversion. The *NSW Industrial Noise* Policy suggests that temperature inversions are most likely to occur during the hour immediately before and after sunrise. So while there may be a significant increase in noise level during those times, the effect over the entire nine hour period of night-time is an increase in $L_{Aeq,9hr}$ of only 1 dBA at most receivers. Temperature inversion is not likely to be a significant contributor of increased operational noise from the project.

With respect to wind, there would be a similar increase in noise level at many receivers if there was a continuous low velocity wind from the west. There is no meteorological data to suggest that this would be the case in Tarcutta. Wind is not likely to be a significant contributor of increased operational noise from the project.

9.5.5 Construction noise and vibration impacts

Construction noise and vibration sources

Table 6-3 identifies the construction activities that are likely to occur during the daytime, evening and night-time periods. Sources of construction noise and vibration used during these activities would comprise a range of heavy plant and equipment and hand tools. These sources, and their typical sound power levels, are listed in Table 14-3 of Technical Paper 6 (Volume 2).

Based on the typical sound power levels, noise level predictions have been undertaken for the construction activities outlined in Table 6-3. These predictions are provided in Table 9-29.

Table 9-29 Predicted sound power level of construction activities

Activity	Typical equipment used	Total sound power level (L_{A10} (dBA))[1]
Site establishment	Excavators, chainsaws, mulching plant and chipper, cranes, generators.	111
Removal of vegetation	25-tonne excavator, mulcher, chainsaw, trucks, grader, combination backhoe FEL, bulldozer.	113
Earthworks	Road trucks, compactor, grader, steel, multi-tyred and vibratory rollers, concrete pour (including trucks and concrete vibrator), asphalt paving plant, backhoe, sweeper, compressors, generators, (excavator with hammer) scrapers, water carts.	114 (120)
Piling	Bored or driven piling rigs, pumps, generators.	115 (bored) to120 (driven)
Bridge works	Piling rigs, cranes, , hand tools, compressors, generators	115 to 120 (possible when piling)
Paving	Road trucks, compactor, (jackhammers), steel, multi-tyred and vibratory rollers, concrete pour (including trucks and concrete vibrator), asphalt paving plant, backhoe, (concrete saw), profiler, sweeper, compressors, generators.	113 (116)
Landscaping of exposed areas	Excavator/bobcat, powered hand tools, air compressor, spoil, material or concrete truck, jackhammer (for concrete embedded parts).	111

Note: 1. The sound power levels in brackets ( ) are for the occasional use of rock breakers, jackhammers and concrete saws.

Table 9-30 provides estimated vibration levels at a range of distances from various construction activities.

Table 9-30 Typical vibration emission levels from construction plant

Activity	PPV vibration level (millimetres per second)		
	10 metres	20 metres	30 metres
Concrete sawing	0.5	0.3	0.2
Four-tonne vibratory roller (high)	2.0 to 2.4	0.4 to 1.2	0.2 to 0.8
Hydraulic hammer (30 tonne)	3	1.5	1.0

Concrete batch plant

Section 6.6 identifies that a concrete batch plant is likely to be required for construction of the project (refer Figure 6-3 for location). Noise generating plant and activities associated with the concrete batch plant would include:

- Conveyor drive.
- Front-end loader.
- Concrete batching, including concrete trucks.
- Trucks unloading into hopper.
- Cement bulk tanker unloading.

The typical overall sound power level of the concrete batch plant during full operation would be approximately $L_{A10,15min}$ 116 dBA. For the possibility of deliveries outside daytime working hours, the estimated source level is $L_{Ae10,15min}$ 113 dBA — the equivalent of one truck and one front-end loader. For the sleep disturbance assessment, a maximum level of L_{A1} 120 dBA is assumed. A temperature inversion of 3°C per 100 metres was included for the evening and night-time and periods. This would account for the potential worst-case impacts of temperature inversion.

Pre-cast yard

Section 6.6 identifies that a pre-cast yard is likely to be required for construction of the project (refer Figure 6-3 for location). Noise generating plant and activities associated with the pre-cast yard would include:

- Boiler.
- Trucks for concrete and deliveries.
- Mobile crane.

The typical overall sound power level of the pre-cast yard would be 113 dBA ($L_{A10,15min}$) during daytime activities and 100 dBA ($L_{A10,15min}$) during evening and night-time activities.

Construction noise impacts

The noise level experienced at any receiver along the project would depend on many factors, such as distance to the construction site, topographic shielding between the site and receivers, and the activity occurring at the construction site. The quietest activities, such as site preparation, would be up to 20 dBA quieter than the noisiest activities such as earthworks using rock breakers. Furthermore, noise levels would be quieter whenever the construction takes place in a cut compared with that undertaken on fill. The length of the project and the transient nature of the construction activities could also alter noise levels experienced at individual receivers.

Table 9-31 shows the predicted noise levels of construction activities at sensitive receivers located within the assessment area during the daytime (6am to 7pm). The predicted construction noise levels presented in Tables 9-31, 9-32 and 9-33 provide an indication of the likely construction noise impacts at sensitive receivers in Zones 1, 2 and 3. As mentioned in Section 9.5.3, because the background noise levels between 6am and 7am and 6pm and 7pm are similar to those experienced between 7am and 6pm. Therefore, the daytime period includes working hours from 6am to 7pm.

Table 9-31 Predicted construction noise levels — daytime (6am to 7pm)

Receiver[1]	Zone[2]	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[3]				
			Site preparation	Earthworks	Piling	Bridge structures	Paving
1	1	42	***49*** (***56***)	***52*** (***59***)	***49*** (***55***)	***44*** (***50***)	***51*** (***58***)
2	1	42	***43*** (***50***)	***46*** (***53***)	***49*** (***54***)	***49*** (***49***)	***45*** (***52***)
3	1	42	***49*** (***55***)	***52*** (***58***)	***48*** (***49***)	***44*** (***48***)	***51*** (***57***)
4	1	42	***57*** (***62***)	***60*** (***65***)	***48*** (***49***)	***44*** (***48***)	***59*** (***64***)
50	2	40	***44*** (***51***)	***47*** (***54***)	***55*** (***57***)	***52*** (***55***)	***46*** (***53***)
51	2	40	***42*** (***48***)	***45*** (***51***)	***53*** (***54***)	***49*** (***53***)	***44*** (***50***)
56	2	40	40 (***46***)	***43*** (***49***)	***43*** (***44***)	39 (***48***)	***42*** (***48***)
63	2	40	37 (***44***)	40 (***47***)	***61*** (***62***)	***56*** (***57***)	39 (***46***)
68	2	40	***48*** (***56***)	***51*** (***59***)	***61*** (***64***)	***56*** (***59***)	***50*** (***58***)
73	2	40	34 (40)	37 (***43***)	***47*** (***48***)	***43*** (***52***)	36 (***42***)
100	3	40	***44*** (***49***)	***47*** (***52***)	***44*** (***45***)	40 (***49***)	***46*** (***51***)
101	3	40	***42*** (***47***)	***45*** (***50***)	***44*** (***45***)	40 (***49***)	***44*** (***49***)
102	3	40	***46*** (***53***)	***49*** (***56***)	***51*** (***52***)	***47*** (***56***)	***48*** (***55***)
103	3	42	***54*** (***62***)	***57*** (***65***)	***59*** (***60***)	30 (***54***)	***56*** (***64***)
154	3	42	31 (38)	34 (41)	39 (40)	35 (***44***)	33 (40)
206	3	42	***57*** (***61***)	***60*** (***64***)	***50*** (***50***)	***45*** (***45***)	***59*** (***63***)

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. First number represents typical predicted sound level; number in brackets ( ) represents maximum predicted sound level; sound levels in ***bold italic*** text indicate exceedances of established criterion.

Table 9-31 shows that isolated receivers in Zone 1 are predicted to experience exceedances in the order of 1 to 23 dBA during daytime construction activities. At receivers between the existing highway and the project (Zone 2), noise levels are predicted to vary between compliance and exceedance in the order of 24 dBA. Noise levels at six receivers in Zone 3 are predicted to vary between compliance and exceedance in the order of 23 dBA.

Where receivers in all zones are not predicted to experience exceeded noise levels, these receivers have not been shown in the above table.

As described in Section 6.5.2, some construction activities would be required to take place in the evening and night-time periods. The predicted noise levels of construction activities at indicative sensitive receivers during the evening (7pm to 10pm) and night-time (10pm to 6am) are shown in Tables 9-32 and 9-33 respectively. The table for night-time noise levels includes a predicted L_{A1} noise level for sleep disturbance.

Table 9-32 Predicted paving and saw cutting noise levels — evening (7pm to 10pm)

Receiver [1]	Zone[2]	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[3]	
			Paving	Saw cutting
1	1	47	***51*** (***58***)	***54*** (***61***)
2	1	47	45 (***52***)	***48*** (***55***)
3	1	47	***51*** (***57***)	***54*** (***60***)
4	1	47	***59*** (***64***)	***62*** (***67***)
50	2	51	46 (***53***)	49 (***56***)
51	2	51	44 (***50***)	47 (***53***)
56	2	51	42 (48)	45 (51)
63	2	51	39 (46)	42 (49)
68	2	51	50 (***58***)	***53*** (***61***)
73	2	51	36 (42)	39 (45)
100	3	51	46 (51)	49 (***54***)
101	3	51	44 (49)	47 (***52***)
102	3	51	48 (***55***)	51 (***58***)
103	3	47	***56*** (***64***)	***59*** (***67***)
154	3	47	33 (40)	36 (43)
206	3	47	***59*** (***63***)	***62*** (***66***)

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. First number represents typical predicted sound level; number in brackets ( ) represents maximum predicted sound level; sound levels in ***bold italic*** text indicate exceedances of established criterion.

Table 9-32 shows that noise levels at isolated receivers in Zone 1 are predicted to vary between compliance and exceedance in the order of 20 dBA. At receivers between the existing highway and the project (Zone 2), noise levels are predicted to vary between compliance and exceedance in the order of 10 dBA. Noise levels at six receivers in Zone 3 are predicted to vary between compliance and exceedance in the order of 20 dBA.

