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Review of Environmental Factors
Main report and appendices

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Executive summary

The proposal

This Review of Environmental Factors (REF) describes the potential impacts of the proposal to realign the Kings Highway (MR51) between Thurralilly Street and approximately 380 m east of Regent Drive, Larmer, east of Queanbeyan NSW. The proposal would include east and westbound overtaking lanes and would be approximately 1.2 km in length. It would replace a section of the existing highway, approximately 1.5 km in length.

Need for the proposal

The Commonwealth Department of Defence has constructed a new Defence Headquarters Joint Operations Command (HQJOC) approximately 14.5 km east of Queanbeyan. This has significantly increased traffic on the Kings Highway between Queanbeyan and the defence facility. The proposal is identified in the RTA's package of improvements for the Kings Highway to mitigate the facility's impact on road safety and traffic efficiency. The proposal is also identified in the NSW Government's State Infrastructure Strategy, in the program of works for the Illawarra – South East region and is consistent with the State Plan in that it would make the road safer and improve traffic efficiency.

This section of the Kings Highway has an 8% grade and a substandard 60 m horizontal radius curve. These characteristics significantly delay eastbound heavy vehicles and impact on overall traffic efficiency and traffic studies have identified the need for additional overtaking opportunities. This section of the Kings Highway has the most substandard horizontal and vertical alignment between Queanbeyan and the NSW/ACT border. The crash rate is 29.79 crashes per 100 million vehicle kilometres travelled with a severity index of 1.29.

The proposal is needed to address existing traffic inefficiencies and crash risks associated with the substandard alignment and the increase in traffic volumes as a result of the new facility. Without an upgrade, these road safety risks will continue to increase as traffic volumes increase over time.

Options considered

Three options were considered for the upgrade to the highway. Option 1 was the 'do nothing' approach, option 2 involved improving and widening the existing alignment of the Kings Highway whilst option 3 involved realignment of the Kings Highway between Thurralilly Street and Regent Road.

Option 3 is the preferred option due to the superior road safety, value for money and travel time benefits. Option 3 would also substantially reduce the amount of property acquisition required. This option provides for a much improved road safety environment for road users and utilises an old road corridor that was widened for a future realignment in 1992, when the Kingsway Estate was created. Option 2, although having similar environmental impacts is not economically viable due a zero benefit cost ratio and negative net present value and rate of returns.

Option 3 meets the project objectives, including providing a safe standard of road commensurate with its importance and use. It also provides the most practical and cost-effective option addressing the current and future road safety issues over the expected life of the road.

Statutory and planning framework

Consent is not required for the works due to the applicability of Clause 94 of the *State Environmental Planning Policy (Infrastructure) 2007* which permits development on land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

The works would be carried out by or on behalf of the RTA and accordingly are subject to assessment under Part 5 of the *Environmental Planning and Assessment Act, 1979*. Development consent from Queanbeyan City Council (QCC) is not required.

Community and stakeholder consultation

The consultation process for this proposal has been iterative and is ongoing. The RTA has consulted with the community, QCC, Ngunnawal Local Aboriginal Land Council and the Department of Defence.

Consultation with the community has included a number of consultation meetings, door knocks, community updates (brochures) and community information days.

Environmental impacts

Environmental impacts include:

- Removal of vegetation including two hollow trees which provide potential habitat to threatened fauna.
- Impact to the Hoary Sunray (*Leucochrysum albicans ssp albicans* var. tricolour) which is

listed as endangered under the Environment Protection and Biodiversity Conservation *(EPBC) Act.*

- Impact to the old Goulburn to Queanbeyan Road, which has a level of local heritage significance.
- Property acquisition of Firth Park and an existing sediment detention basin from QCC.
- Reduction in visual amenity for some residences.
- Increase in noise levels for some residences.
- Potential for erosion and sedimentation and dust (during construction).

Safeguards and best practice management measures for potential environmental impacts are proposed to minimise the impacts of the proposal and to ensure that there is no significant impact on the environment.

Justification and conclusion

The proposal is justified on the grounds that it best achieves the identified road safety and traffic efficiency objectives having also taken account of social, environmental and economic considerations. It is in accordance with the NSW government's strategic framework including the State Infrastructure Strategy and the State Plan and would address traffic volume increases as a result of the new Defence Headquarters Joint Operations Command (HQJOC) located east of the proposal.

The proposal has been assessed within the context of the principles of Ecologically Sustainable Development and by considering the Matters of National Environmental Significance, listed under the *Environment Protection and Biodiversity Conservation Act 1999.* The environmental impacts identified are considered to be manageable.

Display of the review of environmental factors

This REF will be on display for comment from Monday 21 September to Monday 26 October 2009. The documents can be accessed in the following ways:

Internet

The documents will be available as PDF files on the RTA website at www.rta.nsw.gov.au

Display

Copies of the REF can be viewed at the following location:

Queanbeyan City Library

257 Crawford Street

Queanbeyan NSW 2620

Hard Copy

To obtain a copy of this document please contact:

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Facsimile: (02) 4221 2590

How can I make a submission?

To provide a submission on the proposal, please send your written comments to:

RTA Project Manager – see above

Submissions must be received by Monday 26 October 2009.

Privacy information

All information included in submissions is collected for the sole purpose of assisting in the

assessment of this proposal. The information may be used during the environmental impact assessment process by relevant RTA staff and its contractors.

Where the respondent indicates at the time of supply of information that their submission should be kept confidential, the RTA will attempt to keep it confidential. However there may be legislative or legal justification for the release of the information, for example under the *Freedom of Information Act 1989* or under subpoena or statutory instrument.

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by other respondents but does not have access to any identifying information provided by other respondents, if a respondent has indicated that the representation should be kept confidential.

Any respondent may make a correction to the information that they have provided, by writing to the same address the submission was sent.

The information will be held by the Roads and Traffic Authority:

Level 6, 90 Crown Street

Wollongong NSW 2500

What happens next?

Following the submissions period, the RTA will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.

Community submissions received will be considered, along with other matters, by the RTA in determining whether the proposal should proceed as proposed or whether any alterations to the proposal are necessary. The community will be kept informed regarding this RTA determination.

If the proposal is approved, the RTA would proceed with the final design and tenders would be called for the construction of the project.

If you have any queries, please contact the RTA project manager, Paul Vecovski, on (02) 4221 2581.

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1 Introduction

1.1 Proposal identification

The Commonwealth Department of Defence has constructed a new Defence Headquarters Joint Operations Command (HQJOC) approximately 14.5 km east of Queanbeyan. The facility is staffed 24 hours a day, seven days a week with the majority of its 750 workforce on site during normal business hours. With the facility located well away from urban areas and not serviced by public transport, a significant increase in traffic has been forecast on the Kings Highway between the facility and Queanbeyan.

The Roads and Traffic Authority of NSW (RTA) has previously identified a package of proposed improvements designed to mitigate likely impacts of increased traffic to road safety and efficiency on the Kings Highway in New South Wales. The package covers a section of the Kings Highway approximately 8 km long, from Thuralilly Street on the outskirts of Queanbeyan to the NSW/ACT border. Apart from this proposal, it includes intersection upgrades at Weetalabah Drive, The Ridgeway and Captains Flat Road, the provision of additional overtaking opportunities and the sealing of road shoulders at various locations. Other components of the upgrade package would be assessed as separate activities.

This proposal to realign and widen a section of the Kings Highway between Thuralilly Street and approximately 380 m east of Regent Drive on the eastern edge of Queanbeyan was also identified in the RTA package of improvements. This section was found to have the worst horizontal and vertical alignment on the 8 km of the Kings Highway between Queanbeyan and the NSW/ACT border.

The proposal would realign the Kings Highway, within areas zoned for future road infrastructure, thereby improving the existing alignment, road safety and capacity.

The proposal would include:

- Approximately 1.28 km of new carriageway with median separation.
- Two eastbound lanes including a new overtaking/climbing lane and two westbound lanes.
- Provision for cyclists through construction of 2 m wide shoulders.
- Architectural treatments to some nearby dwellings based on recommendations from the noise assessment.
- The intersection of the Kings Highway and Regent Drive being relocated and divided into two access points.

The bypassed section of the Kings Highway would be made redundant. The RTA is undertaking consultation with the community and relevant stakeholders to determine the future use of the redundant section of highway.

The environmental assessment study area for the proposal is located within the Queanbeyan Local Government Area (LGA) and is in RTA's Southern region. The main land uses in the study area include residential, open space and industrial. Other land uses include the Molonglo Gorge Reserve, the Cuumbeun Nature Reserve and the Kowan Pine Forest. Two major water courses are in the study area, these are the Molonglo River and the Queanbeyan River (refer to Figure 1-1).

The proposal site is located on the eastern fringe of Queanbeyan in the suburb of Larmer. The proposal site is defined as the area of direct impact (ie the footprint of the works). It is in a semi-rural area with scattered residences. The majority of the proposal site is in an existing road corridor known as Goulburn Road which has an existing gravel road running its length (see Figure 1-2 and Figure 1-3).

The construction phase of the proposal is expected to last for approximately 15 months. The project would be jointly funded by the RTA and Commonwealth Department of Defence.

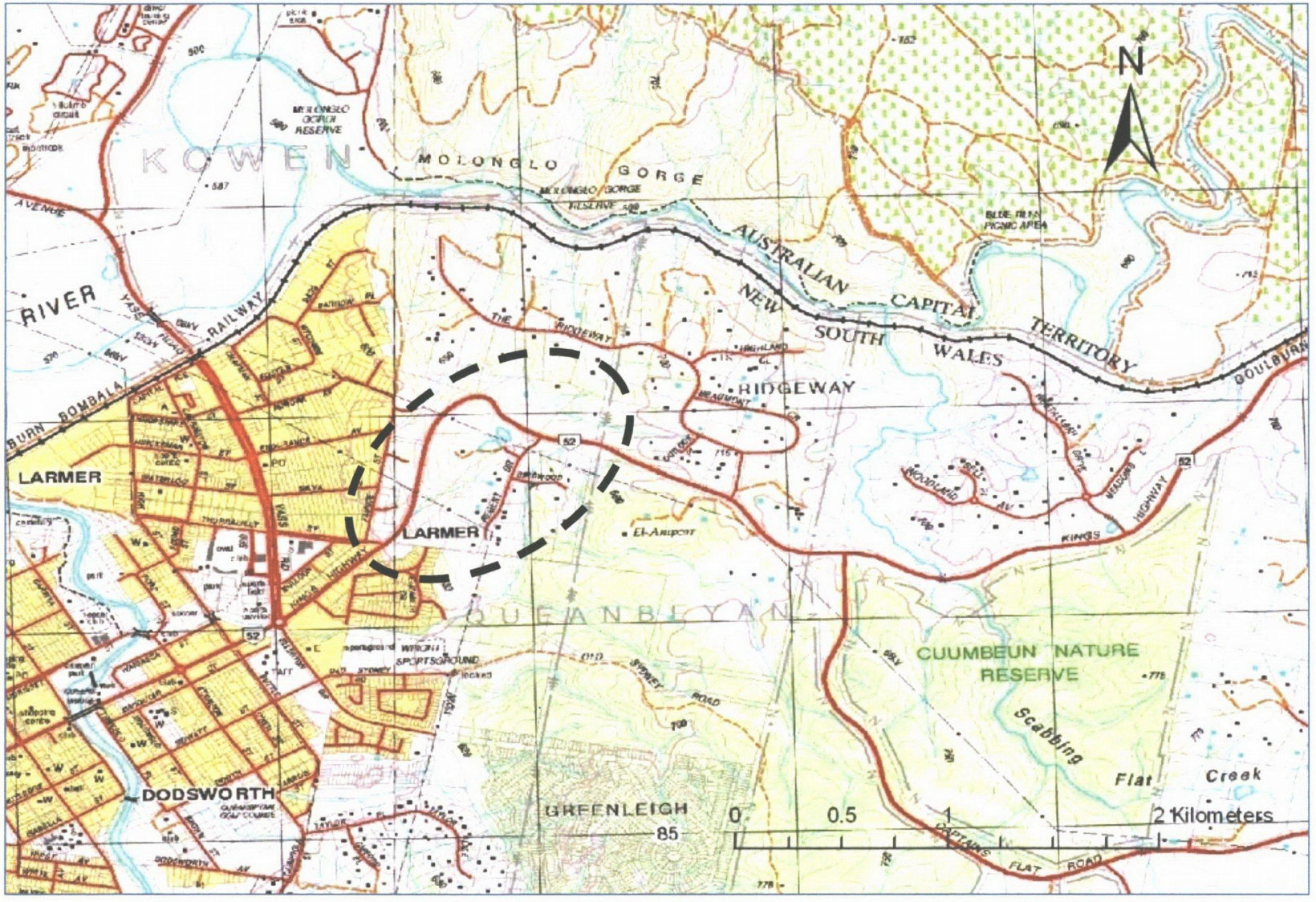


Figure 1-1 Locality of the proposed works (source: Department of Lands)

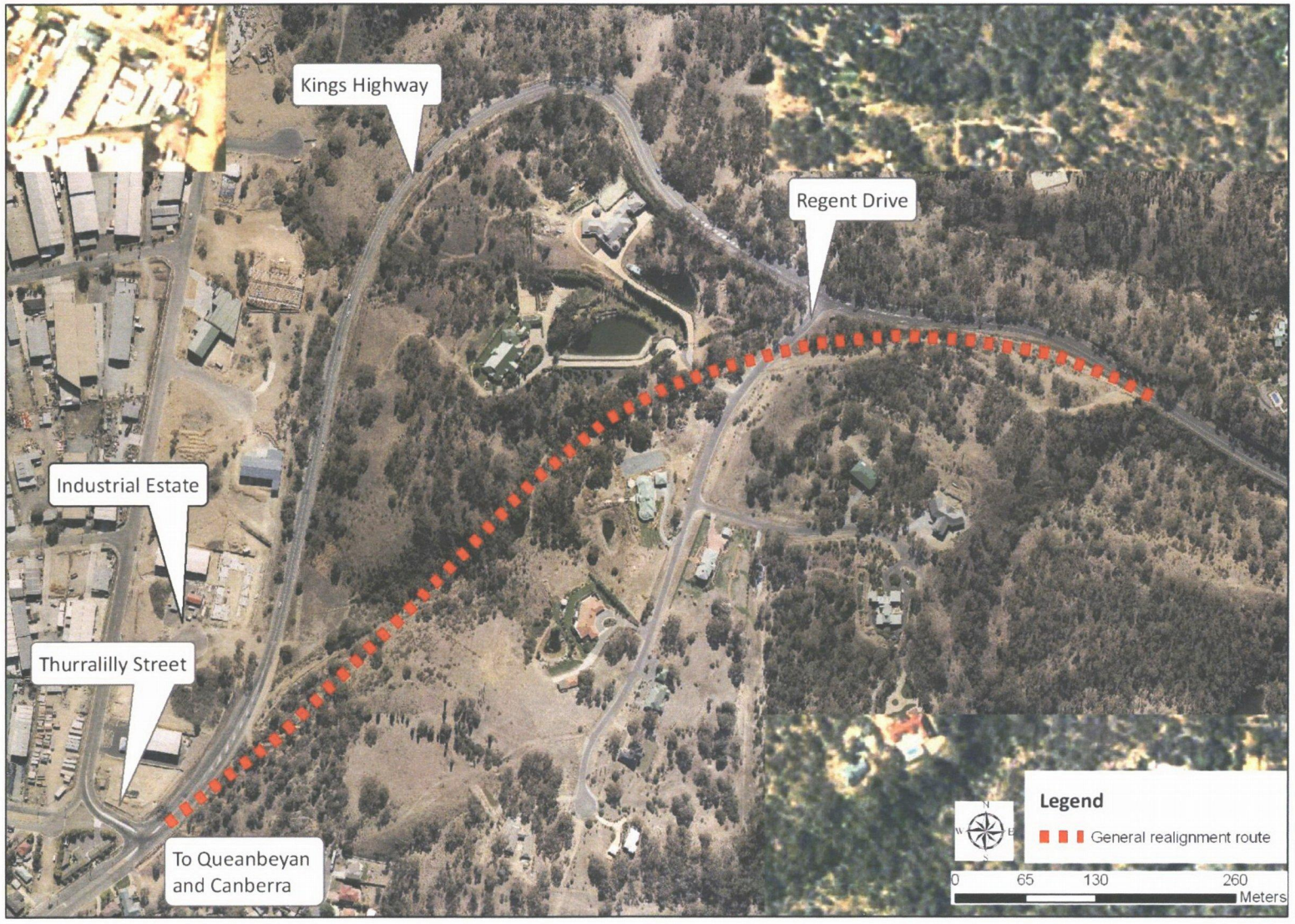


Figure 1-2: Route of the proposal from Thurralilly Street in the west to approximately 380m east of the Regent Drive intersection with the Kings Highway. (Aerial taken 26/04/2004)

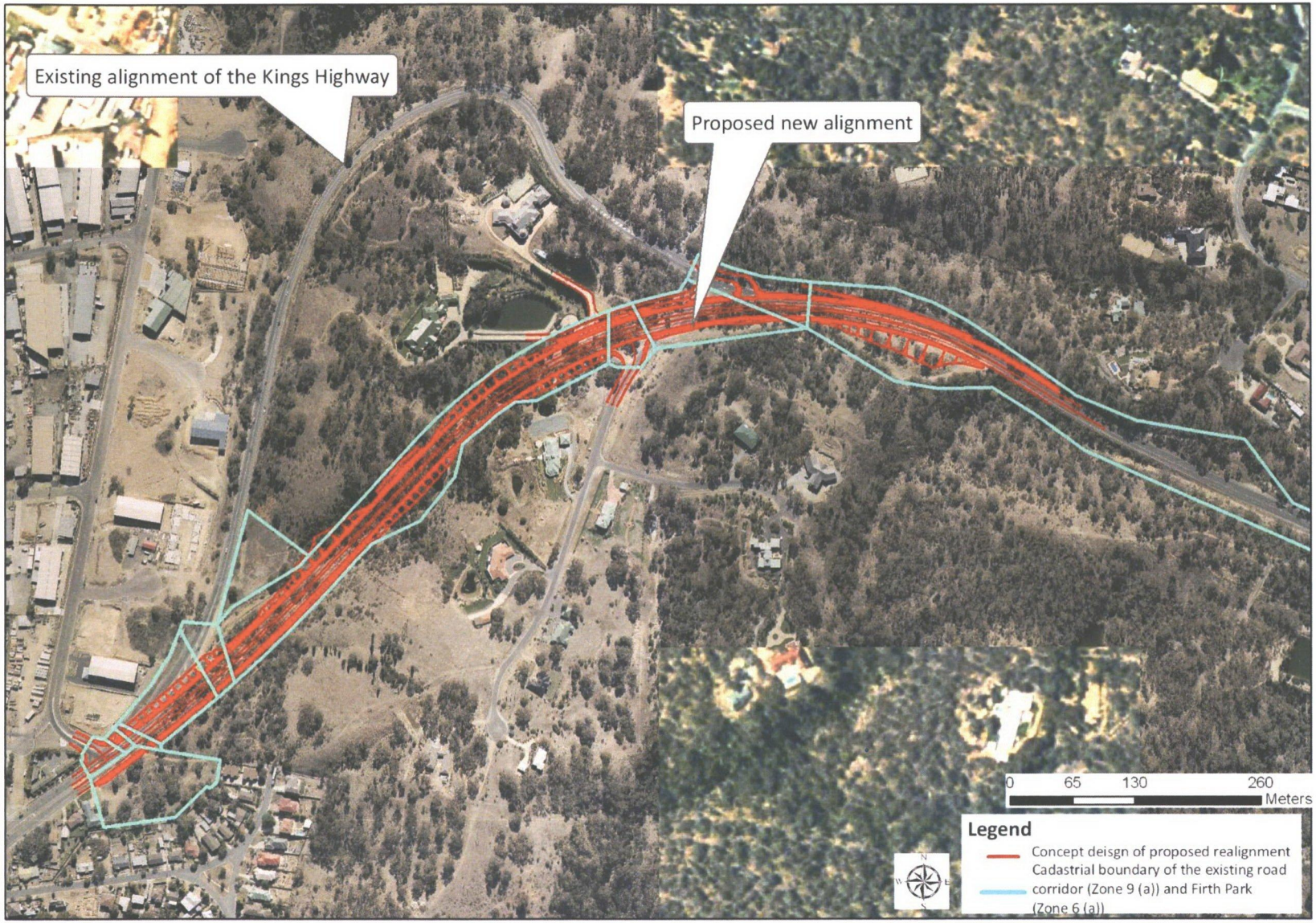


Figure 1-3: The concept design and the road corridor cadastral boundary (Aerial taken 26/04/2004)

1.2 Purpose of the report

This Review of Environmental Factors (REF) has been prepared by **ngh**environmental on behalf of RTA, Operations and Engineering Services, Southern region. For the purposes of these works, RTA is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposed works and associated environmental impacts have been undertaken in the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation Act 1995* (TSC Act) *the Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act, that the RTA examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for approval to be sought under Part 3A of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS); and
- The potential for the proposal to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) for a decision by the Commonwealth Minister for the Environment, Heritage and the Arts on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

2.1 Strategic need for the proposal

The Kings Highway is a major road connecting the Australian Capital Territory (ACT), Queanbeyan, Bungendore and the southern coastal areas of NSW. It is subject to relatively high traffic volumes including local and commercial traffic and an increase in recreational motorists during holiday seasons.

A new Federal Government Defence Headquarters Joint Operations Command facility (HQJOC) has been constructed approximately 14.5 km east of the proposal. The operation of this facility is expected to increase traffic on the Kings Highway between Bungendore and Queanbeyan by 800 to 1,400 counts in the morning and afternoon hourly peaks (RTA 2008). The Kings Highway between Thuralilly Street and Regent Drive had an Average Annual Daily Traffic Level (AADL) pre-HQJOC of approximately 12,000 vehicles. An analysis of preliminary traffic data[1] from the period immediately following the opening of the facility indicates an increase in the morning and hourly peak hours of approximately 300 vehicles an hour. Traffic volumes are expected to continue to grow towards the predicted maximum increase as the facility becomes increasingly active.

The percentage of heavy vehicles may also be expected to increase as would traffic delays, as heavy vehicles negotiate the existing 8% grade ascent on the Kings Highway, with no overtaking opportunities.

The Kings Highway between Thuralilly Street and Regent Drive has a demonstrated crash history and the most substandard horizontal and vertical alignment on the Kings Highway between Queanbeyan and the NSW/ACT border. The crash rate for this area based on AADT of 11099 is 29.79 crashes per 100 Million Vehicle Kilometres Travelled (MVKT) with a severity index of 1.29.

A review of all relevant strategic planning documents was undertaken to determine whether the proposal is consistent with the strategic aims and directions of those documents.

State Infrastructure Strategy – New South Wales 2008-09 to 2017-18

The NSW Government's State Infrastructure Strategy links long-term planning strategies with the State budget. It is designed to assist understanding of infrastructure needs and funding constraints. The strategy identifies key drivers for infrastructure demand in NSW including:

- Population growth and distribution.

[1] The post-opening data is considered preliminary until the surrounding road network adjusts to the additional traffic introduced by the HQJOC.

- Infrastructure renewal.

The strategy forecasts that the population in the Illawarra – South East region will increase by 9.4% between 2008-2018. It also identifies strong growth in the Canberra and Queanbeyan areas. The strategy outlines a program of works for the Illawarra – South East region, including improvement to the Kings Highway between Queanbeyan and Bungendore. The proposal is consistent with the strategy as it is identified in the program of works. It also responds to projected population growth by renewing road infrastructure servicing the region.

NSW State Plan – A New Direction for NSW

The NSW State Plan – A New Direction for NSW establishes a framework for delivering better services for the community from government agencies. It sets clear priorities for government action and includes targets for improving decision making and allocating resources. The plan sets a number of priorities for transport including:

- Maintain and invest in infrastructure (Priority P2).
- Make roads safer (Priority S7).
- Improve the efficiency of the road network (Priority E7).

The RTA is the lead agency for the provision of safer roads. The proposal would improve road safety by bypassing a substandard curve with a history of accidents. It is a long term investment in the road infrastructure network and would contribute to improved road efficiency, including by providing an east bound overtaking lane in addition to two westbound lanes. The proposal is therefore consistent with the NSW State Plan.

2.2 Proposal objectives

The objectives of the proposal are to:

- Improve road safety.
- Provide value for money by reducing travel times, and therefore vehicle emissions and vehicle operating costs.
- Provide more opportunities for motorists to safely overtake slower travelling vehicles.
- Reduce queuing at intersections and provide safer and more efficient access for motorists to the Kings Highway.
- Minimise acquisition of adjacent properties and construction impacts on residents.

2.3 Alternatives and options considered

2.3.1 Methodology for selection of preferred option

The RTA considered three options for meeting the project objectives. The preferred option was selected by evaluating each option against these proposal objectives, stated in Section 2.2.

2.3.2 Identified options

Option 1 – Do nothing option

The 'do nothing' option was considered for this proposal. It is important to assess any proposal against the 'do nothing' option to clearly identify the benefits being achieved compared with taking no action.

The 'do nothing' option would involve retaining the existing substandard curve and two lane section of the Kings Highway and maintaining it as required. The 'do nothing' option would minimise adverse effects on the environment, however it would not contribute to achieving the program of works identified in the NSW Government's State Infrastructure Strategy. It would result in a continued risk to the community of road accidents due to the substandard curve and lack of overtaking opportunities ascending a hill. As traffic volumes continue to increase, primarily as a result of full operation of the HQJOC facility, the safety, capacity and efficiency of the Kings Highway would be reduced. The 'do nothing' option would not meet the strategic need or the proposal objectives as stated in Section 1.2 as it would result in no improvement in road safety, efficiency or capacity. As a result this option was not considered any further.

Option 2 - Widening and adjusting the existing alignment and road surface of Kings Highway

The existing alignment can not be widened to modern standards due to the substandard horizontal and vertical road geometry. Any improvement on the existing alignment would actually require a realignment of the highway. The RTA prepared a strategic concept design to meet the minimum design standards for an 80km/h sign posted speed limit with two eastbound lanes and one westbound lane. The resulting design would result in direct impacts on four private properties that would require multiple partial property acquisitions. It would also require the relocation of the intersection with Regent Drive. This option would be compatible with a proposed future Northern Ring Road that would bypass Queanbeyan to the north and link Canberra Avenue with the Kings Highway. It would not however, meet the project objectives in relation to providing value for money and minimising acquisition of adjacent properties.

Option 3 - Realignment of Kings Highway between Thurralilly Street and Regent Road

This option would improve the existing alignment, safety, efficiency and capacity of the Kings Highway. The RTA prepared a strategic concept design to meet the minimum design standards for an 80 km sign posted speed limit with two eastbound lanes and one westbound lane[2]. The resulting design includes a nearly straight (1500 m) radius horizontal curve and a 500 me radius horizontal curve and could primarily be constructed on land that is a combination of public road and land reserved under the Queanbeyan City Council (QCC) Local Environment Plan (LEP) for future public road without the need for any direct impact on neighbouring private property. It would also require the relocation of the intersection with Regent Drive. This option would be compatible with a proposed future Northern Ring Road that would bypass Queanbeyan to the north, linking Canberra Avenue with the Kings Highway.

The existing road corridor that extends from Thurralilly Street to Regent Drive formed part of the Kings Highway (then known as the Goulburn Road) prior to the current highway alignment being built in 1934. Prior to the approval and subdivision of the Kingsway Estate in 1992 this road corridor was already shown on the QCC LEP. As part of the subdivision, the corridor was widened to a uniform width and reserved on the LEP for future road use.

The majority of the preferred option is located within Zone 9 (a) *Road A – proposed roads* under the *QCC LEP 1998*. Two small parcels of public land managed by QCC would need to be acquired.

This option would render the pavement of the existing alignment of the Kings Highway redundant. The RTA has consulted with QCC and the redundant pavement and associated infrastructure will be removed and the road reserve rehabilitated[3], subject to an approved Rehabilitation Management Plan.

2.3.3 Analysis of options

Option 1 would not meet any of the project objectives and was therefore eliminated from further consideration.

During the ongoing development of the proposal, the RTA undertook an analysis of Options 2 and 3 against the project objectives. This analysis is detailed below in Table 2-1.

[2] Subsequent to the options analysis being completed, Option 3 was revised to include a second westbound lane. This second westbound lane is included in the current proposal.

[3] This activity is not part of the scope of works for this REF.

Table 2-1: Analysis of options against proposal objectives

Objective	Option 2	Option 3
Improve road safety	• Would be approximately 100 m shorter than existing alignment. • Would replace the substandard 60 m radius horizontal curve with a 240 m horizontal radius curve on a similar vertical alignment; improved road safety outcome. • Would provide a new eastbound overtaking/climbing lane; improved road safety outcome. • Would allow for median separation (potentially, a wire rope safety barrier); improved road safety outcome. • Would provide a new Regent Drive intersection with improved sight distance.	• Would improve road safety by significantly shortening the section of highway by approximately 350 m, from 1.150 km to 790 m. • Would replace the substandard 60 m radius horizontal curve with a 500 m horizontal radius curve on a similar vertical alignment; greatly improved road safety outcome. • Would provide a new eastbound overtaking/climbing lane; improved road safety outcome. • Would allow for median separation (potentially, a wire rope safety barrier); improved road safety outcome. • Would provide a new Regent Drive intersection with improved sight distance.
Provide value for money by reducing travel times, vehicle emissions and vehicle operating costs.	• Construction cost of $10.3 million, based on a strategic estimate. • Would be a similar length (approximately 100 m shorter) to the existing highway but would achieve slightly reduced travel times, vehicle emissions and vehicle operating costs. • Performs poorly using three RTA standard tools for the economic evaluation of new road projects. (A summary of these economic evaluations is presented in Table 2-3 below.)	• Construction cost of $11.7 million, based on a strategic estimate. • Would be significantly shorter than the existing highway by approximately 360 m and would therefore achieve greater reductions in travel times, vehicle emissions and vehicle operating costs. • Performs strongly using three RTA standard tools for the economic evaluation of new road projects. (A summary of these economic evaluations is presented in Table 2-3 below.) By being significantly shorter than Option 2, this option provides the community with significant value for money more quickly. This value is derived from formulas which consider community benefits in the form of: reduced vehicle operating costs and emissions, reduced travel times, crash savings and maintenance savings, calculated over the 40-year design life of the upgraded section of highway.
Provide more overtaking opportunities.	• Would provide a new eastbound overtaking/climbing lane.	• Would provide a new eastbound and westbound overtaking/climbing lane.
Reduce queuing time, provide efficient access	Both options would result in changed access arrangements at the Regent Drive intersection which would retain all existing movements. Due to the low number of vehicle movements, the changed arrangements would have no significant impact on intersection queuing or highway access efficiency.	Both options would result in changed access arrangements at the Regent Drive intersection which would retain all existing movements. Due to the low number of vehicle movements, the changed arrangements would have no significant impact on intersection queuing or highway access efficiency.

Minimise acquisition of private land as well as construction impacts on nearby residents.	Substantial construction impacts on residents required. Direct impact on up to four private properties, resulting in partial property acquisitions. This would include two properties to the south of the existing alignment (within Kingsway Estate) and two properties to the north (on the edge of Ridgeway Estate). Direct construction impacts would likely include noise, visual, air quality (dust), potential access restrictions and potential reduction of land value.	Potentially minimal acquisition of one private property required. There is an opportunity for cost savings through a negotiated purchase of a strip of private property immediately to the north of the proposed deviation. Partial (strip) acquisition required on two Council-owned parcels of land on either side of the road corridor at the most southern end of the realignment, near Thuralilly Street. This option would also result in construction impacts including noise, visual, air quality (dust), potential access restrictions and potential reduction of land value.

In response to community feedback received in 2008 (See Section 5.1) the RTA undertook further analysis of both options against a number of other considerations which are listed in Table 2-2 below.

Table 2-2: Analysis of options against additional considerations

Consideration	Option 2	Option 3
Noise impacts	While no detailed noise assessment of this option was undertaken, a desktop analysis indicates it may have noise impacts requiring mitigation on up to eight properties: • Two properties in Kingsway Estate • Two properties in Ridgeway Estate • Four properties on Bungendore Road, near Thuralilly Street	A detailed noise assessment has been undertaken and is referenced at Section 6.8 and provided in full in Appendix F. This option would have noise impacts requiring mitigation on up to ten properties: • Six properties in Kingsway Estate • Four properties on Bungendore Road near Thuralilly Street
Visual impacts	While no detailed visual assessment of Option 2 was undertaken, a desktop analysis indicated that option 2 had the potential to impact on a number of receivers to various extents.	A detailed visual assessment of this option has been undertaken, referenced in Section 6.9 and provided in full in Appendix F. This option would result in: • High level of impact to three receivers • Moderate to high impacts to one receiver • Moderate impacts to three receivers • Low to moderate impacts to one receiver • Long distance views with general low impact to mid distance views Mitigation techniques including planting are further discussed in Section 6.9.

Biodiversity impacts	A road-side assessment was undertaken by **ngh**environmental to understand biodiversity constraints associated with this option. Three hollow bearing trees and two large patches of Hoary Sunray were identified had the potential to be directly impacted. The area also represented potential habitat for the threatened orchids *Diuris aequalis and Caladenia tessellata*[4].	A detailed biodiversity assessment was competed for this option and is presented in Section 6.5 and Appendix B. This assessment identified that two hollow bearing trees and patches of hoary sunray were present within the proposal site. Further, areas of the proposal site represented potential habitat for the threatened orchids *Diuris aequalis and Caladenia tessellata.* The proposal site was subsequently searched during the appropriate flowering periods for these orchids. No individual plants were observed during the targeted searches. It is considered that the implementation of mitigation measures as described in this REF would appropriately manage potential biodiversity impacts.
Utilities	Preliminary analysis indicates no notable constraints.	Preliminary analysis indicates no notable constraints.
Geotechnical	Preliminary analysis indicates no notable constraints.	Preliminary analysis indicates no notable constraints.
Physical considerations	Moderately constrained by landscape factors. The existing alignment cannot be widened to allow for an additional eastbound overtaking/climbing lane. It would involve large-scale earthworks, including a substantial fill off the northern side of the ridge and a sizeable cut through the ridge with associated visual impacts. Existing traffic cannot be diverted during construction hence, this option would need to be constructed while under traffic, adding to its complexity and risk.	Moderately constrained by the width of the reserved road corridor and by the large semi-rural residential lots on either side of the corridor. The strategic concept design (Appendix A) indicates there is sufficient space available to construct two eastbound lanes (with a 2 m shoulder), two westbound lanes (with a 2 m shoulder) and a 2.6 m wide median within the corridor. Existing traffic can be diverted during construction for approximately two-thirds of the route. Only one-third of this option would need to be constructed while under traffic.
Constructability	As stated above, construction 'under traffic' for the majority of the construction phase would likely result in increased delays and presents an increased safety risk to construction employees and members of the public.	As stated above, predominately constructed away from the exiting alignment of the King Highway, reducing construction impacts on users of the Kings Highway during the construction phase.

[4] Survey period in late August was not suitable to detect flowering individuals of these species.

Table 2-3: Economic evaluation of options two and three

Option	Benefit/cost ratio[5]	Net present value[6]	First year rate of return[7]
2	0.0	-$9.9M	-5.9%
3	3.1	$23.3M	14.7%

This analysis provides a notable point of difference, with option three clearly outperforming option two which achieves results so poor as to render it virtually unviable.

Option two does not demonstrate a positive net present value even though it is less expensive to construct.

Option three achieves strong net present values at all ranges considered despite being more expensive to construct. It also achieves strong benefit cost ratios.

These strong relative benefit cost ratio's are a function of the significant cumulative cost savings in the form of reduced vehicle operating costs and emissions, travel time savings, crash savings and maintenance costs over the 40-year design life of the upgraded section of highway.

2.4 Preferred option

The options analysis found that Option 3 - *Realignment of Kings Highway between Thurralilly Street and Regent Road*, best met the objectives of the proposal. In comparison to Option 2, Option 3 would achieve better road safety, value for money, travel time and property acquisition outcomes. It would provide a straighter and safer road alignment.

Option 3 would be approximately 10 percent more expensive to construct but would provide greater value for money across a number of other economic considerations; it would reduce the overall length of this section of road by approximately 350 m (approximately 22 percent), with subsequently reduced

[5] The benefit/cost ratio is the ratio of the returned benefits of an investment proposal relative to its costs. It is a summary of value for money of an investment proposal.

[6] The net present value of a proposal to invest in infrastructure is the current value of the total current and future costs and benefits of the proposal. Broadly speaking a positive net present value indicates a worthwhile investment and a negative net present value indicates an unsound investment.

[7] The first year rate of return is the percentage of the cost of a proposal returned as benefits in the first year.

vehicle operating costs and emissions, reduced travel times and reduced crash risks, calculated over the 40-year design life of the upgraded section of highway.

Option 3 could be constructed without requiring the acquisition of any private property, although the RTA acknowledges there is the potential for cost savings by negotiating the acquisition of a small strip of land from one private property owner. Option 3 is also considered more constructible, as much of the work would be undertaken outside of the existing highway alignment, prior to the commissioning of the new alignment. Identified environmental impacts can be mitigated in line with current best practice and government guidelines in consultation with the community, as set out in this REF.

The preferred option is described in detail in Section 3.

3 Description of the proposal

3.1 Existing road and infrastructure

3.1.1 Kings Highway

The Kings Highway between Thurralilly Street and approximately 380 m east of Regent's Drive, is a two to three lane single carriageway, generally following a ridgeline. There are intersections with local roads at Thurralilly Street and Regent Drive. The existing highway does not formally intersect with the Goulburn Road corridor, rather they merge, refer to Figure 1-2.

At the Thurralilly Street intersection, there is an eastbound pull-in lane and a dedicated right turn lane for west bound traffic. East of Thurrallilly Street, the highway narrows into a two lane single carriageway for approximately 750 m, with lane widths of approximately 3 m. There is an eastbound overtaking lane from approximately 250 m west of the Regent Drive intersection to beyond the proposal site. There is a left and right turn pull-in /out lane at the junction of the Kings Highway and Regent Drive.

The section of the Kings Highway proposed to be realigned has a signposted speed limit of 90 km and is approximately 1.585 km long. The substandard curve has a 60 m horizontal alignment. There are no dedicated footpaths.

Surface drainage consists of open table drains along the eastern edge of the highway. Kerb and guttering is located on both sides of the King Highway in the vicinity of Thurralilly Street. A guardrail commences at 500 m from Thuralilly Street and extends for 500 m on the western side of the current alignment. In the first 120 m there is a sealed shoulder. The shoulder adjacent to the remainder of this section of guardrail is unsealed. There is no guardrail on the eastern side of the current alignment.

There are two private properties with access directly onto the Kings Highway. These accesses are single lane accesses on the northern side of the existing Kings Highway, immediately west of the Regent Drive and Kings Highway intersection.

Uphill gradients along this section of the highway range from 4% to 8% with crossfalls up to 11%.

There are two "gates" denoting the Kingsway Estate located at the intersection of the Kings Highway and Regent Drive. These gates would be relocated to the new intersections as part of the proposal.

3.1.2 Goulburn Road corridor

The Goulburn Road corridor is currently owned by Queanbeyan City Council and has an existing gravel track which is no longer in regular vehicular use. This gravel track traverses a hill on a slight grade. An unnamed drainage line is located along the western edge of the track. There are two sections along the track with cuttings. Images of the track are presented in Figure 3-1.

There is no 'typical' associated road infrastructure such as drains, culverts or kerb and guttering within the Goulburn Road corridor. There are no fences or gates restricting access to the gravel track. The gravel track intersects Regent Drive and Hill Lane in the northern portion of the Goulburn Road corridor and is easily accessible via Regent Drive and Hill Lane.

A section of the Goulburn Road corridor looking north east

Cutting on eastern side of Goulburn Road corridor

Figure 3-1: The Goulburn road corridor

3.1.3 Stormwater detention basin

There is a stormwater detention basin located in the south western section of the proposal site, refer to Figure 6-2. It is estimated the detention basin has a current input capacity of 4.23 cumecs[8] for a 1:100 year flood event. This detention basin was constructed to limit the impact of any floodwaters to the Carwoola Industrial Estate located to the west of the proposal site.

3.2 Design parameters

The design criteria, engineering constraints and major features of the proposal are discussed below. The concept design for the proposal is provided in Appendix A. The concept design may be refined following public exhibition of this REF and during the detailed design phase.

[8] A cumec is a measure of flow rate meaning *cubic metre per second*

3.2.1 Design criteria

The proposal would result in a 100 km design speed and a sign posted speed limit of 80 km. A typical cross section consists of a 3.5 m wide travel lane, a 2 m wide sealed shoulder for eastbound traffic and a 2 m wide sealed shoulder for westbound traffic. Cross falls would be applied in accordance with the RTA Road Design Guide. To reduce the risk of head on collisions, a 2.6 m wide painted median strip would be provided. The option to install a wire rope in the median would also be considered.

The proposal identifies the use of a flexible asphalt road surface instead of a sprayed seal due to asphalt's improved acoustic properties and durability. No pathways for pedestrian access would be provided along the Kings Highway[9].

Geotechnical investigations indicate that the proposal would not require any shot-crete or rock bolts to stabilise the cuttings. Safety barriers would be required for the proposed realignment. At present wire rope safety barriers have been proposed however concrete safety barriers may also be considered.

Horizontal and vertical geometry

The proposed horizontal alignment consists of the extension of the existing straight from Thurralilly Street into a left hand curve (100 km design speed). This leads into a small straight and then a longer right hand curve (100 km design speed) which would tie back into the existing Kings Highway, approximately 380 m east of Regent Drive. The concept plan is primarily located within the existing corridor.

The proposed vertical alignment transitions from the existing 6.7 % vertical grade at Thurralilly Street to an 8 % vertical grade for the entire length of the proposal where it would be matched to the existing Kings Highway east of Regent Drive.

3.2.2 Engineering constraints

A number of constraints have been identified for the design and construction of the proposal. These include:

- The limited space available to achieve the design objectives within the existing road corridor.
- The fill batters for the fill embankments were designed to minimise the width of the proposal and keep it within the designated road corridor.
- Maintenance of property access during construction and operation.

[9] The RTA is currently liaising with QCC regarding the construction of a pedestrian access way to Queanbeyan.

- Utilities are located in the corridor and relocation/protection would be needed (refer to Section 3.5).

3.2.3 Major Design Features

Cut and Fill

Four cuts and fills are located along the proposal. Batters for the cuts and fills have been designed by the RTA to meet geo-technical requirements and minimise the footprint of the road within the current road corridor. A summary of the cut and fill batter design is presented in Table 3-1 below.

Intersections

Two new intersections would be provided for access to homes in the north west and south east of the proposal site, refer to Figure 3-2. The new intersection located in the west of the proposal site would service two homes and allow for both east and west bound access to the Kings Highway. Similarly, the proposed new intersection off Regent Drive would allow for east and west bound access to the Kings Highway. This intersection would service residents of Regent Drive and Birdwood Place.

Drainage works

The unnamed drainage line along the Goulburn Road corridor would be impacted by drainage works. Drainage works would require the installation of a combination of subsurface (piped) and surface drainage systems. Wherever practicable, the existing drainage line would be retained and if required stabilised eg with gabion mattresses etc. There are four pipe lines proposed as part of the works. The pipes range in size from 450 mm to 900 mm diameter. Outlet dissipaters would be constructed as required to reduce flow velocities to levels that minimise the risk of scour. Drainage paths between culverts would be rock lined to minimise scouring and maintenance required. Pipes, pits and headwalls would be precast and delivered to site. Dissipaters would be formed and poured on site.

Sediment basins

The RTA proposes to use the existing stormwater detention basin, located in the southern portion of the proposal site (refer to Figure 6-2), as a sediment basin during the construction phase. This detention basin was installed as part of the industrial estate located on Thurralilly Street and has a current capacity of approximately 4.23 cumecs for a 1:100 year event. Hydrological analysis for the same storm event indicated that discharge into the basin would be in order of 2.05 cumecs. Thus it is considered that the detention basin has sufficient capacity to act as a sediment basin during construction of the proposal.

One additional sediment basin would be constructed with a capacity of 120 m^3. This sediment basin would be located on the eastern side of the existing Kings Highway alignment opposite Thurralilly Street, in Firth Park, and would be removed and rehabilitated at the completion of the construction phase. It is anticipated that this sediment basin would service the immediate up gradient catchment that includes the

proposal site.

Reinforced earth walls

It is likely that a reinforced earth wall would be required for the proposal. It would likely consist of concrete panel facing. Straps connected to the panels would be held in place by compacted backfill material. Generally the backfill material would be a quarry product. This construction would be subject to the urban design objectives and principles for the proposal.

Architectural treatment

The RTA considered a range of possible noise mitigation measures including noise walls and noise mounds but has found that architectural treatments are the most appropriate in terms of urban design and the only form of feasible and reasonable noise control for this proposal (refer to Section 6.8 for further discussion).

At buildings where noise mitigation would be required, architectural treatments would be considered in consultation with the landowner and would be implemented where appropriate. Options considered would include one or more of:

- Fresh air ventilation systems that meet Building Code of Australia requirements with the windows and doors shut.
- Upgraded windows and glazing and solid core doors on the exposed façades of masonry structures only (these techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls).
- Upgrading window and door seals.
- The sealing of wall vents.
- The installation of external screen walls

Urban design objectives

The planning and design of the proposal will be governed by the RTA's urban design principles of:

- Contributing to urban structure and revitalisation.
- Fitting with the built fabric.
- Connecting modes and communities.
- Fitting with the landform.

- Responding to natural pattern.
- Incorporating heritage and cultural contexts.
- Designing roads as an experience in movement.
- Creating self-explaining road environments.
- Achieving integrated and minimal maintenance design.

Refer to the RTA Beyond the Pavement urban design policy, procedures and design principles for further explanation of these principles. These would be tailored to the proposal location and scope during the detailed design stage.

3.3 Construction activities

3.3.1 Work methodology

The work methodology for the proposal would be refined during the detailed designed phase. Construction activities would be guided by a Construction Environmental Management Plan (CEMP) to ensure that works are located within the specified works area and are completed to incorporate all safeguards as described in this REF and any subsequent measures included as a result of submissions to the REF. The proposal is expected to involve the following work methodology:

- Seed collection prior to construction for rehabilitation works where practicable.
- Progressive installation of temporary erosion, sedimentation and drainage controls.
- Adjustment of utilities as required (this may include electricity, telecommunications, gas, water and sewer).
- Establishment of a compound site.
- Establishment of stockpile sites.
- Removal of vegetation and grubbing.
- Drainage works.
- Construction of retaining structures including footings.
- Surface preparation by graders, dozers, scrapers and other equipment.
- Compaction of the resultant surface using compaction equipment.

- Recycling of suitable excavated material and incorporation of suitable material in earthworks.
- Cut and fill material to be transported and placed as compacted fill.
- Importation of gravel materials.
- Installation of roadside drainage structures (note all drainage structures would be constructed on site).
- Construction of roadside batters.
- Construction of roadside gutters and berms.
- Application of flexible asphalt pavement by pavers and rollers.
- Landscaping and re-vegetation of proposal site.
- Installation of line marking, signs and guide posts.
- Site clean up and disposal of all surplus waste materials.

No specific staging of the works is anticipated.

3.3.2 Plant and equipment

Plant and equipment needed for the proposal would be determined during the construction planning phase. It is expected that plant and equipment used for the proposal would include:

- 30 tonne excavators
- air compressors
- asphalt milling machine
- asphaltic paving machines
- bulldozers
- chain saws
- concrete cutters
- concrete pump
- concrete vibrators
- cranes / hiabs
- demolition saw
- excavation plant
- front end loaders
- graders
- jack hammers
- kerbing machine
- road sweeper
- rollers/vibrating compactors
- scrapers
- small excavator or backhoe
- stump grinder
- dump trucks
- trucks

- concrete supply agitator trucks
- line marking vehicles
- mulcher
- water tankers
- light vehicles
- pneumatic hand or power tools

3.3.3 Earthworks

In accordance with the current concept design the total volume of material sourced from the cuts would be 24,300 m^3. Estimates have determined that there would be a deficit of material from cut to fill. A total of 48,100 m^3 of fill would be required to build up the level of the road surface. Thus approximately 23,300 m^3 would be required to be imported to the proposal site. The accuracy of fill required is subject to variations in bulking factors for excavated material, relative compaction achieved for placed material and volume of unsuitable material. Additionally, approximately 13,300 m^3 of pavement materials would be required to be imported.

The material would be sourced from locations outside of the proposal site (see Section 3.3.4 below) and transported to the site using trucks.

The approximate locations and volumes of cut and fill material proposed is set out in Table 3-1.

Table 3-1: Approximate locations and volumes for proposed cut and fill works.

Approximate chainage		Cut / Fill /Pavement Identification	Estimated Volume (m^3)
Eastern end	Western end		
62760 m	62960 m	Cut	10,900
		Fill	500
		Pavement	1900
62960 m	63380 m	Cut	3500
		Fill	25,700
		Pavement	5300
63380 m	63520 m	Cut	3700
		Fill	10,700
		Pavement	1500
63520 m	63900 m	Cut	6200
		Fill	11,200
		Pavement	4300

3.3.4 Source and quantity of materials

Additional fill material for the proposal would be sourced from surplus materials from other RTA projects, wherever possible. Other fill material required for the construction of the reinforced earth walls

and the road pavement would be sourced from appropriately licensed facilities.

Exact material quantities are unknown at this stage but would include concrete, steel, aggregate, road furniture and quarry materials. These materials would be sourced from local quarries and commercial suppliers wherever possible. Initial estimates of quantities of material required include:

- 8400 m^3 of road base.
- 4200 m^3 of asphalt.
- 3000 m^3 of reinforced earth wall backfill (if required).
- 300 m^3 of concrete.
- 400 m^3 of aggregate.

3.3.5 Traffic management and access

The proposal would generate traffic during the construction phase. The majority of the work would be located away from the traffic flow on Kings Highway and traffic flow along the existing alignment of the King Highway would largely be unchanged.

There would be a large number of heavy vehicle movements resulting from the proposal. The movements would primarily be associated with the transportation of construction machinery and equipment to the proposal site, the importation of fill material via trucks (estimated to be a total of 1,700 for the construction period) and removal of machinery post construction. Construction vehicles would access the proposal site from the Kings Highway opposite Thurralilly Street and Regent Drive. Approximately 20-25 additional heavy vehicle movements are anticipated per day during construction with an additional 6 to 10 trucks making small onsite movements. Further it is estimated that an additional 40-50 trucks per day would be required for the importation of fill and 40-50 trucks per day for importing pavement. It is anticipated that the importation of fill would take approximately 30 days. Additionally, it is anticipated that the importation of asphalt would also take 30 days.

A Traffic Management Plan would be prepared to provide for two-way traffic flow and turning movements. Two-way traffic flow would be maintained on the Kings Highway for most of the construction period. At times during construction, traffic may be restricted to one lane with traffic control implemented on the Kings Highway. This would occur when the proposal is being connected to the existing alignment of the Kings Highway. The traffic management plan would also detail specific routes that construction traffic would follow throughout the construction phase.

The proposal would result in intersection changes to existing access arrangements for residential

properties located adjacent to the northern portion of the proposal area, refer to Figure 3-2. The intersection of the Kings Highway and Thurralilly Street would also be subject to change as presented in Figure 3-3.

Table 3-2: Description of proposed new intersections

Property location	Current access/intersection arrangement	Proposed new access/intersection arrangement
Two properties located west of proposed realignment	Access to Kings Highway via Hill Lane and Regent Drive	Access to Kings Highway via new intersection near current Regent Drive intersection.
Properties located along Regent Drive and Birdwood Place	Access to Kings Highway via Regent Drive and Birdwood Place	Access to Kings Highway via new intersection near current Regent Drive / Hill Lane intersection.

Traffic during construction would be managed as follows:

- The Contractor would be required to prepare a Traffic Management Plan, in accordance with the RTA Specification G10 - Control of Traffic.
- Traffic control devices, such as safety barriers, would be installed to protect the workforce during the construction phase.
- All temporary traffic control measures would be carried out in accordance with the RTA document Traffic Control at Work Sites, Volume 3.1.
- Access for residents adjacent to the proposal would be maintained at all times, although there may be some short delays.
- Construction traffic would enter/exit the construction zone only in areas designated for this purpose in the Traffic Management Plan.
- The community would be kept informed about upcoming road construction activities, including through advertisements in the local media and by prominently placed advisory notices.

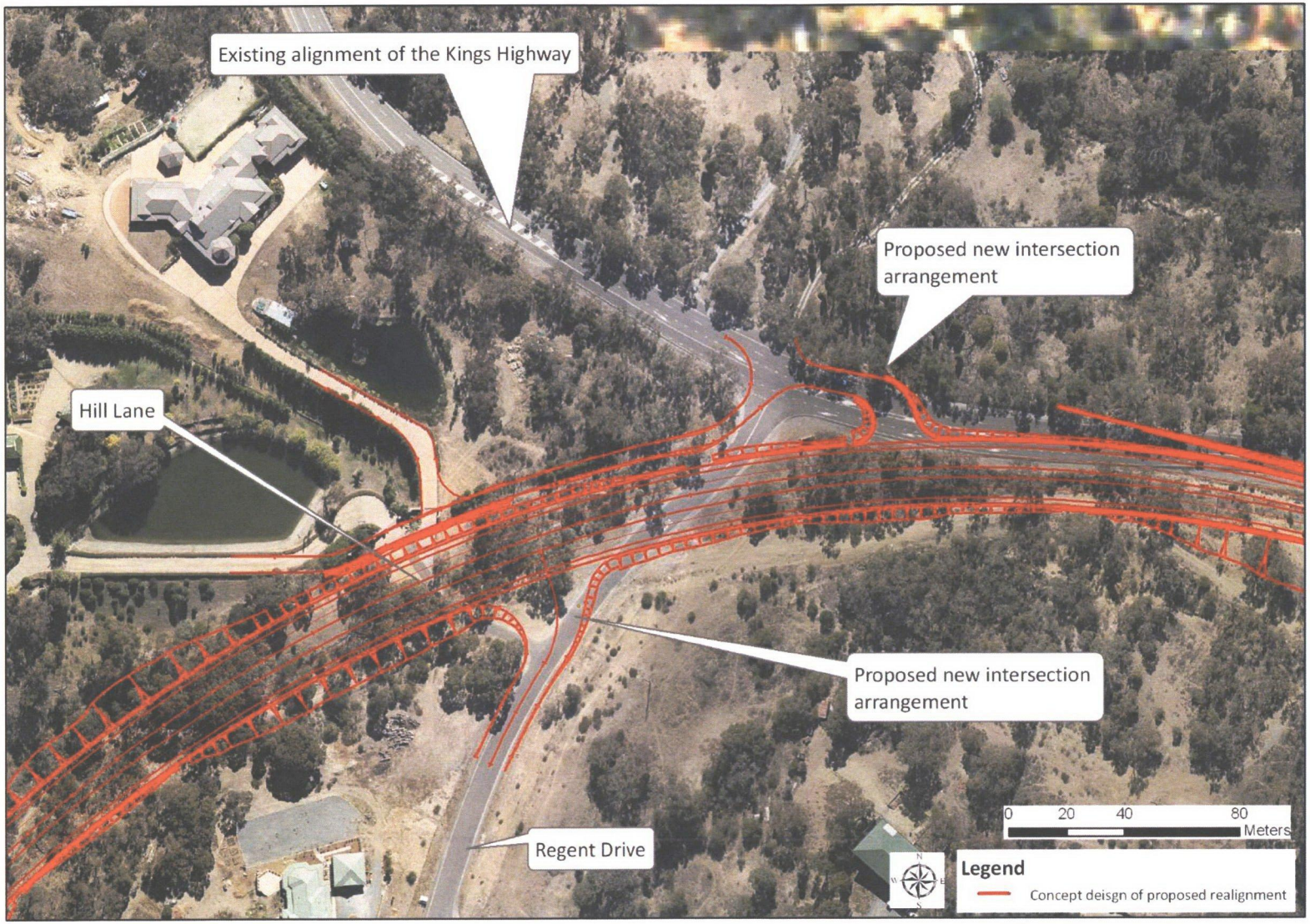


Figure 3-2: General location of new intersections in the northern portion of the proposal site **(Aerial taken 26/04/2004)**

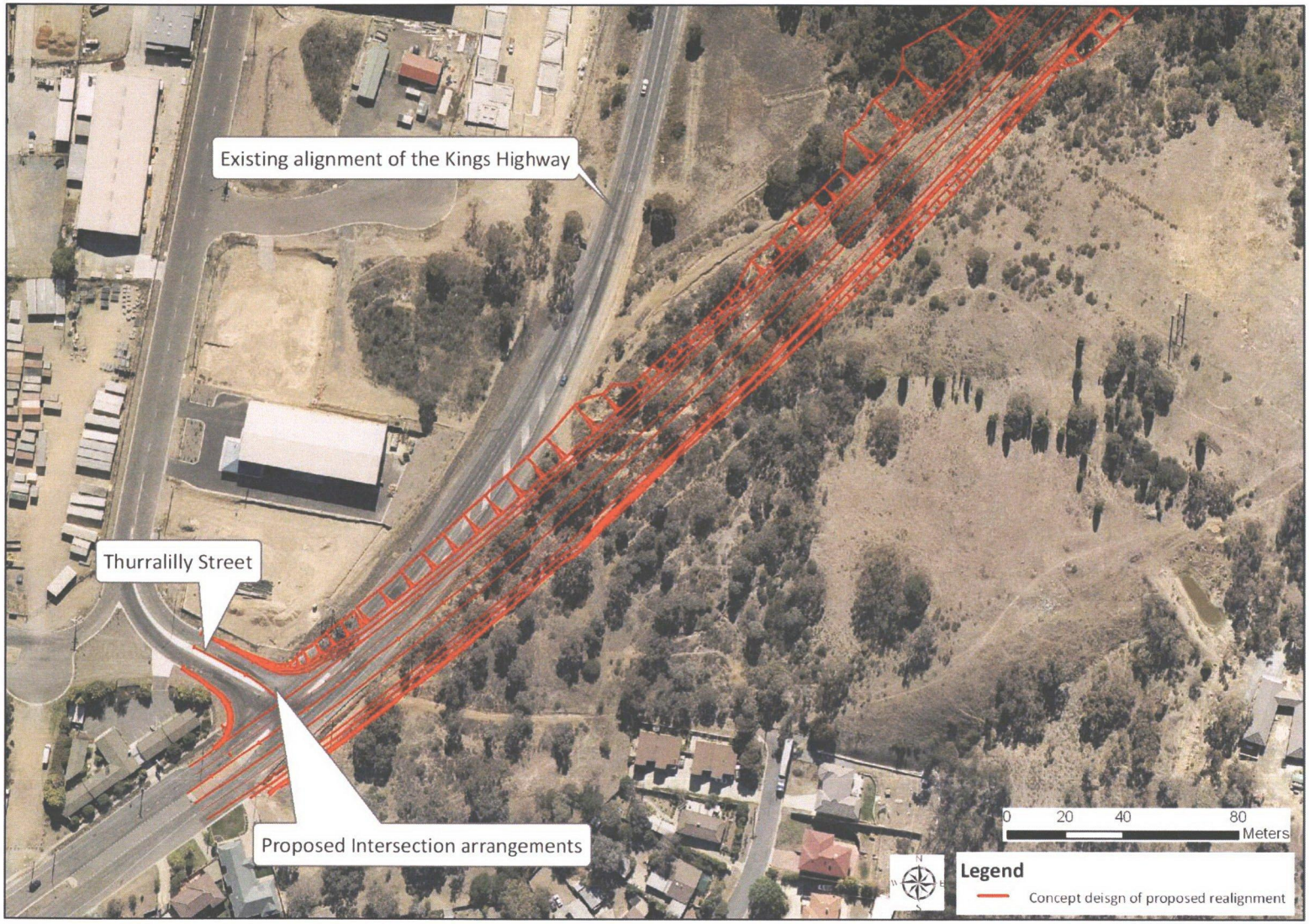


Figure 3-3: General location of new intersection in the southern portion of the proposal site **(Aerial taken 26/04/2004)**

3.4 Ancillary facilities

Ancillary facilities would include a site compound and stockpile sites. Ancillary facilities would be subject to an approved Construction Environmental Management Plan (CEMP).

The site compound would be used to store plant and equipment as well as allowing for construction staff parking, toilets and amenities. Chemicals and fuels required for construction would also be stored in appropriate storage areas within the compound site. The compound and stockpile sites would be subject to the site location criteria set out in the RTA's *Stockpile Site Management Procedures* (RTA 2001). Three options currently exist for the location of the compound site. All of these options are in cleared areas adjacent to the Kings Highway and Captains Flat Road intersection. Two of the alternative compound sites are outside of the proposal site, the Council Depot off Ellerton Drive (subject to negotiations with Council) and an area within the neighbouring industrial estate. The most likely alternative for the compound site is located adjacent to the Kings Highway and Captains Flat Road intersection and is currently being used as a compound and stockpile site for an RTA project further east on the Kings Highway.

The location of a compound and stockpiles is difficult to determine at this stage of project development and would be subject to change during the detail design stage and to that end a preferred site has not yet been selected. When a suitable compound site location is determined during the detailed design phase, RTA regional environmental staff would be consulted for advice on the level of further environmental assessment required. Further assessment may include the preparation of an addendum to this REF once the final site has been identified.

The locations for the compound and stockpile sites would be selected using the following guidelines when practicable:

- Areas not prone to flash flooding and more than 40 m from a watercourse.
- Areas more than 50 m from residential areas, schools, churches or hospitals.
- Located in areas previously disturbed and that do not require the clearing of native vegetation.
- Located in plain view of the public to deter theft and illegal dumping.
- Stockpiles would be maintained outside the drip line of trees and be level wherever possible.
- On stockpile sites that occur on sloping land, a sediment fence would be installed on the downhill side of the stockpile to avoid the discharge of turbid runoff.

3.5 Public utility adjustment

Water, sewer, gas and telecommunications are present within the proposal site. Electricity transmission lines and poles, street lights, road signage, fencing and road safety barriers are also present within the proposal site. Details of utilities are presented in the Concept Design Plans (refer to Appendix A).

The timing and staging of the relocation of utilities and other roadside infrastructure would be carefully managed to minimise disruption to services and inconvenience to residents and road users.

Consultation would be undertaken with the relevant utility agencies and the "Dial Before You Dig" hotline would be contacted. Consultation with relevant utility agencies would be ongoing prior to, and during, detailed design and construction of the proposal.

3.6 Property acquisition

The majority of the proposal is within an existing public road corridor or reservation. The requirement for acquisition of land has been identified immediately opposite Thurralilly Street, at the south-western end of the proposal (Refer to Figure 3-4). The requirement to acquire this land is due to the narrow width of the road corridor in the southern portion. The land proposed to be acquired is Firth Park (Lot 39 DP 26219) and is zoned 6(a) Open Space A. Firth Park is classified as community land wholly owned by Queanbeyan City Council.

The RTA is currently in negotiations with Queanbeyan City Council regarding acquisition of this land. Currently it is not known how much of Firth Park would need to be acquired. Drainage calculations are underway to identify the size of the pipes needed in this section of the proposal, this will determine the amount of acquisition at Firth Park. A small portion of the existing detention basin would also be acquired from Queanbeyan City Council.

For the purposes of this REF it has been assumed that the entire parcel of land would be acquired. When the extent of land required is known, advice would be sought from RTA regional environmental staff to determine whether any further assessment is required.

There is also the potential for the RTA to lease land from the neighbouring industrial estate for use as compound site. The RTA is currently investigating this option and would be dependant on negotiations with owners of the industrial land.

All property valuations and acquisitions would be carried out in accordance with the RTA Land Acquisition Policy and the *Land Acquisition (Just Terms Compensation) Act 1991*.

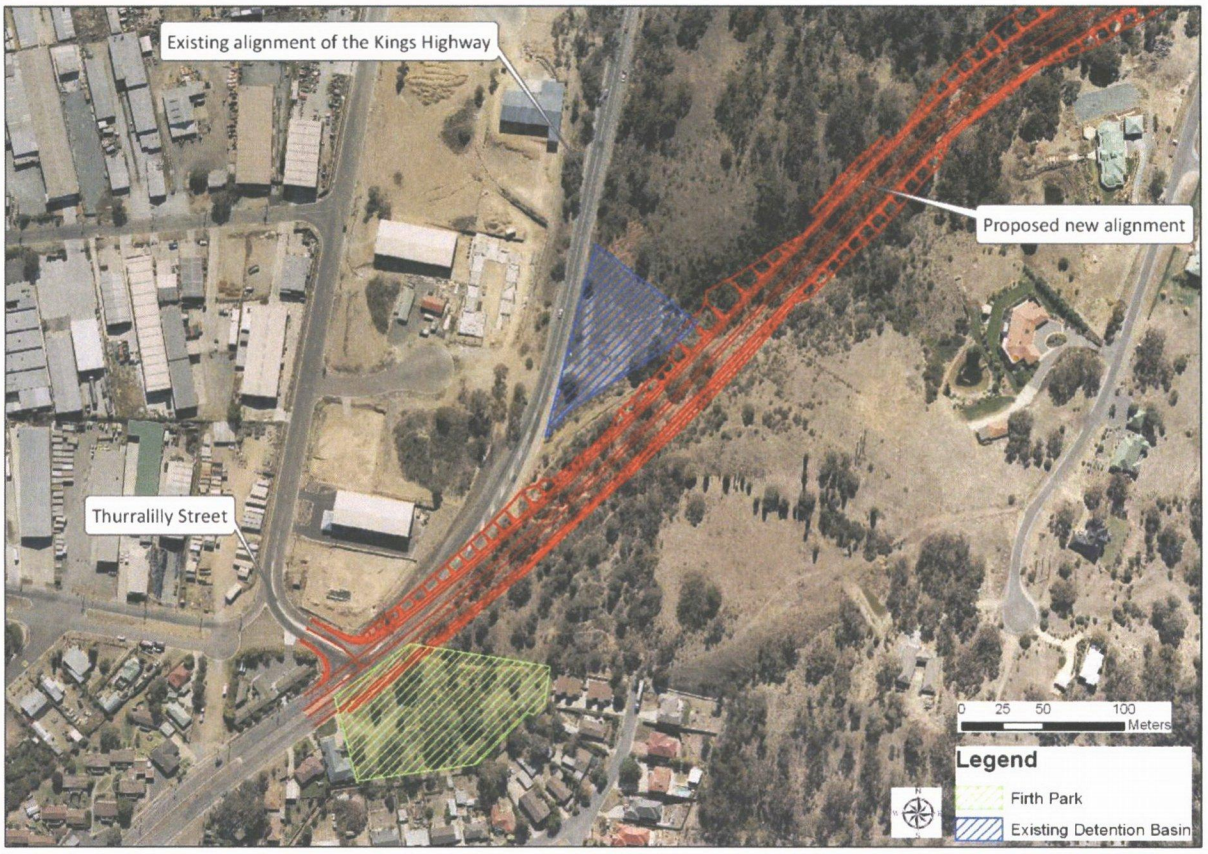


Figure 3-4: Part of Firth Park (green) and a portion of the existing detention basin (blue) would be acquired as part of the proposal **(Aerial taken 26/04/2004)**

4 Statutory and planning framework

4.1 State Environmental Planning Policies

4.1.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and road infrastructure facilities and is to be carried out on behalf of the RTA, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from Council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands, State Environmental Planning Policy No. 26 - Littoral Rainforests* or *State Environmental Planning Policy (Major Projects) 2005.*

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in Section 5 of this REF.

4.1.2 State Environmental Planning Policy No 55 – Remediation of Land

The objective of this policy is to provide a state wide planning approach to the remediation of contaminated land. The RTA is currently preparing a remedial action plan for the remediation of asbestos material.

Illegal dumping has occurred within the proposal site. This dumping includes empty fuel drums, scrap metal, car bodies, non putrescible waste and materials that appear to be asbestos cement material. The proposal would require sampling of the cement material to confirm whether it is in fact asbestos. Further details regarding this process are described in Section 6.12. Safeguards outlined in this REF address the requirements of SEPP 55.

4.2 Local Environmental Plans

4.2.1 Queanbeyan Local Environmental Plan 1998

The proposal would be undertaken within land controlled by the Queanbeyan City Council LGA through provisions of the *Queanbeyan Local Environmental Plan 1998*. The proposal would be carried

out on land zoned:

- 9 (a) Road A – Proposed Roads.
- 9 (b) Road B- Existing Roads.
- 6 (a) Open Space A.
- 1 (c) SP Rural C- Scenic Protection.

Refer to Table 4-1 for the zoning objectives and permissibility of the proposal in these zones.

Land adjacent to the proposal falls under the following zones:

- 1 (c) SP Rural C - Scenic Protection.
- 2 (a) Residential A.
- 2 (b) Residential B – Scenic Protection.
- 6 (b) Open Space B.
- 6 (b) SP Open Space – Scenic Protection.

Table 4-1: Zoning of land within the proposal site

Local Environment Plan	Zone	Objectives	Permissibility
Queanbeyan LEP 1998	9 (a) Road A – Proposed Roads	The objectives of Zone 9 (a) (the Road A zone) are: (a) to enable a future arterial or major local road which provides an alternative road for traffic not wanting to go through the central business district, and (b) to enable a future arterial or major local road which links the Monaro Highway to the Kings Highway, and (c) to enable the widening of Lanyon Drive.	Roads works are permissible with development consent.
Queanbeyan LEP 1998	9 (b) Road B – Existing Roads	To enable the establishment of local roads or laneways identified on the map.	Roads works are permissible with development consent.
Queanbeyan	6 (a)	The objective of Zone 6 (a) (the Open Space A	Roads works are

Local Environment Plan	Zone	Objectives	Permissibility
LEP 1998	Open Space A	zone) is to identify land predominantly in public ownership which is capable of offering a range of recreational opportunities for all members of the community.	permissible with development consent.
Queanbeyan LEP 1998	1 (c) Rural C	(a) to recognise that these areas are on higher elevations and act as a transition between fully urbanised areas and bushland and so should be developed in a sensitive and limited manner, and (b) to allow development consisting mainly of dwelling-houses or single buildings which as far as possible is designed to recognise the bushland character of these areas and minimise the impact of urban development, and (c) to allow suitably controlled subdivision	Roads works are permissible with development consent.
Queanbeyan LEP 1998	Scenic Protection	(a) the height, scale and bulk of the building as well as the construction materials used in, and the colours of external surfaces of, the building will accord with the visual character of the locality, and (b) any landscaping, particularly around buildings for screening purposes, will enhance the visual character of the locality, and (c) the building will be located so as to be unobtrusive, and (d) the part of the site to be used for the building is stable or can be stabilised in accordance with the requirements of the Council, and (e) the effect of the proposed development on the erosion of any land or the siltation of any waterway will be minimal, or appropriate measures can be taken to control erosion or siltation during construction, and (f) adequate measures can be taken during and after construction to protect endangered flora and fauna where these are known to occur on the subject site or on immediately adjoining land, and (g) where required, a tree survey of significant trees showing the likely impact on significant trees of the proposed development has been taken into account and adequate measures are proposed to be taken to retain significant trees	Scenic Protection applies to Zone 1 (c). It is considered that the adoption of the safeguards presented in this REF would provide adequate measures as described in the objectives.

Under these land zonings the proposal is permissible with consent from the Queanbeyan City Council. However, in accordance with clause 94 of the Infrastructure SEPP development consent is not required from Queanbeyan City Council (see Section 4.1.1). The proposal is therefore assessed under Part 5 of the *EP&A Act*.

4.3 Other relevant legislation

4.3.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* provides protection to the environment, particularly matters of national environmental significance. An EPBC protected matters search was undertaken on 7 January 2009 to determine if any matters of national environmental significance or other matters protected by the EPBC Act would be impacted by the proposal. This included a 10 km search radius around the proposal site. The results are discussed in Section 6.5 of this REF. A full copy of the search is presented in Appendix B biodiversity assessment. The search found that the proposal would not affect world heritage properties, national heritage items, wetlands of international importance, is not a nuclear action and would not affect Commonwealth marine areas or Commonwealth land.

Further assessments of potential impact to threatened and migratory species listed under the EPBC Act is included in Appendix B and a Principal assessment of Significance is included in Appendix B.

This REF finds that the proposal would have no significant impact on any matter of national environmental significance or other protected matter and therefore referral to the Federal Minister for the Environment, Heritage and the Arts is not required.

4.3.2 State legislation

Water Management Act 2000

The *Water Management Act, 2000* controls the extraction of and use of water, the construction of works such as dams and weirs, and the carrying out of activities in or near water sources in New South Wales. 'Water sources' are defined very broadly and include any river, lake, estuary, place where water occurs naturally on or below the surface of the ground and New South Wales coastal waters.

If a 'controlled activity' is proposed on 'waterfront land', an approval is required under the Water Management Act (s91E). The proposal has the potential to affect the flow of water in a waterway by the filling of a minor drainage line which is subject to intermittent flow. This would constitute a 'controlled activity' however, pursuant to Clause 39A (1) of the *Water Management (General) Regulation, 2004*, the RTA is exempt from the need to obtain a Controlled Activity Approval.

No water extraction would be required as part of this proposal.

The potential impact to hydrology and water quality by the proposal is assessed in Section 6.2 and mitigation measures provided within this REF to manage this risk.

Fisheries Management Act 1994

The RTA (as a public authority) is required to consult with the Minister for Fisheries for any dredging or reclamation work in accordance with s199 of the *Fisheries Management Act 1994*. The unnamed drainage line that is to be reclaimed is not defined as Key Fish Habitat however, the RTA would provided a copy of this REF to the Fisheries department of the Department of Primary Industries to determine if concurrence is required.

The *Fisheries Management Act 1994* through the Fish Habitat Protection Plan No. 1 requires public authorities, including local government and state authorities, to notify the Minister for Fisheries of any proposal to remove or relocate woody debris.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act, 1997* (POEO Act) includes provisions relating to pollution of air, noise, water or land. The RTA is required to meet the waste licensing obligations of cl.39-42 of Schedule 1 of the POEO Act in relation to the proposed works, except where the RTA excavated road material exemption, 2009 applies for application of excavated road material.

The Contractor and the RTA are obliged to notify DECCW when a "pollution incident" occurs that causes or threatens "material harm" to the environment.

4.4 Confirmation of statutory position

All relevant statutory planning instruments have been examined for the proposal. In accordance with the *State Environmental Planning Policy (Infrastructure) 2007*, the proposal does not require consent from the Queanbeyan City Council and is therefore assessed under Part 5 of the *EP&A Act*.

The *State Environmental Planning Policy (Infrastructure) 2007* outlines consultation provisions that apply to the proposal. These are described in Section 5.3 of this REF.

5 Stakeholder and community consultation

5.1 Consultation and community involvement

The RTA has consulted with the local community in line with the RTA Community Involvement and Communications Resource Manual (draft) June 2008. In September and October 2008 the RTA undertook a community consultation process for the package of road safety and traffic improvements planned on the Kings Highway to mitigate impacts of the HQJOC. The purpose of the consultation was to inform the community and seek feedback about the major aspects of these improvements, namely the planned intersection upgrades at Weetalabah Drive, Captains Flat Road and the Ridgeway Drive as well the planned realignment between Thuralilly Street and Regent Drive.

Between Monday 15 September and Friday 13 October 2008 public displays of the RTA plans for these improvements were exhibited at Queanbeyan City Library and at Captains Flat Convenience Store. In the weeks commencing Monday 15 and Monday 22 September 2008, notices advising of these displays were placed in the Queanbeyan Age, Queanbeyan Chronicle and Canberra Times. In the week commencing Monday 15 September 2008 a four-page colour brochure with information, including preliminary strategic designs, was delivered to approximately 2,000 properties in the local area. The delivery catchment for this brochure included but was not limited to all properties in East Queanbeyan, on the Kings Highway between Queanbeyan and Weetalabah Drive, in the Ridgeway Estate, the Kingsway Estate and the Weetalabah Estate. From Monday 15 September 2008 an electronic version of this brochure was also available on the RTA internet site. RTA project managers also completed a series of face to face meetings with the residents of Kingsway Estate, to provide information and answer resident's questions.

The RTA received a total of 30 submissions in response to this consultation. Fourteen were related to this proposal with the remaining 16 relating to other aspects of the package of works. The issues raised in the submissions received are summarised in Table 5-1 below.

A community involvement plan would be developed prior to the commencement of work. This plan would include strategies to be used to inform the residents directly affected by the works and the broader community of any changes.

On Monday 20 July 2009 the RTA wrote to all residents of the Kingsway Estate (Regent Drive and Birdwood Place) and two indirectly affected residents of The Ridgeway Estate with property accesses on the Kings Highway opposite Regent Drive. This letter advised residents that the review of environmental factors for the proposal was scheduled to be complete and available for public comment by the end of August 2009. Further, the RTA offered to meet in private with these residents.

As a result, on Wednesday 29 and Thursday 30 July 2009 RTA representatives met with residents of the Kingsway Estate in a series of private meetings and in one larger meeting with a number of residents. On

these two days, the RTA also met with the residents of 42 and 36 Bungendore Road Queanbeyan, as well as representatives of Deane's Transit Group, operators of the local school bus service, and with representatives of Queanbeyan City Council. During these consultations the RTA provided all appropriate relevant information required by the stakeholders involved.

Table 5-1: Summary of issues raised by the community

Summary of issues raised	Summary of comment	Further detail available
Unlikely to improve traffic flow	The proposal would improve traffic flow by providing additional lane in each direction, shortening the length of this section of the highway by approximately 360 m and removing the substandard 60 m radius curve.	Section 2.3 and 2.4
Would reduce safety rather than improve safety	The proposal would improve safety by providing a modern standard carriageway with median separation, 3.5 m wide lanes, 2.0 m wide sealed shoulders and more overtaking opportunities through the additional lane in each direction. Shortening the length of this section of the highway by approximately 360 m and removing the substandard 60 m radius curve would also improve road safety.	Section 2.3 and 2.4
Funds could be better allocated	The proposal performs strongly in terms of the RTA's economic evaluation criteria.	Section 2.1 and 2.3.3
School bus stop at Regent Drive	The proposal would impact on the convenience of the existing arrangement.	Section 6.10.1 and 6.10.2
Safety concerns for the Kings Highway Regent Drive intersection	The proposal would provide a new Regent Drive intersection which retains all existing movements but offers improved levels of road safety due to improved sight distance.	Table 2.1
Traffic calming	No traffic calming is proposed as part of the proposal. The proposed speed limit would be 80 km and the RTA does not anticipate the requirement for traffic calming. The RTA would monitor traffic conditions and consult with NSW Police as appropriate regarding the need for any targeted enforcement.	Not applicable
Community division	The proposal would physically divide the estate, resulting in less convenient but maintained pedestrian access within the estate.	Section 6.10
The need for a further reduction in speed limits	The proposal would be designed in accordance with current standards for the 80 km speed environment.	Section 2.3 and 2.4 and 3
Land acquisition	The proposal would require the acquisition of Firth Park in the southern portion of the proposal site as well a small portion of the detention basin also located in the southern portion of the proposal site. There is potential to acquire a small parcel of private land which would result in an opportunity to reduce the need for reinforced earth walls in this area.	Section 3.6
The need and justification of the proposal	The need and justification for this proposal is presented within this REF. It is considered that the proposal is needed on road safety and traffic grounds, and that the proposal best meets the project objectives and is economically viable	Section 2 and 8

Summary of issues raised	Summary of comment	Further detail available
Potential biodiversity impacts	The potential biodiversity impacts have been assessed for the proposed works and are presented in this REF. The proposal would result in the removal of approximately 4 hectares of vegetation including the removal of two hollow bearing trees. This REF presents mitigation measures to manage impacts identified.	Section 6.5
Safe access for walkers and cyclists	At present, there is no footpath or dedicated cycleway along the existing alignment of the Kings Highway. It is recognised that local residents use the Goulburn Road corridor as an informal walking track to access Queanbeyan. The RTA is currently liaising with QCC regarding the provision of and access for foot traffic form the estate into Queanbeyan.	Section 6.10
Noise impacts	The potential noise impacts have been assessed for the proposed works and are presented in this REF. A noise assessment was completed to assess the potential noise impacts associated with the proposal. Noise modelling identified that a total of eight properties would have an exceedance of the 0.5 or 2 dBA allowance goal. A range of mitigation options were assessed and in accordance ENMM architectural treatments were considered the most appropriate option for noise mitigation.	Section 6.8
Inadequate community consultation	The RTA has undertaken and continues to undertake community consultation at a number of stages and utilising a number of methods as described in Section 5.	Section 5
Reduction in land values	The potential impacts have been assessed for the proposed works and are presented in this REF. it is considered that perceived noise and visual impacts would be the likely drivers for any reduction in land value. Specialist assessments for noise and visual impacts were completed and it is considered that mitigation measures outlined in both assessments would reduce the potential for any decrease in land values as a result of the proposal.	Section 6.10
Proposed timing of the proposal	Construction would be over approximately 15 months, from October 2009 to December 2010. No staging of works is planned.	Section 1.1
How the proposal fits with the proposed Queanbeyan bypass	The proposal is compatible with a future Northern Ring Road that would bypass Queanbeyan to the north and link Canberra Avenue with the Kings Highway.	Section 2.3.2

5.2 Aboriginal community involvement

The RTA has undertaken Aboriginal stakeholder consultation in accordance with the RTA procedure for Aboriginal cultural heritage consultation and investigation (PACHCI). The RTA's Aboriginal Cultural Heritage Advisor initially completed an internal RTA assessment to assess if the proposal would be likely to affect Aboriginal cultural heritage. A subsequent preliminary assessment was then completed by RTA including a preliminary site survey involving the relevant Local Aboriginal Land Council (LALC) for the proposal site, Ngunnawal LALC.

Ngunnawal LALC determined that no artefacts or remnants of artefacts were observed during the initial site visit, undertaken on 5 March 2008. The RTA determined that no further archaeological investigation was warranted. The RTA correspondence with the Ngunnawal Local Aboriginal Land Council is at Appendix C. Potential impacts and mitigation measures associated with Aboriginal heritage are presented in Section 6.6.

5.3 Government agency and stakeholder involvement

The RTA has consulted with the Commonwealth Department of Defence and Queanbeyan City Council.

Department of Defence consultation related primarily to funding arrangements.

The RTA attended a meeting with Queanbeyan City Council (QCC) on 29 July 2008 to consult with QCC about works on the Kings Highway, including this realignment proposal. QCC indicated support for the proposal at this meeting. Refer to Table 5-1, below.

Table 5-2: Summary of RTA correspondence to date

Issue raised	Where addressed in REF	Consultation required under ISEPP?
Department of Defence		
Funding arrangements	Section 1.1	No
Queanbeyan City Council		
General information regarding the proposal.	Section 3	No
Flooding impacts on the industrial estate.	Section 6.2	No

ISEPP contains provisions for consultation with local councils and other public authorities prior to the commencement of certain types of development. Table 5-3 details the consultation provisions of ISEPP

under clause 13, whether these apply to the proposal, and if so, the RTA's comments and actions.

Table 5-3: Assessment of items of Clause 13 of the SEPP (Infrastructure)

Item	Consideration	Consultation required
Substantial impact on stormwater management services provided by a council.	The RTA has completed a preliminary hydrological analysis of the proposed works and has determined that the proposed works would not involve substantial impacts to the stormwater system provided by council. As RTA is installing additional stormwater management services, consultation with council for this item has been undertaken.	Yes
Likely to generate traffic to an extent that would strain the capacity of the road system in a local government area.	The proposal is unlikely to generate traffic to the extent that would strain the capacity of the road system. Truck movements would increase during construction, this increase is short term and would be managed through a traffic management plan. This would include defining an appropriate route for trucks, to avoid local roads, and to determine the safest and most efficient method of ingress and egress from the site to limit the impact to local traffic. Traffic would also be generated during operation. Traffic generated as a result of the proposal is expected to be minimal consisting of a small number of maintenance vehicles and would not generate traffic to the extent that would strain the capacity of the road system. Therefore consultation with council for this item is not required.	No

Item	Consideration	Consultation required
Involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council.	The proposal would not impact on the sewage system and would not involve the connection to, or have a substantial impact on the capacity of any part of a sewerage system owned by a council. Therefore consultation with council for this item is not required.	No
Involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council.	The proposal would not involve connection to, and use of a substantial volume of water from any part of a water supply system owned by a council. Construction contractors would obtain water from an appropriately licensed water distribution facility. Therefore consultation with council for this item is not required.	No

Item	Consideration	Consultation required
Involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential.	The proposal would require the acquisition of a small parcel of land which is a public place, zoned 6 (a) Open Space, at the south-western end of the proposal (see Section 3.6 and Figure 3-4) owned by the Queanbeyan City Council. The RTA is currently consulting with council regarding the reserve and an agreement would be reached prior to construction. Following acquisition, the zoning of the land would be changed and the land would no longer be public land. However as the proposal would cause a disruption to pedestrian traffic at this location, consultation with council in accordance with the requirements of the ISEPP has been undertaken for this item.	Yes
Involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the *Roads Act 1993* (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).	The proposal would involve excavation that is not minor or inconsequential excavation of a road or footpath owned by the Queanbeyan City Council. Therefore consultation with council for this item has been completed.	Yes

Table 5-4: Council raised the following issues in regard to consultation for the purposes of ISEPP

Issue raised	Comment	Where addressed in the REF
Property access	Access to Regent Drive and Birdwood place would be maintained during the construction phase. This would allow council waste service vehicles to access Kingsway Estate for the collection of rubbish throughout the duration of the construction phase.	Section 3.3.5
Underground services	The RTA has identified that underground services are present within the proposal site, approximate locations of these services are presented in Appendix A. Appropriate consultation with service providers would be undertaken prior to construction activities to reduce the potential for disruption of services.	Section 3.5
Access to council land	Council noted that they own a property adjacent to the northern portion of the proposal site and would require access to be maintained to this site during construction. The RTA would liaise with Council to ensure that access to this parcel of land is maintained.	Section 5
Cycle way	The proposal would allow for 2 m shoulders in both directions; adequate for these shoulders to be used as a cycle way.	Section 3
Existing road reserve	Council requested that the pavement on the existing alignment of the Kings Highway be removed and the area be revegetated post construction. The RTA would undertake this activity subject to an approved Rehabilitation Management Plan.	Section 2.3.3
Land acquisition	Council recommended that the areas of public land proposed to be acquired be compulsorily acquired under the Land Acquisition (Just Terms Compensation) Act 1991.	Section 3.6
Pedestrian access	The RTA is liaising with Council regarding the provision of pedestrian access for residents of Kingsway Estate to use during construction and operation.	Section 6.10
Stormwater management	Council were concerned that the current stormwater main not be impacted as a result of the proposal. The RTA would identify the location of the water main prior to construction. Calculations completed by the RTA indicate that the capacity of the existing detention pond is sufficient to meet its intended purpose in addition to being used a detention pond for the proposal.	Section 3
Regent drive - bus access	The RTA investigated the potential for the construction of a bus stop on both Regent Drive and the Kings Highway. Due to safety considerations, the RTA considers the installation of a bus stop on the Kings Highway is not desirable. Due to turning circle limitations	Section 6.10

Issue raised	Comment	Where addressed in the REF
	and council requirements regarding the reversing of buses, the RTA believes the installation of a bus stop in Regent Drive is not possible. The school bus service would therefore be accessed via the nearest designated bus stop facility, on Bungendore Road, approximately 190 m south of Thuralilly Drive. This bus stop would be connected to Kingsway Estate by the proposed new pedestrian access, linking Regent Drive with Bungendore Road.	

Clauses 14 (impacts to local heritage), 15 (impacts to flood liable land) and 16 (consultation with public authorities) of ISEPP have been reviewed and no further consultation is required under ISEPP.

5.4 Ongoing or future consultation

This review of environmental factors is to be placed on a five week public consultation period beginning in September 2009. The RTA will directly consult, with Kingsway Estate residents during this period. This consultation would include written correspondence and meetings, as requested by residents.

All issues raised will be considered by the RTA prior to determination of the proposal. A submission report will be made available to the public.

6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. Site-specific safeguards are provided to ameliorate the identified potential impact.

6.1 Soils and landscapes

6.1.1 Existing environment

Topography in the region consists of dissected ranges and plateaus of the Great Dividing Range. Topography within the general locality of the proposal site consists of low rolling hills. The proposal site comprises a gentle slope, generally falling from north east to the south west.

The geology is dominated by the southern portion of the Lachlan Fold Belt. The geology underlying the proposal site generally consists of Ordovician metasediments, Jenkins (2000).

There are two soil landscape groups located within the proposal site, namely: Foxlow (fo) and Queanbeyan (qn) (Jenkins 2000). Details regrading these two soil landscape groups are presented in Table 6-1 below.

Table 6-1: Soil landscape descriptions adapted from Jenkins (2000)

Soil landscape group	General description[10]	Erosion potential	General limitations
Foxlow (fo)	Shallow well drained Rudosols and shallow, moderately to imperfectly drained yellow kandosols and brown kurosols on crests and upper slopes. Shallow well drained rudosols and shallow moderately to well drained red podzolic soils on midslopes. Moderately deep, moderately well drained yellow/brown kandosols intergrades on lower slopes.	Very high (non concentrated flows) Very high (concentrated flows)	Soils shallow, acid and infertile.
Queanbeyan (qn)	Shallow well drained rudosols on crests and upper slopes. Moderately deep and moderately well-drained Red Kurosols on sideslopes.	High (non concentrated flows) Very high (concentrated flows)	Imperfect drainage, strongly acid shallow soils (localised)

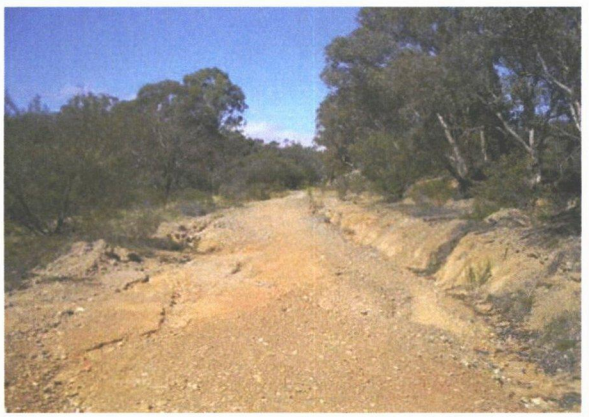
[10] For definitions of terms please see glossary. All terminology in accordance with Australian Soil Classification

There is evidence that the proposal site has been used for illegal dumping in the past. Material that has been dumped includes scrap metal, empty drums and containers, household bricks and tiles and asbestos cement material. It is considered that there is potential for some of the proposal site to be contaminated and require remediation in accordance with SEPP 55. A search of the DECCW contaminated land record on 24 August 2009 indicated that there were no sites registered as contaminated within the Queanbeyan LGA.

