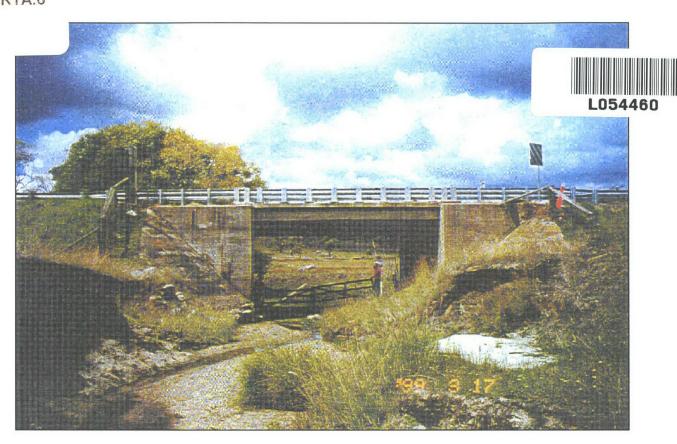
# **Review of Environmental Factors**

625.711 RTA.6 Proposed Realignment of the New England Highway (SH9) at Rose Valley, Bendemeer



**Prepared for RTA Northern Region** 



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# **Document controls**

<b>Business Unit</b>	Environmental Technology Branch			
Project Number	000082			
<b>Document description</b>	REF: Proposed Realignment of the New England Highway (SH9) at Rose Valley, Bendemeer			
	Name Signed Date		Date	
Approving Manager	Sally Durham		Shill	. 16/11/99

Person managing this document	Person(s) writing this document		
Katrina Smallwood	Katrina Smallwood		

Location	Filename	
g:\aptech\environ\proj9900\0082\ref\rosevall.doc	99M1895	

Client Reference	Status	Date
	Final	November 1999

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# **Proposal Identification**

Name of Proposal: REF: Proposed Realignment of the New England Highway at Rose

Valley, Bendemeer

Region / Directorate RTA Northern Region

Local Government Areas: Parry Shire Council.

Road Number and Name: SH9 - The New England Highway

# 1. Introduction and Background

#### 1.1. Introduction

This Review of Environmental Factors (REF) has been prepared by Environmental Technology, RTA Operations, for RTA Northern Region, Grafton. The purpose of the REF is to assess the potential impacts of the proposed realignment of the New England Highway (SH9) at Rose Valley, Bendemeer. It presents details of the Proposal, describes the existing natural and social environments, assesses the potential impacts on the environment, and presents safeguards to minimise and/or remove these identified impacts. The REF includes a consideration of Clause 82 of the *Environmental Planning and Assessment Regulation*, 1994.

The findings of the REF would be considered when assessing:

- whether the Proposal is likely to have any significant impact on the environment and therefore the necessity for an EIS under Section 112 of the EP&A Act; and
- the significance of any impact on threatened species as defined by the *Threatened Species Conservation Act 1995*, in accordance with Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS).

## 1.2. Background

The New England Highway is a State Highway (SH9) which forms an important link between Tamworth and Armidale, and is also an alternative route to the Pacific Highway between Sydney and Brisbane.

This section of the New England Highway includes a tight curve, which has resulted in a number of accidents involving vehicles failing to negotiate the turn. Realignment of the Highway would remove this tight curve and reduce the potential for accidents within this section.

The realignment of this section of New England Highway has been part of an ongoing project and has been subjected to numerous previous studies as listed below. Funding has now been acquired for the project and this REF has been prepared to ensure the Proposal meets all current legislative requirements. The specialist studies undertaken earlier have been assessed against these requirements and consultants engaged to update the information to ensure compliance. Previous studies carried out include:

- March 1993 Review of Environmental Factors (REF), RTA;
- December 1993 Concept Report, RTA;
- May 1994 Consideration of REF, RTA;
- 1995 Value Management Study, RTA;
- June 1995 Environmental Management Plan (EMP), QEM;
- January 1995 Revised Consideration of REF, RTA;
- March 1995 Geotechnical Investigation, Golder Associates;
- May 1995 Traffic Noise Assessment, James Madden Cooper Atkins;
- June 1995 Flora, Fauna and Archaeological Assessment, QEM; and
- July 1995 Final Design Report, HTL Reinhold.

# 2. Proposal Description

#### 2.1. Location

The Proposal involves the realignment of the New England Highway (SH9) at Rose Valley between 35.5 and 39.1km north of Tamworth. The northern extent of the works finishes approximately 0.5km south of the Bendemeer turnoff. The Proposal is located within the Parry Shire Council Local Government Area.

**Appendix A** shows the location of the Proposal.

#### 2.2. General features

The Proposal involves realignment of approximately 3.4 km of the New England Highway, generally 100m to the east of the existing Highway. The proposal would include a northbound overtaking lane, provision of three creek crossings and the diversion of Rose Valley Creek.

This would involve:

- clearing of vegetation and stripping of topsoil;
- possible construction of compound sites adjacent to existing road;
- construction of cuttings and fills;
- construction of sidetracks adjacent to existing road or by widening existing road;
- formation of road corridor and roadside drainage;
- laying of road pavement;
- diversion of Rose Valley Creek and stabilisation of the diversion and convergence with Dunduckety Creek;
- construction of new creek crossings at Rose Valley Creek, Poison Swamp Creek and Dunduckety Creek;
- demolition of old bridges; and
- revegetation of exposed surfaces.

**Appendix A** shows a Design Plan of the Proposal.

#### 2.3. Costs

The Proposal would cost approximately \$12 million. Funds are being sourced from the Federal Government under the Australian Land Transport Development Program.

# 2.4. Timing

The work is proposed to commence in the 1999/2000 financial year and would take approximately 12 months.

# 3. Specialist Studies and Community Involvement

## 3.1. Specialist studies

Three specialist studies were undertaken as part of the REF. The findings of these studies are summarised in Section 6.2 (Environmental Impacts) of this report and full copies of the reports are provided as Appendices.

These studies are listed below:

- A Non-indigenous and Indigenous Heritage Assessment undertaken by Claire Everett of RTA Technology June 1999 (**Appendix B**);
- An Ecological Assessment undertaken by Terra Sciences June 1999 (Appendix C);
   and
- A Noise Assessment undertaken by Atkins Acoustics May 1999 (**Appendix D**).

#### 3.2. Consultation

Environment Australia was contacted due to the Proposal being Federally Funded. Environment Australia consulted with the Australian Heritage Commission and the Biodiversity Group and co-ordinated the response. The issues raised are listed below.

The views and opinions of State Government agencies and adjacent landowners which are likely to have a statutory or property interest in the proposed works was obtained through consultation. This consultation involved the forwarding of a letter providing details of the Proposal. The following were included in the consultation process:

#### **Adjacent Landowners**

- Ollsen
- McKenzie

#### **Government Agencies**

- Environment Australia
- Environment Protection Authority (EPA)
- Department of Land and Water Conservation (DLWC)
- National Parks and Wildlife Service (NPWS)
- Parry Shire Council
- Rural Lands Protection Board
- NSW Fisheries
- Tamworth Local Aboriginal Land Council

The issues raised and comment or the relevant section of the REF addressing these issues is listed in **Table 1** below. Copies of the correspondence received from these groups and authorities are attached in **Appendix E**.

Table 1 Correspondence received

Agency / Resident	Issue	RTA Comment / REF Section
• Environment Australia	<ul> <li>Consent to destroy permits for the two indigenous sites need to be sought from the NPWS.</li> </ul>	<ul> <li>Heritage study completed by Ms Everett. Discussed in Section 6.2.10 and 6.2.11(Full report in Appendix B)</li> </ul>

•	Photographic record of the affected non-indigenous sites should be taken and lodged in the RTA archives and the NSW Heritage Offices.  Reference should be made to the Commonwealth's Endangered Species Protection Act 1992.  If certain flora and fauna species are listed on the ESP Act but are not present at the site, there should be a detailed description on the nature of the survey, the condition of potential habitat for the species and the nearest locations of other colonies.	•	Discussed in Section 6.2.10 and 6.2.11(Heritage report in Appendix B)  Discussed in Section 6.2.7 and 6.2.8.  Discussed in Section 6.2.7 and 6.2.8.
• EPA •	Prepare an Erosion and Sedimentation Control Plan (ESCP) and include a fluviogeomorphic study of creek bed and impacts of proposed works on creek.	•	Discussed in Section 6.2.6
•	Concerned about the effects of bridge and culvert construction on water quality.	•	The RTA is consulting with DLWC and NSW Fisheries on the final design for the creek crossing structures.
•	Concerned about the effects of the creek diversion on water quality.	•	The RTA is consulting with DLWC and NSW Fisheries on the final design for the creek diversion.
•	A reminder that section 120 of the PEOA, 1997 will apply. (Offence to pollute waters).	•	Acknowledged. Discussed in Section 5.5.4 and 7.1.
• DLWC •	Design considerations for Rose Valley Creek.	•	The RTA is consulting with DLWC and NSW Fisheries on the final design for the creek diversion and creek crossing structures.
•	Issues of bank protection, particularly on the outside bends. Rock should be used to prevent undermining and revegetation should take place on upper banks.	•	Acknowledged.
• NPWS •	Concerned about Aboriginal site impact. Concerned that proposal would have impacts on surrounding and downstream environments. Take into consideration Threatened Species Conservation Act, 1995.	•	Section 6.2.10 and 6.2.11(Full report in Appendix B) Terra Sciences undertook a flora and fauna assessment report. Discussed in Section 6.2.7 and 6.2.8 (Full report in Appendix C)
• Parry Shire • Council	Secondary road access issue.	•	Contractor would look at options to keep access to Travelling Stock Route.

**Rural Lands** The Board is concerned about The RTA would meet with the Protection the ability of livestock to move Board's Senior Ranger to decide **Board** safely between two of its large what provisions are to be made travelling stock reserves. for travelling stock between these two reserves. NSW Refer to NSW Fisheries Policy Noted. The RTA is consulting **Fisheries** and Guidelines for Aquatic with NSW Fisheries on the final Habitat Management and Fish design for the creek diversion and Conservation 1998. creek crossing structures. Would like justification for the No longer proposing to use box culvert design. Would use a downgrading of Dunduckety Creek from a bridge structure to bridge structure. a box culvert design Request further environmental A fluvio-geomorphic study would assessment for the creek be included in the ESCP. diversion. Recommendations would be incorporated in the final design. Sedimentation and erosion The Proposal would be subjected controls to be implemented to to a detailed Erosion and ensure aquatic organisms would Sedimentation Control Plan not be impacted upon by (ESCP) to be developed by a increased sedimentation or qualified soil conservationist. turbidity. NSW Fisheries would be Must be informed if fish passage is to be blocked or contacted if there were a altered during construction. likelihood of this happening. Approval required to temporarily or permanently obstruct fish passage. Concerned about alterations to The contractor would be required water flow and velocity. to install all creek-crossing structures to provide minimal disruption to water flow and velocity. Discussed in Section 6.1.4. Request for information on the proposed works and construction of sidetracks. Request for information on the • Discussed in Section 6.1.4. removal of creek crossings. A detailed landscaping plan is Request for information on rehabilitation methods. being developed by the contractor and would be implemented during the construction and postconstruction phases of the project. • Issues covered in Heritage • Local • No written response **Aboriginal Land** Assessment. council Ollsen Private residents would be No response. notified prior to the commencement of construction. **McKenzie** Private residents would be No response. notified prior to the

commencement of construction.

# 4. Strategic Stage

#### 4.1. General

The New England Highway is a State Highway (SH No. 9) which forms an important link between Tamworth and Armidale, and is also an alternative route to the Pacific Highway between Sydney and Brisbane.

This section of the New England Highway includes a tight curve that has resulted in a number of accidents involving vehicles failing to negotiate the turn. Realignment of the Highway would remove this tight curve and reduce the potential for accidents, and costs and delays associated with accidents.

The proposal would also include the diversion of Rose Valley Creek with a new convergence with Dunduckety Creek downstream of the proposed new alignment.

# 5. Concept Stage

## 5.1. Objectives of the Proposal

- Provide an improved alignment of National Highway Standard;
- Provide northbound overtaking opportunities;
- Improve road safety and reduce the accident rate;
- Raise the posted speed limit to match the adjoining sections of Highway; and
- Improve condition of the pavement and the ride qualities of the road.

## 5.2. Options considered

Four options were considered as part of the design development and Concept Report (1993). These were:

- Option 1 realignment between 35.5 km and 39.1 km north of Tamworth, generally located on the western side of the existing highway;
- Option 2 realignment between 35.5 km and 39.1 km north of Tamworth, generally located on the eastern side of the existing highway;
- Option 3 realignment between 35.5 km and 39.1 km north of Tamworth, generally along the existing alignment; and
- Option 4 do nothing and continue with existing conditions and ongoing maintenance requirements.

# 5.3. Proposal selection

Option 2 was selected as the preferred option based on the following criteria:

- Provide National Highway Standards;
- Ensure good horizontal and vertical combination;
- Minimise impact on private property;
- Maximise use of recently reconstructed pavement;
- Provide northbound overtaking lane; and
- Minimise structure costs.

Option 1 was not considered suitable as it had the greatest impact on private property and the environment, the highest risk of damage from blasting, the highest level of noise to private dwellings, poor geometry for climbing lane and a low degree of construction safety.

Option 3 was not considered suitable due to the low degree of construction safety, risk of blasting damage, additional material would be required for earthworks, highest construction costs, greatest impact on existing powerlines, and a greater length of construction over unsuitable ground (Poison Swamp).

Option 4 (do nothing) was not considered suitable based on safety and the objective of meeting National Highway Standards.

The proposed works were subject to a benefit/cost analysis using REVS. The Proposal has a Benefit/Cost Ratio (BCR) of 2.2. Average Annual Savings expected from the Proposal are:

- 7 accidents;
- 384 kl of fuel;
- 24, 364 hrs of travel time;
- 380, 873 veh-kms travelled

A summary of the results is as follows:

Year of Calculations: 1999
Project BCR (based on total project cost of \$11.8m): 2.2
Net Present Value: \$7.91m
First Year Rate of Return: 11.9%

## 5.4. Description of site and surroundings

The surrounding area can be described as rural/residential. Six privately owned properties, two Travelling Stock Routes (TSRs) and Bendemeer Common front onto the New England Highway within the study area. Two residences are located within the vicinity of the Proposal. The property owned by Ollsen is located at the Tamworth end of the Proposal and the residence owned by McKenzie is located at the Bendemeer end of the works.

Native vegetation lines the western side of the New England Highway, while the eastern side has been extensively cleared for grazing with scattered mature trees remaining. Topography of the area consists of undulating to rolling hill slopes and the flat alluvial plain of Rose Valley, Poison Swamp and Dunduckety Creeks. This is discussed further in Section 6.2.1.

Rose Valley Creek passes under the New England Highway at the start of the works and runs roughly parallel to the Highway on the eastern side for the extent of the works and then enters Macdonalds River. Rose Valley Creek has a low flow most of the time and exhibits a high degree of bank erosion with the channel being up to 8m deep adjacent to the project area.

Poison Swamp and Dunduckety Creeks drain an area of the Moonbi Ranges to the west, pass under the New England Highway and join Rose Valley Creek within the project area. Poison Swamp Creek is ephemeral while Dunduckety Creek was observed to have a low flow. Both creek systems also exhibit a high degree of bank erosion. All of the three creeks within the project area are highly degraded as a result of the erosion of sandy soils and high levels of stock movement.

Photographs of site aspects mentioned above are attached at **Appendix F**.

## 5.5. Statutory planning

#### 5.5.1. **Zoning**

The New England Highway has been classified as "Existing Arterial and Main Roads". Council has zoned the adjacent area 1A General Rural in the Parry Local Environmental Plan, 1987.

LEP (1987) requires Council consent for roadworks on an existing road. However as the Proposal comes under the definition of "roads" in the *Roads Act 1993*, State Environmental Planning Policy No.4 (SEPP 4) 11(c) allows the RTA to undertake the proposed works without the consent of Council.

## 5.5.2. State Environmental Planning Policies

#### SEPP No.44 - Koala Habitat Protection

Parry Shire Council is identified within the Schedules of SEPP No. 44 (Koala Habitat Protection) as a Local Government Area in which Koalas are known to occur. As such, the impacts of any developments undertaken in these areas should consider the Proposal in light of the assessment criteria provided in this planning document. These criteria relate to the percentages of feed tree cover, particularly trees listed under Schedule 2- Known Feed Trees. The assessment criteria consider the percentage cover of known feed trees, and whether these are greater or less than 15% of the total tree canopy.

The open forest and woodland that occurs on the site has a strata component of approximately >50% of listed feed tree species. This, along with the listing of the local government area in Schedule 2, makes the site potential koala habitat. However, the area cannot be defined as core koala habitat for the following reasons:

- The proposed works are not likely to isolate or remove a significant area of potential feed trees from the open forest or woodland.
- The closest koala sightings to the site include 1967, 16 km east within the Tara Mountain locality and 1967, 38 km south-east south of the township of Uralla.
- There is no record of breeding females or evidence of a resident population in the study area. The area cannot therefore be defined as core koala habitat (See Section 6.2.8).

#### 5.5.3. Regional Environmental Plans

The area is not subject to the provisions of any Regional Environmental Plans.

#### 5.5.4. Protection of the Environment Operations Act, 1997

Section 120- Prohibition of pollution of waters, Clauses 1-4 states that waters must not be polluted. The penalty to a corporation for causing water pollution can be up to \$250,000 and, in the case of a continuing offence, to a further penalty of \$120,000 for each day the offence continues. In the case of an individual the penalty can be up to \$120,000 and, in the case of a continuing offence, a further penalty of \$60,000 for each day the offence continues may apply.

Under the act, it is, however, a defence if the person establishes that:

- (a) The pollution was regulated by an environment protection licence held by the person or another person, and
- (b) The conditions to which that licence was subject relating to the pollution of waters were not contravened.

If construction activities were likely to cause pollution of the water, a licence would be obtained for the works.

# 6. Detailed Assessment Stage

## 6.1. Design considerations

#### 6.1.1. Existing road

The existing Highway consists of an undivided two-lane single carriageway with sealed shoulders. The highway generally runs north-south with a tight curve in the vicinity of Dunduckety Creek approximately 36.9 km north of Tamworth. The pavement is generally in poor condition and has been subject to numerous recent pavement rehabilitation works.

Existing overtaking lanes for southbound traffic are located 7 km north and 2 km south of the Proposal. Northbound traffic overtaking lanes are provided 4 km south and 4 km north of the Proposal.

## 6.1.2. Existing and forecast traffic

There are three traffic counting stations on the New England Highway within the vicinity of the Proposal. Recent annual average daily traffic figures (AADT) for these stations are:

- 92.034 (5 km south of SH11 Oxley Highway) 5401 (1998);
- 92.036 (Bendemeer north of SH11 Oxley Highway) 5240 (1998-based on 3.2% projected lineal growth rate)
- 92.057 (at Uralla Shire Bdy) 43015 (1998).

Station No. 92.034 is located closest to the Proposal (approximately 1 km south of the southern extent of the proposed works) and is considered the most accurate as there are no major roads joining the New England Highway between this location and the project area.

The estimated 2000 AADT for Rose Valley based on this data and using an annual growth of 2.7% is 6130 (AADT). Traffic levels are expected to increase at the same rate to an AADT of 8020 in 2012. Based on recorded data approximately 21% of the AADT consisted of heavy vehicles. This would be expected to increase temporarily while construction was being carried out.

The recent accident history for Rose Valley includes 39 accidents between 1988 and 1997 of which 54% were as a result of vehicles failing to negotiate the curve.

#### 6.1.3. Design parameters

The following parameters provided limits on the extent and the types of works:

- Design speed of 100km/h;
- Drainage in road corridor to remain and be extended where needed;
- Provide a northbound overtaking lane;
- Maximise use of recently constructed pavement;
- Avoid impacts to utilities where possible;

- Make best use of existing road reserve; and
- Maintain existing access roads.

#### 6.1.4. Construction activities

The Proposal would generally provide two traffic lanes (each 3.5 metre wide) and 3 metre wide shoulders in each direction with a new 100 km/hr alignment

Access to the Ollsen property, Lot 2 and Bendemeer Common would be retained and connected with a sealed road surface to the proposed new alignment. The road base would have an approximate total depth of 380 mm on the new highway and 200 mm on the access roads. A Design Plan of the Proposal is shown in **Appendix A**.

The following major works would also be undertaken as part of the Proposal.

#### **Creek Crossing Structures**

- Sidetracks would not be permitted across Rose Valley or Dunduckety Creeks.
- A sidetrack would be permitted across Poison Swamp but would only be used in dry periods (which is 99% of the time).
- A new single-span arch bridge would be constructed at Rose Valley Creek approximately 15m upstream of the existing bridge.
- A new 5-cell box culvert structure would be constructed at Poison Swamp Creek approximately 100m downstream of the existing 5-cell box culvert structure. The sidetrack would be used here to access the creek for construction.
- A new single-span arch bridge would be constructed at Dunduckety Creek approximately 200m downstream of the existing bridge.

#### **Rose Valley Creek Diversion**

The Rose Valley Creek diversion involves construction of a 175m diversion of Rose Valley Creek with a new convergence with Dunduckety Creek approximately 50m downstream of the proposed new highway alignment. This would include:

- the channel being constructed to match existing creek cross sections;
- loose rock fill being placed in the new diversion channel, Dunduckety Creek upstream, and Rose Valley Creek for approximately 150m downstream of the new convergence for erosion control;
- a loose rock fill drop structure being provided at the new convergence; and
- the isolated section of Rose Valley Creek being backfilled, filled with topsoil and revegetated.

#### **Removal of Creek Crossings**

All existing creek crossings (Rose Valley, Poison Swamp, Dunduckety) on the existing alignment would be removed and the creek bed and banks restored. This would involve using local rock to line banks, restoration of vegetation and erosion and sediment control measures.

The removal methods would be designed to ensure minimum disturbance of creek beds. All of the three creeks are usually dry which would enable the removal and restoration to take place outside of any flow periods.

#### **Earthworks**

Approximately 170,00 cubic metres of cut would be removed from the project area and approximately 152,000 cubic metres of fill would be required for the proposed works. These works would include:

- construction of three cuttings at approximately 36.15 km, 37.2 km and 38.05 km north of Tamworth and each approximate maximum depths of 8m, 14m and 4m respectively; and
- construction of four fills at approximately 35.9 km, 36.75 km, 37.6 km and 38.4 km north of Tamworth and each approximate maximum heights of 6m, 8m, 6m and 6m respectively.

The geotechnical study undertaken indicates that the cuttings are in highly weathered granite. However, there is a high probability of encountering granite corestones which may require blasting. There are three proposed cuttings:

- Cut 1: 100m<sup>3</sup>
- Cut 2: 500m<sup>3</sup>
- Cut 3: 100m<sup>3</sup>

Construction of the cuttings would require the removal of native vegetation from the western side of the existing highway, while the creek diversion would require the removal of mature trees. The area to be diverted consists of a heavily disturbed drainage course with no established riparian vegetation communities.

The approximate area that would be disturbed by the proposed works is 11.5 hectares. Of this, 3.5 hectares would be the removal of the open forest community supporting the two Eucalypt species of that provide koala food source (discussed in Section 6.2.7). Less than one hectare would be disturbed within the open woodland community and the remainder would be within the grassland/pastureland community.

The proposal is unlikely to result in impacts detrimental to native aquatic flora and fauna that potentially use the creek as habitat. The Flora, Fauna and Aquatics Assessment in **Appendix** C shows that no significant habitat would be impacted on in this proposed creek section.

Adequate table drains would be constructed on either side of the road with replacement or extension of existing drainage structures under the Highway. All signage and road markers would be in accordance with current RTA requirements. Topsoil would be stripped. Weeds would be taken to a licensed landfill while native vegetation would be mulched and stored in an area clear of any creeks or waterways for later respreading across the project area. Stockpiles left for more than a week would be seeded with a temporary sterile vegetative cover or kept covered.

The RTA would be responsible for managing the Proposal and RTA employees and contractors would undertake all construction activities. All construction materials are readily available from commercial suppliers.

The main site compound would be located at an RTA depot in Bendemeer which is well clear of any waterways. The contractor may wish to construct compounds closer to the works. If so, these would be located adjacent to the existing road, and clear of any waterways.

There is also a possibility of a batch plant for production of pavement material to be located on site. This would be decided by the contractor and subject to a separate assessment to be undertaken by the contractor.

#### **Traffic Management**

Construction work would be undertaken so as to minimise any disruption to local and through traffic. During construction through traffic would continue to use the existing Highway. A traffic management control plan would be developed in accordance with the RTA's "Traffic Control at Work Sites", and 'AS 1742.3 Manual of Uniform Traffic Control Devices Part 3: Traffic control devices for works on roads'.

#### 6.1.5. Waste disposal

A waste management plan would be prepared prior to commencement of construction. The waste management plan would comply with the Waste Minimisation & Management (WMM) Act, 1995, the WMM Regulation, 1996 and RTA Guidelines. This plan would include the following safeguards:

- Site generated waste including garbage, waste pavement material, bridge
  materials, concrete etc would be recycled where possible and any remaining
  waste would be contained and removed from the site and disposed of to a
  licensed landfill. Prior to offsite removal of any waste to a waste
  facility/landfill, the proponent would check the validity of the waste facility's
  (landfill) licence and/or Council consent to receive this type of waste.
- Recycled materials would be used where possible (eg. recycled crushed road base).
- Waste oil would be sent to approved recyclers.
- Cleared vegetation or other materials would not be burned. Weeds would be taken to a licensed landfill while native vegetation would be mulched and used to revegetate the disturbed areas.
- Secure rubbish bins would be provided within site compounds. These would be regularly emptied.
- All site sewage would be contained in 'portaloo' type toilets, collected and disposed of off-site in accordance with relevant regulations.
- Chemicals would be stored in secure compounds with an impermeable floor and appropriate bund walls built to Australian standards.
- The worksite would be left in a tidy and rubbish free state upon completion of the Proposal.

- If contaminated waste were identified during construction, this would be removed to an EPA approved facility for the purpose of disposal of these materials. All necessary permits for the removal, transportation and disposal of contaminated waste would be obtained prior to any works being undertaken.
- If any contaminated waste was generated during construction the appropriate EPA licences and approvals would be obtained for its disposal and the operators of the disposal site would be notified in advance.

#### 6.1.6. Demand upon resources

The demand on resources is expected to be minimal and typical of other similar projects. Recycled materials such as crushed road base would be used where possible and all other materials would be sourced from the local area. The balance of fill material required for the earthworks would be sourced from local quarries.

# 6.2. Environmental impacts

#### 6.2.1. Landforms

Landforms within the study area consist of undulating to rolling hill slopes (up to 900m AHD) and the flat alluvial plain (840m AHD) of Rose Valley, Poison Swamp and Dunduckety Creeks. The Moonbi Range is located to the west and south and rises up to approximately 1300m AHD.

The proposed new alignment would involve alteration of the existing landform. The Proposal would involve the removal of approximately 170,000 cubic metres of materials from the three cuttings, and require approximately 152,000 of fill for the four batters. Details of each of the cuttings and fills are provided in **Table 2** below

Table 2: Details of cuttings and fills

Description	Length	Width	Depth / Height	<b>Batter Slopes</b>
Cut 1 (36.05km to 36.45km)	175	15	8	66% (west) 50% (east)
Cut 2 (37.00km to 23.38km)	175	75	14	50% (west) no bank east
Cut 3 (38.00km to 38.20km)	75	20	4	50% (both)
Fill 1 (35.50km to 36.05km)	150	25	3.5	50% (both)
Fill 2 (36.45km to 37.00km)	275	25	5	50% (both)
Fill 3 (37.38km to 38.00km)	300	20	7	50% (both)
Fill 4 (38.20km to 38.80km)	300	10	5.5	50% (both)

Note: all dimensions are approximate maximums in metres. All locations are in kilometres north of Tamworth.

For stability both Cuts 1 and 2 would have a table drain positioned approximately halfway down the western batter and backsloped at 10%. The material between Cut 2 and the existing highway would be removed for use as fill in the raised sections of the new alignment.

Erosion control would be undertaken in accordance with the Erosion and Sedimentation Control Plan, which would incorporate the measures discussed in Section 6.2.6.

## 6.2.2. Geology and soils

Igneous intrusive rocks of the New England Batholith underlie the study area. Surface geology is comprised of Bendemeer Adamellite and Moonbi Adamellite which are coarse grained granites. Granite boulders are scattered on the surface throughout the project area and are evident in some sections of the eroded creek beds.

The granites are overlain by soils that are comprised of sands, silts, clays and gravels deposited by erosional processes in the alluvial plain. The soils of the project area are typically highly erosive and of low fertility.

The Proposal would involve the disturbance of soils on site in the form of topsoil stripping and storage, cut and fill operations and road bed formation. Owing to the highly erosive nature of the soils, stringent erosion and sedimentation control measures would be incorporated in the project in the form of an ESCP. These measures would include those discussed in Section 6.2.6.

No acid sulphate soils (ASS) or contaminated soils are expected to be encountered during the proposed works however, should any be found then they would be handled in accordance with the relevant legislation, EPA guidelines and RTA policy or guidelines.

#### 6.2.3. Climate

The average annual rainfall is 673 mm with the majority falling in the summer months. The implication of this for the works is that there is more risk of erosion and sedimentation during summer. However, the ESCP would provide a worksite where the erosion impact of storms would be either substantially reduced or completely avoided. Average temperatures range from 10°C in July to 25°C in January.

During periods of frost and fog, the site area would have warning signs for traffic. Construction may be temporarily postponed in periods of heavy fog or heavy frost as certain activities cannot be undertaken. For example, the laying of bitumen cannot carried out in extreme cold weather.

#### 6.2.4. Landform stability and erosion hazard

The waterways in the vicinity of the Proposal exhibit high levels of bank erosion resulting in significant levels of sand and sediment within the creek beds. This is most prevalent in Rose Valley Creek where the creek banks are up to 6m high adjacent to the project area. Away from the creeks the landscape is well vegetated with grasses and trees and remains relatively stable with little sign of erosion.

There is a very high potential for erosion of disturbed areas during construction, particularly during the proposed creek diversion, placing of new creek crossing structures and removal of old creek crossing structures. This would be minimised by implementation of the measures discussed in Section 6.2.6 and would be addressed in greater detail in the ESCP, which would be developed and implemented prior to commencement of construction activities.

Following completion of construction and revegetation the potential for erosion would be expected to return to pre-construction levels.

#### 6.2.5. Air quality

Existing air quality is considered high owing to the rural nature of the surrounding area.

During and immediately after the construction phase there would be a potential for deterioration in air quality due to dust generated from exposed surfaces and construction activities. This would be minimised by:

- the covering or dampening of all loads;
- use of a water truck or other acceptable means of dust suppression on all exposed surfaces as necessary; and
- revegetation of reformed surfaces as soon as possible.

These factors would be addressed in greater detail in the Project Environmental Management Plan (PEMP) which would be prepared prior to commencement of construction.

The Proposal is not expected to have a long-term impact on air quality following satisfactory revegetation.

The Proposal is not expected to encourage increased traffic usage of the New England Highway and would not be likely to result in increased vehicle pollution. The AADT is expected to increase at the same rate of 2.7% for the year 2000 and 2012.

#### 6.2.6. Water quality and drainage

There are three significant waterways within the vicinity of the Proposal. These are Rose Valley Creek, Poison Swamp Creek and Dunduckety Creek, all of which drain into Macdonalds River, located just to the north of the study area. All three creek systems are highly degraded owing to a combination of the movement of large amounts of sandy sediments and stock movements within the creek lines.

Drainage of the area is generally from the Moonbi Range to the west and south of the project area. Other drainage from the western side of the existing highway passes underneath the highway through numerous pipes and enters Rose Valley Creek on the eastern side.

The Proposal includes the provision of grassed table drains on either side of the proposed alignment and would generally utilise the current drainage patterns. During and immediately following construction there would be significant potential for an adverse impact on water quality due to sediment laden runoff in periods of intensive rainfall owing to the nature of the proposed works and the highly erosive nature of the soils.

In order to minimise the potential adverse impacts associated with the proposed major works the following project specific steps would be undertaken:

- permanent ESC measures would be designed in consultation with DLWC; and
- DLWC and NSW Fisheries would be involved in the final design of the Rose Valley Creek diversion in order to ensure a suitable and practical solution.

As part of the contractual documents the contractor would be required to:

- hire a qualified soil conservationist to develop and implement the temporary ESCP, which would include a fluvio-geomorphic study of Rose Valley Creek bed, and to undertake routine inspections on at least a weekly basis; and
- ensure that disruptions to water flow are minimised in the final design of the creek crossing structures.

In addition to the measures discussed above the following controls would also be implemented:

- storage of stockpiled materials away from drainage lines and placement of diversion banks on the upslope side and sediment control facilities on the downslope side;
- identification of all affected drainage lines prior to commencement of construction and placement of siltation barriers at regular intervals in these drainage lines;
- placement of diversion banks to divert all clean runoff away from construction activities;
- placement of adequate erosion control measures (eg. siltation fences, sedimentation ponds) to entrap all runoff from disturbed surfaces;
- rehabilitation and revegetation of disturbed surfaces as soon as possible following completion of construction activities;
- minimisation of disturbed surfaces;
- inspection of all erosion and sedimentation control on a weekly basis and within 24 hours of a rainfall event;
- undertaking of maintenance as necessary to ensure effective operation of sediment fences, successful revegetation; and
- removal of sedimentation control structures only after adequate stabilisation by revegetation of disturbed surfaces.

These measures would be addressed in more detail in the ESCP. The erosion and sedimentation measures proposed to be incorporated in the construction area as part of the ESCP would comply with the requirements of the Department of Land and Water Conservation and the Guideline for Managing Urban Stormwater – Soils and Construction, 3rd Edition" (NSW Dept. Housing, 1998).

The impact of the Proposal on water quality during and immediately following construction is expected to be minimal provided the safeguards identified above are implemented.

The Proposal is not expected to have a long-term impact on water quality following successful revegetation. Erosion levels would be expected to return to pre-construction levels.

#### 6.2.7. Vegetation

A survey of the site and surrounding areas was undertaken by Terra Sciences from the 11 May to 13 May 1999. The key findings of the Ecological Assessment are summarised below, and the full report can be found in **Appendix C**.

The area covered in the survey included:

- The existing road and shoulders;
- The proposed new alignment (20 metres either side);
- A section of open forest, to the north west of the existing highway, containing the two noted tree species along the proposed route;
- Rose Valley, Poison Swamp and Dunduckety Creek crossings and immediate vicinities:
- Rose Valley Creek proposed diversion site and sections of the creek up and down stream of this location; and
- Any extensions of habitat that were considered to be potentially impacted by the proposed works.

#### **Vegetation Communities**

Vegetation in the vicinity of the study area consists of three floristic communities: open woodland, open forest and grassland/pastureland. These have all been influenced by past (and present) clearing and rural grazing activities.

These communities all showed evidence of thinning and clearing as well as intensive grazing practices. The grassland/pastureland had also been subject to earthworks, soil and sand stockpiling and prior roadworks.

#### **Plant Species**

The Commonwealth's *Endangered Species Protection Act 1992* (ESP ACT) was considered due to the project being Federally funded. Several species were also identified under the *Threatened Species Conservation Act, 1995 (TSC Act)* as potentially occurring in the vicinity of the Proposal. Species occurring under the TSC Act were also listed in the ESP Act. These species are listed in **Table 3** below.

Table 3: Species Considered under the *Endangered Species Protection Act*, 1992 as potentially occurring in the study area.

COMMON	ESP ACT	ECOLOGICAL ASSESSMENT FINDINGS
NAME	STATUS	
McKie's Stringybark	Vulnerable	<ul> <li>Nearest listed sites are 15 and 30 kilometres north of the study area, 9.3 km north west of Tingha and 11-13 km West of Wandsworth.</li> <li>No botanical records have been recorded from the site. Unlikely that species would have been previously undetected while E.elliptica and E.malacoxylon are known within the area.</li> </ul>
Small Snake Orchid	<ul> <li>Only recording for the region 18 km north e study area in 1986.</li> <li>Endangered</li> <li>Eight part test carried out concludes that the proposed works would not have a significant this species.</li> </ul>	
Austral Toadflax	Recorded in 1912 approximately 30 km east of study area near the Oxley Highway.      Nearest known site is north of the study area at Walcha.     Eight part test concluded that the proposed work would not have a significant impact on this species.	
Leafless Tongue Orchid	<ul> <li>Preferred habitat is sandy soils in coastal distribution</li> <li>South from Gibraltar Range. None of this habitat</li> </ul>	
Orchid Species	Vulnerable	<ul> <li>Preferred habitat includes sclerophyll forest amongst grass, often with Callitris. Grassy forested communities have suffered grazing impacts. Callitris was not present.</li> <li>Likelihood of species occurring is negligible due to the absence of preferred habitat and history of grazing practices.</li> <li>No recording listed under the NPWS Wildlife database for the Bendemeer mapsheet 1: 100000.</li> </ul>
Orchid Species	Vulnerable	<ul> <li>Preferred habitat near escarpments close to waterfalls and on moist, sheltered ridges. None of this habitat exists on the study area or is known within the locality.</li> <li>No recording listed under the NPWS Wildlife database for the Bendemeer mapsheet 1: 100000.</li> </ul>

The ecological assessment concluded that the Proposal would not have a significant impact on the species listed in the above table.

Two uncommon Eucalypt species, Bendemeer White Gum and Moonbi Apple Box were identified within the study area. Although not listed on the TSC Act they are listed on the *Rare or Threatened Australian Plants* (ROTAP), 1996. An 8-part test of significance was carried out on these species. The results show that the impact of the proposed removal of Bendemeer White Gum and Moonbi Apple Box trees are unlikely to be classed as 'significant' due to the following considerations:

- The proposed works would remove a low proportion of the existing tree species from the open woodland, leaving the remainder intact and without further intrusion.
- The removal of these trees is unlikely to impact on the viability or endangered status of the species in a local, regional or national context.
- The proposed realignment would not result in the removal of a core population. Other populations of these species exist within a five kilometre radius. (This assists in retaining any genetic variability within localised populations should any single area be destroyed, eg. severe fires).

Approximately 23 mature Bendemeer White Gum and 23 mature Moonbi Apple Box trees would be removed as a result of the project. This is unlikely to be classed as 'significant' due to the low proportion of existing population being removed. The proposed road works are unlikely to threaten the survival or evolutionary development of this species.

In order to minimise the impacts of the Proposal, the following mitigation measures would be undertaken:

- Management of trees within the roadside corridor through minimising tree removal to those absolutely required for the road realignment and implementing appropriate management guidelines for the corridor.
- Minimising tree removal whilst making use of cut logs and branches to create habitat.
- The local importance of the open forest, to be removed between chainage 37 000 and 37 400, should be recognised. Any design modification, which would move the realignment to the east, would reduce disturbance of this open forest and consequently reduce impacts on the species of conservation significance.

The ecological assessment concluded that the removal of vegetation associated with the Proposal, in accordance with mitigation measures, is unlikely to result in a significant effect on threatened species, populations or ecological communities, or their habitats.

#### 6.2.8. Wildlife and habitat

A survey of the site and surrounding areas was undertaken by Terra Sciences from the 11 May to 13 May 1999. The key findings of the Ecological Assessment are summarised below, and the full report can be found in **Appendix C**. During the field survey, the habitats present in, and adjacent to, the project area were surveyed.

A variety of techniques were used to identify the range of native and introduced species present in, and adjacent to, the proposed project area. Prior to the field survey relevant literature was reviewed and a search was conducted of the *NPWS Wildlife Atlas* to determine habitat requirements of the species analysed. Consultation was undertaken with Greening Australia, NPWS, Department of Land and Water Conservation, NSW Fisheries and Parry Shire Council. The Commonwealth's ESP ACT was considered due to the Proposal being Federally funded. Several species were also identified under the *Threatened Species Conservation Act, 1995 (TSC Act)* as potentially occurring in the vicinity of the Proposal.

The fauna field survey involved trapping transects, electronic recording and opportunistic observation of scats, tracks and diggings. The fauna assessment was based on identification of habitat type, quality and potential. Species considered under the ESP Act are included in **Table 4** below.

Table 4: Species considered under the Endangered Species Protection Act 1992.

COMMON	ESP ACT	ECOLOGICAL ASSESSMENT FINDINGS
NAME	STATUS	
Swift Parrot	Endangered	<ul> <li>Principal foods are eucalypt nectar and pollen. Move with respect to food availability.</li> <li>Proposal would not interfere with the availability of foraging trees or the connectivity of neighbouring woodland.</li> <li>No recording under the NPWS Wildlife database for the Bendemeer mapsheet 1: 100 000</li> </ul>
Regent Honeyeater	Endangered	<ul> <li>Four birds recorded in 1994, approximately 45 km north east of the study area.</li> <li>Forages from a few key Eucalypt species of which none are present in the study area.</li> <li>Connective habitats (open woodland and forests) are common throughout the area. Habitat made unsuitable by disturbances from the Proposal would be the removal of 3.5 hectares of woodland.</li> <li>Unlikely species would inhabit the site.</li> </ul>
Green and Golden Bell Frog	Vulnerable	<ul> <li>Aquatic habitat on site had been subjected to sedimentation, bank slumping, erosion and stock grazing and wallowing. Festations of Blackberry, White Willow and Weeping Willow were present.</li> <li>Occurrence unlikely due to the absence of suitable aquatic habitat.</li> </ul>
Boarder Thick-tailed Gecko	Vulnerable	<ul> <li>Two recordings. One in 1989, 6 km south of study area.</li> <li>Secondly in 1994, 10 km north east of study area.</li> <li>Preferred habitat does not occur for the species.</li> <li>Occurrence would be unlikely.</li> </ul>
Spotted-tailed Quoll	Vulnerable	<ul> <li>The open and exposed natures of the woodland areas of the site are not preferred habitat. Potential habitat exists in more remote and intact habitat.</li> <li>Species is unlikely to occur within the woodland areas on the study area due to the high level of disturbances associated with traffic, human presence and agricultural practices</li> </ul>
Bridled Nailtail Wallaby	Endangered	<ul> <li>Known habitat is absent from the study area.</li> <li>Last known sighting near Manilla, NSW, near the Namoi River in 1924.</li> <li>History of grazing and surrounding land use, proximity to the road and associated human disturbances as well as the likely impact from introduced competitive and predator species makes the occurrence of this species highly unlikely.</li> </ul>
Brush-tailed Rock-wallaby	Vulnerable	<ul> <li>Known habitat is absent from the study area.</li> <li>History of grazing and surrounding land use, proximity to the road and associated human disturbances as well as the likely impact from introduced competitive and predator species makes the occurrence of this species highly unlikely.</li> <li>It is unlikely that the detection of this species occurring on the study area would have gone un-noticed.</li> </ul>

The ecological assessment concluded that the Proposal would not significantly impact on the species listed in the above table.

Seven fauna species were identified as requiring consideration within the eight part test of significance under the TSC Act. The findings are summarised in **Table 5**.

Table 5 Summary of eight part test of significance for species listed under Schedules in the TSC Act.