Table 9-33 Predicted paving and saw cutting noise levels — night-time (10pm to 6am)

Receiver[1]	Zone[2]	Predicted noise level (L_{A10} (dBA)[3]			Sleep disturbance levels (L_{A1} (dBA))[3]		
		Criterion	Paving	Saw cutting	Criterion (10pm to 6am)	Criterion (6am to 7am)	Maximum event
1	1	40	***51*** (***58***)	***54*** (***61***)	50	52	***56*** (***63***)
2	1	40	***45*** (***52***)	***48*** (***55***)	50	52	50 (***57***)
3	1	40	***51*** (***57***)	***54*** (***60***)	50	52	***56*** (***62***)
4	1	40	***59*** (***64***)	***62*** (***67***)	50	52	***64*** (***69***)
50	2	42	***46*** (***53***)	***49*** (***56***)	50	50	***51*** (***58***)

Receiver[1]	Zone[2]	Predicted noise level (L_{A10} (dBA))[3]			Sleep disturbance levels (L_{A1} (dBA))[3]		
		Criterion	Paving	Saw cutting	Criterion (10pm to 6am)	Criterion (6am to 7am)	Maximum event
51	2	42	***44*** (***50***)	***47*** (***53***)	50	50	49 (***55***)
56	2	42	42 (***48***)	***45*** (***51***)	50	50	47 (***53***)
63	2	42	39 (***46***)	42 (***49***)	50	50	44 (***51***)
68	2	42	***50*** (***58***)	***53*** (***61***)	50	50	***55*** (***63***)
73	2	42	36 (42)	39 (***45***)	50	50	41 (47)
100	3	42	***46*** (***51***)	***49*** (***54***)	50	50	***51*** (***56***)
101	3	42	***44*** (***49***)	***47*** (***52***)	50	50	49 (***54***)
102	3	42	***48*** (***55***)	***51*** (***58***)	50	50	***53*** (***60***)
103	3	40	***56*** (***64***)	***59*** (***67***)	50	52	***61*** (***69***)
154	3	40	33 (40)	36 (***43***)	50	50	38 (45)
206	3	40	***59*** (***63***)	***62*** (***66***)	50	52	***64*** (***68***)

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. First number represents typical predicted sound level; number in brackets ( ) represents maximum predicted sound level; sound levels in ***bold italic*** text indicate exceedances of established criterion.

Table 9-33 shows that noise levels at isolated receivers in Zone 1 are predicted to vary between compliance and exceedance in the order of 27 dBA. The sleep disturbance criterion at these receivers is predicted to be exceeded in the order of 19 dBA. At receivers between the existing highway and the project (Zone 2), noise levels are predicted to vary between compliance and exceedance in the order of 19 dBA. The sleep disturbance criterion at these receivers is predicted to vary between compliance and exceedance in the order of 13 dBA. Noise levels at six receivers in Zone 3 are predicted to vary between compliance and exceedance in the order of 27 dBA. The sleep disturbance criterion at these receivers is predicted to vary between compliance and exceedance in the order of 19 dBA.

Concrete batch plant

Five receivers are located in proximity to the proposed concrete batch plant. These are receivers 3, 4, 100, 102 and 107. Table 9-34 shows the predicted noise levels during the daytime from the concrete batch plant at these five receivers.

Table 9-34 Predicted concrete batch plant noise levels — daytime (6am to 7pm)

Receiver[1]	Zone[2]	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[3]
3	1	42	***44***
4	1	42	***43***
100	3	42	***43***
102	3	42	***45***
171	3	42	***43***

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. Sound levels in ***bold italic*** text indicate exceedances of established criterion.

The results in Table 9-34 indicate that minor exceedances (up to 3 dBA) are predicted at the receivers during daytime operation of the concrete batch plant.

Table 9-35 shows the predicted noise levels during the evening from the concrete batch plant (operation and deliveries).

Table 9-35 Predicted concrete batch plant noise levels — evening (7pm to 10pm)

Receiver[1]	Zone[2]	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[3]	
			Operation	Deliveries
3	1	42	***44***	41
4	1	42	***43***	40
100	3	42	***43***	40
102	3	42	***45***	42
171	3	42	***43***	40

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. Sound levels in ***bold italic*** text indicate exceedances of established criterion.

The results in Table 9-35 indicate that minor exceedances (up to 3 dBA) are predicted at the receivers during evening operation of the concrete batch plant. Evening deliveries to the concrete batch plant are predicted to comply at all receivers.

Table 9-36 shows the predicted noise levels during night-time from the concrete batch plant (operation and deliveries). A predicted L_{A1} noise level for sleep disturbance is also shown.

Table 9-36 Predicted concrete batch plant noise levels — night-time (10pm to 6am)

Receiver[1]	Zone[2]	Predicted noise level (L_{A10} (dBA))[3]			Sleep disturbance (L_{A1} (dBA))	
		Criterion	Operation	Deliveries	Criterion	Predicted noise level[1]
3	1	40	***44***	***41***	50	48
4	1	40	***43***	40	50	47
100	3	40	***43***	40	50	47
102	3	40	***45***	***42***	50	49
171	3	40	***43***	40	50	47

Notes: 1. Refer to Appendices B and C in Technical Paper 5 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

3. Sound levels in ***bold italic*** text indicate exceedances of established criterion.

The results in Table 9-36 indicate that minor exceedances (up to 3 dBA) are predicted at the receivers during night-time operation of the concrete batch plant. Night-time deliveries to the concrete batch plant are predicted to exceed by up to 2 dBA at two receivers. No exceedance of the sleep disturbance criterion is predicted for night-time operation of the concrete batch plant.

Pre-cast yard

Two receivers are located close to the proposed pre-cast yard. These are receiver 204 (located approximately 300 metres to the south-west) and a house located approximately 850 metres to the north-west. Table 9-37 shows the predicted noise levels during the daytime and evening from the pre-cast yard at these two receivers.

Table 9-37 Predicted pre-cast yard noise levels — daytime (6am to 7pm) and evening (7pm to 10pm)

Receiver[1]	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[2]	
		Daytime (6am to 7pm)	Evening (7pm to 10pm)
204	42	***54***	42
House 850 metres north-west	42	***46***	34

Notes: 1. Refer to Figure 14-3 in Technical Paper 6 (Volume 2) for receiver locations. The receiver located 850 metres north-west of the pre-cast yard has not been assessed for other construction noise impacts.

2. Sound levels in ***bold italic*** text indicate exceedances of established criterion.

The results in Table 9-37 indicate that exceedances up to 12 dBA at receiver 204 and up to 4 dBA at the house to the north-west are predicted during the daytime. No exceedances are predicted during the evening.

Table 9-38 shows the predicted noise levels during the night-time from the pre-cast yard. It also shows a predicted L_{A1} noise level for sleep disturbance.

Table 9-38 Predicted pre-cast yard noise levels — night-time (10pm to 6am)

Receiver[1]	Operation		Sleep disturbance	
	Criterion (L_{A10} (dBA))	Predicted noise level (L_{A10} (dBA))[2]	Criterion (L_{A1} (dBA))	Predicted noise level (L_{A1} (dBA))
204	40	***42***	50	42
House 850 metres north-west	40	34	50	34

Notes: 1. Refer to Figure 14-3 in Technical Paper 6 (Volume 2) for receiver locations.

2. Sound levels in ***bold italic*** text indicate exceedances of established criterion.

The results in Table 9-38 indicate that a minor exceedance (2 dBA) is predicted at receiver 204 during night-time operation of the pre-cast yard. No exceedances of sleep disturbance criteria are predicted. Use of the boiler at night-time may result in some additional low frequency noise.

Construction vibration impacts

The closest residential receiver to the proposed bypass is receiver 103 at 77 metres. This residence is located within the curtilage of the heritage-listed Hambledon Homestead Complex (see Section 9.7). It is currently unoccupied. Vibration levels are predicted to be below one millimetre per second in all frequencies and no exceedance of the damage criterion is predicted. All other known heritage items within the complex and all other residential receivers are more than 100 metres from the construction activities. Vibration from construction activities is predicted to be below the criteria for residential buildings at this distance.

The closest edge of the construction site boundary is approximately 30 metres from the Tarcutta General Cemetery. There are no specific vibration criteria for cemeteries. To be conservative, it is proposed to use the criterion for sensitive heritage buildings (3.0 to 10.0 millimetres per second). Vibration levels at the cemetery are predicted to be less than 3.0 millimetres per second in all frequencies. Construction vibration is unlikely to damage any headstones at the cemetery.

Blasting impacts

As identified in Section 6.1, blasting may be undertaken for construction. Table 9-39 lists the three likely blasting locations, the nearest receivers and the distance to those receivers.

Table 9-39 Location of potential blasting and nearest receivers

Potential blasting location[1]	Nearest receiver	Distance to receiver (metres)
Cut 1 — northern end of project, near chainage 41600	204	370 to 480
Cut 2 — near northbound on-load ramp of northern interchange, near chainage 43000	102	240 to 760
Cut 3 — south of northern interchange and north of Tarcutta Creek bridge, near chainage 44000	68	110 to 670

Note: 1. Refer to Figures 5-2 to 5-5 for chainages.

Recommended maximum instantaneous charges (MICs) for each cut have been determined using relevant standards and guidelines. These are provided in Table 9-40 for the minimum and maximum distance from each cut to each receiver.

Table 9-40 Recommended MIC to achieve blasting criteria

Receiver[1]	Distance to cut (metres)		MIC to meet criteria (from nearest point of cut) (kilograms)		MIC to meet criteria (from furthest point of cut) (kilograms)	
	Minimum	Maximum	Vibration	Overpressure	Vibration	Overpressure
204 (Cut 1)	370	480	370	88	480	193
102 (Cut 2)	240	760	56	24	554	765
68 (Cut 3)	110	670	12	2	430	524

Note: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

9.5.6 Management of impacts

For receivers in Tarcutta village (Zones 2 and 3), where the noise from the existing highway exceeds the base criterion, the project should seek to not increase the existing noise levels by more than 0.5 dB for a 'new road' and 2 dB for a 'redevelopment (receivers 4 and 204) (refer Table 9-24). The project would reduce noise levels (resulting from combined noise) at most residential receivers in the village. While these would be above the ECRTN base criterion in many cases, as the project would reduce noise levels at these receivers, it would not be considered reasonable and feasible to provide further mitigation unless the noise levels are acute.

Where the predicted combined noise levels cannot achieve the above objective, reasonable and feasible mitigation would be considered in accordance with the ENMM.

In the assessment of the provision of mitigation for operational traffic noise, the ENMM gives guidance as to whether it is reasonable and feasible to offer noise mitigation. For new roads, it is generally not considered reasonable and feasible to offer mitigation if the combined levels of traffic noise are:

- Within 2 dBA of 'future existing' noise levels (ie the predicted noise level 'existing highway no project 2012), and
- Not more than 2 dBA above the target noise levels.