RTA engaged a contaminated land specialist who positively identified some asbestos containing material (Chrysotile) in the proposal site. The locations of the known asbestos have been delineated and mapped (JBS 2009).

There evidence of erosion channels indicating that the site is susceptible to erosion events, as presented in Figure 6-1.

Deep erosion channel adjacent to proposal site



Evidence of erosion on the gravel track within the proposal site

Figure 6-1: Erosion channels within the proposal site.

6.1.2 Potential impacts

A risk assessment for the proposed works was completed in accordance with the RTA's draft erosion and sedimentation management procedure (2009). The risk assessment identified that the proposal would not be high risk and would not require the RTA to engage a soil conservation specialist for the proposal. A copy of the assessment is presented in Appendix D.

The impacts on soils would relate to clearing of vegetation, excavation including cuts, placement of fill, use of heavy machinery, stockpiling of materials, construction of reinforced walls, landscaping and removal of the redundant section of the Kings Highway. The proposal would require large scale bulk earthworks including the infilling of a minor drainage line and the importation of a large amount of fill

material, in the order of 20,000 to 30,000 m^3. It is anticipated that approximately 21,000 m^3 of material would be 'won' from cuts during the construction phase. Stockpiles during the construction period have the potential to be large and may be in place for periods longer than three months. These activities may potentially cause erosion and sedimentation of soils or compaction of soils. Refer to Section 3 of this REF for further information on these activities.

It is anticipated that the majority of vegetation within the proposal site would be cleared. Clearing and excavation would also be carried out along the unsealed Goulbourn Road corridor. Removal of vegetation and excavation works would expose soils to potential erosion from wind, rain and run-off. This would potentially degrade the proposal site and cause dust generation and sedimentation of areas down slope.

The unsealed Goulbourn Road corridor would be subject to placement of fill to create a levelled area suitable for vehicle travel. Fill placement would result in large quantities of loose material being deposited on the land. Prior to sealing and stabilisation, fill material would be subject to potential erosion and sedimentation, especially if the area is subject to a high rainfall or wind event.

The proposal would require piping and placement of fill into an intermittent minor drainage line in the unsealed Goulbourn Road corridor. Works in and near this drainage line would have an elevated risk of causing erosion and sedimentation due to the topography and the likelihood that any run off would preferentially flow in the drainage line. Appropriate mitigation measures to reduce this risk are outlined in Section 6.1.3.

The proposal would use large machinery such as excavators, rollers and trucks. Heavy machines can disturb the surface of the soil with their tracks and tyres which can increase the potential for erosion. The large weight can also compact the deeper soil structure. The potential impacts of heavy machinery on soils would be minimised by restricting heavy machinery movements wherever possible.

Soil and materials would be stockpiled for the proposal. Stockpile sites would create a source that could be eroded during high rain or high wind events. Suitable stockpile sites are yet to be determined however the location of the stockpile sites would be subject to the site location criteria set out in the RTA's *Stockpile Site Management Procedures* (RTA 2001). Additionally, stockpile sites would be managed in accordance with the Blue Book.

Construction activities also have the potential to disturb contaminated land that may be located within the proposal site. Field investigations identified material potentially containing asbestos. The RTA engaged JBS Environmental (JBS 2009) to undertake a Phase 2 (intrusive) investigation to determine the extent of potential contamination within the proposal site. JBS (2009) identified that remedial works were required onsite to render the site suitable for the intended land use. The two issues identified as requiring further works were:

- *Stockpiled "dumped" asbestos containing material and mixed debris across the site.*

- *Asbestos containing material (ACM) fragments distributed across the site surface.*

Laboratory tests completed as part of JBS (2009) indicated that both representative samples of ACM tested positive for asbestos (Chrysotile). Additionally, a number of soil samples were collected and sent for laboratory testing for the presence of asbestos fibres. Of these samples there were no asbestos fibres identified above the laboratory limit of reporting[11]. JBS (2009) concluded that this result indicated that asbestos is only present as fragments of ACM and is most likely non-friable.

RTA engaged a contaminated land specialist to prepare a remedial action plan to guide remedial works to render the site suitable for its intended land use. The remedial works would be done prior to any general excavation works and would be completed in accordance with the remedial action plan.

Clearing of vegetation, excavation, placement of fill, use of heavy machinery and stockpiling of materials are activities that have potential to extend degradation beyond the proposal site. The exposure of soil, reduced water permeability (as a result of soil compaction), and the stockpiling of fill can increase the transport of sediments through drainage lines, extending the sphere of impact.

The potential for the proposal to cause erosion and sedimentation would be managed and reduced by implementation of a soil and water management plan (SWMP). The RTA has calculated that the current detention pond, located to the west of the proposal site near Thurralilly Street (Figure 6-2), has the capacity for events up to the 1 in 100 year storm. The use of this detention basin would be included in the SWMP. The RTA would construct an additional sediment basin in the southern portion of the proposal site to capture any runoff generated down gradient of the existing detention basin.

Construction controls to be implemented for the proposal would aim to minimise soil loss from the proposal site and contain impacts to the proposal site. Short term impacts are likely to be moderate though would be controllable via the implementation of the safeguards and management measures detailed below.

During operation, there would be some risk of increased erosion caused by stormwater runoff. This would be due to the increased impervious area from the new road pavement and new areas of local concentration. Detailed design of the road drainage would consider the potential impacts on soils from runoff such as scouring and would identify suitable controls for both construction and operation.

6.1.3 Safeguards and management measures

- Works would be undertaken in accordance with the RTA's specifications G38 Soil and Water Management (Soil and water management plan) and R44 Earthworks (Cut, fill, imported fill and

[11] The limit of reporting (LOR) is the lowest concentration of an analyte at which positive identification and quantification can be achieved with reasonable and/or previously determined confidence in a defined matrix using a specific analytical method (DAFF 2009).

imported selected material) and R50 Stabilisation of Earthworks.

- Erosion and sediment control measures would be implemented and maintained to:
    - Prevent sediment moving off-site and sediment laden water entering any watercourse, drainage lines, or drain inlets.
    - Reduce water velocity and capture sediment on site.
    - Minimise the amount of material transported from site to surrounding pavement surfaces.
    - Divert clean water around the site.

  in accordance with the Landcom/Department of Housing *Manging Urban Stormwater, Soils and Construction Guidelines* (the Blue Book).

- Stockpile sites would be located and managed in accordance with the RTA Stockpile Site Management Procedures (RTA 2001).
- All exposed soil surfaces resulting from the proposal would be stabilised as soon as practicable to reduce the risk of erosion and sedimentation. This applies in particular to the drainage lines and culverts within the proposal site.
- Weather forecasts would be checked daily to ensure that high risk soil and erosion activities are not undertaken immediately prior to or during high rainfall or wind events.
- The RTA would complete all required remedial works in accordance with a remedial action plan prepared specifically for the proposal site prior to the commencement of any general excavation works.
- If contaminated material is uncovered, works that may impact on it would cease immediately and advice would be sought from the RTA senior environmental officer on how to proceed.
- The RTA would prepare a vegetation rehabilitation plan as part of the Construction Environmental Management Plan (CEMP). This rehabilitation plan would facilitate appropriate rehabilitation practices at the site post construction. The plan would also focus on improving the existing erosion characteristics in the vicinity of the proposal site.
- Clearing of vegetation and revegetation activities would be carried out progressively with works to limit the time disturbed areas are exposed to erosion processes.
- Earthworks within the drainage line would not be completed during times of rainfall or when

water is flowing with the drainage line.

- Stockpiles would be stabilised or covered to reduce the potential for sediment and erosion impacts.

- Detailed design of the road drainage would identify and include any structures required to manage runoff and scouring.

6.2 Hydrology and water quality

6.2.1 Existing environment

The proposal site is located within the Molonglo catchment. The nearest major waterway is Molonglo River, located approximately one kilometre to the north of the proposal site. The Molonglo catchment extends from the Murrumbidgee River to the headwaters of Molonglo and Queanbeyan Rivers and Jerrabomberra Creek. It covers approximately 200,000 ha (MCG 2009) and collects and stores drinking water for the locality. The proposal site is located within the Lower Queanbeyan sub catchment which is approximately 8,064 ha (MCG 2009).

The Queanbeyan River joins the Molonglo River on the northern outskirts of Larmer and flows south through the Queanbeyan township. The Queanbeyan River is located approximately 3 km west of the proposal site.

Data obtained from the Bureau of Meteorology for the weather station at the Queanbeyan Bowling Club located approximately 2.2 km from the proposal site identified that the average annual rainfall between 1870 and 2008 is 592.8 mm. Historically the wettest three month period is between October and December with the driest period during the winter months of June to August.

Annual precipitation has generally been below the long term annual average for seven of the last ten years. In seven of the last eight years, the area has experienced below average rainfall. These precipitation data reinforce that drought is currently affecting the local area and suggest this drainage line has the potential under normal conditions to carry a larger volume of water.

There is one natural drainage feature within the proposal site. This is an ephemeral drainage line which runs generally from north-east to south-west, refer to Figure 6-2. The drainage line varies in width and depth and flows into the existing detention basin. The drainage line is degraded, having being subject to illegal dumping of waste including, scrap metal (car bodies, petrol cans), demolition waste (tiles, bricks and asbestos) and general rubbish. During two separate site visits undertaken for the preparation of the REF, there was no flowing water in the drainage line, with only small stagnant ponds observed.

Information provided by the NSW Department of Primary Industries (Industry and Investment NSW) indicated that the unnamed drainage line does not represent key fish habitat.

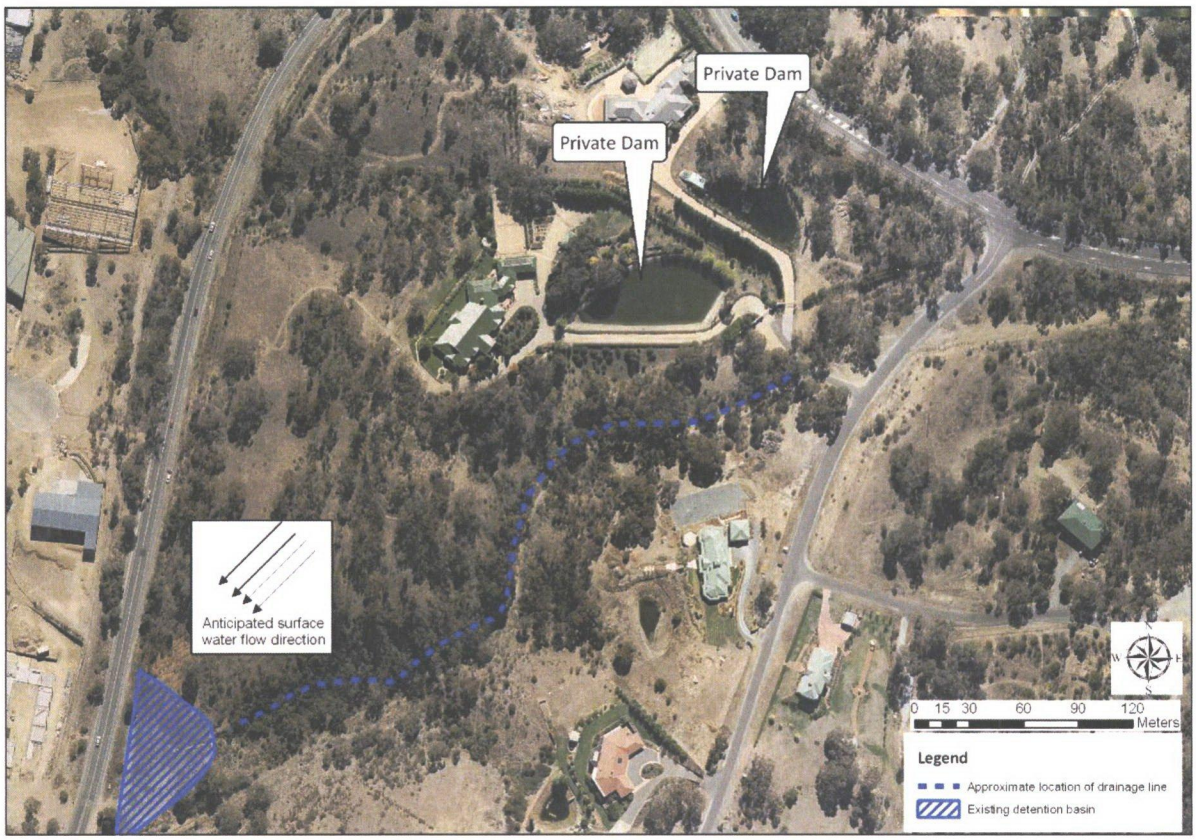


Figure 6-2: Approximate location of drainage line and existing detention pond (Aerial taken 26/04/2004)

There is also a drainage line located to the south west of Regent Drive. This drainage line is outside of the proposal site. Although this drainage line would not be directly impacted as a result of the proposal there is the potential for it to be indirectly impacted through sedimentation. Two private dams, Figure 6-2, are located immediately adjacent to the proposal site.

A stormwater detention basin is located immediately west of the proposal site (Figure 6-2), adjacent to the Kings Highway. It is understood that this detention basin was constructed as part of the Carwoola industrial estate located on the western side of the Kings Highway. It was constructed to capture excess water flowing down the Kings Highway and adjacent area (the proposal site) to reduce the potential for localised flooding within the industrial estate in times of high precipitation. This detention basin would be incorporated into the construction and operational soil and water management plan for the proposal. There is no specific drainage infrastructure, table drains and the like, located within the proposal site. Additionally, there is no kerb and guttering on Regent Drive or Hill Lane.

In addition to the stormwater detention basin, a temporary sediment basin would also be constructed in the southern portion of the proposal site. This sediment basin would be designed for large flood type events rather than total capture.

A search of the NSW Natural Resources Atlas, *NSW Groundwater Works* identified that there were no groundwater bores within the proposal site. There two bores located in the general vicinity of the

proposal site, to the south west. Information from these bores indicated is presented in Table 6-2.

Table 6-2: Groundwater data obtained from NSW Natural Resource Atlas

Bore Number	Authorised Use	Water Bearing Zones	Depth from (m)	Depth to (m)	Thickness of water bearing zones (m)
GW052952	Domestic Stock	Sand	75	75	0.0
		Slate	96	100	4.0
		Slate	102	103	1.0
GW017912	Stock	Slate, Yellow pipe clay seams	25.3	32	6.7
		Slate	59.7	59.7	0.0
		Slate (soft)	87.2	87.2	0.0

This data indicates that water bearing zones within the general vicinity of the proposal site are quite deep, the shallowest zone identified as starting 25.3 m below ground level.

6.2.2 Potential impacts

Water Quality

Potential impacts of the proposal to local hydrology include catchment pollution from turbid runoff as a result of large scale earthworks and exposed surfaces, pollution from petrochemicals and construction litter and local concentration of runoff. The proposal would involve the removal of vegetation within the proposal site, bulk earthworks including excavation and compaction, importation of a large amount of material, 20, 000 to 30,000 m^3, sequential stockpiling of this material and the storage and use of chemicals and hydrocarbon fuels. These activities have the potential to impact on the existing water quality of the proposal site as well as the water quality offsite, through contaminated water entering the local stormwater system.

The key variable influencing the extent of runoff and stormwater pollution is weather. The occurrence of a major storm event during construction could result in high levels of turbid runoff entering local drainage lines and the local stormwater system.

Removal of vegetation prior to excavation works has the potential to increase turbid runoff from the proposal site in the event of rain. Additionally, the large scale of the proposed earth works would increase the potential for turbid runoff during the construction period.

The proposal would require 20,000 to 30,000 m^3 of material to be imported from various sources. The fill requirements would result in a large number of truck movements to and from the proposal site, (estimated at 1700). Potential impacts associated with moving large quantities of loose material include

the generation of dust, particularly when trucks are unloading material and tracking of material onto local roads and Kings Highway at construction site entry and exit points. Any material tracked off site by haulage trucks has the potential to be mobilised and enter the local stormwater system. This potential impact would be mitigated via the provision of appropriate safeguards.

Due to the volume of fill needed for the proposal, stockpiling of material would be required. When it rains there would be potential for materials from stockpile sites to be mobilised thus generating turbid run off. Stockpiles, likely to be established for less than three months, would be managed in accordance with the RTA *Stockpile Site Management Procedures* (RTA 2001).

Groundwater depths in the vicinity of the proposal site are generally deep. Information from the NSW Natural Resource Atlas identified that the shallowest depth to groundwater in the two bores observed is 25.3 m. Direct impacts to groundwater are considered unlikely as a result of the proposal. There is the potential for indirect impacts to groundwater resulting from activities of the proposal. Indirect impacts to groundwater would most likely result from a chemical or fuel spills entering the groundwater system. Safeguards to mitigate these potential impacts have been described below.

Chemical and fuel spills have the potential to impact local water quality in the vicinity of the spill location. They would be stored within the compound site in appropriately bunded storage areas. Chemicals and fuels would be stored and handled in accordance with their relevant Material Safety Data Sheets.

Hydrological Impacts

Proposal activities would also result in impacts to the local hydrology characteristics within the proposal site. The proposal would require the ephemeral drainage line to be removed (via filling). Filling the drainage line would alter the current flow regime within and adjacent to the proposal site. Additionally, the proposal would result in the construction of a large hardstand area (road pavement), that would likely increase the velocity and volume of flow entering the existing detention pond and local stormwater system down gradient of the proposal site. The RTA have completed calculations and consider that the current detention basin would be sufficient to cope with additional water run off resulting from the operation of the proposal.

Removal of vegetation would likely increase the volume and velocity of flow and thus increase the potential severity of erosion and turbid run off.

The local stormwater drainage system has the potential to be impacted during the construction phase of the proposal, through increased runoff. The local stormwater system ultimately drains into the Queanbeyan River. With the implementation of appropriate safeguards the potential for sediment to enter the stormwater system would be reduced.

The RTA would be utilising the stormwater detention basin as a sediment basin throughout the construction phase of the proposal. Initial calculations have indicated that the detention basin would not

require any alteration as the current capacity would be sufficient for its intended use in addition to acting as a construction sediment basin. This basin would be maintained as required throughout the construction phase of the proposal.

The potential impacts of the proposal on water quality would be managed and mitigated by implementing temporary (sand bags, sediment fencing, sediment basins and/or other appropriate controls as identified in the soil and water management plan) and long term controls (revegetation and/or other means of stabilisation of batters and road side drainage). These would be carried out in accordance with RTA design and construction specifications and the bluebook.

Proposed controls implemented within the proposal site are aimed at reducing soil and contaminant loss via polluted run off to ensure that the works would not result in the pollution of the catchments.

Water required for construction would be sourced by the construction contractor. The contractor would be responsible for obtaining water in accordance with all relevant legislation and obtain any approval that may be required.

6.2.3 Safeguards and management measures

- Appropriate erosion and sediment controls, in accordance with RTA *G38 Soil and Water Management (Soil and water management plan)* would be installed at key areas.
- Regular checks of weather forecasts would be made to ensure that the site is appropriately protected during rain events.
- Appropriate measures, such as regular road sweeping, rumble grids or wheel wash bays, would be established to minimise the risk of dirt and mud being tracked off site by construction vehicles.
- Any chemicals, including hydrocarbons and herbicides, would be stored in a bunded, hard stand area, at the site compound away from any water courses or natural depressions or drainage lines.
- A site specific spill containment/contamination management plan would be developed and communicated to all staff prior to the commencement of the works. This would include that an emergency spill kit would be kept on site at all times and staff would be trained in where it is kept and how to use it.
- If a spill occurs, the RTA's Environmental Incident Classification and Management Procedure is to be followed and the RTA senior environmental officer notified as soon as possible.
- Fuelling of machinery would only take place in designated areas appropriately protected by the spill containment/contamination management plan. All sediment basins to be used as part of the

proposal would be monitored throughout the construction phase.

- Outlet dissipaters would be constructed as required to reduce flow velocities to acceptable levels. Drainage paths between culverts would be rock lined to minimise scouring.

6.3 Air quality

6.3.1 Existing environment

Information obtained from the Bureau of Meteorology weather station located at the Canberra Airport[12], approximately 7.5 km northwest of the proposal site indicate that dominant winds are north westerly. The average annual wind speed recorded at the weather station was 17.3 km.

The Department of Environment, Water, Heritage and the Arts (DEWHA) National Pollutant Inventory (NPI) emission report for the Queanbeyan City LGA identifies predominant sources of air pollutants for 2007-2008 reporting year. Pollutant sources include motor vehicles, domestic and commercial solvents / aerosols, architectural surface coatings, solid fuel burning (domestic) burning (fuel reduction, wildfires etc) as well as other sources.

Emissions from motor vehicles represented the greatest percentage of emissions within the Queanbeyan LGA. It is considered that the high motor vehicle emissions would be a result of the high traffic flow within the LGA including along the Kings Highway (refer also Section 6.4).

The dominant north-west winds occur approximately 34% of the time, with westerly winds approximately 19% of the time and northerly winds approximately 12%. The area southeast and east of the proposal site is predominantly rural residential land holdings and forested areas; Queanbeyan East is located to the south of the proposal site. Thus the most likely residential receivers are limited to those residents in the near vicinity of the proposal site, namely residents on Regent Avenue and Birdwood Place. The two properties located off Hill Lane in the immediate vicinity of the proposal site are also considered to be potential high risk receivers in addition to residents located in Queanbeyan East. Any dust generated during construction has the potential to impact on the industrial area adjacent to the proposal site.

The proposal site and broader locality is generally well vegetated and has no major industry source of atmospheric pollutants. Air quality at the site is therefore mainly impacted by road traffic and is of a relatively high quality. The large areas of reserved land in the region contribute to the relatively high air quality.

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[12] Canberra Airport weather station was used rather than Queanbeyan Bowling Club as it provided substantially more recent 3pm wind data. This data was considered more reflective of likely site conditions.

6.3.2 Potential impacts

The proposal may cause temporary impacts to air quality during the construction phase. This would be due to generation of dust and fine particulate matter and increased emissions from the use of construction plant and equipment and trucks to transport materials. Generation of dust may occur during activities involving exposed soils or materials including:

- Excavation.
- Cutting and filling.
- Clearing of vegetation.
- Transport of materials.
- Movement of vehicles on exposed soils.
- Stockpiling activities.
- Construction vehicle movements on exposed soils.

Dust generation is likely to be the key potential impact to air quality during construction. Construction activities with the potential to generate dust include excavation and earth moving works, vegetation removal and stockpiling material. The extent of dust generation depends on the specific activities being undertaken and the prevailing weather conditions, particularly wind direction and strength. There is the potential that dust could be deposited on buildings (homes and businesses), on personal belongings, (clothes washing) and cars. This impact presents a nuisance to affected receivers as surfaces may have to be cleaned and clothes re-washed. The generation of dust can also present an impact to the visual amenity of the area (Refer also Section 6.9).

It is considered unlikely that asbestos fibres would be mobilised during excavation activities post completion of remedial works. JBS (2009) concluded that asbestos on site is most likely non-friable. In addition, remedial works would be completed in accordance with a site specific remedial action plan prior to the commencement of general excavation works onsite.

Dust suppression techniques including avoidance and rapid mitigation response would be implemented throughout construction works. Due to the visible nature of dust and as conditions that exacerbate dust are predictable, it is considered that there would be a moderate potential for the proposal to result in a reduction of air quality due to dust generation. Any impacts from dust would be short-term and would be minimised as a result of the safeguards and management measures described below.

Air quality may be impacted by exhaust emissions from the operation of equipment, such as excavators, heavy machinery and construction vehicles as well as general traffic using the highway. This is further

discussed in Section 6.4 (Climate Change) of this REF.

It is considered that potential impacts on air quality can be adequately managed and mitigated via the mitigation measures described below.

6.3.3 Safeguards and management measures

- Dust generating activities would be suspended during periods of high wind velocity.
- Dust would be visually monitored and suppressed with water or by alternative suppression techniques eg altering work practices or stopping dust generating activities.
- Vehicles transporting materials including waste that may generate dust are to be covered during transportation.
- All stockpiles would be managed to suppress dust emissions in accordance with RTA Stockpile Site Management Procedures (RTA 2001).
- Dust suppression methods such as the use of water carts would be employed when unloading fill and creating stockpiles.
- Tailgates would be secured during operation of trucks and utes.
- Machinery, plant and vehicles would be turned off while not in use where practical, rather than left idling.
- Site vehicles, plant and equipment would be maintained in accordance with manufacturer's specifications.
- Vegetation or other materials would not be burnt on site.
- The RTA would complete all required remedial works in accordance with a remedial action plan prepared specifically for the proposal site prior to the commencement of any general excavation works.

6.4 Climate change

6.4.1 Existing environment

The major existing contributors to the emission of greenhouse gases at the site are vehicles travelling on Kings Highway and the roads within Queanbeyan. The RTA Annual Average Traffic Data records indicate that the average yearly traffic in 2003 travelling on the Kings Highway at the intersection between the highway and Bungendore Street, approximately 1 kilometre west of the proposal, is 10 245

vehicles (RTA AATD 2006). Further, the estimated percentage of heavy vehicles using this section of the Highway is 6.7% during the day and 10% during the evening.

The operation of private and passenger transport and commercial vehicles, primarily emits carbon dioxide (CO_2) a greenhouse gas. The primary method of propulsion for these vehicles is creation of energy through the operation of internal combustion engines powered by fossil fuels.

It is estimated that the total biomass (vegetation) within the proposal site is 488.5 tonnes. This biomass figure was used to calculate potential emissions from removal of vegetation on site. The RTA has developed linear trend lines for maximum above ground biomass for each Catchment Management Authority region based on the FullCAM[13] biomass estimators. For the purposes of measurements of all contributing greenhouse gases, each gas is converted to the common unit carbon dioxide equivalent ($CO2_e$).

The southern portion of the proposal site is located adjacent to an industrial area. Activities within this industrial area may also be emitting greenhouse gases. Additionally, the proposal site is located within an outer suburb of Queanbeyan. Mobile sources such as lawn mowers may also be contributing greenhouse gases in the general locality although these small mobile sources are expected to be negligible.

The NSW state government has the following targets with regard to greenhouse gas emissions:

- Clean air target – to meet the national air quality goals as identified in the National Environment Protection Measure for Ambient Air Quality.
- Greenhouse gas target – to achieve a 60% cut in greenhouse emissions by 2050 and a return to year 2000 greenhouse gas emission levels by 2025.

6.4.2 Potential impacts

During construction, the proposal has a minor potential to contribute to climate change due to the emission of greenhouse gases from use of vehicles and machinery. This would include workers travelling to and from the construction site and the movement and operation of construction machinery. The proposal would require approximately 1,700 truck loads to transport fill for the proposal. At this stage it is unknown where suitable fill material would be sourced. The RTA would endeavour to source suitable

[13] FullCAM provides an estimate of the maximum theoretical above ground biomass that is likely to be attained in undisturbed native forest systems given site productivity, which is calculated based on site factors such as rainfall, frost days, and soil nutrition (for example). This applies to native species only, exotic or improved species are able to attain a higher biomass than that indicated by FullCAM. The implicit assumption relating to species is that, whichever species/species assemblage occupies a site they use site resources to achieve the maximum biomass that the site can support. The use of maximum biomass data derived from FullCAM to estimate actual biomass at a development site therefore provides a conservative estimate of the amount of biomass to be cleared.

fill material from locally available sources, to reduce distances travelled and use of fossil fuels. The by product of the combustion of fossil fuels includes CO_2 which is considered a major contributor to climate change. Other greenhouse gases which would be emitted during the construction works include nitrogen oxides and sulphur dioxide.

Clearing of vegetation for the proposal would also generate greenhouse gas emissions by releasing stored carbon. It is estimated that 488.5 tonnes of biomass would be removed. The RTA anticipates that all of this biomass would be reused onsite throughout the proposal. However, for the purposes of this assessment, the RTA has adopted a conservative approach and have assumed that half of this would be sent for offsite disposal. This assumption allows for a "worst case scenario" with regards to potential emissions to be calculated.

The RTA applied a greenhouse gas calculator to the activities that would be associated with the proposal to determine the approximate level of greenhouse gas emissions for the entire proposal. Inputs used to calculate emissions included mass of vegetation to be cleared, purchased electricity, fuel combustion, operation of plant and equipment, waste disposal and embodied emissions of materials. The RTA Greenhouse Gas (GHG) Inventory for Road Construction Projects determined that the emissions associated with the proposal would be approximately 4478 tCO2e (tonnes of carbon dioxide equivalent). Operation of the site plant and equipment would be the greatest contributor to total emissions for the proposal, emissions from cement, lime and course aggregate, vegetation clearance and transport, operation of site vehicles and transport of materials would also contribute a large proportion of the total emissions.

The existing alignment from Thurralilly Street to Regent Road is approximately 2 km in length. The proposal would reduce this length by approximately 360 m. Post-construction, the proposal would likely reduce congestion and allow for more efficient travel speeds. This would result in a positive impact to air quality through decreased emissions from vehicles using the highway.

The total GHG emissions for NSW in 2004 was 158.7 million tonnes (DECC 2006), therefore the emissions created by this proposal would only constitute a very small proportion of the total emissions for NSW.

RTA GHG emissions calculator was used to determine the potential GHG savings between 2010 and 2030 due to the shortened Kings Highway and increased vehicle efficiency associated with the proposal. The potential GHG savings over this 20 year period would be approximately 21 154 tCO2e greater than four times the total tCO2e anticipated to be generated for the proposed works resulting in a net reduction of 16 676 tCO2e over the twenty year period.

It is considered that potential impacts on climate change can be adequately managed and mitigated via the mitigation measures as described below.

6.4.3 Safeguards and management measures

- When selecting construction plant equipment to be used as part of the proposal, energy (fuel/electrical) efficiency would be considered.
- Where feasible, the use of biofuels (biodiesel, ethanol or blends such as E10 and B80) would be considered for construction plant and equipment.
- Site vehicles, plant and equipment would be maintained in accordance with manufacturers specifications.
- Opportunities to preserve and/or rehabilitate existing vegetation and to avoid unnecessary clearing would be identified and implemented during the detailed design stage.
- Cleared vegetation would be reused on site to reduce the likelihood of off site disposal.
- The design of site facilities and the schedules of site vehicle movements would maximise efficiency of vehicle movement on site.
- Machinery, plant and vehicles would be turned off while not in use where practical, rather than left idling.
- Use of locally sourced resources and reuse of onsite materials would be maximised wherever suitable, available and feasible, to minimise transport related emissions.
- Wastage of resources such as steel and bitumen would be minimised.
- Opportunities to reduce the amount of materials needed to construct the proposal would be investigated.
- Low greenhouse-intensity materials (such as those with high recycled content) would be used preferentially over high greenhouse-intensity materials wherever appropriate.

6.5 Biodiversity

Several biodiversity studies have been completed concerning this area and have helped to guide the proposal to minimise biodiversity impacts:

1. **Preliminary constraints analysis** for proposed upgrade at Kings Highway, (nghenvironmental September 2008).
2. **Threatened flora searches**, Kings Highway, (nghenvironmental January 2009).

3. **Final realignment route biodiversity investigation**, Kings Highway, (nghenvironmental, January 2009).

The biodiversity assessment (refer to Appendix B) outlines the methods and results of these previous studies. Key findings are summarised below.

Flora survey methodology

Desktop and field assessment were undertaken to identify flora values relevant to the proposal. Previous reports were sourced (refer to Appendix B, Sections 2-1 and 2-2). A search of the DECCW threatened species database was undertaken to identify species known or predicted to occur in the Monaro sub-region of the Murrumbidgee CMA. A search of the DEWHA Protected Matters database was also undertaken (refer to Appendix B).

The vegetation and potential habitat within the proposal site was inspected on 10 July 2008 by using the random meander method (as per Cropper 1993). Targeted searches were conducted in spring 2008 for threatened plant species in areas considered likely to provide suitable habitat.

A species list was compiled during the field survey. Evaluations of potential for impact and assessments of significance were undertaken, pursuant to the *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

Fauna survey methodology

Desktop and field assessment were undertaken to identify fauna values relevant to the proposal. Previous reports were sourced (refer to Appendix B, Sections 2-1 and 2-2). A search of the DECCW threatened species database for species known or predicted to occur in the Monaro sub-region of the Murrumbidgee CMA was undertaken. A search of the DEWHA Protected Matters database was also undertaken (refer to Appendix B).

Survey techniques employed included:

- Habitat assessments.
- Bird censuses
- Reptile searches (rock rolling)
- Frog censuses.
- Nocturnal surveys (call playback, spotlighting, stag watching, anabat).
- Searches for scats and other animal signs.

6.5.1 Existing environment

Flora

The proposed route for the Kings Highway is located within an existing cleared gravel road reserve known as Goulburn Road corridor. This road corridor has a gravel track as well as woodland which has been partially cleared and subject to a high level of disturbance.

Cuumbuen Nature Reserve is located approximately 1.5 km to the south east of the subject site. Adjacent land is generally private property in a rural residential setting, partially cleared and with frequent plantings of exotic flora such as pines and other conifers. The area to the south of the site is less developed.

Vegetation communities

Vegetation within the proposal site is classified as:

- Tableland Low Woodland, Braidwood Dry Forest, Tableland Hills Grassy Woodland
- Western Tablelands Dry Forest
- Tablelands Grassy Box-Gum Woodland, Tablelands Grassy Box-Gum Woodland

Endangered ecological communities

One endangered ecological community, Yellow Box – White Box- Blakely's Red Gum Grassy Woodland was identified as potentially occurring in the area during the desktop assessment. The ecological community, hereafter referred to as Box Gum Woodland, is listed as an endangered ecological community under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Some better quality stands of the community meet the definition of the critically endangered Box Gum Woodland EEC under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Based on the detailed site survey, it was concluded that the vegetation on the proposal site did not meet the definition of Box-Gum Woodland ecological community, under either the TSC Act or the EPBC Act. Further discussion on the interpretation of the endangered ecological community definitions is provided within Appendix B, Section 3.1.2.

Threatened flora

No plant species which are listed as threatened under the TSC Act were found on the site. One species listed as Endangered under the EPBC Act was found, the forb Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var. *tricolor*).

Desktop assessment identified a total of 18 threatened plant species known or predicted to occur in the region. A search of the DEWHA Protected Matters database revealed an additional two threatened

plant species with the potential to occur on the site.

An evaluation of the habitat requirements of these species and of the potential for them to occur onsite and be impacted by the proposed works was undertaken (refer to Appendix C of the attached Appendix B *biodiversity assessment*). This assessment determined that three threatened species have the potential to be impacted. These three species are outlined in Table 6-3.

Table 6-3 Threatened flora with potential for impact

Species and Status*	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted
Hoary Sunray *Leucochrysum albicans* subsp. *albicans* var. *tricolor* E EPBC	Present. Recorded onsite.	Present	Yes
Doubletail Buttercup *Diuris aequalis* E TSC V EPBC	The study area provides marginal habitat for the subject species; the dry nature of habitat within the study area indicates that orchids are unlikely to be present.	Possible	Yes
Thick-lipped Spider Orchid *Caladenia tessellata* E TSC V EPBC	The study area provides marginal habitat for the subject species; the dry nature of habitat within the study area indicates that orchids are unlikely to be present.	Possible	Yes

V TSC Listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995*
E TSC Listed as Endangered under the NSW *Threatened Species Conservation Act 1995*
V EPBC Listed as Vulnerable under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
E EPBC Listed as Endangered under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*

Assessments of significance, pursuant to the TSC and EPBC Acts, as relevant, were undertaken for these species (conclusions of the assessment are discussed within Section 6.5.2 of this REF).

Weeds

Weeds listed as noxious in Queanbeyan LGA and which were found in the proposal site are as follows:

- African lovegrass (**Eragrostis curvula*), one to a few plants on the Kings Highway verges in three locations.
- African boxthorn (**Lycium ferocissimum*), a single small plant on the edge of the Goulburn road at the western end of the site.
- Blackberry (**Rubus fruticosus sp. agg.*), abundant in the gully floor in the Goulburn Road corridor at the western end of the site, and present on a steep fill better on the southern Kings Highway verge west of Ridgeway Road junction.
- St John's wort (**Hypericum perforatum*), scattered throughout the proposal site, with some dense patches, often in less visible areas where a road-based spraying program does not penetrate.

- Sweet briar (**Rosa rubiginosa*), scattered sparsely through the site.

The first three species are listed as noxious in Class 4 in Queanbeyan LGA, meaning there is a requirement that they be controlled in accordance with a local management plan.

St John's wort and sweet briar are listed as Class 3 weeds in Queanbeyan LGA, meaning they must be fully and continuously suppressed and destroyed.

Fauna

Fauna habitat types

Four habitat types were identified within the proposal site: rocky outcrops, disturbed areas, woodland and riparian areas (detailed in Appendix B, Section 3.2.1).

Rocky outcrops are scattered throughout the proposal site including the north-eastern portion of the site, east of Regent Drive and adjacent to the gravel track (Goulburn Road) running generally north – south. These areas are disturbed and are likely to be a result of historical construction activities associated with previous road work. Rock characteristics include loose rocks up to 100 mm in diameter on the edges of the gravel track with cutting walls intermittently dispersed along the up gradient edge of the track. The rocky outcrops have the potential to be habitat for a number of threatened fauna species, including little whip snake (*Suta flagellum*), pink tailed legless lizard (*Aprasia parapulchella*), and striped legless lizard (*Delmar impar*). The quality of habitat was considered to be low.

Woodland habitat is located predominantly in the middle of the proposal site. The general vegetation composition can be described as low woodland with a predominantly shrubby understorey. It is considered potential habitat for a number of threatened fauna identified during the desktop assessment. Two hollow bearing trees were noted within the woodland and provide hollows, from small (suitable for microbats) to large (suitable for arboreal mammals and forest owls). Call play back and spotlighting targeted these trees.

There is a natural drainage feature located within the proposal site. Based on analysis of the 1:25000 topographic map, this is a first order stream. This drainage line is not considered key fish habitat by the NSW DPI (Industry and Investment NSW). At the time of the field assessment the majority of this drainage line was dry. There were small ponds of water observed at certain sections of this drainage line. Call play back for the green and golden bell frog (*Litoria aurea*) was undertaken in the vicinity of these ponds.

Potential for threatened and significant fauna species

Desktop assessment determined that four species of frog, 26 species of bird, two species of fish, one insect species, eight mammal species and four reptile species are known or predicted to occur within the sub catchment area. An evaluation of their potential to occur within the proposal site based on the

presence of suitable habitat was undertaken (refer to Appendix B). Of these 45 species, the following ten threatened species are considered to have potential to occur and be potentially subject to adverse impact:

- Speckled warbler (*Chthonicola sagittata*) V TSC.
- Brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) V TSC.
- Hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*) V TSC.
- Diamond firetail (*Stagonopleura guttata*) V TSC.
- Gang-gang cockatoo (*Callocephalon fimbriatum*) V TSC.
- Regent honeyeater (*Xanthomyza phrygia*) E TSC, E EPBC.
- Eastern bentwing Bat (*Miniopterus schreibersii oceanensis*) V TSC.
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) V TSC.
- Rosenbergs goanna (Varanus rosenberg) V TSC.
- Little whip snake (*Suta flagellum*) V TSC.

V TSC Listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995*
E TSC Listed as Endangered under the NSW *Threatened Species Conservation Act 1995*
V EPBC Listed as Vulnerable under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
E EPBC Listed as Endangered under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*

These fauna species were subject to assessments of significance pursuant to the TSC Act and EPBC Act, as required. The conclusions of the assessments are discussed in Section 6.5.2 of this REF.

6.5.2 Potential impacts

Flora

The proposal would result in direct impacts, such as clearing of approximately four hectares of native vegetation. Additionally, there is potential for soil disturbance, erosion and subsequent sedimentation, altered hydrology and weed ingress, all of which may affect native vegetation on and adjacent to the proposal site.

Native vegetation clearing

Clearing of native vegetation is listed as a *Key Threatening Process* in NSW (NSW Scientific Committee 2008).

Impacts of clearing include fragmentation, destruction of habitat, riparian zone degradation, loss of leaf litter layer and increased habitat for invasive species. Clearing is defined as "*...the destruction of a sufficient proportion of one or more strata within a stand or stands of native vegetation ...*" (NSW Scientific Committee 2008).

The proposal would result in the removal of approximately four hectares of woodland in various levels of disturbance. Of this area, the western and eastern ends are less intact; less of the overstorey is present, the vegetation condition is poorer and greater levels of disturbance occur. These areas are considered a low biodiversity constraint. In the middle section, the vegetation is in better condition and has been classified as moderately constrained due to the good condition of vegetation.

The requirement for vegetation clearing has been minimised to clearing critical to the works. Impacts to vegetation would be further minimised by controlling impacts outside the immediate proposal site. This is achieved by clear delineation of the proposal site and implementation of work practices which confine all impacts to the proposal site.

Soil disturbance and compaction

Vegetation removal exposes bare soil to the effects of erosion. Soil compaction can occur through the movement of machinery and materials. Both effects can damage vegetation to be retained and affect recolonisation by native vegetation, both within the immediate works area and in adjacent areas.

Sediment controls would be put in place before construction work begins. With the implementation of appropriate sediment and erosion controls (as outlined in Section 6.1.3 of this REF), the risk of soil disturbance on vegetation is considered manageable.

To reduce the area of soil compaction, impact areas would be clearly demarcated at the proposal site to ensure that the minimum areas are affected. Previously disturbed areas would be used preferentially for stockpiles and access.

Weeds

The proposal would involve disturbance of soil infested with weed seeds. This would have the potential to cause the spread of weeds on the site. This impact would be mitigated through management strategies including washing down of machinery and vehicles before and after works, controlling isolated infestations prior to and during works, not re-using weed infested soil in areas than from where it came and monitoring and controlling weeds after completion of the works, for a period of at least two years.

Class 4 weeds (African lovegrass, African boxthorn, blackberry) would be controlled in accordance with

Queanbeyan City Council weed management plans[14] and Class 3 weeds (St John's wort, sweet briar) would be fully and continuously suppressed and destroyed.

Threatened flora species impacts

Field survey and desktop assessment concluded that three threatened flora species may be affected directly or indirectly by the works. Assessments of significance were undertaken to characterise the significance of impacts to these species, pursuant to the TSC Act (7 part test) and EPBC Act, as required.

Hoary Sunray, (*Leucochrysum albicans ssp albicans var. tricolour*)

The field surveys undertaken established that one species, Hoary Sunray, (*Leucochrysum albicans* ssp *albicans* var. tricolour), occurs within the proposal site, with at least 400 plants counted.

The EPBC Act assessment of significance for this species found that the proposal would reduce the number of individual plants at the site, but the population size of this disturbance tolerant species is unlikely to be affected in the long-term. The works would reduce the area of occupancy of this species by approximately four hectares however, large patches of this species occur outside the impact area and it is likely that some recolonisation would occur, where individuals are removed. The works are not likely to generate a significant impact and measures are available to further reduce identified impacts.

Table 3-2 in Appendix B demonstrates the location of patches of this species which would be outside of the proposal impact zone and which would be fenced to avoid impact and assist with the recovery of this species post-construction work. (Refer also to Appendix B, Figure 3-1 for the general location of the patches).

Caladenia tessellata, Diuris aequalis

Potential for impact was identified for the *Caladenia tessellata* and *Diuris aequalis* within the proposal site, although none of these species were identified on site. It is very unlikely that they occur (possibly present as seed or dormant tubers in the case of the two orchids). The TSC Act 7 part test and the EPBC Act assessment of significance have concluded that the proposed activity is *'unlikely'* to have a *'significant effect'* on these species. Measures are outlined below to further reduce impacts.

Endangered ecological community impacts

There is no vegetation community within the proposal site that would be classified as endangered ecological community and therefore, the works would not impact directly on any endangered ecological

[14] Queanbeyan City Council have developed a Broadleaf Weed Management Plan, Grass Weed Management Plans, Noxious Weed Policy and Woody Weed Management Plan, available at www.qcc.nsw.gov.au/.

community. There are areas of vegetation that could be classified as marginal Box Gum Woodland endangered ecological community in close proximity to the works, but these areas would not be impacted by the proposal. As these areas are elevated above the level of the proposal site it is unlikely that they would be subjected to indirect impacts, such as altered runoff or weed invasion. Recommendations to minimise impacts have been incorporated into the proposal. These include clear delineation of the work site and work practices which would confine all impacts to the work site.

Fauna

The proposal would impact on an area of approximately four hectares, not including areas of existing gravel surface (Goulburn Road). This would include areas of woodland vegetation and disturbed areas including the road verge. Rocky outcroppings and drainage lines would also be affected. The proposal would constitute a direct loss of habitat for fauna and may also affect a larger area, through indirect impacts.

Direct impacts

The primary impact on fauna species would be related to habitat loss through vegetation removal and also the removal of refuge, such as tree hollows, fallen branches and rocks, which represent potential habitat for many species.

Woodland (including loss of hollows)

The proposal would result in the removal of all woodland habitat within the immediate proposal site. Two hollow bearing trees were identified within the woodland located adjacent to the north south trending drainage line. The loss of hollow-bearing trees is listed as a key threatening process by the NSW Scientific Committee. Both hollow bearing trees were observed to be used by brush-tailed possums during the nocturnal surveying work. Brush-tailed possums are not listed as threatened under the TSC Act or the EPBC Act. This species is a highly mobile and considered common. It can however, compete with other hollow-dependant species, such as the threatened Gang-gang cockatoo and Glossy black cockatoo, preventing the use of hollows by these less aggressive and abundant arboreal species. Hence removal of these hollows may have an indirect impact of increasing competition in the local area for hollows. Microbats use smaller hollows and, if used as a communal roost, impacts to local populations may occur.

Considering the proximity of these hollows to other areas of similar habitat to the east, as well as the area reserved in the Cuumbeun Nature Reserve, the loss of these two hollow-bearing trees is unlikely to result in a significant impact to any threatened species, if felled in accordance with the two staged clearing process described below. This protocol ensures that any fauna trapped within a tree during felling are recovered and relocated.

No species of threatened birds were seen or heard during the bird survey and it is considered unlikely

that the removal of woodland from within the proposal site would significantly impact highly mobile species of threatened birds known or predicted to occur within the Monaro sub-catchment. Woodland habitat of similar or likely better quality is considered to be well represented in general locality of the proposal site.

Rocky outcrops

Rocky outcrops occur within the proposal site. It is considered that the disturbed character of the proposal site is likely to provide marginal habitat for rocky outcrop dependant species. The proposal would impact on the rocky habitat by removing areas of rocky outcrops. Impacts to rocky outcrops are not considered likely to significantly impact any threatened fauna.

Riparian habitat

One first order stream would be removed by the works. Associated riparian habitat is of low quality. The removal of this habitat is unlikely to impact on any threatened species.

Indirect impacts

Habitat outside the proposal site can be degraded as a result of indirect impacts associated with the proposal, such as:

1. Weed invasion (discussed under Flora).

2. Noise and vibration may temporarily affect the local presence and behaviour of fauna species, including during nesting periods (for example, birds utilising nearby hollow-bearing trees). Once developed, fauna utilising habitat adjacent to the proposal site are likely to acclimatise to this change. This is considered to be a low impact.

3. Soil disturbance and compaction (discussed under Flora).

Threatened fauna species impacts

Assessments of significance (presented in Appendix D of the attached *biodiversity assessment,* Appendix B), were undertaken to characterise the significance of potential impacts to ten threatened fauna species as a consequence of the works. The assessment concluded that:

> *Vegetation to be affected has been subject to previous disturbance due to past construction activities .... The proposal would also require the removal of two hollow bearing trees. ... Due to the proximity of large areas of good quality habitat adjacent to the impact area, such as the Cuumbeun Nature Reserve and the high mobility of the species which would utilise this habitat feature, their removal was not considered likely to constitute a significant impact.*

Safeguards and management measures designed to minimise the potential impact on these threatened species have been described in Section 6.5.3 of this REF. The TSC Act 7 part tests and EPBC Act assessments of significance have concluded that the proposal is *'unlikely'* to have a *'significant effect'* on the assessed threatened fauna species.

Key threatening processes

Three key threatening processes (listed by the NSW Scientific Committee 2008) are relevant to the fauna impacts of this proposal:

Bush rock removal

Includes removal of rocky outcrops or rock within areas of native vegetation. Impacts of bush rock removal include loss or disturbance of native flora and fauna species habitat. Rocky outcrops occur within the proposal site. It is considered that the disturbed character of the proposal site is likely to provide marginal habitat for rocky outcrop dependant species. The proposal would impact on the rocky habitat by removing areas of rocky outcrops. Impacts to rocky outcrops are not considered likely to significantly impact any threatened fauna. Safeguards include rocks and dead branches on the ground that need to be removed would, where practical, be redistributed in an adjacent area of the road reserve to preserve existing ground refuge.

Loss of hollow-bearing trees

There are two hollow bearing trees that would require removal as part of the proposal. It is considered that the removal of these hollow bearing trees may exacerbate this key threatening process, however their removal would be unlikely to significantly impact on threatened species. Safeguards for the proposal include protocols for removal of hollow bearing trees and the installation of bat boxes to offset the loss of this resource.

Removal of dead wood and dead trees

Removal of standing or fallen dead wood removes hollows as well as understorey litter. A small number of dead stags were evident within the proposal site. The proposed works may exacerbate this process during clearing however their removal would be unlikely to significantly impact on threatened species.

6.5.3 Safeguards and management measures

- The work site would be clearly delineated to reduce the risk of machinery, vehicle and trampling damage and compaction to flora located outside of the proposed works envelope.
- Washing of machinery onsite would take place in a bunded formal washout area, to avoid the spread of weeds.

- Noxious weeds would be removed and destroyed prior to the commencement of construction works, as far as is practicable. This would be undertaken in accordance with Queanbeyan City Council weed management plans.

- Areas where environmental weeds exist would be clearly marked. Soil removed from these areas would not be reused on site unless deeply buried.

- The work site would be inspected to ensure that disturbed areas become stable and weed infestations do not occur. The site would be appropriately rehabilitated and revegetated to provide stability to disturbed areas and to reduce the potential of sediment and erosion damage. A flora plan would be prepared prior to works commencing onsite. This plan would specifically address:

    - Weed management.

    - Treatment of topsoils to maximise their value for revegetation of disturbed sites.

    - Sourcing of local plants for revegetation (prior to any clearing works on site, it may be useful to collect seeds or seedlings of native species present to use in the revegetation of the site).

    - Methods available to maximise opportunities for fauna to recolonise the rehabilitation areas.

    - Disturbed areas would be revegetated with appropriate local native species.

- An appropriate training program would be implemented to make sure all site staff are aware that the endangered flora species, Hoary Sunray (*Leucochrysum albicans ssp albicans* var. tricolour), is present within the proposed impact areas. Impact to areas where Hoary Sunray is identified would be minimised as much as practicable.

- Hoary Sunray patches outside of the direct impact area would be fenced off to avoid inadvertent impact (refer to bold entries in Appendix B, Table 3-2 and Figure 3-1).

- Hoary Sunray seed would be collected prior to the works to assist with colonisation post-construction.

- When removing the two hollow bearing trees (adjacent to the north south trending drainage line), the RTA environmental officer or an appropriately licensed wildlife carer would be onsite to monitor and implement the two stage clearing process as described below:

    - Ensure trees to be retained and habitat trees to be felled are clearly identified and marked.

    - Ensure contractors are provided with a list and map of locations of hollow bearing trees

- Ensure contact details for the nearest vet and wildlife care group are provided to site manager, contractor and made available in site office. Make contact with vet and wildlife care group prior to commencement of clearing to ensure they are willing to assist or take injured animals if necessary.

- Clear everything else around the hollow bearing trees and potential hollow bearing trees as per the list and map produced during pre-clearing stage or earlier.

- If any threatened species are known to be breeding on the site during clearing then special conditions may apply and the requirements for that species must be considered. For example, nest trees may need to be retained as well as foraging resources in the vicinity.

- An ecologist with experience in fauna handling should be present during clearing of habitat trees.

- Hollow bearing trees should be left standing a minimum of 24 hours to allow resident fauna the chance to relocate. Ecologists will spotlight and stagwatch at night. During this time the ecologist may set traps to capture resident animals if hollows are known to be occupied.

- Fell habitat trees as carefully as possible. If possible use swivelling heads so the habitat trees can be lowered to the ground with minimal impact. Request contractors to roll or lift limbs that may be obscuring hollows or fauna.

- Ecologist would capture animals that emerge from hollows of felled trees. Animals are to be inspected for injury (see point below relating to injured animals). The animals would be placed in cloth bags and transferred to suitable holding location to await release. Nocturnal fauna should be released at dusk.

- Ecologist to inspect all hollows once tree has been felled for signs of wildlife.

- Injured animals should be kept in a dark, noise-free place and taken as soon as possible to a wildlife carer or vet – contact details will be supplied to surveyors and clearing contractors.

- Hollows potentially supporting fauna can either be cut, or, if there is a risk of injury (animals can be cut in two) the logs can be left on the ground and rechecked the following day or placed on the edge of adjoining habitat.

- Ecologist is to guide the clearing contractors as to limbs containing or potentially containing hollows.

- Ecologist to guide clearing contractors to expose and turn felled hollow bearing limbs (these may spear into the ground and obscure the hollow entrance when felled).

- Relocate hollows to adjacent land (as approved by DECCW or landowner).
- No trees are to be felled into/towards exclusion zones.
- Provide clearing report outlining any fatalities and number and species of animals relocated.

- Care would be taken not to damage vegetation (e.g. tree limbs and bark) when moving equipment near native vegetation to be retained.
- Cleared vegetation not used as sawlog or to provide habitat (as described below) would be mulched.
- Where possible, some logs from felled trees would be distributed into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional habitat for ground dwelling fauna such as reptiles and small mammals.
- Substantial areas of rock and large dead branches on the ground that need to be removed would, where practical, be redistributed in an adjacent area of the road reserve to preserve existing ground refuge.
- Bat boxes or means to provide roosting opportunities would be installed at strategic locations in the vicinity of the southern-most hollow-bearing tree to facilitate the relocation of bat species which may use this resource. The number of boxes should reflect the number of hollows to be removed at a ratio of 1:1. Alternatively, the felled sections containing hollows could be remounted nearby.
- Only vegetation that is critical to the completion of the proposal would be removed.

6.6 Aboriginal heritage

6.6.1 Approach

The proposal site is located within the boundaries of the Ngunnawal Local Aboriginal Land Council (NLALC). In accordance with the RTA procedure for Aboriginal cultural heritage consultation and investigation, (PACHCI) a determination as to whether the proposal was likely to affect Aboriginal cultural heritage and internal RTA assessment was completed by the RTA Aboriginal cultural heritage advisor. The internal assessment broadly considered the potential of the proposed works to impact any items of Aboriginal cultural heritage. The RTA considered that there was potential for the proposal to impact items of Aboriginal cultural heritage and to that end consultation with the relevant Aboriginal stakeholders, NLALC was undertaken.

The RTA Aboriginal cultural heritage advisor, along with representatives of NLALC undertook a site visit for an extended length of the Kings Highway upgrade area, of which the proposal site was included. The

objective of the site visit was to determine if there were any artefacts or areas of Aboriginal cultural significance that could be impacted as a result of the proposal.

NLALC provided a written letter post the field survey determining that:

> *"The entire area was scanned for artefacts or remnants of artefacts, the vegetation was thick and limited visibility, the scan revealed no artefacts or any remnants of cultural significance."*

Subsequent to the findings of the visit, the RTA determined that no further Aboriginal archaeological assessment was required. A copy of the RTA's correspondence with the Ngunnawal LALC is at Appendix C.

6.6.2 Potential impacts

It is considered that potential impacts to Aboriginal cultural heritage would be confined to the construction phase of the proposal. Based upon the results of RTA Aboriginal cultural heritage investigations and the disturbed nature of the proposal site, no impacts are anticipated.

6.6.3 Safeguards and management measures

- If items are uncovered that could be Aboriginal objects, work in that area would stop immediately. The procedure for the unexpected discovery of an Aboriginal object is described in the RTA procedure for Aboriginal cultural heritage consultation and investigation, PACHCI (August 2008). This procedure would be followed in the event of an unexpected discovery.

6.7 Non-Aboriginal heritage

6.7.1 Existing environment

To determine if there are any listed heritage items within the proposal site, a search for items of Commonwealth or National, State and local significance was conducted. This involved searches of the *Queanbeyan City Council Local Environment Plan (LEP) 1998*, the NSW Heritage Branch (Department of Planning) heritage register (www.heritage.nsw.gov.au, accessed January 2009), the Australian Heritage Database (www.environment.gov.au, accessed October 2008) and the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Protected Matters search tool. A site inspection was carried out by qualified heritage staff from ngh-heritage on 25 May 2009 in order to determine the physical attributes of the site.

Although not listed on any heritage register, an old road alignment (known as the 'Goulburn-Queanbeyan Road') was identified following the site inspection and additional research. The section of the old Goulburn Road alignment at Bungendore Hill is assessed to be of local heritage significance, being identified as one of the earliest roads between Goulburn and the Queanbeyan/ACT region. A

Statement of Heritage Impact (SoHI) (refer to Appendix E) assesses aspects of the heritage significance of the old road alignment and assesses any impact as a result of the proposal, and if those impacts are acceptable. The assessment follows the guidelines set out by the NSW Heritage Branch (Department of Planning) publication Statements of Heritage Impact (refer to Appendix E).

Sections of the Goulburn-Queanbeyan Road including two existing road cuttings within the site from the early/mid 19th century are considered to be of local heritage significance. No other significant elements are identified with the road infrastructure, such as stone culverts and bridges.

The search of the *Queanbeyan City Council LEP 1998* returned 131 local heritage items for the Queanbeyan Local Government Area (LGA). Figure 6-3 presents the Queanbeyan City Council heritage items. The search of the NSW heritage register returned seven items listed under Section 1 (items listed under the NSW *Heritage Act, 1977*) and 154 items listed under Section 2 (items listed by Local Government and State Agencies). The search of the Australian Heritage Database returned 34 items for the Queanbeyan LGA. The search of the EPBC Act returned two Commonwealth listed heritage items.

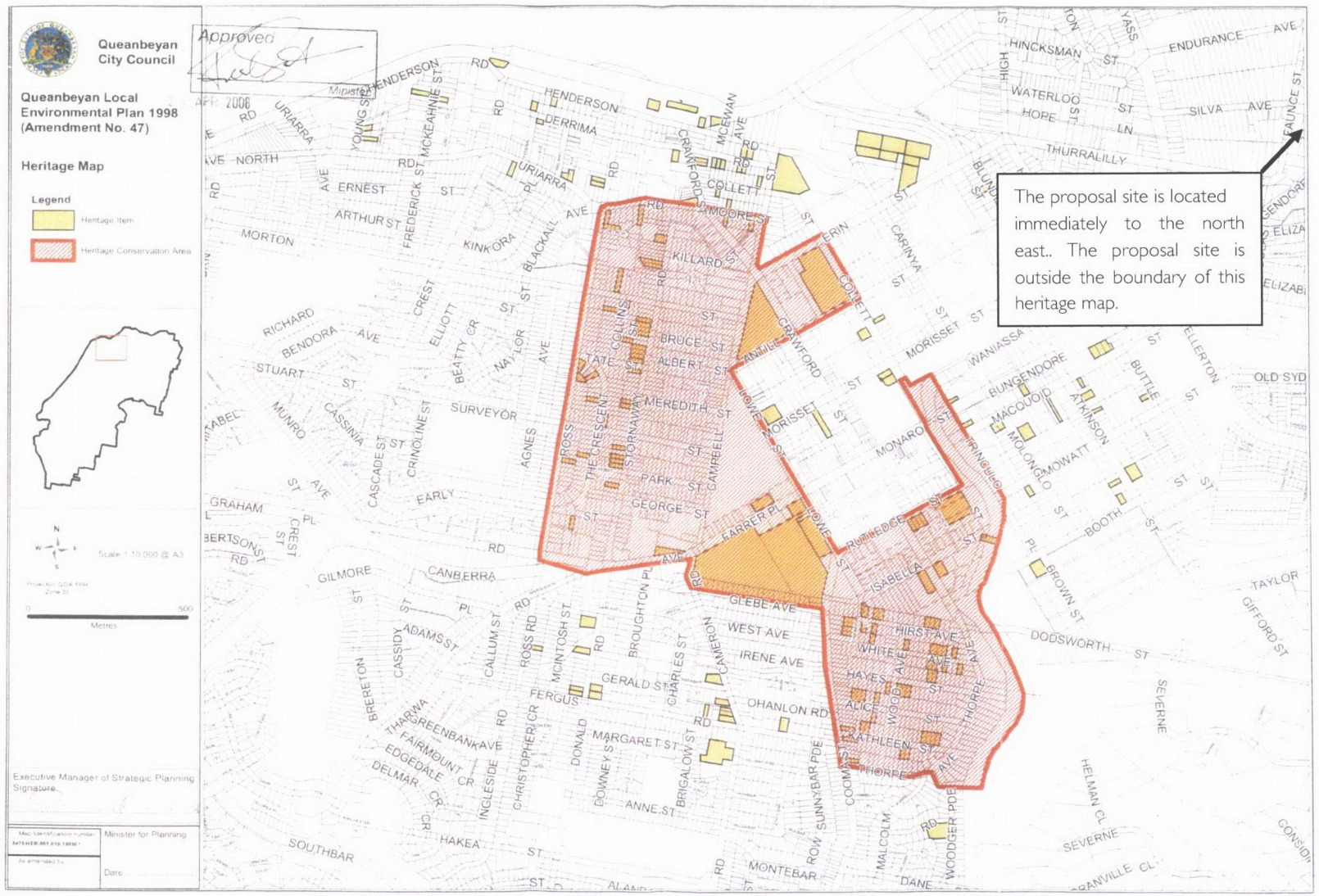

Figure 6-3: QCC Heritage Map (sourced from http://www.qcc.nsw.gov.au/)

6.7.2 Potential impacts

None of the items listed as heritage items within these databases fall within the proposal site and therefore would not be at risk of impact. Further, the Queanbeyan City Council LEP map does not indicate that there are any conservation zones for areas of heritage significance within the proposal site.

The proposal has the potential to indirectly impact on the Queanbeyan River, currently listed on the Register of the National Estate (RNE), as there is the potential for turbid runoff from the proposal to transport sediments into the river, which is located approximately 1 km away from the western end of the proposal at its closest point. However, unlike the National and Commonwealth Heritage lists (protected under the EPBC Act), the RNE does not place any legal constraints or controls on the actions of state or local governments. In addition, impact to the Queanbeyan River would be unlikely with implementation of the safeguards and management measures outlined in Sections 6.1 and 6.2 of this REF.

The identified section of old road alignment (approximately a 1.2 km section of the old Queanbeyan-Goulburn Road) and in particular two cuttings would be impacted by the proposal. This road has not been in use since the 1930s, but would be removed as part of the proposed development to the Kings Highway at this location. Due to the topography of the area and lack of other feasible alternatives for the proposed road alignment, these cuttings would be demolished.

Several other heritage items are located in the streets surrounding the proposal, refer to Figure 6-3, however it is considered that they are located a sufficient distance outside of the potential impact zone of the proposal and would not be impacted.

In summary, the proposal to re-align the existing Kings Highway to the section of old road alignment at Bungendore Hill (old Goulburn to Queanbeyan Road), which has local heritage significance, would not cause a significant impact on the heritage significance of the Goulburn Road (Appendix E).

6.7.3 Safeguards and management measures

The following recommendations are proposed in regards to the old section of the Goulburn-Queanbeyan Road within the study area:

- An archival recording is undertaken for the existing old Goulburn Road alignment at Bungendore Hill. This should follow the guidelines for Items of Local Heritage Significance as outlined in the NSW Heritage Branch publication *How to Prepare Archival Records of Heritage Items*. The recording should pay particular attention to

the old road cuttings from the 19th century, but cover the entire stretch of the old road that would be impacted, including landscape vistas as they exist within the site.

- It is considered at this time that further archaeological investigation is unlikely to contribute valuable information. However, should any relics or items be uncovered within the proposal area after works commence, all works that may affect the find would immediately cease and the RTA Environment Branch (Heritage) should be contacted. If any sections of the road are uncovered, the Senior Environmental Specialist (Heritage) would be contacted. They would then be able to advise whether the Heritage Branch should be informed and when works in the area may recommence.

- It is recommended that mapping be carried out along the line of the road within Queanbeyan LGA and recording any vestigial route information about construction as part of the above archival recording.

6.8 Noise and vibration

A noise and vibration impact assessment was completed for the proposed realignment of the Kings Highway (Heggies Pty Ltd 2009). The assessment is in accordance with the Department of Environment, Climate Change and Water's (DECCW) Environmental Criteria for Road Traffic Noise (ECRTN, EPA - May 1999), which represents the NSW Government's current policy on road traffic noise and with the RTA Environmental Noise Management Manual (ENMM – RTA, December 2001).

Affected residences were grouped into Noise Catchment (NC) areas; representative of areas with similar potential noise exposure from the realignment. A description of each area is as follows:

Noise catchment A

Area to south with two (2) properties directly fronting onto the realigned section of the Kings Highway (ie where it ties in with the existing road) and approximately another ten (10) properties setback one street from Kings Highway in Hybon Avenue and Elizabeth Crescent.

Noise catchment B

Central area east side, ten residential properties 50 - 200 m from Kings Highway.

Noise catchment C

Central area west side, two nearest residential properties, approximately 80 - 120 m from the proposal.

The noise catchment areas are illustrated in Figure 6-4.

Background noise monitoring was undertaken at locations within the vicinity of the proposal site.

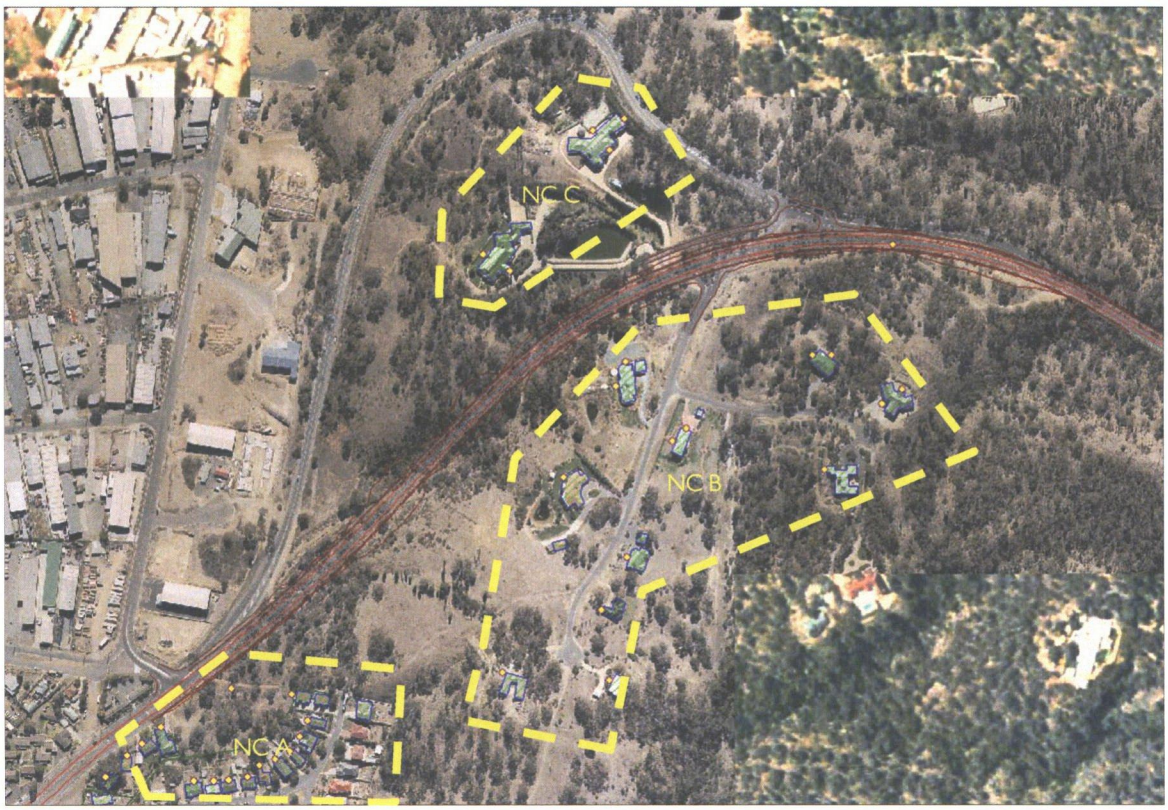

Figure 6-4: Locations of noise catchments (adopted from noise assessment report) **(Aerial taken 26/04/2004)**

Table 6-4: Ambient noise monitoring locations

Location No	Location	Notes
BG1	42 Bungendore Road (Kings Highway), Queanbeyan East	Single-storey residence in NC A fronting Bungendore Road (Kings Highway). Residence exposed to existing road and would be adjacent 'realignment' section of new road. Microphone approximately 12 m from nearest lane
BG2	2 Hill Lane, Queanbeyan East	Residence approximately 130 m east of existing Kings Highway alignment. Indicative of residences in central area (NC B and C) adjacent to new alignment. Microphone on west façade of property.

Results of the unattended noise logging were utilised to determine the various relevant

prevailing road traffic noise descriptors. Based on the noise logger results, background noise levels were estimated at residences located in the vicinity of the proposal site, in order to establish the construction noise goals.

Further details of the approach are presented in Appendix F.

6.8.1 Existing environment

There are a number of residential properties located along the proposal. Residential properties affected by the proposal are located generally through the central corridor area (properties off Regent Drive) and also in the southern section of the proposal site where there are properties currently fronting onto or near the current alignment of the Kings Highway.

Criteria

Construction noise guidelines

When dealing with noise emanating from construction works, DECCW recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works and that the goal of the works is to improve to safety. As a result, the "Environmental Noise Control Manual" (ENCM) presents the DECCW's recommended guidelines for the control of construction works noise. The ENCM recommends that the $L_{A10(15minute)}$ noise levels arising from a construction site and measured within the curtilage of an occupied noise - sensitive premises (ie at boundary or within 30 m of dwelling, whichever is the lesser) should not exceed the noise levels indicated in Table 6-4. These noise goals are consistent with community reaction to construction noise.

Table 6-5: DECCW Recommend Noise Goals for Construction Works

Construction Period	LA10(15minute) Construction Noise Goal
Cumulative noise exposure period not exceeding 4 weeks	LA90(15minute) plus 20 dBA
Cumulative noise exposure period of between 4 weeks and 26 weeks	LA90(15minute) plus 10 dBA
Cumulative noise exposure period longer than 26 weeks	LA90(15minute) plus 5 dBA

Construction vibration guidelines

Vibration targets vary primarily according to whether the particular activities of interest are continuous in nature or intermittent and whether they occur during the day or night-time. The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly

disturbed

- Those in which the integrity of the building or the structure itself may be prejudiced
- Those where the building contents may be affected.

Australian Standard 2670.2 - 1990 "*Evaluation of human exposure to whole-body vibration, Part 2: Continuous and shock-induced vibration in buildings (1 Hz to 80 Hz*) establishes levels of satisfactory vibration with respect to human response. This criteria is considered applicable to proposal and is presented in Table 6-6.

Table 6-6: Vibration Criteria - Human Comfort (from AS 2670:1990)

Type of Space Occupancy	Time of Day	RMS Vibration Levels in mm/s corresponding to a "Low Probability of Adverse Comment"			
		Continuous Vibration (16h Day, 8h Night)		Transient Vibration Excitation with several Occurrences per Day	
		Vertical	Horizontal	Vertical	Horizontal
Critical working areas (eg some hospital operating theatres, some precision laboratories, etc)	Day	0.1	0.3	0.1	0.3
	Night	0.1	0.3	0.1	0.3
Residential	Day	0.2 to 0.4	0.3 to 0.6	6 to 9	18 to 27
	Night	0.14	0.42	0.14 to 2.0	0.3 to 6.0
Offices	Day	0.4	1.2	6 to 13	18 to 38
	Night	0.4	1.2	6 to 13	18 to 38
Workshops	Day	1.2	3.2	9 to 13	27 to 38
	Night	1.2	3.2	9 to 13	27 to 38

Operational road traffic noise criteria, guidelines and objectives

The NSW Environmental Criteria for Road Traffic Noise (ECRTN May 1999) presents guidelines for the assessment of road traffic noise arising from new or redeveloped roads. These guidelines are applicable to the site and have been utilised for the purpose of this assessment.

There are two relevant ECRTN noise guidelines that apply along the Kings Highway, redevelopment of existing freeway/arterial road and new freeway or arterial road corridor. Dwellings adjacent to the 'central' section of the proposal (NC B and C) would fall under the category of 'new arterial road' with dwellings in southern section (NC A) falling under the criteria of redevelopment of existing freeway/arterial road.

These guidelines are applicable to this proposal:

- At the time of project opening (expected in the year 2010).

- For traffic conditions prevailing 10 years after project opening (year 2020).

In achieving compliance with the noise criteria, consideration needs to be given to feasibility and reasonableness, aesthetics, cost implications, equity, community preferences and practicality of potential noise controls. Specific criteria is presented in Table 6-7.

Table 6-7:Road Traffic Noise Criteria for proposed Kings Highway realignment

Type of Development	Criteria Day 7am - 10pm (dBA)	Night 10pm - 7am (dBA)	Where Criteria are Already Exceeded
Criteria for residences fronting Kings Highway at south end where new alignment would tie in with existing road			
Redevelopment of existing freeway/arterial road	$L_{Aeq(15hour)}$ 60 dBA	$L_{Aeq(9hour)}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dBA. 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, such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.
Criteria for residences fronting Kings Highway in central section (adjacent to new alignment)			
New freeway or arterial road corridor	$L_{Aeq(15hour)}$ 55 dBA	$L_{Aeq(9hour)}$ 50 dBA	The new road should be designed so as not to increase existing noise levels by more than 0.5 dBA. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may only be achievable through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, restricted access for sensitive areas or during sensitive times to low-noise vehicles, improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

Environmental noise management manual guiding principles

The RTA's "Environmental Noise Management Manual" (ENMM) presents the RTA's policy on cost-effectiveness, reasonableness and feasibility of noise walls and architectural treatments (refer Practice Note iv (a) and iv (b) respectively). As documented in the ENMM, in this context 'feasibility' refers to engineering practicality, while 'reasonableness' is to be judged by taking account of:

- Noise mitigation benefits and costs.
- Community views and aesthetic impacts.
- Existing and future noise levels at affected land uses.

- The benefits of the proposed development.

Existing and future noise levels that are equal to or higher than 65 dBA L_{Aeq}(15hour) or 60 dBA L_{Aeq}(9hour) are categorised as "acute" within the RTA's ENMM. In such circumstances, noise mitigation should be investigated.

Further details of the results are presented in Appendix F.

6.8.2 Potential impacts

Construction noise emissions

The proposal is conceptual at this stage and final (detailed design) road plans have yet to be prepared. Accordingly, details of specific construction plant and equipment, methodology or programming are unavailable at this early stage. Details of the construction program and activities would be formulated prior to works commencing. Works would be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays).

For the purposes of the construction noise assessment "typical" plant and corresponding noise levels were used. These "typical" plant were categorised into three main groups to aid calculations for the purpose of the noise assessment. Results of this assessment identified that construction noise would exceed the construction noise objective for works over 26 weeks in duration. Further detail is provided in the noise assessment presented in Appendix F.

Construction vibration

Vibration produced by earthworks and road forming operations is expected to be below structural damage criteria. Where vibration-intensive operations would be conducted in close proximity to the buildings nearest to the roadworks (eg residences in NC A), consideration of the type and size of plant should be made. Generally, all receivers are anticipated to be at least 50 m away from the alignment where compaction or other vibration generating works are expected, and minimal impacts due to vibration are anticipated.

Vibration may however be perceptible for relatively short periods of time when construction activities would be immediately adjacent to specific dwellings. However, vibration produced by earthworks and road forming operations is expected to lie well below structural damage criteria.

It is recommended that the construction methodology, plant and equipment, management of vibration impacts and community consultation protocol be reviewed prior to commencing construction. This should be addressed as part of the construction noise and vibration management plan for the proposal.

Operational noise modelling results

Predicted LAeq(15hour) daytime and LAeq(9hour) night-time noise levels were determined as part of the noise assessment. The single point receiver results are provided for numerous façades for some properties where it was considered necessary (i.e. where more than one façade is exposed to existing or future alignments). Full details of the receiver locations, are provided in the noise assessment in Appendix F.

The modelled scenarios were;

- Baseline "future-existing" scenario (Year 2010) representing noise levels which would exist in the Year 2010 without the proposed road upgrade. This includes the additional 5000 vehicles per day associated with the HQJOC facility.

- Year 2020 scenario, representing noise levels at a point in time 10 years after project opening.

Results of the modelling is summarised below. There would be:

- Two exceedances at individual dwellings of the 0.5 or 2 dBA allowance goal in Noise Catchment A.

- Five exceedances at individual dwellings of the 0.5 or 2 dBA allowance goal in Noise Catchment B.

- One exceedance at an individual dwelling of the 0.5 or 2 dBA allowance goal in Noise Catchment C.

Assessment of operational noise levels

The review of the modelling results provides the following key findings:

Southern section (NC A)

- All existing receivers fronting onto the Kings Highway / Bungendore Road are currently exposed to high noise levels and both 'Future Existing 2010' and 'Future 2020' noise levels are above 65 dBA during the day and 60 dBA during the night (i.e. 'acute').

As the properties would experience acute exceedance, consideration of noise mitigation is required.

- Noise levels to all other receivers (Hybon Avenue and Elizabeth Crescent) are typically below the 60 dBA day / 55 dBA night base criteria except for 9 Hybon Avenue where

the criteria is exceeded by a marginal 1 dBA.

There is a 1 dBA exceedance of the base criteria, but the allowance goal is not exceeded. It would be unreasonable to further consider the provision of noise mitigation due the relatively low change in noise level.

Central section (NC B)

- Ten receivers are located in this area east of the proposed realignment, and the results indicate an exceedance of the 55 dBA day / 50 dBA night base criteria at the five nearest receivers.

Whilst there are only minor exceedances at some properties, noise mitigation is to be further considered at five properties. As these properties are "isolated" in nature (as defined within the ENMM), consideration of roadside barriers is not considered reasonable.

Central section (NC C)

- Two receivers are located in this area west of the proposed alignment, and the results indicate an exceedance of the 55 dBA day / 50 dBA night base criteria at both. Noise levels at one receiver exceed the base criteria by 9 dBA while noise levels at the other are within the appropriate allowance goal of 0.5 dBA.

As these properties are "isolated" in nature (as defined within the ENMM), consideration of roadside barriers is not considered reasonable.

Operational noise mitigation options

Option 1 – noise barriers

The receivers in NC A where acute noise levels have been determined have driveway access from Kings Highway and, as such, roadside barriers cannot practically be considered in this area.

In NC B and NC C, it would be possible to implement roadside noise barriers however, given the low density of the housing and undesirable urban design outcome, it would not be considered feasible and reasonable in accordance with the ENMM.

Given the small number of affected receivers, the use of roadside noise barriers would not be considered feasible under the ENMM, and at-dwelling / architectural treatments would provide a more feasible outcome for noise control on this project.

To provide some guidance on the extent and height that would have been necessary to achieve base criteria, two conceptual roadside noise barrier options assessed for consideration by the

RTA, refer to Appendix F. The first option (3 m high barriers) provides up to 4 dBA noise reduction and is not sufficient to achieve the ECRTN base criteria alone, but could be considered in conjunction with other noise control measures. The second option (5 m high barriers) generally provides sufficient noise reduction to achieve the base criteria (except for a 2 dBA excess at one receiver). These two barrier options provide some guidance on the extent and height of barriers necessary to achieve the base criteria.

Option 2 - road surface treatments

All modelling has been based on standard dense graded asphalt along the proposed alignment. A potential noise reduction in the order of 3 dBA can be achieved at all receivers with the use of open graded asphalt. While this alone does not provide the 9 dBA noise reduction necessary at two locations (one in NC C and one NC B) this option should be further analysed as part of a cost benefit analysis and may prove to be a useful noise reduction tool when used in combination with other noise control options.

Option 3 – architectural building treatments

The aim of the architectural building treatments, as discussed in Section 4 of the ENMM, is to provide mitigation where barriers are not feasible and reasonable, or to supplement the insertion loss[15] provided by a barrier.

Realistically, the amount of noise reduction achievable at a particular dwelling depends on its existing condition and construction. This is considered when further refining whether providing treatments at any particular property are 'reasonable'. Such an assessment is taken at a subsequent stage of the overall project.

The acoustic treatments provided by the RTA are selected based on the acoustical benefits obtained, the degree of exceedance and the results of a cost-benefit analysis, but are limited to:

- Fresh air ventilation systems that meet Building Code of Australia requirements with the windows and doors shut.
- Upgraded windows and glazing and solid core doors on the exposed façades of masonry structures only (these techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls).
- Upgrading window and door seals.

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[15] Insertion loss is the noise reduction achieved through the application of a noise barrier.

- The sealing of wall vents.
- The installation of external screen walls.

It is also noted that architectural treatments are only applied to habitable rooms (living / bedrooms) unless the benefit directly impacts on a habitable space. Each particular dwelling would be considered individually for such treatments in consultation with the landowner.

6.8.3 Safeguards and management measures

Construction

- Construction activities would be undertaken in accordance with DECCW's recommended standard daytime construction hours. Any works required outside of normal working hours would be completed in accordance with the RTA's Practice note vii Roadworks outside normal working hours.
- The offset distance between noisy plant items and nearby noise sensitive receivers would be as great as practicable.
- Noise generating maintenance work on all construction plant would be carried out as far away from noise sensitive receivers as practicable and would be confined to standard daytime construction hours.
- Regular compliance checks would be undertaken on the noise emissions of all plant and machinery to indicate whether noise emissions from plant items were higher than normal. Any non compliant machinery would be taken out service and fixed to become compliant.
- Ongoing noise monitoring would be undertaken during construction at sensitive receivers.
- Low noise "silenced" generators would be used.
- Any ventilation fans would be fitted with acoustic silencers where required to minimise noise emission.
- All plant and machinery would be regularly maintained.
- Temporary noise barriers would be constructed providing shielding to nearby noise sensitive receivers, wherever practicable.

- Where feasible, any acoustic barriers or residential building treatments proposed to control operational noise would be installed as early as possible to assist in minimising the impact of construction noise.

- Acoustic enclosures would be constructed around fixed plant operating on a continuous basis during the construction phase at a particular site.

- Community consultation is to be undertaken in accordance with the RTA's Community Involvement and Communications Resource Manual.

- Complaints received are to be recorded and attended to promptly in accordance with the RTA Community Involvement and Communications Resource Manual.

Operation

- The RTA would liaise with individual landholders whose properties have been identified as being affected by operational noise that exceeds the criteria for the proposal. The noise mitigation option would be developed in consultation with relevant landholders and in accordance with RTA's Environmental Noise Management Manual (ENMM).

- The RTA would undertake noise monitoring in accordance with ENMM to coincide with the commencement of the operation period of the proposal.

6.9 Visual Amenity

A visual impact assessment for the proposal was completed by Phillips Marler in association with POD landscape architecture in August 2009. The visual impact assessment involved an analysis of the visual character of the proposed route, private road connections and their potential impacts on the surrounding visual catchment area. The visual sensitivity of the existing landscape was examined and the effect of the proposed highway and subsequent visual impact was assessed particularly with regard to views from the surrounding properties. For further details please refer to Appendix G.

6.9.1 Existing environment

Site character

The surrounding natural landscape is characterised by a valley with steep slopes and rocky outcrops. The proposal site is dominated by open woodland creating intermittent shade and open areas, rocky outcrops and cuts reveal rock and soil formations associated with historic construction activity. These features create a sense of enclosure and constitute site character.

The Goulburn Road alignment and the surrounding vegetation limit views to nearby residential areas. There is little opportunity for long distance views towards Queanbeyan from the proposal site itself. Some long distant views are detectable from the north-eastern end of the alignment. Views beyond the proposal site to the surrounding residential subdivisions are towards Hill Lane, and Regent Drive. There are surrounding views to the west from Regent Drive over Queanbeyan and towards the Brindabellas.

The surrounding built form is varied. At the western end of the proposal, the Kings Highway is flanked by an industrial area of large warehouses generally with blank elevations to the Kings Highway. To the south there is a residential subdivision around Hybon Avenue and Elizabeth Crescent which is surrounded on three sides by open woodland. The timber fences of the most northerly group in the subdivision are visible from the western end of the road corridor. In the middle section of the road corridor to the east is a residential subdivision centred around Regent Drive of single modern brick houses on large blocks. To the north-west, located on Hill Lane two red brick, single and double storey residential buildings are located.

Visual catchment

The majority of the proposal is located within a small valley. The enclosing hills generally limit the extent of visual catchment, constraining the visual envelope to the near distance views.

The ridge to the north of the proposal site (Hill Lane area) defines the visual catchment to the north-west. Views to the proposal site are restricted to 100-150 m from the road. The views to the road in this area are filtered through existing vegetation. Immediate views look down the slope of the hill towards the road. The spur lines to the south east of the proposed road alignment (Regent Drive and Birdwood Place) define the visual catchment to the south east. There are immediate views looking down the slope of the hill to the road.

Near distance views exist from along Regent Drive and Birdwood Place looking along the gentle spur lines towards the road. The views from Birdwood Place are heavily filtered through the existing vegetation. Near distance views are from the entry of the new road from the intersection with Thurralilly Street and Kings Highway. There are views north east along the Kings Highway directly up along the proposal, as it is an extension of the existing Kings Highway.

Medium distance views from the wide valley floor of Queanbeyan look up the valley to the proposal. These are glimpses of views between buildings and vegetation.

Long distance views are from higher points, and small hills within Queanbeyan. These include Mount Jerrabomberra, Bicentennial Park, and Nimmitabel Street Park Letchworth.

Urban and landscape design considerations

The proposal would seek to integrate to the rural residential landscape with mitigation techniques designed to interface with rural properties and landscapes in colours, materials and planting selection.

Connection of the proposal and the existing highway is within a bushland area. Planting within the bushland interface would be undertaken using bush regeneration techniques to enhance the connection with existing bush. The objectives for the design would allow for intergrading highway edges with the bushland landscape, minimising incursions into the bushland and retention of vegetation and rock edges.

6.9.2 Potential impacts

Construction

During construction, the degree of visual impact may be greater than when the road is operational, mostly due to the lack of mitigation techniques to control the view lines into the proposal site. During construction the proposal site would be subject to tree removal and general clearance for construction, material stockpiles and the continuous movement of equipment. In addition, cut batters, stockpiles and site facilities would have a stark appearance and may be visible from greater distances. This impact would be temporary in nature and confined only to the construction phase of the proposal.

Operation

The proposal is at times elevated up to seven m from the existing ground level which alters the visibility of the proposed constructed level of the road from the existing ground levels within the proposal site. View of traffic, the road and road infrastructure including night lighting constitute the post-construction impacts of the proposal. Representative viewpoints were selected to assess the impacts of the proposal during operation. Generally, most consideration in the selection of the viewpoints is given to the adjacent residential dwellings and immediate streets. Viewpoints representative of the medium and long distance views have also been included.

It is anticipated that lighting would be required at the intersection with Regent Drive and the proposed extension to Hill Lane. This would create more light spill for residents, particularly in Hill Lane.

General visual impacts

Noise mitigation

Noise walls are a visually intrusive solution to noise mitigation. Noise walls can interrupt existing views and cast shadows over homes and businesses located nearby. The length of a potential noise wall that may be required is typically 160° from the receiver. There are a variety of materials that can be used to construct noise walls including precast panels, lightweight concrete, concrete masonry block, timber, stone and gabion walls. These materials are often not transparent and therefore have the potential to interrupt existing views.

The potential impacts and subsequent impact assessment is presented in Table 6-8 below. For further details of the location and descriptions of each viewpoint assessed, please refer to the visual assessment in Appendix G. In summary the viewpoints that would be most affected are those within the Regent Drive and Hill Lane area. It is considered that 1 Hill Lane would have a moderate to high impact, and 2 and 4 Regent Drive and 2 Hill Lane, would experience high visual impact as a result of the proposal. Moderate visual impacts to 9 and 12 Hybon Avenue are also anticipated.

High visual impacts can be moderated using walls which are a quick solution to visual abatement. The use of tree planting to mitigate visual impact could be as successful but may take longer to achieve. Ultimately, the combination of walls and tree planting would be the best solution to moderating high visual impacts, with low maintenance input.