Fauna Species	Impact of Proposal on Species		
Underwoodisaurus	• Better quality habitat exists away from the subject site in areas of rocky-outcrops in ungrazed woodland and forest.		
• Koala	<ul> <li>The closest koala sightings to the site were recorded in 1967, 16 km east within the Tara Mountain locality and 38 km south-east south of the township of Uralla.</li> <li>No evidence of resident population or breeding females. Therefore, the area cannot be defined as core koala habitat.</li> </ul>		
• Yellow-bellied Sheathtail- bat	• Study area forms small proportion of total available habitat. More mature age forest and woodland exists away from study site.		
• Large Pied Bat	• Study area forms small proportion of total available habitat. More mature age forest and woodland exists away from study site.		
Great Pipistrelle	• Study area forms small proportion of total available habitat. More mature age forest and woodland exists away from study site.		
Square-tailed Kite	<ul> <li>Study area comprises of small proportion of total available habitat.</li> <li>Better quality open woodland habitat with lower human disturbances exist within locality.</li> </ul>		
Turquoise Parrot	• Developers would not impact habitat resources favoured by this species.		

The ecological assessment concluded that the removal of vegetation associated with the Proposal, in accordance with mitigation measures, is unlikely to result in a significant effect on threatened species, populations or ecological communities, or their habitats.

In order to minimise the impacts of the Proposal, the following mitigation measures would be undertaken:

- Minimising tree removal whilst making use of cut logs and branches to create habitat.
- Relocation of any larger reptilian species.

#### **Aquatics**

There is limited habitat and refuge for aquatic species in the study area due to the degraded nature of the creek channel and drainage courses. The species observed within the creek were very limited. The Common Brown Toadlet was identified from calls from several locations. No fish species were identified from dip netting of deeper pools.

The proposed crossing sites and diversion area were considered to be between Class 2 and Class 3 habitat quality levels in accordance to the NSW Fisheries classification scheme. Class 2 is defined as Moderate Fish Habitat with ephemeral to semi-permanent waterways with a clearly defined channel with semi-permanent waters in pools. Class 3 is classified as Minimal Fish Habitat with potential refuge for breeding or feeding areas for some aquatic fauna species.

NSW Fisheries and Terra Sciences concluded that there were no threatened aquatic species or aquatic species of significance known to exist within the Macdonald River system, which incorporates the Dunduckety, Poison Swamp and Rose Valley Creek systems.

Mitigation measures for the Proposal include:

- Restoration and maintenance of creek beds and banks to original or consistent channel characteristics of the immediate crossings.
- Installation of appropriate erosion and sediment control measures during and after construction to minimise sediment transport and siltation.

The ecological assessment concludes that the removal of vegetation associated with the Proposal, in accordance with mitigation measures, is unlikely to result in a significant effect on threatened species, populations or ecological communities, or their habitats.

#### 6.2.9. Socio-economic considerations

The town of Bendemeer is located approximately 0.5 km north of the northern extent of the works, and the city of Tamworth is located 35.5 km south of the project area. The New England Highway provides an important transport link between Tamworth and Armidale, and provides an alternative route to the Pacific Highway to Brisbane. Local bus companies as well as larger commercial companies use this route north and south bound daily.

Through traffic would be maintained throughout construction by utilising the existing Highway and creek crossings. Connection of the new alignment to the existing Highway would be timed where possible so as to result in minimal disruption to Highway traffic, although some traffic delays may be experienced during certain stages of construction.

Land use of the surrounding area is dominated by rural grazing activities. Two private residences (Ollsen and McKenzie) are located within the vicinity of the Proposal, and a third residence (Lot 2) is located approximately 1.5 km west of the project area. Direct access to the existing New England Highway is currently available from the Ollsen residence (ch. 36.3 km) and Lot 2 (ch. 36.7 km) and Bendemeer Common (ch. 37.4 km). The McKenzie residence has access into Bendemeer via the Old New England Highway. The Proposal would allow for retention of all existing accesses and would provide sealed connections to the new alignment.

All land acquisition has been completed. This mainly involved the attainment of land from the Travelling Stock Route. Further discussions would be held between the RTA and the Board's Senior Ranger to decide what provisions are to be made for travelling of stock between these two reserves.

The community is expected to benefit from the Proposal due to improved safety as a result of the new alignment and road surface. The proposal would not be expected to result in any adverse economic effects.

#### 6.2.10.Indigenous heritage

A survey of the study area for relics or sites of indigenous heritage significance was undertaken by Claire Everett of RTA Technology on 27 and 28 April 1999. A copy of this report is included in **Appendix B**.

No previously unrecorded indigenous heritage sites were located as a result of the survey. Navin Officer surveyed the route of the proposed highway realignment in 1995 with two indigenous heritage sites being found. The survey team investigated the location of the two sites identified by Officer in 1995. Both sites were classified as Open Camp Site. The results of the scientific significance assessment for Aboriginal sites located within the study area are summarised below.

Table 6: Summary of scientific significance

Site Number	Site Contents	Site Condition	Representativeness (Regional Distribution)	Scientific Significance
Rose Valley Four	0 (no artefacts)	0 (destroyed)	1 (common occurrence)	1 (low)
Rose Valley Five	1 (may contain 1-10 artefacts)	1 (deteriorated)	1 (common occurrence)	3 (low)

The proposed realignment would result in the destruction of the two Aboriginal sites Rose Valley Four and Rose Valley Five. As both sites have suffered substantial disturbance, conservation or salvage excavation of either site is not warranted. Consent to Destroy permits for both sites would be sought from the NSW NPWS before commencement of construction.

The Aboriginal Site 'Rose Valley Three' is located immediately outside the study area. Construction personnel would be made aware of this site and it would be considered "out of bounds" to all construction personnel and equipment.

If, in the course of development, relics are discovered the NPWS would be notified and work that could disturb or damage a relic must cease until a permit application is determined. An archaeologist and representative of the LALC would attend the site, make an assessment and lodge the appropriate documents.

The consulting archaeologist has engaged the Aboriginal Land Council to consider the results of the findings. As a consequence, there would be a need to liaise with the consultant to finalise any further involvement by RTA prior to work commencing.

#### 6.2.11.Non-indigenous heritage

A survey of the study area for items or sites of non-indigenous heritage significance was undertaken by Navin Officer in 1995 and Claire Everett of RTA Technology on 27 and 28 April 1999. A copy of the RTA's report is included in **Appendix B. Table 7** lists the non-indigenous heritage sites located within the study area.

Table 7: Non-indigenous heritage sites located within the study area.

Site name	Site type	Previously recorded?
Granite Quarry (northern & southern workings)	Granite quarry	Recorded by Navin Officer as RVH1 (a & b)
Historic artefact scatter	Artefact scatter	Recorded by Navin Officer as RVH2
Plough machinery	Plough Machinery	Recorded by Navin Officer as RVH3
Dunduckety Creek Bridge	Concrete bridge	Not previously recorded
Ruins of earlier Dunduckety Creek Bridge	Concrete bridge ruins	Not previously recorded
Poison Swamp Creek Bridge	Concrete culvert	Not previously recorded
Rose Valley Creek Bridge	Concrete bridge	Not previously recorded

The field study conducted for the present Proposal failed to locate any evidence of either site RVH2 or RVH3. The location of RVH2 appears to have been obscured by thick vegetation, whilst RVH3 has been removed, to an unknown location.

A statement of heritage significance was prepared for each item in accordance with the NSW Heritage Office's Heritage Manual (1996). The NSW heritage management system uses thirty-five State themes. Each site has been assessed using these themes.

#### **Granite Quarry**

The relevant NSW State heritage theme for the Granite Quarry is *Mining*. The quarry is assessed as being of high local significance. The granite quarry would not be directly impacted upon by the Proposal. However, the edge of the proposed realignment would come within ten metres of the northern quarry workings. The following mitigation measures, as recommended in the study, would be implemented:

- A vertical wall would be constructed to reduce visual impacts of the works upon the northern quarry workings;
- A curtilage area would be fenced off to avoid damage occurring to both quarry sites during construction.
- The quarry would be landscaped after construction has been completed and future visitor interpretation would be considered in consultation with members of the Bendemeer community.

#### Bridges

The relevant NSW State heritage theme for the Dunduckety, Poison Swamp and Rose Valley Creek Bridges is *Transport*. The bridges are all assessed as having low local heritage significance. The Dunduckety Creek Bridge, Poison Swamp Creek Bridge, and Rose Valley Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record would be made of the structures prior to demolition. The negatives and prints would be lodged in the RTA archives. A copy of the prints would be sent to the NSW Heritage Office.

The earlier Dunduckety Creek Bridge is assessed as being of moderate local heritage significance. The proposed works would not directly impact upon remains of the earlier Dunduckety Creek Bridge. However, the remains would be fenced off for the duration of construction to prevent damage occurring to them. If future visitor interpretation were planned the site would be fenced off, as the remains are unstable and could be disturbed by members of the public.

#### Requirements for Permits under the NSW Heritage Act

The non-indigenous heritage sites (with the exception of the Dunduckety Creek Bridge) are considered relics under Part 1, Section 4 of the NSW Heritage Act 1977. Under the Act, a relic is defined as: any object, deposit or material evidence relating to the settlement of the area that comprises NSW, not being Aboriginal settlement and which is fifty or more years old. The Dunduckety Creek Bridge is less than 50 years old and is thus not covered under the relic provision of the Act.

The Act provides automatic statutory protection for relics in Sections 139-145, which prevent the excavation or disturbance of land for the purpose of discovering, exposing or moving a relic except in accordance with an excavation permit. However, the Heritage Office does not require an excavation permit for the removal of bridges if the removal does not disturb another relic (such as the remains of the earlier Dunduckety Creek Bridge). Section 146 of the Act also requires that if a relic is discovered (or located) the Heritage Council should be notified as soon as possible. Therefore, permits are not required under the Heritage Act if the above mentioned mitigation measures are undertaken.

#### 6.2.12.Landscape and visual considerations

The Proposal is located in a rural setting within an undulating topographic landscape. The local existing visual quality is considered to be low to medium owing to the disturbance of the study area. Hill slopes leading down to Rose Valley Creek have been extensively cleared for grazing and cropping. Removal of trees and ground cover has led to soil mobility and erosion, and deposition of sediments in valley floors, leading to subsequent entrenchment and erosion of creek lines. Exotic vegetation is visible along the creek banks, and high and low-voltage power lines (for which clearing would have been required) are also present.

During construction and immediately after construction the visual quality of the area would be reduced due to the construction activities. This would be minimised by undertaking progressive revegetation where possible and minimising disturbed areas.

A detailed landscape plan for the whole site is currently being prepared and would address issues raised in the flora and fauna studies, creek diversion, batter stabilisation and creek restoration. The landscaping would be undertaken following completion of construction activities in the area to ensure no long term adverse impacts on visual quality.

#### 6.2.13. Noise and vibration effects

#### **Traffic Noise**

Atkins Acoustics undertook traffic noise monitoring in May 1999. A copy of this report is provided in **Appendix D**.

Four residential properties were identified as being potentially affected by road traffic noise. These properties were used as sites for the study. The findings of the noise assessment were that the existing noise levels exceed the EPA's "Environmental Criteria For Road Traffic Noise, May 1999" base line goals at residential locations.

With respect to the proposed works, the relevant classification under the EPA's "Environmental Criteria for Road Traffic Noise, May 1999" is "Redevelopment of existing freeway/ arterial road". This classification requires that the improvements should be designed so as to not increase existing noise levels. The relevant EPA criteria are:

- L<sub>Aeq</sub> (15 hr) 60, and
- L<sub>Aeq</sub> (9 hr) 55

The Proposal exceeds the above EPA criteria. The EPA document states that where the existing noise level already exceeds the EPA's criteria, then the redevelopment should be designed so as not to increase existing noise levels by more than 2dB. However, it is understood that where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria.

Post construction traffic noise levels were predicted to increase more than the EPA's criteria of 2dB at three of the monitored sites. To address this exceedance, the following mitigation measures would be undertaken:

- Earth mounding would be constructed for a length of 100 metres and a height of up to 1.5 metres adjacent to the two residential properties at chainage 38700.
- Post construction noise monitoring would be undertaken to determine if:
  - further earth mounding is required near affected residences; and
  - double glazing or insulating of houses is required for affected residences.

#### **Construction Noise and Vibration**

Construction activities are programmed to take place over a 12 month period, proposed to commence in the 1999-2000 financial year. The guidelines for assessment of construction noise are those established by the EPA in chapter 171 of the EPA's *Environmental Noise Control Manual*.

The EPA criteria for construction noise are as follows:

- For a construction period of 4 weeks or less, the L10 noise level must not exceed the background noise level during the scheduled daytime hours by more than 20 dBA.
- For a construction period of between 4 weeks and 26 weeks, the L10 level must not be exceeded by more than 10dBA.
- For a construction period of greater than 26 weeks, the L10 levels must not be exceeded by more than 5dBA.

The expected duration of the proposed work would therefore limit the exceedance of L10 to 5dBA. The EPA recognises that construction and demolition operations are typically noisy. Therefore, if these activities are of short duration, the above noise criteria may be exceeded provided that the standards outlined in chapter 82-3 of the EPA's *Environmental Noise Control Manual* are adhered to.

The closest residence is located approximately 130 m from the probable blasting site. This has been identified as being potentially affected by construction noise. Any noise impact would be minimised as much as practical. Residents would be regularly consulted and notified of the construction schedules, and would be provided with a contact number should any construction noise problems arise.

To minimise construction noise impacts all construction activities would be restricted to:

Monday to Friday: 7:00 am to 6:00 pmSaturdays: 8:00 am to 1:00 pm

• Sundays and Public Holidays: no work.

For work performed outside 'normal working hours', (eg. Saturday after 1:00 pm and night work) the "Consultation Procedure For Road Maintenance Undertaken Outside Normal Working Hours" would be strictly followed. These procedures include the notification of the Environment Protection Authority and nearby residents at least 5 days before the day on which the work is to occur.

It is not known at the time of preparing the REF what types of construction machinery would be used. Construction noise and ground vibration would be minimised by consideration of the following measures:

- establishment of a construction noise and vibration plan (this would also address the possible effects from blasting);
- selection of plant and equipment based on acoustic performance where possible;
- the use of the plant and equipment to minimise potential noise and vibration impacts;
- timing of construction activities so that the noisiest activities are undertaken to result in minimal impact where possible;
- the implementation of a monitoring program to ensure that the construction noise and vibration is controlled and that the best possible practices are being implemented; and
- consultation with local residents as required.

International standards such as DIN 4150 (1986) set safe vibration levels for structural damage at 5 mm/ second. These limits could be expected to be exceeded if impact hammers or vibratory rollers are used within 10 metres of any habitable dwelling. These limits could be exceeded to a distance of 20m by large rock breakers or pile driving equipment.

It is possible however to safely use alternative methods or equipment to lower levels of vibrations within these distances.

Human perception and comfort level are however usually reached at a much lower level. In this regard the British Standard BS6472 is most appropriate. Deductions from this result in **Tables 8** and **9**.

**Table 8: Vertical Vibration Levels and Human Perception** 

Approximate Vibration Level	Degree of Perception	
0.10 mm/s	Not Felt	
0.15 mm/s	Threshold of Perception	
0.35 mm/s	Barley Noticeable	
1.0 mm/s	Noticeable	
2.2 mm/s	Easily Noticeable	
6 mm/s	Strongly Noticeable	
14 mm/s	Very Strongly Noticeable	

Note: These approximate vibration levels (in floors of buildings) are for vibration having a frequency content in the range of 8Hz to 80Hz.

Table 9: Vibration Dose Values (mm/s<sup>1.75</sup>) Versus Degrees of Adverse Comment Expected in 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

Given that the nearest dwelling is approximately 130 metres the construction site, it is not expected that residents would be significantly affected by construction vibration. The vibration energy from construction activities is not considered to be sufficient to cause structural damage to any residences or buildings located at this distance.

To ensure that safe working levels are adhered to, the Project Environmental Management Plan would highlight the issue and specify that the method to be used for excavation must comply with EPA criteria.

As a result of distance separation between the construction activities and the residential buildings, the ground vibration modelling has shown that it is unlikely that construction activities (not including blasting) would give rise to vibration levels that exceed the structural damage criterion for residential buildings or unacceptable impacts in terms of annoyance.

Notwithstanding, the residents would be provided with a contact number in the event that problems associated with construction vibration arise. Should any serious complaints be received concerning construction noise and/or vibration that cannot be resolved by any other practical means then monitoring would be undertaken to determine the noise and/or vibration levels. These would then be used to determine the most appropriate course of action in consultation with the EPA and local residents where necessary.

#### **Blasting Noise and Vibration**

The EPA suggested criteria for blasting are as follows:

Time of blasting	Blast over-pressure level (dB(linear))	Ground vibration, peak particle velocity (mm/sec)
Monday - Saturday, 9 am - 3pm	115	5
Monday – Saturday, 6 am – 9 am and 3 pm – 8 pm	105	2
Sunday, Public Holiday, 6 am – 8 pm Any day, 8 pm – 6 am	95	1

(Table 154-1, Environmental Noise Control Manual, EPA)

Blasting operations would generally be confined to Monday to Saturday, 9.00 a.m. to 3.00 p.m. Blasting outside of those times would comply with chapter 154-1 of the EPA's *Environmental Noise Control Manual*.

The following table shows the distance of residences from construction and blasting.

Owner/ Ref Resident No	Ref. No	From Cons	truction	From Potential Blasting		Comment
		Direction	Distance	Directio n	Distance	
?	1	East	550m	East	700m from cut 1	
?	2	West	130m	West	130m from cut 1	
Morton	3	West	550m	West	550m from cut 1	Owners building a new house closer to the project.
Smith	4	West	50m	North west	500m from cut 3	
?	5	West	250m	West	800m from cut 3	
Ploughman	5	East	250m	east	900m from cut 3	

The following measures and controls would be implemented where blasting is carried out:

• Each blast would be monitored to ensure the noise and vibrations levels are not exceeded;

- A condition survey would be carried out (prior to blasting) on structures within 550m of blasting sites;
- Surveys would be undertaken to determine whether additional structures outside the 550m radius should be subject to condition surveys;
- Blasting mats would be used to prevent fly rock;
- Blasting would not be carried out in unfavourable weather conditions such as temperature inversions or high winds in the direction of the residences;
- Where misfires occur, blasting would take place as soon as possible for safety reasons;
- Maximum instantaneous charge would be reduced by use of delays, reduced hole diameter, and/or deck loading;
- Broken rock and excessive humps would be removed before firing of the main blastholes;
- Secondary blasting would not be undertaken;
- The detonating cord would be covered with at least 300 mm of quarry dust or road base; and
- Holes would be spaced in a manner that the explosive force is just sufficient to break the stone to the required size;
- Airblast overpressure and ground vibration monitoring equipment would meet EPA criteria as set out in Chapter 154 of the EPA'S *Environmental Noise* Control Manual;
- Blast performance should be regularly reviewed;
- Blasting at night should be avoided.

These measures would be expanded on in the PEMP with reference to Chapter 154 of the EPA's *Environmental Noise Control Manual*.

#### 6.3. Cumulative environmental effects

The positive cumulative benefit of the Proposal is to provide improved safety through provision of a straighter alignment with speed limits consistent with the adjoining sections of Highway, and the removal of narrow bridges. Noise levels for nearby residents are expected to decrease in the long-term due to the current road surface being replaced by a quieter spray seal or similar road surface.

There are no major negative cumulative effects of the Proposal, as traffic levels are not expected to increase as a result of the works. Any adverse impacts from construction would be of a short-term nature and would be minimised provided the mitigation measures detailed in the REF are implemented.

# 7. Implementation Stage

# 7.1. Summary of proposed safeguards

Potential Impact	Safeguards	
General construction and	Preparation of a Project Environmental Management Plan.	
operation impacts.	ı J	
operation impacts.  Noise.   OC P 3 1 8	<ul> <li>Construction hours would generally be confined to 7.00 am to 6.00 pm Monday to Friday, Saturday 8.00 am to 1.00 pm and no work on Sundays or public holidays.</li> <li>For work performed outside these times the EPA and local residents will be notified in accordance with the "Consultation Procedure For Road Maintenance Undertaken Outside Normal Working Hours" and RTA Night Work Standards where applicable.</li> <li>RTA would consult with affected residents and property owners prior to commencement. Residents would be notified prior to commencement of construction.</li> <li>The construction noise criteria of the EPA would be adopted for the period of the works. If these levels were likely to be exceeded, all potentially affected residents would be notified in accordance with EPA requirements.</li> <li>Spray seal or similar road surface would replace the stone chip seal. This would be extended to the commencement of the McDonalds River bridge crossing.</li> <li>Noise would be minimised during construction in accordance with EPA guidelines.</li> <li>Earth mounding would be constructed for a length of 100 metres and a height of up to 1.5 metres adjacent to the two residential properties at chainage 38700.</li> <li>Select and use plant equipment that will have minimal noise and vibration impacts.</li> <li>Time construction activities so that the noisiest activities are undertaken to result in minimal impact where possible.</li> <li>Implement a monitoring program to ensure that the construction noise and vibration is controlled and that the</li> </ul>	
Access and Traffic Management	<ul> <li>best possible practices are being implemented.</li> <li>A Traffic Management Control Plan would be prepared and implemented in accordance with the RTA's requirements.</li> <li>Through traffic would be maintained by utilising the existing highway and creek crossings.</li> <li>All existing accesses would be maintained and be provided with sealed connections to the new alignment.</li> <li>Temporary safety structures would be erected between the construction site and through traffic if necessary.</li> <li>Connection of the existing road to the completed roadworks</li> </ul>	
	<ul> <li>would be undertaken outside peak hour periods where practical.</li> <li>Reduced speed limits would be implemented, in accordance with Work Cover guidelines, if required.</li> </ul>	

	Signage would be provided to inform the public of the roadworks taking place, the duration of works and a contact number, in accordance with RTA guidelines.
Generation of Waste	<ul> <li>A waste management plan would be prepared and implemented prior to commencement of construction.</li> <li>Site generated waste including garbage, waste pavement material, concrete etc would be recycled where possible and any remaining waste would be contained and removed from the site and disposed of to a licensed landfill.</li> <li>Recycled materials would be used where possible (eg. Recycled crushed road base).</li> <li>Waste oil would be sent to approved recyclers.</li> <li>Cleared vegetation or other materials would not be burned but mulched and used to revegetate the disturbed areas. Weeds would be taken to a licensed landfill.</li> <li>The worksite would be left in a tidy and rubbish free state upon completion of the Proposal.</li> <li>The worksite would be left in a tidy and rubbish free state upon completion of the Proposal.</li> </ul>
Contaminated Waste	<ul> <li>If any contaminated waste were identified, this would be removed to an EPA approved facility for the purpose of disposal of these materials. All necessary permits for the removal, transportation and disposal of contaminated waste would be obtained prior to any works being undertaken.</li> <li>If any contaminated waste is generated, the appropriate EPA licences and approvals would be obtained for its disposal and the operators of the disposal site would be notified in advance.</li> </ul>
Site Compound	<ul> <li>Compounds and batchplant would be located clear of any waterways.</li> <li>The compound area would be bunded to prevent contamination of land outside.</li> <li>A secure, lockable and floored area would be provided for the storage of fuel, oil and chemicals.</li> <li>Secure rubbish bins would be provided within site compounds. These would be regularly emptied.</li> <li>All site sewage would be contained in 'portaloo' type toilets, collected and disposed of off-site in accordance with relevant regulations.</li> </ul>
Plant and Equipment  Erosion and	<ul> <li>All plant and equipment would be contained within the area of site operations.</li> <li>Plant and equipment would be inspected regularly to ensure there are no leakages of fuel, oil and hydraulic fluid.</li> <li>Prior to construction a temporary ESCP including a fluvio-</li> </ul>
Sedimentation	<ul> <li>geomorphic study of Rose Valley Creek bed would be prepared by the contractor and implemented in accordance with DLWC and the RTA's requirements.</li> <li>As part of the Plan, all erosion and sedimentation control measures would be maintained particularly after storm or rain events.</li> <li>Permanent erosion and sedimentation control management measures are being designed in consultation with DLWC.</li> <li>The soil conservationist would undertake routine inspections on at least a weekly basis.</li> </ul>

	Construction would take place outside the summer months where rainfall is heaviest.
Reduction in water quality - operational	<ul> <li>An Erosion and Sedimentation Control Plan including a fluvio-geomorphic study would be prepared and implemented by a qualified soil conservationist.</li> <li>DLWC and NSW Fisheries would be involved in the final design of the Rose Valley Creek diversion in order to ensure a suitable and practical solution.</li> <li>The contractor would be required to ensure that disruptions to water flow are minimised in the final design of the creek crossing structures.</li> <li>Existing drainage lines would be identified prior to construction and siltation barriers placed at regular intervals within the drainage line. Erosion and sedimentation</li> </ul>
	<ul> <li>structures would be erected prior to commencement of-construction.</li> <li>Diversion banks would be positioned to divert all clean runoff away from construction activities.</li> <li>A license would be obtained if there is likelihood of waters being polluted during construction.</li> <li>Approval is required from NSW Fisheries if there is a likelihood of fish passage being blocked or altered during construction.</li> <li>Adequate erosion control measures (eg. siltation fences and sedimentation ponds) would be positioned to entrap all runoff from disturbed surfaces.</li> <li>All erosion and sedimentation control structures would be inspected on a weekly basis and within 24 hours of a rainfall event to ensure effective operation.</li> <li>The area exposed at any one time would be minimised and rehabilitated/revegetated as soon as possible.</li> <li>Stockpile materials away from drainage lines and surround them, on the downslope side with sediment control facilities, and diversion banks on the upslope side.</li> <li>Provide temporary cover for exposed areas during construction wherever possible.</li> <li>Undertake maintenance or revegetate areas as necessary to ensure successful stabilisation.</li> <li>Removal of old creek crossings would be undertaken outside any flow periods.</li> <li>Approval is required from NSW Fisheries to temporarily or permanently obstruct fish passage.</li> <li>Adequate table drains would be constructed on either side of the road with replacement or extension of existing drainage structures under the highway.</li> <li>Erosion and sedimentation control devices would only be removed once the works have been completed and exposed</li> </ul>
Air quality	surfaces have become stabilised.
Air quality	<ul> <li>A water cart would be present on site to dampen all exposed surfaces to reduce dust generation.</li> <li>All vehicles transporting materials would be covered.</li> </ul>
	Stockpiles would be kept damp or covered

	D' 11 11 11 11 1 1
	<ul> <li>Disturbed areas would be minimised and progressive revegetation of disturbed areas would be undertaken as soon as possible.</li> </ul>
	No burning of timber or other combustible materials would
	occur. If vegetation were unsuitable for woodchips it would
	be removed to an approved waste disposal site. habital
Vegetation	• Any threatened or endangered flora or fauna species would
Ore	be identified prior to construction. Paraweb fencing would
	be placed around any identified threatened or endangered
V	species to protect them during construction works.
	P
V	If any threatened or endangered species are identified during
dur	construction, work would cease immediately and NPWS
	would be consulted as to the management of the site.
	• Topsoil would be stripped. Weeds would be taken to a
7	licensed landfill while native vegetation would be mulched
	and stored in an area clear of any creeks or waterways for
	later respreading across the project area.
an	Trees to be retained within the worksite would be protected
Lo. C	from damage by machinery or unnecessary removal by
	paraweb or other appropriate fencing.
	Any plants that would be affected by clearing would be
pre	assessed as to their suitability for replanting.
	Vegetation would be chipped for future use in the
dur	revegetation program if suitable.
	Topsoil stockpiles would be located clear of drainage lines
\.\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	*
Soils )	and suitably protected to prevent erosion.
	Topsoil would be retained if suitable (weed free) and used
	8 during revegetation of the site.
- Sen .	• During construction there would be no stockpiling or parking
	of equipment in areas where vegetation is protected.
44	• Stocknile materials would be placed a minimum of 5 metres
aur	/- away from protected trees
	The houndary of the proposed readyworks would be defined
	<ul> <li>away from protected trees.</li> <li>The boundary of the proposed roadworks would be defined with fencing or pegs and access to workers and vehicles would be restricted outside this boundary for the protection of vegetation.</li> <li>Construction works would be restricted to the existing road corridor.</li> <li>Particular care needs to be taken to avoid the spread of weed species during construction. Consideration would be given to</li> </ul>
MA	with fencing or pegs and access to workers and vehicles
	would be restricted outside this boundary for the protection
	of vegetation.
	• Construction works would be restricted to the existing road
au	7 corridor.
	Particular care needs to be taken to avoid the spread of weed
All o	anaises during construction. Consideration would be given to
<i>eace</i>	
	\simplementation of a weed control program prior to any
	construction works on site.
post	<ul> <li>Following completion of the works, weed control measures</li> </ul>
1 -	4 would be applied on any ares disturbed during construction.
<b>Landscape Treatment</b>	A detailed landscape plan would be implemented during the
Zamascape i reasilient	post-construction phase of the project.
	To reduce the visual impacts of the area, progressive
	revegetation would be undertaken.
	• Creek beds and banks would be restored after existing creek
	crossings are removed by using local rock to line banks,
	restoration of vegetation and erosion and sediment control
	measures.
Indigenous and Non	
Indigenous and Non-	<ul> <li>Consent to Destroy permits for the two Aboriginal sites</li> </ul>
Indigenous Heritage	would be obtained from NSW NPWS.

	<ul> <li>If during the course of construction any artefacts of medium to high significance are discovered, all works within 50 metres of the artefacts would cease and a representative of both the LALC and NPWS would be asked to inspect the discovery. Work would only recommence following the consent of the NPWS and LALC.</li> <li>A vertical wall would be built as a measure to reduce visual impacts of the works upon the northern quarry workings.</li> <li>A fenced off area would be established to avoid damage occurring to both quarry areas during construction.</li> <li>The quarry would be landscaped after construction. Future visitor interpretation should be considered.</li> <li>An archival photographic record would be made of the structures prior to demolition. The negatives and prints would be lodged in the RTA archives. A copy of the prints would be sent to the NSW Heritage Office.</li> <li>The ruins of the earlier Dunduckety Creek Bridge would be fenced off for the duration of construction to prevent damage occurring to them.</li> </ul>
Fire Control	<ul> <li>Burning of material would not be permitted on site.</li> <li>Two general purpose fire extinguishers and two oil/petrol fire extinguishers would be kept on site at all times.</li> <li>An adequate supply of water would be available to the site during periods of high to extreme fire risk.</li> </ul>

This is not a complete and exhaustive list of measures, but can be expanded in the PEMP.

# 7.2. Implementation process

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the Proposal and as part of its construction and operation. These safeguards would reduce any potential adverse impact arising from the proposed works on the surrounding environment. All of the safeguards described throughout this REF would be incorporated into the PEMP.

The PEMP would form part of any contractual requirements. The PEMP would also identify the requirements for compliance with relevant legislation, requirements for ensuring implementation of the environmental safeguards and development of self-assessment and auditing schedules.

The PEMP would provide a checklist of actions to ensure that the environment is adequately protected during the pre construction, construction and post construction phases of the Proposal.

# 8. Summary of Key Issues

### 8.1. Summary of beneficial effects

Following the preparation of the REF, the Proposal would provide:

- Improved road safety;
- Improved pavement surface and therefore lower traffic noise levels;
- Overtaking opportunities for northbound traffic; and
- Provide a continuous section of highway with the same speed limit.

## 8.2. Summary of adverse effects

- Temporary increases in noise during construction.
- Increased truck movements during construction.
- Temporary loss of vegetation.
- Potential erosion due to construction activities.
- Loss of indigenous and non-indigenous heritage sites.

These impacts would be managed during the construction period through consultation with local residents and the implementation of mitigation measures identified in this REF, which would be implemented through the PEMP.

### 9. Clause 82 Checklist

The factors which need to be taken into account when considering the environmental impact of an activity are listed in *Clause 82* of the *Environmental Planning and Assessment Regulation*, 1994. These factors have been considered in relation to the Proposal and are listed below.

FACTOR

#### a) Any environmental impact on a community?

+ve

**Comments:** During construction there would be temporary increases in noise for residents. Some traffic delays may be experienced during construction. The Proposal is expected to have a positive impact on the community through provision of a safer alignment with travel speeds consistent with adjoining sections of the highway.

#### b) Any transformation of a locality?

nil

**Comments:** The Proposal would not result in a transformation of the locality due to the realignment being generally on the eastern side of the existing highway.

#### c) Any environmental impact on the ecosystems of the locality?

nil

**Comments:** There would be potential for an adverse impact on the ecosystem during construction however, the implementation of mitigating measures such as erosion and sedimentation control structures, dust suppression and revegetation of disturbed areas following construction would ensure these are minimised and short term only.

# d) Any Reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?

nil

**Comments:** The Proposal would not result in a reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality.

# 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?

-ve

**Comments:** A heritage survey identified two Aboriginal sites. Consent to Destroy permits would be obtained from the NSW NPWS prior to construction. The granite quarry would not be affected by the Proposal. Dunduckety Creek Bridge, Poison Swamp Creek Bridge, and Rose Valley Creek Bridge would be demolished. The earlier Dunduckety Creek Bridge would not be directly impacted upon.

# f) Any impact on the habitat of any protected or endangered fauna (within the meaning of the National Parks and Wildlife Act 1974)?

nil

**Comments:** There would be no impact on the habitat of any protected or endangered fauna as a result of the Proposal.

# g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?

nil

**Comments:** There would be no endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.

#### h) Any long-term effects on the environment?

nil

**Comments**: No long term negative effects on the environment are expected provided the safeguards identified in the REF are implemented. Potential erosion would be minimised by the implementation of the erosion and sedimentation control plan.

#### i) Any degradation of the quality of the environment?

-ve

**Comments:** During construction there is the potential for adverse impact on air and water quality, however the implementation of mitigation measures, revegetation and landscaping would ensure that these are short term in nature only. Following construction the local environment is expected to be similar to that which existed prior to construction with improved road safety.

#### j) Any risk to the safety of the environment?

+ve

**Comments:** The Proposal is expected to have a positive impact on the safety of the environment through provision of improved road safety.

#### k) Any reduction in the range of beneficial uses of the environment?

nil

**Comments:** The Proposal would not result in any reduction in the range of beneficial uses of the environment.

#### l) Any pollution of the environment?

-ve

**Comments:** During construction there is potential for adverse impacts on air and water quality, however the implementation of mitigation measures and revegetation and landscaping would ensure that these are short term in nature only. Following construction the risk of pollution to the environment is expected to be similar to that which existed prior to construction.

#### m) Any environmental problems associated with the disposal of waste?

nil

**Comments:** No environmental problems are expected with the disposal of waste. All waste would be assessed as to its suitability for recycling. Material not suitable for recycling would be disposed of at an appropriate waste disposal facility.

# n) Any increased demands on resources, natural or otherwise which are, or are likely to become in short supply?

nil

**Comments:** Where possible recycled materials would be used for the Proposal. All other materials required are readily available in the local area and would not place a demand on any resources that are in short supply.

#### o) Any cumulative environmental effect with other existing or likely future activities?

+ve

**Comments:** The Proposal would not have any significant cumulative environmental impact with other existing or likely future activities. The Proposal would result in an overall positive cumulative effect through improved traffic safety on the New England Highway.

## 10. References

- Atkins Acoustics and Associates, *Noise Impact Assessment New England Highway Rose Valley, Tamworth*, 1999.
- HTL Reinhold, Final Design Report for Rose Valley Realignment, 1995.
- James Madden Cooper Atkins, Traffic Noise Assessment, 1995.
- QEM, Flora, Fauna and Archaeological Assessment, 1995.
- RTA, Environment Manual Volume 3 Environmental Impact Assessment, NSW RTA, 1998.
- RTA, *Heritage Assessment*: Proposed realignment of the New England Highway, Rose Valley, Bendemeer, 1999.
- RTA, Review of Environmental Factors (REF), RTA, 1993.
- RTA, Concept Report for the Realignment between Rose Valley Creek and McDonald River Bridge, 35.5 km to 39.1 km North of Tamworth, RTA, 1993.
- Terra Sciences, *Ecological Assessment*, 1999.

## 11. Declaration

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.

Katrina Smallwood

Environmental Officer

Date:

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

Stephen Tyler Project Manager

Date:

# 12. Appendices

Appendix A – Proposal Location and Design Plan

Appendix B – Indigenous and Non-indigenous Heritage Assessment

Appendix C – Flora, Fauna and Aquatics Assessment

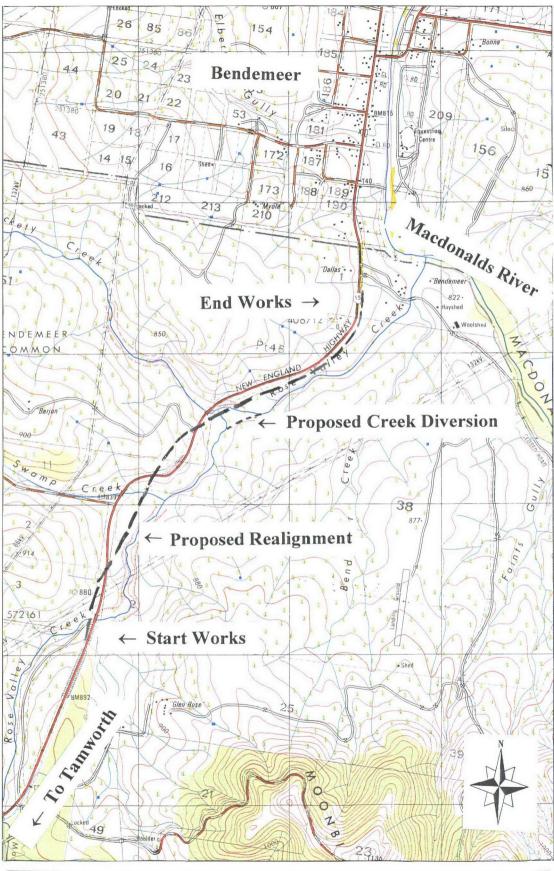
Appendix D - Noise Assessment

**Appendix E – Consultation** 

**Appendix F - Photographs** 

# Appendix A

Proposal Location and Design Plan



Topographic Map	Location
1:25 000	New England Highway- South of Bendemeer

(Source: Map extract from Bendemeer 9136-111-S Topographic Map, Second Edition.)

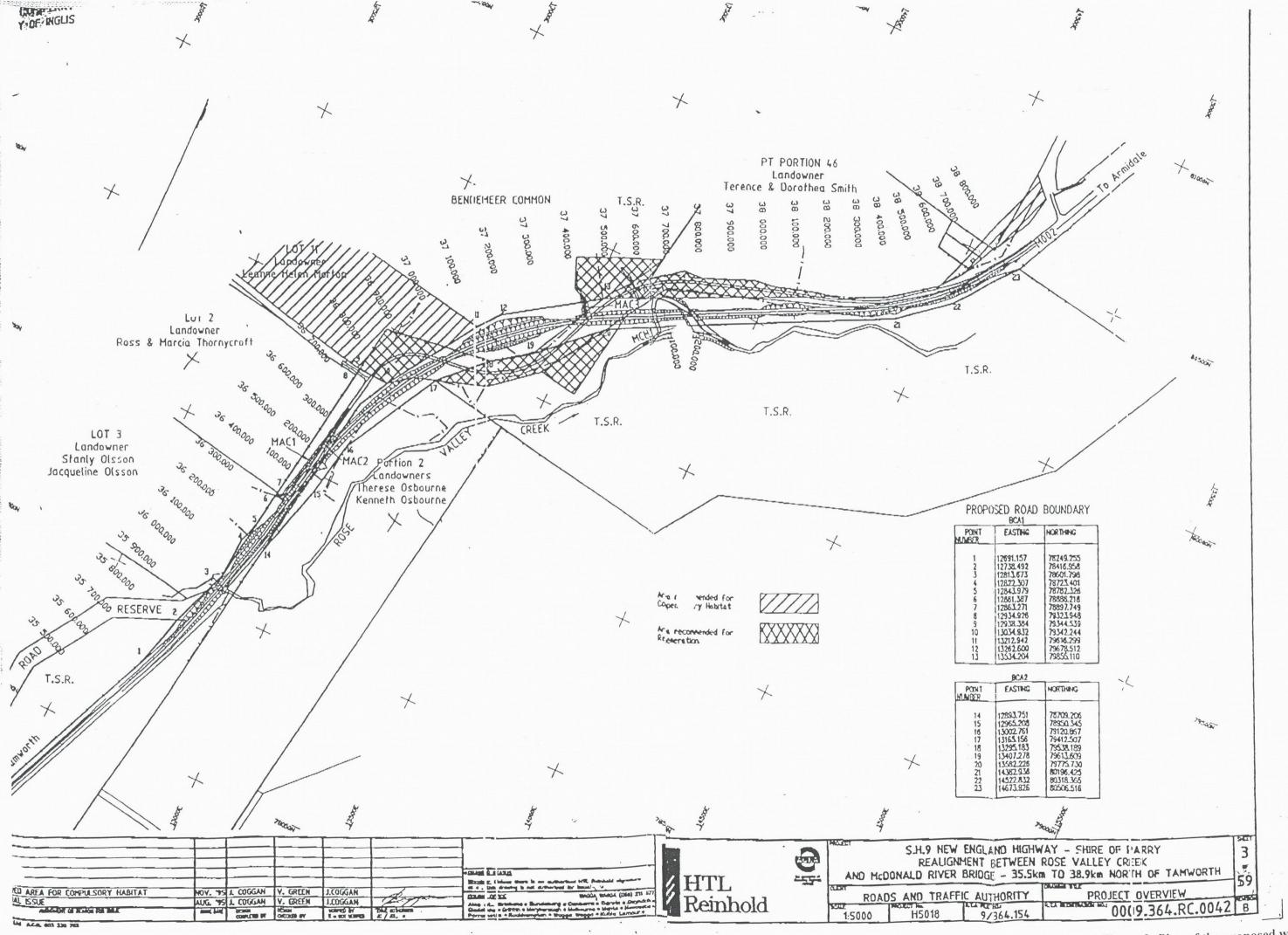


Figure 2: Plan of the proposed works

# Appendix B

Non-indigenous and Indigenous Heritage Assessment



# **Heritage Assessment**

# Proposed realignment of the New England Highway Rose Valley, Bendemeer, NSW



Prepared for RTA Northern Region by Environmental Technology Level 3, 52 Rothschild Avenue Rosebery NSW 2018 ph (02) 9662 5360 fax (02) 9662 5045 email Claire\_Everett@rta.nsw.gov.au

**July, 1999** 

# **Document Controls**

<b>Business Unit</b>	Environmental Technology			
Project No.	1338	数数数数		1 - W
Document description	Heritage Assessment of a proposed realignment of the New England Highway, Rose Valley, Bendemeer			
有的效果的。我们是	Nar	ne	Signed	↑ Date
Approving Manager	Annette Ross	U	Threse 6	Ross 12.7.9

Person managing this document	Person(s) writing this document
Claire Everett	Claire Everett

Location	File
Level 3, Rosebery	99M22378

Client Reference	Status	Date
	Final	12 July 1999

# © Roads and Traffic Authority

Prepared by RTA Technology

Prepared for:	Prepared by:
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# **Executive Summary**

The RTA is proposing to realign a five kilometre section of the New England Highway at Rose Valley, south of Bendemeer. As part of the Review of Environmental Factors prepared for the Proposal, a heritage of the proposed route was required. An earlier heritage assessment of the same route was prepared in 1995. However, the earlier assessment did not assess the heritage significance of the existing concrete bridges which would be affected by the proposal, and changes to the design of the proposed route had been made during the intervening years.