A barrier sensitivity analysis was carried out for the project (see Section 11 of Technical Paper 6 (Volume 2)) to determine the effectiveness of noise barriers to mitigate noise impacts. To be effective, barriers should reduce the total noise level by 5 dBA at the most affected receivers and not be of excessive height. The analysis of barriers along the eastern side of the project showed that noise levels from the project would not be reduced by 5 dBA. Barriers would be ineffective in reducing noise levels from the existing highway. Barriers would not be adopted for the project.

Seventeen receivers are to be considered for architectural treatment to mitigate noise impacts from the project. Those receivers, and the reasons for consideration of architectural treatment for each, are provided in Table 9-41.

Table 9-41 Summary of receivers to be considered for architectural treatment

Receiver[1]	Zone[2]	Reason
1	1	Exceeds criteria
2	1	Exceeds criteria
3	1	Exceeds criteria
4	1	Exceeds criteria
50	2	Exceeds criteria
51	2	Acute
63	2	Exceeds criteria
64	2	Exceeds criteria
65	2	Exceeds criteria
66	2	Exceeds criteria
67	2	Acute
68	2	Exceeds criteria
69	2	Acute
102	3	Exceeds criteria
103	3	Exceeds criteria
204	1	Exceeds criteria
206	3	Exceeds criteria

Notes: 1. Refer to Appendices B and C in Technical Paper 6 (Volume 2) for receiver locations.

2. Refer to Figure 9-9.

Mitigation and management measures for noise and vibration impacts are presented in Table 9-42. These measures have been incorporated into the draft statement of commitments in Chapter 11.

Table 9-42 Noise and vibration mitigation and management measures

Potential impact	Mitigation and management measure
Construction	
Noise impacts to sensitive receivers during construction activities	▪ Implement best practice mitigation and management measures to minimise construction noise and vibration at sensitive receivers. ▪ Undertake monitoring to determine the effectiveness of mitigation measures. Implement additional mitigation measures where required if construction noise generates complaints and the monitoring confirms unreasonable noise impacts. ▪ Implement a notification and negotiation procedure where noise impacts from evening and night construction activities are above criteria. This would involve consultation with sensitive receivers to develop appropriate management measures. ▪ Develop a procedure for dealing with and responding to complaints.

Potential impact	Mitigation and management measure
Operation	
Noise levels from traffic exceeding criteria at sensitive receivers	▪ Develop and implement all reasonable and feasible mitigation measures to meet the noise criteria applicable to the project in consultation with the sensitive receiver.
	▪ Measure operational noise along the project between six months and one year after opening. Should the monitoring indicate that traffic noise impacts exceed the levels predicted, implement further reasonable and feasible mitigation measures in consultation with the sensitive receiver.

9.6 Social and economic

A social and economic assessment for the project has been undertaken as presented below.

DGRs	Where addressed
Social and economic (including but not limited to):	
Local community socio-economic impacts associated with traffic, property and amenity related issues.	Section 9.6.2, 9.6.3
Business (including agribusiness) impacts, including the overall viability, profitability, productivity and sustainability of businesses.	Sections 9.6.2, 9.6.3

9.6.1 *Existing social and economic environment*

Surveys and interviews were undertaken to better understand the social and economic environment, and to identify the potential impacts of the project on the local community and businesses. The following surveys and interviews were carried out:

- Highway related businesses survey, which identified and profiled businesses in Tarcutta village.
- Stopping motorist survey, which identified reasons for travel, origin and destination, previous stop locations, length of stop and expenditure patterns.
- Overnight stayers survey, which identified origin and destination, purpose and mode of travel, length and frequency of stay, and expenditure patterns.
- Interviews with landowners directly affected by the project, which established profiles for each agribusiness and considered impacts of the project on agribusiness operations.

The assessment was supported by baseline socio-economic data comprising Australian Bureau of Statistics (ABS) Census Data (2001 and 2006) and planning documents to understand the social and demographic profile of Tarcutta. It was also informed by observations made during site visits, the key findings of other technical investigations for the project and previous economic assessments of bypassed towns.

Social profile

The village of Tarcutta is located in a rural environment. Cattle and sheep grazing and the production and harvest of grain and fodder crops, such as lucerne and oats, are the primary rural activities in the area. Tarcutta also houses a truck interchange facility and is a major truck stop between Sydney and Melbourne. The Truck Drivers' Memorial on the main street reinforces the important strategic location of Tarcutta between Sydney and Melbourne for heavy vehicles, and has formed an integral part of Tarcutta's social fabric. The businesses in Tarcutta provide basic goods and services for this highway traffic.

The social profile of the ABS Statistical Local Area of Tarcutta can be summarised as a small but relatively stable population characterised by an ageing demographic with an above average unemployment rate (in 2006, 9.3 per cent identified as unemployed and looking for work). The total population in 2006 was 245 persons (128 male and 117 female).

In 2006 the most significant industry groups were accommodation and food services (18.5 per cent) followed by agriculture, forestry and fishing (13.2 per cent). The most common occupation was labourers (23.0 per cent) followed by technicians and trade workers (20.7 per cent).

The existing Hume Highway serves as the main street of Tarcutta. This frames the environmental amenity of the village, characterised by high levels of light and heavy vehicle traffic using the highway (see Section 9.7). Properties within Tarcutta village are currently affected by traffic noise from the existing highway, while rural properties directly affected by the project are predominantly removed from these impacts.

Community cohesion in Tarcutta is promoted through various active community organisations, including the Tarcutta Valley Landcare Group, Country Women's Association, Tarcutta Progress Association and other community activities, including the annual Australian Truck Drivers' Memorial service.

Business profile

The business environment in Tarcutta has changed considerably in recent years with a downward trend in the economic base of the village resulting from the closure of business and services. Since 2003, 10 local businesses and services have closed, including a medical centre, primary school, general stores, cafés and an aged care facility. The businesses that presently remain in Tarcutta are generally those serving the needs of highway travellers. The local population increasingly relies on businesses and services in Wagga Wagga for most of their lower and higher order goods. Over the last few years, businesses in Tarcutta have been experiencing economic benefits from the construction activities north and south of the village associated with the Hume Highway duplication.

Tarcutta's businesses (all located on the existing Hume Highway) comprise:

- Tarcutta Half-way Motor Inn
- Tarcutta Textiles
- Tarcutta RSL Club
- Farmhouse Industries
- Rural supplies store
- Tarcutta Horse and Jockey Hotel
- Mobil Petrol Station
- Tarcutta Auto Repairs
- Half-way Café and Takeaway
- Post office.

Of these, two businesses — the rural supplies store and post office — are typical businesses of small towns and are primarily dependent on local trade. These businesses can be described as profitable and viable. One of these businesses has recently invested considerable sums of money in modernisation of the business and expansion of product lines.

The remaining eight businesses were identified as highway-related and formed the focus of the economic assessment.

Information obtained during surveys highlighted the contribution of passing trade to the local economy. This importance was reflected in the business survey responses indicating that six businesses reported more than an 80 per cent dependence on passing trade.

Despite the closure of main street businesses over the past five years, the highway-related businesses that remain in Tarcutta can be described as profitable and viable based on the current level of passing trade. In addition, these businesses are likely to benefit from projected increases in Hume Highway traffic up to 2012, which would potentially result in increased passing trade. This passing trade is supported by Tarcutta's ties to the heavy vehicle industry with the operation of the truck interchange facility. Tarcutta would continue to be a strategic stopping point for both heavy and light vehicles due to its location halfway between Sydney and Melbourne.

Seven of the highway-related businesses have turnover figures for 2007-08 that exceed their expenditures and salaries, although there is considerable variation across the businesses. Only one business may be considered marginal in terms of profitability and viability. Six businesses have salaries below 15 per cent of turnover; an indication of a generally lower level of employment and efficient use of employees. Only two businesses have salaries that exceed 20 per cent of turnover. These businesses tend to rely either on a larger pool of casual labour or employ a more specialist skilled labour force.

The sustainability of these highway-related businesses would rely mainly on passing trade and population. Given that passing trade is likely to increase and the population of Tarcutta, overall, is fairly steady, it is likely that these highway-related businesses would continue to be sustainable. This ability to remain sustainable would be influenced by the age distribution of the population — although the population of Tarcutta is ageing, the increase of enrolments at the primary school could indicate a strong presence of younger families that could potentially support the labour industry.

Agribusiness profile

The project directly affects seven rural properties varying in size from large (around 1600 hectares) to small (around 35 hectares). Some agribusinesses use additional land in the region through direct ownership, leasing or share-farming to improve viability. The larger properties are generally commercial agricultural businesses where agricultural enterprises provide the majority of the income. The smaller 'lifestyle' farms produce a range of agricultural products to supplement non-farm income. The primary rural activities conducted on these properties include sheep and cattle grazing and the production of cereal grain and fodder crops such as lucerne and sorghum. The rural supplies store provides goods and services to these and other agribusinesses in the region.

Land use

The project passes through and/or is adjacent to land zoned for rural (Zone No. 1 (Rural)) or residential (Zone No. 2 (Village)) purposes under the *Wagga Wagga Rural Local Environmental Plan 1991*. No changes to zoning in the area are currently proposed by Wagga Wagga City Council.

The Council development application register and the Department of Planning major projects register were searched to identify significant development proposals located close to the project. A development application has been lodged with Wagga Wagga City Council for a truck stop and highway service centre approximately four kilometres south of the project. The proposed development would be on the eastern side of the existing dual carriageway, and would provide grade separated access to both northbound and southbound traffic. The proposed development would contain facilities that include approximately 160 truck parking spaces; heavy vehicle repair services and facilities; accommodation for drivers; petrol

services; fast-food outlets, a food court; and a supermarket. These facilities are expected to create 80 full-time positions.

The rural land capability in the locality varies from Class 2 (most suitable for cropping) through to Class 6 (grazing land) as defined in the eight-class Rural Land Capability classification system (NSW Department of Land and Water Conservation) (see Figure 9-10). The land classes on properties impacted by the project vary from Class 2 to Class 5 and the dominant land uses vary accordingly.

A travelling stock route is located along the Hume Highway between Mates Gully Road and Humula Road. The Department of Lands has indicated that this travelling stock route is operational.