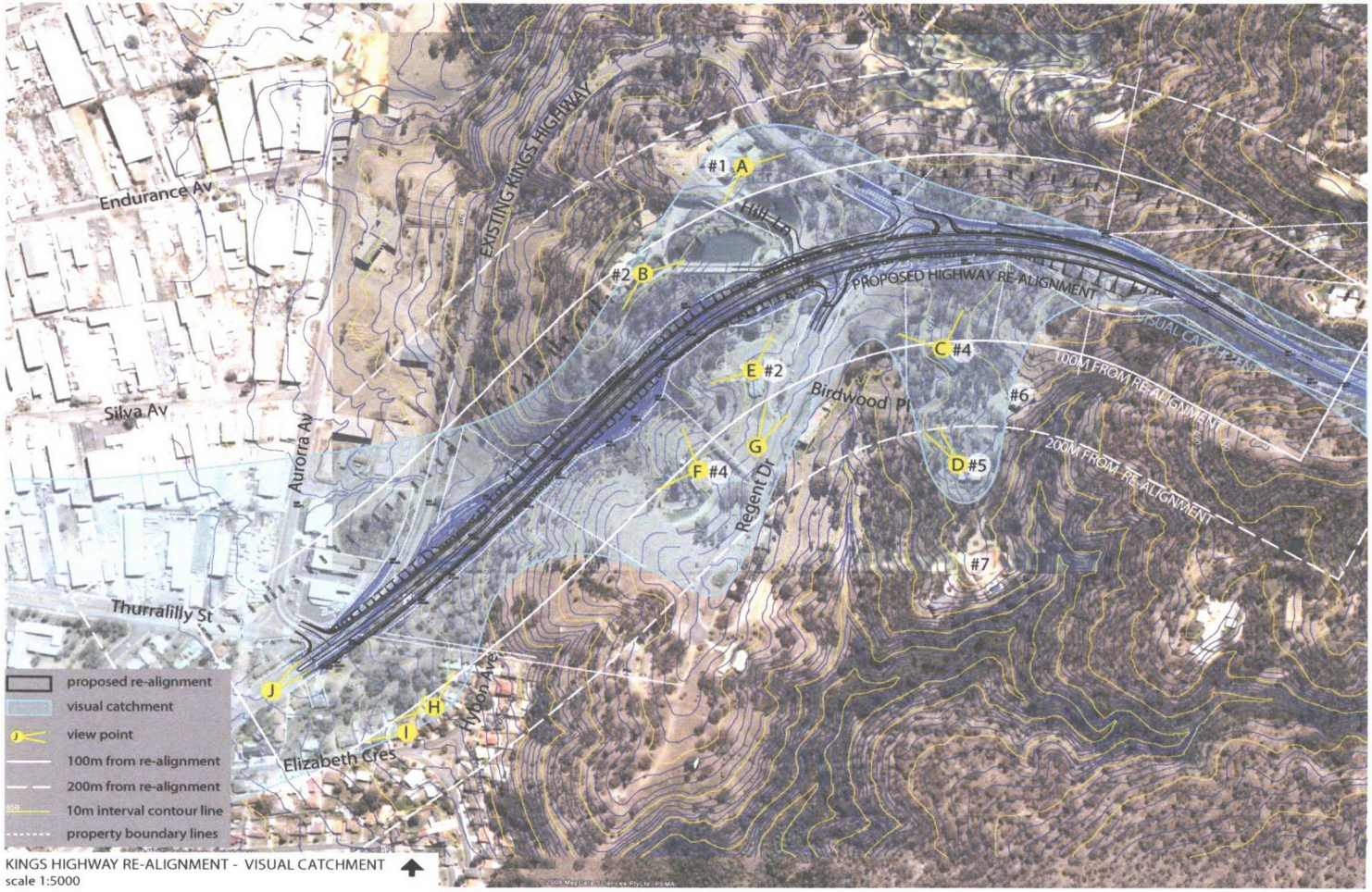

Figure 6-5: Visual Envelope Map – Visual Catchment (Aerial taken 26/04/2004)

Table 6-8: Summary of potential impacts from each viewpoint, from least to greatest potential impact

Viewpoint ID	Nature of impact	Sensitivity of viewpoint	Visual impact
Viewpoint L	The proposal would run perpendicular to the hill and be more striking in the longer distance within the darker backdrop of the surrounding hills.	Low	Low to moderate
Viewpoint K	The proposal would run perpendicular up the hill and the clearance of bushland for the corridor would increase visibility making the road a dominant feature.	Moderate	Low to moderate
Viewpoint H	The adjacent area of the proposal would be elevated and the road easement cleared of trees. Scattered trees that filter views to the corridor would be thinned.	Moderate	Low to moderate
Viewpoint I	The elevation of the residence is around 4 m above existing but would be around 2 m above the most adjacent area of the proposal. The backyard fence of the property may obscure views.	Moderate	Low to moderate
Viewpoint D	The view from this location is along the spur line towards the intersection with Regent Drive. There are also glimpses across the Regent Drive ridge towards the road alignment within the valley. It is expected that only partial views to this would be possible above the ridge. The dense vegetation in this area also obscures views	High	Low to moderate
Viewpoint J	The commencement of the proposal is directly adjacent with the intersection close by. From this viewpoint looking north-east the surrounding industrial warehouses have blank elevations to the street. The magnitude of the road construction would be no greater than it is now.	High	Low
Viewpoint C	The existing road is visible due north from this location which is situated on a spur and views follow down the slope which is partially obscured by vegetation. The proposal would elevate the road 3 m above the ground level.	High	Moderate to high

Viewpoint ID	Nature of impact	Sensitivity of viewpoint	Visual impact
Viewpoint A	This location is situated on a ridge adjacent to the existing road and experiences a wide cone of visibility of traffic travelling east and west. The proposal would be at least 100-150 m from the ridge reducing visibility. However, the proposal would raise levels to approximately 4 m above existing.	High	Moderate to high
Viewpoint B	The residence is situated on a spur line which looks directly into the valley approx 17 m below the existing level of the residence. The proposal is elevated 5 m above existing. There is little vegetation on the property to reduce visibility.	High	High
Viewpoint E	The proposal is situated 5 m above the existing alignment with a residence within fifty m of the road corridor. The residence is elevated above the proposal by approximately 17 m. There is limited tree canopy on private property. The tree canopy close to the road easement has limited impact of reducing visibility at the edge of the road alignment. There are oblique views to the excavated slopes on the NW roadside.	High	High
Viewpoint F	The residence is elevated 7 m above the existing valley. Visibility is masked by scattered groups of trees. The proposal is raised 7 m above existing and the profile is achieved through extensive cutting and filling for the road pavement as well as the tree canopy removal within the corridor. There are views to the excavated slopes on the NW roadside. The raw cut into bedrock will diminish in visual prominence as the rock ages	High	High

6.9.3 Safeguards and management measures

- Trees which are not affected by the proposal would be retained within the road easement.

- Specific recommendations detailed in Section 10 of the visual impact assessment (refer to Appendix G) would be adopted by the RTA.

- A landscape design including a tree planting program to reduce the potential visual impacts of the proposal, would be implemented. The tree planting program would be designed in consultation with affected residents and should consist of a range of trees at different heights. Extra consideration should be given to screening views across the valley with tall planting on the SE roadside batter nearest the residences.

- The use of earth mounds to facilitate visual screening would be investigated.

- Should noise walls be constructed, appropriate position eg avoid noise walls on top of cuttings or noise walls that would impact on views and design eg heights and length would be considered to reduce the potential impact of these walls.

- The proposal site would be kept clean and orderly at all times, ensuring that no waste is left at the site following completion of the works.

- Temporary erosion and sediment controls would be removed from the site once landforms have been assessed as stable.

6.10 Socio-economic considerations

6.10.1 Existing environment

The Kings Highway is a major transport corridor between the ACT, Bungendore, and Batemans Bay on the far south coast of NSW. The safety, efficiency and capacity of this section of Kings Highway directly contributes to businesses including the distribution of goods and tourism in the region to the east of the ACT and Queanbeyan, also within the Central Business District (CBD) of Queanbeyan. This section of the Kings Highway is the primary access for road users travelling between Queanbeyan and Bungendore and onto the south coast.

The majority of the residents within the Kingsway Estate are located on the eastern side of the Goulburn Road corridor. Two residents, both on Hill Lane are located on the western side of the Goulburn Road corridor.

There is no dedicated public bus services currently using the Kings Highway proposed for realignment. An 'on demand' service operates between Queanbeyan and Bungendore on Thursdays only, however this service needs to be booked in advance and does not run if there are no bookings. There is a public bus service (Deanes Buslines route 832) that runs along Thurrallily Street and the Bungendore Road.

The local bus service company also is responsible for picking up and dropping off school children in the morning and afternoon peaks from the Kingsway estate in addition to residents to the east of the proposal site. The existing pick up and drop off points are not approved and are considered unsafe. There is no approved bus stop within the Kingsway estate. The nearest approved bus stops are; to the east within The Ridgeway Estate and to the west on Bungendore Road near Thuralilly Street.

There are no footpaths or cycle ways along either edge of the existing Kings Highway.

Firth Park is located at the southern end of the proposal site, Figure 3-4. There is no dedicated play or recreation equipment located in Firth Park. Additionally, no picnic facilities (tables and barbeques) were observed at the park. It is understood that Firth Park maybe used as an informal access, on foot, for local residents in the subdivision east of the proposal site.

Thurralilly Street, in Larmer, East Queanbeyan, distributes local traffic into the urban areas of Queanbeyan to the west of the proposal site. An industrial area and other business enterprises are located at the Thurralilly Street - Kings Highway intersection.

6.10.2 Potential impacts

The proposal would require the acquisition of Firth Park, located at the south western end of the proposal site opposite Thurralilly Street. This park would be removed as a result of the proposal. Presently there is no recreational infrastructure at the park and the park does not provide for formal sporting opportunities. It is understood that the park is used as a thoroughfare for local residents in the area and informal recreation. A portion of the existing highway is located within the boundaries of this park, likely as a result of erroneous zoning. The Goulburn Road corridor is also used for informal recreation, and this capacity would be removed as a result of the proposal. There are a number of other park and recreation facilities within the locality and greater Queanbeyan area and the loss of these amenities is considered to be minor.

The proposal would also require the acquisition of a small portion of the detention pond currently servicing the Carwoola industrial estate. This small acquisition is not expected to impact on the ongoing function of the detention pond to reduce the potential for localised flooding within the industrial estate.

It is likely that some delays would be created by the proposal for west bound traffic entering Queanbeyan's CBD and residential areas or travelling to work to the east of Queanbeyan. It is considered that stakeholders with the potential to be impacted by the proposal include local residents, businesses, agriculturalists, freight companies and other regular and intermittent road users.

During the construction phase, productivity may be impacted in the industrial area due to traffic delays at the intersection of Thurralilly Street and Kings Highway. Deliveries, pickups and customer access could be disrupted during construction. It is considered unlikely that the proposal would place local businesses at risk as the majority of the proposed construction works would be located off the current highway alignment. Potential impacts are only likely to occur at the 'tie-in' stage of the proposal (when the new road is connected to the existing highway at either end) which is anticipated to be over a short period of time. Further, it is considered that during the operational phase, productivity has the potential to increase due to increase efficiency and safety thus providing a positive impact to local businesses.

Works being undertaken at the intersection of Regent Drive and Kings Highway would impact on residents whose only point of access to their property is located on Regent Drive. These impacts, primarily delays, would be temporary, occurring only during the construction period and are considered manageable with the implementation of safeguards and management measures specified in this REF. It is important to note that access would be maintained during construction and residents would be kept fully informed of planned works which may cause delays.

Wherever possible the RTA would engage local subcontractors and supply and maintenance companies. It is considered that engaging local contractors and supply companies would represent a positive impact to the local community through a short term increase in jobs and economic activity.

As discussed there are no dedicated bus stops (primarily for school children) within the Kingsway estate. The RTA's preferred arrangement would be for the school bus service to turn off the Kings Highway and use a bus stop within the Kingsway Estate. This would be consistent with the current practice for the same bus service at The Ridgeway Estate and The Weetalabah Estate. The RTA has investigated this option and found there is insufficient space within the Kingsway Estate for the school bus (14.5 m length) to turn around without executing a three point turn. School buses are prohibited from executing three point turns by Queanbeyan City Council regulations. The school bus service would therefore be accessed via the nearest designated bus stop facility, on Bungendore Road approximately 190 m south of Thuralilly Street. This bus stop would be connected to Kingsway Estate by the proposed new pedestrian facility linking Regent Drive with Bungendore Road.

The proposal would result in two properties off Hill Lane being separated from the remainder of Kingsway Estate, as they would be on the western side of the proposed realignment while the remainder of the properties of the Kingsway Estate are on the eastern side of the proposed realignment. Residents of these two properties would still be able to access Kingsway Estate via the new alignment. Residents entering Kingsway Estate from the newly constructed access on

the western side would be able to make a right turn onto the highway then a left turn into Regent Drive, refer to Figure 3-2 and Figure 3-3.

It is understood that local residents often use Goulburn Road as an informal walking track to access Queanbeyan on foot and via bicycles. During both construction and operation of the proposal, the proposed activities would preclude residents from using this area for access. The RTA is currently investigating the potential to provide an alternate access way for residents of the Kingsway Estate to walk to Queanbeyan. The RTA has begun consultation with Queanbeyan City Council regarding an appropriate location for this footpath. It is proposed that the RTA would construct infrastructure foot bridges / stairs and the like to allow for easy and safe access.

There is the potential for the proposal to impact on private land value for property in close proximity to the proposal site. It is considered that perceived and actual noise and visual impacts resulting from the proposal would be the likely drivers for any potential impact to land values. A noise impact assessment, (refer to Section 6.8 and Appendix F) and a visual impact assessment, (refer to Section 6.9 and Appendix G) were completed for this proposal. It is considered that these assessments have identified appropriate mitigation measures to minimise potential noise and visual impacts which would minimise potential impacts to land value.

Construction sites have an inherent safety risk to workers, and the general public utilising areas within or adjacent to such sites. These impacts would, however, be temporary, occurring only during the construction period and would be mitigated by the implementation of appropriate safety procedures.

The works would contribute to a long-term benefit to all road users, including all of the above mentioned stakeholders by improving the safety and efficiency of this section of Kings Highway.

6.10.3 Safeguards and management measures

- Hazards would be minimised by ensuring that works are completed in accordance with relevant RTA standards and OH&S guidelines.
- Activities would be completed in the minimum timeframe practicable.
- The RTA would keep the community informed regarding the progress of the proposal throughout the construction phase. Additionally, the RTA would provide a phone number and website address which members of the community could access to register complaints regarding construction activities. Any complaints would be collated in a complaints register and actioned within two working days of receipt of the complaint.

- The RTA would provide a footpath for residents of the Kingsway estate to access Queanbeyan on foot. This path would be established prior to the commencement of construction activities.

- Wherever possible, RTA would engage local subcontractors and supply and maintenance companies.

- All land acquisition would be undertaken in accordance with the RTA Land Acquisition Policy and the *Land Acquisition (Just Terms Compensation) Act 1991*.

6.11 Traffic and Transport

6.11.1 Existing environment

The Kings Highway is the primary route for vehicles travelling between Queanbeyan, Bungendore and the south coast of NSW. Annual average traffic data (AADT) for the Kings Highway east of Thurralilly Street recorded the following volumes[16]:

- 10, 525 for 2004.

- 10, 798 for 2005.

- 11, 072 for 2006.

- 11, 346 for 2007.

- 11, 620 for 2008.

In addition to this data the RTA has also prepared projected traffic volumes for this section of the Kings Highway. The projected data for the next five years is presented below:

- 11, 983 for 2009 (pre operation of HQJOC).

- 16, 893 for 2009 (post operation of HQJOC).

- 17, 167 for 2010.

- 17, 441 for 2011.

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[16] AADT is the average daily traffic assessed as the total volume of traffic recorded at a specific road location, taken over a calendar year and divided by the number of days in that year.

- 17, 714 for 2012.
- 17, 988 for 2013.

Current and projected AADT is further presented on Figure 6-6.

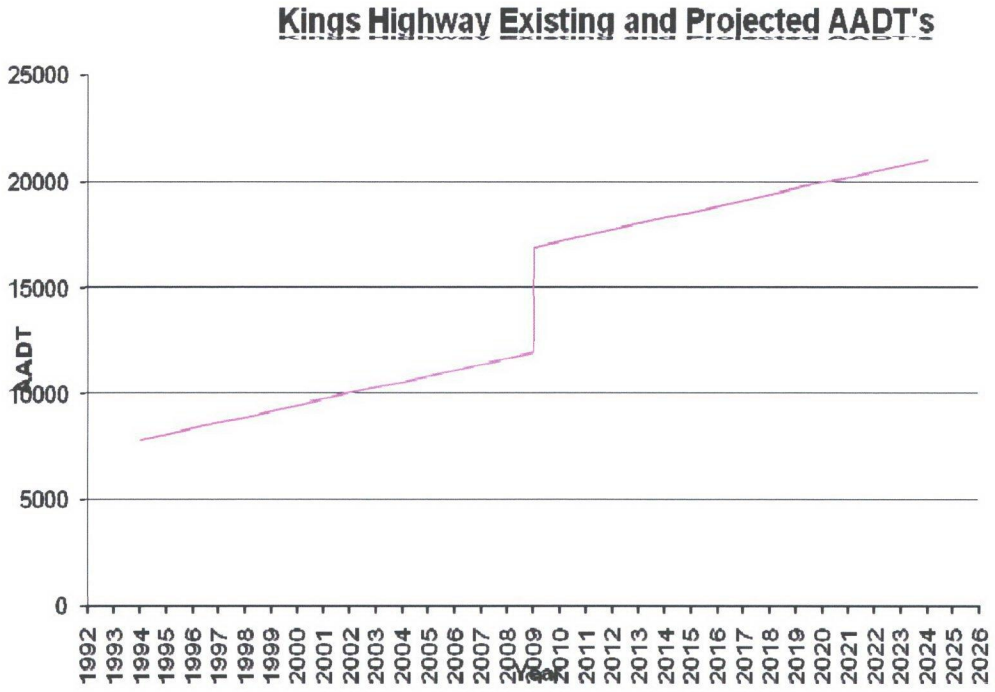

Figure 6-6: Actual and projected AADT data for the Kings Highway (Source: RTA)

There is a substandard curve on the existing alignment of the Kings Highway. The substandard curve has a 60 m horizontal radius which is an extremely tight curve. This curve radius is significantly below the minimum safe modern design standard for a curve in an 80km zone. The substandard curve substantially delays traffic and poses a risk to road safety.

6.11.2 Accident history

Road crash data for this section of highway for the five year period between 1 July 2003 and 1 July 2008 was reviewed as part of this REF. The crash rate for this area based on AADT of 11099 is 29.79 crashes per 100 million vehicle kilometres travelled with a severity index[17] of 1.29. During this period there were a total of eight crashes, three of which were injury crashes. The remaining accidents were non-causality (tow-away) crashes. Three of these accidents were

[17] This severity index calculation provides an average severity weighting for each section that enables some comparison amongst planning sections. The maximum possible index is 3 (most hazardous) and the minimum is 0 (least hazardous). The lower the index for a planning section, the better the safety performance.

classed in the movement type of *off road on curve, hit object,* and all three were located on the substandard curve. The remaining crashes included head-on, opposing vehicles; turning, U-turn and rear end crashes.

6.11.3 Potential impacts

Potential impacts of the proposal include inconvenience to road users as a result of potential delays. Although the majority of the construction activities would be located outside of the existing alignment of the Kings Highway, the area would represent a construction zone. Therefore there would be a need to reduce the speed limit along the existing alignment of the Kings Highway for the duration of the construction phase. Although the speed limit would be reduced for the duration of the construction phase, two way traffic flow would be able to maintained except during intersection construction and tie ins.

The proposal would also increase the traffic volumes in the vicinity of the construction site. It is expected that both heavy and light vehicles would be associated with this increase in traffic. There is a large amount of fill to be trucked to the proposal site. It anticipated that up to 1,700 truck movement carrying approximately 15 m^3 of material each would be required during construction.

Delays would be expected as one lane of the Kings Highway would need to be closed to complete the required work during the integration of the realigned section of Kings Highway with the existing highway. This would apply at the south western end of the proposal site, at the intersection of Thurralilly Street and Kings Highway and at the north eastern end of the proposal site at the intersection of Regent Drive and Kings Highway. Further delays could be expected during the works along the short sections of Kings Highway east of Regent Drive and around Thurralilly Street where the proposal would reconnect with the existing Kings Highway. These delays would not be expected to be excessive for traffic travelling east or west. Appropriate signage (to RTA standards) would be installed prior to and during the construction period to inform road users of potential traffic delays.

Delays throughout the majority of the proposal are unlikely as the vast majority of construction works are located away from the existing alignment. Additionally, the scheduling of works would be planned to limit the impact to traffic along the King Highway during construction.

It is considered that the realignment would also result in a positive impact to traffic. The provision of a new road alignment that has increased efficiency, capacity and safety is expected to reduce the number of accidents along this section of the highway.

6.11.4 Safeguards and management measures

- A traffic management program (prepared by the RTA) would be implemented which would include the use of signs, barriers, temporary speed zones and traffic control for the duration of the proposed road works. The plan would be in accordance with the relevant RTA guidelines including, the RTA's Traffic Control at Work Sites Volume 3.1 and the specification G10 Control of Traffic.

- Construction works would be avoided on Sundays and public holidays.

- Access for residents living adjacent to the proposal would be maintained at all times.

- Construction traffic would enter/exit the construction zone only in areas designated for this purpose in the Traffic Management Plan.

6.12 Waste minimisation and Management

6.12.1 Existing environment

Proposal activities have the potential to generate waste from:

- Existing alignment of Kings Highway (eg pavement materials).

- Existing alignment of the Goulburn Road corridor (eg spoil not suitable for re-use).

- Vegetation (native, exotic and noxious) located along the road verges and within the new alignment.

Existing rubbish dump areas. Specifically, a small drainage line that has been used for the illegal dumping of domestic and builders waste. Waste observed on site consisted of household waste, car bodies, forty four gallon drums, jerry cans, bricks, tiles and other construction waste. Asbestos Cement Material (ACM) was also observed at the site. This material would need to be disposed of in an appropriately licensed waste disposal facility by an appropriately licensed and qualified asbestos remover prior to the commencement of construction.

6.12.2 Waste management strategies

The RTA is committed to ensuring responsible management of unavoidable waste and to promoting the reuse of such waste through appropriate measures in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act, 2001* (WARR Act). The resource management hierarchy principles outlined in the WARR Act are:

- Avoid unnecessary resource consumption as a priority.
- Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery).
- Disposal is undertaken as a last resort.

By adopting the above principles, RTA encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ESD, as outlined in Section 8.2 of this REF.

6.12.3 Potential impacts

In addition to potential wastes mentioned above, the proposed works would generate additional waste, primarily during the construction phase. Wastes that are likely to be generated as part of construction include:

- Vegetation from clearing.
- Noxious weed material.
- Potentially contaminated material from dumped rubbish.
- Pavement to be removed from the existing Kings Highway.
- Hydrocarbon and chemical wastes (from the compound area).
- General office wastes (paper, plastics etc).
- Wastes from compound toilet facilities.
- Soil excavated that cannot be reused onsite.

Impacts of waste generation at the proposal site are likely be low, and would largely be a result of proposed vegetation clearing, excavation and general construction waste. It is anticipated that excess cleared vegetation and soil not utilised on site would be reused at alternative RTA construction sites, or deposited at a landfill and utilised as a resource (e.g. mulched for reuse).

The RTA would remove waste that has been illegally dumped. A remedial action plan is being prepared to guide appropriate remediation of the site prior to the commencement of construction. The draft remedial action plan details that the preferred method for remediation is a combination of offsite disposal and on site sorting to remove asbestos cement material.

Disposal of asbestos material would be done in accordance with the final remedial action plan. The removal of this rubbish would be a positive impact for this proposal.

There is also the potential for waste generation during the operation of the proposal. This waste may include pesticides for weed control, green waste from landscape maintenance general litter discarded by road users and road maintenance waste. This waste would be managed in accordance with RTA maintenance programs.

6.12.4 Safeguards and management measures

- Cleared vegetation would be chipped and reused onsite to stabilise disturbed soils where possible. The excess would be removed from the site to the nearest recycling depot. Weedy mulch would not be reused.

- Noxious weeds would be removed and destroyed prior to the commencement of construction works, as far as is practicable. This would be undertaken in accordance with Queanbeyan City Council weed management plans.

- Cleared vegetation would not be burned at the site.

- Excess excavated material would be disposed of at an appropriate waste management or stock pile site for reuse.

- Garbage receptacles would be provided and recycling of materials encouraged. Rubbish would be transported to an appropriate waste disposal facility.

- Toilets (e.g. portable toilets) would be provided for construction workers.

- Site inductions of all construction staff would take place. They would be recorded by a Site Supervisor and would have a goal of ensuring staff have a thorough knowledge of all key environmental/safety issues.

- The RTA would ensure that asbestos remedial works would be undertaken by suitably licensed contractors, in accordance with the approved RAP and be fully completed prior to any general excavation be undertaken.

- All wastes would be managed in accordance with the *Protection of the Environment Operations Act, 1997 (POEO Act).*

- The works would be managed so that they follow the hierarchy in the Waste Avoidance and Resource Recovery Act, 2001 as follows:

- Avoid the generation of waste (for example, order only what is needed to prevent the need to dispose of excess materials).
- Reuse materials wherever possible.
- Recycle.

- Disposal is a last resort. Any approval required for offsite disposal would be obtained prior to disposal.

6.13 Demand on resources

The activities proposed require the use of a number of resources, including:

- Direct resource use:
  - Resources associated with the operation of construction machinery, and motor vehicles (this includes a variety of resources, the major one being fossil fuels).
  - Resources associated with the construction of roads (road-base, guard rails, paints, solvents, asphalt, sand, concrete, aggregate, steel etc.).
  - Construction water (for concrete and dust suppression).
- Indirect resource use:
  - Vegetation cleared onsite including native vegetation and habitat for native species.
  - Compaction of soils and vegetation through machinery access.
  - Risk of spills (potential soil and water contamination).

The materials required for the proposed construction works are not currently restricted resources however materials such as metals and hydrocarbon based fuels, solvents and road products are considered non-renewable and should be used conservatively. Road construction materials would be sourced from commercial quarries and suppliers. Wherever possible, spoil from the proposed works would be recycled as fill for the proposal.

Top soils are a very slowly renewing resource and can take a lengthy period to be rehabilitated if contaminated. Topsoil would be stockpiled and if of good quality and weed free, then it would be reused onsite with minimal disturbance to the structure of the soil if possible. Compaction of soils should be avoided, as much as practical.

Vegetation clearing should be minimised as much as practical. Refer to Section 6.5 for further details.

The proposed activities do not qualify as a scheduled activity under the *Protection of the Environment Operations Act 1997.* The works would, however, involve the disturbance of soils, clearing of vegetation and use of substances which require spill controls to protect water and soils.

The proposal would require the use of substantial amounts of water during construction. According to the Department of Primary Industries (Industry and Investment NSW) data for June 2009, 66% of NSW is in drought, Figure 6-6. The proposal site is located within a region that is drought declared.

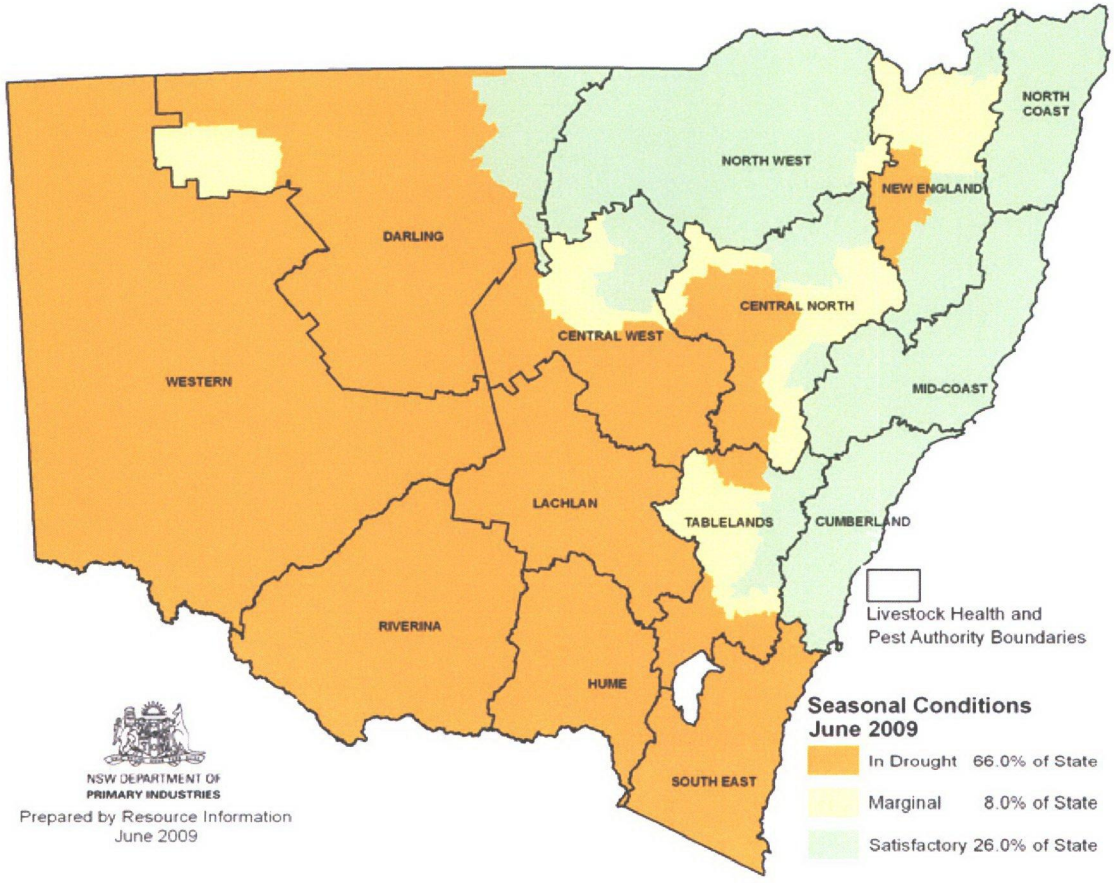

Figure 6-7: Seasonal Conditions June 2009 (Source: NSW Department of Primary Industries)

Further, the Queanbeyan City Council LGA currently (as at 3 July 2009) has compulsory level 3 water restrictions in place for the LGA.

6.13.1 Safeguards and management measures

- Energy efficient equipment and practices would be incorporated into the project

environmental management plan.

- Impacts would be addressed by rehabilitation of disturbed areas, reuse of cleared vegetation onsite and implementation of controls appropriate to manage fuels and lubricants onsite.
- Provision would be made for workers to take out any litter or other waste brought onto the site.
- A contribution to green power would be made for electricity at site offices.
- Water from the sediment basins would be preferentially used for dust suppression purposes.
- Rain water tanks would collect water from site sheds which would be reused onsite.
- The works would be managed so that they follow the hierarchy in the *Waste Avoidance and Resource Recovery Act* as follows:
    - Avoid the generation of waste (for example, order only what is needed to prevent the need to dispose of excess materials).
    - Reuse materials wherever possible.
    - Recycle.
    - Disposal is a last resort.

6.14 Operational hazards and risks

6.14.1 Hazard and risk identification

Potential hazards and risks associated with the operation of the proposal include:

- Traffic accidents.
- Contamination of local soils and groundwater.
- General pollution of the local environment.
- Damage and/or pollution of services or utilities.
- Damage to public and private property.

In line with the objectives as identified in Section 2.2, the proposal would result in:

- Improved road alignment including the removal of the substandard 60 metre radius curve.
- Improved efficiency through a reduction in section length and the creation of an eastbound overtaking lane.
- Safer intersection and access arrangements.

It is considered that the changes described above would reduce the current hazards and associated risks, resulting in an overall improvement to traffic conditions and an improved level of service.

The removal of the substandard 60 m radius curve is expected to increase safety to motorists travelling on this section of the highway. Additionally, the proposal would result in a substantially straighter alignment which is also expected to increase the safety of this section of the highway.

The proposal would result in increased hard surface areas (road pavement), which has the potential to increase turbid runoff and flooding pollution to receivers down gradient of the proposal site. The concept design has established appropriate drainage designs to reduce and mitigate any such impacts, refer to Section 6.2.

6.14.2 Hazard and risk management

- The detailed design would be completed to ensure that appropriate drainage features are created to minimise the potential off site migration of turbid runoff and any flooding pollution that may generated.

6.15 Cumulative environmental effects

6.15.1 Existing environment

Cumulative environmental impacts can be defined as the combined effect of individual impacts generated by the proposal, in addition to the impacts of other activities in the area. These may include current and future road works and local land development that could result in ongoing biodiversity, noise, air quality, visual, waste generation and traffic impacts.

In terms of concurrent development, the federal Government has pledged $16.3 million to fund the upgrade of Kings Highway between Queanbeyan and Bungendore. At present, a seagull intersection is being constructed at the intersection of Kings Highway and Weetalabah Drive. There is an existing proposal for the upgrade of Kings Highway between the area where

this proposal would finish, approximately 380 m east of Regent Drive, to an area east of Captains Flat Road which would involve the construction of an over taking lane and round about. Currently, the works being undertaken at Weetalabah Drive, and the proposed project at Captains Flat Road along with this proposal are the only works scheduled for the local area along Kings Highway though there is the potential for further work to be carried out on Kings Highway in the future. It is anticipated that the Weetalabah Drive and Captains Flat Road intersection works would be completed before the commencement of construction of the proposal.

6.15.2 Potential impacts

Construction impacts

At present, there are a number of road work projects being undertaken on the Kings Highway in the vicinity of this proposal site. Each of these projects has the potential to present a number of construction impacts including but not limited to noise, visual and biodiversity. Having a number of projects located within a relatively close proximity has the potential to increase impacts on a local and regional scale. Each individual project would have completed a review of environmental factors to ensure that appropriate environmental safeguards were applied during constriction and operation. It is considered that the potential cumulative impacts associated with projects being undertaken by the RTA would be limited as each project would be completed with consideration to the principles of ecologically sustainable development (ESD) including through the adoption of appropriate environmental safeguards.

Operational impacts

As discussed in Section 2.2, the objectives of the proposal include improving road safety and traffic flow. The proposal would be completed as one component of a larger scope of upgrade works between Thurralilly Street, Queanbeyan and the Australian Capital Territory border. To that end it is considered that the majority of cumulative operational impacts would be positive. Positive impacts would include:

- Reduced GHG emission through shortening of this section of the highway in addition to increased efficiency.
- Improved travel time along this section of the Kings Highway.
- Improved safety along this section of the Kings Highway.

The realignment of the Kings Highway would require the acquisition of Firth Park which is council owned land designated as open space for the purpose of recreation. The proposal would result in a direct loss of this land and reduce the potential long term development of this

parcel of open space land in the future.

6.15.3 Safeguards and management measures

- The proposed works would be appropriately staged with other projects in the general locality along the Kings Highway to limit impacts to traffic during construction.
- Design considerations should aim to minimise the amount of land to be acquired from Firth Park.

6.16 Summary of beneficial effects

Beneficial effects resulting from the proposal include:

- Reduction in risks of accidents (improved road safety).
- Reduction in travel time along this section of the Kings Highway through a substantially straighter and shorter alignment.
- Provision of safer intersection arrangements for local residents entering and exiting the Kings Highway.
- The RTA would provide improved pedestrian access for residents of the Kingsway Estate to Queanbeyan.
- Remediation of contaminated land.
- Short term increase in employment.

6.17 Summary of adverse effects

Adverse impacts associated with the proposal include:

- Increased noise and vibration.
- Reduction in visual amenity.
- Greenhouse gas emissions.
- Potential traffic delays.
- Impact to the Hoary Sunray (*Leucochrysum albicans ssp albicans var. tricolour*) which is listed as endangered under the *EPBC Act*.

- Removal of vegetation including two hollow trees which provides potential habitat to threatened fauna.
- Impact to the old Goulburn to Queanbeyan Road which has local heritage significance.
- Property acquisition of Firth Park which is used as open space.
- Reduction in visual amenity for some residences.
- Increase in noise levels for some residences.

7 Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided with reference to environmental management plans and relevant RTA QA specifications. A summary of site specific environmental safeguards is provided as detailed in Chapter 6 and the licence and/or approval requirements required prior to construction are also listed throughout this REF.

7.1 Environmental management plans (or system)

A construction environmental management plan (CEMP) would be prepared prior to the commencement of construction. The CEMP facilitates the management of all aspects of the works through the adoption of a number specific of sub-plans. The sub-plans outline environmental issues associated with the proposal, the safeguards to be adopted to reduce impacts of the proposal and the auditing procedure to ensure that contractors are compliant with the specified safeguards. Auditing onsite would be carried out by a qualified RTA environmental officer. Site inductions would occur and be recorded by a Site Supervisor to ensure staff have a thorough knowledge of all key environmental issues and the safeguards required.

All works would be carried out by the RTA and its subcontractors and would comply with current RTA QA specifications including general specifications including:

- G22 - *Occupational Health and Safety (Major Works).*
- G35 – *Environmental Protection (Management Plan).*
- G36 - *Environmental Protection (Management System).*
- G38 - *Soil and Water Management (Soil and Water Management Plan).*
- G40 - *Clearing and Grubbing.*

Further, the proposal would comply with all QA road works specifications. In addition to QA specifications identified above the CEMP would also include a vegetation clearance control plan including a protocol for the removal of hollow bearing trees and a rehabilitation plan.

7.2 Summary of safeguards and management measures

Environmental safeguards outlined in this document would be incorporated into the detailed

design phase of the proposal and during construction and operation of the proposal. These safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. All safeguards described in this REF and the decision report would be incorporated into the contractor's environmental management plan (CEMP). These are summarised in Table 7-1.

Table 7-1: Summary of Safeguards

Environmental Issue	Safeguards	Timing
Soils and landscapes	• Works would be undertaken in accordance with the RTA's specifications G38 Soil and Water Management (Soil and water management plan) and R44 Earthworks (Cut, fill, imported fill and imported selected material) and R50 Stabilisation of Earthworks.	Construction
	• Erosion and sediment control measures would be implemented and maintained to: o Prevent sediment moving off-site and sediment laden water entering any watercourse, drainage lines, or drain inlets. o Reduce water velocity and capture sediment on site. o Minimise the amount of material transported from site to surrounding pavement surfaces. o Divert clean water around the site. in accordance with the Landcom/Department of Housing *Manging Urban Stormwater; Soils and Construction Guidelines* (the Blue Book).	Pre-construction
	• Stockpile sites would be located and managed in accordance with the RTA Stockpile Site Management Procedures (RTA 2001).	Construction
	• All exposed soil surfaces resulting from the proposal would be stabilised as soon as practicable to reduce the risk of erosion and sedimentation. This applies in particular to the drainage lines and culverts within the proposal site.	Construction
	• Weather forecasts would be checked daily to ensure that high risk soil and erosion activities are not undertaken immediately prior to or during high rainfall or wind events.	Construction
	• The RTA would complete all required remedial works in accordance with a remedial action plan prepared specifically for the proposal site prior to the commencement of any general excavation works.	Construction
	• If contaminated material is uncovered, works that may impact on it would cease immediately and advice would be sought from the RTA senior environmental officer on how to proceed.	Construction and post
	• The RTA would prepare a vegetation rehabilitation plan as part of the Construction Environmental Management Plan (CEMP). This rehabilitation plan would facilitate appropriate rehabilitation practices at the site post construction. The plan would also focus on improving the existing erosion characteristics in the vicinity of the proposal site.	Construction

Environmental Issue	Safeguards	Timing
	• Clearing of vegetation and revegetation activities would be carried out progressively with works to limit the time disturbed areas are exposed to erosion processes.	Construction
	• Earthworks within the drainage line would not be completed during times of rainfall or when water is flowing with the drainage line.	Construction
	• Stockpiles would be stabilised or covered to reduce the potential for sediment and erosion impacts.	Construction
	• Detailed design of the road drainage would identify and include any structures required to manage runoff and scouring.	Detailed design
Hydrology and water quality	• Appropriate erosion and sediment controls, in accordance with RTA *G38 Soil and Water Management (Soil and water management plan)* would be installed at key areas.	Construction
	• Regular checks of weather forecasts would be made to ensure that the site is appropriately protected during rain events.	Construction
	• Appropriate measures, such as regular road sweeping, rumble grids or wheel wash bays, would be established to minimise the risk of dirt and mud being tracked off site by construction vehicles.	Construction
	• Any chemicals, including hydrocarbons and herbicides, would be stored in a bunded, hard stand area, at the site compound away from any water courses or natural depressions or drainage lines.	Construction
	• A site specific spill containment/contamination management plan would be developed and communicated to all staff prior to the commencement of the works. This would include that an emergency spill kit would be kept on site at all times and staff would be trained in where it is kept and how to use it.	Pre-construction
	• If a spill occurs, the RTA's Environmental Incident Classification and Management Procedure is to be followed and the RTA senior environmental officer notified as soon as possible.	Construction
	• Fuelling of machinery would only take place in designated areas appropriately protected by the spill containment/contamination management plan. All sediment basins to be used as part of the proposal would be monitored throughout the construction phase.	Construction
	• Outlet dissipaters would be constructed as required to reduce flow velocities to acceptable levels. Drainage paths between culverts would be rock lined to minimise scouring.	Construction

Environmental Issue	Safeguards	Timing
Air quality	• Dust generating activities would be suspended during periods of high wind velocity.	Construction
	• Dust would be visually monitored and suppressed with water or by alternative suppression techniques eg altering work practices or stopping dust generating activities.	Construction
	• Vehicles transporting materials including waste that may generate dust are to be covered during transportation.	Construction
	• All stockpiles would be managed to suppress dust emissions in accordance with RTA Stockpile Site Management Procedures (RTA 2001).	Construction
	• Dust suppression methods such as the use of water carts would be employed when unloading fill and creating stockpiles.	Construction
	• Tailgates would be secured during operation of trucks and utes.	Construction
	• Machinery, plant and vehicles would be turned off while not in use where practical, rather than left idling.	Construction
	• Site vehicles, plant and equipment would be maintained in accordance with manufacturer's specifications.	Construction
	• Vegetation or other materials would not be burnt on site.	Construction
	• The RTA would complete all required remedial works in accordance with a remedial action plan prepared specifically for the proposal site prior to the commencement of any general excavation works..	Construction
Climate change	• When selecting construction plant equipment to be used as part of the proposal, energy (fuel/electrical) efficiency would be considered.	Construction
	• Where feasible, the use of biofuels (biodiesel, ethanol or blends such as E10 and B80) would be considered for construction plant and equipment.	Construction
	• Site vehicles, plant and equipment would be maintained in accordance with manufacturers specifications.	Construction
	• Opportunities to preserve and/or rehabilitate existing vegetation and to avoid unnecessary clearing would be identified and implemented during the detailed design stage.	Detailed design / Construction
	• Cleared vegetation would be reused on site to reduce the likelihood of off site disposal.	Construction
	• The design of site facilities and the schedules of site vehicle movements would maximise efficiency of vehicle movement on site.	Detailed design
	• Machinery, plant and vehicles would be turned off while not in use where practical, rather than left idling.	Construction

Environmental Issue	Safeguards	Timing
	• Use of locally sourced resources and reuse of onsite materials would be maximised wherever suitable, available and feasible, to minimise transport related emissions.	Construction
	• Wastage of resources such as steel and bitumen would be minimised.	Construction
	• Opportunities to reduce the amount of materials needed to construct the proposal would be investigated.	Construction
	• Low greenhouse-intensity materials (such as those with high recycled content) would be used preferentially over high greenhouse-intensity materials wherever appropriate..	Construction
Biodiversity	• The work site would be clearly delineated to reduce the risk of machinery, vehicle and trampling damage and compaction to flora located outside of the proposed works envelope.	Pre-Construction
	• Washing of machinery onsite would take place in a bunded formal washout area, to avoid the spread of weeds.	Construction
	• Noxious weeds would be removed and destroyed prior to the commencement of construction works, as far as is practicable. This would be undertaken in accordance with Queanbeyan City Council weed management plans.	Pre-Construction
	• Areas where environmental weeds exist would be clearly marked. Soil removed from these areas would not be reused on site unless deeply buried.	Pre-Construction
	• The work site would be inspected to ensure that disturbed areas become stable and weed infestations do not occur. The site would be appropriately rehabilitated and revegetated to provide stability to disturbed areas and to reduce the potential of sediment and erosion damage. A flora plan would be prepared prior to works commencing onsite. This plan would specifically address: o Weed management. o Treatment of topsoils to maximise their value for revegetation of disturbed sites. o Sourcing of local plants for revegetation (prior to any clearing works on site, it may be useful to collect seeds or seedlings of native species present to use in the revegetation of the site). o Methods available to maximise opportunities for fauna to recolonise the rehabilitation areas. o Disturbed areas would be revegetated with appropriate local native species.	Construction
	• An appropriate training program would be implemented to make sure all site staff are aware that the endangered flora	Construction

Environmental Issue	Safeguards	Timing
	species, Hoary Sunray (*Leucochrysum albicans ssp albicans* var. tricolour), is present within the proposed impact areas. Impact to areas where Hoary Sunray is identified would be minimised as much as practicable.	
	• Hoary Sunray patches outside of the direct impact area would be fenced off to avoid inadvertent impact (refer to bold entries in Appendix B, Table 3-2 and Figure 3-1).	Pre-Construction
	• Hoary Sunray seed would be collected prior to the works to assist with colonisation post-construction.	Pre-Construction
	• When removing the two hollow bearing trees (adjacent to the north south trending drainage line), the RTA environmental officer or an appropriately licensed wildlife carer would be onsite to monitor and implement the two stage clearing process as described below: o Ensure trees to be retained and habitat trees to be felled are clearly identified and marked. o Ensure contractors are provided with a list and map of locations of hollow bearing trees o Ensure contact details for the nearest vet and wildlife care group are provided to site manager, contractor and made available in site office. Make contact with vet and wildlife care group prior to commencement of clearing to ensure they are willing to assist or take injured animals if necessary. o Clear everything else around the hollow bearing trees and potential hollow bearing trees as per the list and map produced during pre-clearing stage or earlier. o If any threatened species are known to be breeding on the site during clearing then special conditions may apply and the requirements for that species must be considered. For example, nest trees may need to be retained as well as foraging resources in the vicinity. o An ecologist with experience in fauna handling should be present during clearing of habitat trees. o Hollow bearing trees should be left standing a minimum of 24 hours to allow resident fauna the chance to relocate. Ecologists will spotlight and stagwatch at night. During this time the ecologist may set traps to capture resident animals if hollows are known to be occupied. o Fell habitat trees as carefully as possible. If possible use swivelling heads so the habitat trees can be lowered to the ground with minimal impact. Request contractors to roll or lift limbs that may be obscuring hollows or	Construction

Environmental Issue	Safeguards	Timing
	fauna. o Ecologist would capture animals that emerge from hollows of felled trees. Animals are to be inspected for injury (see point below relating to injured animals). The animals would be placed in cloth bags and transferred to suitable holding location to await release. Nocturnal fauna should be released at dusk. o Ecologist to inspect all hollows once tree has been felled for signs of wildlife. o Injured animals should be kept in a dark, noise-free place and taken as soon as possible to a wildlife carer or vet – contact details will be supplied to surveyors and clearing contractors. o Hollows potentially supporting fauna can either be cut, or, if there is a risk of injury (animals can be cut in two) the logs can be left on the ground and rechecked the following day or placed on the edge of adjoining habitat. o Ecologist is to guide the clearing contractors as to limbs containing or potentially containing hollows. o Ecologist to guide clearing contractors to expose and turn felled hollow bearing limbs (these may spear into the ground and obscure the hollow entrance when felled). o Relocate hollows to adjacent land (as approved by DECCW or landowner). o No trees are to be felled into/towards exclusion zones. o Provide clearing report outlining any fatalities and number and species of animals relocated.	
	• Care would be taken not to damage vegetation (e.g. tree limbs and bark) when moving equipment near native vegetation to be retained.	Construction
	• Cleared vegetation not used as sawlog or to provide habitat (as described below) would be mulched.	Construction
	• Where possible, some logs from felled trees would be distributed into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional habitat for ground dwelling fauna such as reptiles and small mammals.	Construction
	• Substantial areas of rock and large dead branches on the ground that need to be removed would, where practical, be redistributed in an adjacent area of the road reserve to preserve existing ground refuge.	Construction
	• Bat boxes or means to provide roosting opportunities	Construction

Environmental Issue	Safeguards	Timing
	would be installed at strategic locations in the vicinity of the southern-most hollow-bearing tree to facilitate the relocation of bat species which may use this resource. The number of boxes should reflect the number of hollows to be removed at a ratio of 1:1. Alternatively, the felled sections containing hollows could be remounted nearby. • Only vegetation that is critical to the completion of the proposal would be removed.	Construction
Aboriginal heritage	• If items are uncovered that could be Aboriginal objects, work in that area would stop immediately. The procedure for the unexpected discovery of an Aboriginal object is described in the RTA procedure for Aboriginal cultural heritage consultation and investigation, PACHCI (August 2008). This procedure would be followed in the event of an unexpected discovery.	Construction
Non-Aboriginal heritage	• An archival recording is undertaken for the existing old Goulburn Road alignment at Bungendore Hill. This should follow the guidelines for Items of Local Heritage Significance as outlined in the NSW Heritage Branch publication *How to Prepare Archival Records of Heritage Items*. The recording should pay particular attention to the old road cuttings from the 19th century, but cover the entire stretch of the old road that would be impacted, including landscape vistas as they exist within the site. • It is considered at this time that further archaeological investigation is unlikely to contribute valuable information. However, should any relics or items be uncovered within the proposal area after works commence, all works that may affect the find would immediately cease and the RTA Environment Branch (Heritage) should be contacted. If any sections of the road are uncovered, the Senior Environmental Specialist (Heritage) would be contacted. They would then be able to advise whether the Heritage Branch should be informed and when works in the area may recommence. • It is recommended that mapping be carried out along the line of the road within Queanbeyan LGA and recording any vestigial route information about construction as part of the above archival recording.	Pre-Construction Construction Pre-Construction
Noise	• Construction activities would be undertaken in accordance with DECCW's recommended standard daytime construction hours. Any works required outside of normal	Construction

Environmental Issue	Safeguards	Timing
	working hours would be completed in accordance with the RTA's Practice note vii Roadworks outside normal working hours.	
	• The offset distance between noisy plant items and nearby noise sensitive receivers would be as great as practicable.	Construction
	• Noise generating maintenance work on all construction plant would be carried out as far away from noise sensitive receivers as practicable and would be confined to standard daytime construction hours.	Construction
	• Regular compliance checks would be undertaken on the noise emissions of all plant and machinery to indicate whether noise emissions from plant items were higher than normal. Any non compliant machinery would be taken out service and fixed to become compliant.	Construction
	• Ongoing noise monitoring would be undertaken during construction at sensitive receivers.	Construction
	• Low noise "silenced" generators would be used.	Construction
	• Any ventilation fans would be fitted with acoustic silencers where required to minimise noise emission.	Construction
	• All plant and machinery would be regularly maintained.	Construction
	• Temporary noise barriers would be constructed providing shielding to nearby noise sensitive receivers, wherever practicable.	Construction
	• Where feasible, any acoustic barriers or residential building treatments proposed to control operational noise would be installed as early as possible to assist in minimising the impact of construction noise.	Construction
	• Acoustic enclosures would be constructed around fixed plant operating on a continuous basis during the construction phase at a particular site.	Construction
	• Community consultation is to be undertaken in accordance with the RTA's Community Involvement and Communications Resource Manual.	Construction
	• Complaints received are to be recorded and attended to promptly in accordance with the RTA Community Involvement and Communications Resource Manual.	Construction
	• The RTA would liaise with individual landholders whose properties have been identified as being affected by operational noise that exceeds the criteria for the proposal. The noise mitigation option would be developed in consultation with relevant landholders and in accordance with RTA's Environmental Noise Management Manual (ENMM).	Operation
	• The RTA would undertake noise monitoring in accordance	Operation

Environmental Issue	Safeguards	Timing
	with ENMM to coincide with the commencement of the operation period of the proposal..	
Visual	• Trees which are not affected by the proposal would be retained within the road easement.	Construction
	• Specific recommendations detailed in Section 10 of the visual impact assessment (refer to Appendix G) would be adopted by the RTA.	Construction
	• A landscape design including a tree planting program to reduce the potential visual impacts of the proposal, would be implemented. The tree planting program would be designed in consultation with affected residents and should consist of a range of trees at different heights. Extra consideration should be given to screening views across the valley with tall planting on the SE roadside batter nearest the residences.	Post-Construction
	• The use of earth mounds to facilitate visual screening would be investigated.	Construction
	• Should noise walls be constructed, appropriate position eg avoid noise walls on top of cuttings or noise walls that would impact on views and design eg heights and length would be considered to reduce the potential impact of these walls.	Post-Construction
	• The proposal site would be kept clean and orderly at all times, ensuring that no waste is left at the site following completion of the works.	Construction
	• Temporary erosion and sediment controls would be removed from the site once landforms have been assessed as stable.	Post-Construction
Socio-economic	• Hazards would be minimised by ensuring that works are completed in accordance with relevant RTA standards and OH&S guidelines.	Construction
	• Activities would be completed in the minimum timeframe practicable.	Construction
	• The RTA would keep the community informed regarding the progress of the proposal throughout the construction phase. Additionally, the RTA would provide a phone number and website address which members of the community could access to register complaints regarding construction activities. Any complaints would be collated in a complaints register and actioned within two working days of receipt of the complaint.	Construction
	• The RTA would provide a footpath for residents of the Kingsway estate to access Queanbeyan on foot. This path	Pre-construction

Environmental Issue	Safeguards	Timing
	would be established prior to the commencement of construction activities.	
	• Wherever possible, RTA would engage local subcontractors and supply and maintenance companies.	Pre-construction
	• All land acquisition would be undertaken in accordance with the RTA Land Acquisition Policy and the *Land Acquisition (Just Terms Compensation) Act 1991.*	Pre-construction
Traffic	• A traffic management program (prepared by the RTA) would be implemented which would include the use of signs, barriers, temporary speed zones and traffic control for the duration of the proposed road works. The plan would be in accordance with the relevant RTA guidelines including, the RTA's Traffic Control at Work Sites Volume 3.1 and the specification G10 Control of Traffic.	Pre-Construction
	• Construction works would be avoided on Sundays and public holidays.	Construction
	• Access for residents living adjacent to the proposal would be maintained at all times.	Construction
	• Construction traffic would enter/exit the construction zone only in areas designated for this purpose in the Traffic Management Plan.	Construction
Waste minimisation	• Cleared vegetation would be chipped and reused onsite to stabilise disturbed soils where possible. The excess would be removed from the site to the nearest recycling depot. Weedy mulch would not be reused.	Construction
	• Noxious weeds would be removed and destroyed prior to the commencement of construction works, as far as is practicable. This would be undertaken in accordance with Queanbeyan City Council weed management plans.	Construction
	• Cleared vegetation would not be burned at the site.	Construction
	• Excess excavated material would be disposed of at an appropriate waste management or stock pile site for reuse.	Construction
	• Garbage receptacles would be provided and recycling of materials encouraged. Rubbish would be transported to an appropriate waste disposal facility.	Construction
	• Toilets (e.g. portable toilets) would be provided for construction workers.	Construction
	• Site inductions of all construction staff would take place. They would be recorded by a Site Supervisor and would have a goal of ensuring staff have a thorough knowledge of all key environmental/safety issues.	Construction
	• The RTA would ensure that asbestos remedial works would be undertaken by suitably licensed contractors, in	Construction

Environmental Issue	Safeguards	Timing
	accordance with the approved RAP and be fully completed prior to any general excavation be undertaken. • All wastes would be managed in accordance with the *Protection of the Environment Operations Act, 1997 (POEO Act).* • The works would be managed so that they follow the hierarchy in the Waste Avoidance and Resource Recovery Act, 2001 as follows: o Avoid the generation of waste (for example, order only what is needed to prevent the need to dispose of excess materials). o Reuse materials wherever possible. o Recycle. • Disposal is a last resort. Any approval required for offsite disposal would be obtained prior to disposal.	Construction Construction Construction
Demand on resources	• Energy efficient equipment and practices would be incorporated into the project environmental management plan. • Impacts would be addressed by rehabilitation of disturbed areas, reuse of cleared vegetation onsite and implementation of controls appropriate to manage fuels and lubricants onsite. • Provision would be made for workers to take out any litter or other waste brought onto the site. • A contribution to green power would be made for electricity at site offices. • Water from the sediment basins would be preferentially used for dust suppression purposes. • Rain water tanks would collect water from site sheds which would be reused onsite. • The works would be managed so that they follow the hierarchy in the *Waste Avoidance and Resource Recovery Act* as follows: o Avoid the generation of waste (for example, order only what is needed to prevent the need to dispose of excess materials). o Reuse materials wherever possible. o Recycle. o Disposal is a last resort.	Construction Construction Construction Construction Construction Construction
Hazards and risk	• The detailed design would be completed to ensure that appropriate drainage features are created to minimise the potential off site migration of turbid runoff and any flooding pollution that may generated.	Design

Environmental Issue	Safeguards	Timing
Cumulative	• The proposed works would be appropriately staged with other projects in the general locality along the Kings Highway to limit impacts to traffic during construction.	Construction
	• Design considerations should aim to minimise the amount of land to be acquired from Firth Park.	Construction

7.3 Licensing and approvals

There are no licences required for this proposal.

The RTA to would provide the Department of Primary Industries with a copy of the REF. The DPI would consider the specific impacts to the unnamed drainage line to determine if concurrence from the Minister for Fisheries is required.

8 Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the principles of ecologically sustainable development as defined in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

8.1 Justification

The Kings Highway is a major road connecting the Australian Capital Territory (ACT), Queanbeyan, Bungendore and the southern coastal areas of NSW. It is subject to relatively high traffic volumes including local and commercial traffic with an increase in recreational motorists during holiday seasons.

A new Federal Government Defence Headquarters Joint Operations Command facility has been constructed approximately 10 km east of the proposal. The operation of this facility is expected to increase traffic on the Kings Highway between Bungendore and Queanbeyan by 800 to 1,400 counts in the morning and afternoon hourly peaks (RTA 2008c).

The proposal is identified in the NSW Government's State Infrastructure Strategy, in the program of works for the Illawarra – South East region and is consistent with the State Plan in that it would make the road safer and improve traffic efficiency.

This section of the Kings Highway has an 8% grade and a substandard 60 m horizontal radius curve. These characteristics significantly delay eastbound heavy vehicles and impact on overall traffic efficiency. Traffic studies have identified the need for additional overtaking opportunities. This section of the Kings Highway has the most substandard horizontal and vertical alignment between Queanbeyan and the NSW/ACT border. The crash rate is 29.79 crashes per 100 million vehicle kilometres travelled, with a severity index of 1.29.

The proposal is needed to address existing traffic inefficiencies and crash risk associated with the substandard alignment and the increase in traffic volumes as a result of the new facility. Without an upgrade, these road safety issues will continue to increase as traffic volumes increase over time.

8.1.1 Social and economic factors

The proposal would reduce travel times for users of the Kings Highway primarily by reducing congestion in the morning and afternoon peak times through the installation of two additional lanes. Highway safety would also be improved through the removal of the substandard 60 m

radius curve, installation of a median strip and the addition of two metre wide sealed shoulders.

The proposal is one project in suite of projects that have been completed along the Kings Highway to accommodate an increase in traffic volumes resulting from the operation of the Defence Department's HQJOC facility. It is considered that the proposal is consistent with these other upgrades to improve the safety, efficiency and capacity of this section of the Kings Highway.

The proposal design has aimed to keep the proposed road within the boundaries of the existing road corridor. This has minimised the amount of land acquisition required for construction. No private properties (or parts thereof) would be required to complete construction works. Two small parcels of land would be required to be acquired from the Queanbeyan City Council.

The proposal would result in some negative impacts to residents in the vicinity of the proposal site. Noise during construction works may affect residents and it is anticipated that some residents would be affected by operational noise levels above the allowance criteria if unmitigated. Management measures would be developed with affected residents and implemented prior to operation to reduce impacts.

The Old Goulburn Road corridor was considered through the completion of a Statement of Heritage Impact (SoHI). As the proposal requires the removal of this road the SoHI determined that there would be an impact on this heritage item. An archival recording of the road would be prepared.

8.1.2 Biophysical factors

The proposal would result in the removal of vegetation located within the proposal site. Vegetation to removed would include Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var. *tricolor*) listed as endangered under the *EPBC Act*. An assessment of significance completed for this species concluded that the works would not generate a significant impact and measures are available to further reduce identified impacts.

The proposal would also impact on a number of habitat types within the proposal site including areas of woodland and the removal of two hollow bearing trees, fallen timber and rocky outcrops. It is considered that the removal of these habitats would not significantly impact on fauna species predicted and known to be within the proposal site.

The proposal would fill a disturbed ephemeral drainage line. The detailed design and management measures would ensure impacts associated with infilling the drainage line and increases in surface water flow associated with larger areas of impermeable paved surfaces are appropriately managed.

8.2 Ecologically sustainable development

In NSW, the principles which would assist in the achievement of Ecologically Sustainable Development (ESD) are set out in Schedule 2 of the *Environmental Protection & Assessment Regulation 2000.*

a) *The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

b) *Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*

c) *Conservation of biological diversity and ecological integrity – namely, that a full and diverse range of plant and animal species should be maintained.*

d) *Improved valuation, pricing and incentive mechanisms – these mechanisms would enable environmental factors to be included in the valuation of assets and services.*

The EPBC Act 1999 adopted the above definition of ESD and added a fifth principle:

e) *Decision making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.*

These principles have been used to guide the assessment of environmental impacts in this REF, as set out below.

8.2.1 Precautionary principle

This review of environmental factors has employed the 'precautionary principle' when assessing the proposal. That is, where there is a lack of full scientific certainty as to whether the proposal would threaten or cause serious irreversible damage to an aspect of the surrounding environment, then the proposal would not proceed in its current form. The precautionary principle is integrated into the selection of the preferred option and the development of the management measures in Section 6. Conservative, worst case scenarios have been addressed in this REF to ensure a precautionary approach has been taken in the environmental assessment.

8.2.2 Intergenerational equity

This REF has been designed to assess the potential impact of the proposal and describes safeguards and management measures to minimise the potential impacts of the proposal. The

proposal would not have an impact on natural or cultural features to an extent that would compromise the health, diversity and productivity of the environment to be maintained or enhanced for the benefit of future generations. The proposal also has positive impacts which would benefit future generations; increasing the safety and efficiency of the Kings Highway. Issues that have potential long-term implications, such as consumption of resources, waste disposal, removal of vegetation and impacts of visual amenity, noise and water quality have been avoided where possible and minimised as much as possible through development and design of the proposal and the application of best practice management measures.

8.2.3 Conservation of biological diversity and ecological integrity

Potential biodiversity impacts have been identified and evaluated. Diversity and integrity of ecosystems could be affected by the removal of vegetation and habitat, such as rock outcrops, woodland fragments and hollow bearing trees. The proposal has sought to avoid and minimise biodiversity impacts as much as possible. Assessments of significance were undertaken for all species and communities listed under state and Commonwealth legislation (TSC Act, EPBC Act) with the potential to be affected by the proposal (refer to Appendix F of the attached Appendix B *biodiversity assessment.* These assessments determined that the proposal would not have a significant effect on any NSW or commonwealth listed species or ecological community.

8.2.4 Improved valuation, pricing and incentive mechanisms

The purpose of these mechanisms is to enable environmental factors to be included in the valuation of assets and services. Means to accomplish this for the proposal include:

- The RTA would bear the cost of containment, avoidance or abatement in relation to the potential generation of waste and pollution.
- The RTA, as a user of goods, would pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.
- The RTA would establish environmental goals. These would be pursued by establishing incentive structures that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The mitigation measures in this REF aim to retain the value of environmental features where possible and to manage potential for indirect impacts, such as siltation and erosion and impact to air quality. In this way, costs of remediation are recognised and minimised as a part of the works. The proposal would also result in an increased value of the asset by improving the safety

and efficiency of this section of the Kings Highway. The pursuit of ecologically sustainable development will continue during the detailed design and construction process.

8.3 Conclusion

The proposal would best meet the project objectives in terms of road safety, travel times, value for money and overtaking opportunities. Upgrades to the Kings Highway is also identified in the NSW Government's State Infrastructure Strategy and is consistent with the State Plan in that it would make the road safer and improve traffic efficiency.

The section of the Kings Highway that would be realigned has a substandard curve and provides limited overtaking opportunities. The proposed improvement to the road alignment is necessary to cater for existing and future traffic volumes, to improve road safety and overtaking opportunities and to provide for a consistent speed environment along this section of the highway.

Three options were considered for the upgrade to the highway. Option 1 was the 'do nothing' approach. Option 2 involved realigning and widening the existing alignment of the Kings Highway. Option 3 involved realignment of the Kings Highway between Thurralilly Street and Regent Road.

Option 3 utilises a road corridor shown on the Queanbeyan City Council Local Environment Plan that was widened for a future realignment in 1992 when the Kingsway Estate was created and that has been previously disturbed. This option 3 was assessed to achieve greater improvements than Option 2 in terms of the project objectives related to road safety, value for money and travel times, and property acquisition.

Option 3 would be approximately 10 percent more expensive to construct but would reduce the overall length of this section of road by approximately 350 m or approximately 22 percent (Option 2 would not significantly shorten this section of road). This would provide greater community savings in reduced vehicle operating costs and emissions, reduced travel times, crash savings and maintenance savings.

Option 3 could be constructed without requiring the acquisition of any private property, although the RTA acknowledges there is the potential for cost savings by negotiating the acquisition of a small strip of land from one private property owner. Option 2 would have significant direct impacts on four properties and require acquisitions from each of them.

Option 3 has the added benefits of being more constructible as much of the work would be undertaken outside of the existing highway alignment.

Although Option 3 does have adverse environmental impacts, these are considered manageable with the effective implementation of mitigation measures detailed in this REF

The beneficial outcomes of the proposal include:

- Improving road safety through the removal of the substandard 60 metre radius curve.
- Reducing vehicle operating costs through a straighter and shorter alignment.
- Improving road efficiency for road users by providing additional lanes, both east and west bound.
- Providing a design and preferred alignment that would minimise potential direct impacts to private properties and minimise the need for property acquisition.
- Greater benefits than option two in terms of road safety, value for money, travel times, property acquisition.
- Greater benefits than option two due the shorter length (approximately 30% shorter) and the increase in efficiency resulting in a net reduction of greenhouse gas emissions over the next 20 year period.

Potential environmental impacts include:

- Noise impacts on nearby residents.
- Reduction in visual amenity for nearby residences.
- Removal of four hectares of vegetation including two hollow trees which provides potential habitat to threatened fauna.
- Impact to the Hoary Sunray (*Leucochrysum albicans ssp albicans var. tricolour*) which is listed as endangered under the EPBC Act.
- Impact to the old Goulburn to Queanbeyan Road which has local heritage significance.
- Property acquisition of Firth Park which is used as open space.
- Potential for dust during construction.

Safeguards and management measures for potential environmental impacts are proposed to ensure the proposal does not have a significant impact on the surrounding environment. No

further assessment of environmental impacts is considered to be required.

In conclusion, the objectives of the REF have been achieved, namely:

- The REF has been prepared in accordance with Section 111 of the EP&A Act with reference to the factors listed in Clause 228 of the Environmental Planning and Assessment Regulation 2000. The REF examines and takes into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

- It provides sufficient information to allow the RTA to assess whether the proposed activity would significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats; and whether it is necessary for approval to be sought under Part 3A of the EP&A Act.

- It provides sufficient information to allow the RTA to assess whether the proposed activity would significantly affect the environment (including critical habitat) or threatened species, populations or ecological communities, or their habitats; and whether an SIS in accordance with Section 112 and Section 5A of the EP&A Act is required.

- Provides sufficient information to allow the RTA to assess whether proposed activity would not significantly impact on matters of national environmental significance; and whether referral to the Commonwealth Minister for the Environment for approval, in accordance with the EPBC Act, is not required.

9 Certification

This Review of Environmental Factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Tim Browne

Project Officer - **ngh**environmental

Date: 27/08/09

I have examined this Review of Environmental Factors and the certification by Tim Browne and accept the Review of Environmental Factors on behalf of the RTA.

Paul Vecovski

Project Manager – Roads and Traffic Authority, NSW

Date: 17/09/09

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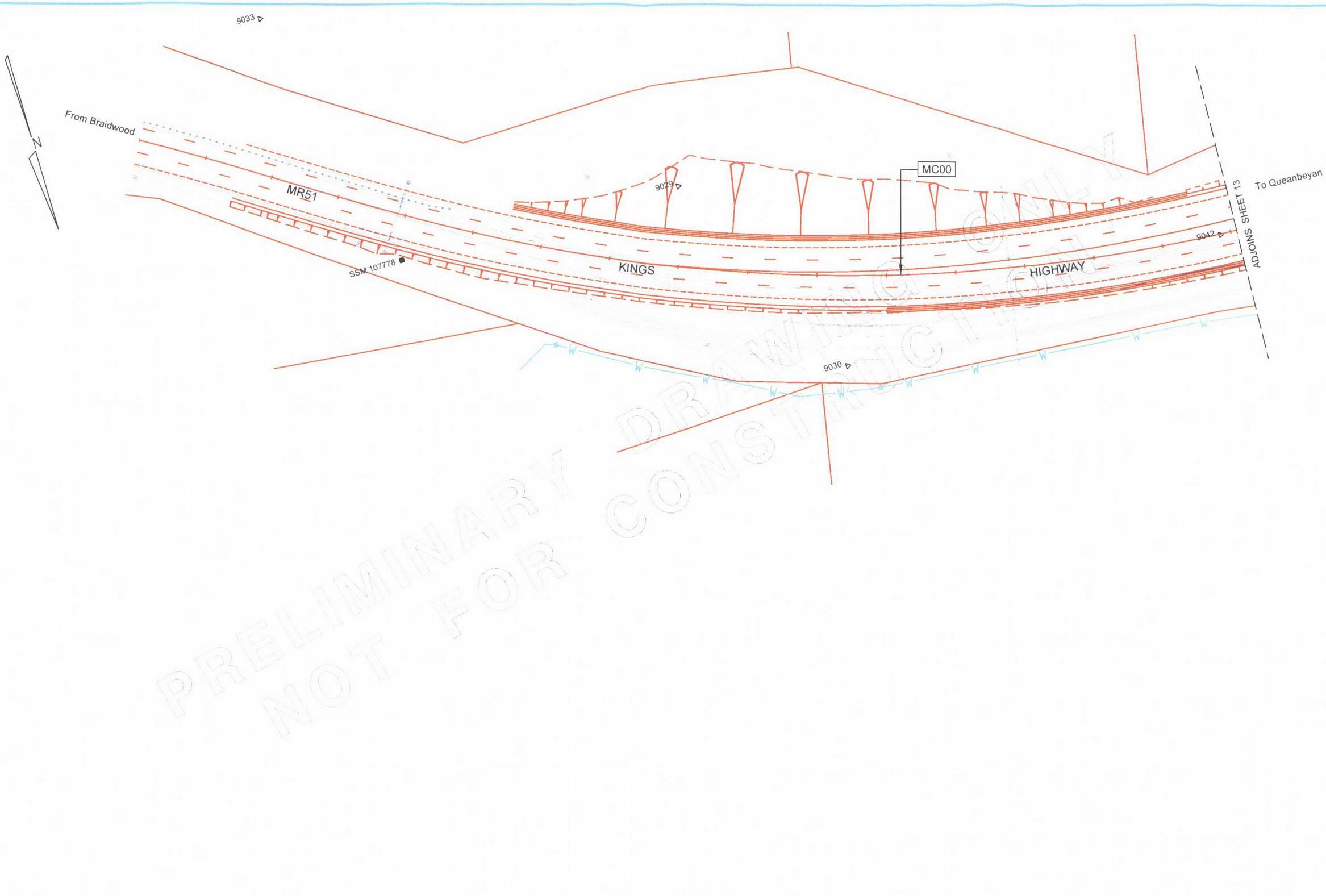
Terms and acronyms used in this REF

AATD	Annual Average Traffic Data – Recorded by the RTA on roads around NSW.
CEMP	Construction Environmental Management Plan.
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Ephemeral waterway	A waterway that flows intermittently.
FM Act	Fisheries Management Act 1994 (NSW)
Heritage Act	Heritage Act 1977 (NSW)
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007
Kandosols	Soils that have well developed B_2 horizons
Kurosols	Soils with abrupt B horizon that is often strongly acidic

LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
MNES	Matters of national environmental significance. Refers to the seven matters
Noxious Weeds Act	Noxious Weeds Act 1993 (NSW)
NPW Act	National Parks and Wildlife Act 1974 (NSW)
QCC	Queanbeyan City Council
Podzolic	Acid strong soils with strong texture contrast between topsoils and subsoils
RTA QA Specifications	Specifications developed by the RTA for use with roadworks and bridgeworks contracts let by the RTA or local councils.
Rudosols	Soils with negligible pedologic organisation.
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
TSC Act	Threatened Species Conservation Act 1995 (NSW)
Turbid	Sediment laden water.

Appendix A

Concept design



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DESIGNED. . . . . G. KOZAROSKI . . . . . .

REVIEWED. . . . . .

ROADS AND TRAFFIC AUTHORITY OF NSW

GREATER QUEANBEYAN COUNCIL
MR51 KINGS HIGHWAY
DEVIATION OF THE HIGHWAY BETWEEN
THURRALILLY STREET AND RIDGEWAY ROAD
DETAIL PLAN AND LONGITUDINAL SECTION

FILE No.	DRAWING	PRINTED DATE	SHEET No.
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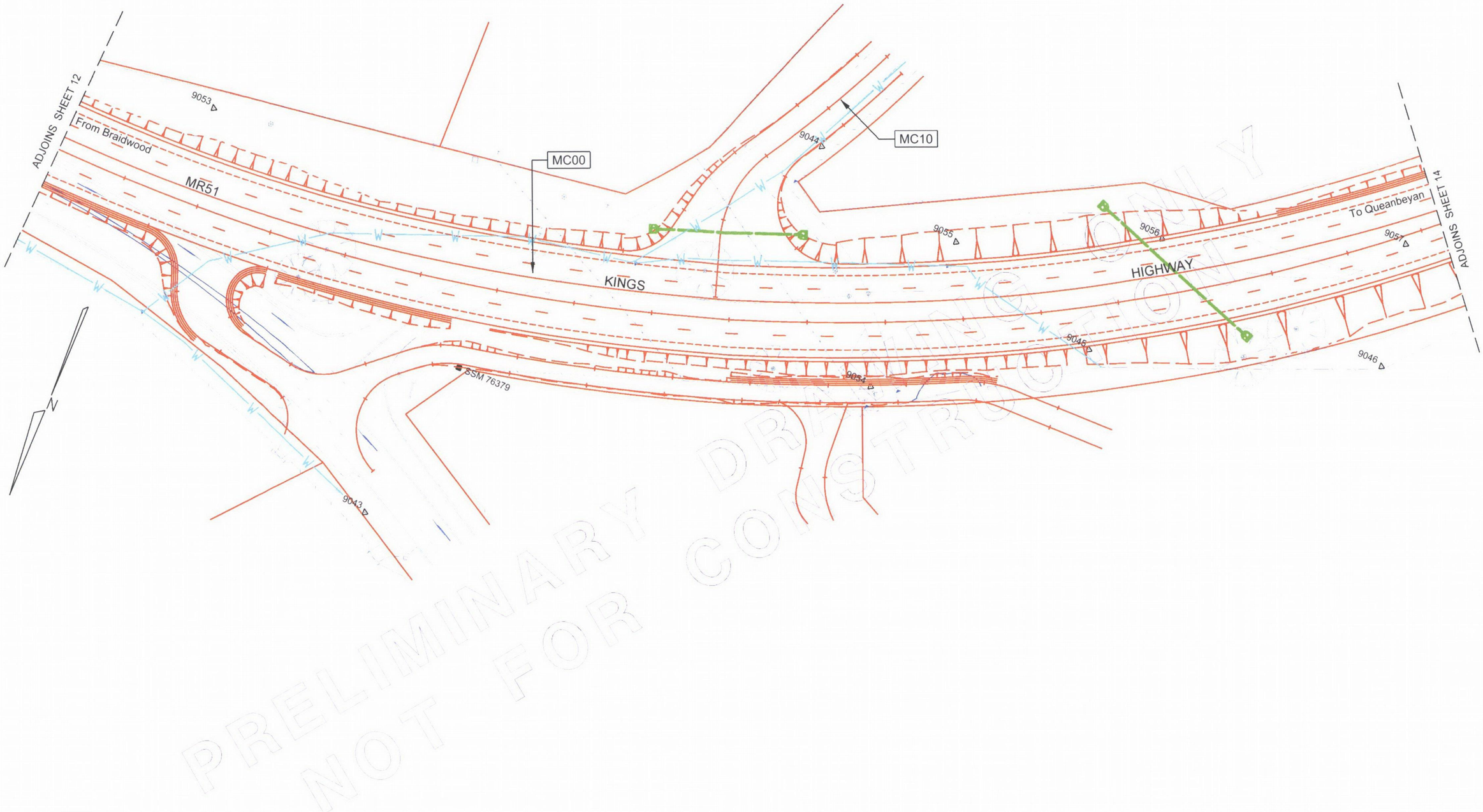

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RTA PREPARED BY ENGINEERING TECHNOLOGY DESIGN SOUTHERN

DESIGNED. G. KOZAROSKI

REVIEWED.

ROADS AND TRAFFIC AUTHORITY OF NSW

GREATER QUEANBEYAN COUNCIL
MR51 KINGS HIGHWAY
DEVIATION OF THE HIGHWAY BETWEEN
THURRALILLY STREET AND RIDGEWAY ROAD
DETAIL PLAN AND LONGITUDINAL SECTION

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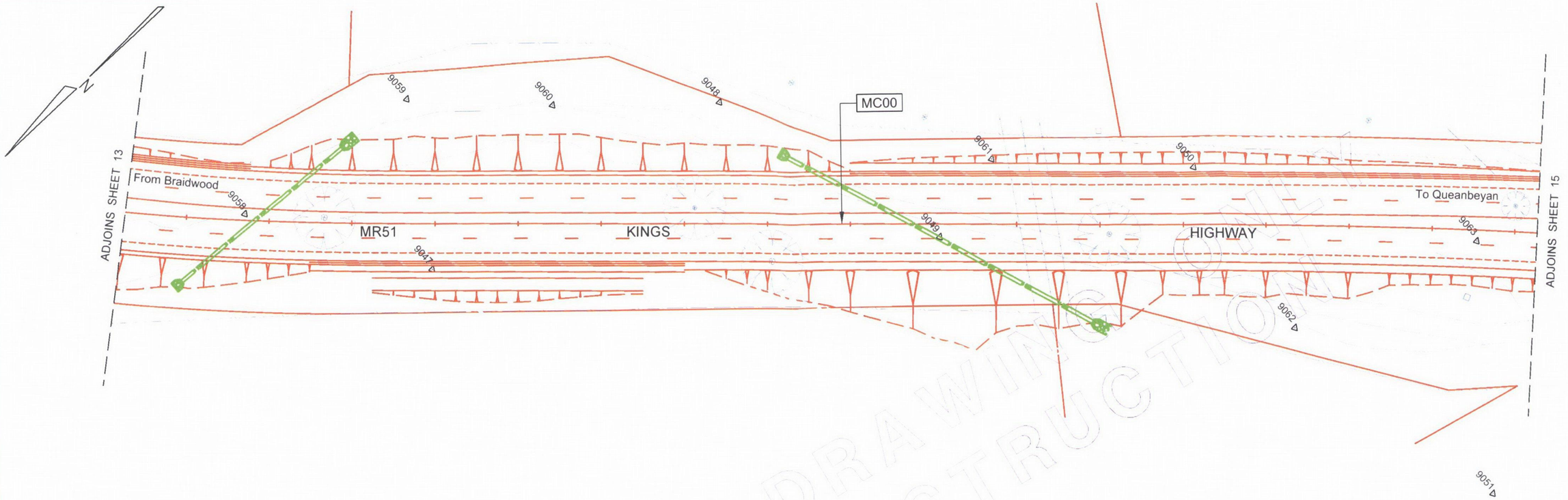

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THURRALILLY STREET AND RIDGEWAY ROAD
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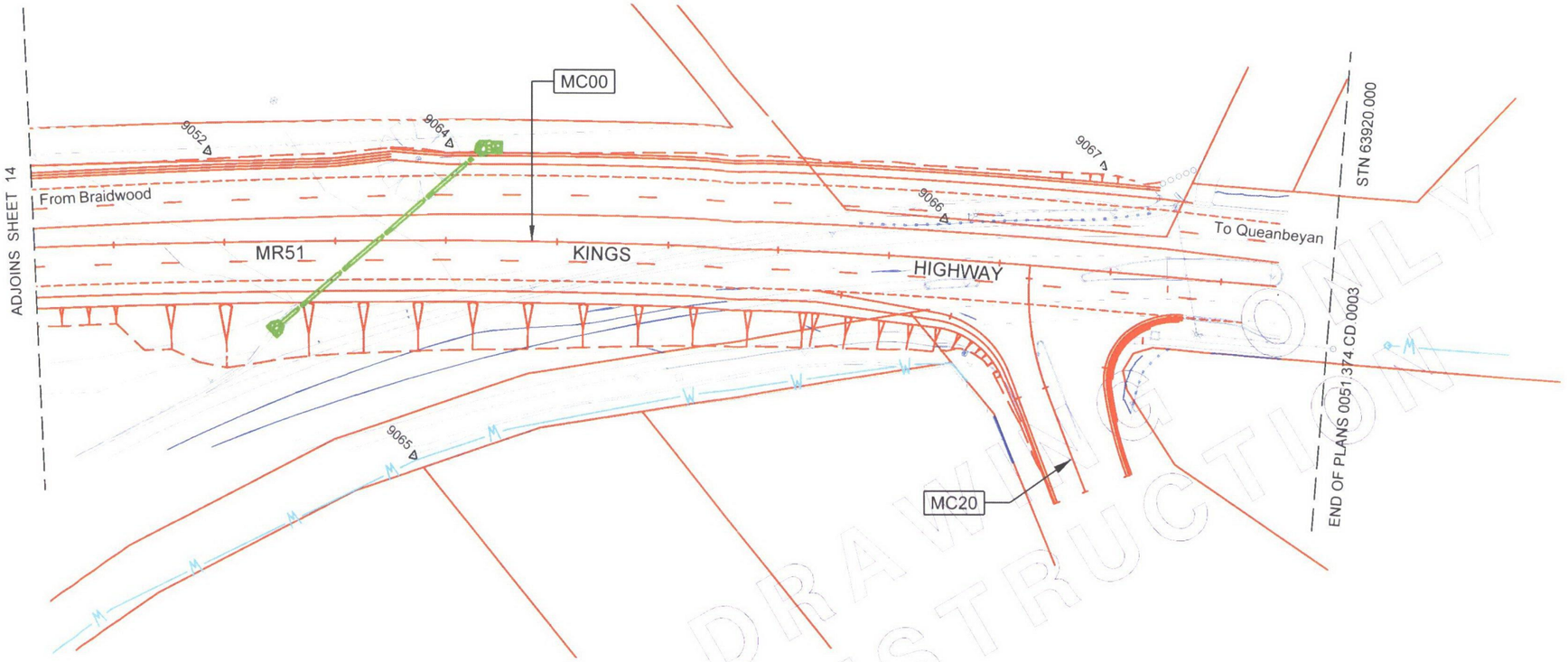

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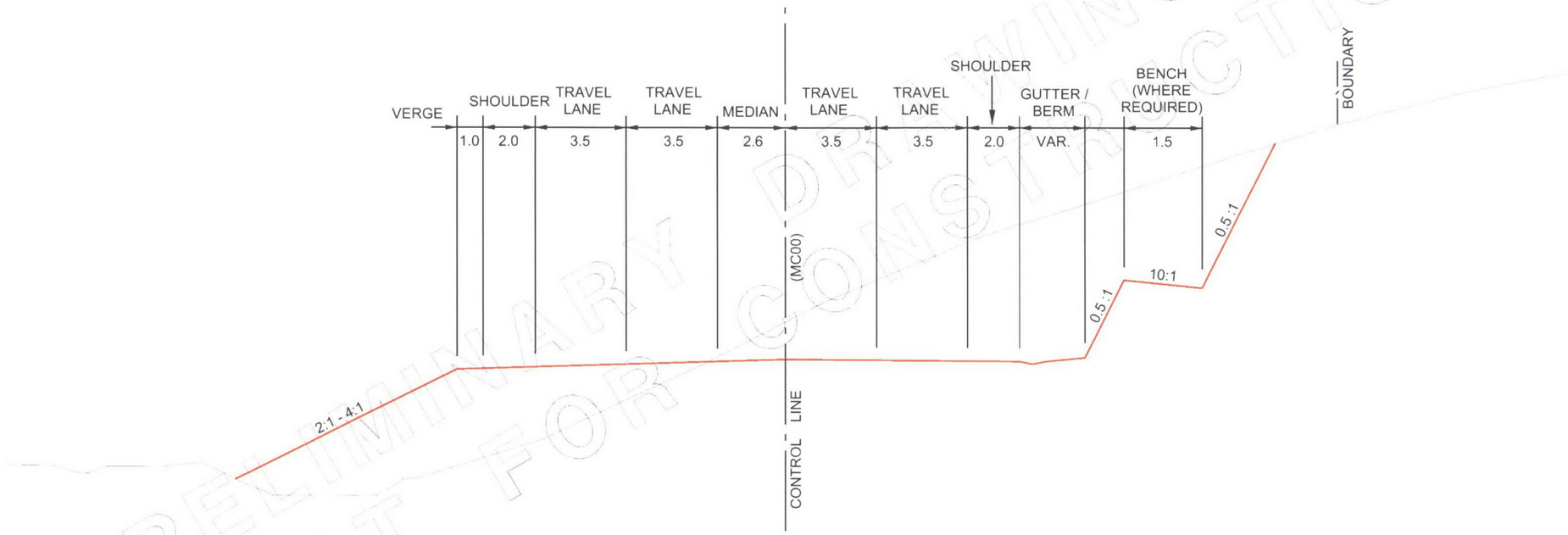

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THURRALILLY STREET AND RIDGEWAY ROAD
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Appendix B

Biodiversity assessment

Biodiversity Assessment

KINGS HIGHWAY REALIGNMENT

AUGUST 2009

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1 INTRODUCTION

The RTA propose to realign the Kings Highway (MR51) on the eastern outskirts of Queanbeyan, between Thurralilly Street and Regent Drive, to an area approximately 400m west of The Ridgeway. Several biodiversity studies have been completed concerning this area and have helped to guide the proposal to minimise biodiversity impacts.

This report outlines previous studies relevant to the proposal and documents the findings of the site visit undertaken to assess the final realignment route. Recommendations to minimise impacts are included.

2 BACKGROUND

In total, three biodiversity investigations are relevant to the final realignment route:

1. **Preliminary Constraints Analysis** for proposed upgrade at Kings Highway, prepared for the RTA by nghenvironmental September 2008
2. **Threatened Flora Searches**, Kings Highway, prepared for the RTA by nghenvironmental January 2009
3. **Final realignment route biodiversity investigation**, carried out for the RTA by nghenvironmental, January 2009

Items 1 and 2 are summarised below in Section 2 of this report, where relevant to the final realignment route. Item 3 is documented in full in Section 3 of this report. The study areas are shown in Figure 2-1.

2.1 PRELIMINARY CONSTRAINTS ANALYSIS SEPTEMBER 2008

In September 2008, **ngh**environmental prepared a Preliminary Constraints Analysis for the RTA, targeting an approximately 4.5 kilometre section of the Kings Highway east of Queanbeyan. This analysis included the area which is now the subject of the Kings Highway proposed realignment REF, refer to Figure 2-1.

2.1.1 Methods (Preliminary Constraints Analysis 2008)

The Preliminary Constraints Analysis involved a site visit by a botanist and project officer (10 July 2008), coupled with desktop assessment.

It was identified that the proposed study area is located adjacent to the Cuumbeun Nature Reserve.

A review of the Department of Environment and Climate Change (DECC) Wildlife of NSW Atlas identified that 32 fauna and nine flora species had the potential to be present within the area, defined by the topographic map Canberra (8727, 1:100 000).

The Department of Environment Water Heritage and the Arts (DEWHA) Protected Matters Search Tool identified 13 fauna species and seven flora with potential to occur within a 10 kilometre radius of the general study area.

The analysis adopted a 'traffic light' model risk assessment to portray four constraints categories:

- Highly constrained (red)
- Moderate constrained (amber)
- Low to moderate constrained (yellow)
- Low constrained (green)

Management options relevant to these constraint categories are presented in Table 2-1.

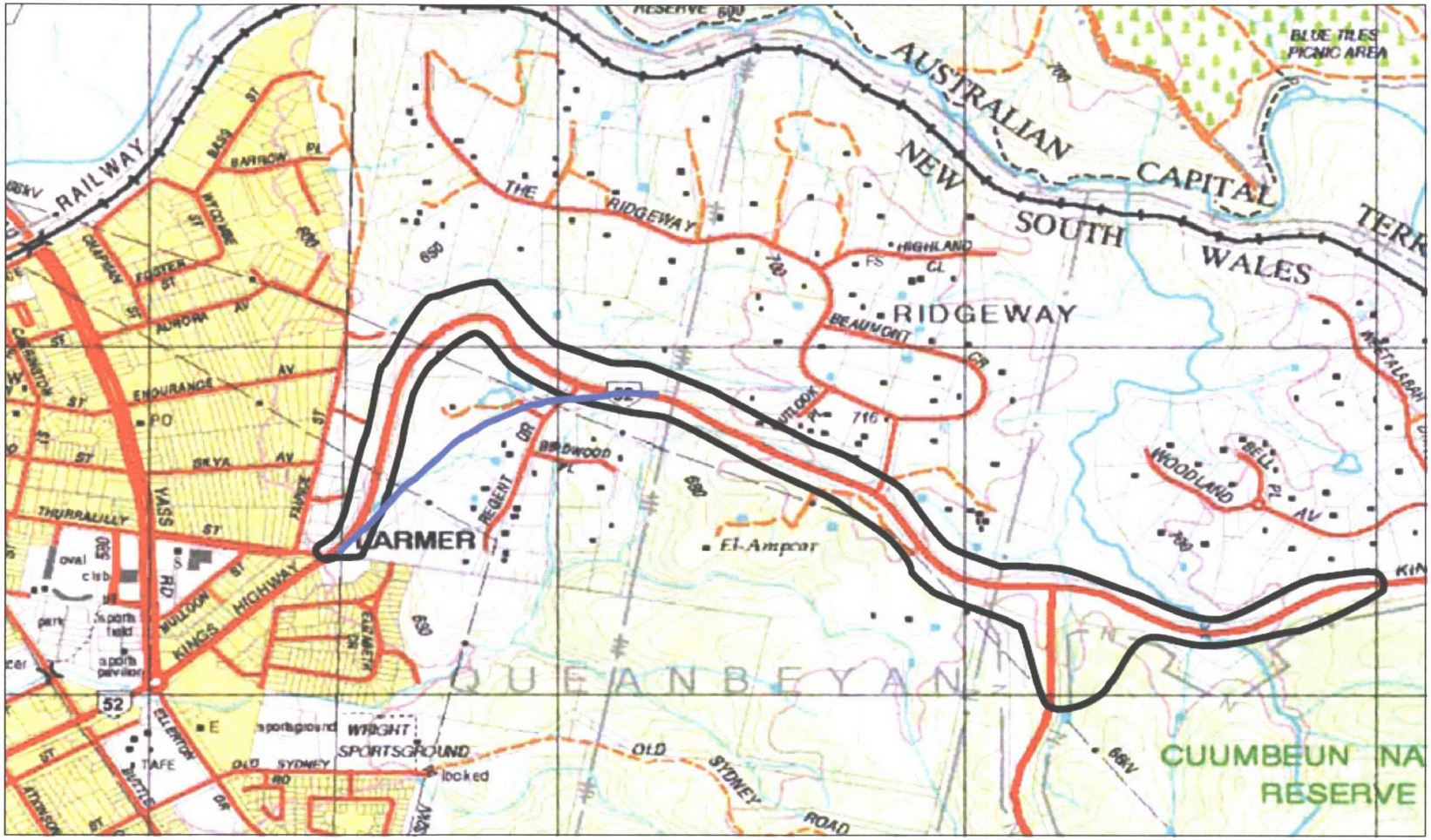

Figure 2-1 Study area: Kings Highway, Larmer.