#### Results

The heritage study identified two indigenous and seven non-indigenous sites within the study area. The two indigenous sites were the same sites identified in the earlier study, one of which could not be relocated and is assumed to have eroded away during the four years since the original assessment was conducted. Of the seven non-indigenous sites, one had been removed, another could not be relocated, and four additional sites were identified which were not covered by the earlier report.

#### Impact of the Proposal

The proposed road realignment would result in the destruction of the two indigenous sites. Of the non-indigenous sites, it is likely that the three bridge sites would be removed, as they would no longer be in operation, although the remains of the earlier Dunduckety Creek Bridge would not be affected by the Proposal.

#### Management recommendations

- 1. The proposed road realignment would result in the destruction of the two Aboriginal sites Rose Valley Four and Rose Valley Five. As both sites have suffered substantial disturbance, conservation or salvage excavation of either site is not warranted. Consent to Destroy permits for both sites should be sought from the NSW National Parks and Wildlife Service.
- 2. The Aboriginal site Rose Valley Three is located immediately outside the study area. However, the construction manager and relevant construction site supervisors should be made aware of the location of this site. The location of the site should be considered "out of bounds" to all construction personnel and equipment, and all personnel should be advised as such. Mr Ivan Johnson of TLALC has indicated that this, rather than fencing off the site, is the preferred option for management of this site during the construction phase (Ivan Johnson, pers. comm).
- 3. The historical granite quarry would not be directly impacted upon by the Proposal. However, the edge of the proposed realignment would come within ten metres of the northern quarry workings. Batter slopes in this part of the works should be reduced to the vertical as much as possible, and the possibility of installing a vertical wall in this area should be investigated. These mitigation strategies would go toward minimising the visual impact of the works upon the northern quarry workings. Prior to construction works occurring, a curtilage area would need to be established around both quarry areas, which should be fenced during the construction period to avoid damage occurring to the site during construction. The fenced off areas should incorporate the both the quarried tors and the heaps of partially quarried stone associated with them. All workers on site should be informed that the heaps of partially quarried stone are not to be moved, nor should pieces of stone be removed from the heaps. The quarry should be landscaped after construction has been completed, and the possibility of future visitor interpretation should be considered. Any decisions of this type should be made in consultation with members of the Bendemeer community.

- 4. The Dunduckety Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office. The ruins of the earlier Dunduckety Creek Bridge would not be directly impacted upon by the proposed works. However, the ruins should be fenced off for the duration of construction, to prevent any damage occurring to them. Should future visitor interpretation of this site (in conjunction with the historic granite quarry) be planned, it would be necessary to fence off the site, as the remains are unstable, and could be disturbed by members of the public climbing on and around it.
- 5. The Poison Swamp Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office.
- 6. The Rose Valley Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office.
- 7. Providing the above recommendations are undertaken, no further heritage work would be required within the study area as part of the works required for the Proposal.

# 1 Introduction

## 1.1 Introduction & Background to the study

The Roads and Traffic Authority (RTA) is proposing to realign a five kilometre section of the New England Highway at Rose Valley, south of Bendemeer. The section of highway to be realigned is 35.5 to 39.1 kilometres north of Tamworth (see **Figure 1**). This section of the New England Highway currently has a tight curve that has resulted in a number of accidents involving vehicles failing to negotiate the turn.

The proposed realignment would entail the construction of a single carriageway for two lane traffic including a northbound overtaking lane. The maximum width of the carriageway and road verge would be approximately 16 metres. Extensive landform excavation and filling would be required to provide an alignment with a suitable grade for vehicle traffic to traverse easily. The maximum width of the road corridor would be approximately 80 metres. **Figure 2** is a plan of the proposed works.

A Review of Environmental Factors (REF) was prepared for the proposal in 1995 when the intention to realign the road was first promulgated. A survey for indigenous and non-indigenous heritage sites was conducted at that time, as part of the environmental assessment process. However, the proposal did not proceed after the REF was completed. The RTA has now decided to proceed with the proposed works. A new REF has been prepared to reflect both design modifications and changes in environmental legislative requirements that have occurred over the past four years. As part of the REF process, a new indigenous and non-indigenous heritage study was also required. The initial heritage study, prepared by Navin Officer heritage consultants in 1995, identified two indigenous and three non-indigenous heritage sites within the corridor of the proposed road realignment.

This study, undertaken by the Archaeology and Heritage Officer, Environmental Technology Branch, Operations Directorate, reviews the previous heritage report, and describes the recent investigation of the study area for indigenous and non-indigenous heritage sites. The report considers the indigenous heritage sites separately from the non-indigenous heritage sites.

#### 1.2 Aims

The aims of this study were to conduct the following tasks:

- Review previous archaeological work conducted in the local area.
- Conduct an inspection of the proposed works area to determine its potential to contain indigenous and non-indigenous heritage sites.
- Conduct an inspection of the sites identified by Navin Officer in 1995 to determine their current condition.
- Assess the significance of known sites within the study area.
- Prepare management recommendations for sites and potential sites within the study area.

# 2 Environmental Background

#### 2.1 The natural environment

#### 2.1.1 Geology and landforms

The project area is underlain by igneous intrusive rocks of the New England Batholith. Surface geology is comprised of Bendemeer Adamellite and Moonbi Adamellite that are coarse grained granites. Granite boulders are scattered on the surface throughout the project area and are evident in some sections of the eroded creek beds.

The granites are overlain by soils that are comprised of sands, silts, clays and gravels deposited by erosional processes in the alluvial plain. The soils of the project area are typically highly erosive and of low fertility. Landforms within the project area consist of undulating to rolling hill slopes (up to 900m AHD) and the flat alluvial plain (840m AHD) of Rose Valley, Poison Swamp and Dunduckety Creeks. **Figure 3** is a photograph taken from the hill slope above Dunduckety Creek, looking south across the alluvial plain. The Moonbi Range is located to the west and south and rises up to approximately 1300m AHD. The proposed road route would be located on the hill slope running down to Rose Valley Creek and the alluvial plains of Rose Valley Creek.

#### 2.1.2 Flora and fauna

Three floristic communities occur within the study area: open woodland; open forest; and grassland/pastureland. Each of these communities has been altered by either past clearing or past or present agricultural practices. The upper storey of the open woodland community is dominated by Ribbon Gum (*Eucalyptus viminalis*), with Bendemeer White Gum (*E. elliptica*), Moonbi Apple Box (*E. malacoxylon*) and Blakely's Red Gum (*E. blakelyi*) also present. The under storey and ground cover in the open woodland consists of Couch Grass (*Cynodon dactylon*), Lovegrass (*Eragrostis sp.*), and Paspalum (*Paspalum dilatatum*) in the grazed areas, whereas in areas excluded from grazing, such as road verges there are Phalaris (*Phalaris aquatica*), Purpletop (*Verbena bonarriensis*), and Australian Cransbill (*Geranium solanderi*). Introduced species include Blackberry (*Rubus ulmifolius*) and Aaron's Rod (*Verbascum thapsus*) (Terra Sciences, 1999: 7-8)

The upper storey of the open forest community is occupied by the same species as the open woodland community, with the inclusion of Rough-barked Apple-box (*Angophora floribunda*) on elevated slopes to the west of the study area. The majority of trees in this community are young or young-mature individuals, the age of trees suggesting that the area was cleared in excess of 40 years ago. The understorey and ground cover of this community comprises a range of native grasses, forbs and low shrubs, including Purple Wiregrass (*Aristida ramosa*) and Wallaby Grass (*Danthonia sp.*)(Terra Sciences, 1999: 8-9).

The grassland/pastureland community dominates the study area. The majority of this community has been cleared of trees, and in the lower storey, exotic and introduced plants dominate. Ungrazed areas of this community, particularly in the less accessible rocky outcrops contain plants such as Kangaroo Grass (*Themeda australis*), Barbed-wire Grass (*Cymbopogon refractus*) and Western Rat's-tail grass (*Sporobolus creber*). In drainage channels and creekbeds, exotics such as willows are present, whereas in slow-draining areas of creek beds, species such as Cumbungi (*Typha domingensis*), Rush (*Juncus sp.*) and Phalaris (*Phalaris aquatica*) (Terra Sciences, 1999: 9-10).

The study area contains restricted habitat diversity, as the landscape of the study area has undergone substantial change in the post-contact period. Fauna observed in the study area consisted primarily of birds, such as Currawongs, Kookaburras, Miners, Magpies and Rosellas. The short-beaked echidna was also present, as were introduced species such as fox and rabbit (Terra Sciences, 1999: 14-15). Prior to extensive clearing the area would have provided habitat for Kangaroos and Wallabies.

# 2.2 Previous landscape disturbance

The majority of the study area has been substantially disturbed. Hill slopes leading down to Rose Valley Creek have been extensively cleared for grazing and cropping. Removal of trees and ground cover has led to soil mobility and erosion, and deposition of sediments in valley floors, leading to subsequent entrenchment and erosion of creek lines. Other sources of disturbance include construction and maintenance of overhead power lines and several phases of road construction eventuating in the current alignment of the New England Highway. **Figure 4** is a photograph taken from a point 100 metres north of the southern end of the Proposal. The photograph looks north along the centreline of the proposed route and illustrates the disturbance some areas of the Proposal have suffered in the past. The foreground of the photograph shows an area of disturbance beside the road, exotic vegetation is visible along the creek banks, and high and low-voltage power lines (for which clearing would have been required) are visible in the top right corner.

Landscape disturbance that the study area has experienced to date would have affected the preservation of Aboriginal site types in different ways. Tree clearance prejudices the survival of scarred trees, whilst road construction, soil erosion and ploughing disturb or destroy open campsites. Other earthworks such as the construction of dams or drainage channels can destroy sites, whilst burrowing and surface "scratchings" of rabbits is also destructive. **Figures 5** and 6 are photographs taken within the Bendemeer Common showing tree clearing and loss of ground cover caused by rabbit activity.

# 3 Indigenous Archaeological Sites

# 3.1 Regional archaeological context

Previous archaeological work in the Bendemeer area has been fairly limited in scope, covering either areas of proposed developments or focusing on isolated, significant art and quarry sites. Site types recorded within a 40 kilometre radius of the study area include open camp sites, rock shelters containing art and/or cultural deposits, burials, bora/ceremonial sites, scarred and carved trees, stone arrangements, stone quarries, natural mythological sites and isolated finds. The majority of these sites have been recorded to the south of the study area in the Moonbi Ranges and the Moore Creek Valley (Officer, 1995:8).

Dr Isobel McBryde conducted several investigations into the site of a hatchet stone quarry on a steep ridge on Daruka station in Moore Creek Valley, 16 kilometres north of Tamworth. The site consists of outcrops of andesitic greywacke which were quarried by Aboriginal people to provide the raw material for stone hatchets. Stone from this quarry was traded extensively by Aboriginal people, with pieces from this site having been found as far away as Inverell. In 1991, Appleton conducted a survey of 625 hectares of land also on Daruka station. The survey located 34 Aboriginal sites, consisting of 24 open camp sites and ten isolated finds.

In 1993, Gaynor and Wilson conducted a survey of the proposed Woonooka Park Estate subdivision at Moore Creek. Five isolated artefacts were located in what was assessed as being a disturbed context. Prior to the survey it had been thought (from a written account of a Corroboree by an early white settler) that a bora ground was located either within or nearby the area of the proposed subdivision. However, no evidence of a bora ground having been present was located during the survey. The actual location of the bora ground remains unknown (Gaynor & Wilson, 1993).

Aboriginal art sites have been recorded on granite boulders and overhangs in both the Moonbi Ranges (to the south of the study area) and the Moore Creek Valley. McBryde considered there to be distinct stylistic differences between the art at these sites and the art located at sites in the river valleys of the north coast (McBryde, 1974). Four art sites were recorded by McBryde at Glendon Station in the Moonbi ranges to the south of the study area. McBryde's excavations in 1964-5 at two of these sites provided the only radiocarbon dates recorded in this area to date. The upper levels of cultural deposit at the shelter site Bendemeer 1 yielded dates between 800 and 400 years Before Present (BP), while the upper levels of cultural deposit at the shelter site Bendemeer 2 yielded a date of approximately 900 years BP. In 1991 Wilson prepared a conservation plan for these sites on behalf of the Tamworth Local Aboriginal Land Council (TLALC), in response to concerns the TLALC had regarding deterioration of the artwork at these sites (Wilson, 1991).

### 3.2 Previous archaeological work in the study area

The route of the proposed highway realignment was surveyed by Navin Officer in 1995. The survey located two indigenous and three non-indigenous heritage sites. The location of these sites is shown in **Figure 7**. The indigenous heritage sites were both low-density artefact scatters in contexts which had been disturbed through trenching, road cutting and subsequent erosion. The sites were assessed as being of low significance, and it was recommended that Consent to Destroy Permits for both sites be applied for prior to any construction activity occurring (Officer, 1995:16-36).

In 1997 Wilson conducted a survey for Aboriginal sites in the Travelling Stock Reserve (TSR) both within, and to the south of the present study area, as part of the research for her PhD thesis. The survey located three open artefact scatters. One of these sites, Rose Valley Three, is located on the southern side of Rose Valley Creek, (outside of the area which would be affected by the proposed road works) approximately 150 metres up slope from the creek line (the location of this site is shown in **Figure 7**). The site consists of a small scatter of five artefacts located in sediments trapped behind a series of rock outcrops and in cattle tracks that skirt around the rock outcrops. In the survey notes attached to the site card, Wilson notes that she also surveyed the slope on the northern side of the creek, which falls within the study area. No Aboriginal sites were located by Wilson in this area, and she notes that the ground surface on this side of the creek had been disturbed by construction of the current highway alignment, and the clearing and bulldozing of land for the erection and maintenance of power lines.

# 3.3 Aboriginal consultation

The study area falls within the boundaries of the area covered by the Tamworth Local Aboriginal Land Council (TLALC). Ivan Johnston, Chairperson of the TLALC was contacted initially regarding the project by Mary-Lou Buck, Aboriginal Liaison Officer, RTA Northern Region. Mr Johnston was then contacted by the author to arrange a date for the survey. A copy of the draft report was sent to the TLALC for comment. Comments from the TLALC had not been received by the time this report was finalised. When the TLALC's comments have been received, they will be forwarded to the Project Manager, NSW NPWS and RTA's Aboriginal Liaison Officer, Northern Region.

### 3.4 Field Survey

The field survey was conducted over two days on 27 and 28 April 1999. The field team consisted of Claire Everett, Archaeology and Heritage Officer, RTA Technology, Ivan Johnson, Chairperson, TLALC, Ricky Lonsdale, TLALC trainee, and Gary Pinkerton, Road Design Engineer, RTA Technology. The first day of the field survey was devoted to surveying for indigenous heritage sites, whilst the second day involved Claire Everett working solo and recording the three concrete bridges and historic granite quarry sites within the study area.

The field survey technique was for the survey team to walk abreast, covering an area with a width of approximately 50 metres, covering the width of the proposed road corridor and associated works. Areas excluded from the survey were the points where the current route of the New England Highway intersects the route of the proposed roadworks and areas of known infill adjacent to the current highway. Special attention was paid to areas of exposure beside tracks, on spurline crests and closely grazed areas within the TSR where ground surface visibility was good. Particular attention was given to re-visiting the two low density artefact scatters identified during Navin Officer's survey in 1995 to investigate their current condition.

After the initial survey had been conducted, the author was informed by Stephen Tyler, Project Manager, Project Services, Northern Region that the design of the project had been altered slightly along the portion of the route which runs through Bendemeer Common. In order to avoid importing an extra 40 000 cubic metres of fill to construct the road alignment, the portion of the Common between the proposed route and the current alignment would be excavated to a depth of 13 metres below current ground level. As the area of the Common between the proposed route and current road alignment had not been surveyed previously, the author and Ivan Johnson of the TLALC carried out a further site inspection on 4 June 1999.

A large proportion of the study area has been subject to ground disturbance in the various forms of road construction, soil erosion, rabbits burrowing and creating "scratchings" and agricultural cultivation. The northern end of the study area, north of Dunduckety Creek, is characterised by granite outcrops, and thin soil cover. The granite tors which are a feature of this portion of the study area would have provided ideal "look-out" or vantage points for the Aboriginal inhabitants of this area in the past, but no evidence of Aboriginal cultural material was located on or around the tors.

The portion of the study area that has been subject to the least ground disturbance is the area through the Bendemeer Common. Although this area is still relatively thickly forested, compared to the rest of the study area, there is evidence of tree clearing having taken place. Soil mobility has occurred in this portion of the study area also, as some of the more mature trees are either elevated on little "islands" of soil, or have small mounds of soil banked immediately up slope of the root system. Some drainage lines have been cut across the slope leading down to Dunduckety Creek, presumably in an attempt to curb erosion and soil mobility. Rabbits, whilst not actively burrowing in this area, have also been contributing to soil disturbance by creating "scratchings" on the surface.

### 3.4.1 Coverage analysis

The effectiveness of an archaeological survey is constrained by the nature of the ground surface visibility, as dense vegetation and recent fill deposits can cover less obtrusive sites such as open artefact scatters. Coverage analysis attempts to quantify how much of the area surveyed has been surveyed effectively (taking into account the effects of visibility). The method used to determine the effectiveness of the survey coverage was the one used by Witter in his archaeological survey of a pipeline route between Wagga and Young (Witter 1980). This method uses the formula:

 $A (B \times C) + D = metres of effective survey$ 

The field observations were converted into values using the following rules:

A = metres covered

B = visibility: 0% = 0.1

5% = 0.2

10 to 20 % = 0.5

50 to 100 % = 1.0

C = exposure: degrading surface = 1.0

Degrading surface with natural quartz = 0.5

Stable, degrading? aggrading? = 0.5

As above, but with gullies = 1.0

Stable aggrading with quartz in soil = 0.1

Aggraded with gullies = 0.5

Aggrading, tilled land = 0.1

Aggrading, never ploughed = 0.0

D = deviations: assume 1.0 visibility and 1.0 exposure per metre, deviated away from main line (Witter, 1980).

The length of the survey route was five kilometres. The route can be divided into three areas of visibility. These are shown in **Table 3.4.1** below.

Table 3.4.1: Landform visibility areas

Landform	Sources of exposure		
Toe slopes	Stock and vehicle tracks, drainage channels, road cuttings		
Spurline crests	Road cuttings, sheet and gully erosion, vehicle tracks, patchy vegetation cover		
Creek flats	Creek banks		

Deviations were assumed to be 0. The methods outlined in Witter (1980) were used to estimate effective coverage. As can be seen in **Table 3.4.2** below, the majority of the area surveyed had a low effective coverage, as although 5000 metres were covered in the survey, only 2320 metres can be considered to have been covered effectively.

Table 3.4.2: Survey coverage data

Length	Visibility	Exposure	Effective Coverage
Toe slopes – 3150 m	50 %	1.0	1575 m
Spurline crests – 800 m	80 %	1.0	640 m
Creek flats – 1050 m	10%	0.5	105 m

### 3.5 Results of the survey

No previously unrecorded indigenous heritage sites were located as a result of the survey. However, the survey team did investigate the location of the two sites identified by Officer in 1995. As the sites located by Officer were not registered with the NPWS Aboriginal sites database at the time of recording, other sites located outside of the study area were subsequently registered as Rose Valley One and Two. The sites located by Officer in 1995 have subsequently been registered with NPWS as Rose Valley Four and Five. **Table 3.5.1** below shows the reference used in Officer's report, and the subsequent titles the sites have been registered under.

Table 3.5.1 – NPWS Registered site names versus those used in Officer's 1995 report

NPWS Site Name	Reference in Officer's report	Site Type
Rose Valley Four	Rose Valley One	Open camp site
Rose Valley Five	Rose Valley Two	Open Camp site

The study team was unable to locate any artefactual material at the site of Rose Valley Four (referred to in Officer's report as Rose Valley One). It appears that this site, badly disturbed and eroded in 1995, has completely eroded away (see **Figure 8**). The site of Rose Valley Five (referred to in Officer's report as Rose Valley Two) was present although still actively eroding (see **Figure 9**). Only two artefacts were located, one grey chert flaked piece measuring 13 x 13 x 2 millimetres, and one grey-blue chert blade, with some cortex present, measuring 40 x 15 x 6 millimetres.

### 3.6 Significance assessment

Assessment of archaeological site significance can be complex and encompass a range of heritage values. The heritage values of a site can be broadly defined as the "aesthetic, historic, scientific or social value for past, present and future generations" (Australia ICOMOS Burra Charter in Marquis-Kyle & Walker, 1996: 73). The archaeological or "scientific" significance of a site is considered separate to its cultural significance to the Aboriginal community. An assessment of a site's cultural significance can only be made by the Aboriginal community.

The scientific significance methodology outlined below is based on a score for research potential, which is derived from site contents, site condition and representativeness. The system was derived by duCros and Associates from a system devised by Sullivan and Bowdler (duCros & Associates, 1998: 11). The scientific significance assessment methodology varies with site type – open artefact scatter, quarry, rock shelter, shell midden, burial, scarred tree, mound and rock art.

### 3.6.1 Criteria for significance assessment

Scientific significance is assessed by examining research potential and representativeness of archaeological sites recorded. Research potential is in turn assessed by examining site contents and site condition. Site contents refers to all cultural material and organic remains associated with human activity at a site. Site contents also refers to the site structure – the size of the site, the patterning of cultural materials within the site, the presence of any stratified deposits and the rarity of particular artefact types. Site condition refers to the degree of disturbance to the contents of a sit at the time it was recorded. Ratings for site contents and condition are given below.

The site contents ratings used for Aboriginal archaeological sites are:

- 0 No cultural materials remaining.
- Site contains a small number (1-10 artefacts) or limited range of cultural materials with no evident stratification.

- 2 Site contains:
  - a) A larger number, but limited range of cultural materials; and/or
  - b) Some intact stratified deposit; and/or
  - c) Rare or unusual examples or a particular artefact type.
- 3 Site contains:
  - a) A large number and diverse range of cultural materials; and/or
  - b) Largely intact stratified deposit; and/or
  - c) Surface spatial patterning of cultural materials that still reflect the way in which the cultural materials were laid down.

The site condition ratings used for Aboriginal sites are:

- 0 Site destroyed.
- Site in deteriorated condition with a high degree of disturbance; some cultural materials remaining.
- 2 Site in fair to good condition, but with some disturbance.
- 3 Site in excellent condition with little or no disturbance. For surface artefact scatters this may mean that the spatial patterning of cultural materials still reflects the way in which the cultural materials were laid down.

Representativeness refers to the regional distribution of a particular site type. It is assessed on whether the site is common, occasional or rare in a given region. Assessments of representativeness are subjectively biased by current knowledge of the distribution and numbers of archaeological sites in a region. This varies from place to place depending upon the extent of previous archaeological research. Consequently, a site which is assigned low significance values for contents and condition, but a high significance value for representativeness, can only be regarded as significant in terms of current knowledge of the regional archaeology. Any such site should be subject to re-assessment as further archaeological research is carried out.

Assessment of representativeness also takes into account the contents and condition of a particular site. For example, in any region, there may only be a limited number of sites of any type which have suffered minimal disturbance. Such sites would therefore be given a high significance rating for representativeness, although they may occur commonly within the region.

The representativeness ratings used for Aboriginal archaeological sites are:

- 1 Common occurrence
- 2 Occasional occurrence
- 3 Rare occurrence

Overall significance ratings for sites, based on a cumulative score for site contents, site integrity and representativeness are given as follows:

- 1-3 Low scientific significance
- 4-6 Moderate scientific significance
- 7-9 High scientific significance

Table 3.6.1 Scientific significance assessment for Aboriginal sites located within the study area

Site number	Site contents	Site condition	Representativeness	Scientific significance
Rose Valley Four	0	0	1	1 (low)
Rose Valley Five	1	1	1	3 (low)

The two Aboriginal sites Rose Valley Four and Rose Valley Five are assessed as being of low scientific significance.

# 3.7 Legislative requirements

Under the provisions of the *National Parks and Wildlife Act, 1974*, Aboriginal archaeological sites are defined as "relics". A "relic" is any deposit, object or material evidence (not being a handicraft made for sale) relating to the indigenous and non-European habitation of the area that comprises New South Wales, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

Under Section 91 of the Act: "A person who is aware of the location of a relic that is the property of the Crown or, not being property of the Crown, is real property, and does not, in the prescribed manner, notify the Director-General thereof within a reasonable time after he first became aware of that location is guilty of an offence against this Act unless he believes on reasonable grounds that the Director-General is aware of the location of that relic". This means that if a relic is found the National Parks and Wildlife Service must be informed.

Under Sections 86 and 90 of the Act it is an offence to disturb or excavate any land for the purpose of discovering a relic or knowingly destroy, deface or damage or cause or permit the destruction, defacement or damage of a relic. Permits can be obtained to allow excavations or destruction of a relic.

Therefore if, in the course of a development, relics are discovered the National Parks and Wildlife Service should be notified and work that could disturb or damage a relic must cease until a permit application is determined. Typically this would require an archaeologist and representative of the Local Aboriginal Land Council to attend the site, make an assessment and lodge the appropriate documents.

If a relic or relics are found the developer should contact the following:

Rebecca Edwards-Booth Archaeologist – Northern Zone NSW National Parks & Wildlife Service PO Box 914 Coffs Harbour, NSW 2450

Ph: 02 6659 8225

Ivan Johnson Chairperson Tamworth LALC 123 Marius Street Tamworth, NSW 2340 Ph: 02 6766 9028

# 4 Historical Background

### 4.1 History of the Bendemeer area

The first Europeans to pass through the Bendemeer area were a squatter, Edward Cory, and his party of twelve who passed through the area in 1832, in search of new grazing lands to the east of Tamworth. Over the next fourteen years more squatters arrive to take up pastoral leases on the southern part of the Northern Tablelands. The Bendemeer area formed part of the Bendemeer pastoral lease, taken up by Richard Wiseman in 1834. The run covered 16 000 acres (6 500 hectares) and centered upon the main route though the Northern Tablelands across the Moonbi Ranges. Wiseman employed a manager by the name of Henry MacDonald who lived at the station located on the southern banks of the river known to the local Aboriginal people as "Muluerindie". However, the river and squatting run both soon came to be known as "MacDonald's River" (Easterman, 1985 in Officer, 1995: 10).

Bendemeer station was held by Wiseman for two years, after which it was held by a Mr Coxen until 1839. In that year Thomas Perry, the son of the New South Wales Deputy Surveyor General, took out a depasturing licence for "MacDonald's River" run. By the middle of the 1840s a hotel and store had been set up at the river crossing, forming the nucleus for the later town. In 1856 Perry and his family moved to live on the station, renaming it "Bendemeer". The township of "MacDonald's River" which had been formally surveyed in 1852 was also renamed by Perry (Easterman, 1985 in Officer, 1995: 10).

In 1861 the Robertson Land Acts were passes in order to facilitate free selection of Crown Land, being an attempt to break the monopoly of the "squattocracy" and to regulate their use of leasehold Crown Land. The Acts enabled the selection of small portions of land under various purchase agreements with the objective of promoting closer settlement. The response of many squatters was to select prime or strategic areas of their runs, either themselves or via "dummy selectors". The first two portions of freehold land in the Parish of Perry were selected by Thomas Perry and covered his assets of the station buildings on the MacDonald River and an area of arable land on Rose Valley Creek, of which portions of both are located within the study area.

Although the passing of the Robertson Land Acts did free up the Bendemeer area for the selection of small holdings, no further purchase of freehold land occurred within the study area until the 1920s, when portions 41 and 46 were purchased. Officer suggests that this was due to the recognition of the route along Rose Valley Creek as a link in the important supply route between Tamworth and the New England area, to Armidale and beyond (Officer, 1995: 10-11). However, the travelling stock reserve was not gazetted until 1895.

# 4.2 History of the New England Highway

The New England Highway originally formed part of the "Great Northern Road" which ran from Sydney via Wisemans Ferry to the Queensland border. John Oxley, Surveyor-General of NSW from 1812 until 1828 was the first European to traverse any section of the New England area, crossing over the Liverpool Ranges on his route from the Macquarie River, near Warren, east toward the coast at Port Macquarie. Allan Cunningham was the next explorer to venture into northern NSW, journeying from Segenhoe (on the Hunter River just north of Aberdeen), along the western edge of the Northern Tablelands and up into Queensland, in 1827. In 1831, Sir Thomas Mitchell, on one of his numerous expeditions, travelled from Sydney, crossed the Peel River, the Namoi River, the Nandewar Range and the Gwydir River, then turned west and travelled toward the Darling River (Main Roads, 1952: 68-70).

All three explorers came back with favourable reports of the grazing and agricultural potential of the land to the north of the Hunter, which encouraged ambitious settlers to venture north and settle these areas. In 1832 the first pastoral station was established on the Northern Tablelands at Walcha. By 1834 squatters were establishing themselves in the Armidale district, and in 1839 G.T. MacDonald was appointed first Government Commissioner for the New England district. MacDonald established his headquarters on what is today the City of Armidale. The township of Armidale was officially established in 1849, as was the township of Tamworth (Main Roads, 1952:71).

By 1856 the Great Northern Road between Tamworth and Bendemeer had been fenced and cleared, whilst the section between Bendemeer and Armidale had been "metalled" in sections. Improvements and "metalling" of the road continued on into the late 1860s. However, floods and wet weather caused major problems, as a letter to the *Sydney Morning Herald* about the Great Northern Road in 1870 reveals:

...it is impossible...to conceive that one of the main thoroughfares of this colony should be in its present disgraceful and dangerous state...nearly the whole way to Tamworth the bed of the road is one mass of slime and mud. From Tamworth to Uralla the road is as bad, and from Armidale to Glen Innes a great deal worse (SMH 23 August 1870 in Main Roads, 1952: 75).

In 1928 the section of the Great Northern Road from Sydney via Peat's Ferry to Newcastle, Hexham and the Queensland border was renamed the "Great Northern Highway". In 1931, the Sydney-Hexham section of the Great Northern Highway became part of the Pacific Highway. As the Great Northern Highway traversed in the main the New England area, it was considered appropriate that the name of the Highway be changed to reflect this. The route was renamed the New England Highway in 1933 (Main Roads, 1952: 68).

# 5 Non-Indigenous Heritage Sites

# 5.1 Non-indigenous heritage site background

Officer's 1995 study identified three non-indigenous heritage sites within the study area. These were:

- Rose Valley Historic Site 1(RVH1) (areas A & B), a site within the TSR where two granite tors had been quarried;
- Rose Valley Historic Site 2 (RVH2), a low density artefact scatter of bottle glass, ceramic and rusted metal, located within the TSR and interpreted as a drover's short stay camp site, and;
- Rose Valley Historic Site 3 (RVH3), two pieces of abandoned farm machinery, one appearing to be a horse-drawn plough, the other, tractor drawn.

In addition to these items, the present study identified the concrete bridges over Rose Valley, Dunduckety and Poison Swamp Creeks to be heritage items along the current road alignment, in addition to the remains of an earlier bridge immediately to the south east of the present bridge over Dunduckety Creek. The presence of the earlier Dunduckety Creek Bridge was noted in Officer's 1995 report, but it was not recorded as an individual site.

The field study conducted for the present project failed to relocate any evidence of either sites RVH2 or RVH3. The location of RVH2 appears to have been obscured by thick vegetation, whilst the plough machinery comprising RVH3 has been removed, to an unknown location. **Table 5.1.2** lists all non-indigenous heritage sites located within the study area.

Table 5.1.2 Non-indigenous heritage sites located within the study area.

Site name	Site type	Previously recorded?
Granite Quarry( northern & southern workings)	Granite quarry	Recorded by Officer as RVH1 (a & b)
Historic artefact scatter	Artefact scatter	Recorded by Officer as RVH2.
Plough machinery	Plough Machinery	Recorded by Officer as RVH3
Dunduckety Creek Bridge	Concrete bridge	Not previously recorded
Ruins of earlier Dunduckety Creek Bridge	Concrete bridge ruins	Not previously recorded
Poison Swamp Creek Bridge	Concrete culvert	Not previously recorded
Rose Valley Creek Bridge	Concrete bridge	Not previously recorded

### 5.2 The Granite Quarry

#### 5.2.1 Historical themes

A historical theme is a way of describing a major force or process that has made a contribution to history. Historical themes provide a context within which the heritage significance of an item can be understood, assessed and compared. Thirty-five State themes have been adopted for use within the NSW heritage management system, although regional and local themes can also be developed (HO/DUAP, 1996a: 6). The relevant NSW State heritage theme for the Granite Quarry is *Mining*.

The granite quarry contains evidence of hand quarrying techniques that have been superseded by mechanisation and the wider availability of explosives. The site is thus significant as evidence of early granite quarrying techniques in NSW.

The granite quarry comprises two areas of quarried granite tors; the first workings located upslope of the northern bank of Rose Valley Creek, immediately downstream of the confluence of Dunduckety and Rose Valley Creeks, and; the second approximately 240 metres to the north. The location of the two quarried areas is shown on **Figure 7**. The southern workings consist of the partially quarried tor and scattered heaps of partially worked stone blocks, covering an area of approximately 30 x 30 metres (see **Figures 10** and **11**). The tor measures 10.5 metres across the southern quarried face and is 8.75 metres wide by 5.3 metres wide. Rough access tracks are located to the east and west of the tor. Originally these would probably have been used to carry quarried stone away from the site, although today they provide vehicular access to the power line easement located to the west of the tor.

The manner in which the tor was quarried was to drill holes in alignment along the surface of the tor, and then induce fracturing along the alignment (see **Figure 12** for a detail of these drill holes). Officer observed that the drill holes were of two sizes, small and large. The small holes have a diameter of between 25-29 millimetres that extend to a depth of 80-90 millimetres and are arranged in alignments 85-150 millimetres apart. This type of drill hole was also used in secondary quarrying of stone removed from the main body of the tor, and is exhibited on some of the partially worked stone blocks scattered in heaps beside and downslope of the tor. On the stone blocks the drill holes vary in depth between 55-75 and 120-140 millimetres. Officer interprets this type of drill hole as having been used when the depth of fracture required was no greater than 1-2 metres. When deeper fracturing of the main tor was required, an arrangement of small and large drill holes was utilised (Officer, 1995: 19-20)

The large drill holes have a diameter of approximately 45 millimetres and are 260-280 millimetres deep. They are arranged in alignments interspersed with varying numbers of small drill holes. These larger holes were able to produce deep tor fractures in a relatively controlled manner, and Officer notes that they were executed exclusively when adjacent to a right-angled quarry face (Officer, 1995: 20).

The nature of the drill holes suggests they were created using a hand-powered drill, using it to gradually pulverise the rock. The resulting dust and chips of stone were removed periodically by adding water and scooping the resulting paste out with a small metal scoop. Once drilling was completed, the tor needed inducement to fracture along the drilled alignment. Fracturing could be induced by several methods. One technique that could have been used was "feathering", recounted to Officer by a former Bendemeer resident, which involved filling a line of drilled holes with water and driving wooden pegs into the holes. The pegs were kept wet for a period of time, with the expansion of the wood eventually fracturing the rock. A variation of this method was known as the "feathers and plugs" technique, in which two half round steel plugs were placed in a drilled hole and bent over to provide two opposing metal faces within the hole. A long tapered rod was then hammered lightly between the rods. When this was conducted in drill holes along an alignment, it was possible for a skilled mason to create a direct fracture through the tor (Officer, 1995: 20). These techniques, albeit in a more mechanised form using pneumatic drills and explosives, were in use at the Moruya Quarry in the 1930s (Rogers, 1997: 74-76). Granite from the quarry at Moruya was used to surface the pylons of the Sydney Harbour Bridge.

The stages in which quarrying activities were undertaken are evident on the surface of the tor. The first step would have been to provide a flat surface on top of the tor as a platform for further quarrying activities. The absence of drill holes on the edges of the top of the tor suggests that either some alternative method of stone removal was used, or else the surface was removed by drilling and fracturing, and all evidence of these preparation activities has been worn away. Once the upper surface had been levelled, a line of drill holes running roughly east west was made along the top and down the side of the tor. The tor was then fractured along this alignment, presumably by one of the methods outlined above. However, the south face of the tor demonstrates that the tor did not fracture cleanly along this alignment, instead running along a fault and producing the curved surface evident on the south face and failing to fracture at all along the continuation of the line of drill holes which ran down the eastern face (see Figure 13).

Obviously the stone masons believed the tor was still suitable for quarrying, as the upper surface of the tor was then drilled and fractured along two alignments running roughly north south, splitting the tor into three sections (see **Figure 11**). It appears that quarrying of this tor was abandoned after this without attempting to subdivide it further.

The second workings, located upslope of the first, were interpreted by Officer as being a secondary, more minor, area of quarrying (Officer, 1995: 20) (see **Figure 14**). However, after closer inspection it appears that the tor at this site was quarried more extensively than that at the first, hence appearing smaller today, as the majority of stone has been removed (see **Figure 15**). The same quarrying technique was employed at this site as at the southern workings, but the remaining tor is much smaller and lower to the ground. Several piles of roughly worked stone are located adjacent and downslope of the second workings, but the piles are heavily overgrown with blackberry and bracken fern.

Although it has been difficult to find any information pertaining to the date, output and ownership of the quarry, some information on the history of granite quarrying in NSW is available. A draft Conservation Management Plan (CMP) for the Moruya Quarry has been prepared, which provides some historical background. Granite is a stone widely distributed throughout NSW and is an excellent source of building material. The granites of Uralla, the next town on the New England Highway to the north of Bendemeer, are considered to be very high quality dark grey granites, being "undoubtedly one of the finest granites found in any country, being full of life" (Baker in Heritage Group, 1998: 81). The country around Uralla has a similar topography to Bendemeer, with granite tors and outcrops a prominent feature of the landscape. However, it is not known whether the Bendemeer granite is also of the same high quality of the Uralla material.

The granite industry in NSW did not develop properly until the 1850s. The majority of the colony at this time was situated in Sydney, that is built on sandstone, and although granite was available and was quarried in some country centres, difficulties in transporting the stone meant that its use in Sydney was limited. In addition to transport difficulties, its hardness made it harder to work, and thus more expensive, than the softer stones such as sandstone. Later on, in the Victorian era, sandstone and brick were the favoured building materials, and only small amounts of granite were used in base courses, lintels, and, in more elaborate buildings, columns (Wallace, in Heritage Group, 1998: 86).

# 5.3 History of the Dunduckety, Poison Swamp and Rose Valley Creek Bridges

#### 5.3.1 History of concrete bridges in New South Wales

The chief ingredient of concrete, Portland cement, was developed in England between 1813 and 1824. However, concrete did not begin to gain real popularity as a building material until the 1840s. During the mid-nineteenth century, concrete was used primarily to replace stone in mass footings. However, its uses as a structural and ornamental material soon became apparent, and its use in a variety of building forms began to widen (Lewis, 1988: 4). The use of concrete as a structural item is linked to the development of the Monier system of reinforced concrete. Joseph Monier was a gardener who was seeking to manufacture large flowerpots. Wooden flowerpots lacked durability, whilst those made of concrete alone were too heavy. Whilst concrete has very high compressive strength, its tensile strength is very low. The Monier system works by embedding wrought iron bars in mortar at the points where tension occurs (Evans, 1987: 2). Thus the use of reinforcing in concrete allowed the construction of items that both utilised less concrete and had higher tensile strength than mass concrete alone.

Monier's experiment worked so well that the idea was applied to the construction of concrete tanks, pipes and arches (Evans, 1987: 2). The first use of the Monier system in Australia was the construction of a small Monier arch culvert under Parramatta Road at Burwood in 1894. The construction cost was approximately half of the estimated cost of a standard brick construction. The first Monier arch road bridge constructed in New South Wales, was at Reads Gully, near Tamworth, in 1900.

With the formation of the Main Roads Board in 1924, design and construction of all road bridges was transferred over from the Public Works Department. The Main Roads Board developed several designs in reinforced concrete that became fairly standard over the next 20 years. These designs included: slab bridges; simply supported girder bridges; continuous girder bridges; framed bridges; and arch bridges. Slab bridges were found to be an economical form of concrete bridge construction for spans not exceeding 6.1 metres (29 feet) for simply supported bridges and 8.23 metres (27 feet) for continuous and framed bridges. The bridges over Dunduckety and Rose Valley Creeks are examples of simply supported slab bridges. The simply supported slab bridge design achieved popularity because of the simplicity of the formwork, falsework and reinforcing used. Although the volume of concrete used was greater than in other designs, the simplicity of construction outweighed the increased concrete cost.

### 5.3.2 Historical themes

A historical theme is a way of describing a major force or process that has made a contribution to history. Historical themes provide a context within which the heritage significance of an item can be understood, assessed and compared. Thirty-five State themes have been adopted for use within the NSW heritage management system, although regional and local themes can also be developed (HO/DUAP, 1996a: 6). The relevant NSW State heritage theme for the Dunduckety, Poison Swamp and Rose Valley Creek Bridges is *Transport*.

At a state level, the bridges can be seen in the context of the history of concrete bridge design and the development of the NSW highway network. The evolution of a centralised authority through variously the Public Works Department, The Main Roads Board, The Department of Main Roads and the Roads and Traffic Authority has allowed for consistency in road and bridge design and maintenance. At a regional level, the three bridges can be seen in the context of their role in the road network of the Northern Tablelands, as the New England Highway is an important inland road link between Sydney and Brisbane.

# 5.3.3 Comparative analysis

It is difficult to prepare a comparative analysis of concrete slab bridges in NSW, as their design is not well documented, much in the same way as timber beam bridges are poorly documented. As with timber beam bridges, they are a common, simple solution to the need for a minor creek or river crossing, and thus do not attract as much attention for researchers, as the larger, more spectacular designs. As these bridges age, there will be increasing pressure for their removal from the road network, as they become less able to cope with increasing traffic loads. A comprehensive study of the number and nature of these bridge types within the NSW road network is required to adequately understand the nature, extent and condition of bridges of this particular design.

# 5.4 Dunduckety Creek Bridge

The Dunduckety Creek Bridge is a concrete bridge constructed in 1955. The location of the bridge is shown in **Figure 7**. The bridge consists of a single concrete slab span with concrete wing walls and abutments (see **Figure 16**). Beside each of the wing walls is a curved concrete-faced mound, which stretches from the wingwall, back toward the roadway (see **Figure 17**). The rationale behind the construction of these items is unknown, as the bridge maintenance file cannot be located for this structure. However, it is assumed that each of these items is an erosion control device, to prevent the fill beside the bridge abutments eroding away. This was discussed with Ray Wedgwood, RTA Chief Bridge Engineer who concurred with this interpretation. It is not known whether this was a unique solution to a problem, but it is certainly not a common feature. Each of the mounds has been faced with a concrete render, which has had a pattern resembling ashlar masonry incised into it. This appears to be a purely decorative element, with no functional purpose.

