Jenolan Caves Road, Cut Slopes Remediation

Review of Environmental Factors

RTA ENVIRONMENTAL TECHNOLOGY BRANCH

MARCH 2005

Document Controls

Business Unit	Environmental Technology Branch.		
Project No	H/45083/A		
Document Description	REF Jenolan Caves Road, Cut Slopes Remediation		
	Name	**Signed**	**Date**
Approving A/Manager	Andrew Cook	A.B. Cook	11-3-2005
Reviewing Officer	Rokeya Sabur	A.B. Cook	11-3-2005

Person(s) managing this document	**Person(s) writing this document**
Peter Ryan	Peter Ryan

Location	**File No.**
g:\ops\environ\assessments_section\projects\0405 \jenolan caves slope remediation\ref\jenolan cut slopes final ref.doc	5M96

Document Status	**Date**
Final	11-3-2005

Prepared For	**Prepared By**
Chris Barnett Operations, Technical Services Operations Western Region 15-33 Cooerwull Road BOWENFELS, NSW 2790	Environmental Technology Branch RTA Operations Directorate Level 5, Pod D, 99 Phillip Street Parramatta NSW 2150 T (02) 8837 0583 F (02) 8837 0053 E peter_ryan@rta.nsw.gov.au

Prepared by RTA Operations – Environmental Technology Branch
Version 1

A person using RTA Environmental Technology documents or data accepts the risk of:

- *Using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version; and*
- *Using the documents or data for any purpose not agreed to in writing by RTA Environmental Technology.*

Contents

APPENDICES

Appendix A: Ecology Study
Appendix B: Landscape and Visual study
Appendix C: Photographs of Proposal site
Appendix D: Concept Design
Appendix E: Results of Database Searches
Appendix F: Pejar LALC and Gundungurra Tribal Council

1 Introduction and Methodology

1.1 Name of the Proposed Activity

Jenolan Caves Road, Cut Slopes Remediation.

1.2 Local Government Area

Oberon Council.

1.3 RTA Region

Western Region.

1.4 Introduction

The NSW Roads and Traffic Authority (RTA) proposes to carry out remediation of cut slopes along Jenolan Caves Road (MR 253) within the Five Mile Hill Section, located 20km south east of Oberon.

This Proforma 1 Review of Environmental Factors (REF) has been prepared by Environmental Technology Branch (RTA Operations Directorate) on behalf of RTA Technical Services Western Region. For the purposes of these works, the RTA is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment (EP&A) Act 1979*.

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

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

This REF has been prepared in accordance with the RTA's Proforma 1 REF as presented in the RTA's *Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4 2001*.

The findings of the REF would be considered when assessing:

- Whether the Proposal is likely to have a significant impact on the environment and therefore the necessity for an Environmental Impact Statement (EIS) under Section 112 of the EP&A Act.

- The significance of any impact on threatened species as defined by the TSC Act, in Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS).
- The potential for the Proposal to significantly impact on a matter of national environmental significance or Commonwealth land and the need to make a referral to the Commonwealth Environment Minister in accordance with the EPBC Act.

1.5 Background

The Jenolan Caves Road provides access for tourist and service vehicles to the Jenolan Caves and the Kanangra Walls, which is accessed from the Great Western Highway west of Hartley.

Under the *National Parks and Wildlife Act 1974*, the Jenolan Caves Reserve Trust (the Trust) is responsible for the conservation of the heritage and cultural resources of the Jenolan Caves. The Trust is subject to the direction and control of the NSW Minister for the Environment, and is currently being managed by an administrator.

Cut slopes along 5 Mile Hill have been assessed by the RTA as being unstable with the following features: toppling, planar sliding, wedge failures, and rock falls from overhangs and residual soil. The assessed risk level (ARL) of the cut slopes are currently high at greater than 3 (ie. ARL 1 and 2). The residual soils at the crest of the cut slopes have been cut oversteep, and weathering and erosion of these materials releases rock fall boulders. Minimal rock support has been employed to date. There is also no provision for surface water management at the crest of the cut slopes to limit infiltration and build up of groundwater pressures (RTA 2003a).

The RTA has identified the need to undertake remediation of cut slopes adjacent to Jenolan Caves Road at the Proposal site to provide safer road travel. Following completion of these remediation works, further remediation works are planned at other sites along Jenolan Caves Road.

Works undertaken to date include the following:

- In 2004, minor slope regrading at three sites involved cutting existing rock slopes to match existing batter slopes; and
- Installation of cantilever structures and Thriebeam guardrail at three sites commenced in 2004 and will be completed in 2005.

REF's were prepared for the above works, including preparation of a specialist ecological assessment.

1.6 Methodology

The method in which this document has been prepared is as follows:

1. A meeting was held with the Project Manager on 25 November 2004 to discuss the Proposal.

2. An RTA Environmental Technology representative undertook a site visit on 19 January 2005 to inspect the Proposal site.

3. The following agencies and RTA personnel were notified and/or consulted:
   - RTA Regional Environmental Advisor, Western Region;
   - RTA Aboriginal Programs Consultant, Western Region;
   - Oberon Council;
   - DIPNR;
   - Sydney Catchment Authority (SCA);
   - DEC (Parks Service Division);
   - Jenolan Caves Reserve Trust; and
   - Pejar Local Aboriginal Land Council (LALC) and Gundungurra Tribal Council.

4. A desktop search was conducted on the following databases to identify any potential issues:
   - Australian Heritage Database;
   - NSW Heritage Office State Heritage Register and State Heritage Inventory;
   - National Native Title Claims Search;
   - DEC Aboriginal Heritage Information Management System (AHIMS);
   - DEC Atlas of NSW Wildlife - Threatened Flora and Fauna Records;
   - DEH Protected Matters (EPBC Act) Database;
   - DPI FishFiles Database and NSW Fisheries Threatened Species List;
   - DEC Contaminated Land Records;
   - DEC Air Quality Records; and
   - DPI Noxious Weeds List.

5. As part of the environmental assessment of the Proposal, ecology and visual specialist studies were undertaken to identify the Proposal constraints and to provide environmental safeguards. Details and findings from the investigations are further discussed in Chapter 8 of this REF with a copy of the specialist studies included as **Appendix A and B** to this REF.

6. A literature review was undertaken with regards to the following:
   - Landform, Geology, and Soils;
   - Groundwater;
   - Local Environment Plans;
   - Regional Environmental Plans;
   - State Environmental Planning Policies;
   - Council's State of Environment Report; and
   - NSW Fisheries Policy and Guidelines.

2 Description of Proposal Site and Study Area

2.1 Location

The Proposal site is located adjacent to Jenolan Caves, and approximately 20km south east of Oberon within the Oberon Local Government Area (LGA).

The Proposal site is defined as the area of direct impact, which would result from the Proposal, including an existing stockpile/compound site, and remediation of cut slopes (Refer to Section 3.1 for Proposal description details). Based on ecological habitat, the study area is defined as lands located within 10km of the Proposal site.

Refer to Figure 2.1 for a map of the locality.

2.2 Description of the Existing Environment

2.2.1 General

The Five Mile Hill Section of Jenolan Caves Road (MR 253) is a two lane single carriageway road. This section of the road is narrow, has sharp curves, restricted lane widths and poor site distances. Safety posts and mesh fencing are present along this section of the road. Road shoulders are generally unformed and less than 1m in width. The posted speed limit is 40kph with 20kph advisory signs.

Due to safety concerns, daily one-way traffic flow out of Jenolan Caves is currently provided for between 11.45am and 1.45pm. Additional traffic control measures (ie. boom gate and mini electronic variable message sign) have been in place since January 2004 to support the one-way traffic flow. Permanent variable message signs (VMS) are now present at Hartley, Hampton, Lithgow and Kelso. These VMS's are used to assist with traffic movements to and from Jenolan Caves.

2.2.2 Topography and Landform

The topography of the study area consists of steep to very steep hills and mountains. Slopes are greater than 30% and local relief is greater than 300m. Elevation is greater than 120m to generally less than 1000m. Small narrow, convex crests occur above steep to very steep, deeply incised valleys. Occasional areas of rock occur on some slopes. Small cliffs are evident on some upper slopes (CALM, 1994). Land slopes within the Proposal site are steep to very steep.

2.2.3 Geology and Soils

The Proposal site is located within the Kanangra George Soil Landscape Group. The following qualities and limitations apply to the Kanangra George Soil Landscape Group: severe water erosion hazard, steep slopes, severe foundation hazard, mass movement hazard, rock fall hazard (localised), and stony soils of very low fertility. The geology within the Proposal site consists of Devonian, Silurian and Ordovician steeply dipping metasediments (CALM, 1994).

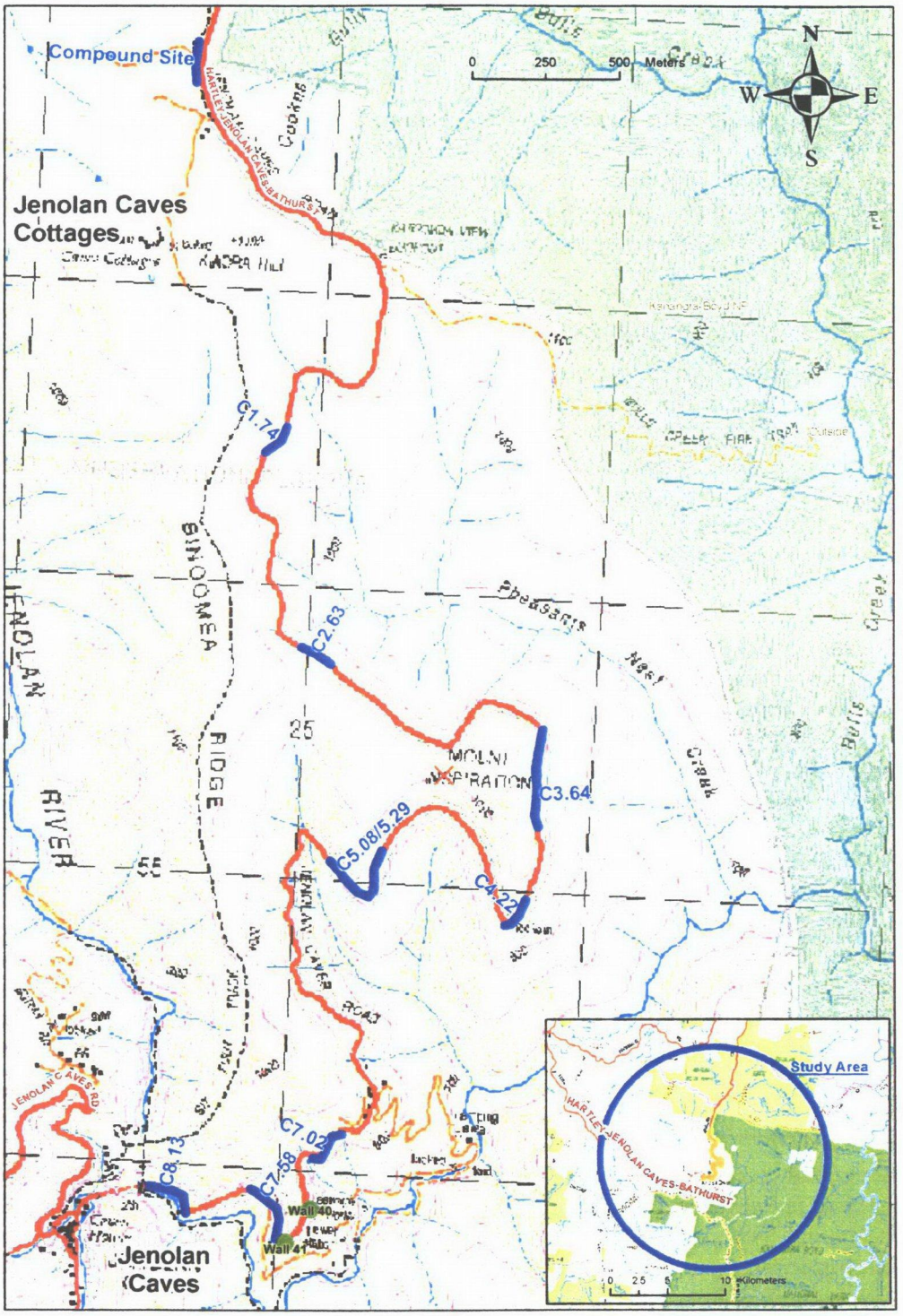


Figure 2.1: Location of the Proposal site and study area.
(Map extract courtesy of Land and Property Information NSW)

Soils within the Proposal site fall within the Kanangra George (ka) Soil Landscape Grouping. The soils are very shallow (<50cm), stony, well-drained Structured Loams and Lithosols on rocky, very steep to precipitous sideslopes, narrow crests and upper slopes. On lower slopes, soils are moderately deep to deep (>80cm), moderately well-drained Brown Podzolic Soils, Red Podzolic Soils and Yellow Podzolic Soils. Along narrow deeply incised drainage

lines, the soils are moderately deep (<100cm), moderately well-drained Alluvial Soils. Soil material fertility is very low, with moderate to very strong acidity.

2.2.4 Climate

Records from the Jenolan Caves recording station are representative of the Proposal site, which is located in a temperate zone. The mean annual rainfall is 966mm with a slight summer dominance. In summer the mean daily maximum temperature is 25.6°C. In winter the mean daily minimum temperatures are close to freezing (0.2°C) (Bureau of Meteorology, 2004). Fog and frosts are known to occur within the Proposal site during winter.

2.2.5 Drainage and Watercourses

The Proposal site is located within the Jenolan River catchment. The Proposal site is located 15m from the Jenolan River at it's closest point (ie. southern section of the Proposal site), and 100m and beyond from the river at other Proposal site locations (ie. northern sections of the Proposal site). In the vicinity of the southern section of the Proposal site, the Jenolan River has been dammed, and the riverbanks have been impacted by some trampling by tourists. The river water at this location has an attractive aqua colour due to the local limestone geology (Refer to **Appendix C** for photographs). Minor water seepage is evident at cut slopes 1.74 and 5.08.

The existing stockpile/compound site is located approximately 1.2km west of the Jenolan River. Drainage lines traverse under, and occur adjacent to Jenolan Caves Road, but none are located within any of the cut slope sites or the stockpile/compound site. The northern section of the Proposal site is located within the catchment of Pheasants Nest Creek. Pheasants Nest Creek flows into the Jenolan River. The Jenolan River flows easterly into the Coxs River, which then flows into Lake Burragorang, Sydney's major water supply storage.

The Jenolan River is subject to sediment and nutrient loads from the Oberon area (Oberon Council 2003). The SCA is responsible for management of the catchment area and waters of Lake Burragorang. Lake Burragorang forms part of the Hawkesbury-Nepean River catchment. The medium to steep hills and deeply incised gorge topography of the region provides for medium to rapid stream flows. Flooding is not evident within the Proposal site due to the steep topography and the separation distance of the Proposal site from waterways.

2.2.6 Biodiversity

An ecological assessment of the Proposal was undertaken by Lesryk Environmental Consultants in February 2005. In addition, a targeted survey was undertaken by Mjadwesch Environmental Service Support to determine the presence of the Purple Copper Butterfly (*Paralucia spinifera*) (Refer to **Appendix A** for the full report).

Flora

Bushland is present within and adjacent to the Proposal site. The Proposal site is surrounded by the Jenolan Caves Karst Conservation Reserve. Kanangra-Boyd National Park is located approximately 1.2km east of the Proposal site, and to the immediate east of the existing stockpile/compound site. Jenolan Karst Conservation Reserve and Kanangra-Boyd National Park are part of the Greater Blue Mountains World Heritage Area. The *Jenolan Karst Conservation Reserve Draft Plan of Management (2004)* is in preparation, and applies to the Proposal site. No vegetation management plans apply to the Proposal site.

No critical habitat is present within the Proposal site. Eleven plants of conservation significance have been previously recorded in the Jenolan Caves region. No plants or vegetation communities of national, state or regional conservation significance (EPBC or TSC Acts) were recorded or indicated as occurring within the Proposal site. The Proposal site consists of a dry open-forest community on the upper slopes with a sparse shrub and groundcover layer, and a moist open forest on lower slopes near the Jenolan River with a dense shrub and groundcover layer. Both communities are dominated by *Eucalyptus fastigata, E. dalrympleana ssp. dalrympleana* and *E. viminalis*. The Proposal sites do not show a great diversity of species. At each site generally only a few species make up the majority of the vegetation community. This is common in many alpine and semi-alpine habitats. The Proposal site is not important habitat for any of the threatened plant species, plant populations or ecological communities that are known to occur in the region.

Several species of weed are declared noxious in the Upper Macquarie County Council control area. Blackberry (*Rubus ulmifolius*), a Class 3 weed, is present within the Proposal site at cut slopes 4.22, 7.02, 7.58 and 8.13. To suppress growth of weeds, the Upper Macquarie County Council undertakes regular spraying of weed species (including Blackberry) that occur along Jenolan Caves Road.

Unstable vegetation growth present at the cut slope sites currently represents a hazard to road users. Vegetation present within and adjacent to the Proposal site also presents a bushfire hazard.

Fauna

One fauna habitat type, a eucalypt woodland is uniformly present throughout the Proposal site and study area. The eucalypt woodland supports trees that are between 10 and 15m in height. Throughout the eucalypt woodland the tree canopy is generally continuous, though some gaps up to 8m wide are present. The understorey is either absent, or composed of isolated saplings up to 2m in height. Similarly the ground cover layer is absent, or composed of a sparse distribution of native grasses, ferns and forbs. Leaf litter, fallen trees and branches are common, as is some exposed rock.

Isolated hollow bearing trees are present on top of the cut slopes adjacent to the Proposal site. Hollow bearing trees are also present adjacent (ie. beyond the Proposal site) to the existing stockpile/compound site. No critical habitat, important wildlife corridors or endangered ecological communities are present within the Proposal site. No endangered fauna populations are expected to be present within the Proposal site, and no fauna or habitat management plans apply to the Proposal site.

The following mammals were recorded during the field investigation: Short-beaked Echidna, Brown Antechinus, Common Wombat, Greater Glider, Common Brushtail Possum, Eastern Grey Kangaroo, Red-necked Wallaby, Swamp Wallaby, Southern Forest Bat, Little Forest Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Large Forest Bat, White-striped Freetail Bat, Grass Skink and Red-bellied Black Snake.

The following birds were recorded during the field investigation: Tawny Frogmouth, Wonga Pigeon, Gang-gang Cockatoo, Yellow-tailed Black Cockatoo, Sulphur-crested Cockatoo, Sacred Kingfisher, Crimson Rosella, Southern Boobook, Laughing Kookaburra, Superb Lyrebird, White throated Treecreeper, Supurb Fairy-wren, Striated Pardalote, White-browed Scrubwren, Brown Thornbill, Striated Thornbill, Noisy Friarbird, Red Wattlebird, Bell Miner, Yellow-faced Honeyeater, White-plumed Honeyeater, Eastern Spinebill, Eastern Whipbird, Grey Shrike-thrush, Black-faced Cuckoo-shrike, Grey Butcherbird, Australian Magpie, Pied Currawong, Australian Raven, Welcome Swallow and Silvereye.

Seven terrestrial fauna species listed under the Schedules of the TSC Act were recorded within the vicinity of the Proposal site. These animals include the Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Yellow-bellied Glider (*Petaurus australis*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Large-footed Myotis (Myotis adversus), Eastern Bentwing Bat (*Miniopterus schreibersii*), and Eastern False Falsistrelle (*Falsistrellus tasmaniensis*). The Gang-gang Cockatoo (*Callocephalon fimbriatum*) has received preliminary listing for inclusion under the TSC Act. The Proposal site currently provides some native fauna habitat for these threatened species.

Two animals listed under the Commonwealth EPBC Act were found or indicated as occurring within the Proposal site. These animals included the Large-eared Pied Bat (*Chalinolobus dwyeri*) and the Satin Flycatcher (*Myiagra cyanoleuca*). No other terrestrial fauna species listed under the TSC Act or EPBC Act are expected to utilise habitat present within the Proposal site.

Targeted surveys for the Purple Copper Butterfly (*Paralucia spinifera*) did not identify any areas of suitable habitat. During the field investigation only *Bursaria spinosa ssp. spinosa* was recorded, this plant is not known to be utilised by the Purple Copper Butterfly. As such, the Purple Copper Butterfly is not expected to be present within the Proposal site.

The Oberon Council is identified within Schedule 1 of SEPP 44 (Koala Habitat Protection) as a Local Government Area in which Koalas are known to occur. *Eucalyptus viminalis* was recorded during surveys, and is a listed Koala feed tree under Schedule 2 of SEPP 44. Within the Proposal site, *E. viminalis* constitutes greater than 15% of the total tree canopy and therefore, constitutes Potential Koala habitat. During the field surveys no koalas were observed, none were heard calling during the nocturnal surveys, and no characteristic scratching or scats were found. As such, the Proposal site is not considered to be Core Koala habitat (Refer to Section 4.3.1).

2.2.7 Non-indigenous Heritage

The Jenolan Caves Road was first constructed on its current alignment in the 19th century, and was completed in c.1896. The alignment is consistent with construction for horse-drawn or early motorised vehicles (constant grade of about 5%, with no geometric control over horizontal alignment) and has only been slightly modified since that time.

As part of the original construction, numerous retaining structures were built to support the formation on the down slope side. These were generally dry stone structures up to about 2m in height, although some were higher. There are approximately eighty dry stone walls present along Jenolan Caves Road. Dry stone walls are present within the Proposal site. The dry stone walls are not listed on any heritage registers, but are relics under the NSW *Heritage Act 1977*. With reference to the State Heritage Register assessment criteria, the dry stone walls have a low local significance due to their value from a historic perspective (ie. construction in 1896).

2.2.8 Sensitive Noise Receptors

The Proposal site exists within a natural bushland area that is subject to road noise (ie. tourist cars and buses), with low background noise levels. The Jenolan Caves Reserve Trust has advised that there are no private residences located nearby the Proposal site. No sensitive noise receivers are present in the vicinity of the Proposal site, except for guests staying at the Bellbird cottage approximately 100m east of the southern end of the Proposal site. Other noise receivers would be guests staying in the following Jenolan Caves Trust accommodation:

- Caves House (located approximately 400m west of the Proposal site);
- Jenolan Caves Camping ground (located approximately 600m east of the Proposal site (southern end); and
- Jenolan Caves cottages (located approximately 600m south of the existing stockpile/compound site).

2.2.9 Air Quality

The closest DEC Air quality monitoring site to the Proposal site is Bathurst, located approximately 60km away. The two parameters measured at Bathurst are ozone and number of particles less than 10 micrometers in diameter. Both the maximum one hour averages were well under the DEC goal measurements. Due to the absence of any nearby major pollutant sources, air quality within the Proposal site can be expected to be good.

Carter Holt Harvey Wood Products Australia Pty Limited (Carter Holt Harvey MDF) and Carter Holt Harvey Wood Products Australia Pty Limited (Structaflor Oberon) are the top two facilities for pollutant emissions for the Oberon LGA. Both facilities are located at Oberon, approximately 20km south east of Proposal site. Both facilities contribute low emissions (ie. less than 25% of total emissions for each substance) of Polychlorinated dioxins and furans, Total Volatile Organic Compounds, Polycyclic aromatic hydrocarbons and Particulate Matter (10.0 um). The Carter Holt Harvey Wood Products Australia Pty Limited (Carter Holt Harvey MDF) facility contributes medium emissions (ie. 26-50% of total emissions for each substance) of Formaldehyde (methyl aldehyde) (DEH 2005). The two facilities have a low potential to impact on air quality within the Proposal site during high wind periods.

2.2.10 Visual Amenity

A landscape and visual assessment of the Proposal was undertaken by Urban Design Office in February 2005 (Refer to **Appendix B** for the full report).

Jenolan Caves Road offers spectacular views of the World Heritage listed native bushland located below the roadway. The nearby Jenolan Caves are well known for recreation activity, and is a popular destination for cave tours, bushwalks, camping, picnics, bird watching and weddings (JCRT 2004). The nearby Kanangra-Boyd National Park is known for its vast gorges, high lookouts and wild and scenic rivers. Recreation activities within the national park include bushwalking, camping, picnics, bird watching and abseiling.

View corridors within the Proposal site are almost exclusively confined to the road corridor itself and therefore road users are the principal viewer group. Distant views back to Jenolan Caves Road from adjacent high ridges do not provide sufficient visual access to be of consequence due to the distance (over 1km), and due to the effective screening of vegetation growth. There is no visual access from the Jenolan Caves Camping ground to Jenolan Caves Road, and there is no visual access from nearby lookouts or rest areas to Jenolan Caves Road.

The visual amenity of the Proposal site is considered to be high, due to it being surrounded by native bushland.

Each of the cut slopes displays a similar landscape character of open forest, with trees to about 10m in height with a moderate foliage cover. The shrub layer is generally sparse with low shrubs to 1m, occasionally to 3m in height. The groundcover consists of a variable layer of sparse grasses and herbs. From distant views toward the Proposal site, the foliage cover is

generally fairly dense, screening the road completely. Within the road corridor, white guide posts (1m high) are present at 2m spacings along the road edge, and dry stone retaining walls are present on the downslope side of the road.

The existing stockpile/compound site is a highly disturbed area and has been previously used as a parking area for tourist coaches and for road materials storage. Large mounds of old road base and pavement material occur across the site and the area is vegetated by weed species. There is a secure fenced area within the existing stockpile/compound site, containing demountable offices and storage sheds. Some hardy native species occur in the disturbed area. The surrounding bushland is vegetated by the native eucalypt forest up to 15m high, with a moderate cover, and an open shrub understorey and groundcover of sparse grasses and herbs.

2.2.11 Existing and Forecasted Traffic

Jenolan Caves Road is used by light and heavy vehicles (tourist coaches 6%). The light vehicle traffic load along Jenolan Caves Road consists mainly of tourist traffic (230-280 vehicles per day on weekdays, 420-500 vehicles per day on weekends), and there is currently no traffic growth.

2.2.12 Socio-economic Considerations

Landuse in surrounding areas is dominated by nature-based activities (eg. cave tours, bushwalking) and nature conservation. The Jenolan Caves village is located on Jenolan Caves Road 400m west of the Proposal site. The villages of Lowther and Hampton are located on Jenolan Caves Road north of the Proposal site. The Proposal site is surrounded by the Jenolan Caves Karst Conservation Reserve. Kanangra-Boyd National Park is located approximately 1.2km east of the Proposal site, and to the immediate east of the existing stockpile/compound site. Jenolan Karst Conservation Reserve and Kanangra-Boyd National Park are part of the Greater Blue Mountains World Heritage Area. The Six Foot track is located to the immediate east of the existing stockpile/compound site. Visitation to the Jenolan Caves has been declining in recent years, and visitation to Kanangra-Boyd National Park is generally low due to it's remote location.

Jenolan Caves House provides public accommodation, and is located within the Jenolan Caves village. Jenolan Caves cottages provide public accommodation at the top of the "5 Mile Hill", approximately 600m south of the existing stockpile/compound site. Bellbird cottage is located approximately 100m to the east of the southern end of the Proposal site. Bellbird cottage provides public accommodation at a spur overlooking the Jenolan River. Hydro cottage is located nearby the Bellbird cottage. Hydro cottage is a residence owned by the Jenolan Caves Reserve Trust, but is not currently leased. Jenolan Caves Camping ground is located approximately 600m north east of the southern end of the Proposal site. Private bus companies provide public transport to Jenolan Caves via Jenolan Caves Road.

3 Description of the Proposal

3.1 Description of the Proposal

All proposed works would be undertaken within the existing RTA road reserve for Jenolan Caves Road. The Proposal would improve road safety along Jenolan Caves Road by reducing the risk level of cut slopes, and by limiting the potential for further geotechnical hazards to develop. The Proposal would include the following works at ten (10) cut slope sites:

- Scaling of loose rocks;
- Crest treatment (ie. removal of unstable rock and soil), vegetation removal and slope regrading;
- Installation of metal rock bolts and face plates (both grey in colour);
- Installation of metal rock catch fencing (the colour would be chosen to blend in with the faces of the cut slopes); and
- Minor application of shotcrete and/or mortar may be required at the cut slope sites.

Refer to Table 3.1, Section 3.2.1 and **Appendix D** for further details/design drawings of the proposed works.

Table 3.1 Proposed cut slope remediation work details.

	Proposed works[1]		
Cut slope chainage / cut slope height	**Crest treatment and regrading (m^3)**	**Scaling of loose rock (m^3)**	**Installation of rock bolts**
1.74 (6m)	70	1	0
2.63 (5.5m)	85	8	34
3.64 (20m)[2,3]	0	100	0
4.22 (5m)	50	12	15
5.08 (8m)	325	20	11
5.29 (6m)[4]	70	30	18
7.02 (7m)	500	5	6
7.44 (5m)[5]	25	0	2
7.58 (7m)	70	30	17
8.13 (10m)[6]	73	5	25
Totals	1268	211	128

1: A small amount of vegetation (ground covers, shrubs and trees) would require removal.
2: Six small diameter holes (150mm) would be drilled, then piezometers and inclinometers inserted to monitor geotechnical conditions. Two small concrete pits would be established locally to temporarily store data loggers, and short lengths of trenching would be required to install cabling.
3: An access track/work area above cut 3.64 is not included in the scope of works for this REF, even though the access track/work area above cut 3.64 has been assessed by the 'Ecology' and 'Landscape and Visual' specialist studies. A separate REF would be prepared to assess the impact of an access track/work area above cut 3.64.
4: Between chainages 5250-5290 either the existing earth drain would be widened slightly, or a rock catch fence would be installed.
5: Cut slope 7.44 is also known as Wall 40/41
6: Between chainages 8105-8120 and 8158-8168, rock catch fencing would be installed.

The following design constraints apply to the Proposal:

- Due to physical constraints of Jenolan Caves Road, access for heavy machinery and construction vehicles would be restricted; and
- The existing road formation is very narrow, and therefore the majority of work would only be possible during nightly road closures.

3.2 Construction Activities

3.2.1 Construction Processes and Work Methodology

Construction processes and work methodology would include the following:

Crest treatment and regrading

- Crest treatment would involve selected removal of identified geotechnical hazards (rocks greater than 200mm);
- Where regrading of rock cuttings is undertaken, the back slope would be cut at 0.5H:1.0V;
- In areas with remediation involving the clearing of rocks above the crest of the slope, the zone of clearing would be up to 5m from the crest; and
- Trees along the crest that present an OH&S risk would be removed.

Scaling of loose rock

- Scaling would involve the selected removal of rocks that represent a geotechnical hazard. This includes rocks which are isolated from the rock mass and have moved from their original in-situ location;
- Large rocks identified as being loose would be carefully removed by an excavator; and
- Where large areas of scaling are proposed (ie. areas of root jacking), an excavator would be used.

Rockbolting

- Rockbolts would be installed to reinforce the cut slopes;
- Rockbolts would incorporate a polyethylene sheath and hemispherical dome with a grout injection hole, retainer ring and nut. They would be installed in a nominal 45mm diameter drilled hole;
- Rockbolts would have a minimum design life of 50 years;
- Water would be used as a lubricant to undertake the drilling;
- Prior to inserting the rock bolts into the drill holes, drill cuttings/sludge would be removed from the drill holes and placed in watertight containers; and
- Rockbolts would be 22mm in diameter, and between 2.1m and 3.6m long. Each rockbolt would be furnished with a steel face plate (150mm x 150mm).

Rockbolt grouting

- Cement grouting of the bolts would be completed subsequent to initial installation;
- The cement grout would be of a toothpaste consistency with a water/cement ratio (by weight) of between 0.35 to 0.4;
- The grout would be injected through a grout injection hole at the head of the bolt to provide complete coverage inside and outside of the polyethylene sheath;
- Grouting pressure would be no more than is required to fill the drill hole with grout, but would be adequate to displace groundwater from within the drill hole. Grouting would be continued until a consistent flow of grout is emerging from a breather hole in the bearing plate. The breather hole would than be plugged; and

- Rock bolt face plates would be sealed to ensure the grout is contained within the drill hole. The bolt heads would be protected by a coating of epoxy resin.

Rock catch fencing

- Fencing would be installed in accordance with RTA requirements (ie. DCM 161);
- Fencing would be double twist with hot-dipped galvanised steel posts; and
- The fence height above the road level would be 1500mm, and post spacing would not exceed 3m.

Shotcreting and/or mortar packing

- Application of shotcrete and/or mortar may be required at the cut slope sites (up to 10m^2 area in total).
- Use of shotcrete and/or mortar would be limited to small-scale applications to seal erodable soil seams and/or highly weathered rock.

Waste disposal

- Material removed (ie. rock, soil and vegetation) would be temporarily stored at the existing stockpile/compound site; and
- Rockbolting and grout waste (ie. bolts, drill cuttings/sludge, grout and epoxy resin) would be disposed of at a licenced waste facility.

3.2.2 Construction Equipment

Construction equipment is expected to include:

- Scaling bars;
- Excavators;
- Cherry pickers;
- Air track;
- Small trucks;
- Chainsaws;
- Bobcats;
- Shotcreting/mortar packing equipment;
- Augers; and
- Lighting.

3.2.3 Access

Access along Jenolan Caves Road within the Proposal site is planned to be restricted from Sunday nights to Thursday nights inclusive from 4pm to 10am. Remediation works are proposed to be undertaken during these times due to the narrowness of the road, and to prevent interruptions to traffic flow. Access along Jenolan Caves Road would be available during the winter school holiday period from 2-17 July 2005. Construction vehicles would enter/exit the Proposal site from both the northern and southern ends of the Proposal site from Hartley or Oberon. The posted speed limit of 40kph with 20kph advisory signs would remain unaffected by the Proposal.

3.2.4 Utilities

No adjustment to utilities would be required to implement the Proposal.

3.2.5 Source of Material

No fill material is anticipated to be required by the Proposal.

3.2.6 Additional Truck Movements

Up to approximately 200 truck movements would be required to undertake the works. The truck movements would be undertaken over 20 nights, with a maximum of 10 truck movements per night (including water tankers). Water would be sourced from Lithgow or

Oberon town supplies, and would be delivered in a 10,000L water tanker (maximum one truck per night over 20 nights).

3.2.7 Stockpile and Compound Sites

One stockpile/compound site (approximately 0.5ha) would be located at the northern end of the works adjacent to Jenolan Caves Road (see **Appendix C**). The site is owned by the RTA and is currently being used as a stockpile/compound site. The site has been cleared of native vegetation, and road-building materials are currently stored at the site. The site is only vegetated with weed species (no noxious plant species are present) and commonly occurring hardy native groundcovers. The majority of the stockpile/compound site ground surface is covered in loose blue-metal gravel. A fenced site office and cement washout bays are established at the stockpile/compound site. Machinery, materials (ie. grout mix, rock bolts, rock catch fencing) and waste (temporary storage) would be temporarily stored at the stockpile/compound site.

Portable toilets would be utilised at stockpile/compound site(s), and sewage would be disposed of off-site at DEC approved locations.

Temporary small stockpile/compound sites may also be established at small rest areas located along Jenolan Caves Road on a need basis. These rest areas are located within the RTA road reserve, and currently receive minimal public use. These sites have been cleared of native vegetation (no noxious plant species are present) and some road building materials are occasionally stored at the sites. These sites consist of grass cover, bare earth and loose blue-metal gravel. Construction materials from the proposed works would be stored at these stockpile/compound sites.

3.3 Workforce and Working Hours

The workforce would comprise up to twelve personnel. Standard working hours adopted by the RTA are detailed below:

Standard Working Hours:

Monday – Friday:	7.00am to 6.00pm
Saturday:	8.00am to 1.00pm
Sunday and Public Holidays:	No work.

The works would be undertaken partially during non-standard working hours (ie. from 4pm to 10am) from Sunday nights to Thursday nights inclusive.

As works would be undertaken outside of the standard working hours, the procedure contained in the RTA's *Environmental Noise Management Manual 2001*, "*Practice Note vii – Roadworks Outside of Normal Working Hours*" would be followed.

3.4 Period of Construction

It is anticipated that works would commence on 14 June 2005 and be completed by 14 October 2005 given ideal working conditions.

3.5 Proposal Cost and Source of Funds

The Proposal would cost approximately $2M and funding allocation would be sourced from NSW Government Maintenance Funds.

4 Statutory Position

4.1 Local Environmental Plans

Development on land within the Oberon Local Government Area (LGA) is controlled by Oberon Council under the *Oberon Local Environmental Plan 1998* (LEP). The zoning within the Proposal site is Zone No 1 (a) (Rural 'A' Zone). Zoning in nearby areas include Zone No 1 (d) (Non Urban 'D' Zone) south of the Proposal site at Jenolan Caves, and Zone No 8 (National Parks Zone) at the north end of the Proposal site (east side). The Proposal is not prohibited under Zone 1 (a). Consent would be required for works undertaken within Zone No 1 (a) (Rural 'A' Zone).

Section 38 of the LEP (Public Authority works) states "Nothing in this plan requires the Council or any other public authority to obtain consent for development on land within any zone for the purpose of roads, stormwater drainage, recreation areas, landscaping, gardening, bushfire hazard reduction or parking." Accordingly, the RTA would not require development consent to undertake the proposed works.

Relevant LEP clauses for which consent from Council is required have been considered below:

Environmentally sensitive land

The Jenolan River is classified as environmentally sensitive land in Schedule 1 of the LEP. The Council must not consent to the carrying out of development on environmentally sensitive land if, in the opinion of the Council, the carrying out of the development will degrade the environment. Providing the proposed site specific safeguards are implemented, the Proposal is not expected to degrade the Jenolan River. Consent would therefore not be required for the works.

Heritage items

The Six Foot Track, and Jenolan Caves Reserve (Heritage Conservation Area) are both listed in Schedule 2 of the LEP. The Six Foot track is located to the immediate east of the existing stockpile/compound site, and the Jenolan Caves Reserve is located adjacent to the Proposal site on either side of the Jenolan Caves Road Reserve. Development consent would be required if the Proposal would adversely affect the heritage significance of the Six Foot Track and/or the Heritage Conservation Area. The Proposal is not expected to adversely affect the heritage significance of the Six Foot Track or the Heritage Conservation Area. Consent would therefore not be required for the works.

Water catchment area

Where a development application is received for land considered by the Council to be within a water catchment area, the Council must not grant consent unless it has considered:
(a) the impact of the proposed development on the water quality of stored waters within the water catchment area, and
(b) the impact of the proposed development on the ecological integrity of the water catchment area.

The Proposal is not expected to adversely affect the water quality of stored waters within the water catchment area or the ecological integrity of the water catchment area. As consent is not required, this requirement would not affect the Proposal.

4.2 Regional Environmental Plans

4.2.1 Sustaining the Catchments – The Regional Plan to protect the drinking water catchments

This draft Regional Plan is currently on public display. Once finalised it would establish the *Drinking Water Catchments Regional Environmental Plan No 1* which would repeal SEPP 58 (see Section 4.3.2). Although the document places no legislative requirements on the RTA, consideration of the aims of the REP have been made.

It is not expected that the Proposal would result in any adverse impacts to the water quality of the catchment and would therefore be in accordance with the aims of the *Drinking Water Catchments Regional Environmental Plan No 1*. For reference, the aims of the REP are to:

a) create healthy water catchments that will deliver high water quality while sustaining diverse and prosperous communities,

b) provide the statutory components in Sustaining the Catchments that, together with the non-statutory components in Sustaining the Catchments, will achieve the aim set out in paragraph (a), and

c) achieve the water quality management goals of:
   i) improving water quality in degraded areas and critical locations where water quality is not suitable for the relevant environmental values and
   ii) maintaining or improving water quality where it is currently suitable for the relevant environmental values.

4.3 State Environmental Planning Policies

The following State Environmental Planning Policies (SEPPs) apply to the Proposal:

4.3.1 SEPP 44 – Koala Habitat Protection

The Oberon Council is identified within Schedule 1 of SEPP 44 (Koala Habitat Protection) as a Local Government Area in which Koalas are known to occur. While the requirements of the SEPP do not technically apply to this Proposal, as it is not subject to Council consent, it is the RTA's practice to consider SEPP 44 criteria in its EIA process. 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.

Eucalyptus viminalis was recorded during surveys, and is a listed Koala feed tree under Schedule 2 of SEPP 44. Within the Proposal site, *E. viminalis* constitutes greater than 15% of the total tree canopy and therefore, constitutes Potential Koala habitat. During the field surveys no koalas were observed, none were heard calling during the nocturnal surveys, and no characteristic scratching or scats were found. As such, the Proposal site is not considered to be Core Koala habitat. Given the limited extent of the works proposed, the known ability for Koalas to traverse open ground, combined with the amount of bushland present both adjacent to and beyond the limits of the Proposal site it is not considered that the Proposal would have a significant impact on any Koala individuals, their populations or habitat. Therefore a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of the Proposal.

4.3.2 SEPP 58 – Protecting Sydney's Water Supply

SEPP 58 aims to limit the impact of development on water quality. This SEPP applies to the catchments that comprise Sydney's water supply. The Proposal site is within this area. Schedule 2 of SEPP 58 requires all transport facilities including major road works to obtain development consent. The Proposal is not classified as major road works.

Clause 10 of SEPP 58 sets out three matters to be considered irrespective of the Proposal requiring development consent. They are as follows:

a) whether the development or activity will have a neutral or beneficial effect on the water quality of rivers, streams or groundwater in the hydrological catchment, including during periods of wet weather.

It is not anticipated that the Proposal would have any adverse effects on the water quality of rivers, streams or groundwater in the catchment.

b) whether the water quality management practices proposed to be carried out as part of the development or activity are sustainable over the long term.

Erosion and sediment control measures would be implemented during the proposed works. In the long term, no water quality management practices would be required, as the Proposal would have no effect on the water quality of the catchment.

c) whether the development or activity is compatible with relevant environmental objectives and water quality standards for the hydrological catchment when these objectives and standards are established by the Government.

The Proposal is not expected to have an adverse affect on water quality, and therefore would not be incompatible with relevant environmental objectives and water quality standards for the catchment.

4.4 Confirmation of Part 5 Position

All relevant statutory planning instruments have been examined for the Proposal. It is concluded that Section 38 of the Oberon LEP operates to remove the development consent requirements, thereby permitting assessment of the Proposal under Part 5 of the EP&A Act.

5 Strategic Stage

5.1 Strategic Planning

The Proposal would be funded by State Maintenance funds and is part of an ongoing commitment by the RTA to address road safety in accordance with the RTA's responsibilities for ensuring a maximum level of service to road users and to maintain appropriate services for adjacent landholders.

The Proposal would contribute to achieving the objectives set out in *Road Safety 2010. Road Safety 2010* is a strategy developed to help New South Wales move towards having the safest roads in the world and sets out how the road toll can be halved through change in a number of areas. This Proposal would contribute to the objective of safer roads. The remediation of cut slopes on Jenolan Caves Road would create a safer road and therefore help the RTA achieve the objectives of *Road Safety 2010.*

5.2 Need for the Proposal

The remediation of cut slopes is needed to reduce the assessed risk level (ARL) of the cut slopes to 3 or better[1]. The works would improve road safety in accordance with objectives set out in *Road Safety 2010.*

[1] The RTA's *Guide to Slope Risk Analysis* classifies sites as follows:

- High risk sites have an Assessed Risk Level (ARL) rating of 1 or 2;
- Medium risk sites have an ARL rating of 3 or 4; and
- Low risk sites have either an ARL rating of 5, or are other natural batters or cut or fill slopes.

6 Concept Stage

6.1 Proposal Objectives

The main objective of the Proposal is to remediate cut slopes to reduce the assessed risk level (ARL) of the cut slopes to 3 or better.