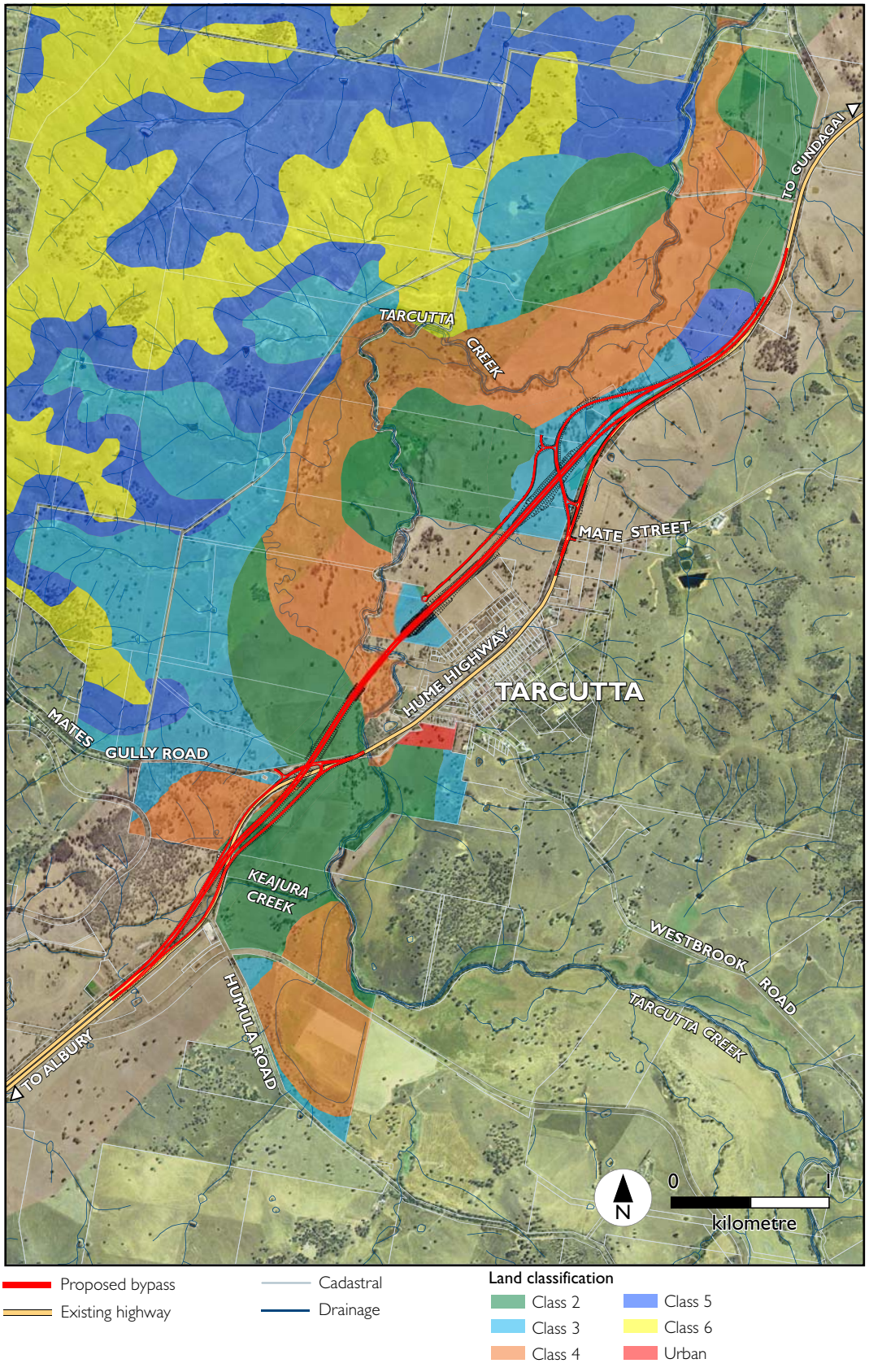

Figure 9-10 **Land capability in the locality**

9.6.2 Social and economic impacts

Impacts attributable to the project during construction and operation are discussed in this section.

Local community

Traffic

Construction

Construction works have the potential to cause temporary inconvenience to the community and interrupt local travel on local roads and the existing highway. This is due to changes in traffic and local access that would occur during construction, including increases in heavy vehicles on the road network, diversions and partial road closures (see construction traffic impacts as detailed in 9.7.3). Intersection arrangements would be provided to facilitate the safe movement of vehicles into the construction site from the surrounding road network.

Operation

The removal of through traffic on the existing highway and local road access arrangements would support social cohesion within the confines of the village.

The project is also expected to contribute to improved safety along the Hume Highway and within Tarcutta village by reducing conflicts between local traffic and through traffic in the village.

Tarcutta's identification as a town servicing the trucking industry would be maintained. The interchange arrangements at both ends of the project would facilitate the easy movement of trucks to the village, where the truck interchange facility is located.

Property

Acquisition

Land acquisition would be limited to agricultural-based properties on the western side of Tarcutta village. The project would result in the acquisition of approximately 80 hectares of agricultural land over seven properties. Agribusiness impacts are discussed further below.

Acquisition would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the RTA's (1999) *Land Acquisition Policy*.

The project would result in the acquisition of approximately 12 hectares of Crown land (on two independent lots) and approximately four hectares of travelling stock route. The project would reduce the amount of land available in the town common. The travelling stock route would be maintained.

Connectivity and severance

The project would reduce connectivity to Tarcutta for rural residences on the western side of the project. A local service road would be provided to maintain a connection to Tarcutta for these properties.

The project could result in changes to local travel patterns and incrementally longer travel distances to and from some properties. The increased control of access points would, however, result in substantially improved safety benefits.

In consultation with affected landowners, the project has been designed to minimise property severance as much as practicable. The concept design indicates that three properties would be severed to some degree. Further consultation would be carried out with landowners to develop and implement reasonable and feasible measures to mitigate severance impacts during construction and operation.

Access

The project would result in both temporary and permanent changes to property access arrangements. If required, temporary access during construction or permanent alternative access would be provided in consultation with the affected landowner(s).

Amenity

Construction

Potential amenity effects during construction would include noise and dust (detailed in Sections 9.5 and 10.3 respectively). There would also be minor visual impacts in terms of outlook to the construction site and ancillary facilities from some properties. Road construction on the Hume Highway has been occurring to the north and south of Tarcutta for the past few years. Local residents and communities, to a certain degree, are accustomed to construction activities. However, prolonged construction activity could cause a level of annoyance related to multiple inconveniences over a period of time within the community, potentially causing 'construction fatigue'. The community would be kept informed of any changes to access, traffic and construction activities. This would assist in facilitating greater acceptance for the project.

Operation

During the day, the general amenity of Tarcutta village would improve as the project would remove a majority of through traffic, including heavy vehicles, from the existing highway. The traffic assessment undertaken for the project (see Section 9.7) predicted that (under the high diversion scenario) approximately 64 per cent of heavy and light vehicles using the existing highway would divert to the project rather than driving through the main street of Tarcutta. During the evening period there would be continued use of the Tarcutta truck interchange facility.

Most residences to the east of the existing highway are predicted to experience a reduction in noise level as traffic moves onto the project. Noise from the project would result in a changed noise environment for some rural residences. Where noise criteria exceedances are predicted, all reasonable and feasible mitigation measures would be developed and implemented in consultation with the sensitive receiver(s) (refer Section 9.5).

Viability, profitability, productivity and sustainability of business

Construction

During construction, the project is likely to have positive economic benefits for local and regional businesses. In addition to existing highway traffic there would be up to 250 workers on site. The economic benefits from such construction personnel would filter into Tarcutta village through the local economy. This may include localised economic stimulus and increased business turnover from the workforce purchasing local goods, services and accommodation, engagement of local goods and services for construction as well as more regional economic benefits through the provision of specialised goods and services.

Operation

Impacts of the project are likely to be greater for highway-related businesses than those that rely on local trade. However, indirect impacts would be experienced by other local businesses and the community generally.

Previous studies of the impacts of highway bypasses have indicated that there is a reduction in stopping traffic (ie typically short stops for fuel, food, rest facilities etc) following the opening of a bypass. In Yass (Parolin and Garner 1996) this was estimated as a 50 per cent reduction in stopping traffic and in Karuah (Rowe and Phibbs 2005) in excess of 90 per cent reduction. A reduction in stopping trade can result in a decrease in the value of highway generated trade, the closure of highway-related businesses, loss of jobs and flow-on effects for other businesses and the community as a whole, predominately caused by the out-migration of population.

The motel is likely to be least affected by the project. Previous studies of bypassed towns have indicated that the accommodation sector is likely to experience higher activity levels in the immediate post-bypass period compared to the pre-bypass period (Parolin and Garner 1996), as well as in the longer term. This is as a result of the improved environmental amenity of the village, which is appealing to both potential short-term and long-term stayers and the increased tourism potential of the village.

The project would alter patronage to businesses along the existing highway as traffic wishing to access these businesses would have to leave the Hume Highway and enter Tarcutta via the northern or southern interchanges. The extent of adverse impact due to the change in traffic patterns and access would largely be a function of reliance on passing trade. As indicated above, highway-related businesses have reported up to 80 per cent dependence on passing trade. The analysis of results from the stoppers survey suggests that at least 50 per cent of those who currently stop would no longer stop in Tarcutta once the project is opened.

All eight highway-related businesses surveyed expect that decreases in turnover would occur as a result of the project:

- One business expects turnover to decrease by less than five per cent.
- Two businesses expect turnover to decrease by between 30 and 40 per cent.
- One business expects turnover to decrease by more than 50 per cent.
- Four businesses expect a decrease in turnover between 80 and 90 per cent.

The impact of the project on gross annual turnover in highway-related businesses is expected to be considerable. Information collected through survey data suggests that this reduction would be in the order of $4.7 to $7.4 million. The survey data also suggests that an estimated 50 to 80 jobs could be lost at the highway-related businesses following the opening of the project. This represents approximately 50 to 90 per cent of the 87 workers employed by seven of the eight businesses in 2009 (one business is staffed by volunteers).

The closure of some or all of these businesses could have a negative indirect impact on the community. The loss of employment caused by any businesses that close may see a reduction in spending at businesses that cater for the local community. This would be further exacerbated if the closure of businesses caused an out-migration of population from Tarcutta and the surrounding area. As only two businesses in the village are dependent on local trade, the indirect impacts are likely to be limited.

While the survey data collected is limited in terms of timeframe and seasonality, it highlights the potential for adverse impacts of the project on the viability, profitability, productivity and sustainability of highway-related businesses in Tarcutta. These impacts are likely to be less severe for the motel as it is strategically placed as a halfway point between Sydney and Melbourne. Those who currently stay overnight are likely to continue to stop and that additional stayers would be attracted by the improved amenity in Tarcutta. The income generated from the motel would also have some positive effects on other businesses in Tarcutta, as income would flow both from the motel and the stayers themselves.