Immediately downstream of the present bridge are the remains of an earlier bridge. The location of the bridge remains is shown in **Figure 7**. The date of construction of the bridge is not known, other than it would have been built some time after 1900, when concrete bridge construction first began in NSW, and 1955 when the current bridge was built. The only part of the bridge that remains even partially intact is the abutment on the south eastern bank of Dunduckety Creek (see **Figure 18**). The north western abutment has completely disappeared, and the bridge deck has collapsed into the bed of the creek (see **Figure 19**)

# 5.5 Poison Swamp Creek Bridge

The Poison Swamp Creek Bridge is a five-cell concrete box culvert constructed in 1934 (see **Figure 20**). The location of the bridge is shown in **Figure 7**. A 1935 DMR quarterly report mentions the construction of the culvert, the report stating that:

A five-cell 9ft. x 5ft. reinforced concrete box culvert is being constructed by contractor J. Reid, at the 23½ m.p. on the New England Highway in Cockburn Shire. The structure replaces an old pipe culvert (Main Roads 1935,6.2: 27).

The culvert would have been constructed by pouring the slab for the invert (base of the culvert), then constructing the formwork for the walls of the culvert, and pouring the concrete for each, and finally constructing the roof (Ray Wedgwood, pers. comm.). This would have been a relatively cheap, simple method of construction, suited to creeks with a low average flow. The existing maintenance file for the Bridge was established in 1961, although an inspection report from 1959 is the first item on the file, which suggests that no earlier maintenance file existed. The inspection report reveals that the structure was in good condition at the time, with only the shoulder on the downstream side requiring some work, and the first cell of the culvert being silted up. The next inspection record on file dates from 1976, in which the structure was reported to be in good condition. The inspection reports for 1977 and 1978 identified the bridge as being in good condition, but trees growing upstream of the bridge required removal. The 1981 inspection report noted that minor cracks had formed in the walls of each cell, and it was recommended that they be sealed with thickened epoxy. More cracking was identified and repaired in each subsequent year up to 1985. In 1985 it was reported that the structure was sound, but that vegetation clearing was required upstream of the bridge to prevent obstruction of the flow and silting. Urgent repairs were made to the bridge after a motor vehicle accident in 1988 in which the handrails were damaged. Inspection reports for the bridge appear to have ceased after 1987, which is the last report listed on the file (Bridge maintenance file 9/364.117;1).

# 5.6 Rose Valley Creek Bridge

The Rose Valley Creek Bridge is a two span concrete bridge constructed in 1936. The location of the bridge is shown in **Figure 7**. The bridge originally comprised a reinforced concrete slab continuous over pier (ie without an expansion joint at the pier) and simply supported at the abutments. Each span is approximately 7.75 metres long. The deck slab is restrained by dowels at abutments and pier. The original bridge was 6097 millimetres wide between kerbs. It was widened in 1966 by constructing cantilever slabs on either side of the bridge deck. The deck level of the bridge was raised by placing a concrete topping ranging in thickness between from 205 millimetres to 305 millimetres. The bridge is currently a width of 8422 millimetres between the kerbs.

The bridge was inspected by the author on 26 April 1999. There is marked evidence of cracking on the underside of the deck and the abutments, in addition to calcium leaching to the surface and spalling of concrete (see **Figure 21**). When standing beneath the bridge it is possible to establish how the bridge was constructed. The pier and abutments were not sunk or piled into the river bed, but rather built directly onto the granite tors which protrude just above the surface of the river bed. Formwork for the construction of the pier and abutments was constructed directly onto the bedrock, and the concrete poured. Once these had been built, the deck was constructed on top. Evidence of the planks used to construct the formwork is visible on the surface of the concrete in places. However, the majority of the surface of the pier and abutments has been covered with a concrete render which has a pattern of ashlar masonry inscribed upon it (see **Figure 21**). This appears to be a purely decorative treatment with no structural basis. It is possible, given that the bridge was constructed during the Great Depression, that the bridge construction was used as unemployment relief, and that the extra labour required to add a decorative surface to the underside of the bridge provided several additional days work for the otherwise unemployed.

The first documents on the bridge's maintenance file date from 1972. It is not known whether an earlier maintenance file existed or not. In 1973 a memorandum was prepared which noted that cracks to the deck which had appeared and had subsequently been repaired in 1972, had reappeared, indicating that flexing and/or expansion of the deck was still occurring. The cracks were then filled with a flexible sealant, and it was proposed that the deck be sprayed with bitumen to provide an additional sealant. Later that year, more cracks appeared, and were again filled.

The first formal inspection record appears on the file in 1977. The inspection revealed the bridge to be in generally good condition, but with some minor cracking visible in both abutments and old cracks on the underside of the deck reopening, as the old epoxy putty fill was drying out. From 1978 to 1984, the inspection report for each year mentions minor cracking in the deck and abutments that required sealing. From 1985 to 1987, the condition of the bridge remained stable, with no additional cracking reported. In 1993 a structural assessment was prepared, and the bridge was assessed as being in very poor condition, suffering overstress in the main reinforcements. The cause of this was felt to be a combination of heavier traffic loads than the bridge was originally designed for, and stress from the extra weight of the widened deck. Additional problems were identified, such as insufficient cover and permeable concrete causing corrosion of reinforcing, and temperature movement of the deck and pier being prevented by their monolithic construction, causing cracks on the pier and deck soffit near the support. The outcome of the assessment was the recommendation that the bridge not be subject to further widening or upgrading, but that the bridge be abandoned and a new structure built as soon as possible. An inspection report from 1995 is the last document on the file, which again describes the poor condition of the structure and its inability to cope with current traffic loads.

# **6 Significance Assessment**

# 6.1 Listings

None of the non-indigenous sites located within the study area are listed on the Register of the National Estate database, the NSW State Heritage Register or Inventory, the RTA Heritage Register or the Parry Shire Council Local Environment Plan.

#### 6.2 Assessment criteria

Four broad criteria are used to assess the nature of an item's heritage significance. These criteria have evolved from definitions used in the NSW *Heritage Act* 1977.

The four "nature" of significance criteria are:

Criterion 1 – historical significance (evolution and association). An item having this value is significant because of the importance of its association with, or position in the evolving pattern of our cultural history.

Criterion 2 – aesthetic significance (scenic/architectural qualities/creative accomplishment). An item having this value is significant because it demonstrates positive visual or sensory appeal, landmark qualities and/or creative or technical excellence.

**Criterion 3 – technical/research significance** (archaeological, industrial, educational, research potential and scientific significance values). Items having this value are significant because of their contribution or potential contribution to an understanding of our cultural history or environment.

Criterion 4 – social significance (contemporary community esteem). Items having this value are significant through their social, spiritual or cultural association with a recognisable community.

Two other criteria are used to assess the degree of an item's significance. The two degree criteria are:

Criteria A – representativeness. Items having this value are significant because they are fine representative examples of an important class of significant items or environments.

Criterion B – rarity. An item having this value is significant because it represents a rare, endangered or unusual aspect of our history or cultural environment.

To be assessed as significant an item must:

- Qualify under one of the four nature of significance criteria; and
- Must also retain the integrity of its key attributes of significance.

Integrity is the degree to which an item retains fabric related to its cultural significance.

# 6.3 Heritage assessment

### 6.3.1 Granite quarry

The granite quarry has an association with the history of NSW as it has an association with the development of the Bendemeer township. The view toward and from the two quarry areas is of some aesthetic merit, and the quarry itself (particularly the southern workings), with the tors split open and piles of worked stone scattered about has a dramatic visual impact. The two quarry areas are also of technical significance, as several stages of the quarrying process are present, giving an appreciation of how the quarry operated. The quarry area has social significance through its association with the Bendemeer community, both as a link to the community's past, and as an item of historical interest with the potential to generate visitor interest in the town and surrounds. As few examples of small, local granite quarries have been recorded as historical items, the granite quarry is assessed as being a rare example of its type. However, more examples of this type of quarry may come to light in the future. The quarry retains a high level of integrity, as the drill holes in the tor are well preserved, and the partially quarried blocks of stone left by the quarry workers are still lying where they were left when the quarry was abandoned.

# 6.3.2 Dunduckety Creek Bridge

The Dunduckety Creek Bridge has an association with the history of NSW as it is part of the state road network, and is an example of simple, functional concrete slab bridge construction. The bridge has an association with the history of the New England Highway, in its role as a route to serve the needs of inland communities between Sydney and the Queensland border, and also as an alternative route to the Pacific Highway. However, as this association is at a general level without a single event or group of events to distinguish this bridge from any other along the New England Highway, its level of historical significance must be seen as low.

This bridge is not an item that demonstrates creative or technical excellence or innovation. It was built to a fairly standard design, without any exceptional technical merit that would distinguish it from another of the same type and era. The bridge itself is not of any particular aesthetic merit, although its setting, with the flat grassy banks of the Creek, and the steep hill slopes behind, is aesthetically pleasing. The Bridge does not have a social, spiritual or cultural association with the Bendemeer community, and does not have the potential to yield information contributing to an understanding of the history or historic environment of NSW. The Bridge is not rare, but is a representative example of a single span concrete bridge. The Dunduckety Creek Bridge retains a high level of integrity, as it retains a majority of its original fabric. This fabric appears to be in good condition.

# 6.3.3 Poison Swamp Creek Bridge

The Poison Swamp Creek Bridge has an association with the history of NSW as it is part of the state road network, and is an example of simple, functional concrete culvert construction. The bridge has an association with the history of the New England Highway, in its role as a route to serve the needs of inland communities between Sydney and the Queensland border, and also as an alternative route to the Pacific Highway. However, as this association is at a general level without a single event or group of events to distinguish this bridge from any other along the New England Highway, its level of historical significance must be seen as low.

This bridge is not an item that demonstrates creative or technical excellence or innovation. The bridge was built to a simple, standard design, without any exceptional technical merit that would distinguish it from another of the same type and era. The bridge and its setting, do not have any particular aesthetic merit. The Bridge does not have a social, spiritual or cultural association with the Bendemeer community, and does not have the potential to yield information contributing to an understanding of the history or historic environment of NSW. This bridge is not rare, but is a representative example of a multiple cell concrete culvert. The Poison Swamp Creek Bridge retains a high level of integrity, as it retains a majority of its original fabric that is in good condition.

#### 6.3.4 Rose Valley Creek Bridge

The Rose Valley Creek Bridge has an association with the history of NSW as it is part of the state road network, and is an example of simple, functional concrete slab bridge construction. The bridge has an association with the history of the New England Highway, in its role as a route to serve the needs of inland communities between Sydney and the Queensland border, and also as an alternative route to the Pacific Highway. However, as this association is at a general level without a single event or group of events to distinguish this bridge from any other along the New England Highway, its level of historical significance must be seen as low.

This bridge is not an item that demonstrates creative or technical excellence or innovation. However, the treatment of the pier and abutments of the Bridge with render in an ashlar masonry pattern, does give the underneath of the bridge some aesthetic appeal. The bridge was built to a fairly standard design, without any exceptional technical merit that would distinguish it from another of the same type and era, and does not have a social, spiritual or cultural association with the Bendemeer community. The bridge does not have the potential to yield information contributing to an understanding of the history or historic environment of NSW. This bridge is not rare, but is a representative example of a double span concrete bridge. The Rose Valley Creek Bridge retains a high level of integrity, as it retains a majority of its original fabric. However, this fabric is in poor condition.

# 6.3 Statement of cultural significance

# 6.3.1 Granite quarry

The granite quarry has heritage significance for its association with the history of the development of Bendemeer. This quarry is significant as it demonstrates an early hand-quarrying technique that is no longer practiced. The heaps of partially quarried stone associated with both the northern and southern workings are significant in that they help to define the spatial layout of the quarry, and are a physical manifestation of the secondary stone working activities which were conducted at the quarry. The quarry is assessed as being of high local significance.

# 6.3.2 Dunduckety Creek Bridge

The Dunduckety Creek Bridge has heritage significance for its association with the history of NSW as part of the road transport network. The bridge represents a standard solution to crossing a small, permanent watercourse. The fabric and design of the bridge are significant as evidence of technical change and evolution of design in bridge construction, and the standardisation of bridge design which occurred after the Main Roads Board was formed in 1924.

The bridge is assessed as being of low local heritage significance. The remains of the earlier Dunduckety Creek Bridge also have heritage significance for their association with the development of the NSW road transport network. The remains represent the early use of concrete in bridge construction. The remains, and the evidence of the old line of the New England Highway, are significant in representing how road alignments change over time as new river crossings are created, overtaking lanes are added, and tight corners are replaced with sweeping bends. The remains are also an example of how structures collapse and decay once decommissioned and no longer maintained. The remains of the earlier Dunduckety Creek Bridge are assessed as being of moderate local heritage significance.

# 6.3.3 Poison Swamp Creek Bridge

The Poison Swamp Creek Bridge has heritage significance for its association with the history of NSW as part of the road transport network. The bridge represents a standard solution to crossing a small, permanent watercourse. The fabric and design of the bridge are significant as evidence of technical change and evolution of design in bridge construction, and the standardisation of bridge design which occurred after the Main Roads Board was formed in 1924. That this bridge was built of concrete during the Great Depression, while on lesser roads timber bridges were still being constructed into the 1960s demonstrates both the importance of the New England Highway as a road route, and the recognition of concrete as a building material of superior strength, suitable for the construction of highway bridges. The structural integrity of the bridge is good, with a majority of the original fabric remaining. The Poison Swamp Creek Bridge is assessed as being of low local heritage significance.

# 6.3.4 Rose Valley Creek Bridge

The Rose Valley Creek Bridge has heritage significance for its association with the history of NSW as part of the road transport network. The bridge represents a standard solution to crossing a small, permanent watercourse. The fabric and design of the bridge are significant as evidence of technical change and evolution of design in bridge construction, and the standardisation of bridge design which occurred after the Main Roads Board was formed in 1924. The treatment of the pier and abutments of the bridge with render marked up to resemble ashlar masonry is significant in demonstrating that the design and construction of this bridge was intended to be visually appealing, rather than purely functional, even though the decorative treatment remained hidden from the majority of users of the bridge. That this bridge was built of concrete during the Great Depression, while on lesser roads timber bridges were still being constructed into the 1960s demonstrates both the importance of the New England Highway as a road route, and the recognition of concrete as a building material of superior strength, suitable for the construction of highway bridges. However, the maintenance file for the bridge reveals a long history of maintenance problems for this bridge, due in part to the extra load created by the deck widening, but also due to poor quality concrete. Thus the structural integrity of the bridge is poor, even though a majority of the original fabric remains. The Rose Valley Creek Bridge is assessed as being of low local heritage significance.

# 6.4 Legislative requirements

The non-indigenous heritage sites (with the exception of the Dunduckety Creek Bridge) are considered relics under Part 1, Section 4 of the NSW Heritage Act 1977. Under the Act, a relic is defined as: any object, deposit or material evidence relating to the settlement of the area that comprises NSW, not being Aboriginal settlement and which is fifty or more years old. The Dunduckety Creek Bridge is less than 50 years old and is thus not covered under the relics provision of the Act.

The Act provides automatic statutory protection for relics in Sections 139 – 145 which prevent the excavation or disturbance of land for the purpose of discovering, exposing or moving a relic except in accordance with an excavation permit. Section 146 of the Act also requires that if a relic is discovered (or located) the Heritage Council should be notified as soon as possible.

# 7 Management Issues

# 7.1 Impact of the Proposal

Construction works for the proposed realignment would result in the destruction of the two Aboriginal sites, Rose Valley Four and Five. The proposed road alignment would run between the two areas of historic granite quarrying. While the quarry areas would not be directly impacted upon by the proposed road works, the edge of the roadway and associated earthworks would pass within 10 metres of the northern workings and 24 metres of the southern workings (see **Figure 22**). The bridges over Dunduckety, Poison Swamp and Rose Valley Creeks would no longer be on an existing road alignment and, if not kept intact for educational purposes, would be removed. The remains of the earlier Dunduckety Creek Bridge would not be directly affected by the proposed works. However, care would need to be taken that they are not harmed if and when the current bridge is demolished.

# 8 Conclusions and Management Recommendations

# 8.1 Indigenous sites

- 8. The proposed road realignment would result in the destruction of the two Aboriginal sites Rose Valley Four and Rose Valley Five. As both sites have suffered substantial disturbance, conservation or salvage excavation of either site is not warranted. Consent to Destroy permits for both sites should be sought from the NSW National Parks and Wildlife Service.
- 9. The Aboriginal site Rose Valley Three is located immediately outside the study area. However, the construction manager and relevant construction site supervisors should be made aware of the location of this site. The location of the site should be considered "out of bounds" to all construction personnel and equipment, and all personnel should be advised as such. Mr Ivan Johnson of TLALC has indicated that this, rather than fencing off the site, is the preferred option for management of this site during the construction phase (Ivan Johnson, pers. comm).
- 10. No further work is required along the proposed route.

# 8.2 Non-indigenous sites

- 11. The historical granite quarry would not be directly impacted upon by the Proposal. However, the edge of the proposed realignment would come within ten metres of the northern quarry workings. Batter slopes in this part of the works should be reduced to the vertical as much as possible, and the possibility of installing a vertical wall in this area should be investigated. These mitigation strategies would go toward minimising the visual impact of the works upon the northern quarry workings. Prior to construction works occurring, a curtilage area would need to be established around both quarry areas, which should be fenced during the construction period to avoid damage occurring to the site during construction. The fenced off areas should incorporate the both the quarried tors and the heaps of partially quarried stone associated with them. All workers on site should be informed that the heaps of partially quarried stone are not to be moved, nor should pieces of stone be removed from the heaps. The quarry should be landscaped after construction has been completed, and the possibility of future visitor interpretation should be considered. Any decisions of this type should be made in consultation with members of the Bendemeer community.
- 12. The Dunduckety Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office. The ruins of the earlier Dunduckety Creek Bridge would not be directly impacted upon by the proposed works. However, the ruins should be fenced off for the duration of construction, to prevent any damage occurring to them. Should future visitor interpretation of this site (in conjunction with the historic granite quarry) be planned, it would be necessary to fence off the site, as the remains are unstable, and could be disturbed by members of the public climbing on and around it.
- 13. The Poison Swamp Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office.

- 14. The Rose Valley Creek Bridge would be demolished after the proposed realignment is completed. An archival photographic record should be made of the structure prior to demolition. The negatives and prints should be lodged in the RTA archives. A copy of the prints should be sent to the NSW Heritage Office.
- 15. Providing recommendations 4-7 are undertaken, no further heritage work would be required within the study area as part of the works required for the Proposal.

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- Witter, D. 1980 An archaeological survey of the natural gas pipeline between Wagga Wagga and Young, Report to NSW National Parks and Wildlife Service

**Figures** 

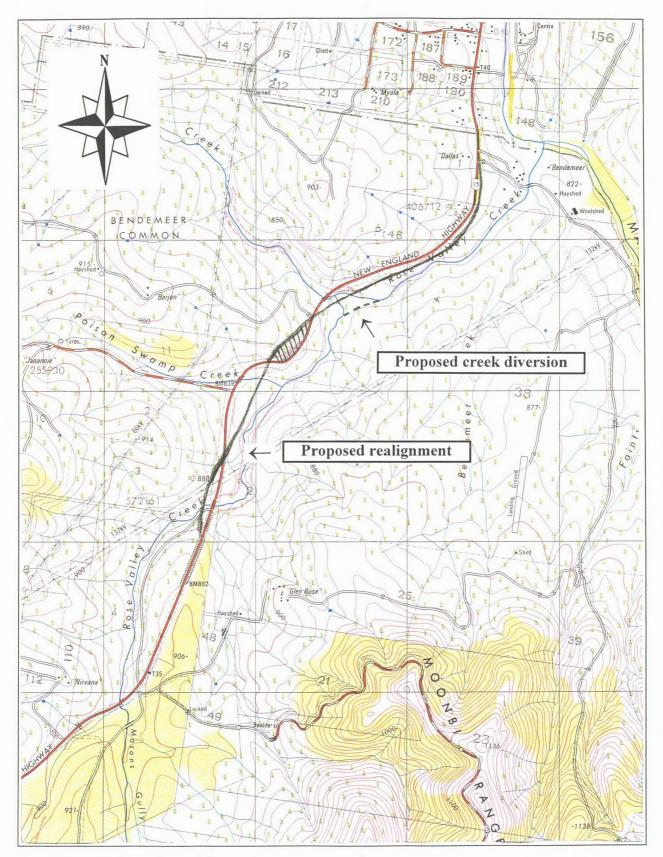


Figure 1: Location of the study area

(Source: Bendemeer 1:25 000 topographic map, second edition, 1984. Map extract courtesy of Surveyor General's Department)

Key: Area to be removed for fill



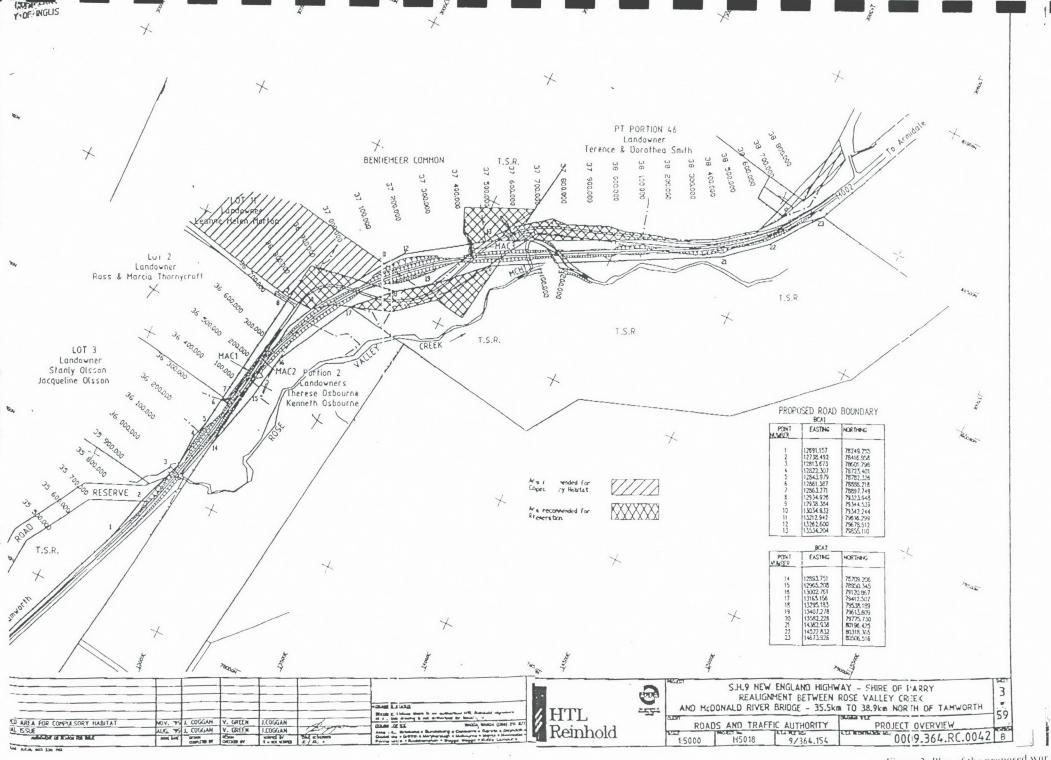
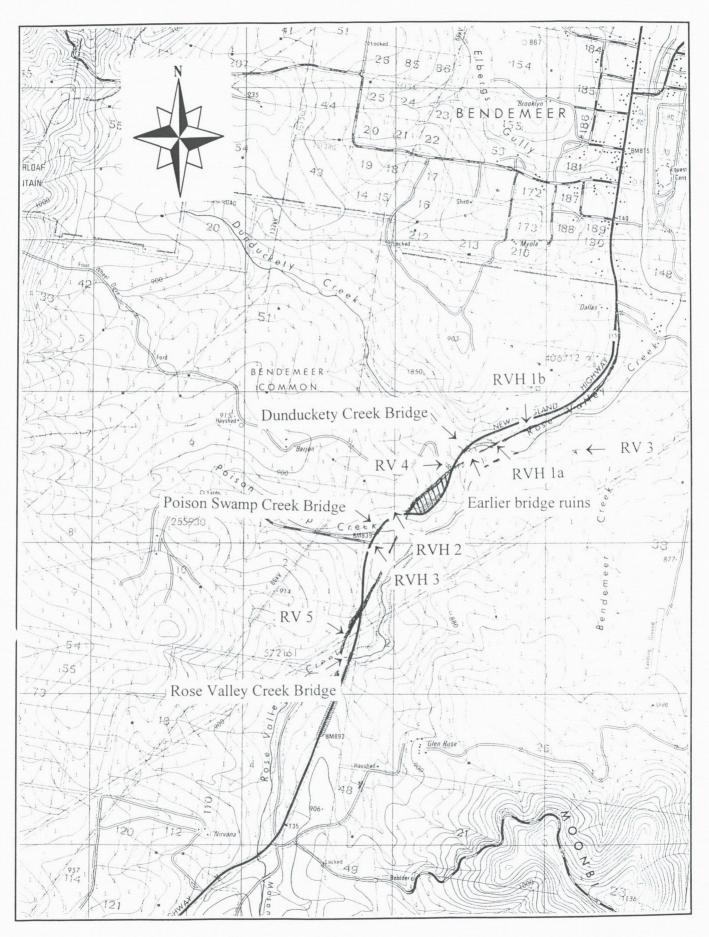


Figure 2: Plan of the proposed wor



**Figure 7: Location of heritage sites within the study area.** (Source: Bendemeer 1: 25 000, Edition 2, 1984. Map extract courtesy of the Surveyor General's Department)

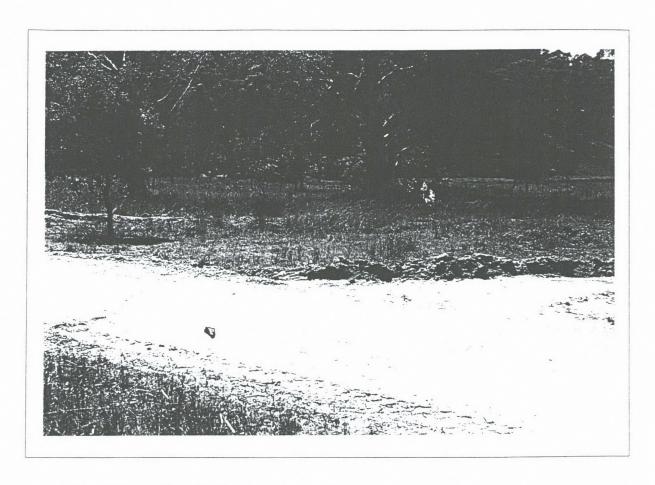


Figure 8: Site of Rose Valley 4



Figure 9: Site of Rose Valley 5

# CLIENT:

#### ROADS AND TRAFFIC AUTHORITY

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A.C.N 002 745 020 239 Marius Street, Tamworth NSW 2340

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Inc in NSW

PLAN SHOWING LOCALITY OF HISTORIC QUARRY 'A' RELATIVE TO THE PROPOSED CENTRELINE OF THE NEW ENGLAND HIGHWAY DEVIATION AT 'ROSE VALLEY' BENDEMEER

Our Ref: 93209 Drawing: DWG3209Q Date: 4-6-1999

L.G.A.: PARRY

Locality: BENDEMEER

Scale: 1:200 Datum: Parish: PERRY

County: INGLIS

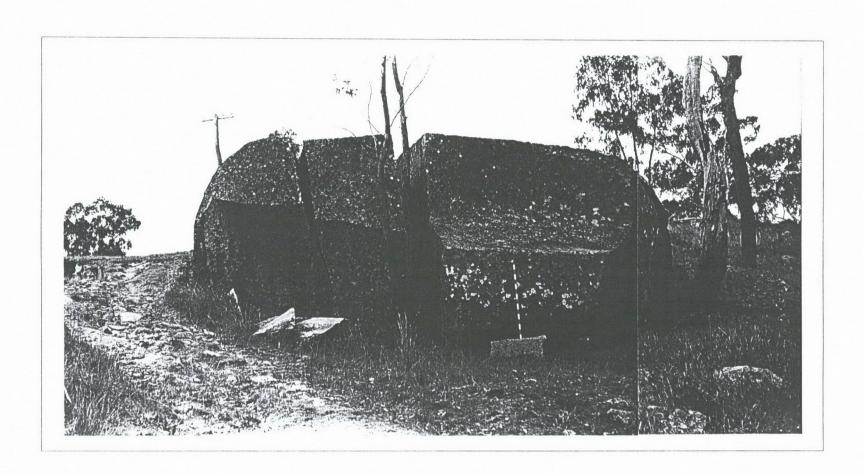


Figure 11: Granite quarry, southern workings

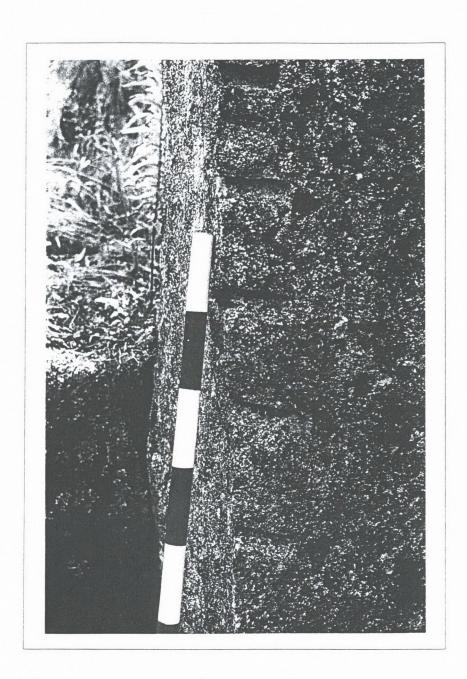


Figure 12: Detail of drill holes in quarried tor

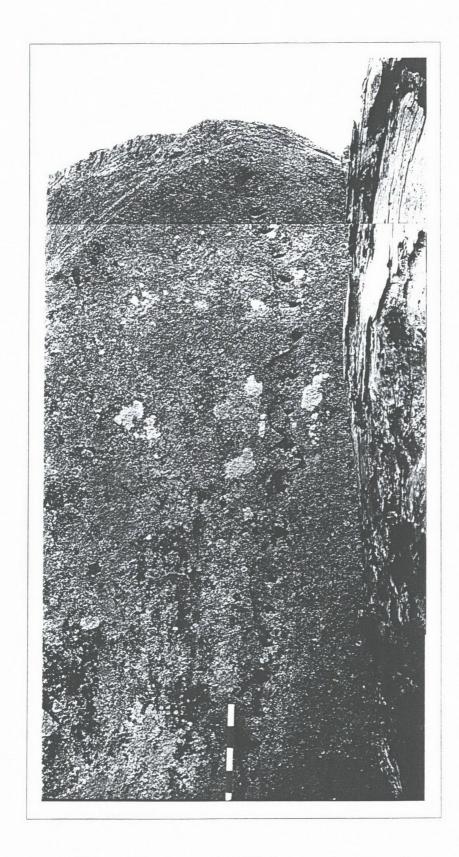


Figure 13: Unfractured drill holes on eastern face of tor

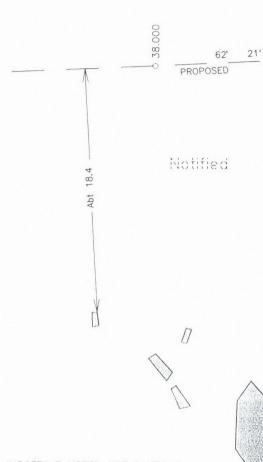
38.

ROAD

23-2-1895

CENTRELINE

56"



#### IMPORTANT NOTES AND CAUTIONS

- 1) AZIMUTH FOR THIS SURVEY IS BASED ON THE GRID BEARING FROM SSM 31210 (MR 9/6354) TO PM 42497, BEING AS SUPPLIED BY THE ROADS AND TRAFFIC AUTHORITY
- 2) ALL SURVEY CONTROL IS BASED ON PLAIN CO-ORDINATES
- 3) THIS PLAN HAS BEEN PREPARED AT A REDUCTION RATIO OF 1:200 HORIZONTAL. THE ACCURACY OF ANY ENLARGEMENT OR OTHER REPRODUCTION MAY BE LESS THAN THAT OF THE ORIGINAL.
- 4) FEATURES SHOWN ON THIS PLAN AS REQUESTED BY CLAIR EVEREIT ON SITE ON 4TH JUNE 1999.
- 5) ROAD CENTRELINE SHOWN ON THIS PLAN OBTAINED FROM DRAWINGS R.T.A. REGISTRATION NO. 0009.364.R.C.0042



ROCK SHOWING QUARRY MARKS SHOWN THUS

81 91

RATIO

REDUCTION F



UNMARKED ROCK SHOWN THUS

### CLIENT:

#### ROADS AND TRAFFIC AUTHORITY

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CONSULTING SURVEYORS

Inc in NSW A.C.N. 002 745 020

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Description:

PLAN SHOWING LOCALITY OF HISTORIC QUARRY 'B' RELATIVE TO THE PROPOSED CENTRELINE OF THE NEW ENGLAND HIGHWAY DEVIATION AT 'ROSE VALLEY' BENDEMEER

Our Ref: 93209 Drawing: DWG3209R Date: 4-6-1999 L.G.A.: PARRY

Locality: BENDEMEER

Scale: 1:200

Datum:

Parish: PERRY County: INGLIS



Figure 15: Granite quarry, northern workings

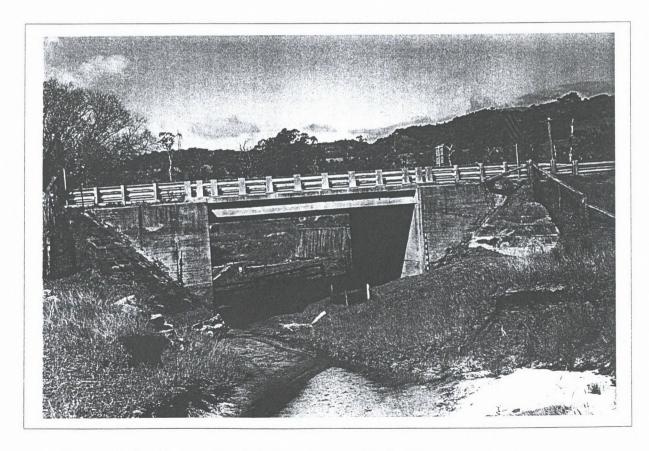


Figure 16: Dunduckety Creek Bridge, western side, looking east

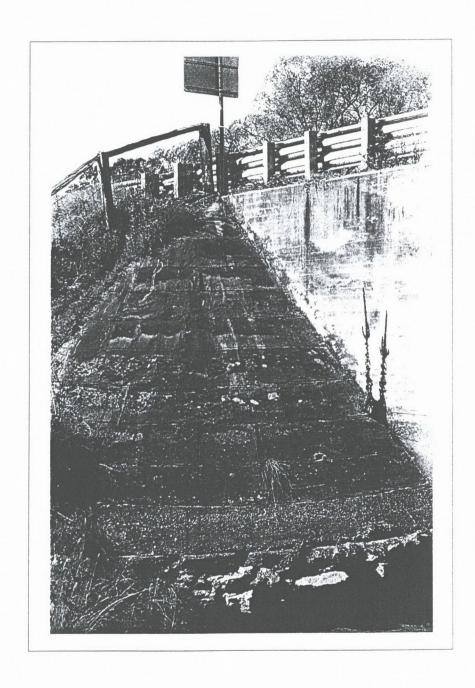


Figure 17: Detail of concrete mound beside wingwall on southern abutment

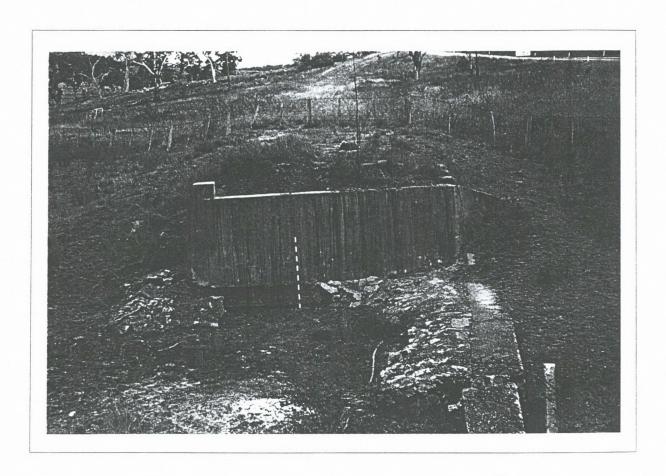


Figure 18: Old Dunduckety Creek Bridge – remains of south eastern abutment

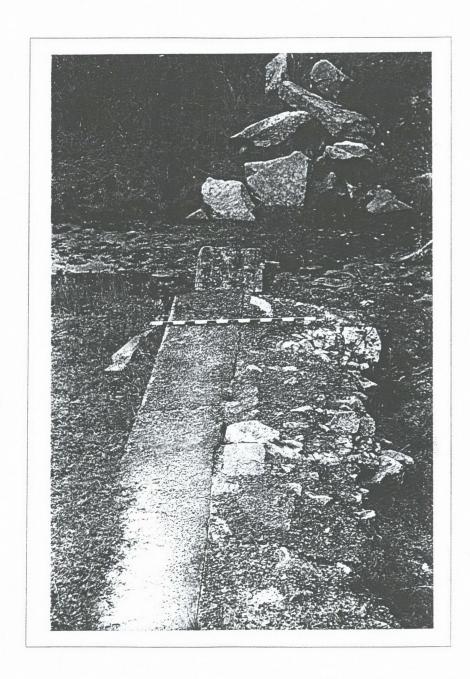


Figure 19: Collapsed deck of Dunduckety Creek Bridge



Figure 20: Poison Swamp Creek Bridge, western side

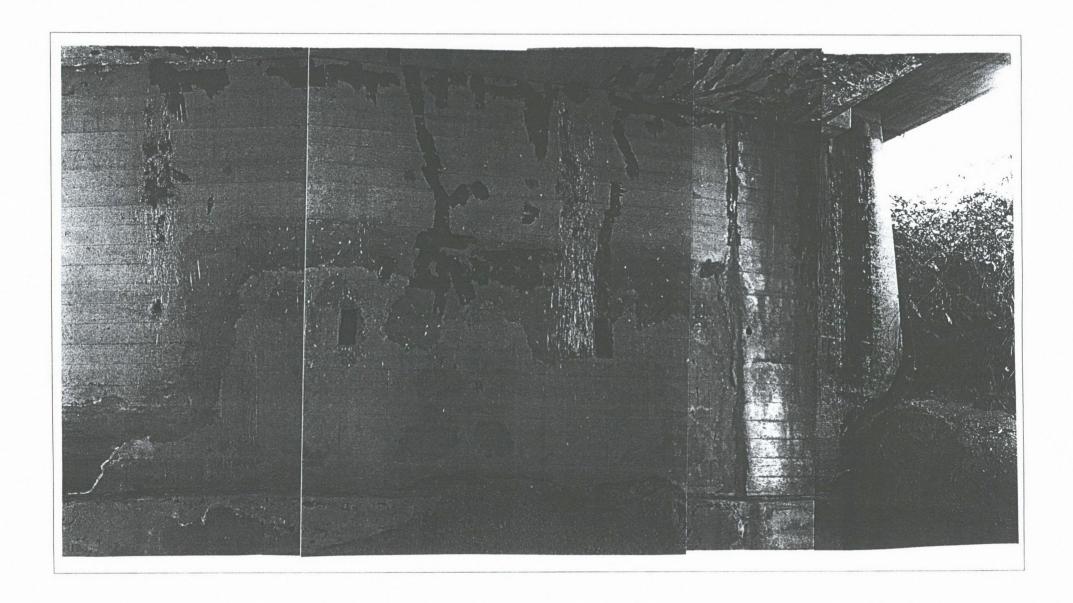
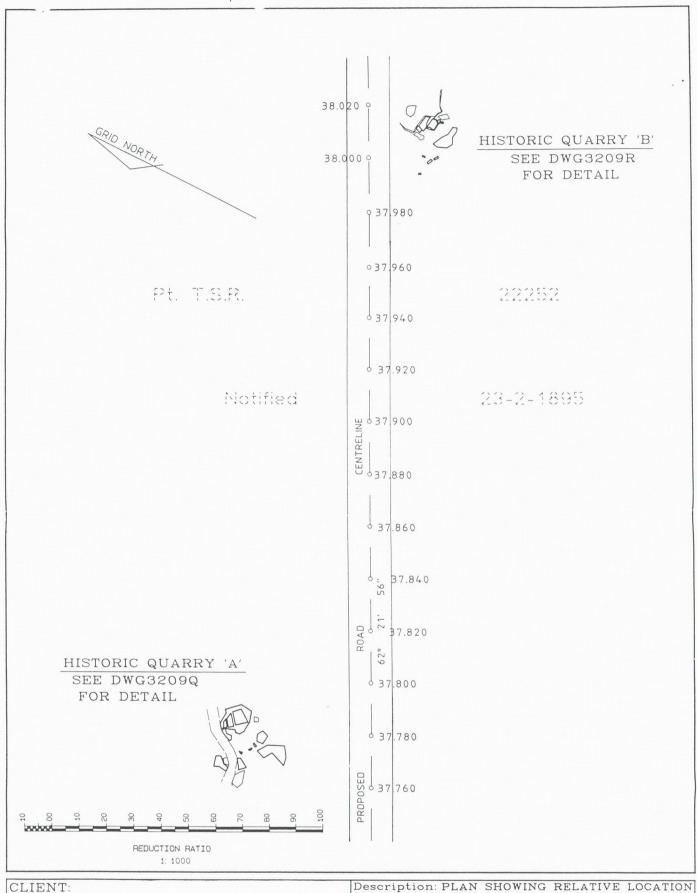


Figure 21: Northern abutment of Rose Valley Creek Bridge, showing ashlar masonry pattern and extensive patching of cracks



#### ROADS AND TRAFFIC AUTHORITY

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OF HISTORIC QUARRIES 'A' AND 'B' TO THE PROPOSED CENTRELINE OF THE NEW ENGLAND HIGHWAY DEVIATION AT 'ROSE VALLEY' BENDEMEER

Our Ref: 93209 Drawing: DWG3209S

Date: 4-6-1999 L.G.A.: PARRY

Locality: BENDEMEER

Scale: 1:1000

Datum:

Parish: PERRY County: INGLIS

# Appendix C

Flora, Fauna & Aquatics Assessment

# ROSE VALLEY HIGHWAY REALIGNMENT

Prepared for

**RTA TECHNOLOGY** 

**JUNE 1999** 

by



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# Section 1.0

# Introduction

#### 1.1 BACKGROUND

The Roads and Traffic Authority (RTA) is proposing to realign the New England Highway at Rose Valley between 35.5 and 39.1 kilometres north of Tamworth. The works will involve construction of 3.6 km of new road including a new bridge at Rose Valley Creek, new culverts at Poison Swamp Creek and Dunduckety Creek, and a 140 m diversion of Rose Valley Creek.

The location and extent of these works is shown in Figures 1.1, 1.2 and 1.3 as well as Plates 1 to 4.