A secondary objective of the Proposal is to maintain road safety by maintaining the current speed limit of 40kph with 20kph advisory signs.

6.2 Options Considered

Option 1 – Do Nothing

This option was not considered suitable, as it would not address the RTA's responsibilities to maintain classified roads in accordance with the Proposal's objectives.

Option 2 – Major structural treatment

Major structural treatment would include a combination of rock fall shelters, retaining walls, gabion walls, pattern rock bolting, flexible meshing and shotcreting.

This option would address the RTA's responsibilities to maintain classified roads in accordance with the Proposal's objectives, but was considered not suitable, as the obtrusive appearance of a major structural treatment would detract from the attractive appearance of the natural bushland setting.

Option 3 – Major realignment

Major realignment would involve realignment of the road where the topography permits by constructing new cut slopes on the upslope side of the existing road.

This option would address the RTA's responsibilities to maintain classified roads in accordance with the Proposal's objectives, but was considered not suitable for the following reasons:

- Major realignment works would create new cut slopes that would have an obtrusive appearance for the short to medium term, which would detract from the attractive appearance of the natural bushland setting; and
- New cut slopes could have geotechnical stability problems, which cannot be predicted (ie. the new cut slopes could be less geotechnically stable than the existing cut slopes).

Option 4 – Local treatment (Preferred Option)

Option 4 would include the following works:

- Scaling of loose rocks;
- Crest treatment (ie. removal of unstable rock and soil), vegetation removal and slope regrading;
- Installation of metal rock bolts and face plates;
- Installation of metal rock catch fencing; and
- Application of shotcrete and/or mortar may be required at the cut slope sites (up to 10m^2 area in total).

This option was considered suitable, as it would address the RTA's responsibilities to maintain classified roads in accordance with the Proposal's objectives, and would not detract from the appearance of the attractive natural bushland setting in the medium to long term.

7 Background Investigations and Consultation

7.1 Background Investigations and Database Searches

The following results were obtained from desktop database searches conducted for the study area. The information below provides a summary of the search results. Copies of all the search results are provided in **Appendix E**.

Australian Heritage Database

The Australian Heritage Database was searched on 17 January 2005 for the Oberon LGA. The database returned 25 items, however only three are in close proximity to the Proposal site. 'The Greater Blue Mountains Area' is a declared place on the World Heritage List and covers the area surrounding the Proposal site including Kanangra Boyd National Park and the Jenolan Caves Reserve. 'Kanangra Boyd National Park' is a registered place on the Register of the National Estate (RNE). It is located to the immediate east of the existing stockpile/compound site, and approximately 700m east of the Proposal site (cut 3.64) at its closest point. 'Jenolan Caves and Reserve' is listed as a registered place on the RNE. The reserve is located adjacent to the Proposal site, on either side of the Jenolan Caves Road Reserve. The Jenolan Caves are located approximately 100m west of the Proposal site (cut 8.13). These items are not expected to be affected by the Proposal. Refer to Section 8.5 for further discussion.

NSW Heritage Office State Heritage Register/Inventory

The NSW Heritage Office State Heritage Register/Inventory was searched for the Oberon LGA on 17 January 2005. Three items are State listed. One State listed item, Jenolan Caves Reserve, is located adjacent to the Proposal site, on either side of the Jenolan Caves Road Reserve.

Forty-two items are listed by Oberon Local Government/State Government Agencies. Five items listed by Oberon Local Government [Kanangra Boyd National Park, Jenolan Caves (listed twice), Jenolan Caves Reserve and the Six Foot Track] are located in the vicinity of the Proposal site. The Six Foot Track is located to the immediate east of the existing stockpile/compound site. (Refer to the section above on "Australian Heritage Database" for locations of the other listed items). Jenolan Caves House is listed on the Oberon LEP (but not on the NSW Heritage Office State Heritage Register/Inventory). Jenolan Caves House is located approximately 400m west of the Proposal site. These items are not expected to be affected by the Proposal. Refer to Section 8.5 for further discussion.

National Native Title Tribunal

The National Native Title Tribunal was searched for the Oberon LGA on 17 January 2005. Five Native Title applications have been lodged within the Oberon LGA. The Gundungurra Tribal Council Aboriginal Corporation #6 Native Title application (NC97/7) is active and applies to the entire Proposal site. There are no records of Indigenous Land Use Agreements within the Proposal site. Refer to Section 8.6 for further discussion.

NSW DEC Aboriginal Heritage Information Management System (AHIMS)

The DEC AHIMS was searched for the Proposal site (including a 1km buffer) on 30 April 2004. Eighteen Aboriginal objects and places were found. Only four of the Aboriginal objects and places were within 1km of the Proposal site. A burial site is located 350m west of the Proposal site (southern section), two open camp sites are located approximately 400m south of the existing stockpile/compound site and a burial site is located 500m northwest of Proposal site (southern section). These items are not expected to be affected by the Proposal.

Following undertaking the above search on 30 April 2004, the Pejar LALC and Gundungurra Tribal Council inspected the Proposal site on 21 May 2004 with the RTA Project Manager and the RTA's APC. The Pejar LALC and Gundungurra Tribal Council had no concerns regarding Aboriginal objects and/or places within or in the vicinity of the Proposal site. Refer to Section 8.6 for further discussion.

NSW DEC Atlas of NSW Wildlife - Threatened Flora and Fauna Records

The DEC Wildlife Atlas Flora and Fauna records were searched for the Proposal site (including a 2km buffer) on 29 April 2004. Three threatened flora species were recorded in the vicinity of the Proposal site. The closest, *Stemmacantha australis* was found 1.8km east of the Proposal site (southern section).

The DEC Wildlife Atlas recorded fourteen fauna sitings within the vicinity of the Proposal site. The closest siting to the Proposal site was a Brush-tailed rock wallaby (*Petrogale penicillata*) approximately 450m west of the Proposal site (southern section). There were several other fauna sitings located nearby the Brush-tailed rock wallaby siting. These items are not expected to be affected by the Proposal.

Following undertaking the above search on 29 April 2004, Lesryk Environmental Consultants have prepared an ecological assessment of this Proposal, including undertaking searches of the NSW DEC Atlas of NSW Wildlife - Threatened Flora and Fauna Records. For more discussion and information refer to Section 8.4 and **Appendix E**.

DEH Protected Matters (EPBC Act) Database

The Commonwealth Department of Environment and Heritage Database was searched for the Proposal site on 17 January 2005. A summary of the EPBC Act database search is provided below. The complete results of the search are provided in **Appendix E**. It should be noted that the species identified in this database search include all species whose habitat requirements may be found in the search area rather than known occurrences from the Proposal site.

World Heritage Properties	1 found
National Heritage Places	None found
Wetlands of International Significance	Within the same catchment as Macquarie Marshes Nature Reserve
Commonwealth Marine Areas	None found
Listed Marine Species	12 found
Threatened Ecological Communities	None found
Threatened Species	18 potentially occurring
Migratory Species	8 potentially occurring
Commonwealth Lands	1 found
Commonwealth Reserves	None found
Regional Forest Agreements	None found

These listed items are not expected to be affected by the Proposal. Refer to Sections 8.4, 8.5 and 10.2, and **Appendix E** for further discussion and information.

NSW DPI FishFiles Database and Threatened Species List

The NSW Fisheries FISH FILE Database was searched on 17 January 2005 for the Hawkesbury-Nepean catchment. Silver perch (*Bidyanus bidyanus*) and Macquarie perch (*Macquaria australasica*) have been recorded in Hawkesbury-Nepean catchment. These species are not expected to be affected by the Proposal.

The NSW Fisheries Threatened Species website was consulted on 24 January 2005. The following matters have relevance to the proposed works:

- Key threatening processes - *the degradation of native riparian vegetation along New South Wales water courses*; and
- Habitat protection plans - *Habitat Protection Plan No. 3: Hawkesbury-Nepean River System.*

Refer to Section 8.4 for further discussion.

NSW DPI Noxious Weeds List

The NSW Department of Agriculture Noxious Weeds list was searched on 17 January 2005 for the Upper Macquarie County Council control area (including Oberon Council). Several weed species are declared noxious within this control area. Blackberry (*Rubus ulmifolius*), a Class 3 weed, is present within the Proposal site at cut slopes 4.22, 7.02, 7.58 and 8.13. Refer to Section 8.4 for further discussion.

NSW DEC Contaminated Land Records

The NSW DEC Contaminated Land Records were searched on 24 January 2005 for the Oberon Council area. No contaminated land is listed as present within the Oberon LGA. Oberon Council has advised that they are not aware of any contaminated sites located within the Proposal site. Refer to Section 8.4 and 8.11 for further discussion.

NSW DEC Air Quality Information

The NSW DEC Air Quality database was searched on 24 January 2005. The closest DEC Air quality monitoring site to the Proposal site is Bathurst. The two parameters measured here are ozone and number of particles less than 10 micrometers in diameter. Both the maximum one hour averages were well under the DEC goal measurements. These measurements are unlikely to be affected by the Proposal. Refer to Section 8.8 for further discussion.

The DEH National Pollutant Inventory

The National Pollutant Inventory was searched on 8 February 2005 for the Oberon LGA. Carter Holt Harvey Wood Products Australia Pty Limited (Carter Holt Harvey MDF) and Carter Holt Harvey Wood Products Australia Pty Limited (Structaflor Oberon) are the top two facilities for pollutant emissions for the Oberon LGA. Both facilities are located at Oberon, approximately 20km south east of Proposal site. The top pollutant sources within the Oberon LGA are: Other Wood Product Manufacturing; Basic Chemical Manufacturing; Cropping – Murray-Darling Basin; Unimproved Pasture - Murray-Darling Basin; and all others. The main substances emitted within the Oberon LGA include Formaldehyde (methyl

aldehyde), Polychlorinated dioxins and furans, Total Volatile Organic Compounds, Polycyclic aromatic hydrocarbons, and Particulate Matter (10.0 um) (DEH 2005). Refer to Section 8.8 for further discussion.

7.2 Government and Community Consultation and Involvement

7.2.1 Government and stakeholder consultation

Relevant state government agencies and stakeholders were contacted and provided with the opportunity to comment on the Proposal. Table 7.2.1 lists the government agencies and stakeholders that were invited to comment on the Proposal for this REF. Responses received are summarised in column 1, while column 2 identifies the Section in the REF where addressed.

Table 7.2.1: Summary of issues raised by government agencies and stakeholders.

Summarised Issues	Section in REF Where Addressed
Department of Environment and Conservation (DEC)	
A response to the consultation letter dated 27 April 2004 was received in May 2004. DEC had the following comments to make with regard to the proposed works.	
• DEC understands that the works would be fully contained within the existing road reserve and would not extend into the Kanangra Boyd National Park, nor into the Jenolan Caves Karst Conservation Area.	Sections 3.1 and 3.2
• DEC understand that the RTA will consider threatened species, and Aboriginal and Historic Cultural aspects.	Sections 8.4, 8.5 and 8.6
• DEC is aware that the RTA has made contact with the Jenolan Caves Trust Administrator and will make contact with the Sydney Catchment Authority.	Section 7.2.1
• The DEC contact officer will be the Kanangra Area Manager, Kim de Govrik (ph 6336 1972 or Kim.DeGovrik@npws.nsw.gov.au).	Noted
Meeting with DEC	
A meeting was held with Geoff Luscombe (Regional Manager, Blue Mountains Region) on 3 May 2004. DEC had the following comments to make with regard to the proposed works.	
<u>RTA Road reserve</u>	
• Approval from the DEC under Part 5 of the EP&A Act would not be required providing works are undertaken within the road reserve.	Noted
• Environmental impacts of the Proposal under the EPBC Act would not need to be assessed, as the Proposal would be contained within the NSW RTA road reserve.	Sections 8.4 and 10.2
<u>Stockpile site</u>	
• If the stockpile site is not located within the road reserve or on RTA owned land, the DEC recommended that the RTA obtain an agreement from the Jenolan Caves Reserve Trust to utilise the stockpile site at the top of Five Mile Hill.	Section 3.2.7

Sydney Catchment Authority (SCA)	
A response to the consultation letter dated 19 April 2004 was received in May 2004. SCA had the following comments to make with regard to the proposed works.	
• The assessment must consider the matters contained in Clause 10 of *SEPP 58 – Protecting Sydney's Water Supply.*	Section 4.3.2
• The REF should state that a Construction Environmental Management Plan would be prepared and that it would include a soil and water management plan.	Section 9.1
• Considerable care would be required to ensure excavated materials are not eroded from the site.	Section 9.1
• The assessment should have regard for the *draft Regional Plan – Sustaining the Catchments.*	Section 4.2.1
Jenolan Caves Reserve Trust (JCRT)	
A response to the consultation letter dated 19 April 2004 was received in May 2004. JCRT had the following comments to make with regard to the proposed works.	
• The Trust is a statutory government body charged with the care, control and management of Abercrombie, Borenore, Jenolan and Wombeyan Karst Conservation Reserves.	Noted
• The Trust would appreciate the additional opportunity to comment on the proposal when the relevant documentation (including the REF) becomes available.	Noted
• Work sites are located in relative close proximity to the Jenolan River and subterranean wetlands, both of which are ecologically significant. The impact on water quality, flora and cave invertebrates warrants particular consideration due to their high susceptibility to environmental change.	Section 8.3
• Consideration should be given to the installation of sediment traps and other forms of erosion control. A comprehensive survey of the proposed development site to "ascertain the presence or otherwise of threatened, rare or vulnerable flora and fauna communities is recommended.	Sections 9.1 and 8.4
• Maintaining a clear thoroughfare for vehicular traffic during periods of peak visitation (i.e. 7:30am - 5:30pm daily) is important.	Section 3.2
• Whilst it is accepted that proposed works will incur temporary impact on prevailing landscape values, the preparation of a site plan that gives consideration to parking requirements, plant storage etc. may help to reduce impacts in this regard.	Section 9.1
<u>Site Compound and Stockpile</u>	
• The removal of native vegetation (including trees, shrubs and grasses), noise associated with the maintenance and use of plant, and the proximity of the proposed stockpile/compound site to accommodation facilities (i.e. Jenolan Caves Cottages) are issues of fundamental concern.	Sections 8.4 and 8.10
• From a practical perspective, the construction and operation of a stockpile/compound site in proximity to an established accommodation facility is less than desirable. The primary attractant for the majority of patrons is the peace and quite. Similarly, the frequent presence of native fauna (ie. wallaby and kangaroo) at and in proximity to the facility is a proven drawcard.	Sections 8.4 and 8.10
• The impact of the Proposal (i.e. noise and movement) on these attractants, and its potential ramifications with respect to Trust revenue streams, requires careful consideration.	Sections 8.4 and 8.10

World Heritage Values • The Jenolan Karst Conservation Reserve forms part of the Greater Blue Mountains World Heritage Area (GBMWHA). By definition, these areas require more stringent management practice then that generally applied to other parks and reserves.	Sections 8.5 and 10.2
• It can be expected that public scrutiny of the Proposal will be high and as such, it is recommended that a comprehensive and appropriately targeted program of community consultation public relations be developed. Karst Conservation Reserves • Karst Conservation Reserves contain natural features that are highly susceptible to disturbance. Legislation dictates that the management of these reserves should be such, that these features are protected. Any development should be of a type and design to avoid adverse impacts on these features. • Inappropriate disposal of wastes could cause damage to caves. • Statutory/legislative responsibilities not being met could cause the Trust's reputation to be tarnished. • Inadequate site remediation could cause contamination of soil, visual amenity of Reserve to be compromised, and rockfalls and ongoing soil erosion.	Noted Sections 8.5 and 10.2 Section 8.11 Section 1.5 Section 9.1
Oberon Council	
No response was received from Oberon Council in response to the consultation letter sent 18 April 2004 at the time of publication.	NA
DIPNR	
No response was received from DIPNR in response to the consultation letter sent 18 April 2004 at the time of publication.	NA

7.2.2 Community Consultation and Involvement

The community would be informed of the proposed works on Jenolan Caves Road via local newspaper advertisements, community information sheets and road signage. Meetings have been held with the Jenolan Caves Reserve Trust (and lessees), and bus and coach operators to discuss completed, ongoing and future works on Jenolan Caves Road.

Community feedback (to date) regarding completed and ongoing works has been positive. The community generally understands the importance of undertaking the works to improve road safety along Jenolan Caves Road.

8 Environmental Assessment

8.1 General

This section of the REF provides a detailed description of the potential environmental impacts associated with the Proposal during both construction and operation, and provides site-specific safeguards to ameliorate the identified potential impacts.

The environmental safeguards predominately outline additional site-specific requirements which are not covered by the RTA's QA Specifications – Environmental Protection (Management System) G36, *Soil and Water Management (Erosion and Sediment Control Plan) QA Specification G39, and Clearing and Grubbing QA Specification G40* for inclusion into the Contractors Environmental Management Plan (CEMP) and the Project Environmental Management Plan (PEMP). These safeguards would be implemented prior to construction, during construction and post construction. The CEMP and PEMP would be reviewed by the RTA's Regional Environmental Adviser Western Region prior to the commencement of work.

8.2 Landform, Geology and Soils

Potential Impacts

The Proposal would remove rock and soil material, vegetation growth at the cut slope sites, and may require minimal application of shotcrete and/or mortar. Up to 1479m^3 of rock and soil material is expected to be removed by the Proposal. Due to the low density of vegetation growth present at the cut sites, only a small amount of vegetation is expected to be removed by the Proposal. Removal of the rock and soil material, and vegetation growth would create an erosion potential due to the disturbance of the cut slopes. Application of shotcrete and/or mortar would assist with stabilisation of the cut slopes. Loose soil material could be eroded from the cut slope sites by wind and water action. Natural regeneration of native ground covers and shrubs can be expected to assist with stabilising the cut slopes in the medium to long term.

Rock, soil material, and vegetation growth removed would be transported by truck to the existing stockpile/compound site. Truck movements has the potential to track mud and particles along the Jenolan Caves Road, particularly during wet weather. Erosion of rock and soil stockpiles also has the potential to occur as a result of wind and water action.

Following completion of the works, the existing potential for rock, soil and tree falls would be reduced (ie. the assessed risk level of the cut slopes would be 3 or better). The landform of the cut slopes would essentially remain the same, as only selective removal of rock, soil and vegetation would be required at each cut slope. Some parts of the majority of the cut slopes would be regraded to a flatter grade to reduce the potential for future geotechnical hazards.

Site Specific Safeguards

- An erosion and sedimentation control plan would be developed and incorporated into the CEMP. The plan would incorporate specifications outlined in the *NSW Erosion and Sediment Control Handbook No. 2*, identify areas requiring management controls,

include inspections and checklist sheets and would be reviewed by the RTA's Regional Environmental Adviser, Western Region prior to the commencement of works.

- Temporary stormwater control devices or erosion and sedimentation controls would be implemented at stormwater drains to prevent sediment-laden runoff entering the local receiving waters. Temporary erosion control measures would be implemented at the source of disturbance to minimise any potential runoff of erodible material.
- Maintenance and checking of the erosion and sedimentation controls would be undertaken on a regular basis and records kept and provided at anytime upon request. Sediment would be cleared from behind barriers on a regular basis and all controls would be managed in order to work effectively at all times.
- All stockpiles would be designed, established, operated and decommissioned in accordance with the RTA's *Stockpile Management Procedures 2001*. In addition, all stockpiles would be located 50m away from the high bank of any rivers or drainage lines.
- Stockpiles would not be established on slopes greater than 2:1 (horizontal to vertical).
- All loose rock and soil material would be removed daily from the cut slope sites.
- Any material transported onto pavement surfaces would be swept and removed at the end of each working day.
- Hardstand material or rumble grids would be implemented at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces.
- Works would not be undertaken during periods of high rainfall.
- Site rehabilitation of disturbed areas would be undertaken progressively as works are completed at each cut slope site.
- Disturbed areas would be restored to their pre-works shape (where not regraded) at the completion of works.

8.3 Water Quality and Hydrology

Potential Impacts

The Proposal is not expected to impact on the water quality of the Jenolan River or the karst limestone caves. The Proposal would be limited to rock, soil and vegetation material removal (up to 1479m^3), minimal application of shotcrete and/or mortar, and temporary storage of rock, soil, vegetation and waste material at the existing stockpile/compound site. Displaced groundwater from within drill holes, grout and epoxy resin spillage, shotcrete and/or mortar spillage, establishment of rock catch fence post holes, and drill cuttings/sludge removed from the drill holes would have a low potential to cause impacts on receiving waters. It is expected that the Proposal would only have a minor impact on erosion and sedimentation, and impacts on water quality are not expected providing the site specific safeguards below are implemented.

During drilling for rock bolts and piezometers/inclinometers, only small volumes of groundwater are expected to be encountered. No waterways or culverts would be altered by the Proposal, and no impact on hydrology and/or flooding is expected.

Site Specific Safeguards

- An incident emergency spill plan would be developed and incorporated into the CEMP. The plan would include measures to avoid spillages of fuels, chemicals, and fluids onto any surfaces or into any adjacent/nearby waterways. An emergency spill kit would be kept onsite at all times.

- All staff would be inducted to the incident emergency procedures and made aware of the location of where the emergency spill kit would be kept.
- Any accidental spills would be managed in accordance with the RTA *Emergency and Incident Response Procedure.*
- Should a spill occur during construction, the incident emergency spill plan would be implemented, and the Regional Environmental Adviser Western Region contacted.
- All fuels, chemicals, and liquids would be stored at least 50m away from any waterways or drainage lines and would be stored within an impervious bunded areas within the stockpile/compound site(s).
- The refuelling of plant and maintenance of machinery would be undertaken within impervious bunded areas within the stockpile/compound site(s).
- Vehicle wash downs and/or cement truck washouts would be undertaken within a designated bunded area of an impervious surface or undertaken offsite.
- All concrete works would be undertaken in accordance with DEC's *Environmental Best Management Practice Guideline for Concreting Contractors* (2002).
- To avoid contact with groundwater, no drill holes would be positioned at sites of known water seepage.
- Drop sheets would be used where appropriate during construction to prevent cement slurry and other materials (ie. grout and epoxy resin, shotcrete and/or mortar) from polluting any waterways.
- Excess concrete, shotcrete and/or mortar would be scraped off equipment prior to being washed. All remaining concrete, shotcrete and/or mortar residue would be collected and disposed of at a licenced landfill.
- All waste material (ie. grout, epoxy resin, shotcrete, mortar, workers refuse) would be collected and removed at the end of each working day.
- Wastewater generated from the construction process (ie. drill cuttings, sludge, displaced groundwater) would be collected, contained onsite, and treated (if necessary) in accordance with DEC specifications prior to its disposal. The release of dirty water into any waterways would be prohibited.
- Erosion and sediment control structures would be put in place to protect the water quality of the Jenolan River and the karst limestone caves.
- No polluted water generated by the Proposal would be permitted to be discharged to waterways.
- Sewage from portable toilets would be disposed of off-site at DEC approved locations.
- If any activities are likely to cause pollution of waterways, a licence would be obtained for the works under the POEO Act.

8.4 Biodiversity

An ecological assessment of the Proposal was undertaken by Lesryk Environmental Consultants in February 2005 (Refer to **Appendix A** for the full report).

Potential Impacts

Flora

'The clearing of native vegetation' is a key threatening process under the TSC Act, and 'Land clearance' is a key threatening process under the EPBC Act. Impacts of the removal of the vegetation would be minor in comparison to the amount of the same vegetation types

occurring in the surrounding region (350,106ha). The Proposal would remove up to 6.15ha of native vegetation. Within the areas of likely disturbance, the vegetation communities present are considered to be of limited value for those species recorded or expected. The Proposal would not fragment, disturb or alter any movement, dispersal or pollination vectors corridors, or isolate any proximate areas of suitable habitat.

The Proposal would not cause compaction of root zones, ringbarking, or smothering or waterlogging of vegetation. Expansion of weed growth within and adjacent to the Proposal site is not expected to occur as a result of the Proposal. Operation of the stockpile/compound site (refer to Section 3.2.7) is not expected to impact on the surrounding bushland.

The Proposal would not affect any threatened species, ecological communities or populations listed on the Schedules to the TSC Act. As such, the preparation of a Species Impact Statement is not considered to be required as part of the Proposal.

The Proposal is not considered to affect, threaten or have an adverse impact on any of those plants listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. Therefore, the matter would not require referral to the Federal Minister for the Environment for further consideration or approval.

The Proposal has a minor potential to disturb Blackberry (a Class 3 weed), which is present within the Proposal site at cut slopes 4.22, 7.02, 7.58 and 8.13.

Fauna

The Proposal would not cause significant impacts on the following TSC Act listed species observed within the Proposal site: Powerful Owl, Sooty Owl, Yellow-bellied Glider, Large-eared Pied Bat, Large-footed Myotis, Eastern Bentwing Bat, and Eastern False Falsistrelle. The Proposal would not cause significant impacts on the Gang-gang Cockatoo (proposed TSC Act listing) observed within the Proposal site. Within the areas of likely disturbance, the habitats present are considered to be of limited value for those species recorded or expected. The Proposal sites are very small, none providing any important areas of foraging, sheltering, roosting or breeding habitat.

The Proposal would not cause significant impacts on the Large-eared Pied Bat or the Satin Flycatcher (both EPBC Act listed) observed within the Proposal site. Therefore, the matter would not require referral to the Federal Minister for the Environment for further consideration or approval.

Other native fauna species recorded within the Proposal site are protected, as defined under the NSW *National Parks and Wildlife Act 1974*, but considered to be common to abundant throughout their distribution ranges. These animals are regularly recorded in the surrounding region in association with their habitat types. The undertaking of the Proposal would not remove habitats important to any of these animals, such that the disturbance of these would affect the local status of any of these species. The Proposal would not present a barrier to the dispersal patterns of any of these species, nor would it isolate any proximate areas of their necessary habitats.

The Proposal is not expected to remove any hollow bearing trees, as they are located outside of the Proposal site. No critical habitat, important wildlife corridors or endangered ecological communities would be impacted, as none are present within the Proposal site. No endangered fauna populations would be impacted, as none are present within the Proposal site.

Given the limited extent of the works proposed, the known ability for Koalas to traverse open ground, combined with the amount of bushland present both adjacent to and beyond the limits of the Proposal site it is not considered that the Proposal would have a significant impact on any Koala individuals, their populations or habitat. Therefore a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of the Proposal.

Aquatic

"*The degradation of native riparian vegetation along New South Wales water courses*" is a Key threatening process under the FM Act. The Proposal is not expected to cause degradation of native riparian vegetation present along the Jenolan River.

Habitat Protection Plan No. 3: Hawkesbury-Nepean River System has relevance to the Proposal site. The Proposal is not expected to cause impacts on the habitat of the Hawkesbury-Nepean River System.

Due to the minor nature of the proposed works, Silver perch and Macquarie perch (threatened FM Act listed species recorded in Hawkesbury-Nepean catchment) are not expected to be affected by the Proposal.

Site Specific Safeguards

Flora

- All personnel taking part in construction activities would be instructed through regular toolbox talks in the importance of the conservation value of the surrounding World Heritage area, and the need to minimise disturbance to the area.
- The limit of disturbance would be clearly marked, and work practices, including vehicular movements, would take care to not cause any damage to any vegetation stands or potential habitat located outside construction areas.
- All earthmoving plant and equipment would be thoroughly washed down prior to arrival on site to remove all soil and weed seeds. Wash down certificates would be held on project environmental files.
- Prevention of spreading, and reduction of the quantity and distribution of Blackberry (*Rubus ulmifolius*), a Class 3 weed, at cut slopes 4.22, 7.02, 7.58 and 8.13 would be achieved by treatment of the noxious weed. Treatment of the noxious weed would be undertaken in consultation with Upper Macquarie County Council, and the CRC Weed Management Guide for Blackberry (http://www.weeds.crc.org.au/publications/weed_man_guides.html).
- Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licenced landfill facility. Weed infested or contaminated topsoil would not be reused for revegetation works and would not be stockpiled adjacent to any areas of native vegetation.
- Weed growth present within the Proposal site (particularly at the stockpile/compound site) would be monitored weekly. Weed growth present would be removed/treated regularly to prevent the spread of weeds into adjacent bushland areas.
- If a chemical herbicide is used to suppress the growth of weed species, and/or to kill vegetation that presents a geotechnical hazard, a product would be selected that would readily break down and not impact on fauna species.
- The area of vegetation to be removed would be restricted to those areas specified in this REF. These areas would be clearly marked onsite, and on site plans prior to the commencement of works. Should additional clearing be required, the RTA's Regional

Environmental Adviser, Western Region would be contacted and consulted to determine the need for further environmental impact assessment.

- All vegetation to be retained would be clearly highlighted on site and on site plans, and would be protected with fencing (or other suitable material). Protective fencing (or other suitable material) would be erected beyond the drip-line of trees and erected prior to the commencement of works. All staff would be informed and inducted of the limits of vegetation clearing and the areas of vegetation to be retained.
- Trees present within the cut slope sites would not be removed unless they present a geotechnical hazard (ie. causing root jacking of rock).
- All trimming of mature native trees would be undertaken by a qualified arborist.
- Vehicles and machinery would be parked in cleared areas and not under the drip-line of retained vegetation or trees. Retained vegetation or trees would not be smothered by stockpiles, sediment, or by the storage of materials and equipment.
- Construction stockpile/compound sites, stockpile sites and the storage of materials would be established within existing cleared areas.
- Cleared native vegetation would be mulched and used in site rehabilitation works (where practical).
- Cleared and disturbed areas within stockpile/compound sites would be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion.
- Work areas would be monitored regularly for up to 3 months following completion of construction works to identify any potential loss of topsoil and/or vegetation up-hill of the works due to unforeseen wash-outs or soil slippage. The need for planting mitigation would be re-assessed.

Fauna

- Any fauna species found inhibiting works within Proposal site areas to be disturbed, would be removed by licenced persons under the NPW Act 1974.
- During vegetation clearing, woody debris suitable for fauna habitat would be retained and replaced on site outside of clear zones, as the removal of any dead wood, trees and logs is a Key Threatening Process under the TSC Act.

Aquatic

- The Proposal would not cause degradation of native riparian vegetation present along the Jenolan River.
- The Proposal would be undertaken in accordance with the *Habitat Protection Plan No. 3: Hawkesbury-Nepean River System.*

8.5 Non-Indigenous Heritage

Potential Impacts

Providing the site specific safeguards below (and in Sections 8.2 and 8.3) are implemented, the proposed works are not expected to cause any impact on the following heritage items:

- Dry stone walls (relics);
- Jenolan Caves, Kanangra Boyd National Park, Jenolan Caves Reserve, The Six Foot Track (LEP listed heritage items); and
- The Greater Blue Mountains Area which includes the Kanangra Boyd National Park and Jenolan Caves Reserve (World Heritage listed).

Site Specific Safeguards

- Should archaeological remains be uncovered during construction, all works would cease within the vicinity of the material/find and the RTA's Regional Environmental Adviser Western Region contacted.
- Machinery and trucks would be parked away from the downslope side of the road to avoid heavy loads being placed on the dry stone walls.
- Adverse affect on the heritage significance of the Six Foot Track would be avoided by maintaining foot access along the Six Foot Track (including installation of track markers) in the vicinity of the stockpile/compound site.

8.6 Indigenous Heritage

Potential Impacts

The Pejar LALC and Gundungurra Tribal Council inspected the Proposal site on 21 May 2004 with the RTA Project Manager and the RTA's APC. The Pejar LALC and Gundungurra Tribal Council had no concerns regarding Aboriginal objects and/or places within or in the vicinity of the Proposal site (refer to **Appendix F**).

The Proposal site has been previously disturbed by road construction works. The Proposal would cause moderate soil and rock disturbance and removal of a small amount of native vegetation. Taking into account advice received from The Pejar LALC and Gundungurra Tribal Council (see above), the works would only have a minor potential to impact on archaeological items.

The Gundungurra Tribal Council Aboriginal Corporation #6 Native Title application (NC97/7) is active and applies to the entire Proposal site. The Proposal subsequently has a potential to impact on the Native Title application.

Site Specific Mitigation Safeguards

- All personnel working on site would receive training in their responsibilities under the *National Parks and Wildlife Act 1974.*
- Should Indigenous heritage items be uncovered during works, all works in the vicinity of the find would cease and the RTA's Aboriginal Programs Consultant, Regional Environmental Adviser Western Region, DEC representative and relevant LALC representatives would be contacted. Works would not re-commence until appropriate clearance has been received.
- The RTA's Property section would deal with the matter relating to the Gundungurra Tribal Council Aboriginal Corporation #6 Native Title application (NC97/7).

8.7 Noise and Vibration

Operational Noise

The Proposal would not increase the capacity or the operational noise of the road.

Construction Noise

Construction equipment likely to be used during construction would include: scaling bars; excavators; cherry pickers; air track; small trucks; chainsaws; bobcats; and augers. The works would be undertaken from 4pm to 10am, from Sunday nights to Thursday nights inclusive, which would include the following non-standard working hours:

- Sunday 4pm to midnight; and
- Monday to Thursday 6pm to 7am.

Jenolan Caves Reserve Trust accommodation (Caves House, Jenolan Caves Cottages, Bellbird cottage) may be occupied during the works. The Proposal may cause noise impacts during the construction period, particularly at Bellbird cottage, which is located approximately 100m from the south end of the Proposal site. Noise impacts on visitors to Caves House and Jenolan Caves Cottages are not expected due to ample separation distances between the Proposal site and these accommodation houses.

The Jenolan Caves Camping ground can expected to be only lightly to moderately patronized at night during the April to September works period. Due to the ample separation distance between the Proposal site and camping ground of approximately 600m, the Proposal is not expected to impact on campers at the camping ground.

The RTA adopts the construction noise control criteria of the NSW DEC and EPA *Environmental Noise Control Manual (1999)*. In accordance with the DEC guidelines, target noise levels for the Proposal (5 months duration) would be 'background' +10dBA. The criteria recognises that moderate to high construction noise levels are likely to be accepted by local residents and workers due to the short-term duration activities such as those proposed. Short-term noise is also more likely to be accepted if the work is part of essential safety works such as those being undertaken for this Proposal.

Noise from night time construction activities are expected to exceed the current DEC Criteria, and the works may be expected to cause noise levels that can potentially cause adverse comment.

"Out of standard working hours" work would be undertaken to minimise impacts on traffic flow. The majority of the night work would be classified as being outside normal working hours and consequently *Practice Note vii* of the *RTA Environmental Noise Management Manual* would be adhered to at all times.

Vibration

No buildings are located within 30m of the Proposal site, and no blasting would be undertaken. No vibration impacts are therefore expected.

Site Specific Safeguards

- The procedures contained in the RTA's *Environmental Noise Management Manual, 2001* "*Practice Notes vii – Roadworks Outside of Normal Working Hours*" would be followed for works undertaken outside standard hours.
- Prior to the commencement of works, the Jenolan Caves Reserve Trust would be notified of the Proposal details, including the potential for noise impacts to occur.
- Background noise levels at the Proposal site would be recorded prior to the commencement of works. Construction noise monitoring would be undertaken during the works, if it is deemed necessary by the RTA Project Manager and/or RTA Regional Environmental Advisor, Western Region.

- If accommodation cabins are occupied by Trust guests during the works, it may be necessary to vacate them (particularly Bellbird cottage) if unacceptable noise levels occur during the Proposal. The RTA Project Manager would maintain close liaison with the Jenolan Caves Reserve Trust during the works.
- The idling of machinery and equipment when not in use, and for prolonged periods of time would be prohibited.
- Best management practices would be adopted that are consistent with the *RTA's Environmental Noise Management Manual, 2001*.
- Noise from reverse alarms would be limited to the lowest possible levels consistent with safety or, during the night, replaced with flashing lights, or other warning devices. Machines with excessively noisy alarms would be modified or removed from the site.
- All machines would be in good working condition, with particular attention to exhaust silencers, engine covers and other noise reduction devices.
- Short, sharp sounds primarily caused by physical impacts, would be avoided where possible to minimise sleep disturbance to Trust guests.

8.8 Air Quality

Potential Impacts

The Proposal has a minor potential to deteriorate the local air quality as a result of vehicle emissions, and from dust from earthworks/vegetation removal and stockpile erosion generated during construction.

No change in the operational vehicle emissions is expected, as the Jenolan Caves Road speed limits would remain unchanged. In order to ameliorate the potential impacts of the Proposal on local air quality, the following mitigation measures would be incorporated.

Site Specific Safeguards

- Construction activities that generate high dust levels would be avoided during high wind periods.
- Where dust generated by the proposed works is visible, dust suppression measures would be implemented.
- If winds are high and works are creating high levels of dust that are likely to cause discomfort to local residents or a safety hazard to traffic or work personnel, the works would be modified or stopped until the dust hazard is eliminated or has been reduced to an acceptable level.
- Any stockpiles and general works areas with the capacity to cause dust would be dampened or covered to suppress dust emissions.
- Long term stockpiles would be sprayed with a sterile grass mix to suppress dust generation.
- All stockpiles would be fenced with sediment control fencing.
- Truck movements would be controlled on site and restricted to designated roadways.
- To minimise exhaust emissions, vehicles and operating equipment used on-site would be switched off when not operating.
- Any materials transported in trucks would be appropriately covered to reduce dust generation.
- Tailgates would be secured during operation of trucks.

- Rehabilitation of disturbed surfaces would be undertaken as soon as practicable.

8.9 Visual Amenity / Landscape

A landscape and visual assessment of the Proposal was undertaken by Urban Design Office in February 2005 (Refer to **Appendix B** for the full report).

Potential Impacts

Visual impacts of the Proposal have been assessed in accordance with the RTA's *Environmental Impact Assessment Policy Guidelines Procedures (Version 4).*

Construction Phase

The necessary presence of night lighting, warning signs, temporary safety fencing and construction equipment would have a negative impact upon the road corridor for the duration of the works. Taking into account the small scale of the proposed works, and that the proposed works would generally be executed above eye level, the overall visual impact is expected to be Moderate to Low.

Works at the stockpile/compound site are not expected to be visible to surrounding land users, as the site is surrounded by dense native vegetation.

Operational Phase

The rock scaling works would be limited to small well defined areas. The nature of the scaling work is such that within a short timeframe, the freshly exposed cut slope faces would weather to match the existing appearance of the cut slopes. The scaling work is generally considered to be of Low visual impact.

The crest treatment and regrading works would be similar in extent at each of the cut slopes. The zone of crest treatment and regrading works would be limited to 5m from the existing crest. The minor scale of the work against the scale and density of the existing vegetation is comparatively small. The crest treatment and regrading works is considered to be of Moderate to Low visual impact.

The size of the rock bolts/face plates (grey colour) would be limited to 150mm x 150mm, and would be constructed of ferrous iron which would quickly weather and take on an organic appearance. Against the scale of the height of the cut slopes (5-10m range) the rock bolt faces/plates would be generally considered to be of Low visual impact.

The shotcrete and/or mortar application would be limited to small areas, and is generally considered to be of Low visual impact.

The rock catch fences would not exceed 1500mm in height, 15m in length, and would only be present at up to three locations (ie. at cuts 5.29 and 8.13). The rock catch fences would be considered to be of Moderate to Low visual impact.

Site Specific Safeguards

- The Proposal would be undertaken with the intent to only remove amounts of soil, rock and vegetation necessary to achieve the project objectives.
- The colour of the metal rock catch fencing would be chosen to blend in with the cut slope faces.

- Application of shotcrete and/or mortar would be undertaken in accordance with RTA's *QA Specification B82 Shotcrete Work.*
- The colour of the shotcrete and/or mortar would be chosen to match (as close as possible) the colour of the surrounding weathered rock at each cut slope site.
- The application of shotcrete and/or mortar would be minimised to that necessary to achieve stabilisation of the cut slope sites.
- Lights would be positioned to avoid light impacting on areas located beyond the Proposal site.
- The construction site would be kept tidy and rubbish free.

8.10 Socio-economic Considerations

Potential Impacts

Jenolan Caves Road would be closed during work periods from Sunday nights to Thursday nights (4pm to 10am) from 26 April 2005 to 23 September 2005. The timing of the works has been planned to occur outside peak periods for cave visitation (ie. summer, autumn and spring school holidays).

The Proposal would impact on visitors who would normally use Jenolan Caves Road to access Kanangra Walls and/or Jenolan Caves, including accommodation at Jenolan Caves House, Bellbird Cottage and Jenolan Caves Camping ground. Access to these destinations during the proposed work periods (Sunday to Thursday 4pm to 10am) would be possible via Oberon Road or Two-Mile Hill Road. The alternative routes are longer than the Jenolan Caves Road route, and are not suitable for tourist buses and/or coaches. Private bus companies would not be able to access Jenolan Caves via Jenolan Caves Road during work hours. During the works, buses would have to travel via Two-Mile Hill. A mini-bus shuttle service would transport passengers between Two-Mile Hill and the Jenolan Caves.

Due to sufficient separation distances between places of accommodation and the Proposal site, impacts from lighting, noise and dust are not expected.

Impacts on visitor numbers to Kanangra Walls and/or Jenolan Caves, and a subsequent reduction in tourism income is expected to be minor given that the Proposal would be undertaken during an off-peak period.

No post-construction community impacts are expected as a result of the Proposal.

Site Specific Safeguards

- A pre-construction audit of the local network condition, with particular focus on Jenolan Caves Road would be conducted to monitor whether additional truck movements result in the deterioration of the road surface.
- A Traffic Control Plan would be prepared in accordance with the RTA's *Traffic Control at Work Sites Manual 2003*, and approved by the RTA prior to implementation. The Traffic Control Plan would include the notification of any traffic alterations or closures.
- Telstra mobile network coverage would be available at Jenolan Caves for visitors to the Jenolan Caves area.
- Access along Jenolan Caves Road would be available during the winter school holiday period from 2-17 July 2005.

- Alternate access to Kanangra Walls, Jenolan Caves and accommodation (Jenolan Caves House, Bellbird cottage, Jenolan Caves Camping ground) would be available via Oberon or Two-Mile Hill Road.
- A mini-bus shuttle service between Two-Mile Hill and the Jenolan Caves would be provided as needed.
- All construction work areas on Jenolan Caves Road would be made trafficable at the end of each working day.
- Jenolan Caves Road would be accessible between 10am and 4pm Monday to Thursday, and all day Friday and Saturday.
- Signs would be used to advise drivers to use alternate access routes into Jenolan Caves via Oberon Road and Two-Mile Hill Road. The signs would be located at Hartley, Hampton, Top of Five Mile Hill, Top of Two Mile Hill, Lithgow and Bathurst, and traffic access advice would be provided through the media.
- A Community Liaison Group would be established to advise stakeholders and local road users of the progress of the works, and to seek input and feedback regarding the works. The Community Liaison Group would consist of Jenolan Caves Trust and staff, Caves House and staff, and local business owners.
- If accommodation cabins are occupied during the works, it may be necessary to vacate them (particularly Bellbird cottage) if unacceptable noise levels occur during the Proposal. The RTA Project Manager would maintain close liaison with the Jenolan Caves Reserve Trust during the works.
- In accordance with the RTA's *Community Involvement Practice Notes and Resource Manual (1988),* members of the affected community (including local residents, bus companies and emergency services) would be notified of the proposed works at least two (2) weeks prior to their commencement. The notification would identify the nature of the works, give an estimated duration, advise of anticipated delays and identify any changes to traffic, wide load restrictions, or access during the works.
- All booked visitors to Jenolan Caves would be advised of traffic management arrangements prior to their visit.
- All tourist bus and coach operators travelling to Jenolan Caves would be advised of traffic management arrangements prior to travelling to Jenolan Caves.