The black outline and blue line delineate the study are for Items 1 and 2. The study area for Item 3 is restricted to the blue line, which represents the proposed realignment.

Table 2-1 Potential management options for environmental risks

Risk Level	Likely Management Options
High	Potential no go zones. If impacts cannot be **avoided** in these areas, further investigation will be required to quantify the level of impact (via field work and the assessment of the significance of the impact, pursuant to state and federal legislation). The results of further investigation may lead to a recommendation to undertake a Species Impact Statement, the involvement of the Department of Environment and Climate Change, and the recommendation to alter the proposal to minimise identified environmental risks.
Moderate	Impacts to these areas should be **strictly minimised** in order to avoid a significant impact. Further investigation may be required to quantify to level of impact if recommended management options cannot be implemented. Management options may include fencing out areas or the implementation of specific controls such as weed eradication or revegetation.
Low-Moderate	Although risk to these areas is lower, impacts to these areas should also be **strictly minimised** in order to avoid a significant impact. Further investigation may be required to quantify to level of impact if recommended management options cannot be implemented. Management options may include fencing out areas or the implementation of specific controls such as weed eradication or revegetation.
Low	Impacts to these areas are **generally acceptable**, with the implementation of standard environmental controls, such as sediment and erosion controls.

2.1.2 Results (Preliminary Constraints Analysis 2008)

In general, the Preliminary Constraints Analysis concluded that the study area is not highly constrained in relation to biodiversity. Two map sheets produced for the Analysis are relevant to the final realignment route; Flora constraints map 1 and Fauna constraints map 1. These maps are included as Appendix A.

The following features were identified, relevant to the final realignment route:

Flora constraints

Approximately half of the route, coinciding with the middle section of the route, was considered a moderate constraint, this containing more intact native vegetation than surrounding areas. The remainder was mapped as a low-moderate constraint. Specifically:

- The proposed realignment route contains occurrences of the Hoary Sunray, a species listed as threatened under the Commonwealth EPBC Act but which is locally common on the NSW Southern Tablelands. It is most abundant at each end of the route, but thinly scattered over its whole length. This is considered a low-moderate constraint.
- Numerous environmental and some noxious weeds (blackberry, African boxthorn) occur at the site.
- The entire route was mapped as potential threatened orchid habitat. Further assessment was recommended to be undertaken in November to coincide with the flowering periods of the threatened orchids, *Diuris aequalis* and *Caladenia tessellata* (both listed as endangered under the TSC Act and vulnerable under the EPBC Act).
- Although some yellow box is present, the vegetation does not appear to belong to the Box-Gum Woodland EEC.

Fauna constraints

The entire route was mapped as a low-moderate constraint, with one high constraint feature identified. Specifically:

- A hollow-bearing tree, midway along the route, was categorised as a high constraint to be avoided. Hollows and mature trees were noted to be important resources for threatened species known from the areas (several microbat species, Eastern Pygmy Possum, Koala).

2.2 THREATENED FLORA SEARCHES, JANUARY 2009

2.2.1 Methods (Threatened Flora Searches, January 2009)

On the basis of recommendations within the Preliminary Constraints Analysis, a targeted Spring flora survey was undertaken. It surveyed areas of potential habitat for the *Diuris aequalis* and *Caladenia tessellata* within the area identified in Figure 2-1. In the Threatened Flora Searches, this area is referred to as study area 1.

Two site inspections were undertaken in the study area; the first on 16 October 2008 and second on 4 November 2008. The site inspections were undertaken by Jackie Miles (Botanist) and RTA Environmental Officer, Graham Roche. Inspections involved targeted searches on foot in areas considered to hold suitable habitat for the subject species.

2.2.2 Results (Threatened Flora Searches, January 2009)

There were no individual plants of either subject species observed within the survey areas during either site survey. Survey timing was considered appropriate to identify individuals of the subject species, had they been present.

It was concluded that the study area provides marginal habitat for the subject species; the dry nature of habitat within the study area indicates that orchids are unlikely to be present.

An Assessment of Significance was conducted to assess to potential for significant impact as a consequence of road works in the study area. The assessment indicated that a Species Impact Statement (SIS) is unlikely to be warranted for potential to impact *Caladenia Tessellata* or *Diuris Aequalis,* as a consequence of proposed future road work within the study area.

3 BIODIVERSITY ASSESSMENT OF THE FINAL REALIGNMENT ROUTE

In 2009, **ngh**environmental were engaged by the RTA to undertake additional biodiversity investigations, as part of the additional investigations associated with the preparation of a Review of Environmental Factors (REF) for the final realignment of the Kings Highway.

The study area for the realignment defined by the blue line on Figure 2-1. This area is a small component of the larger study area covered by the Preliminary Constraints Analysis and Threatened Flora Searches, discussed in Section 2.

This section describes the methods and results of the biodiversity assessment and identifies recommendations that have the objective of minimising the identified biodiversity impacts of the proposed realignment. This assessment takes into account the constraints and assessments completed in the previous studies; Preliminary Constraints Analysis and Threatened Flora Searches.

Methods, results and discussion of identified biodiversity impacts are discussed separately for flora and fauna. Mitigation measures are provided to minimise biodiversity impacts.

3.1 FLORA

3.1.1 Methods

Desktop and field assessment were undertaken to identify flora values relevant to the proposal.

Previous reports were sourced (refer to Sections 2.1 and 2.2). A search of the DECC threatened species data base was undertaken to determine threatened species known or predicted to occur in the Monaro sub-region of the Murrumbidgee CMA, prior to field work. A Search of the DEWHA Matters of National Significance database revealed an additional two threatened plant species with the potential to occur on the site (refer to Appendix D).

The vegetation and potential habitat within the study area was subject to an additional field assessment on 10 July 2008 by an **ngh**environmental Botanist (Jackie Miles) and Project Officer. The field survey was undertaken using the Random Meander method (as per Cropper 1993) by traversing the study area on foot. Targeted searches were conducted for threatened plant species in areas considered likely to provide suitable habitat. The survey timing, in winter, was poor both for detecting threatened flora species and for determining the plant species present however, this work was undertaken to augment previous survey work (refer to Sections 2.1 and 2.2) and was considered to provide adequate information for the determination of vegetation and flora impacts.

The area surveyed included the final realignment route, between the intersection of Thurralilly Street and the existing Kings Highway to the intersection of Regent Drive and Kings Highway. A short section of Kings Highway between Regent Drive and The Ridgeway was also surveyed.

A species list was compiled during the field survey (see Appendix B). Exotic species are preceded by an asterisk in this list and throughout the text.

3.1.2 Results

The proposal site is at an elevation of approximately 600-680 metres above sea level and located on metamorphosed Ordovician siltstone, with shallow to skeletal infertile soils covering a large proportion of the site. Surrounding topography includes a mixture of near-level ridge tops and steep slopes carrying rocky skeletal clay-loam soils, interspersed with minor ephemeral drainage lines.

The final realignment for the Kings Highway is located between Thurralilly Street and Regent Drive, an existing road reserve known as Goulburn Road which consists of a non-vegetated gravel road surface. This road passes through woodland which has been partially cleared and appears to have been subject to a high level of disturbance.

Figure 2-1 illustrates the high degree of development to the west, north and east of the route. The Cuumbuen Nature Reserve is located nearby, to the east of the study area, starting at the Captains Flat Road junction. South of the site, is less developed. Adjacent land is generally private property in a rural residential setting, partially cleared and with frequent plantings of exotic flora such as pines and other conifers.

Plant species

The dominant tree species vary between ridge top and gully areas within the proposal site, and include apple box (*Eucalyptus bridgesiana*), red box (*E. polyanthemos* ssp *polyanthemos*), mealy-bundy (*E. nortonii*), brittle gum (*E. mannifera*), and red stringybark (*E. macrorhyncha*), with yellow box (*E. melliodora*) scattered throughout the site, but nowhere dominant. Small trees include black wattle (*Acacia mearnsii*), silver wattle (*A. dealbata*), the garden escapee Cootamundra wattle (*A. baileyana*) and native cherry (*Exocarpus cupressiformis*), with taller shrubs red-stem wattle (*A. rubida*), poverty wattle (*A. dawsonii*), *Daviesia mimosoides, Bursaria spinosa, Cassinia quinquefaria,* and *Dillwynia sieberi.*

Exotic shrubs and small trees are prominent in the gully adjacent to the gravel road at the western end of the site, but uncommon elsewhere on the site. They include blackberry (**Rubus fruticosus* spp. agg.), privets (**Ligustrum* spp), hawthorn (**Crataegus monogyna*), firethorn (**Pyracantha* spp), cotoneaster (**Cotoneaster glaucophylla*), tagasaste or tree lucerne (**Chamaecytisus palmensis*), Cape broom (**Genista monspessulana*), sweet briar (**Rosa rubiginosa*) and African boxthorn (**Lycium ferocissimum*). The introduced flora of the site also includes occasional Australian native plants not native to the Queanbeyan area, which have escaped from nearby gardens (*Grevillea rosmarinifolia, Acacia boormanii, Acacia cultriformis, Westringia fruticosa*).

The groundcover in the less disturbed and drier areas such as cutting tops and upper slopes is dominated by low shrubs such as *Pultenaea microphylla, P. procumbens, Daviesia genistifolia* and *Cryptandra amara*, grasses *Austrodanthonia* spp., *Austrostipa* spp and *Themeda australis* and native forbs including *Lomandra* spp., *Dianella revoluta, Xerochrysum viscosum, Leucochrysum albicans, Chrysocephalum apiculatum* and *Gonocarpus tetragynus*, most of which are sparse in most areas. There are occasional patches of exotic forbs (agricultural weeds), such as St John's wort (**Hypericum perforatum*), ribbed plantain (**Plantago lanceolata*), black thistle (**Cirsium vulgare*) and mullein (**Verbascum thapsus*). In the roadside drains of the Kings Highway and over parts of the highway northern verge the groundcover is mostly exotic, dominated by the grasses paspalum (**Paspalum dilatatum*), cocksfoot (**Dactylus glomerata*) or phalaris (**Phalaris aquatica*).

Vegetation communities

There are two vegetation classification schemes available for the Queanbeyan area, the Southern CRA study (Thomas *et al.* 2000) and the SCIVI classification (Tozer *et al.* 2006). The latter incorporates data from the former, and supersedes it. Both schemes are used here to describe the native vegetation types found on the site.

Tableland Low Woodland, Braidwood Dry Forest, Tableland Hills Grassy Woodland (SCIVI classification)

Dry woodland or open forest dominated by brittle gum (*E. mannifera*) and red stringybark (*E. macrorhyncha*) and including mealy-bundy (*E. nortonii*) or red box (*E. polyanthemos*) belongs under the SCRA classification to Forest Ecosystem 114, Tablelands Dry Shrub/ Tussock Grass Forest and under the SCIVI classification to any one of several very similar communities, including DSFp9, Tableland Low Woodland, DSFp15 Braidwood Dry Forest or GWp23, Tableland Hills Grassy Woodland, all of which are said to occur in the relevant area and have quite similar species composition.

Western Tablelands Dry Forest (SCIVI classification)

Stands dominated by mealy-bundy, such as the ridge top vegetation around Regent Drive, would be included as a variant within FE114 under the SCRA classification, but are not covered by the SCIVI classification, which does not record this species in any of its vegetation communities. The similar species, *E. goniocalyx*, which occupies very similar habitat, is found in only one SCIVI vegetation community, DSFp14, Western Tablelands Dry Forest, said to be widely distributed on rocky hills and ridges from the Central Tablelands to Captains Flat. DSFp14 is typically dominated by *Eucalyptus macrorhyncha, E. rossii, E. dives, E. mannifera* or *E. goniocalyx*, and may occasionally include *E. polyanthemos, E. bridgesiana* or *E. melliodora*. The shrub composition of DSFp14 is somewhat similar to that on the drier parts of this site, and it is therefore also a fair match for the drier woodland on the site.

Tablelands Grassy Box-Gum Woodland, Tablelands Grassy Box-Gum Woodland (SCIVI classification)

Vegetation which includes apple box (*E. bridgesiana*) and yellow box (*E. melliodora*) could belong to a number of communities described under the SCRA classification, including Forest Ecosystem 90, Northern Tablelands Acacia/Herb/Grass Dry Forest (dominated by *E. bridgesiana*, which may also include *E. dives, E. macrorhyncha, E. mannifera* and *E. melliodora*) and FE92, Tablelands Acacia/Herb/Grass Dry Forest (dominated by *E. bridgesiana* and *E. melliodora*, with *E. cinerea, E. macrorhyncha, E. mannifera, E. rubida, E. goniocalyx, E. polyanthemos* and *E. viminalis* also possibly present). Under the SCIVI classification GWp24, Tablelands Grassy Box-Gum Woodland may be the closest association, although GWp23, Tablelands Hills Grassy Woodland, is also somewhat similar.

Endangered Ecological Communities

One Endangered Ecological community (EEC), Yellow Box – White Box- Blakely's Red Gum Grassy Woodland, has the potential to occur on the subject site. However, the bulk of the subject site carries a dry shrubby woodland or open forest type dominated by trees other than yellow box, which is not equivalent to the Box-Gum Woodland EEC, under either TSC Act or EPBC Act definitions, as while it may contain occasional yellow box trees, it has an open shrub-dominated understorey, not a grassy one.

It is assessed that vegetation to be affected by the proposal does not meet the definition of EEC, under either the TSC Act or EPBC Act definitions. The following section details, transparently how this conclusion was reached, given the scope for interpretation within the definitions.

EEC determinations: to EEC or not to EEC

Areas of vegetation including Yellow Box could fit within the definition of the Endangered Ecological Community Yellow Box – White Box- Blakely's Red Gum Grassy Woodland, listed as an EEC in NSW under the *Threatened Species Conservation Act 1995*, and as the Critically Endangered Yellow Box – White Box-Blakely's Red Gum Grassy Woodland and Derived Native Grasslands under the *Environment Protection and Biodiversity Conservation Act 1999*.

On the site this would include the SCIVI unit GWp24, Tablelands Grassy Box-Gum Woodland. The SCIVI report (Tozer *et al.* 2006) states that three of their vegetation communities could fit within the definition of the Box-Gum Woodland EEC, GWp24, GWp420 (found on rolling terrain on granite and including *E. viminalis*, so not relevant to this site) and DSFp35 (Wollondilly-Cox's-Shoalhaven Gorge Woodland, found in steep gorges and including *E. tereticornis*, so not relevant to this site).

Alternatively, if the view is taken that the vegetation on the site is closer to GWp23 (Tableland Hills Grassy Woodland) than to GWp24, then it would not generally be regarded as being part of this EEC. While GWp23 is most commonly dominated by tree species of drier slopes, *E. dives, E. macrorhyncha* and *E. mannifera* (present in 53%, 38% and 31% respectively of sample sites), samples of this community may also contain *E. bridgesiana* (15% of sites), *E. melliodora* (12%) and *E. blakelyi* (4%). There is clearly a substantial overlap in species composition between communities which do and which don't fall within the Box-Gum woodland definition, creating some confusion with assigning vegetation which is intermediate in composition, as it is on parts of this site.

The Department of Environment and Climate Change has taken the view that woodland dominated by apple box and yellow box in Cuumbeun Nature Reserve, is likely to be reasonably similar to that on parts of the site, belongs to the Box-Gum Woodland EEC. The Cuumbeun Nature Reserve Plan of Management (DECC, 2006) states that, within the reserve,

> *"undulating valley floors with deeper soils on the escarpment support apple box, yellow box and red stringybark, with a herb grass understorey. This community, with an abundance of yellow box and a grassy understorey, is listed as an endangered ecological community under the Threatened Species Conservation Act, 1995."*

The vegetation on the site, while dominated by apple box and including yellow box, lacks a diverse grassy understorey, and is not located on "undulating valley floors", and therefore does not conform to this EEC definition.

With regard to the *TSC Act* listing in relation to EEC condition, remnants consisting only of yellow box trees above a largely exotic or low diversity native understorey (such as appears to occur at the Ridgeway Road junction) could be considered to fall within the definition of the EEC under State legislation. The Final Determination of the NSW Scientific Committee states that:

> *"Some remnants of the community may consist only of an intact overstorey or an intact understorey, but may still have high conservation value due to the flora and fauna they support.....Disturbed remnants are still considered to form part of the community including remnants where the vegetation, either understorey, overstorey or both, would, under appropriate management, respond to assisted natural regeneration, such as where the natural soils and associated seed bank are still at least partially intact."*

This interpretation suggests that even substantially degraded remnants should be considered as belonging to the EEC. The identification guidelines for the Box-Gum Woodland EEC (NSW NPWS 2002) indicate that if the remnant in question occurs within the geographical area (tablelands and slopes) defined as the habitat of the community, carries, or is likely to have formerly carried, white box, yellow box or Blakely's red gum, is mainly grassy rather than shrubby and includes any of the indicator species

listed in the determination (either as plants or in the soil seed bank), and if degraded, is considered to have potential for natural regeneration of the overstorey or understorey, then it is regarded as being part of the EEC. Treeless areas of secondary grassland from which trees have been cleared may be regarded as part of the EEC.

The Box-Gum Woodland Fact Sheet (NSW NPWS, undated) further states that the three characteristic tree species may occur either as pure stands or in mixtures with other trees including apple box (*Eucalyptus bridgesiana*), red stringybark (*E. macrorhyncha*), candlebark (*E. rubida*) and brittle gum (*E. mannifera*). Red box (*E. polyanthemos*) is not mentioned, but might be assumed, since it is usually associated with the other species. It appears therefore to be the intention of the Department of Environment and Climate Change that ecotonal stands be included within the EEC definition.

A different and much more stringent set of guidelines for identifying the Box-Gum Woodland CEEC as listed under the *EPBC Act* is provided on the DEWHA website (www.environment.gov.au/epbc.index.html). This definition requires:

> *'That patches be of at least 0.1 ha (50 x 20 metres) in size, have a groundcover layer comprising at least 50% cover of native species (as assessed in autumn when high numbers of spring flowering annuals are not present) and include 12 or more native understorey species (excluding grasses), of which at least one must be from a group of species listed as being important in that community, in a list of numerous species potentially occurring within the EEC provided by DEH. The latter requirement may be waived if the patch is greater than 2 hectares in size, with 20 or more mature trees per hectare or natural tree regeneration present.'*

Under this more stringent definition little or none of the vegetation on the site would be likely to fall within the CEEC as listed under the *EPBC Act*. Sites where yellow box or Blakely's red gum are not at least the co-dominant canopy species are not considered the CEEC under the *EPBC Act* definition (Department of Environment and Heritage, 2006), which would exclude all of the vegetation onsite, where Apple Box tends to be the dominant species in the locations where Yellow Box occurs. In addition, to be included within the CEEC a patch must have 12 or more native understorey species (excluding grasses) present. None of the vegetation on the road verges or between Thurralilly Street and Regent Drive would satisfy this standard, although vegetation on adjacent private property at Ridgeway Road junction may do so if surveyed at an optimal time (late spring or early summer).

Threatened flora

No plant species which are listed as threatened under the NSW *Threatened Species Conservation Act 1995* were found on the site. One species listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* was found, the forb Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var. *tricolor*). The timing of the initial survey in winter was poor for detecting the presence of some plants such as orchids, which are only visible above ground for a small proportion of the year. This assessment was supplemented by targeted orchid surveys, completed in October and November, 2008 (documented in *Threatened Flora Searches, Kings Highway, nghenvironmental January 2009* and summarised in Section 2.2 of this report). During the October and November surveys no other threatened species were observed on site.

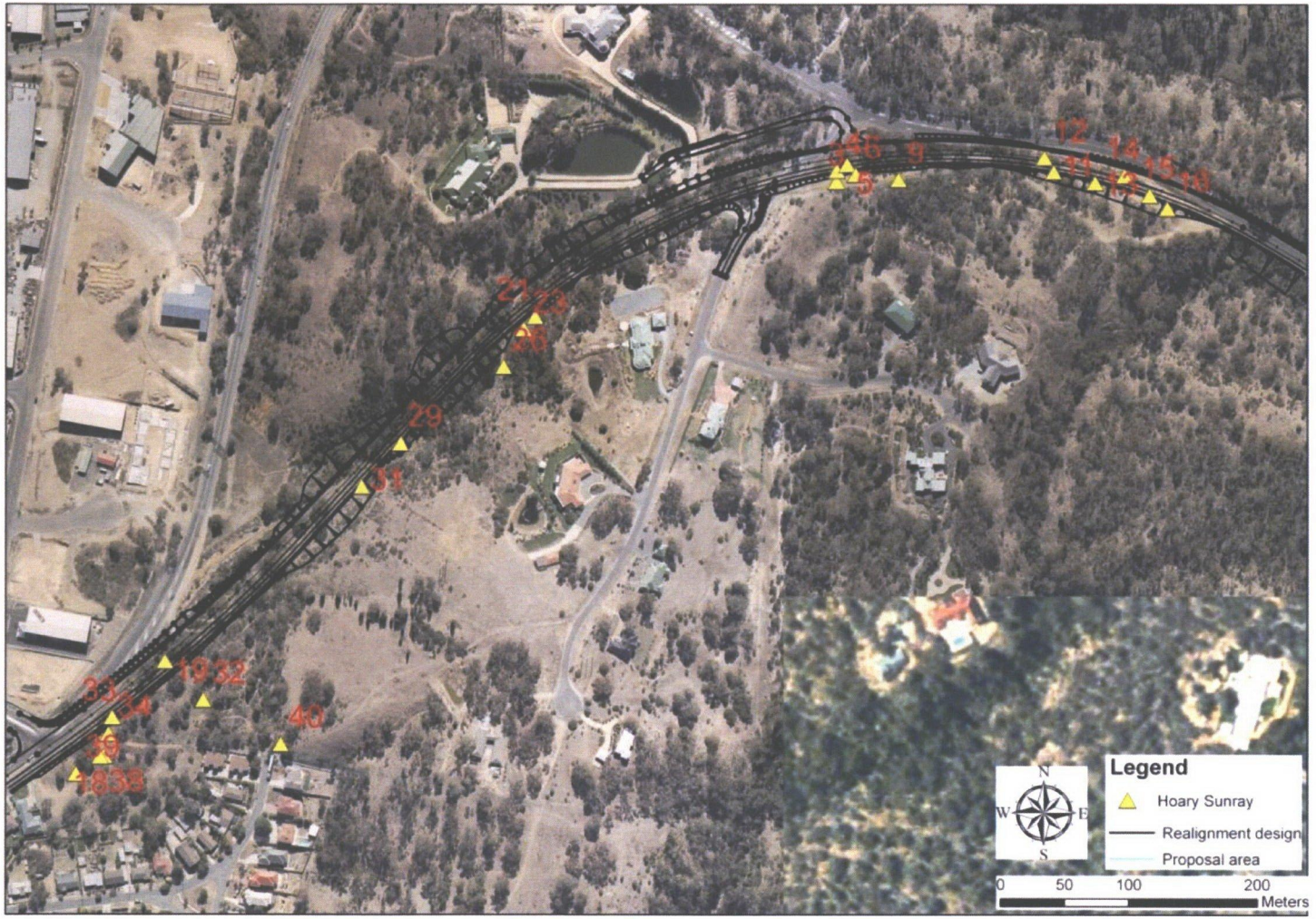

Figure 3-1 General locations of Hoary Sunray known within and adjacent to proposal site

Hoary Sunray *Leucochrysum albicans* ssp *albicans* var. *tricolor*

Hoary Sunray has been listed as Endangered nationally as a consequence of its rarity in Tasmania and Victoria, but it can be locally common on the NSW southern tablelands. It appears to favour sites with poor, stony or gravelly soils, in either grassy woodland or dry sclerophyll forest. The fact that it frequently occurs on roadsides but is less abundant in adjacent paddocks suggests that it is either advantaged by disturbance or does not tolerate grazing pressure. It was found scattered throughout the site, both on ridges and in gullies, wherever the groundcover or shrub layer is sparse. It is common in this general area, occurring not only on this site, but around the Weetalabah Drive junction to the east and along the verges on the first few kilometres of Captains Flat Road. The Cuumbeun Nature Reserve Plan of Management states that it occurs in the reserve, "within the power easements and other areas with sparse groundcover". The species is not listed as threatened under the NSW *TSC Act.*

The distribution of this species onsite is mapped, Figure 3-1.

Targeted searches: *Caladenia tessellata, Diuris aequalis, Lepidium hyssopifolium*

Appropriately timed targeted searches for *Caladenia tessellata, Diuris aequalis,* both listed as endangered under the TSC Act and vulnerable under the EPBC Act, were conducted in spring 2008, as documented in Section 2.2 of this report. These searches covered all parts of the site in which native vegetation is dominant in the groundcover. Aromatic Peppercress (*Lepidium hyssopifolium*) was also targeted in these searches. A few additional plant species were identified following these searches. These are included in the species list for the site (refer to Appendix B).

There were no individual plants of these species observed. It was concluded that the study area provides marginal habitat for the subject species; the dry nature of habitat within the study area indicates that orchids are unlikely to be present.

Other threatened species with potential to occur

A search of the DECC threatened species database for threatened species known or predicted to occur in the Monaro sub-region of the Murrumbidgee CMA was undertaken. This search identified a total of 18 threatened plant species known or predicted to occur in the region. A Search of the DEWHA Matters of National Environmental Significance database revealed an additional two threatened plant species with the potential to occur on the site.

An evaluation of the habitat requirements of these species and of the potential for them to occur onsite and be impacted by the proposed works is provided in Appendix C, Table 11-3. This assessment determined that three threatened species could be affected, if present:

Table 3-1 Threatened flora with potential for impact

Species and Status*	Presence of habitat and nearest records	Likelihood of occurrence	TSC Act AOS required	EPBC Act AOS required
Hoary Sunray *Leucochrysum albicans* subsp. *albicans* var. *tricolor* **E EPBC**	Present Recorded onsite.	Present	No	Yes
Doubletail Buttercup *Diuris aequalis* **E TSC** **V EPBC**	Present The site was surveyed for this species and it was not detected. There are no records for this species.	Possible, though low given results of spring survey	Yes	Yes
Thick-lipped Spider Orchid *Caladenia tessellata* **E TSC** **V EPBC**	Present The site was surveyed for this species and it was not detected. This species has been recorded in the Queanbeyan and Braidwood areas	Possible, though low given results of spring survey	Yes	Yes

V TSC Listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995*
E TSC Listed as Endangered under the NSW *Threatened Species Conservation Act 1995*
V EPBC Listed as Vulnerable under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
E EPBC Listed as Endangered under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*

Assessments of significance, pursuant to the *TSC* and *EPBC Acts*, as relevant, were undertaken for these species, Appendix F, and are discussed under Section 3.2.3.

Disturbance and noxious weeds

The area between the intersections of Thurralilly Road and Regent Drive with the Kings Highway, a length of approximately 800m, has a history of disturbance. A gravel road is located within the proposed road easement, with the old road remaining cleared and adjacent land on either side formerly cleared but regenerated. Further clearing has occurred in association with the construction of residential buildings in the area, household and construction rubbish has been dumped in the small drainage line. In the section of the Kings Highway east of Regent Drive (towards The Ridgeway), approximately 300m of the southern road verge has been disturbed by construction of the current carriageway and the old gravel road parallels the existing road, around the intersection of Regent Drive and the Kings Highway.

There are numerous environmental weeds found in the more disturbed areas close to Queanbeyan, particularly the old road, many of which are escapees from gardens. These would have been distributed primarily by birds, though there is evidence of dumping of garden waste along the old gravel road and in the adjacent drainage line north of it.

Weeds listed as noxious in Queanbeyan LGA which were found on the site are as follows:

- **African lovegrass (**Eragrostis curvula*),** one to a few plants on the highway verges in three locations

- **African boxthorn (**Lycium ferocissimum*),** a single small plant on the edge of the old road at the western end of the site
- **Blackberry (**Rubus fruticosus sp. agg.*),** abundant in the gully floor on the road reserve at the western end of the site, and present on a steep fill better on the southern highway verge west of Ridgeway Road junction
- St John's wort (**Hypericum perforatum*), scattered throughout the site, with some dense patches, often in less visible areas where a road-based spraying program does not penetrate;
- Sweet briar (**Rosa rubiginosa*), scattered sparsely through the site.

The first three species **(in bold)** are listed as noxious in Class 4 in Queanbeyan LGA, meaning there is a requirement that they be controlled in accordance with a local management plan.

St John's wort and sweet briar are listed as Class 3 weeds in Queanbeyan LGA, meaning they must be fully and continuously suppressed and destroyed.

3.1.3 Potential impacts

The proposal would impact on an area of approximately 4ha, outside of the existing road surface. This would include vegetation in the area between Thurralilly Street and Regent Drive and in the existing road verges of Kings Highway and Regent Drive. The vegetation here predominately consists of disturbed eucalypt woodland with some native understorey including native grasses and cleared areas dominated by exotic species. Vegetation found here has been subject to previous disturbance due to past construction activities such as the construction of Kings Highway and other clearing activities most likely related to the residential dwellings in the area and the proximity to the city of Queanbeyan.

The proposal would result in direct impacts, such as clearing of native vegetation. Additionally, there is potential for soil disturbance and soil sedimentation, altered hydrology and weed ingress, all of which may affect native vegetation onsite and adjacent to the works.

Native vegetation clearing

Clearing of native vegetation is listed as a **Key Threatening Process in NSW** (NSW Scientific Committee 2008).

Impacts of clearing include fragmentation, destruction of habitat, riparian zone degradation, loss of leaf litter layer and increased habitat for invasive species. Clearing is defined as *"...the destruction of a sufficient proportion of one or more strata within a stand or stands of native vegetation ..."* (NSW Scientific Committee 2008).

The proposal would result in the removal of approximately 4ha of woodland in various levels of condition. The middle of the route has been identified as more highly constrained (moderate) than the beginning and end (low-moderate) due to its more intact structure (canopy trees retained). Recommendations to minimise impacts centre on limiting the extent of vegetation removal required and controlling offsite impacts.

Soil disturbance and compaction

Sedimentation is a potential indirect impact on the flora located within the proposed work site and also adjacent to the site. During the course of clearing vegetation and construction works, the potential for erosion and turbid runoff is increased; sediment controls would need to be put in place before

construction work begins. With the implementation of appropriate sediment and erosion controls as described in Section 6.1, the risk of this occurring is considered low.

Similarly, soil compaction can have the effect of preventing native vegetation recolonisation. Impact areas should be demarcated to ensure that the minimum areas are affected. Previously disturbed areas should be used preferentially as stock pile and access ways.

Weeds

Any works involving disturbance and relocation of soil have the potential to cause the spread of weeds on the site. Amelioration strategies could include washing down of machinery and vehicles before and after works, controlling isolated infestations prior to commencing works, refraining from re-using soil from infested parts of the site in other areas and monitoring and controlling weeds after completion of the works, for a period of at least two years.

Furthermore, Class 4 weeds (African lovegrass, African boxthorn, Blackberry) are required to be controlled in accordance with a local management plan and Class 3 weeds (St John's wort, Sweet briar) must be fully and continuously suppressed and destroyed.

Threatened species impacts

Field survey and desktop assessment concluded that four threatened species may be affected by the works. Assessments of significance were undertaken to characterise the significance of impacts to these species, pursuant to the *TSC* and *EPBC Act*, as required.

Caladenia tessellata, Diuris aequalis

Potential for impact was identified for the *Caladenia tessellata* and *Diuris aequalis* within the site, although none of these species was identified on site. It is very unlikely that they occur (possibly present as seed or dormant tubers in the case of the two orchids). With the implementation of the measures stated below, these assessments have concluded that the proposed activity is *'unlikely'* to have a *'significant effect'* on these species.

Hoary Sunray, *Leucochrysum albicans* ssp *albicans* var. *tricolor*

The field surveys undertaken onsite established that one species, Hoary Sunray, *Leucochrysum albicans* ssp *albicans* var. *tricolor,* does occur on the site, with at least 400 plants counted.

The Assessment of Significance for this species found that the proposal would reduce the number of individual plants at the site, but the population size of this disturbance tolerant species is unlikely to be affected in the long-term. The works would reduce the area of occupancy of this species, however large patches of this species occur outside the impact area and it is likely that some recolonisation will occur, where individuals are removed. The works are not likely to generate a significant impact and measures are available to further reduce identified impacts.

The location of the patches, the approximate number of individual plants in those patches of Hoary Sunray and whether the patch would be impacted by the proposal is included in Table 6-1. This table corresponds with the patch numbers indicated in the map location of Hoary Sunray represented in Figure 6-1. This map indicates location of the patches which would be outside of the proposal impact zone and which should be fenced to avoid impact and assist with the recovery of this species post-construction work (in bold).

Table 3-2 Impact to Hoary Sunray observed at the proposal site

Patch number	Easting	Northing	Approximate number of plants observed	Impacted by the proposal Y/N
3	705041.7	6086825	3	Y
4	705041.9	6086834	10	Y
5	705050.1	6086838	>20	Y
6	705056.7	6086831	10	Y
9	705090.1	6086827	3	Y
11	705211.4	6086833	6	Y
12	705204.1	6086844	>50	Y
13	705243.7	6086824	15	Y
14	705266.5	6086830	10	Y
15	705286.1	6086814	15	Y
16	705299.8	6086804	10	Y
18	**704469.1**	**6086374**	**15**	**N**
19	704515.8	6086449	20	Y
21	704806.4	6086719	5	Y
23	704797.5	6086709	10	Y
26	704781.9	6086680	3	Y
29	704700.6	6086620	4	Y
31	704670.1	6086586	10	Y
32	**704545.1**	**6086419**	**10**	**N**
33	704475.4	6086405	20	Y
34	704472.6	6086392	>20	Y
38	704466	6086374	>20	Y
39	**704447.6**	**6086361**	**15**	**N**
40	**704606.0**	**6086384**	**>100**	**N**

Refer to Figure 3-1 for the general location of the patch numbers.

Mitigation measures designed to minimise the potential impact on these threatened species have been described below.

EEC impacts

There is no vegetation community within the proposed impact area that would be classified as EEC. Therefore the works would not impact on any EEC. There are areas of vegetation that could be classified as marginal Box Gum Woodland EEC in close proximity to the works, but these areas would not be impacted by the proposal. As they are located on private property and elevated above the level of the highway it is unlikely that they would be subjected to indirect impacts, such as altered runoff or weed invasion.

3.1.4 Safeguards and management measures

- The work site would be clearly delineated to reduce the risk of machinery, vehicle and trampling damage and compaction to flora located outside of the proposed works envelope.
- Washing of machinery onsite would take place in a bunded formal washout area, to avoid the spread of weeds.
- Noxious weeds would be removed and destroyed prior to the commencement of construction works, as far as is practicable.
- Areas where environmental weeds exist would be clearly marked. Soil removed from these areas would not be reused on site unless deeply buried.
- The work site would be inspected to ensure that disturbed areas become stable and weed infestations do not occur. The site would be appropriately rehabilitated and revegetated to provide stability to disturbed areas and to reduce the potential of sediment and erosion damage. A flora plan would be prepared prior to works commencing onsite. This plan would specifically address:
  - Weed management.
  - Treatment of topsoils to maximise their value for revegetation of disturbed sites.
  - Sourcing of local plants for revegetation (prior to any clearing works on site, it may be useful to collect seeds or seedlings of native species present to use in the revegetation of the site).
  - Methods available to maximise opportunities for fauna to recolonise the rehabilitation areas.
  - Disturbed areas would be revegetated with appropriate local native species.
- An appropriate training program would be implemented to make sure all site staff are aware that the endangered species, Hoary Sunray (*Leucochrysum albicans*), is present within the proposed impact areas. Impact to areas where Hoary Sunray is identified would be minimised as much as practicable.
- Areas outside of the impact area containing Hoary Sunray would be fenced off to avoid inadvertent impact (refer to bold entries in Table 3-2).
- Hoary Sunray seed would be collected prior to the works to assist with colonisation post-construction.

3.2 FAUNA

3.2.1 Methods

Desktop and field assessment were undertaken to identify fauna values relevant to the proposal.

Previous reports were sourced (refer to Sections 2.1 and 2.2). A search of the DECC threatened species listed by Catchment Management Authority (CMA) region for species known or predicted to occur in the Monaro sub-region of the Murrumbidgee CMA was undertaken prior to field work. A search of the DEWHA Matters of National Significance database was also undertaken (refer to Appendix E). These searches identified a total of 46 threatened fauna known or predicted to occur in the region.

The fauna habitat within the subject site was inspected on 8 January 2009 by an **ngh**environmental ecologist (Nick Graham-Higgs) and Project Officer (Tim Browne) over 6 hours. An additional visit was undertaken to derive a bird list on 21 January 2009, by a senior ecologist (Steven Sass). The area surveyed included the final realignment route, between the intersection of Thurralilly Street and the existing Kings Highway to the intersection of Regent Drive and Kings Highway. A short section of Kings Highway between Regent Drive and The Ridgeway was also surveyed. Comprehensive surveying was employed, including; bird, reptile and frog census, Anabat recording, spotlighting, call playback, stag watching and habitat assessment. Greater focus was given to areas considered most likely to provide habitat for threatened fauna. For example, two hollow bearing trees (HBTs) were identified within the proposal site and were the subject of targeted nocturnal surveys (see Figure 6-2 for location of surveys).

Survey techniques and effort

- Habitat assessments were undertaken over the entire proposal site. Habitat assessment considered vegetation composition and structure, disturbances and provision of habitat and resources for threatened species.
- Bird censuses were undertaken over the entire proposal site on 21 January 2009 (entire route, 1 person-hour).
- Reptile searches (rock rolling) were undertaken in suitable habitat (rocky outcrops) on the ridge predominately in the north eastern portion of the proposal, east of Regent Drive although, searches were also conducted opportunistically on lower slopes and valleys wherever suitable habitat was present (entire route, 2 person-hours).
- Frog censuses were undertaken in representative examples of riparian areas and drainage lines to identify the diversity of frog species (by call identification).
- Nocturnal surveys included call playback for the threatened Powerful Owl and Barking Owl (2 locations, 0.25 hours per species) as well as for the Green and Gold Bell frog (1 location, 0.25 hours) followed by foot-based spotlighting survey (entire route, 3 person-hours). Stag watching was undertaken (1 location, 2 person-hours) as well as Anabat recording (1 location, overnight).
- Searches for scats and for signs of animal presence were conducted opportunistically while conducting other surveys. All opportunistic records of fauna were recorded throughout the survey period.

A species list from the fauna surveys are presented in Appendix C.

Figure 3-2: Location of fauna surveys within the study area

Threatened and significant species

The aim of the field survey was to evaluate the potential of the proposal to impact native fauna and their habitat, with a focus on threatened and significant species.

Threatened and migratory fauna listed under the *TSC Act* and the *EPBC Act* as known or predicted to occur from the region were targeted. Following the field surveys, the likelihood of threatened species using habitat within the proposal site was undertaken. This assessment, presented in Appendix E, identified threatened species with potential to occur onsite and also be impacted by the proposal. These latter species were then subject to Assessments of Significance, pursuant to the *TSC Act* and the *EPBC Act,* as required (see Appendix D).

3.2.2 Existing environment

Habitat types

Four habitat types were described within the proposal site: rocky outcrops, disturbed areas, woodland and riparian areas.

Rocky outcrops and disturbance areas

Rocky outcrops have the potential to be habitat for a number of threatened species, including Little Whip Snake, Pink-Tailed Legless Lizard, and Striped Legless Lizard.

A number of rocky outcrops and disturbed areas occur within the final realignment route (see Figure 3-3 and Figure 3-4). These include the north-eastern portion of the proposal site, east of Regent Drive and adjacent to the track running generally north – south. Rock characteristics include loose rocks up to 100 mm in diameter on the edges of the track with cutting walls intermittently dispersed along the up gradient edge of the track. These areas are likely to be a result of historical construction activities associated with road work. Additionally, there was evidence of dumping of domestic waste with materials such as house bricks and tiles observed. The quality of habitat was considered to be low.

Figure 3-3 Example of rocky disturbance zone

Figure 3-4 Example of rocky outcrop

Woodland

Woodland habitat is located predominantly in the middle of the proposal site. The woodland habitat can be described as cleared or partially cleared woodland. The general vegetation composition can be

described as low woodland with a predominately shrubby understorey rather than a grassy understorey. It is considered potential habitat for a number of threatened fauna identified during the desktop assessment. Two hollow bearing trees were noted within the woodland of the proposal site, as presented in Figure 3-5. These provided hollows, from small (suitable for microbats) to large (suitable for arboreal mammals and forest owls). Call play back and spotlighting targeted these trees.

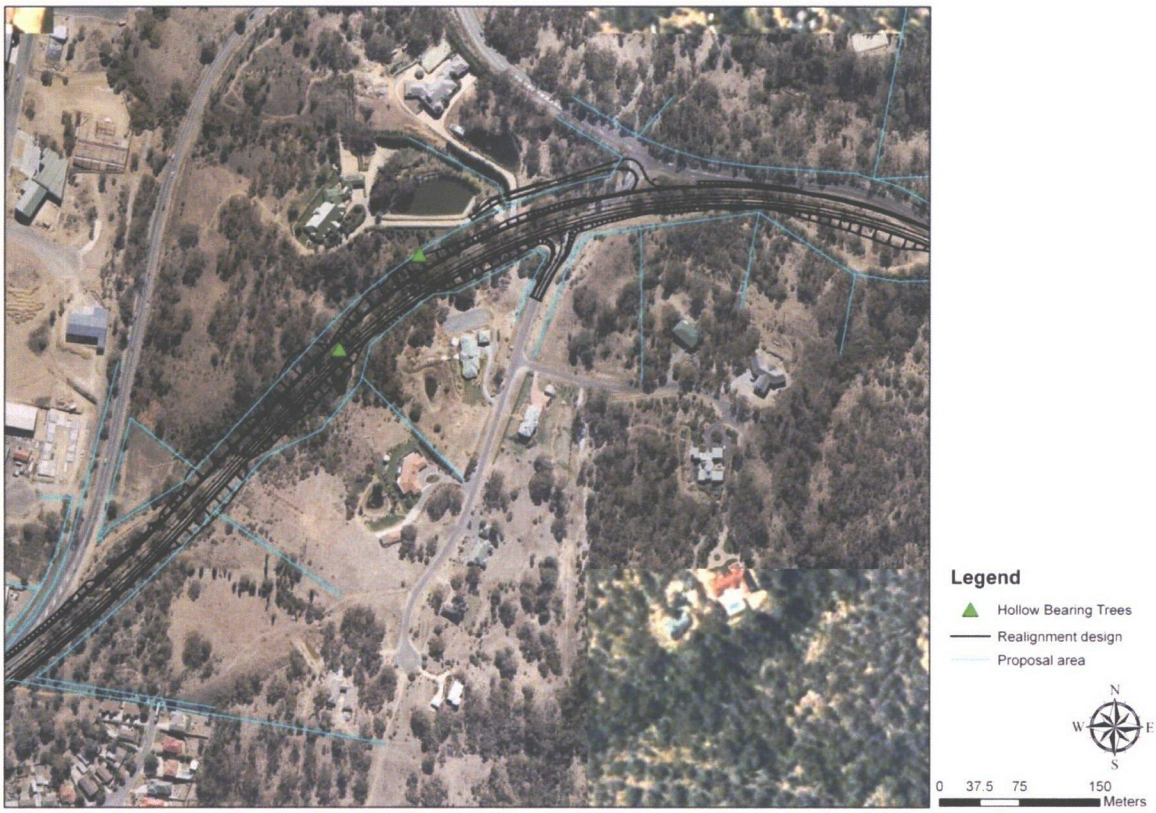

Figure 3-5: Location of Hollow bearing trees

Riparian habitat

There is a natural drainage feature located within the proposal site. It is a first order creek. This drainage line runs in a general north east–south west direction, flowing into the stormwater drain opposite Thurralilly Street. At the time of the field assessment the majority of this drainage line was dry.

There were small ponds of water observed at certain sections of this drainage line. Call play back for the Green and Golden Bell frog was undertaken in the vicinity of these ponds.

Survey results

Nocturnal surveys

No species responded to call playback (targeting the two hollow-bearing trees as well as drainage lines).

Four Common Brush-tailed Possums (*Trichosurus vulpecula)* and one Tawny Frog-mouth (*Podargus strigoides)* were observed in hollows during stag watching, none of which are listed as threatened species.

Sugar glider (*Petaurus breviceps)* was identified onsite by two tails (provided by a neighbour to the site and identified by Barbara Triggs).

Anabat recording yielded 110 microbat calls, able to be identified to species level for seven species. This included two threatened species (**bold entries** Table 3-3, below).

Table 3-3: Results of Anabat survey

Scientific name	Common name	Number of calls	Status
Falsistrellus tasmaniensis	**Eastern False Pipistrelle**	**1**	**V TSC**
Miniopterus schreibersii oceanensis	**Eastern Bentwing-bat**	**3**	**V TSC**
Chalinolobus gouldii	Gould's Wattled Bat	66	Not listed
Tadarida australis	White-striped Freetail Bat	13	Not listed
Vespadelus regulus	Southern Forest Bat	10	Not listed
Mormopterus species		2	Not listed
Vespadelus darlingtoni	Large Forest Bat	2	Not listed
Vespadelus vulturnus	Little Forest Bat	1	Not listed
Nyctophilus sp		1	Not listed

V TSC Listed as Vulnerable under the *Threatened Species Conservation Act 1995*

Diurnal surveys

Thirty-two bird species were observed onsite. No species listed as threatened were observed within the proposal site. A full list of all birds observed on site is presented in Appendix B.

One reptile species were observed onsite. No species listed as threatened were observed within the proposal site.

No frog species were observed onsite. No species listed as threatened were observed within the proposal site

Threatened and significant fauna species

The Cuumbeun Nature Reserve is located approximately 2.3 kilometres to the south east of the proposal site. Several threatened species have been identified in the Cuumbeun Nature Reserve Plan of Management (2006), as occurring within or in close proximity to the reserve. These species include the Koala (*Phascolartus cinereus*), Hooded Robin (*Melanodryas cucullata)*, Speckled Warbler (*Pyrrholaemus saggitata*), Diamond Firetail (*Stagonopleura guttata*) and Rosenberg's Goanna (*Varanus rosenberg*).

Two threatened fauna species both listed as vulnerable under the TSC Act were observed during the field surveys. Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), and Eastern Bentwing Bat (*Miniopterus*

schreibersii oceanensis), were recorded during the echolocation survey. Potential impacts are discussed below in Section 3.2.3.

A search of the NSW DECC threatened species database for the Monaro sub catchment of the Murrumbidgee Catchment Management Authority (CMA) area, identified four species of frog, 26 birds, two species of fish, one insect, 8 mammals and 4 reptiles known or predicted to occur within the sub catchment area.

An evaluation of their potential to occur and be impacted by the proposal identified ten threatened species to be at risk:

Speckled Warbler (*Chthonicola sagittata*)	**V TSC**
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	**V TSC**
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	**V, TSC**
Diamond Firetail (*Stagonopleura guttata*)	**V TSC**
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	**V TSC**
Regent Honeyeater (*Xanthomyza phrygia*)	**E TSC, E EPBC**
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	**V TSC**
Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	**V TSC**
Rosenbergs Goanna (*Varanus rosenberg)*	**V TSC**
Little Whip Snake (*Suta flagellum*)	**V TSC**

V TSC Listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995*
E TSC Listed as Endangered under the NSW *Threatened Species Conservation Act 1995*
V EPBC Listed as Vulnerable under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
E EPBC Listed as Endangered under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999*

These were then subject to Assessments of Significance pursuant to *TSC* and *EPBC Acts*, as required.

3.2.3 Potential impacts

The proposal would impact on an area of approximately 4ha, outside of the existing road surface. This would areas of woodland vegetation disturbed areas, including road verge. Rocky outcroppings and drainage lines would also be affected. The proposal would constitute a direct loss of habitat for fauna and may also affect a larger area, through indirect impacts.

Direct impacts

The primary impact on fauna species would be related to habitat loss through vegetation removal and also the removal of refuge, such as tree hollows, fallen branches and rocks, which represent potential habitat for many species.

Woodland (including loss of hollows)

The proposal would result in the removal of 4 ha of woodland habitat. Two hollow bearing trees were identified within the woodland located adjacent to the north south trending drainage line. The loss of

hollow-bearing trees is also listed as a Key Threatening Process (refer to Sections 3.2.3). Both hollow bearing trees were observed to be used by Brush-tailed Possums during the nocturnal surveying work. Brush tailed possums are not listed as threatened under the TSC Act or the EPBC Act. This species is a highly mobile and considered common. It can however, compete with other hollow-dependant species, such as the threatened Gang-Gang Cockatoo, preventing the use of hollows by these less aggressive and abundant arboreal species. Hence removal of these hollows may increase competition in the local are for hollows. Microbats use smaller hollows and, if used as a communal roost, impacts to local populations may occur.

Considering the proximity of these hollows to other areas of similar habitat to the east, as well as the area reserved in the Cuumbeun Nature Reserve, the loss of these two hollow-bearing trees is unlikely to result in a significant impact to any threatened species, if felled in accordance with the nghenvironmental Tree Policy. This specifies protocols to ensure any trapped fauna are recovered and relocated.

No species of threatened birds were seen or heard during the bird survey and it is considered unlikely that the removal of woodland from within the proposal site would significantly impact highly mobile species of threatened birds known or predicted to occur within the Monaro sub-catchment. Woodland habitat of similar or likely better quality is considered to be well represented in general locality of the proposal site.

Rocky outcrops

It is considered that the disturbed character of the proposal site is likely to provide marginal habitat for rocky outcrop dependant species. Construction works associated with the proposal have the potential to create artificial rocky habitat structures in strategic locations. Impacts to rocky outcrops are not considered likely to be significant to any threatened fauna and not specific mitigation regarding habitat creation has been suggested.

Riparian habitat

The route is located adjacent to a natural drainage feature. This is a first order creek. Habitat within this riparian habitat is disturbed and did not appear to be of high quality. Threatened fauna with potential to utilise onsite resources such as this area were evaluated in Appendix E of this report. This included the Green and Golden Bell Frog, Southern Bell Frog Yellow-spotted Tree Frog, and Alpine Tree Frog. While the former two have been recorded locally (within several kilometres of the site), the habitat is marginal with respect to these species. It is unlikely that the site provides important riparian habitat and very unlikely that any threatened species would be impacted by its removal.

Indirect impacts

Habitat outside the immediate impact area can be degraded as a result of indirect impacts associated with the proposal, such as:

1. Weed invasion (discussed in Section 3.1.3).
2. Noise and vibration may temporarily affect the local presence and behaviour of fauna species, including during nesting periods (for example, birds utilising nearby hollow-bearing trees). Once developed, fauna utilising habitat adjacent to the site are likely to acclimatise to this change. This is considered to be a low impact.
3. Soil disturbance and compaction (discussed in Section 3.1.3).

Threatened species impacts

The proposed works would remove habitat for two species of threatened bats, identified during the Anabat survey; Eastern Bentwing-bat and Eastern False Pipistrelle. Both are likely to forage onsite (4 ha). The Eastern False Pipistrelle may also ultilise hollows within the works area (two trees bearing hollows would be removed), although no bats were observed emerging from the stag during the assessment.

Assessments of significance, presented in Appendix D, were undertaken to characterise the significance of impacts to threatened species likely to be affected by the works. These included the Speckled Warbler, Brown Treecreeper (eastern subspecies), Hooded Robin (south-eastern form), Diamond Firetail, Gang-gang Cockatoo, Regent Honeyeater, Superb Parrot, Eastern Bentwing Bat, Eastern False Pipistrelle, Rosenberg's Goanna and Little Whip Snake.

The assessment concluded that:

> *Vegetation to be affected has been subject to previous disturbance due to past construction activities such as the construction of Kings Highway and other clearing activities most likely related to the residential dwellings in the area and the proximity to the city of Queanbeyan .... The proposal would also require the removal of two hollow bearing trees. ... Due to the proximity of large areas of good quality habitat adjacent to the impact area, such as the Cuumbeun Nature Reserve and the high mobility of the species which would utilise this habitat feature, their removal was not considered likely to constitute a significant impact. The recommendation of this REF is that an RTA Environmental Officer or appropriately licensed wildlife carer be present during the removal of these trees.*

Mitigation measures designed to minimise the potential impact on these threatened species have been described in Section 3.2.4. With the implementation of these measures, these assessments have concluded that the proposed activity is *'unlikely'* to have a *'significant effect'* on the assessed threatened species.

Key Threatening Processes

Four Key Threatening Processes (DECC 2009) are relevant to this proposal:

Bush Rock Removal

Includes removal of rocky outcrops or rock within areas of native vegetation. Impacts of bush rock removal include loss or disturbance of native flora and fauna species habitat, including those described. Rocky outcrops occur within the proposal site. Disturbed rocks would be relocated to adjacent areas where possible to ensure suitable micro-habitat resources are maintained.

Clearing of native vegetation

Considered in Section 3.1.3.

Loss of hollow-bearing trees

Around 174 NSW vertebrate species are known to use tree hollows for shelter and nesting, including those discussed. Generally hollow-nearing trees are in decline due to reasons including lack of recruitment and clearing. In particular, trees bearing large hollows are rare, and required by species discussed including Eastern False Pipistrelle. Generally hollow-bearing trees near riparian habitat are most valuable.

There are two hollow bearing trees that would require removal as part of the proposal. It is considered that the removal of these hollow bearing trees may exacerbate this key threatening process, however their removal would be unlikely to significantly impact on threatened species.

Removal of dead wood and dead trees

Removal of standing or fallen dead wood removes hollows as well as understorey litter. A small number of dead stags were evident within the proposal site. The proposed works may exacerbate this process during clearing, however their removal would be unlikely to significantly impact on threatened species.

3.2.4 Safeguards and management measures

- When removing the two hollow bearing trees (adjacent to the north south trending drainage line, the RTA environmental officer or an appropriately licensed wildlife carer would be onsite to monitor and implement the following controls.
    - Check for animals in the zone of disturbance before clearing and scare them away or remove them before beginning operations where possible. Re-check after clearing to ensure no animals have become trapped or injured during clearing operations.
    - Fell trees into the zone of disturbance to avoid damaging adjacent vegetation and do not push felled vegetation into areas to be retained.
- Take care not to damage vegetation (e.g. tree limbs and bark) when moving equipment near native vegetation to be retained.
- Mulch rather than burn cleared native vegetation. Where possible, consider distributing some logs from the felled trees into areas of vegetation to be retained where it would not be considered a fire hazard. This would provide additional habitat for ground dwelling fauna such as reptiles and small mammals.
- Any rocks and dead branches on the ground that need to be removed would, where practical, be redistributed in an adjacent area of the road reserve to preserve existing ground refuge.
- Bat boxes would be installed at strategic locations in the vicinity of the southern-most hollow-bearing tree to facilitate the relocation of bat species which may use this resource. The number of boxes should be equal in number to the hollows removed as a consequence of the works.
- Removal only of vegetation that is critical to the completion of the project.

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APPENDICES

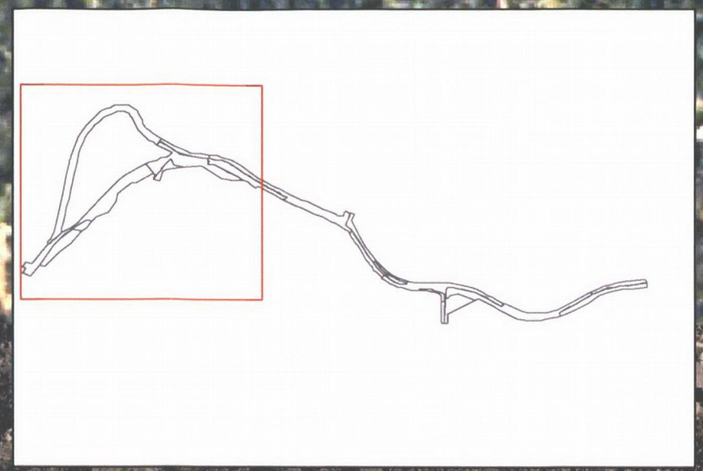
APPENDIX A: BIODIVERSITY CONSTRAINTS MAPPING

In September 2008, **ngh**environmental prepared a Preliminary Constraints Analysis for the RTA, targeting approximately 4.5 kilometre section of the Kings Highway east of Queanbeyan. The following maps were produced as part of the analysis, and illustrate the flora and fauna constraints for the area that would be affected by the final realignment route.

Flora Constraints 1 of 3

704400 704600 704800 705000 705200 705400

6087100 6087000 6086900 6086800 6086700 6086600 6086500 6086400



Legend

- Potential Orchid Habitat
- Flora Constraints
- Low
- Low-moderate
- Moderate
- High

N

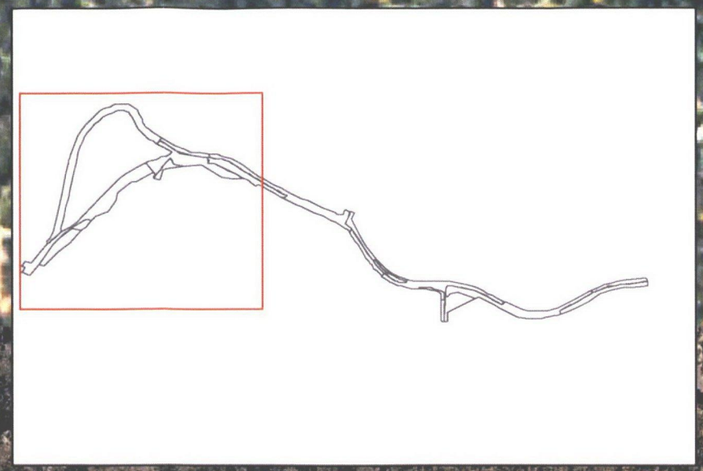
150 75 0 150 Meters

704400 704600 704800 705000 705200 705400

Fauna Constraints 1 of 3

704400 704600 704800 705000 705200 705400

6087100 6087000 6086900 6086800



Legend

- Potential feed tree
- Hollow Bearing Tree

Fauna Constraints

- Low
- Low-moderate
- Moderate
- High

N

150 75 0 150 Meters

704400 704600 704800 705000 705200 705400

APPENDIX B: FLORA SPECIES LIST

This table includes the flora species that were recorded at the site of the proposal during field surveys.

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

1 1 to a few individuals present, less than 5% cover

2 many individuals present, but still less than 5% cover

3 5 - < 20% cover

4 20 - < 50% cover

5 50 - < 75% cover

6 75 - 100% cover

Cover/abundance scores relate to general abundance over the entire site, not to representative quadrats.

*Introduced species are preceded by an asterisk.

Scientific name	Common name	Family	Abundance
TREES			
**Acacia baileyana*	Cootamundra wattle	Fabaceae	0-2
Acacia dealbata	silver wattle	Fabaceae	1
Acacia mearnsii	black wattle	Fabaceae	0-2
**Chamaecytisus palmensis*	tagasaste	Fabaceae	0-2
**Crataegus monogyna*	hawthorn	Malaceae	1
**Cupressus* spp	cypress	Cupressaceae	1
Eucalyptus bridgesiana	apple box	Myrtaceae	0-4
Eucalyptus macrorhyncha	red stringybark	Myrtaceae	0-2
Eucalyptus mannifera	brittle gum	Myrtaceae	1
Eucalyptus melliodora	yellow box	Myrtaceae	1
Eucalyptus nortonii	mealy bundy	Myrtaceae	0-3
Eucalyptus polyanthemos ssp *polyanthemos*	red box	Myrtaceae	0-4
Eucalyptus rossii	scribbly gum	Myrtaceae	1
Exocarpus cupressiformis	native cherry	Santalaceae	1
**Malus x domestica*	apple	Malaceae	1
**Pinus* spp.	pine	Pinaceae	1
**Populus nigra* cv. *Italica*	Lombardy poplar	Salicaceae	1
Shrubs, sub-shrubs			
**Acacia boormanii*	Snowy River wattle	Fabaceae	1
**Acacia cultriformis*	knife-leaved wattle	Fabaceae	1
Acacia dawsonii	poverty wattle	Fabaceae	0-3
Acacia genistifolia	early wattle	Fabaceae	0-4
Acacia rubida	red-stem wattle	Fabaceae	0-4
Acacia siculiformis	dagger wattle	Fabaceae	1
Astroloma humifusum	cranberry heath	Epacridaceae	1
Amyema pendulum	a mistletoe	Loranthaceae	0-2
Bossiaea buxifolia		Fabaceae	0-3
Brachyloma daphnoides	daphne heath	Epacridaceae	1
Bursaria spinosa ssp *lasiophylla*	blackthorn	Pittosporaceae	0-2

Scientific name	Common name	Family	Abundance
Cassinia arcuata	sifton bush	Asteraceae	1
Cassinia longifolia	dogwood	Asteraceae	1
Cassinia quinquefaria	dogwood	Asteraceae	0-4
**Cotoneaster glaucophyllus*	cotoneaster	Malaceae	1
Cryptandra amara var. *floribunda*		Rhamnaceae	0-2
Daviesia genistifolia	broom bitter pea	Fabaceae	0-3
Daviesia mimosoides ssp *mimosoides*		Fabaceae	0-3
Dillwynia ?sericea		Fabaceae	1
Dillwynia sieberi		Fabaceae	0-3
Dodonaea viscosa ssp *angustissima*	hop bush	Sapindaceae	1
**Genista monspessulana*	Cape broom	Fabaceae	0-2
**Grevillea rosmarinifolia*		Proteaceae	1
Hibbertia obtusifolia	guinea flower	Dilleniaceae	1
Hovea heterophylla		Fabaceae	1
Indigofera australis	austral indigo	Fabaceae	1
Leucopogon ericoides		Epacridaceae	0-2
**Ligustrum lucidum*	large-leaved privet	Oleaceae	1
**Ligustrum sinense*	small-leaved privet	Oleaceae	0-3
Lissanthe strigosa	peach heath	Epacridaceae	1
**Lycium ferocissimum*	African boxthorn	Solanaceae	1
Melichrus urceolatus	urn heath	Epacridaceae	1
Persoonia chamaepeuce		Proteaceae	1
Pultenaea microphylla		Fabaceae	0-4
Pultenaea procumbens		Fabaceae	0-2
**Pyracantha angustifolia*	firethorn	Malaceae	1
**Pyracantha fortuneana*	firethorn	Malaceae	1
**Rosa rubiginosa*	briar rose	Rosaceae	1
**Rubus fruticosus* sp. agg.	blackberry	Rosaceae	0-4
Ferns			
Cheilanthes sieberi ssp *sieberi*	rock or mulga fern	Sinopteridaceae	0-2
Vines And Twiners			
**Anredera cordifolia*	Madeira vine	Basellaceae	1
Glycine clandestina	twining glycine	Fabaceae	Pr, 1
Hardenbergia violacea	native sarsaparilla	Fabaceae	0-4
**Hedera helix*	English ivy	Araliaceae	1
Forbs			
Acaena sp.		Rosaceae	1
**Acetosella vulgaris*	sheep sorrel	Polygonaceae	0-3
Ajuga australis	austral bugle	Lamiaceae	1
Brachyscome heterodonta		Asteraceae	Pr, 1
Bulbine bulbosa	bulbine lily	Asphodelaceae	1
**Centaurea calcitrapa*	star thistle	Asteraceae	1
Chrysocephalum apiculatum	yellow buttons	Asteraceae	0-2
Chrysocephalum semipapposum	clustered everlasting	Asteraceae	1
**Cirsium vulgare*	black or spear thistle	Asteraceae	0-3
**Conyza bonariensis*	fleabane	Asteraceae	1
Daucus glochidiatus		Apiaceae	1
Desmodium varians	slender tick trefoil	Fabaceae	Pr, 1
Dianella revoluta	blue flax lily	Phormiaceae	0-3

Scientific name	Common name	Family	Abundance
Diuris semilunulata	early leopard orchid	Orchidaceae	1
**Erodium cicutarium*	common storksbill	Geraniaceae	0-2
Galium gaudichaudii		Rubiaceae	1
Geranium solanderi var. *solanderi*	native geranium	Geraniaceae	1
Gonocarpus tetragynus	raspwort	Haloragaceae	1
Goodenia hederacea ssp *hederacea*		Goodeniaceae	1
**Hirschfeldia incana*	Buchan weed	Brassicaceae	1
Hydrocotyle laxiflora	stinking pennywort	Apiaceae	1
Hypericum gramineum	native St Johns wort	Clusiaceae	1
**Hypericum perforatum*	St John's wort	Clusiaceae	0-4
**Hypochaeris radicata*	cat's ear, flatweed	Asteraceae	0-2
Leptorhynchos squamatus	scaly buttons	Asteraceae	Pr, 1
Leucochrysum albicans ssp *albicans* var *tricolor*	hoary sunray	Asteraceae	0-3
**Modiola caroliniana*	orange flowered mallow	Malvaceae	0-3
Opercularia aspera	stinkweed	Rubiaceae	1
Oxalis perennans	native oxalis	Oxalidaceae	Pr, 2
Pimelea curviflora var. *sericea*		Thymeleaceae	Pr, 2
**Plantago lanceolata*	ribbed plantain	Plantaginaceae	1-3
Plantago varia		Plantaginaceae	1
Ranunculus lappaceus	common buttercup	Ranunculaceae	1
Rumex brownii	native dock	Polygonaceae	1
**Rumex conglomeratus*	clustered dock	Polygonaceae	1
**Sanguisorba minor* ssp *muricata*	sheep's burnet	Rosaceae	0-2
Scleranthus fasciculatus		Caryophyllaceae	1
Senecio quadridentatus	cotton fireweed	Asteraceae	Pr, 1
Senecio tenuiflorus		Asteraceae	1
Solenogyne gunnii		Asteraceae	1
**Sonchus asper*	prickly sow thistle	Asteraceae	1
Stackhousia monogyna	creamy candles	Stackhousiaceae	1
**Tragopogon* sp.		Asteraceae	1
Tricoryne elatior	yellow rush lily	Anthericaceae	Pr, 1
**Trifolium ?angustifolium*	narrow-leaf clover	Fabaceae	1
**Trifolium arvense*	hare's foot clover	Fabaceae	1
**Trifolium repens*	white clover	Fabaceae	1
Velleia paradoxa		Goodeniaceae	Pr, 1
**Verbascum thapsus*	giant mullein	Scrophulariaceae	0-2
**Verbascum virgatum*	twiggy mullein	Scrophulariaceae	1
Veronica plebeia	common speedwell	Scrophulariaceae	1
Vittadinia muelleri	fuzzweed	Asteraceae	0-2
Wahlenbergia communis	tufted bluebell	Campanulaceae	Pr, 2
Wahlenbergia luteola		Campanulaceae	1
Wurmbea dioica	early Nancy	Colchicaceae	1
Xerochrysum viscosum		Asteraceae	0-2
Grasses			
Aristida ?ramosa	wiregrass	Poaceae	1
Austrodanthonia spp.	wallaby grass	Poaceae	2-4
Austrostipa ?densiflora		Poaceae	1
Austrostipa scabra		Poaceae	0-4
**Avena* sp.	wild oats	Poaceae	1

Scientific name	Common name	Family	Abundance
Bothriochloa macra	red grass	Poaceae	1
**Briza maxima*	quaking grass	Poaceae	1
Cymbopogon refractus	barbed wire grass	Poaceae	1
**Dactylis glomerata*	cocksfoot	Poaceae	0-5
Dichelachne micrantha	common plume grass	Poaceae	1
Elymus scaber	common wheat grass	Poaceae	Pr, 1
**Eragrostis ?cilianensis*		Poaceae	0-3
**Eragrostis curvula*	African lovegrass	Poaceae	1
Joycea pallida	robust wallaby grass	Poaceae	0-3
Panicum effusum	hairy panic	Poaceae	1
?**Panicum* sp.		Poaceae	0-4
**Phalaris aquatica*	phalaris	Poaceae	0-4
Poa sieberiana var. *sieberiana*		Poaceae	1
**Setaria gracilis*	pigeon grass	Poaceae	0-3
Themeda australis	kangaroo grass	Poaceae	0-5
Graminoids			
Carex appressa	tall sedge	Cyperaceae	1
Carex ?breviculmis		Cyperaceae	1
**Cyperus eragrostis*		Cyperaceae	1
Juncus ?filicaulis		Juncaceae	1
Juncus sp.		Juncaceae	1
Lepidosperma gunnii		Cyperaceae	1
Lomandra filiformis ssp *coriacea*		Lomandraceae	0-3
Lomandra filiformis ssp *filiformis*		Lomandraceae	1
Lomandra longifolia	spiny matrush	Lomandraceae	1
Lomandra multiflora ssp *multiflora*		Lomandraceae	1

APPENDIX C: FAUNA SPECIES LIST

Common name	Scientific name	Method of observation
Mammalia		
Sugar Glider	*Petaurus breviceps*	Feeding marks on tree
Eastern Grey Kangaroo	*Macropus giganteus*	Scat
Red-necked Wallaby	*Macropus rufogriseus*	Scat
Feral cat	**Felis catus*	Sighted
European Rabbit	**Oryctolagus cuniculus*	Scat

Common name	Scientific name
Birds	
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Brown Thornbill	*Acanthiza pusilla*
Common Blackbird	**Turdus merula*
Common Starling	*Sturnus vulgaris*
Crimson Rosella	*Platycercus elegans*
Dollarbird	*Eurystomus orientalis*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Galah	*Cacatua roseicapilla*
Grey Fantail	*Rhipidura fuliginosa*
House Sparrow	*Passer domesticus*
Indian myna	*Acridotheres Tristis*
Laughing Kookaburra	*Dacelo novaeguineae*
Magpie-lark	*Grallina cyanoleuca*
Nankeen Kestrel	*Falco cenchroides*
New Holland Honeyeater	*Phylidonyris novaehollandiae*

Common name	Scientific name
Noisy Friarbird	*Philemon corniculatus*
Noisy Miner	*Manorina melanocephala*
Red Wattlebird	*Anthochaera carunculata*
Red-browed Finch	*Neochmia temporalis*
Sacred Kingfisher	*Todiramphus sanctus*
Silvereye	*Zosterops lateralis*
Sulphur-crested Cockatoo	*Cacatua galerita*
Striated Pardalote	*Pardalotus striatus*
Superb Fairy-wren	*Malurus cyaneus*
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*
Weebill	*Smicrornis brevirostris*
White-eared Honeyeater	*Lichenostomus leucotis*
White-plumed Honeyeater	*Lichenostomus penicillatus*
White-throated Treecreeper	*Cormobates leucophaeus*
White-winged Chough	*Corcorax melanorhamphos*
Reptiles	
Garden Sun skink	*Lampropholis guichenoti*

APPENDIX D: THREATENED FLORA EVALUATIONS

Threatened flora evaluation

The table below evaluates the likelihood of impact on threatened flora and Endangered Ecological Communities (EEC) recorded from EPBC database of Matters of National Significance, which fall within a 10km buffer of the site. Threatened flora and EEC from the DECC database for the Monaro sub-catchment of the Murrumbidgee Catchment Management Authority (CMA), known or with the potential to occur at the proposed work site is also included in this evaluation. Recorded sightings of threatened species and EEC were determined through the NPWS Wildlife Atlas database, within the 1:100 000 Canberra (8727) map sheets. For each species, the table assesses whether habitat is present, if there are any recorded sightings near the proposed project area, and based on this, the likelihood of the species or EEC occurring at the site and being adversely affected by the proposal. The categories are defined below.

Presence of habitat:

Present:	Potential or known habitat is present within the study area
Absent:	No potential or known habitat is present within the study area

Likelihood of occurrence

None:	Species has a very low, or no probability of occurrence
Unlikely	Species known or predicted within the locality but unlikely to occur in the study area.
Possible:	Species could occur in the study area
Present:	Species was recorded during the field investigations, or those of PMA Consulting (2005) and nghenvironmental (2007)

Possible to be impacted

No:	The proposal would not impact this species or its habitats. No Assessment of Significance (AoS) is necessary for this species
Yes:	The proposal could impact this species or its habitats. An AOS has been applied to these entities.

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Trees						
Small-leaved Gum *Eucalyptus parvula* **V TSC** **V EPBC**	Grows on the margins of wet grassy flats along the upper parts of catchments on the top of the coastal escarpment, with one outlying record from the Tinderry Range.	Absent There are no records for this species	None	No	No	No
Silver-leafed Gum *Eucalyptus pulverulenta* **V TSC** **V EPBC**	Grows in shallow, poor soils as an understorey plant in open forest, typically dominated by Brittle Gum (*Eucalyptus mannifera*), Red Stringybark (*E. macrorhyncha*), Broad-leafed Peppermint (*E. dives*), Silvertop Ash (*E. sieberi*) or Apple Box (*E. bridgesiana*) (DECC 2009). Populations are known from the Bathurst to Lithgow area, Bredbo and Bombala areas.	Present There are no records for this species	None. Conspicuous species, not seen.	No	No	No
Shrubs						
Creeping Hop-bush *Dodonaea procumbens* **V TSC** **V EPBC**	This species is conspicuous and grows in woodland or secondary grassland, principally in the Monaro region of the Southern Tablelands, with one record from the Lake Bathurst area east of Goulburn. Usually found on bare ground and in areas with outcropping Ordovician metasiltstone (J. Miles, pers. obs.).	Present There are no records for this species.	None. Conspicuous species, not seen.	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Michelago Parrot-pea *Dillwynia glaucula* **E TSC**	Occurs on exposed patches of clay or on rocky outcrops in eucalypt woodland often dominated by Scribbly Gum (*Eucalyptus rossii*), Snow Gum (*E. pauciflora*), Broad-leafed Peppermint (*E. dives*) and Red Stringybark (*E. macrorhyncha*) The understorey may be either grassy or shrubby. Grows adjacent to Natural Temperate Grassland in the Michelago area (DECC 2009). Three locations are known, Windellama south-east of Goulburn, Michelago south of Canberra and Numeralla, north-east of Cooma.	Absent There are no records for this species.	None	No	No	No
Trailing Monotoca *Monotoca rotundifolia* **E TSC**	This species grows in shrub land and mallee heath at Big Badja Hill and Wadbilliga Trig on the western edge of the coastal escarpment above 1250m elevation, and on the Nunniong Plateau in Victoria (DECC 2009).	Absent There are no records for this species.	None.	No	No	No
Pale Pomaderris *Pomaderris pallida* **V TSC** **V EPBC**	This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or *Callitris* spp. woodland, in association with watercourses and rocky ground (DECC 2009), scattered in the ranges south from Canberra.	Present This species has been recorded approximately 5km south of the site, near the Queanbeyan River	Unlikely	No	No	No
Dwarf Kerrawang *Rulingia prostrata* **E TSC** **E EPBC**	Grows in a range of woodland and forest types in a few scattered sites on the Southern Tablelands, Southern Highlands and North Coast and in Victoria. It appears to colonise bare ground, such as roadside cuttings (for example, on the Braidwood to Nerriga Road)	Present There are no records for this species.	None. Conspicuous species, not seen.	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Kydra Westringia *Westringia kydrensis* **E TSC** **E EPBC**	This procumbent shrub grows in or adjacent to *Allocasuarina nana* heath land on granite in the Kydra Reefs area south-east of Cooma and in Coolumbooka Nature Reserve east of Bombala (J. Miles, pers. obs.)	Absent There are no records for this species.	None	No	No	No
Lemon Zieria *Zieria citriodora* **E TSC** **V EPBC**	Lemon Zieria grows in low woodland of *Eucalyptus mannifera - E. macrorhyncha - E. dives* with a shrub understorey in two areas of the Southern Tablelands, Numeralla and Kybeyan Trig north-east of Cooma, and in Victoria, where it is also rare.	Present There are no records for this species.	None. Conspicuous species, not seen.	No	No	No
Forbs						
Monaro Golden Daisy *Rutidosis leiolepis* **V TSC** **V EPBC**	This perennial mat-forming forb grows in scattered populations in natural temperate grassland on the Monaro and in subalpine grassland in Kosciuszko National Park.	Absent There are no records for this species.	None	No	No	No
Ginninderra Peppercress *Lepidium ginninderrense* **V EPBC**	This species is determined to have the potential to occur by the EPBC Act Protected Matters search tool. This species occurs on a single site on Belconnen Naval Transmission Station in Lawson (ACT), on the floodplain of Ginnindera Creek in natural temperate grassland with an open structure, dominated by *Austrodanthonia* species and *Bothriochloa macra*. Appears to be sensitive to grazing pressure. No suitable habitat (moist natural grassland) occurs on the site.	Absent There are no records for this species.	None	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Button Wrinklewort *Rutidosis leptorrhynchoides* **E TSC** **E EPBC**	This species grows in grassland and grassy woodland of the ACT and Monaro regions.	Absent This species has been recorded 5km west of the site, in Queanbeyan.	Unlikely	No	No	No
Mauve Burr-daisy *Calotis glandulosa* **V TSC** **V EPBC**	Mauve Burr-daisy grows in montane or subalpine grassland or grassy woodland on the tablelands and western slopes, including disturbed areas. Most of its distribution is south of Canberra, but with a single record from the Oberon area.	Absent There are no local records for this species.	None	No	No	No
Hoary Sunray *Leucochrysum albicans* subsp. *albicans* var. *tricolor* **E EPBC**	This species may be locally common on the Southern Tablelands, and is therefore not listed as threatened in NSW. It grows in natural and secondary grasslands and grassy woodlands, often colonising disturbed sites such as road verges, but does not persist well in grazed situations. It occurs patchily on road verges around the Goulburn area.	Present Recorded onsite.	Present	Yes.	No	Yes
Austral Toadflax *Thesium australe* **V TSC** **V EPBC**	This species is found in small populations across eastern NSW, on the coast and from the Northern to Southern Tablelands. It occurs in grassland or grassy woodland (DECC 2009), sometimes in damp sites, and almost invariably associated with kangaroo grass (*Themeda australis*).	Present This species has been recorded approximately 25km south west of the site, near Bullem Range Nature Reserve.	None	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Silky Swainson-pea *Swainsona sericea* **V TSC**	A declining small perennial pea recorded in grassland and grassy woodland from the northern to southern tablelands, and western slopes and plains. Flowers Oct-Dec. All Southern Tableland records in the DECC Atlas are from south of Canberra.	Present This species has been recorded approximately 10km south of the site, near Googong Dam.	None	No	No	No
Mountain Swainson-pea *Swainsona recta* **E TSC** **E EPBC**	A perennial forb to 30cm high, flowering in spring to early summer. Its distribution has contracted from the South West Slopes to the Canberra-Queanbeyan and Wellington-Mudgee areas. It grows in grassy woodland or secondary grassland, usually in ungrazed sites. The rail easement between Canberra and Cooma was one of its strongholds, possibly due to regular burning, which would reduce competition from dominant grasses such as *Themeda australis*.	Present This species has been recorded approximately 2km south west of the site, in Queanbeyan.	Unlikely	No	No	No
Orchids						
Doubletail Buttercup *Diuris aequalis* **E TSC** **V EPBC**	This species has been recorded in a range of grassy woodland and forest types, on the Great Dividing Range, from the Wombeyan Caves area south to the Braidwood area. Flowering has been recorded in early November near the site.	Present The site was surveyed for this species and it was not detected.	Possible	Yes	Yes	Yes

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Tarengo Leek Orchid *Prasophyllum petilum* **E TSC** **E EPBC**	Known from three sites on the Southern Tablelands, at Boorowa, and Captain's Flat in NSW and Hall in the ACT, growing in Natural Temperate Grassland, Yellow Box, Blakely's Red Gum Woodland or moist grassy flats, with kangaroo grass or wallaby grasses (*Austrodanthonia spp*). The Captains Flat population occurs in an area with a high watertable. Flowers Oct-Nov.	Present This species has been recorded 25km from the site, to the north west of Canberra.	Unlikely	No	No	No
Thick-lipped Spider Orchid *Caladenia tessellata* **E TSC** **V EPBC**	This species grows on the NSW South and Central Coast, and the Victorian coastline, with records from the Braidwood and Queanbeyan areas on the Southern Tablelands, (DECC 2009). Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil, as the early record from Queanbeyan is likely to have been. Flowering period on the Southern Tablelands is late Sept-Oct.	Present The site was surveyed for this species and it was not detected. This species has been recorded in the Queanbeyan and Braidwood areas	Possible	Yes	Yes	Yes

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
EECs						
Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT **EEC EPBC**	Natural Temperate Grassland is a naturally treeless of sparsely-treed community, characterised by the dominance of native grasses including Kangaroo grass (*Themeda australis*), Poa Tussock (*Poa sieberiana*), River Tussock (*P. labillardieri*), spear grasses and wallaby grasses, with a diversity of native forbs (DECC 2009). It grows in frost hollows, wet areas, on heavy clay soils derived from basalt and in other situations where summer drought or winter cold make conditions unsuitable for tree seedling establishment, usually on flat to undulating terrain.	Absent The nearest records for this EEC are unknown.	None	No	No	No
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland **EEC TSC** **CEEC EPBC**	Woodland or open woodland or secondary grassland community, dominated by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) or Blakely's Red Gum (*E. blakelyi*), with several other tree species potentially present but not generally dominant. Intact sites may contain some shrubs, though the understorey is generally grassy, with better quality remnants having a high diversity of grasses and forbs.	EEC TSC and CEC EPBC absent within the proposal site This community has been recorded in the Queanbeyan area, on flats, lower slopes and drainage lines.	Possible (nearby)	Yes.	Yes	No Does not satisfy EPBC CEEC definition

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AoS required	EPBC Act AoS required
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps **EEC TSC**	Variable community occurring in drainage depressions and seepage areas of the NSW tablelands to alps. May be dominated by herbaceous species (sedges, grasses, forbs) or shrubs.	Absent The nearest records for this EEC are unknown.	None	No	No	No

E TSC = listed as Endangered under Schedule 1 of the NSW *TSC Act 1995*

E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*

EEC TSC = Endangered Ecological Community listed under Schedule 1 of the NSW *TSC Act 1995*

V TSC = listed as Vulnerable under Schedule 2 of the *TSC Act 1995*.

V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

EEC EPBC = Endangered Ecological Community listed under the Commonwealth *EPBC Act 1999*

CEEC EPBC = Critically Endangered Ecological Community listed under the Commonwealth *EPBC Act 1999*

APPENDIX E: THREATENED FAUNA EVALUATIONS

Threatened fauna evaluation

The table below evaluates the likelihood and extent of impact on threatened fauna listed in the EPBC Database Matters of National Significance, which fall within a 10 kilometre buffer of the site. Threatened fauna species from the Monaro sub-catchment of the Murrumbidgee CMA region are also included in this evaluation. Recorded sightings of threatened species were determined through the NPWS Wildlife Atlas database, within the 1:100 000 Canberra (8727) map sheets. For each species, the table assesses whether habitat is present, if there are any recorded sightings near the proposed project area, and based on this, the likelihood of the species utilising the site and being adversely affected by the proposal. The categories are defined below.

Presence of habitat:

Present:	Potential or known foraging, roosting, nesting, refuge, movement corridor (including movement of genetic material) or other habitat is present within the study area
Absent:	No potential foraging, roosting, nesting or other habitat is present within the study area

Likelihood of occurrence

None:	Species has a very low, or no probability of occurrence
Unlikely	Species known or predicted within the locality but unlikely to use site resources
Vagrant:	Species could occur on occasion as a vagrant or passing over/across the study area (usually applies to more mobile species)
Possible:	Species could occur and utilise resources in the study area
Present:	Species was recorded during the field investigations, or those of PMA Consulting (2005) and nghenvironmental (2007)

Potential to be impacted

No:	The proposal would not impact this species or its habitat. No Assessment of Significance (AOS) is considered necessary for this species
Yes:	The proposal could impact this species or its habitat. An AOS has been undertaken for these entities.