As has occurred with other bypasses, the project may allow some businesses to capitalise on the improvements in amenity in the village and redirect trade towards local patronage, attracting more locals to shop in Tarcutta rather than Wagga Wagga. This can include focussing on improvements to services, appearance of premises, promotions and advertising (Parolin and Garner 1996). These changes to business can often add to amenity and attract more travellers to stop. New business opportunities may also arise especially in tourism and recreational based trade including gift shops, museums and promoting other attractions.

Tarcutta would remain the strategic interchange location for the heavy vehicle industry between Sydney and Melbourne and demand for goods and services from the trucking community would continue. The project may allow the opportunity to tailor business functions to this target market.

Notwithstanding the continued operation of the truck interchange facility, for the majority of highway-related businesses, the adverse impacts of the project on turnover and employment are likely to affect the profitability and viability of these businesses. It was reported that there is a strong likelihood that two businesses would close after the opening of the project as they would not be viable if the expected decrease in turnover eventuates. The other highway-related businesses would generally be required to scale down their operations to accommodate the new trading environment immediately after project opening. This may include reduced hours and days of operation, staff and numbers of stock items. The project may also trigger other changes such as the sale of a business (if the property is owned) or sale of the lease/license. However, other businesses may be able to capture any residual demand for services provided by those businesses that have closed, possibly allowing Tarcutta to maintain business functionality.

The experience from other bypassed towns suggests that the reduction in stopping traffic in the post-bypass period may be more acute than the 50 per cent (predicted by business owners) and could reach up to 80 per cent. Such a reduction is supported by the assessment of predicted traffic volumes (see Section 9.7.4), which has indicated that, excluding residential and business traffic that is committed to driving into Tarcutta, only an estimated seven to 15 per cent of vehicles would continue to use the existing highway.

All highway-related businesses indicated that they would use the earnings from road construction workers to assist in maintaining a viable business immediately after project opening. However, the adverse impact on profitability would likely result in impacts on the long-term sustainability of highway-related business.

It was reported that only a few businesses appear to be preparing for project opening by making changes to the nature of their businesses to capitalise on the positives of the project. This may not be conducive to longer term business sustainability. Section 9.6.3 outlines some opportunities for consideration by stakeholders such as Wagga Wagga City Council,

Tarcutta Progress Association and local businesses to develop opportunities to sustain viable businesses following project opening and into the longer term.

Viability, profitability, productivity and sustainability of agribusiness

The extent of impact to individual agribusinesses is influenced by how much land is affected and whether productive land is severed. Previous studies in the bypasses of Yass (Parolin and Garner 1996) and Goulburn (Phibbs 1980) indicate that the loss of this agricultural land is likely to result in a small reduction in gross annual turnover at the rural supplies business in Tarcutta.

The concept design of the project minimises land acquisition, severance and fragmentation of properties by either closely following property boundaries or providing a means of access between separated portions of land where possible. The RTA has held discussions with all directly affected landholders on how to best minimise the impact on the function and amenity of their land use. These discussions would continue through detailed design.

The seven rural properties directly affected by the project would experience different levels of agribusiness impacts. The seven properties range in size from approximately 35 hectares (lifestyle property) to 1600 hectares (agribusiness enterprise). The proportion of land lost to acquisition would be in the range of less than one per cent to approximately 15 per cent. The extent of impact on individual agribusinesses would be influenced by the area and quality of land acquired, and whether productive land is severed by the project. The loss of land may reduce production, which in turn may reduce profitability. Severance of land can reduce efficiency of management leading to reduced productivity and profitability. Reductions in profitability may reduce viability of the agribusiness but the extent would depend on the individual business structure. Reduction in viability may have an impact on employment of labour for individual agribusinesses.

The likely impact on the seven directly affected rural properties is provided in Table 9-43.

Table 9-43 Impact on individual agribusinesses

Property	Impact on agribusiness
1	This property operates as a self-contained agribusiness enterprise where livestock grazing is the main activity. Approximately 1.5 per cent of the property would be acquired. Impacts would be limited to minor edge effects and there would be no severance of the property. There would be no impact to infrastructure. The project would result in a small loss to livestock carrying capacity. The project would be unlikely to result in any significant impacts on the viability, profitability, productivity or sustainability of this agribusiness.
2	This property is operated in conjunction with other parcels of land nearby. Around half the land is used for the harvest of crops. The remaining land is used solely for grazing. Approximately 10 per cent of the property would be acquired. The property would be severed by the project. There would be minimal impacts to infrastructure. Discussion with the landowner(s) is ongoing to develop and implement reasonable and feasible measures to mitigate severance impacts during construction and operation. The project would result in a relatively small loss of crop production and livestock carrying capacity in relation to the total enterprise. The project may result in some impact on the profitability and productivity of this agribusiness. There would not likely be any significant impacts on the viability or sustainability of this agribusiness.

Property	Impact on agribusiness
3	This property operates in conjunction with another small property to the east of Tarcutta. It is used solely for cattle grazing. Approximately 15 per cent of the property would be acquired. The property would be severed by the project and there would be some impact on infrastructure. Discussion with the landowner(s) is ongoing to develop and implement reasonable and feasible measures to mitigate severance impacts during construction and operation. The project would result in a reduction in arable land and could reduce the productive capacity. The project may result in an impact on the profitability and productivity of this agribusiness. There would not likely be any significant impacts on the viability or sustainability of this agribusiness.
4	This property is operated in conjunction with another parcel of land some distance to the south-east of Tarcutta. The main activities are lucerne hay production and beef cattle fattening. Approximately 10 per cent of the property would be acquired. Impacts would be limited to edge effects and there would be no severance of the property. There would be some impact to infrastructure (eg the removal of a hayshed). The project would result in the removal of a large portion of the lucerne paddocks and resulting hay production. The project would have some impact on the cattle grazing potential. The project may result in an impact on the profitability and productivity of this agribusiness. There would not likely be any significant impacts on the viability or sustainability of this agribusiness.
5	This property is used for improved pastures (phalaris, ryegrass, sub-clover) and fodder crops, used to fatten beef steers and lambs. Less than one per cent of the property would be acquired. Impacts would be limited to minor edge effects and there would be no severance of the property. There would be no impact to infrastructure. The project would result in a minor loss of agricultural land. The project would be unlikely to result in any significant impacts on the viability, profitability, productivity or sustainability of this agribusiness.
6	This property operates as a self-contained agribusiness enterprise where lucerne and fodder crops are harvested, but grazing is the main activity. Approximately three per cent of the property would be acquired. The property would be severed by the project and there would be minimal impact on infrastructure. Discussion with the landowner(s) is ongoing to develop and implement reasonable and feasible measures to mitigate severance impacts during construction and operation. The project would result in a relatively small loss of crop production and livestock carrying capacity in relation to total enterprise. The project may result in minor impacts on the profitability and productivity of this agribusiness. There would not likely be any significant impacts on the viability or sustainability of this agribusiness.
7	This property operates as a lifestyle property. Approximately 1.5 per cent of the property would be acquired. Impacts would be limited to edge effects and there would be no severance of the property. There would be no impact to infrastructure. The project would result in no loss of productivity. The project would be unlikely to result in any significant impacts on the viability, profitability, productivity or sustainability of this property.

The loss of land is likely to have some impact on the profitability and productivity of the affected agribusinesses. To some extent, the loss of agribusiness profitability and productivity would be offset by acquisition of the land. Land would be purchased at an unaffected market value that reflects the current productive potential. Agribusiness owners could also consider diversification of operations and/or employment of more efficient farm management practices, which may assist in maintaining the long-term sustainability of individual agribusinesses.

The loss of approximately 80 hectares of land as a result of the project would result in the loss of less than one per cent of the agricultural land in the Tarcutta Statistical Local Area. No prime agricultural land would be impacted by the project. Impacts would be to land ranging from land capability Class 2 (most suitable for cropping) through to Class 5 (grazing land) (refer Figure 9-10). The loss of this agricultural land would have minimal impact on the viability, profitability, productivity and sustainability of agribusiness in the region.

9.6.3 Management of impacts

Table 9-44 identifies the mitigation and management measures that would be implemented for social and economic impacts. These measures have been incorporated into the draft statement of commitments in Chapter 11. The measures to mitigate and manage construction impacts associated with noise, traffic and air quality are addressed in Sections 9.5, 9.7 and 10.3 respectively.

Table 9-44 Social and economic mitigation and management measures

Potential impact	Mitigation and management measure
Pre-construction	
Impacts on viability of directly affected agribusiness enterprises	▪ Undertake all property acquisitions required for the project in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the RTA's (1999) *Land Acquisition Policy*. ▪ Undertake consultation with all affected landowners throughout detailed design and construction to develop and implement measures to mitigate impacts on land use viability, infrastructure and severance. ▪ Continue consultation with Wagga Wagga City Council through detailed design and construction to assist in developing strategies to encourage the continued viability of Tarcutta.
Construction	
Construction impacts leading to reduced community cohesion and non-acceptance of the project	Keep the community informed with measures such as: ▪ Letter box drops, media releases and/or community updates. ▪ An internet site established and maintained for the duration of the project. ▪ Variable message signs. ▪ Targeted consultation with affected individuals or groups. Information to be provided will include: ▪ Changes to access and traffic conditions. ▪ Details of future works programs. ▪ General construction progress.
Property access	▪ Maintain property access for the duration of the construction. Should temporary or alternative access be required this would be provided in consultation with the affected landowner(s).

Potential impact	Mitigation and management measure
Positive benefits on social and economic environment of Tarcutta during construction	▪ Locally source construction materials and other products and services as far as possible.
Operation	
Maintain connectivity	▪ Provide a local service road to connect rural residences on the western side of the project with the village.
Reduction in motorists stopping in Tarcutta impacting the economic viability of highway-related businesses and Tarcutta	▪ Provide appropriate signage near to interchanges.
	▪ Facilitate heavy vehicle access to and from Tarcutta village to support its function as a 'trucking town' through detailed design.

In addition to the management measures to be implemented by the RTA, experience from other bypass projects has shown that other strategies could be adopted by the community or other stakeholders to assist in managing certain social and economic impacts of the project.

These strategies typically seek to identify future advantages that can be realised for the local community when a bypass has been opened. They usually relate to programs that enhance the character and amenity of community places or areas, and that promote and revitalise business activities and community events.