#### 1.2 PURPOSE OF REPORT

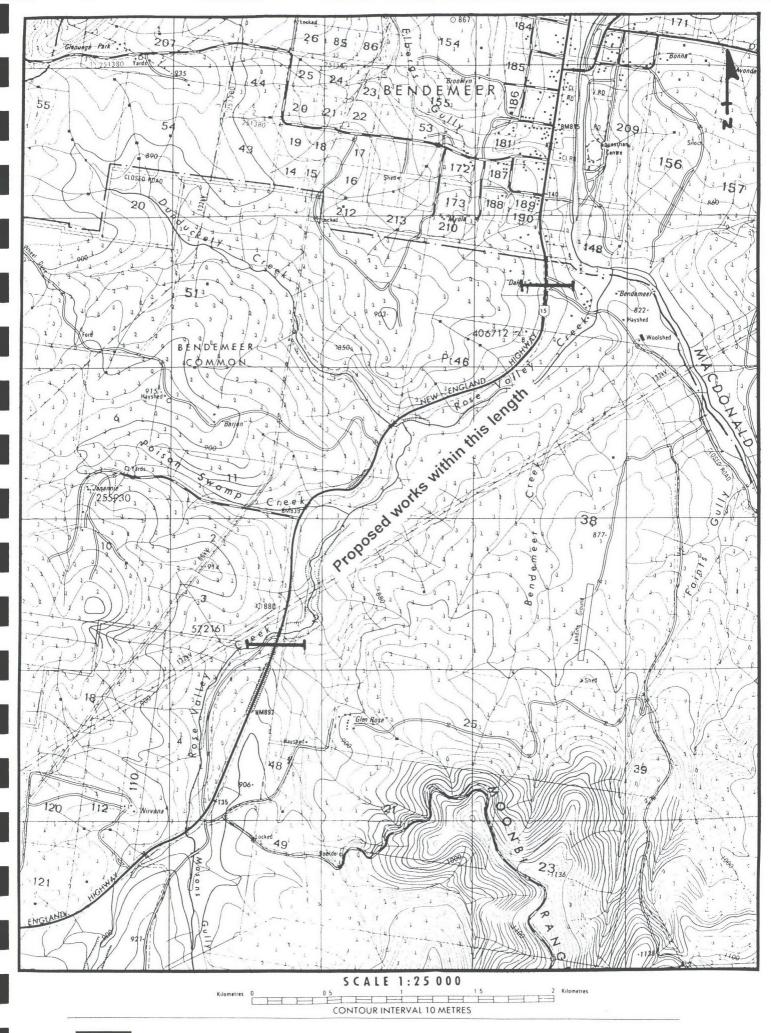
Consistent with planning and assessment obligations, pursuant to the *Environmental Planning and Assessment Act, 1979*, RTA Environmental Technology is preparing a Review of Environmental Factors (REF) for the RTA's Northern Region.

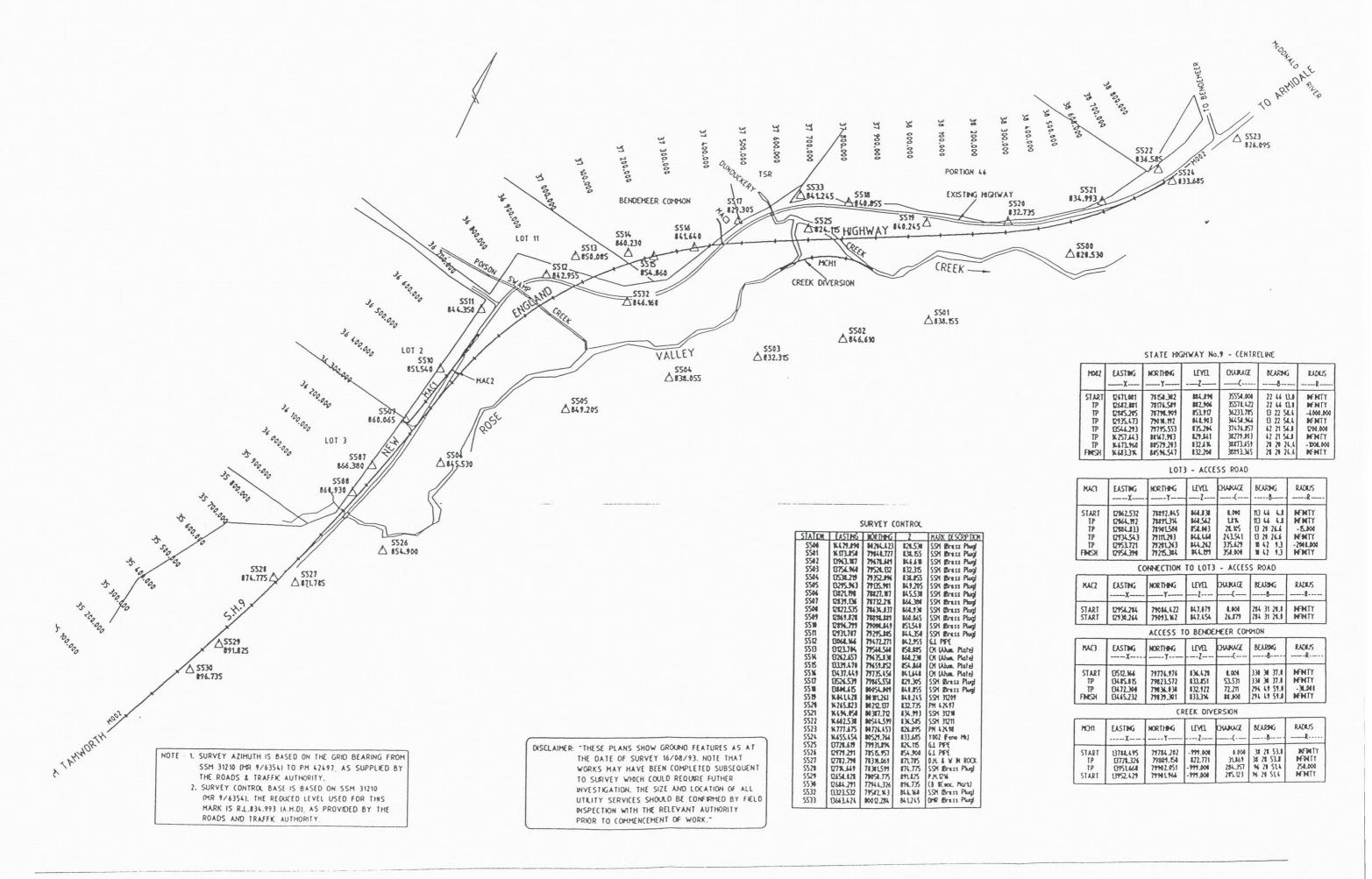
RTA Environmental Technology commissioned Terra Sciences to prepare an ecological assessment (flora, fauna and aquatics), as a supplementary report, for inclusion in the REF.

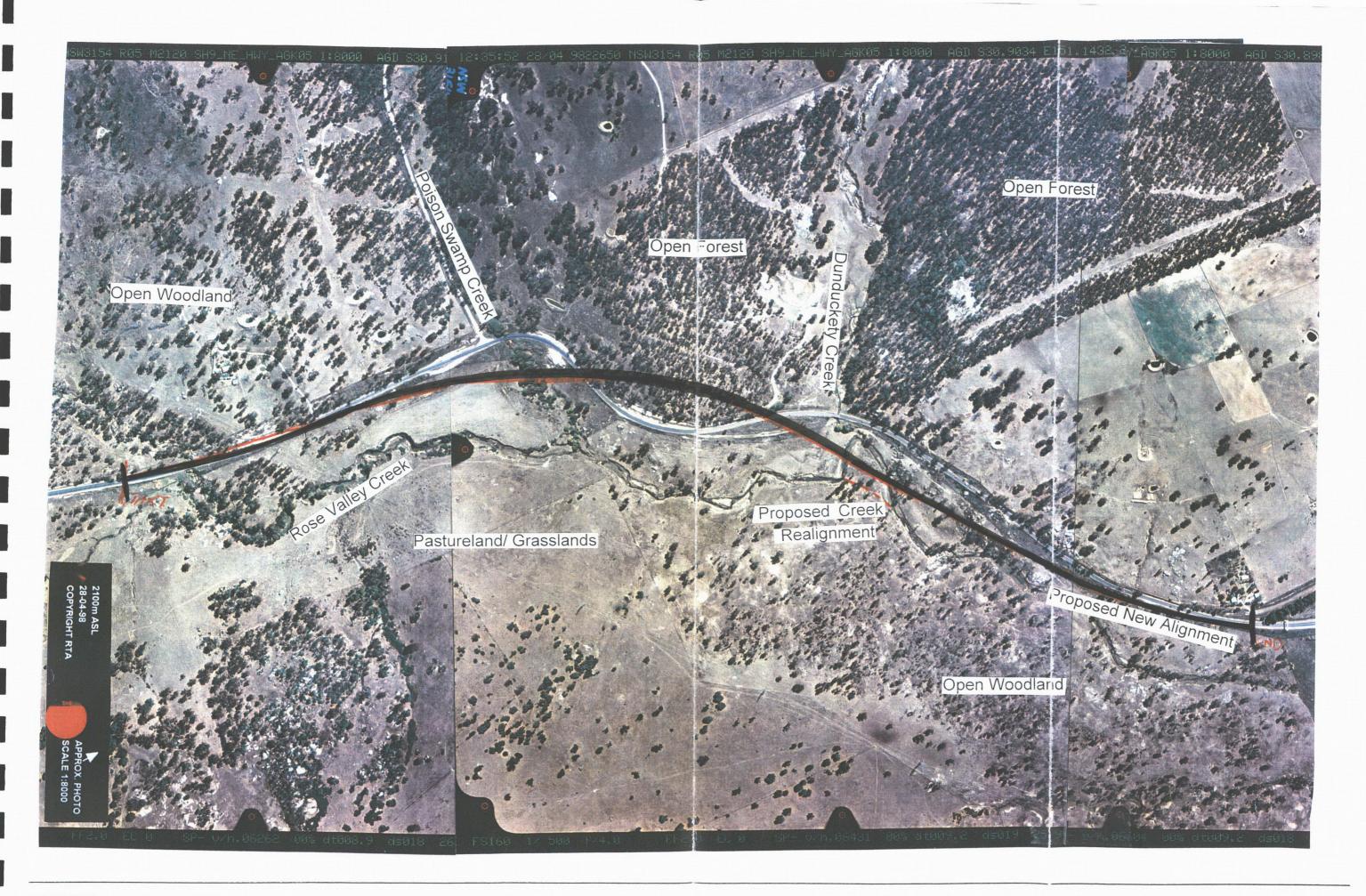
#### 1.3 SCOPE OF WORK

The following tasks were specified in the preparation of this report.

- Review the Flora and Fauna Assessment undertaken by QEM in 1995.
   Specifically assess and update to ensure compliance with current legislative requirements.
- Undertake a new field survey of flora and fauna to confirm, and if necessary revise the findings of the 1995 QEM report.
- Address the conservation significance of the Bendemeer White Gum and Moonbi Apple Box and determine the impact of the proposed works on these species, and apply eight part tests of significance if necessary.
- Identify the conservation significance of the Torquoise Parrot, Koala and White-Striped Mastiff Bat and determine the impact of the proposed works on these species, and apply eight part tests of significance if necessary.









- Identify if any other threatened or endangered species are present in the area and may be impacted by the proposed works.
- Undertake a field survey of aquatic species in Rose Valley Creek, Poison Swamp Creek and Dunduckety Creek to establish if any rare or threatened species are present and determine potential impacts, as well as investigate potential impacts of the works on any Platypus populations in Macdonald River.

#### 1.4 REPORT STRUCTURE

In addition to those requirements specified in Section 1.3 above, the report must:

- Provide a description of the methodologies used.
- Identify and direct or indirect potential impacts on all flora, fauna and aquatic species and ecosystems.
- Include recommendations for appropriate measures for conservation where impacts are likely on species of conservation significance.
- Include recommended measures to reduce impacts on flora, fauna and aquatic ecosystems.
- Include maps, plans and photographs of the study area, areas of high sensitivity and the location of any rare or threatened species located during the survey.

#### 1.5 OUTLINE OF REPORT

- Section 1 provides a background to the report.
- Section 2 describes the study methodology.
- Section 3 presents the field survey results.
- Section 4 identifies the conversation significance of potentially impacted species.
- Section 5 describes the direct and indirect physical impacts.
- **Section 6** identifies mitigation measures.
- Section 7 assess the significance of potential impacts.
- Section 8- provides a conclusion.

### Section 2.0

# Study Methodology

#### 2.1 DESKTOP

Prior to the field survey a search was conducted of the National Parks and Wildlife Service's Atlas of NSW Wildlife database. This search was conducted for the Bendemeer 9136, 1:100,000 map sheet.

Available literature detailing the distribution of threatened species (National Parks and Wildlife Service 1995; Briggs and Leigh 1996; Strahn 1995) were reviewed to obtain a list of threatened species that potentially occur in the region. The vegetation within the study area and surrounding lands was assessed from aerial photographs (SH9 New England Highway Tamworth to Glen Innes 1:8000 28/4/98) in order to obtain an overview of the vegetation structure.

A copy of a Flora, Fauna and Archeology Report by Quality Environmental Management (QEM) (June 1995), prepared for NSW Roads and Traffic Authority, was reviewed prior to commencement of the field survey.

All plants listed on the *NPWS Wildlife Atlas* for the surrounding areas were referenced and habitat requirements of the species analysed so that the capability of the study area to support any threatened species could be determined.

#### 2.2 CONSULTATION

Consultation was undertaken with the following people or organisations:

- Greening Australia, Armidale Ofiice, David Carr. Information on the distribution of the Bendemeer White Gum (*Eucalyptus elliptica*) and Moonbi Apple Box (*Eucalyptus malacoxylon*) was given along with information about nearby communities which contain the species.
- National Parks and Wildlife Service, Harry Creamer, Technical Officer, Armidale Office. Information on the distribution of the Bendemeer White Gum (*Eucalyptus elliptica*) was forwarded along with information on surrounding National Parks and Reserves.
- Department of Land and Water Conservation, Tamworth Office, Vegetation Unit. Verbal information on the species and associations within the Bendemeer surrounds. Also distribution information on the Moonbi Apple Box (*Eucalyptus malacoxylon*), Bendemeer White Gum (*E. elliptica*) and *Thesium australe*.

- NSW Fisheries; George Manner, Peel Fisheries Officer. Tamworth. Confirming no threatened aquatic species in the creek systems within the study area.
- NSW Fisheries; James Sacker, Threatened Species Officer. Central Region, Port Stephens. Confirming no threatened aquatic species within the Macdonald River system into which Rose Valley flows.
- Shire of Parry, Tamworth. Information on the Travelling Stock Route and Bendemeer Common boundaries.

#### 2.3 FIELD SURVEY

#### 2.3.1 General

The field investigation was conducted from the 11 May to 13 May 1999. The location of the survey was a stretch of road on the New England Highway, Rose Valley Creek, from 35.5 to 39.1 kilometres north of Tamworth (**Figure 1.1**).

The survey covered an area which included:

- The existing road and shoulders.
- The proposed new alignment (20 metres either side).
- A section of open forest, to the north west of the existing highway, containing the two noted tree species along the proposed route.
- Rose Valley, Poison Swamp and Dunduckety Creek crossings and immediate vicinities.
- Rose Valley Creek proposed diversion site and sections to the creek up and down stream of this location.
- Also any extensions of habitat that were considered to also be potentially impacted by the proposed works were included in the survey.

These areas will be referred to as the study area.

Over the three days of the survey conditions were changeable. Weather conditions varied from light misty drizzle in the afternoon of the 11 May to warm still and sunny conditions during the 12 May. Weather degenerated into rainy periods again during 13 May. Diurnal field temperatures ranged from 15 to 21 degrees Celsius. Nocturnal temperatures dropped to approximately 9 degrees. Wind strength remained low with all days experiencing only light breezes. The site recorded a total of 4 millimetres over the three days.

#### 2.3.2 Flora

A general reconnaissance by foot of the study area was carried out with landform and vegetation units located and correlated with topographic map and air photo details. Specific sites appearing to be more diverse or unusual were investigated in order to obtain an overview of community diversity.

A more specific survey was then carried out along the proposed alignment and on sites of importance. Data on vegetation structure, coverage, species, tree statistics (height, hollows and species condition) were compiled.

#### 2.3.3 Fauna

The fauna survey involved trapping transects, electronic recording and opportunistic observation of scats, tracks and diggings. The fauna assessment was based on identification of habitat type, quality and potential.

The fauna component of the habitat assessment included:

- A description of the fauna in the study area in terms of overall distribution, possible habitat and abundance.
- Assessment of impacts on potential habitat of threatened fauna species that could occur in the locality.
- Consideration of the status of habitat and existing fauna which occur in the area.
- Identification of specific microhabitats, particularly those which could provide suitable conditions for threatened flora and fauna.
- Fauna species identification included point observation surveys adjacent to selected areas (eg morning and evening surveys along the three creeks and within better identified habitat areas), opportunistic sightings, recording evidence of species presence (ie tracks, scats etc) and identification of fauna habitat.
- Echolocation equipment and 50 type 'B' Elliott traps with universal bait were placed in two lines throughout better quality habitat. The purpose of these traps was not to obtain data on population dynamics of species, but to provide an overview of terrestrial species which may occur on the site.

#### 2.3.4 Aquatic

The aquatic survey included the following:

- Direct observations along the Rose Valley, Poison Creek and Dunduckety Creeks to identify and map aquatic habitat. This provided information on the availability and health of the aquatic systems within the survey area. Collection of invertebrates by way of dip netting and kick samples at selected sites also assisted in obtaining a better idea of the health of the creek systems. The aim of the aquatic component was to comment on the health of the aquatic habitat, particularly in relation to any threatened aquatic species.
- A thorough search of the junction (and surrounds) of the Dunduckety and Rose Valley Creek to assess aquatic species diversity and habitat quality, in conjunction with an investigation of the proposed diversion area for the Rose Valley Creek. This provided information on what aquatic habitat would be removed or modified by the proposed works.

#### 2.3.5 Survey Limitations

Climatic conditions were not considered to have impacted on the survey's effectiveness. Adverse climatic conditions were not experienced during, or prior to, the field survey. Similarly, adequate vegetation and accessible water provided suitable conditions for most fauna. Further, climatic conditions were not considered to be significant as the study has primarily assessed habitat quality and quantity.

Most flora species were in good health or retained seeds at the time of the survey. This assisted in precise identification.

Flow in the creek lines was absent or only very slow. Although small fish and invertebrate species could use some in and out-flows, larger species would be unable to negotiate the shallows and in-stream vegetation. The occasional small sandy pools along the creek lines in the study area were suitably deep and large enough to provide resources for a range of larger amphibian species and were able to be sampled.

### Section 3.0

## Field Survey Results

#### 3.1 OVERVIEW

The structure of the vegetation communities closely reflect those identified in the 1995 QEM surveys. At the time of the QEM survey, the locality was effected by drought, however most species which were identified during that survey were also identified to be present during this survey.

Fauna habitat is closely reflected by the vegetation communities. Additional habitat units were present in association with rocky out crops and the creek course. These units were also accounted for in the survey by Goldney in 1995.

#### 3.2 FLORA

Three floristic communities were identified over the study area. These included **open woodland, open forest and grassland/pastureland**. Each of these communities exhibited induced structural diversity from either past clearing or past and existing agricultural practices.

#### 3.2.1 Open Woodland

The structural composition of this community varies throughout the study area, often possessing a mosaic configuration with both pastureland and open forest. The boundaries of these communities are often difficult to distinguish. The open woodland of the study area has been influenced strongly by past (and present) clearing and grazing practices.

The community is typically comprised of the four local species; Bendemeer White Gum (*Eucalyptus elliptica*), Moonbi Apple Box (*E. malacoxylon*), Ribbon Gum (*E. viminalis*) and Blakely's Red Gum (*E. blakelyi*). Deeper and/ or alluvial soils tend towards the Ribbon Gum and Blakely's Red Gum alliance with shallower, better drained granite soils favoring a Ribbon Gum/ Moonbi Apple Box association.

The open woodland is dominated over most areas by Ribbon Gum. More open areas have an older age composition. Up to 50% of individual trees within or adjacent to pasture areas are mature or old growth trees. This contrasts with a younger open woodland community typical on areas adjacent to or within the open forest community.

The lower storey of this community varies in composition density and diversity. Open woodland within grazed pasture has low to very low diversity in lower storey components. Open woodland which has had restricted grazing or less clearing has a more diverse understorey. These areas are often partially protected by broader areas of woodland or by open forest community buffers. Recruitment of species is also largely dependant on land usage. Areas with restricted grazing practices have a moderate recruitment level of mostly dominant tree species.

The understorey and ground cover within the community varies with respect to land usage. Grazed areas are restricted to common pasture related species which included Couch Grass (*Cynodon dactylon*), Lovegrass (*Eragrostis sp.*) and Paspalum (*Paspalum dilatatum*). Woodland existing within areas excluded from grazing (eg. on fenced road verges) has dense populations of mainly introduced species such as Blackberry (*Rubus ulmifolius*) and Aaron's Rod (*Verbascum thapsus*). Many of these areas are dominated by Phalaris (*Phalaris aquatica*), Purpletop (*Verbena bonariensis*) and Australian Cransbill (*Geranium solanderi*). The ground cover within grazed areas is often consistent with surrounding or adjoining grassland/pastureland.

Ground logs and stags throughout this community are generally sparse. Small areas appear to have suffered from die-back (north of 38 500). Areas which were identified as forest during the 1995 QEM survey were assessed to be currently composed of an open woodland community. Aerial photographs indicate that these areas have been thinned and cleared (west of 36 500)

The health of the open woodland community varies across the study area. Open woodland subject to continuous intensive grazing practices has a higher proportion of trees displaying stressed growth or crown die-back.

#### 3.2.2 Open Forest

This community is generally located in belts extending in a westward direction from the New England Highway. The open forest retains a relatively consistent structure with slight variances in composition induced through soil, drainage and aspect.

The open forest community of the study area is dominated by Ribbon Gum (*E. viminalis*). Other species present within the upperstorey include Bendemeer White Gum, Moonbi Apple Box and Blakely's Red Gum. Variance in community composition tends toward the inclusion of Rough-barked Applebox (*Angophora floribunda*) on more elevated slopes westward of the study area.

The community is mostly comprised of young aged or young-mature individuals. Recruitment is well represented with all species regenerating. The lower storey is sparse with few (if any) tall shrub species present. Saplings dominate this stratum. Understorey and ground components are relatively diverse with a range of native grasses, forbs and low shrubs. Species present included Purple Wiregrass (*Aristida ramosa*) and Wallaby Grass (*Danthonia sp.*). This stratum was generally dominated by *Hibbertia obusifolia*.

Ground logs and stumps were common throughout the community.

This community exhibits varying intensities of past grazing by domestic stock. Most areas are currently subject to a relatively low grazing regime. Much of the community has evidence of past thinning and clearing impacts. Uniformly younger aged portions of the community, old tree stumps and cut logs indicate past timber clearing taking place more than 40 years ago. Narrow clear belts (observed on aerial photographs), have been formed for tracks, contour banks and utility servicing corridors.

The proposed alignment crosses this open forest community between CL 37 000.000 and CL 37 400.000. Within this alignment, the community is primarily dominated by Ribbon Gum with a high proportion of Bendemeer White Gum. The open forest which is present on this section of proposed works has a tree stratum composition of approximately 55% Ribbon Gum, 30% Bendemeer White Gum and <5% Moonbi Apple Box.

#### 3.2.3 Grassland/Pastureland

This community dominates the study area. The grassland/pastureland has a relatively low diversity over the entire study area with exception of ungrazed areas within the fenced road verges. Community composition within grazed paddocks indicates that consistent agricultural impacts have continued for a long period of time. Species over open grazed pastures include mainly exotics and introduced species. Native species are restricted to more robust or less palatable species such as Sheep's Burr (*Acaena agnipila*) and Couch Grass (*Cynodon dactylon*).

Ground species within the ungrazed road verges is much denser as expected. Species present in these areas reflect the diversity inherent of the neighbouring agricultural land. Areas exist within these verges where the community is dominated by weeds such as Sweet Briar (*Rosa rubiginosa*) and Blackberry (*Rubus fruticosus*). Other ungrazed areas of the community include rocky outcrops which are less accessible to stock. These areas are often confined as islands within large areas of grazed pasture. Species identified as occurring in these rocky outcrops included Kangaroo Grass (*Themeda australis*), Barbedwire Grass (*Cymbopogon refractus*) and Western Rat's-tail Grass (*Sporobolus creber*).

Trees across the grassland/ pastureland community are scattered to sparse. Trees become denser towards woodland and forest fringes. Isolated trees across the community are remnant of the parent stratums. These trees are mostly mature to old aged trees with a high proportion of these trees showing signs of stress or crown damage.

In many areas the grassland/pastureland community remains continuous adjacent to and through drainage channels. In-channel vegetation remains consistent with surrounding pasturelands. Willows exist in disjunct stands along creek courses with slow draining areas of the creek beds vegetated with species including Cumbungi (*Typha domingensis*), Rush (*Juncus sp.*) and Phalaris (*Phalaris aquatica*).

The community has been subject to numerous and varying impacts. These include grazing, clearing, earthworks, soil and sand stockpiling and prior roadworks.

#### 3.2.4 Observed Flora Species

	TABLE 3.	1			
OBSERVED FLORA LIST					
FAMILY NAME	BOTANICAL NAME	COMMON NAME	Α	В	С
ADIANTACEAE	Adiantaceae aethiopicum	Common Maidenhair Fern		/	/
SINOPTERIDACEAE	Cheilanthes sieberi	Mulga Fern		<b>✓</b>	/
DENNSTAEDTIACEAE	Pteridium esculentum	Bracken		1	
AZOLLACEAE	Azolla filculoides	Azolla		/	
RANUNCULACEAE	Ranunculus inundatus	River Buttercup		1	
POLYGONACEAE	ACEAE Acetosa vesicaria * Bladder Dock			✓	
DILLENIACEAE	Hibbertia obusifolia		<b>√</b>		/
URTICACEAE	Urtica incisa Scrub Nettle			✓	
SALICACEAE	Salix babylonica *	Weeping Willow		/	
	Salix alba *	White Willow		/	
BRASSICACEAE	Lepidium pseudohyssopifolium	Peppercress		✓	
CLUSIACEAE	Hypericum perforatum *	St. John's Wort	v'	✓	/
	Rubus ulmifolius *	Blackberry		<b>✓</b>	/
ROSACEAE	Acaena agnipila	Sheep's Burr		✓	
	Rosa rubiginosa *	Sweet Briar		✓	
MALACEAE	Malus domestica *	Apple		✓	
	Angophora floribunda	Rough-barked Apple	<b>✓</b>		
MYRTACEAE	Eucalyptus blakelyi	Blakely's Red Gum	<b>✓</b>		/
	Eucalyptus malacoxylon	Moonbi Apple Box	<b>✓</b>		/
	Eucalyptus elliptica	Bendemeer White Gum	<b>√</b>		/
	Eucalyptus viminalis	Ribbon Gum		✓	/
MIMOSOIDEAE	Acacia longifolia	Sydney Golden Wattle	✓		
FABOIDEAE	Hardenbergia violacea	False Saraporilla		✓	/

	TABLE 3					
OBSERVED FLORA LIST						
FAMILY NAME	BOTANICAL NAME	COMMON NAME	Α	В	С	
	Trifolium repens *	White Clover		<b>√</b>		
	Trifolium arvense *	Haresfoot Clover		<b>✓</b>		
GERANIACEAE	Geranium solanderi	Australian Cransbill		<b>✓</b>		
CAMPANULACEAE	Wahlenbergia sp.	Bluebell sp.	<b>✓</b>		~	
	Conyza bonariensis *	Flax-leaf Fleabane		<b>✓</b>	<b>✓</b>	
	Gnaphalium involucratum	Star Cudweed	<b>✓</b>			
	Chrysocephalum apiculatum	Yellow Buttons		<b>✓</b>	/	
ASTERACEAE	Ammobium alatum	Daisy		1	✓	
	Chondrilla juncea *	Skeleton Weed		<b>✓</b>		
	Taraxacum officinale *	Dandelion		✓		
	Sonchus oleraceus *	Common Sowthistle		✓		
SOLANACEAE	Datura ferox *	Fierce Thornapple		✓		
EPACRIDACEAE	Melichrus urceolatus	Urn Heath	<b>V</b>			
SCROPHULARIACEAE	Verbascum thapsus *	Aaron's Rod		1		
PLANTAGINACEAE	Plantago debilis			1		
(5555)	Verbena bonariensis	Purpletop		<b>✓</b>		
VERBENACEAE	Lantana camara *	Lantana		<b>✓</b>		
LOMANDRACEAE	Lomandra longifolia	Spiny-headed Mat-rush		<b>✓</b>	/	
TYPHACEAE	Typha domingensis	Cumbungi		<b>✓</b>		
JUNCACEAE	Juncus sp.	Rush		<b>✓</b>		
	Bothriochloa macra	Red-leg Grass	/	<b>✓</b>	/	
	Cymbopogon refractus	Barbed-wire Grass	/	<b>✓</b>	/	
	Themeda australis	Kangaroo Grass	1		/	
	Paspalum dilatatum *	Paspalum	/	<b>✓</b>	/	
	Aristida ramosa	Purple Wiregrass	1	1	/	
	Chloris truncata	Windmill Grass		✓	/	
	Cynodon dactylon	Couch grass		1	/	
	Sporobolus creber	Western Rat's-tail Grass	/	/	/	
POACEAE	Eragrostis sp.	Lovegrass		/	/	
	Danthonia sp.	Wallaby Grass	/	1		
	Phragmites australis	Common Reed		/	/	
	Avena fatua *	Wild Oats		✓	/	
	Triticum sp *	Wheat		✓		
	Briza maxima *	Quaking Grass		1		
	Briza minor *	Shivery Grass		/	/	
	Phalaris aquatica *	Phalaris		1	/	
	Stipa scabra	Variable Speargrass	/	-		

<sup>\*</sup> denotes Introduced Species

 <sup>✓</sup> represents the vegetation communities in which species were present.
 A = Open Forest

B = Grassland/Pastureland C = Open Woodland

#### 3.2.5 Threatened Flora Species

Two uncommon species of Eucalypt were identified during the field survey. A review of NPWS *Wildlife* database and *Rare and Threatened Australian Plants* indicate that eleven threatened species could be present in the region. **TABLE** 3.2 lists these species.

TABLE 3.2 FLORA SPECIES		
Flora Name Reasons for Inclusion		
Acacia pubifolia	Wildlife	
Eucalyptus elliptica	Wildlife, ROTAP	
Eucalyptus mckieana	Wildlife	
Eucalyptus nicholii	Wildlife	
Diuris pedunculata	Wildlife	
Thesium australe	Wildlife	
Eucalyptus malacoxylon	ROTAP	
Acianthus amplexicaulis	ROTAP	
Crypostylis hunteriana	ROTAP	
Diuris shaeffiana	ROTAP	
Pterostylis pulchella	ROTAP	
Wildlife – Listed under NPWS Wildlife ROTAP-Based on information from E	Database (10/05/99) Briggs and Leigh 1996, Rare & Threatened Austra	
Plants.		

Following the physical site inspection and an appreciation of the actual habitat of the study area, seven of these species are considered not likely to be in the area.

The remaining four species that could occur or were identified on the subject site are considered in the significance of potential impacts in **Section 7.0**. This is based on published information on habitat preferences and consideration of the current physical status of the study area. These include *Eucalyptus elliptica*, *E. malacoxylon*, *Thesium australe* and *Diuris pedunculata*. It is noted however, that two of these species are not threatened species (ie. *E elliptica*, *E. malacoxylon*).

#### 3.3 FAUNA

Fauna habitat has been impacted at varying levels across the study area by agricultural practices, clearing and earthworks.

Four principal habitat types exist in the study area. These include Creek-lines, Granite Outcrops, Open woodland/ Open forest and Disturbed Pastureland/ Grassland (including road verges).

#### 3.3.1 Habitat Units

#### Creek-lines

Little remnant riparian vegetation exists in the study area. Creek-lines in the study area are mostly well incised drainage courses with sandy beds and areas of active and stabilised bank erosion. The creeks are situated across pastureland and so, much of the natural tree stratum has been removed with Willow species (*Salix* sp.) now establishing on banks and within the creek beds. Terrestrial habitat in this area is sparse due to the level of vegetation removal along the drainage courses. Creek verges are subject to the highest level of grazing in the whole study area. This stock access to the creek-line has resulted in bed degradation and bank slumping.

#### **Granite Outcrops**

The granite outcrops exist mostly on sloping pastureland along the Rose Valley drainage line. These areas typically occur as small islands within the broader areas of open, grazed pastureland. The less accessible areas within these outcrops have dense weed, sedge and fern communities with high levels of litter. The numerous crevices and loose rock material provide moderate to good habitat for smaller terrestrial species, in particular, reptile species.

#### Open woodland/ Open forest

Past and existing land uses have modified the structure and composition of these communities. The open forest community is typically a younger aged forest with scattered hollow bearing trees and ground logs throughout. The open woodland community is more open with a higher proportion of hollow bearing mature aged trees. Ground habitat within the open woodland areas is more limited and availability is influenced by levels of grazing and clearing.

#### Disturbed Pastureland/Grassland (including road verges)

Much of the open pastureland/grassland areas have been subject to grazing practices which have removed a high proportion of the ground cover. Habitat diversity over this area, given the high disturbances, is low. Native species are present within the open pasture areas which have the potential to provide foraging resources for granivorous birds. Taller vegetation exists within the ungrazed road verges. These areas are made up of flora species which are present across grazed pasturelands and grasslands. Roadside disturbances are higher within this habitat, arising from traffic noise, light and movement. A high population of rabbits was observed using the tall road verge vegetation. Fox scats and runs were also found. This species appears to use the under-road pipes for refuge and as a route across the highway.

#### 3.3.2 Fauna Results

The agricultural influence of the study area is reflected by the restricted habitat diversity of the site. Observed fauna was generally low for the study area. More diverse species counts were recorded from the open forest area, with the diversity and total counts greatly reduced across pasturelands.

Bird species were the most frequent fauna observation made with these species reflecting the mosaic composition of the agricultural country and woodland across the study area. All species observed were considered common for the area. Very high populations of Noisy Miner (*Manorina melanocephala*) were observed over the entire study area. Flocks on excess of 100 birds were recorded in isolated trees on grazed agricultural country.

No reptile species were identified however it is likely that common reptilian species would inhabit the numerous granite outcrops, open woodland and forest areas as well as the tall roadside vegetation. The granite outcrop areas would provide good refuge sites, protected from stock related impacts. These areas do however, lack safe connecting habitat.

Trapping indicated that there are low small mammal populations. Mammal habitat is limited over the study area due to lack of connective habitat, high past and existing disturbances, and the restrictive nature of some of the habitat units (eg. individual granite outcrops could be easily impacted on by predator species in a short period of time). Open woodland and forest arboreal habitat is available in the form of hollow bearing trees and stags. Quality habitat would exist further removed from areas of human and agricultural disturbances.

Echolocation recordings were inconclusive due to wet nocturnal conditions during the survey. Widely available bat habitat in the form of hollow bearing trees was observed across the study area. Grassland/pastureland would also provide bat species with potential foraging areas. A general scarcity of large – cavity hollow bearing trees and absences of caves indicates that the site is unlikely to provide wintering chambers or maternal roosts.

A fauna list is provided in **TABLE 3.3**.

	TABLE 3.3 VED FAUNA LIST
	AMPHIBIANS
Scientific Name	Common Name
Crinia signifera Brown Froglet	
	REPTILES
Scientific Name	Common Name
Diplodactylus vittatus	Gecko
	MAMMALS
Scientific Name	Common Name
Tachyglossus aculeatus	Short-beaked Echidna

TABLE 3.3
VED FAUNA LIST
Fox
European Rabbit
BIRDS
Common Name
White-faced Heron
Australian Hobby
Crested Pigeon
Galah
Crimson Rosella
Eastern Rosella
Laughing Kookaburra
Welcome Swallow
Willy Wagtail
Superb Blue
Yellow Thornbill
Noisy Miner
Magpie-lark
Grey Butcherbird
Australian Magpie
Pied Currawong
Australian Raven

#### 3.3.3 Threatened Fauna Species

No fauna species or habitat likely to be of local, regional or state conservation significance was identified during the field survey. A review of the NPWS *Wildlife* database and *Threatened Animal Species of New South Wales* indicated that 45 threatened species could be present in the region. **TABLE 3.4** lists these species.

Following the physical site inspection and based on an appreciation of the actual habitat of the study area, 38 of these species are not likely to occur. These 38 species are listed in **TABLE 3.4** without an asterisk.

# TABLE 3.4 THREATENED FAUNA SPECIES

Fauna Species	Inclusion Reason	
Spagnum Frog	Bioclimatic	
(Philoria shagnicola)	Biociinatic	
Green and Golden Bell Frog	Bioclimatic	
(Litoria aurea)	Diodiffiatio	
Glandular Frog	Bioclimatic	
(Litoria subglandulosa)	Diociiriatic	
Underwoodisaurus *	Bioclimatic	
(Underwoodisaurus sphyrurus)	Biodiffiatio	
Pale-headed Snake	Bioclimatic	
(Hoplocephalus bitorquatus)	Biodifficatio	
Spotted-tailed Quoll	Bioclimatic	
(Dasyurus maculatus)	Biodiffiatio	
Eastern Quoll	Bioclimatic	
(Dasyurus viverrinus)	Diceimatic	
Brush-tailed Phascogale	Bioclimatic	
(Phascogale tapoatafa)	Diceimatic	
Koala *	Bioclimatic	
(Phascolarctos cinereus)	Biociiriatic	
Yellow-bellied Glider	Bioclimatic	
(Petaurus australis)	Biodifficatio	
Squirrel Glider	Bioclimatic	
(Petaurus porfolcensis)	Diocimatic	
Rufous Bettong	Bioclimatic	
(Aepyprymnus rufescens)	Biodifficatio	
Black-striped Wallaby	Bioclimatic	
(Macropus dorsalis)	Biodifficatio	
Bridled Nailtail Wallaby	Bioclimatic	
(Onychogalea fraenata)	Biodiffiatio	
Brush-tailed Rock-wallaby	Bioclimatic	
(Petrogale penicillata)	Biodifficatio	
Yellow-bellied Sheathtail-bat *	Bioclimatic	
(Saccolaimus flaviventris)	Biodifficatio	
Beccari's Freetail-bat	Bioclimatic	
(Mormopterus beccarii)	Dicomination	
Common Bent-wing Bat	Bioclimatic	
(Miniopterus schreibersii)	Biodifficatio	
Large Pied Bat *	Bioclimatic	
(Chalinolobus dwyeri)	Biodifficatio	
Little Pied Bat	Bioclimatic	
(Chalinolobus picatus)	Biodifficatio	
Great Pipistrelle *	Bioclimatic	
(Falsistrellus tasmaniensis)		
Large-footed Mouse-eared Bat	Bioclimatic	
(Myotis adversus)	2100mmatio	
Greater Broad-nosed Bat	Bioclimatic	
(Scoteanax rueppellii)	Biodifficatio	
Eastern Cave Bat	Bioclimatic	
(Vespadelus troughtoni)	Diodiniano .	
Australasian Bittern	Bioclimatic	
(Botaurus poiciloptilus)	Diodiinatio	
Black-necked Stork	Bioclimatic	
(Ephippiorhynchus asiaticus)	Diodiinatic	
Osprey	Bioclimatic	
(Pandion haliaetus)	Diodimatic	

#### **TABLE 3.4**

#### THREATENED FAUNA SPECIES

Fauna Species	Inclusion Reason	
Square-tailed Kite *	Wildlife, Bioclimatic	
(Lophoictinia isura)	vviidine, Biociiriatic	
Black-breasted Buzzard	Bioclimatic	
(Hamirostra melanosternon)	Bioclimatic	
Grey Falcon	Bioclimatic	
(Falco hypoleucos)	Biociiriatic	
Magpie Goose	Bioclimatic	
(Anseranas semipalmata)	Biociimatic	
Freckled Duck	Bioclimatic	
(Stictonetta naevosa)	Biociiriatic	
Blue-billed Duck	Bioclimatic	
(Oxyura australis)	Biociimatic	
Brolga	Bioclimatic	
(Grus rubicundus)	Biociinatic	
Painted Snipe Bioclimatic		
(Rostratula benghalensis)	Biociimatic	
Bush Thick-knee Bioclimatic		
(Burhinus grallarius)	Biociimatic	
Black-tailed Godwit	Bioclimatic	
(Limosa limosa)	Biociimatic	
Glossy Black-Cockatoo Bioclimatic		
(Calyptorhynchus lathami)	Biociiriatic	
Turquoise Parrot *	Bioclimatic	
(Neophema pulchella)	Biociimatic	
Swift Parrot	Bioclimatic	
(Lathamus discolor)	Biociinalic	
Powerful Owl	Bioclimatic	
(Ninox strenua)	Diociinatic	
Sooty Owl	Bioclimatic	
(Tyto tenebricosa)	Biociimatic	
Pink Robin	Bioclimatic	
(Petroica rodinogaster)	DIOCIIIIalic	
Regent Honevester		
(Xanthomyza phrygia)	Bioclimatic	
Painted Honeyeater	Bioclimatic	
(Grantiella picta)	Riocilmatic	

Bioclimatic – Based on bioclimatic information from *Threatened Animal Species of NSW* 1992
Bioclimatic – Based on bioclimatic information *Threatened Species of Western New South Wales*1996

Wildlife - Information sourced from the Atlas of NSW Wildlife from NPWS

#### 3.4 AQUATIC

The creek channel and drainage courses of the study area offer limited habitat and refuge for aquatic species. The creek lines have all been subject to sedimentation, bank slumping, erosion and stock grazing and wallowing.

The creek beds have mostly sandy beds with sporadic areas of raised pebbly banks. Sand banks within the creeks appear to be mobile.

At the time of the survey Rose Valley Creek and Poison Swamp Creek had very slow flows. Water within the creek course meandered along broad areas of the creek bed with large areas of the reed bed supporting pasture species. Evidence of past earthworks within the Rose Valley creek was observed between chainage 37 600.000 and 37 900.000.

These levels of impact have significantly degraded in stream habitat. Evidence of old deep waterholes at the base of in-stream boulders have since been filled with sediment or sand. Little diversity exists in-steam. No significant logs or snags exist within the creek courses. The unstable nature of banks and bed have reduced the occurrence of bank overhangs and deep pools. No intact native riparian vegetation exists. Willows and dense stands of Cumbungi and Common Reed (*Phragmites australis*) have further restricted habitat and system quality.

Species observed within the creek were very limited. The Common Brown Toadlet was identified from calls from several locations (usually with established in stream vegetation). No fish species were identified from dip netting of deeper pools.

It is unlikely that the creeks on the study area provide significant habitat for native fish species except in longer lived, high flow seasons. This is supported by consultation with NSW Fisheries

All areas of the creek courses have been grazed and trampled by stock. Nutrient enrichment and eutrophication has resulted in in-stream algal blooms and weed growth.

The proposed re-alignment on Poison and Dunduckety creeks are both infested with Willow and Blackberry. The unstable nature of the sandy bed has resulted in numerous unstable sand banks and hollows within the creek course. Bank instability was also observed.