8.11 Waste Minimisation and Management

Potential Impacts

The Proposal would generate the following waste streams:

- Rock, soil and vegetation material;
- Metal rockbolts and face plates off-cuts;
- Drill cuttings and sludge;
- Grout and epoxy resin;
- Concrete;
- Shotcrete and/or mortar;
- Sewage;
- Workers refuse (eg. food waste).

The principles of waste management are to minimise the amount of waste generated, recycle waste wherever possible and dispose of the remainder in a responsible manner in accordance with appropriate RTA policy. The RTA adopts the Resource Management

Hierarchy principles embodied in the *Waste Avoidance & Resource Recovery Act 2001* (WARR Act).

Site Specific Safeguards

- A Waste Management Plan would be prepared in accordance with RTA's QA Specifications and in accordance with RTA's *Waste Minimisation & Management Guidelines, 1998* and the principles of the WARR Act.
- Trees to be removed would be assessed for their value as millable timber.
- Leaf material and small branches of native vegetation would be chipped and used as mulch in revegetation works.
- There would be no burning of waste.
- All exotic plant species removed would be bagged and disposed of at a licenced landfill facility.
- All construction materials, surplus soils and wastes generated from the Proposal would be stockpiled and stored at the stockpile/compound site prior to reuse, recycling or disposal.
- All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.
- Wastes would not be stored for long periods during construction of the Proposal. Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction.
- Any contaminated waste found would be identified and classified by a suitably qualified consultant.
- Any contaminated waste identified or generated during the Proposal would be disposed in accordance with DEC guidelines.

In addition, the Resource Management Hierarchy principles of the WARR Act would be adopted as follows:

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

8.12 Summary of Beneficial Effects

The Proposal has the following beneficial effects:

- The remediation of Jenolan Caves Road cut slopes would reduce the assessed risk level (ARL) of the cut slopes to 3 or better, and accordingly would improve road safety in accordance with objectives set out in *Road Safety 2010.*

8.13 Summary of Adverse Effects

The Proposal would result in some adverse effects that would include:

- Night closures of Jenolan Caves Road.
- Removal of a small amount of native vegetation.
- Potential for minor erosion and sedimentation.

- Potential for minor noise impacts.
- Potential for minor night lighting impacts.
- Potential for a minor temporary reduction in tourism income.
- A low operational impact on the high visual amenity of the Proposal site.

9 Implementation Stage

9.1 Summary of Proposed Environmental Safeguards

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the Proposal and during construction and operation of the Proposal. These safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. All safeguards described in this REF and the Decision Report/ Conditions of Approval would be incorporated into the Contractor's Environmental Management Plan (CEMP) and the Project Environmental Management Plan (PEMP).

The CEMP and PEMP (if required) would be developed in accordance with the specifications set out in the RTA's Environmental Protection (Management System) – QA Specification G36, and/or G39 and G40.

Table 9.1: Site Specific Environmental Safeguards.

Impact	Environmental Safeguards
Landform, Geology & Soils	• An erosion and sedimentation control plan would be developed and incorporated into the CEMP. The plan would incorporate specifications outlined in the *NSW Erosion and Sediment Control Handbook No. 2*, identify areas requiring management controls, include inspections and checklist sheets and would be reviewed by the RTA's Regional Environmental Adviser, Western Region prior to the commencement of works. • Temporary stormwater control devices or erosion and sedimentation controls would be implemented at stormwater drains to prevent sediment-laden runoff entering the local receiving waters. Temporary erosion control measures would be implemented at the source of disturbance to minimise any potential runoff of erodible material. • Maintenance and checking of the erosion and sedimentation controls would be undertaken on a regular basis and records kept and provided at anytime upon request. Sediment would be cleared from behind barriers on a regular basis and all controls would be managed in order to work effectively at all times. • All stockpiles would be designed, established, operated and decommissioned in accordance with the RTA's *Stockpile Management Procedures 2001*. In addition, all stockpiles would be located 50m away from the high bank of any rivers or drainage lines. • Stockpiles would not be established on slopes greater than 2:1 (horizontal to vertical). • All loose rock and soil material would be removed daily from the cut slope sites. • Any material transported onto pavement surfaces would be swept and removed at the end of each working day.

Impact	Environmental Safeguards
	• Hardstand material or rumble grids would be implemented at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces. • Works would not be undertaken during periods of high rainfall. • Site rehabilitation of disturbed areas would be undertaken progressively as works are completed at each cut slope site. • Disturbed areas would be restored to their pre-works shape (where not regraded) at the completion of works.
Water Quality & Hydrology	• An incident emergency spill plan would be developed and incorporated into the CEMP. The plan would include measures to avoid spillages of fuels, chemicals, and fluids onto any surfaces or into any adjacent/nearby waterways. An emergency spill kit would be kept onsite at all times. • All staff would be inducted to the incident emergency procedures and made aware of the location of where the emergency spill kit would be kept. • Any accidental spills would be managed in accordance with the RTA *Emergency and Incident Response Procedure*. • Should a spill occur during construction, the incident emergency spill plan would be implemented, and the Regional Environmental Adviser Western Region contacted. • All fuels, chemicals, and liquids would be stored at least 50m away from any waterways or drainage lines and would be stored within an impervious bunded areas within the stockpile/compound site(s). • The refuelling of plant and maintenance of machinery would be undertaken within impervious bunded areas within the stockpile/compound site(s). • Vehicle wash downs and/or cement truck washouts would be undertaken within a designated bunded area of an impervious surface or undertaken offsite. • All concrete works would be undertaken in accordance with DEC's *Environmental Best Management Practice Guideline for Concreting Contractors* (2002). • To avoid contact with groundwater, no drill holes would be positioned at sites of known water seepage. • Drop sheets would be used where appropriate during construction to prevent cement slurry and other materials (ie. grout and epoxy resin, shotcrete and/or mortar) from polluting any waterways. • Excess concrete, shotcrete and/or mortar would be scraped off equipment prior to being washed. All remaining concrete, shotcrete and/or mortar residue would be collected and disposed of at a licenced landfill. • All waste material (ie. grout, epoxy resin, shotcrete, mortar, workers refuse) would be collected and removed at the end of each working day.

Impact	Environmental Safeguards
	• Wastewater generated from the construction process (ie. drill cuttings, sludge, displaced groundwater) would be collected, contained onsite, and treated (if necessary) in accordance with DEC specifications prior to its disposal. The release of dirty water into any waterways would be prohibited. • Erosion and sediment control structures would be put in place to protect the water quality of the Jenolan River and the karst limestone caves. • No polluted water generated by the Proposal would be permitted to be discharged to waterways. • Sewage from portable toilets would be disposed of off-site at DEC approved locations. • If any activities are likely to cause pollution of waterways, a licence would be obtained for the works under the POEO Act.
Biodiversity	*Flora* • All personnel taking part in construction activities would be instructed through regular toolbox talks in the importance of the conservation value of the surrounding World Heritage area, and the need to minimise disturbance to the area. • The limit of disturbance would be clearly marked, and work practices, including vehicular movements, would take care to not cause any damage to any vegetation stands or potential habitat located outside construction areas. • All earthmoving plant and equipment would be thoroughly washed down prior to arrival on site to remove all soil and weed seeds. Wash down certificates would be held on project environmental files. • Prevention of spreading, and reduction of the quantity and distribution of Blackberry (*Rubus ulmifolius*), a Class 3 weed, at cut slopes 4.22, 7.02, 7.58 and 8.13 would be achieved by treatment of the noxious weed. Treatment of the noxious weed would be undertaken in consultation with Upper Macquarie County Council, and the CRC Weed Management Guide for Blackberry (http://www.weeds.crc.org.au/publications/weed_man_guides.html). • Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licenced landfill facility. Weed infested or contaminated topsoil would not be reused for revegetation works and would not be stockpiled adjacent to any areas of native vegetation. • Weed growth present within the Proposal site (particularly at the stockpile/compound site) would be monitored weekly. Weed growth present would be removed/treated regularly to prevent the spread of weeds into adjacent bushland areas. • If a chemical herbicide is used to suppress the growth of weed species, and/or to kill vegetation that presents a geotechnical hazard, a product would be selected that would readily break down and not impact on fauna species.

Impact	Environmental Safeguards
	• The area of vegetation to be removed would be restricted to those areas specified in this REF. These areas would be clearly marked onsite, and on site plans prior to the commencement of works. Should additional clearing be required, the RTA's Regional Environmental Adviser, Western Region would be contacted and consulted to determine the need for further environmental impact assessment. • All vegetation to be retained would be clearly highlighted on site and on site plans, and would be protected with fencing (or other suitable material). Protective fencing (or other suitable material) would be erected beyond the drip-line of trees and erected prior to the commencement of works. All staff would be informed and inducted of the limits of vegetation clearing and the areas of vegetation to be retained. • Trees present within the cut slope sites would not be removed unless they present a geotechnical hazard (ie. causing root jacking of rock). • All trimming of mature native trees would be undertaken by a qualified arborist. • Vehicles and machinery would be parked in cleared areas and not under the drip-line of retained vegetation or trees. Retained vegetation or trees would not be smothered by stockpiles, sediment, or by the storage of materials and equipment. • Construction stockpile/compound sites, stockpile sites and the storage of materials would be established within existing cleared areas. • Cleared native vegetation would be mulched and used in site rehabilitation works (where practical). • Cleared and disturbed areas within stockpile/compound sites would be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion. • Work areas would be monitored regularly for up to 3 months following completion of construction works to identify any potential loss of topsoil and/or vegetation up-hill of the works due to unforeseen wash-outs or soil slippage. The need for planting mitigation would be re-assessed. ***Fauna*** • Any fauna species found inhibiting works within Proposal site areas to be disturbed, would be removed by licenced persons under the NPW Act 1974. • During vegetation clearing, woody debris suitable for fauna habitat would be retained and replaced on site outside of clear zones, as the removal of any dead wood, trees and logs is a Key Threatening Process under the TSC Act. ***Aquatic*** • The Proposal would not cause degradation of native riparian vegetation present along the Jenolan River.

Impact	Environmental Safeguards
	• The Proposal would be undertaken in accordance with the *Habitat Protection Plan No. 3: Hawkesbury-Nepean River System.*
Non-Indigenous Heritage	• Should archaeological remains be uncovered during construction, all works would cease within the vicinity of the material/find and the RTA's Regional Environmental Adviser Western Region contacted. • Machinery and trucks would be parked away from the downslope side of the road to avoid heavy loads being placed on the dry stone walls. • Adverse affect on the heritage significance of the Six Foot Track would be avoided by maintaining foot access along the Six Foot Track (including installation of track markers) in the vicinity of the stockpile/compound site.
Indigenous Heritage	• All personnel working on site would receive training in their responsibilities under the *National Parks and Wildlife Act 1974.* • Should Indigenous heritage items be uncovered during works, all works in the vicinity of the find would cease and the RTA's Aboriginal Programs Consultant, Regional Environmental Adviser Western Region, DEC representative and relevant LALC representatives would be contacted. Works would not re-commence until appropriate clearance has been received. • The RTA's Property section would deal with the matter relating to the Gundungurra Tribal Council Aboriginal Corporation #6 Native Title application (NC97/7).
Noise and Vibration	• The procedures contained in the RTA's *Environmental Noise Management Manual, 2001* "*Practice Notes vii – Roadworks Outside of Normal Working Hours*" would be followed for works undertaken outside standard hours. • Prior to the commencement of works, the Jenolan Caves Reserve Trust would be notified of the Proposal details, including the potential for noise impacts to occur. • Background noise levels at the Proposal site would be recorded prior to the commencement of works. Construction noise monitoring would be undertaken during the works, if it is deemed necessary by the RTA Project Manager and/or RTA Regional Environmental Advisor, Western Region. • If accommodation cabins are occupied by Trust guests during the works, it may be necessary to vacate them (particularly Bellbird cottage) if unacceptable noise levels occur during the Proposal. The RTA Project Manager would maintain close liaison with the Jenolan Caves Reserve Trust during the works. • The idling of machinery and equipment when not in use, and for prolonged periods of time would be prohibited. • Best management practices would be adopted that are consistent with the *RTA's Environmental Noise Management Manual, 2001.* • Noise from reverse alarms would be limited to the lowest possible levels consistent with safety or, during the night,

Impact	Environmental Safeguards
	replaced with flashing lights, or other warning devices. Machines with excessively noisy alarms would be modified or removed from the site. • All machines would be in good working condition, with particular attention to exhaust silencers, engine covers and other noise reduction devices. • Short, sharp sounds primarily caused by physical impacts, would be avoided where possible to minimise sleep disturbance to Trust guests.
Air Quality	• Construction activities that generate high dust levels would be avoided during high wind periods. • Where dust generated by the proposed works is visible, dust suppression measures would be implemented. • If winds are high and works are creating high levels of dust that are likely to cause discomfort to local residents or a safety hazard to traffic or work personnel, the works would be modified or stopped until the dust hazard is eliminated or has been reduced to an acceptable level. • Any stockpiles and general works areas with the capacity to cause dust would be dampened or covered to suppress dust emissions. • Long term stockpiles would be sprayed with a sterile grass mix to suppress dust generation. • All stockpiles would be fenced with sediment control fencing. • Truck movements would be controlled on site and restricted to designated roadways. • To minimise exhaust emissions, vehicles and operating equipment used on-site would be switched off when not operating. • Any materials transported in trucks would be appropriately covered to reduce dust generation. • Tailgates would be secured during operation of trucks. • Rehabilitation of disturbed surfaces would be undertaken as soon as practicable.
Visual Amenity / Landscape	• The Proposal would be undertaken with the intent to only remove amounts of soil, rock and vegetation necessary to achieve the project objectives. • The colour of the metal rock catch fencing would be chosen to blend in with the cut slope faces. • Application of shotcrete and/or mortar would be undertaken in accordance with RTA's *QA Specification B82 Shotcrete Work.* • The colour of the shotcrete and/or mortar would be chosen to match (as close as possible) the colour of the surrounding weathered rock at each cut slope site. • The application of shotcrete and/or mortar would be minimised to that necessary to achieve stabilisation of the cut slope sites. • Lights would be positioned to avoid light impacting on areas located beyond the Proposal site.

Impact	Environmental Safeguards
Socio-Economic Considerations	• The construction site would be kept tidy and rubbish free. • A pre-construction audit of the local network condition, with particular focus on Jenolan Caves Road would be conducted to monitor whether additional truck movements result in the deterioration of the road surface. • A Traffic Control Plan would be prepared in accordance with the RTA's *Traffic Control at Work Sites Manual 2003*, and approved by the RTA prior to implementation. The Traffic Control Plan would include the notification of any traffic alterations or closures. • Telstra mobile network coverage would be available at Jenolan Caves for visitors to the Jenolan Caves area. • Access along Jenolan Caves Road would be available during the winter school holiday period from 2-17 July 2005. • Alternate access to Kanangra Walls, Jenolan Caves and accommodation (Jenolan Caves House, Bellbird cottage, Jenolan Caves Camping ground) would be available via Oberon or Two-Mile Hill Road. • A mini-bus shuttle service between Two-Mile Hill and the Jenolan Caves would be provided as needed. • All construction work areas on Jenolan Caves Road would be made trafficable at the end of each working day. • Jenolan Caves Road would be accessible between 10am and 4pm Monday to Thursday, and all day Friday and Saturday. • Signs would be used to advise drivers to use alternate access routes into Jenolan Caves via Oberon Road and Two-Mile Hill Road. The signs would be located at Hartley, Hampton, Top of Five Mile Hill, Top of Two Mile Hill, Lithgow and Bathurst, and traffic access advice would be provided through the media. • A Community Liaison Group would be established to advise stakeholders and local road users of the progress of the works, and to seek input and feedback regarding the works. The Community Liaison Group would consist of Jenolan Caves Trust and staff, Caves House and staff, and local business owners. • If accommodation cabins are occupied during the works, it may be necessary to vacate them (particularly Bellbird cottage) if unacceptable noise levels occur during the Proposal. The RTA Project Manager would maintain close liaison with the Jenolan Caves Reserve Trust during the works. • In accordance with the RTA's *Community Involvement Practice Notes and Resource Manual (1988),* members of the affected community (including local residents, bus companies and emergency services) would be notified of the proposed works at least two (2) weeks prior to their commencement. The notification would identify the nature of the works, give an estimated duration, advise of anticipated delays and identify any changes to traffic, wide load restrictions, or access during the works.

Impact	Environmental Safeguards
Waste Minimisation & Management	• All booked visitors to Jenolan Caves would be advised of traffic management arrangements prior to their visit. • All tourist bus and coach operators travelling to Jenolan Caves would be advised of traffic management arrangements prior to travelling to Jenolan Caves. • A Waste Management Plan would be prepared in accordance with RTA's QA Specifications and in accordance with RTA's *Waste Minimisation & Management Guidelines, 1998* and the principles of the WARR Act. • Trees to be removed would be assessed for their value as millable timber. • Leaf material and small branches of native vegetation would be chipped and used as mulch in revegetation works. • There would be no burning of waste. • All exotic plant species removed would be bagged and disposed of at a licenced landfill facility. • All construction materials, surplus soils and wastes generated from the Proposal would be stockpiled and stored at the stockpile/compound site prior to reuse, recycling or disposal. • All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day. • Wastes would not be stored for long periods during construction of the Proposal. Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction. • Any contaminated waste found would be identified and classified by a suitably qualified consultant. • Any contaminated waste identified or generated during the Proposal would be disposed in accordance with DEC guidelines. In addition, the Resource Management Hierarchy principles of the WARR Act would be adopted as follows: 1. Avoid unnecessary resource consumption as a priority; 2. Avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery; and 3. Disposal is undertaken as a last resort.

9.2 Licences and Approvals

Protection of the Environment Operations Act, 1997

The Proposal is not expected to cause pollution of water (ie. any chemical, biological, physical change to existing water quality). An Environment Protection Licence (EPL) would therefore not be expected to be required under the POEO Act, 1997.

The Contractor and the RTA would notify the DEC if a "pollution incident" occurs that causes or threatens "material harm" to the environment.

10 Consideration of State and Commonwealth Environmental Factors

10.1 Clause 228(2) Factors (NSW Legislation)

The factors which need to be taken into account when considering the environmental impact of an activity are listed in Clause 228(2) of the *Environmental Planning and Assessment Regulation, 2000.* Those factors have been addressed in Table 10.1 below to ensure that the likely impacts of the proposed activities on the natural and built environment are fully considered.

Table 10.1: Compliance with Clause 228(2) of the EP&A Regulation 2000.

Clause 228(2) Factors	Impact
a) Any environmental impact on a community? Short term negative impacts include night closures of Jenolan Caves Road, and could potentially include noise impacts (particularly at Bellbird cottage), adverse light impacts and temporary minor reduction in tourism income. These impacts would be limited to the construction period, and would be eliminated or minimised through the implementation of safeguards described in Section 9 of this report. In the long term, the community would be provided with a safer roadway. Refer to Section 8.10.	Short term - ve Long term + ve
b) Any transformation of a locality? In the short term, the freshly cut rock/soil surface, and possibly the absence of vegetation, would be visible along Jenolan Caves Road during daylight hours. In the long term, the locality is not expected to be transformed. The introduction of rock bolts/face plates, shotcrete and/or mortar, and rock catch fencing can be expected to be noticeable to road users, but would not be noticeable to surrounding land users. Vegetation growth adjacent to the roadway would assist to screen the rock bolts/face plates, shotcrete and/or mortar, and rock catch fencing from the view of surrounding land users. Refer to Section 8.10.	Short term - ve Long term Minor -ve
c) Any environmental impact on the ecosystem of the locality? The areas likely to be directly and indirectly impacted by the Proposal are not considered to be important for either the integrity or life cycle requirements of endangered ecological communities and/or threatened species. The Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Powerful Owl, Sooty Owl, Yellow-bellied Glider, Large-eared Pied Bat, Large-footed Myotis, Eastern Bentwing Bat, and Eastern False Falsistrelle, Gang-gang Cockatoo or Satin Flycatcher. Refer to Section 8.4.	Nil
d) Any reduction of the aesthetics, recreational, scientific or other environmental quality or value of a locality? The Proposal is not expected to reduce the aesthetic, recreational, scientific or other environmental quality or value of the locality. In the medium to long-term, the cut slope sites can be expected to regenerate with vegetation growth. The rock bolts/face plates would weather in the medium to long-term, and the colour of the shotcrete and/or mortar, and rock catch fencing would be a chosen to blend in with the cut slope faces.	Short term- ve Long term Nil

Clause 228(2) Factors	Impact
The aesthetically attractive travel route would be maintained in the medium to long-term. Refer to Section 8.10.	
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 generations? The Proposal would not remove any locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present generations. Refer to Sections 8.5, 8.6, 8.10.	Nil
f) Any impact on habitat of any protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of any protected fauna. Refer to Section 8.4.	Nil
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? It is not anticipated that the Proposal would result in the endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air. Refer to Section 8.4.	Nil
h) Any long-term effects on the environment? The Proposal is not expected to cause long term negative impacts on the environment. Refer to Section 8.	Nil
i) Any degradation of the quality of the environment? In the medium to long-term, the Proposal is not expected to degrade the quality of the environment. The cut slope sites can be expected to regenerate with vegetation growth. Introduction of rock bolts/face plates, shotcrete and/or mortar, and rock catch fencing is not expected to degrade the quality of the environment. The appearance of the cut slope sites would only appear slightly different to their existing appearance following completion of the works. There may be some minor short term impacts during construction, however these would be managed via the safeguards listed in Section 9. Refer to Section 8.4, 8.9.	Short term- ve Long term Nil
j) Any risk to the safety of the environment? In the long term there would be positive impacts as the Proposal would improve the level of safety for road users. Refer to Sections 8.3 and 8.12.	Long term + ve
k) Any reduction in the range of beneficial uses of the environment? Jenolan Caves Road would be closed during work periods from Sunday nights to Thursday nights (4pm to 10am) from 26 April 2005 to 23 September 2005. Access to Kanangra Walls and/or Jenolan Caves, including accommodation during the proposed work periods would be possible via Oberon Road or Two-Mile Hill Road. The alternative routes are longer than the Jenolan Caves Road route, and are not suitable for tourist buses and/or coaches. Impacts on visitor numbers to Kanangra Walls and/or Jenolan Caves, and a subsequent reduction in tourism income is expected to be minor taking into account the Proposal would be undertaken during an off-peak period. No post-construction community impacts are expected as a result of the Proposal. Refer to Section 8.3.	Short term- ve Long term Nil

l) Any pollution of the environment?	
It is expected that the Proposal would not pollute the environment, providing that the safeguards in Section 9 are implemented. Refer to Section 8.3.	Long term Nil
m) Any environmental problems associated with the disposal of waste?	
Minimal waste would be generated as a result of the Proposal. Waste material would be disposed of at approved waste disposal sites and managed in accordance with the Resource Management Hierarchy of the WARR Act. Refer to Section 8.11.	Nil
n) Any increased demands on resources, natural or otherwise which are, or are likely to become, in short supply?	
There would not be any increased demand on resources, natural or otherwise which are, or are likely to become in short supply. Refer to Sections 3.1 and 8.11.	Nil
o) Any cumulative environmental effect with other existing or likely future activities?	
The proposed works would have a positive cumulative effect on the safety of the current use of Jenolan Caves Road in conjunction with other proposed works on this road (ie. installation of cantilever structures and Thriebeam guardrail at three sites). During construction, installation of cantilever structures and Thriebeam guardrail on Jenolan Caves Road have a potential to cause negative cumulative impacts during construction (ie. water quality, noise, visual) in association with the proposed cut slopes remediation. During operation, the cantilevers/Thriebeam guardrail on Jenolan Caves also have a minor potential to cause negative visual cumulative impacts in association with the proposed cut slopes remediation. Refer to Section 1.5.	Short term -ve Long term +ve and - ve

10.2 EPBC Act 1999 Factors (Commonwealth Legislation)

The EPBC Act requires that the following matters of National Environmental Significance (NES) be considered.

Table 10.2: Compliance with Commonwealth EPBC Act requirements.

EPBC Act Factors	Impact
a) Any environmental impact on World Heritage property? The Proposal is not expected to impact on the Greater Blue Mountains World Heritage Area.	Nil
b) Any environmental impact on National Heritage places? The Proposal would not impact any National Heritage places, as there are no National Heritage places present within 10km of the Proposal site.	Nil
c) Any environmental impact on wetlands of international importance? The Proposal is not located within the catchment of the Macquarie Marshes, which is located 340km north west of the Proposal site. The Proposal would not impact on any wetland of international importance.	Nil
d) Any environmental impact on Commonwealth listed threatened species or ecological communities? There are 18 threatened species and no ecological communities recorded as potentially occurring within a 10km search area around the locality. The Proposal would not have a significant impact on any of these species.	Nil
e) Any environmental impact on Commonwealth listed migratory species? There have been 8 migratory species recorded within a 10km search area around the locality. The Satin Flycatcher was observed within the Proposal site. No habitat for any of these species would be affected by the Proposal, and a significant impact on the Satin Flycatcher is not expected. The Proposal would therefore not have any impact on Commonwealth listed migratory species.	Nil
f) Does any part of the Proposal involve nuclear action? The Proposal would not involve a nuclear action.	Nil
g) Any environmental impact on a Commonwealth Marine area? The Proposal would not impact on a Commonwealth marine area.	Nil
In addition: Any impact on Commonwealth Land? Commonwealth land would not be affected, directly or indirectly, as part of this Proposal.	Nil

11 Certification

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

P. Ryan

Peter Ryan
Environmental Officer
Date: 11-3-2004

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

Chris Barnett
Project Manager
Date:

12 References

Australian Heritage Database, 2005, (http://www.ahc.gov.au/register/easydatabase/database.html).

Bureau of Meteorology 2004. *Climate data obtained from www.bom.gov.au.* May 2004

CALM 1994. *Soil Landscapes of the Katoomba 1:100,000 Sheet (Mount Tomah, Woodford, Jenolan Caves, Hampton).* D.P King.

DEC website (http://www.dec.nsw.gov.au)

DEC Contaminated Land Register, 2005, (http://www2.epa.nsw.gov.au/prpoeo/LicenceN.asp)

Department of Environment and Heritage, Protected Matters Search Tool, 2005 (http://www.deh.gov.au/erin/ert/epbc/index.html)

Department of Environment and Heritage 2005. *National Pollutant Inventory* (http://www.npi.gov.au/index.html)

EPA 1999. *Environmental Noise Control Manual* .

EPA 2002. *Environmental Best Management Practice Guideline for Concreting Contractors.*

JCRT 2004. *The Jenolan Karst Conservation Reserve Draft Plan of Management.* Manides Roberts.

JCRT 2005. *Jenolan Caves Reserve Trust web site.* 2005

NSW Heritage Office State Heritage Inventory 2005, (http://www.heritage.nsw.gov.au/07_subnav_01.cfm)

Oberon Council 2003. *State of the Environment Report (1/7/02 to 30/6/03).*

RTA 1998. *Waste Minimisation & Management Guidelines.* RTA, NSW.

RTA 1999. *RTA Statutory Planning Guidelines.* RTA, NSW.

RTA 2001a. *Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4.*

RTA 2001b. *Stockpile Management Procedures.* RTA, NSW.

RTA 2002. *Aboriginal Heritage Guidelines.* RTA, NSW.

RTA 2003a. *Preliminary Draft Report on Concept Design Remediation Work for Rock Cuts MR 253 Jenolan Caves Road.* Golder Associates, December 2003.

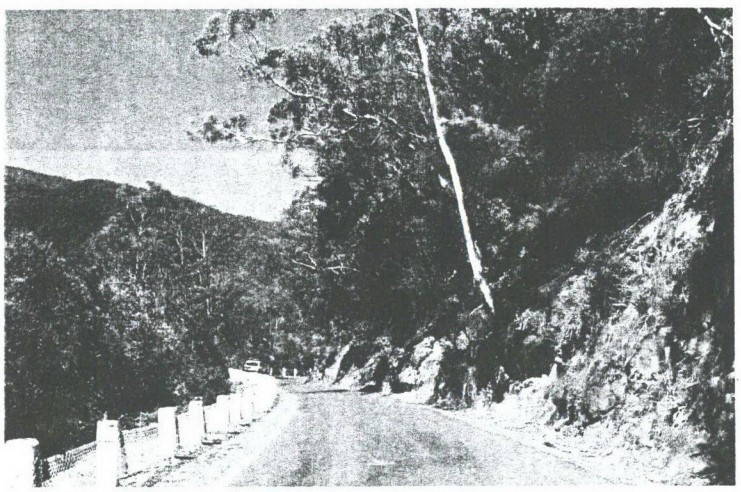
RTA 2003b. *Traffic Control at Work Sites Manual.* RTA, NSW.

RTA 2005. *Ecological Assessment of Proposed Cut Slopes Remediation on Jenolan Caves Road, Jenolan Caves.* Lesryk Environmental Consultants.

RTA Heritage and Conservation Register 2005, (http://www.rta.nsw.gov.au/environment/heritage/heritageconservreg/hunter/index.html)

Appendix A Ecology Study

Ecological assessment of proposed cutslope remediation works.



Jenolan Caves Road,
Jenolan Caves

February 2005

lesryk
ENVIRONMENTAL
CONSULTANTS

Report prepared on behalf of:

The NSW Roads and Traffic Authority
by

LesryK Environmental Consultants
PO BOX 3001
BUNDEENA NSW 2230

Telephone: (02) 9523 2016
Mobile: 0408 25 8129
Facsimile: (02) 9544 1835

Email: admin@lesryk.com.au
www.lesryk.com.au

Please note that, given the dynamic nature of the relevant pieces of environmental legislation considered in this report, the authors consider that this report only has a 'shelf life' of six months. If a development application, review of environmental factors or statement of environmental effect is not submitted to a determining authority for consideration within this time frame, it is recommended that this report be reviewed and revised where required in light of any relevant legislative listings or changes.

EXECUTIVE SUMMARY

At the request of the New South Wales Roads and Traffic Authority (RTA), a flora and fauna assessment was undertaken of the lands that occur within, and adjacent to, Jenolan Caves Road, Jenolan Caves, New South Wales. The survey has been carried out as the RTA is proposing to conduct remedial works at several sites, thereby improving the safety of Jenolan Caves Road to road users. The survey was conducted to identify the presence of any species, populations or communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or NSW *Threatened Species Conservation Act 1995*, thereby assessing their reliance on the proposed works sites and determining the extent of any likely impacts on the viability of these as a result of the undertaking of the Proposal.

By the completion of the field surveys, no state or nationally listed threatened plants or Endangered Ecological Communities had been recorded within the study area. Similarly no plants or vegetation communities of regional conservation concern had been detected. As such, no locally or regionally significant populations of any plants or vegetation communities of conservation significance would be adversely affected as a result of the undertaking of the Proposal.

Seven state listed threatened animals were recorded during the fauna surveys undertaken as part of the investigation, these being the Powerful Owl *Ninox strenua*, Sooty Owl *Tyto tenebricosa*, Yellow-bellied Glider *Petaurus australis*, Large-eared Pied Bat *Chalinolobus dwyeri*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Large-footed Myotis *Myotis adversus* and Eastern Bentwing Bat *Miniopterus schreibersii*. In addition to these, the Gang-gang Cockatoo *Callocephalon fimbriatum* was detected, this bird being preliminary listed for inclusion under Schedule 2 of the *Threatened Species Conservation Act 1995*. Two nationally listed animals were also recorded, these being the Satin Flycatcher *Myiagra cyanoleuca* (a migratory bird) and Large-eared Pied Bat *Chalinolobus dwyeri* (a vulnerable species). Giving consideration to the scale of works proposed, the structure and quality of the habitats present at each site, and the presence of large conservation reserves adjacent to the study area, it was not considered that any individuals or populations of any of these fauna species of state and/or national conservation concern would be significantly impacted upon, such that the extinction or displacement of these animals would arise. Giving consideration to the assessment criteria provided in association with the Commonwealth *Environment Protection and Biodiversity Conservation Act's* Administrative Guidelines on Significance and Section 5A of the NSW *Environmental Planning and Assessment Act 1979* it is not considered that the Proposal would have an adverse impact on any state or nationally listed threatened species, their populations, ecological communities or habitats. As such, it is not considered necessary that a referral to Environment Australia be made, or a Species Impact Statement prepared, as part of the Proposal.

By the completion of the field surveys, no ecological constraints were identified that would impede the Proposal proceeding as planned. The Proposal could be undertaken without requiring the preparation of any further terrestrial ecological studies.

Recommendations are presented to ensure that the activities associated with the Proposal are undertaken in an ecologically sustainable manner, thereby minimising the indirect impact of the works on adjacent features of state and/or national conservation value.

TABLE OF CONTENTS

List of Figures.

Photographic record of study area.

List of Tables.

List of Appendices.

1. Introduction.

This report presents the findings of a flora and fauna survey of the lands that occur within, and in-close proximity to, ten sites that occur adjacent to Jenolan Caves Road, Jenolan Caves, New South Wales (NSW). The survey has been carried out as the NSW Roads and Traffic Authority (RTA) is proposing to conduct remedial work at each of the ten sites.

The ten sites being investigated are:

- Cut slope C1.74 (approximate length 150 metres [m]);
- Cut slope 2.63 (100m);
- Cut slope 3.64 (200m);
- Cut slope 4.22 (150m);
- Cut slopes 5.08 and 5.29 (300m);
- Cut slope 7.02 (75m);
- Cut slope 7.58 (150m);
- Cut slope 8.13 (100m); and
- Walls 40 and 41 (115m).

In addition to these, the existing compound site was also investigated, as was an access track and proposed works area that would be established above cut slope 3.64.

For reference, each of the sites surveyed are highlighted on Figure 1.

The remediation works proposed to be undertaken at each of the cut slopes would include the scaling of loose rock, the installation of rock bolts, steel meshing and barrier fencing and the repair / replacement of drainage structures. The proposed works would be undertaken at night, generally between the hours of 4pm and 10am, from the 26th of April to the 23rd of September 2005.

At cut slope 3.64, an access track and works compound may be required. The access track and works compound would be established above the cut slope, the track being approximately 500m long and 5m wide. To establish both the access track and works compound, some native vegetation would require removal.

Based on a worst case scenario (this assuming a clearing width of 10m for the cut slopes), it is assumed that a total of 6.15 hectares (ha) of native vegetation would be cleared to permit the undertaking of the proposed works, this including the remediation of the cut slopes, and the establishment of both the access track (50 x 500m in size) and works site (80 x 300m in size). Whilst this is the case, it is noted that several of the cut slopes are currently cleared or sparsely vegetated, these being slopes composed mainly of exposed rock (e.g. refer to photographs 4 and 6). These cleared slopes were included in the estimates made for total vegetation removal.

It is noted that some works have already been completed at Walls 40 and 41, the cut slopes at these locations having been cleared and scaled of loose rock (refer to photograph 1). The works compound is also an existing facility, this area supporting a series of demountables, stockpiles and fenced enclosures (refer to photograph 2).

Where required, more detailed information on the scope of the project is provided in the project's Review of Environmental Factors (REF).

For ease of reference, unless a specific site or component of the investigation area is referred to, the entire area surveyed (that being the nine cut slopes, Walls 40/41, the existing compound site, the proposed access track, works site and their adjacent habitats) will hereafter be referred to as the 'study area', whilst the surrounding lands will be referred to as the 'study region'.

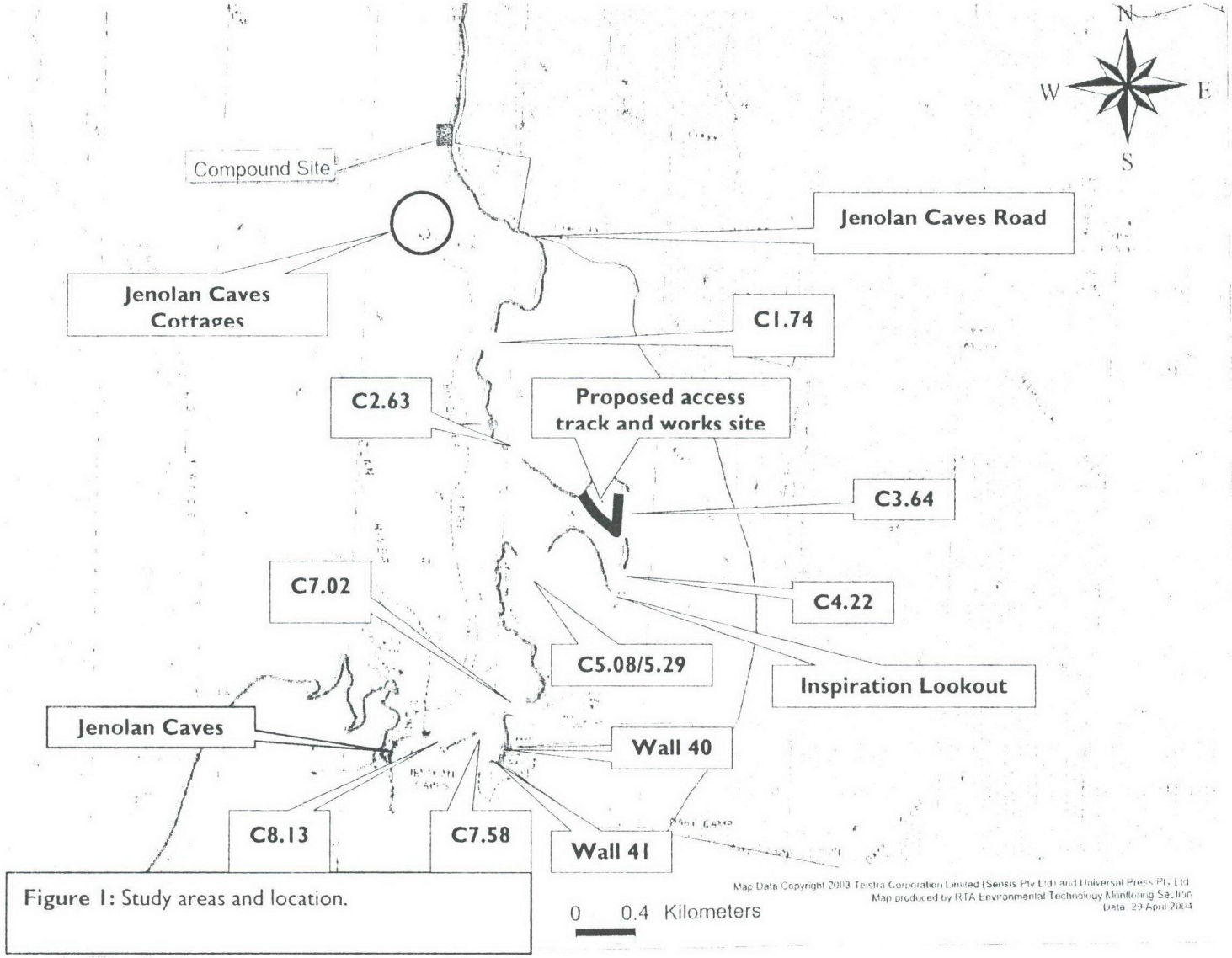


Figure 1: Study areas and location.

For the purpose of the current investigation, where access was physically possible and safe, the area surveyed encompassed all the lands that occur within the study area and for a distance of 30 metres (m) either side of Jenolan Caves Road.

The assessment of possible impacts associated with the Proposal is based on a field survey of the study area, a literature review of previous studies undertaken in both the region and the Oberon Local Government Area, the consultation of standard databases and the consideration of the objectives of the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, the NSW *Environmental Planning and Assessment Act (EPA) 1979*, NSW *National Parks and Wildlife (NPW) Act 1974*, NSW *Threatened Species Conservation (TSC) Act 1995*, and any relevant State Environmental Planning Policies (SEPP) (e.g. SEPP 44 – Koala habitat protection).

2. Environmental setting.

The study area is located within the Oberon Local Government Area. The ten survey sites all occur adjacent to Jenolan Caves Road, northeast of Jenolan Caves. Jenolan Caves Road is situated within Kanangra Gorge, on the eastern slopes of Binoomea Ridge. The proposed works are located within an 8km section of Jenolan Caves Road, commencing near the Grand Arch and finishing near Kiaora Hill (Figure 1).

For reference, a photographic record of several portions of the study area has been provided.

It is noted that cut slopes C1.74, 2.62, 3.64, 4.22. 5.08 7.02 and Walls 40/41 all have an easterly aspect, whilst cut slopes 5.29, 7.58 and 8.13 are all generally south to south west facing. All cut slopes and walls have a slope of between 60 and 80 degrees.

Jenolan Caves Road is located within a landscape that is characterised by steep to very steep valleys. The dominant soils of the study area are derived from Devonian and Silurian metasediments and volcanics (King 1994). These consist generally of structured Loams / Lithosoils (on rocky steep slopes and crests), Brown, Red and Yellow Podzolic Soils (on the lower slopes) and alluvial soils along drainage lines (King 1994). These soils have low fertility, and are susceptible to severe water erosion, mass movement, localised rock falls and foundation hazards (King 1994).

Natural elevations within the study area are between 750 and 1000m above sea level. The annual average rainfall in the region is 966.2 millimetres with the greatest falls being experienced during the summer months (Bureau of Meteorology Jenolan Caves 2005). Average temperatures range between a winter low of 0.2°C to a summer high of 25.6°C (Bureau of Meteorology Jenolan Caves 2005). Frosts are also common during the winter months (Oberon Council 2004).

Drainage lines that occur down slope of the study area include Jenolan River, Pheasants Nest and Bulls Creeks, Cookes Gully and several unnamed drainage channels (Figure 1). The smaller drainage lines feed into the Jenolan River, this river eventually flowing into the Coxs River 13km east of the study area. The unnamed drainage channels are all considered to be ephemeral, whilst the major rivers and creeks are permanent water bodies. Each of the drainage lines occurs within a catchment that is dominated by relatively pristine natural bushland.

Whilst drainage lines traverse under, and occur adjacent to Jenolan Caves Road, it is noted that none are located within any of the proposed remediation sites.

Jenolan Caves Road is surrounded by a network of large conservation reserves. These reserves, or other protected lands, include the Jenolan Caves Reserve Conservation Area, Blue Mountains and Kanangra-Boyd National Parks and both Jenolan and Hampton State Forests. These reserves cover areas of 2260, 264848, 68661, 9607 and 4771ha respectively (National Parks and Wildlife Service [NPWS] 1998, Oberon Council 2004). In relation to the Jenolan Caves Reserve Conservation Area, Blue Mountains and Kanangra-Boyd National Parks, these are part of a group of reserves that contribute to the largest conservation area in NSW (this being the Greater Blue Mountains Area which was inscribed on the World Heritage List during the 24th Session of the World Heritage Committee) (Oberon Council 2004, Department of Environment and Heritage [DEH] 2005a).

PHOTOGRAPHIC RECORD OF STUDY AREA

Photo 1: Extent of completed works at Walls 40/41.