In this context, the opportunities identified below are presented for consideration by stakeholders such as Wagga Wagga City Council, the Tarcutta Progress Association and individual businesses. The potential measures outlined below do not form part of the draft statement of commitments identified in Chapter 11, nor do they amount to an exhaustive list:

- Enhance the amenity of Tarcutta through the development of a streetscape and heritage strategy.
- Develop a coordinated approach to a 'vision' for Tarcutta that captures community expectations and an identity for the village.
- Increase local business promotional activities for Tarcutta (promote the village to attract local residents, tourism or the trucking industry).

The RTA has commenced discussions with Wagga Wagga City Council and the Tarcutta Progress Association to assist in developing strategies to encourage the continued viability of Tarcutta. Consultation would continue throughout construction and operation of the project.

9.7 Traffic and transport

A detailed traffic and transport assessment was undertaken for the project as presented below. This is supported by *Technical Paper 7 — Traffic and Transport* (Volume 2).

DGRs	Where addressed
Traffic and transport (including but not limited to):	
Demonstrate how the preferred route and road design meets the traffic and transport objectives for the project, particularly with respect to increasing infrastructure handling capacity and efficiency, and improving transport productivity on nationally strategic and export-oriented freight corridors.	Sections 9.7.1, 9.7.4, 3.3, 12.1.1 Technical Paper 7 (Volume 2)
Opportunity for the provision of a heavy vehicles inspection point, for compliance with the *Road and Rail Transport (Dangerous Goods) Act 1997.*	Section 9.7.4
Construction impacts, including spoil haulage routes.	Section 9.7.3 Technical Paper 7 (Volume 2)
Operational traffic and transport impacts to the local and regional road network, road users and travelling stock routes.	Section 9.7.4 Technical Paper 7 (Volume 2)
Opportunity for the provision of cycle way connections along the highway and to adjoining communities.	Section 9.7.4 Technical Paper 7 (Volume 2)

9.7.1 Assessment approach

Technical Paper 7 (Volume 2) provides a detailed description of the approach taken for the traffic and transport assessment. The assessment included:

- Patterns and trends of traffic on the Hume Highway were established using existing traffic data as well as additional data gathered for the project:
  - Classified tube counts from 5 to 10 December 2008.
  - Licence plate survey from 6pm to 6am on 8 and 9 December 2008.
  - Travel time surveys were undertaken indirectly through licence plate origin/destination surveys.
- Traffic flow and pattern predictions were made into the future to assess the potential impacts of the project.

9.7.2 Existing traffic and transport environment

Existing traffic volume

Traffic volumes surveyed to the north and south of Tarcutta were annualised to give indicative annual average numbers for 2008. The volumes were similar, with the south being slightly higher. Table 9-45 shows the average annual daily traffic (AADT) existing traffic volumes north of Tarcutta and Table 9-46 shows the AADT existing traffic volumes south of Tarcutta.

Table 9-45 Existing traffic volumes (AADT) north of Tarcutta

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Weekday	1239	1675	2913	1405	1640	3046
Weekend	1350	692	2042	1524	562	2085
Weekly (AADT)	1270	1201	2471	1439	1135	2574

Table 9-46 Existing traffic volumes (AADT) south of Tarcutta

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Weekday	1483	1375	2858	1468	1382	2850
Weekend	1529	642	2170	1635	579	2214
Weekly (AADT)	1496	1165	2661	1516	1153	2668

Traffic volumes change throughout the day. As shown for the south of Tarcutta in Figure 9-11, the bulk of light vehicle traffic occurs in the middle of the day. While total traffic volumes are higher during the middle of the day, truck traffic builds steadily from a low at 4am to a peak at around midnight. This is when the truck facilities in Tarcutta are at their busiest.

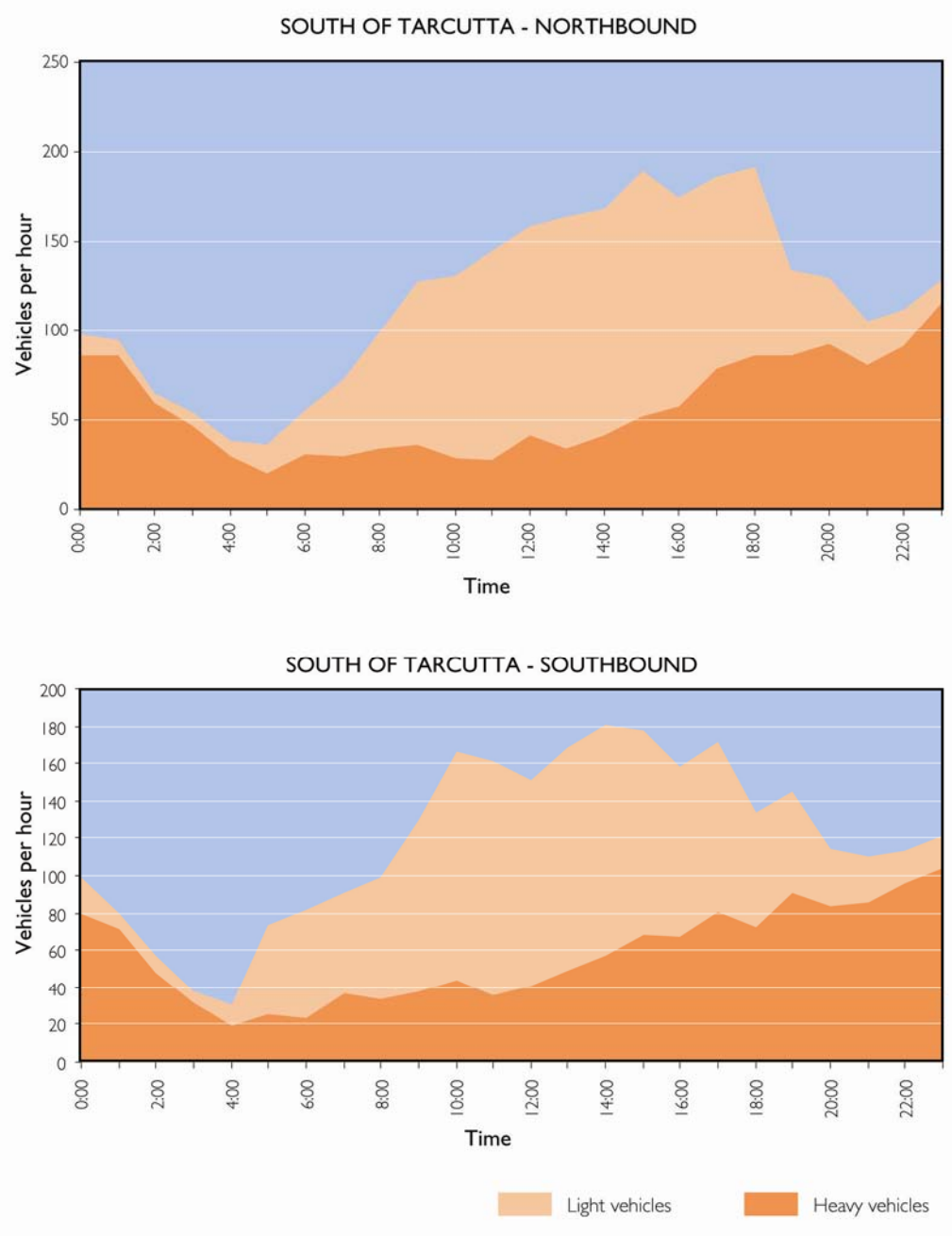

Figure 9-11 **Hourly change in traffic volume on the Hume Highway, south of Tarcutta**

Peak hour traffic volumes south of Tarcutta are summarised in Table 9-47.

Table 9-47 Peak hour traffic volumes south of Tarcutta

	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
Weekday midday peak	137	52	190	110	68	178
Weekday night-time truck peak	13	116	129	18	104	122
Weekend	155	23	177	138	33	170
Weekly	142	44	186	118	58	176

The peak traffic time for all vehicles is between 3pm and 4pm on weekdays and weekends. The peak volume of heavy vehicles occurs between 11pm and midnight due to Tarcutta being the halfway point between Sydney and Melbourne. Heavy vehicles pass through Tarcutta at this time having left Melbourne or Sydney after the evening peak and aiming to arrive at their destination before the start of the morning peak.

Travel times

For the northbound direction, it was found that 80 per cent of northbound vehicles had a travel time of three minutes or less through the village. Travel times longer than three minutes occurred much less frequently and were widely distributed. Given that Tarcutta has no traffic signals to delay through traffic, this is taken to indicate that travel time for vehicles travelling through the village without stopping is less than three minutes.

Vehicles with travel times between three and 10 minutes (about three per cent of total flow) are not likely to have had substantial business in Tarcutta. Vehicles with travel times longer than 10 minutes are considered as stopped trips.

Approximately 75 per cent of southbound vehicles had travel times less than three minutes, and five per cent had a travel time between three and 10 minutes.

Travel patterns

The 12 hour night-time vehicle counts demonstrate the importance of Tarcutta's truck facilities (the truck interchange facility, service station and two layover areas in the middle of the main street). Figure 9-12 shows the location of these facilities and the surveyed vehicle volumes.

Figure 9-12 **Traffic using truck facilities in Tarcutta**

Approximately 30 per cent of the trucks entering Tarcutta from both directions stop at one of the four truck facilities. About 12 per cent of light vehicles entering Tarcutta also use these facilities.

The traffic movements in Tarcutta (as determined from the licence plate survey) are described as follows:

- Vehicles entering Tarcutta but not recorded exiting within 12 hours: These vehicles may have been residents returning home, they may have exited the village on roads that were not surveyed or there may have been survey errors.
- Vehicles entering and leaving Tarcutta via the Hume Highway: These vehicles either travelled straight through or stopped in the village before continuing on their journey.
- Vehicles making U-turns: These vehicles entered Tarcutta, completed their business and then exited the village on the same road as they entered.

A large proportion of the U-turning traffic was observed to stay for a long period of time, especially heavy vehicles. This is because trucks from Sydney and Melbourne meet at Tarcutta, swap trailers and then travel back to their city of origin.

Light vehicles showed a different pattern with the majority of light vehicles either travelling through or ending their trip in Tarcutta. Of the 139 who continued through the village, 115 drove straight through or stopped for a very short time. Seventy-seven light vehicles stopped for longer than 12 hours (ie completed their journey in Tarcutta). These patterns are repeated in the northbound direction with a higher proportion of through traffic.

The proportions of vehicles making each movement are shown in Table 9-48.