Table 0-1 Threatened fauna evaluation

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Amphibia						
Green and Golden Bell Frog *Litoria aurea* **E TSC** **V EPBC**	Formerly, this species had a wide distribution across most of NSW, although since 1990 recorded populations have become largely isolated and separated, restricted to small, coastal or near coastal populations. It is known to inhabit marshes, dams and stream-sides, particularly those containing bulrushes (Typha spp.) or spikerushes (Eleocharis spp.) (Daly and Senior, 2003). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki); have a grassy area nearby and diurnal sheltering sites available (DECC 2009). It occurs 'close to, or in water or very wet areas in forests, woodlands and shrublands and open or disturbed areas' and breeds in permanent lakes, swamps and dams with still water (Hero et al. 1991).	Absent This species has been recorded approximately 7km south of the site near Googong Dam.	Unlikely	No	No	No
Yellow-spotted Tree Frog *Litoria castanea* **E TSC** **E EPBC**	Litoria castanea is found in and amongst long grasses, reeds and sedges of permanent marshes and lagoons. It may also take shelter in winter and avoid desiccation under debris and fallen timber found on the ground (Cogger, 2000).	Absent This species has been recorded approximately 20km west of the site near Mt Arawang.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Southern Bell Frog *Litoria raniformis* **E1 TSC**	Similar to that of *Litoria aurea* (Cogger, 2000) Usually found in or around permanent or ephemeral swamps or billabongs with Black Box/Lignum/Nitre, Goosefoot, Lignum/Typha and River Red Gum, along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (DECC 2009).	Absent This species has been recorded approximately 6km south of the site near Googong Dam.	Unlikely	No	No	No
Alpine Tree Frog *Litoria verreauxii alpina* **E1 TSC**	The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1100 m asl. Most locations are within National Park and some are close to alpine resorts. Found in a wide variety of habitats including woodland, heath, grassland and herb fields. Breed in natural and artificial wetlands including ponds, bogs, fens, streamside pools, stock dams and drainage channels that are still or slow flowing, (DECC 2009).	Absent There are no local records for this species.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Aves						
Speckled Warbler *Pyrrholaemus saggitatus* **V TSC**	This species frequents woodlands and dry forests, of inland Australia. These areas usually have a grassy understorey, often on ridges or gullies. It is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. Foraging takes place on the ground and in the understorey for arthropods and seeds (Ford et al. 1986). It is distributed from south-eastern Queensland, through central and eastern NSW to Victoria.	Present This species has been recorded approximately 7km south of the site, near Googong Dam.	Possible	Yes	Yes	No
Square-tailed Kite *Lophoictinia isura* **V TSC**	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Absent There are no local records for this species.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Blue-billed Duck *Oxyura australis* **V TSC**	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover, (DECC 2009).	Absent This species has been recorded to the north west in the Yass Valley local government area.	Unlikely	No	No	No
Freckled Duck *Stictonetta naevosa* **V TSC**	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers. This species prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree, (DECC 2009).	Absent This species has been recorded approximately 18km to the north east of the site.	Unlikely	No	No	No
Australasian Bittern *Botaurus poiciloptilus* **V TSC**	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. This species favour permanent freshwater wetlands with tall, dense vegetation, particularly bulrushes (Typha spp.) and spikerushes (Eleoacharis spp.), (DECC 2009).	Absent This species has been recorded to the north of the site in the vicinity of Lake George.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Gang-gang Cockatoo *Callocephalon fimbriatum* **V TSC**	In summer, this species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it may occur at lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-ironbark assemblages (Shields and Crome 1992). This species requires large hollows in which to breed (Gibbons 1999, Gibbons and Lindenmayer 2000).	Present This species has been recorded less than 1km from the site.	Possible	Yes Two hollow bearing trees would require removal for the proposal.	Yes	No
Glossy Black Cockatoo *Calyptorhynchus lathami* **V TSC**	This species prefers open forest or woodland with a very specific food requirement for the seeds of *Allocasuarina spp*. Glossy Black Cockatoos nest in tree hollows, usually at considerable heights (Emison *et al.* 1987).	Present - marginal This species has been recorded approximately 12km north west of the site near Mt Ainslie.	Unlikely	No	No	No
Brown Treecreeper *Climacteris picumnus* **V TSC**	The species occurs in eucalypt woodlands, mallee and drier open forest of eastern Australia (Schodde & Tidemann 1995). The species has a distinct call, with pairs or groups of three to six holding the same territory of 5 to 10 hectares. The presence of fallen timber is an important habitat component for foraging for this species.	Present This species has been recorded approximately 6km south of the site near Googong Dam.	Possible	Yes	Yes	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Diamond Firetail *Stagonopleura guttata* **V TSC**	This species is distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas. Habitat is eucalypt woodlands, forests and mallee where there is a grassy understorey. This species forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers et al. 1984).	Present This species has been recorded approximately 6km south west of the site near Mt Jerrabomberra.	Possible	Yes	Yes	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Regent Honeyeater *Xanthomyza Phrygia* **E1 TSC** **E EPBC** **M EPBC**	This species inhabits eucalypt forests and woodlands (Blakers *et al.* 1984). It is highly nomadic and relatively large numbers can arrive at and vacate areas depending on local and regional flowering of favoured species. It feeds mostly on the flowers of eucalypts (particularly box and ironbark species), but also eats invertebrates and exotic fruits (Blakers *et al.* 1984). This species is now almost completely restricted to a few relatively intact extensive stands of its favoured tree species, mostly on the inland side of the Great Dividing Range (Garnett 1992). There are only two known key breeding regions remaining in NSW at Capertee Valley and the Bundarra-Barraba region. In some years non-breeding flocks converge on flowering coastal swamp mahogany and spotted gum woodlands and forests.	Present –marginal This species has been recorded approximately 10km north west of the site near Mt Ainslie.	Possible	Yes Yellow Box and Red Box are found onsite, though the area would be considered marginal habitat for this species as it has been subject to some modification .	Yes	Yes

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Olive Whistler *Pachycephala olivacea* **V TSC**	The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. It forages in trees and shrubs and on the ground, feeding on berries and insects, (DECC 2009).	Absent There are no local records for this species.	Unlikely	No	No	No
Hooded Robin (south-eastern form) *Melanodryas cucullata* **V TSC**	This species occupies a wide range of Eucalypt woodlands, Acacia shrublands and open forests (Blakers et al. 1984). It is widespread, occurring in pairs or solitary in lightly timbered country (Schodde & Tidemann 1995) and spends much of its time on the ground foraging for insects. It frequents places with dead trees and fallen timber (Schodde and Tidemann 1995). This species nests in strong bark cusps of trees.	Present This species has been recorded approximately 6km south west of the site, near Jerrambomberra	Possible	Yes	Yes	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Pink Robin *Petroica rodinogaster* **V TSC**	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Absent This species has been recorded to north west within the Yass Valley local government area.	Unlikely	No	No	No
Swift Parrot *Lathamus discolor* **E TSC** **e EPBC**	Breeds in Tasmania, migrating to south and eastern NSW in autumn/winter where it inhabits eucalypt forests and woodlands (Blakers *et al.* 1984). Mostly occurs on the south-west slopes. It feeds on flowers of eucalypts, and eats psyllids and exotic fruits (Blakers *et al.* 1984). In eastern NSW swift parrots favour habitat containing *Eucalyptus robusta* (swamp mahogany) and *Corymbia maculata* (spotted gum) (Brereton 1996).	Present - marginal This species has been recorded approximately 15km east of the site in Canberra.	Vagrant	No *Eucalyptus robusta* and *Corymbia maculata* were not observed on site.	No	No
Superb Parrot *Polytelis swainsonii* **V TSC** **v EPBC**	This species inhabits river red gum, black box, yellow box and river oak forests mostly near rivers. It nests in the hollows of river red gums and yellow box, generally near water. Forages on the ground in grassy woodland, also on fruit, seeds and blossoms of acacias, eucalypts and mistletoes (Pizzey and Knight, 2003).	Present -marginal This species has been recorded approximately 25km north west of the site.	Possible (foraging)	No Wide ranging species	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Cattle egret *Ardea ibis/ Bubulcus ibis* **M EPBC**	The Cattle Egret is found in grasslands, woodlands and wetlands. It also utilises pasture lands where drainage is poor, often in association with cattle and other stock. Originally found in Africa, Europe and Asia, the Cattle Egret is now found on nearly every continent, with birds in Australia originating from Asia	Present This species has been recorded approximately 17km north west of the site in Canberra.	Vagrant	No Wide ranging migratory species	No	No
Great Egret *Ardea alba* **M EPBC**	Great Egrets occur throughout most of the world. They are common throughout Australia, with the exception of the most arid areas. Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	Absent This species has been recorded approximately 17km north west of the site in Canberra.	Unlikely	No	No	No
Latham's Snipe *Gallinago hardwickii* **M EPBC**	This species breeds in northern Japan during the Australian winter. During the non breeding season they migrate to Australia to inhabit freshwater wetlands, especially those vegetated with rushes, reeds, sedges and tea tree. This species may utilise modified environments such as sewage treatment works, irrigation channels and flooded plains.	Absent This species has been recorded approximately 15km north east of the site near Lake Burley Griffin	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Painted Snipe or Australian Painted Snipe *Rostratula benghalensis s. lat.* *Rostratula australis, Rostratula benghalensis australis* **E TSC** **V EPBC** **M EPBC**	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. It is most common in the Murray-Darling Basin. A small freshwater wader that prefers the fringes of swamps, dams and nearby marshy areas.	Absent This species has been recorded approximately 15km west of the site near Lake Burley Griffin.	Unlikely	No	No	No
Barking Owl *Ninox connivens* **V TSC**	The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It is most frequently recorded on the western slopes and plains. It inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting, (DECC 2009).	Absent There are no local records for this species.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Powerful Owl *Ninox strenua* **V TSC**	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well, (DECC 2009).	Absent There are no local records for this species.	Unlikely	No	No	No
Rainbow Bee-eater *Merops ornatus* **M EPBC**	This species inhabits open woodlands with sandy, loamy soil. It builds a burrow in sandy ground or bank cuttings such as roads or creeks. The species is a summer breeding migrant (Sept-Apr) to south-eastern Australia, but winters in northern Australia, Solomon Islands, PNG and Indonesia.	Present This species has been recorded approximately 7km south of the site near Googong Dam.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Rufous Fantail *Rhipidura rufifrons* **M EPBC**	This species generally prefers wetter habitats than the common grey fantail. It is found in the undergrowth of rainforests, and wet eucalypt forests and gullies (Pizzey and Knight, 2003). From October to February it migrates to south east Australia, when it can be found in more open habitats and can nest in a horizontal fork of a tree up to 12m from the ground. Breeds in southern Australia, but is known to migrate to inland Australia, PNG, Solomon Islands, New Caledonia and Indonesia.	Absent This species has been recorded approximately 10km west of the site near Mugga Quarry.	Unlikely	No.	No	No
Satin Flycatcher *Myiagra cyanoleuca* **M EPBC**	This species is normally found in heavily vegetated gullies in tall forests, woodlands wherever a shrub layer is present. During migration it is often found in coastal forests, woodlands and trees in open country. It breeds mostly in south-east Australia, nestings on a dead branch 5-25m high under live foliage, regularly returning to the same locality to breed.	Absent This species has been recorded approximately 7km south of the site near Googong Dam.	Unlikely	No	No	No
White-bellied Sea-Eagle *Haliaeetus leucogaster* **M EPBC**	This species occurs around coastal areas, islands and estuaries, but is also found in inland areas where there are from large rivers, wetlands and reservoirs.	Absent This species has been recorded approximately 7km south of the site near Googong Dam.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
White-throated Needletail *Hirundapus caudacutus* **M EPBC**	Noted as one of the world's fastest birds, this species has been recorded in the airspace above woodlands, forests and farmlands. It is often seen 'patrolling' favoured feeding grounds above ridges and hilltops. It feeds on flying insects. This species migrates to Australia from mid-October and is a regular summer migrant until April when it returns to the northern hemisphere to breed. This species migrates to Australia from mid-October and is a regular summer migrant until April when it returns to the northern hemisphere to breed.	Present This species has been recorded approximately 3km west of the site in Queanbeyan.	Possible	No Highly mobile species.	No	No
FISH						
Murray Cod *Maccullochella peelii peelii* **V EPBC**	This species occurs naturally in the waterways of the Murray–Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs (DEWHA 2009).	Absent There are no local records for this species.	None	No	No	No
Macquarie Perch *Macquaria australasica* **V TSC** **E EPBC**	Macquarie perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries, (DECC 2009).	Absent There are no local records for this species.	None	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Insecta						
Golden Sun Moth *Synemon plana* **E1 TSC** **CE EPBC**	This species is distributed in an area of NSW between Queanbeyan, Gunning, Young and Tumut (DECC 2009). It occurs in grassy Box-Gum woodlands and natural temperate grasslands, typically low, open and dominated by several wallaby grass species. Also may be associated with spear-grasses (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis).*	Present - marginal This species has been recorded approximately 5km south-east of the site near Jerrabomberra.	Unlikely	No The understory of the woodland area is shrubby rather than grassy. Further, there is no grassland within the proposal site.	No	No
Mammalia						
Eastern Pygmy-possum *Cercartetus nanus* **V TSC**	Feeding largely on nectar, and insects, the species is found from rainforest through sclerophyll forest to tree heath. *Banksias* and myrtaceous shrubs and trees are favoured as food sources (Strahan 1995). Its small size allows it to nest in very small spaces during the day, and hollows in trees are favoured (Strahan 1995).	Present This species has been recorded approximately 12km north east of the site near Cohen Creek. The site does not contain banksias or myrtaceous shrubs.	Unlikely	No There are limited food resources for this species on site.	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Spotted-tailed Quoll *Dasyurus maculatus maculatus* **V TSC** **E EPBC**	This species is found in a variety of forest types, although generally it prefers moister environments such as rainforest and wet sclerophyll forest breeding and sleeping in nests in rock caves or hollow logs or trees (Strahan 1995). Prime habitat would therefore be adjacent moist gully communities, although it is likely to prey on ground mammals and other species over a large range.	Absent This species has been recorded approximately south of the site near Googong Reservoir.	Unlikely	No	No	No
Koala *Phascolarctos cinereus* **V TSC**	This species inhabits eucalypt woodlands and forests over a broad but fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts, they are also know from several sites on the southern tablelands (DECC 2009). This species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species but in any one area it will selectively browse on preferred species. For the Southern Tablelands, the primary feed tree species are identified as Ribbon Gum (*Eucalyptus viminalis*) and River Red Gum (*E. camaldulensis*) along with a number of secondary food tree species including Candle Bark, Yellow Box and Brittle Gum (NSW NPWS Recovery Plan for the Koala 2003).	Present (marginal) This species has been recorded within 1km of the site.	Possible	Unlikely	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Yellow-bellied Glider *Petaurus australis* **V TSC**	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. It occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein, (DECC 2009).	Absent There are no local records for this species.	No	No	No	No
Grey-headed Flying-fox *Pteropus poliocephalus* **V EPBC**	This species occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy, (DECC 2009)	Present (Marginal foraging) There are no local records for this species. Non evidence of roost camp on site.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Eastern False Pipistrelle *Falsistrellus tasmaniensis* **V TSC**	Little is known in relation to the habitat requirements of this species. It is widely distributed in eastern NSW from the Dividing Ranges through to the coast (Strahan 1995). It is found in a range of habitats including dry and wet sclerophyll forest but appears to prefer wet sclerophyll forest (Hall and Richards 1979). This species roosts in tree hollows.	Present Recorded onsite.	Present	Yes Two hollow bearing trees would be removed as a result of the proposal.	Yes	No
Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis* **V TSC**	This species is a common, although vulnerable species, that is likely to be widely distributed throughout the region and found in a wide range of habitats. The species roosts and raises its young in caves and mine tunnels (Strahan 1995). Typically, the species forages in well timbered habitats, above the tree canopy (Strahan 1995).	Present Recorded onsite.	Present	Yes	Yes	No
Large-footed Myotis *Myotis adversus* **V TSC**	This species roosts in small colonies in caves, mines, buildings and under bridges, and forages over water bodies ranging from small streams and dams to reservoirs for aquatic invertebrates and small fish (Strahan 1995).	Absent This species has been recorded approximately 4km south west of the site.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Reptilia						
Little Whip Snake *Suta flagellum* **V TSC**	This is a small, secretive, nocturnal species that feeds mostly on small lizards and frogs. It is found in Natural Temperate Grasslands and grassy woodlands (DECC 2009), including those dominated by Snow Gum (*Eucalyptus pauciflora)* or Yellow Box (*E. Melliodora),* and also occurs in secondary grasslands derived from clearing of woodlands. This species is usually found on well drained hillsides, mostly associated with scattered loose rocks especially on stony hills, where it shelters under rocks and logs (Cogger, 2000).	Present This species has been recorded approximately 14km north east of the site near Reedy Creek.	Possible	Yes The site of proposed work contains Yellow Box and timber debris on the ground.	Yes	No
Pink-tailed Legless or Worm Lizard *Aprasia parapulchella* **V TSC** **V EPBC**	This species inhabits sloping, open woodland areas with predominantly native grass ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Typically these areas are well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks in burrows below these rocks; the burrows usually have been constructed by and are often still inhabited by small black ants and termites. This species feeds on the larvae and eggs of these ants (DECC 2009).	Absent This species has been recorded approximately 1.5km south of the site.	Unlikely	No	No	No

Species and Status*	Ecology and habitat requirements	Presence of habitat and nearest records	Likelihood of occurrence	Potential to be impacted	TSC Act AOS required	EPBC Act AOS required
Rosenberg's Goanna *Varanus rosenbergi* **V TSC**	This species is found in heath, open forest and woodland. It is often associated with termites and nests in the mounds. Termite mounds are considered a critical habitat component. Foraging is mainly on carrion, birds, eggs, reptiles and small mammals. This species shelters in hollow logs, rock crevices and in burrows, which they dig for themselves, or use other species' burrows (DECC 2009).	Present This species has been recorded within 1km of the site of the site.	Possible	Yes	Yes	No
Striped Legless Lizard *Delma impar* **V TSC** **V EPBC**	This species is a grassland specialist, being found only in areas of native grassland and nearby grassy woodland, exotic pasture and occasionally in open Box-Gum Woodland (DECC 2009). It is usually found under logs and rocks and ground debris (Cogger, 2000). It forages on spiders, crickets, moth larvae and cockroaches.	Absent There are no local records for this species.	Unlikely	No	No	No
Grassland Earless Dragon *Tympanocryptis pinguicolla* **E TSC** **E EPBC**	This species inhabits Natural Temperate Grassland sites dominated by wallaby grasses (Nothodanthonia spp.), spear grasses (Austrostipa spp.), Poa Tussock (Poa sieberiana), Red Grass (Bothriochloa macra), and occasionally Kangaroo Grass (Themeda australis) (DECC 2009). It prefers areas with an open structure, containing bare patches between grasses, rocks, and spider and insect holes used for shelter. Foraging is mainly on ants and spiders.	Absent There are no local records for this species.	Unlikely	No	No	No

E TSC = listed as Endangered under Schedule 1 of the NSW *TSC Act 1995*

E EPBC = listed as Endangered under the Commonwealth *EPBC Act 1999*

V TSC = listed as Vulnerable under Schedule 2 of the *TSC Act 1995.*

V EPBC = listed as Vulnerable under the Commonwealth *EPBC Act 1999*

CE = critically endangered

M = Migratory

CAMBA = Chinese-Australia Migratory Bird Agreement

JAMBA = Japan-Australia Migratory Bird Agreement

APPENDIX F: ASSESSMENTS OF SIGNIFICANCE

Threatened Species Conservation Act 'Seven part test'

Section 5A of the *Environmental Planning and Assessment Act 1979 (NSW)* specifies seven factors to be considered prior to determining if the proposed activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats under the *Threatened Species Conservation Act 1995 (NSW).*

The following Assessments of Significance (seven-part tests) assess the significance of likely impacts associated with the Kings Highway Realignment proposal on NSW listed threatened flora and fauna species and Endangered Ecological Communities considered at risk from the proposal (See Appendix C for the threatened species evaluation):

Flora

Thick-lipped or Tessellated Spider Orchid (*Caladenia tessellata*)	**E TSC, V EPBC**
Buttercup Doubletail (*Diuris aequalis*)	**E TSC, V EPBC**

Endangered Ecological Communities

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	**EEC TSC**

Fauna

Speckled Warbler (*Chthonicola sagittata*)	**V TSC**
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	**V TSC**
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	**V, TSC**
Diamond Firetail (*Stagonopleura guttata*)	**V TSC**
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	**V TSC**
Regent Honeyeater (*Xanthomyza phrygia*)	**E1 TSC, E EPBC**
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	**V TSC**
Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	**V TSC**
Rosenbergs Goanna (*Varanus rosenberg)*	**V TSC**
Little Whip Snake (*Suta flagellum*)	**V TSC**

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	
Flora	
Ecology	**Thick Lip or Tessellated Spider Orchid and Double-tail Buttercup Orchid** Suitable habitat for the Buttercup Doubletail is difficult to determine, since it has been recorded in a wide range of forest and woodland types, all along the Great Dividing Range, and has occasionally been found in secondary grassland. Where it does occur, over its extremely scattered distribution between the Blue Mountains and Braidwood, it tends to be found in small populations. The species profile on the DECC threatened species website states that a total of 200 plants are known from 20 populations. However, numbers will vary from year to year depending on conditions. The population on the Wombeyan Caves Road alone consisted of 200 plants or more in 2005, as numbers recovered after the 2002-04 drought (K. McDougall, DECC, pers. comm.). Numbers recorded at the Kings Highway site were 24 plants in 2005 (J. Miles, pers. obs.), and 50 in 1999 (K. McDougall, pers. comm.). At Mt Rae only 10 widely scattered plants were found in an intensive search of an area of about 300 hectares, in groups of 1-3 plants (J. Miles, pers. obs.). Given its tendency to be very thinly scattered through the landscape, the probability of this species occurring on the site is very low. However, it cannot be discounted altogether. The Thick-lip Spider Orchid grows on the NSW South and Central Coast, and the Victorian coastline, with records from the Braidwood and Queanbeyan areas on the Southern Tablelands (DECC 2009). It is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil, as the early record from Queanbeyan is likely to have been. This species is even less likely to be present, given the lower number of records from the Southern Tablelands.
Assessment	The likelihood of the proposed works coinciding with a population of these species is extremely small but given that remnant populations of these species can be small and isolated, if a population were present, it could be eliminated. Surveys for these species during their flowering period were undertaken as discussed in Section 6.5, to coincide with documented flowering periods of each species. No plants were found within the study area during the searches. In addition, an inspection of habitat at Mulloon Hill, a known site for *Diuris aequalis* noted that in areas of drier habitat, individuals were absent, while individuals were noted in moister areas at this site. It is considered that external factors including drought may have impacted on the presence of these known individuals. Habitat within the study area is somewhat dry, similar to the drier areas at Mulloons Hill where individuals were not observed. Although the study area potentially offers habitat for these two species of orchids, targeted searches were carried out at appropriate times and the species were not found within the study area. It is considered that the likelihood of this species occurring onsite is extremely low and the proposal is unlikely to have an adverse effect on the lifecycle of the species such that a viable local population would become extinct.
Fauna **Woodland Birds**	
Ecology	**Speckled Warbler, Diamond Firetail, Hooded Robin, Brown Treecreeper** The Speckled Warbler, Diamond Firetail and Hooded Robin forage for seeds and insects on the ground in *Eucalyptus* dominated communities with a grassy understorey and sparse shrub layer (Garnett & Crowley 2000). The Hooded Robin also utilises perches, while the Brown Treecreeper forages for invertebrates on tree trunks and on the ground amongst fallen timber and leaf litter (DECC 2009).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	
	All three species are sedentary and persist only in large woodland areas (100-300 ha) containing structurally diverse habitat (Barrett et al. 1994). Warblers appear to be averse to open canopy areas, thus limiting dispersal between fragments (Garnett & Crowley 2000). All three generally occur in low densities, although the Diamond Fire tail and Brown Treecreeper are gregarious (Cooney & Watson 2005; DECC 2009). The territory ranges in size from 2-20 ha depending on habitat richness (Olsen et al. 2005). Threats to these species are clearance and fragmentation of habitat including removal of dead timber, over-grazing, invasion of exotic grasses and increases in edge predators (Cooper and Walters 2002; Garnett & Crowley 2000). Poor dispersal abilities increase the vulnerability of the Speckled Warbler to these threats (Garnett & Crowley 2000). Diamond Firetails have been recorded to travel 5km during dispersal (Olsen et al. 2005).
Assessment	None of these species were detected in the study area. However, suitable habitat was found within the study area, primarily in the woodland area around the north – south trending drainage line. The potential lifecycle risk factors are: *Persist only in large woodland/forest areas:* The proposal would require clearing of woodland vegetation. This may affect the carrying capacity of the local area by reducing habitat and dispersal potential. However, potential habitat loss, degradation or fragmentation resulting from proposed works is likely to be a low risk to local populations of Speckled Warbler, Diamond Firetail, Hooded Robin, Brown Treecreeper due to the availability of continuous habitat of equal quality to the east of the site in the Cuumbeun Nature Reserve.
Ecology	**Regent Honeyeater** The Regent Honeyeater is found at low densities in eucalypt open forests and woodlands, particularly ironbark-box and box-gum assemblages, and has specialist dietary and habitat requirements. The Regent Honeyeater prefers wetter, more fertile sites along creek flats, broad river valleys and lower slopes. Riparian forests of River She-oak *Casuarina cunninghamiana* are also important for feeding and breeding. Regent Honeyeaters forage from limited eucalypt species (Mugga Ironbark, Yellow Box, Yellow Gum, Blakely's Red Gum and White Box). Stands of suitable species growing on high quality sites where nectar production is copious and relatively predictable appear to be critical to the survival of the Regent Honeyeater, although such areas are increasingly uncommon (Menkhorst & Knight 2001). Regent Honeyeaters are known to undertake large-scale nomadic movements hundreds of kilometres between coastal and inland resources (DECC 2009). Threats including habitat loss, fragmentation and degradation) are compounded by competition from aggressive and non-specialist honeyeaters such as the Noisy Miner (Menkhorst & Silveira 2003; Menkhorst *et al.* 1999).
Assessment	The Regent Honeyeater was not detected in the study area. Life cycle stages potentially affected include foraging due to loss and degradation of habitat. The works pose a low risk to local populations of Regent Honeyeaters due to mobility of species and sufficiently large areas of continuous woodland nearby.
Ecology	**Gang-gang Cockatoo** In summer, this species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it may occur at lower altitudes in drier, more open eucalypt forests and woodlands, particularly box-ironbark assemblages (Shields and Crome 1992). This species requires large tree hollows in which to breed (Gibbons and Lindenmayer 2000).

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	
Assessment	The Gang-gang Cockatoo was not detected in the study area. Life cycle stages potentially affected include foraging due to loss and degradation of habitat. The works pose a low risk to local populations due to mobility of species and sufficiently large areas of continuous woodland nearby.
Microbats	
Ecology	**Eastern Bentwing Bat** The Eastern Bentwing Bat is a cave dependant species. Eastern Bentwing Bats require forested areas to forage in, flying above the canopy and to some height over the canopy to capture insects on the wing. The species also forage along flyways (along clear areas such as tracks or streams), and are known to utilise cleared paddocks during dispersal (Dwyer 1968).
Distribution and movements	The Eastern Bentwing Bat was recorded by Anabat surveys at the site conducted in January 2009. The species distribution covers a wide area along the east coast of Australia, with populations dispersed within 300 kilometres of each of the known maternity roosts (DECC 2009). Eastern Bentwing Bat is a long-lived species with low fecundity.
Assessment	Potential impacts on this species include foraging habitat removal (woodland) from the following life-cycle characteristics: *Habitat requirements:* The occurrence of Eastern Bentwing Bat within the woodland patches in the proposal site is likely to be relatively infrequent as there is foraging habitat of similar or better quality located within the Cuumbuen Nature Reserve. Life cycle stages potentially affected include foraging due to loss and degradation of habitat. The risk to the population from removal of foraging habitat is likely to be low given the species' apparent utilisation of partially cleared habitat. In addition, there were no caves or other potential roost sites identified within the proposal site.
Ecology	**Eastern False Pipistrelle** The Eastern False Pipistrelle utilises tree hollows for roosting, and has also been found under loose bark and in buildings (DECC, 2009). Colonies are small, from 3 to 36 individuals having been recorded, often segregated by sex (Churchill 1998). The Eastern False Pipistrelle relies on forested areas and forages within or just above the forest canopy. It is a relatively fast, manoeuvrable flyer that hunts prey by pursuit. The species prefers tall wet sclerophyll forest with trees approximately 20 metres in height, though has been found foraging in drier forests. It travels medium distances to forage (c. 12km) (Churchill 1998). It is a winter hibernating species and it has been suggested that some highland populations migrate to the coast for winter (Strahan 1995), though by what route is unknown.
Assessment	The Eastern False Pipistrelle was recorded by Anabat surveys in January 2009. Further, it is possible that an individual was roosting in the southern most hollow bearing tree located within the proposal site at the time of the survey. Life cycle stages potentially affected include foraging and roosting due to loss and degradation of habitat. Safeguards to be implemented during the construction phase would include a tree removal process to minimise the potential to impact on this species, along with the installation of bat boxes to provide an alternative to bats potentially roosting in the southern hollow bearing tree. The study area is primarily dry woodland that may constitute marginal foraging habitat for the species. It is considered that vegetation within the Cuumbeun Nature Reserve, which appears to be of similar age to the vegetation noted on site, would be likely to provide a similar density of hollow bearing trees. Additionally, the Eastern False Pipistrelle is a highly mobile species and likely to use any roosting habitat resources

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	
	located within the Nature Reserve. Thus, with implementation of the safeguards described in Section 6.6 and Section 7 and the presence of similar or better quality habitat within the Cuumbean Nature Reserve, the risk to a local population of Eastern False Pipistrelle is likely to be low.
Reptiles	
Ecology	**Little Whip Snake and Rosenberg's Goanna** Little Whip Snake has been found in grasslands, grassy woodlands, and secondary grasslands. It requires well-drained slopes with loose scattered rocks or rocky outcrops as these provide basking, shelter and foraging habitat. Grazing, clearing and weed invasion has been shown to reduce the suitability of rocky sites for reptile species (Fischer et al., 2004, Dorrough and Ash, 1999) and these processes are listed as threats for both species (DECC, 2009). Rosenberg's Goanna occurs in the Goulburn and ACT regions and near Cooma in the south. It can be found in heath, open forest and woodland and is associated with termite mounds, a critical habitat component for the Rosenberg's Goanna, (DECC 2009). Rosenberg's Goanna shelters in hollow logs, rock crevices and in burrows (DECC 2009).
Assessment	Potential impacts on these reptile species arising as a result of the proposed development include rocky outcrop and woodland habitat removal, degradation and fragmentation. Rocky outcrops on well-drained slopes provide habitat for both species. This habitat is scattered throughout the proposal site, although most of the rocky outcrops appear to be man-made rather than natural outcrops. One termite nest was identified within the proposal site near the corner of Regent Drive and Hill Lane. No signs of goanna activity were observed within the nest. Woodland within the proposal site offers potential habitat for Rosenberg's Goanna, however there are areas of similar or better quality habitat located to the east of the proposal site in addition to habitat located within the Cuumbeun Nature Reserve that is likely to be used by this species. Life cycle stages potentially affected include foraging and taking refuge, due to loss and degradation of habitat. The works pose a low risk to local populations due to mobility of species and sufficiently large areas of continuous woodland nearby.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction
N/A

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at the risk of extinction, or ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Although Yellow Box is scattered on the site, it is generally a minor component within a drier woodland type with a shrubby understorey and is therefore not an indicator of the presence of Box-Gum Woodland. There is one small patch adjacent to the site which may fit the (TSC Act) definition of this EEC, but as this is on private property, and located up-slope of the road reserve, it is unlikely to be affected.

d) in relation to the habitat of a threatened species, population or ecological community:

- **i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **iii) the importance of the habitat to be removed, modified, fragmented or isolated, to the long-term survival of the species, population or ecological community in the locality**

Flora

The site is not known to provide habitat for the Buttercup Doubletail or Thick-lip Spider Orchid, and the failure to locate either species despite searches within their flowering period suggests they do not occur there. A large proportion of the 4ha site is potential habitat, but there is no evidence that it is actual habitat of these species. Fragmentation is unlikely to be an issue with this species, which typically occur in small, isolated populations.

Birds

Speckled Warbler, Diamond Firetail, Hooded Robin, Brown Treecreeper, Regent Honeyeater, Gang-gang Cockatoo

i) The total proposal site is 4ha, all of which would be impacted by the proposal. Approximately half of this area could be considered woodland suitable for these species.

ii) The proposal site is bounded to the west and south by residential developments and the City of Queanbeyan. To the north, the proposal site is currently separated from areas of rural residential development and woodland by the Kings Highway. To the east of the proposal site, a semi-continuous to continuous woodland area is present and continues into the Cuumbeun Nature Reserve. The proposal site is considered to represent that 'edge' of this woodland and as such the proposal would not act to fragment or isolate areas of habitat.

iii) Suitable habitat is reserved nearby (Cuumbeun Nature Reserve), and occurs adjacent to the proposal site (north). Therefore the habitat within the proposal site is considered of low importance.

Microbats

Eastern False Pipistrelle and Eastern Bentwing bat

i) The total proposal site is 4ha, all of which would be impacted by the proposal. This would include the removal of the two hollow bearing trees located within the proposal site.

ii) Given the mobile nature of these species, it is considered that habitat fragmentation is unlikely impact on them. Two hollow bearing trees would be removed as a result of the proposal, with similar habitat, likely to contain many hollow-bearing trees, located to the east of the proposal site.

iii) It is considered that the hollow bearing trees, particularly the southern most hollow bearing tree, a likely roost site for an Eastern False Pipistrelle individual(s), is potentially important to these individual(s). The vegetation located to the east of the proposal site is semi continuous to continuous and appears to be of similar age to the vegetation within the proposal site. Therefore it is likely that there would be a similar density of hollow bearing trees located outside of the proposal as evident within the proposal site. In addition, the nearby Cuumbuen Nature Reserve is likely to offer similar or better quality habitat to that within the proposal site. Mitigation measures identified in this report, namely the installation of bat boxes and having an appropriately qualified person on site during tree removal would minimise the impact of the removal of these two trees. The removal of the two hollow bearing trees is unlikely to affect the long term survival of the species with effective implementation of the safeguards in addition to the abundance of surrounding potential habitat. The Eastern Bentwing bat is a cave dwelling bat and typically does not roost in hollows. The proposal would not affect the long term survival of this species.

Reptiles

Little Whip Snake and Rosenberg's Goanna

i) The total proposal site is 4ha, all of which would be impacted by the proposal. All rocky outcrops and disturbance zones within the proposal site would be impacted. It is considered that the proposal would likely generate rocky disturbance zones similar to those zones currently on site.

d) in relation to the habitat of a threatened species, population or ecological community:

i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii) the importance of the habitat to be removed, modified, fragmented or isolated, to the long-term survival of the species, population or ecological community in the locality

ii) Areas of rocky habitat located outside of the proposal site would become fragmented as a result of the proposal. It is considered that rocky habitat located on the western side of the proposed highway route would be fragmented by the highway. The western side of the proposed alignment predominately consists of small rural lots with residences that only have limited rocky habitat. Any fragmentation of potential habitat is likely to be minor. The majority of the rocky habitat would not be fragmented from similar habitat in the locality.

iii) Rocky habitat observed onsite appear to be a result of past anthropogenic activities and are considered to be of low quality. Therefore the risk to the long-term survival of these species is considered to be low.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No areas of critical habitat have been declared within the district.

f) whether the action proposed is consistent with the objectives or action of a recovery plan or threat abatement plan

Fauna

Recovery Plans have been adopted for the following species:

Regent Honeyeater

The broad objective of the National Recovery Plan for the Regent Honeyeater 1999-2003 is to ensure that the species persists and increases in the wild through maintaining and enhancing the value of habitat throughout their former range (Menkhorst & Knight 2001). Relevant mitigation measures include:

- Minimise impacts to feed tree species (including Yellow Box, Blakely's Red Gum, White Box) within woodland remnants.
- Avoid impacting habitat connectivity by restricting impacts to the edges of continuous woodland or isolated stands

The proposal would potentially result in the removal of individual Yellow Box trees however the proposal site does not contain any continuous woodland that would be considered habitat for this species. The proposal site has a previous history of disturbance due to previous clearing on residential properties and offers little in the way of connectivity between areas of suitable habitat due to the proximity to Queanbeyan. There is a large area of continuous woodland habitat in the area, in Cuumbeun Nature Reserve however this proposal would not impact on this area. Therefore the proposal would be consistent with the recovery plan for this species.

Priority Action Statements have been developed for:

- **Tessellated Spider Orchid** and **Doubletail Buttercup**

  The additional survey work done for these species is in accordance with PAs. The proposal is not contrary to any of the PAs.

- **Speckled Warbler, Brown Treecreeper (eastern subspecies), Hooded Robin (south-eastern form), Diamond Firetail, Gang-gang Cockatoo, Regent Honeyeater, Superb Parrot, Eastern Bentwing Bat, Rosenberg's Goanna** and **Little Whip Snake**

  Generally, the proposal does not address, nor is it contrary to any PAs developed for these species (sourced May 2009 from DECC website). An exception is the requirement for most species to have

targeted surveys undertaken within areas of suitable habitat. The proposal site has been identified as suitable for all of these species. Surveys have been undertaken during the preparation of the Preliminary Constraints Analysis (nghenvironmental September 2008) and the final realignment route biodiversity investigation (this document). Targeted searches included bird and reptile census, anabat, call play back and spotlighting and stag watching.

- **Eastern False Pipistrelle**

  'Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments or other land assessment tools. (Medium priority)'

  No hollows are able to be retained and therefore, the proposal is not able to fully implement this PA. Nest boxes are being used to offset the loss of hollows.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Four Key Threatening Processes (DECC 2009) are relevant to this proposal:

1. **Bush Rock Removal.** Includes removal of rocky outcrops or rock within areas of native vegetation. Impacts of bush rock removal include loss or disturbance of native flora and fauna species habitat, including those described. Rocky outcrops occur on within the proposal site. Disturbed rocks would be relocated to adjacent areas where possible to ensure suitable micro-habitat resources are maintained.
2. **Clearing of native vegetation**. Impacts of clearing include fragmentation, destruction of habitat, riparian zone degradation, loss of leaf litter layer and increased habitat for invasive species. Clearing is defined as *"...the destruction of a sufficient proportion of one or more strata within a stand or stands of native vegetation ..."* (DECC 2009). The proposal would result in the removal of approximately 4ha of woodland in various levels of condition.
3. **Loss of hollow-bearing trees.** Around 174 NSW vertebrate species are known to use tree hollows for shelter and nesting, including those discussed. Generally hollow-nearing trees are in decline due to reasons including lack of recruitment and clearing. In particular, trees bearing large hollows are rare, and required by species discussed including Eastern False Pipistrelle. Generally hollow-bearing trees near riparian habitat are most valuable.

   There are two hollow bearing trees that would require removal as part of the proposal. It is considered that the removal of these hollow bearing trees may exacerbate this key threatening process, however their removal would be unlikely to significantly impact on those species
4. **Removal of dead wood and dead trees.** Removal of standing or fallen dead wood removes hollows as well as understorey litter. A small number of dead stags were evident within the proposal site. The proposed works may exacerbate this process during clearing.

Environment Protection and Biodiversity Conservation Act Principal Significant Impact Assessment

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species, listed at the Commonwealth level. To avoid repetition, any information contained within the seven-part test assessment of significance above, will not be included in this section. The following assessment assesses the significance of the likely impacts associated with the proposed works on:

Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var. *tricolor*)	**E EPBC**
Doubletail Buttercup (*Diuris aequalis*)	**E TSC, V EPBC**
Thick Lipped Spider Orchid (*Caladenia tessellata*)	**E TSC, V EPBC**

EPBC Act listed species and communities – Flora

Hoary Sunray (*Leucochrysum albicans* ssp *albicans* var. *tricolor*) **E EPBC**

a) Will the action lead to a long-term decrease in the size of a population of a species?

Hoary Sunray

The Hoary Sunray is patchily present along the length of the proposal, from single plants up to greater than fifty plants within some patches. The proposed works would impact on the Hoary Sunray, and the population could be substantially reduced, at least in the short term. However, a large patch of the Hoary Sunray estimated to contain >100 plants was observed in close proximity to the proposal though outside the impact area. Further, this species appears to require some degree of disturbance, or the presence of bare soil or gravel, for recruitment to occur. It is an annual or short-lived perennial, so the loss of individual plants is not highly significant, as long as a seed source remains in the vicinity. As with most grassland or woodland daisies, it does not have a long-lived soil seed bank but the presence of plants outside the impact area should ensure a seed source for recolonisation of the site. It has previously been observed to be quite common along the Kings Highway in this general area and has also been recorded within disturbed areas of the nearby Cuumbeun Nature Reserve, such as track edges and powerline easements (Cuumbeun Nature Reserve Plan of Management, NSW NPWS, 2006). Being tolerant of disturbance, it is often more abundant on road verges than in nearby less disturbed vegetation. It is likely that the population would recover from any temporary disturbance in this area due to the location of large patches of Hoary Sunray in the area which would not be impacted. Nevertheless, it would be preferable to avoid clearing or other disturbances where there are large patches, in order to ensure that a source of seed persists in this area. If mitigation measures described in this REF are adhered to, then the action is unlikely to lead to a long-term decrease in the size of the population of this species.

b) Will the action reduce the area of occupancy of the species?

The works could have this effect, at least temporarily, for the Hoary Sunray. Approximately 4ha would be impacted by the proposal, which contains patches of Hoary Sunray (see Figure 6-1). However large patches of this species were observed in close proximity to the proposal site which would remain outside of the impact area (see Figure 6-1). Further, on the nearby Captains Flat Road, this species has been observed to be present over a range of conditions on the road verge, including quite disturbed situations such as around culverts and in roadside drains (J. Miles, pers. obs.), so that it may eventually reclaim much of the area from which it is removed. Given its apparent abundance along the Kings Highway verges to the west of Queanbeyan, the scale of the reduction in area of occupancy would be low.

c) Will the action fragment and existing population into two or more populations?

The action would be unlikely to have the effect of fragmenting habitat for this species, which already has a highly fragmented natural distribution.

d) Will the action adversely affect habitat critical to the survival of a species?

The site is not habitat critical to the survival of this species, which has a wide distribution on the NSW Southern Tablelands (as well as in Victoria and Tasmania, where it is rarer). The Hoary Sunray is able to tolerate quite disturbed conditions on road verges, and is known to occur elsewhere in the vicinity, such as on the Captains Flat Road. The road verges of the Kings Highway at this location and the area located between Thurralilly Street and Regent Drive are not habitat critical to the survival of this species. The species is likely to be able to recolonise disturbed areas following construction.

e) Will the action disrupt the breeding cycle of a population?

The disturbance which would result from the proposal could reduce the total seed production in the immediate area if Hoary Sunray plants are removed during the flowering or seeding period. However, as this species seems to be advantaged by disturbance, the proposed works may enhance opportunities for recruitment, particularly if plants in surrounding areas are not removed and are protected from inadvertent damage and indirect impacts such as sedimentation. The collection of Hoary Sunray seed would mitigate against the breeding cycle disruption if it were used to revegetate the site.

f) Will the action modify, destroy, remove or isolate of decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal would result in the removal and disturbance of habitat for Hoary Sunray. However, evidence at the site of the proposal and surrounding areas suggests that disturbed areas are preferred by the Hoary Sunray. This is particularly apparent on the site adjacent to the intersection of Captains Flat Road and Kings Highway which has previously been used as a stockpile site. Hoary Sunray has recruited very freely into this area which has a high level of previous and continuing disturbance.

g) Will the action result in invasive species that are harmful to a critically endangered or endangered/vulnerable species becoming established in the endangered / critically endangered /vulnerable species habitat?

The proposal could have this impact, if seeds of invasive plants were introduced on machinery or vehicles, or enabled to spread from the existing infestations such as the noxious blackberry found in the drainage line onsite. Weeds are often opportunistic species and spread as a result of disturbance of the groundcover or soil on the site. A dense infestation of weeds could reduce the amount of bare ground available for native species such as Hoary Sunray. Mitigation measures to ensure that this does not occur have been described in this REF, see Section 6.5 and Section 7.

h) Will the action interfere with the recovery of the species?

There is no recovery plan in place for Hoary Sunray. Therefore the action would not interfere with the recovery of this species.

Doubletail Buttercup (*Diuris aequalis*) **E TSC, V EPBC**

and Thick Lipped Spider Orchid (*Caladenia tessellata*) **E TSC, V EPBC**

a) Will the action lead to a long-term decrease in the size of, reduce the area of occupancy of, or fragment an existing important population of a species?

Specific searches for both these species did not detect their presence on site. Important populations of these species are highly unlikely to occur on the site.

b) Will the action adversely affect habitat critical to the survival of a species?

A large proportion of the site has the potential to provide habitat for these species, however, this is not known as actual habitat. The total of 4 ha which would be impacted by the proposal is not considered important in the context of similar habitat in the locality. These species were not detected on site and as such the affected habitat is highly unlikely to be critical to the survival of these species.

c) Will the action disrupt the breeding cycle of an important population?

Specific searches for both these species did not detect their presence on site. Important populations of these species are highly unlikely to occur on the site.

d) Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Doubletail Buttercup and Thick Lipped Spider Orchid generally occur in small isolated populations. Further fragmentation resulting from this proposal is not likely to affect the likelihood of these species establishing on the site. As these species were not detected on site, it is highly unlikely that the loss of possible habitat resulting from the proposal will result in the isolation or decline of these species.

e) Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat?

The proposal could have this impact, if seeds of invasive plants were introduced on machinery or vehicles, or enabled to spread from the existing infestations such as the noxious blackberry found in the drainage line onsite. Weeds are often opportunistic species and spread as a result of disturbance of the groundcover or soil on the site. A dense infestation of weeds could reduce the amount of bare ground available for native species to establish. Mitigation measures to ensure that this does not occur have been described in this REF, see Section 6.5 and Section 7.

f) Will the action introduce disease that may cause the species to decline?

The proposal does have the potential to introduce diseases that may impact on flora species, however, as the Doubletail Buttercup and Thick Lipped Spider Orchid were not detected on site, there is no potential for disease to cause their decline.

g) Will the action interfere substantially with the recovery of the species?

There is no recovery plan in place for the Doubletail Buttercup or Thick Lipped Spider Orchid. Therefore the action would not interfere with the recovery of this species. The proposal is not contrary to the priority actions that have been developed for these species.

EPBC Act listed species and communities – Fauna

Regent Honeyeater (*Xanthomyza phrygia*) **E1 TSC, E EPBC**

a) Will the action lead to a long-term decrease in the size of a population of a species?

Regent Honeyeater

The Regent Honeyeater was not detected in the study area. Foraging may be affected due to loss and degradation of habitat. The works pose a low risk to the size of a population of Regent Honeyeaters due to mobility of species and sufficiently large areas of continuous woodland nearby.

b) Will the action reduce the area of occupancy of the species?

4ha of potential habitat would be removed. The habitat is marginal with respect to this species. The proposal is unlikely to have this effect.

c) Will the action fragment and existing population into two or more populations?

4ha of potential habitat would be removed. The proposal site is bounded to the west and south by residential developments and the City of Queanbeyan. To the north, the proposal site is currently separated from areas of rural residential development and woodland by the Kings Highway. To the east of the proposal site, a semi-continuous to continuous woodland area is present and continues into the Cuumbeun Nature Reserve. The proposal site is considered to represent that 'edge' of this woodland and as such the proposal would not act to fragment or isolate areas of habitat generally, or with respect to this species.

d) Will the action adversely affect habitat critical to the survival of a species?

Suitable habitat is reserved nearby (Cuumbeun Nature Reserve), and occurs adjacent to the proposal site (north). Therefore the habitat within the proposal site is considered of low importance.

e) Will the action disrupt the breeding cycle of a population?

No breeding habitat would be affected, nor would the breeding cycle of a population be affected.

f) Will the action modify, destroy, remove or isolate of decrease the availability or quality of habitat to the extent that the species is likely to decline?

Given the size, quality and location of the proposal site and area of habitat to be affected, the proposal is unlikely to have this effect.

g) Will the action result in invasive species that are harmful to a critically endangered or endangered/vulnerable species becoming established in the endangered / critically endangered /vulnerable species habitat?

Invasive species are present at the site of proposed work, though they are mostly confined to the areas of previous disturbance. Species that were evident during field surveys included African Lovegrass, St John's Wort, Blackberry and African Boxthorn (for full list of exotic species observed during field surveys, see Appendix B).

There are relatively few weeds in the woodland areas in close proximity to the works area. This REF includes measures to mitigate the spread of exotic species in the surrounding area, including washing of the machinery before entering the site and also before leaving the site (for more mitigation measures see Section 6.5). It is considered unlikely that the action would result in the establishment of invasive species to a level that would be harmful to this species or its habitat.

h) Will the action interfere with the recovery of the species?
The proposal does not address, nor is it contrary to any PAs developed for these species (sourced May 2009 from DECC website). An exception is the requirement for targeted surveys undertaken within areas of suitable habitat. The proposal site has been identified as suitable for this species. Surveys have been undertaken during the preparation of the Preliminary Constraints Analysis (nghenvironmental September 2008) and the final realignment route biodiversity investigation (this document).

EPBC Act listed species and communities - Migratory species

The Regent Honeyeater has been assessed in the above table. No other migratory species was assessed to have potential for impact.

Conclusion and recommendations of Assessments of Significance

The proposal would impact on an area of approximately 4ha, outside of the existing road surface. This would include vegetation in the area between Thurralilly Street and Regent Drive and in the existing road verges of Kings Highway and Regent Drive. The vegetation here predominately consists of disturbed eucalypt woodland with some native understorey including native grasses and cleared areas dominated by exotic species. Vegetation found here has been subject to previous disturbance due to past construction activities such as the construction of Kings Highway and other clearing activities most likely related to the residential dwellings in the area and the proximity to the city of Queanbeyan. The proposal would also require the removal of two hollow bearing trees. Due to the proximity of large areas of good quality habitat adjacent to the impact area, such as the Cuumbeun Nature Reserve and the high mobility of the species which would utilise this habitat feature, their removal was not considered likely to constitute a significant impact. The recommendation of this REF is that an RTA Environmental Officer or appropriately licensed wildlife carer be present during the removal of these trees. Also, that all vegetation removal is to be limited to that which is essential to the completion of the proposal.

Mitigation measures designed to minimise the potential impact on these threatened species have been described in Section 3.1.4 and Section 3.2.4.

With the implementation of these measures, these assessments have concluded that the proposed activity is 'unlikely' to have a 'significant effect' on the **Thick-lipped or Tessellated Spider Orchid, Doubletail Buttercup, Hoary Sunray, Speckled Warbler, Brown Treecreeper (eastern subspecies), Hooded Robin (south-eastern form), Diamond Firetail, Gang-gang Cockatoo, Regent Honeyeater, Eastern Bentwing Bat, Eastern False Pipistrelle, Rosenberg's Goanna** and **Little Whip Snake**.

APPENDIX G: ERT DATA BASE SEARCH

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

7 January 2009 13:29

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

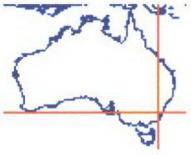
You may wish to print this report for reference before moving to other pages or websites.

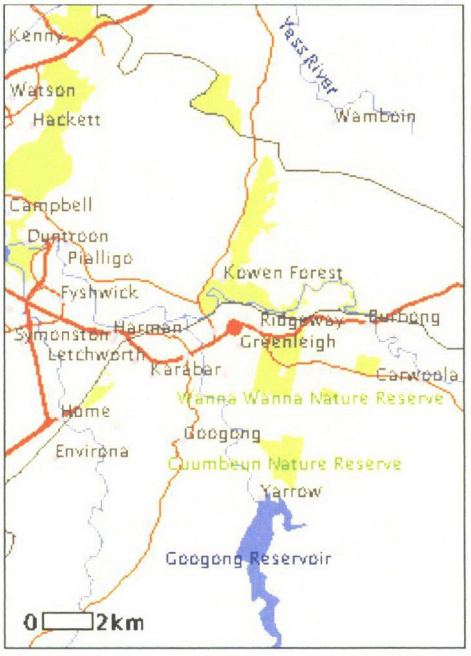
The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Search Type: Point

Buffer: 10 km

Coordinates: -35.34138,149.2536





This map may contain data which are
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Report Contents:

Summary
Details
- Matters of NES
- Other matters protected by the EPBC Act
- Extra Information

Caveat
Acknowledgments

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	1

Commonwealth Marine Areas:	None
Threatened Ecological Communities:	2
Threatened Species:	19
Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	6
Commonwealth Heritage Places:	2
Places on the RNE:	34
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Other Commonwealth Reserves:	None
Regional Forest Agreements:	2

Details

Matters of National Environmental Significance

Wetlands of International Significance [Dataset Information]
(Ramsar Sites)

FIVEBOUGH AND TUCKERBIL SWAMPS	Within same catchment as Ramsar site

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence

Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area
Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Lathamus discolor Swift Parrot	Endangered	Species or species habitat may occur within area
Polytelis swainsonii Superb Parrot	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria castanea Yellow-spotted Tree Frog, Yellow-spotted Bell Frog	Endangered	Species or species habitat likely to occur within area
Insects		
Synemon plana Golden Sun Moth	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Ray-finned fishes		
Maccullochella peelii peelii Murray Cod, Cod, Goodoo	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch	Endangered	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard	Vulnerable	Species or species habitat likely to occur within area
Delma impar Striped Legless Lizard	Vulnerable	Species or species habitat likely to occur within area
Tympanocryptis pinguicolla Grassland Earless Dragon	Endangered	Species or species habitat may occur within area
Plants		
Lepidium ginninderrense Ginninderra Peppercress	Vulnerable	Species or species habitat may occur within area
Leucochrysum albicans var. tricolor Hoary Sunray	Endangered	Species or species habitat likely to occur within area
Pomaderris pallida	Vulnerable	Species or species habitat likely to occur within area
Rutidosis leptorrhynchoides Button Wrinklewort	Endangered	Species or species habitat likely to occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea	Endangered	Species or species habitat likely to occur within area

Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly	Species or species habitat may occur within area

	marine area	
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Communications, Information Technology and the Arts - Australian Postal Corporation

Communications, Information Technology and the Arts - Telstra Corporation Limited

Defence

Defence - Defence Housing Authority

Transport and Regional Services - Airservices Australia

Unknown

Commonwealth Heritage Places [Dataset Information]

Redwood Plantation ACT

Three Wartime Bomb Dump Buildings ACT

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Air Disaster Memorial ACT

Boer War Memorial NSW

Bulls Cottage NSW

Byrnes Mill and Millhouse NSW

Christ Church Anglican Church Precinct NSW

Colverwell Cemetery ACT

Coroda NSW

Dog and Stile Inn (former) NSW

Duntroon Woolshed ACT

Glenrock NSW

Hibernia Lodge NSW

Hotel Queanbeyan NSW

Kent House NSW

Queanbeyan Public School NSW

Queanbeyan Railway Station Group NSW

Queanbeyan Railway Station NSW

Queanbeyan Swimming Pool and Surrounds NSW

Queanbeyan and District Historical Society Museum NSW

RAAF Base Fairbairn Group ACT

Redwood Plantation ACT

Rusten House NSW

School of Arts Building (former) NSW

St Benedicts Convent (former) and Kitchen Block NSW

St Gregorys Catholic Church NSW

Suspension Bridge NSW

The Oaks ACT

Three Wartime Bomb Dump Buildings ACT

Wartime Bomb Dump Buildings ACT

Indigenous

Queanbeyan Showground Reserve NSW

Natural

Goorooyarroo Nature Reserve (1978 boundary) NSW

Mount Jerrabomberra Area NSW

Poplars Rutidosis Site NSW

Rutidosis Site, Queanbeyan NSW

Woolshed Creek Geological Site ACT

Extra Information

State and Territory Reserves [Dataset Information]

Cuumbeun Nature Reserve, NSW

Goorooyarroo Nature Reserve, NSW

Molonglo Gorge Nature Reserve,

Queanbeyan Nature Reserve, NSW

Stony Creek Nature Reserve, NSW

Wanna Wanna Nature Reserve, NSW

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

ACT Cmwth Land Exclusion, Australian Capital Territory

Southern RFA, New South Wales

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations

under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia

- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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Appendix C

Local Aboriginal Land Council correspondence

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REPORT ON SITE SURVEY @ MR 51

KINGS HIGHWAY TO BUNGENDORE (HQJOC)

This report highlights the survey undertaken on Wednesday 5 March 2008, on behalf of the Ngunnawal Local Aboriginal Land Council for the Road and Traffic Authority.

The entire area was scanned for artifacts or remnants of artifacts, the vegetation was thick and limited visibility, the scan revealed no artifacts or any remnants of cultural significance.

A further section of the highway was scanned that did not reveal nay items of cultural significance.

Your sincerely

Geoff Murray

Ngunnawal Local Aboriginal Land Council

13 March 2008

Appendix D

Sediment and erosion risk assessment

Attachment 1a: Preliminary Erosion and Sedimentation Assessment

Required Actions

This assessment is to be completed in the concept design phase by the Project Development Manager (PDM) in consultation with the Senior Environment Officer (SEO) or Environmental Services Manager (ESM). If the answer to any of the questions is "Yes", a soil conservation consultant is to be engaged in the concept design phase to prepare an Erosion and Sedimentation Management Report and risk assessment.

Table 1a.1: Preliminary Erosion and Sedimentation Assessment

Project Name: Kings Highway MR51 HQJOC Upgrade Kingsway Deviation		**Project Location and Size:** Approximately 900 metres Thuralilly Street to West of Regent Drive, Queanbeyan
Estimated Timing / Duration of Works: Approx 13 months from Oct./Nov 2009 to Dec 2010		**Description of Works:** Construction of new deviation using road corridor
Triggers	**Yes / No**	**Comments to support decision**
1. Does the complexity or size of the project result in it being inherently high risk as ongoing installation and maintenance of controls will require extensive coordinated resources?	No	Comments:
2. Assess the erosion hazard of each catchment area to be disturbed for the proposed project using Attachment 1b. Are any of the proposed construction areas defined as "High Erosion Hazard"?	No	Comments:
3. Are there known site constraints that limit the implementation of appropriate erosion and sedimentation control measures? For example (but not limited to): • Is there sufficient land available for installation of sedimentation controls such as basins?	No	Comments: Construction is constrained by the road corridor. The road corridor is a steep gully which forms a natural watercourse
4. Is there potential for sediment laden runoff to impact sensitive environments. Examples of sensitive environments include: • Listed wetland (SEPP14) • State and National Parks • Littoral Rainforest (SEPP 26) • Drinking water catchments	No	Comments:

Is the answer to any of the questions "Yes"?

Yes	
No	X

If "Yes", a soil conservation consultant is to be engaged in the concept design phase to prepare an Erosion and Sedimentation Management Report (model brief at Attachment 2).

If "No", include this assessment in the environmental impact assessment.

Assessment prepared by Project Development Manager:	Assessment reviewed by SEO or ESM:
SIGNATURE: A. Berry	SIGNATURE: Julian Watson
DATE: 22.7.09	DATE: 22-7-2009

Attachment 1b: Erosion Hazard Assessment

The following assessment methodology is derived from Blue Book 1 - *"Managing Urban Stormwater – Soils and Construction", Landcom, 2004.*

The potential erosion hazard of each catchment to be disturbed can be simply determined using Figure 1b.1 below, based on:

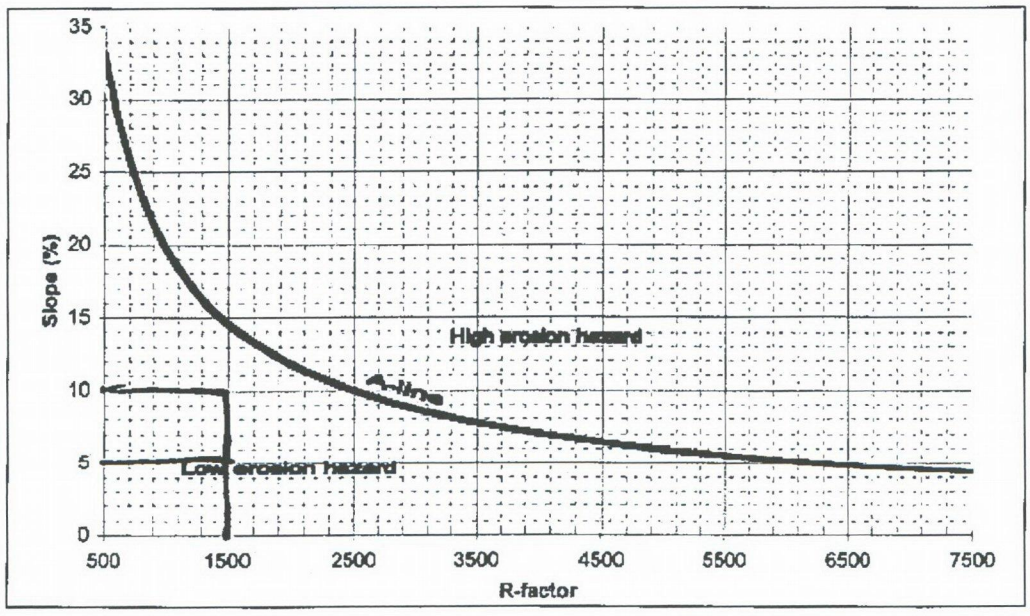
1. The R-factor is a measure of rainfall erosivity that relates to the project's geographical location. (Refer to maps within Appendix B of the Blue Book). The Blue Book, including appendix B, is available on the RTA intranet site at:

   http://home.rta.nsw.gov.au/org/ceo/envb/documents/managingurbanstormwater.pdf

2. The Slope (%) is the typical upper slope gradient of the site landform. If proposed earthworks are likely to increase upper slope gradients compared to the existing topography, then the higher slope gradient should be used.

Sites below the A line of Figure 2 have low potential erosion hazard and sites above the A line have high erosion hazard.

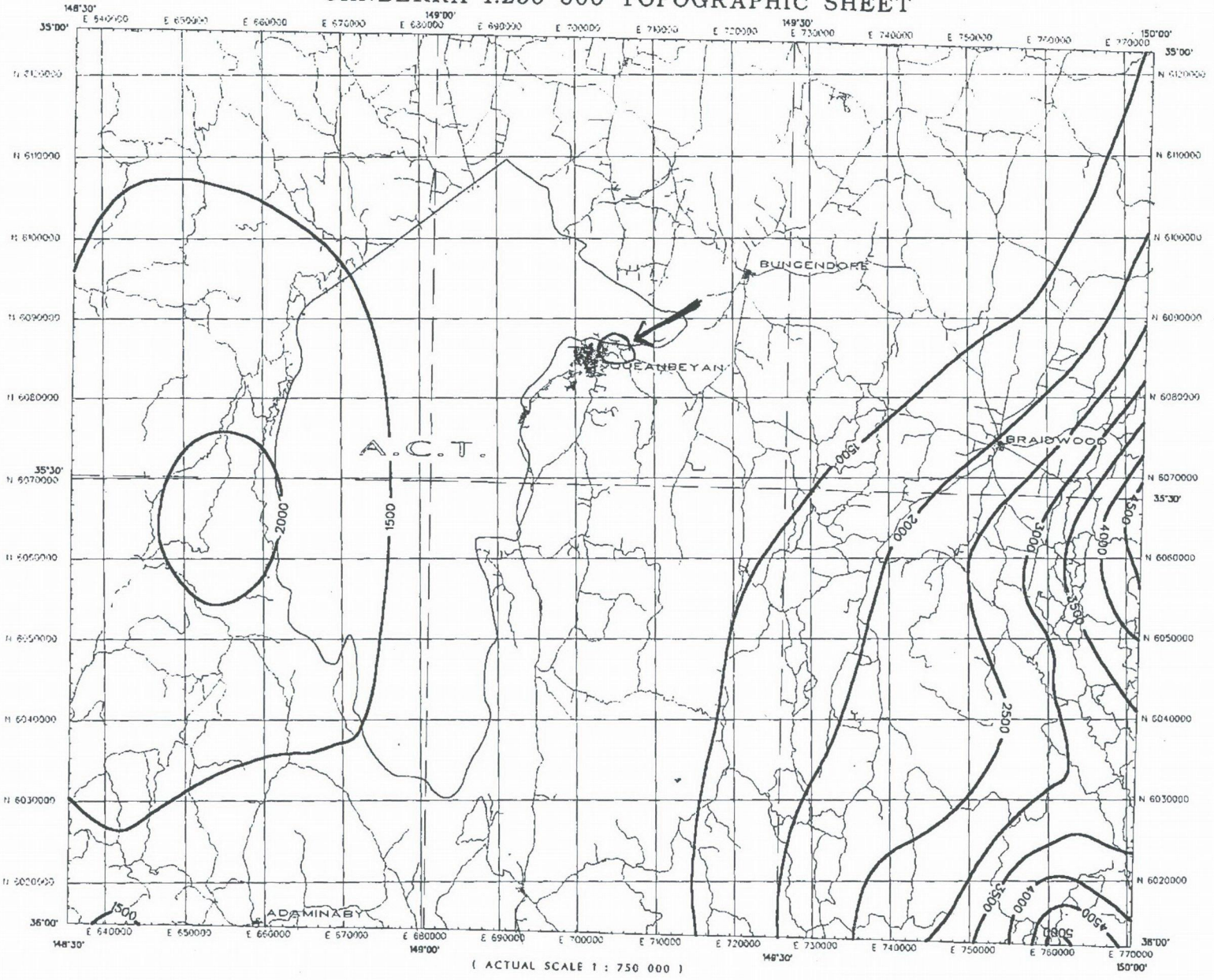
Figure 1b.1: Assessment of potential erosion hazard (reference: *Managing Urban Stormwater – Soils and Construction, Landcom, 2004*)



Site slope 5% - 10% range

R-factor < 1500

RAINFALL EROSIVITY OF THE CANBERRA 1:250 000 TOPOGRAPHIC SHEET



(ACTUAL SCALE 1 : 750 000)

Appendix E

Statement of heritage impact

Statement of Heritage Impact

OLD GOULBURN ROAD

KINGS HIGHWAY REALIGNMENT

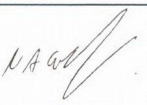
ngh heritage

www.ngh-heritage.com.au

Cover Photos: The western and eastern ends of the old Goulburn Road, near Queanbeyan, NSW

Document Verification

Job title	Kings Highway Realignment Heritage Impact Statement

Document Title		Heritage Impact Statement					
File Location		\\Server\NGH-Active\Projects\RTA\Kings Highway Realignment/Heritage Impact					
Vers.	Date	Prepared by Glenn Shaw		Checked by: Nick Graham-Higgs		Approved by: Nick Graham-Higgs	
Draft	1 June 2009	Sign.		Sign.		Sign.	
Final	July	Sign.		Sign.		Sign.	

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1 INTRODUCTION

1.1 BACKGROUND

nghheritage were commissioned to prepare a Statement of Heritage Impact (SHI) relating to proposed works to the Kings Highway, near Queanbeyan, NSW.

The Roads and Traffic Authority of NSW (RTA) proposes to realign the Kings Highway (MR51) from Thurralilly Street, Queanbeyan, to approximately 380 metres east of Regent Drive. The realignment would remove a sub-standard curve (constructed in the 1930s) and provide overtaking opportunities for an expected increased traffic volume. The proposal would incorporate three 3.5 m wide lanes, including an overtaking lane for eastbound traffic. Existing intersections would remain in their current locations. Two additional intersections would be provided for homes to the north west and south east of the realignment. The proposal would involve bulk earthworks including the construction of four cuts and four fills along the realignment route. Additionally, the proposal would require a large amount of fill material to be imported to the proposal site during construction.

A Review of Environmental Factors (REF) has been prepared concurrently with this SHI by **ngh**environmental on behalf of the RTA Southern Branch. The purpose of the REF is to describe the proposal, document the likely impacts of the proposal on the environment, and detail mitigation measures to be implemented.

This SHI is required to assess the impacts of the proposal on an old road alignment at Bungendore Hill. The old road alignment (known locally as the old 'Goulburn Road') was identified following a site inspection and additional research. This road is considered to be of potential heritage significance being one of the earliest roads between Goulburn and the Queanbeyan/ACT region.

The SHI assesses aspects of the heritage significance of the old road alignment and assesses any impact on the site of the old road, and if those impacts are acceptable. The assessment follows the guidelines set out by the NSW Heritage Branch (Department of Planning) publication *Statements of Heritage Impact* and the principles and guidelines of the Australia ICOMOS *Burra Charter*. The Burra Charter sets the standard of practice for providing advice or making decisions about, or undertaking works at places of heritage or cultural significance, including owners, managers and custodians (ICOMOS 1999). All Australian states have adopted the Charter as the basis for the conservation assessment and management of heritage places in Australia.

A site inspection was carried out by **ngh**heritage on May 25th 2009 in order to determine the physical attributes of the site.

1.2 LOCATION

The proposal site is located in Larmer, a suburb on the north eastern outskirts of Queanbeyan NSW, (Fig. 1.1) at Bungendore Hill, the location of the earlier road alignment (Fig 1.2) of the Goulburn Road (via Bungendore and Tarago).

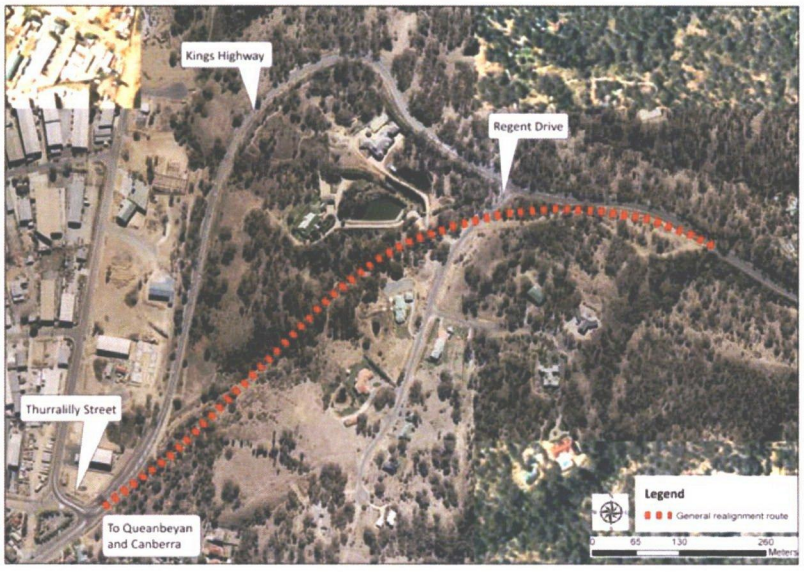

Figure 1.1 Proposed realignment route for the Kings Highway on the outskirts of Queanbeyan

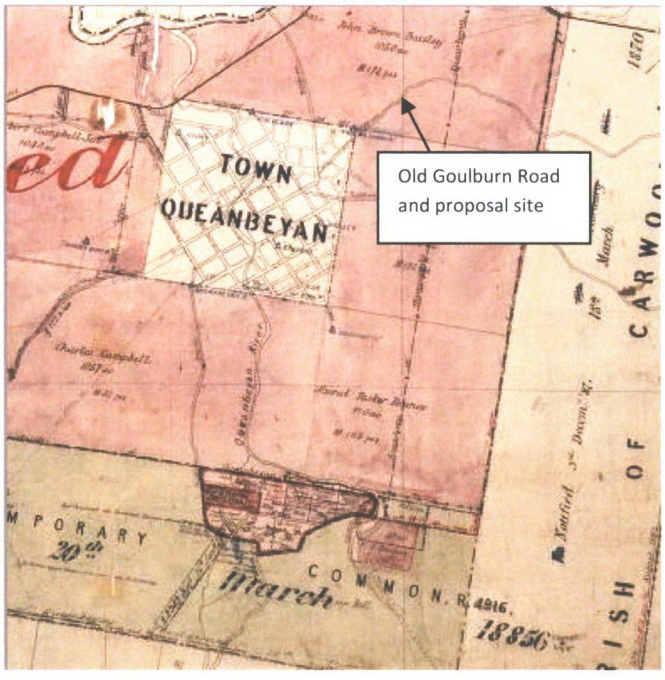

Figure 1.2. Parish map showing original route of the Queanbeyan – Goulburn Road c.1881. Subsequent Parish maps into the 1900s also show the same alignment until the early 1930s.

(Dept. of Lands, NSW)

1.3 REPORT STRUCTURE

This report:

- outlines the background of the current study/proposal and discusses issues such as statutory heritage listings and requirements (Section 1)
- provides a contextual framework in terms of an historical overview of the area (Section 2)
- identifies and describes the present physical overview of the heritage items and potential heritage items in the area of investigation (Section 3)
- provides a description and evaluates the significance of affected items (Section 4)
- assesses the potential impacts from the proposal (Section 5), and
- makes recommendations regarding the items in regard to those impacts (Section 6).

1.4 HERITAGE LISTINGS & STATUTORY CONSIDERATIONS

Places of heritage value can be subject to different levels of recognition and protection. This protection (at local, State and Commonwealth levels) includes specific measures for the protection of heritage items. The text below provides a summary of the legislative framework at each level of government.

1.4.1 NSW Heritage Act

The NSW *Heritage Act 1977* is a statutory tool designed to conserve the cultural heritage of NSW and used to regulate development impacts on the state's heritage assets. Administered by the NSW Heritage Office, the Act details the statutory requirements for protecting historic buildings and places and includes *any place, building, work, relic, movable object, which may be of historic, scientific, cultural, social, archaeological, natural or aesthetic value.*

When items are listed on the State Heritage Register (SHR), applications to carry out works on those items need to be made to the Heritage Council under Section 60 of the Act. A search of the study area and surrounds indicates that no items in the vicinity of the proposed works to the Princes Highway are included on the SHR, therefore no Section 60 applications are required.

State agencies in NSW are also required to keep a register of heritage places under their management under Section 170 of the Act. The s.170 registers are also held in the NSW Heritage Branch's State Heritage Inventory (SHI), an electronic database of statutory listed heritage items in NSW protected by heritage schedules of Local Environmental Plans (LEP's), Regional Environmental Plans (REP's) and State agencies. The old Goulburn Road alignment within the proposal site is *not* listed under s.170 of the Act.

1.4.2 Local Planning Instruments

The *Environmental Planning & Assessment Act 1979* (EP&A Act) controls land use planning in NSW. The planning system established by the EP&A Act includes Local Environment Plans (LEPs) and other provisions relating to development control.

The proposal site is located within land currently zoned 9 (a) *Road A – proposed roads* under the Queanbeyan Local Environment Plan 1998. This zoning provides for the construction of roads into the future. Option 3 would not require the acquisition of any private land but would require the acquisition of a small parcel of public land managed by QCC.

The old road alignment is *not* listed as a heritage item within the QCC LEP, therefore Council consent is *not* required.

1.4.3 State Environment Planning Policy (Infrastructure)

Division 17 of State Environment Planning (Infrastructure) 2007 (ISEPP) allows public authorities to undertake road works on any land without Council consent. In particular, Clause 94(1) states that:

> *Development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land.*

Therefore, pursuant to statutory requirements the proposed works are normally permissible without Council consent. However, Clause 14 of this SEPP relates to development carried out by a public authority with potential to impact local heritage items. This applies to development carried out by, or on behalf of a public authority if the proposal:

(a) is likely to have an impact that is ***not*** *minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area, and*

(b) is development that this Policy provides may be carried out without consent.

The RTA must therefore consider Clause 14 which also states that:

A public authority, or a person acting on behalf of a public authority, must not carry out development to which this section applies unless the authority or the person has:

(a) had an assessment of the impact prepared, and

(b) given written notice of the intention to carry out the development, with a copy of the assessment, to the council for the area in which the heritage item or heritage conservation area (or the relevant part of such an area) is located, and

(c) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given."

Consultation is not needed with Council under this clause of ISEPP as there would be no impact to heritage items listed on the LEP.

1.4.4 Environment Protection & Biodiversity Act (Commonwealth)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) enhances the management and protection of Australia's heritage places. Any action that is likely to have a significant impact on the matters of National Environmental Significance (NES) protected under the EPBC Act must be referred to the Commonwealth Environment Minister for further consideration.

The Australian Heritage Database (AHD) includes the National & Commonwealth Heritage Lists, which include the natural, historic and indigenous places that are of outstanding national heritage value to the nation.

There are no items listed in the area on the National or Commonwealth Heritage Lists of relevance to the proposal.

There are no items above are listed in the Register of the National Estate (RNE) kept under the *Australian Heritage Council Act 2003* (and included on the AHD). The RNE does not, however, place any legal constraints or controls on the actions of state or local governments.

2 HISTORICAL OVERVIEW

2.1 QUEANBEYAN AREA

After the founding of the colony a rush to take up pastoral lands around Sydney and its environs forced latecomers to turn their attention inland past the mountainous ranges to more isolated lands beyond. By the 1820s settler's tracks led to the small village of Goulburn, Lake George and the eastern hills of the Southern Tablelands (Lea-Scarlett 1970). One of those early tracks is likely to have become the road that departed the Hume Highway at Goulburn going via Tarago before reaching Bungendore and then Queanbeyan.

On 8 December 1820, an exploration party while searching for the Murrumbidgee River came upon two small streams flowing from the hills to form a single river winding through a valley at the eastern end of the Limestone Plains. This site near Queanbeyan was to become a halting place for travellers crossing to the Monaro (QTC 1982). The fact that the Limestone Plains were comparatively close to Sydney meant that there was competition to acquire land in the area or to obtain title to land occupied without authority, and before 1830 large estates were making their appearance and township sites had been reserved by the Government at various locations, including Queanbeyan (Lea-Scarlett 1970).

By 1828, ex-convict, Timothy Beard, who was known as an Innkeeper from Campbelltown, had a squattage called 'Quinbean' on the Molonglo River. Beard was credited with having the first settlement close to the present site of Queanbeyan, though his occupancy was not legal (QTC 1982). Old maps of 1833 show no less than twelve stations around the Molonglo, Gundaroo, Lake George and Bungendore areas.

Surveyor Robert Hoddle's map of February 1833 shows the site of Timothy Beard's station huts, which had by then, become part of Lot 4 County of Murray, parish unknown. 'Queebeeann', or 'Queenbeearm', as it was written on the Grant of Land, was on the south bank of the Molonglo River, and is the northeast corner of the property (MC & BP 2001). The original huts at 'Queenbeeann' are described by Cross (1985), as being made from bark. These buildings were located adjacent to the river and approximately a mile from the road that runs from Maneroo to the Limestone Plains.

One of the largest of the early estates in the region was Duntroon (originally Pialigo), the property of Robert Campbell, a prosperous Sydney merchant; and Jerrabomberra which was owned by Campbell's brother-in-law John Palmer. During the 1830s all large tracts of land remaining in the district were taken up, resulting in the formation of Woden, Yarralumla and Lanyon (Lea-Scarlett 1970). An early Inn of the area, the 'Elmsall' was opened in 1838 by William Hunt and Joseph Kaye in the house now known as 'The Oaks' on Oaks Estate (now part of the ACT).

By 1841 there were three brick buildings and seven wooden buildings in Queanbeyan. There were 372 residents in 1851 and 526 in 1861 by which time gold was being discovered in many places. 1851 saw the discovery of gold traces in the area; lead and silver mines flourished briefly. Bushrangers were harassment to settlers: John Tennant, Jacky Jacky, Frank Gardiner, Ben Hall were among the

more notorious who worked the area (Lea-Scarlett 1970). Monaro Street became the main thoroughfare, lined with buildings including the new court house, three large stores and two hotels. Another six inns were doing business on the roads leading out of town. The diversity of Queanbeyan can be attributed to the people who lived there: descendents of the pioneers – convicts and squatters, publicans, farmers, shopkeepers, Irish, Scots and English – those displaced from labour camps in Europe, and people seeking a better life (Withycombe 1985).

During the 1860s communications were improved considerably by the extension of the telegraph line from Braidwood to Queanbeyan (1864) and the approach of the railway which reached Goulburn in 1869. When the railway extension past Goulburn commenced, the line was directed to Yass, forty miles from Queanbeyan, and after many years of campaigning until 1881, the Government extended a line from Goulburn to Cooma via Queanbeyan. The first official train reached Bungendore in March 1885, but difficulties with bridge construction delayed the opening of the section to Queanbeyan until 1887 (Lea-Scarlett 1970).

The incorporation of the town was presented to Government in February 1885 and Queanbeyan was proclaimed a municipality containing an area of 5,700 acres. When the centenary of proclamation of the town occurred in 1938 it was officially marked by a week of celebrations in October, during which the memorial of the famous wheat experimentalist, William Farrer was held (Lea-Scarlett 1970).

By far the most significant event in the first hundred years of the European settlement of the district was the separation on 1st January 1911 of the Federal Capital Territory on which construction of the National Capital, Canberra, had commenced. Although Parliament did not move to Canberra until 1927 the many works undertaken at Canberra brought a new life to Queanbeyan, a result of new opportunities for employment and the stimulation of business and housing development (Lea-Scarlett 1970). Benefits resulting from further expansion of Canberra in the 1920s included electricity (1920) and water (1926).

The outbreak of the second world war, while depriving the town of many residents who joined the services, boosted business and created a great need for accommodation (Lea-Scarlett 1970). Further while the transfer of Government departments from Melbourne to Canberra was incomplete, there were many women and children voluntarily evacuated from Sydney as well as public servants, servicemen and their families seeking accommodation close to the still tiny capital (Lea-Scarlett 1970).

2.2 ROADBUILDING IN THE AREA

2.2.1 Overview

Below is a brief history of three of the main roads in the area. Information on the Gunning to Queanbeyan Road and the proposed new Federal Highway is detailed, in addition to the Goulburn to Queanbeyan Road, which incorporates the 1.2km section of road under assessment in this SHI. Both of these roads share a history of being the early transport routes to and from Queanbeyan and the National Capital.

During 1926 the Commonwealth directed the NSW Main Roads Board (MRB) to the need for improving suitable road access between Sydney and Canberra. The transfer of the seat of Government from Melbourne to Canberra in 1927, and the works being undertaken within the Federal Territory by the Federal Capital Commission (FCC) in preparation for the transfer, made it essential that the operations of the FCC and the NSW MRB in relation to roads be coordinated.

Prior to the Federal Highway being constructed, there were two existing roads from the north (see below and Figure 2.3): one leaving the Hume Highway at Goulburn; the other leaving the Hume Highway at Gunning (MRB 1930).

2.2.2 Goulburn – Queanbeyan Road

The Goulburn to Queanbeyan Road via Tarago and Bungendore was the main route in general use, providing the main link to and from Goulburn, and pending the opening of the Federal Highway, was still functioning in that respect. The road followed the railway between Goulburn and Queanbeyan/Canberra on the eastern side of Lake George. The road within the proposal area appears to have existed since the 1820s during the first appearance of settlers to the district (MRB 1930). After traversing gentle country from Goulburn adjacent to the Mulwaree Creek as far as Tarago, the road climbs the Great Dividing Range (which forms the eastern watershed of Lake George). The road then passes at a point some seven miles north Bungendore (refer Figure 2.3).

As one travelled south along the road from near Bungendore the road passed through more difficult terrain. The road traverses the Cullerin Range, which is the western watershed of Lake George, at the boundary of the ACT, midway between Bungendure and Queanbeyan. From here it passed over the Molonglo River in the ACT near Burbong railway siding, re-entering New South Wales to negotiate more hills (MRB 1930). This difficult section of the route described by MRB (1930) included the section of original road alignment (within the current proposal area) that left Queanbeyan to traverse Bungendore Hill (Fig 2.1). The distance between Goulburn and Canberra by this route was sixty seven miles.

The Goulburn-Queanbeyan road fell into disrepair from May 1927. The Canberra Times (1928b) reported that:

> *...nearly £10,000 was spent by the Mulwaree shire in putting the road in first-class order from Goulburn to Tarago up to 1928. Through inattention, this section is fast relapsing to its former state, and motorists coming through report very rough rides. One motorist, on Monday, found on arrival at Bungendore that his numberplate, tail light and bracket had been snapped off by the jolting caused by ruts and holes in the road.*

Later in 1928, the Queanbeyan Progress and Defence Association proposed a deviation in the original road to Goulburn in 1928, in order to avoid the Bungendore and Burbong Hills.

Figure 2.1. Cobb and Co. Coach travelling on the 'new' section of the road constructed in 1934 (National Archives of Australia, ACT)

In 1930, the main road to the coast from Queanbeyan (which included the Queanbeyan-Bungendore section of the Goulburn Road), was described as:

> *...the alignment and grade, except between Queanbeyan and Bungendore, where the Burbong and Bungendore Hills and a railway level crossing at Burbong have to be traversed, are generally satisfactory, and a total length of approximately seven miles of deviation or one seventh of the whole length of the road, is required to bring it up to standard. Elsewhere, the existing road can be suitably regraded where necessary (Canberra Times 1930).*

In 1934, thirty men who were registered at the Queanbeyan Labour Bureau were chosen for constructional work on the deviation to the Goulburn to Queanbeyan Road at Bungendore Hill (the proposal area). The men were chosen according the Government system of giving preference first to married returned soldiers and to men with families of more than six. The men engaged worked continuously until the completion of the project, which was estimated to take ten months. The deviation was described as being:

> *...located almost entirely within the municipality and commenced just at the other side of the town bridge. The new route followed the graded spur on the left of the present (old) road and rejoined it a few metres outside the municipal boundary. The deviation was surveyed over three years prior to 1934 (Canberra Times 1934).*

The Queanbeyan Municipal Council received a letter from Mr A W Hedges, MLA, stating that:

> *...he did not see his way clear to employ local men only. However, he did agree to send only 20 men from Sydney, and to engage a further 20 from Bungendore, in addition to the 30 already recruited from the Queanbeyan Labour Bureau (Canberra Times 1934c).*

Historic Parish maps from 1913 show the original road alignment of the old Goulburn Road prior to the 1934 deviation (Fig 2.2). When the new road alignment (the 1934 deviation) was completed, the Department of Main Roads (DMR; formerly MRB) informed the council that:

> *...the old Goulburn Road on Bungendore Hill would not be closed, and that it would be available for a stock route should the council so desire. On the motion of Ald. A. H. Collett the council resolved that 'the DMR be asked to have both ends of the road fenced so that it could be used as a stock route, and that signs be erected.'* (Canberra Times 1934b).

The old road was eventually closed, at least to traffic. However, the road alignment is still visible today for most of its length (with the exception of the junction of the more recent Regent Drive). Some locals who live near Regent Drive (refer Fig 1.1) currently access the track for walking to and from Queanbeyan.

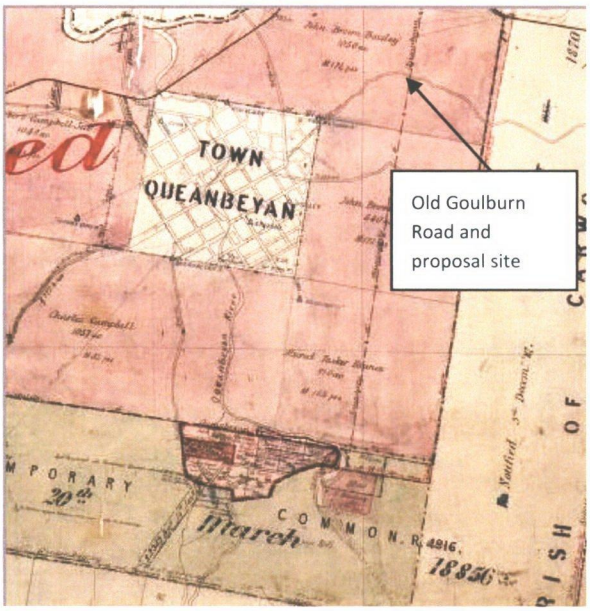

Figure 2.2. 1913 Parish map showing the original road alignment (arrow) from Queanbeyen to Goulburn via Bungendore (Dept of Lands, NSW)

2.2.3 Gunning – Queanbeyan Road

The second established route from the north was located on the western side of Lake George. It left the Hume Highway at Gunning, about thirty miles west of Goulburn, and passed through Gunderoo, Sutton and Queanbeyan (refer Fig 2.3). It reached Canberra at a total distance of eighty two miles from Goulburn (MRB 1930). Both this route and the Goulburn to Queanbeyan Road are important in the early road development in the region and were both considered as the main road to Canberra.

The country traversed on this route was mainly hilly. Mundoonen Range is crossed at a point approximately eight miles south of Gunning, after which the valley of the Yass River is followed closely for the remainder. If, instead of following the road to Queanbeyan from Sutton, and an

alternative direct course to Canberra adopted the distance between Goulburn and Canberra would have been reduced to seventy six miles. This option, however, never came into existence.

It was deemed apparent at the time and as can be seen on Figure 2.3 below, neither of these routes could be regarded as direct, and from what has been said it will be realised that the improvement of either to a standard comparable with the importance of the chief link between the two capitals would be very costly. An alternative was therefore required.

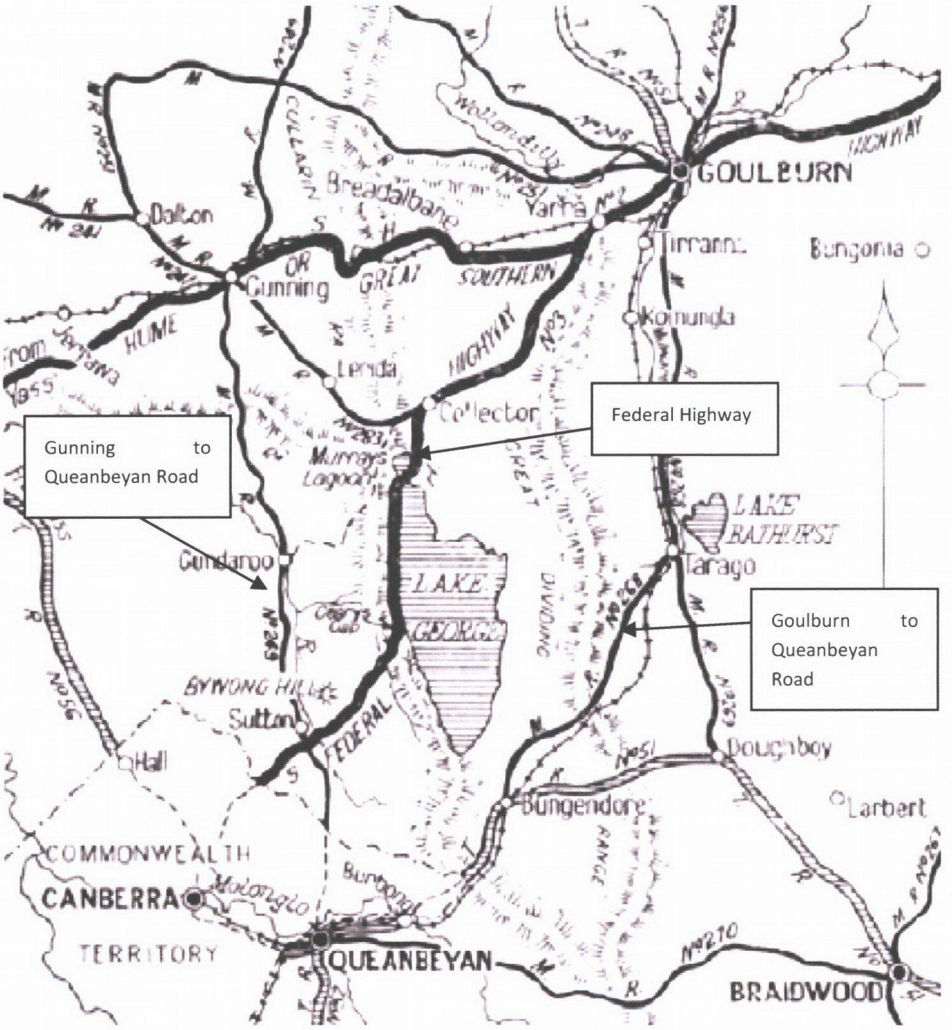

Figure 2.3 Map showing the extent of the two original routes from Goulburn and Gunning to Queanbeyan and Canberra, and the then proposed Federal Highway, located closer to Lake George (thicker dark line) (MRB 1930)

2.2.4 The Federal Highway

In the 1920s a route between Goulburn and Canberra was thoroughly examined to determine whether there was a more direct and less expensive route than the existing roads mentioned above. Such a route was identified and investigated by the MRB via Collector, skirting close to the western

shore of Lake George, and, for the greater part of the distance using existing public roads (refer Fig 2.3) (MRB 1930).

The Canberra Times reported in 1928 that:

> *'Work on the first section of the new main road from Goulburn to Canberra, via the Collector route, is now well in hand, and the contractor (Mr. AV. McDonald, of Canberra) has a big gang of men preparing the roadway. The starting point is about ten miles from Collector and eighteen miles from Bungendore, and the first section will traverse some fine scenic country round the northern end and western shore of Lake George' (Canberra Times May 1928).*

When completed, the new road was to displace the existing road via Tarago, Bungendore and Queanbeyan to Canberra, resulting in considerable reduction in distance travelled.

Leaving the Hume Highway just beyond the locality of Yarra, six miles west of Goulburn, the new road passed in a south-westerly direction to Collector, then turning to the south, passed between the drained head of Murray's Lagoon and the land-locked waters of Lake George. The proposed route for the new main road followed closely an old, but little used road located at the foot of the steep ridge forming the western watershed of the lake.

This route reached the Territory boundary at a point almost due north of Canberra. The distance from Goulburn to Canberra was to be just fifty five miles, considerably shorter than the two existing roads that were in use (MRB 1930).

Figure 2.4 Overlooking the Yass River near Sutton with formation work for the Federal Highway in progress (MRB 1930)

In September, 1927, the new road from Yarra, via Collector, Lake George, Geary's Gap, and passing south of Sutton to the Territory boundary was proclaimed a main road (Fig 2.5).

Figure 2.5. Section of the new Federal Highway adjacent to Lake George (MRB 1930)

Upon the reclassification of the main roads of the State in July 1928, the new road was proclaimed a State Highway under the name of the 'Federal Highway'. In common with the other State Highways, the MRB was now solely responsible for its construction and maintenance. Funds for a commencement of this work of construction were allotted from the Federal Aid Fund for the years 1927-28 and 1928-29, amounting to £77,000 (MRB 1930).

3 PHYSICAL OVERVIEW

3.1 NEW & OLD ROAD ALIGNMENT

A new section of road is proposed to be developed to replace the 1.5 kilometre section of the Kings Highway, the deviation that was constructed in 1934 (Fig 3.1).

This realignment would include three lanes, 3.5 metre in width with a 2.6 metre painted central median strip. Two lanes would be east bound; one lane would be west bound. The total length of the proposal is approximately 1.2 kilometres (refer Fig 1.1). There would be changes to the access arrangements for private properties. Two new intersections would be provided for homes in the north west and south east of the proposal site. Noise walls may be installed to minimise the impact of noise on adjacent residential properties.

Figure 3.1. Existing section of the Kings Highway that is to be re-aligned, near Queanbeyan

The proposed realignment would commence opposite the intersection of Thurralilly Street and the Kings Highway (Fig 3.2), travelling north-east to approximately 380 metres east of the Regent Drive intersection with the Kings Highway. The REF (**ngh**environmental 2009) includes detailed plans of the proposal (also see Figure 1.1 in this SHI).

At the Thurrilly Street intersection, a pull in lane is currently located on the eastbound side of the highway with a dedicated right turn lane for west bound traffic. The Highway then narrows into a two lane carriage way for approximately 750 metres in both the east and west bound direction. An east bound overtaking lane begins approximately 200 metres west of the Regent Drive intersection and continues in an easterly direction beyond the proposal site. There is a left and right turn pull in out lane for motorists using Regent Drive.