The proposed crossing sites (and also the proposed diversion area) were each considered to be between Class 2 and Class 3 habitat quality levels in accordance to the NSW Fisheries classification scheme. (Policy & Guidelines for fish Friendly Roads & Waterway Crossings, NSW Fisheries, 1999) The variance between these classes is largely dependant on flow levels. Class 2 is defined as Moderate Fish Habitat, consisting of ephemeral to semi-permanent waterways with a clearly defined channel with semi-permanent waterways with an ephemeral fish habitat. Class 3 has some potential refuge for breeding or feeding areas for some aquatic fauna species. This class of waterway interconnects wetlands or stream habitat.

It is unlikely that the construction of the new alignment will present constraints in the way of aquatic habitat and the species that use this habitat. Basic guidelines would be followed in the form of maintaining fish passage and protecting the quality of both up and downstream habitat.

No significant aquatic habitat is likely to be directly affected by the proposed alignment. No native riparian vegetation would be significantly impacted by the proposed works.

#### 3.4.1 Threatened Aquatic Species

Consultation with NSW Fisheries, Tamworth and Port Stephens offices, concluded that there were no threatened aquatic species or aquatic species of significance known to exist within the Macdonald River system which incorporates the Dunduckety, Poison Swamp and Rose Valley Creek systems. The Macdonald River, which the Rose Valley Creek flows into, is located approximately 300 metres to the north east of the works (Bendemeer end).

#### 3.5 QEM REPORT REVIEW

#### 3.5.1 Overview

Quality Environmental Management Pty Ltd undertook flora and fauna surveys during April 1995. The flora survey carried out forest mapping, identified species found within the different habitat types and addressed certain conservation issues identified by NPWS. While the timing and duration of the survey was not optimal, the fauna and flora survey primarily focused on the identification of habitat value and addressed threatened species listed by NPWS. The survey was carried out using standard trapping and monitoring methods.

The analysis carried out for the floristic component identified three categories of vegetation cover occurring on the site. These included Woodland, Open Forest and Grassland. Since the QEM survey and report, areas towards the eastern end of the realignment have been thinned resulting in areas which were once open forest now being classified as open woodland. Broad areas which were classified woodland by the QEM report referred to a wide variation in total tree coverage. Areas located to the western end of the study area (across agricultural fields) tended to have a very sparse tree distribution rather than QEM projected woodland composition (10>30% projective foliage cover. Specht et al. 1974).

Based on Terra Sciences field survey results areas mapped as woodland by QEM were considered to be larger than currently exists.

Although no listed Schedule 1 or 2 species were identified as potentially occurring on the study area, several flora species of 'concern' or of 'regional conservation significance' were identified as occurring or having the potential to occur on the study area. On analysis, the QEM conclusions were that;

- For the **several orchid species**; no plants were identified, however suitable habitat was present. The proportion of suitable habitat impacted by the works is negligible compared to similar available orchid habitat in the locality. It was concluded that the conservation significance of these species would not be altered by the works.
- Toadflax (*Thesium australe*); specialist survey was conducted over potential habitat but no plants were identified. The occurrence of this species in the study area was considered 'unlikely'.
- Bendemeer White Gum (*Eucalyptus elliptica*); this species was identified as occurring over many sites of the study area. Regions of the study area were identified as having a significant occurrence of naturally occurring individuals. The study site forms one of 12 core locations of Bendemeer White Gum stands in this species' distribution range. The survey identified that at least 23 mature and 'hundreds' of smaller trees would be lost due to the proposed works.

The QEM report concluded that the 'Open Forest' area was dominated by Bendemeer White Gum and Moonbi Apple Box. The findings of the Terra Sciences survey do not support this. Based on on-site observations the 'Open Woodland' and 'Open Forest' communities are largely dominated by Ribbon Gum (*E. viminalis*).

• Moonbi Apple Box (*E. malacoxylon*); this species was identified as occurring along sites of the study area. The study area forms one of 9 core locations of Moonbi Apple Box stands in this species' distribution range. The survey identified that at least 23 mature trees would be lost due to the proposed works.

The QEM report established mitigation measures to allow for the continued viability of the species of interest occurring in the locality. These measures are considered appropriate and include;

- Minimising tree removal to those absolutely necessary.
- Special consideration into the future management of remaining tree corridors.
- Provision of compensatory habitat by dedication of equivalent areas of land containing both the species of trees with conservation significance.
- Minimising tree removal whilst making use of cut logs and branches to create habitat.
- A replanting operation along the verges of the realignment as well as the abandoned alignment. This revegetation program would include native trees and grasses and involve the replanting of both species of conservation significance.
- Relocation of any larger species of fauna.

The analysis carried out, by QEM, for the fauna component identified five habitats forming the study area. These include; creek-lines, open woodland adjacent to the roadside, cleared farmland, outcropping granite with islands of native vegetation and modified woodland. Species identified occurring in these habitats were considered comon and expected. Predicted impacts on fauna species include habitat destruction and noise generation. Each of these impacts were considered acceptable.

Twenty-five threatened fauna species were addressed based on distribution records. Of these 25, three were considered 'likely' to utilise habitat present over the study area. These species included the Turquoise Parrot, White-striped Mastiff Bat and the Koala. Consideration of these species under the seven part test concluded that no threatened species would be significantly impacted by the proposed works. Terra Sciences concurs with this conclusion.

#### 3.5.2 White-striped Bat

The White-striped Mastiff Bat is not classed as a Schedule 1 or Schedule 2 species on the *Threatened Species Conservation Act*, 1995. It is a common to uncommon species occupying a diverse range of habitats. QEM identifies only minor likely impacts occurring on this species within the Modified Woodland and Open Woodland (sub-optimal habitat). QEM recommended regeneration of compensatory habitat to assist in mitigating any potential impacts to this species. Terra Sciences supports these conclusions. Further, the provision of protected or managed compensatory habitat would assist in the mitigating against longer term degradation of habitat for this and other microchiropteran bat species.

#### 3.5.3 Platypus

The Platypus is not classed as a Schedule 1 or Schedule 2 species on the *Threatened Species Conservation Act*, 1995. It is a common but vulnerable species occupying a diverse range of habitats along the eastern regions of Australia and Tasmania.

The fauna survey undertaken by Ass. Professor David Goldney within the QEM report also assessed the potential impacts on the Platypus downstream of the development within the Macdonald River. Professor Goldney is a specialist in the study of this species. While this species is an important aquatic top carnivore it is not listed on the *Threatened Species Conservation Act*, 1995. Terra Sciences supports Goldney's conclusions that impacts from the proposed works would not impact on this species if appropriate erosion and sediment controls are in place.

#### 3.5.4 Threatened Species

Following investigation of threatened species, by Terra Sciences, which may use the study area, based on bioclimatic information and NPWS Wildlife data searches, 11 flora and 45 fauna species were identified. Of these species the following are considered within the 8 part test of significance within Section 7. These species included Thesium australe. Diuris pedunculata. Phascolarctos Saccolaimus Underwoodisaurus sphyrurus cinereus. flaviventris, Chalinolobus dwyeri, Falsistrellus tasmaniensis, Lophoictinia isura and Neophema pulchella.

Terra Science threatened species lists expanded on the QEM threatened species list in order to up date records from recordings occurring after 1995. Habitat quality observed during the Terra Science survey has differed from the QEM survey due to better conditions than those observed during the 1995 QEM survey.

### Section 4.0

# Conservation Significance

Two flora species of conservation significance were identified on the site:

- Bendemeer White Gum (Eucalyptus elliptica) and
- Moonbi Apple Box (Eucalyptus malacoxylon)

Whilst not listed on the *Threatened Species Conservation Act*, 1995 these species are listed on the *Rare or Threatened Australian Plants* (ROTAP), 1996.

Bendemeer White Gum (*Eucalyptus elliptica*) is listed as 3KC- and the Moonbi Apple Box (*Eucalyptus malacoxylon*) as 3R. A key to the ratings is provided within **TABLE 4.1**.

	TABLE 4.1		
	ROTAP Ratings		
Rating	Explanation		
3	<b>Distribution Category</b> — Geographic range in Australia greater than 100 kilometres.		
К	Conservation Status — Poorly Known: taxon that is suspected, but not definitely know, to belong to another of the categories. These being Presumed Extinct, Endangered, Vulnerable or Rare. At present, accurate field distribution information is inadequate.		
R	Conservation Status — Rare: taxon which is rare in Australia but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.		
С	Conservation Status — Reserved: indicates taxon has at least one population within a national park, other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora. The taxon may or may not be considered adequately conserved within the reserve(s), as reflected by the conservation status assigned to it.		
-	Size Class — reserved population size is not accurately know.		

#### 4.1 BENDEMEER WHITE GUM

This species is a medium tree to 20 metres high. It is similar in appearance to *Eucalyptus viminalis*. It locally frequent but restricted. Occurs in grassy woodland on sandy soils. Distributed within the Nandewar Range and east of Armidale to the Tomalla area.

This species was identified within the study area, with the larger population occurring between chainage 37 000.000 and 37 400.000, within the open forest community.

Communities supporting this species were also identified to the north-east and south-east of the study area. An open forest community dominated by Bendemeer White Gum was identified within the road boundary and continuing back into neighbouring lands approximately one kilometre northeast of the village of Bendemeer, outside of the study area.

#### 4.2 MOONBI APPLE BOX

This species is a small to medium-sized (15m) woodland or forest tree, restricted to the tablelands of New South Wales from north and east of Tamworth, south-eastwards towards Nundle. Similar in appearance to *Eucalyptus bridgesiana* subsp. *bridgesiana*. It is locally frequent but restricted. Occurs in grassy or sclerophyll woodland on sloping sandy soils.

This species was identified within the study area, with the larger population occurring between chainage 37 000.000 and 37 400.000, within the open forest community.

The Moonbi Apple Box has be recorded within the Watson' Creek Nature Reserve which is located approximately 15 kilometres north-west of the study area. This Nature Reserve is located within similar vegetation communities along the same mountain range, Moonbi Range, which passes through the study area. This mountain range continues to the south-east and similar vegetation communities were identified during the field survey.

### Section 5.0

# Physical Impacts

Much of the proposed new highway alignment will occur over areas where moderate to high levels of prior impact have reduced the significance of floristic communities and available habitats.

The proposed creek diversion of the section of Rose Valley Creek (approximately between chainage 37 600.000 and 37 900.000) including the convergence of Dunduckety Creek is unlikely to result in impacts detrimental to native aquatic flora and fauna which potentially use the creek as habitat. No significant habitat or will be impacted on in this proposed creek section. The area to be diverted consists of a heavily disturbed drainage course with no established riparian vegetation communities. Mobile sand bars are present with both the banks and bed containing active erosion. The convergence of the two creeks is in a similar condition with past bank stabilisation structures in place.

The approximate area to be disturbed by the proposed works is 11.5 hectares. Of this, 3.5 hectares will be the removal of the open forest community supporting the two Eucalypt species of interest (between chainage 37 000.000 and 37 400.000). Less than one hectare will be disturbed within the open woodland community and the remainder will be within the grassland/pastureland community.

### Section 6.0

## Mitigation Measures

Mitigation measures for the proposed highway realignment concur with those outlined in the QEM report. A summary of these measures are outlined below.

- Management of trees within the road side corridor through minimising tree removal to those absolutely required for the road realignment and implementing appropriate management guidelines for the corridor.
- Provision of compensatory habitat by dedication of equivalent areas of land containing both of the tree species of conservation significance.
- Re-establishment of compensatory habitat which would include replanting operations along the verges of the realignment as well as the abandoned alignment. This revegetation program would include native trees and grasses.
   Regeneration of compensatory habitat would involve the replanting of both species of conservation significance.
- Minimising tree removal whilst making use of cut logs and branches to create habitat.
- Relocation of any larger reptilian species.

Additional mitigation measures identified by Terra Science would include:

- Restoration and maintenance of creek beds and banks to original or consistent channel characteristics of the immediate crossings.
- Installation of appropriate erosion and sediment control measures during and after construction to minimise sediment transport and siltation.
- The local importance of the open forest to be removed between chainage 37 000.000 and 37 400.000 should be recognised. Any design modification which would move the realignment to the east would reduce disturbance of this open forest and consequently reduce impacts on the species of conservation significance.

### Section 7.0

# Significance of Potential Impacts

#### 7.1 INTRODUCTION

On the basis of the field survey and a review of available data, it is considered that no threatened flora, fauna or aquatic species are likely to by impacted by the proposed works. No threatened species were identified within the study area. Two uncommon Eucalypt species were identified within the open forest area within the study area. While these species are not listed on the *Threatened Species Conservation Act*, 1995 they are listed on the *Rare or Threatened Australian Plants* (ROTAP), 1996. An assessment of significance of impacts has been compiled individually for these two species below.

An assessment of the significance of impacts for other flora and fauna species has been compiled. These assessments are based on the impact on potential habitat by the proposed works, as opposed to impact on individual species. Threatened species which could potentially occur in the region have been included in the assessments below. These are based on bio-climatic considerations, known data records and sightings, and available habitat in the study area and include;

- Thesium australe
- Diuris pedunculata
- Underwoodisaurus (Underwoodisaurus sphyrurus)
- **Koala** (*Phascolarctos cinereus*)
- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)
- Large Pied Bat (Chalinolobus dwyeri)
- Great Pipistrelle (Falsistrellus tasmaniensis)
- Square-tailed Kite (Lophoictinia isura)
- Turquoise Parrot (Neophema pulchella)

#### 7.2 BENDEMEER WHITE GUM (EUCALYPTUS ELLIPTICA)

(a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The open forest containing the main population of Bendemeer White Gum exists between chainage 37 000.000 and 37 400.000. The new highway alignment between these chainage points would involve a clearing and cutting width averaging between 53 and 89 metres. This would effectively remove any island of vegetation between the old and new alignments (approximately 3.5 hectares). The QEM report outlines that approximately 23 mature trees and many juveniles would be removed as a result of the proposed alignment within this open forest area. This number corresponds reasonably with field counts taken during survey. Less than eight isolated individuals of these species would

potentially be removed from areas of 'open woodland' and 'grassland/pastureland'.

The impact of the proposed removal of Bendemeer White Gum trees is unlikely to be classed as 'significant' due to the following considerations.

- The proposed works will remove a low proportion of the existing tree species from the open woodland, leaving the remainder intact and without further intrusion.
- The removal of these trees is unlikely to impact on the viability or endangered status of the species in a local, regional or national context.
- The proposed realignment will not result in the removal of a core population. Other populations of these species exist within a five kilometre radius. (This assists in retaining any genetic variability within localised populations should any single area be destroyed, eg. severe fires).

The potential impact of removing the section of woodland can be ameliorated through the adoption of recommendations contained in this report.

The removal and disturbance of approximately 3.5 hectares from the open forest community will not place the local population at risk of extinction.

Open forest supporting the species further to the west and north of the study area will be retained and not disturbed by the proposed works.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act*, 1995. Bendemeer White Gum (*Eucalyptus elliptica*) is not listed as an endangered population. Therefore, the proposed road works would not significantly compromise the viability of any endangered population.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The proposed works would remove an area of approximately 3.5 hectares of known habitat and cause disturbance to adjacent habitat during construction works.

Distribution data collected from National Parks and Wildlife Service, Greening Australia and sourced from the University of New England Botanical Database indicates that open forest which the species exists is one of more than 15 known sites in which the species exists. As these records are considered as *adhoc* and not a complete spatial record it is highly likely that further populations occur in the region. The proposed works will remove a small proportion of the existing open forest, retaining broader areas of existing habitat. Mitigative measures will ensure protection of nearby similar habitat.

It can be concluded that a significant area of known habitat within the region for this species will not be modified or removed.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat for this species will become isolated due to the proposed road works. The removal of an area of open forest will not isolate any further areas of this community. The open forest proposed to be removed is located on the edge of the open forest community adjoining the existing highway and open pastureland areas.

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act*, 1995, defines critical habitat as habitat declared under Part 3 of the Act. The open forest vegetation community which includes the Bendemeer White Gum is not listed as a endangered ecological community under Part 3 of the Act. Therefore, no critical habitat will be effected.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

Communities supporting this species were identified during the field survey adjacent to the New England highway, located to the north-east and south-east of the study area. An open forest community dominated by Bendemeer White Gum was identified within the road boundary, extending onto neighbouring lands located approximately one kilometre north-east of the village of Bendemeer.

The study area is located on the boundary of two IBRA Region, Nandewar and the New England Tableland. The Nandewar region is comprised of hills on Palaeozoic sediments; lithosols and earths. It is dominated by *Eucalyptus albens* woodlands. The New England Tableland is comprised of elevated plateau of hills and plains on Palaeozoic sediments, granites and basalts. It is dominated by Stringy Bark, Peppermint and Box species. Thackway and

Creswell (1995) have identified this region as being moderately conserved with between one and five percent of the region dedicated to conservation areas.

Conservation areas within the immediate and neighbouring localities of the study area are moderately provided for. Three Nature Reserves and one National Park are located within a 50 kilometre radius of the study area. National Parks and Wildlife Service conservation areas and areas managed under State Forests which occur within a 50 kilometre radius include the following.

Northward of subject site;

Watsons Creek NR <20km
Warrabah NP <50km
Linton NR <50km
Mount Yarrowy Creek NR
<50km
Ironbark NR <70km
The Basin NR <80km
Hattons Corner SF <60km
Hillgrove Creek SF <70km
Armidale SF <70km
Duval SF <70km
Boorolong SF <70km
Mother of Ducks Lagoon
NR <90km
New Valley SF <90km

Southward of subject site;

Buchanan SF < 90km

Walladadah NR <80km Ben Halls Gap SF <80km Hanging Rock SF <70km Nundle SF <70km Tomalla SF <80km Terrible Billy SF <60km Tuggolo SF <80km Riamukka SF <80km Enfield SF <90km

Eastward of subject site

Oxley Wild Rivers NP <80km Winterbourne SF <70km Enmore SF <70km Styx River SF <90km

Westward of subject site
Attunga SF <40km
73039 TR <60km
Somerton SF <70km
Dinawirindi SF <60km
Dowe SF <70km
Kelvin SF <80km
Black Jack SF <90km
Vickery SF <90km

# (g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *Threatened Species Conservation Act*, 1995, defines a threatening process as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Schedule 3 of the *Threatened Species Conservation Act*, 1995 lists *Gambusia holbrooki* (Mosquito Fish) and *Vulpes vulpes* (European Red Fox) as the only two key threatening processes.

The proposed road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of this species.

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

Distribution data for this species indicates, while within a restricted range, the Bendemeer White Gum is not on the limit of its known distribution.

#### 7.3 MOONBI APPLE BOX (EUCALYPTUS MALACOXYLON)

(a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The open forest containing the Moonbi Apple Box exists between chainage 37 000.000 and 37 400.000. The new highway alignment between these chainage points would involve a clearing and cutting width averaging between 53 and 89 metres. This would effectively remove any island of vegetation between the old and new alignments (approximately 3.5 hectares). The QEM report outlines that approximately 23 mature trees of this species would be removed as a result of the proposed alignment within this open forest area. This number corresponds reasonably with field counts taken during survey.

The impact of the proposed removal of Moonbi Apple Box trees is unlikely to be classed as 'significant' due to the following considerations.

- The proposed works will remove a low proportion of the existing tree species from the open woodland, leaving the remainder intact and without further intrusion.
- The removal of these trees is unlikely to impact on the viability or endangered status of the species in a local, regional or national context.
- The proposed realignment will not result in the removal of a core population. Other populations of these species exist within a five kilometre radius. (This assists in retaining any genetic variability within localised populations should any single area be destroyed, eg. severe fires).

The potential impact of removing the section of woodland can be ameliorated through the adoption of recommendations contained in this report.

The removal and disturbance of approximately 3.5 hectares from the open forest community will not place the local population at risk of extinction.

Open forest supporting the species further to the west and north of the study area will be retained and not disturbed by the proposed works.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act*, 1995. Moonbi Apple Box (*Eucalyptus malacoxylon*) is not listed as an endangered population. Therefore, the proposed road works would not significantly compromise the viability of any endangered population.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The proposed works would remove an area of approximately 3.5 hectares of known habitat and cause disturbance to adjacent habitat during construction works.

Distribution data collected from National Parks and Wildlife Service, Greening Australia and sourced from the University of New England Botanical Database indicates that open forest which the species exists is one of 8 known sites in which the species exists. As these records are considered as *adhoc* and not a complete spatial record it is highly likely that further populations occur in the region. The proposed works will remove a small proportion of the existing open forest, retaining broader areas of existing habitat. Mitigative measures will ensure protection of nearby similar habitat.

It can be concluded that a significant area of known habitat within the region for this species will not be modified or removed.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No areas of known habitat for this species will become isolated due to the proposed road works. The removal of an area of open forest will not isolate any further areas of this community. The open forest proposed to be removed is located on the edge of the open forest community adjoining the existing highway and open pastureland areas.

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act*, 1995, defines critical habitat as habitat declared under Part 3 of the Act. The open forest and woodland communities in which the Moonbi Apple Box occur are not listed as endangered ecological communities under Part 3 of the Act. Therefore, no critical habitat will be effected.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The Moonbi Apple Box has be recorded within the Watson' Creek Nature Reserve which is located approximately 15 kilometres north-west of the study area. This Nature Reserve is located within the similar vegetation communities of the Moonbi Range, which passes through the study area.

The study area is located on the boundary of two IBRA Region, Nandewar and the New England Tableland. The Nandewar region is comprised of hills on Palaeozoic sediments; lithosols and earths. It is dominated by *Eucalyptus albens* woodlands. The New England Tableland comprises of elevated plateauu of hills and plains on Palaeozoic sediments, granites and basalt's. It is dominated by Stringy Bark, Peppermint and Box species. Thackway and Creswell (1995) have identified this region as being moderately conserved with between one and five percent of the region dedicated to conservation areas.

Conservation areas within the immediate and neighbouring localities of the study area are moderately provided for. Three Nature Reserves and one National Park are located within a 50 kilometre radius of the study area. National Parks and Wildlife Service conservation areas and areas managed under State Forests which occur within a 50 kilometre radius include the following.

Northward of subject site;

Watsons Creek NR <20km
Warrabah NP <50km
Linton NR <50km
Mount Yarrowy Creek NR
<50km
Ironbark NR <70km
The Basin NR <80km
Hattons Corner SF <60km
Hillgrove Creek SF <70km
Armidale SF <70km
Duval SF <70km
Boorolong SF <70km
Mother of Ducks Lagoon
NR <90km
New Valley SF <90km

Southward of subject site;

Buchanan SF < 90km

Walladadah NR <80km Ben Halls Gap SF <80km Hanging Rock SF <70km Nundle SF <70km Tomalla SF <80km Terrible Billy SF <60km Tuggolo SF <80km Riamukka SF <80km Enfield SF <90km

Eastward of subject site

Oxley Wild Rivers NP <80km Winterbourne SF <70km Enmore SF <70km Styx River SF <90km

Westward of subject site Attunga SF <40km 73039 TR <60km Somerton SF <70km Dinawirindi SF <60km Dowe SF <70km Kelvin SF <80km Black Jack SF <90km Vickery SF <90km (g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *Threatened Species Conservation Act*, 1995, defines a threatening process as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Schedule 3 of the *Threatened Species Conservation Act*, 1995 lists *Gambusia holbrooki* (Mosquito Fish) and *Vulpes vulpes* (European Red Fox) as the only two key threatening processes.

The proposed road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of this species.

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

Distribution data for this species indicates, while within a restricted range, the Moonbi Apple Box is not on the limits of its known distribution.

#### 7.4 THREATENED FLORA SPECIES

The following two flora species have been considered in the eight part test of significance:

- Thesium australe
- Diuris pedunculata
- (a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The site provides some potential habitat in the form of moist grassy areas within the open forest and woodland communities. The majority of the proposed works passes through the pasture/grassland community. Both communities have low ground habitat values due to past disturbances from agricultural and clearing practices. The open forest and woodland communities, whilst providing potential habitat, are better represented within similar structured communities further removed from disturbances associated with the highway, agricultural practices and clearing.

Surveys conducted in liaison with QEM, concluded that it is unlikely that these species would have their conservation status significantly altered by the proposed works due to much larger areas of similar local habitat occurring in the locality. Specialist survey assessed that the occurrence of *Thesium australe and Diuris pedunculata* was 'unlikely'. Terra Sciences concurs with these findings.

Due to disturbances and the availability of better habitat within the region it is highly unlikely that any viable local population of these threatened flora species would be placed at risk of extinction.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act*, 1995. None of these species are not listed as an endangered population. Therefore, the proposed road works would not significantly compromise the viability of any endangered population.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The proposed highway realignment would not modify or remove an area of known habitat which in either a local or regional context, is unique or important for the conservation of these species. No areas of known habitat for these species would be removed or modified as a result of the proposed works.

Floristic habitat across much of the pasture/grassland and woodland communities has been modified through grazing, past clearing and weed domination. Habitat which the listed subject flora species require is commonly associated with less disturbed regions with higher proportions of the native component present. It is unlikely that suitable habitat exists for either of the subject species. In relation to the distribution of the habitat of either of the threatened species, no significant area is likely to be removed or modified.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No area of known habitat would become isolated from currently interconnecting or proximate areas of habitat for these species. The proposed works do not isolate any area of known interconnecting habitat or proximate areas of habitat.

#### (e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act*, 1995, defines critical habitat as habitat declared under Part 3 of the Act. The three communities identified within the study area are not listed as endangered ecological communities under Part 3 of the Act. Therefore, no critical habitat will be effected.

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The study area is located on the boundary of two IBRA Region, Nandewar and the New England Tableland. The Nandewar region is comprised of hills on Palaeozoic sediments; lithosols and earths. It is dominated by *Eucalyptus albens* woodlands. The New England Tableland comprises of elevated plateauu of hills and plains on Palaeozoic sediments, granites and basalt's. It is dominated by Stringy Bark, Peppermint and Box species. Thackway and Creswell (1995) have identified this region as being moderately conserved with between one and five percent of the region dedicated to conservation areas.

Conservation areas within the immediate and neighbouring localities of the study area are moderately provided for. Three Nature Reserves and one National Park are located within a 50 kilometre radius of the study area. National Parks and Wildlife Service conservation areas and areas managed under State Forests which occur within a 50 kilometre radius include the following.

Northward of subject site;

Watsons Creek NR < 20km Warrabah NP < 50km Linton NR <50km Mount Yarrowy Creek NR <50km Ironbark NR <70km The Basin NR < 80km Hattons Corner SF <60km Hillgrove Creek SF <70km Armidale SF < 70km Duval SF < 70km Boorolong SF < 70km Mother of Ducks Lagoon NR < 90km New Valley SF < 90km Buchanan SF < 90km

Southward of subject site;

Walladadah NR <80km Ben Halls Gap SF <80km Hanging Rock SF <70km Nundle SF <70km

Tomalla SF <80km Terrible Billy SF <60km Tuggolo SF <80km Riamukka SF <80km Enfield SF <90km

Eastward of subject site

Oxley Wild Rivers NP <80km Winterbourne SF <70km Enmore SF <70km Styx River SF <90km

Westward of subject site Attunga SF <40km 73039 TR <60km Somerton SF <70km Dinawirindi SF <60km Dowe SF <70km Kelvin SF <80km Black Jack SF <90km Vickery SF <90km

(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *Threatened Species Conservation Act*, 1995, defines a threatening process as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Schedule 3 of the *Threatened Species Conservation Act*, 1995 lists *Gambusia holbrooki* (Mosquito Fish) and *Vulpes vulpes* (European Red Fox) as the only two key threatening processes.

The proposed road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of these species.

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The site is not on the limit of any of the threatened flora species' known distribution.

#### 7.5 THREATENED FAUNA SPECIES

The following 7 fauna species have been considered in the eight part test of significance:

- Underwoodisaurus (Underwoodisaurus sphyrurus)
- **Koala** (*Phascolarctos cinereus*)
- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris)
- Large Pied Bat (Chalinolobus dwyeri)
- **Great Pipistrelle** (Falsistrellus tasmaniensis)
- Square-tailed Kite (Lophoictinia isura)
- Turquoise Parrot (Neophema pulchella)
- (a) In the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

#### Underwoodisaurus sphyrurus

This species was included in the 8 Part Test due to the presence of exfoliating rocky out crops and deep litter in woodland areas on the study area.

High level impacts limits this species' habitat range, lowering habitat quality and isolating potential refuge areas. Better quality habitat exists away from the subject site in areas of rocky-outcrops in ungrazed woodland and forest.

#### Koala, Phascolarctos cinereus

The koala is relatively widespread across eastern and central NSW. It inhabits open forest and woodland where-ever suitable food trees are available. Potential food trees vary from region to region with known foraging trees occurring in the locality. Listed trees for the area include White Box (*Eucalyptus albens*), Scribbly gum (*E. signata*) and Grey Gum (*E. punctata*). The species is dependant on good tree coverage allowing for shelter and adequate foraging.

Threats to the species in general include clearing, predation, road kills and other accidental deaths related to populated areas.

The open forest and woodland which occurs on the site has a strata component of approximately >50% of listed feed tree species. This, along with the listed local government area makes the site potential koala habitat. However the proposed works are not likely to isolate or remove a significant area of potential feed trees (*Eucalyptus viminalis*) for the open forest or woodland. The connectivity of the open forest has been fragmented further to the west by agricultural clearing practices, utility servicing corridors and access trails.

The closest koala sightings to the site include;

- 1967, 16km east within the Tara Mountain locality.
- 1967, 38km south-east south of the township of Uralla.

Components similar to the woodland structures in these localities is expected on the study area, however there no known records or recollections of koalas occurring within the area of the site. No evidence of their scats, markings or calls were recorded. While it is possible that koalas could and may use forests in the locality, the areas surveyed indicate that there is no population existing on the site.

There is no record of breeding females or evidence of a resident population in the study area. It is unlikely that a population could exist within the locality without past knowledge or detection. The area cannot be defined as core koala habitat.

The proposed works would not impact on the connectivity of surrounding forest, nor would it have the likelihood of isolating any area of potential koala habitat.

Bat Species, Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris), Large Pied Bat (Chalinolobus dwyeri) & Great Pipistrelle (Falsistrellus tasmaniensis)

These species have been included in the 8 Part Test presence of potential habitat in the form of hollow bearing trees and stags in open woodland and open forest communities. Potential foraging sites exist across the study area.

The study site however, forms a very small proportion of total available habitat for these bat species. More mature aged forest and woodland areas exist away from the study site in the locality.

#### Square-tailed Kite Lophoictinia isura

This species was included in the 8 Part Test due to a recording listed on the NPWS Wildlife database located on the western edge of Bendemeer. The species is a predator of open forest, woodland, scrubs and heathland.

High levels of human disturbances lower the potential of the subject site for breeding or refuge. The study area would comprise a very small proportion of any potential individuals' home range (greater than 100 km²). Better quality open woodland habitat with lower human associated disturbances exist within the locality.

#### Turquoise Parrot, Neophema pulchella

This species occurs at the interface between eucalypt woodlands and grasslands or heaths. It prefers sheltered valleys among rocky hills. The species is widely distributed over the eastern part of the state. It nests low in hollows within fence posts, dead trees or logs.

The species takes to the ground to feed on seeds from native and exotic grasses, forbs and herbs. Partly nomadic, and requires daily access to water. Usually seen in pairs or small flocks, particularly in feeding areas. Competition for food from domestic stock, especially during drought conditions threatens the species.

The site provides potential breeding and foraging habitat for the species. The tall eucalypts within the open forest, open woodland and grassland/pastureland have the potential to provide this species with opportunities for nesting hollows and ground feeding. Habitat is likely to be limited by competitive hollow using species and predators. Habitat resources favoured by this species would not, however, be impacted by the development.

The site provides potential habitat within the open forest and woodland communities. The majority of the proposed works passes through the pasture/grassland community. This community has low habitat value due to past disturbances from agricultural and clearing practices. The open forest and woodland communities, whilst providing potential habitat, are better represented within similar structured communities further removed from disturbances associated with the highway, agricultural practices and clearing.

Due to these disturbances and the availability of better habitat within the region it is highly unlikely that any viable local population of threatened fauna species would be placed at risk of extinction.

(b) In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act*. 1995. None of these species are not listed as an endangered population. Therefore, the proposed road works would not significantly compromise the viability of any endangered population.

(c) In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The proposed highway realignment would not modify or remove an area of known habitat which in either a local or regional context, is unique or important for the conservation of these species. No areas of known habitat for these species would be removed or modified as a result of the proposed works.

The fauna habitat of the study area is modified with low to moderate diversity. No unique features exist within the study area which are unlikely to occur elsewhere in the region.

(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

No area of known habitat would become isolated from currently interconnecting or proximate areas of habitat for these species. The proposed works do not isolate any area of known interconnecting habitat or proximate areas of habitat.

The proposed alignment would impact mainly on areas of the already disturbed pasture/grassland community. Creek crossings provide low habitat potential due to infestation by Willow and Blackberry species. Woodland areas provide low habitat potential due to the existing disturbances from grazing and the highway.

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act*, 1995, defines critical habitat as habitat declared under Part 3 of the Act. No critical habitat will be affected

(f) Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

The study area is located on the boundary of two IBRA Region, Nandewar and the New England Tableland. The Nandewar region is comprised of hills on Palaeozoic sediments; lithosols and earths. It is dominated by *Eucalyptus albens* woodlands. The New England Tableland comprises of elevated plateau of hills and plains on Palaeozoic sediments, granites and basalt's. It is dominated by Stringy Bark, Peppermint and Box species. Thackway and Creswell (1995) have identified this region as being moderately conserved with between one and five percent of the region dedicated to conservation areas.

Conservation areas within the immediate and neighbouring localities of the study area are moderately provided for. Three Nature Reserves and one National Park are located within a 50 kilometre radius of the study area. National Parks and Wildlife Service conservation areas and areas managed under State Forests which occur within a 50 kilometre radius include the following.

Northward of subject site;

Watsons Creek NR < 20km Warrabah NP < 50km Linton NR < 50km Mount Yarrowy Creek NR <50km Ironbark NR <70km The Basin NR < 80km Hattons Corner SF <60km Hillgrove Creek SF < 70km Armidale SF < 70km Duval SF < 70km Boorolong SF < 70km Mother of Ducks Lagoon NR <90km New Valley SF < 90km Buchanan SF < 90km

Southward of subject site;

Walladadah NR <80km Ben Halls Gap SF <80km Hanging Rock SF <70km Nundle SF <70km

Tomalla SF <80km Terrible Billy SF <60km Tuggolo SF <80km Riamukka SF <80km Enfield SF <90km

Eastward of subject site

Oxley Wild Rivers NP <80km Winterbourne SF <70km Enmore SF <70km Styx River SF <90km Dinawirindi SF <60km Dowe SF <70km Kelvin SF <80km Black Jack SF <90km Vickery SF <90km

Westward of subject site Attunga SF <40km 73039 TR <60km Somerton SF <70km

(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

The *Threatened Species Conservation Act*, 1995, defines a threatening process as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Schedule 3 of the *Threatened Species Conservation Act*, 1995 lists *Gambusia holbrooki* (Mosquito Fish) and *Vulpes vulpes* (European Red Fox) as the only two key threatening processes.

The proposed road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of these species.

(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.

The site is not on the limits of any of the threatened fauna species' known distribution.

# Section 8.0

# Conclusion

This ecological assessment concludes that the removal of vegetation associated with the proposed New England Highway realignment at Rose Valley Creek, in accordance with mitigation measures, is unlikely to result in a significant effect on threatened species, populations or ecological communities, or their habitats.

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**Colour Plates** 

PLATE 1 Facing north east at CL37900.000. Photo shows open woodland, grassland and pastureland.

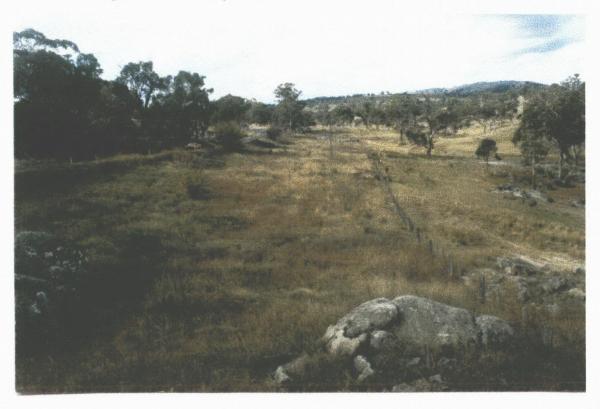


PLATE 2 Facing west at CL 37250.000. Open woodland community. Note scarcity of lower storey components.





PLATE 3 Facing South at CL 37000.000. View from edge of existing cutting along proposed alignment (across Poison Swamp Creek)

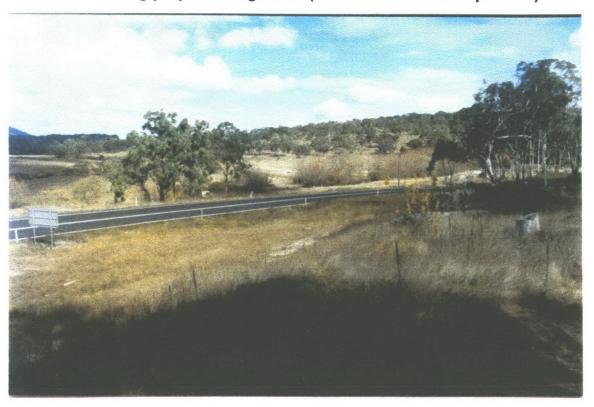


PLATE 4 Facing upstream of Rose Valley Creek to proposed diversion area.





#### ROSE VALLEY CREEK REALIGNMENT ADDENDUM

The following addendum has been prepared in response to Environment Australia's (EA) comments on the Ecological Assessment Report for Rose Valley Highway Realignment, Terra Sciences (dated 1<sup>st</sup> November 1999).

The ecological assessment for the realignment of the New England Highway at Rose Valley was carried out in accordance with the planning and assessment obligations of the *Environmental Planning and Assessment Act*, 1979. Due to the project becoming federally funded, amendments pursuant to the Commonwealth's *Endangered Species Protection Act* 1992 (ESP Act) must be considered.

The Endangered Species Protection Act, 1992 (ESP Act) obliges the Chief Executive Officer of Biodiversity Group, Environment Australia to prepare inventories that identify and indicate the abundance of listed native species and ecological communities present on commonwealth land. The ESP Act reflects similar objectives and issues as those raised within the Threatened Species Conservation Act, 1995 (TSC Act). This TSC Act has been accounted for within the original Ecological Assessment. Due to variations within the species listed between the two Acts the additional species (Table 1) are considered. The Biodiversity Group identified these additional species, on the grounds that they could potentially occur on the study area.

	TABLE 1				
Additional Species Considered					
SPECIES	COMMON NAME	ESP ACT STATUS			
Eucalyptus mckieana	McKie's Stringybark	Vulnerable			
Diuris pedunculata	Small Snake Orchid	Endangered			
Thesium australe	Austral Toadflax	Vulnerable			
Cryptostylis hunteriana	Leafless Tongue Orchid	Vulnerable			
Diuris tricolor {sheaffiana}	Orchid Species	Vulnerable			
Pterostylis pulchella	Orchid Species	Vulnerable			
Lathamus discolor	Swift Parrot	Endangered			
Xanthomyza phrygia	Regent Honeyeater	Endangered			
Litoria aurea	Green and Golden Bell Frog	Vulnerable			
Underwoodisaurus sphyrurus	Boarder Thick-tailed Gecko	Vulnerable			
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable			
Onychogalea fraenata	Bridled Nailtail Wallaby	Endangered			
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable			

#### Eucalyptus mckieana (McKie's Stringybark)

A small to medium sized tree distributed from Tingha to Bendemeer. This species has been recorded with dry sclerophyll forest or woodland on poor sandy loam on acid granite.

The species has been historically recorded from gently sloping alluvial flats associated with the MacDonald River. The nearest listed sites for this species (NPWS Wildlife recordings 1999) are 15 and 30 kilometres respectively, north of the study area. Other recordings of this species have been made from 9.3 km NW of Tingha, R.D.Johnston & G.M.Chippendale and 11-13 km W of Wandsworth. While this species is known to be locally abundant, botanical records and collection data indicate that its occurrence is likely to be limited.

No botanical records for this species have been recorded from the site. It is unlikely that the species would have been previously undetected while the threatened species E. elliptica and E. malacoxylon are known within the area.

E. mckieana was not identified as occurring within the study area during the Terra Sciences (June 1999) survey or the QEM survey (April 1995).

#### Diuris pedunculata (Small Snake Orchid)

This is an orchid species that has been recorded growing in moist grassy areas in sclerophyll forest; chiefly from Port Jackson to Tenterfield. The only recording for the region (NPWS Wildlife 1999) was 18 kilometres to the north east of the study area, made in 1986. The result of the eight part test carried out for this species by Terra Sciences in the ecological Assessment (June 1999) concludes that the proposed works would not have a significant impact on this species.

#### Thesium austral (Austral Toadflax)

This species is an erect perennial herb to 40cm high. It is recorded growing in grassland or woodland, often in damp sites; widespread but rare.

The only recording for this species for the region was in 1912, taken near Sugar Loaf Hill on the Oxley Highway approximately 30 kilometres east of the study area. The conclusion of the eight part test carried out for this species by Terra Sciences in the ecological Assessment (June 1999) concludes that the proposed works would not have a significant impact on this species.

As outlined in the QEM report the 'specialist survey' was carried out by Catherine Nano a member of the Armidale National Parks and Wildlife Service on 10/4/95. A team from the NPWS Armidale Office undertook the survey. Consultation with NPWS northern

zone (Coffs Harbour) establishes that Catherine Nano compiled no report for *Thesium australe*. Consultation with Armidale National Parks and Wildlife Service established that Catherine Nano no longer works with that office.

All information regarding this issue outlined in the QEM report is as following.

*Toadflax (Thesium australe)* 

The Armidale district office of the NPWS was also consulted on the distribution of Thesium australe. This is a 'vulnerable' (3Vci) plant species distributed from Southern Queensland to the Coast and tablelands of NSW, Victoria and Tasmania.

A Species Recovery Plan (1992) for Thesium australe has been prepared by NPWS (Griffith 1992). This plan identifies 30 sites in NSW where there are known populations. Twelve of these sites are on the Northern Tablelands of NSW. The nearest of these sites to Rose Valley is to the north of the study area at Walcha. Although there have not been any recordings of this plant species within Rose Valley, the study area was considered to be potential habitat on the basis of habitat characteristics of sites where it has been found. The characteristics of known or recorded Thesium australe habitat are:

- roadside edges
- open woodland which has been affected by medium to low disturbance
- associated (parasitic) with Themeda australis (a species identified within all three sites)
- relatively fertile soils (which area present on the alluvial plain)

As a result of liaison with QEM, the study area was surveyed by Catherine Nano (10/4/95), who is a member of the Armidale NPWS Thesium australe survey team. Over a 2.5 hour period, the length of the proposed realignment was walked, with particular attention paid to likely habitat sites. No individuals of Thesium australe were found and its occurrence was suggested by Ms Nano to be "unlikely".

#### Cryptostylis hunteriana (Leafless Tongue Orchid)

This species is a sapropytic terrestrial herb that is known from swamp-heaths on sandy soils, chiefly in coastal districts, south from Gibraltar Range. None of this known habitat exists on the study area or is known to occur within the locality.