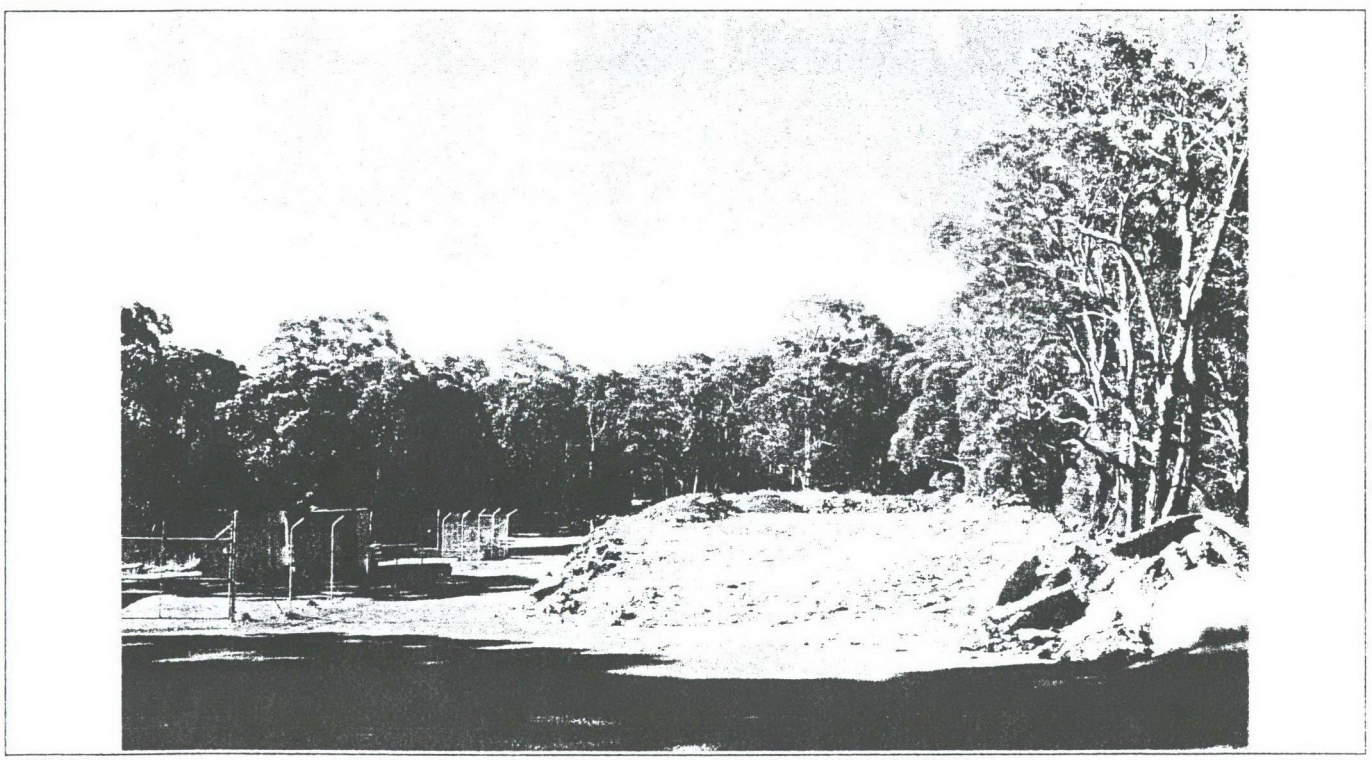


Photo 2: Existing character of the works compound. Photograph taken looking west through site.

PHOTOGRAPHIC RECORD OF STUDY AREA

Photo 3: Structure of woodland on top of cut slope 3.64, within the alignment of the proposed access track.

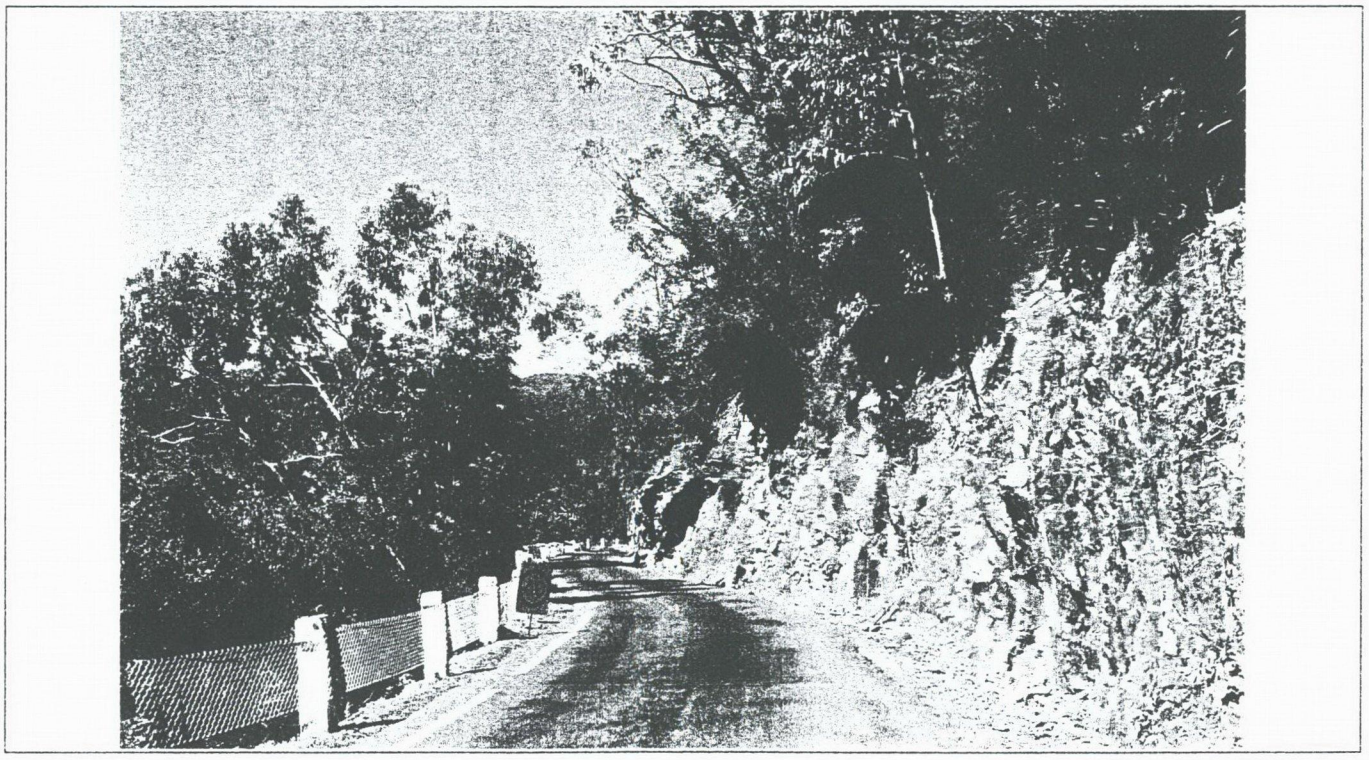


Photo 4: Cut slope 3.64.

PHOTOGRAPHIC RECORD OF STUDY AREA

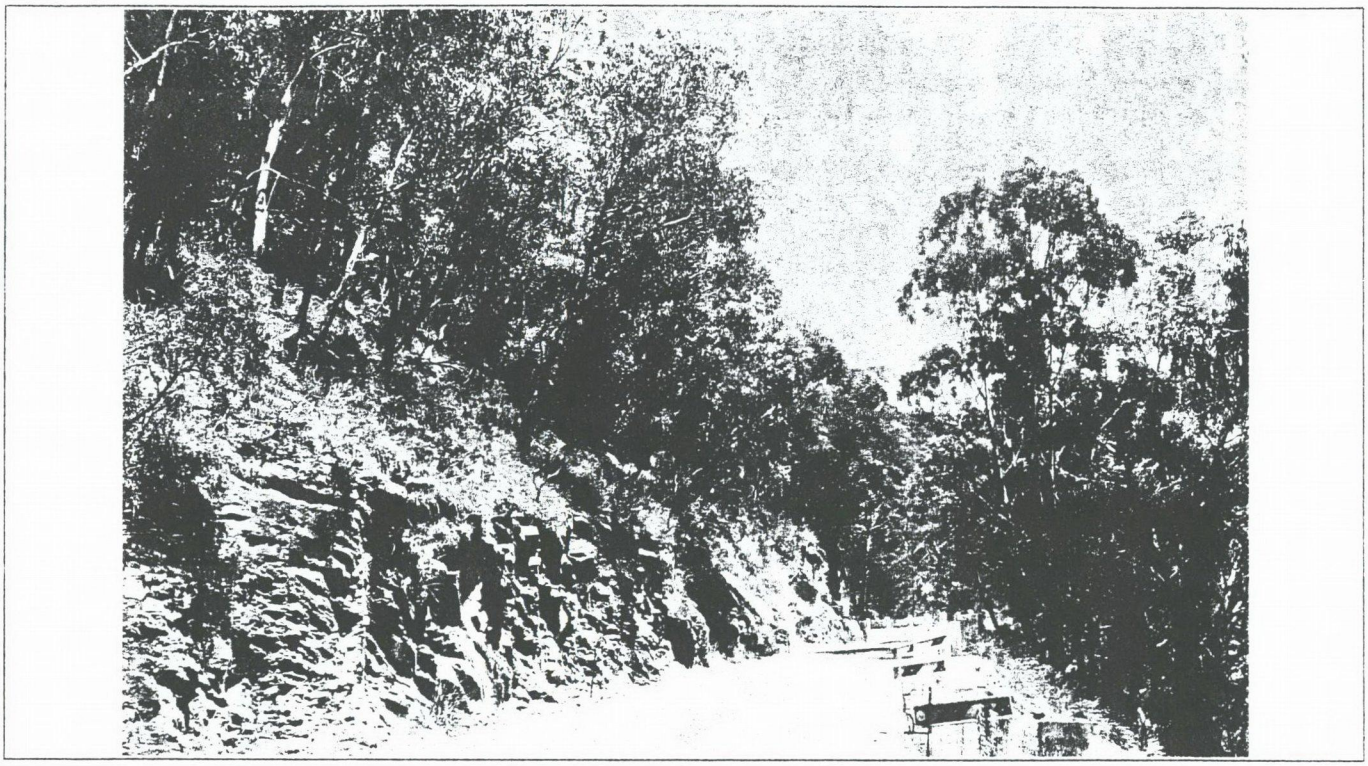


Photo 5: Cut slope 2.63.

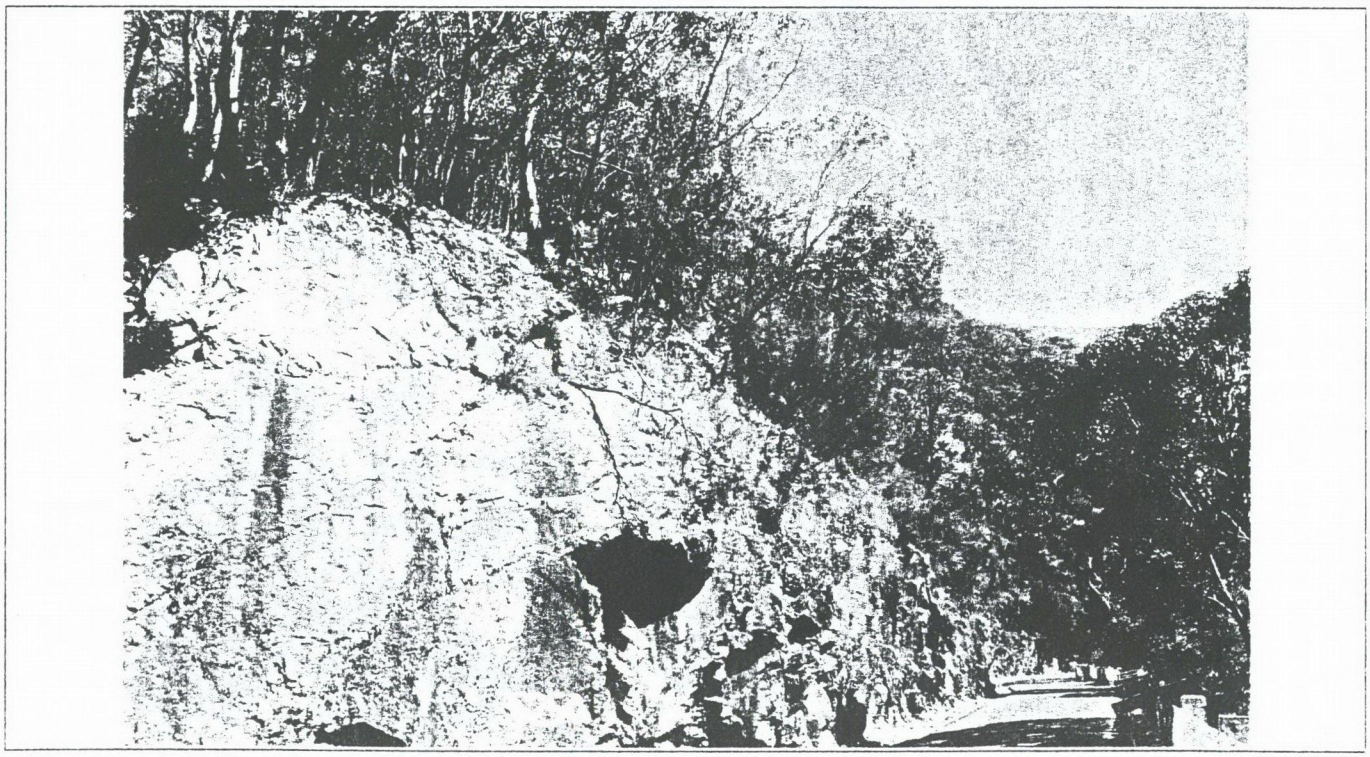


Photo 6: Cut slope 5.08/5.29.

The Greater Blue Mountains World Heritage Area is approximately 1.03 million hectares in size (DEH 2005a).

Jenolan Caves Road traverses through an area that is dominated by eucalypt woodlands. As such, the majority of the proposed cut slopes support a suite of native plants, though the species diversity of these is dependant upon the impacts associated with the previous road works activities, and any ongoing vegetation maintenance / hazard reduction schemes. In relation to this it is noted that on going maintenance has resulted in a number of trees and shrubs being prunes and/or removed from the cut slopes themselves.

Through consultation of the Australian Heritage Council and Australian Heritage Database, it was identified that the following "ecological features" were listed as state heritage items:

- Jenolan Caves (Type of Item: Archaeological Terrestrial; Category: Cave);
- Jenolan Caves Reserve Conservation Area (Type of Item: Archaeological Terrestrial; Category: Cave);
- Kanangra-Boyd National Park (Type of Item: Archaeological Terrestrial; Category: Reserve); and
- The Oberon Area (Type of Item: Area/Complex/Group; Category: Geological site or area) (NSW Heritage Office 2005).

Given the scale of the works associated with the Proposal, none of these state listed heritage items would be significantly affected.

3. Field survey methods.

3.1 Flora survey.

A botanical investigation of the study area was undertaken by John Speight $_{(B.Sc.)}$ on the 11th and 12th of January 2005. The methods employed during this investigation were:

- The identification of all plants within the areas of likely disturbance, including both direct and indirect impacts; and
- The identification of the structure of those vegetation communities and fauna habitats present.

The botanical survey identified the diversity of plants present within, and adjacent to each of the Proposal areas, as well as the structure and nature of the vegetation communities. To survey each of the likely disturbance sites, foot traverses were undertaken where possible. During the field surveys the area down slope of the existing road was surveyed where appropriate but the steep to very steep slopes and loose rubble was considered to be generally unsafe to access most of these down slope sites.

The investigation considered each of the likely works sites, and a distance of up to 30m either side of the existing road.

3.2 Fauna survey.

A survey of the study area was undertaken by Deryk Engel $_{(B.Env.Sc.HONS)}$ between the 6th and 8th of January 2005. To survey each of the cut slopes, the proposed access track and works site, foot traverses were undertaken within and adjacent to the likely disturbance areas. During the field investigations, the diversity of animals present within, and adjacent to, the nine cut slopes, Walls 40/41, the access track, works site and existing compound, were recorded. For the purposes of the field investigations, to consider the likely direct and indirect impacts of the works, where possible and safe, the survey of each of the study areas incorporated the proposed remediation sites themselves, and a distance of up to 30m either side of the existing road.

The fauna survey methods employed during the field investigations were:

- The direct observation of any species within, or adjacent to, the study area;
- The identification of any indirect evidence that would suggest the presence of any fauna species;
- Litter and ground debris searches for reptiles and frogs;
- Diurnal and nocturnal call identifications with all calls being identified in the field;
- Call determinations undertaken on dusk;
- Spotlighting;
- Echolocation targeting microchiropterans (insectivorous bats);
- Call playbacks targeting threatened owls and mammals; and
- Targeted searches for those species of state and national conservation concern, or their likely habitat areas, that were identified during the literature review stage of the project.

Where required, greater detail on several of the fauna survey methods employed are provided below.

The nocturnal surveys were undertaken on the 6th and 7th of January 2005 these lasting for around 3 hours per night. The weather conditions experienced during the nocturnal surveys were clear skies, warm temperatures (19.7°C) and slight breezes and, partial cloud cover [3/8], slight breezes and cool temperatures (14.3°C) respectively. During these surveys, a variety of fauna identification techniques were employed.

During each of the nocturnal sessions, call identifications were undertaken on dusk. The call identifications involved a researcher being located within a portion of study area, the researcher listening for any territorial calls that were broadcast by native species as they left, or entered, their roosting sites. The dusk call identifications were undertaken on top of cut slope 3.64 (6/01/05) (Easting 225761, Northing 6255358 – in the vicinity of Bat 2 [Figure 2]) and at the base of cut slope 1.74 (7/01/04) (Easting 224833, Northing 6256491– in the vicinity of Bat 4 [Figure 2]), the researcher being on site at approximately 19.30hours. At the completion of this survey method, which lasted for approximately 30 minutes after dark, no territorial owl or mammal calls had been detected.

Whilst conducting the nocturnal surveys, spotlighting (using 100 watt hand held spotlights) was undertaken. The spotlighting transects were either conducted on foot, or via motor vehicle at a rate of 5km/h. The spotlighting sessions commenced 30 minutes after dark and lasted for approximately 2 hours. During the spotlighting sessions, efforts were made to target those habitats considered suitable for nocturnal animals, particularly those species of conservation significance identified during the literature review process as having been previously recorded in the study region. Site sampled during the spotlighting sessions are identified on Figure 2.

During the nocturnal surveys, the identification of microchiropterans, using Anabat II echolocation detectors, was undertaken. The detectors used to identify the presence of these species were placed at a variety of locations (Figure 2, Table 1), these sites being selected as they corresponded to those habitats likely to be used by microchiropterans as roosting sites (i.e. woodland stands), or during their foraging and dispersal periods (i.e. woodlands and habitat ecotones). The echolocation detectors were generally turned on fifteen minutes prior to dusk (thereby endeavouring to detect any microbats that were leaving those likely roosting sites targeted) and were left in place all night (the tape recorders being set for voice activation with sun set being approximately 20.30 hours and sun rise 6.00 am). Any calls recorded were analysed using Anabat 6.3 computer software. The survey locations and effort obtained through use of this method are provided in Table 1.

Based on the results of the literature review, call playbacks targeting the presence of the Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Yellow-bellied Glider (*Petaurus australis*) and Koala (*Phascolarctos cinereus*) were undertaken during the spotlighting sessions. During these sessions, the calls (which were taken from Buckingham and Jackson 1990 and Stewart 1999 and lasted for five minutes per species) of these threatened species were broadcast through a megaphone connected to a compact disc player. The sites chosen for the call playbacks are identified in Table 1 and mapped on Figure 2.

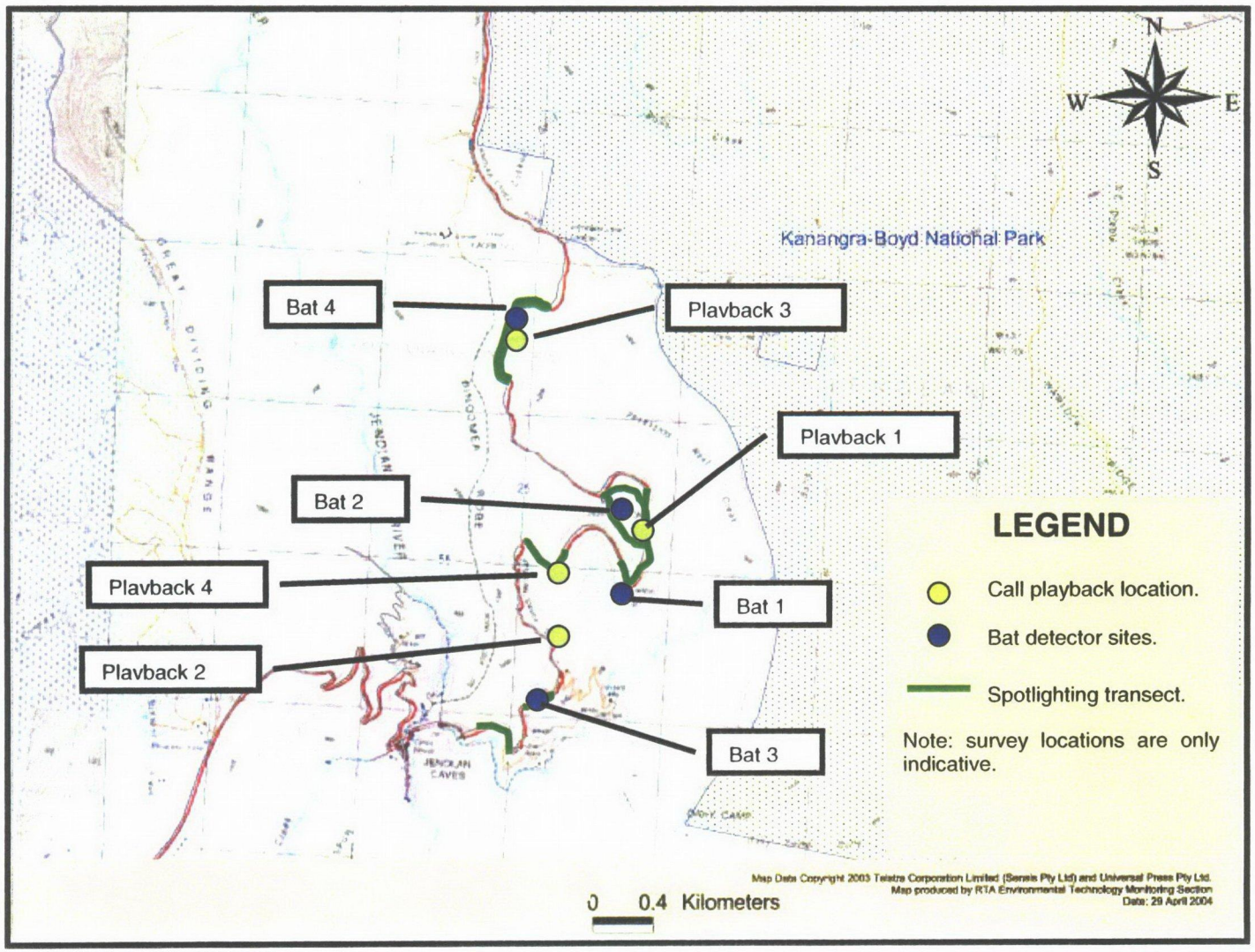


Figure 2. Locations of fauna survey sites.

Table 1. Fauna survey locations.

Site	Date	Location	Easting	Northing	Survey effort
Bat 1	6/1/05	Inspiration lookout.	225738	6254911	9.75 hours
Bat 2	6/1/05	Access track atop of cut slope 3.64.	225715	6255370	9.75 hours
Bat 3	7/1/05	Cut slope 7.02	225150	6254044	9.75 hours
Bat 4	7/1/05	Cut slope 1.75	224833	6256491	9.75 hours
Playback 1	6/1/05	Cut slope 3.64	225815	6255392	45 mins
Playback 2	6/1/05	200m north of cut slope 7.02	225278	6254478	45 mins
Playback 3	7/1/05	Cut slope 1.75	224827	6256473	45 mins
Playback 4	7/1/05	Cut slope 5.08 / 5.29	225251	6254950	45 mins
				TOTAL	42 hours

To detect any calls or responses made by the threatened species targeted during the call playbacks, prior to, and after, the call playbacks, a ten minute listening period was undertaken. After the call playbacks and subsequent listening periods, spotlighting of the area was also undertaken to detect any species that may have been attracted to the calls, but which did not respond vocally. By the completion of this component of the field investigation, a total survey effort of approximately 3 hours had been accumulated.

The purpose of the field investigations was to locate within the areas surveyed any plants, animals or vegetation communities that are of regional, state and/or national conservation significance. When conducting the field investigations, the 'Random Meander Method' (as per Cropper 1993) (or an adaptation of this) was employed. This method is suitable for covering large areas and for locating any rare species (and their associated vegetation communities / habitat types) that may occur within a survey site. The method involves walking randomly across the survey area while sampling all of the various habitat types and vegetation communities until no new species have been recorded for at least thirty minutes.

By the completion of the field surveys, approximately 28 person hours of active investigation had been accumulated. Given the relatively small size of the study area, combined with its open nature, no limitations to the success of the field investigations were encountered. Similarly, for those threatened species targeted as potentially occurring, based on their previous recording within this portion of the Oberon Local Government Area, no limitations based on seasonal conditions and survey timings were encountered.

In addition to the field surveys methods employed, a targeted survey was undertaken by Mjadwesch Environmental Service Support to determine the presence of the Purple Copper Butterfly (*Paralucia spinifera*) (refer to attached report, Appendix 4)

4. Literature review and field guides.

Prior to the undertaking of any field work, previous studies conducted in the region and known databases were consulted to identify the diversity of species known for, or potentially occurring in, the study region. These species could potentially utilise or occupy the study area on occasion but were not observed, recorded or indicated during the current field investigation. The literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered. This approach increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly those of conservation concern.

The identification of known, or potentially occurring, native species within the region, particularly those listed under the *EPBC* and *TSC Acts*, also permits the tailoring of the field survey strategies to the detection of these animals and plants, or their necessary habitats and vegetation associations.

The studies, reports and databases referred to include:

- The natural vegetation of the Katoomba 1:100,000 map sheet (Keith and Benson 1988);
- The Jenolan Caves Reserve Draft Plan of Management (Mt King Ecological Surveys 1989);
- A flora and fauna assessment undertaken in relation to the proposed widening of Jenolan Caves Road between Lithgow Road and Hampton Halfway House, and Duckmaloi Road between Oberon and Jenolan Caves Road (LandScope Environmental Consultants 1996);
- A Review of Environmental Factors for the maintenance of a culvert under the Grand Arch at Jenolan Caves (LandScope Environmental Consultants 1997);
- A flora and fauna assessment of five rock cuttings that occur adjacent to Jenolan Caves Road (LesryK Environmental Consultants 2004);
- A Review of Environmental Factors for the removal of weeds and the regeneration of bushland within the Jenolan Karst Conservation Reserve (Woodlots and Wetlands Pty. Ltd. and Urban Bushland Management Consultants 2004);
- The Jenolan Karst Conservation Reserve Draft Plan of Management (Manidis Roberts 2004);
- Oberon Council's State of the Environment Report (Oberon Council 2004);
- The DEH online database (DEH 2005b); and
- The Department of Environment and Conservation's (DEC) Atlas of NSW Wildlife Database (DEC 2005).

When accessing the DEC and DEH databases, the search area specified was 10 square kilometres (km^2) centred on the study area. Other reports and documents referred to are provided within the bibliography section of this report.

Field guides and standard texts used were:

- Harden (1992, 1993, 2000 and 2002) (for the identification of plants);
- Cogger (1992) (reptiles and frogs);
- Simpson and Day (1999) (birds);
- Strahan (1995) (mammals);
- Churchill (1998) (bats); and
- Triggs (1996) (identification of scats, tracks and markings).

The naming of those species recorded or known for the region follows the nomenclature presented in these texts or as described on the Schedules to the *EPBC* and *TSC Acts*.

The stands of vegetation present are described in accordance to Keith and Benson (1988) and Mt King Ecological Surveys (1989).

The state and national conservation significance of those plants and animals recorded is made with reference to the *EPBC* and *TSC Acts*, the publication *Rare or Threatened Australian Plants (ROTAP)* (Briggs and Leigh 1996) and Oberon Council's State of the Environment Report. In the regional context, the conservation significance of those plants and animals recorded was established with reference to:

- The natural vegetation of the Katoomba 1:100,000 map sheet (Keith and Benson 1988); and
- The Jenolan Caves Reserve Draft Plan of Management - Vegetation survey (Mt King Ecological Surveys 1989);
- The Jenolan Karst Conservation Reserve Draft Plan of Management (Manidis Roberts 2004).

5. Flora results.

5.1. Plant species.

A list of plant species recorded within the study area is provided in Appendix 1. It should be noted that this is not a comprehensive list of all exotic or weed species present, and only represents those plants recorded whilst searching for species of national or regional conservation concern that are known or have the potential to occur in the study area. It is a comprehensive list of those native plant species present.

By the completion of the field survey, no species of national or state conservation significance as listed on the Schedules to the *EPBC* or *TSC Acts* had been recorded.

Consultation of the DEC and DEH online databases identified a number of plants of conservation significance that have been previously recorded in the area of the Katoomba 1:100,000 map sheet. Of these, 11 were considered to have the potential to occur in the study area based on their known habitat requirements and the habitats occurring in association with the cut slopes (Table 2). Although these species were targeted during the field investigations, none were located within, or in close proximity to, the boundaries of any of the proposed works sites.

Table 2. Plant species of conservation significance previously recorded in the Oberon Local Government Area.

Key
S1 = Schedule 1 (Endangered). S2 = Schedule 2 (Vulnerable).
Regionally Significant: The species is considered to be of regional significance by some authors due to its restricted occurrence in the study region.

Species (Family)	Conservation Status			
	ROTAP	Regional Significance	*EPBC Act*	*TSC Act*
Acacia flocktoniae (Mimosaceae)	2VC-		S2	S2
Beyeria lasiocarpa (Rutaceae)	Not listed	R	Not listed	Not listed
Caladenia tessellata (Orchidaceae)	3V		S2	S1
Eucalyptus pulverulenta (Myrtaceae)	3V		S2	S2
Euphrasia scabra (Scrophulariaceae)	3Kca		Not listed	S1
Geranium graniticola (Geraniaceae)	3RC-		Not listed	Not listed
Gonocarpus longifolius (Haloragaceae)	3RC-		Not listed	Not listed
Hakea dohertyi (Proteaceae)	2VCi		S1	S1
Melaleuca armiliaris (Myrtaceae)	Not listed	R	Not listed	Not listed
Persoonia acerosa (Proteaceae)	2VC-		S2	S2
Pseudanthus divaricatissimus (Euphorbiaceae)	3RCa		Not listed	Not listed
Stemmacantha australis (Asteraceae)	3V		S2	Presumed extinct
Thesium australe (Santalaceae)	3VCi+		S2	S2

During the field survey, Blackberry (*Rubus ulmifolius*) was recorded at cut slopes 4.22, 7.02, 7.58 and 8.13, this being listed as a noxious within the Oberon Local Government Area (Upper Macquarie County Council pers.comm. 4/2/05). This is a Class 3 weed, thereby requiring that it be prevented from spreading and its numbers and distribution be reduced. In relation to the presence of this plant, it is noted that the Upper Macquarie County Council undertakes regular spraying of those weed species that occur along Jenolan Caves Road (Upper Macquarie County Council pers.comm. 4/2/05).

5.2. Vegetation communities.

No Endangered Ecological Communities listed under the *TSC* and/or *EPBC Acts* were recorded within the study area, and none have been previously identified in the study region.

The study area along Jenolan Caves Road grades from a dry open-forest on the upper slopes with a sparse shrub and groundcover layer, to a moist open-forest with a dense shrub layer and a dense understorey of grasses, climbers and ferns. The community is generally consistent throughout the length of the road, with some species either present or absent at a site-specific level as a result of soil moisture and aspect differences. Southern Blue Gum *Eucalyptus bicostata* only occurs on the lower parts of the ridge, in association with those cut slopes that are present near the Jenolan River.

The study area and the surrounding vegetation was mapped and described by Mt King Ecological Surveys in 1989 as part of a Draft Plan of Management for the Jenolan Caves Reserve (Mt King Ecological Surveys 1989). That study updated and refined the vegetation community descriptions provided in Keith and Benson (1988). The Mt King study mapped nine vegetation communities within the Jenolan Karst Conservation Area, the area on the eastern side of Binoomea Ridge above 1100m (along which Jenolan Caves Road is constructed) is mapped as being:

- Map unit 9n Open-forest: *Eucalyptus fastigata, E. dalrympleana* ssp. *dalrympleana* and *E. viminalis*.

All of the cut slopes showed signs of past disturbance, possibly including logging. Past disturbances for road construction have resulted in areas of unstable slopes where soil slip continues to create disturbances to the vegetation.

The trees occurring in and around each of the cut slopes / walls were:

- **Cut slope C1.74:** *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii – E. fastigata* Open-forest.
- **Cut slope C2.63:** *Eucalyptus viminalis – E. dalrympleana - E. fastigata* Open-forest.
- **Cut slope C3.64:** *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.
- **Cut slope C4.22:** *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.
- **Cut slopes C5.08 and 5.29:** *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.
- **Cut slope C7.02:** *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii - E. bicostata* Open-forest.
- **Walls 40/41:** *Eucalyptus eugenoides - Eucalyptus bicostata* Open-forest.
- **Cut slope C7.58:** *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii - E. fastigata – E. bicostata* Open-forest.
- **Cut slope C8.13:** *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii - E. fastigata – E. bicostata* Open-forest.

For reference, a description of the main species occurring at each of the sites is provided below.

Cut slope C1.74: *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii – E. fastigata* Open-forest.

Structure:
Open- forest with trees to 15m in height forming a moderate foliage cover. The shrub layer is generally sparse with low shrubs to 2m in height. The groundcover consists of a variable density layer of grasses and herbs.

The down slope side is very steep with unstable rocky soil. Vegetation consists of the same species but with a higher density of ferns and grasses. The area was not surveyed on foot due to safety concerns.

Common Species (* = exotic species):

Trees:

Manna Gum *Eucalyptus viminalis*, Brown Barrel *E. fastigata*, Blaxland's Stringybark *E. blaxlandii* and Mountain Gum *E. dalrympleana*. The tall shrub/small tree Wattle Blackwood *Acacia melanoxylon* also occurs.

Shrubs:

River Lomatia *Lomatia myricoides* and Scrub Nettle *Urtica incisa*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Mother-shield Fern *Polystichum proliferum*, Prickly Starwort *Stellaria pungens*, Native Tussock *Poa labillardieri*, Pennywort *Hydrocotle peduncularis*, Cranesbill *Geranium potentilloides*, Native Violet *Viola hederacea* and Centuary *Centaurium tenuiflorum* *.

Cut slope C2.63: *Eucalyptus viminalis – E. dalrympleana - E. fastigata* Open-forest.

Structure:

Open- forest with a dense stand of sapling trees to about 10m in height forming a moderate foliage cover. The shrub layer is generally sparse. The groundcover consists of a dense cover of *Lomandra longifolia* as well as native grasses and herbs.

The down slope side of the road is very steep and consists of the same species mix but highly disturbed by previous road works. The area was not surveyed on foot due to safety concerns.

Common Species:

Trees:

Manna Gum *Eucalyptus viminalis*, Brown Barrel *E. fastigata* and Mountain Gum *E. dalrympleana*. The tall shrub/small trees Wattle Blackwood *Acacia melanoxylon* and Broad-leaved Hickory *Acacia falciformis* also occur.

Shrubs:

Blackthorn *Bursaria spinosa* ssp. *spinosa*, River Lomatia *Lomatia myricoides*, Cherry Ballarat *Exocarpos cupressiformis* and Narrow-leaved Geebung *Persoonia linearis*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Smooth Darling-pea *Swainsona galigefolia*, Prickly Starwort *Stellaria pungens*, Pennywort *Hydrocotle peduncularis*, Cranesbill *Geranium potentilloides*, Native Violet *Viola hederacea* and Native Tussock *Poa labillardieri*.

Cut slope C3.64: *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.

Structure:

Open – forest with sparse trees that up are to 15m in height within the study area, forming a moderate foliage cover. Sparse shrub layer to 2m in height. The groundcover consists of a variable layer of sparse grasses and herbs.

The down slope side is very steep and consists of the same species but is more highly disturbed by previous road works. The area was not surveyed on foot due to safety concerns.

Note: This description also covers the proposed new access track and works site. The access track and works site are located in an area that is generally covered in young trees with little or no shrubs and a very sparse groundcover layer. The species occurring in these areas are the same as those occurring above the cutting but in much lower abundance.

Common Species:

Trees:

Manna Gum *Eucalyptus viminalis*, Brown Barrel *E. fastigata*, Blaxland's Stringybark *E. blaxlandii* and Mountain Gum *E. dalrympleana*. The tall shrub/small tree Wattled Blackwood *Acacia melanoxylon* also occurs.

Shrubs:

Blackthorn *Bursaria spinosa* ssp. *spinosa*, River Lomatia *Lomatia myricoides*, Native Cranberry *Lissanthe strigosa*, Native Holly *Oxylobium ilicifolium* and Narrow-leaved Geebung *Persoonia linearis*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Smooth Darling-pea *Swainsona galigefolia*, Prickly Starwort *Stellaria pungens*, Pennywort *Hydrocotle peduncularis*, Bracken Fern *Pteridium esculentum*, Hyacinth Orchid *Dipodium punctatum* and Native Tussock *Poa labillardieri*.

Cut slope C4.22: *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.

Structure:

Open – forest with trees to about 15m in height, forming a moderate foliage cover. A sparse low shrub layer to 2m in height occurs across the slope. The groundcover consists of a sparse layer of grasses and herbs.

The down slope side is steep and consists of the same species but is more highly disturbed by previous road works. The area was not surveyed on foot due to safety concerns.

Common Species:

Trees:

Manna Gum *Eucalyptus viminalis*, Brown Barrel *E. fastigata*, Blaxland's Stringybark *E. blaxlandii* and Mountain Gum *E. dalrympleana*. A single Grey Gum *E. punctata* also occurs in the study area. The tall shrub/small tree Wattled Blackwood *Acacia melanoxylon* also occurs.

Shrubs:

Blackthorn *Bursaria spinosa* ssp. *spinosa*, River Lomatia *Lomatia myricoides*, Native Cranberry *Lissanthe strigosa*, Native Holly *Oxylobium ilicifolium* and Narrow-leaved Geebung *Persoonia linearis*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Smooth Darling-pea *Swainsona galigefolia*, Prickly Starwort *Stellaria pungens*, Pennywort *Hydrocotle peduncularis*, Bracken Fern *Pteridium esculentum*, Wallaby Grass *Austrodanthonia* sp. and Native Tussock *Poa labillardieri*.

Cut slopes C5.08 and 5.29: *Eucalyptus viminalis – E. dalrympleana - E. fastigata – E. blaxlandii* Open-forest.

Structure:

Open- forest with trees to about 15m in height, forming a moderate foliage cover. A sparse low shrub layer to 2m in height occurs. The groundcover consists of a sparse to locally dense layer of native grasses and herbs. The site grades from a dry forest to a more moist forest on the southern face of cut slope 5.29.

The down slope side is very steep and consists of the same species but is more highly disturbed by previous road works. The area was not surveyed on foot due to safety concerns.

Common Species:

Trees:

Manna Gum *Eucalyptus viminalis*, Brown Barrel *E. fastigata*, Blaxland's Stringybark *E. blaxlandii* and Mountain Gum *E. dalrympleana*. The tall shrub/small tree Wattled Blackwood *Acacia melanoxylon* and Blueberry Ash *Eleocarpus reticulatus* also occurs.

Shrubs:

Blackthorn *Bursaria spinosa* ssp. *spinosa*, Tree Violet *Hymenanthera dentata*, River Lomatia *Lomatia myricoides*, Native Cranberry *Lissanthe strigosa*, Nodding Blue Lily *Stypandra glauca*, Native Holly *Oxylobium ilicifolium* and Everlasting Daisy *Ozothamnus diosmifolium*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Pennywort *Hydrocotle peduncularis*, Prickly Starwort *Stellaria pungens*, Sickle Fern *Pellaea falcata*, Maidenhair Fern *Adiantum aethiopicum* and Necklace Fern *Asplenium flabellifolium*.

Climbers

Old Man's Beard *Clematis aristata* and Scrambling Lily *Geitonoplesium cymosum*.

Cut slope C7.02: *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii – E. bicostata* Open-forest.

Structure:

Open – forest with trees to about 15m in height that form a moderate foliage cover. A sparse low shrub layer to 2m in height occurs. The groundcover consists of a sparse to locally dense layer of native grasses and herbs.

The down slope side is extremely steep and unstable, and consists of the same species but is more highly disturbed by previous road works. The area was not surveyed on foot due to safety concerns.

Common Species:

Trees:

Manna Gum *Eucalyptus viminalis*, Blaxland's Stringybark *E. blaxlandii*, Mountain Gum *E. dalrympleana* and Southern Blue Gum *E. bicostata*. The tall shrub/small tree Wattle Blackwood *Acacia melanoxylon* also occurs.

Shrubs:

Blackthorn *Bursaria spinosa* ssp. *spinosa*, Tree Violet *Hymenanthera dentata*, River Lomatia *Lomatia myricoides*, Native Cranberry *Lissanthe strigosa*, Lance Beard-heath *Leucopogon lanceolatus* and Hop-Goodenia *Goodenia ovata*.

Groundcovers:

Spiny Mat-rush *Lomandra longifolia*, Pennywort *Hydrocotle peduncularis*, Prickly Starwort *Stellaria pungens*, Sickle Fern *Pellaea falcata*, Maidenhair Fern *Adiantum aethiopicum*, Necklace Fern *Asplenium flabellifolium* and Bracken Fern *Pteridium esculentum*.

Climbers

Old Man's Beard *Clematis aristata*, False Sarsaparilla *Hardenbergia violaceae* and Scrambling Lily *Geitonoplesium cymosum*.

Walls 40/41: *Eucalyptus eugenoides - Eucalyptus bicostata* Open-forest.

Note: A large portion of these walls has already been cleared and remediated.

Structure:
Open – forest with trees to about 10m in height form a sparse to moderate foliage cover. A dense low shrub layer to 1m in height occurs across the slope. The groundcover consists of a sparse layer of mat rush, grasses and herbs.

Common Species:
Trees:
Thin-leaved Stringybark *Eucalyptus eugenoides* and Southern Blue Gum *E. bicostata.*

Shrubs:
Blackthorn *Bursaria spinosa*, Native Cranberry *Lissanthe strigosa*, Broad-leaved Hickory *Acacia falciformis*, Austral Indigo *Indigophora australis* and Large Mock Olive *Notelaea longifolia.*

Groundcovers:
Spiny Mat-rush *Lomandra longifolia*, Kangaroo Grass *Themeda australis*, Wallaby Grass *Austrodanthonia* sp., Kidney Weed *Dichondra repens*, Prickly Starwort *Stellaria pungens* and Necklace Fern *Asplenium flabellifolium.*

Cut slope C7.58: *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii - E. fastigata – E. bicostata* Open-forest.

Structure:
Open- forest with trees to about 15m in height, forming a moderate foliage cover. A moderately dense shrub layer to 2m in height occurs. The groundcover consists of a locally dense layer of native grasses and herbs. The site is south-facing and has higher ground moisture levels. The low shrubby weed Tutsan *Hypericum androsaemum* covers most of the slope. Blackberry also occurs.

The down slope side is very steep and consists of the same species but is more highly disturbed by previous road works and an existing dirt road. The area was not surveyed on foot due to safety concerns.

Common Species:
Trees:
Manna Gum *Eucalyptus viminalis*, Blaxland's Stringybark *E. blaxlandii*, Southern Blue Gum *E. bicostata* and Mountain Gum *E. dalrympleana.* The tall shrub/small tree Blackwood *Acacia melanoxylon* also occurs.