The proposed site for the re-alignment of the road includes the old track that was previously known as a section of the old 'Goulburn Road' – the original alignment from the early/mid 19th century. This road had not been utilised formally as a road since the creation of the deviation in 1934 and is currently in poor condition (Fig 3.3). There is no evidence of the road formation being elevated and appears to all be constructed on the natural grade, apart from two areas where cuttings are present. There is no evidence of blasting at the cuttings, however it appears some of the stone was used in the road formation. No other artefact material was located within the site area other than rubbish that has been dumped recently.

Figure 3.2. The proposal site adjacent to the Kings Highway at its western end with the old road alignment visible

Figure 3.3. Section of the old road alignment ('Goulburn Road') looking to the north east within the proposed site

The old Goulburn Road route ascends the hill on a relatively flat grade. An unnamed drainage line is located along the western edge of the track with woodland tree species also present. There is no evidence of historical plantings throughout the study area. There are two sections along the old road which appear to be historical road cuts whose purpose would have been to soften the grade of the old road over Bungendore Hill (Fig 3.4 and 3.5). The proposal site is mainly in disturbed woodland, modified by clearing for quarrying, road and residential construction. As mentioned, the illegal dumping of rubbish has also occurred along the road.

Figure 3.4. & 3.5. Sections of the old road alignment with original cuttings visible (looking north east)

Other than the historic road cuttings on the site and the road surface, no additional stone culverts or other historic infrastructure (including buildings) were identified during site visits to the area, from old maps or from database searches within the study area. This includes other sections of the old road and it is likely this is one of the only remaining sections of the old road in the area. It is possible

however, that there may be historic items along the route that could potentially be uncovered during works.

4 HERITAGE SIGNIFICANCE

4.1 INTRODUCTION

'Heritage (or cultural) significance' is a term used to describe the inherent cultural and historical value of an item. Significance may be contained within the fabric of a building or other place, in its setting and its relationship with other nearby items. The main aim in assessing significance is to produce a succinct statement of significance, which summarises an item's heritage values. The statement is the basis for policies and management structures that will affect the item's future (NSW HO 2001b). Further to this, an additional significance assessment has been completed for individual components of the bridge (Section 4.3).

The NSW State Heritage Branch recommends assessment of heritage items in a number of situations, which include:

- Making decisions about whether to retain an item
- Considering changes to an item
- Preparing a heritage study
- Preparing a conservation management plan
- Considering an item for listing on the State Heritage Register or on the schedule of heritage items in a local environmental plan, or
- Preparing a statement of environmental effects or a heritage impact statement as part of the development and building approval process.

4.2 ASSESSMENT OF SIGNIFICANCE

An item will be considered to be of state or local heritage significance if it meets one or more of the seven NSW heritage criteria as listed below.

a) an item is important in the course, or pattern, of NSW 's cultural or natural history

b) an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW 's cultural or natural history

c) an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW

d) an item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons

e) an item has the potential to yield information that will contribute to an understanding of NSW 's cultural and natural history

f) an item possesses uncommon, rare or endangered aspects of NSW 's cultural or natural history; and/or

g) an item is important in demonstrating the principal characteristics of a class of NSW 's cultural or natural places; or cultural or natural environments.

The old road alignment present within the study area (the old Goulburn Road) is assessed to be of significance against four of the seven criteria, as listed below.

Criterion (a) an item is important in the course, or pattern, of the cultural or natural history of the local area);

The section of the original 'Goulburn Road' from Queanbeyan to Goulburn via Bungendore and Tarago that would be impacted by the proposed Kings Highway realignment is of historic significance as a remnant of one of the first road alignments to be established from the areas south of Sydney, near Goulburn to the Queanbeyan and Canberra region. Although the road from Queanbeyan to Goulburn is still in use, the majority of the road is now sealed and the section at Bungendore Hill is the only known section, at least at the southern end, that remains unsealed.

Although not considered as significant as historic roads such as the Old North Road and the Old Windsor Road near Sydney, the small 1.2 kilometre section of the old Goulburn Road alignment of the study area is considered to be significant at the local level due to its historical significance in relation to the ongoing development of the road system in the region and NSW from the 1820s, particularly in respect to transport in the local area.

Criterion (e) an item has potential to yield information that will contribute to an understanding of the cultural or natural history of the local area;

The 1.2 kilometre unsealed section of road alignment at Bungendore Hill on the old Goulburn Road that would be impacted by the proposed Kings Highway realignment physically demonstrates the work patterns, skills and organisation of road work gangs.

Although currently in poor condition, the road may have been upgraded from when first constructed, and the road demonstrates the standards and practice of road engineering in the colony during the period of great road expansion of the late 1820s and 1830s.

As discussed in Section 3 no existing additional material or infrastructure appeared to be present within the section of the old road alignment, or adjoining the section of road. Therefore, in summary, the old alignment of the Queanbeyan-Goulburn Road is considered to have limited potential to yield information that may contribute to an understanding of the cultural history of the local area.

Criterion f) an item possesses uncommon, rare or endangered aspects of NSW 's cultural or natural history; and

Criterion g) an item is important in demonstrating the principal characteristics of a class of NSW 's cultural or natural places; or cultural or natural environments;

The 1.2 kilometre section of road is considered to be a rare survivor of transport links from the period before the growth of Canberra and is representative of the types of road-building technology that existed in NSW during the period of expansion in the colony in the early part of the 19th century.

4.3 SUMMARY: STATEMENT OF SIGNIFICANCE

Old Goulburn Road (Bungendore Hill section)

The section of the old Goulburn Road alignment at Bungendore Hill is assessed to be of local heritage significance for the following reasons, the:

- The road incorporates a section (albeit short) of one of the original road alignments to be developed in the region from Queanbeyan to Goulburn
- The road played an important role in the settlement of the region and the development of the Queanbeyen area
- The road provided an essential transport corridor to and from the Queanbeyan/Canberra area from the north. It has close historic links with the moving of people and goods from one place to another, and the systems for the provision of such movements
- The remaining historic road fabric, although in poor condition, demonstrates the methods of road construction and maintenance over a century, especially the two historic road cuttings of the site
- It is also a rare survivor of transport links from the period before the growth of Canberra and is representative of the types of road-building technology, and
- The road is part of the history and has direct links with a phase of road development to the south of Sydney in the 19th century.

5 IMPACT ASSESSMENT

5.1 THE PROPOSED DEVELOPMENT

The proposal would demolish the existing 1.2 kilometre section of road alignment on the old Goulburn Road as part of the proposed upgrade and re-alignment to this section of the Kings Highway, near Queanbeyan.

The preferred option would remove what is defined by the RTA as a substandard curve on the existing Kings Highway (the 1934 deviation to the north of the proposal site) and provide overtaking opportunities to increase efficiency.

Three options to improve the safety, efficiency and capacity of the proposal site were considered by the RTA. They include:

- The 'do nothing' approach. This option is assessed as not addressing the strategic objective to improve efficiency or capacity of the existing road, nor does it address the safety issues associated with the substandard curve.
- Increasing the width of the existing Kings Highway route between Thurralilly Street and Regent Drive would retain the substandard curve, considered a safety risk by the RTA. It is also constrained in the south by an industrial estate which limits proposed road widening in this area.
- Realignment of the Kings Highway between Thurralilly Street and Regent Drive. The preferred option that would improve the safety, efficiency and capacity of the Kings Highway and would remove the existing substandard curve. Furthermore, construction activities on the realignment route would not impede the existing traffic-flow on the Kings Highway.

5.2 COMPLIANCE WITH STATUTORY HERITAGE LISTINGS

The proposal would not conflict with any State or Commonwealth statutory heritage listings. The old road alignment is not listed on the RTA Heritage and Conservation Register; however as it is over 50 years old it is protected under the *Heritage Act*.

There are no other listings on the Australian Heritage Database, which includes the National and Commonwealth Heritage Lists, both protected under the Commonwealth *Environment Protection & Biodiversity Act*.

5.3 HERITAGE IMPACT

The following questions are presented in the NSW Heritage Manual document *Statements of Heritage Impact* to address proposals on heritage items which would result in the *Demolition or*

removal of the item (NSW SHO 1996). This determines whether the level of impact on the heritage significance of the site is acceptable.

Have all options for retention and adaptive re-use been explored

The option of retaining the section of the old road alignment is not considered viable, due to:

- The increased volume and loadings of modern traffic that use the Kings Highway, combined with the proposal objectives of improving the safety, efficiency and capacity of the road has made it necessary to realign the existing section of road. The only suitable alternative due to the topography of the area is to utilise the area that contains the section of the old Goulburn Road alignment
- The old road alignment has not been maintained or used for its original purpose since the deviation of the road in the 1930s and is currently in poor condition
- The relative heritage significance of all former road alignments in NSW should be considered. In this regard, the former old Goulburn Road alignment is considered to be of relatively low significance when compared to other road alignments from the 1820s to 1830s era (i.e. the Old North Road, Cox's Road and the Old Windsor Road)
- The old Goulburn Road alignment is not located in an area that is particularly appealing to visit, nor is it likely to attract people to it for any aesthetic value; however there is an option for the existing section of the Kings Highway to be scaled back and re-used as a walkway or cycle trail that could interpret both the old road and the 1930s deviation. This has been acknowledged by the RTA as an option for the existing road.

Can all of the significant elements of the heritage item be kept

The most significant element of the road is considered to be the two original road cuttings, as these demonstrate the methods of road construction and maintenance over almost two centuries. The cuttings and the overall site could at least be partially preserved through a full archival photographic record (refer Appendix A). The assessment of this section of the old Goulburn Road alignment does not identify or assess any part or element of the site to have considerable significance that demands their retention.

It is assessed the retention of the road alignment is no longer feasible due to a number of factors including:

- The increased volume and loadings of modern traffic that use the Princes Highway makes it necessary to construct a safer road alignment to cater for increased traffic on the road
- The two existing road cuttings from the early/mid 19th century are considered to be of some local significance, however due to the topography of the area and lack of other feasible alternatives for the new road alignment, these cuttings would be demolished
- No other significant elements are identified with the road infrastructure, such as stone culverts and bridges
- There is no feasible alternative for the location of the proposed new re-alignment of the Kings Highway.

Is demolition essential at this time

The demolition is considered necessary at this time due to:

- The proposed Kings Highway re-alignment would require the demolition of the former old Goulburn Road alignment that has been unused since the deviation for the existing 'new road' in 1934. Other options have been considered, but due to topographical constraints, the preferred option is considered necessary in relation tor the proposed re-alignment of the highway.
- As discussed above the old road is not considered suitable for other adaptive re-use.
- If the planned re-alignment of the Kings Highway was postponed, the continued safety issues of the existing road alignment would remain. This would impact on not only the local community, but visitors and commercial traffic that need to access the road to travel between Canberra, Queanbeyan to Bungendore and the South Coast.

6 CONCLUSION AND RECOMMENDATIONS

The proposal to re-align the existing Kings Highway to the section of old road alignment at Bungendore Hill (old Goulburn to Queanbeyan Road), which has local heritage significance, would not cause a significant impact on a heritage item. This assessment has been undertaken in accordance with the NSW *Heritage Act 1977,* and the *Environmental Planning and Assessment Act 1979.*

The following recommendations are therefore made for the proposed activity:

- An archival recording is undertaken for the existing old Goulburn Road alignment at Bungendore Hill. This should follow the guidelines for Items of Local Heritage Significance as outlined in the NSW Heritage Branch publication *How to Prepare Archival Records of Heritage Items* (Appendix A). The recording should pay particular attention to the old road cuttings from the 19th century, but cover the entire stretch of the old road that would be impacted, including landscape vistas as they exist within the site
- It is considered at this time that further archaeological investigation is unlikely to contribute valuable information. However, should any relics or items be uncovered within the proposal area after works commence, all works that may affect the find would immediately cease and the RTA Environment Branch (Heritage) should be contacted. If any sections of the road are uncovered, the Senior Environmental Specialist (Heritage) would be contacted. They would then be able to advise whether the Heritage Branch should be informed and when works in the area may recommence
- It is recommended that mapping be carried out along the line of the road within Queanbeyan LGA and recording any vestigial route information about construction as part of the above archival recording.

An additional option to above, if feasible, would be to preserve a small cross-section of the road or buried at a place that it could be retrieved if needed. This may also negate the need for any further archaeological investigation should any items be uncovered. However, the combination of an archival recording and mapping of the route is considered a better mitigation offset.

The alternative of using the existing Kings Highway alignment (the 1934 deviation) as a possible walkway/cycleway has been considered as an option by the RTA but would be subject to discussions with the community and relevant stakeholders including Queanbeyan City Council. This would provide a use for the existing section of highway, and also provide an opportunity to interpret the history of the area.

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APPENDIX A. ARCHIVAL RECORDINGS

ITEMS OF LOCAL HERITAGE SIGNIFICANCE

HERITAGE COUNCIL OF NEW SOUTH WALES

MINIMUM REQUIREMENTS FOR ARCHIVAL RECORDING

Title page with subject, author, client, date, copyright etc.

Statement of why the record was made.

Outline history of the item and associated sites, structures and people.

Statement of heritage significance of the items in accordance with the Burra Charter and the State Heritage Inventory.

Inventory of archival documents related to the item and their location (e.g. company records, original drawings and photographs), when available.

Location plan

Show relationship to surrounding geographical features, structures, roads etc. Include a north point.

A site plan or floor plan should show any movable items.

Base plans, drafted or hand-drawn.

Cross-referenced to photographs. Name the relevant features, structures and spaces. Show a north point.

Black and white photographic record

One set of 35 mm black and white negatives, labelled and cross-referenced to base plans and accompanied by informative catalogues and two copies of proof sheets. Images should include:

• views to and from the site (possibly from four compass points)

• views showing relationships to other relevant structures, landscape

features and movable items

• all external elevations

• views of all external and internal spaces (e.g. courtyards, rooms, roof

spaces etc.)

• external and internal details (e.g. joinery, construction joints, decorative

features, paving types etc.).

Selected prints to give an overall picture of the item may be required. They

should be mounted and labelled.

Colour slides

One set of slides mounted in archivally stable slide pockets, clearly labelled

and cross-referenced to base plans. Images should include:

- views to and from the site and/or the heritage item
- views and details of external and internal colour schemes as appropriate.

Selected colour prints may be required. They should be mounted and labelled.

Appendix F

Environmental noise impact assessment

HEGGIES

REPORT 40-1743

Revision 1

Kings Highway Realignment
Environmental Noise Impact Assessment

PREPARED FOR

nghenvironmental
Suite 1 / 216 Carp Street
BEGA NSW 2550

20 AUGUST 2009

HEGGIES PTY LTD
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Kings Highway Realignment

Environmental Noise Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
40-1743	Revision 1	20 August 2009	Jim Antonopoulos	Gustaf Reutersward	Gustaf Reutersward
40-1743	Revision 0	5 May 2009	Jim Antonopoulos	Gustaf Reutersward	Gustaf Reutersward

EXECUTIVE SUMMARY

A noise and vibration impact assessment has been carried out for the realignment of the Kings Highway between Thurralilly Street and The Ridgeway, Queanbeyan East.

This assessment is based on the Department of Environment and Climate Change's (DECC) *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA - May 1999), which represents the NSW Government's current policy on road traffic noise. Reference is also made to the *Environmental Noise Management Manual* (ENMM – RTA, December 2001) which was developed by the RTA, in consultation with the DECC.

The results in this report are an acoustical evaluation of the resultant impacts prior to input from the authorities or the community.

Operational Noise

Operational traffic noise predictions have been conducted for the relevant future scenarios as defined within the ECRTN and the results for all residential receivers in the three nominated Noise Catchment (NC) areas are provided in **Table 13** of this report.

In the southern area of the development (NC A), where the new realignment joins into the existing Kings Highway, noise levels to receivers fronting onto the Kings Highway realignment were found to be above the ECRTN base criteria for all future noise modelling scenarios, and acute (above 65 dBA day, 60 dBA night). The future noise levels at these receivers are primarily due to the traffic flow increases associated with the new defence facility opening in 2009. As these properties are accessed via the Kings Highway, roadside barriers cannot be implemented and only architectural (or at-dwelling) treatments can be considered.

Noise levels at receivers set-back from the existing Kings Highway (in the southern area NC A) comply with the ECRTN base criteria.

In the central areas (NC B and C), the appropriate base criteria are more stringent, as per the requirements for a new arterial road defined within the ECRTN. Predicted noise levels indicate an excess of up to 9 dBA at the two nearest receivers in this area. Options for noise control for this area have been provided and include;-

- Roadside noise barriers
- road surface treatments (Open Graded Asphalt), which can provide in the order of 3 dBA noise reduction
- at-dwelling architectural or barrier treatments.

Two conceptual roadside noise barrier options have been provided in this report for consideration by the RTA. The first option (3 m high barriers) provides up to 4 dBA noise reduction and is not sufficient to achieve the ECRTN base criteria alone, but could be considered in conjunction with other noise control measures. The second option (5 m high barriers) generally provides sufficient noise reduction to achieve the base criteria at all but one receiver (where there is still a 2 dBA excess). These two barrier options provide some guidance on the extent and height of barriers necessary to achieve the base criteria.

Given the small number of affected receivers, the use of roadside noise barriers would not be considered feasible under the ENMM, and at-dwelling / architectural treatments would provide a more feasible outcome for noise control on this project. Consultation with the RTA and community will provide further guidance on a preferred approach forward.

Construction Noise and Vibration

Construction noise levels are likely to exceed DECC guidelines during some periods of construction, particularly when works are being conducted immediately adjacent to dwellings.

Vibration impacts are generally anticipated to be minimal as there is likely to be at least a 50 m distance between vibration generating activities and the nearest dwellings.

A combination of selection of quietest available equipment and construction techniques and engineering controls in combination with environmental management and community consultation is recommended to minimise the construction noise and vibration impacts. It is recommended that a Construction Noise and Vibration Management Plan be prepared to assess the potential construction noise impacts in consideration of the proposed construction methodology and plant selection and to document procedures to control and minimise the impacts.

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1 INTRODUCTION

The Roads and Traffic Authority of NSW (RTA) has developed a concept design for the re-alignment of a section of the Kings Highway between Thurralilly Street and The Ridgeway, Queanbeyan.

The proposal is for a 1.2 km length road incorporating two 3.5 m wide east bound lanes and two 3.5 m wide west bound lanes with painted centre median strip.

Heggies Pty Ltd (Heggies) has been commissioned by **ngh**environmental to assess the potential road traffic and construction noise and vibration impacts for the proposed realignment of the Kings Highway described above.

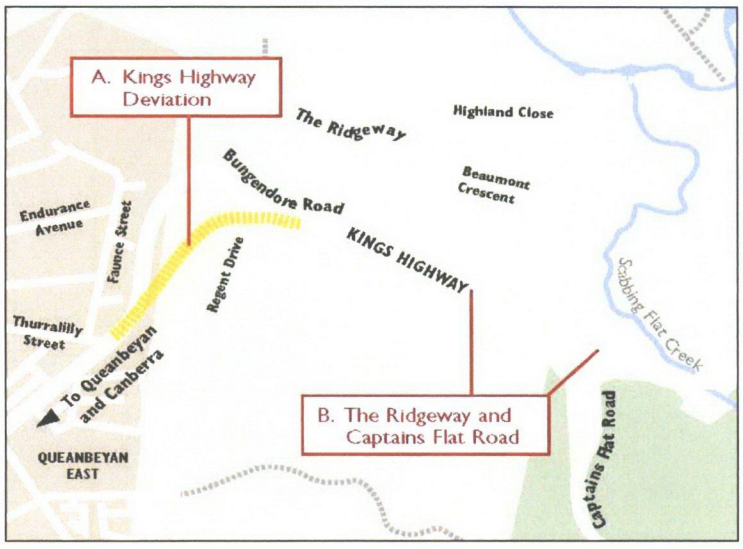
This assessment is based on the Department of Environment and Climate Change's (DECC) *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA - May 1999), which represents the NSW Government's current policy on road traffic noise. Reference is also made to the *Environmental Noise Management Manual* (ENMM – RTA, December 2001) which was developed by the RTA, in consultation with the DECC.

2 SITE DESCRIPTION AND NOISE CATCHMENT AREA

The Proposal is located on the Kings Highway (MR52) between Thurralilly Street and The Ridgeway, to the east of Queanbeyan (refer to **Figure 1**). Thuralilly Street is located on the eastern boundary of Queanbeyan, adjacent to the southern side of the Queanbeyan Industrial area. To the north of Thurralilly Street, the existing Kings Highway travels in a northerly direction for approximately 750 m, where there is a large sweeping right hand bend which directs the road in an easterly direction, approximately 300 m west of Regent Drive.

The realignment of Kings Highway would run in a north easterly direction from the existing intersection between Thurralilly Street and Kings Highway. The realignment would be situated in an existing road corridor known as Goulburn Road and would include a gentle right hand bend, rejoining with the existing Kings Highway surface at the intersection between Regent Drive and Kings Highway. The realignment would be located adjacent to a number of residential properties whose main access is off Regent Drive.

Figure 1 Proposed Kings Highway Deviation (Source: RTA)



Residential properties affected by the proposed alignment are located generally through the central corridor area (properties off Regent Drive) and also in the southern section of the realignment where there are properties currently fronting onto or near the current alignment of the Kings Highway.

The various areas of affected residences have been grouped into Noise Catchment (NC) areas being representative of areas with similar potential noise exposure from the realignment. A description of each area is as follows:

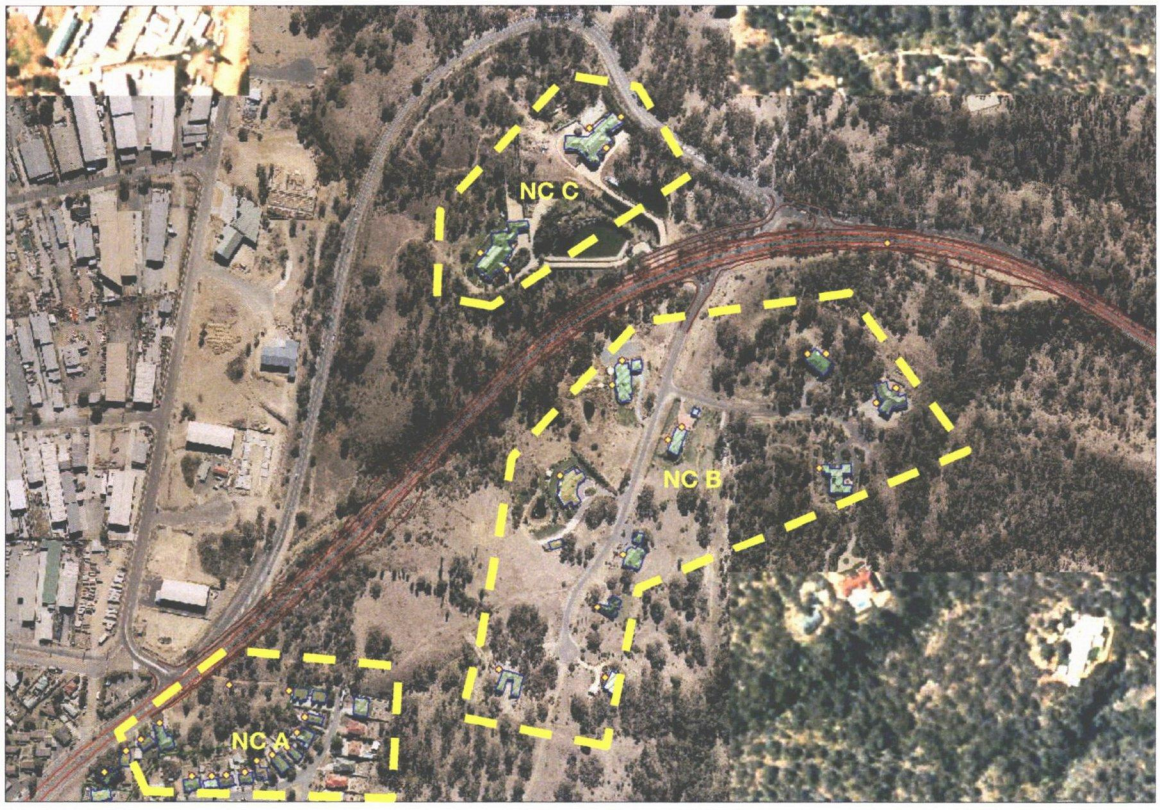
Noise Catchment A (NC A) – Area to south with two (2) properties directly fronting onto the realigned section of the Kings Highway (ie where it ties in with the existing road) and approximately another ten (10) properties setback one street from Kings Highway in Hybon Avenue and Elizabeth Crescent.

Noise Catchment B (NC B) – Central area east side, ten (10) residential properties 50 to 200 m from Kings Highway

Noise Catchment C (NC C) – Central area west side, two (2) nearest residential properties approximately within 80 to 120 m from the proposed alignment

Refer also to **Figure 2**

Figure 2 Proposed Alignment and Noise Catchment Areas



3 NOISE MONITORING

3.1 Noise Monitoring Locations

Environmental noise monitoring was conducted at representative noise-sensitive locations in order to:

- Characterise the existing noise environment adjacent to the study area;
- Establish the noise levels upon which to base the construction and operational noise emission objectives; and
- Provide data to assist in verification of the noise modelling.

Table 1 lists the selected locations in tabular form. Refer also to **Appendix C** which shows the positions on a locality aerial photograph.

Table 1 Ambient Noise Monitoring Locations

Location No	Location	Notes
BG1	42 Bungendore Road (Kings Highway), Queanbeyan East	Single-storey residence in NC A fronting Bungendore Road (Kings Highway). Residence exposed to existing road and will be adjacent 'realignment' section of new road. Microphone approximately 12 m from nearest lane
BG2	2 Hill Lane, Queanbeyan East	Residence approximately 130 m east of existing Kings Highway alignment. Indicative of residences in central area (NC B and C) adjacent to new alignment. Microphone on west façade of property.

The noise survey utilising unattended noise monitors was conducted over a period of seven days, between Tuesday 27 January 2009 and Tuesday 3 February 2009. Noise monitoring was carried out 1 m from the facade of the subject building, in accordance with the ECRTN.

The results of the unattended noise logging were utilised to determine the various relevant prevailing road traffic noise descriptors. Based on the noise logger results, L_{A90} background noise levels were also estimated at residences located in the vicinity of the construction works, in order to establish the construction noise goals.

Information from the Bureau of Meteorology for the period of the noise survey was used to assist in identifying conditions that could have had an adverse effect on the measured noise levels, such as rainy periods, etc. Potentially affected data during adverse weather conditions was excluded from the analysis, as was any other data that appeared to be due to extraneous noise sources.

3.2 Noise Monitoring Instrumentation

All items of acoustic instrumentation employed during the noise monitoring surveys were designed to comply with the requirements of AS IEC 61672.1-2004: "Electroacoustics-Sound level meters-Specifications and carried appropriate and current NATA (or manufacturer) calibration certificates.

Equipment for the continuous unattended noise surveys comprised of Acoustic Research Laboratories (ARL) Environmental Noise Loggers Type EL 316 fitted with microphone windshields. Calibration of the loggers was checked prior to and following measurements using a Brüel & Kjær Electronic Calibrator Type 4231. Drift in calibration did not exceed ±0.5 dBA.

Unattended noise loggers were programmed to continuously monitor the ambient noise levels, recording relevant road traffic and environmental statistical noise descriptors at the end of each 15 minute period within the duration of the noise survey.

3.3 Ambient Noise Monitoring Results

The results of the ambient noise surveys are presented in tabular form in **Table 2** and graphically in **Appendix A**.

The noise surveys are intended to only measure the noise from the existing nearby road network. Therefore, the data was processed and some individual extraneous readings excluded when taking into account the effects of:

- Weather conditions.
- Uncharacteristic changes in the noise indices which might be attributed to noise from extraneous local noise sources such as lawn mowers, air-conditioners, owner's vehicle, etc, primarily indicated by sudden and uncharacteristic variations of the noise descriptors.

Table 2 presents ambient L_{Aeq} noise data relevant to the assessment of operational road traffic noise.

Table 2 Summary of Ambient L_{Aeq} Unattended Noise Survey Results

Location Number	Address	Road Traffic Noise Indices – dBA	
		Daytime (7am to 10pm)	Night-time (10pm to 7am)
		$L_{Aeq(15hour)}$	$L_{Aeq(9hour)}$
BG1	42 Bungendore Road	65	60
BG2	2 Hill Lane	50	45

Table 3 presents the rating background level (RBL) for each of the noise monitoring locations, which is used in determining the appropriate construction noise criterion.

Table 3 Summary of Ambient L_{A90} Unattended Noise Survey Results

Location Number	Address	Construction Noise Indices: Ambient L_{A90} (RBL)		
		DECC Preferred Construction Hours [1]	Evening Period [2]	Night-time Period [3]
BG1	42 Bungendore Road	46	40	36
BG2	2 Hill Lane	41	37	31

Note 1 DECC standard construction hours: 7.00 am to 6.00 pm Monday to Friday, 7.00 am to 1.00 pm (if inaudible at residential premises) otherwise 8.00 am to 1.00 pm on Saturdays and no work on Sundays or Public Holidays.

Note 2 Evening hours: 6.00 pm to 10.00 pm.

Note 3 Night-time hours: 10.00 pm to 7.00 am Sunday to Friday, 10.00 pm Saturday to 8.00 am Sunday. Consistent with the DECC guidelines where levels are found to be less than 30 dBA, then it is set to 30 dBA.

At BG1 the ambient noise levels are typical of an environment affected by a major arterial road carrying predominantly "continuous" traffic. For BG2, noise levels are lower, being well away from the arterial road.

4 CRITERIA

4.1 Operational Road Traffic Noise Criteria, Guidelines and Objectives

The NSW *Environmental Criteria for Road Traffic Noise* (ECRTN May 1999) presents guidelines for the assessment of road traffic noise arising from new or redeveloped roads. The policy document provides road traffic noise guidelines for a range of road or residential developments, as well as guidelines that apply for other nominated sensitive land uses. These guidelines are applicable to the upgrade of the Kings Highway and have been utilised for the purpose of this assessment.

Factors considered in setting road traffic noise levels, according to this policy, include the following:

- Whether there is an existing road corridor, and if so, whether the road project is intended to increase traffic-carrying capacity substantially or whether the mix of traffic would be substantially changed.
- Whether or not substantial horizontal or vertical changes in the road alignment are proposed.
- Whether the area affected is an urban or rural environment where existing noise levels will vary substantially and response to additional noise will also vary.

The road traffic guidelines recommended in the policy document are based on the functional categories of the subject roads, as applied by the RTA.

The functional categories are as follows:

- Arterial roads (including freeways) carrying predominantly through-traffic from one region to another, forming principal avenues of communication for urban traffic movements.
- Sub-arterial roads connecting the arterial roads to areas of development and carrying traffic from one part of a region to another. They may also relieve traffic on arterial roads in some circumstances.
- Collector roads connecting the sub-arterial roads to the local road system in developed areas.
- Local roads, which are the subdivisional roads within a particular developed area. These are used solely as local access roads.

All residences within the vicinity of this proposal are subjected to noise from the Kings Highway. Some residences to the south front intersecting local or collector roads.

Table 4 presents the relevant ECRTN noise guidelines that apply along the Kings Highway. These guidelines are applicable to this project:

- At the time of project opening (expected in the year 2010).
- For traffic conditions prevailing 10 years after project opening (year 2020).

It is noted that the noise criteria presented within the ECRTN noise policy document are guidelines and as such, are non-mandatory.

In achieving compliance with the noise criteria, consideration needs to be given to feasibility and reasonableness, aesthetics, cost implications, equity, community preferences and practicality of potential noise controls.

To assist with the determination of the appropriate criteria at existing residential dwellings, the existing noise levels need to be considered. The *Environmental Noise Management Manual (RTA 2001)* provides clarification in the setting of criteria and the clarification of the terms 'reasonable' and 'feasible' referred to in the ECRTN.

Table 4 Road Traffic Noise Criteria for Proposed Road Development

Type of Development	Criteria		
	Day 7am - 10pm (dBA)	Night 10pm - 7am (dBA)	Where Criteria are Already Exceeded
Criteria for Residences fronting Kings Highway at south end where new alignment will tie in with existing road			
Redevelopment of existing freeway/arterial road	$L_{Aeq(15hour)}$ 60 dBA	$L_{Aeq(9hour)}$ 55 dBA	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dBA. 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, such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.
Criteria for Residences fronting Kings Highway in central section (adjacent to new alignment)			
New freeway or arterial road corridor	$L_{Aeq(15hour)}$ 55 dBA	$L_{Aeq(9hour)}$ 50 dBA	The new road should be designed so as not to increase existing noise levels by more than 0.5 dBA. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may only be achievable through medium-term and long-term strategies, such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, restricted access for sensitive areas or during sensitive times to low-noise vehicles, improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

With reference to **Table 4** (from the ECRTN) and Practice Note (i) of the ENMM, dwellings adjacent to the 'central' section of the realignment (NC B and C) would fall under the category of 'new arterial road' for which a daytime $L_{Aeq(15hour)}$ criterion of 55 dBA and a night-time $L_{Aeq(9hour)}$ criterion of 50 dBA is applicable.

4.1.1 Environmental Noise Management Manual Guiding Principles

The RTA's *"Environmental Noise Management Manual"* (ENMM) presents the RTA's policy on cost-effectiveness, reasonableness and feasibility of noise walls and architectural treatments (refer *Practice Note iv (a)* and *iv (b)* respectively). For example:

> *In the case of a road redevelopment, the RTA believes that it is generally not "reasonable" to take action if (a) the change in noise level 10 years after the road opens is no greater than 2 dBA, and (b) the noise levels 10 years after the road opens are no more than 2 dBA above the ECRTN noise goals for the road, namely daytime and night-time period L_{Aeq} noise levels of 60 dBA and 55 dBA respectively.*

In the above instance, it is assumed consideration has been given to road design and traffic management options to reduce the impacts from the traffic stream.

> *In the case of a road redevelopment where existing noise levels already exceed ECRTN noise goals, the RTA further believes that it is generally not "reasonable" to apply additional treatments (noise walls, etc) if the change in noise level prior to the road opening and at a point in time ten years after the road opening is no greater than 2 dBA and daytime and night-time*

period LAeq noise levels do not exceed 65 dBA and 60 dBA respectively, which the RTA define as "acute" noise levels.

Noise levels that are equal to or higher than 65 dBA $L_{Aeq(15hour)}$ or 60 dBA $L_{Aeq(9hour)}$ are categorised as "acute" within the RTA's ENMM. In such circumstances, noise mitigation should be investigated.

4.1.2 Maximum Noise Level Events

The ECRTN and RTA's ENMM provide guidance as to the likelihood of sleep disturbance resulting from maximum noise level events (mainly associated with heavy vehicle movements). The ECRTN points out the following:

- There are no universally accepted criteria governing the likelihood of sleep disturbance. In other words, at the current level of understanding, it is not possible to establish absolute noise level goals that would correlate to levels of sleep disturbance (for all or even a majority of people).
- The ECRTN suggests that:
  - Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to cause awakening reactions.
  - One or two events per night, with maximum internal noise levels of 65 dBA to 70 dBA, are not likely to affect health and wellbeing significantly.
  - At locations where road traffic is continuous rather than intermittent, the $L_{Aeq(9hour)}$ target noise level should sufficiently account for sleep disturbance impacts. However, where the emergence of L_{Amax} noise levels over the ambient L_{Aeq} noise level is greater than 15 dBA, the $L_{Aeq(9hour)}$ criteria may not sufficiently account for sleep disturbance impacts.

Thus, the ECRTN recommends that the assessment of sleep disturbance should include a consideration of the maximum noise level exceedances occurring during the night-time period and the emergence of these exceedances above the ambient noise level.

4.2 Construction Noise and Vibration Criteria

4.2.1 Construction Noise Guidelines

When dealing with noise emanating from construction works, the DECC (formerly EPA) recognises that higher levels of noise are likely to be tolerated by people in view of the relatively short duration of the works. As a result, the *"Environmental Noise Control Manual"* (ENCM) presents the DECC's recommended guidelines for the control of construction works noise.

Chapter 171-1 of the ENCM recommends the following approaches to mitigating adverse noise impacts from construction sites:

Noise Emission Objectives

The ENCM recommends that the $L_{A10(15minute)}$ noise levels arising from a construction site and measured within the curtilage of an occupied noise-sensitive premises (ie at boundary or within 30 m of dwelling, whichever is the lesser) should not exceed the noise levels indicated in **Table 5**. These noise goals are consistent with community reaction to construction noise.

Table 5 DECC-Recommended Noise Goals for Construction Works

Construction Period	$L_{A10(15minute)}$ Construction Noise Goal
Cumulative noise exposure period not exceeding 4 weeks	$L_{A90(15minute)}$ plus 20 dBA
Cumulative noise exposure period of between 4 weeks and 26 weeks	$L_{A90(15minute)}$ plus 10 dBA
Cumulative noise exposure period longer than 26 weeks	$L_{A90(15minute)}$ plus 5 dBA

Preferred Hours of Construction

The DECC guidelines recommend confining permissible work times as outlined in **Table 6**.

Table 6 Preferred Daytime Construction Hours

Day	Preferred Construction Hours
Monday to Friday	7.00 am to 6.00 pm
Saturdays	7.00 am to 1.00 pm (if inaudible at residences) Otherwise, 8.00 am to 1.00 pm.
Sundays or Public Holidays	No construction

Works Undertaken Outside of Preferred Construction Hours

Where it is necessary for construction works to be undertaken outside the DECC's preferred daytime construction hours, the condition normally applied is that:

- $L_{A10(15minute)}$ noise levels emitted by the works should not exceed the L_{A90} level during the relevant evening or night-time period by a margin of more than 5 dBA, *independent* of the duration of the construction activity.

Silencing

All practical measures should be used to silence construction equipment, particularly in instances where extended hours of operation are required.

Impulsive and/or Tonal Noise

For plant or operations with impulsive or tonal noise characteristics, such as rock hammers, a noise penalty of up to 5 dBA (depending on degree of impulsiveness or tonality) should be added to measured or predicted $L_{A10(15minute)}$ noise levels when comparing L_{A10} noise levels from construction works to the limits presented in **Table 5**.

Sleep Disturbance

In order to minimise the risk of sleep disturbance during night-time construction activities, the ENCM recommends that:

- The $L_{A1(60second)}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dBA. The $L_{A1(60second)}$ noise level may conservatively be estimated by the typical maximum level of noise emission.

General Comment on DECC Construction Noise Criteria

In the case of major demolition, excavation and construction projects in close proximity to residential buildings, it can be difficult to comply with the DECC's ENCM construction noise criteria (refer **Table 5**). However, the following is noted:

- The criteria nominated in the ENCM are adopted as *"noise design goals"*. Where these goals cannot be achieved in practice, DECC recommends the use of best practice measures and management measures in order to minimise the risk of potential noise impacts.

The essence of the ENCM-based approach then is that:

- The potential for residential (and other receiver) disturbance should firstly be established, regardless of the practicality of achieving the resulting noise goals in specific instances; and
- Once potential exceedances are identified, best practice is to be applied to minimise the risk of adverse impacts.

4.2.2 Construction Vibration Guidelines

Vibration targets vary primarily according to whether the particular activities of interest are continuous in nature or intermittent and whether they occur during the day or night-time. The effects of vibration in buildings can be divided into three main categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed, ie human disturbance;
- Those in which the integrity of the building or the structure itself may be prejudiced; and
- Those where the building contents may be affected.

Criteria which are relevant to the response of building occupants to vibration are more severe than those relevant to building damage. This is because people are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building.

This ability of people to sense vibration at relatively low magnitudes has created a widespread and strong public misconception which can cause considerable overestimation of the risk of damage associated with vibration in buildings. This is particularly the case when the source of that vibration is outside the building, and generally not within the occupant's control.

Many people, for example, believe that even barely perceptible levels of building vibration from say, traffic, excavation or construction works, can damage dwellings, or may affect delicate objects or other items of personal value within their homes. This largely subjective response is particularly the case when these low levels of vibration are accompanied by high noise levels, or if there are other adverse connotations or effects associated with the source of the vibration. These might include startle, loss of privacy or perceived loss of property value, fear, inconvenience, smell, loss of view, etc.

On the other hand, sources of much higher levels of vibration (eg domestic appliances, people walking on floors, slamming of doors, etc) are readily accepted due to their day-to-day familiarity or because they are "within the control" of the occupant.

It is primarily these effects which cause the gradual, long-term fatigue-induced deterioration of most structures, considered to be normal ageing. Provided that the levels of vibration-induced stress from an additional source are well below those of these "normal" stress-inducing events, then the additional source of vibration is unlikely to accelerate the normal ageing process.

Vibration Criteria - Human Disturbance

Ground-borne vibrations, particularly during construction phases of the project, have the potential to cause disturbance to people within nearby residences. Guidelines for assessing these impacts are set out in Australian Standard 2670.2 - 1990 "*Evaluation of human exposure to whole-body vibration, Part 2: Continuous and shock-induced vibration in buildings (1 Hz to 80 Hz).*"

AS 2670.2-1990 establishes levels of satisfactory vibration with respect to human response, as shown in **Table 7**. In this table, Columns 3 and 4 detail the continuous RMS vibration amplitudes associated with a "low probability of adverse comment" from occupants.

Table 7 Vibration Criteria - Human Comfort (from AS 2670:1990)

Type of Space Occupancy	Time of Day	RMS Vibration Levels in mm/s corresponding to a "Low Probability of Adverse Comment"			
		Continuous Vibration (16h Day, 8h Night)		Transient Vibration Excitation with several Occurrences per Day	
		Vertical	Horizontal	Vertical	Horizontal
Critical working areas (eg some hospital operating theatres, some precision laboratories, etc)	Day Night	0.1 0.1	0.3 0.3	0.1 0.1	0.3 0.3
Residential	Day Night	0.2 to 0.4 0.14	0.3 to 0.6 0.42	6 to 9 0.14 to 2.0	18 to 27 0.3 to 6.0
Offices	Day Night	0.4 0.4	1.2 1.2	6 to 13 6 to 13	18 to 38 18 to 38
Workshops	Day Night	1.2 1.2	3.2 3.2	9 to 13 9 to 13	27 to 38 27 to 38

The satisfactory vibration levels presented in **Table 7** are based on the RMS or "root mean squared" vibration level. The RMS is a vibration level averaged within a defined time period. In order to determine corresponding allowable peak vibration levels during various construction activities, the RMS vibration levels should generally be multiplied by an appropriate "crest" factor (ie ratio of the peak level to RMS level). Crest factors will vary from 1.4 for construction activities of a sinusoidal nature (eg continuous vibratory rolling and rotating plant) up to 4 or more for intermittent activities such as rock breaking and ripping.

The vibration levels given in **Table 7** for continuous daytime vibration apply to a 16-hour exposure period. As exposure periods for construction related activities are typically intermittent, British Standard 6472:1992 provides a method for calculating a "vibration dose" value (VDV) associated with the above RMS level. An estimated VDV (eVDV) may be calculated by the following formula using vibration measured in frequency-weighted acceleration:

$$eVDV = 1.4 \times a_{RMS} \times t^{0.25} \quad (m/s1.75)$$

where a_{RMS} = RMS acceleration (m/s^2)

t = time (seconds)

Over the frequency range 8 Hz to 80 Hz, the above formula based on frequency-weighted acceleration can also be expressed in terms of unweighted (ie flat frequency response) vibration velocity, which is often easier to measure in the field.

$$eVDV = 0.05 \times V_{PPV} \times t^{0.25} \quad (mm/s1.75)$$

where V_{PPV} = peak particle velocity (mm/s)

t = time (seconds)

The permissible peak velocity corresponding to the vibration dose value varies according to the duration of exposure. **Table 8** shows the vibration dose values *above* which various degrees of adverse comment may be expected in residential buildings. British Standard 6472:1992 does not provide VDV for other occupancies, however a similar relationship between residential and other occupancies shown in **Table 7** may be applied.

Table 8 Vibration Dose Values (mm/s$^{1.75}$) Versus Varying Degrees of Adverse Comment (Residential Buildings)

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hour night	0.13	0.26	0.51

Vibration Criteria - Building and Contents Damage

British Standard BS 7385:Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" is an internationally recognised standard which provides criteria against which the likelihood of building damage from ground vibration can be assessed. This is one of the most recent vibration standards and is based on a comprehensive review of the then current international standards and guidelines. The standard also takes into consideration the frequency of the vibration which is significant in the assessment of likelihood of building damage.

Guide values are set for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to result in a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

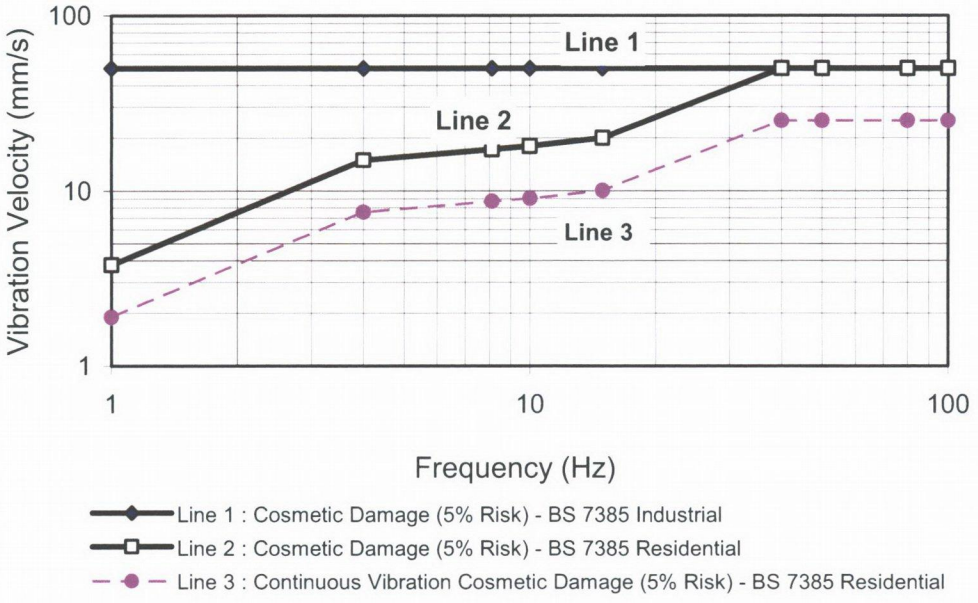
Sources of vibration which are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery. The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and heavy commercial / industrial buildings are presented numerically in **Table 9** and graphically in **Figure 3**.

Table 9 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for the building types corresponding to Line 2 (residential) are more stringent. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

Figure 3 Graph of Transient Vibration Guide Values for Cosmetic Damage



The standard goes on to state that:

- minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 9**.
- major damage to a building structure may occur at values greater than *four times* the tabulated values.

The standard also states that the guide values in **Table 9** relate predominantly to transient vibration which does not give rise to resonant responses in structures, as would generally be the case for low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table 9** may need to be reduced by up to 50% (ie Line 3 in **Figure 3**.).

5 OPERATIONAL ROAD TRAFFIC NOISE MODELLING OF THE STUDY AREA

Noise modelling of the present study was carried out using the UK Department of Transport, *"Calculation of Road Traffic Noise"* (CORTN 1988) algorithms incorporated in the SoundPLAN noise software. The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, ground absorption and shielding from ground topography and physical noise barriers. The algorithm output of CORTN has been modified to calculate the relevant L_{Aeq} road traffic noise emission descriptors, as required.

The algorithm output of CORTN (fundamentally an L_{A10} predictor) has been modified to calculate the relevant L_{Aeq} road traffic noise emission descriptors, as required. Based on the measured noise monitoring data and consistent with default conversions, a modifying factor of -3 dBA has been used to convert L_{A10} to L_{Aeq} in the noise prediction model.

A summary of additional model parameters used in this study are provided at the end of this section in **Table 11**.

5.1 Study Area: Terrain, Roadways and Single Point Receivers

Receiver (house) locations, ground topography, current and future road alignment and other cadastral data (eg property boundaries) were derived from aerial photographs and information supplied electronically. The noise modelling was based on 3D design strings provided by the RTA for the future road design.

The noise impacts at residences have been evaluated through so-called "single point receiver" (SPR) calculations, whereby a "receiver" is placed at a distance of 1 m from the most exposed facade of the critical residence and at a height of 1.5 m above the ground elevation at that location.

5.2 Choice of Scenarios to be Modelled and Relevant Criteria

The criteria used for evaluating the operational noise impact of the project require a prediction of noise levels for two scenarios:

- Baseline "future-existing" scenario (Year 2010) representing noise levels which would exist in the Year 2010 without the proposed road upgrade, but including the 5000 extra vehicles associated with the opening of the new defence facility.
- Year 2020 scenario, representing noise levels at a point in time 10 years after project opening.

A further scenario was run for existing (Year 2009) conditions to verify and calibrate the noise model against measured noise levels.

5.3 Traffic Count Data

As part of the preparation of the overall REF for the proposed Kings Highway upgrade by the RTA, traffic counts were undertaken. The traffic counters were located on the Kings Highway approximately 270 m north of the Thurralilly Street intersection. These traffic volumes have been used for the purpose of verifying the noise model for this project.

The traffic counting was arranged to be concurrent with the noise survey.

Projected traffic volume data for the Year 2010 and Year 2020 were also provided by the RTA as design input for assessment purposes. The estimated growth (determined as 2.3%) was based on historic traffic data counts at the same monitoring location. An inclusion of 5000 extra vehicles per day was incorporated in the model from 2010 based on the anticipated impact of the new defence facility opening. This has been split as 90% during the day (7 am to 10 pm) and 10% at night (10 pm to 7 am), which is similar to the existing day / night split in traffic volumes. The future percentage heavy vehicles have been assumed to be the same as for existing traffic flows.

5.4 Traffic Volumes, Vehicle Make-Up and Vehicle Speed for ECRTN Scenarios

Computer model noise predictions were carried out for the existing (Year 2009), future-existing (Year 2010) and future (Year 2020) road traffic volumes. The corresponding traffic volumes used for each scenario are presented in **Table 10**.

Table 10 Traffic Volume Details for the Modelling Scenarios

Road Section	Traffic Volume (Total)	Percentage Heavy Vehicles	Traffic Speed (km/h)[1]
Existing 2009			
15-hour daytime period	9,964	6.7%	90
9-hour night-time period	893	10.9%	90
Future-Existing 2010 – Including New Defence Facility Traffic			
15-hour daytime period	15,794	6.7%	90
9-hour night-time period	1,373	10.9%	90
Future 2020 (10 Years after Project Opening)			
15-hour daytime period	18,312	6.7%	80
9-hour night-time period	1,592	10.9%	80

NOTE: 1. The above traffic speeds are relevant from approximately 200 m north of Thurralilly Street (for all scenarios). Traffic speeds are 60 km/h to the south of this location (ie all of NC A is opposite 60 km/h road)

5.5 Other Model Parameters

Within SoundPLAN, roadways are sub-divided firstly into small segments, where each segment has a constant gradient. In this way, the additional noise contributions due to road gradient can be adequately modelled.

The CORTN method assumes a uniform source emission height of 0.5 m above road elevation for all road vehicles. This can *underestimate* the contribution of heavy vehicle noise where there is partial acoustic shielding from topography or noise walls. A modified CORTN algorithm has therefore been applied to account for truck exhausts at 3.5 m, truck engines at 1.5 m and truck tyres and cars at 0.5 m. The energy split for the truck emission relative to the total truck emission level is -2.4 dBA for the truck engines, -5.4 dBA for the truck tyres and -8.4 dBA for the truck exhausts. This energy split has historically been used by Heggies and has been accepted by authorities on numerous previous projects.

Table 11 summarises the various parameters utilised in the noise modelling.

Table 11 Summary of Modelling Parameters

Parameter	Value used in Model
Vehicle Speed (Kings Highway)	Current 60 km/h to approximately 200 m north of Thurralilly Street, then 90 km/h
	Future Realignment 60 km/h to approximately 200 m north of Thurralilly Street, then 80 km/h
Percentage of Heavy Vehicles	As per **Table 10**
Traffic Volumes	As per **Table 10**
Road Surface	Standard dense graded asphalt
Vehicle Source emission heights	0.5 m cars
	0.5 m truck tyres
	1.5 m truck engines
	3.5 m truck exhausts
Receiver height	1.5 m
Receiver location	1 m from the building façade
Receiver façade reflection	+2.5 dBA
Additional information	A 1.6 m high fence has been included along the rear boundary of the properties located on Hybon Avenue and Elizabeth Crescent.

6 OPERATIONAL ROAD TRAFFIC NOISE ASSESSMENT

6.1 Verification of Noise Model

The road traffic noise model was verified against the results of the ambient noise monitoring. This was achieved by carrying out predictions to the unshielded noise logger monitoring locations (refer **Table 1**). The results of the single point receiver runs for the current Year 2009 scenario are presented in **Table 12**.

Table 12 Comparison of Predicted versus Measured Noise Levels at Noise Logging Locations

Monitoring Location	Address	Measured Year 2009		Model Prediction Year 2009		Predicted Minus Measured	
		L_{Aeq} (15hour)	L_{Aeq} (9hour)	L_{Aeq} (15hour)	L_{Aeq} (9hour)	L_{Aeq} (15hour)	L_{Aeq} (9hour)
BG1	42 Bungendore Road	65	60	65	60	0	0
BG2	2 Hill Lane Road	50	45	54	49	4	4

Note: Noise levels rounded to the nearest whole number.

A comparison of the predicted versus measured L_{Aeq} levels shows very good agreement at BG1 which is close to the existing Kings Highway, but a 4 dBA variation at BG2. This is expected as the computer models are not as accurate over large distances where variations may occur due to additional ground, foliage and air absorption. BG2 is approximately 130 m from the current Kings Highway location, and is surrounded by foliage covered terrain – which is not considered in the modelling process CORTN adopts.

Given the above, we would consider that the model is sufficiently accurate for properties close to the alignment but provides slightly overestimated noise levels at large distances where there may be significant additional attenuation due to ground foliage absorption.

For predictions of noise levels from the future existing alignment, a correction of -4 dBA has been applied to receiver results along and around Regent Drive as all of these receivers are as far from or further from the Kings Highway than BG2 and have similar ground terrain and cover in their surrounding area. This correction has not been applied to the new alignment predictions however, where the nearest affected receivers are typically within 100 m.

6.2 Noise Modelling Results without Mitigation Measures

A summary of the predicted $L_{Aeq(15hour)}$ daytime and $L_{Aeq(9hour)}$ night-time noise levels for all scenarios are presented in tabulated form in **Table 13**. Also included in **Table 13** are the relevant base noise goals and acute noise level thresholds for each receiver. Note that the receivers are ordered in a north to south arrangement in the table.

The single point receiver results are provided for numerous facades for some properties where it was considered necessary (ie where more than one façade is exposed to existing or future alignments). Full details of the receiver locations, including x, y and z co-ordinates for each receiver point are provided in **Appendix C**.

The modelled scenarios were;-

- Baseline "future-existing" scenario (Year 2010) representing noise levels which would exist in the Year 2010 without the proposed road upgrade. This includes the additional 5000 vehicles per day associated with the new defence facility.
- Year 2020 scenario, representing noise levels at a point in time 10 years after project opening.

Table 13 Predicted Future Existing (2010) and Future (2020) Noise Levels and Assessment

Address	2010 FUTURE EXISTING[1] noise levels, LAeq, dBA		2020 FUTURE [2] noise levels, LAeq, dBA		Base Criteria 15h/9h, dBA	Exceedance of Base Criteria dBA	Exceedance of the 0.5 or 2 dBA Allowance Goal [3]	Acute Noise Levels	Further Consideration of Noise Mitigation
	15h	9h	15h	9h					
Noise Catchment C (NC C)									
212 Kings Hwy north	71	65	56	50	55/50	1	No	No	No
212 Kings Hwy west	59	54	48	43	55/50	Nil	N/A	No	No
212 Kings Hwy east	62	57	60	55	55/50	5	No	No	No
2 Hill Ln west	53	48	49	44	55/50	Nil	N/A	No	No
2 Hill Ln east	52	46	64	59	55/50	9	Yes	No	Yes
Noise Catchment B (NC B)									
4 Birdwood Pl west	54	48	61	56	55/50	6	Yes	No	Yes
4 Birdwood Pl north	53	48	59	54	55/50	4	Yes	No	Yes
2 Regent Dr north	51	46	64	59	55/50	9	Yes	No	Yes
2 Regent Dr west	45	40	61	56	55/50	6	Yes	No	Yes
6 Birdwood Pl north	52	47	56	51	55/50	1	Yes	No	Yes
6 Birdwood Pl east	52	44	56	51	55/50	1	Yes	No	Yes
3 Regent Dr north	49	44	56	51	55/50	1	Yes	No	Yes
3 Regent Dr west	49	44	56	51	55/50	1	Yes	No	Yes
5 Birdwood Pl	48	43	54	49	55/50	Nil	N/A	No	No
4 Regent Dr	49	44	60	55	55/50	5	Yes	No	Yes
5 Regent Dr	46	41	53	48	55/50	Nil	N/A	No	No
7 Regent Dr	46	41	52	47	55/50	Nil	N/A	No	No
8 Regent Dr	47	42	52	47	55/50	Nil	N/A	No	No
9 Regent Dr	43	38	48	43	55/50	Nil	N/A	No	No
Noise Catchment A (NC A)									
9 Hybon Ave Ground	57	52	58	53	60/55	Nil	N/A	No	No
9 Hybon Ave Floor 1	60	55	60	55	60/55	Nil	N/A	No	No
7 Hybon	54	49	55	50	60/55	Nil	N/A	No	No
42 Bungendore Rd	67	62	68	63	60/55	8	Yes	Yes	Yes
5 Hybon Ave	54	49	56	51	60/55	Nil	N/A	No	No
36 Bungendore Rd	67	62	67	62	60/55	7	Yes	Yes	Yes
3 Hybon Ave	55	50	55	50	60/55	Nil	N/A	No	No
1 Hybon Ave	56	51	56	51	60/55	Nil	N/A	No	No
52 Elizabeth Cr	56	51	56	51	60/55	Nil	N/A	No	No
54 Elizabeth Cr	57	52	56	51	60/55	Nil	N/A	No	No
56 Elizabeth Cr	57	52	57	52	60/55	Nil	N/A	No	No

Address	2010 FUTURE EXISTING[1] noise levels, LAeq, dBA		2020 FUTURE [2] noise levels, LAeq, dBA		Base Criteria 15h/9h, dBA	Exceedance of Base Criteria dBA	Exceedance of the 0.5 or 2 dBA Allowance Goal [3]	Acute Noise Levels	Further Consideration of Noise Mitigation
60 Elizabeth Cr	57	52	57	52	60/55	Nil	N/A	No	No
58 Elizabeth Cr	58	53	57	52	60/55	Nil	N/A	No	No

NOTES:

1. 2010 Future Existing is for current alignment including growth due to 5000 extra vehicles on the Kings Highway due to the defence facility opening in 2009
2. 2020 FUTURE is for the proposed alignment allowing for annual growth in traffic over the next 10 years (and also includes the extra 5000 vehicles introduced in 2009).
3. This is the exceedance allowance relative to the existing (or future existing) noise levels. When the Base Criteria are not exceeded, consideration of allowance goal exceedances is not required.

Appendix D provides full noise contour calculation plots for the year 2020 $L_{Aeq(15hour)}$ daytime noise levels.

6.3 Assessment of Noise Levels

The review of the modelling results provides the following key findings:

Southern Section (NC A)

- All existing receivers fronting onto the Kings Highway / Bungendore Rd are currently exposed to high noise levels and both 'Future Existing 2010' and 'Future 2020' noise levels are above 65 dBA during the day and 60 dBA during the night (ie 'acute'). As the properties are acute, consideration of noise mitigation is required, though as the 'acute' level is triggered by the increase in traffic flow attributed with the opening of the new defence facility, the responsibility for the provision of the mitigation is to be clarified.
- Noise levels to all other receivers (Hybon Avenue and Elizabeth Crescent) are at or below the 60 dBA day / 55 dBA night base criteria.

Central Section (NC B)

- Ten receivers are located in this area east of the proposed alignment, and the results indicate an exceedance of the 55 dBA day / 50 dBA night base criteria at the five nearest receivers. Whilst there are only minor exceedances at some properties, consideration of noise mitigation is to be further considered at a number of properties (as identified in **Table 13**). As these properties are "isolated" in nature (as defined within the ENMM), consideration of roadside barriers is not considered reasonable.

Central Section (NC C)

- Two receivers are located in this area west of the proposed alignment, and the results indicate an exceedance of the 55 dBA day / 50 dBA night base criteria at both along their most exposed facades. Noise levels at 2 Hill Lane exceed the base criteria by 9 dBA while noise levels at 212 Kings Highway are within the appropriate allowance goal of 0.5 dBA.
- As these properties are "isolated" in nature (as defined within the ENMM), consideration of roadside barriers is not considered reasonable

6.4 Operational Traffic Noise – Mitigation Options

There are a number of noise mitigation options available for traffic noise control including:

- Modification of road alignment (gradient, cut / fill arrangements etc)
- Reducing traffic speeds

- Roadside noise barriers and mounds
- Barriers and mounds close to dwellings
- Low noise road surface treatments
- Building treatments

The proposed alignment already incorporates an 80 km/h traffic speed, being a reduction from the 90 km/h existing posted speed on the Kings Highway.

There is no obvious available scope for further improving the alignment (in regards to gradient or other modifications) to achieve a useful noise reduction.

The available forms of noise control are noise barriers, road surface treatments and building treatments. Strategies for noise control can be one or a combination of these treatments. A number of options and consideration are provided below.

6.4.1 Option 1 - Noise Barriers

The receivers in NC A where acute noise levels have been determined have driveway access from Kings Highway and, as such, roadside barriers cannot practically be considered in this area.

In NC B and NC C it would be possible to implement roadside noise barriers although, given the low density of the housing in this area, it would not be considered feasible under the ENMM.

However, for the purposes of obtaining some indication of the potential extent of barriers required in this area, a concept noise barrier design has been incorporated in the noise modelling software. The barriers run on both sides of the alignment to shield receivers in NC B and NC C and have been modelled at a height of 3 m and 5 m.

The barrier has generally been located on the edge of the road alignment (where it is in fill) or at the top of the cut batter (when in cut) and has been extended slightly into Regent Drive so as to provide some overlap and 'line of site' shielding to the nearest affected dwellings. The location of the barriers is approximate at this stage for preliminary calculation purposes. The single point receiver results for the affected premises in NC B and NC C are provided in **Table 14** for both barrier options as well as the 'no barrier' option. An indication of the barrier locations is shown in **Appendix E**.

Table 14 Year 2020 Future noise levels with and without barriers

Address	Base Criteria 15h/9h, dBA	Noise levels, No Barriers L_{Aeq}, dBA			Noise levels, 3 m Barriers L_{Aeq}, dBA			Noise levels, 5 m Barriers L_{Aeq}, dBA		
		15h	9h	Excess	15h	9h	Excess	15h	9h	Excess
Noise Catchment C (NC C)										
212 Kings Hwy north	55/50[1]	55	50	Nil	54	49	Nil	54	49	Nil
212 Kings Hwy west	55/50[1]	47	42	Nil	47	42	Nil	46	41	Nil
212 Kings Hwy east	55/50[1]	60	55	**5**	56	51	**1**	55	50	Nil
2 Hill Ln west	55/50	49	44	Nil	49	44	Nil	49	44	Nil
2 Hill Ln east	55/50	64	59	**9**	59	54	**4**	55	50	Nil
Noise Catchment B (NC B)										
4 Birdwood Pl west	55/50	59	54	**6**	58	52	**3**	55	50	Nil
4 Birdwood Pl north	55/50	59	54	**4**	56	51	**1**	54	49	Nil
2 Regent Dr north	55/50	64	59	**9**	61	56	**6**	57	52	**2**

Address	Base Criteria 15h/9h, dBA	Noise levels, No Barriers L_{Aeq}, dBA			Noise levels, 3 m Barriers L_{Aeq}, dBA			Noise levels, 5 m Barriers L_{Aeq}, dBA		
		15h	9h	Excess	15h	9h	Excess	15h	9h	Excess
2 Regent Dr west	55/50	60	55	**6**	59	54	**4**	55	50	Nil
6 Birdwood Pl north	55/50	56	51	**1**	55	50	Nil	55	50	Nil
6 Birdwood Pl east	55/50	54	49	**1**	55	50	Nil	55	50	Nil
3 Regent Dr north	55/50	55	50	**1**	54	49	Nil	54	49	Nil
3 Regent Dr west	55/50	56	51	**1**	54	49	Nil	54	49	Nil
4 Regent Dr	55/50	60	55	**5**	58	53	**3**	54	49	Nil

The results provided in **Table 14** indicate that a 5 m high barrier could potentially provide sufficient noise reduction to achieve the base noise criteria at all receiver locations except 2 Regent Drive where a marginal 2 dBA excess is obtained. A slight barrier increase in the vicinity of this location could provide the necessary additional reduction.

The 3 m high barrier also provides a useful (typically 3 to 4 dBA) noise reduction and this could be a more practical height barrier for the road corridor. This could be used in conjunction with quieter road surfacing or at-dwelling treatments.

The approximate length and area of barriers used in the above calculations are provided in **Table 15**.

Table 15 Barrier Option Quantities

Barrier Location	Approximate Length, m	Approximate Area, m^2	
		3 m high	5 m high
South of alignment, east of Regent Drive (shielding NC B)	215	645	1075
South of alignment, west of Regent Drive (shielding NC B)	500	1500	2500
North of alignment (shielding NC C)	370	1110	1850
TOTAL	1085 m	3255 m^2	5425 m^2

A potential complication arises when vertical noise barriers are located on both sides of a road alignment. Noise can 'build up' between the two barriers due to multiple reflections, which results in the barriers being less effective than the modelling would indicate. This affect can be eliminated by using absorptive faced barriers or by angling the barriers sufficiently outwards to ensure reflections are directed in an upwards direction. This does however imply additional cost for the barriers.

6.4.2 Option 2 - Road surface treatments

All modelling has been based on standard Dense Graded Asphalt along the proposed alignment. A potential noise reduction in the order of 3 dBA can be achieved at all receivers with the use of Open Graded Asphalt. While this alone does not provide the 9 dBA noise reduction necessary at some locations this option should be further analysed as part of a cost benefit analysis and may prove to be a useful noise reduction tool when used in combination with other noise control options.

6.4.3 Option 3 - Architectural Building Treatments

Based on the normal procedures and requirements of the ENMM, architectural building treatments are the only form of feasible and reasonable noise control for the noise catchments in this project.

The aim of the building treatments, as discussed in Section 4 of the ENMM, is to provide mitigation where barriers are not feasible and reasonable, or to supplement the insertion loss provided by a barrier.

Realistically, the amount of noise reduction achievable at a particular dwelling depends on its existing condition and construction, and this is considered when further refining whether providing treatments at any particular property are 'reasonable'. Such an assessment is taken at a subsequent stage of the overall project.

The acoustic treatments provided by the RTA are selected based on the acoustical benefits obtained, the degree of exceedance and the results of a cost-benefit analysis, but are limited to:

- Fresh air ventilation systems that meet Building Code of Australia requirements with the windows and doors shut;
- Upgraded windows and glazing and solid core doors on the exposed façades of masonry structures only (these techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls);
- Upgrading window and door seals;
- The sealing of wall vents, and
- The installation of external screen walls.

It is also noted that architectural treatments are only applied to habitable rooms unless the benefit directly impacts on a habitable space.

Each particular dwelling would be considered individually for such treatments.

6.5 Review of Maximum Noise Levels

The RTA define a "maximum noise event" as any single event where the L_{Amax} noise level exceeds 65 dBA and the L_{Amax} noise level exceeds the $L_{Aeq(1hr)}$ noise level by more than 15 dBA.

From review of the noise monitoring results obtained at the two measurement locations BG1 and BG2, some indication of the maximum noise levels can be obtained for the current situation, and this can be used as a basis for predicting maximum noise levels at future locations near to the realignment. **Table 16** provides a summary of the monitored maximum noise levels and **Table 17** provides predicted levels based on adjustment for distance between the road and receiver.

All data is for the night period where sleep disturbance may occur.

It is noted that there is a distinct 'shoulder' period in the daily traffic noise levels starting from approximately 4.00 to 5.00 am. For the assessment of sleep disturbance, the summary below typically excludes this period so as to be more representative of the quieter periods of the night.

Table 16 Summary of maximum and Leq noise levels - existing monitoring locations

Location	Typical Night Maximum, L_{Amax}	Typical Night Hourly L_{Aeq}	Difference
BG1 (12 m from road edge)	70 to 80 dBA	45 to 55 dBA	Up to 25 dBA
BG2 (130 m from road)	50 to 60 dBA	35 to 45 dBA	Approximately 15 dBA

Table 17 Predicted maximum noise levels to nearest central area receivers (NC B and C)

Location	Predicted Maximum Noise Level, L_{Amax}	Predicted Night Hourly L_{Aeq}	Comment
2 Regent Drive (50 m)	60 to 70 dBA	45 to 50 dBA	Could exceed criteria of 65 dBA and 15 dBA margin
2 Hill Lane (70 m)	55 to 65 dBA	40 to 55 dBA	Marginal
4 Birdwood Place 4 Regent Drive (100 m)	52 to 62 dBA	35 to 45 dBA	Maximum level typically below 65 dBA

The above indicates that maximum noise levels to the closest receiver could exceed the nominated 65 dBA criteria. It is noted that the normal ECRTN base criteria are also exceeded at this receiver by a significant amount. As such, noise control treatments designed for achieving the ECRTN base criteria would also likely result in appropriate noise reduction to maximum noise level events.

Future maximum noise levels to receivers fronting Kings Highway in NC A would be similar to maximum noise levels currently obtained at BG1 – ie also well above the 65 dBA criteria.

In regards to the number of maximum events, the traffic data (existing and projected) indicates an 11% night period percentage of heavy vehicles, equating to approximately 175 heavy vehicles during the night for the year 2020. Further analysis of the supplied current hourly traffic flows provided the following breakdown for heavy vehicles:

- Between 10.00 pm and 4.00 am typically less than 4 heavy vehicle pass-bys occur (combined both directions) per hour
- Between 4.00 am and 5.00 am, 7 heavy vehicles pass-bys per hour occur on average
- From 5.00 am to 7.00 am, the heavy vehicles are significantly more regular, in the order of 30 to 50 per hour

7 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

7.1 Construction Noise Emission Objectives

Table 18 presents typical rating background noise levels (RBL) and noise emission objectives for the potentially most affected noise-sensitive properties within the study area based on the results of the ambient noise monitoring and DECC guidelines.

Table 18 Ambient L_{A90} Background Noise Levels & Corresponding Construction Noise Emission Objectives

Period	RBL L_{A90} Background Noise Level (dBA)	L_{A10} Noise Objectives (dBA)		
		Up to 4 Weeks	4 to 26 Weeks	Over 26 Weeks
Buildings Fronting Kings Highway (NC A)				
Daytime - 7:00 am to 6:00 pm	46	66	56	51
Evening - 6:00 pm to 10:00 pm	40	45	45	45
Night-time - 10:00 pm to 7:00 am	36	41	41	41
Buildings in 'Central' area (NC B & C)				
Daytime - 7:00 am to 6:00 pm	41	61	51	46
Evening - 6:00 pm to 10:00 pm	37	42	42	42
Night-time - 10:00 pm to 7:00 am	31	36	36	36

7.2 Construction Noise Emissions

The proposal is conceptual at this stage and final (detailed design) road plans have yet to be prepared. Accordingly details of specific construction plant and equipment, methodology or programming are unavailable at this early stage. Details of the construction program and activities will be formulated following approval of the project and following engagement of a contractor to carry out the works. The following preliminary construction information is however provided.

The construction process would include the following activities;

- Site preparations including removal of vegetation and establishment of stockpile site
- Construction of retaining structures including footings
- Surface preparation by graders, dozers, scrapers and other equipment
- Compaction with typical compaction equipment
- Cut and fill earthwork transportation, gravel transportation etc
- Construction of roadside batters, gutters and berms
- Application of paving by pavers and rollers
- Line marking, signs and guideposts
- Landscaping, revegetation and site cleanup
- Anticipated 18 months construction stage

Expected plant and equipment associated with the construction works are as follows:

- Typical 30T excavator along with trucks and graders
- Bulldozers and front end loaders

- Asphalt milling and paving machines
- Concrete pumps, concrete supply agitator trucks, concrete vibrators,
- Expectation for the use of rock breaker is unlikely.
- Various vehicles including dump trucks and water tankers would also be involved.
- Fill plant. Vibrating rollers will be used. In addition other equipment such as mixing plant and pavers would be used for finishing

Typical maximum expected noise levels of typical construction plant measured at a distance of 7 m with the units operating at maximum load are shown in **Table 19**.

Table 19 Noise Level of Construction Plant Items

Plant Item	L_{Amax} Noise Level at 7m (dBA)
Scraper	86
Bulldozer	85
Grader	84
Front end Loader	86
Vibrating Roller	82
Backhoe	83
Excavator	80
Compressor	75
Concrete Vibrators	87
Concrete Pumps	84
Dump Truck	83
Water Tanker	84
Compactor	85

The noise levels shown in **Table 19** are maximum noise levels. The difference between the L_{Amax} and L_{A10} noise levels for large construction projects is generally between 5 dBA and 10 dBA depending on the intensity and type of operation. For the purpose of this assessment, a conservative noise reduction of 5 dBA has been applied to convert L_{Amax} noise levels to L_{A10} levels for comparison with the L_{A10} construction noise objectives.

The following are three groups of indicative construction and excavation plant which could be expected to be used at different stages of the works. These do not represent all potential noise sources and activities but are considered reasonable scenarios with representative noise levels for the purposes of indicative assessment.

Group 1: Front-end loader
Excavator
Dump truck

Group 2: Scraper
Bulldozer
Water tanker

Group 3: Vibrating roller
Backhoe
Concrete vibrator
Concrete pump

Table 20 presents the calculated L_{A10} noise emission at the representative potentially most affected noise-sensitive receiver locations in comparison with the corresponding construction noise emission objectives.

Calculations are for the worst case condition during construction operations immediately adjacent to the assessment point.

Table 20 Construction Noise Emission and Noise Emission Objectives (Day)

Address or Location	Distance to Works	L_{A10} Noise Emission (dBA)			L_{A10} Noise Objectives (dBA)		
		Group 1	Group 2	Group 3	Up to 4 Weeks	4 to 26 Weeks	Over 26 Weeks
Central Area (NC B & C) residents (2 rec.)	50 m - 70 m	63 - 67	66 - 69	66 - 69	61	51	46
Central Area (NC B & C) residents (5 rec.)	100 m - 140 m	55 - 60	57 - 62	57 - 62			
Central Area (NC B & C) residents (5 rec.)	> 200 m	< 50	< 51	< 51			
Kings Highway receivers (NC A) fronting Hwy	30 m - 50 m [1]	67 - 72	68 - 73	68 - 73	66	56	51
Southern Area (NC A) setback receivers	70 m - 100 m	52 - 55	54 - 57	54 - 57			

NOTES: 1. Anticipated distance from 42 Bungendore Road to nearest point of works. Other properties in this area are further away

When reviewing the noise emission levels in **Table 20** it is necessary to consider the following:

- The receiver noise levels were calculated for the worst case condition of all plant and equipment operating at the closest potential location to the receivers. This is conservative for the purpose of this assessment as for most of the time equipment will generally be operated further away, resulting in lower noise emission at the receiver locations. For large periods of time, in particular when all plant items are not operating simultaneously, noise levels are likely to be lower than the calculated levels shown in **Table 20**.
- When reviewing predicted noise levels it should be noted that these levels do not take into account any noise mitigation strategies or treatments recommended in this report to be implemented by the Construction Contractor.

Given that the noise levels presented in **Table 20** are indicative of the highest anticipated construction noise levels generated when works are undertaken immediately adjacent to the dwellings, the shorter duration criteria (i.e. "4 to 26 weeks") are considered most appropriate for assessment purposes.

Table 20 indicates that there will be periods when the noise objectives will be exceeded when construction operations are conducted at the closest point to specific dwellings.

7.3 Noise Mitigation of Construction Activities

Given the potential for the predicted noise exceedances indicated in **Table 20,** comprehensive noise mitigation strategies should be implemented wherever feasible during the construction works. Wherever possible, subject to feasibility and reasonability, the quietest plant and equipment should be utilised in combination with management measures to minimise the noise impact on the local community.

Australian Standard AS 2436-1981 *"Guide to Noise Control on Construction, Maintenance and Demolition Sites"* sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on this proposed upgrade are listed below, including the typical noise level reduction achieved, where applicable.

Operational Strategies:

- An important aspect of the mitigation of noise impacts during all construction phases would be adherence to the DECC's recommended standard daytime construction hours (refer **Section 4.2.1**).
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers would also result in reduced noise emissions.
- Where practicable, the offset distance between noisy plant items and nearby noise sensitive receivers should be as great as possible.
- As far as possible, maintenance work on all construction plant should be carried out away from noise sensitive receivers and confined to standard daytime construction hours.
- Regular compliance checks on the noise emissions of all plant and machinery used for the project would indicate whether noise emissions from plant items were higher than normal.
- Ongoing noise monitoring during construction at sensitive receivers during critical periods (ie times when noise emissions are expected to be at their highest) will assist in identifying and controlling high risk noise events.

Source Noise Control Strategies:

- Engines and exhausts are typically the dominant noise sources on mobile plant such as bulldozers, cranes, graders, excavators, trucks, etc. In order to reduce noise emissions, more efficient silencers or exhausts could be fitted potentially providing additional attenuation.
- Low noise "silenced" generators should be used on the project where feasible.
- Similarly, any ventilation fans should be fitted with acoustic silencers where this is required to minimise noise emission.
- Regular maintenance of all plant and machinery used for the project will assist in minimising noise emissions.

Noise Barrier Control Strategies:

- Where appropriate, temporary noise barriers could be constructed providing line of sight shielding to nearby noise sensitive receivers wherever feasible. Typically, 7 dBA to 15 dBA of attenuation can be achieved with a well constructed barrier. However, with the elevated receivers associated with this project through the central realignment area, line of site barriers may be difficult to practically implement.
- Where feasible, any acoustic barriers or residential building treatments proposed to control operational noise should be installed as early as possible to assist in minimising the impact of construction noise.
- Acoustic enclosures could be constructed around fixed plant operating on a continuous basis during the construction phase at a particular site. Such enclosures can provide between 15 dBA to 30 dBA attenuation.

Community Consultation:

- Active community consultation and the maintenance of positive relations with local residents and would assist in alleviating concerns and thereby minimising complaints.

On the basis of previous construction monitoring studies carried out by Heggies, it is predicted that the above strategies could potentially result in indicative noise level reductions ranging:

- Up to 10 dBA in instances where space requirements place limitations on the attenuation options available.
- To potentially over 20 dBA where equipment controls (enclosures, silencers, etc) can be combined with noise barriers and management techniques (eg avoidance of clustering).

The level of potential exceedances shown in **Table 20** indicates the degree of noise reduction required at any particular site to meet the project construction noise goals for different time periods. A review of the majority of the attenuation requirements suggests that noise emissions from most activities associated with the project may be managed through a combination of comprehensive noise mitigation treatments (noise barriers, equipment enclosures, silencers, regular equipment maintenance, etc), noise management plans and close consultation with the local community.

Following engagement of a construction contractor for the project, preparation of a Construction Noise and Vibration Management Plan is recommended prior to commencing works on site. This should establish criteria, assess impacts based on the proposed methodology and plant and equipment selections and set out procedures for managing the impacts.

7.4 Construction Vibration

It is understood blasting would not be undertaken, therefore the major potential sources of construction vibration include bulldozers ripping rock strata, possible rock-breaking and vibratory rollers.

Bulldozers

Typical ground vibration levels from bulldozers range from 1 mm/s to 2 mm/s at a distance of approximately 5 m. At distances greater than 20 m, vibration levels are usually below 0.2 mm/s.

Hydraulic Rockbreakers

Table 21 sets out the typical ground vibration levels at various distances from a large rockbreaker operating in hard sandstone.

Table 21 Typical Rockbreaker Vibration Levels (mm/s) versus Distance

Operation	Vibration Level (mm/s) at Given Distance					
	5 m	10 m	20 m	30 m	40 m	50 m
Heavy Rockhammering	5	1.5	0.50	0.20	0.15	0.10

Vibratory Rollers

Levels of ground vibration caused by vibratory rollers can be up to 1.5 mm/s at 25 m. The highest levels of vibration usually occur as the roller is brought to rest and the frequency of the centrifugal forces passes through resonance with the natural frequency of the roller/ground structure.

Based on recommendations used by the NSW RTA, **Table 22** sets out safe working distances for the use of vibratory rollers adjacent to buildings.

Table 22 Safe Working Distances for Vibratory Rollers

Roller Class		Weight Range	Centrifugal Force Range	Distance from Building	
				A	B
I	Very Light	Less than 1.25 tonnes	10 - 20 kN	3 m	No effect
II	Light	1 to 2 tonnes	20 - 50 kN	5 m	No effect
III	Medium	2 to 4 tonnes	50 - 100 kN	6 m	12 m
IV	Medium Heavy	4 to 6 tonnes	100 - 200 kN	12 m	24 m
V	Heavy	7 to 11 tonnes	200 - 300 kN	25 m	50 m
VI	Very Heavy	12 tonnes and over	Over 300 kN	25 m	50 m
A	Values suggested to prevent damage to buildings.				
B	Values suggested to minimise strongly adverse comment from residents.				

Note: Source of data: ARRB Special Report No.11, *"Ground Vibrations: Damaging Effects to Buildings"*.

All receivers are at least 50 m from compaction activities, and as such, even with the heaviest roller class, no significant vibration impacts are anticipated.

Summary of Vibration Impacts

In general, vibration produced by earthworks and road forming operations is expected to lie well below structural damage criteria. Where vibration-intensive operations are being conducted in close proximity to the buildings nearest to the roadworks (eg residences in NC A), some consideration of the type and size of plant should be made.

Generally, all receivers are anticipated to be at least 50 m away from the alignment where compaction or other vibration generating works are expected, and minimal impacts due to vibration are likely on this project.

Vibration may however be perceptible for relatively short periods of time when construction activities are immediately adjacent to specific dwellings.

It is recommended that the construction methodology, plant and equipment, management of vibration impacts and community consultation protocol be reviewed prior to commencing construction. This should be addressed as part of the Construction Noise and Vibration Management Plan for the project.

8 CONCLUSION

A noise and vibration impact assessment has been carried out by Heggies for the realignment of the Kings Highway between Thurralilly Street and The Ridgeway, Queanbeyan East.

The assessment was based on the Department of Environment and Climate Change's (DECC) *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA - May 1999), which represents the NSW Government's current policy on road traffic noise. Reference is also made to the *Environmental Noise Management Manual* (ENMM – RTA, December 2001) which was developed by the RTA, in consultation with the DECC.

The results in this report are an acoustical evaluation of the resultant impacts prior to input from the authorities or the community.

Operational Noise

Detailed three dimensional noise modelling was conducted for the proposed Kings Highway realignment in order to evaluate the potential noise impacts to the community. The assessment was generally conducted for three defined noise catchment areas;-

Noise Catchment A (NC A) – Area to south with two (2) properties directly fronting onto the realigned section of the Kings Highway (ie where it ties in with the existing road) and approximately another ten (10) properties setback one street from Kings Highway in Hybon Avenue and Elizabeth Crescent.

Noise Catchment B (NC B) – Central area east side, ten (10) residential properties 50 to 200 m from Kings Highway

Noise Catchment C (NC C) – Central area west side, two (2) nearest residential properties approximately within 80 to 120 m from the proposed alignment

The results of modelling for all residential receivers in the above areas are provided in **Table 13** of this report.

In NC A noise levels for the two receivers fronting onto the Kings Highway realignment were found to be above the ECRTN base criteria for all future noise modelling scenarios, and acute (above 65 dBA day, 60 dBA night). The future noise levels at these receivers are primarily due to the traffic flow increases associated with the new defence facility opening in 2009. As these properties are accessed via the Kings Highway, roadside barriers cannot be implemented and only architectural (or at-dwelling) treatments can be considered.

Noise levels at receivers set-back from the existing Kings Highway in NC A comply with the ECRTN base criteria.

In the central areas NC B and NC C, the appropriate base criteria are more stringent, as per the requirements for a new arterial road defined within the ECRTN. Predicted noise levels indicate an excess of up to 9 dBA at the two nearest receivers in this area. Options for noise control for this area have been provided and include;-

- Roadside noise barriers
- road surface treatments (Open Graded Asphalt), which can provide in the order of 3 dBA noise reduction
- at-dwelling architectural or barrier treatments.

Two conceptual roadside noise barrier options have been provided in this report for consideration by the RTA. The first option (3 m high barriers) provides up to 4 dBA noise reduction and is not sufficient to achieve the ECRTN base criteria alone, but could be considered in conjunction with other noise control measures. The second option (5 m high barriers) generally provides sufficient noise reduction to achieve the base criteria (except for a 2 dBA excess at one receiver). These two barrier options provide some guidance on the extent and height of barriers necessary to achieve the base criteria.

Given the small number of affected receivers, the use of roadside noise barriers would not be considered feasible under the ENMM, and at-dwelling / architectural treatments would provide a more feasible outcome for noise control on this project. Consultation with the RTA and community will provide further guidance on a preferred approach forward.

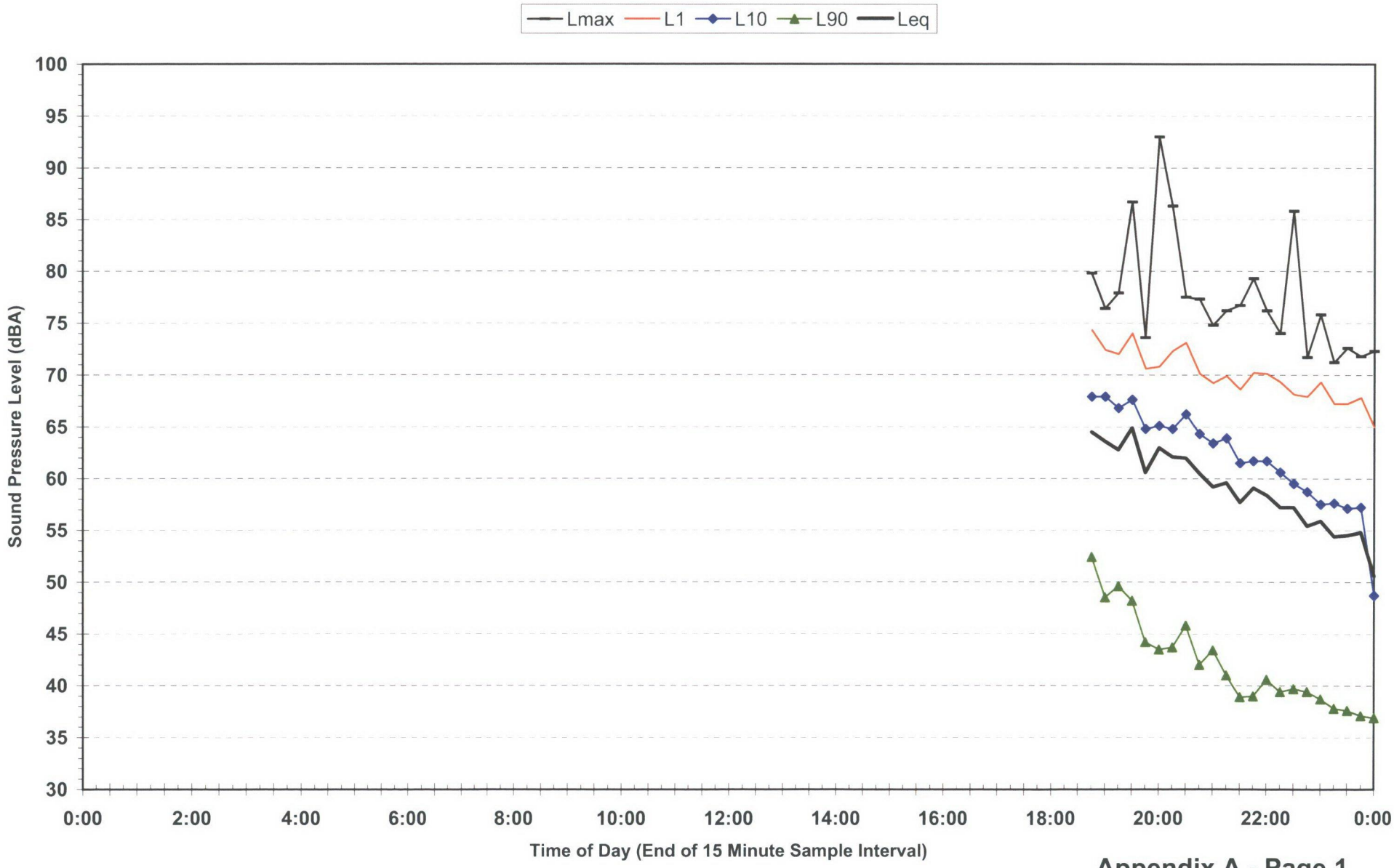
Construction Noise and Vibration

Construction noise levels are likely to exceed DECC guidelines during some periods of construction, particularly when works are being conducted immediately adjacent to dwellings.

Vibration impacts are generally anticipated to be minimal as there is likely to be at least a 50 m distance between vibration generating activities and the nearest dwellings.

A combination of selection of quietest available equipment and construction techniques and engineering controls in combination with environmental management and community consultation is recommended to minimise the construction noise and vibration impacts. It is recommended that a Construction Noise and Vibration Management Plan be prepared to assess the potential construction noise impacts in consideration of the proposed construction methodology and plant selection and to document procedures to control and minimise the impacts.