Table 9-48 Proportion of stopping, through and U-turn vehicles

Traffic movement	Northbound		Southbound	
	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Straight through the village — no stopping for a substantial length of time.	66%	65%	52%	53%
Through the village with stop for any length up to 12 hours.	0%	16%	11%	15%
Stopped in the village for longer than 12 hours.	26%	9%	35%	22%
Came into the village, completed their business and went back out ('U-turn').	8%	10%	3%	9%

These proportions were considered when estimating how much traffic would divert to the project. It has been assumed that the travel patterns measured during the night-time are applicable during the daytime.

Road network performance

The amount of congestion on a road is related to the volume of traffic, the characteristics of the road and the composition of the traffic stream. The mid-block level of service (LoS) is a qualitative measure used to describe the potential for delay during traffic operation, usually in peak demand situations. Mid-block LoS is designated by assigning ratings of A to F, with A the best and F the worst. An LoS D or better is considered acceptable.

The estimated road LoS at peak times in Tarcutta was determined from estimates of the volume to road capacity ratio, as summarised in Table 9-49.

Table 9-49 Road LoS in Tarcutta at peak times

	Annual highest hourly volumes		Volume/ capacity ratio	LoS
	Northbound	Southbound		
50th highest hourly volume.	337	433	0.42	D
Weekday peak hour.	190	178	0.19	B
Weekday night-time truck peak.	129	122	0.18	B

Table 9-49 indicates that traffic conditions on the highway through Tarcutta are acceptable. Conditions are worse during the night-time due to the high volume of truck traffic, but are still acceptable.

Crash history

Table 9-50 compares crash data on the single carriageway section of the highway around Tarcutta for the five years from 2002 to 2006 with divided carriageway sections of the highway between the Sturt and Olympic highways and typical two-lane rural main roads.

Table 9-50 Crash rate comparison 2002 to 2006

Location	Rate per 100 MVKT[1]			
	Fatal	Injury	Tow-away	Total
Single carriageway section, Tarcutta.	0.0	10.0	20.1	30.1
Divided carriageway sections, Sturt Highway to Olympic Highway.	1.1	7.9	15.6	24.6
Typical two-lane rural main roads.	1.4	14.2	17.2	32.8

Source: Connell Wagner (2004).

Note: 1. MVKT = million vehicle kilometres travelled.

The crash rate comparison indicates that the highway around Tarcutta experiences slightly more crashes than the divided carriageway sections of the Hume Highway between the Sturt Highway and Olympic Highway, and a similar amount to the typical crash rates for two-lane rural main roads. It is noted that the crash rate on the single carriageway section around Tarcutta is calculated from a relatively low number of total crashes.

9.7.3 Construction traffic and transport impacts

Construction programming and temporary roadworks

The proposed construction works would be programmed to minimise the interaction between the construction works and the local and regional road network. This would minimise disruption to local and through traffic. Construction of the northern and southern interchanges would enable traffic to be switched between the existing highway and the project to facilitate the continual flow of traffic through and around Tarcutta.

Temporary roadworks would be required during construction to tie the existing road network into the construction works. Locations at which temporary roadworks are likely to be required include the intersections of the existing highway and Mate Street, and Humula and Mates Gully roads. Temporary roadworks may be constructed under traffic and could result in some short-term traffic impacts to users of the existing road network.

Vehicle numbers

An average of 100 light vehicles is expected to be driven to site each day for the two year construction period. These vehicles would be parked at the main site compound and pre-cast yard. Many of these vehicles would be driven to and from Wagga Wagga.

An estimate has been made of the number of construction vehicle trips per day on the public road network (for the purposes of this calculation, a trip is considered as an in or out movement, hence a delivery would be counted as two trips). The number of vehicles would vary depending on the construction activities being carried out:

- Staff vehicles — 240 trips per day.
- Delivery of equipment — 20 trips per day.
- Delivery of materials — 40 trips per day.

- Delivery of select fill —90 trips per day.
- Construction movements outside the construction site boundary — 50 trips per day.

Based on the above, construction activities are expected to generate approximately 240 light vehicle and 200 heavy vehicle trips per day on public roads. This represents an increase of approximately eight per cent of daily weekday traffic on the road network around Tarcutta. These increases are relatively small and would be difficult to detect above normal daily fluctuations in traffic. Construction vehicles could result in a small increase in delay at some intersections. However, there is adequate road capacity to accommodate this temporary increase.

Spoil haulage

As outlined in Section 6.3.1, the project is not likely to generate excess spoil as the design seeks to achieve balanced earthworks. If spoil haulage is required, vehicles would use the proposed construction haul roads and the existing road network. Vehicle movements would be relatively small, as noted above, difficult to detect above normal daily fluctuations in traffic.

Access impacts

Site compound

Section 6.6.1 details the likely location of the main site compound. Access to this compound would be via the new northbound on-ramp that would be constructed at the northern interchange. Until the ramp is constructed, a temporary access would connect to the existing highway near the northern tie-in. Vehicles arriving at the site in the morning would do so during periods of lower traffic volume. Vehicles leaving the site compound during the early evening are likely to experience higher traffic volumes on the highway.

Construction access

Access points at the northern and southern tie-ins would be required to facilitate construction activities. Right-turn lanes and widened shoulders would be provided at the site compound entry, and where construction turning volumes are likely to be high or where adverse geometry exists. All access points would:

- Have safe intersection sight distances.
- Accommodate the turning movements of the largest heavy vehicle.

Local roads

During construction, some temporary changes to access arrangements may be needed for local roads in and around Tarcutta, including Mates Gully and Humula roads. Temporary changes to access arrangements for Mates Gully Road would consider the turning requirements of school buses and would be finalised during detailed design.

Properties

Property access would be maintained for the duration of the construction. If required, temporary or alternative access would be provided in consultation with the affected landowner(s).

Heavy vehicles

The Hume Highway plays a vital role in the transport of goods by road between NSW and Victoria. To reduce the impact of construction on road freight, night-time construction affecting highway traffic would be minimised.

Public transport

School bus services operate on the Hume Highway and Mates Gully Road. Services operate between 7.45am and 8.30am, and between 4pm and 5pm. Local bus operators and the community would be consulted on any alternative arrangements required for school bus stops.

Long-distance bus services between Sydney and Melbourne also use the existing highway. These services stop in Tarcutta when requested. Access to Tarcutta would be maintained throughout construction so these services would not be affected.

Pedestrians and bicycles

Access for pedestrians and cyclists in and around Tarcutta would be maintained throughout construction. Any temporary changes to these access arrangements would be undertaken in accordance with RTA requirements.

Travelling stock route

A travelling stock route runs along the Hume Highway between Mates Gully Road and Humula Road (see Figure 9-13). The temporary access arrangements for both Mates Gully Road and Humula Road during construction would facilitate the movement of stock through this route. This would be further developed during detailed design in consultation with relevant stakeholders.

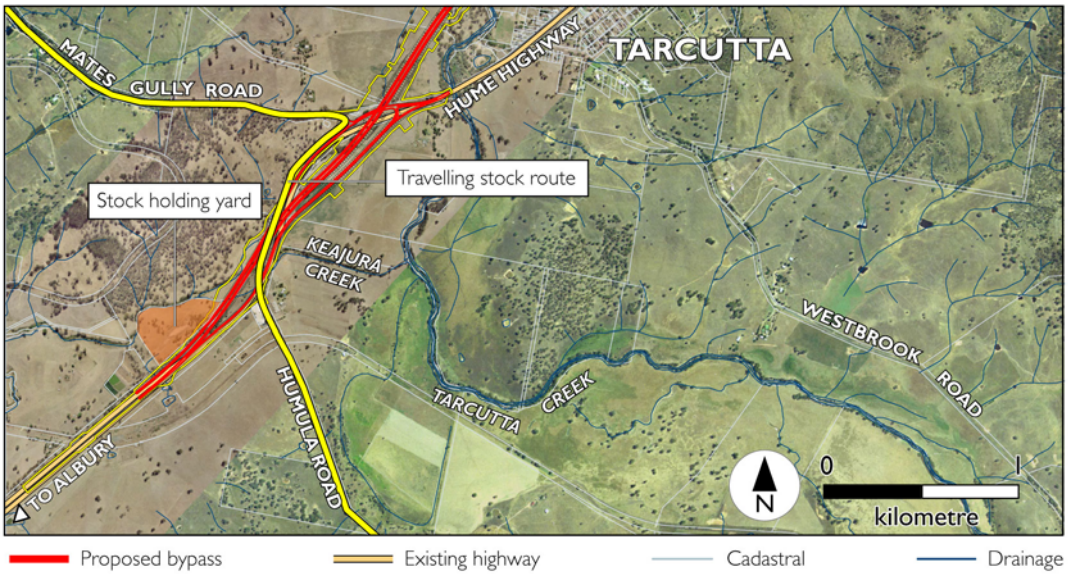

Figure 9-13 **Travelling stock route between Mates Gully Road and Humula Road**

9.7.4 Operational traffic and transport impacts

Travel times

The current travel time for the 6.1 kilometre section of the existing Hume Highway that would be bypassed is approximately five and a half minutes.

The travel time on the project has been estimated at approximately three and a half minutes based on the speed limit of 110 kilometres per hour and a length of 5.9 kilometres. Therefore, it is estimated that the project would result in a travel time saving of approximately two minutes.

Local access

All local road access would be maintained for operation of the project. Some local accesses would need to be altered from their existing arrangements. This would be confirmed during detailed design in consultation with the relevant road authority and any affected landowners.

Travel patterns

The project would provide a shorter travel time and less disrupted journey than travelling through the village. It is likely that travellers seeking a faster journey would use the project. It is also possible that some of the through vehicles that currently stop for a short time in Tarcutta may use the project because it may be more convenient for them to keep moving and stop at another location.

High and low diversion scenarios have been applied for the assessment. This has been based on the stoppers survey carried out for the project (refer Section 9.6) and the post-opening report on the Karuah bypass of the Pacific Highway titled *The Economic and Social Impacts of the Karuah Bypass: the 1 Year Report* (Rowe and Phibbs 2005). The following assumptions have been applied for the two scenarios:

- High diversion scenario forecasts:
  - Light vehicles: the results of the Karuah bypass study indicated that 90 per cent of stoppers would use the bypass.
  - Heavy vehicles: the results of the stopper survey for the economic assessment for this project indicated that 29 per cent of stopping heavy vehicles would use the project.
- Low diversion scenario forecasts:
  - Light vehicles: the results of the stopper survey for the economic assessment for this project indicated that 53 per cent of stopping light vehicles would use the project.
  - Heavy vehicles: it has been assumed that all heavy vehicles that currently stop in Tarcutta would continue to stop following project opening.