Shrubs:
Blackthorn *Bursaria spinosa* ssp. *spinosa*, Tree Violet *Hymenanthera dentata*, River Lomatia *Lomatia myricoides*, Lance Beard-heath *Leucopogon lanceolatus* and Sticky Hop-bush *Dodonaea viscosa.*

Groundcovers:
Spiny Mat-rush *Lomandra longifolia*, Pennywort *Hydrocotle peduncularis*, Prickly Starwort *Stellaria pungens*, Sickle Fern *Pellaea falcate* and Bracken Fern *Pteridium esculentum*.

Climbers
Old Man's Beard *Clematis aristata*, False Sarsaparilla *Hardenbergia violaceae* and Scrambling Lily *Geitonoplesium cymosum*.

Cut slope C8.13: *Eucalyptus viminalis – E. dalrympleana - E. blaxlandii - E. fastigata – E. bicostata* Open-forest.

Structure:
Open- forest with trees to about 15m in height, forming a moderate foliage cover. A moderately dense shrub layer to 2m in height occurs. The groundcover consists of a locally dense layer of native grasses and herbs. The site is south-facing, close to Jenolan River and has higher ground moisture levels.

The down slope side is very steep and consists of the same species but is more highly disturbed by previous road works and an existing dirt road. The area was not surveyed on foot due to safety concerns.

Common Species:
Trees:
Manna Gum *Eucalyptus viminalis*, Blaxland's Stringybark *E. blaxlandii*, and Southern Blue Gum *E. bicostata* and Mountain Gum *E. dalrympleana*. The tall shrub/small tree Blackwood *Acacia melanoxylon* also occurs.

Shrubs:
Blackthorn *Bursaria spinosa* ssp. *spinosa*, Tree Violet *Hymenanthera dentata*, River Lomatia *Lomatia myricoides*, Blue Nodding Lily *Stypandra glauca* and Sticky Hop-bush *Dodonaea viscosa*.

Groundcovers:
Spiny Mat-rush *Lomandra longifolia*, Pennywort *Hydrocotle peduncularis*, Prickly Starwort *Stellaria pungens*, Tongue Orchid *Dendrobium linguiforme* and Bracken Fern *Pteridium esculentum*.

Climbers
Old Man's Beard *Clematis aristata*, False Sarsaparilla *Hardenbergia violaceae* and Scrambling Lily *Geitonoplesium cymosum*.

5.3. Flora discussion.

The sites surveyed are all very small and do not show a great diversity of species. At each site generally only a few species make up the majority of the vegetation community. This is common in many alpine and semi-alpine habitats. None of the cut slopes are important habitat for any of the threatened plants, plant populations or ecological communities that are known to occur in the region. The direct impacts of the removal of vegetation from the study area would be small in comparison to the amount of similar vegetation that occurs on Binoomea Ridge and within the surrounding region.

Though targeted, no threatened plants were found in the study area and the vegetation community recorded is not listed as an Endangered Ecological Community under either the *TSC* and/or *EPBC Acts*. The removal of up to 6.15ha of this vegetation type, which is common throughout Binoomea Ridge, from the study area would not result in the loss of any plant biodiversity from the locality.

6. Fauna results.

6.1. Habitat types.

One habitat type, a eucalypt woodland, is uniformly present throughout the study area (including the proposed access track and works site), this habitat type also being present adjacent to, and beyond the limits of, the likely works areas.

The eucalypt woodland supports trees that are between 10 and 15m in height, the majority of which, particularly those on the cut slopes themselves, are not hollow bearing. Whilst this is the case, particularly on top of the cut slopes, isolated hollow bearing trees are present at various locations, these supporting hollows that have a diameter of 700mm (density of hollow bearing trees throughout the eucalypt woodlands is approximately 1 hollow bearing tree per 0.2ha). Throughout the eucalypt woodland the tree canopy is generally continuous, though some 8m wide gaps are present. The understorey is either absent, or composed of isolated saplings that are to 2m in height. Similarly the ground cover layer is absent, or composed of a sparse distribution of native grasses, ferns and forbs. Leaf litter, fallen trees and branches are common, as is some exposed rock. For reference, percentage covers of those habitat layers observed within a randomly selected 10 x 10m quadrate are provided:

- Tree cover = 15%;
- Shrub cover = >1%;
- Ground cover = 10%;
- Leaf litter = 70%; and
- Bare earth = 30%.

On the cut slopes themselves, exposed rock faces are common, none of which were observed to support any suitable sheltering caves, crevices or ledges. The Jenolan Karst system (Jenolan Caves) is located nearby, this providing a vast supply of potential resources for cave-dwelling native fauna. Given the extent of works proposed, the Jenolan Karst system would not be affected by the Proposal. The cut slopes are vegetated by several native saplings, shrubs and ground cover plants, the density of which is generally sparse. In regards to several of those plants present on the cut slopes, these have either been removed or trimmed as part of the ongoing maintenance activities associated with the use of Jenolan Caves Road. Where present, the trees are to 8m in height, the shrubs 2m and the ground cover plants 0.3m. No hollow bearing trees were observed in association with any of the cut slopes.

As noted previously, the Proposal would require the removal of approximately 6.15ha of woodland. In comparison with the surrounding 350,106ha of similar bushland, the woodland present within the study area is not considered to represent a significant area of habitat for any native animals. The removal of those plants that have re-established on the rock batters after construction of Jenolan Caves Road is not considered to have an adverse impact on the local or regional occurrence of any native fauna. The resources offered by the study area are not unique to this site, this environment being regularly recorded in the surrounding region. As such, the proposed works can proceed as planned without significantly altering the region's biodiversity.

As mentioned, no drainage lines were observed within the study area.

6.2. Fauna species recorded.

By the completion of the field investigations, a total of 19 native mammals, 34 native birds and 2 reptiles had been recorded (Appendix 2). In regards to the detection of these species:

- All birds were either observed within, adjacent to or flying over the study area, or identified from their distinct calls;

- The Tawny Frogmouth *Podargus strigoides* was spot lite on the 6/01/05 whilst the Southern Boobook *Ninox novaeseelandiae* was heard calling during each of the spotlighting sessions;

- The Powerful Owl *Ninox strenua* and Sooty Owl *Tyto tenebricosa* were both identified during the call playback sessions;

- The Grass Skink *Lampropholis delicata* was observed during the ground debris searches, whilst a road kill Red-bellied Black Snake *Pseudechis porphyriacus* was observed on Jenolan Caves Road, north of cut slope 1.74;

- The Brown Antechinus *Antechinus stuartii*, Greater Glider *Petauroides volans*, Common Brushtail Possum *Trichosurus vulpecula*, Eastern Grey Kangaroo *Macropus giganteus*, Red-necked Wallaby *Macropus rufogriseus* and Swamp Wallaby *Wallabia bicolor* were all spot lite;

- The Short-beaked Echidna *Tachyglossus aculeatus* and Common Wombat *Vombatus ursinus* were both identified through the observation of their characteristic droppings;

- The Yellow-bellied Glider *Petaurus australis* was heard calling during the call playback sessions; and

- All microchiropterans were detected through the analysis of those bat calls recorded (Table 3).

Of those species recorded by the completion of the field investigation the Powerful Owl *Ninox strenua*, Sooty Owl *Tyto tenebricosa*, Satin Flycatcher *Myiagra cyanoleuca*, Yellow-bellied Glider *Petaurus australis*, Large-eared Pied Bat *Chalinolobus dwyeri*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Large-footed Myotis *Myotis adversus* and Eastern Bentwing Bat *Miniopterus schreibersii* are all listed under the state and/or national environmental legislations. In addition to these species, the Gang-gang Cockatoo *Callocephalon fimbriatum* has been Preliminary listed (i.e. a Preliminary Determination has been made by the NSW Scientific Committee) for inclusion as a vulnerable species under Schedule 2 of the *TSC Act*.

In regards to the detection of these species of state and/or national conservation concern:

- The Powerful Owl, a species listed under Schedule 2 of the *TSC Act*, was heard during the call playback sessions, this species being heard down slope of Jenolan Caves Road at playback sites 2 (1 individual) and 4 (2 individuals);

- The Sooty Owl (Schedule 2 of the *TSC Act*) responded to the call playback undertaken at playback site 4, this species entering cut slope 5.29 from a southerly, down slope, direction;

- A pair of Satin Flycatchers (migratory bird listed under the *EPBC Act*) were observed traversing through the woodland that is present on cut slope 5.29;

- Several Yellow-bellied Gliders (Schedule 2 of the *TSC Act*) were heard down slope of playback sites 1 and 4;

- The threatened microchiropterans were recorded at bat sites 1, 3 and 4 (Table 1). Of those microchiropterans recorded, it is noted that the Large-eared Pied Bat *Chalinolobus dwyeri* is listed under the Schedules to both the *EPBC* and *TSC Acts*, the remainder of the bats only being listed under the *TSC Act*; and

- The Gang-gang Cockatoo was heard calling down slope of cut slopes 3.64, 5.08 and 7.02.

For reference, profiles of these species of conservation concern are provided in Sections 6.2.1 to 6.2.9 of this report. As an aside, it is noted that the Powerful Owl, Sooty Owl, Eastern False Pipistrelle and Eastern Bentwing Bat were all recorded within the study area during the previous investigation undertaken at this site (LesryK Environmental Consultants 2004).

The remainder of the native fauna species recorded are protected, as defined under the NSW *National Parks and Wildlife Act 1974*, but considered to be common to abundant throughout their distribution ranges. These animals would be regularly recorded in the surrounding region in association with their documented habitat types. None of the species recorded would be solely dependant upon the resources provided by the study area, such that the disturbance of those habitats

present would cause either the local or regional displacement of any of these animals. The undertaking of the Proposal would not remove any habitats important to any of these animals, such that the disturbance of these habitats would affect the local or regional status of any of these species. The proposed works would not present a barrier to the dispersal patterns of any of these species, nor would it isolate any proximate areas of their necessary habitats.

Table 3. Results of bat call analysis.

Survey Location	Common Name	Scientific Name	Call Confidence	No. of Passes
Bat 1	Gould's Wattled Bat	*Chalinolobus gouldii*	C	13
	Chocolate Wattled Bat	*Chalinolobus morio*	P	3
	# Eastern Bentwing Bat	*Miniopterus schreibersii*	C	11
	Large Forest Bat	*Vespadelus darlingtoni*	C	102
	Southern Forest Bat	*Vespadelus regulus*	C	9
	Little Forest Bat	*Vespadelus vulturnus*	P	3
	Eastern Freetail Bat	*Mormopterus* sp. 2	P	2
	Unidentified bat			40
	White-striped Freetail Bat	*Nyctinomus australis*	C	1
Bat 2	Large Forest Bat	*Vespadelus darlingtoni*	C	1
	Little Forest Bat	*Vespadelus vulturnus*	C	1
	Unidentified bat			1
Bat 3	# Eastern Bentwing Bat	*Miniopterus schreibersii*	Po	1
	# Large-footed Myotis	*Myotis adversus*	P	1
	Large Forest Bat	*Vespadelus darlingtoni*	C	1
	Southern Forest Bat	*Vespadelus regulus*	P	1
	Little Forest Bat	*Vespadelus vulturnus*	C	5
	Unidentified bat			3
Bat 4	* # Large-eared Pied Bat	*Chalinolobus dwyeri*	C	2
	Chocolate Wattled Bat	*Chalinolobus morio*	P	2
	# Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	P	2
	# Eastern Bentwing Bat	*Miniopterus schreibersii*	C	2
	Large Forest Bat	*Vespadelus darlingtoni*	C	71
	Southern Forest Bat	*Vespadelus regulus*	P	1
	Little Forest Bat	*Vespadelus vulturnus*	C	6
	Unidentified bat			21

* - indicates species listed under the *EPBC Act.*
# - indicates species listed under the *TSC Act.*

Note:
In relation to the analysis of those microchiropteran calls obtained, it is noted that some insectivorous bat species have distinctive echolocation calls that are unlikely to be confused with those of other species. Other bat species overlap in both call frequency and structure making identification problematic in some cases. The degree of confidence attached to call identifications will depend on the quality of the recordings as well as the activity of the bat at the time of recording and its direction of flight. In some instances a particular species may be identified with confidence, while at other times its identification will be less certain. For this report, echolocation call identifications have been assigned to three categories with regard to certainty of identification, these being :

C Confident Identification. Small possibility of confusion of calls with those of other bat species.
P Probable Identification. Some possibility of confusion of calls with those of other bat species.
Po Possible Identification. Likely to be confused with calls with those of other bat species.

6.2.1. Powerful Owl (*Ninox strenua*).

The Powerful Owl favours gullies and gorges that are unlogged to lightly logged (Chafer 1992, Debus and Chafer 1994). These gullies usually consist of wet to dry sclerophyll forest with a dense understorey (Garnett 1993, Hollands 1991). It nests in large hollows, nearly always in the trunk or the top of a broken eucalypt (Hollands 1991). When not breeding, the Powerful Owl will roost during the day within shelter provided by a dense overstorey canopy, such as a bushy eucalypt or vine forest, usually clutching the remains of the previous evenings meal (Pavey 1995, McNabb 1996). Information on the size of its home range is scant with estimates ranging from 300ha to more than 1000ha (Garnett 1993, McNabb 1996). The Powerful Owl breeds from June to September with pairs being faithful to particular roost trees (C.Chafer, researcher, pers.comm., Pavey *et al.* 1994). The close proximity of roosts to residential and/or recreational areas does not appear to affect the breeding success of Powerful Owls (Pavey *et al.* 1994). This species is able to traverse open country therefore not being affected by habitat fragmentation and isolation (Garnett 1993). The Powerful Owl's main prey are the medium-sized arboreal marsupials, particularly the Ringtail Possum and Sugar Glider (Pavey *et al.* 1994, Pavey 1995, McNabb 1996). Birds, rodents, fruit bats and rabbits will also be taken (Pavey *et al.* 1994). The main threat to the survival of this species is the loss of old-growth forest elements, particularly trees that are large enough for the owl to use for nesting (Garnett 1993).

Based on the above information, and the results of the field investigations, it is not considered that the Powerful Owl would rely upon the study area such that the Proposal would have any impact on this species, its population or habitats. Although this is the case, to further consider the likely impacts of the works on this species, an assessment using the criteria listed under Section 5A of the *Environmental Planning and Assessment Act 1979* (these commonly being referred to as the "eight part test") has been undertaken in Section 7.2.5.

6.2.2. Sooty Owl (*Tyto tenebricosa*).

Occurring along the south-eastern coast and adjacent southern and eastern slopes of the Great Dividing Range, the Sooty Owl is distributed from south-eastern Queensland through to southern Victoria (Garnett 1993, Simpson and Day 1996). Throughout this range it is considered to be scarce (Garnett 1992). Inhabiting tall, wet, old growth forests on fertile soils with a dense understorey, the Sooty Owl usually roosts in the trunks of mature Eucalypts. (Garnett 1993). This habitat is usually confined to gully areas with the Sooty Owl appearing to be loyal to nest sites (Garnett 1993, Hollands 1991). Prey species include arboreal mammals, though some birds and terrestrial mammals will be taken (Frith 1977, Garnett 1993). Accurate home range estimates for this species are presently unknown, but current radiotelemetric research on tagged individuals caught in the Royal National Park, Sydney, approximated 3000ha (R.Kavanagh, NSW Forestry, pers. comm.). Within this home range, the owls have only been recorded as using two thirds of this total area (R.Kavanagh, pers. comm.).

The survival of this species is threatened through habitat clearance, inappropriate forestry practices, fire, and habitat isolation (Garnett 1993, Hollands 1991). There also appears to be a strong correlation between the presence of this species and a high diversity and abundance of prey species (Garnett 1993). Where this is not the case, this species is not found, even though the habitat structure may be suitable (Garnett 1993). The Sooty Owl has therefore been described as an indicator species of undisturbed old growth forest and hollow-dependent mammal species (Norton and Lindenmayer 1991).

As with the Powerful Owl, it is not considered that the Sooty Owl would be reliant upon those habitats recorded within the study area. As such, the Proposal would not have a significant impact on this species, its populations or habitats. To further consider the impacts of the Proposal on this species, an eight part test has been undertaken (Section 7.2.6). In regards to this species it is noted that the cut slopes generally occur near the top of a ridge and that the Sooty Owl detected entered the study area from a southerly, down slope location.

6.2.3. Satin Flycatcher (*Myiagra cyanoleuca*).

The Satin Flycatcher is a migratory bird that over winters in New Guinea and its adjacent islands (Frith 1997). This species moves north between March and April, returning south between September and October (Frith 1997). The Satin Flycatcher occupies eucalypt woodlands, forests and timbered watercourses, this species feeding on a variety of insects, including grasshoppers, beetles and moths (Frith 1997, Beruldsen 2003). Breeding occurs between October and January, the Satin Flycatcher nesting in loose colonies of 2 to 5 pairs (Frith 1997).

To further consider the impacts of the Proposal on this species, an assessment using the *EPBC Act*'s Administrative Guidelines on Significance for a migratory species has been undertaken in Section 7.1.2 of this report.

6.2.4. Yellow-bellied Glider (*Petaurus australis*).

The Yellow-bellied Glider is distributed from eastern Victoria through to central Queensland, with an isolated population occurring in northern Queensland (Russell 1980, Strahan 1995). Throughout these areas this animal's distribution is patchy, the Yellow-bellied Glider being restricted to areas of tall mature eucalypts where suitable feed trees are available (Strahan 1995). A nocturnal species, the Yellow-bellied Glider sleeps during the day in a large mature trees (Strahan 1995). This species is an exudivorous feeder, feeding predominantly on the sap that is obtained from incisions gnawed into the trunks of eucalyptus trees (Goldingay 1989, Strahan 1995). Preferred feed trees include *Eucalyptus gummifera*, *E. maculata* and *E. piperita* with *E. saligna*, *E. viminalis* and *E. fastigata* also being utilised (Goldingay 1989, Goldingay and Kavanagh 1991, Goldingay and Kavanagh 1993). These food resources undergo seasonal variations in abundance, therefore the Yellow-bellied Glider will modify its home range to utilise other food resources including nectar, pollen and insect honeydew (Goldingay 1989, Van Dyck 1992).

The Yellow-bellied Glider is a highly mobile species, gliding or climbing through the forest canopy (Braithwaite 1983, Goldingay and Kavanagh 1991). Where the tree cover is of sufficient height and density to provide for unobstructed movement, glide distances can be quite considerable (in the order of 70 – 100m) (author's field notes, Goldingay 1989, Goldingay and Kavanagh 1991, Engel and Fanning 1995).

Glider groups are usually comprised of three to four individuals, often consisting of an adult breeding pair and several subadults (Goldingay and Kavanagh 1993). This group will inhabit an exclusive home range, the size of which is variable, with estimates being from 20 to 85ha (Henry and Craig 1984, Craig 1985, Goldingay 1992, Goldingay and Kavanagh 1993, Goldingay *et al.* 2001, Lindenmayer 2002). Within this home range, the Yellow-bellied Glider will generally occupy one mature hollow bearing tree, the family group being loyal to this site (this loyalty appears to extend over a series of breeding periods) (author's field notes).

The Yellow-bellied Glider is threatened by habitat clearing and fragmentation, including the removal of hollow-bearing trees utilized for nesting, certain fire regimes which may isolate populations or affect food resources, and predation by feral animals such as foxes and cats (NPWS 1999).

During the field survey, no characteristic feeding incisions were observed on any of the trees present within the study area. Similarly, during the dusk sampling sessions, no individuals were heard exiting any of the hollow bearing trees present within the study area, particularly those that occur above cut slope 3.64. During the field surveys, whilst several Yellow-bellied Glider's were heard calling down slope of Jenolan Caves Road, none were actually detected within the study area itself. On occasion the Yellow-bellied Glider could potentially traverse through and across the study area, but given their ability to traverse relatively large open space areas, the extent of works proposed is not considered to present any barriers, or fragment any habitat areas. Given the restriction of the works to small portions of the road reserve of Jenolan Caves Road, opportunities would still exist for the east west movement of this species. Whilst the Proposal is not considered to have a significant impact on this species, its populations or habitats, to further consider the impacts of the slope remediations on this species, an eight part test has been undertaken in Section 7.2.7.

6.2.5. Large-eared Pied Bat (*Chalinolobus dwyeri*).

The Large-eared Pied Bat is distributed from central southern Queensland through to southern NSW (Strahan 1995, Churchill 1998). Throughout this range its status is described as uncommon (Parnaby 1992). Its preferred habitat is timbered woodland and dry sclerophyll forest (Hall and Richards 1979, Strahan 1995). The Large-eared Pied Bat is known to roost in caves, tunnels, rock overhangs, mines if available or even the abandoned nests of Fairy Martins (Strahan 1995, Churchill 1998, NPWS 2000). In contrast to other bats this species often chooses to roost close to the entrance of the cave, within the "twilight areas" (Strahan 1995, Churchill 1998). The Large-eared Pied Bat is a slow to moderate flier, with good manoeuvrability that forages on insects collected below the tree canopy (Strahan 1995, NPWS 2000). Threats to the survival of this species include the loss of caves which provide suitable roosting and breeding habitat (Strahan 1995).

Within the study area, no suitable caves, tunnels or rock overhangs were observed. As such, this species would not be roosting within the study area. Foraging opportunities exist within the study area for the Large-eared Pied Bat, though the loss of isolated patches of woodland from several sites within the entire study area is not considered to constitute a significant impact. The cumulative loss of a total of 6.15ha of potentially insect attractive plants, from the extensive area of similar woodland is not considered to reduce or significantly affect the extent of foraging resources available to this species. To further consider the potential impacts of the Proposal on the Large-eared Pied Bat, an assessment using the *EPBC Act*'s Administrative Guidelines on Significance for a vulnerable species has been undertaken in Section 7.1.2 of this report. In addition, an eight part test has also been undertaken within Section 7.2.8 of this report.

6.2.6. Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).

The Eastern False Pipistrelle is distributed southwards from south-eastern Queensland, along the coast and Great Dividing Range through to western Victoria and Tasmania (Strahan 1995). This species commonly occurs at high elevations with cool climates, and in Victoria shows a clear preference for wet habitats with trees taller than 20m (Menkhorst and Lumsden 1996). This species has also been recorded within eucalypt woodlands (Menkhorst and Lumsden 1996). Usually roosting in tree hollows, this species has also been recorded within caves in the Jenolan area and cave substitutes (e.g. buildings) (Menkhorst and Lumsden 1996). Known home ranges are in the order of 12km, though this may be a maximum size (Menkhorst and Lumsden 1996). The Eastern False Pipistrelle feeds on a variety of insects that are usually collected from around, or just below, the tree canopy (Menkhorst and Lumsden 1996). In relation to this species winter activities, there appears to be some conflict within the literature with some researchers suggesting that the Eastern False Pipistrelle migrates coastward, while others comment that it is a sedentary hibernator (Menkhorst and Lumsden 1996). Though not documented in the literature, the main threat to the survival of this species is expected to be the loss of suitable roosting trees.

Based on the information provided, and the results of the field survey it is not considered that the Eastern False Pipistrelle would significantly rely upon the study area such that the Proposal would have an adverse impact on this species. Although the works are not considered to have an adverse impact on this microchiropteran, an eight part test has been completed (Section 7.2.9).

6.2.7. Large-footed Myotis (*Myotis adversus*).

Found where there is permanent and/or slow flowing water, this species is generally found in the coastal regions of south-eastern South Australia, through Victoria, New South Wales, Queensland, the Northern Territory and the top of Western Australia (Hall and Richards 1979, Parnaby 1992, Strahan 1995). This species commonly roosts in caves and cave substitutes, but will also occupy tree hollows and dense foliage, the roosting site nearly always being in the vicinity of a suitable water body (Churchill 1998). This species emerges at dusk, feeding on aquatic insects that are "raked" off the waters surface (Strahan 1995). This species appears to be restricted to the vicinity of major waterways, some of which can be brackish (Hall and Richards 1979, Smith and Smith 1990, Parnaby 1992). In Victoria, Myotis roosting sites have been located both immediately over, and up to 400m away from, suitable water bodies (Lumsden and Menkhorst 1996). Breeding occurs between

November and December, with young being weaned after 3 to 4 weeks (Churchill 1998). The main threat to this species appears to be the disturbance of colonies, particularly during the colder months (Reardon and Flavel 1987).

Within the study area, no suitable caves or cave substitutes are present. Similarly, no water bodies suitable for the foraging needs of this species are present. Given the number of passes recorded for this species, the individual recorded is expected to have only been detected whilst traversing across the site. Given that no resources suitable for the life cycle requirements of the Large-footed Myotis are present within the study area, it is not considered that any adverse impacts would arise that would threaten either the local or regional occurrence of this microchiropteran. Whilst this is the case, to further consider the likely impacts of the Proposal on the presence of this species, an eight part test has been undertaken in Section 7.2.10 of this report.

6.2.8. Eastern Bentwing Bat (*Miniopterus schreibersii*).

The Eastern Bentwing Bat is the dominant cave-dwelling bat in south-eastern Australia (Parnaby 1992). This species occurs along the east coast and ranges of Australia, from south-eastern South Australia through to Queensland, the northern parts of Western Australia and the Northern Territory. Within its distribution this species roosts in caves, storm water channels, mines and other cave substitutes (Strahan 1995). Estimates of home ranges for this bat are in the order of 10km^2, which is a distance this species may travel from its roosting site during foraging periods (Hoye and Spence 2004). This species forages within habitats that include well timbered woodlands and open grasslands (Churchill 1998). Large distances, usually to 300km, are travelled between different roosts within a population's specific territory according to seasonal requirements (Churchill 1998). During winter, cold roosts are sought to allow for hibernation (Strahan 1995). Annually, discrete populations of females will travel great distances (up to 300km) to a nursery cave where the temperature, humidity and physical dimensions permit breeding and rearing of young (Churchill 1998). Nursery caves may support up to 150,000 females and juveniles and these may be used by a number of groups year after year (Reardon and Flavel 1987). After leaving maternity roosts, juvenile bats disperse into roosts only utilised by juvenile bats, before moving to adult roosts after one year (Hoye and Spence 2004). This species dependence on suitable seasonal caves has placed the Eastern Bentwing Bat in jeopardy (Strahan 1995).

Based on the information provided, and the results of the habitat assessments (during which time no suitable caves or cave substitutes were observed) it is not considered that the Eastern Bentwing Bat would significantly rely upon the study area such that the Proposal would have a significant impact on this species. Although this is the case, to further consider the impacts of the Proposal on this species, an eight part test has been undertaken (Section 7.2.8).

6.2.9. Gang-gang Cockatoo (*Callocephalon fimbriatum*).

The Gang-gang Cockatoo is distributed from southern Victoria through to south and central eastern NSW (Shields and Crome 1992). During summer, the Gang-gang Cockatoo prefers the higher altitude tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests (Frith 1997). In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). This species has also been observed within urban areas including gardens and parklands (Morcombe 1986). During breeding, the Gang-gang Cockatoo utilises tree hollows that are located within the trunks or limbs of large trees (Gibbons 1999, Gibbons and Lindenmayer 2000). Nests are most commonly found within large live eucalypt trees, close to water (Beruldsen 1980). Breeding occurs between October and January (Frith 1977). The primary food source of this Cockatoo includes fruits of native shrubs and trees, although they have been known to take fruits off exotic trees (Frith 1977). The main threat to their survival is habitat destruction, with the alteration of fire regimes contributing to this threat (NSW Scientific Committee 2005).

The Gang-gang Cockatoo is being considered for listing under the *TSC Act* due to a dramatic decline in this species' numbers as a result of unknown causes (NSW Scientific Committee 2005).

The Gang-gang Cockatoo was only recorded down slope of Jenolan Caves Road, though it is likely that it could forage within the study area on occasion. No evidence of any occupation of those hollow bearing trees present was obtained during the field investigation, though there is the potential that this species could use several of these on occasion (though the lack of proximity to water would reduce their suitability). Whilst this is the case, the loss of one or two hollow bearing trees, compared to the extent of similar resources in the surrounding region, is not considered to present a significant impact to the occurrence of the Gang-gang Cockatoo. As the hollow bearing trees were mainly recorded above cut slope 3.64, within the area proposed for the access track and works site, it is expected that, given the density of hollow bearing trees at this location, an alignment / works area can be selected that minimises the number of hollow bearing trees requiring removal. Whilst the Proposal is not considered to have a significant impact on this species, its populations or habitats, to further consider the impacts of the slope remediations on the Gang-gang Cockatoo, an eight part test has been undertaken (Section 7.2.11).

6.3. Fauna species of conservation significance previously recorded in the study region.

Based on the consultation of the DEH and DEC databases, and previous studies that are relevant to this region, 21 terrestrial fauna species listed under the *TSC* and *EPBC Acts* are known, or have the potential to be present, within this part of the Oberon Local Government Area (Appendix 3). Though targeted, none of these threatened species were observed or indicated as occurring within the study area. Within the area surveyed, no habitats important to the roosting or breeding requirements of any of the species listed in Appendix 3 were observed. Although there are some hollow-bearing trees located within, and in close proximity to, the access track, proposed work site and several of the cut slopes, it is not considered that the loss of several of these would present a significant effect to the occurrence of any of the hollow dependant fauna. The study area may provide some foraging resources for some of the animals listed in Appendix 3, however since the Proposal would only remove a maximum of 6.15ha (which is minimal compared to 350,106ha of surrounding conserved vegetation), it is not considered that the works would have a significant impact on the local or regional occurrence of any of these species. Post-development, it is considered that those state and national listed threatened species known or potentially occurring within the study area would still be able to traverse across and forage within the study area.

7. Ecological assessments.

7.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

7.1.1 Flora considerations.

By the completion of the field investigations, no plants listed under the Schedules to the *EPBC Act* had been recorded within, or in the vicinity of, the proposed works. Similarly, no nationally listed Endangered Ecological Communities or populations are listed as occurring, or were recorded in the study area. The works would not have a detrimental impact on any species of national conservation significance and therefore it is not considered that the matter requires referral to the Federal Minister for the Environment for further consideration and approval in regards to botanical matters of national environmental significance.

7.1.2 Fauna considerations.

By the completion of the field surveys, two species, the Satin Flycatcher *Myiagra cyanoleuca* and Large-eared Pied Bat *Chalinolobus dwyeri*, listed under the *EPBC Act* had been recorded. Within the study area suitable foraging and nesting habitat exists for the Satin Flycatcher, whilst the Large-eared Pied Bat is only expected to be foraging through the area (due to a lack of any suitable roosting and breeding

sites). Based on a consideration of the *EPBC Act*'s Administrative Guidelines on Significance for a migratory and vulnerable species, it is not considered that the Proposal would:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for the Satin Flycatcher;
- result in invasive species that are harmful to the Satin Flycatcher becoming established in an area of important habitat for this migratory species;
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the Satin Flycatcher's population;
- lead to a long-term decrease in the size of an important population of the Large-eared Pied Bat;
- reduce the area of occupancy of an important population of the Large-eared Pied Bat;
- fragment an existing important Large-eared Pied Bat population into two or more populations;
- adversely affect habitat critical to the survival of the Large-eared Pied Bat;
- disrupt the breeding cycle of an important Large-eared Pied Bat population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Large-eared Pied Bat is likely to decline;
- result in invasive species that are harmful to the Large-eared Pied Bat becoming established; or
- interfere substantially with the recovery of the Large-eared Pied Bat.

"Land clearance" has been listed as a threatening process under the *EPBC Act*. The Proposal would include the clearance of a total of 6.15ha of native vegetation. Based on the findings of the field investigations, habitat assessments and literature review process, it is not considered that the Proposal would:

- cause a native species or an ecological community to become eligible for listing as extinct, extinct in the wild, critically endangered, endangered or vulnerable;
- cause a native species or an ecological community to become eligible to be listed in another category representing a higher degree of endangerment; or
- adversely affect 2 or more listed threatened species or 2 or more listed threatened ecological communities.

Therefore, giving consideration to the obligations and objectives of the *EPBC Act*, it is not considered that the Proposal would require referral to the Federal Minister for the Environment for further consideration or approval in relation to fauna matters of national environmental significance.

7.2. State *Environmental Planning and Assessment Act 1979*.

7.2.1 Flora assessment.

No plant species, Endangered Ecological Communities or populations listed under the Schedules of the *TSC Act* were recorded or indicated as occurring within the study area. The vegetation communities present within the study area are not unique to this location, these occurring within the surrounding bushland areas, including the large adjacent conservation reserves of the Blue Mountains and Kanangra-Boyd National Parks and the Jenolan Karst Conservation Reserve.

Although no species, populations or ecological communities listed on the Schedules to the *TSC Act* were recorded within the study area, based on a precautionary approach, a *generic* eight part test has been completed below.

7.2.2 Eight part test – Flora.

(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 habitats present within the study area are not considered critical for the life cycle needs of any plant species of conservation significance that could potentially occur in the area, based on the habitat types present. No threatened species were located during the field surveys and the activities associated with the Proposal would not result in the removal of any individuals of threatened species, or any habitat that are important for the survival of any potentially occurring threatened plants. This is due to the lack of suitable habitat, the very small area potentially affected by the Proposal and the absence of any threatened species within, and adjacent to, the study areas.

(b) "*...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...*"

There are no listed endangered populations in the study area or within the sphere of influence of the proposed works.

(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 habitat that would be removed to permit the undertaking of the works is not considered to be significant for any of those threatened species that are known to occur in the region. The further disturbance of the habitat present would not have an impact on, or compromise the viability of, any of those threatened plants potentially occurring in either the locality or surrounding region. No threatened populations or Endangered Ecological Communities occur at within the study area and none are listed as occurring in the surrounding district.

(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...*"

Jenolan Caves Road currently forms a minor barrier to plant interbreeding and the minor widening of the existing road pavement by 2 to 3m would not change the existing situation in terms of connectivity or cross-pollination potential.

(e) "*...whether critical habitat will be affected...*"

No part of the study area is listed as critical habitat under Part 3 Division 1 of the *TSC Act*. There is no critical habitat within the sphere of influence of the Proposal.

(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...*"

No threatened species, ecological communities or populations occur in the study area. All of the species and ecological communities recorded within the study area are common throughout the Jenolan Karst Conservation Reserve and Kanangra-Boyd National Park.

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

'Loss of biodiversity as a result of loss and/or degradation of habitat following clearing and fragmentation of native vegetation' is a Key Threatening Process on Schedule 3 of the *TSC Act*. However, the current proposal would not result in the further clearance of any significant or

extensive existing native vegetation stands and would not result in the significant loss or degradation of native habitat, or the loss of biodiversity from the locality or the region.

(h) *"...whether any threatened species, populations or ecological community is at the limit of its known distribution..."*

No threatened species, ecological communities or populations occur in the study area.

7.2.3. Flora conclusion.

The minor widening of Jenolan Caves Road along Binoomea Ridge Hill at the sites surveyed would not affect any threatened species, ecological communities or populations listed on the Schedules to the *TSC Act*. The preparation of a Species Impact Statement that further considers the Proposal in relation to its impact on threatened plants, is therefore not considered necessary.

7.2.4. Fauna assessment.

The potential impacts associated with the Proposal on the Powerful Owl *Ninox strenua*, Sooty Owl *Tyto tenebricosa*, Yellow-bellied Glider *Petaurus australis*, Large-eared Pied Bat *Chalinolobus dwyeri*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Large-footed Myotis *Myotis adversus* and Eastern Bentwing Bat *Miniopterus schreibersii* are considered using the eight part test as provided under Section 5A of the *Environmental Planning and Assessment Act 1979*. These criteria are designed to determine "whether there is likely to be a significant effect on these threatened species, their populations, ecological communities, or habitats", and consequently whether a Species Impact Statement is required.

In accordance with the NPWS's information circular on the eight part test (NPWS 1996), due to the similarity in the habitat requirements of the Large-eared Pied Bat *Chalinolobus dwyeri* and Eastern Bentwing Bat *Miniopterus schreibersii* (i.e. both are cave roosting and woodland foraging species) these species have been grouped together when undertaking the Section 5A assessment.

It is noted that the Gang-gang Cockatoo *Callocephalon fimbriatumare* is currently being considered for listing under the *TSC Act*. Given that a favourable decision is expected to be made in regards to the listing of this species prior to the commencement of the Proposal an eight part test for this bird has also been prepared.

7.2.5. (a) Eight part test – Powerful Owl.

(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..."

During the field investigations no evidence was obtained that would indicate that the Powerful Owl was roosting or breeding within the any of the cut slopes. When detected through use of call playbacks, the Powerful Owl was only heard down slope of Jenolan Caves Road, no individuals being detected within any of the cut slope sites. Whilst this species is expected to forage over the study area, the removal of a maximum 6.15ha of native vegetation is not considered to reduce the extent of foraging resources available to the Powerful Owl's prey species. All of the Powerful Owl's prey species were recorded beyond the limits of the proposed remediation sites, in association with the better developed woodlands, particularly those areas that support hollow bearing trees. In relation to the proposed access track and works site that are to be located on top of cut slope 3.64, whilst these may require the removal of several hollow bearing trees, the loss of these in regards to the breeding needs of the Powerful Owl is not considered to be significant, particular given the extent of similar resources that occur within the study region. As such, the Proposal is not considered to significantly disrupt the life cycle of the locally occurring Powerful Owl population such that it is placed at risk of extinction.

(b) "*...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 *TSC Act*. Therefore the Powerful Owl is not an 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 study area is not considered to constitute a significant regional area of known habitat for the Powerful Owl. Within the study area, no significant Powerful Owl breeding, roosting or foraging sites were observed. The study area may provide a small portion of this species foraging resources however, given that only a maximum of 6.15ha of vegetation would be modified, it is not considered that this represents a significant area of this species regional habitat.

(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...*"

The Powerful Owl is a highly mobile species, one that is known to easily negotiate open spaces (including the existing Jenolan Caves Road). As such, the Proposal would not present any new barriers to the movement patterns of this species. Therefore, no areas of habitat known or expected to be used by this species would be isolated or further fragmented.

(e) "*...whether critical habitat will be affected...*"

No critical habitat will be adversely affected by the Proposal. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Powerful Owl is known to occur within the adjacent Kanangra-Boyd National Park (DEC 2005), though whether it is adequately represented in this area is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any Powerful Owl individuals, populations or their necessary habitats.

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

Currently 21 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act*. Of these, "clearing of native vegetation" is applicable to the Proposal. The Proposal would result in the clearance of a maximum of 6.15ha of native vegetation, this, when compared to the surrounding 350,106ha, not considered to present a significant loss. As such, it is not considered that the Proposal would constitute a Key Threatening Process such that the life cycle requirements of this species would be significantly compromised.

(h) "*...whether any threatened species, populations or ecological community is at the limit of its known distribution...*"

The Powerful Owl does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.5. (b) Expected impact on the Powerful Owl.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Powerful Owl. No habitats were observed within the area of possible impact (including both direct and indirect impacts) that would be considered significant for the conservation and preservation of this species. Due to the small scale of the likely works and the extent of similar bushland in the surrounding region, no Powerful Owl dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. During the field survey, no roosting populations of this species, or their necessary habitat areas, were recorded within the study area. As such, no locally viable populations of this animal are considered to occur. Therefore, the expected impacts associated with the Proposal on the Powerful Owl are considered to be minimal, and therefore, the preparation of a Species Impact Statement is not recommended.

7.2.6. (a) Eight part test – Sooty Owl.

(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...*"

During the field investigations no evidence was obtained that would indicate that the Sooty Owl was roosting or breeding within the any of the cut slopes. When detected through use of call playbacks, the Sooty Owl was only heard down slope of Jenolan Caves Road, no individuals being detected within any of the cut slope sites themselves. Whilst this species is expected to forage over the study area, the removal of a maximum 6.15ha of native vegetation is not considered to reduce the extent of foraging resources available to the Sooty Owl's prey species. All of the Sooty Owl's prey species were recorded beyond the limits of the proposed remediation sites, in association with the better developed woodlands, particularly those areas that support hollow bearing trees. In relation to the proposed access track and works site that are to be located on top of cut slope 3.64, whilst these may require the removal of several hollow bearing trees, the loss of these in regards to the breeding needs of the Sooty Owl is not considered to be significant, particular given the extent of similar resources that occur within the study region. As such, the Proposal is not considered to significantly disrupt the life cycle of the locally occurring Sooty Owl population such that it is places at risk of extinction.

(b) "*...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 *TSC Act*. Therefore the Sooty Owl is not an 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 study area is not considered to constitute a significant area of regional habitat for the Sooty Owl. Within the study area, no significant breeding, roosting or foraging sites were observed. The study area may provide a small portion of this species foraging resources however, given that only a maximum of 6.15ha of vegetation would be modified, it is not considered that a significant area of known regional habitat will be 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...*"

The Sooty Owl is a highly mobile species known to easily negotiate open spaces (including the existing Jenolan Caves Road). As such, the proposed works would not present any new barriers to the movement patterns of this species. Therefore, no areas of habitat known to be used by this species will be isolated or further fragmented.

(e) *"...whether critical habitat will be affected..."*

No critical habitat will be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Sooty Owl is known to occur within Kanangra-Boyd National Park (DEC 2005), though whether it is adequately represented in this area is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any Sooty Owl individuals, populations or their necessary habitat areas.

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

Of the 21 Key Threatening Processes listed for mainland NSW, "clearing of native vegetation" is applicable to the Proposal. The Proposal would result in the clearance of only a small portion of native vegetation (6.15ha in total), this, when compared to the surrounding 350,106ha, not considered to present a significant loss in relation to the life cycle requirements of the Sooty Owl. As such, it is not considered that the Proposal would constitute a Key Threatening Process such that the life cycle requirements of this species would be significantly compromised.

(h) *"...whether any threatened species, populations or ecological community is at the limit of its known distribution..."*

The Sooty Owl does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.6. (b) Expected impact on the Sooty Owl.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Sooty Owl. No habitats were observed within the area of possible impact (including both direct and indirect impacts) that would be considered significant for the conservation and preservation of this species. Due to the vast surrounding conservation reserves, no Sooty Owl dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. During the field survey, no roosting populations of this species, or their necessary habitat areas, were recorded within the study area. As such, no locally viable populations of this animal are considered to occur. Therefore, the expected impacts associated with the Proposal on the Sooty Owl are considered to be minimal and therefore the preparation of a Species Impact Statement is not necessary.

7.2.7. (a) Eight part test – Yellow-bellied Glider.

(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..."*

During the field survey, no individuals of the Yellow-bellied Glider were spot lite or heard calling from the study area, all records being made down slope of Jenolan Caves Road. Whilst this is the case, it is expected that this species would forage and possibly roost within, and upslope of, the study area on occasion. On the cut slopes themselves, no hollow bearing trees are present therefore no possible Yellow-bellied Glider roosting or breeding sites would be removed. In regards to the access track and works site, the loss of several hollow bearing trees from this area, in comparison with the surrounding extent of similar resources, is not considered to present a significant impact on the local viability of this species. In regards to this area, it is noted that no individuals were heard calling during

the dusk call identifications, as such, given the loyalty of this species to its roosting sites, no resident sheltering populations are considered to be present. Given the extent of better developed bushland within the surrounding region, the loss of only a small portion of native vegetation (a maximum of 6.15ha in total) is not considered to present a significant disruption to the life cycle requirements of this species. As such, the viability of the local Yellow-bellied Glider population is not considered to be compromised such that this species would be placed at risk of extinction.

(b) "*...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 *TSC Act*. Therefore the Yellow-bellied Glider is not an 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...*"

Based on the results of the field investigation, the lack of any detections of this species within any of the cut slopes and the lack of any evidence that would indicate this species is foraging in these areas (i.e. no incised trees were observed), it is not considered that the study area would constitute a significant regional resource for this species. As such, no significant areas of regional habitat for the Yellow-bellied Glider would be removed or modified as a result of the undertaking of the Proposal.