No recording for this species were listed under the NPWS Wildlife database for the Bendemeer mapsheet, 1:100000

#### Diuris tricolor {sheaffiana} (Orchid Species)

Known habitat for this orchid species includes sclerophyll forest amongst grass, often with *Callitris*. While grassy forested communities were present in the study area these communities have been subject to grazing impacts resulting in an understorey comprised of more common and robust species. *Callitris* communities were not present on the study area. The likelihood of this species occurring is negligible due to the absence of preferred habitat and the level and history of grazing practices across the forested areas of the study area.

No recording for this species were listed under the NPWS Wildlife database for the Bendemeer mapsheet, 1:100000

#### Pterostylis pulchella (Orchid Species)

This orchid species has been recorded from escarpments close to waterfalls and on moist, sheltered ridges, chiefly from Blue Mountains to Fitzoy Falls. None of this known or preferred habitat exists on the study area or is known within the locality. This species is unlikely to occur on the study area.

No recording for this species were listed under the NPWS Wildlife database for the Bendemeer mapsheet, 1:100000

#### **QEM** orchid conclusion

During verbal liaison with QEM, Paul Davies, a Ranger in the Armidale NPWS office elaborated on the "several species of orchids" which have the potential to occur on the site. Based on the occurrence of species at comparable habitats in the northern tablelands, Mr Davis believed the following species to be potential occupants of the site:

Acianthus amplexicaulis Cryptostylis hunteriana Diuris sheaffiana Pterostylis longicurva Diuris pendunculata Adenochilus nortonii Eriochilus autumnalis Dipodium ensifolium Dipodium hamiltonianum Dendrobium tenuissimum

As a result of his liaison with QEM, Paul Davies conducted a brief inspection of the study area on 9 March 1995, but was unable to locate any species of orchid. The QEM survey undertaken for this assessment also failed to locate any species of orchids. The presence of terrestrial orchid species cannot be ruled out on the basis of these surveys because the seasonal conditions were not optimum for identifying flower and vegetative parts.

However, the area of land to be affected by the proposed road realignment works is tiny relative to similar local orchid habitat. Therefore, it is considered unlikely that any orchids disturbed by the works would have their conservation status significance altered.

#### Lathamus discolor (Swift Parrot)

The Swift Parrot breeds in Tasmania and nearby islands. The species migrates to southeast mainland Australia during late summer and return to Tasmania to breed in Spring. In Australia they occur within many habitat types, depending upon where there are suitable flowering blossoms. Principal foods are eucalypt nectar and pollen. The species are highly mobile and move with respect to food availability.

The major threat to the species is clearing of potential food trees. This makes it highly unlikely that the proposal would have a significant impact on this species as the development does not interfere with the availability of foraging trees or the connectivity of neighbouring woodland.

No recording for this species were listed under the NPWS Wildlife database for the Bendemeer mapsheet, 1:100000.

#### Xanthomyza phrygia (Regent Honeyeater)

This species uses a wide variety of habitat types, dependant on food availability. Open forests, woodlands (often well shrubbed), timbered watercourses, coastal heaths and banksia scrubs. Also mallee areas, stands of timber along roadsides, shelter-belts and trees in gardens are occasionally used. The species stronghold is Hunter Valley through SE NSW to central Victoria. Occurs inland to Inverell, Pilliga Nature Reserve, Warrumbungle NP, Wellington, Cowra, Holbrook and Finley.

This species forages from a few 'key' Eucalypt species including Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Yellow Box (*E. melliodora*), Yellow Gum (*E. leucoxylon*) and Blakely's Red Gum (*E. blakelyi*). This species is attracted to stands of these trees where nectar production is plentiful and predicable. Known preferred habitat also possesses a taller shrub layer.

Given that the study area does not comprise of any favoured or preferred key foraging Eucalypt communities it is unlikely that this species would inhabit the site apart from opportunistic foraging visitations. Connective habitat in the form of open woodland and forests are common throughout the area (eg vegetation communities associated with the Moonbi Range). The extent of habitat made unsuitable by disturbances from the proposal is limited to the removal of approximately 3.5 hectares of woodland.

Four birds were recorded in 1994 approximately 45 kilometres to the north east of the study area within hilly open woodland.

#### Litoria aurea (Green and Golden Bell Frog)

A large, mainly aquatic species found among vegetation within or at the edges of permanent water (streams, swamps, marshes, lagoons, dams and ornamental ponds). Often found under debris on low, frequently flooded river flats.

A study by Pyke and White (1996) indicates that the ideal location likely to support this species is one with a still, shallow, ephemeral, unpolluted water body. Vegetation would include a grassy area nearby and aquatic plants (preferably Bulrushes, *Typha* sp.). The water body should be un-shaded and free of Mosquito Fish and other predatory fish. Substrate should be sand or rock and a range of possible diurnal shelter sites should be available, including vegetation and rocks.

Threats to this species include habitat destruction, alterations to drainage patterns, drought, disease, climate change, pesticides, salination and herbicides.

The occurrence of this species is considered unlikely due to the absence of suitable aquatic habitat. Aquatic habitat on the site had been subjected to sedimentation, bank slumping, erosion and stock grazing and wallowing. Aquatic habitat had also been reduced by infestations of Blackberry (*Rubus ulmifolius*), White Willow (*Salix alba*) and Weeping Willow (*Salix babylonica*).

#### Underwoodisaurus sphyrurus (Boarder Thick-tailed Gecko)

This species occurs at low densities and is difficult to detect in a 'snap shot survey' therefore known habitat records are generally used to determine the likelihood of occurrence for this species.

This species is confined to the northern granite belt of New England, which is closely associated with exfoliating rocky outcrops and stony hills in eucalypt woodland. This species has been recorded from shelters beneath slabs of granite resting on soil, and in burrows. It is distributed from New England tablelands and Stanthorpe district in southern QLD, occurs west to about Moree.

Granite boulders within the study area were not exfoliating in nature and tended to occur as large solid rock masses. The granite outcrops occurring in the study area were present in the grassland/pastureland vegetation community supporting a very scattered, open stand of eucalypt species. These outcrops tended to be isolated islands surrounded by open grazed pasture areas. The history of habitat impact by grazing stock is also likely to reduce the potential of these areas to provide suitable refuge and foraging for the species. No granite outcrops were present within the open forest study area. Preferred habitat of rock exfoliations on soil in eucalypt woodland and stony wooded hillsides are not present. Preferred habitat does not exist for this gecko species amongst the outcrops of the study area.

Two recordings from the NPWS Wildlife database have been made for this species. One in 1989, occurring 6 kilometres south on steeply undulating country associated with Moonbi lookout. Secondly in 1994, the species was recorded on hilly woodland near 'Shanty Woodland' occurring 10 kilometres to north east of the study.

The reptile survey of the site included the following:

- Turning and replacing of rocks.
- Examining of rock crevices.
- Examining exfoliations.
- Rolling logs and other ground cover.
- Lifting decortication bark and tree debri were present.
- Scanning stumps, branches and tree trunks.
- Closely expecting clearings, such as dusty tracks and exposed boulders for active and inactive specimens as well as those thermo-regulating or feeding.
- Surveying for tracks and other traces.

The remains of lizards and snakes were also checked under any feeding roosts of raptor species. Special consideration was given to more general reptile habitat such as rocky outcrops and boulder areas.

#### Dasyurus maculatus (Spotted-tailed Quoll)

This species has been recorded from a wide range of habitats, including rainforest, open woodland, coastal heathland and inland riparian forest. It is probably extinct in SA and uncommon to rare in Vic, NSW and southern Qld. Its distribution is now disjunct over much of its present range.

It is an efficient predator, taking prey ranging from small wallabies to insects. Loss of habitat through land clearing for agriculture and forestry, poisoning and trapping are also implicated in the decline.

This species is unlikely to occur within the woodland areas on the study area due to the high level of disturbances associated with traffic, human presence and agricultural practices. While potential habitat for the species may exist in more remote and intact habitat (eg forested hills and valleys associated with the Moonbi range) it is unlikely that the open and exposed nature of the woodland areas of the study site would provide preferable habitat for this species.

#### Onychogalea fraenata (Bridled Nailtail Wallaby)

This species is presently only known from near Dingo, in the central-eastern Queensland brigalow belt. It is considered extinct under the *Threatened Species Conservation Act 1995*, however, listed as Endangered by the *Endangered Species Protection Act 1992*. Habitat included semi-arid inland areas from slopes and plains west of the great Dividing

Range. Preferred habitat is a mixture of shrubland, savannah scrubland and grassy woodland. The remaining population in Queensland inhabits an area of eucalypt forest/woodland and Brigalow scrub.

Known habitat of shrubland is absent from the study area. Further, the history of grazing and surrounding land use, proximity to the road and associated human disturbances as well as the likely impact from introduced competitive and predator species makes the occurrence of this species highly unlikely. Historical recordings for his species places the last known sighting near Manilla (NSW) near the Namoi River in 1924.

#### Petrogale penicillata (Brush-tailed Rock-wallaby)

This species is found on suitable rocky areas in a wide variety of habitats, including rainforest gullies, wet dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country.

It has declined west of the watershed of the Great Divide where sheep grazing is the major land use. Introduces predators (fox) and competition from introduced herbivores (rabbit and goat) have been widely suggested as precipitating its decline.

Rock slopes and cliff lines that provide this species with protection from predators are absent from the site. Dense shrub areas that may also provide refuge are not present. Further, the history of grazing and surrounding land use, proximity to the road and associated human disturbances as well as the likely impact from introduced competitive and predator species makes the occurrence of this species highly unlikely. It is unlikely that the detection of this species occurring of this species on the study area would have gone un-noticed.

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# Appendix D

Noise Assessment

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# NOISE IMPACT ASSESSMENT NEW ENGLAND HIGHWAY ROSE VALLEY TAMWORTH

29.4925.R1:GA112 Rev 00

Prepared for: Roads & Traffic Authority

Level 3, 52 Rothschild Avenue

**ROSEBERY NSW 2018** 

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May 1999

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APPENDIX 1: STUDY AREA

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APPENDIX 3: EXISTING AMBIENT TRAFFIC NOISE LEVELS.

#### 1.0 INTRODUCTION

The Road and Traffic Authority propose to realign and upgrade State Highway N9 between Rose Valley Creek and McDonald River, north of Tamworth (Appendix 1). A preliminary assessment of the proposal has identified that the road works could result in rural/residential properties being affected by road traffic noise and construction noise and vibration impacts.

Atkins Acoustics was commissioned by the Roads and Traffic Authority to undertake a noise and vibration impact assessment of the proposal. The main aims of the assessment, were;

- to measure the existing ambient noise levels in the study area;
- □ to predict the likely changes to the existing noise levels;
- to predict the post construction traffic noise levels for the years 1999, 2000 and 2010,
- to assess the predicted noise levels in accordance with goals referenced in the
   NSW Draft Government Environmental Criteria for Road Traffic Noise;
- where the predicted traffic noise levels exceed the recommended assessment goals, consider and recommend noise control options to satisfy the assessment goals;
- to predict and assess potential noise and vibration impacts from the envisaged construction activities; and
- up to report on the results and findings of the assessment.

The information presented in this report has been prepared for the investigation described herein, and should not be used in any other context or for any other purpose.

#### 2.0 OVERVIEW

The findings and recommendation presented in this report are based on site inspections, field measurements, traffic data provided by the Roads and Traffic Authority (RTA), and predictions of the future traffic noise levels.

#### 2.1 Description of the Proposed Road Works

The proposed road works (Appendix 2) essentially comprise the realignment and reconstruction of the existing highway. The vertical and horizontal load alignment of the existing road will be altered to achieve desirable grades and curves, producing cuttings up to thirteen (13) metres in depth and fills up to six (6) metres high.

The main features of the proposal are the removal of existing bends, the construction of a northbound overtaking lane between chainage 37400 and 38300, and the resurfacing of the road with dense graded asphaltic concrete.

#### 2.2 Reference Assessment Locations

Four (4) reference residential properties in the study area have been identified as being potentially affected by road traffic noise. These locations are identified at chainage 36150, 38700 and 40000 (Appendix 2).

#### 2.3 Existing Noise Level Measurements

To confirm the range of noise levels prevailing in the area, unmanned noise measurements were conducted at the residential dwelling located at chainage 38700. The measurements were conducted over a continuous seven (7) day period commencing Wednesday 19 May '99.

The measurement location was located at a distance of approximately two (2) metres from the residential building facade facing the highway and approximately thirty five (35) metres from the existing road alignment.

#### 2.4 Instrumentation

The instrumentation selected for the noise measurements was comprised of a Tonin Technology, Environmental Noise Data Logger. The noise data logger was installed with the meter set to A-weighting, fast response, and a fifteen (15) minute sampling period.

The instrument reference level was checked prior to and after the measurements with a NATA Calibrated (Certificate No 1766), Sound Level Calibrator Type 4230, Serial No. 597264, and remained within  $\pm$  0.5dB(A).

#### 2.5 Traffic Noise Descriptors

The traffic noise levels presented in the report are assessed as A-weighted energy equivalent continuous (constant) sound levels. From the energy equivalent sound levels, the  $L_{Aeq,15hour}$  (the energy equivalent fifteen (15) hour level for the period 7.00am to 10.00pm), and the  $L_{Aeq,9hour}$  (the equivalent level for the period 10.00pm to 7.00am) levels have been determined.

#### 2.6 Road Traffic Noise Predictions

The traffic noise predictions presented in the report are based on the UK Department of Transport (1988), "The Calculation of Road Traffic Noise" (CORTN) traffic noise model. The CORTN model considers vehicle numbers, vehicle speed, percentage of heavy vehicles, the road alignment and the road surface. In addition the noise modelling has considered distance attenuation, screening effects from topographical features, the height of the noise source above the finished road level and the height of the noise receiver.

#### 3.0 ASSESSMENT OF STUDY CORRIDOR

#### 3.1 Preamble

The location and extent of the study corridor considered in this assessment is shown in Appendices 1 and 2.

#### 3.2 Description of Existing Road

The distance along the section of highway to be realigned and upgraded is approximately 3.6km.

The present road surface is worn chip sealed bitumen, and is sign posted with road speed of 100kph.

The '95 annual average daily traffic volumes (AADT) recorded for this section of the highway (count station 92034) was 5138. For the purpose of the noise assessment a projected traffic growth rate of 4.9% has been assumed. From the projected traffic growth rate, the daily projected traffic volumes of 6221 for the year 1999, 6526 for the year 2000, and 10529 for the year 2010 were determined.

Traffic counts conducted near Armidale have shown that the daily highway traffic composition consists of approximately 16% heavy vehicles. The estimated night-time heavy vehicle content was 65%. The noise assessment has assumed that the existing heavy vehicle percentages will not change significantly.

#### 3.3 Existing Traffic Noise Levels

The acoustic environment in the study area was found to be typical of a semi-rural environment exposed to highway road traffic noise. That is, the noise levels being controlled by road traffic and vary in level as a result of traffic volumes and the distance from the road, local domestic and natural elements (wind, etc).

#### 3.3.1 Measurement Results

The pre-construction noise levels measurement results for the reference residential property (M1) are presented in Appendix 3.

From the noise monitoring results, Table 1 presents a summary of the existing  $L_{Aeq,15hour}$  and  $L_{Aeq,9hour}$ , noise levels.

Table 1: Existing Ambient Noise Levels dB(A) re 20 x 10<sup>-6</sup> Pa

Date	Sound Pressure Levels dB(A) re: 20x10 <sup>-6</sup> Pa			
	LAeq,15 hour	LAeq,9 hour		
Location M1:				
Wednesday 19 May	-	60.4		
Thursday 20 May	59.7	60.8		
Friday 21 May	611	59.2		
Saturday 22 May	60.9	53.7		
Sunday 23 May	59.6	56.5		
Monday 24 May	61.1	60.5		
Tuesday 25 May	60.9	60.0		

From the measurement results in Table 1, the daily noise levels were averaged to yield the averaged  $L_{Aeq, 15 \text{ hours}}$  and  $L_{Aeq, 9 \text{ hours}}$  levels. Table 2 presents a summary of the seven (7) day averaged noise levels for location M1 and the estimated traffic noise levels for locations M2, M3 and M4.

Table 2: Pre-Construction '99 Ambient Noise Levels

Reference Location	Sound Pressure Levels dB(A) re: 10 <sup>-6</sup> Pa.		
	LAeg,15hr	LAeq,9hr	
M1	60.5	58.7	
M2	54.5*	52.7*	
M3	58.5*	56.7*	
M4	58.5*	56.7*	

<sup>\*</sup> Estimated Noise Levels

#### 4.0 TRAFFIC NOISE ASSESSMENT GOALS

The NSW, EPA, Draft Environment Criteria for Road Traffic Noise (ECRTN) recommends procedures for the assessing road traffic noise. In presenting these goals, it is recognised that there will be situations where planning strategies are not feasible and solutions to mitigate traffic noise are not always practical.

#### 4.1 Overview

For the redevelopment of existing highway/freeways/arterial roads, the Draft ECRTN recommend base line traffic noise goals for residential properties of  $L_{Aeq,15\ hour}$  60dB(A) and  $L_{Aeq,9\ hour}$  55dB(A).

Where the existing noise levels exceed the base line goals, it is recommended that the traffic noise resulting from the proposal should not increase the existing levels by more than 2dB(A), and that noise control options be considered to reduce the traffic noise to the base line goals where practical.

For the assessment of road traffic noise at residential dwellings, the noise is assessed at the building facade which is most exposed to the traffic noise and a height one point five (1.5) metres above the floor level.

For evaluating the traffic noise for the Rose Valley proposal, the assessment has considered the predicted noise levels for the years 1999, 2000 and 2010.

#### 4.2 Recommended Project Assessment Goals

From the procedures and recommendations of the EPA, Draft Environment Criteria for Road Traffic Noise (ECRTN) Table 3 presents a summary of the existing noise levels and the assessment goals recommended for the Rose Valley project.

Table 3: Traffic Noise Assessment Goals

Reference Location	Sound Pressure Levels dB(A) re: 10 <sup>-6</sup> Pa.								
	Pre Construction 1999		Baseline Assessment Goals		Project Assessment Goals				
	LAeq,15hr	$L_{Aeq,9hr}$	LAeg,15hr	LAeq,9hr	LAeq,15hr	LAeg,9hr			
M1	60.5	58.7	60	55	62.5	60.7			
M2	54.5*	52.7*	60	55	60.0	55.0			
M3	58.5*	56.7*	60	55	60.0.	58.7			
M4	58.5*	56.7*	60	55	60.0	58.7			

<sup>\*</sup> Estimated Noise Levels

#### 5.0 TRAFFIC NOISE MODELLING

Factors that affect road traffic noise include vehicle numbers, percentage heavy vehicles, vehicle speed, the vertical and horizontal road alignment, road surfaces, the distance to the noise receiver, noise source heights, local topography, building facade reflections, the presence of road cuttings and shielding from man made structures. The following factors have been considered in the Rose Valley assessment:-

#### 5.1 Road Alignment

The conceptual road alignments shown in Appendix 2.

#### 5.2 Traffic Volumes

The existing and projected traffic volumes summarised in Chapter 2.

#### 5.3 Traffic Speed

An average traffic speed of 100km/h.

#### 5.4 Building Facade Correction

A building facade correction of plus 2.5dB(A).

#### 5.5 Road Surfaces

It is proposed that the upgraded road will be surfaced with dense graded asphaltic concrete (DGAC) or an equivalent low noise road surface.

Noise investigations (Roads & Transport Research '95) conducted for various road surfaces have shown that a dense graded asphaltic surface is 2-3dB(A) quieter than a chip sealed surface and approximately 1dB(A) quieter than a hessian dragged concrete surface. The noise modelling for Rose Valley has assumed that the DGAC road surface will be 1dB(A) quieter than the existing stone chip sealed surface.

#### 5.6 Noise Source Heights

The noise source heights adopted for the modelling were point five (0.5) of a metre for cars, one point five (1.5) metres trucks and three point six (3.6) metres for truck exhausts.

#### 5.7 Predicted Traffic Noise Levels

In accordance with the assessment procedures discussed earlier, the noise modelling has considered the projected traffic volumes for the years 1999, 2000 and 2010. Table 4 presents a summary of the project assessment goals and the post construction predicted traffic noise levels.

Table 4: Post Construction Predicted Traffic Noise Levels dB re: 20 x 10° Pa

Reference Location	Predicted Road Traffic Noise Levels dB(A) re: 20 x 10 <sup>-6</sup> Pa									
	Pro Assessme	ject ent Goals		struction 99	Post Con 20		Post Con 20	struction 10		
	LAeg,15hr	LAeg,9hr	LAeq,15hr	LAeg,9hr	LAeq,15hr	LAeq,9hr	LAeq,15hr	LAeq,9hr		
M1	62.5	60.7	60.5	58.7	60.7	58.9	62.8	61.0		
M2	60.0	55.0	54.0	52.2	54.2	52.4	56.3	54.5		
M3	60.0	58.7	58.5	56.7	58.7	56.9	60.8	59.0		
M4	60.0	58.7	58.5	56.7	58.7	56.9	60.8	59.0		

#### 5.8 Findings

The noise modelling has shown that as a result of the proposed road works and the quieter road surface, the existing traffic noise levels at the reference locations would decrease by up to 0.5dB(A), and as a result of natural traffic growth the post construction ('99) traffic noise levels projected to the year 2010 would increase by 2.3dB(A).

#### **6.0 ASSESSMENT**

The findings of the noise assessment, have shown that the existing noise levels (Table 3) exceed the RTA 'Interim Traffic Noise Policy', base line night-time goal  $L_{Aeq,9hours}$  55dB(A) at locations M1, M3 and M4, and the daytime goal  $L_{Aeq,15hours}$  60dB(A) at location M1. The assessment has also shown that the existing daytime noise levels marginally satisfy the base line goal  $L_{Aeq,15hours}$  60dB(A) at locations M2, M3 and M4., and the night-time goal  $L_{Aeq,9hours}$  55dB(A) at location M2.

The noise modelling has shown that with allowances for natural traffic growth to the year 2010, the pre-construction noise levels (Table 3) would increase by 2.3dB(A) at locations M1, M3 and M4, and 1.8dB(A) at location M2.

In terms of the project assessment guidelines, ie., "where the existing noise levels exceed the base line goals, it is recommended that the traffic noise resulting from the proposal should not increase the existing levels by more than 2dB(A), and that noise control options be considered to reduce the traffic noise to the base line goals where practical", it is recommended that noise control measures be considered for the residential properties identified at locations M1, M3 and M4, if it can be demonstrated that they are cost-effective and practical.

#### 6.1 Discussion

This section of the report provides a discussion of attenuation measures that could be considered to reduce the road traffic noise.

#### 6.1.1 Road Surfacing

At present the road surface from chainage 39700 to the McDonald River Bridge will be surfaced with a stone chip seal. Replacing the stone chip seal with dense grade asphalt concrete (DGAC) or a similar surface will reduce the traffic noise by 2-3 dB(A).

#### 6.1.2 Acoustic Barriers

To achieve higher noise reductions, the use of noise control barriers in the form of earth mounds, acoustic screens or road cuttings are required.

In determining the effectiveness of a barrier, its attenuation depends on the relative location and height of the source and receiver, and the effective height above the sight line cut-off level. Considering a distance separation is thirty five (35) metres, and a source height of 1.5 metres above the road level, Table 5 provides an estimate of the noise attenuation that could be achieved with different barriers heights above the sight line cut-off level.

Table 5: Typical Barrier Noise Attenuation dB(A) re: 20 x 10<sup>-6</sup> Pa

Barrier Height (m)	Noise Reduction dB(A)		
0.5 metres	1-2		
1.0 metres	5-6		
1.5 metres	8-9		

#### **6.2 Recommended Noise Control Measures**

For evaluating possible additional noise control options for the Rose Valley project, it is recommended that:-

- □ the DGAC road surface be extended to the commencement of the McDonalds River bridge crossing,
- and earth mounding be constructed for a length of approximately 100 metres adjacent to the two (2) residential properties (M1 and M3) at chainage 38700.

#### 7.0 CONSTRUCTION NOISE AND VIBRATION

#### 7.1 Overview

The proposal at present is conceptual and no final plan or road contractor have been established. Similarly no final road construction program or construction techniques have been determined. The final details will be established when the project is approved and a contractor has been engaged. However, it is understood that the construction activities will be based on normal road design and construction procedures, ie., site preparation, sub-base preparation, and asphalt laying.

To assess the likely noise and vibration impacts during the construction of the road, the following activities and plant schedules have been considered.

#### 7.1.1 Preliminary Site Works

The preliminary site works will involve the relocation of services and access adjustments to local roads. At this time it is envisaged that three (3) trucks, a dozer, a grader and an excavator will be used to excavate and move materials during the site works.

#### 7.1.2 Earthworks

The main construction activities envisage during this phase of the project will involve excavation, filling and compaction. During this phase of the project, dozers, scrapers, excavators, graders and compactors will be used to excavate, load, transport, spread, level and compact the fill material to form the road base.

#### 7.1.3 Sub-base Preparation

Following the earthworks, the road sub-base would be prepared by a fleet of trucks and compactors.

#### 7.1.4 Road Surfacing

The laying of the asphalt surface would be carried out by asphalt laying machines and a fleet of trucks and rollers.

#### 7.1.5 Construction Compounds

The location of construction compound sites for the establishment of material, plant and stockpile sites would be identified and carried out by the construction contractor. These areas are normally located within the road reservation, or by prior agreement with individual property owner on private property

#### 7.1.6 Construction Plant and Equipment Schedules

Table 6 presents a summary of the likely construction plant and construction schedules.

Table 6: Operations and Equipment for Site Preparation/Construction

Operation	Plant Type	No. Required (Av max)
Preliminary	Grader	1
Site Works	Dozer	1
	Excavator	1
	25T trucks	3
Earthworks	25T trucks	3
	Excavator	1
	Scrapers	2
	Dozers	1
	Compactors	2
Sub-base Preparation	25T trucks	3
	Compactors	2
Road Surfacing	Concrete/asphalt	3
	trucks	
	Trucks	3
	Rollers	2

#### 7.2 Construction Hours

To minimise noise impacts during construction, the activities will be restricted to between 7.00am and 6.00pm., Monday to Friday, and 8.00am to 5.00pm Saturday. With prior approval from the EPA and Council and notification to residents construction outside these hours could be undertaken provided the construction noise did not give rise to an unreasonable nuisance or disturbance to the occupiers of nearby residential dwellings.

### 7.3 Construction Noise

### 7.3.1 Plant and Equipment Noise Levels

For the modelling and assessment of noise levels from the construction activities, the sound power levels summarised in Table 7 have been established from data presented in Australian Standard AS2436-1981 and previous studies conducted by Atkins Acoustics.

Table 7: Construction Plant and Equipment Sound Pressure Levels dB(A) re: 20 x 10<sup>-6</sup> Pa

Plant Description	Plant Type	Sound Power Level	
Dozer	Caterpillar D7, D9	113	
Front End Loader	Wheeled	110	
Scraper	Caterpillar 651	110	
Grader	Caterpillar 16	110	
Compactor	Caterpillar 825	110	
Vibratory Roller	10-12 tonne	110	
Water Cart		106	
Excavator	Kato 750	107	
Truck		106	
Crane	truck mounted	110	
Compressor	600 CFM	100	
Backhoe		108	
Grader	Caterpillar	106	
Spreader	asphalt, concrete	95	
Tip Truck		106	
Concrete Paver		115	
Concrete Truck		108	
Concrete Pump		109	
Concrete Vibrators		105	

### 7.3.2 Construction Noise Assessment Goals

For the evaluation of noise impacts from construction activities, the EPA, ENCM recommends the following assessment goals.

### (i) Construction periods of 4 weeks and under

For construction periods of less than 4 weeks, the  $L_{A10,15min}$  noise level from the construction activities should not exceed the background level by more than 20dB(A).

### (ii) Construction periods greater than 4 weeks

For construction periods greater than 4 weeks, the  $L_{A10,15min}$  noise level from the construction activities should not exceed the background noise level by more than 10dB(A).

### 7.3.3 Project Assessment Goals

The ambient noise survey results (Appendix 3) confirmed that the existing daytime (0700-1800 hours) background (L<sub>A90</sub>) noise levels range between 31-42dB(A), the lowest repeatable level was 34dB(A). Considering the background measurements results and above the EPA assessment goals, the project goals for the construction noise assessment is presented in Table 8.

Table 8: Construction Noise Assessment Goals

L<sub>A10</sub> dB re: 20 x 10<sup>-6</sup> Pa

Referenc e Location		Sound Pressure Level dB(A) re: 20x10 <sup>-6</sup> Pa		
Location	Range Background L <sub>A90,15min</sub>	Short Term Construction LA10,15min	Medium Term Construction L <sub>A10,15min</sub>	
M1	34	54	44	

### 7.3.4 Predicted Construction Noise Levels at Exposed Properties

Considering the construction scenarios described above, the range of construction noise levels have been predicted for each residential receiver location. Table 9 presents a summary of the predicted noise levels for the worst case scenario, ie. when the activities are adjacent to the referenced location. It is noted that as the intensity of the construction activities decrease or the activities are more distant or shielded from the referenced location the associated noise levels will also decrease.

Table 9: Range of Noise Levels from Construction Activities

L<sub>A10</sub> re: 20 x 10<sup>-6</sup> Pa

Reference Location				
	Site Preparation	Earthworks	Sub-base Preparation	Road Surfacing
M1	77	80	76	77
M2	68	71	67	68
M3	74	77	73	74
M4	74	77	73	74

#### 7.3.5 Assessment of Construction Noise

The modelling has shown that the noise emissions from the construction activities immediately adjacent to a residential properties will exceed both the short term and medium term construction goals.

From our experience, other than plant selection, there is little opportunity to reduce the construction noise. To minimise potential noise impacts during the construction period, it is recommended that the plant and equipment be selected and operated with appropriate mufflers and noise controls, and where practical work practices and plant selection be considered so as to minimise noise impacts.

#### 7.4 Construction Vibration

### 7.4.1 Plant and Equipment Vibration Levels

As part of the road construction it will be necessary to use plant and equipment that will generate ground vibration. To evaluate the possible effects of ground vibration from the construction activities, the following vibration levels have been established from similar assessments and considered in this assessment.

Table 10: Construction Plant Vibration Levels

Plant Description	Vibration Levels mm/sec		
	5 metres	20 metres	
Dozer	2	0.2	
Vibrating Compactor	20	2	

### 7.4.2 Vibration Assessment Goals

For evaluating ground vibration impacts from construction activities, the following assessment goals have been considered.

### (i) EPA Human Comfort and Disturbance

The EPA's Noise Control Manual (Chapter 174) recommends goals for assessing vibration in buildings. The EPA base their goals on weighted curves developed in the British Standard BS6472, and recommend that the vibration levels measured on the floor of a residence should not exceed the base Curve 60 (approx. 8mm/sec); where the levels are less than Curve 60 (approx 8mm/sec) and exceed Curve 2 (approx. 0.3mm/sec) it is recommended that the construction activities be restricted to between 7.00am and 6.00pm Monday to Friday, 7.00am and 1.00pm Saturday.

### (ii) British Standard Effects on Building Occupants

British Standard BS6472<sup>1992</sup> provides guidelines for assessing potential disturbance to persons exposed to continuous and intermittent vibration in buildings. The vibration levels referenced in the standard that may give rise to "adverse comment" are shown in Table 11. For comparison purposes continuous vibration is normally felt at about 0.15mm/sec and becomes "noticeable" at approximately 1mm/sec.

Table 11: Vibration Levels for Assessing Human Comfort (Ref: British Standard BS6472)

Type of Space	Time of Day			on Levels n/sec	
Occupancy		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vert.	Hor.	Vert.	Hor.
Residential	Day	0.3 to 0.66	0.8 to 1.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8

### (iii) Effects on Structures - DIN 4150

German Standard DIN 4150 - Part 3:1986 provides guidelines for evaluating the effects of vibration on structures. The values recommended in the standard (maximum levels measured in any direction at the building foundation) are summarised in Table 12.

Table 12: Structural Damage - Safe Limits for Building Vibration
Reference: German Standard DIN4150

Type of	Vibration Velocity mm/sec			
Structure	Frequency		,	
	Less than 10Hz	10Hz to 50Hz	50Hz to 100Hz	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	

As the buildings in the vicinity of the road works would be classified as residential structures, a vibration level of 5mm/sec has been recommended for assessing the potential for structural damage from the construction activities. It should be noted that the standard states that this level is a "safe limit", up to which no damage due to vibration effects has been observed for the particular class of building. "Damage" is defined by DIN 4150 to include minor non-structural superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.

### (iv) Effects on Building Contents

The threshold for visible movement of susceptible building contents (eg. plants, hanging pictures, etc) is approximately 0.5mm/sec; the audible rattling of loose objects (eg. crockery) generally does not occur until levels of about 0.9mm/sec.

#### 7.5 Predicted Ground Vibration Levels

Table 13 presents a summary of the predicted vibration levels that could be generated by the envisaged construction plant at various distances from the activity.

Table 13: Typical Plant Vibration Levels velocity (mm/sec)

Plant Description	Vibration Levels mm/sec			
	20 metres	40 metres	100 metres	
Dozer	0.2	0.02	0.002	
Compactor	2	0.3	0.03	

#### 7.6 Assessment of Ground Vibration Levels

The main sources of ground vibration from the envisaged construction activities is associated with compactors. Typical ground vibration levels from compactors, can range up to 2mm/sec at a distance of twenty (20) metres, at distances greater than forty (40) metres the levels will generally be below 0.3mm/sec.

As a result of the distance separation, it is unlikely that the construction activities will give rise to vibration levels that exceed the structural damage criterion for residential buildings of 5mm/sec or unacceptable impacts in terms of annoyance.

#### 7.7 Recommendations

To control construction noise and vibration impacts, in consultation with the EPA and Council it is recommended that as part of the construction contractors undertaking an "Environmental Management Plan" (EMP) be prepared to address the issues of noise and vibration. As part of the "EMP", the following issues should be considered;

- the establishment of a construction noise and vibration control plan,
- the selection of plant and equipment where practical on acoustic performance,
- the use of the plant and equipment to minimise potential noise and vibration impacts,
- the implementation of a monitoring program to ensure that the construction noise and vibration is controlled and that the best possible practices are being implemented.

#### 8.0 CONCLUSION

This report has considered potential noise and vibration impacts associated with the proposed upgrading of State Highway No. 9, between Rose Valley Creek and the McDonald River north of Tamworth.

The assessment has identified four (4) residential properties that are exposed to traffic noise from the existing and future road alignments.

The findings of the noise study have shown that with the completion of the proposed road works, the existing traffic noise levels will decrease marginally. By the year 2010, the noise modelling has shown that the existing traffic noise levels would increase by up to 2.3dB(A).

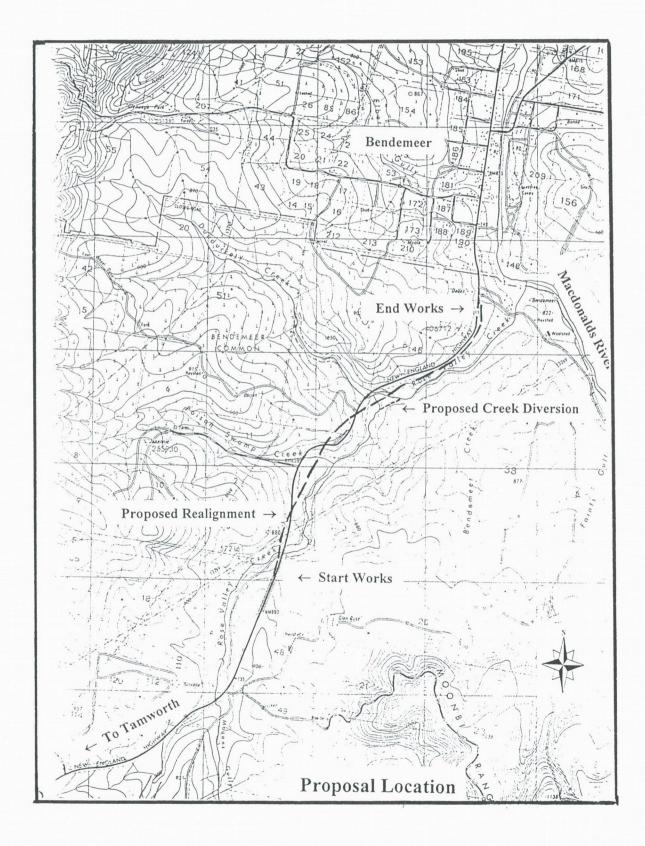
In terms of the project assessment goals and the present RTA noise policies for upgrading roads, that is "where the existing noise levels exceed the base line goals, it is recommended that the traffic noise resulting from the proposal should not increase the existing levels by more than 2dB(A), and that noise control options be considered to reduce the traffic noise to the base line goals where practical", the noise assessment has shown that the existing noise levels exceed the base line goals at three (3) residential properties and the predicted increases are greater than 2dB(A). Based on these findings, it would normally be considered by the RTA that additional noise controls be considered for the three (3) residential properties at the northern end of the project. Section 6 of this report presents noise controls options that could be considered for the properties providing they can be shown to be practical and cost effective

During the road construction, the assessment has shown that there could be localised noise impacts where the earthworks and road construction takes place adjacent to residential properties and the noise levels exceed the recommended assessment goals.

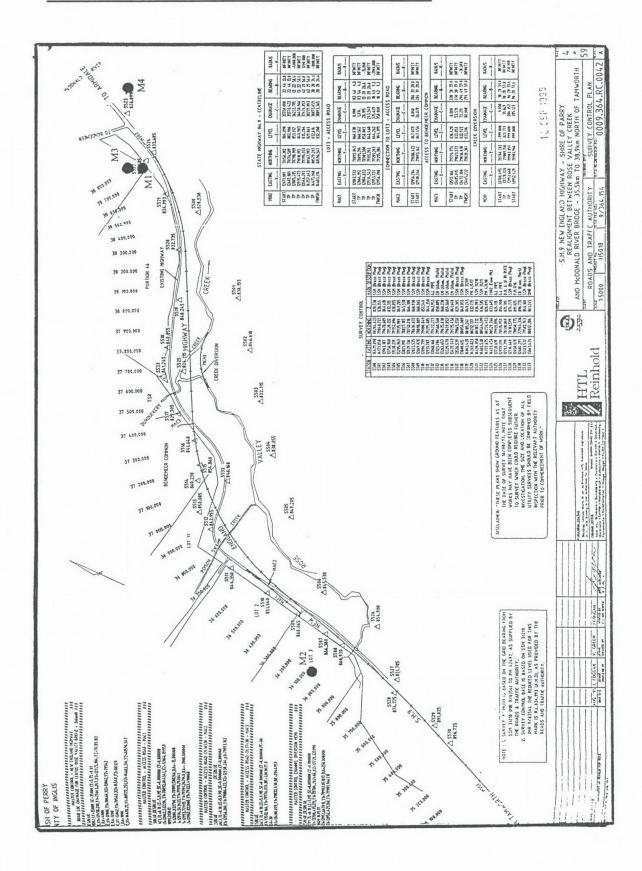
Noise emissions from these activities which are considered to be transient and short term, can be ameliorated through programming of the road works and consultation with the residents.

As a result of distance separation between the construction activities the residential buildings, the ground vibration modelling has shown that it is unlikely that the construction activities will give rise to vibration levels that exceed the structural damage criterion for residential buildings of 5mm/sec or unacceptable impacts in terms of annoyance.