Using the above assumptions, traffic movements during each of the design years (2012, 2022 and 2032) have been applied to the project and the existing highway. The following traffic has been assumed to use the project between the northern and southern interchanges:

- Hume Highway northbound and southbound traffic that does not stop.
- Hume Highway northbound and southbound traffic that used to stop but is forecast to choose a different stopping location once the project is built.

Traffic movements that would continue to use the existing highway include:

- Hume Highway northbound and southbound traffic that continues to stop in Tarcutta.
- Traffic staying in Tarcutta (eg residents, motel guests, traffic using side roads).

- Traffic coming into Tarcutta to do business and then leaving via the same road they arrived on.

Vehicles that would continue to use the existing highway following project opening are not likely to drive through Tarcutta without stopping. This is due to Tarcutta's strategic position between Sydney and Melbourne and its importance as a truck stop.

Traffic volume

If the project did not proceed, traffic volumes will continue to increase in Tarcutta, as will traffic congestion. The 2008 volumes have been factored up using a 2.8 per cent per annum growth factor for the design years of 2012, 2022 and 2032. Table 9-51 shows the forecast traffic volumes on the existing highway in Tarcutta if the project did not proceed.

Table 9-51 Future AADT volumes south of Tarcutta with no project

Year	Northbound			Southbound		
	Light vehicles	Heavy vehicles	Total vehicles	Light vehicles	Heavy vehicles	Total vehicles
2012	1670	1301	2972	1693	1287	2980
2022	2202	1715	3917	2231	1697	3928
2032	2902	2261	5163	2940	2236	5177

If the project proceeds, the traffic volume would be shared between the highway and the project. The project would create additional capacity for future growth. Table 9-52 shows the forecast southbound volumes under the low and high diversion scenarios for the project and the existing highway to the north of Tarcutta.

Table 9-52 Future southbound AADT volumes for the project and existing highway north of Tarcutta

Year	Diversion scenario	Vehicle type	North of interchange	Project		Existing highway	
			Total AADT	AADT	%	AADT	%
2012	High	Light	1693	1042	62	651	38
		Heavy	1287	746	58	541	42
	Low	Light	1693	974	58	719	42
		Heavy	1287	688	53	600	47
2022	High	Light	2231	1373	62	858	38
		Heavy	1697	983	58	713	42
	Low	Light	2231	1283	58	948	42
		Heavy	1697	907	53	790	47
2032	High	Light	2940	1810	62	1131	38
		Heavy	2236	1296	58	940	42
	Low	Light	2940	1691	58	1249	42
		Heavy	2236	1195	53	1041	47

Table 9-53 shows the forecast northbound volumes under the low and high diversion scenarios for the project and the existing highway to the south of Tarcutta.

Table 9-53 Future northbound AADT volumes for the project and existing highway south of Tarcutta

Year	Diversion scenario	Vehicle type	South of interchange	Project		Existing highway	
			Total AADT	AADT	%	AADT	%
2012	High	Light	1670	1103	66	567	34
		Heavy	1301	907	70	394	30
	Low	Light	1670	1103	66	567	34
		Heavy	1301	846	65	456	35
2022	High	Light	2202	1454	66	748	34
		Heavy	1715	1196	70	519	30
	Low	Light	2202	1454	66	748	34
		Heavy	1715	1115	65	601	35
2032	High	Light	2902	1916	66	986	34
		Heavy	2261	1576	70	685	30
	Low	Light	2902	1916	66	986	34
		Heavy	2261	1469	65	792	35

The predicted traffic volumes presented in Tables 9-52 and 9-53 indicate that:

- For the high diversion scenario, 64 per cent of all vehicles would use the project.
- For the low diversion scenario, 62 per cent of light vehicles and 59 per cent of heavy vehicles would use the project.

Excluding traffic that is committed to driving into Tarcutta (ie residents, people with business in the village), of the vehicles that could potentially use the project, the following proportions are forecast to use the project rather than travelling through the village:

- High diversion scenario: 92 to 93 per cent would use the project.
- Low diversion scenario: 85 to 90 per cent would use the project.

Road network performance

Traffic volumes on the highway are forecast to increase with or without the project. This will have an impact on the LoS experienced on the existing highway. Table 9-54 shows the LoS if the project does not proceed as well as the LoS on the project and existing highway if the project does proceed. This analysis has used the high diversion scenario to show the likely maximum conditions on the project.

Table 9-54 Future LoS with and without the project

	No project		With project			
	Hume Highway		Existing highway		Project	
	vol/cap ratio	LoS	vol/cap ratio	LoS	vol/cap ratio	LoS
2008						
50th highest hourly traffic volumes	0.42	D	-	-	-	-
Weekday midday peak	0.20	B	-	-	-	-
Weekday night-time truck peak	0.20	B	-	-	-	-
2012						
50th highest hourly traffic volumes	0.47	D	0.20	B	0.19	A
Weekday midday peak	0.22	B	0.08	A	0.09	A
Weekday night time-truck peak	0.22	B	0.08	A	0.08	A
2022						
50th highest hourly traffic volumes	0.62	E	0.26	C	0.25	A
Weekday midday peak	0.29	C	0.11	A	0.12	A
Weekday night-time truck peak	0.29	C	0.10	A	0.11	A
2032						
50th highest hourly traffic volumes	0.87	E	0.34	C	0.33	A
Weekday midday peak	0.40	D	0.15	B	0.16	A
Weekday night-time truck peak	0.40	D	0.15	B	0.14	A

The results indicate that, if the project does not proceed, the conditions on the existing highway are likely to slip into the unacceptable range (LoS E) during the highest traffic times of the year (eg long weekends and school holidays). If the project does proceed, traffic volumes would be split between the two roads. The average weekday peak and the night-time truck peak are likely to maintain acceptable operating conditions.

Crash potential

The project is anticipated to have a lower crash rate than the existing highway as it would be a dual carriageway. This would provide safer overtaking opportunities, reducing the chance of a head-on collision. The reduction of traffic on the existing highway may also reduce the likelihood of crashes at intersections as there should be larger gaps in traffic.

The project is anticipated to save 12 crashes, including four injury crashes, over the 20 year period from 2012 to 2032.

The project may take on the crash characteristics of the existing divided carriageway sections of the Hume Highway between the Sturt and Olympic highways. If this occurred, the crash rate could be 24.6 crashes per 100 MVKT, which is lower than the existing crash rate of 30 crashes per 100 MVKT.

Heavy vehicle inspection point

The RTA, along with DECCW and Police, undertake various enforcement activities in regulating the use of vehicles and roads. The DECCW administers inspections of heavy vehicles under the *Road and Rail Transport (Dangerous Goods) Act 1997*. These inspections are carried out at vehicle inspection sites where safety considerations allow the stopping and parking of heavy vehicles.

The project is not considered an appropriate location to establish a heavy vehicle inspection point for enforcement activities for a number of reasons:

- Its location would allow heavy vehicles to avoid inspection by detouring through Tarcutta village.
- Its proximity to Tarcutta residences (in the village and rural residences) would increase amenity impacts, particularly noise and visual.
- The design of the project involves a number of bridges and major interchanges, limiting the ability to provide safe entry/exit arrangements.
- Given the environmental constraints in the area, the large footprint required for the inspection point would be difficult to position without increasing environmental impacts.

The RTA acknowledges the need to establish a heavy vehicle inspection point along the Hume Highway in this region. This will be investigated independent of the project.

Cycle facilities

While cyclists could potentially use the project, it is considered likely that most would choose to use the existing highway through Tarcutta. Cyclists would be directed to use the off-load ramps at each end of the project.

Travelling stock route

A travelling stock route runs along the Hume Highway between Mates Gully Road and Humula Road (refer Figure 9-13). The route would be maintained during operation of the project. Any changes required would be further developed during detailed design in consultation with relevant stakeholders.

Consistency with traffic and transport objectives

The project aims to improve safety and traffic and transport efficiency, and would meet the traffic and transport objectives (refer Sections 3.1.6 and 3.3) as presented in Table 9-55.

Table 9-55 Project consistency with traffic and transport objectives

Traffic and transport objective	Consistency with objective
Increase infrastructure handling capacity and efficiency	▪ The project would improve performance of the road network (level of service). ▪ The project would result in a shorter travel time and less disrupted journey.
Improve safety and security	▪ The project would meet desing codes (ie traffic lane widths, shoulder widths, grades) to improve safety. ▪ The project would provide for a lower crash rate than the existing highway. ▪ The project would provide consistent dual carriageway driving conditions (including posted speed limit).

Traffic and transport objective	Consistency with objective
Improve transport productivity on its nationally strategic and export-oriented freight corridors	▪ The project would improve performance of the road network (level of service). ▪ The project would result in a shorter travel time and less disrupted journey.
Improve the reliability of travel on interstate and inter-regional corridors	▪ The project would improve performance of the road network (level of service). ▪ The project would result in a shorter travel time and less disrupted journey.

Transport infrastructure capacity, efficiency and productivity

Completion of the project as part of the Hume Highway Duplication would enable the improvement of travel efficiency and driving conditions on this nationally strategic and export-oriented freight corridor. As described above, the project would result in improved travel efficiencies (through travel time savings and better network performance), a less disrupted journey and improved road safety. This would facilitate increased infrastructure handling capacity and improved transport productivity.

9.7.5 Management of impacts

Table 9-56 identifies the mitigation and management measures that would be implemented for traffic and transport impacts. These measures have been incorporated into the draft statement of commitments in Chapter 11.

Table 9-56 Traffic and transport mitigation and management measures

Potential impact	Mitigation and management measures
Construction	
Reduced speeds, traffic delays and disruptions during construction	▪ Incorporate traffic control measures into construction vehicle movements and works programs to minimise traffic and transport impacts on local roads and the existing highway. ▪ Ensure that highway users and local communities are provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.
Local road dilapidation	▪ Prepare pre-construction and post-construction road dilapidation reports for local roads likely to be used for construction. Any damage resulting from construction (not normal wear and tear) will be repaired unless alternative arrangements are made with the relevant road authority.
Operation	
Local road access	▪ Maintain operation of local road accesses. Confirm the requirements for any changes to local access arrangements during detailed design in consultation with the relevant road authority and any affected landowners.
Operation of the travelling stock route	▪ Adopt reasonable and feasible measures in consultation with Hume Livestock Health and Pest Authority to maintain the travelling stock route between Mates Gully Road and Humula Road.