Statistical Ambient Noise Levels
(BG1) 42 Bungendore Road, Queanbeyan East - Tuesday 27 January 2009



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Statistical Noise Levels
Heggies Report 40-1743

Statistical Ambient Noise Levels
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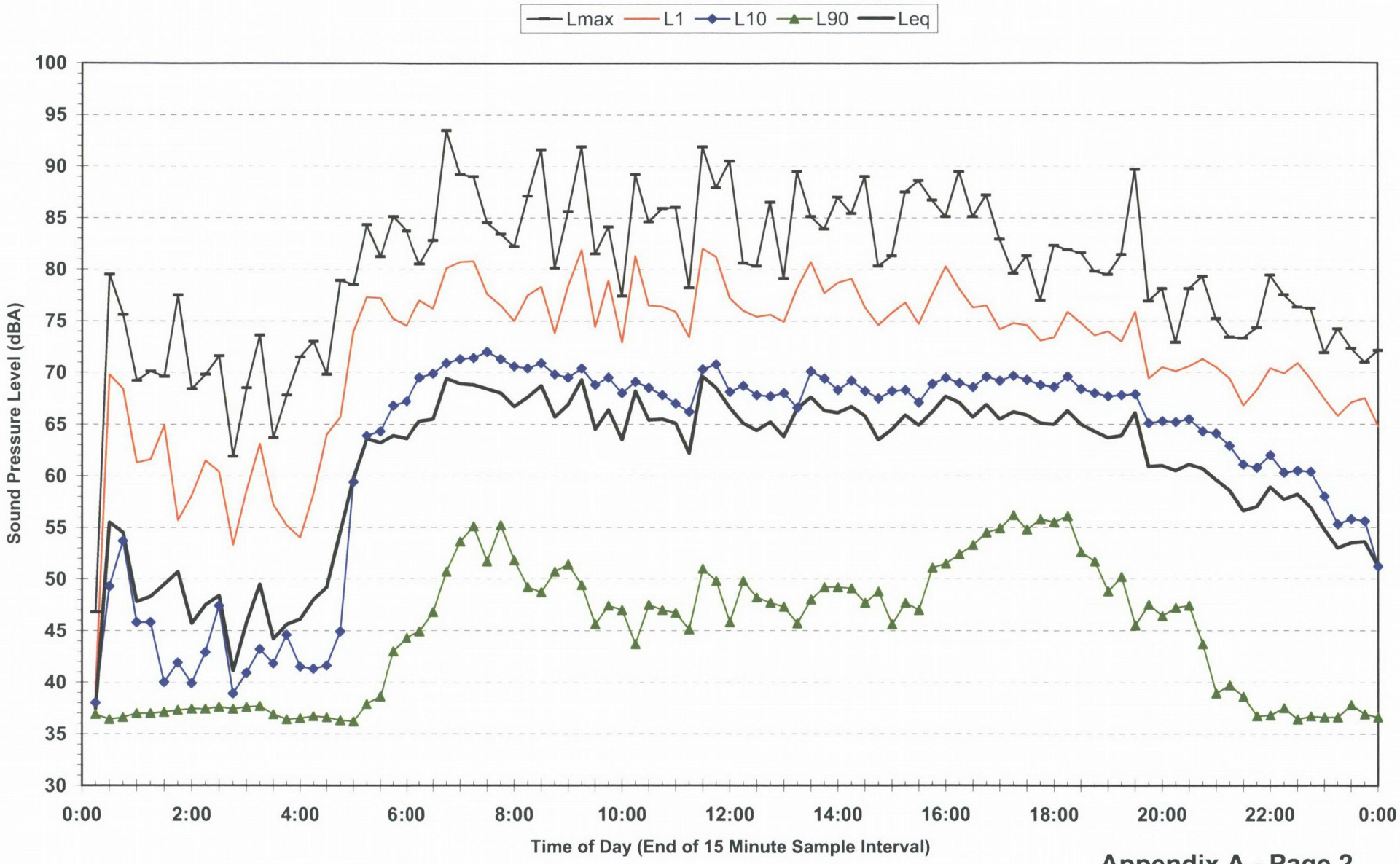

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Statistical Noise Levels
Heggies Report 40-1743

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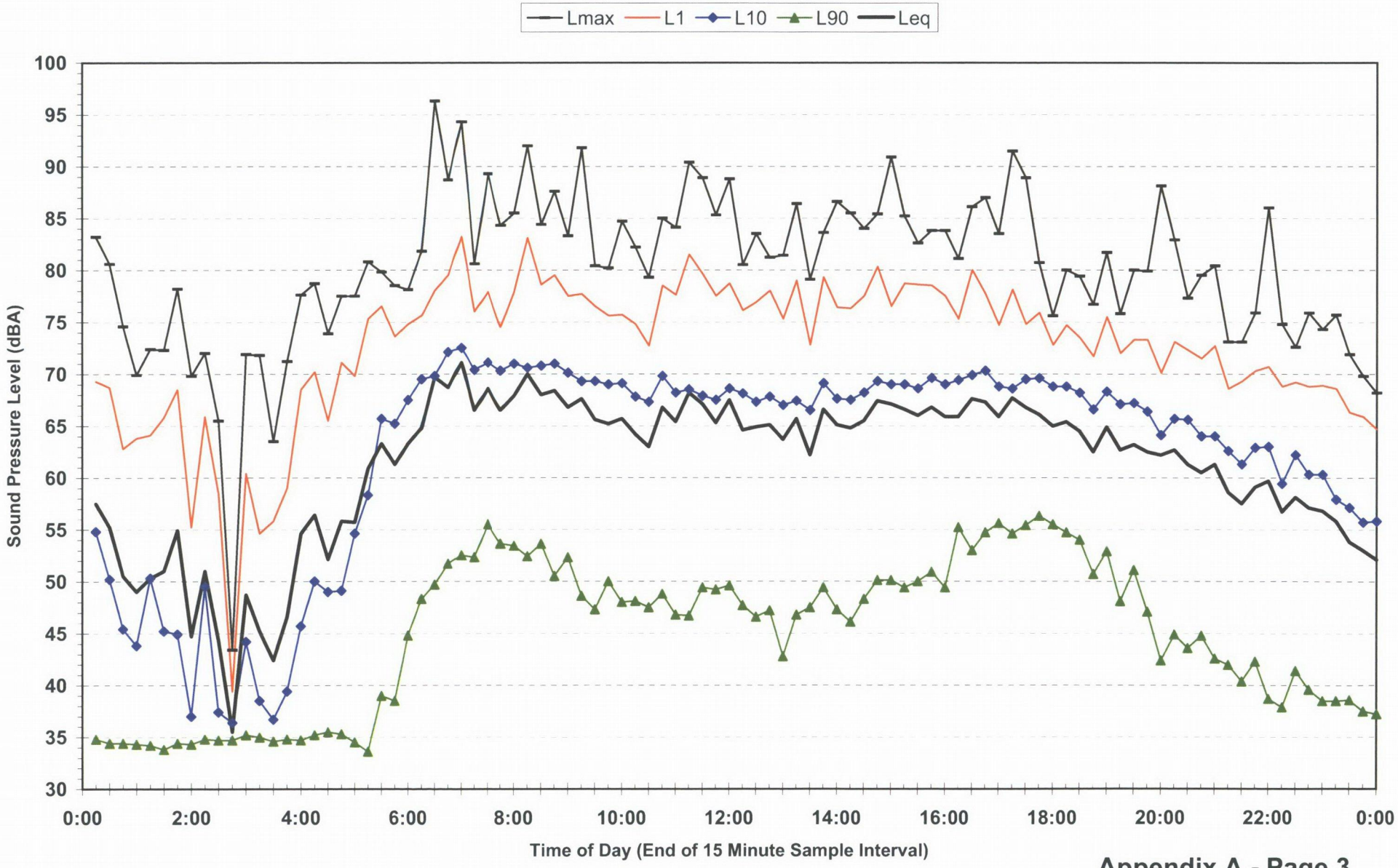

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Statistical Noise Levels
Heggies Report 40-1743

Statistical Ambient Noise Levels
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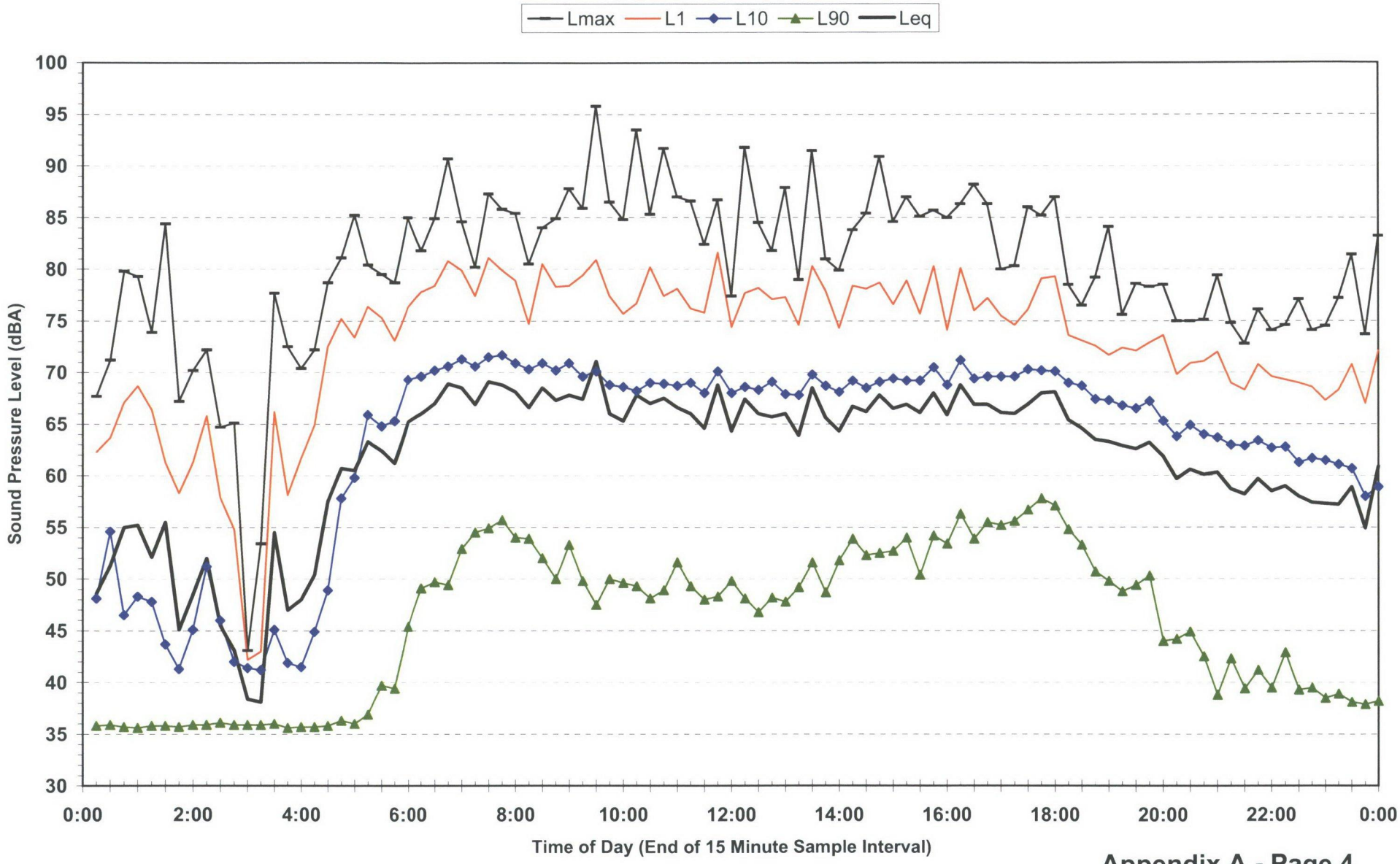

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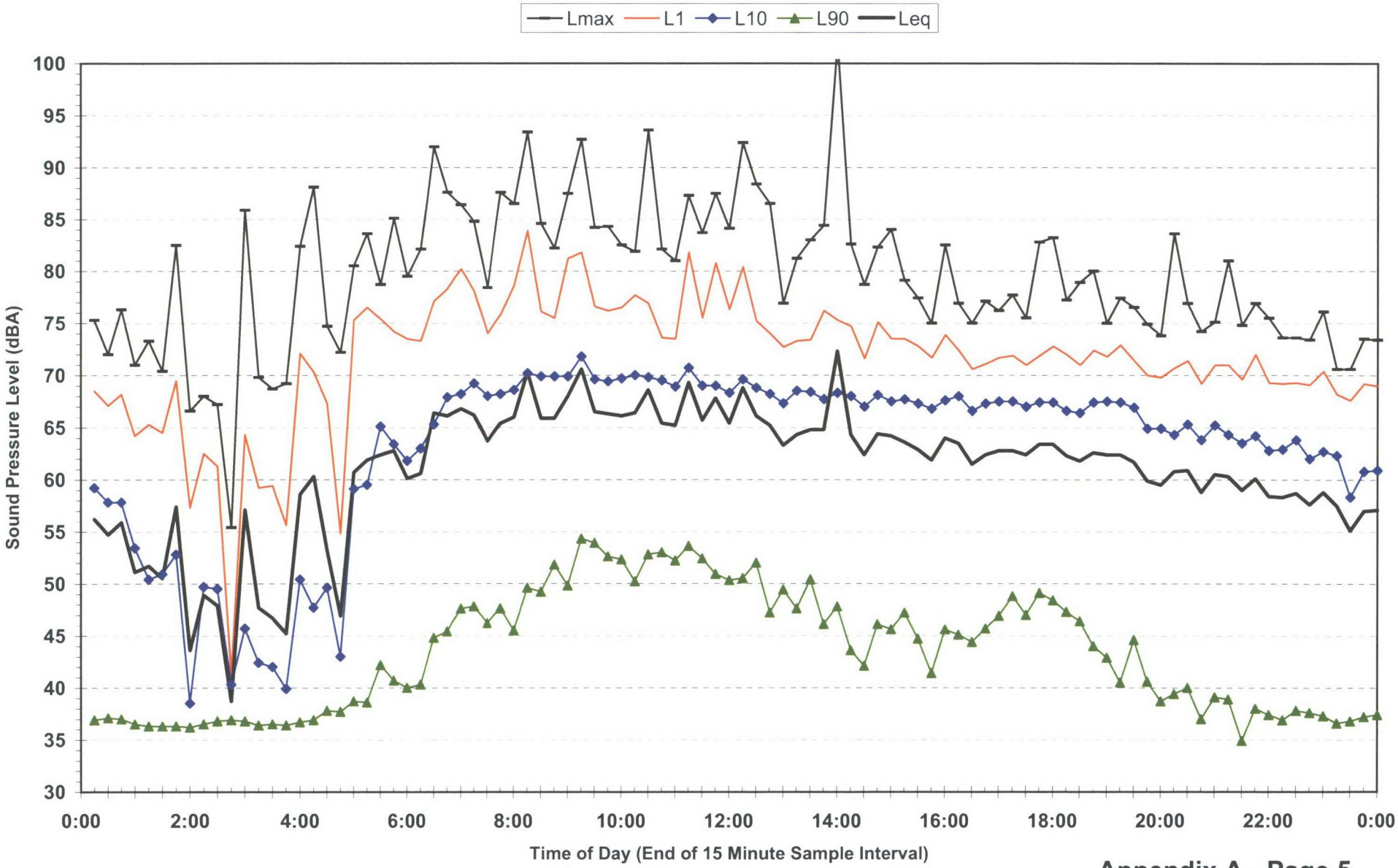

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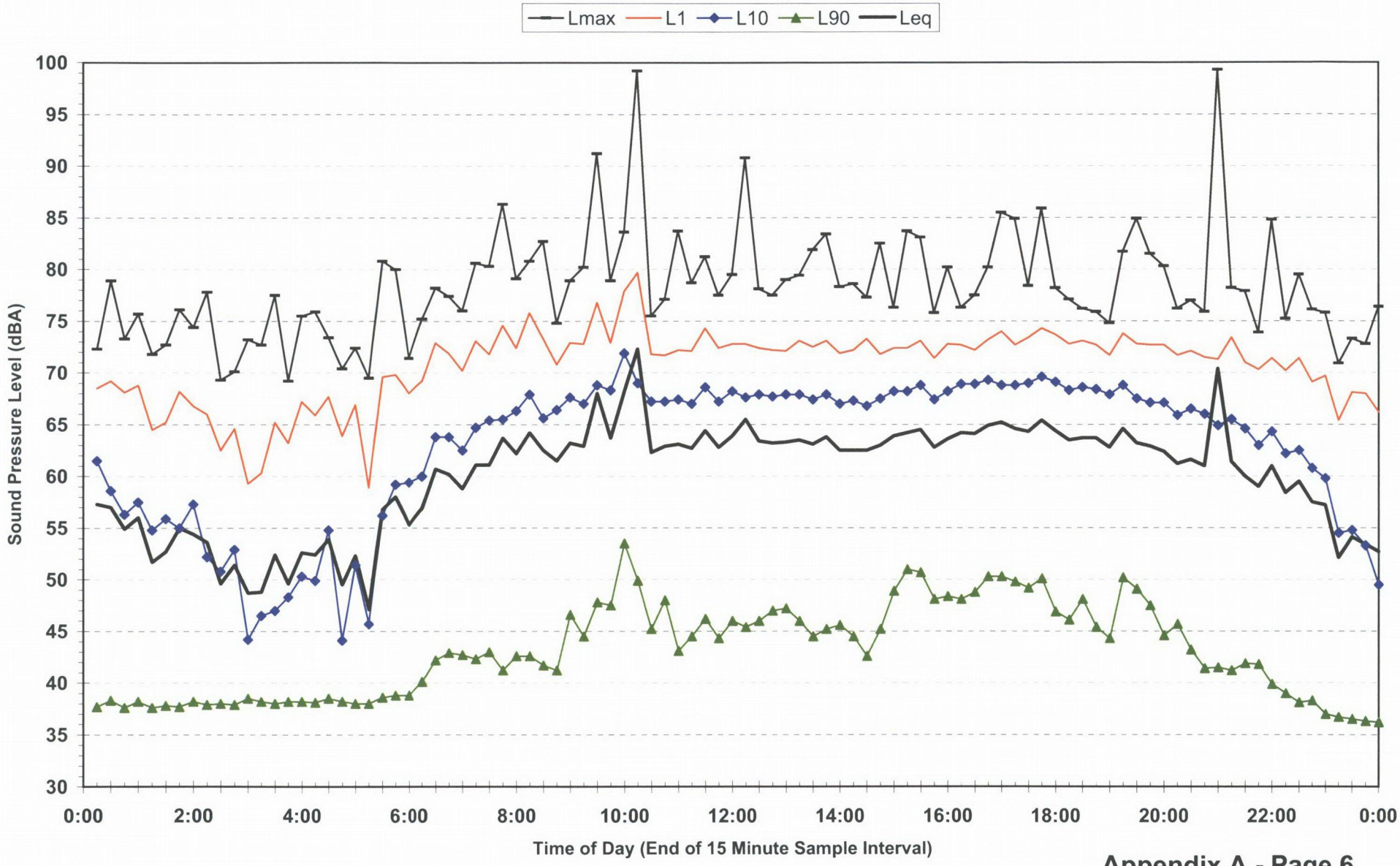

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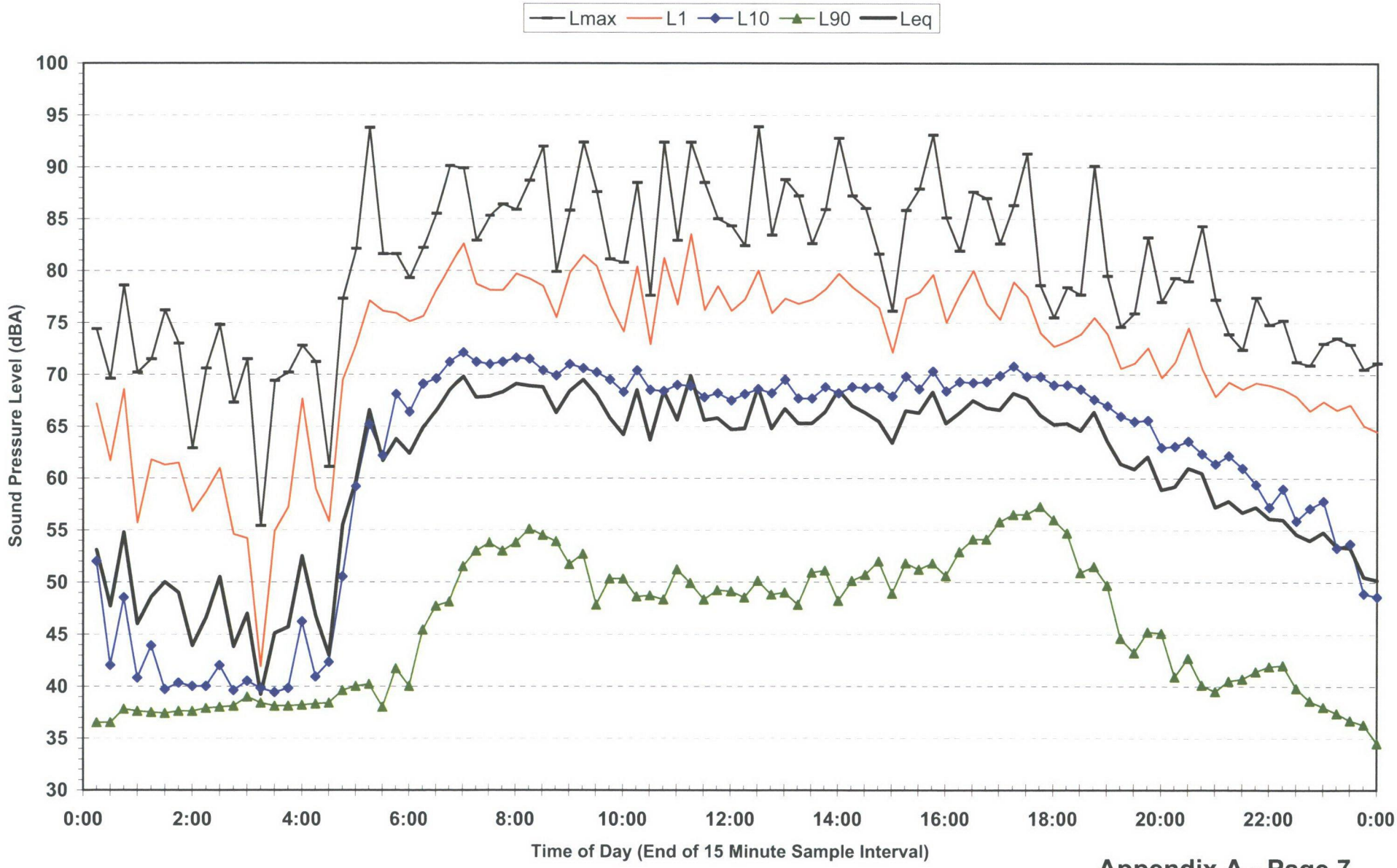

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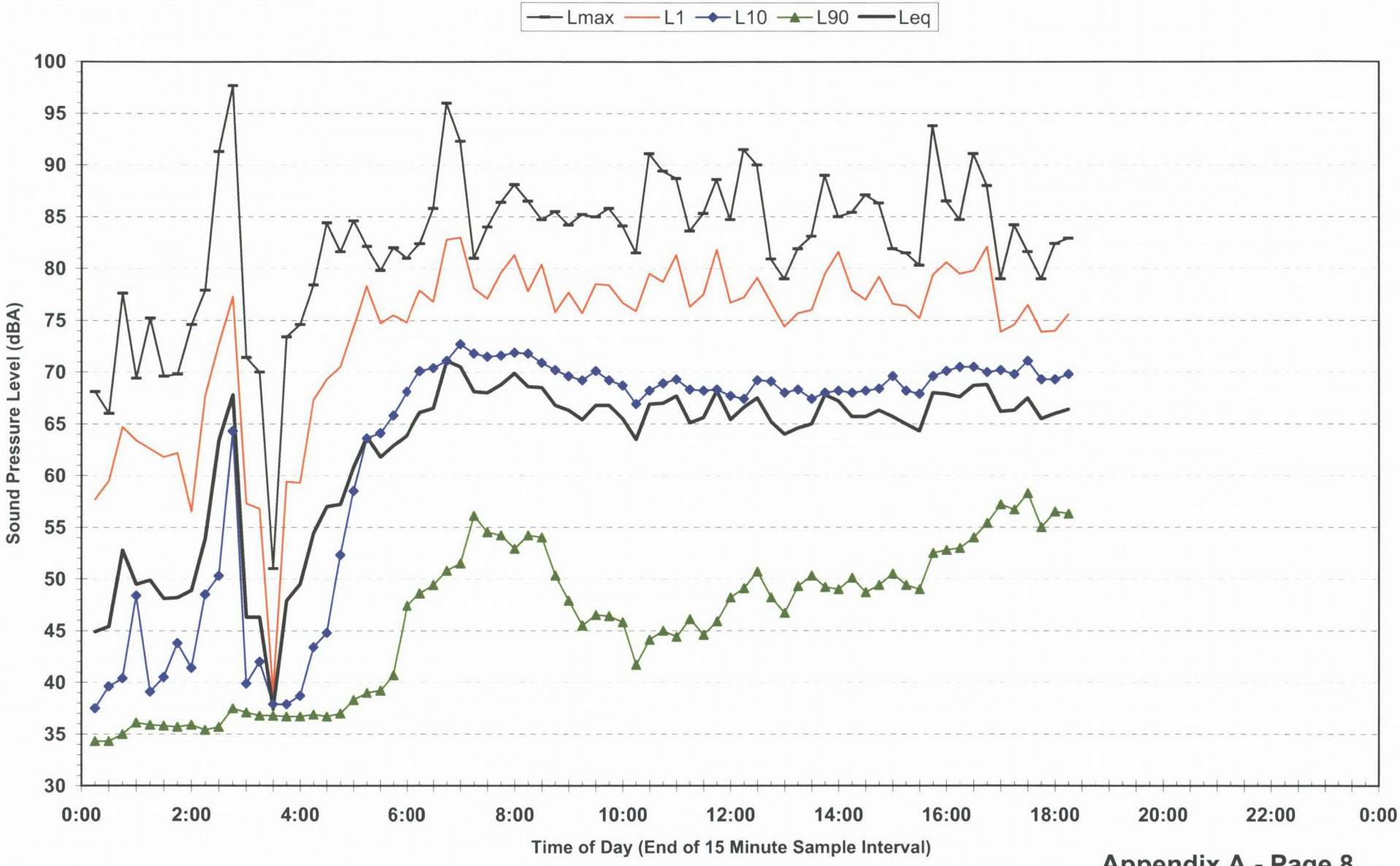

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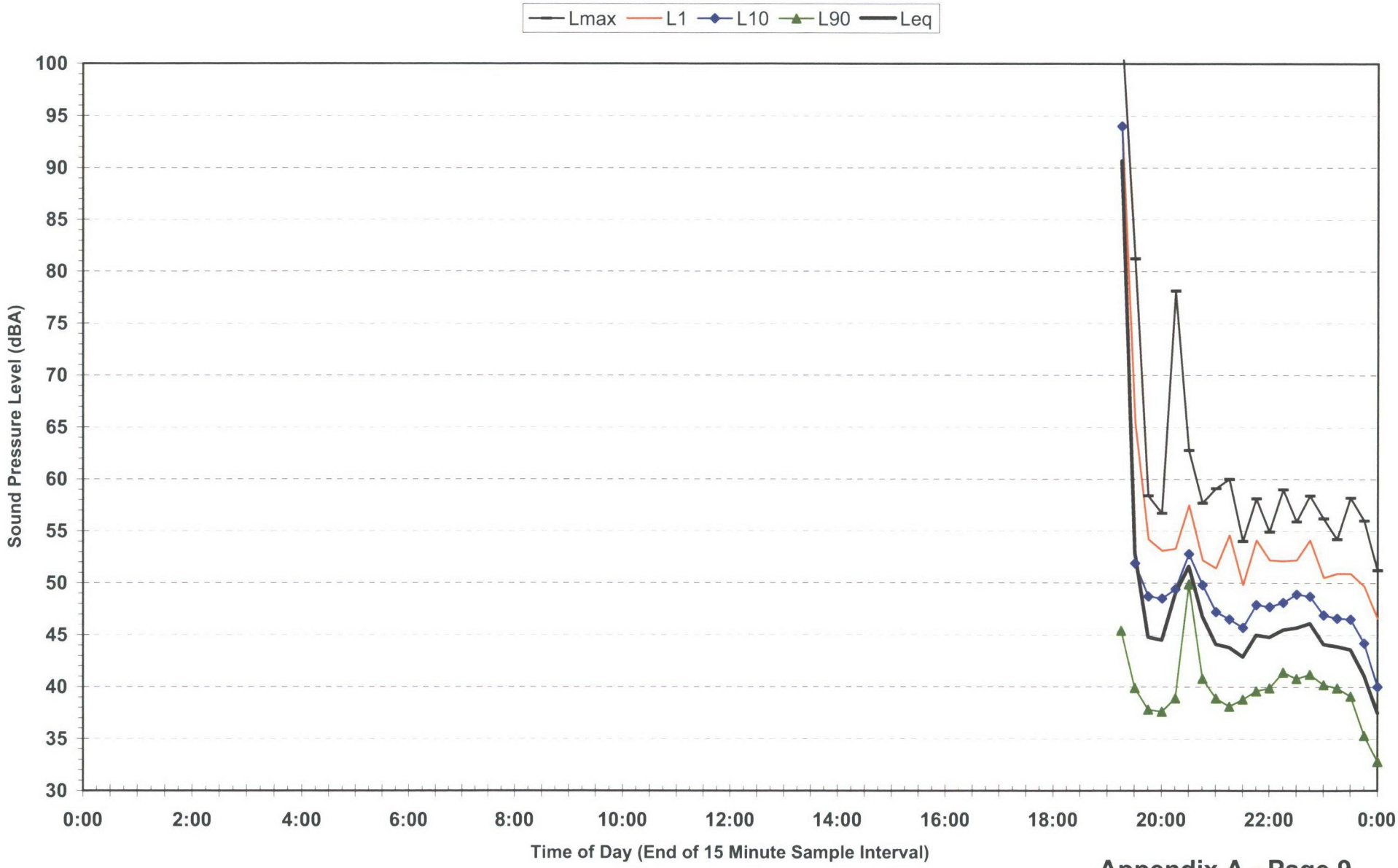

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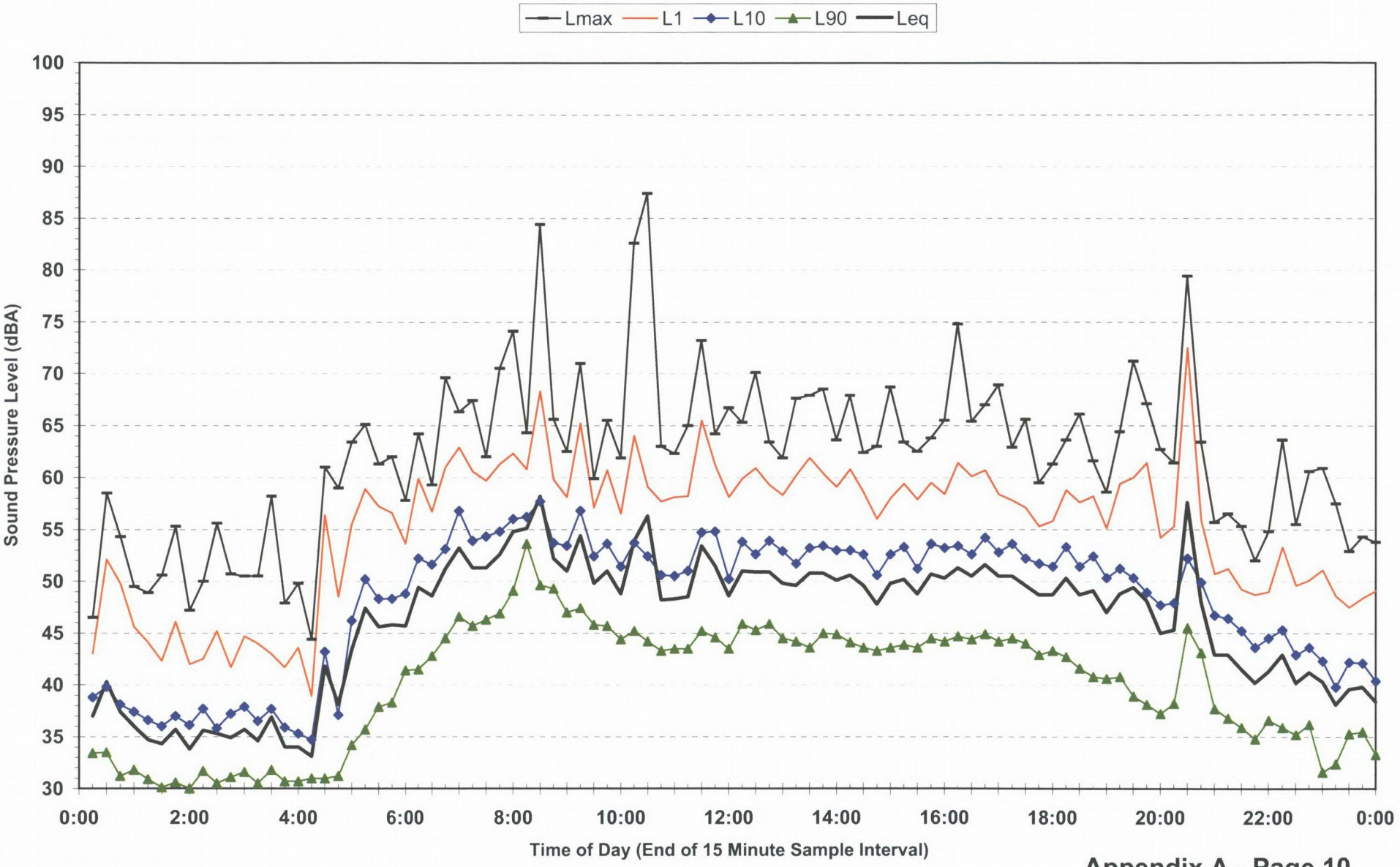

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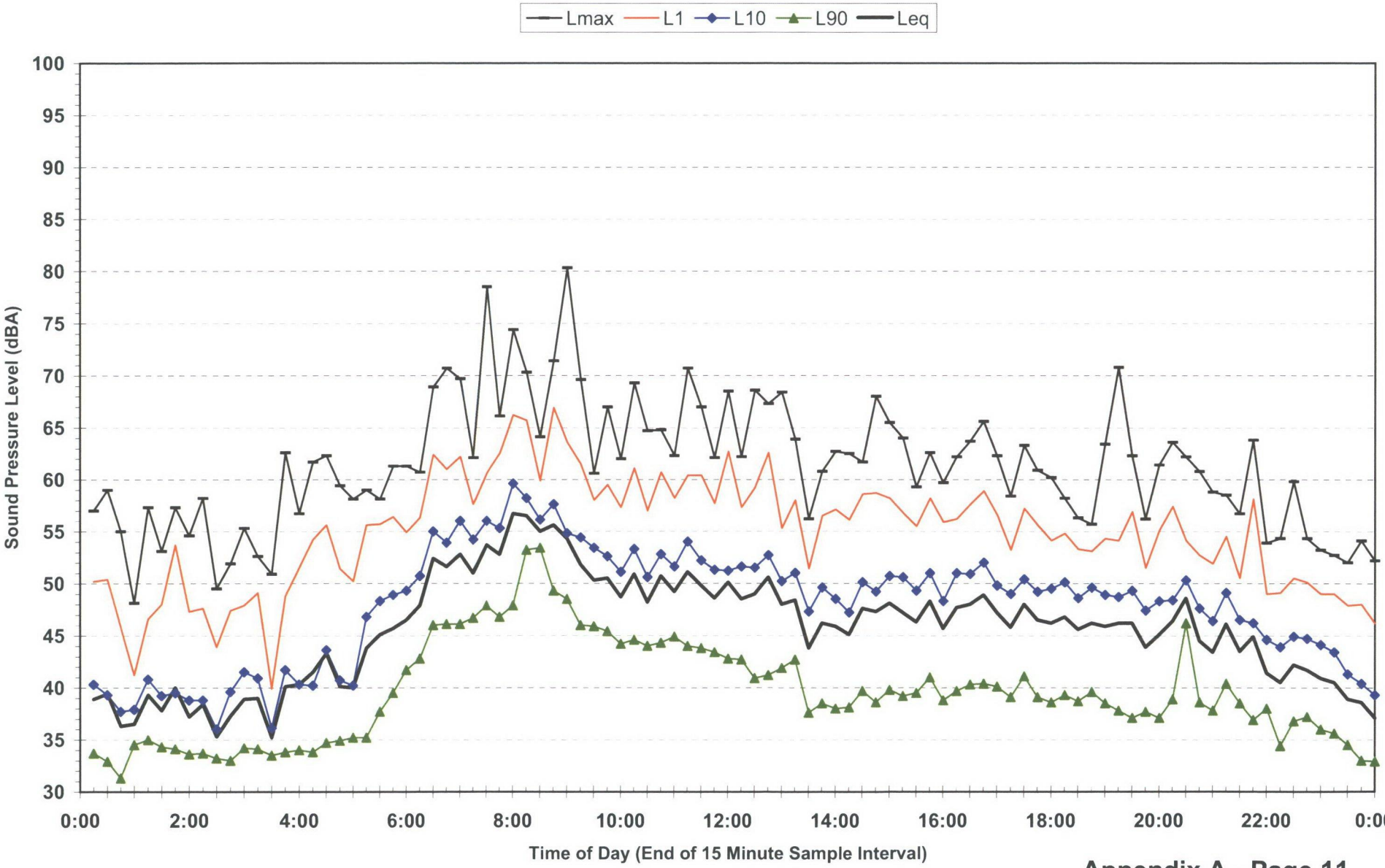

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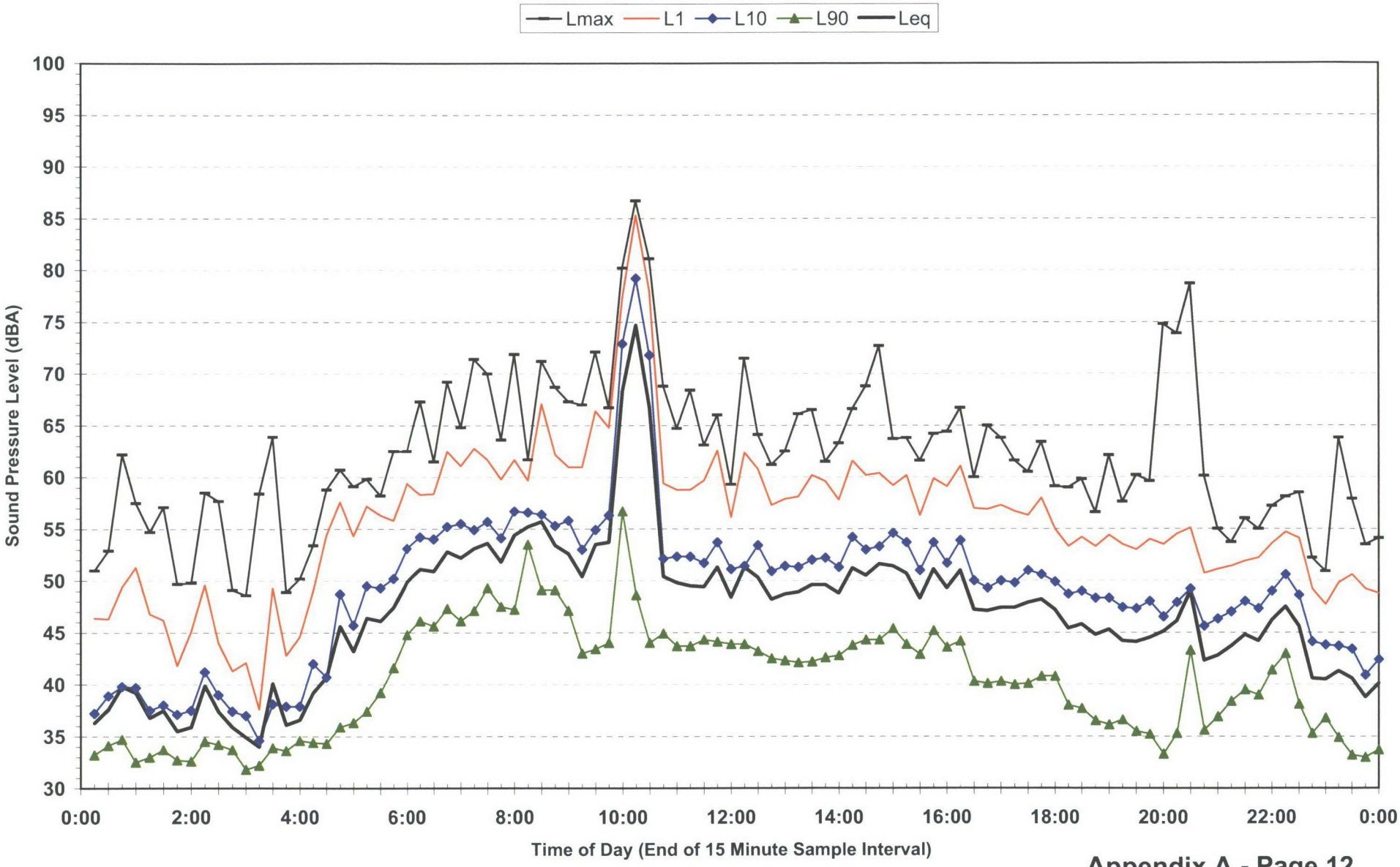

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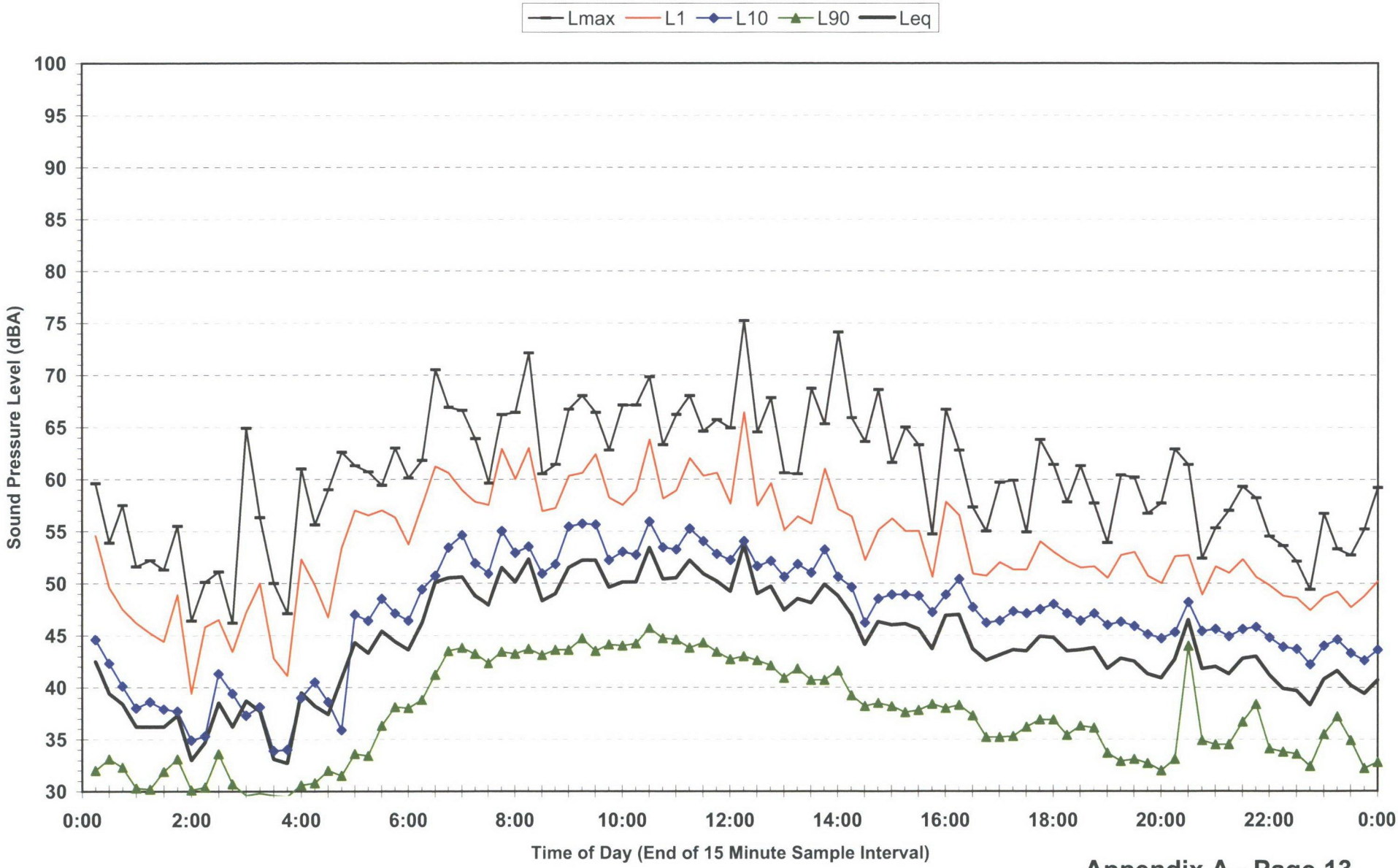

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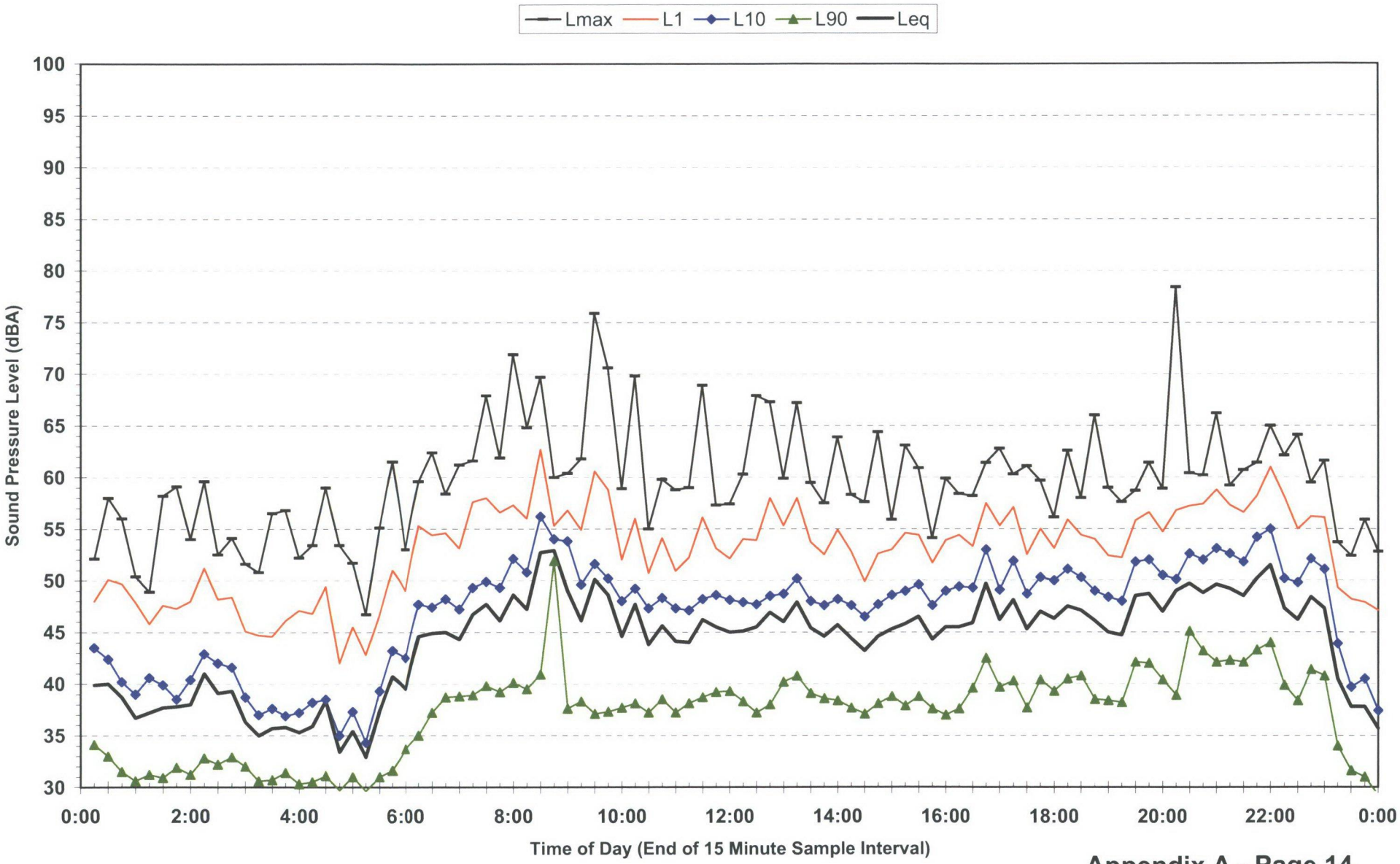

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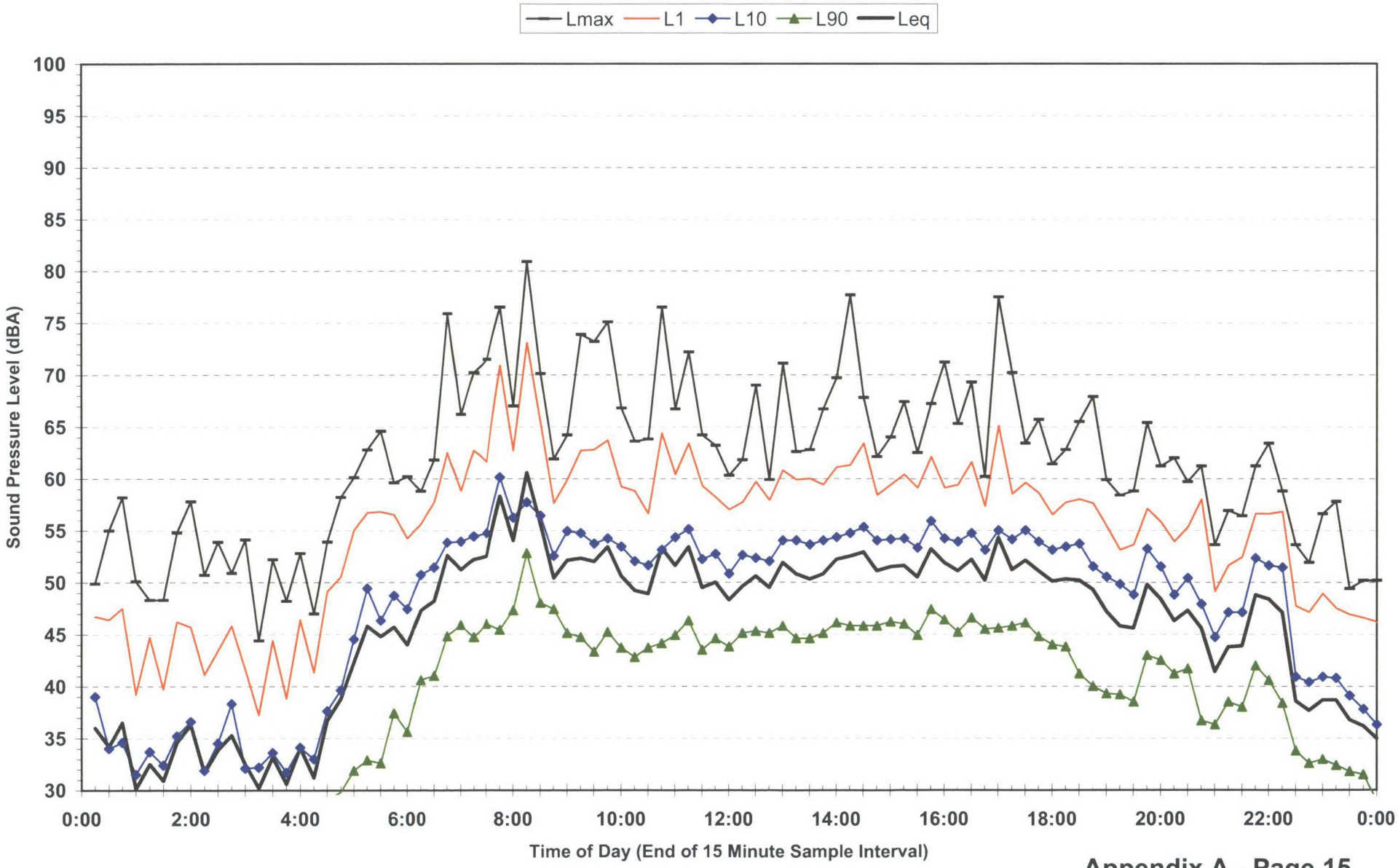

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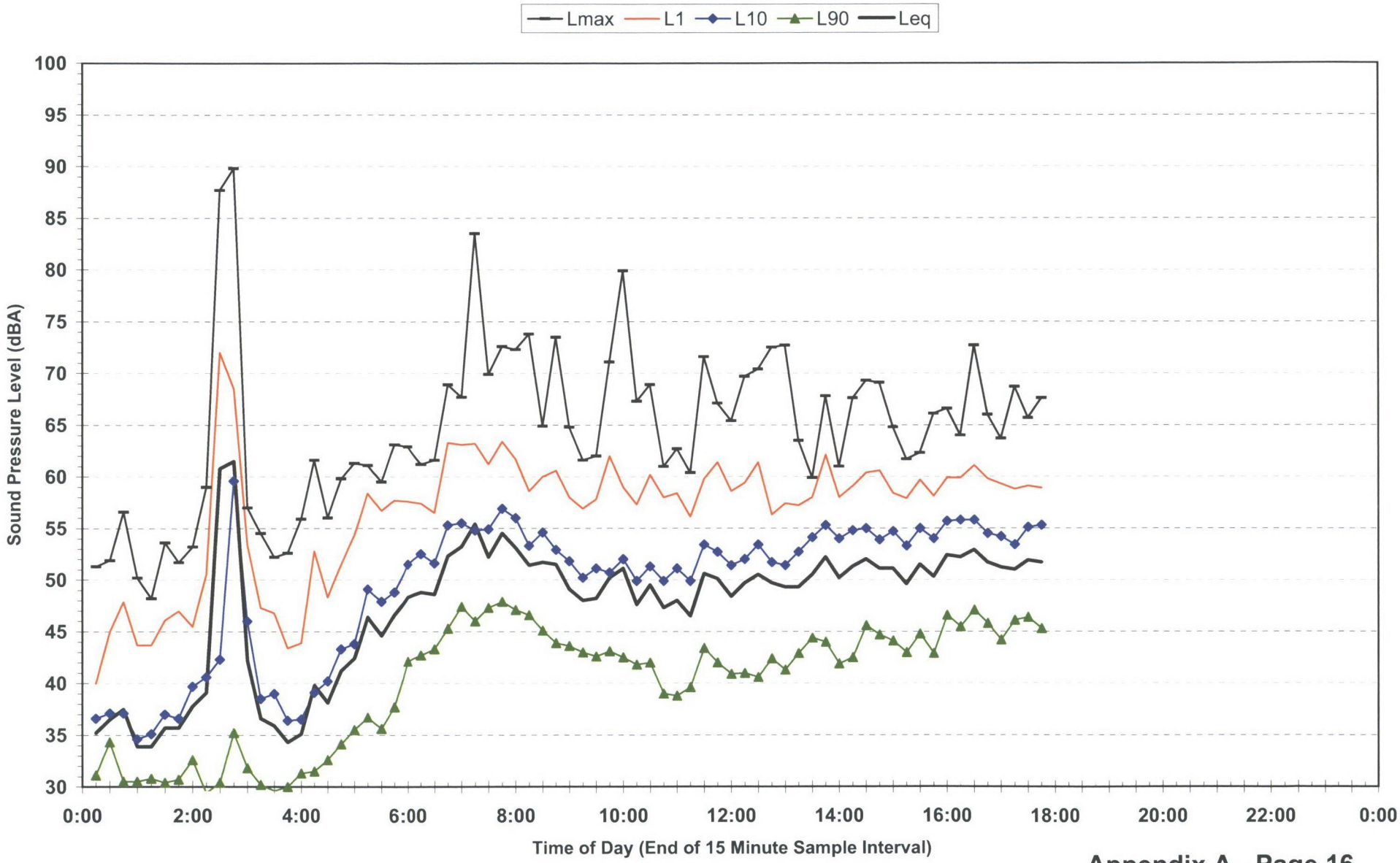
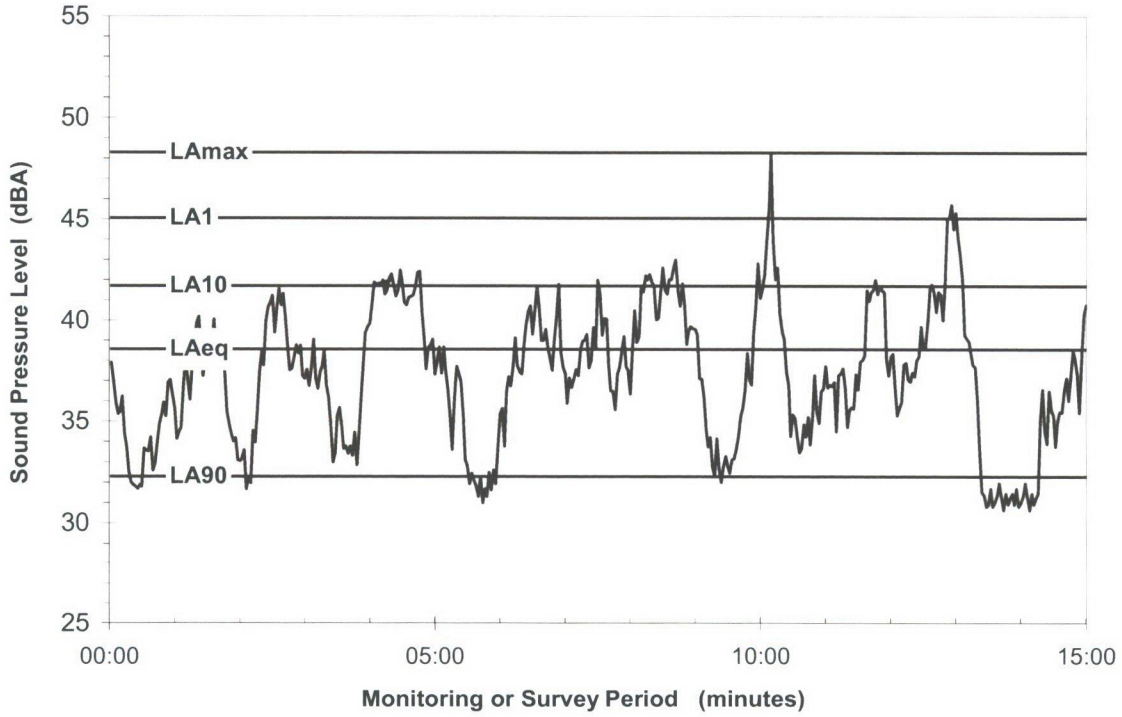


ACOUSTIC TERMINOLOGY

This Report makes repeated reference to certain noise level descriptors, in particular the L_{A10}, L_{A90} and L_{Aeq} and L_{Amax} noise levels.

- The L_{A10} is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound over the same measurement period.
- The L_{A90} noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the "background" level.
- The L_{Amax} noise level is the maximum A-weighted noise level associated with road traffic movements.

Graphical Display of Typical Noise Indices



Typical Noise Levels

Examples of typical noise levels:

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130 120 110	Threshold of pain Heavy rock concert Grinding on steel	Intolerable Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerb side of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to Quiet
40 30	Inside private office Inside bedroom	Quiet to Very quiet
20	Unoccupied recording studio	Almost silent

A-Weighting or dBA Noise Levels

The overall level of a sound is usually expressed in terms of dBA, which is measured using the "A-weighting" filter incorporated in sound level meters. These filters have a frequency response corresponding approximately to that of human hearing. People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the "loudness" of that sound. Different sources having the same dBA level generally sound about equally as loud, although the perceived loudness can also be affected by the character of the sound (eg the loudness of human speech and a distant motorbike may be perceived differently, although they are of the same dBA level).

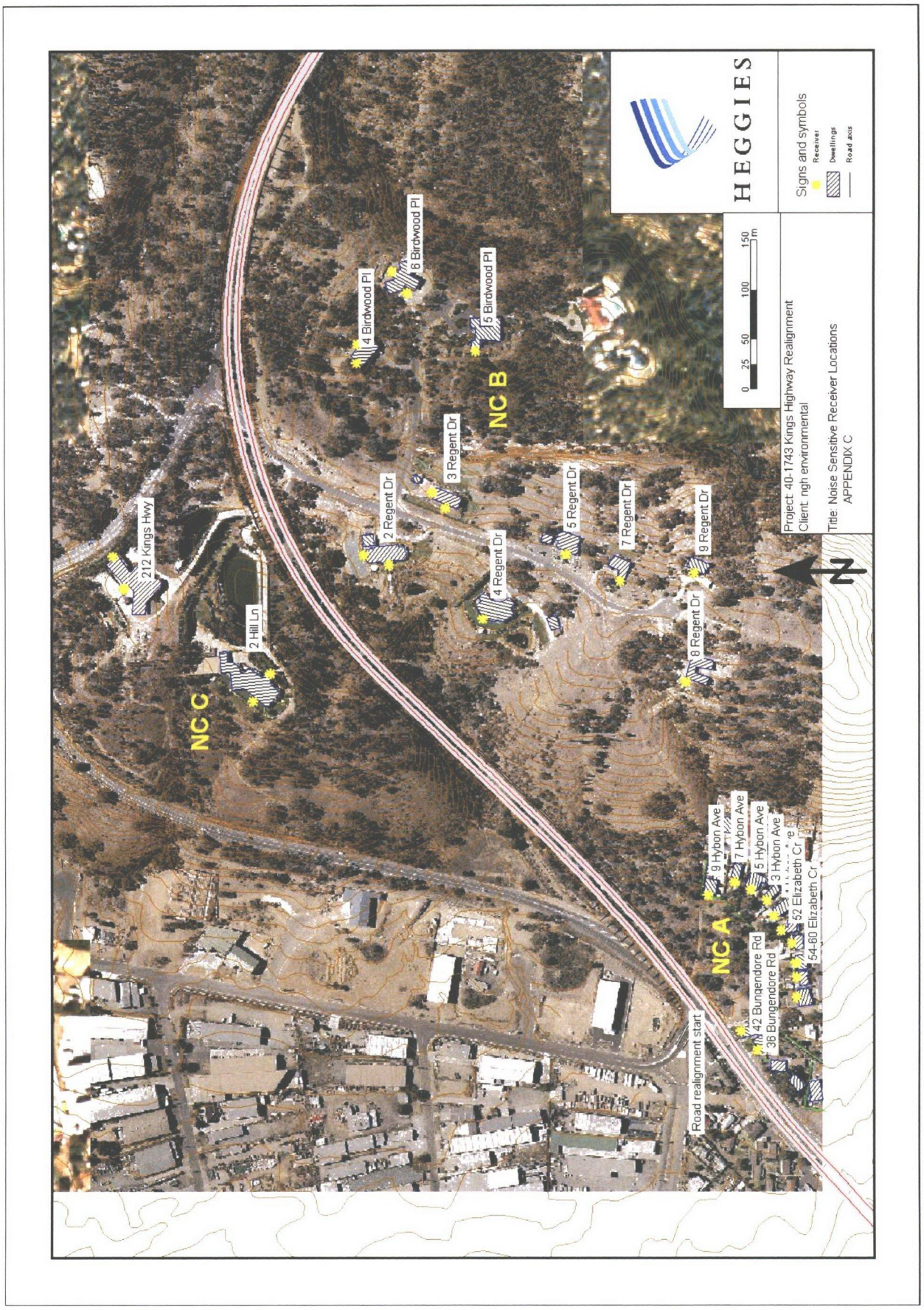
Sensitivity of People to Noise Level Changes

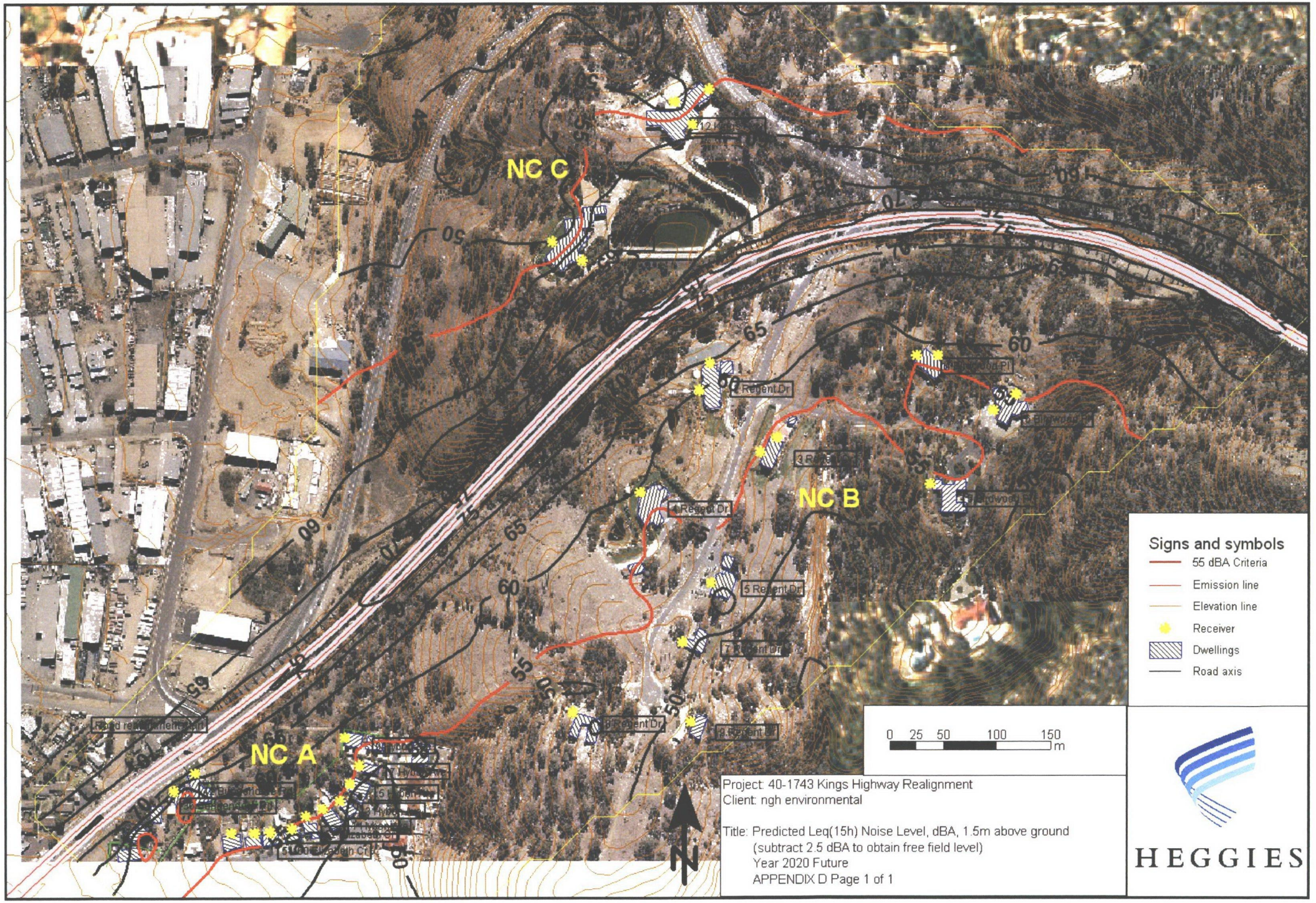
A change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

Noise Calculation Receiver Location Details

Address	Floor	X	Y	Z
212 King Hwy north	1	704887.4	6086975.1	661.7
212 King Hwy west	1	704855.2	6086963.4	661.7
212 King Hwy east	1	704872.4	6086942.4	661.7
2 Hill Ln west (BG2)	1	704741.5	6086833.7	656.7
2 Hill Ln east	1	704769.3	6086816.0	656.7
4 Birdwood Pl west	1	705081.3	6086728.4	667.4
4 Birdwood Pl north	1	705100.6	6086727.8	667.4
2 Regent Dr north	1	704888.3	6086721.0	653.7
2 Regent Dr west	1	704878.6	6086695.8	653.7
6 Birdwood Pl north	1	705173.5	6086692.3	674.8
6 Birdwood Pl nest	1	705152.5	6086677.4	674.8
3 Regent Dr north	1	704950.9	6086651.8	655.6
3 Regent Dr west	1	704935.9	6086638.4	655.6
5 Birdwood Pl	1	705093.5	6086608.8	665.1
4 Regent Dr	1	704823.8	6086601.0	651.1
5 Regent Dr	1	704889.2	6086516.8	658.7
7 Regent Dr	1	704862.2	6086462.0	659.7
8 Regent Dr	1	704760.7	6086396.5	649.4
9 Regent Dr	1	704870.5	6086387.8	654.5
9 Hybon Ave	1	704542.9	6086374.0	610.1
	2	704542.9	6086374.0	612.9
7 Hybon	1	704559.7	6086347.0	612.1
42 Bungendore Rd (BG1)	1	704407.9	6086340.4	600.3
5 Hybon Ave	1	704551.1	6086330.4	610.5
36 Bungendore Rd	1	704388.6	6086323.6	599.8
3 Hybon Ave	1	704541.1	6086314.5	609.0
1 Hybon Ave	1	704525.3	6086307.0	608.0
52 Elizabeth Cr	1	704509.2	6086300.3	606.2
54 Elizabeth Cr	1	704497.0	6086288.6	606.0
56 Elizabeth Cr	1	704477.0	6086285.3	604.5
60 Elizabeth Cr	1	704441.5	6086284.4	601.0
58 Elizabeth Cr	1	704462.5	6086284.4	603.4

Noise Calculation Receiver Location Details




NC C
NC B
NC A
Signs and symbols
55 dBA Criteria
Emission line
Elevation line
Receiver
Dwellings
Road axis
0 25 50 100 150 m
N
Project: 40-1743 Kings Highway Realignment
Client: ngh environmental
Title: Predicted Leq(15h) Noise Level, dBA, 1.5m above ground
(subtract 2.5 dBA to obtain free field level)
Year 2020 Future
APPENDIX D Page 1 of 1
HEGGIES

2 Regent Dr
4 Regent Dr
5 Regent Dr
Signs and symbols
Noise Barrier
Elevation line
Receiver
Dwellings
Road axis
0 15 30 60 90
m
Project: 40-1743 Kings Highway Realignment
Client: ngh environmental
Title: Year 2020 Future - NOISE BARRIER LOCATION
APPENDIX E Page 1 of 1
HEGGIES

Appendix G

Visual impact assessment

Kings Highway Realignment

Visual Impact Assessment - Final

prepared for

NGH Environmental

by

phillipsmarler

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pod

August 20th 2009

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1.0 Executive Summary

This Visual Impact Assessment is being prepared as part of a Review of Environmental Factors (REF) for the proposed realignment of the Kings Highway east of Queanbeyan. The realignment project is required to improve road design and safety. The Visual Impact Assessment should be read in conjunction with other specialist inputs into the REF including an acoustic assessment.

The proposed works are located between Thurralily Street and 400metres to the east of the Ridgeway Road. A residential subdivision is situated to the south of the realignment site. The proposed realignment is within an existing road reserve which follows the route of an old cart track through partially cleared woodland, and traverses the hill in a gentle curve in a north easterly direction. The realignment runs along the rear of a group of properties in a semi-rural residential development.

The length of the proposed realignment is approximately 900metres. The intended realignment is in proximity of residences in Hill Lane to the north-west, Regent Drive to the east and Birdwood Lane to the south east. The road is designed to be a four lane highway with two lanes running north-east (outward bound) and two lanes running south-west (Queanbeyan bound). The speed limit is to be 80km and the realignment is designed to improve economic efficiency, road safety, and be aesthetically pleasing.

The road is designed at a continuous 8% fall through the entire corridor falling 95.723metres from the north-east to the south-west. Only minor level changes are in evidence at the two merging areas of the realignment. Within the middle section between chainage 63180 to 63620, road levels are achieved through extensive filling, raising the level of the road pavement in some areas to between 3-5metres in all areas. In the vicinity of chainage 63440, there is extensive cutting on the western edge of the corridor to allow a road level 5.5metres below existing and filling on the eastern side of the corridor to approx 3metres.

The road corridor is characterised by the valley form with steep slopes and rocky outcrops and dominated by open woodland creating intermittent shade and open areas, rocky outcrops and cuts. A former road with an unmade rocky gravel surface climbs steeply through the site. The vegetation of the site is dry woodland or open forest community dominated by brittle gum. The heights of the trees throughout the dry woodland are between 6-10metres indicating patterns of canopy regrowth. The views within the woodland are open and filtered due to the tree spacing and sparse understorey.

Due to the enclosed nature of the winding road corridor, there is little opportunity for long distance views towards Queanbeyan from the site itself. Some long distant views are detectable from the north-eastern end of the alignment. Views beyond the site to the surrounding residential subdivisions are towards Hill Lane, and Regent Drive. There are surrounding views to the west from Regent Drive over Queanbeyan and towards the Brindabellas.

The surrounding built form is varied. At the western end of the realignment, the Kings Highway is flanked by an industrial area of large warehouses generally with blank elevations to the Kings Highway. To the south, is a residential subdivision, around Hybon Avenue and Elizabeth Crescent which is surrounded on three sides with open woodland. In the middle section to the east is a residential subdivision zoned 1c SP rural scenic protection centred around Regent Drive of single modern brick houses on large blocks. To the north west, located on Hill Lane two red brick, single and double storey residential buildings are located.

The visual envelope is generally contained with the valley limiting views to those at near distance. The proposal is at times elevated up to 7metres from the existing ground levels which alters the visibility of the proposal from the existing ground levels within the proposal area.

The ridge to the north of the road alignment (Hill Lane area) defines the visual catchment to the north west. Views to the road alignment are restricted to 100-150metres from the road. Zoned '1c SP rural scenic protection' views to the road are filtered through existing vegetation. Immediate views look down the slope of the hill. The spur lines to the south east of the road alignment at Regent Drive and Birdwood Place define the visual catchment to the south east. There are immediate views looking down the slope of the hill to the road.

Near distance views exist along Regent Drive, Hill Lane and Birdwood Place and are heavily filtered through existing vegetation. Near distance views are from the entry of the new road. There are views north- east along the Kings Highway directly along the new road alignment, which is an extension of the existing Kings Highway. Medium distance views are from the wide valley floor of Queanbeyan towards the proposed road alignment. These are glimpses of views between buildings and vegetation. Long distance views are from higher points and small hills within Queanbeyan.

The visual impact assessment is based on unmitigated view corridors to the proposed realignment. The assessment is based on a combination of magnitude of road construction and visual impact from the key viewpoints. The magnitude of the project is determined by the nature of the constructed project

and view point proximity. The realignment is broadly at its greatest constructed magnitude in the valley where the pavement is raised in some instances up to 7metres and where there are significant cut batters. Visual sensitivity has the greatest impact along the valley area, with Regent Drive. Visual impact is determined by a combination of these factors which are then ranked accordingly from negligible to high.

The Visual Impact Assessment broadly rates the viewpoints into three categories - high, moderate and low. The most highly affected viewpoints are at 2 and 4 Regent Drive and 2 Hill Lane. Moderate to high impacts affect 1 Hill Lane. Moderate impacts will affect 4 Birdwood Place and 9 and 12 Hybon Avenue. 6 Birdwood Place will receive low to moderate impact as will long distant views from Nimmitabel Street, Letchworth. Mid distance views from Ellerton Drive close to Bungendore Road roundabout are generally low impact.

Mitigation techniques should be developed to be appropriate to the character of the surrounding landscape. It is preferred that the softer methods of using earth mounds and additional trees is adopted in every scenario and serve as a mitigation to noise walls if required. In general, the mitigation techniques should be as discreet as possible using colours and materials that blend in with the surrounding landscape and where possible reinforce the semi-rural bushland character of the site. Additionally, RTA are encouraged to liaise with residents to facilitate additional tree planting on private property where practical and generally make efforts to reduce the number of trees that need to be removed in the easement and to appropriately maintain any trees in the easement during construction.

Mitigation requirements for key viewpoints and design measures for mitigation should be commensurate with the degree of impact that is predicted. The three most impacted viewpoints are 2 and 4 Regent Drive and 2 Hill Lane. All of these sites have relatively little vegetation between the residence and the proposed road and both additional planting on private land and retaining of trees in the easement would assist in screening and afford benefit to the zoning requirement of scenic protection.

The mitigation techniques proposed are broadly noise walls, earth mounds and additional planting, and can be used in combination or separately depending on the level of visual impact being mitigated. The viewpoints more moderately impacted are due in part to greater distance from the road realignment and could be mitigated with a combination of earth mounds and tree planting. Low impact views would benefit from additional planting.

Figure 1
Viewing south to Queanbeyan overlooking proposed road realignment
Source: Phillips Marler 2009

Figure 2
Existing road reserve traversing through proposed road realignment
Source: Phillips Marler 2009

2.0 Project Background

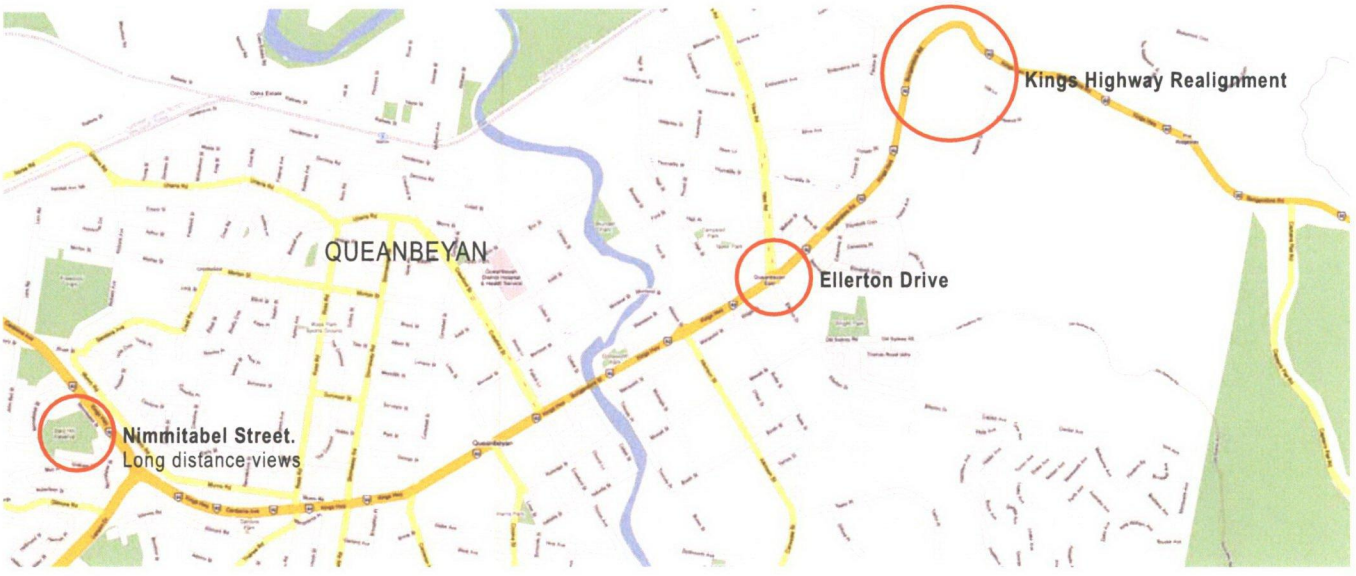
The following Visual Impact Assessment is being prepared as part of a Review of Environmental Factors (REF) for the proposed realignment of the Kings Highway east of Queanbeyan (fig. 1). The realignment project is required to improve road design and safety. The Visual Impact Assessment will be written in conjunction with other specialist inputs into the REF including an acoustic assessment.

This Visual Impact Assessment is based on the understanding that the alignment and general grading requirements of the project are essentially determined.

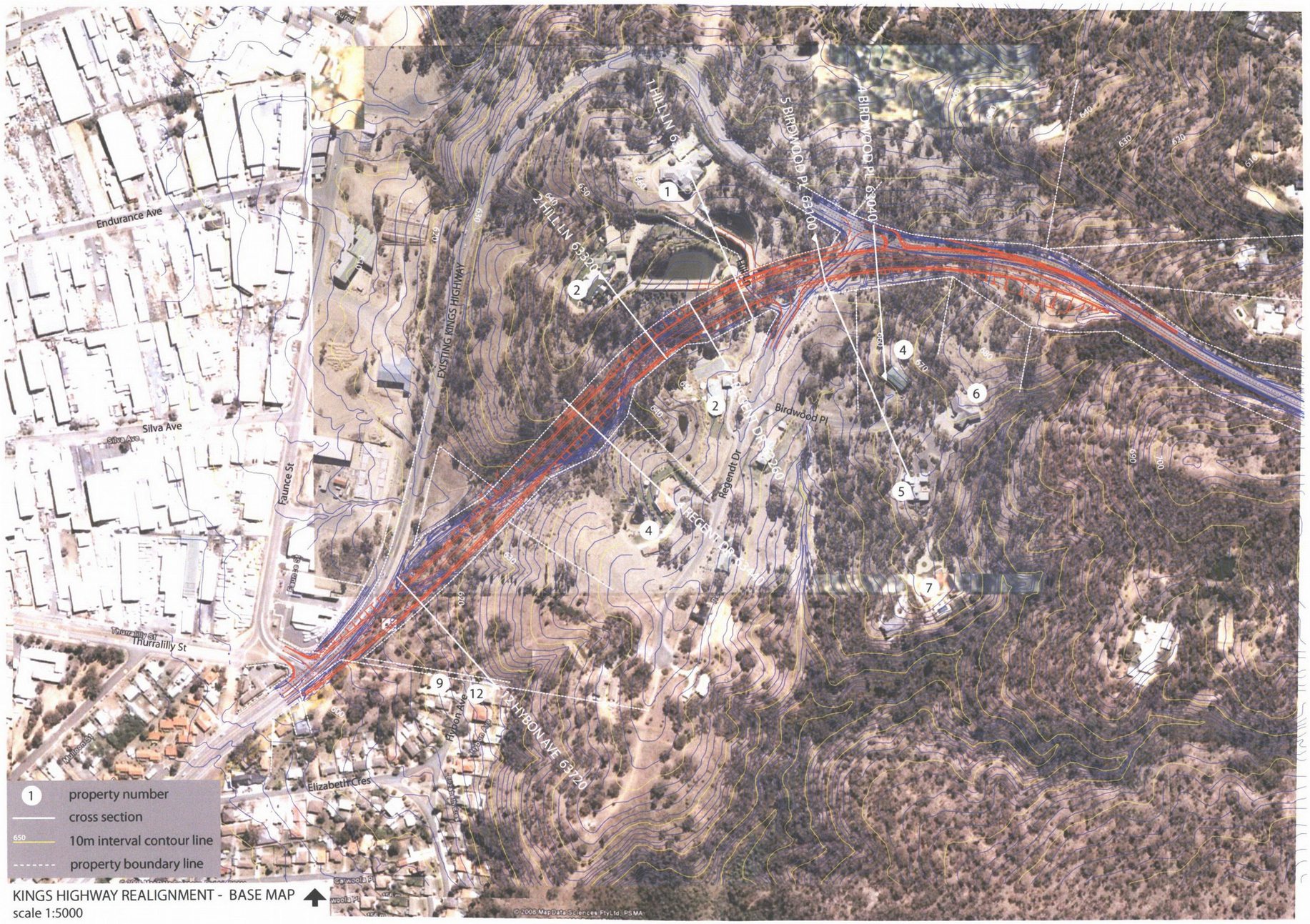
3.0 Project Locality

The proposed works are located between Thurralily Road and 400metres to the east of the Ridgeway Road (Map 2). The proposed start of the realignment is adjacent to a large industrial warehousing area running alongside the Kings Highway to the west. A residential subdivision is situated to the south of the realignment site. The proposed realignment is within an existing road reserve which follows the route of an old cart track (fig. 2) through partially cleared woodland, and traverses the hill in a gentle curve in a north easterly direction. The realignment runs along the rear of a group of properties in a semi-rural residential development.

The length of the proposed realignment is approximately 900metres. The intended realignment is in proximity of residences in Hill Lane to the north-west, Regent Drive to the east and Birdwood Lane to the south east.



Map 1
Context Map



KINGS HIGHWAY REALIGNMENT - BASE MAP
scale 1:5000

Map 2
Location Plan

Figure 3
Southern entrance of proposed road alignment alongside Industrial warehouses
Source: Phillips Marler 2009

Figure 4
Northern entrance of proposed road alignment sloping down through semi-cleared woodland
Source: Phillips Marler 2009

4.0 Study Corridor

4.1 Character of proposed road

The road is designed to be a three lane highway with two lanes either direction. The speed limit is to be 80km and the realignment is designed to improve economic efficiency, road safety, and be aesthetically pleasing. The road corridor width is a varied width of 60metres on average, with a pavement width of 23metres, and is likely to include a central median.

The proposal may include noise walls for part or all of the length of the new road alignment. This is to be determined through a concurrent Acoustic Assessment. On approach to Queanbeyan, the driving experience on the proposed road would afford views along the road down the valley to Queanbeyan township.

4.2 Proposed gradient and cut and fill

The road is designed at a continuous 8% fall (1:12.5) through the entire corridor falling 95.723metres from the north-east to the south-west. At the north eastern end of the corridor, there is little change to the road level (between chainages 62540 to 62640) and the road matches with existing. In the north-eastern section of the road corridor, between chainage 62680 (end of merging area) to 63080 (close to the Regent Drive intersection) there is only minor change in levels between existing and proposed. Between chainage 63180 to 63620 road levels are achieved through extensive filling, raising the level of the road pavement in some areas to between 3-5metres in all areas. However, in the vicinity of chainage 63440 there is extensive cutting on the western edge of the corridor to allow a road level 5.5metres below existing and filling on the eastern side of the corridor to approx 3metres. Small areas of cut form the edge of the road alignment at the south-western end.

4.3 Character of road merging areas (each end)

The commencement of the realignment on the southern end is flanked by industrial warehouses north of Thurralilly Street (fig. 3) and residential and commercial developments to the south of Thurralilly Street. The existing Kings Highway at the commencement of the realignment within East Queanbeyan, is a four lane separated road, with wide grassed median.

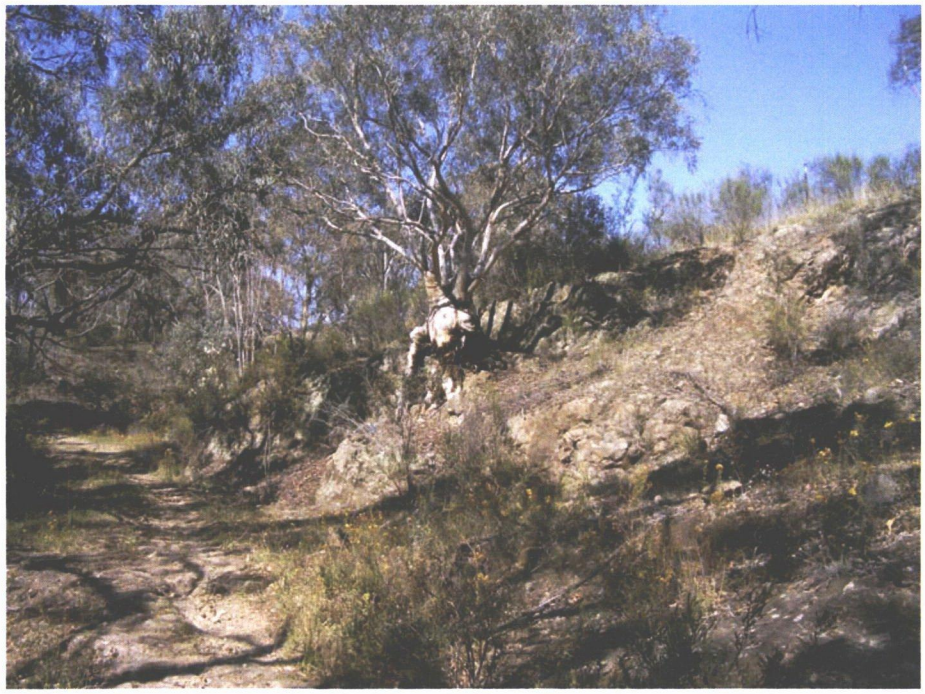


Figure 5
Dry gully with vegetated slopes along proposed road alignment
Source: Phillips Marler 2009

Figure 6
Dry woodland/open forest community
Source: Phillips Marler 2009

The existing Kings Highway at the commencement of the realignment at the north-east on top of the ridge is a 3 lane road. The road merging area landscape consists of semi-cleared woodland (fig. 4) with patchy remnant woodland on the highway verges (NGH Environmental p.2).

5.0 Landscape Character

5.1 Topography

The site is at an elevation of approximately 600-700 metres ASL and is located on metamorphosed Ordovician siltstone, visible in outcrops with shallow soils and areas of near vertical cuttings. It is a valley with a dry gully to the western edge with vegetated slopes each side (fig. 5). A former road with an unmade rocky gravel surface climbs steeply through the site.

5.2 Vegetation

The vegetation of the site is of a dry woodland or open forest community dominated by brittle gum (fig. 6). *Eucalyptus mannifera* and Red Stringybark *Eucalyptus macrorhyncha* are the dominant species with a mix of taller shrubs such as *Bursaria spinosa* and *Dillwynia sieberi*. There are also a variety of grasses including *Austrodanthonia* spp., *Themeda australis, Lomandra* spp. and *Dianella revoluta*. On the less disturbed areas of the site, there are a variety of low shrubs and some grasses including *Danthonia* spp, *Pultanea micorophylla*.

Within the low point of the gully, there are some agricultural weeds including *Hypericum perforatum* (St Johns Wort) and *Plantago lanecolata* (Ribbed plantain) (NGH Environmental 2008).At the south-western end, there is limited understorey and the site is partly disturbed by past roadworks, rubbish dumping and weed invasion. There are occurrences of the endangered plant Hoary Sunray *Leucochrysum albicans ssp albicans var. tricolor*, scattered within the proposed corridor.

The heights of the trees throughout the dry woodland are between 6-10metres indicating patterns of canopy regrowth within the woodland with the exception of some larger trees which appear to be remnant woodland and are 20-25metres tall with large developed canopies. Middle storey vegetation is between 2-5metres in height and predominate in the gully. This creates a vegetation character that is more dense in appearance. There is limited understorey planting due to the dry nature of the woodland. The views within the woodland are open and filtered due to the tree spacing and sparse understory. The tree canopy when viewed from outside creates a cohesive covering along the valley.