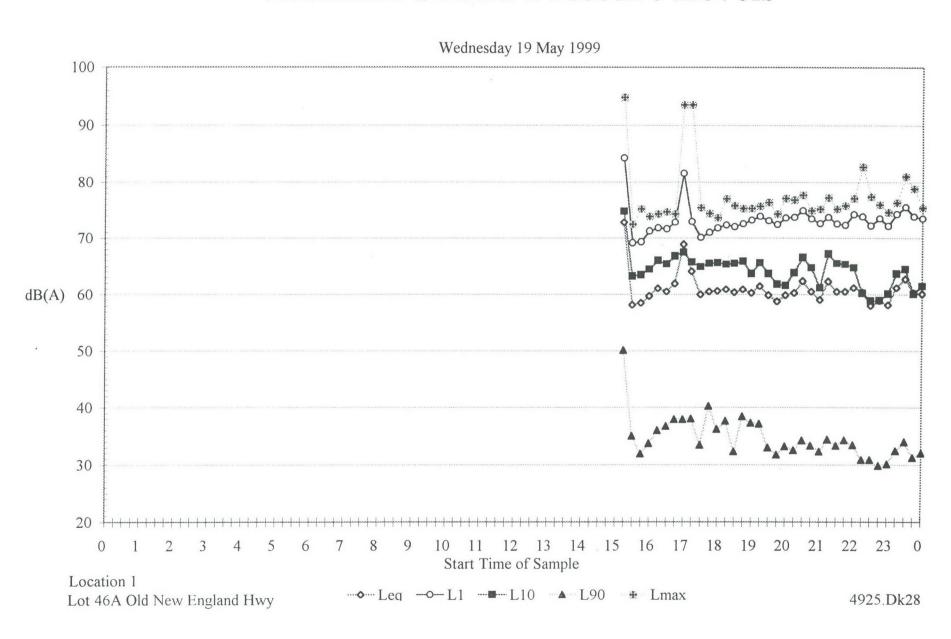
### **APPENDIX 1: STUDY AREA**

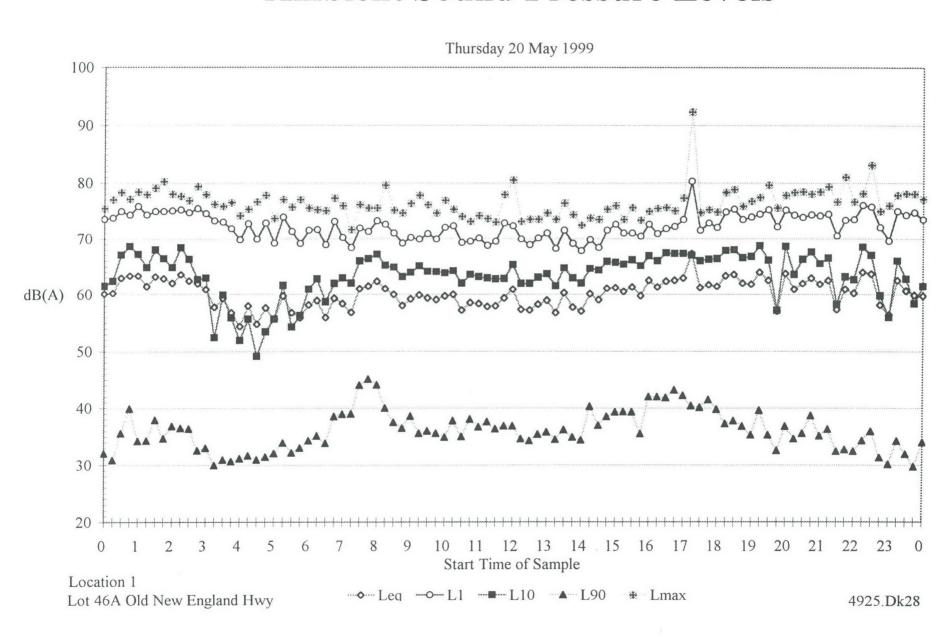


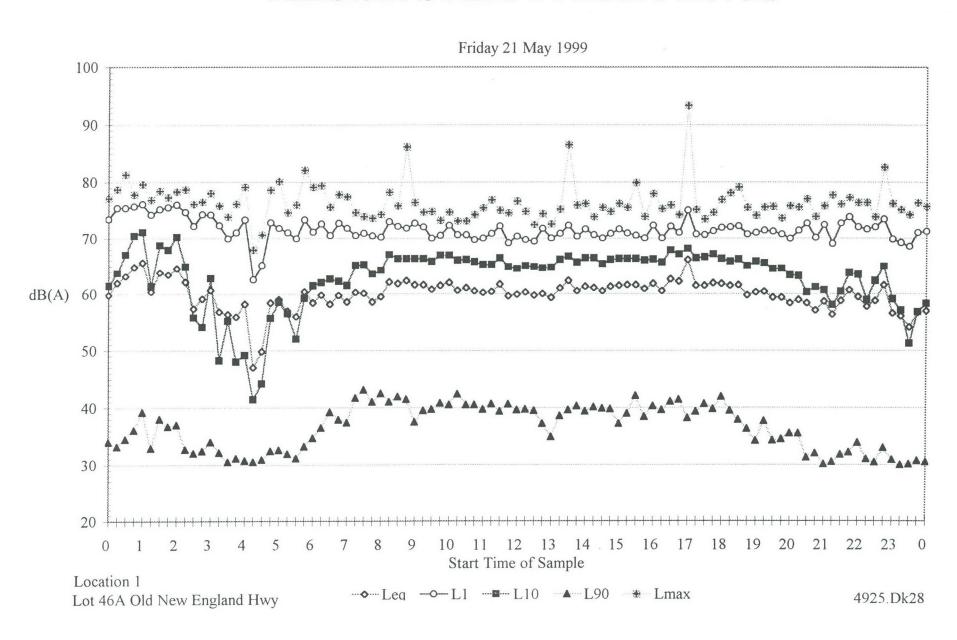
### APPENDIX 2: PROPOSED HIGHWAY ALIGNMENT

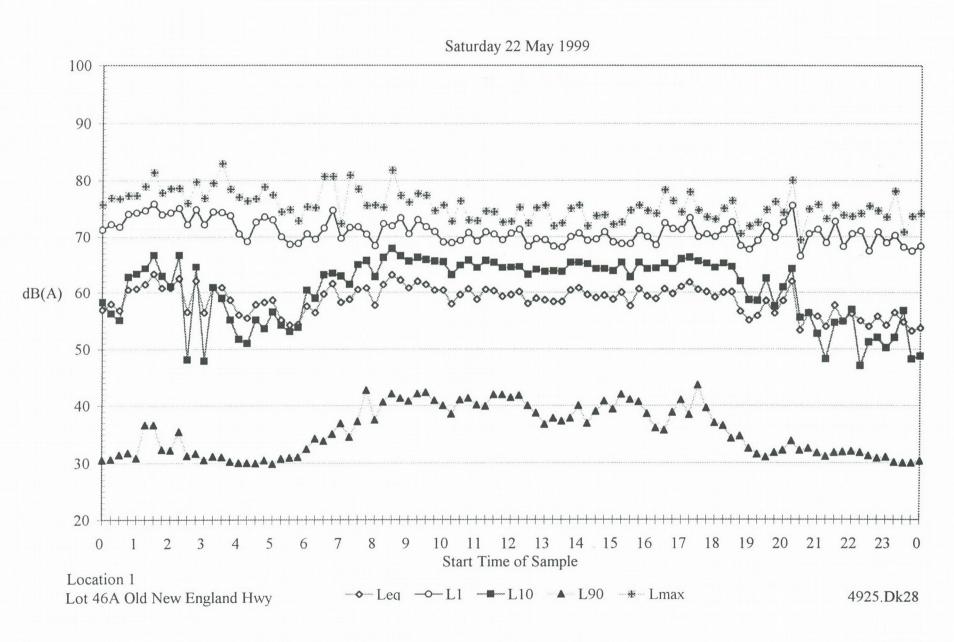


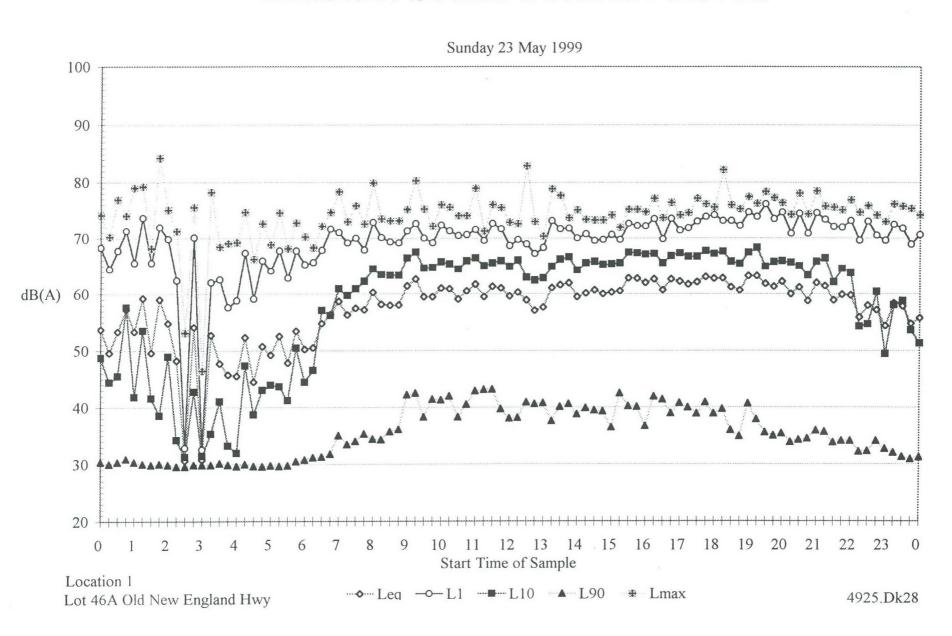
### **APPENDIX 3: EXISTING AMBIENT TRAFFIC NOISE LEVELS**

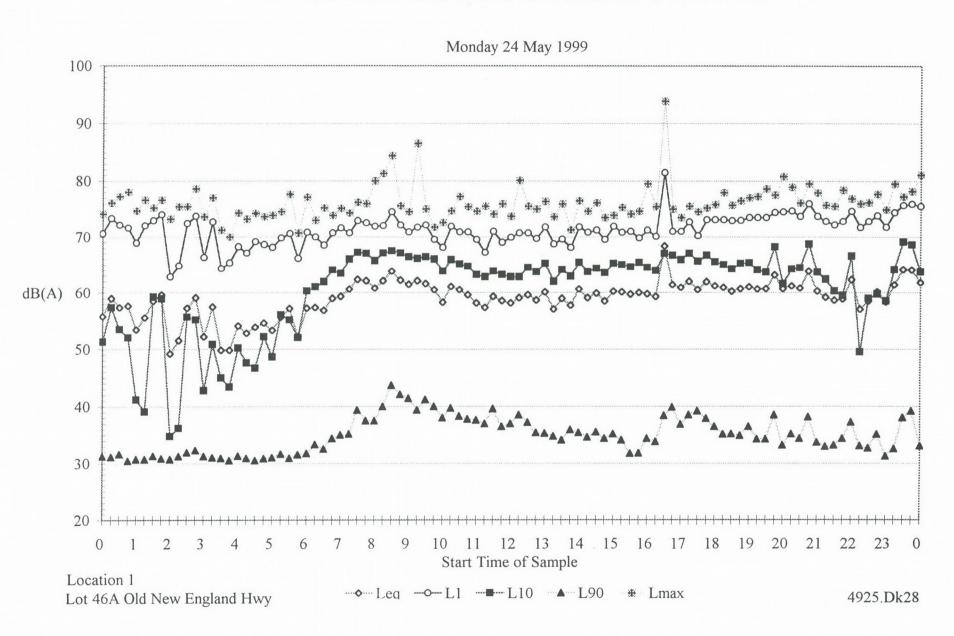


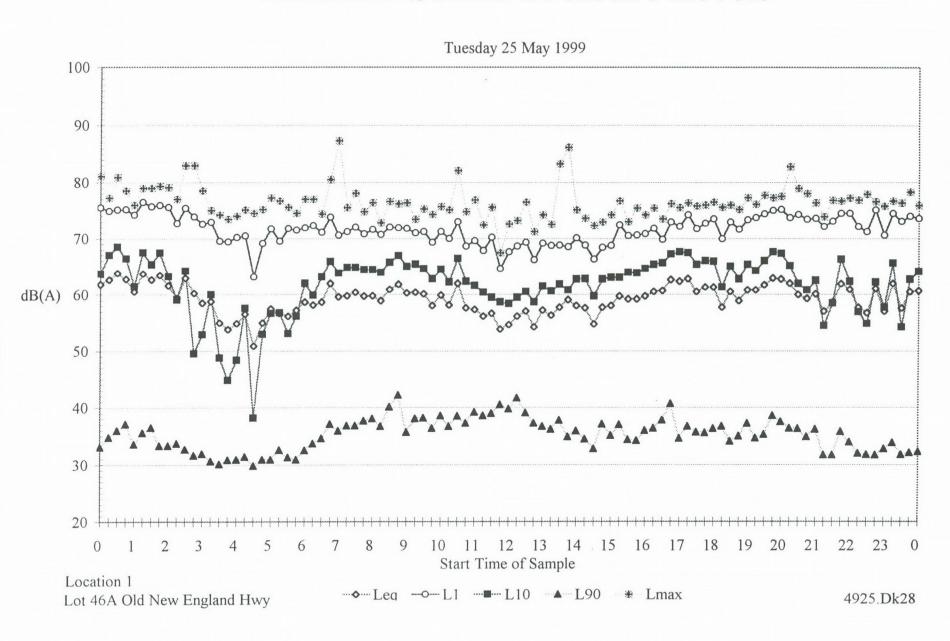


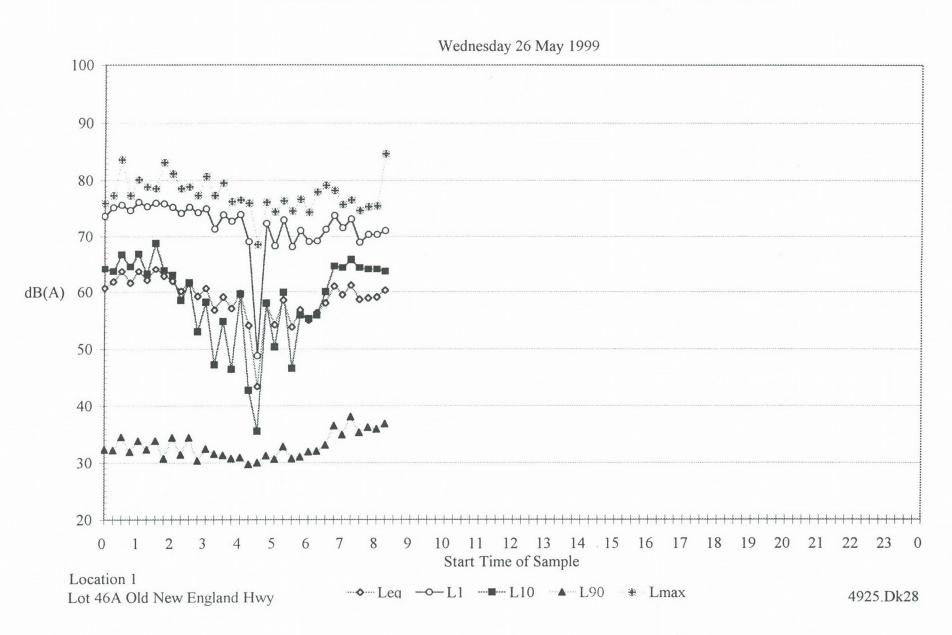












# Appendix E

Consultation



Department of the Environment and Heritage

FILE NO 99/8625

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Ms Katrina Smallwood RTA Operations PO Box K198 HAYMARKET NSW 1238

Dear Ms Smallwood

### PROPOSED REALIGNMENT OF THE NEW ENGLAND HIGHWAY AT ROSE VALLEY, BENDEMEER, NSW

I refer to your letter of 6 July 1999 requesting comments on the Draft Review of Environmental Factors (DREF) and Certified Statement of Environmental Evidence for the proposed realignment of the New England Highway at Rose Valley, Bendemeer, NSW.

As the proposal has not been referred for assessment in accordance with the Administrative Procedures under the *Environment Protection (Impact of Proposals) Act 1974* (EPIP Act), these comments are for your information only and should not be regarded as an assessment under the EPIP Act.

The Biodiversity Group (BG) and the Australian Heritage Commission (AHC) have been consulted in relation to this proposal.

The AHC has advised that there are no places included in the Register of the National Estate (RNE) or the RNE database that are affected by this proposal. The AHC would like to point out that the RNE is not a comprehensive list of places of national estate significance, and many places have yet to be assessed, as is likely to be the case in this proposal.

Environment Australia (EA) notes that the RTA has carried out a heritage assessment of the proposed route and in the DREF have identified two

Indigenous sites that will be destroyed by the proposal and three sites that will require protection during the construction stage. The AHC has advised that consent to destroy permits for the two indigenous sites need to be sought from the NSW National Parks and Wildlife Service.

The heritage assessment also identified five non-indigenous sites as having heritage values including a granite quarry; concrete bridges over Rose Valley, Dunduckety, and Poison Swamp creeks; and the earlier bridge over Dunduckety creek. EA notes that the bridges over Rose Valley, Dunduckety and Poison Swamp creeks would need to be demolished for the proposal. EA supports the recommendation that a photographic record of the affected places are taken and lodged in the RTA archives and the NSW Heritage Offices.

EA notes that no reference has been made to the Commonwealth's *Endangered Species Protection Act* 1992 (ESP Act) in the DREF and no national listings have been included in tabloid listings of flora and fauna.

The BG has listed a number of species that are protected under the ESP Act, which are situated in the vicinity of the proposal.

SPECIES	COMMON NAME	ESP ACT STATUS
Eucalyptus mckieana	Eucalypt species	Vulnerable
Diurus pedunculata	Small Snake Orchid	Endangered
Thesium australe	Austral Toadflax	Vulnerable
Cryptostylis hunteriana	Leafless Tongue Orchid	Vulnerable
Diurus sheaffiana	Orchid species	Vulnerable
Pterostylis pulchella	Orchid species	Vulnerable
Lathamus discolor	Swift Parrot	Endangered
Xanthomyza phrygia	Regent Honeyeater	Endangered
Litoria aurea	Green & Golden Bell	Vulnerable
Underwoodisaurus sphyrurus	Frog Border Thick-tailed Gecko	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable
Onychogalea fraenata	Bridled Nailtail Wallaby	Endangered
Petrogale penicillata	Brush-tailed Rock- wallaby	Vulnerable

EA accepts that it is unlikely that certain species (*Litoria aurea*, *Onychogalea fraenata* and *Petrogale penicillata*) would be present at the development site. However, we do consider that more information should be provided in relation to the above threatened species or reasons for the absence of these species from

the DREF (eg. outside the geographic range of the species, insufficient foraging/breeding habitat to support species).

In relation to the species of orchids listed above, EA believes that it is highly likely that surveys conducted in April/May would not locate flowering specimens. With the exception of *Pterostylis pulchella*, which is recorded as flowering between February and May, all the other species flower between September and February. One species, *Cryptostylis hunteriana*, is leafless and would be very difficult to detect when not flowering.

EA has similar concern with the 'specialist survey' for *Thesium australe*. It would be worthwhile to discuss the nature of the survey, the condition of potential habitat for the species and the nearest locations of other colonies that have been recorded. Such additional information would assist in adding some value to the final determination of the species' absence.

The fact that the fauna survey failed to locate any reptile species, including common species, does not support the assessment made in relation to *Underwoodisaurus sphyrurus*. EA suggest that further details in relation to the condition of the habitat, the nearest records for this species, a detailed description of the survey techniques employed for this and other reptile species should be provided before reaching this conclusion.

EA notes that Bendemeer White Gum (*Eucalyptus eliptica*) and Moonbi Apple Box (*Eucalyptus malacoxylon*) are both listed as rare or threatened Australian Plants in Briggs and Leigh (1996). Woodlands, and in particular box woodlands, are recognised as being threatened throughout eastern Australia, with Grassy White Box Woodland recently being listed as an endangered ecological community under the ESP Act. Woodlands in the area of the proposal should be retained where possible. In addition, EA suggest that mature trees with hollows be protected as they provide essential nesting sites for many species, including threatened species.

EA propose that equivalent areas of woodland be revegetated in the area using indigenous native species of grasses, herbs, shrubs, and trees to compensate for vegetation removed during road construction, including replacement of *Eucalyptus eliptica* and *Eucalyptus malacoxylon* using local seed.

EA supports the following recommendations made by Terra Sciences Pty Ltd:

- Minimising tree removal particularly mature tree specimens.
- Provision of compensatory habitat by dedication of equivalent areas of land containing the tree species listed as threatened under NSW legislation.
- Re-establishment of compensatory habitat via regeneration of areas along the alignment using planting's of species of conservation significance.

We further support the development and implementation of a comprehensive Erosion and Sedimentation Control Plan for this project to minimise adverse impacts on existing and diverted watercourses.

Thank you for the opportunity to comment on this proposal. If you have any queries please contact David Knobel on 02 6274 1558.

Yours sincerely

Gerry Morvell

**Assistant Secretary** 

Environment Assessment Branch

November 1999

RTA GRAFTON

### ARMIDALE RURAL LANDS PROTECTION BOARD

126-130 TAYLOR STREET, ARMIDALE

POSTAL ADDRESS: PO BOX 110, ARMIDALE NSW 2350 PH. (02) 6772 2366 FAX (02) 6772 7274 A.H. ADMIN OFFICER 6772 3017 A.H. DISTRICT VETERINARIAN 6772 3672 EMAIL ripb@tpgl.com.au



17 September 1999

Divisional Engineer
Roads & Traffic Authority
155-157 Marius Street
TAMWORTH NSW 2340

Dear Sir

The Board is very concerned about the ability of livestock to move safely between two of its large travelling stock reserves near Bendemeer. With this letter is a copy of a map with the two reserves highlighted in yellow. The Board asks for an on site inspection with the R T A and the Board's Senior Ranger Munday to decide what provisions are to be made for travelling of stock between these two reserves.

Yours faithfully

ADMINISTRATIVE OFFICER

Q Casharth

RECEIVED

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R.T.A. TAMWORTH DISTRICT OFFICE

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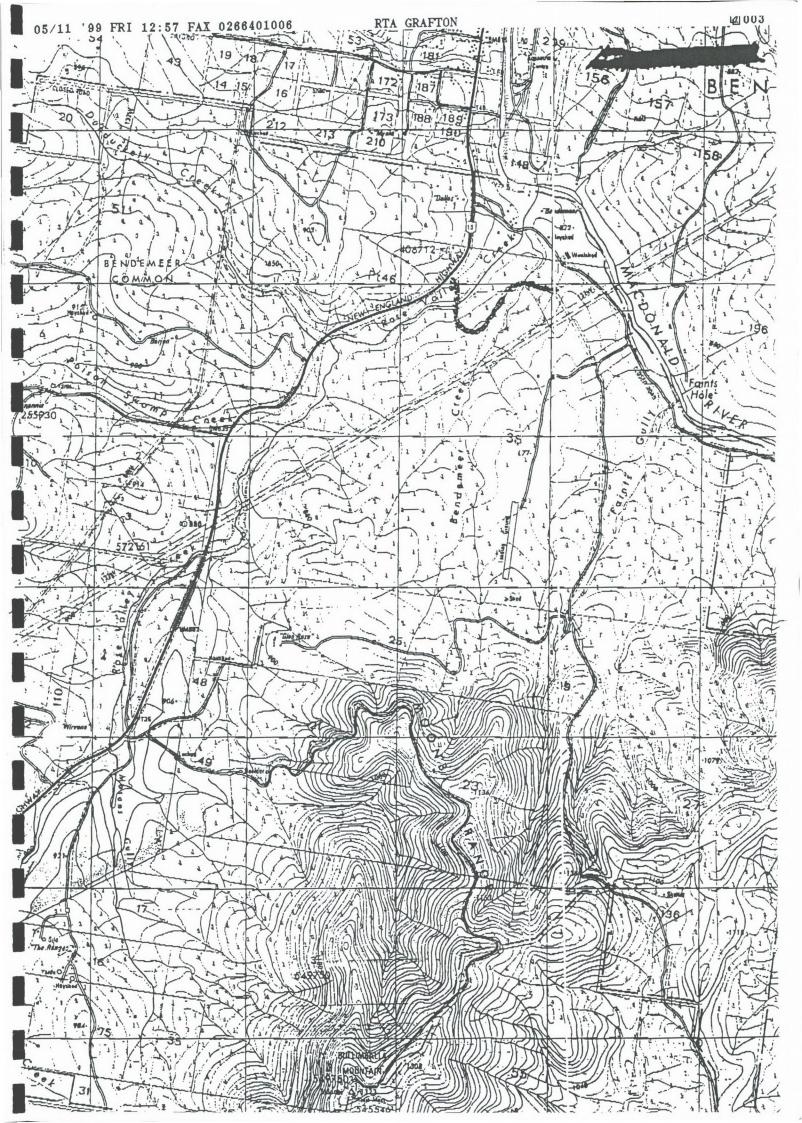
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CORRESPONDENCE
REG. NO. 4559
Errord by

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Fnvironment Protection Authority

Ground Floor NSW Government Offices 85 Faulkner Street Armidale NSW 2350 PO Box 494 Armidale NSW 2350 Tel: 02 6773 7000 Fax: 02 6772 2336 www.epa.nsw.gov.au

FAXED

Mr Simon Pearce **Environmental Services Officer** Roads and Traffic Authority PO Box K198 HAYMARKET NSW 1238

Our Reference:

AR195

Cms1338

Your Reference: Contact:

Angus Adair

Dear Mr Pearce.

### NEW ENGLAND HIGHWAY REALINGMENT - ROSE VALLEY, PROPOSED REVIEW OF ENVIRONMENTAL FACTORS

The Environment Protection Authority (EPA) has received your letter of 21 April 1999. We have reviewed your outline of the proposed works and provide the following comments regarding the issues that need to be addressed in the Review of Environmental Factors (REF).

#### General Road Works

We note that approximately 4.5km of road works are proposed. The EPA expects that a detailed sediment and erosion control plan will be prepared for all stages of the proposal. We note that much of the work will be within close proximity of Rose Valley Creek and its tributaries. As such, the sediment and erosion control works should ensure that no polluted waters reach these streams.

#### Stream Crossings

We also note that it is intended to reconstruct three bridges. Again these works may significantly impact on the creeks that the bridges span. A detailed assessment must be undertaken of the impact these works may have on the creek environment. A plan should be included aimed at minimising impacts.

### Diversion of Rose Valley Creek

The EPA notes that it is intended to divert flow in a small section of Rose Valley Creek. As you will be aware, this creek is extremely eroded. There are gully banks of 6 to 8 meters in height upstream of this site. The EPA recommends the RTA undertake an extensive sediment erosion control plan. This will need to include a complete fluvio-geomorphic study of the creek bed and the impacts the proposed works will have on the creek.



It is understood that these works will be undertaken in the 1999–2000 financial year. Under the *Protection of the Environment Operations Act 1997* these activities are not scheduled. As such you will not require EPA approval for these works. However, section 120 will apply (offence to pollute waters).

If you have any further queries regarding the above then please contact Angus Adair in our Armidale office on 6773 7000.

Yours faithfully,

DAVID DUTAILLIS

Head, Regional Operations Unit Nortehrn Tablelands for <u>Director-General</u>

11 May, 1999

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Simon Pearce Environmental Services Officer Roads and Traffic Authority PO Box K198 HAYMARKET NSW 1238



3rd May 1999

Dear Simon

### Re: New England Highway Reconstruction Rose Valley Project

Further to your letter of 7th April and recent telephone conversations, I have reviewed the design proposal for the realignment of Rose Valley Creek and its confluence with Dunducketty Creek. As requested I have provided an alternative to the current proposal as detailed below.

#### POTENTIAL PROBLEMS

The realignment of these watercourses will result in a higher channel slope than at present. If untreated, this may cause a headcut to develop within the stream channel resulting in massive bed and bank erosion upstream of the confluence, and increased sedimentation problems downstream.

Realignment of Rose Valley Creek will also make this channel more susceptible to erosion, particularly if high flow events are experienced soon after commencement of the work.

#### **DROP STRUCTURE**

As detailed on the plan, a drop structure is required to prevent formation of a headcut and its subsequent migration upstream. However, the use of rock baskets is not recommended as experience has shown they are subject to failures in creek and river systems, resulting in increased erosion. Often, failures occur through damage from logs and debris during high flows. In addition, they provide little habitat benefit and harbour weeds.

The design of the bed control structure needs to include provision for the development of scour on the downstream side of the structure and should also be consistent with NSW Fisheries requirements. Large boulders are the most suitable material for construction of these types of structures.

Similar structures have been placed in the Cockburn River between Kootingal and Tamworth and have been effective in preventing further bed lowering and associated bank erosion. These structures were designed by Mr Wal Hader from the Department of Land and Water Conservation (Ph. 02 9895 7827).

#### **BANK PROTECTION**

The shaded areas of river channel indicated on your plan will also require some form of bank protection, particularly on the outside bends. Once again, rock is the safest option. Rock should extend to at least 1 metre above the low flow and also be keyed into the bed to prevent undermining. The size of rock to be used is dependent upon channel slope, bankfull capacity (or design capacity), depth of flow, Manning's roughness and the radius of curvature for the particular bend. Upper banks should be revegetated with a mixture of pasture species together with native shrub and tree species.

If you require further input or wish to clarify any of the above information, please do not hesitate to contact me on (02) 6764 5120.

Yours sincerely

Juni Elde

Tim Elder

River Planner

10 June, 1999

Roads and Traffic Authority PO Box K198 HAYMARKET NSW 1238 PARKS & WILDLIAM SERVICE

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Our Reference: Your reference:

99/624/1560 rose.doc

Cms1338

Attention: Simon Pearce

Dear Sir

### INVITATION TO COMMENT ON PROPOSED REALIGNMENT OF THE NEW ENGLAND HIGHWAY AT ROSE VALLEY, PARRY SHIRE

Reference is made to your letter dated 21 April 1999 in which you seek the National Parks and Wildlife Service's (NPWS) further comments on the above matter. NPWS has a statutory responsibility for the care and protection of native flora and fauna and Aboriginal sites throughout NSW and for the management of NPWS estate. The NPWS notes that the Roads and Traffic Authority (RTA) is updating an existing Review of Environmental Factors (REF) for the proposed works the following comments are forwarded to further target this investigation.

### 1. Natural Heritage

The proposed realignment would appear to involve substantial modification of existing landforms and limited clearing. Based on the information forwarded to NPWS for review it would appear that the activity has the potential to have a significant impact upon the Aboriginal heritage values of the area. In addition, it would appear that the proposed diversion of Rose Valley Creek; reconstruction of bridges and culverts along drainage features and; clearing of riparian vegetation may have an impact on the surrounding and downstream environments. In particular, water quality, vegetation communities and existing fauna habitat within and adjacent to the subject area may be adversely affected.

Insufficient information has been forwarded to enable NPWS to provide advice regarding the presence or absence of threatened species (*Threatened Species Conservation Act 1995*) within the subject area. The NPWS has, however, conducted a search of the NPWS Atlas of NSW Wildlife to determine what threatened species have been recorded within the vicinity of the proposed works. Of particular concern are the records of two threatened species adjacent to the New England Highway. These species are the Square-tailed Kite (*Lophoictinia isura*) which was recorded adjacent to the McDonald River in the northern part of

Northern Zone GIO House 24 Moonee Street Coffs Harbour NSW 2450 Australia Locked Bag 914 Coffs Harbour 2450

Tel: (02) 6651 5946 Fax: (02) 6651 6187

Head Office 43 Bridge Street PO Box 1967 Hurstville NSW 2220 Australia

Tel: (02) 9585 6444 Fax: (02) 9585 6555 www.npws.nsw.gov.au the study area, and *Underwoodysaurus sphyrurus* recorded near the southern extremity of the subject lands. An endangered plant species, *Diurus pendunculata* or Small Snake Orchid, has also been recorded in moist grassy areas in sclerophyll forest of this area.

In general NPWS recommends that the RTA consider the potential impact of the activity on areas of significance for native vegetation, with particular reference to the value of habitat for threatened species, populations or ecological communities and their habitats. In addition, regionally significant species and vegetation associations, including Rare or Threatened Australian Plants (ROTAPs) should be considered.

Prior to determination the RTA should ensure that any potential impacts of the proposed activity on the above species and any other relevant threatened species thought to occur in the subject area, are adequately assessed by completion of an eight part test in accordance with section 5A of the *Environmental Planning and Assessment Act 1979*.

### 2. Cultural Heritage

With regard to the potential for the activity to impact upon Aboriginal sites and places of significance to the Aboriginal community, discussions between Rebecca Edwards-Booth (NPWS) and your Claire Everett indicate that an archaeological assessment has been completed in relation to the present study. It is understood that this assessment will review the results of an earlier assessment completed by Navin-Officer Heritage Consultants (1995) and will survey any additional areas not covered in this earlier survey. The NPWS notes that this earlier archaeological report identified two Aboriginal sites referred to as Rose Valley 1 and 2. As neither Aboriginal site appears on the NPWS Aboriginal Sites Register, it would be in the RTA's interest to ensure that these sites are properly recorded as a part of the present investigation. As agreed with Claire Everett of your office, NPWS welcomes the opportunity to view and discuss the outcome of this assessment upon completion.

Should you wish to discuss the matter further please contact Rebecca Edwards-Booth, A/Environmental Planning Officer, on (02) 6659 8266

Yours faithfully,

Brendan Diacono

Manager Environmental Planning

Beacons : 10/6/99

for Director-General

# **Parry Shire Council**

Council Administrative Office:

468-472 Peel Street, Tamworth 2340

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99.M.13/11329 JBO'C:IH

parry@parry.nsw.gov.au

ALL COMMUNICATIONS TO BE ADDRESSED TO THE GENERAL MANAGER

PROUD TO BE PARRY PROTECTING THE ENVIRONMENT PLANNING FOR PROSPERITY

Our Ref: Your Ref:

4 June, 1999

Roads and Traffic Authority Asset Performance Technology Branch PO Box K198 HAYMARKET NSW 1238

Attention:

Simon Pearce

Dear Sir

Re:

Proposed Realignment of the New England Highway

at Rose Valley

Further to your correspondence of 21 April 1999 concerning the above proposed realignment and your preparation of a Review of Environmental Factors (REF), Council wishes to note that a dedicated public road junction currently exists off the New England Highway to service land to the east of the New England Highway along the MacDonald River.

Currently access is located via a private access through Bendemeer Station, and this has been the cause of some dispute between neighbours over recent years.

Whilst there is no proposal by Council to relocate access provisions from the existing Bendemeer Station access to the dedicated alignment at this point in time, it is requested that a provision be taken into account in the Rose Valley Plan.

It has also been suggested that a more suitable location for a public road access might be through the TSR on the eastern side of the New England Highway, possibly at the existing TSR access point. It is requested that an adequate provision be made for access into the current TSR with a view to the fact that there is a possibility this access point could be used for future public road connection.

Further discussions in this matter should be directed to Council's Director of Engineering Services, Mr J O'Connor.

Yours faithfully Glenn Inglis

General Manager

and on behalf of (J B O'Connor)

DIRECTOR OF ENGINEERING SERVICES

### **NSW FISHERIES**



12/5/99

Mr Simon Pearce Environmental Services Officer Roads and Traffic Authority PO Box K198 HAYMARKET NSW 1238

Dear Simon,

RE: PROPOSED REALIGNMENT OF THE NEW ENGLAND HIGHWAY AT ROSE VALLEY.

Thank you for your letter dated 21 April 1999 inviting NSW Fisheries to comment on the proposed realignment of the New England Highway at Rose Valley.

The RTA is advised to refer to sections 5.1 and 5.4 of the *NSW Fisheries Policy and Guidelines for Aquatic Habitat Management and Fish Conservation 1998* which deal specifically with the requirements for dredging and reclamation and the construction of bridges and other waterway crossings respectively. In particular, please note design requirements in relation to invert levels and maintenance of the cross-sectional area of a waterway to ensure that fish passage is not impacted by the crossing designs (section 5.4). Copies of these extracts are attached.

NSW Fisheries also requests that the following considerations are addressed in the Review of Environmental Factors (REF):

- written justification for the proposed crossing types in particular the reasons for downgrading the crossing at Dunduckety Creek from a bridge structure to a box culvert design.
- written justification outlining the need for the proposed creek diversion works on Rose Valley Creek. NSW Fisheries requests further environmental assessment on potential impacts on creek hydrology, bank and bed erosion rates, fish passage and fish habitat associated with the diversion and proposed rock protection works.
- sedimentation and erosion controls to ensure that at no stage aquatic organisms
  will be impacted by increased sedimentation or turbidity (detailed sketches of the
  proposed location of any sediment and erosion control works (eg silt curtains
  etc.) on design drawings of the proposed works would assist in the assessment
  process).
- maintenance of fish passage NSW Fisheries must be informed if fish passage is to be blocked or altered during the course of bridge replacement works. A separate approval is required from NSW Fisheries to temporarily or permanently obstruct fish passage

- water velocity and flow the REF should outline whether water flow and velocity will be altered by any of the proposed waterway crossing structures. In particular information on the chosen designs and invert levels should be justified in line with section 5.4 of the NSW Fisheries Policy and Guidelines (attached).
- description of the proposed works to be conducted the REF should outline how
  the proposed works will be undertaken in and around the creeks. The REF
  should also advise whether side tracks will be constructed across the creek, and
  give details on the proposed design of these side tracks. This information will
  assist in visualising how the proposed construction works will affect the bed and
  banks of the river and the aquatic organisms inhabiting the area.
- removal of existing waterway crossings NSW Fisheries requests further
  information on the fate of the existing crossings once the realignment is
  complete. In particular, an outline of the proposed removal methods should be
  stated in the REF so that NSW Fisheries can asses any potential impacts.
- site rehabilitation NSW Fisheries requests that the REF outlines how the site will be rehabilitated after the completion of the works.

If you would like to further discuss these requirements, please contact me on (02) 6686 2018.

Yours sincerely,

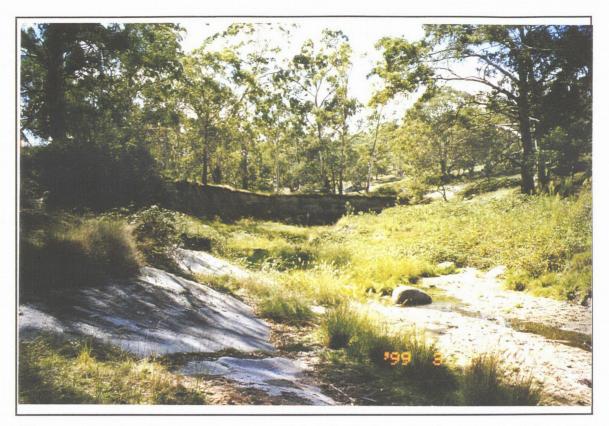
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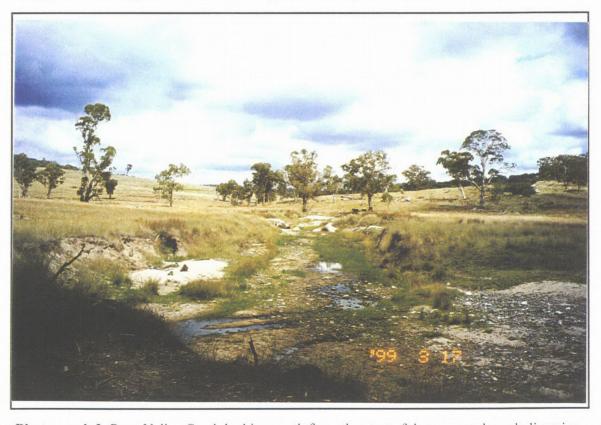
**CONSERVATION MANAGER** 

# Appendix F

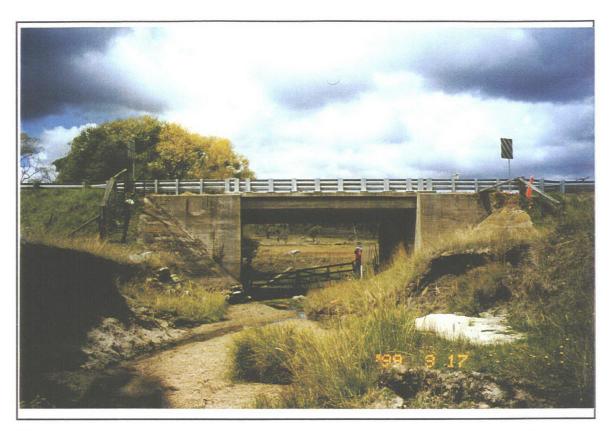
Photographs



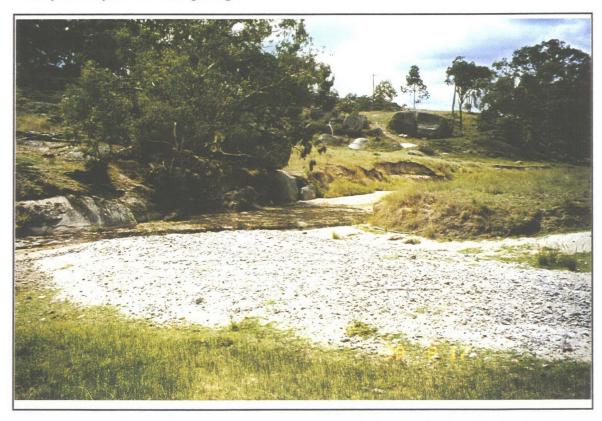
**Photograph 1** Looking east along Rose Valley Creek from just downstream of the existing bridge. Note the high level of erosion and granite outcrops.



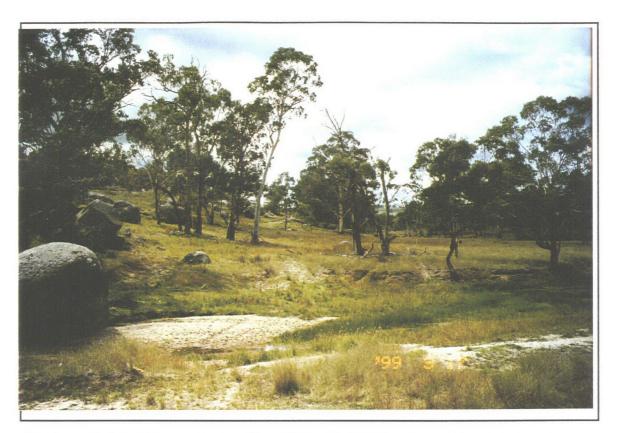
**Photograph** 2 Rose Valley Creek looking south from the start of the proposed creek diversion.



**Photograph 3** Dunduckety Creek looking east towards the convergence with Rose Valley Creek past the existing bridge.



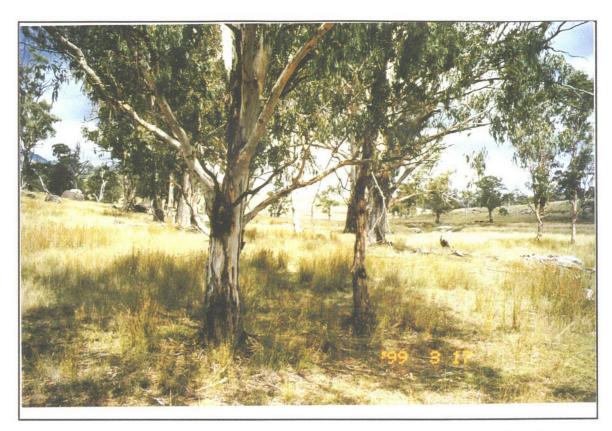
**Photograph 4** The existing convergence between Rose Valley Creek (from the right) and Dunduckety Creek (from the left).



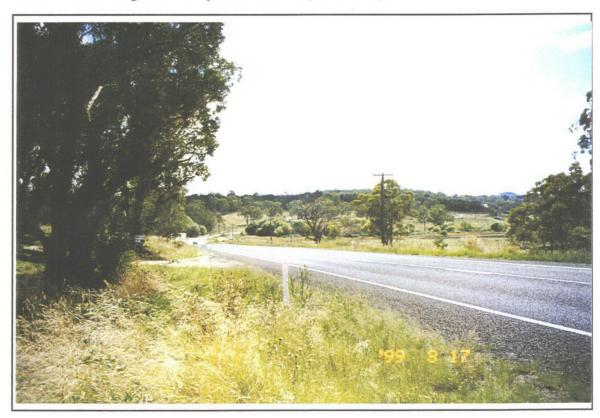
**Photograph 5** Looking north across Rose Valley Creek below the existing convergence with Dunduckety Creek. The new alignment would cross at this point and travel along the centre of the photo.



**Photograph 6** Looking north along Rose Valley Creek towards Macdonalds River. The proposed creek diversion would rejoin the existing channel at this location.



**Photograph** 7 Looking south along the centreline of the proposed creek diversion towards the existing Rose Valley Creek channel (see Photo 2).



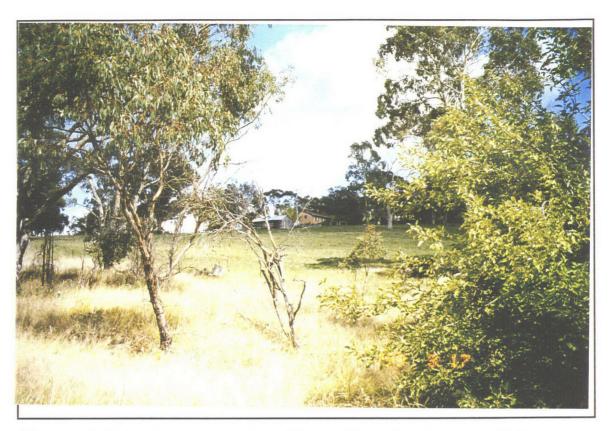
**Photograph 8** Looking north along the existing highway towards Poison Swamp Creek. The new alignment would cross the existing highway at this location.



**Photograph 9** Looking south from Rose Valley Creek along the centre line of the proposed alignment. The proposed road would pass through Cut 2 in the large hill in the middle background. The trees would be removed as part of the proposed works.



**Photograph 10** Looking south along the existing highway. The new alignment would rejoin the existing highway at this location. The new alignment would pass along an embankment on the left hand side of the existing road. The McKenzie residence is located just to the right of the photo.



**Photograph 11** Looking west towards the Ollsen residence from the existing highway. The proposed alignment would pass along the road corridor in the front of the photo.



**Photograph 12** Looking west towards the McKenzie residence from the existing highway. The proposed alignment would rejoin the existing highway at this location (see Photo 10).