(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...*"

The Proposal would not isolate any currently interconnecting or proximate areas of habitat suitable for use by the Yellow-bellied Glider. Due to the existing presence of Jenolan Caves Road and its associated series of exposed rock batters, the eucalypt woodlands are already considered to be "fragmented", the proposed works not considered to have an adverse cumulative impact when combined with the existing situation. As such the Proposal would not further isolate any areas of importance to the foraging or dispersal needs of this species. Given this, as well as the extent of the proposed works and the maintained connectivity of those corridors that occur beyond the limits of the proposed slope remediation sites, the Proposal would not present any new barriers to the movement patterns of this species. Therefore, no areas of habitat known or expected to be used by this species would be isolated or further fragmented.

(e) "*...whether critical habitat will be affected...*"

No critical habitat will be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Yellow-bellied Glider is known to occur within the adjacent national park, although whether it is adequately represented in this area is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any Yellow-bellied Glider individuals, populations or their necessary habitat areas.

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

Twenty Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act*. Of these, "the clearing of native vegetation" is applicable to the Proposal. Whilst it is acknowledged that the Proposal would result in the clearing of some native vegetation (a maximum of 6.15ha in total) potentially available for the foraging and roosting needs of the Yellow-bellied Glider, taking into account the presence of around 350,106ha of similar bushland in the surrounding conservation reserve network, it is not considered that the clearing that would occur would result in a significant loss of any habitat for this species from the region. As such, it is not considered that the Proposal would constitute a significant Key Threatening Process such that the life cycle requirements of the Yellow-bellied Glider would be compromised.

(h) "*...whether any threatened species, populations or ecological community is at the limit of its known distribution...*"

The Yellow-bellied Glider does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.7. (b) Expected impact on the Yellow-bellied Glider.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Yellow-bellied Glider. Due to the small scale of the Proposal, and the presence of similar conserved bushland area in the surrounding region, no Yellow-bellied Glider dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. Therefore, the expected impacts associated with the Proposal on the Yellow-bellied Glider are considered to be minimal, and therefore the preparation of a Species Impact Statement is not necessary.

7.2.8. (a) Eight-part test – Cave dependant microchiropterans (Large-eared Pied Bat and Eastern Bentwing Bat).

(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 resources present within the study area are not considered to constitute a major component of the Large-eared Pied Bat or Eastern Bentwing Bat's roosting, breeding or foraging requirements. Within the study area, no natural or artificial caves suitable for the roosting requirements of either of these species were observed. Neither the Large-eared Pied Bat nor the Eastern Bentwing Bat are considered to be solely dependant upon those resources present in the study area such that the undertaking of the Proposal would significantly affect the viability of a local population of either of these microchiropterans.

(b) "*...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 *TSC Act*. Therefore the Large-eared Pied Bat and Eastern Bentwing Bat are not an 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 study area is not considered to constitute a significant regional area of known habitat for either of the cave dependant microchiropterans that were recorded during the field survey. There were no suitable caves observed within the study area, which is an essential habitat feature for the roosting

requirements of these species. The study area itself may provide some foraging resources for these species, however, the value of the vegetation proposed to be removed is minimal compared to the remaining areas of similar foraging resources (both adjacent to, and beyond the limits of, the study area). Therefore, the Proposal would not modify or remove a significant area of known regional habitat for either of the cave dependant microchiropterans.

(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..."*

The cave dependant microchiropterans are both known to easily negotiate urban infrastructure, including roads, open fields and developed areas (Hoye and Spence 2004). The study area is surrounded by 350,106ha of well conserved bushland. As such, the Proposal would not present a barrier to the movement patterns of these species such that their necessary habitat areas are likely to become isolated.

(e) *"...whether critical habitat will be affected..."*

No critical habitat would be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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..."*

Both of the cave dependant microchiropterans are known to be present within the Kanangra-Boyd National Park, including roosting populations within the nearby Jenolan Caves, though whether they are adequately represented in these areas is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any cave dependant microchiropterans, their populations or necessary habitat areas.

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

Of the 21 Key Threatening Processes listed for mainland NSW "the clearing of native vegetation" is applicable to the Proposal. Whilst it is acknowledged that the Proposal would result in the clearing of some insect attracting native vegetation (this equating to a maximum of 6.15ha) potentially available for the foraging needs of the cave dependant microchiropterans, taking into account the presence of around 350,106ha of similar bushland in the surrounding conservation reserve network, it is not considered that this clearance would result in a significant loss of any habitat for these species from the region. As such, it is not considered that the Proposal would constitute a significant Key Threatening Process such that the life cycle requirements of any cave dependant microchiropterans would be compromised.

(h) *"...whether any threatened species, populations or ecological community is at the limit of its known distribution..."*

Neither of the cave dependant microchiropterans reach the limits of their known distributions in the vicinity of the study area.

7.2.8. (b) Expected impact on cave dependant microchiropterans.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of either of the cave dependant microchiropterans recorded during the field investigation. No habitats were observed within the area of possible impact (including both direct and indirect impacts) that would be considered significant for the conservation and preservation of

these species. Due to the extent of similar woodland in the surrounding conservation reserves, no microchiropteran dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. During the field survey, no roosting sites suitable for the needs of these species were recorded within the study area, and therefore no locally viable populations of these animals are considered to occur. Therefore, the expected impacts associated with the Proposal on the cave dependant microchiropterans is considered to be minimal, and therefore, the preparation of a Species Impact Statement for these species is not necessary.

7.2.9. (a) Eight-part test – Eastern False Pipistrelle.

(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 resources present within the study area are not considered to constitute a major component of the Eastern False Pipistrelle's roosting, foraging or breeding requirements. During the field survey, no caves or suitable sheltering sites (tree hollows) were observed on any of the cut slopes, the only possible roosting/breeding sites being recorded above cut slope 3.64. At this location, the establishment of the proposed access track and works compound is expected to result in the removal of several hollow bearing trees, though the number is expected to be minimised through appropriate design. The loss of several hollow bearing trees when compared to the extent of similar resources adjacent to and beyond the limits of the study area is not considered to adversely affect the local viability of a population of the Eastern False Pipistrelle, such that it is placed at risk of extinction.

(b) "*...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 *TSC Act*. Therefore the Eastern False Pipistrelle is not an 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 study area is not considered to constitute a significant regional area of known habitat for the Eastern False Pipistrelle. Within the study area, no significant roosting or foraging areas are present, the resources present being continuous with those that occur beyond the limits of the likely works area. On occasion, the Eastern False Pipistrelle may forage over and through the study area however the clearing that would occur would only result in the removal of 6.15ha of possibly insect attracting plants from the surrounding 350,106ha of similar bushland. Therefore, the Proposal would not modify or remove a significant area of known regional habitat that is currently important to the presence of the Eastern False Pipistrelle.

(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...*"

Proposal would not present a barrier to the movement patterns of the Eastern False Pipistrelle such that its necessary habitat areas are likely to become isolated.

(e) "*...whether critical habitat will be affected...*"

No critical habitat would be adversely affected by the Proposal. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Eastern False Pipistrelle is known to be present within the Kanangra-Boyd National Park, and has been found in Jenolan Caves, though whether it is adequately represented in these areas is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any Eastern False Pipistrelle individuals, populations or their necessary habitats.

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

Of the 21 Key Threatening Processes listed for mainland NSW, "clearing of native vegetation" is applicable to the Proposal. The Proposal would result in the clearance of only a small portion of native vegetation (6.15ha), this, when compared to the surrounding 350,106ha, not considered to present a significant loss in relation to the life cycle requirements of the Eastern False Pipistrelle. As such, it is not considered that the Proposal would constitute a Key Threatening Process such that the life cycle requirements of this species would be significantly compromised.

(h) "*...whether any threatened species, populations or ecological community is at the limit of its known distribution...*"

The Eastern False Pipistrelle does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.9. (b) Expected impact on the Eastern False Pipistrelle.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Eastern False Pipistrelle. No habitats were observed within the area of possible impact (including both direct and indirect impacts) that would be considered significant for the conservation and preservation of this species. Due to the extent of similar woodland in the surrounding conservation reserves, no Eastern False Pipistrelle dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. As such, no locally viable populations of this animal are considered to occur. The expected impacts associated with the Proposal on the Eastern False Pipistrelle are therefore considered to be minimal. As such, the preparation of a Species Impact Statement is not necessary.

7.2.10. (a) Eight part test – Large-footed Myotis.

(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...*"

No resources are present within the study area that would be suitable for the Large-footed Myotis' roosting, breeding or foraging requirements. As such, no impacts would arise that would disrupt the local viability of this species. Therefore, the undertaking of the Proposal is not considered to remove any resources important to the local viability of this species.

(b) "*...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 *TSC Act*. Therefore the Large-footed Myotis is not an 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 study area is not considered to constitute a significant regional area of known habitat suitable for the Large-footed Myotis. Within the study area, no suitable roosting, foraging or breeding sites are present. Therefore, the Proposal would not modify or remove a significant area of known regional habitat that is important to the occurrence of the Large-footed Myotis.

(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...*"

The proposed works would not present a barrier to the movement patterns of the Large-footed Myotis such that its necessary habitat areas are likely to become isolated. This species is known to easily negotiate open space areas (e.g. open expanses of water), therefore no impacts to the dispersal or movement patterns of this species are expected to arise.

(e) "*...whether critical habitat will be affected...*"

No critical habitat would be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Large-footed Myotis is known to be present within the Kanangra-Boyd National Park though whether it is adequately represented in this area is unknown. Although this is the case, the undertaking of the Proposal is not considered to threaten the presence of any Large-footed Myotis individuals, populations or their necessary habitat areas.

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

The activities likely to be undertaken during the proposed remediation works would not have an adverse impact on any resources important to the Large-footed Myotis. The works would not threaten any Myotis foraging, roosting or breeding site. As such, the Proposal is not considered to constitute a Key Threatening Process such that the life cycle requirements of this species would be significantly compromised.

(h) "*...whether any threatened species, populations or ecological community is at the limit of its known distribution...*"

The Large-footed Myotis does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.10. (b) Expected impact on the Large-footed Myotis.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats suitable for the life cycle requirements of the Large-footed Myotis. No habitats were observed within the area of possible impact (including both direct and indirect impacts) that would be considered significant for the occurrence of this species. As such, no locally viable populations of this animal are considered to occur and therefore none would be significantly affected. The expected impacts associated with the Proposal on the Large-footed Myotis are considered to be minimal, and therefore, the preparation of a Species Impact Statement is not necessary.

7.2.11. (a) Eight part test – Gang-gang Cockatoo.

(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...*"

During the field survey, no individuals of the Gang-gang Cockatoo were observed or heard calling from the study area, all records being made down slope of Jenolan Caves Road. Whilst this is the case, it is expected that this species would forage and possibly roost within, and upslope of, the study area on occasion. On the cut slopes themselves, no hollow bearing trees are present therefore no possible roosting and breeding sites would be removed. In regards to the access track and works site, the loss of several hollow bearing trees from this area, in comparison with the surrounding extent of similar resources, is not considered to present a significant affect on the local viability of this species. Given the extent of better developed bushland within the surrounding region, the loss of only a small portion of native vegetation (this equating to a maximum of 6.15ha) is not considered to present a significant disruption to the life cycle requirements of this species. As such, the viability of the local Gang-gang population is not expected to be placed at risk of extinction.

(b) "*...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 *TSC Act*. Therefore the Gang-gang Cockatoo is not an 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 habitats within the study area extend well beyond the boundaries of the Proposal into the surrounding national park, this covering an area of 350,106ha. At a regional level, the habitats present within the study area are not considered to constitute a significant area in relation to the regional requirements of the Gang-gang Cockatoo.

(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...*"

This species is highly mobile and can traverse open spaces and as such the Proposal would not isolate any currently interconnecting or proximate areas of habitat suitable for use by the Gang-gang Cockatoo.

(e) "*...whether critical habitat will be affected...*"

No critical habitat would be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(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 Gang-gang Cockatoo has been recorded within various conservation reserves throughout its distribution (DEC 2005) though whether it is adequately represented in these areas is unknown. Although this is the case, it is not expected that the Proposal would compromise the viability of a resident population of this species.

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

Of the 21 listed Key Threatening Processes, "clearing of native vegetation" is applicable to the Proposal. The Proposal would result in the clearance of only a small portion of native vegetation (this equating to a maximum of 6.15ha), this not considered a significant loss in comparison to the remaining 350,106ha. As such, it is not considered that the Proposal would constitute a Key Threatening Process such that the life cycle requirements of this species would be significantly compromised.

(h) *"...whether any threatened species, populations or ecological community is at the limit of its known distribution..."*

The Gang-gang Cockatoo does not reach the limits of its known distribution range in the vicinity of the study area.

7.2.11. (b) Expected impact on the Gang-gang Cockatoo.

The Proposal is not considered to have a significant impact on the local status of the Gang-gang Cockatoo. The works would not remove any significant portions of this species roosting or breeding sites and no major foraging areas would be significantly affected. The works would not present a barrier to the dispersing or movement patterns of this species, the Gang-gang Cockatoo known to easily negotiating open space and rocky areas. Therefore it is not considered that the Proposal would have a significant impact on this threatened species, its population, ecological community or habitats. Therefore, the preparation of a Species Impact Statement which further considers the impacts of the works on this species is not required.

7.3 State - *State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection.*

The Oberon Local Government Area is identified under Schedule 1 – Local Government Areas of SEPP 44 – Koala Habitat Protection. This Policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas.

Six eucalypts were recorded during the botanical surveys, these being, *Eucalyptus bicostata, E.dalrympleana, E. blaxlandii, E. eugenoides, E. viminalis* and *E. fastigata*. Of these, *E.viminalis* is a listed Koala feed tree under Schedule 2 of SEPP 44. Within the study area, *E..viminalis* constitutes greater than 15% of the total tree canopy and therefore, based on the criteria provided under SEPP 44, the study area is considered to constitute potential Koala habitat. Although this is the case, during the field surveys no individuals of this animal were spot lite or observed, none were heard calling during the nocturnal surveys and no characteristic scratching or scats were found. As such, the study area is not considered to be core Koala habitat. Given the limited extent of the works proposed, the known ability for Koalas to traverse open ground, combined with the amount of bushland present both adjacent to and beyond the limits of the study area it is not considered that the Proposal would have a significant impact on any Koala individuals, their populations or habitat. Therefore a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of the current Proposal.

8. Conclusions.

Based on the results of the flora and fauna surveys, combined with a review of known literature and database sources, it is not considered that there are any ecological constraints to the proposed stabilisation of several of the cut slopes that occur adjacent to Jenolan Caves Road proceeding as planned. The Proposal would not significantly affect any populations of any native plants or animals such that they are placed at risk of extinction. Similarly the works would not remove or significantly affect any habitats of local, regional, state or national conservation concern.

No regionally significant, state or nationally listed plants or ecological communities were recorded within the study area. As such, no plants or vegetation communities of conservation concern would be adversely affected as a result of the undertaking of the Proposal.

The proposed works are not considered to affect, threaten or have an adverse impact on any of those plants or animals listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (including the migratory Satin Flycatcher *Myiagra cyanoleuca* and vulnerably listed Large-eared Pied Bat *Chalinolobus dwyeri* that were recorded during the field survey). Therefore, it is not considered that the matter would require referral to the Federal Minister for the Environment for further consideration or approval.

Within the areas of likely disturbance, the habitats and vegetation communities present are considered to be of limited value for those species recorded or expected. The proposed works sites are all very small, none providing any significant areas of foraging, sheltering, roosting or breeding habitat. The proposed works would therefore not result in any threatened plants or animals (including the seven threatened animals recorded during the survey), their populations, ecological communities or habitats being significantly impacted upon such that a viable population of that species is placed at risk of extinction. Similarly, the works would not fragment, disturb or alter any of these species movement, dispersal or pollination vector corridors, or isolate any proximate areas of suitable habitat. Therefore, giving consideration to the assessment criteria listed under Section 5A of the NSW *Environmental Planning and Assessment Act 1979*, the preparation of a Species Impact Statement for any threatened plants or animals would not be required.

The Proposal would not have an adverse impact on the local or regional viability of the Gang-gang Cockatoo *Callocephalon fimbriatum*, a bird that has been Preliminary listed for inclusion under the *TSC Act*. Based on a consideration of the habitat requirements of this species, combined with the results obtained during the field survey, it is not considered that the proposed remediation works would have a significant effect on this species, its populations or habitats. As such, the preparation of a Species Impact Statement that further considers the impact of the Proposal on this species is not required.

Whilst meeting the criteria of potential Koala habitat as provided under SEPP 44, the study area is not considered to be core Koala habitat. Therefore, giving consideration to the objectives of SEPP 44, it is not considered that the proposed remediation works would require the preparation of a Plan of Management for Koalas, or the adoption of any other appropriate mitigative measures.

9. Recommendations.

The following recommendations are provided to ensure that the Proposal does not have an adverse impact on those habitats that occur beyond the limits of the works. The recommendations are also provided to ensure that the works are undertaken in an ecologically sustainable manner:

- All areas that occur beyond the limits of the proposed works should be clearly defined on site to ensure they are not disturbed. These areas should be highlighted on any plans provided to the RTA's woks contractors to ensure no adjacent habitats are adversely affected.

- The sighting of the access track and works site should be such that it minimise the number of hollow bearing trees requiring removal from atop of cut slope 3.64. Given the sparse distribution of mature hollow bearing trees at this site, a suitable alignment for each component of this works area could be selected that minimises the number of hollow bearing trees requiring removal.

- An erosion and sediment control plan should be prepared. This plan should include the stabilisation of exposed surfaces as soon as possible to reduce the potential for any erosion.

- The erosion and sedimentation control plan should ensure that no sediments leave the study area and that the works do not adversely affect the Jenolan River. The quality of this drainage line should not be reduced as a result of the Proposal.

- Cleared native vegetation should be mulched and used in the sites stabilisation works post-treatment.

- The Blackberry (*Rubus ulmifolius*) infestations recorded at cut slopes 4.22, 7.02, 7.58 and 8.13 should be treated. The treatment of this noxious weed should be undertaken in consultation with Upper Macquarie County Council.

- Weeds and seed bearing exotic plants that are removed should not be mulched but should be taken to an approved Council waste facility.

- If a chemical herbicide is used to aid in the removal of weed species, a product should be selected that will readily break down and not impact on any fauna species.

- Cleared and disturbed areas should be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion.

10. Bibliography.

Australian Heritage Commission (2005) *Register of the National Estate.* http://www.ahc.gov.au/register/. [Accessed January 2005].

Bennett, A.F. (1993) Microhabitat use by the Long-nosed Potoroo, *Potorous tridactylus*, and other small mammals in remnant forest vegetation of South-western Victoria. *Wildlife Research.* 20(3), 267-285.

Beruldsen, G. (2003) *Australian birds, their nests and eggs.* G. Beruldsen, Kenmore Hills, Queensland.

Braithwaite, L.W. (1983) Studies on the arboreal marsupial fauna of eucalypt forests being harvested for woodpulp at Eden NSW I. The species and distribution of animals. *Australian Wildlife Research.* 10, 219-229.

Briggs, J. and Leigh, J. (1996) *Rare or Threatened Australian Plants.* CSIRO Publishing, Collingwood, Victoria.

Brooker, M.I.H. and Kleinig, D.A. (1999) *Field guide to Eucalypts. South-eastern Australia Volume I Second Edition.* Bloomings Books, Hawthorn, Victoria.

Brouwer, J. and Garnett, S. (1990) *Threatened Birds of Australia* RAOU Report Number 68. Royal Australian Ornithologists Union, Victoria.

Buckingham, R. and Jackson, L. (Eds) (1990) *A field guide to Australian birdsongs, Cassette Numbers 5 and 6.* Audio Cassette, Bird Observers Club Australia, Victoria.

Bureau of Meteorology (2005) *Bureau of Meteorology Climate Averages.* http://www.bom.gov.au/climate/averages. [Accessed January 2005].

Chafer, C.J. (1992) Observations of the Powerful Owl (*Ninox strenua)* in the Illawarra and Shoalhaven regions of New South Wales. *Australian Bird Watcher.* 14, 289-300.

Churchill, S. (1998) *Australian bats.* Reed - New Holland, Frenches Forest, NSW.

Cogger, H. (1992) *Reptiles and amphibians of Australia.* Reed Books, Chatswood, NSW.

Costermans, L. (1996) *Native trees and shrubs of South-eastern Australia.* Landsdowne Publishing, Sydney, NSW.

Craig, S.A. (1985) Social organisation, reproduction and feeding behaviour of a population of Yellow-bellied Gliders, *Petaurus australis* (Marsupialia: Petauridae). *Australian Wildlife Research.* 12, 1-18.

Cropper, S. (1993) *Management of Endangered Plants.* CSIRO, Melbourne, Victoria.

Debus, S.J. and Chafer, C.J. (1994) The Powerful Owl in New South Wales. *Australian Birds.* 27.

Department of Environment and Conservation (2005) *Atlas of NSW Wildlife Database.* http://wildlifeatlas.npws.gov.au [Accessed January 2005].

Department of Environment and Heritage (2005a) *The Greater Blue Mountains Area: Inscribed 2000.* http://www.biodiversity.ea.gov.au/heritage/worldheritage/sites/blue/index.html [Accessed February 2005].

Department of Environment and Heritage (2005b) *Environment Protection and Biodiversity Conservation Act Online Database.* http://www.environment.gov.au/epbc/db/index.html [Accessed January 2005].

Ehmann, H. (1992) *Encyclopaedia of Australian Animals Reptiles.* Angus and Robertson. Pymble, NSW.

Ehmann, E. (1997) *Threatened frogs of New South Wales: Habitats, status and conservation.* Frog and Tadpole Study Group, Sydney, NSW.

Eldridge, M.D.B. and Close, R.L. (1995) Brush-tailed Rock-wallaby, in Strahan, R. (Ed.) *The Mammals of Australia.* Reed Books, Chatswood, NSW.

Engel, D. and Fanning, F.D. (1995) *A review of the Yellow-bellied Glider, proposed golf course extension, Pambula, Fauna Impact Statement.* Report prepared by Gunninah Consultants, Crows Nest, NSW.

Fairley, A. and Moore, P. (2000) *Native plants of the Sydney District: an identification guide.* Kangaroo Press, Kensington, NSW.

Ford, H., Davies, W., Debus, S., Ley, A., Recher, H. and Williams, B. (1993) Foraging and aggressive behaviour of the Regent Honeyeater (*Xanthomyza phrygia*) in northern NSW. *EMU.* 93(4), 277-280.

Frith, H.J. (Ed) (1997) *Complete book of Australian birds.* Readers Digest, Surry Hills, NSW.

Garnett, S. (1992) *The action plan for Australian birds Australian National Parks and Wildlife Service, Endangered Species Program.* Project Number 121, Australian Museum.

Garnett, S. (Ed) (1993) *Threatened and Extinct Birds of Australia.* RAOU Report Number 82, Royal Australian Ornithologists Union, Victoria.

Gibbons, P. (1999) *Habitat-tree retention in wood production forests.* PhD thesis. Australian National University, Canberra, ACT.

Gibbons, P. and Lindenmayer, D. (2000) *Tree hollows and wildlife conservation in Australia.* CSIRO Publishing, Canberra, ACT.

Goldingay, R. (1989) *The behavioural ecology of the gliding marsupial, Petaurus australis.* Ph.D. Thesis, University of Wollongong, Wollongong, NSW.

Goldingay, R. (1992) Socioecology of the Yellow-bellied Glider (*Petaurus australis*) in a coastal forest. *Australian Journal of Zoology.* 40, 267-278.

Goldingay, R. and Kavanagh, R. (1991) The Yellow-bellied Glider: a review of its ecology, and management considerations in *Conservation of Australia's Forest Fauna* Chapter 31 Royal Zoological Society of New South Wales pp 365-375.

Goldingay, R. and Kavanagh, R. (1993) Home-range estimates and habitat of the yellow-bellied glider (*Petaurus australis*) at Waratah Creek, New South Wales. *Australian Wildlife Research.* 20, 387-404.

Goldingay, R., Quin, D. and Churchill, S. (2001) Spatial variability in the social organisation of the Yellow-bellied Glider near Ravenshoe, north Queensland. *Australian Journal of Zoology.* 49, 397-409.

Hall, L.S. and Richards, G.C. (1979) *Bats of Eastern Australia.* Queensland Museum Booklet No 12.

Harden, G. (Ed) (1992-2002) *Flora of New South Wales Vols 1,2,3 and 4.* NSW University Press, Kensington, NSW.

Henry, S.R. and Craig, S.A. (1984) Diet, ranging behaviour and social organisation of the Yellowbellied Glider (*Petaurus australis* Shaw) in Victoria. Pp. 331-341 in A.P. Smith and I.D. Hume (Eds) *Possums and Gliders.* Australian Mammal Society, Sydney, NSW.

Hollands, D. (1991) *Birds of the Night.* Reed Books, Chatswood, NSW.

Hoye, G. and Spence, J. (2004) The Large Bent-wing Bat *Miniopterus schreibersii* in urban environments: a survivor? Pp 138-147 in D. Lunney and S. Bergin (Eds) *Urban wildlife: more than meets the eye.* Royal Zoological Society of New South Wales, Mosman, NSW.

Keith D.A and Benson, D.H., (1988) The natural vegetation of the Katoomba 1:100,000 map sheet. *Cunninghamia.* 2(1).

King, D.P. (1994) *Soil Landscapes of the Katoomba 1:100 000 Sheet. (mount Tomah, Woodford, Jenolan Caves, Hampton).* Department of Conservation and Land Management, Sydney, NSW.

LandScope Environmental Consultants (1996) *Flora and Fauna Assessment: Proposed widening of Jenolan Caves Road between Lithgow Road and Hampton Halfway House, and Duckmaloi Road between Oberon and Jenolan Caves Road.* Report prepared for the Roads and Traffic Authority (Western Region) by LandScope Environmental Consultants, Bundeena, NSW.

LandScope Environmental Consultants (1997) *Review of Environmental Factors. Maintenance of a culvert under the Grand Arch at Jenolan Caves, NSW.* Report prepared for the Roads and Traffic Authority (Western Region) by LandScope Environmental Consultants, Bundeena, NSW.

LesryK Environmental Consultants (2004) *Flora and fauna assessment of five sites that occur adjacent to Jenolan Caves Road, Jenolan Caves, NSW.* Report prepared for the Roads and Traffic Authority by LesryK Environmental Consultants, Bundeena, NSW.

Lendon, A.H. (1979) *Australian Parrots in Field and Aviary.* Angus and Robinson, Sydney, NSW.

Lindenmayer, D. (2002) *Gliders of Australia.* University of NSW Press, Sydney, NSW.

Manidis Roberts (2004) *Jenolan Karst Conservation Reserve Draft Plan of Management* Version 3- 27/2/04. Manidis Roberts, Sydney, NSW.

McNabb, E.G. (1996) Observations on the Biology of the Powerful Owl *Ninox strenua* in Southern Victoria. *The Australian Bird Watcher.* 16(7), 267-295.

Menkhorst, P.W. (Ed) (1995) *Mammals of Victoria: Distribution, Ecology and Conservation.* Oxford University Press, Melbourne, Victoria.

Menkhorst, P.W. and Lumsden, L.F. (1996) *Eastern False Pipistrelle.* Menkhorst, P.W. (Ed) *Mammals of Victoria: distribution, ecology and conservation.* Oxford University Press, Melbourne, Victoria.

Menkhorst, P.W., Weavers, B.W. and Alexander, J.S.A. (1988) Distribution, habitat and conservation status of the Squirrel Glider *Petaurus norfolcensis* (Petauridae: Marsupialia) in Victoria. *Australian Wildlife Research.* 15, 59-72.

Menkhorst, P.W and Collier, M. (1987) Diet of the Squirrel Glider, *Petaurus norfolcensis* (Marsupialia : Petauridae) in Victoria. *Australian Mammalogy.* 11, 109-116.

Morcombe, M. (1986) *The Great Australian Bird Finder.* Lansdowne Press, Sydney, NSW.

Mt King Ecological Surveys (1989) *Jenolan Caves Reserve Draft Plan of Management - Vegetation survey* (In Mitchell McCotter 1989).

Norton, T. and Lindenmayer, D. (1991) Integrated management of forest wildlife: towards a coherent strategy across state borders and land tenures. *Conservation of Australia's Forest Fauna.* Pp 237 – 244. D. Lunney (Ed), Royal Zoological Society of New South Wales, Mosman, NSW.

NSW Heritage Office (2005) *Online State Heritage Register.* http://www.heritage.nsw.gov.au/ [Accessed January 2005].

National Parks and Wildlife Service (1996) *Information circular No. 2: Threatened species assessment under the EP&A Act: The '8 Part Test' of significance*. NSW National Parks and Wildlife Service, Hurstville, NSW.

National Parks and Wildlife Service (1998) *Glovebox guide – your new way to discover your national parks*. NSW National Parks and Wildlife Service, Hurstville, NSW.

National Parks and Wildlife Service (1999) *Threatened species management – Species information*. NSW National Parks and Wildlife Service, Hurstville, NSW.

National Parks and Wildlife Service (2000) *A guide to threatened fauna of the Northern Central Tablelands*. NSW National Parks and Wildlife Service, Mudgee, NSW.

NSW Scientific Committee (2005) *Threatened Species Final Determinations*. NSW Scientific Committee. http://www.npws.nsw.gov.au/news/tscdets/index.html [Accessed January 2005].

Oberon Council (2004) *State of the Environment Report*. Oberon Council, Oberon, NSW.

Parnaby, H. (1992) *An Interim Guide to Identification of Insectivorous Bats of South-eastern Australia*. Technical Reports of the Australian Museum No 8.

Pavey, C.R. (1995) Food of the Powerful Owl *Ninox strenua* in suburban Brisbane, Queensland. *EMU*. 95(3), 231-232.

Pavey, C., Smith, A. and Mathieson, M. (1994) The breeding season diet of the Powerful Owl (*Ninox strenua*) at Brisbane, Queensland. *EMU*. 94(4), 278-284.

Reardon, T.B. and Flavel, S.C. (1987) *A guide to the Bats of South Australia*. South Australian Museum, South Australia.

Robinson, L. (1994) *Field guide to the native plants of Sydney*. Second edition. Kangaroo Press, Sydney, NSW.

Russell, R. (1980) *Spotlight on Possums*. University of Queensland Press, St Lucia, Queensland.

Schodde, R. (1994) *The bird fauna of western New South Wales: geography and status Future of the Fauna of Western New South Wales* (Eds D.Lunney, S.Hand, F.Reed and D.Buthcher). Royal Zoological Society of NSW Mosman, 107-121.

Shields, J. and Chrome, F. (1992) *Parrots and pigeons of Australia*. Angus and Robertson, Sydney, NSW.

Simpson, K. and Day, N. (1999) *Field guide to the birds of Australia*. Version 6. Penguin Books Australia, Victoria.

Smith, J. and Smith, P. (1990) *Fauna of the Blue Mountains*. Kangaroo Press, Kenthurst, NSW.

Smith, P., Smith, J., Pressey, R. and Whish, G. (1995) *Birds of Particular Conservation Concern in the Western Division of New South Wales: Distributions, Habitats and Threats*. National Parks and Wildlife Service Occasional Paper Number 20, National Parks and Wildlife Service, Hurstville NSW.

Stewart, D. (1999) *Bird and Mammal Calls of NE-NSW Western Slopes and Plains*. Nature Sound, Mullumbimby, NSW.

Stone, B. (2003) *Assessment of the environmental impacts of self-guided tours on Sooty Owl occupying Nettle Cave*. University of Sydney, Orange campus, NSW.

Strahan, R. (Ed) (1995) *The mammals of Australia*. Reed Books, Chatswood, NSW.

Swan, G., Shea, G. and Sadlier, R. (2004) *A field guide to reptiles of New South Wales second edition*. Reed New Holland, Sydney, NSW.

Triggs, B. (1996) *Tracks, scats and other traces : A field guide to Australian mammals*. Oxford University Press, Melbourne, Victoria.

Van Dyck, S. (1992) Lasting impressions of Mahogany Gliders (*Petaurus gracilis*). *Australian Natural History*. 32-41.

Woodlots and Wetlands Pty Ltd and Urban Bushland Management Consultants (2004) *Review of environmental factors for weed removal and bushland regeneration works at the Jenolan Karst Conservation Reserve*. Report prepared for Jenolan Caves Reserve Trust by Woodlots and Wetlands Pty Ltd and Urban Bushland Management Consultants, Sydney, NSW.

Appendix 1. Plant species list.

KEY:

C1 = Cut slope C1.74.
C2 = Cut slope C2.63.
C3 = Cut slope C3.64, plus the proposed access track and work site.
C4 = Cut slope C4.22.
C5 = Cut slope C5.08 and C5.29.
C6 = Cut slope C7.02.
W = Walls 40/41.
C7 = Cut slope C7.58.
C8 = Cut slope C8.13.
* = Introduced species.

FAMILY	GENUS SPECIES	C1	C2	C3	C4	C5	C6	W	C7	C8
FILICOPSIDA										
Adiantaceae	*Adiantum aethiopicum*	•				•	•		•	•
	Pellaea falcata var. *falcata*					•	•	•		•
Aspleniaceae	*Asplenium flabellifolium*	•					•	•	•	•
Dennstaedtiaeae	*Pteridium esculentum*	•	•	•	•	•	•		•	•
Dryopteridaceae	*Polystichum proliferum*	•								
MAGNOLIOPSIDA – MAGNOLIIDAE										
Apiaceae	*Hydrocotle peduncularis*	•	•	•	•	•	•		•	•
Asteraceae	*Bracteantha bracteata*	•	•	•	•	•	•	•	•	•
	Brachycome aculeata			•						
	Brachycome angustifolia		•			•				
	Chrysocephalum semipapposum	•	•	•	•	•	•			
	Cirsium vulgare *					•			•	
	Galinsoga parviflora					•				
	Gnaphalium gymnocephalum	•	•	•	•	•	•		•	•
	Hypochoeris radicata *	•	•	•	•	•	•		•	•
	Ozothamnus diosmifolium					•				
	Senecio lautus ssp. *dissectifolius*				•			•		
	Senecio linearifolius	•		•	•	•	•		•	
	Senecio madagascariensis *	•	•	•	•	•	•	•	•	•
	Sonchus oleraceaus *	•	•	•	•	•	•	•	•	•
	Vittadinia cuneata		•	•						
Bignoniaceae	*Pandorea pandorana*					•				
Boraginaceae	*Austrocynoglossum latifolium*	•	•							
	Echium plantagineum *	•			•					
	Cynoglossum suaveolens	•	•							
Campanulaceae	*Wahlenbergia communis*	•	•	•	•	•	•	•	•	•
	Wahlenbergia stricta		•			•				
Carophyllaceae	*Stellaria pungens*	•	•	•	•	•	•	•	•	•
Clusiaceae	*Hypericum androsaemum* *								•	•
Convolvulaceae	*Dichondra repens*	•	•	•	•	•		•		
Elaeocarpaceae	*Elaeocarpus reticulatus*					•				
Epacridaceae	*Leucopogon lanceolatus*	•		•	•	•			•	•
	Lissanthe strigosa		•	•	•	•	•	•	•	•
Euphorbiaceae	*Poranthera microphylla*	•	•	•	•		•		•	
Fabaceae: Faboideae	*Desmodium varians*									•
	Glycine microphylla		•	•			•			
	Hardenbergia violaceae		•		•	•	•		•	•
	Indigophora australis			•	•	•		•		
	Oxylobium ilicifolium			•	•	•				
	Swainsona galegifolia		•	•	•		•			
	Trifolium campestre *	•								
	Trifolium repens *	•								
	Trifolium subterraneum *	•								
Fabaceae: Mimosoideae	*Acacia falciformis*	•	•	•	•	•	•	•	•	•

FAMILY	GENUS SPECIES	C1	C2	C3	C4	C5	C6	W	C7	C8
	Acacia implexa	•	•	•	•	•		•		•
	Acacia melanoxylon	•								
Gentianaceae	*Centaurium tenuiflorum* *	•	•	•	•	•	•		•	•
Geraniaceae	*Geranium potentilloides*									•
	Geranium solanderi var. *solanderi*	•	•	•	•	•	•		•	•
Goodeniaceae	*Goodenia ovata*						•			
Lamiaceae	*Plectranthus parviflorus*		•							
Malvaceae	*Sida rhombifolia* *	•	•	•	•	•	•		•	•
	Sida corrugata			•	•					
Myrtaceae	*Eucalyptus blaxlandii*	•	•	•	•					
	Eucalyptus bicostata						•	•	•	•
	Eucalyptus dalrympleana ssp.*dalrympleana*				•	•				
	Eucalyptus eugenoides							•		
	Eucalyptus fastigata	•								•
	Eucalyptus viminalis	•	•	•						
Oleaceae	*Notelaea longifolia* forma *longifolia*						•	•		•
Onagraceae	*Epilobium billardierianum.*	•			•		•		•	
Oxalidaceae	*Oxalis corniculata* *	•	•	•	•	•	•		•	•
Pittosporaceae	*Billardiera scandens*		•							
	Bursaria spinosa ssp. *spinosa*	•	•	•	•	•	•	•	•	•
Plantaginaceae	*Plantago lanceolata* *	•	•	•	•	•	•		•	•
	Plantago varia		•							
Polygonaceae	*Persicaria decipiens*	•								
	Rumex sp.	•		•			•		•	•
Primulaceae	*Anagallis arvensis* *	•								
Proteaceae	*Lomatia myricoides*	•	•	•	•	•			•	•
	Persoonia linearis		•		•	•	•			
Ranunculaceae	*Clematis aristata*	•	•	•	•	•	•		•	•
Rhamnaceae	*Pomaderris ?prunifolia*									•
Rosaceae	*Acaena ovina*	•	•	•	•	•	•		•	•
	Rosa rubignosa *						•			
	Rubus ulmifolius *				•		•		•	•
Rubiaceae	*Galium gaudichaudii*					•				
Santalaceae	*Exocarpos cupressiformis*		•		•	•		•		
Sapindaceae	*Dodonaea viscosa*				•			•	•	•
Scrophulariaceae	*Verbascum virgatum* *	•	•				•		•	•
	Veronica pleibeia			•						
Solanaceae	*Solanum prinophyllum*	•							•	•
Stylidiaceae	*Stylidium graminifolium*									•
Urticaceae	*Urtica incisa*	•	•	•		•	•		•	•
Violaceae	*Hymenanthera dentata*					•	•		•	•
	Viola betonicifolia	•	•	•	•	•	•		•	•
MAGNOLIOPSIDA – LILIIDAE										
Anthericaceae	*Dichopogon fimbriatus*						•			
Asphodeliaceae	*Bulbine bulbosa*						•		•	•
Cyperaceae	*Lepidosperma laterale*			•						
Lomandraceae	*Lomandra longifolia*	•	•	•	•	•	•	•	•	•
	Lomandra glauca ssp. *glauca*			•	•	•				
	Lomandra multiflora			•	•	•		•		
Orchidaceae	*Dipodium punctatum*			•		•				
Philesciaceae	*Geitonoplesium cymosum*		•	•		•	•		•	•
Phormiaceae	*Dianella longifolia* var. *longifolia*	•	•		•	•			•	•
	Stypandra glauca					•			•	•
Poaceae	*Austrodanthonia* sp.	•	•	•	•	•	•		•	•
	Avena fatua						•			
	Echinopogon caespitosus var. *caespitosus*					•	•		•	•
	Paspalum dilatatum *						•			
	Poa labillardieri	•	•	•	•	•	•	•	•	•
	Themeda australis		•	•			•		•	•

Appendix 2. Fauna species recorded or previously detected within the study region.

Source of Records:

1 = Species recorded during the current investigation.
2 = DEC (2005).
3 = LesryK Environmental Consultants (2004).
4 = Landscope Environmental Consultants (1996).

KEY:

A – Indicates a species listed under the *EPBC Act.*
F – Migratory Family listed under the *EPBC Act.*
B – Indicates a species listed under the *TSC Act.*
P – Preliminary determination for listing under the *TSC Act.*
C – Confident identification of bat call analysis.
Pr – Probable identification of bat call analysis.
* – Indicates introduced species.