Figure 7
Rocky outcrops
Source: Phillips Marler 2009

Figure 8
Residence along 4 Regent Street overlooking proposed road corridor
Source: Phillips Marler 2009

5.3 Scenic and experiential values of the corridor

The road corridor is characterised by the valley form with steep slopes and rocky outcrops. The valley is dominated by open woodland creating intermittent shade and open areas, rocky outcrops and cuts (fig. 7) revealing rock and soil formation possibly associated with historic construction activity (NGH Environmental 2008). Trees, rock outcrops and vegetation at the top of cut slopes create a sense of enclosure and constitute site character. The winding nature of the old road and the surrounding vegetation limit views to surrounding residential areas. Due to the enclosed nature of the winding road corridor, there is little opportunity for long distance views towards Queanbeyan from the site itself. Some long distant views are detectable from the north-eastern end of the alignment. Views beyond the site to the surrounding residential subdivisions are towards Hill Lane, and Regent Drive. There are surrounding views to the west from Regent Drive over Queanbeyan and towards the Brindabellas.

5.4 Character of surrounding built form including residential subdivision

The surrounding built form is varied. At the western end of the realignment, the Kings Highway is flanked by an industrial area of large warehouses generally with blank elevations to the Kings Highway. To the south, is a residential subdivision, around Hybon Avenue and Elizabeth Crescent which is surrounded on three sides with open woodland. The timber fences of the most northerly group in the subdivision are visible from the western end of the road corridor. In the middle section of the road corridor to the east is a residential subdivision centred around Regent Drive of single modern brick houses on large blocks. (fig. 8) To the north west, located on Hill Lane two red brick, single and double storey residential buildings are located.

The Queanbeyan LEP 1998 states that the surrounding residential development is zoned 1c SP rural scenic protection and the LEP calls for areas on 'higher elevations to act as a transition between fully urbanized areas and bushland which should be developed in a sensitive manner'. All remaining tree canopy along the road corridor adjacent to the housing should be maintained to assist visual screening.

The views from the rural residential properties along Regent Drive and Hill Lane overlook the vegetated valley.

5.5 Surrounding views

More distant views are visible to the surrounding areas across Queanbeyan to the south and west generally from the Regent Drive area.

5.6 Urban and Landscape Considerations

The highway experience merges from an urban environment, through rural residential, to bushland contexts.

The highway is an extension of the Queanbeyan townscape at the southern area of the project. The highway connects to the streetscape that leads through the town. The highway passes through areas of residential and warehouse industrial built environment in this area. The objectives for the highway passing through urban areas is to integrate into the urban streetscape, establishing a structured and cultivated landscape and street tree planting and provide a pedestrian human scale to the street footpaths and crossings.

The rural residential area includes remnant tree canopy and regenerating understorey merging with the cultivated landscapes of the properties. The objective for the highway design in this area is to integrate the edge conditions at the road into the informal vegetated gully landscape character.

6.0 Visual Catchment

The Visual Envelope of the proposed road alignment is essentially defined by landform. Within the envelope, the vegetation and built form obscures views and visibility.

Figure 9
Ridge defines extent of visual catchment from 2 Hill Lane
Source: Phillips Marler 2009

Figure 10
Near distance views at the new road near the intersection of Thurralilly Street and Kings Highway
Source: Phillips Marler 2009

6.1 Visual Envelope

The extent of the visual catchment for the close and distant areas are depicted in the Visual Envelope Map (VEM) (Map 3 page 18 and Map 4 page 21).

The majority of the proposed road alignment is located within a small valley. The enclosing hills generally limit the extent of visual catchment, constraining the visual envelope to the near distance views. The proposal is at times elevated up to 7metres from the existing ground levels which alters the visibility of the proposal from the existing ground levels within the proposal area.

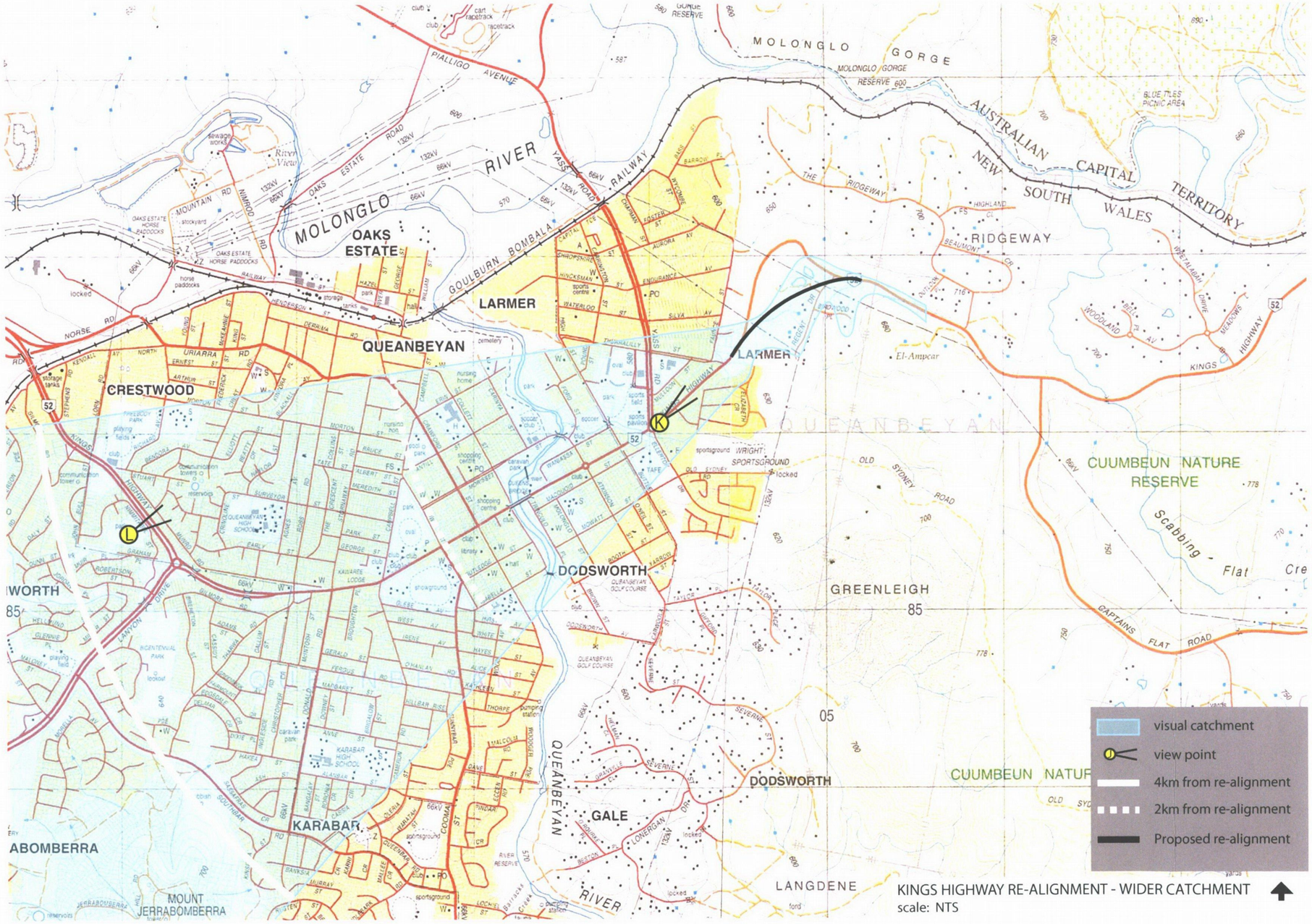
The road alignment deviates from the current road alignment at the top of the ridge, before dipping into the valley. The new road alignment is generally not visible from the north as the road is dipping through the valley to the south west.

The ridge to the north of the road alignment (Hill Lane area) defines the visual catchment to the north west (fig. 9). Views to the road alignment are restricted to 100-150m from the road. The views to the road in this area are filtered through existing vegetation. Immediate views look down the slope of the hill towards the road. The spur lines to the south east of the road alignment (Regent Drive and Birdwood Place) define the visual catchment to the south east. There are immediate views looking down the slope of the hill to the road.

Near distance views exist from along Regent Drive and Birdwood Place looking along the gentle spur lines towards the road. The views from Birdwood Place are heavily filtered through the existing vegetation. Near distance views are from the entry of the new road from the intersection with Thurralilly Street and Kings Hwy. (fig. 10) There would be views north east along the Kings Hwy directly up along the new road alignment, as it is an extension of the existing King Hwy.

Medium distance views from the wide valley floor of Queanbeyan look up the valley to the proposed road alignment. These are glimpses of views between buildings and vegetation.

Long distance views are from higher points, and small hills within Queanbeyan. These include Mount Jerrabomberra, Bicentennial Park, and Nimmitabel Street Park Letchworth.



Map 3
Visual Envelope Map - Wider Catchment

Figure 11
Immediate views to proposed road alignment have filtered views from 2 Regent Drive
Source: Phillips Marler 2009

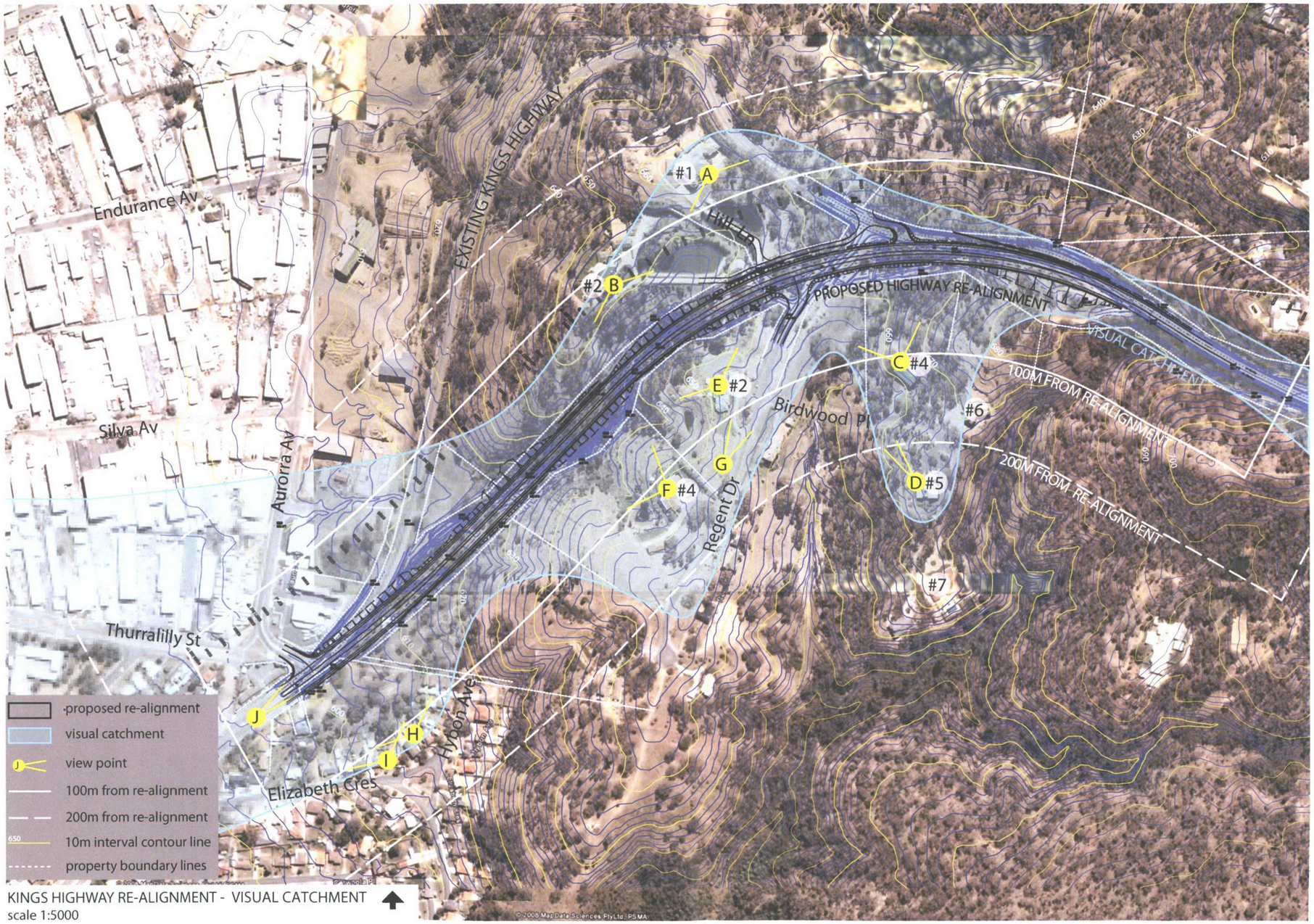
6.2 Influencing Factors

The immediate distance views looking to the proposed road alignment are filtered through the existing vegetation canopy (fig. 11). The impact of the loss of vegetation within the corridor would have an influence on the visibility of the proposal with the corridor.

The medium distance views within the wide valley floor of Queanbeyan are obscured or filtered through vegetation and built form adjacent to the viewer.

6.3 Viewing Distance

The proximity of the viewer within the visual envelope influences the magnitude of the visibility. Key view points have been identified within the visual envelope.



KINGS HIGHWAY RE-ALIGNMENT - VISUAL CATCHMENT
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Map 4
Visual Envelope Map - Visual Catchment

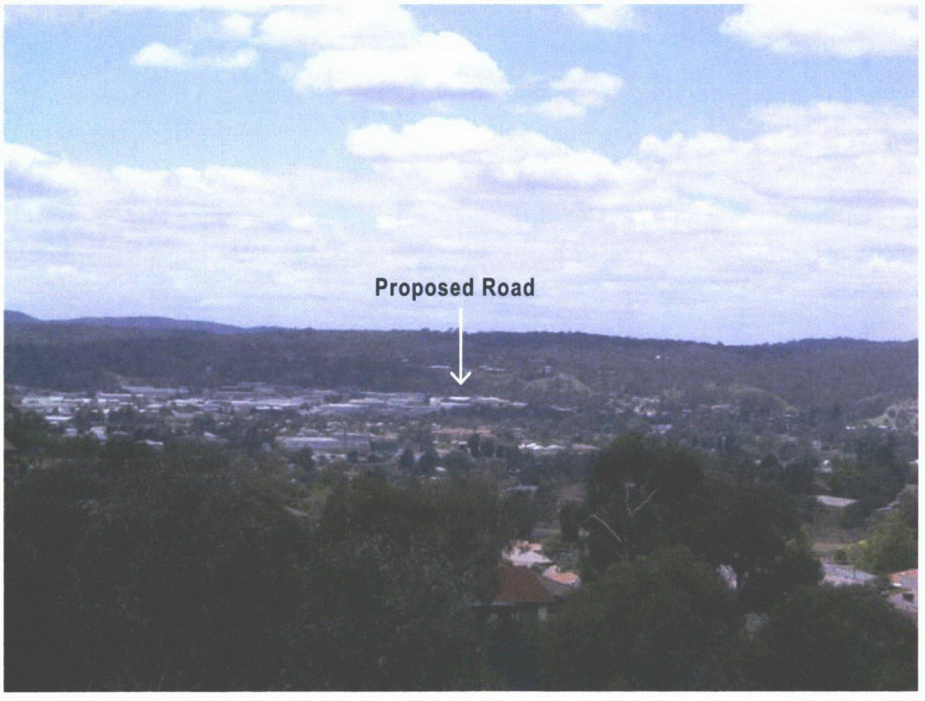


Figure 12
Viewpoint L: northeast of road alignment
Source: Phillips Marler 2009

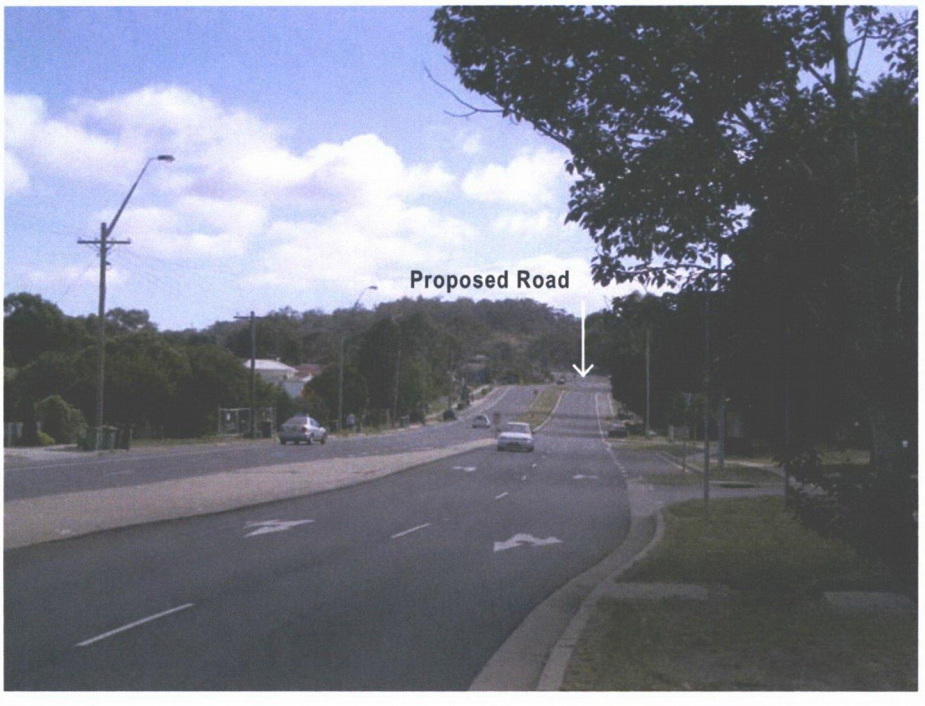


Figure 13
Viewpoint K: direct view of proposed road alignment
Source: Phillips Marler 2009

7.0 Viewpoint Identification

Viewpoints within the Visual Envelope have been selected on the basis of where the proposed road alignment would appear to be the most prominent based on sensitivity and magnitude. Generally, most consideration in the selection of the viewpoints is given to the adjacent residential dwellings and immediate streets. Viewpoints representative of the medium and long distance views have also been included.

7.1 Long Distance Views
Views greater than 1km from the proposal

The long distance views to the proposed road alignment are available from higher points of the small hills within Queanbeyan. These include Mount Jerrabomberra, Bicentennial Park, and Nimitabel Street Park Letchworth.

Viewpoint L: Watertank at Nimmitabel Street

The selected viewpoint (L) south-east of Queanbeyan at the water tank at Nimmitabel Street looks north-east to the proposed road realignment (fig. 12). The park has local views over Queanbeyan and to surrounding hills

7.2 Medium Distance Views (Map 4 page 21)
Views 400m – 1 km from the proposal

Medium distance views from the wide valley floor of Queanbeyan looking up the valley of the proposed road realignment. Generally the views from the middle distance are obscured by vegetation and buildings.

Viewpoint K: Roundabout at Ellerton Crescent and Bungendore Road

The roundabout at Ellerton Crescent and Bungendore Road was selected as it provides a more direct view of the proposed road alignment, looking along the length of the Kings Hwy (Bungendore Rd). The existing views in this location are dominated by the highway corridor.

7.3 Near Distance Views (Map 3 page 18 and Map 4 page 21)
Views 100 – 400m from the proposal

Near distance views of the proposal will have a moderate to high magnitude of

Figure 14
Viewpoint J: commencement of proposed road alignment at Thurralilly Street and Kings Highway intersection
Source: Phillips Marler 2009

impact due to the proximity to the proposed road realignment. The views from the near distance may be obscured by vegetation and buildings.

Viewpoint H: 12 Hybon Avenue

At 12 Hybon Avenue, which is elevated, the adjacent area of the proposed road realignment would be elevated and the road easement cleared of trees. The existing views are from the rear of the property and are generally obscured by the rear fence.

Viewpoint I: 9 Hybon Avenue

The elevation of the residence is around 4metres above existing but would be around 2m above the most adjacent area of realignment at chainage 63760. The existing views are from the rear of the property and are generally obscured by the rear fence.

7.4 Immediate Views (Map 4 page 21)

Viewpoint J: Thurralilly Street/Kings Highway

The viewpoint at the Thurralilly Street/Kings Highway intersection is at the commencement of the proposed road realignment (fig. 14). From this viewpoint looking north east the surrounding industrial warehouses have blank elevations to the street. The view from this location is dominated by the existing road corner.

Figure 15
Viewpoint C: 4 Birdwood Place
Source: Phillips Marler 2009

Figure 16
Viewpoint A: 1 Hill Lane
Source: Phillips Marler 2009

Figure 17
Viewpoint B: 2 Hill Lane
Source: Phillips Marler 2009

Figure 18
Viewpoint B: 2 Hill Lane
Source: Phillips Marler 2009

Figure 19
Viewpoint E: 2 Regent Drive
Source: Phillips Marler 2009

Figure 20
Viewpoint E: 2 Regent Drive
Source: Phillips Marler 2009

Viewpoint C: 4 Birdwood Place

The existing road is partly visible due north from this residence which is situated on a spur and views follow down the slope which is partially obscured by vegetation (fig. 15). The area has a high level of visual sensitivity. The view is characterised by elevated open views through the woodland.

Viewpoint A: 1 Hill Lane

1 Hill Lane situated on a ridge is adjacent to the existing road and experiences a wide cone of visibility of traffic travelling east and west. The proposed road realignment would be at least 100-150metres from the ridge (Hill Lane) and filtered through vegetation on site (fig. 16). The view is open and elevated towards the east. Immediate views to the valley are currently screened by dense vegetation on the property.

Viewpoint B: 2 Hill Lane

The residence is situated on a spur line which looks directly into the valley approximately seventeen metres below the existing level of the residence (fig. 17). The views through the vegetation on the slope is open and filtered canopy. The views are focused in the valley and to adjacent slopes.

Viewpoint E: 2 Regent Drive

The proposed road realignment is situated 5metres above the existing alignment with the house within 50metres of the road corridor. The house is elevated above the realignment by approx 7metres (fig. 19). There is limited tree canopy on private property. The existing views are focused in the valley, looking onto the vegetation in the gully and on the adjacent slopes.

Figure 21
Viewpoint F: High visual impact from the tree canopy removal near 4 Regent Drive
Source: Phillips Marler 2009

Figure 22
Viewpoint G: proposed road alignment will be visible at the northern intersection of Regent Drive
Source: Phillips Marler 2009

Viewpoint F: 4 Regent Drive

The proposed road realignment is elevated 7metres above the existing valley. Visibility is masked by scattered groups of trees. The views are directed into the valley as well as open and elevated above the tree canopy looking to the north west.

Viewpoint G: Regent Drive

The new road alignment is visible along Regent Drive towards the intersection with Regent Drive (fig. 22). The proposed road realignment would be elevated in this area. Views are looking to scattered trees along the road and to the front of houses.

8.0 Visual Impact Assessment

8.1 Rationale for Assessing Visual Impact

The visual impact rationale is based on unmitigated view corridors to the proposed realignment from the viewpoints as identified earlier. The visual impact is assessed from a combination of magnitude of road construction and visual sensitivity to the realignment at the key viewpoints. The magnitude of the project is determined by the nature of the constructed project and view point proximity. Visual sensitivity is determined by the degree of change and impact to landscape character at any given part of the site with the greatest impact within the gully area, within Regent Drive. The realignment is broadly at its greatest constructed magnitude in the valley where the pavement is raised in some instances up to 7metres and where there are significant cut batters. Visual impact is determined by a combination of these factors which are then ranked accordingly from negligible to high (fig. 23).

The following table describes in notated form each viewpoint, its degree of sensitivity in terms of landscape character, and the magnitude of the road construction, the degree of visual impact and proposed steps for mitigation.

The ranking used for sensitivity, magnitude and visual impact are low, moderate and high in differing combinations.

Figure 23
Visual Impact Grading

VIEWPOINT	SENSITIVITY	MAGNITUDE	VISUAL IMPACT	MITIGATION
CONTEXT				
Mid distance views These views are from within the immediate contextual environment of the road corridor, mostly in East Queanbeyan. Ellerton Drive to Bungendore roundabout the realignment will appear running perpendicular up the hill with visibility close to the intersection with the existing highway to the east.	Low This view point being part of the highway intersection will be mostly experienced from the highway not from surrounding residences	*Moderate* The constructed road is some distance away from this mid distant viewpoint and the impact of construction is low.	*Low* The road alignment will be visible running perpendicular up the hill visible in the dark backdrop of the surrounding hills	Additional tree planting along the eastern side of Bungendore Road could assist in screening the proposed intersection further.

Long distance views Watertank Nimmitabel Street Letchworth	*Moderate* This viewpoint has clear visibility of the surrounding hills east of Queanbeyan and will be a visible intervention into the landscape	*Low* At this distance the magnitude of road construction is low	*Moderate to low* The degree of visual impact is tempered by the distance but the new road will stand out from the background of surrounding hills	No mitigation required
ROAD CORRIDOR				
Close views from adjacent residences to the road corridor				
4 Birdwood Place	*Moderate* This viewpoint is at some distance from the proposed alignment with scattered bushland reducing the view corridor	*Moderate* The constructed road is raised 1.5m above existing filled batters producing some modification to existing levels resulting in moderate visual impact	*Moderate* The visual impact is moderated by distance and the slight degree of elevation but the tree canopy is thinner at this point resulting in moderate visual impact	Refer Sections 15-17 Page 46 Consider mounds and tree planting for effective mitigation
Thurralilly Street/Kings Highway intersection	*Low* This area is close to the existing highway, and is flanked by industrial warehouses and already highly modified. The new road intersection will result in some tree clearing and low filled batters	*Low* The new alignment will require minor filling for new levels and some tree removals but the degree of constructed magnitude will be no greater than it is now	*Low* The visual impact will be mostly experienced by drivers similar to existing conditions and the visual impact is therefore low	Adopt tree planting measures outside the clear zone to help integrate the new alignment with the existing road
12 Hybon Avenue	*Moderate* The landscape adjacent to this viewpoint is already cleared and scattered trees that filter views will be cleared	*Moderate* The road alignment will require filling and clearing in this area resulting in moderate constructed impact	*Moderate* The proximity of the road alignment to this viewpoint and the degree of construction will cause moderate visual impact	Refer Sections 18-20 Page 48 Consider mounds and tree planting for effective mitigation

5 Birdwood Place	*Low* The viewpoint is some distance from the road alignment close to intersection with Regent Drive There is some dense woodland which obscures views	*Moderate* The road construction requires filling and clearing but the dense vegetation results in low to moderate constructed magnitude	*Moderate* The visual impact is ameliorated by the distance of the road to this viewpoint and the amount of existing vegetation resulting in low to moderate visual impact	Sections 21-23 Page 49 Consider mounds and tree planting for effective mitigation
1 Hill Lane	*High* This site is situated on a ridge with a wide cone of visibility for traffic travelling both east and well resulting in high sensitivity	*Moderate* The proposed road alignment would be at least 100-150 metres from the ridge and 4 metres above its surroundings on filled batters. This results in moderate constructed magnitude	*Moderate to high* The elevation of this viewpoint and the curve of the road alignment means this viewpoint will experience moderate to high visual impact by day and night	Refer Sections 12-14 Page 45 Use vegetation including tree planting on filled batters with or without the use of noise walls
2 Regent Drive	*High* The viewpoint is situated 3 metres above the existing alignment within 60 metres of the road corridor. There is limited tree canopy on private property, affording views to the towards the valley and creating a bushland backdrop to the property. This results in a high degree of sensitivity	*High* The proposed road alignment will be 3 metres below the level of the house and 60 metres away. The alignment is elevated considerably above the surroundings with filled batters modifying this area of the gully resulting in a high level of constructed magnitude. The excavation into rocky cut slopes on the north-west side of the road will create a high degree of visual impact viewed from residence.	*High* The elevation and proximity of this viewpoint means there will result in high visual impact	Refer Sections 1-5 Pages 40-41 Use vegetation including tree planting on filled batters with or without the use of noise walls

4 Regent Drive	*High* The proposed road alignment is elevated 6 metres above the existing valley. Visibility is limited by scattered trees, but the existing gully is the bushland context for this residence. The excavation into rocky cut slopes on the north-west side of the road will create a high degree of visual impact viewed from residence.	*High* The realignment is 6 metres above existing with extensive cutting and filling as well as the removal of tree canopy creating a high magnitude of construction at this point.	*High* The elevation and proximity of this viewpoint combined with the magnitude of construction means there will be high visual impact both night and day at this viewpoint. The excavation into rocky cut slopes on the north-west side of the road will create a high degree of visual impact viewed from residence.	Refer Sections 6-8 Page 42 Use vegetation including tree planting on filled batters with or without the use of noise walls. The rocky cut slopes on the north-west roadside hints potential for revegetation.
2 Hill Lane	High This viewpoint is on a spur line and is elevated above the new road alignment. The views to the existing gully are through some scattered trees creating filtered views	*High* The road alignment is elevated considerably above the surroundings with filled batters modifying this point of the gully resulting in high magnitude	*High* The modification of the existing gully, and the extent and proximity of the new road will be of high visual impact at this viewpoint	Refer Sections 9-11 Page 43 Use vegetation including tree planting on filled batters with or without the use of noise walls

8.2 Long Distance Views

Viewpoint L: Watertank at Nimmitabel Street

From south-east of Queanbeyan at the water tank at Nimmitabel Street, looking north-east to the proposed road realignment, the existing road alignment is obscured as it increases in elevation. The realignment corridor would run perpendicular to the hill and be more striking in the longer distance within the darker backdrop of the surrounding hills. The magnitude of the road corridor is low at this distance and the site sensitivity moderate. The visual impact is considered to be low to moderate.

8.3 Medium Distance Views

Viewpoint K: Roundabout at Ellerton Crescent and Bungendore Road

From the roundabout at Ellerton Crescent and Bungendore Road, the proposed realignment would run perpendicular up the hill and the clearance of bushland for the corridor would increase visibility making the road a dominant feature. The magnitude of the road corridor is moderate in this area and the sensitivity from the viewpoint is low. The visual impact is low to moderate.

8.4 Near Distance Views

Viewpoint H: 12 Hybon Avenue

At 12 Hybon Avenue, which is elevated, the adjacent area of the proposed realignment would be elevated and the road easement cleared of trees. Scattered trees that filter views to the corridor would be thinned and the magnitude of the road enhanced and be more visible. Sensitivity would be moderate as the view is partial indicating low to moderate impact.

Viewpoint I: 9 Hybon Avenue

The elevation of the residence is around 4metres above existing but would be around 2metres above the most adjacent area of realignment at chainage 63760. The backyard fence of the property may obscure views but the magnitude of the road would be greater and sensitivity would be moderate as the view is partial indicating low to moderate impact.

Viewpoint D: 5 Birdwood Place

The view from this property is along the spur line towards the intersection with Regent Drive. There are also glimpses across the Regent Drive ridge towards the road alignment within the valley. It is expected that only partial views to this would be possible above the ridge. The dense vegetation in this area also obscures views. The sensitivity of the area is high, however the magnitude would be low to moderate due to the screening of vegetation.

8.5 Immediate Distance Views

Viewpoint J: Thurralilly Street/Kings Highway intersection

At the Thurralilly Street/Kings Highway intersection, the commencement of the road realignment is directly adjacent with the intersection close by. From this viewpoint looking north-east the surrounding industrial warehouses have blank elevations to the street. The magnitude of the road construction would be no greater than it is now. The magnitude is high however the sensitivity is low due to the road in its new alignment having a similar visual effect as the existing road.

Viewpoint C: 4 Birdwood Place

The existing road is visible due north from this residence which is situated on a spur and views follow down the slope which is partially obscured by vegetation.

The proposed realignment would elevate the road 1.5metres above the ground level which would increase the magnitude of the realignment to a moderate level with a high level of visual sensitivity due to the thinning of the tree canopy in the easement. The result is a moderate to high visual impact.

Viewpoint A: 1 Hill Lane

1 Hill Lane situated on a ridge is adjacent to the existing road and experiences a wide cone of visibility of traffic travelling east and west. The proposed realignment would be at least 100-150metres from the ridge (Hill Lane) reducing visibility. However, the proposed realignment would raise levels to approx 4metres above existing which would result in a moderate magnitude with a high sensitivity of constructed road corridor but a narrower cone of visibility from this viewpoint. This results in a moderate to high degree of impact.

Viewpoint B: 2 Hill Lane

The residence is situated on a spur line which looks directly into the valley approx 17metres below the existing level of the residence. The proposed realignment is elevated 5metres above existing. There is little vegetation on the property to reduce visibility. The magnitude of the road is increased by steep batters increasing visibility and the sensitivity to the view corridor is high. The result is a high visual impact.

Viewpoint E: 2 Regent Drive

The realignment is situated 5metres above the existing alignment with the house within 60metres of the road corridor. The house is elevated above the realignment by approx 3metres. There is limited tree canopy on private property. The tree canopy close to the road easement has limited impact of reducing visibility at the edge of the road alignment. There are oblique views to the excavated slopes on the north-west roadside. The magnitude of the road within the corridor is high within the gully, the degree of sensitivity is high resulting in high visual impact.

Viewpoint F: 4 Regent Drive

The residence is elevated 20metres above existing the existing valley. Visibility is masked by scattered groups of trees. The realignment is raised 6metres above existing and the profile is achieved through extensive cutting and filling for the road pavement as well as the tree canopy removal within the corridor. There are views across to the excavated slopes on the north-west roadside. The raw cut into the bedrock will diminish in visual prominence as the rock ages. As a result the magnitude of the road construction is high at this point with a high degree of sensitivity resulting in high visual impact.

8.6 Visual Impact during Construction

During the construction of the proposed realignment, the degree of visual impact may be greater than when the road is operational, mostly due to the lack of mitigation techniques to control the viewlines into the site. The construction site would also be subject to tree removal and site clearance for construction, material stockpiles and the continuous movement of construction equipment. In addition, cut batters would have a raw and stark appearance which may be visible from greater distances. There would also be a need to locate temporary construction compounds. It would be anticipated that tree planting and other vegetation could be considered within the overall road corridor particularly on filled slopes.

8.7 Visual Impact of Noise Mitigation

Noise mitigation can be achieved via a variety of methods including noise walls, and architectural treatments. The length of sound wall that is required is typically 160 degrees from the receiver (RTA noisewall guidelines) A variety of materials can be used for sound walls including precast panels, lightweight concrete, concrete masonry block, timber, stone and gabion walls. It may be useful to consider transparent panels where noise mitigation is required but also where views to topographical features or distant views can be achieved. Tree planting can also be used to assist visual screening where it is possible to plant between the road easement and the affected viewpoint. Trees cannot completely screen a view but if the view line is incomplete, trees can be used to good effect.

Additionally, consideration can be given to using architectural sound proofing systems which may negate the need for noise walls.

Where noise wall mitigation techniques are not required, lighter timber fencing could be used where visual screening is required.

8.8 Lighting Impacts

It is anticipated that lighting would be required at the intersection with Regent Drive and the proposed extension to Hill Lane to allow traffic onto the Kings Highway. This would as a consequence lead to more light spill for residents particularly in Hill Lane.

9.0 Mitigation Techniques

9.1 Areas requiring mitigation

The visual impact assessment has identified the viewpoints most affected by the realignment construction.

In summary these are viewpoints most affected are those within the Regent Drive and Hill Lane area. It is considered that 1 Hill Lane would have a moderate to high impact, and 2 and 4 Regent Drive and 2 Hill Lane, would experience high visual impact as a result of the proposal. Moderate visual impacts to 9 and 12 Hybon Avenue are also anticipated.

Due to the proximity of the affected residences to the realignment, noise wall solutions may be required to mitigate any acoustic impacts. Although architectural sound proofing solutions may be investigated, further mitigation techniques may need to be implemented, including, earth barriers and earth mounds. It is also expected that road design considerations may mitigate noise including the use of quieter surfaces.

9.2 Conservation of vegetation adjacent to easement in the rural environment

In order to reduce impact to the surrounding landscape of the realignment, it is preferable to consider the reinstatement and enhancement of vegetation particularly extending the tree canopy. Where practical, trees would be retained in areas within the road easement which are not affected by the road or its construction. The RTA can liaise with affected residents to facilitate planting.

9.3 Noise Walls

Noise walls are an expensive and visually intrusive solution but may need to be considered for this project. Noise wall design for the project should refer to the RTA Noise Wall guidelines. In summary, noise wall should be built at least 1metre above the road surface and 1.5metres above the adjacent residence floor level. Generally for noise mitigation the wall must span a 160 degree angle to be effective. Materials suitable for noise walls in the gully area of the project should be compatible with the semi rural urban environment that they pass through. Options for this site could include precast concrete panels, timber and gabion walls with the possibility of integration of perspex panels in walls where possible to allow views to surrounding landscape.

9.4 Earth Mounds

Earth mounds are useful for noise mitigation as well as visual screening in situations where there is adequate space and availability of fill materials. Earth mounds also have potential for planting which can enhance the tree canopy and provide a more attractive visual screen. Moundings would be a good solution at the south west edge of the road corridor to ameliorate views from the road corridor to 9 and 12 Hybon Road.

9.5 Landscape Design and Planting

The use of plant material whether on earth mounds or filled slopes can contribute to the overall visual amelioration of the road corridor. Tree planting can be used on sloped batters both on and behind sound walls to improve the visual amenity for motorists. If seed mix is the preferred method for vegetating slopes and filled batters, seed mixes should be as per the RTA Landscape Guideline Page 34 and 35. Within the seed mix, 5kgs per hectare should be native seeds sourced locally to the site. Advice on appropriate trees to include in the seed mix should be part of the landcape specification for the project.

9.6 Conclusion

Mitigation techniques would need to be developed appropriate to the character of the landscape though which the road is passing. It is preferred that the softer methods of using earth mounds and additional trees is adopted in every scenario and serve as a mitigation to noise walls if required. In general, the mitigation techniques should be as discreet as possible using colours and materials that blend in with the surrounding landscape and where possible reinforce the semi-rural bushland character of the site. Additionally, RTA are encouraged to liaise with residents to facilitate additional tree planting on private property where practical. Generally efforts should be made to reduce the number of trees that need to be removed in the easement and to appropriately maintain any trees in the easement during construction.

10.0 Mitigation Recommendations

These recommendations are based on mitigation requirements for key viewpoints particularly those which have been most impacted by the road alignment and design measures for mitigation which should be commensurate with the degree of impact that is predicted.

The three most impacted viewpoints are 2 and 4 Regent Drive and 2 Hill Lane. All of these sites have relatively little vegetation between the residence and the proposed road and both additional planting on private land and retaining of trees in the easement would assist in screening and afford benefit to the zoning requirement of scenic protection.

10.1 High Impact Viewpoints

2 Regent Drive, 4 Regent Drive and 2 Hill Lane

As all these properties are well elevated above the proposed road corridor, similar mitigation techniques can be used.

Noise Walls
If noise walls are prefered then the screening required for visual mitigation would need to be approximately 5.1metres (refer Section 2 page 40). Consideration could also be given to perspex panels in the top of noise walls to enable viewing to views beyond.

Planting
The filled batter facing the residences could be planted extensively with trees further mitigating noise walls (if used), for the new batter and roadway (refer Sections 2 page 40 and Section 3 page 41). However, if noise walls are not used, it is still preferred that vegetation including trees are planted on the filled batters.

For 4 Regent Drive, views would also extend to the cut batter on the western edge of the proposed road (refer Sections 6, 7 and 8 page 42) It is preferred that the cut is not stablised with concrete and the rock and shale is exposed. Planting of low ground covers within any existing soil layers would be possible. Extra consideration should be given to screening views across the valley with tall planting on the south-east roadside batter nearest the residencies.

2 Regent Drive
Scale 1:1000 @ A4

Legend

existing vegetation

existing vegetation to be removed

proposed vegetation

existing groundline

proposed road pavement level

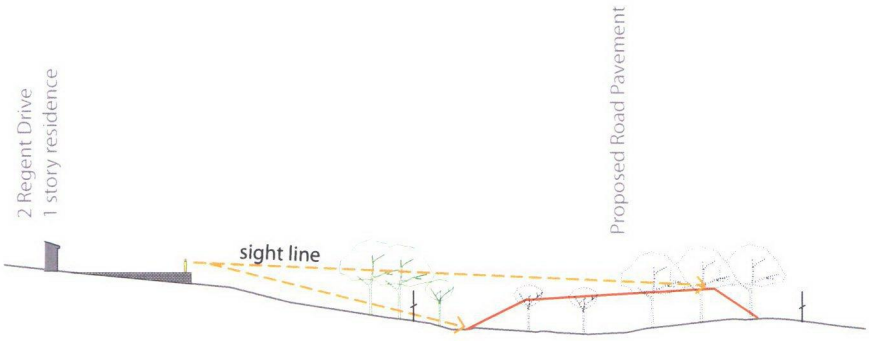
boundary line/fence between RTA land and private residence

person

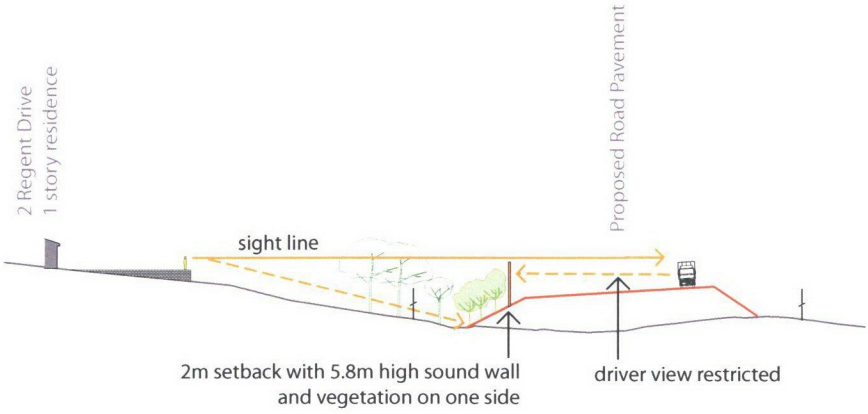
truck

filtered view

direct view

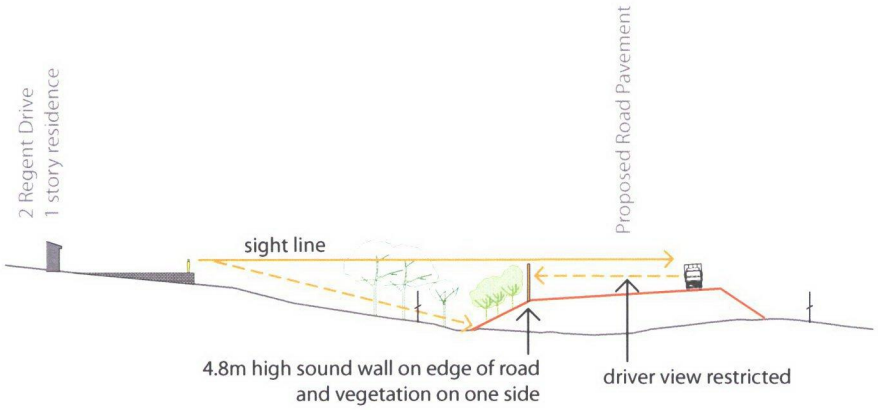


Section 1
Unmitigated road corridor

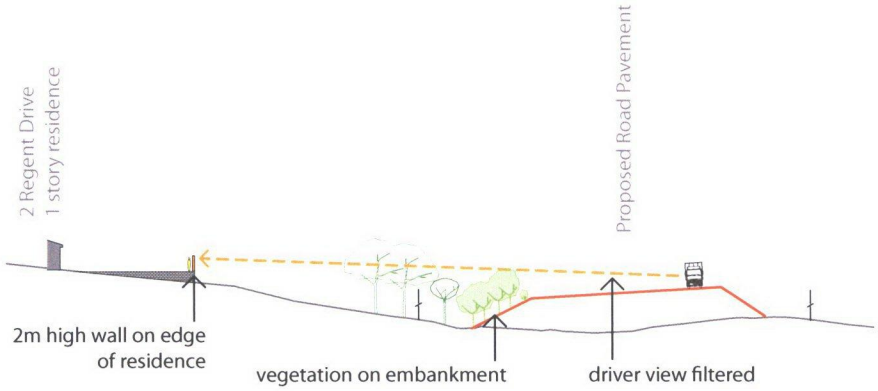


Section 2
Option A: Sound wall on battered slope

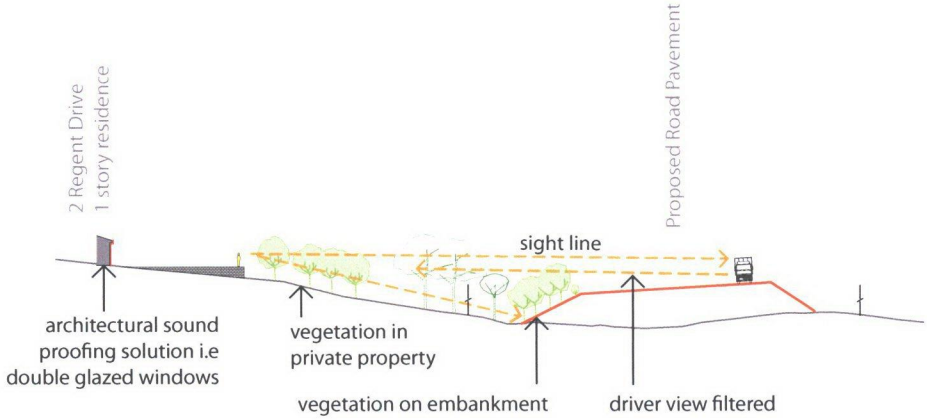
2 Regent Drive
Scale 1:1000 @ A4



Section 3
Option B: Sound wall on edge of pavement



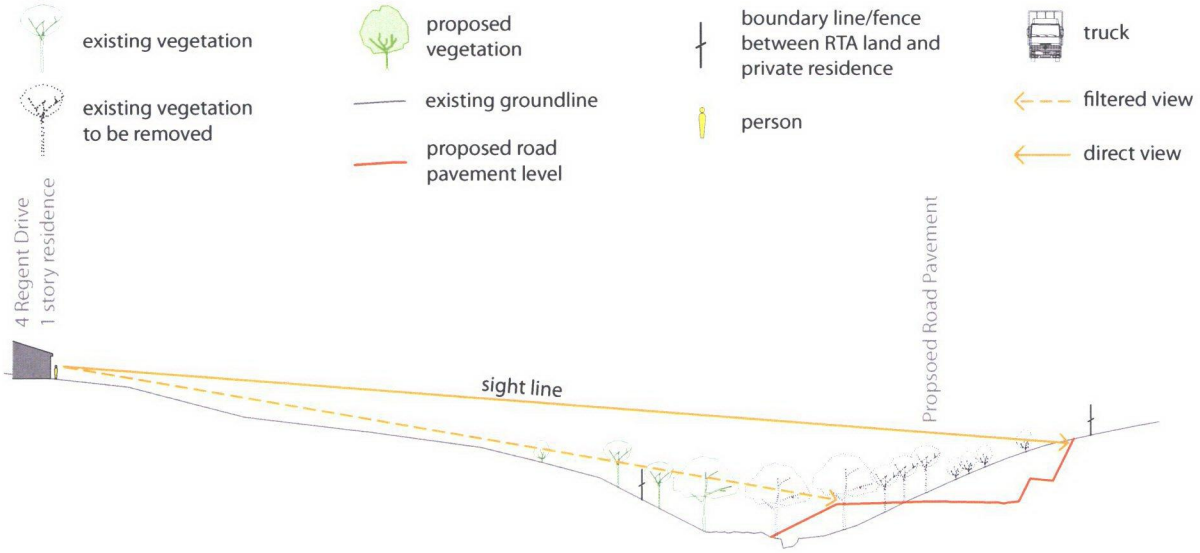
Section 4
Option C: Fence/wall on residence property



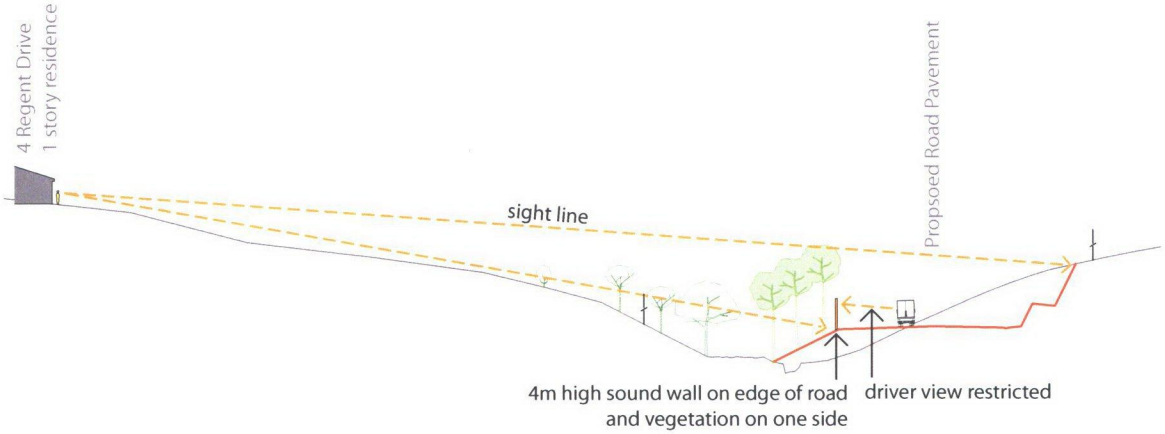
Section 5
Option D: Tree planting enhancement

4 Regent Drive
Scale 1:1000 @ A4

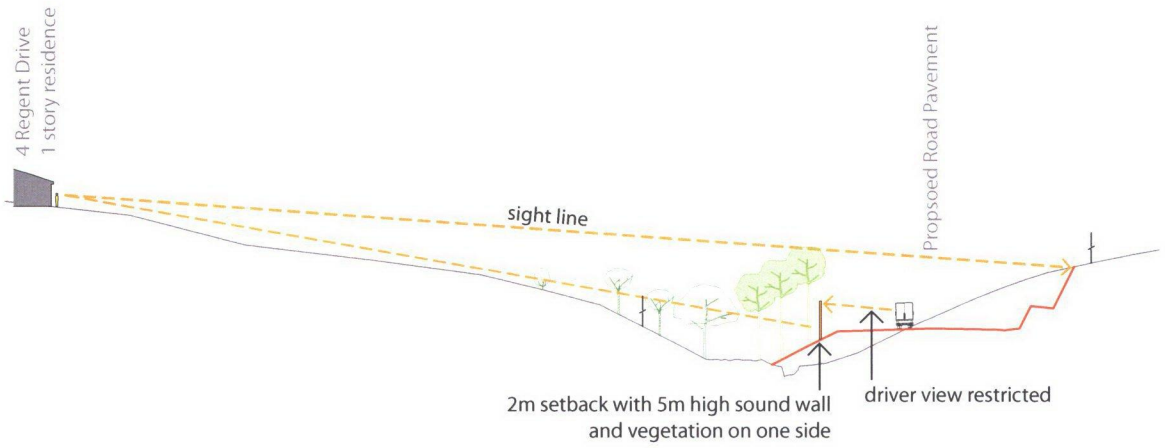
Legend



Section 6
Unmitigated road corridor



Section 7
Option A: Sound wall on edge of pavement

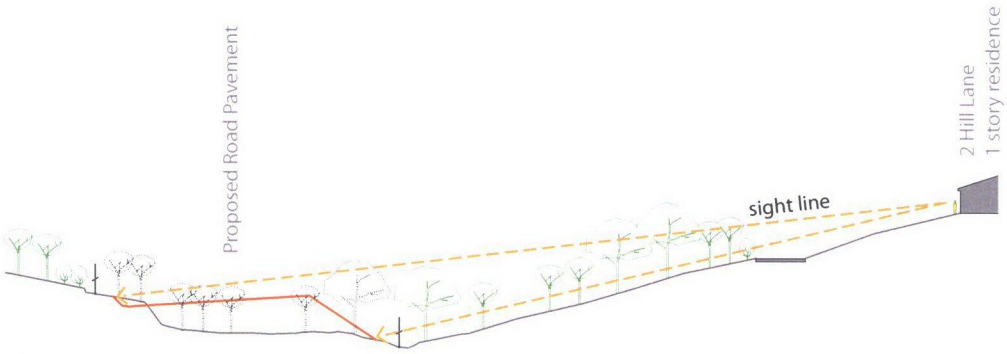


Section 8
Option B: Sound wall on battered slope

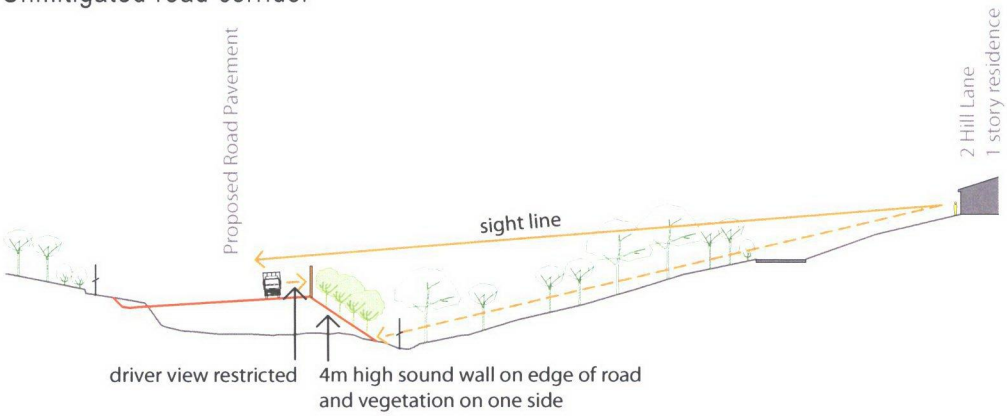
2 Hill Lane
Scale 1:1000 @ A4

Legend

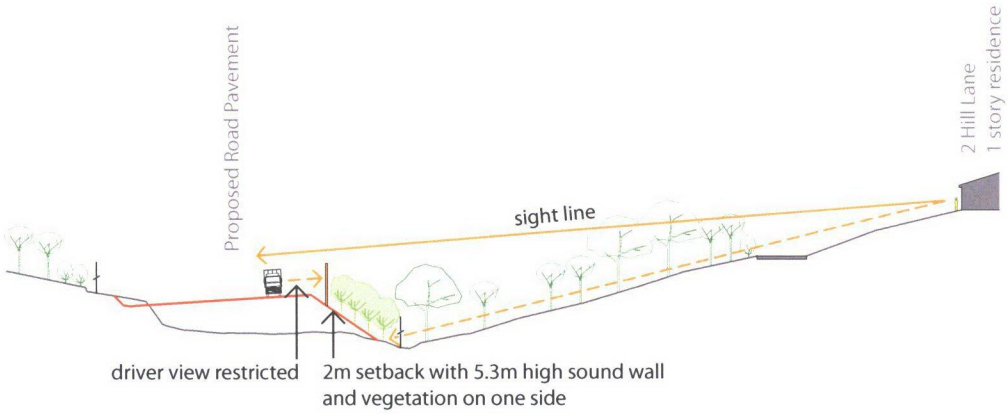
existing vegetation
existing vegetation to be removed
proposed vegetation
existing groundline
proposed road pavement level
boundary line/fence between RTA land and private residence
person
truck
filtered view
direct view



Section 9
Unmitigated road corridor



Section 10
Option A: Sound wall on edge of pavement



Section 11
Option B: Sound wall on battered slope

10.2 Moderate Impact Viewpoints

1 Hill Lane

This residence is also elevated from the road. It is set within a planted property with view glimpses to the proposed road realignment.

Noise Walls
If a noise wall/fence is preferred to mitigate this impact then it would need to be at least 5metres high (refer Section 14 page 45) and set back 2metres from the road pavement to facilitate tree and shrub planting on one side. If noise walls are preferred at the edge of the pavement, height could be reduced to 3.5metres for visual mitigation purposes.

Planting
The filled batter facing the residences could be planted extensively with trees further mitigating noise walls (if used), the new batter and the roadway.

4 Birdwood Place

This residence is mostly on level or slightly raised above the proposed road pavement with scattered planting in between.

Noise Walls
If noise walls are preferred to mitigate noise impact then the elevation of the residence would require that the wall be 5.5metres high (refer Section 16 page 46) to provide adequate visual screening. The form and colour of the sound wall in this area would need to be carefully addressed and designed in conjunction with tree planting.

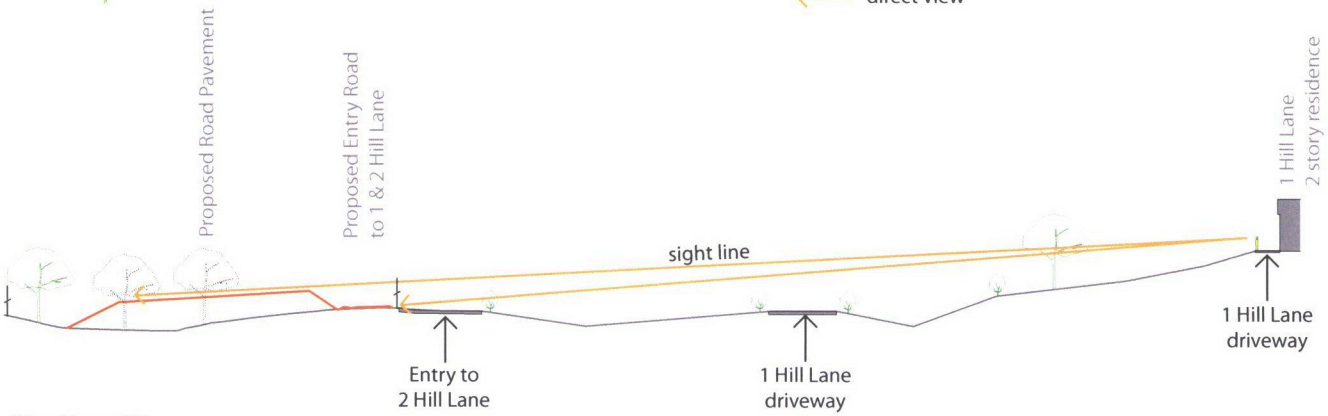
Earth Mounds
The cleared areas in the woodland would allow for vegetated earth mounds to mitigate views, and provide sculpted elements that contribute to the surrounding landform. Additional tree planting can be used on the mounds contributing to the open woodland character of the surrounds (refer Section 17 page 46).

Planting
The filled batter and adjacent proposed road reserve facing the residences could be planted extensively with trees further mitigating noise walls (if used), the new batter and the roadway.

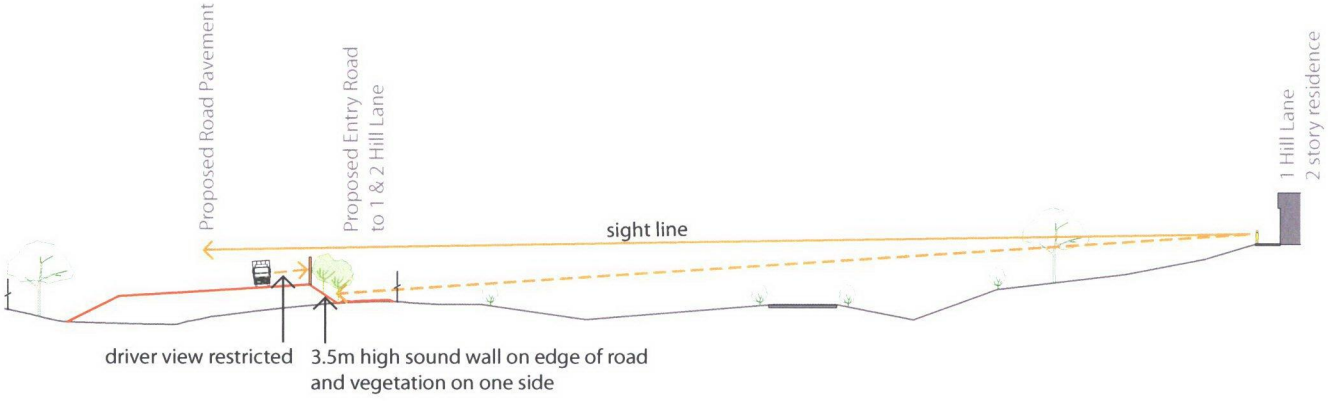
1 Hill Lane
Scale 1:1000 @ A4

Legend

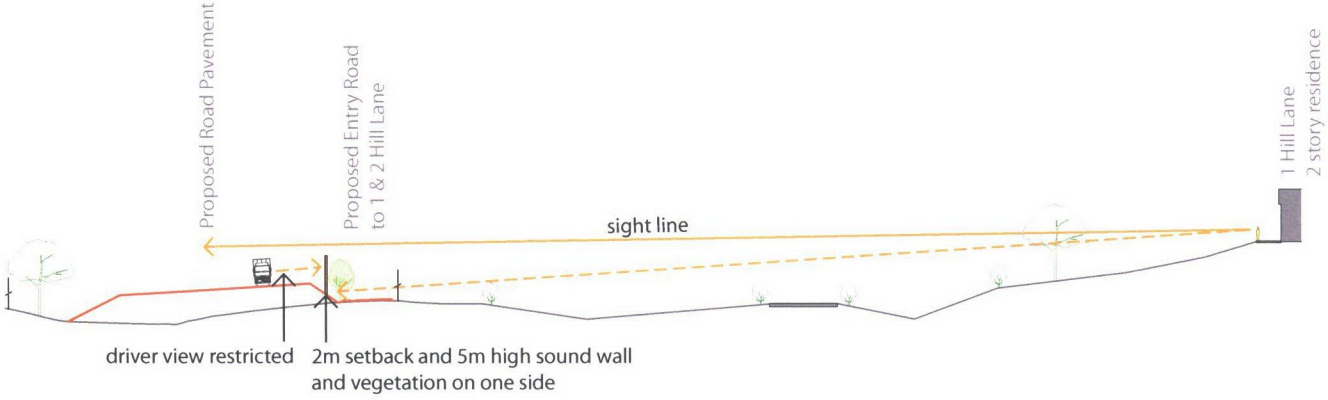
existing vegetation
existing vegetation to be removed
proposed vegetation
existing groundline
proposed road pavement level
boundary line/fence between RTA land and private residence
person
truck
filtered view
direct view



Section 12
Unmitigated road corridor



Section 13
Option A: Sound wall on edge of pavement



Section 14
Option B: Sound wall on battered slope

4 Birdwood Place

Scale 1:1000 @ A4

Legend

existing vegetation

existing vegetation to be removed

proposed vegetation

existing groundline

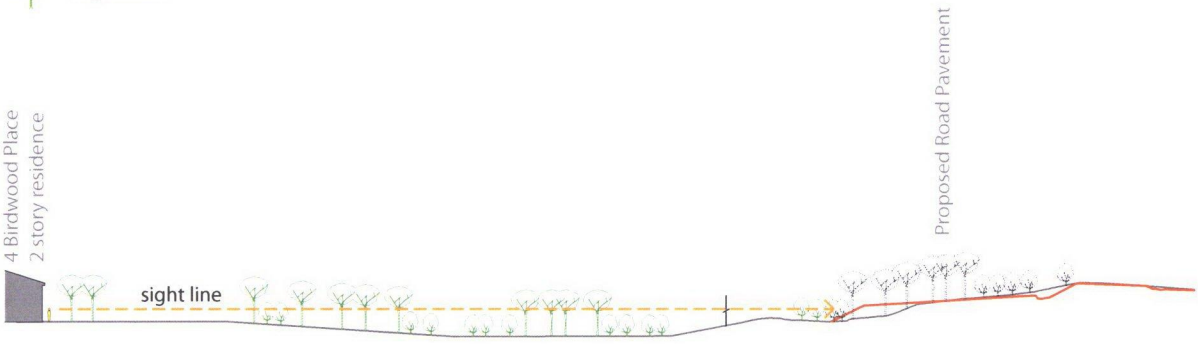
proposed road pavement level

boundary line/fence between RTA land and private residence

person

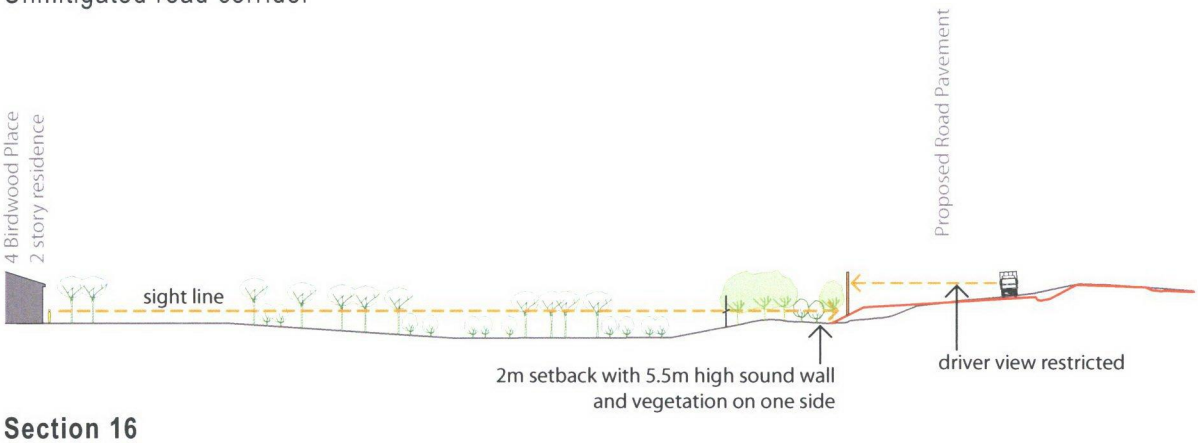
truck

filtered view



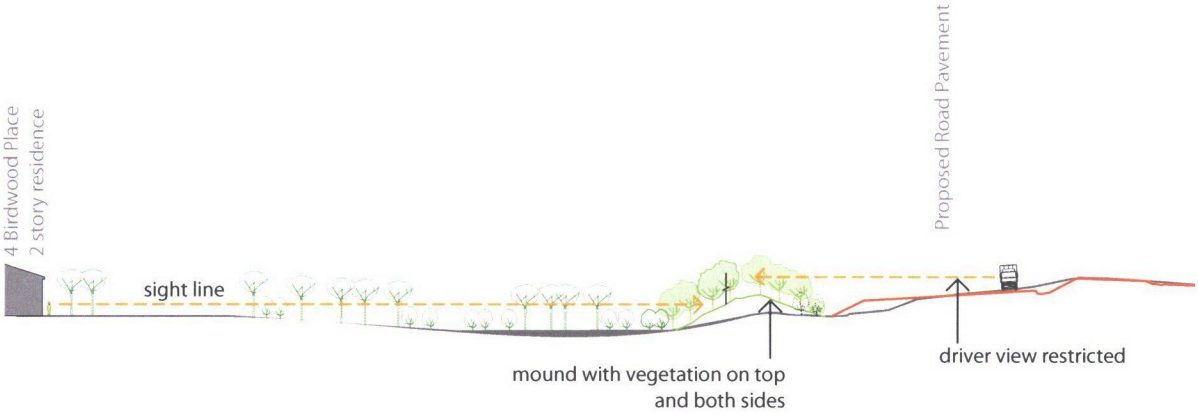
Section 15

Unmitigated road corridor



Section 16

Option A: Sound wall on battered slope



Section 17

Option B: Mound and tree planting enhancement

12 Hybon Avenue

This residence is elevated above the proposed road corridor and set back approx 130metres.

Noise Walls
If noise walls are preferred to mitigate noise impact then the elevation of the residence would require that the wall be 4.4metres high to provide adequate visual screening. The form and colour of the sound wall in this areas would need to be carefully addressed and designed in conjunction with tree planting.

Earth Mounds
The cleared areas in the woodland would allow for vegetated earth mounds to mitigate views, and provide sculpted elements that contribute to the surrounding landform. Additional tree planting can be used on the mounds contributing to the open woodland character of the surrounds (refer Section 20 page 48).

Planting
The adjacent proposed road reserve facing the residences could be planted extensively with trees further mitigating noise walls (if used), the new batter and the roadway.

5 Birdwood Place

This residence is slightly elevated with the proposed road corridor and setback at approx 250metres, with scattered planting between. Due to its distance from the proposed road corridor, noise walls may not be preferred at this viewpoint.

Earth Mounds
Cleared areas of woodland would allow for vegetated earth mounds to mitigate views and provide sculpted elements that contribute to the surrounding landform. Additional tree planting can be used on the mounds contributing to the open woodland character of the surrounds (refer Section 23 page 49).

Planting
The adjacent proposed road reserve facing the residences could be planted extensively with trees, further mitigating views and contribute to the open woodland character and surrounds.

12 Hybon Avenue
Scale 1:1000 @ A4

Legend

existing vegetation

existing vegetation to be removed

proposed vegetation

existing groundline

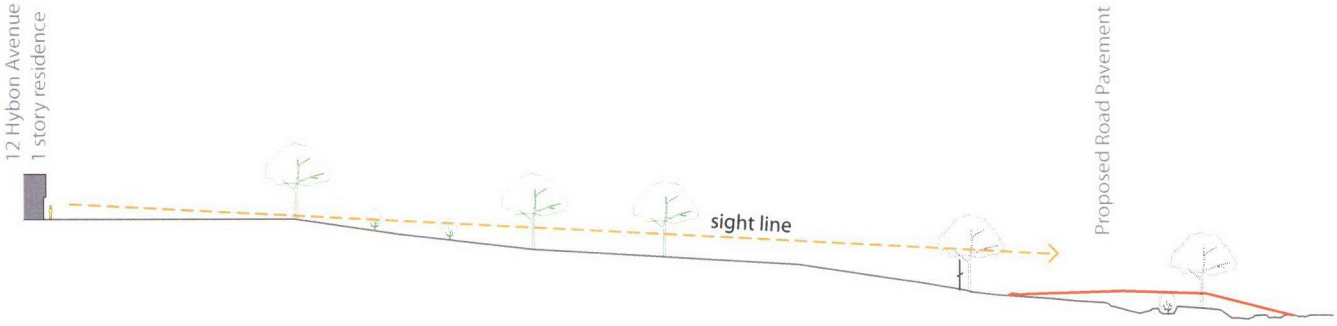
proposed road pavement level

boundary line/fence between RTA land and private residence

person

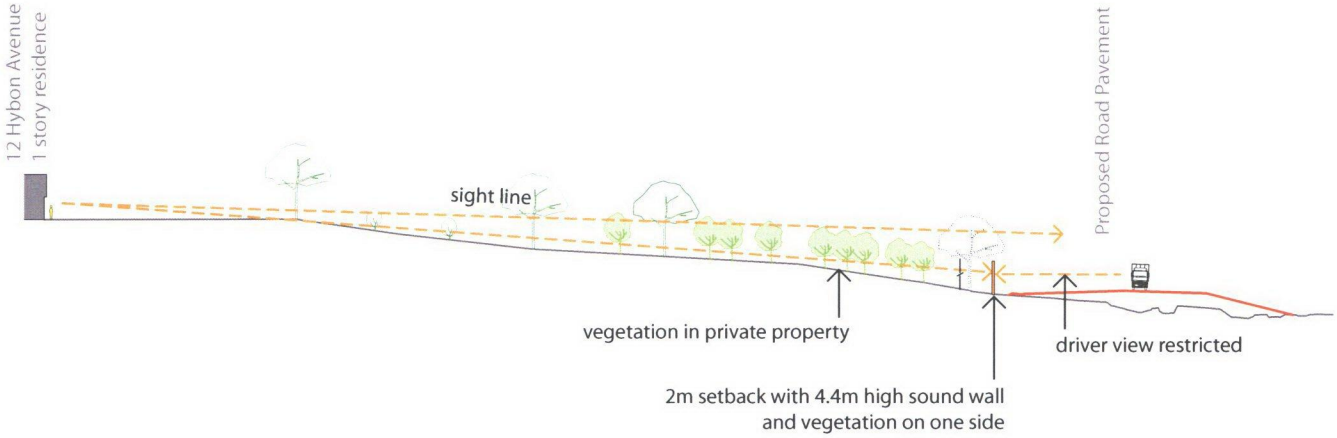
truck

filtered view



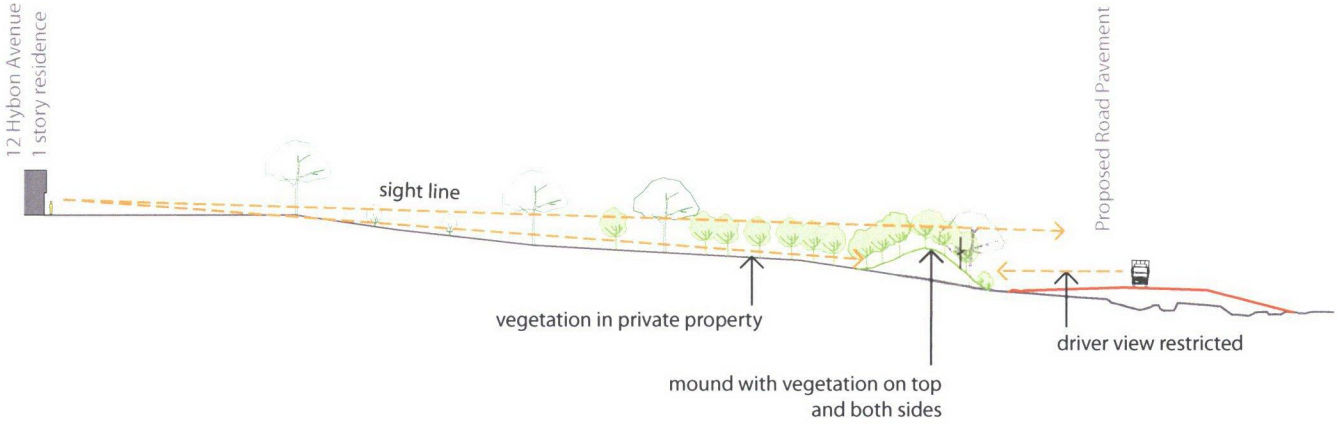
Section 18

Unmitigated road corridor



Section 19

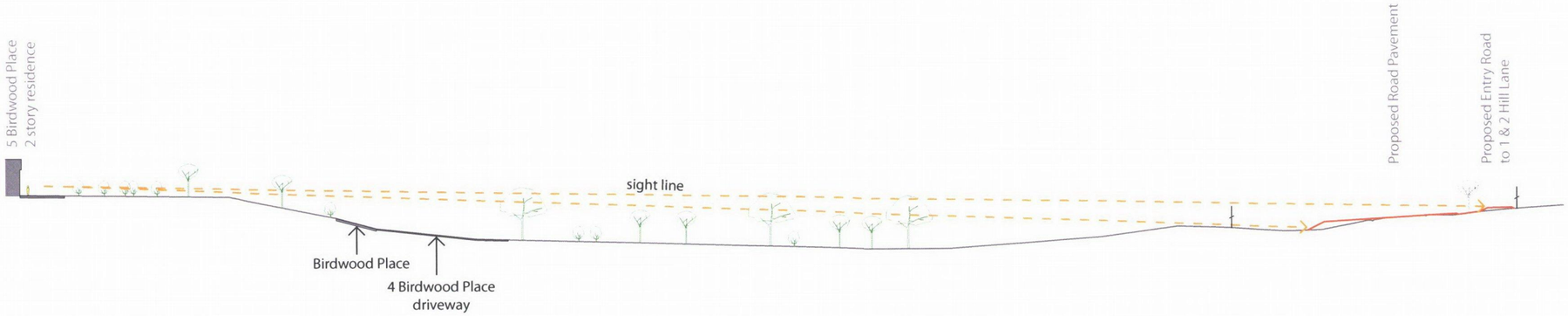
Option A: Sound wall on battered slope



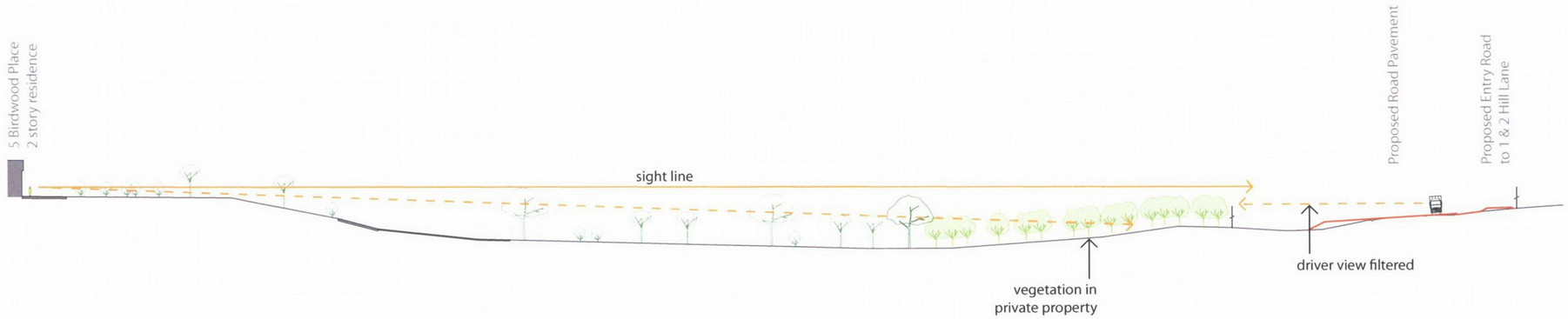
Section 20

Option B: Mound and tree planting enhancement

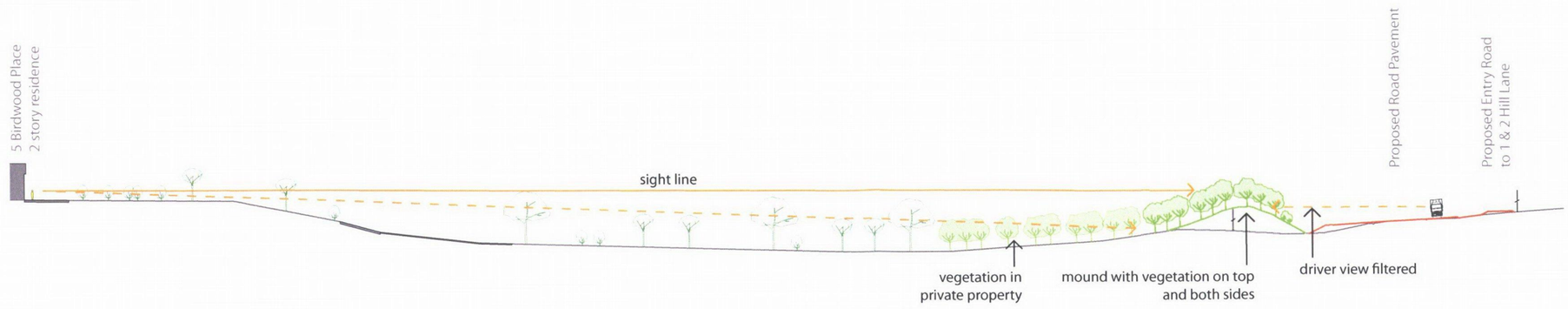
5 Birdwood Place
Scale 1:1000 @ A4



Section 21
Unmitigated road corridor



Section 22
Option A: Tree planting enhancement



Section 23
Option B: Mound and tree planting enhancement

Legend

- existing vegetation
- existing vegetation to be removed
- proposed vegetation
- existing groundline
- proposed road pavement level
- boundary line/fence between RTA land and private residence
- person
- truck
- filtered view
- direct view

10.3 Low Impact Viewpoints

Watertank at Nimmitabel Street (long distance view) Ellerton Drive, Bungendore roundabout, Thurralilly Street/Kings Highway intersection.

In all these locations, the visual impact will be determined by the visibility of mitigation treatments.

Noise Walls

If noise walls are adopted, the colour and form of these elements may be visible from the long and mid distance viewpoints. If this is the case then the integration of design elements into the landscape should be carefully considered for their long distant effect as for those viewpoints much closer to the proposed road corridor.

Planting

As with the highly impacted viewpoints, the use of additional tree canopy would be particularly effective in screening noise walls and to reinstate a consistent canopy to the valley.

10.4 Urban and Landscape Considerations

The highway experience merges from an urban environment, through semi- rural residential, to bushland contexts. The highway is an extension of the Queanbeyan townscape at the south western intersection of the project. The intersection of the new alignment at the western end meets the existing road corridor close to Thurralily Road. At this intersection, the highway forms part of the streetscape that leads through the town. The highway passes through areas of residential and warehouse industrial built environment in this area. The semi-rural residential area includes remnant tree canopy and regenerating understorey merging with the cultivated landscapes of the properties.

The overall impact on landscape character is more pronounced within the narrow areas of the existing gully in the proposed alignment. The extent of cut and fill batters will transform the base of the gully and alter the existing landform. At the eastern and western intersections of the alignment, there is less impact as the road reaches existing grade and the degree of filling required is lessened. The modified elevation of the realignment within the gully, should have little or no impact on existing views across the site towards the Brindabellas from the more elevated residences such as 2 Hill Lane and 2 Regent Drive. However, the broader landscape of hills and valleys to the east and north east of Queanbeyan in which the existing gully lies, reads as part of a dark mass of wooded hills with

scattered dwellings. The modified gully will transform this view and appear as a site with much reduced tree canopy with the rawness of cut slopes and filled batters clearly visible.

The highway and surrounding environment should seek to integrate to the rural residential landscape. The choice of planting and walls (if required) should be designed to interface with the rural properties and landscape in colours, materials (such as timbers and muted colour masonry) and planting selection. The planting in the rural residential landscapes is an endemic native tree and shrub planting palette with areas of cultivated native plantings backing onto the properties. The objective for the highway design in this area is to integrate the edge conditions of the highway to maintain the vegetated gully landscape character and sensitively integrate walling or other mechanisms to mediate local direct views over the highway.

The connection of the highway scope of works and existing highway roadway is within a bushland area. Intervention with and contrast to the bushland should be minimised. Planting within the bushland interface should be through bush regeneration techniques to enhance the connection of the bush to the highway edge. The objective for the Highway design for this area is to integrate the highway edges with the bushland landscape, minimise incursions into the bushland, retain vegetation and rock edges and remove redundant roadworks to allow bushland regeneration.

Appendix H

Consideration of the Clause 228 factors and matters of national environmental significance

Clause 228 Checklist

The following factors, listed in Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, are required to be considered to assess the likely impacts of the proposal on the natural and built environment.

EP&A Act factor	Impact
a) Any environmental impact on a community?	
There would be a long-term reduction in visual amenity during operation of the proposal associated with a change in views from some residences. These impacts would be greatest in the short term. Two residences would be separated from other residences in Kingsway Estate due to the construction of the proposal. There would be an increase in noise at some residences. These impacts would be minimised with implementation of safeguards and management measures identified in this REF.	Long-term moderate negative
During construction, there would be a reduction in visual amenity and traffic would be disrupted. There is also the potential for short term impact associated with the construction process, such as increased dust and noise.	Short-term negative
In the long term there would be improvements for the community in the increased safety, capacity and efficiency of this section of the Kings Highway.	Long-term positive

EP&A Act factor	Impact
b) Any transformation of a locality? The works would have an impact on the visual environment at the proposal site through the removal of four hectares of vegetation, and the creation of disturbance areas through excavation, cuttings and placement of fill. These impacts would be greatest in the short term. The proposal would alter the existing land form within the proposal site. Mitigation measures such as landscaping described in the REF would reduce the potential impacts to the local land form. Minimising clearing of vegetation, (wherever possible) outside the immediate proposal site would also assist mitigate this impact.	Short-term negative
c) Any environmental impact on the ecosystems of the locality? The impact on native ecosystems would be of a low level. The proposal would involve clearing approximately four hectares of disturbed native vegetation including two hollow bearing trees. In the local context, the vegetation, and the habitat it provides, is marginal due to the disturbed nature of the vegetation and there is sufficient better quality habitat in the area to accommodate these losses. The threatened species, Hoary Sunray (*Leucochrysum albicans ssp albicans* var. tricolour) listed as endangered under the EPBC Act is present onsite and would be impacted by the proposal. As this species is disturbance tolerant, exists in the areas around the proposal site, and as recolonisation is likely, any impacts are expected to be minor with implementation of the safeguards identified in this REF. Assessments of significance were undertaken for all threatened species with potential for impact and it was concluded that significant impacts were unlikely. No further assessment is recommended.	Negligible Long-term minor negative

EP&A Act factor	Impact
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The proposal site is not utilised for scientific purposes (e.g. research). Visual amenity would be impacted during construction and operation of the proposal. However, safeguards and management measures identified in this REF would be implemented to minimise the impact. The proposal would acquire Firth Park. This land is zoned as open space and may be used by local residents for informal recreation activities. The use of the Goulburn Road corridor for recreation would be reduced and replaced with a pathway alongside the Kings Highway.	Long-term moderate negative Long-term minor negative
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There are no Aboriginal cultural heritage constraints. The old Queanbeyan - Goulburn Road which has local heritage significance, would be impacted by the proposal. A statement of heritage impact has been prepared and has found that there would be no significant impact with implementation of the identified safeguards and management measures.	Long-term minor negative

EP&A Act factor	Impact
f) Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? Four hectares of disturbed native vegetation and two hollow bearing trees would be removed. In the local context, the vegetation, and the habitat it provides for protected fauna, is marginal due to the disturbed nature of the vegetation and there is sufficient better quality habitat in the area to accommodate these losses.	Negligible
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would not endanger any species of animal, plant or other life form. Assessments of significance were undertaken for all species and communities listed under state and Commonwealth legislation (TSC Act, EPBC Act) with the potential to be affected by the proposal (refer to Appendix F of the attached Appendix B *biodiversity assessment.*. The biodiversity assessment found that with implementation of the identified safeguards and management measures, that there was unlikely to be a significant impact on any threatened species, ecological community or their habitat as a result of the proposal.	Nil

EP&A Act factor	Impact
h) Any long-term effects on the environment? The proposal would have long-term minor to moderate negative impacts by clearing native vegetation, increasing noise, decreasing the visual amenity of some residents, acquiring land used for informal recreation and impacting on an old road with local heritage significance. These impacts are considered moderate to minor with implementation of the safeguards and management measures identified in this REF.	Long-term minor to moderate negative
i) Any degradation of the quality of the environment? The proposal would cause degradation of the quality of the local environment during construction and operation due to removal of vegetation, increased noise and decreased visual amenity. The impacts of the proposal are manageable through the adoption of the safeguards and management measures identified in this REF. Medium and long-term impacts are considered to be less.	Long-term minor to moderate negative

EP&A Act factor	Impact
j) Any risk to the safety of the environment? There is a risk of environmental pollution during construction works. However, safeguards and management measures will be in place to ensure the works would not adversely impact on the safety of the environment at this location. The proposal would improve the safety of the road and motoring conditions for residents and visitors utilising this section of Kings Highway.	Short-term Minor negative Long-term positive
k) Any reduction in the range of beneficial uses of the environment? In the short-term, there would be some disruption to traffic due to the proposed construction activities. In the long-term, there would be a loss of recreational space through construction of the proposal on the Goulburn Road corridor and acquisition of Firth Park There are a number of other park and recreation facilities within the locality and greater Queanbeyan area and the loss of these amenities is considered to be minor.	Short-term minor negative Long-term minor negative

EP&A Act factor	Impact
l) Any pollution of the environment? There is a risk that pollution of the local environment would occur as a result of contaminants, including silt and hydrocarbons migrating off site, especially during construction. Pollution may also occur as a result of the use of machinery onsite which would emit gasses that contribute to climate change. The risk would be readily minimised as a result of the environmental safeguards and management measures described in this REF. There would be no increase in pollution of the environment from the proposal in the long-term.	Nil
m) Any environmental problems associated with the disposal of waste? All waste produced as a result of the proposal would be disposed of in a responsible manner. Guidelines for the management of waste disposal are outlined in Section 6.12 and Section 6.13.	Nil
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal would not create an increase in the demands on resources that are likely to become in short supply.	Nil

EP&A Act factor	Impact
o) Any cumulative environmental effect with other existing or likely future activities? Cumulative impacts of the proposal are related to the ongoing work scheduled for the Kings Highway as part of a major upgrade program. The overall cumulative effect is that this proposal combined with other proposed upgrades of Kings Highway would ultimately improve the efficiency and safety of the highway and would benefit the community and motorists. The majority of the proposal would be constructed outside of the existing Kings Highway alignment and would staged to minimise traffic impacts associated with other nearby projects. The proposal would remove four hectares of disturbed vegetation, however it is anticipated the surrounding habitat would adequately compensate for this loss. There would be impact to an old road with local heritage significance and to the Hoary Sunray (*Leucochrysum albicans ssp albicans var. tricolour*) listed as endangered under the EPBC Act. However the proposed safeguard measures would adequately protect the environment from negative cumulative effects associated with impacts to biodiversity and heritage on other projects. The proposal would result in increased road safety, traffic efficiency and would represent a good financial investment in existing assets.	Net positive

Matters of National Environmental Significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following Matters of National Environmental Significance are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment and Water Resources.

EPBC Act factor	Impact
a) Any impact on a World Heritage property? The proposal would not have any impact on any World Heritage property.	Nil
b) Any impact on a National Heritage place? The proposal would not have any impact on a National Heritage place.	Nil
c) Any impact on a wetland of international importance? The proposal would not have any impact on wetlands of international importance.	Nil

EPBC Act factor	Impact
d) Any impact on a listed threatened species or communities? A search of the EPBC Act Database found that within 10 km of the proposal site, 19 listed threatened species could potentially occur. One EPBC listed ecological community has the potential to occur onsite, Yellow Box – White Box- Blakely's Red Gum Grassy Woodland and Derived Native Grasslands, however it does not occur in the proposal site. The forb, Hoary Sunray (*Leucochrysum albicans ssp albicans* var. tricolour) listed as endangered under the EPBC Act was found onsite, though it is locally common and appears to favour areas of disturbance. As this species is disturbance tolerant, exists in the areas around the proposal site, and as recolonisation is likely, any impacts are expected to be minor with implementation of the safeguards identified in this REF. An assessment of the threatened species likely to occur within the vicinity of the proposal has been undertaken in Appendix B. This found that there is the potential for threatened species to be impacted, though an assessment (refer to Appendix B) determined that the proposal would not significantly affect Commonwealth listed threatened species or ecological communities.	Long-term minor negative, referral not required.
e) Any impacts on listed migratory species? A search of the EPBC Act Database found that within 10 km of the proposal site, 13 listed migratory species could potentially occur. No potential habitat for these migratory species occurs within the proposal site. The proposal would therefore be unlikely to impact on Commonwealth listed migratory species.	Nil

EPBC Act factor	Impact
f) Any impact on a Commonwealth marine area? The proposal would not affect a Commonwealth marine area.	Nil
g) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
h) Additionally, any impact (direct or indirect) on Commonwealth land? The proposal would not affect Commonwealth Land.	Nil