A	B	Common Name	Family and Scientific Name	1	2	3	4
		MAMMALS					
			Tachyglossidae				
		Short-beaked Echidna	*Tachyglossus aculeatus*	x	x		x
			Dasyuridae				
x	x	Spotted-tailed Quoll	*Dasyurus maculatus*		x		
		Brown Antechinus	*Antechinus stuartii*	x	x		
		Dusky Antechinus	*Antechinus swainsonii*		x		
		Common Dunnart	*Sminthopsis murina*		x		
			Phascolarctidae				
	x	Koala	*Phascolarctos cinereus*		x		
			Vombatidae				
		Common Wombat	*Vombatus ursinus*	x	x	x	x
			Petauridae				
	x	Yellow-bellied Glider	*Petaurus australis*	x	x		
		Sugar Glider	*Petaurus breviceps*		x	x	
			Pseudocheiridae				
		Greater Glider	*Petauroides volans*	x	x	x	
		Common Ringtail Possum	*Pseudocheirus peregrinus*		x	x	
			Acrobatidae				
		Feathertail Glider	*Acrobates pygmaeus*		x		
			Phalangeridae				
		Common Brushtail Possum	*Trichosurus vulpecula*	x	x	x	x
			Macropodidae				
		Eastern Grey Kangaroo	*Macropus giganteus*	x	x	x	x
		Common Wallaroo	*Macropus robustus*		x		
		Red-necked Wallaby	*Macropus rufogriseus*	x	x	x	
x	x	Brush-tailed Rock-Wallaby	*Petrogale penicillata*		x		
		Swamp Wallaby	*Wallabia bicolor*	x	x		x
			Rhinolophidae				
		Eastern Horseshoe Bat	*Rhinolophus megaphyllus*			x	
			Vespertilioidae				
x	x	Large-eared Pied Bat	*Chalinolobus dwyeri*	C	x		
		Gould's Wattled Bat	*Chalinolobus gouldii*	C	x	x	
		Chocolate Wattled Bat	*Chalinolobus morio*	Pr	x		

A	B	Common Name	Family and Scientific Name	1	2	3	4
	x	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Pr	x	x	
	x	Large-footed Myotis	*Myotis adversus*	Pr			
	x	Eastern Bentwing Bat	*Miniopterus schreibersii*	C	x	x	
		Lesser Longeared Bat	*Nyctophilus geoffroyi*		x		
		Gould's Longeared Bat	*Nyctophilus gouldi*		x		
		Eastern Broadnosed Bat	*Scotorepens orion*			x	
		Large Forest Bat	*Vespadelus darlingtoni*	C	x	x	
		Southern Forest Bat	*Vespadelus regulus*	C	x		
		Little Forest Bat	*Vespadelus vulturnus*	C	x		
			Molossidae				
		White-striped Freetail Bat	*Nyctinomus australis*	C	x	x	
			Muridae				
		* House Mouse	*Mus musculus*		x		
		Bush Rat	*Rattus fuscipes*		x		
		* Black Rat	*Rattus rattus*		x		
			Canidae				
		Dingo	*Canis lupus dingo*		x		
		* Fox	*Vulpes vulpes*		x	x	x
			Leporidae				
		* Rabbit	*Oryctolagus cuniculus*		x		x
			Suidae				
		* Pig	*Sus scrofa*		x		
		BIRDS					
			Podicipedidae				
		Australasian Grebe	*Tachybaptus novaehollandiae*				x
F			**Anatidae**				
		Pacific Black Duck	*Anas superciliosa*		x		x
		Grey Teal	*Anas gracilis*				x
		Australian Wood Duck	*Chenonetta jubata*				x
			Rallidae				
		Eurasian Coot	*Fulica atra*				x
			Ardeidae				
		White-faced Heron	*Egretta novaehollandiae*		x		x
F			**Charadriidae**				
		Masked Lapwing	*Vanellus miles*				x
F			**Accipitridae**				
		Wedge-tailed Eagle	*Aquila audax*		x	x	x
F			**Falconidae**				
		Brown Falcon	*Falco berigora*				x
		Nankeen Kestrel	*Falco cenchroides*				x
			Columbidae				
		Wonga Pigeon	*Leucosarcia melanoleuca*	x	x	x	
			Cacatuidae				
		Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*	x	x		x
	P	Gang-Gang Cockatoo	*Callocephalon fimbriatum*	x	x	x	x
		Galah	*Eolophus roseicpilla*				x
		Sulphur-crested Cockatoo	*Cacatua galerita*	x	x	x	x
			Psittacidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Rainbow Lorikeet	*Trichoglossus haematodus*			x	
		Australian King Parrot	*Alisterus scapularis*		x		x
		Crimson Rosella	*Platycercus elegans*	x	x	x	x
		Eastern Rosella	*Platycercus eximius*				x
			Cuculidae				
		Fan-tailed Cuckoo	*Cuculus flabelliformis*		x		
		Channel-billed Cuckoo	*Scthrops novaehollandiae*		x		
			Strigidae				
	x	Powerful Owl	Ninox strenua	x	x	x	
		Southern Boobook	*Ninox novaeseelandiae*	x	x	x	
	x	Barking Owl	*Ninox connivens*		x		
			Tytonidae				
	x	Sooty Owl	*Tyto tenebricosa*	x	x	x	
		Barn Owl	*Tyto alba*		x		
			Podargidae				
		Tawny Frogmouth	*Podargus strigoides*	x	x		
			Caprimulgidae				
		White-throated Nightjar	*Eurostopodus mysticalis*		x		
			Aegothelidae				
		Australian Owlet-nightjar	*Aegotheles cristatus*		x		
			Apodidae				
x		White-throated Needletail	*Hirundapus caudacutus*		x		
			Alcedinidae				
		Laughing Kookaburra	*Dacelo naxaeguineae*	x	x	x	x
		Sacred Kingfisher	*Todiramphus sanctus*	x			
			Menuridae				
		Superb Lyrebird	*Menura novaehollandiae*	x	x		
			Neosittidae				
		Varied Sittella	*Daphoenositta chrysoptera*		x		
			Climacteridae				
		White-throated Treecreeper	*Cormobates leucophaeus*	x	x		x
		Red-browed Treecreeper	*Climacteris erythrops*		x		
			Maluridae				
		Superb Fairy-wren	*Malurus cyaneus*	x	x		x
		Variegated Fairy-wren	*Malurus lamberti*		x		
			Pardalotidae				
		Spotted Pardalote	*Pardalotus punctatus*		x		x
		Striated Pardalote	*Pardalotus striatus*	x	x		x
		Rockwarbler	*Origma solitaria*		x		
		White-browed Scrubwren	*Sericornis frontalis*	x	x		x
		Brown Gerygone	*Gerygone mouki*		x		
		Brown Thornbill	*Acanthiza pusilla*	x	x	x	x
		Yellow Thornbill	*Acanthiza nana*		x	x	x
		Striated Thornbill	*Acanthiza lineata*	x	x		
		Buff-rumped Thornbill	*Acanthiza reguloides*		x		
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*				x
			Meliphagidae				
		Red Wattlebird	*Anthochaera carunculata*	x	x	x	x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Noisy Friarbird	*Philemon corniculatus*	x	x		x
		Bell Miner	*Manorina melanophrys*	x		x	
		Lewin's Honeyeater	*Meliphaga lewinii*		x	x	
		Yellow-faced Honeyeater	*Lichenostomus chrysops*	x	x		x
		White-eared Honeyeater	*Lichenostomus leucotis*		x		x
		White-plumed Honeyeater	*Lichenostomus pencillatus*	x	x		
		Brown-headed Honeyeater	*Melithreptus brevirostris*		x		
		White-naped Honeyeater	*Melithreptus lunatus*		x		
		New Holland Honeyeater	*Phylidonryis novaehollandiae*		x		
		Eastern Spinebill	*Acanthorhynchus tenuirostris*	x	x		x
			Orthonychidae				
		Eastern Whipbird	*Psophodes olivaceus*	x	x		
			Cinclosomatidae				
		Spotted Quail-thrush	*Cinclosoma punctatum*		x		
			Petroicidae				
		Rose Robin	*Petroica rosea*		x		
		Flame Robin	*Petroica phoenicea*		x		
		Scarlet Robin	*Petroica multicolor*		x		
		Eastern Yellow Robin	*Eopsaltria australis*		x		
			Pachycephalidae				
		Grey Shrike-thrush	*Colluricincla harmonica*	x	x		x
		Golden Whistler	*Pachycephala pectoralis*		x		
			Dicruridae				
		Grey Fantail	*Rhipidura fuliginosa*		x		x
x		Rufous Fantail	*Rhipidura rufifrons*		x		
		Willie Wagtail	*Rhipidura leucophrys*				x
		Leaden Flycatcher	*Myiagra rubecula*		x		
x		Satin Flycatcher	*Myiagra cyanoleuca*	x	x		
		Magpie Lark	*Grallina cyanoleuca*				x
			Ptilonorhynchidae				
		Satin Bowerbird	*Ptilonorhychus violaceus*		x		
			Campephagidae				
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	x	x		x
		Cicadabird	*Coracina tenuirostris*		x		
			Artamidae				
		Grey Butcherbird	*Cracticus torquatus*	x	x		
		Pied Butcherbird	*Cracticus nigrogularis*				x
		Australian Magpie	*Gymnorhina tibicen*	x	x	x	x
		Pied Currawong	*Strepera graculina*	x	x		x
		Grey Currawong	*Strepera versicolor*		x	x	x
			Corvidae				
		Australian Raven	*Corvus coronoides*	x	x	x	x
			Corcoracidae				
		White-winged Chough	*Corcorax melanorhamphos*		x	x	
			Hirundinidae				
		Welcome Swallow	*Hirundo neoxena*	x	x	x	x
		Fairy Martin	*Hirundo ariel*				x
			Motacillidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Richard's Pipit	*Anthus naovaeseelandiae*				x
			Alaudidae				
		Singing Bushlark	*Mirafra javanica*				x
			Passeridae				
		* House Sparrow	*Passer domesticus*				x
			Fringillidae				
		* European Goldfinch	*Carduelis carduelis*				x
			Ploceidae				
		Red-browed Finch	*Neochmia temporalis*		x		
			Dicaeidae				
		Mistletoebird	*Dicaeum hirundinaceum*			x	
			Zosteropidae				
		Silvereye	*Zosterops lateralis*	x	x		x
F			**Muscicapidae**				
		Bassian Thrush	*Zoothera lunulata*		x		
			Sturnidae				
		* Common Starling	*Sturnus vulgaris*			x	x
		* Common Myna	*Acridotheres tristis*				x
		REPTILES					
			Agamidae				
		Jacky Lizard	*Amphibolurus muricatus*				x
		Eastern Water Dragon	*Physignathus lesueurii*				x
			Scincidae				
		Red-throated Skink	*Bassiana platynota*		x		
		"No Common Name"	*Cyclodomorphus michaeli*		x		
		Cunningham's Skink	*Egernia cunninghami*		x		
		Heatwole's Water Skink	*Eulamprus heatwolei*		x		
		Eastern Water Skink	*Eulamprus quoyii*		x		
		Grass Skink	*Lampropholis delicata*	x	x		x
		Garden Skink	*Lampropholis guichenoti*		x		
		Southern Forest Cool-skink	*Niveoscincus coventryi*		x		
		Woodland Tussock-skink	*Pseudemoia entrecasteauxii*		x		
		"No Common Name"	*Pseudemoia spenceri*		x		
		Weasel Skink	*Saproscincus mustelinus*		x		
		Blotched Blue-tongued lizard	*Tiliqua nigrolutea*				x
		Eastern Blue-tongued Lizard	*Tiliqua scincoides*				x
			Elapidae				
		Red-bellied Black Snake	*Pseudechis porphyriacus*	x	x		
		AMPHIBIANS					
			Myobatrachidae				
		Common Eastern Froglet	*Crinia signifera*		x		x
		Eastern Banjo Frog	*Limnodynastes dumerilii*		x		
		Striped Marsh Frog	*Limnodynastes peronii*		x		x
			Hylidae				
		Leseur's Tree Frog	*Litoria lesueuri*		x		
		Leaf Green Tree Frog	*Litoria phyllochroa*		x		
		Verreaux's Tree Frog	*Litoria verreauxii*		x		

Appendix 3. Fauna species of conservation significance previously recorded in the study region.

* habitat requirements were generally extracted from Frith (1997), Cogger (1992), Strahan (1995), NPWS (1999) and the NSW Scientific Committee (2005), with other references used being identified in the bibliography.
(m) – migratory bird listed under the *EPBC Act*.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
BIRDS			
White-throated Needletail (*Hirundapus caudacutus*)	*EPBC Act* (m)	The White-throated Needletail breeds in the northern hemisphere and arrives in Australia in October. Most commonly associated with the east coast highlands, coastal plains and the hinterlands of arid inland Australia. Within this are, becomes locally nomadic in response to local weather changes. Drinks and feeds on insects while on the wing. Roost during the night in trees in forests.	Due to its nomadic nature and ability to traverse over a variety of habitat types, this species could be present throughout all portions of the study area. Although this is the case, the Proposal would not have a significant impact on any resources important to the local or regional occurrence of this species.
Rufous Fantail (*Rhipidura rufifrons*)	*EPBC Act* (m)	The Rufous Fantail migrates south from north-eastern Queensland and New Guinea to breed within the southern states during the summer months (October to February). Generally this species inhabits rainforests, moist sclerophyll forests and vegetated riparian corridors along the east coast and ranges. This bird forages on a variety of insects that occur within the shrub layers of its preferred habitat type.	The necessary habitat requirements of this species are not present within the study area. As such, the Rufous Fantail would not be present.
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	*TSC Act*	Nesting and roosting in hollows of large eucalypt trees this bird can spend up to 88% of each day foraging. Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits. This species shows a strong preference for individual trees with a high seed to cone ratio.	This species was not observed or heard calling during any of the field investigations. Similarly, this species was not detected during the previous investigation (LesryK Environmental Consultants 2004). During the surveys, no crushed Casuarina cones were discovered. The Glossy Black-Cockatoo is not considered to be dependant upon those portions of the eucalypt woodland that occur within the study area.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Speckled Warbler (*Chthinicola sagittata*)	*TSC Act*	Distributed from Suttor Creek in southeast Queensland, through central and eastern NSW to the Grampians in Victoria. Occupies eucalypt and cypress woodlands with an open grassy and shrubby understorey often associated with gullies and rocky ridges. Has a home range area of between 6 to 12ha. Foraging for seeds, insects, larvae and other invertebrates, it occurs amongst leaf litter and under shrubs, trees and grasses. The breeding season is from August to January. Generally not being present in areas of habitat less than 100ha in size.	This species may forage within the study area on occasion, however, the removal of a maximum of 6.15ha of bushland, compared to the remaining 350,106ha that occurs within the surrounding conservation reserves, is not considered to significantly reduce the extent of any resources available for this species.
Swift Parrot (*Lathamus discolor*)	*EPBC Act* *TSC Act*	The Swift Parrot breeds in Tasmania but migrates to mainland Australia to feed on winter blossoms during the winter months. On the mainland, this species occurs in a wide variety of habitats, depending on where there are flowering blossoms. Feeds either alone or in parties within the topmost branches of eucalypts. Winter flocks are nomadic in response to the availability of food sources, but, where suitable resources are present, may remain in one place for a while.	This species may forage within the study area on occasion. However the removal of a total of 6.15ha of bushland, compared to the remaining 350,106ha that occurs within the surrounding conservation reserves, is not considered to significantly reduce the extent of any resources available for this species.
Australian Painted Snipe (*Rostratula benghalensis australis*)	*EPBC Act* *TSC Act*	The Painted Snipe is a well camouflaged, nomadic bird that lives within muddy ground in boggy swamps. They prefer shallow freshwater swamps where they feed on aquatic insects and earthworms found in soft mud. They are primarily a nocturnal bird however they have been known to be active during the day. The Painted Snipe nests in a raised area of damp mud, lined with grass and reeds, surrounded by shallow water often within River Red Gum *Eucalyptus camaldulensis*. The Painted Snipe breeds between October and December.	Not targeted as no suitable habitat for this species is present within the study area.
Regent Honeyeater (*Xanthomyza phrygia*)	*EPBC Act* *TSC Act*	The Regent Honeyeater prefers open forests, woodlands, timbered watercourses, and a variety of other habitat types. This species constructs a grass nest in trees or saplings. This species feeds primarily on four eucalypt species, Red Ironbark *Eucalyptus sideroxylon*, White Box *E. albens*, Yellow Box *E. melliodora* and Yellow Gum *E. leucoxylon* as well as heavy infestations of mistletoe (*Amyema* spp.). The Regent Honeyeater breeds from August to January.	This species may forage within the study area on occasion, however, the removal of a total of 6.15ha of bushland, compared to the remaining 350,106ha that occurs within the surrounding conservation reserves, is not considered to significantly reduce the extent of any resources available for this species.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Grey Falcon (*Falco hypoleucos*)	*TSC Act*	Flat mainly treeless or lightly timbered plains with open, drier vegetation such as tussock grassland. Nest in large eucalypt trees near, or overhanging dry or wet watercourses. Forages in wooded area adjacent to water bodies where prey species drink. Feeds on species caught on the ground, such as ground birds, small mammals and reptiles.	Not targeted as no suitable habitat for this species is present within the study area. Species not observed or heard calling during any of the field surveys.
Barking Owl (*Ninox connivens*)	*TSC Act*	Inhabits tall, wet, old growth forests on fertile soils with a dense understorey. Has a home range area of between 200ha to 800ha in which a permanently bonded pair occurs. Breeds in the trunks of mature Eucalypts and appears to be loyal to nest sites. Roosts apart by day on a number of set perches throughout their territory. Prey species include mainly arboreal mammals.	Specifically targeted during the field investigations. Though not recorded, this species may be present in the eucalypt woodlands. However the removal of a total of 6.15ha of bushland, compared to the remaining 350,106ha that occurs within the surrounding conservation reserves, is not considered to significantly reduce the extent of any resources available for this species.
MAMMALS			
Spotted-tailed Quoll (*Dasyurus maculatus*)	*EPBC Act* *TSC Act*	The Spotted-tailed Quoll occurs within a variety of habitat types including wet and dry sclerophyll forests through to rainforests. The quoll is nocturnal and shelters in tree hollows, dense undergrowth, hollow logs or under rock outcrops. Home range sizes for this species are known to be large with males travelling up to 15km^2/night, and females between 3-4km^2/night. The quoll preys on a wide variety of terrestrial and arboreal vertebrates, including rabbits, brush-tails and ringtails.	Specifically targeted during the investigations. During the surveys this species was not recorded. Within the study area, no habitats significant for the local occurrence of this species are present. Post development, this species is still expected to be able to traverse over, and forage within/through, the study area if present on occasion.
Brush-tailed Rock-Wallaby (*Petrogale penicillata*)	*EPBC Act* *TSC Act*	The Brush-tailed Rock-Wallaby is found in suitably rocky areas within a variety of habitats such as rainforest gullies, wet and dry sclerophyll forest, open woodland and rock outcrops in semi-arid country. Sites with numerous ledges, caves and crevices are favoured.	During the survey this species was not recorded. The majority of Brush-tailed Rock-Wallaby's present in this region are confined to a predator proof enclosure that occurs near Jenolan Caves. Within the study area, no habitats significant for the local occurrence of this species are present. Post development, this species is still expected to be able to traverse over, and forage within/through, the study area if present on occasion.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Long-nosed Potoroo (*Potorous tridactylus tridactylus*)	*EPBC Act* *TSC Act*	Generally restricted to areas with an annual rainfall greater than 760mm, it inhabits coastal heath and dry and wet sclerophyll forests with dense cover, which provides diurnal sheltering sites and protection from predators. Forages in adjacent, open areas. Feeds predominantly on fungi, which is dug for within soft and sandy soil. Also known to feed on roots, fruits, seeds and soft bodied animals in the soil.	During the survey this species was not recorded. No significant impacts on this species are considered to occur as a result of the Proposal.
Squirrel Glider (*Petaurus norfolkensis*)	*TSC Act*	Inhabits woodlands and dry sclerophyll forests, usually in diverse stands of shrubs and trees. Shelters and breeds in tree hollows, and is primarily an insectivorous animal but has also been known to ingest plant exudates. Family groups occupy a home range of 2 - 4ha. Where trees are up to 20m in height, this species is known to traverse across open space areas 40m wide.	Specifically targeted during the field investigations. Though not recorded, this species may be present in the eucalypt woodlands. However the removal of a total of 6.15ha of bushland, compared to the remaining 350,106ha that occurs within the surrounding conservation reserves, is not considered to significantly reduce the extent of any resources available for this species.
Koala (*Phascolarctos cinereus*)	*TSC Act*	The Koala occupies areas of acceptable food trees in open eucalypt forests and woodlands. Areas of preferred feed trees appear to be restricted to sites that support high nutrient soils, areas that have historically been converted to farmland.	No evidence, such as characteristic scratchings or scats were observed within the study area. Post development, if present on occasion, the Koala is still expected to be able to traverse over, and forage within/through, the study area.
Greater Longeared Bat (*Nyctophilus timoriensis*)	*EPBC Act* *TSC Act*	The Greater Long-eared Bat inhabits dry open woodland areas and mallees. Within these areas this species roosts in tree hollows and under loose bark. This species feeds on insects such as large moths, beetles, ants and crickets.	Specifically targeted during the field investigations. During the surveys the species was not recorded. Within the proposed development areas, no hollow bearing trees, caves or cave substitutes are present.
Grey-headed Flying Fox (*Pteropus poliocephalus*)	*EPBC Act* *TSC Act*	The Grey-headed Flying Fox is a canopy-feeding frugivore, blossom-eater and nectarivore that inhabits a variety of habitats. Roosts and breeds communally in 'camps', with these camps containing between 500 to 5000 individuals. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring. Foraging occurs opportunistically on both native and exotic plants, often at distances between 30- 70km from camps.	Specifically targeted during spotlighting. During the survey the species was not recorded, nor were any active or historic roosting camps observed. The Grey-headed Flying Fox has the potential to fly over the study area on occasion. Although this is the case, this bat is known to easily traverse open space areas.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
REPTILES			
Broad-headed Snake (*Hoplocephalus bungaroides*)	*EPBC Act* *TSC Act*	This species is largely confined to the Hawkesbury Sandstone formations within the wider Sydney basin. Sheltering under exfoliated material, in rock crevices and caves during the day, and to hunt at night, usually feeding on small lizards, geckos and frogs.	Not targeted as no suitable habitat for this species is present within the study area.
AMPHIBIANS			
Borroolong Frog (*Litoria booroolongenis*)	*TSC Act*	The Booroolong Frog occurs along the Great Dividing Range of NSW. It is almost always associated with rocky flowing streams in mountainous regions.	Not targeted as no suitable habitat for this species is present within the study area.
Giant Burrowing Frog (*Heleioporus australiacus*)	*EPBC Act* *TSC Act*	Associated with sandstone outcrops. Lives in small semi-permanent to slightly flowing streams, breeding in sandy river bank burrows. Not found in creeks affected by stormwater or other pollutants, or in urbanised areas.	Not targeted as no suitable habitat for this species is present within the study area.
Red-crowned Toadlet (*Pseudophryne australis*)	*TSC Act*	The Red-crowned Toadlet is confined to drainage lines in areas of Hawkesbury Sandstone, especially those that support weathered shale lenses. This species shelters under stones, vegetation or logs and is highly susceptible to pollutants, storm water runoff from urban areas and weed infested areas.	Not targeted as no suitable habitat for this species is present within the study area.
INVERTEBRATES			
Purple Copper Butterfly (*Paralucia spinifera*)	*EPBC Act* *TSC Act*	Locations for the Purple Copper Butterfly are restricted, with all occurring above 900m in altitude. This butterfly is only found in open eucalypt woodlands/forests with a sparse understorey dominated by Blackthorn shrubs (*Bursaria spinosa* subsp. *lasiophylla*). This shrub is important for the occurrence of the Purple Copper Butterfly, these plants always having to be present thereby meeting the foraging requirements of the butterfly's larvae. Most occupied sites are exposed to full day sun, generally having a northwest to westerly aspect. The Purple Copper Butterfly is also associated with a species of small ant (*Anonychomyrma itinerans*). To date, all published records for this butterfly have been made to the east of Bathurst.	Targeted surveys for this species did not identify any areas of suitable habitat (refer to Appendix 4). During the field investigation only *Bursaria spinosa* ssp. *spinosa* was recorded, this plant not known to be utilised by the Purple Copper Butterfly. As such, this species would not be present within the study area.

Appendix 4. Results of targeted survey undertaken to determine the presence of the Purple Copper Butterfly (*Paralucia spinifera*).

23rd December 2004

MJADWESCH
ENVIRONMENTAL
SERVICE SUPPORT

Mr Nick Francesconi
Acting Environmental Officer - Biodiversity and Sustainability
Level 8 260 Elizabeth Street
Surry Hills, NSW, 2010

Dear Nick,

In accordance with your request for an inspection of the Jenolan Caves roadworks for habitat of the Purple Copper Butterfly (*Paralucia spinifera*) I visited the site on 13.1.5 and checked for key habitat attributes at cuttings associated with Wall 1 and chainages C3.64, C4.22, C5.08, C5.29 and C7.58, as well as at the compound.

These inspections covered the range of altitudes and aspects presented by the site, and while suitable elements existed in terms of aspects and incident sunshine as well as some of the associated vegetation (particularly *Lissanthe strigosa*, *Monotoca scoparia* and *Stellaria pungens*) the species of Blackthorn noted throughout (*Bursaria spinosa*) has a glabrous undersurface to the leaf (see attached specimen), being a species which is not known to be utilised by the butterfly - *B. lasiophylla atriplicina*, the food plant of the butterflies larvae, has a minutely hairy / hoary underside to the leaf.

During the field assessment a consulting botanist (John Spate) was also engaged in inspections of the proposed cuttings, and he was briefed on requirements of the butterfly and the differences in the Blackthorn species, and directed to alert my office if he found any plants resembling *B. lasiophylla atriplicina*. He was contacted on 23.1.5 and again confirmed that there were none of this species on the site.

The Jenolan project area does not contain habitat for the Purple Copper Butterfly, and there will be no impact on this species under the proposal, or any requirement for further assessment for this species.

If you have any further questions or requirements please do not hesitate to contact me.

Yours R. Mjadwesch.

Raymond Mjadwesch (consulting ecologist)
Principal Mjadwesch Environmental Service Support

MJADWESCH ENVIRONMENTAL SERVICE SUPPORT
26 Keppel Street
BATHURST NSW 2795

email: mjad@tpg.com.au
ph / fax: (02) 6331 5655
ABN: 72 578 295 925

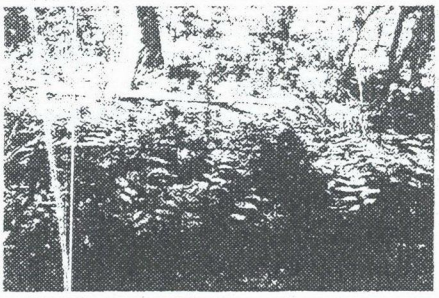


Figure 1. *Wetter vegetation occurs at lower altitudes where it is often too shady for the butterfly ..*

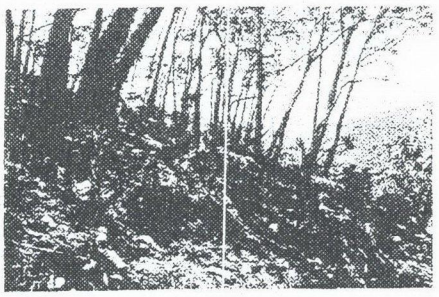


Figure 2. *...however drier more suitable habitats occur at higher altitudes and on exposed knolls*

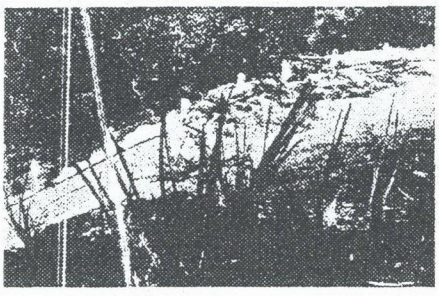


Figure 3. *Bursaria spinosa occurs right up to the edge of existing cuttings...*

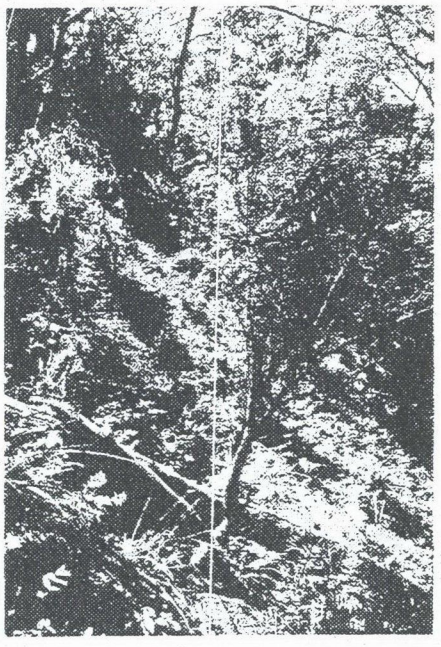


Figure 4. *... however this species, which sometimes takes the form of a small tree, is not utilised by the Purple Copper Butterfly*

MJADWESCH ENVIRONMENTAL SERVICE SUPPORT
6 Keppel Street
BATHURST NSW 2795

email: mjad@tpg.com.au
ph / fax (02) 6331 5858
ABN: 72 878 295 925

Appendix B Landscape and Visual study

UDO

Jenolan Caves Road Landscape and Visual Assessment

PROPOSAL TO REMEDIATE CUT SLOPES on JENOLAN CAVES ROAD
(Main Road No. 253)

FOR

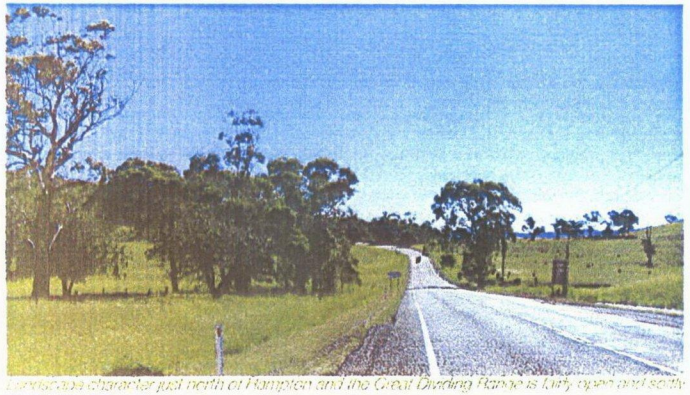
RTA

NSW ROADS AND TRAFFIC AUTHORITY
Parramatta

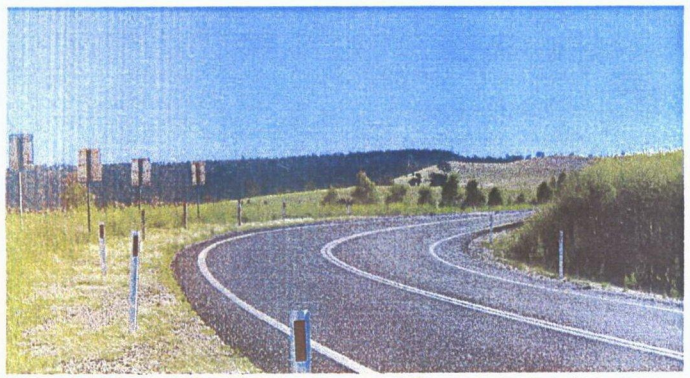
FEBRUARY 2005

URBAN DESIGN OFFICE PTY LTD
a [illegible]
p [illegible]
f [illegible]
e [illegible]
abn [illegible]

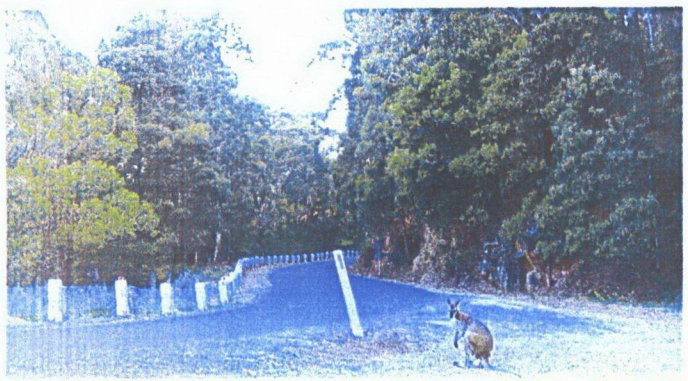
CONTENTS



Landscape character just north of Hampton and the Great Dividing Range is dry, open and partly undulating



On approaches the Great Dividing Range in the region of Bindo the topography becomes more steeply inclined with greater forest cover



Within the Proposal area the topography is steep, rugged and densely forested, almost to the exclusion of all else. Viewpoints are closely framed by road side foliage and cuttings

BACKGROUND

The NSW Roads and Traffic Authority (RTA) proposes to remediate cut slopes on Jenolan Caves Road (Main Road No. 253). The proposed work sites are located nearby and to the north of Jenolan Caves.

The remediation works at the top of the cut slopes would involve scaling loose rocks, drilling holes for rock bolt installation, installing galvanised steel chain link rock fencing, and repair/replacement of drainage structures. Works at an individual cut slope 'Cut 3.63' would involve scaling loose rock, and drilling holes to enable insertion pre-cambers and fine adjustments to be carried out. Works above 'Cut 3.64' may require establishment of an access track (500m length, 4m width) and a working area. Minor vegetation would need to be removed to establish an access track, and some native vegetation would need to be removed to establish a working area.

In addition, a compound site would be used during construction works for storage of plant and material. The compound site is located approximately 2km north of Wall 1 (see *Location Plan* opposite).

Construction works would be undertaken during night shifts (6pm to 10am) from Sunday nights to Thursday nights inclusive.

An EIA is required for the Proposal to fulfil the requirements of *Section 111 (2) of the Environmental Planning and Assessment Act 1979*, and to take into account all matters affecting or likely to affect the environment as a result of the Proposal. Specialist input is required for the EIA in the area of landscape and visual impact assessment.

LIMITS OF STUDY AREA

The Study Area consists of 10 cut slopes, plus Cut 3.64 and a compound site within 10km of Jenolan Caves.

PURPOSE OF STUDY

Jenolan Caves Road is surrounded by a network of large conservation reserves. These reserves and other protected lands include the Jenolan Caves Reserve Conservation Area, Blue Mountains and Kanangra Boyd National Park and both Jenolan and Hampton State Forests. The road leads to the popular Jenolan Caves tourist destination of regional and international significance. The area is therefore of great significance and as such potentially sensitive to any proposal that could potentially impact on the pristine character of the landscape.

This landscape and visual assessment will be used by the RTA in determining the effects of the Proposal on the landscape and visual amenity of the study area, and in the development of appropriate mitigation measures for any identified potential impacts.

It is RTA's intention that the landscape and visual assessment produce one set of working papers which will identify matters relevant to the study area and satisfy the relevant legislation, policies and guidelines of NSW and the Commonwealth Governments.

FINDINGS

The visual assessment was carried out over 2 days in fine weather. Each of the proposed work sites were assessed, plus the existing compound site. The Proposal was also assessed from the vantage point of 2 important lookout/rest areas, and also from the camping ground mid way between Jenolan Caves and Mount Inspiration.

The Study found that 'viewer sensitivity' to the Proposal would be limited to the users of Jenolan Caves Road – the group that will benefit most from the proposal.

The Study found that the Proposal would have a Low to Moderate Visual Impact during the Construction Phase, and a Low Visual Impact in the Operational Phase.

The one exception to this finding is the proposal to construct an access track to the hill crest above Cut 3.64 for the purpose of achieving there the works at that cut. The Study concluded that the construction of the track cannot be achieved without significant High, long term, Visual Impact upon the existing landscape character. Furthermore, the Study questioned the buildability and practicality of constructing the track. The Study recommends that other methods of achieving this particular section of work be seriously considered. For example, the work could be substantially completed from the road below by an excavating excavator. Work beyond the reach of an excavator machine may be achieved working by hand from a chain, ladder, or even from above by helicopter. A number of options are available. The Study strongly recommends that the access track option is abandoned.

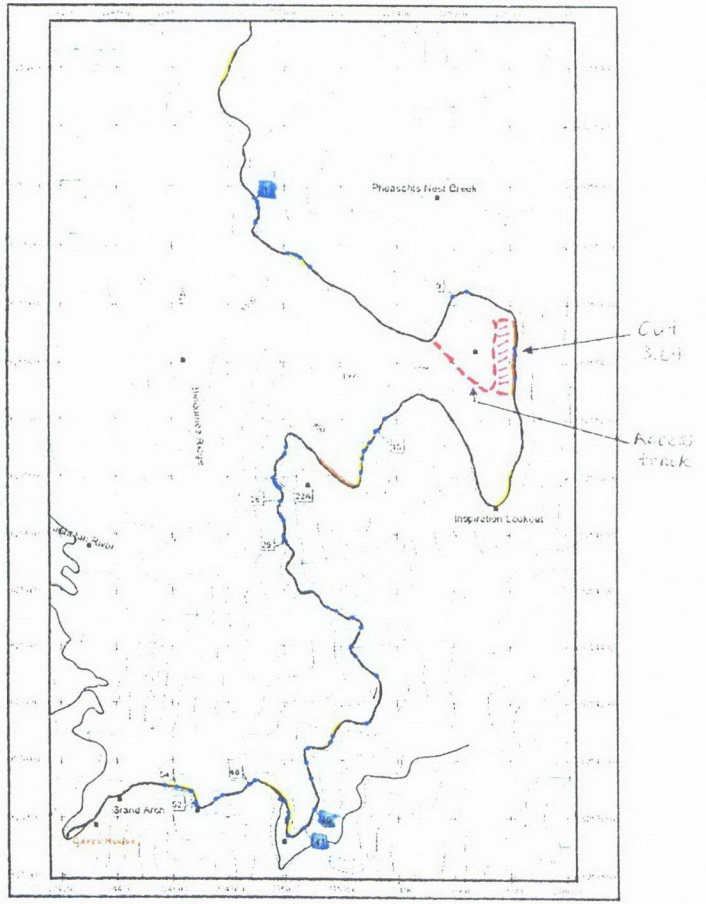
RECOMMENDATIONS

The Study recommends that, with the exception of the access track discussed above, the Proposal does not present an unacceptable visual impact either in the construction or operational phase, and may, therefore proceed. A number of mitigation options are discussed in the report.

Appendix A

Jenolan Caves Road MR253

Proposed treatment programme: retaining walls and ARL1-2 slopes



Location of Retaining Walls and ARL 1-2 slopes

INTRODUCTION

BACKGROUND

The NSW Roads and Traffic Authority (RTA) proposes to remediate cut slopes on Jenolan Caves Road (Main Road No. 253). The proposed work sites are located nearby and to the north of Jenolan Caves.

The remediation works at the ten (10) cut slopes would involve scaling loose rock, drilling holes (installing rock bolts), installing steel mesh and barrier fencing, and repair/replacement of drainage structures. Works at an additional cut slope 'Cut 3.64' would require scaling loose rock, and drilling holes to enable insert piezometers and inclinometers to be inserted. Works above 'Cut 3.64' may require establishment of an access track (500m length, 5m width) and a working area. Native vegetation would need to be removed to establish an access track, and some native vegetation would need to be removed to establish a working area.

In addition, a compound site would be used during construction works for storage of plant and material. The compound site is located approximately 2km north of Wall 1 (see *Location Plan* opposite).

Construction works would be undertaken during night shifts (4pm to 10am) from Sunday nights to Thursday nights inclusive.

An REF is required for the Proposal to fulfil the requirements of *Section 111 (Part V) of the Environmental Planning and Assessment Act 1979* and to take into account all matters affecting or likely to affect the environment as a result of the Proposal. Specialist input is required for the REF in the area of landscape and visual impact assessment.

LIMITS OF STUDY AREA

The Study Area locations (10 cut slopes, plus Cut 3.64, compound site) are identified on the *Location Plan* opposite. The cut slopes are identified as:

- Cut slope, yellow highlight (7 sites);
- Cut slope, orange highlight (1 site to the west of Inspiration Lookout);
- Cut slope, Wall 1 (1 site);
- Cut slope, Wall 40/41 (1 site);
- Cut 3.64 (1 site, orange highlight to the north of Inspiration Lookout);
- Access track (500m length, 5m width) to above Cut 3.64 and work area above the cut (see pink markup); and
- Compound site (approximately 2km north of Wall 1).

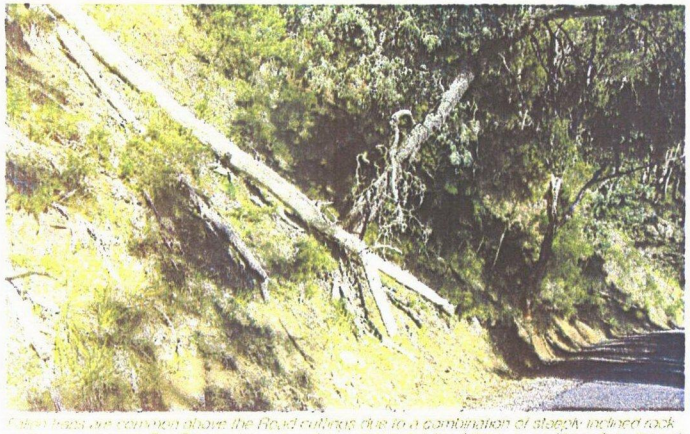
Note: Chainage markers are present on site at 100m intervals commencing at the top of the hill (north end - CH. 0m) and finishing near Jenolan Caves (south end - CH. 8000m).

KEY TO VISUAL ASSESSMENT LOCATIONS (from north to south, up to down)

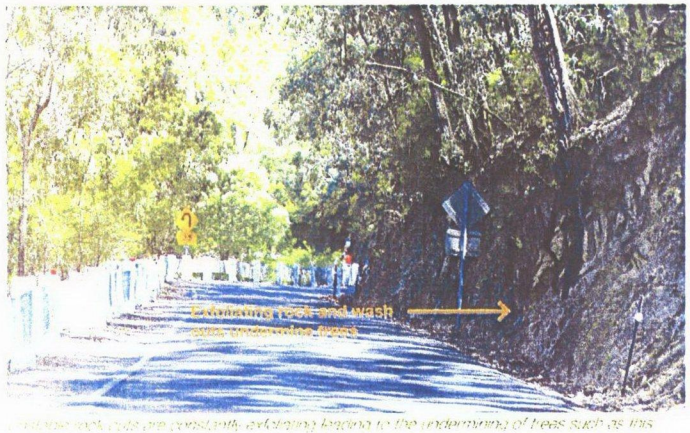
ASSESSSMENT SITES	Cut No.	Chainage
#1 COMPOUND SITE		
#2 KATOOMBA VIEW LOOKOUT		
#3 PROPOSED CUT SITE	C1.74	1.72 – 1.86
#4 PROPOSED CUT SITE	Wall 1	2.26 – 2.4
#5 PROPOSED CUT SITE	C2.65	2.6 – 2.75
#6 PROPOSED ACCESS TRACK		
#7 PROPOSED CUT SITE	C3.64	3.6 – 3.9
#8 PROPOSED CUT SITE	C4.22	4.2 – 4.4
#9 INSPIRATION LOOKOUT		
#10 PROPOSED CUT SITE	C5.08 and C5.29	5.06 – 5.48
#11 PROPOSED CUT SITE	C7.02	7.0 – 7.18
#12 PROPOSED CUT SITE	Wall 40/41	7.4 – 7.5
#13 PROPOSED CUT SITE	C7.58	7.58 – 7.8
#14 VALLEY CAMPING SITE		
#15 PROPOSED CUT SITE	C8.13	8.1 – 8.25

Note: The Study Team carried out the Visual Assessment in the order described above from north to south over 3 days. Refer to the Methodology below.

Note: On completion of the site assessment the RTA directed the Site #4/Wall 1 was to be excluded from the assessment.



Cutting heels are removed above the Road cuttings due to a combination of steeply inclined rock and soil wash outs. The Proposal is required in order to stabilised the cuts and to reduce the risk of falls rocks onto the road.



Extensive rock cuts are constantly exhibiting lessons to the undermining of trees such as this.

SCOPE OF WORK

BACKGROUND DATA

All relevant, available information on the proposal was reviewed including the following data.

- Study Area Map Showing the Proposal as provided with the RTA Brief *"Jenolan Caves Road- Cut Slope Remediation, Landscape and Visual Impact Assessment Brief"* RTA, December 2004).
- Aerial photograph of the Study area as provided by the RTA.
- Concept Designs for the Proposed Works provided by Golder Associates (as available, for the site assessment 12/01/05).
- Ecology Report, *"Flora and Fauna Assessment of Five Sites That Occur Adjacent to Jenolan Caves Road, Jenolan Caves, NSW."* Lesryk Environmental Consultants, May 2004.

KNOWN SENSITIVE SITES

Based on a preliminary review of existing documentation and database searches the following sensitive sites are known to occur within the vicinity of the study area:

- Kiarangra Boyd National Park.
- "Greater Blue Mountains Area" which is a World Heritage listed area.
- Jenolan Karst Conservation Reserve.
- Dry stone walls along Jenolan Caves Road.

ANALYSIS OF EXISTING ENVIRONMENT

A site analysis was undertaken over a 3 day period between the 12th and 14th January, 2005 in order to analyse and record the existing landscape and visual environment.

Each proposed site within the study area was assessed jointly against a visual assessment *"Process"* in order to address such issues as:

- The existing landscape character,
- A description of existing vegetation,
- A description of the adjacent landforms and
- A typical cross section of the road reserve.

The analysis included:

- The significance of existing landscape types (i.e., *High, Moderate* or *Low*)
- The sensitivity of the landscape to alteration by the Proposal
- Viewer sensitivity to alteration by the Proposal for all relevant viewer groups, and
- The significance of existing views and vistas e.g. are the views significant on a local, regional, state, national or international level?

The viewshed was mapped for a maximum distance of one (1) km from each cut slope site.

PURPOSE OF STUDY

This landscape and visual assessment will be used by the RTA in determining the effects of the Proposal on the landscape and visual amenity of the study area, and in the development of appropriate mitigation measures for any identified potential impacts.

It is RTA's intention that the landscape and visual assessment produce a set of working papers which will identify matters relevant to the study area and satisfy the relevant legislation, policies, and guidelines of NSW and the Commonwealth Government.

VISUAL ASSESSMENT METHODOLOGY

PROGRAM CONSTRAINTS

A significant feature of this study was the required program. The study was initiated at the end of December 2004, just prior Christmas shut-down period. The Draft Study was required to be completed by 21st January 2005. The following critical dates therefore shaped the adopted methodology;

- The Study Engagement commenced 21st December 2004
- Draft documents for Typical Cut Slope (C1.74) received from Golder Associates C.O.B 22nd December 2004.
- Electronic copy of Ecology Report, plus received from RTA 22nd December 2004.
- C.O.B 22nd December 2004 -10th January 2005 UDO Christmas shut-down period.
- During the Christmas shut-down period UDO completed the background data review, review of the typical design concept provided by Golders Associates, created the base Study Report, prepared the visual assessment '*Proforma*' sheets.
- 11th January 2005 briefing reviews with Golders Associates and RTA prior to site assessment.
- 12th January 2005 Study Team commenced on Site visual assessment. The assessment Team consisted of 2 landscape architects, an assessor and a 'spotter/recorder'. (A 2-man team that included a '*spotter*' was necessary owing to the potentially dangerous traffic conditions prevailing on this very narrow winding road.) The on site assessment and analysis was carried out as per the (*Scope of Work*) description above and recorded on the pre-prepared '*Proforma*' sheets.
- 14th January 2005 Study Team complete on the visual assessment.
- 17th - 20th January 2005 complete desk-top visual assessment, photomontage analysis and draft report production.
- 21st January 2005 *Draft Visual Assessment* submitted to RTA for review and comment.

ON SITE VISUAL ASSESSMENT

Jenolan Caves Road is a very narrow winding road with many blind corners. OH&S issues were therefore of primary concern when executing the on site visual assessment.

The first day of the site assessment was taken up with travelling to the site from Sydney. On the way into the Study Area an initial assessment was made of the Compound Site. The Study Team then travelled the full extent of the Study Area several times in order to become fully familiar with the general layout and extent of the works within the landscape context. During this initial analysis the team finalised the order of assessment for the following day.

On Day 2 of the assessment the Study Team commenced at first light in order to avoid traffic. Starting at Cut #1, the highest, the Study Team worked back down towards Jenolan Caves, assessing each work area and lookout in succession.

As each subject area was approached a traffic cone was dropped at the kerbside (or on top of an appropriate fence post) adjacent to the start of the proposed work area. A second cone was dropped at the kerbside adjacent to the end of the proposed work area. The Study Team then proceeded back up the road to the next blind corner north of the subject area. The Study Team then proceeded slowly back down towards the subject area noting the various view corridors and vantage points along the way. As soon as the start of the work area could be seen (i.e. because the 1st traffic cone was visible) the Study Team commenced a photographic record of the visual assessment. On reaching the each subject area the proposed works (if known) were assessed against the existing visual condition and the assumed extent of impact noted. This method was repeated for each of the subject areas throughout the rest of Day 2 until all work areas except for Cuts #9 and #10 had been assessed.

At first light of Day 3, Cuts # 9 and #10 were assessed. Then the rest of the morning was spent reviewing the assessment again working from Cut #1 back down to Cut #10. The Study Team also used this opportunity to confirm and record all of the significant view corridors along the entire Study Area.

Each on site assessment was recorded in draft on the pre-prepared visual assessment *Proforma* sheets. These were later finalised electronically.

EXISTING LANDSCAPE CHARACTER

ECOLOGY REPORT

This Study refers to the ecologic study: *"Flora and Fauna Assessment of Five Sites that Occur Adjacent to Jenolan Caves Road, Jenolan Caves, NSW"* (Early Environmental Consultants) for confirmation of the vegetation types within the Study area.

The flora and fauna assessment was undertaken in May 2004 within and in close proximity to two of the proposed work areas along the Jenolan Caves Road.

GENERAL DESCRIPTION LANDSCAPE CHARACTER

Jenolan Caves Road is located within a landscape that is characterised by steep to very steep ridges. The dominant soils of the study area are derived from Devonian and Silurian metasediments and volcanics (Jung 1994). These consist generally of Structured Loams - Lithosols (on rocky steep slopes and crests), Brown, Red and Yellow Podzolic Soils (on the lower slopes and alluvial soils along drainage lines (Jung 1994). These soils have low fertility, and are susceptible to severe water erosion, mass movement (inclusive of slips and landslip hazards (Jung 1994).

Natural elevations within the study area are between 740 and 1150 metres above sea level. The annual average rainfall is for the region is 965.7 millimetres with the greatest falls being experienced during the summer months (Council of Metropolitan Jenolan Caves 2004). Average temperatures range from a winter low of 0.3°C to a summer high of 25.6°C (Council of Metropolitan Jenolan Caves 2004). Frosts are also common during the winter months (Oberon Council 2005).

Drainage lines that occur downslope of the proposed works include Jenolan River, Pheasants Nest and Side Creeks, Oberon Gully and several unnamed drainage channels. The smaller drainage lines feed into the Jenolan River, the river eventually flowing into the Coxs River 15km east of the study area. The unnamed drainage channels are all considered to be ephemeral, whilst the major rivers and creeks are perennial water bodies. Each of the drainage lines occurs within a catchment that is considered to be relatively pristine in natural condition.

Jenolan Caves Road is surrounded by a network of large conservation reserves. These reserves, or other protected areas, include the Jenolan Caves Reserve Conservation Area, Blue Mountains and Kanangra Boyd National Parks and Hampton State Forests. These reserves cover areas of 7260, 264845, 68051, 906, and 4... ha respectively (Oberon Council 2005, NPWS 2004). In relation to the Blue Mountains and Kanangra Boyd National Parks, these are part of a group of reserves that contribute to the largest conservation area in NSW (Oberon Council 2005).

Jenolan Caves Road traverses through an area that is dominated by areas of woodlands. As such, the majority of the proposed rock cuttings support a suite of native plants, though the species diversity of these is dependant upon the aspect associated with the previous road works activities, and any ongoing vegetation maintenance (mowing/weed control, etc).

From [illegible] (Early Environmental Consultants) [illegible]

No plants or vegetation communities of national, state or regional conservation significance were recorded or anticipated as occurring within the Study area. The proposed works are not considered to significantly affect any threatened plants or vegetation communities, thereby causing them to become locally extinct. No ecological constraints were identified that would impede the Proposal proceeding as planned.

EXISTING VEGETATION

As noted in the *Flora and Fauna Assessment*, Jenolan Caves Road grades from a moist upper slope to a moist gully, with the vegetation changing from forest with a tall shrub understorey in the area of the proposed components through to an open forest structure with a low shrub layer and sparse grass groundcover, to a moist open forest with an understorey of rainforest shrubs and ferns. This transition is characterised by the varied dominance of the indigenous Eucalyptus species. However, the variations is so subtle that to the casual observer the general character of open forest structure is consistent.

The vegetation communities/groups/species occurring within the Study Area:

Component Site:	Cleared Grounds
Between Cuts 1.74 and 3.06 (Well 1 of *Flora and Fauna Assessment*);	Open Forest of *Eucalyptus cypellocarpa*;
Between Cuts 5.06 and 7.02 (Well 15 of *Flora and Fauna Assessment*);	Open Forest of *Eucalyptus oreades*;
Between Cut 7.02 and [illegible] (Well 40-41 of *Flora and Fauna Assessment*);	Open Forest of *Eucalyptus cypellocarpa*; *Eucalyptus oreades*;
Below Cut 7.58 (Well 48 of *Flora and Fauna Assessment*)	Open Forest of *Eucalyptus cypellocarpa* or *oreades*

EXISTING VEGETATION (CONT.)

All of the proposed work sites show signs of disturbance. Past disturbances as a result of the roads construction have resulted in areas of unstable slopes where soil slip continues to create disturbances to the vegetation.

COMPOUND SITE

The works compound site is a highly disturbed area and has been previously used as a parking area for tourist coaches and for road materials storage/disposal. Large mounds of old road base and pavement material occur across the site and the area is vegetated by weed species. There is a secure fenced area, containing demountable office and storage sheds, within the compound. Some hardy native species also occur in the disturbed area. The surrounding bushland is vegetated by the native eucalypt forest up to 15m high forming moderate cover with an open shrub understorey and groundcover of sparse grasses and herbs. This forest is not expected to be directly disturbed by the use of the site as a works compound.

Common Species

Trees

Manna Gum *Eucalyptus viminalis*, Brown Barrel *Eucalyptus fastigata*, Blaxland's Stringybark *Eucalyptus blaxlandii* and the tall shrub/small tree Black Wattle *Acacia melanoxylon* occur in the area surrounding the proposed compound site.

Shrubs

Common shrubs are Everlasting Daisy *Bracteantha bracteata* and Lance-leaved Beard heath *Leucopogon lanceolatus*.

Groundcovers

Common groundcover species include Spiny Mat-rush *Lomandra longifolia*, Prickly Starwort *Stellaria pungens*, Wallaby Grass *Austrodanthonia sp.*, and Native Tussock *Poa labillardieri*.

Weeds

Groundcover species in the cleared compound area include the weeds Pimpernel *Anagallis arvensis**, Fennel *Foeniculum vulgare** Lamb's Tongue *Plantago lanceolata* and Twiggy Mullein *Verbascum virgatum**, as well as Native Tussock *Poa labillardieri*.

Note: Weed Control

*Denotes exotic weed species.

The compound is bordered by a low berm of site-soil that controls overland flows generated within the site. This flow discharges off the site through a gap in the berm midway along the western edge, directly opposite a fenced off "Wildlife Reserve" about 40m west of the compound. It is evident that weed growth generated within the compound is spreading off-site with the overland flow. We strongly recommend that a shallow detention basin and filter fabric trap be incorporated into the overland flow path to reduce the spread of weed growth beyond the compound. This should be done as part of a general weed eradication program for the compound.

CUT SLOPE SITES

Each of the proposed work areas displays the very similar landscape character of open forest, with trees to about 10m in height and forming moderate foliage cover. From distant views i.e. outside of the road corridor, the foliage cover is generally fairly dense screening the road completely. The shrub layer is generally sparse with low shrubs to 1m, occasionally to 3m in height. The groundcover consists of a variable layer of sparse grasses and herbs.

Common Species

Trees

Thin leaved Stringybark *Eucalyptus eugenioides* and Southern Blue Gum *Eucalyptus bicostata*, Manna Gum *Eucalyptus viminalis*, Blaxland's Stringybark *Eucalyptus blaxlandii*, and the tall shrub/small tree Lightwood *Acacia implexa*.

Shrubs

Blackthorn *Bursaria spinosa*, Everlasting Daisy *Bracteantha bracteata*, River Lomatia *Lomatia myricoides*, Threeveined Groundsel *Senecio linearifolius*, Austral Indigo *Indigofera australis*, Broad-leaved Hickory *Acacia falcatoramis*, Native Cranberry *Astroloma stinsoni* and Large Mock Olive *Notelaea longifolia*.

Groundcovers

Common groundcover species include Spiny Mat-rush *Lomandra longifolia*, Prickly Starwort *Stellaria pungens*, Kidney Weed *Dichondra repens*, Kangaroo Grass *Themeda australis*, Wallaby Grass *Austrodanthonia sp.*, Prickly Starwort *Stellaria pungens*, Sickle Fern *Pellaea falcata*, Maidenhair Fern *Adiantum aethiopicum* and Necklace Fern *Asplenium flabellifolium*.

Climbers

Old Man's Beard *Clematis aristata* and Scrambling Lily *Geitonoplesium cymosum*.

JENOLAN CAVES ROAD VISUAL ASSESSMENT	DATE: January 2005	CUT #:

ANALYSIS			
Existing Landscape Character	Description of Existing Vegetation	Description of Adjacent Landform	Significance of Existing Landscape Type (Low/Medium/High)
Sensitivity of Landscape to Alteration by the Proposal (Low/Medium/High)	Viewer Sensitivity To Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views. (Local/State/Regional/national/International)	Notes: The viewshed extends beyond 1 km to adjacent peaks and ridgelines (fine weather).

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL QUALITY	HIGH	MODERATE	LOW
HIGH	H		
MODERATE		M	
LOW			L

Visual Assessment Sample Recording Sheet

VISUAL ASSESSMENT

METHODOLOGY - VISUAL ASSESSMENT

General Approach

The Visual Assessment was undertaken by a qualified landscape architect experienced in visual assessment. The Assessment took place on 13-14 January 2005 in fine, clear weather conditions of maximum visibility.

It should be noted that scenic values alter with location and setting. What may be considered of low or moderate scenic value in one location could be of high scenic value in another. The setting of a proposal is therefore critical in determining its impact on the scenic quality and value of the area. Similarly, the visual impact of a proposal will also change over time, as will the proposed mitigation options. This Visual Assessment has carefully considered all of these aspects.

On visiting the site the relevant visual features were analysed, and recorded on a *Proforma sheet* (see opposite) including;

- Landscape Character
- Major topographical and geological features
- Natural landscape features
- Cultural landscape features
- Visual catchment
- View corridors, vistas etc

This Visual Assessment determines the construction (short-term) and operational (long-term) impacts that would occur as an effect of the Proposal on its natural surroundings. Adverse impacts can occur, for example, as a result of earthworks or vegetation clearance, the alignment of a road or the siting of a component that is unsympathetic with the surrounding landscape or the use of materials that distract from the adjoining fabric.

Other aspects considered in our Visual Analysis included;

- Potential obstruction or obscuring of existing views for casual users, adjoining owners and motorists.
- Creation of unattractive views, such as stockpiles, plant and/or machinery.
- Alterations of the existing aesthetics of localities such as tree lined roads and natural settings.
- Alignment and design features, including details such as proposed materials, associated infrastructure and signage, that reinforce or distract from the existing landscape or rural area.

This Visual Assessment includes the following components:

- An analysis of the existing landscape, rural and visual resources to assess:
  - the significance of existing landscape types (eg. Natural, Cultural, Urban, Rural etc)
  - sensitivity of the landscape units to alteration by the proposal
  - viewer sensitivity to alteration by the proposal
  - significance of existing views and vistas
- An assessment of impacts identifying the potential impacts on the existing landscape/rural/visual resources if the proposal proceeds. The level of impacts is based on the relative assessment of the significance of existing landscape/rural visual quality.
- Proposed strategies to minimise adverse impacts and improve the existing landscape/rural visual resource.

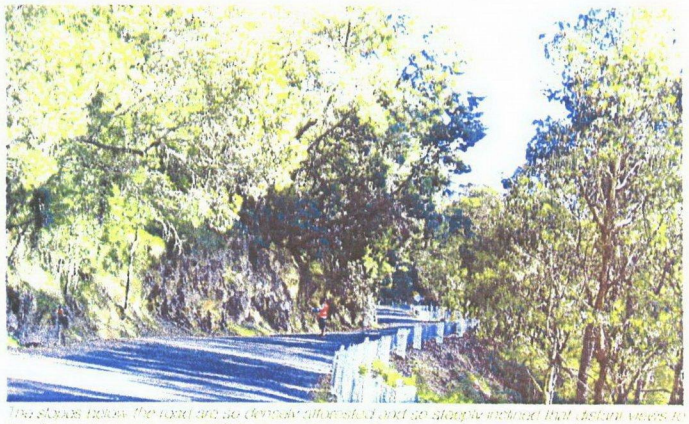
A description of the visual impact of the Proposal activity requires an assessment of the scenic quality and value of the site within its broader landscape context. Three levels of scenic quality and value are assessed:

- High - areas with visually prominent features of landform, land cover, waterform or built elements. These may include escarpments, elevated ridgelines, visually significant stands of vegetation, geological formations, river, parks, buildings, built skylines or streetscapes. Views from an elevated position are also usually of high scenic value.
- Moderate - areas with landform or built features which tend to be common throughout the region and are not outstanding in visual quality.
- Low - areas with features of minimal diversity or variety.

A photographic record of the site was also made, including;

- Panoramic photographs from panoramic and key view points
- Record of special features
- Record of features of particular visual sensitivity
- Photographic models were developed for key view point analyses and hand drawn sketches made to assess impacts of the proposal were supplied in order to illustrate the visual assessment.

The area as an elevated and be always limited that distant views to the Pinnacle are only accessible from a limited number of vantage points along the road, usually on the opposite side of Jenolan Caves Village. Even at these locations the value of the road as an small viewed within the corridor is relatively small but it is appropriate to note the road in the elevated effect of the views.



The Above, below the road are be densely afforested and so along be viewed that distant views to the Pinnacle are only accessible from a limited number of vantage points along the road, usually on the opposite side of Jenolan Caves Village. For the majority of the route, and the Pinnacle is only visually accessible from within the road corridor itself, and then viewed and generally restricted to the road carriageway, and occasionally to a wall.

SUMMARY OF FINDINGS

VIEWER SENSITIVITY AND VIEWSHED

Viewer sensitivity to alteration by the proposed works was assessed for all relevant viewer groups. These were assessed to be almost exclusively users of the Jenolan Caves Road.

The initial assessment of the works confirmed that visual access to the proposed works will be very limited owing to the dense foliage cover provided by existing vegetation both below and above the Jenolan Caves Road, virtually throughout the length of the Study Area.

Where this screening effect is not apparent the resultant view corridors have been noted and are generally framed to restrict views perpendicular to the road and proposed works. The resultant visual catchment, or viewshed, extends only to the east, well beyond the 1 km distance (in fine weather) and is captured by the high surrounding ridge lines (refer diagram opposite).

To the west of Jenolan Caves Road the effective viewshed limit is the cut face of the Road itself, generally forming a sheer wall of an average 4m high above the road edge. There is no shoulder, hard or soft. It is possible to see above this vertical limit in long views up, or down, the road corridor as one travels along it. However, even these long views are limited and framed by the dense vegetation immediately above the rock cut walls.

Where view corridors do exist across narrowly folded valleys to road sections opposite the viewing point the distance is such that the proposed scale of works is too small to observed from a moving car. Usually such view corridors are also partially screened by intermittent vegetation which, particularly when viewed from a moving vantage point, are effectively occluded.

View corridors within the Study Area are therefore almost exclusively confined to the road corridor itself and therefore road users are the principal viewer group to be considered. This is a reasonable assessment that can be applied throughout the Study Area.

Other possible viewer groups were considered and assessed.

It was concluded that long views back to the road from adjacent high ridges would not provide sufficient visual access to be of consequence due to the distance (over 1km) and due to the effective screening of the downhill slope vegetation in particular.

Long views up to the road from the camp site in the deep valley below CH7-8 were assessed. It was evident that there was no visual access to the road corridor from this vantage point.

View corridors from each of the existing Lookouts and rest areas within the Study Area were also assessed. It was evident that there was no visual access to the road corridor from these vantage points.

DISCUSSION OF POTENTIAL VISUAL IMPACTS OF THE PROPOSAL

Construction Phase

Viewer sensitivity to alteration during the proposal during the Construction Phase will depend on the methods adopted and the duration of the works. The existing works (for example, the cantilever bridging section at Wall 48) give us some indication of the potential construction impact. Clearly, the very necessary presence of warning signs, temporary safety fencing and construction equipment will have a negative impact upon the road corridor for the duration of the works. However, taken in the context of the overall scale of the site and the comparatively small scale of the proposed works, and remembering that, unlike Wall 48, the proposed works will generally be executed above eye level, the overall impact is considered to be Moderate to Low.

Operational Phase

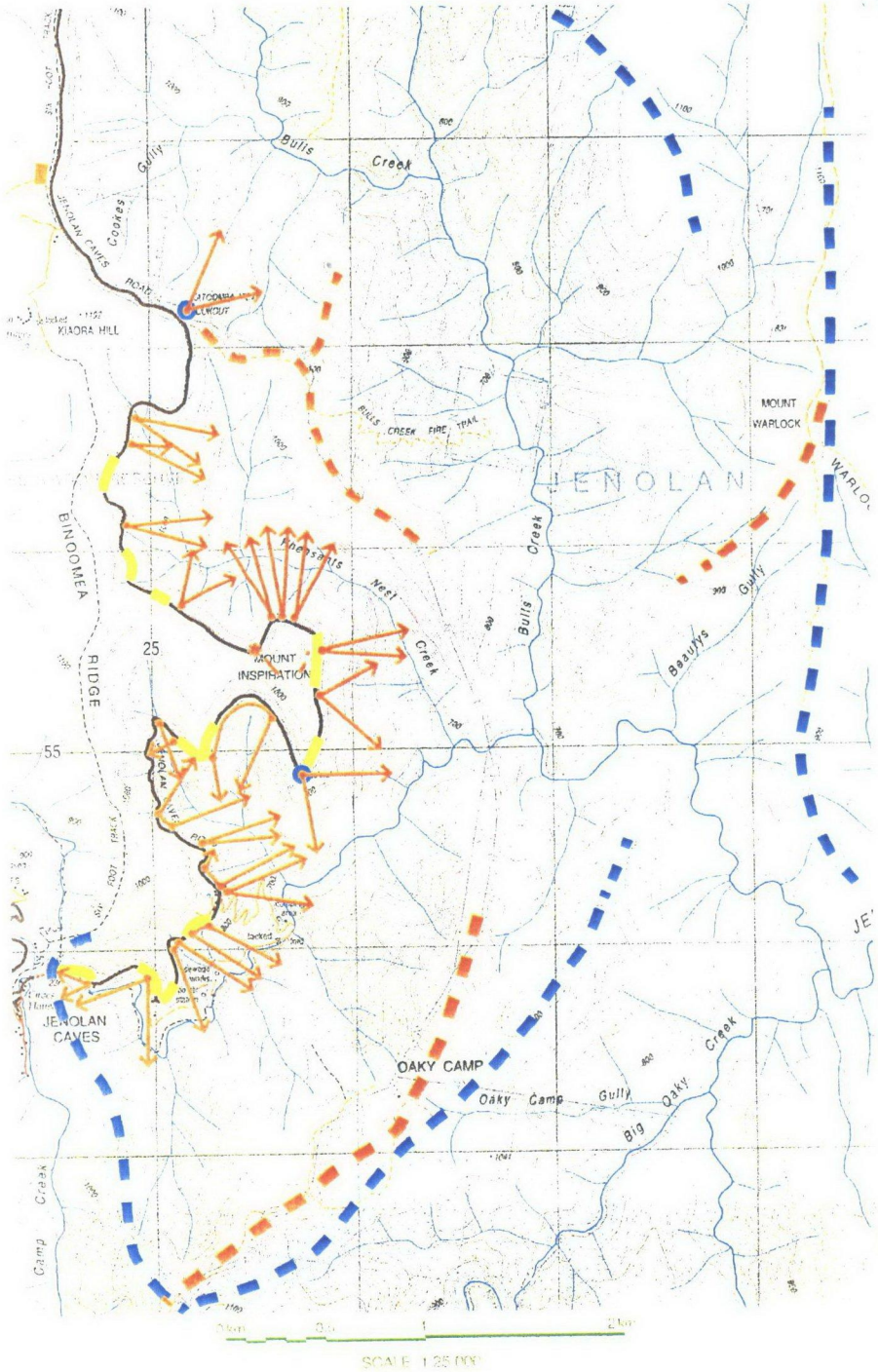
Viewer sensitivity to alteration during the Operational Phase will depend on the scale of the proposed works and their long term effect of upon existing vegetation.

The amount of rock scaling works is limited to small well defined and easily controlled areas (refer to Work Proposal Summary Sheets). The nature of the scaling work is such that within a short time newly revealed rock face will weather to match the existing. The scaling work is generally considered to be of Low Impact.

The proposed rock bolt placements do not exceed of 300 x 300mm plates, and are to be constructed of galvanised steel which will quickly take on a neutral patina. Read against the scale of the average 4m high rock cut these are considered to be of Low Visual Impact.

The proposed rock fences do not exceed a height of 1200mm and are limited to only one Work area (Cut 8.13), one section of approximately 10m Long and another of 15m. Read against the scale of the average 4m high rock cut these are considered to be of Low Visual Impact.

The proposed crest work is fairly uniform in extent at each of the cut slopes. It is assumed that the crest work will be limited only back to within 2-3m of the crest of each cut face. The method of crest work requires careful consideration. Most of the work should be carried out by experienced plant operators under careful supervision of the coordinating engineer in order control and limit the extent of soil and vegetation disruption to the minimum. This said the scale of the work when read against the scale and density of the existing vegetation is comparatively small and this work is considered to be of moderate to Low Visual Impact.



RECOMMENDATIONS

Given the relatively small scale of the proposed works together with the dense structure of the existing Eucalyptus forest, throughout the Proposal, no long-term mitigation strategies are considered essential. However, the following recommendations are offered.

Construction Phase

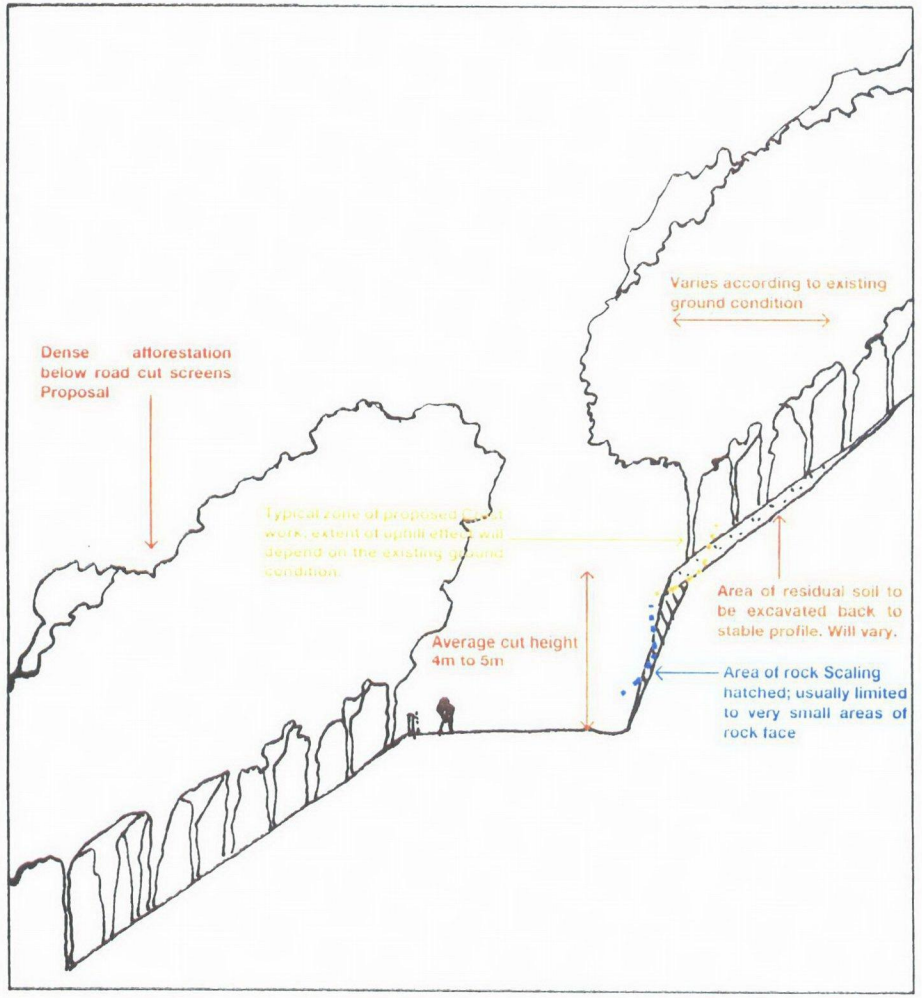
The Proposal must be undertaken in an ecologically sustainable manner and each section of the works must be constantly monitored with the objective of restricting the physical impacts of the work to the absolute minimum required to achieve the proposal objectives.

- All areas that occur beyond the limits of the proposed works should be clearly defined on site to ensure they are not disturbed.
- An Erosion and Sediment Control Plan must be prepared for each cut site. This plan should include the stabilising of exposed surfaces as soon as possible to reduce the potential for any erosion. The existing Erosion and Sediment Control Plan for the Compound area must be reviewed and upgraded to prevent the spread of weed seed along the current overland flow path.
- The Erosion and Sedimentation Control Plans should ensure that no sediment leaves the Proposal sites and that the works do not adversely affect the downstream catchment. In particular care must be taken to ensure that no debris stream washouts can occur below the road itself.
- A Weed Eradication and Control Plan should be prepared for each work area and the compound site.
- Each work area should be assessed after the works are complete to identify the need, if any, for planting mitigation. If planting mitigation is required to make good any loss of vegetation, the planting palette should match the endemic plant species for each individual site. The approved planting palette should consist of a mix of Eucalyptus and understorey shrubs in an appropriate ratio to reflect the existing plant mix. Only tubestock grown on stock locally collected seed should be used.
- Cleared native vegetation should be mulched and used in the sites stabilising works post treatment.
- Weeds and seed bearing exotic plants that are removed should not be mulched but should be taken to an approved Council waste facility.
- If a chemical herbicide is used to aid in the removal of weed species, a product should be selected that will rapidly break down and not impact on fauna species.
- Cleared and disturbed areas should be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion.

Operations Phase

- Work areas should be monitored regularly, for up to 3 months following completion of the Works, to identify any potential loss of topsoil and /or revegetation uptake of the Works due to unforeseen washouts or soil slippages. The need for planting mitigation is to be re-assessed at that time.
- The general condition and placement of amenities at the various Lookouts and Rest Areas along the Jenolan Caves Road should be reviewed and upgraded.

Legend



Typical Section Showing Proposed Cut Slopes

VISUAL ASSESSMENT PROFORMA SHEETS

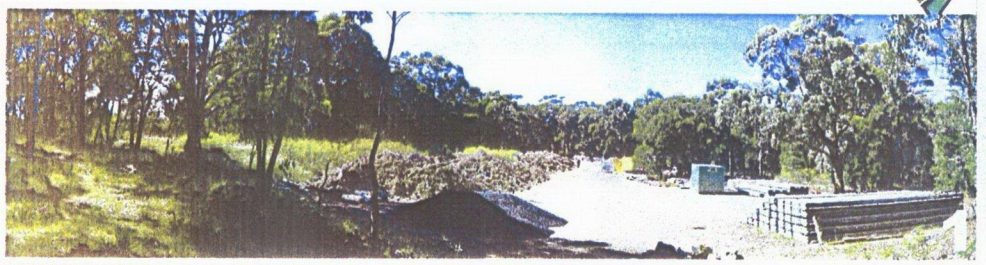
KEY TO VISUAL ASSESSMENT LOCATIONS (from north to south, up to down)

ASSESSSMENT SITES	Cut No.	Chainage
COMPOUND SITE # 1		
KATOOMBA VIEW LOOKOUT SITE # 2		
PROPOSED CUT SITE # 3	C1.74	1.72 - 1.86
~~PROPOSED CUT SITE # 4~~	~~Wall 1~~	~~2.26 - 2.4~~
PROPOSED CUT SITE # 5	C2.63	2.6 - 2.75
ACCESS TRACK SITE # 6		
PROPOSED CUT SITE # 7	C3.64	3.6 - 3.9
PROPOSED CUT SITE # 8	C4.22	4.2 - 4.4
INSPIRATION LOOKOUT SITE # 9		
PROPOSED CUT SITE # 10	C5.08 and C5.29	5.06 - 5.48
PROPOSED CUT SITE # 11	C7.02	7.0 - 7.18
PROPOSED CUT SITE # 12	Wall 40/41	7.4 - 7.5
PROPOSED CUT SITE # 13	C7.58	7.58 - 7.8
VALLEY CAMP SITESITE # 14		
PROPOSED CUT SITE # 15	C8.13	8.1 - 8.25

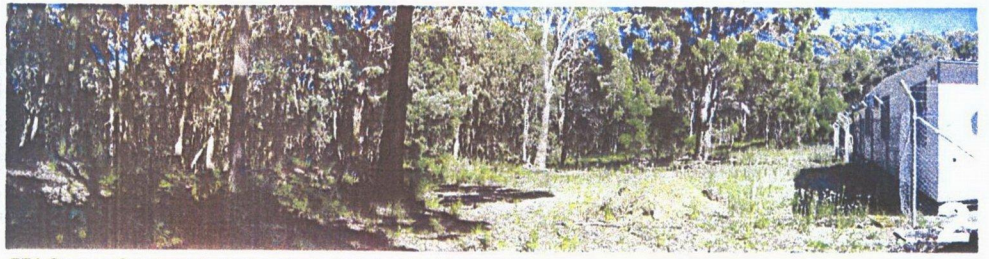
Note: The Study Team carried out the Visual Assessment in the order described above from north to south over 3 days. Refer to the Methodology below.

Note: On completion of the site assessment the RTA directed the Site #4/Wall 1 was to be excluded from the assessment.

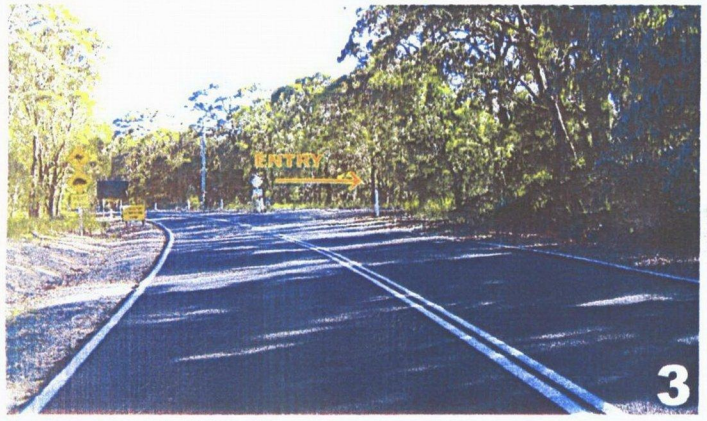
Landscape and Visual Assessment Proforma Sheet



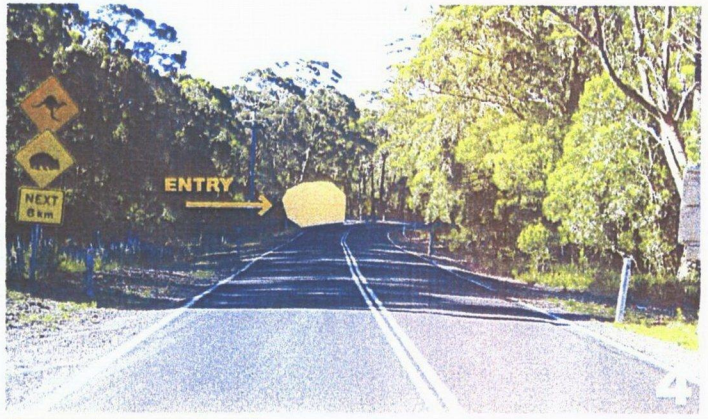
RTA Storage Compound- view south



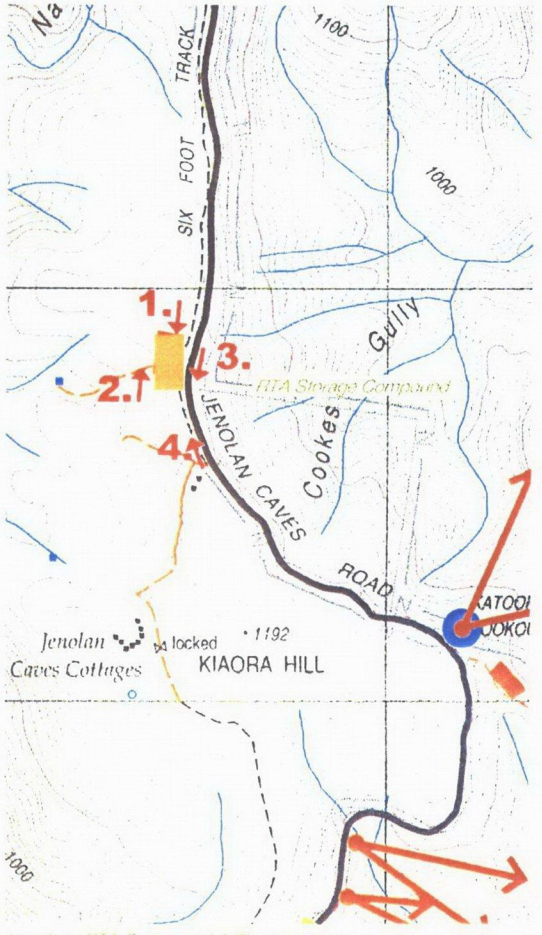
RTA Storage Compound- view north on western side of compound



Compound entry point due south



Compound entry point due north



Locality, RTA Compound & Photo position

VISUAL ANALYSIS

Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low-Medium-High)
Site lies on an elevated section of the road approx 1000m above sea level. Approached via 2-lane tarmac, well screened by dense trees and shrubs on both sides of road, from both directions. Generally open forest, no obvious physical features outside road corridor.	Trees: *Eucalyptus radiata*, *E. viminalis*, *E. fastigata*, *E. fibrosa* and *Acacia mearnsii* occur in the area surrounding the proposed compound site. Shrubs: *Bursaria spinosa* and *Leptospermum flavescens*. Groundcovers include *Lomandra longifolia*, *Stellaria pungens*, *Austrostipa* sp., and *Poa labillardieri*.	Generally open forest, no obvious physical features outside road corridor	HIGH
Sensitivity of Landscape to Alteration to the Proposal (Low-Medium-High)	Viewer Sensitivity To Alteration by the Proposal (Low-Medium-High)	Significance of Existing Views (Local-State/Regional-National/International)	Notes
LOW	LOW to MEDIUM	State/Regional	Site already cleared and in use for some time. Weed eradication and management program required. Site would benefit from additional screen planting at entry area, especially views from south.

ASSESSMENT OF IMPACT

	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

Visual Impact: Moderate to Low

The visual impact of the RTA Compound area is limited to views into the compound for traffic travelling form the south from approx.250m due south of the entry.
This impact should be eliminated by the introduction of native screen planting (minimum 5mx30m) immediately south of the entry area.
Refer Sheet 2.

Legend

View point & distribution

Edge of paved carriageway

Notional centre line

Photo location & number

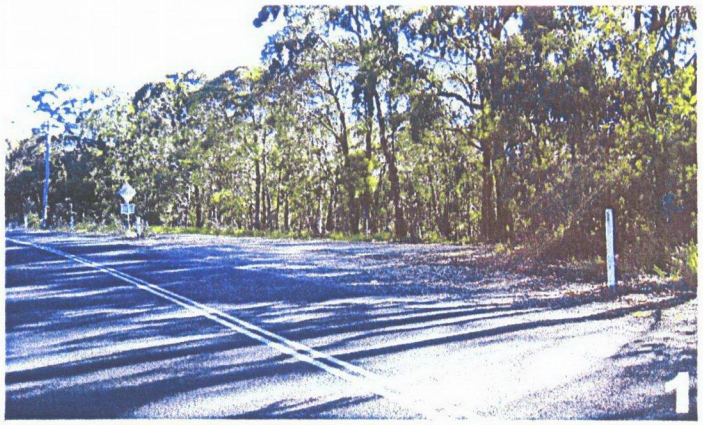
RTA Storage compound

Cut section

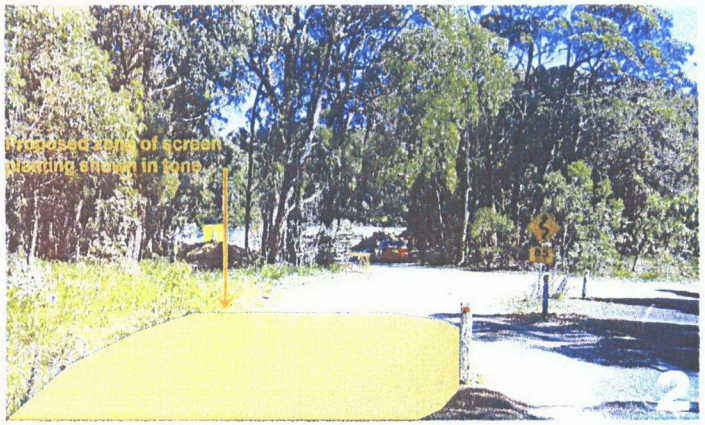
Lookout

JENOLAN CAVES ROAD

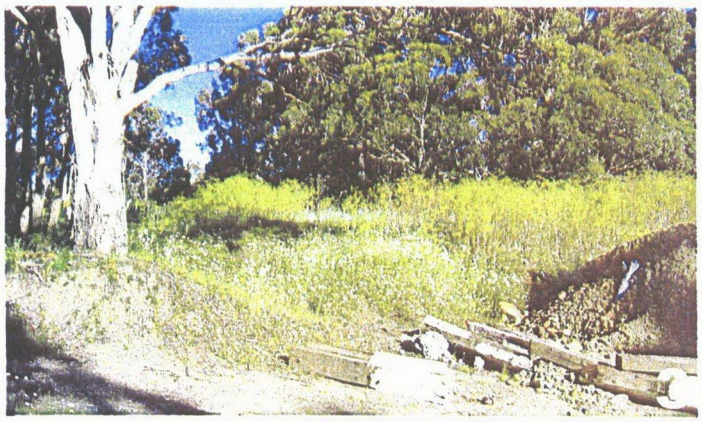
UDO



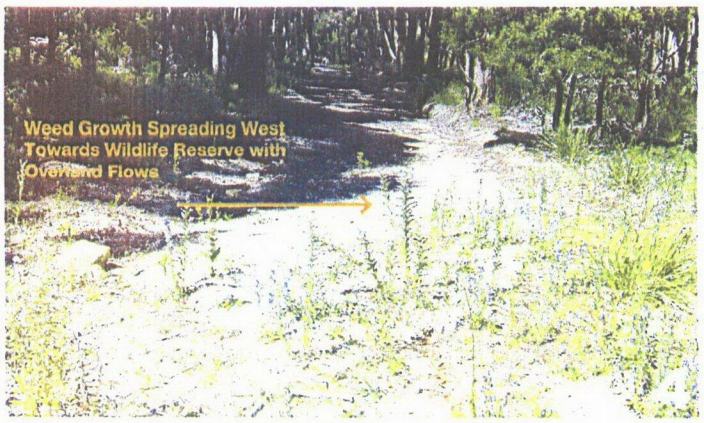
RTA Storage Compound- view south



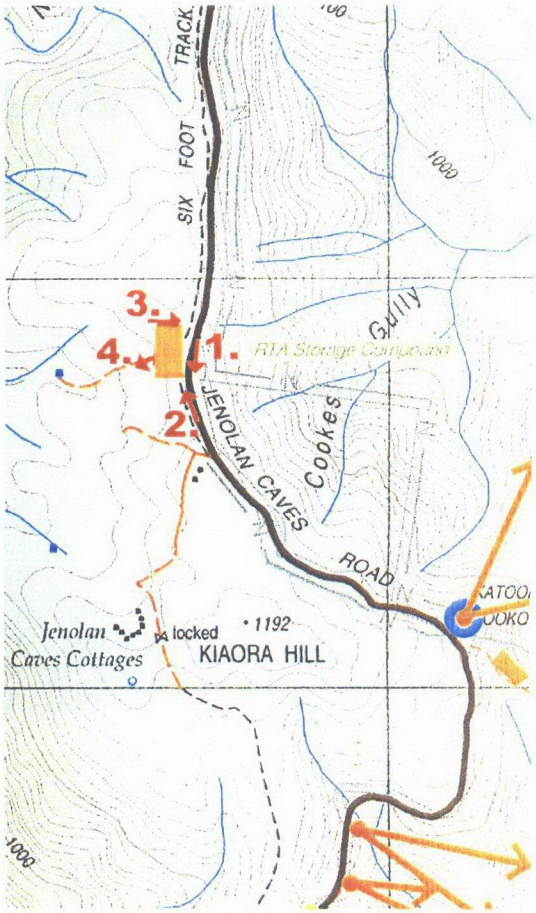
RTA Storage Compound- view north entry position



View east onto stock piles, weed infestation



Gateway to wildlife reserve, weed infestation



Location: RTA Compound & Photo position

Notes

Weed Control

Survey

Legend

Viewpoint & direction

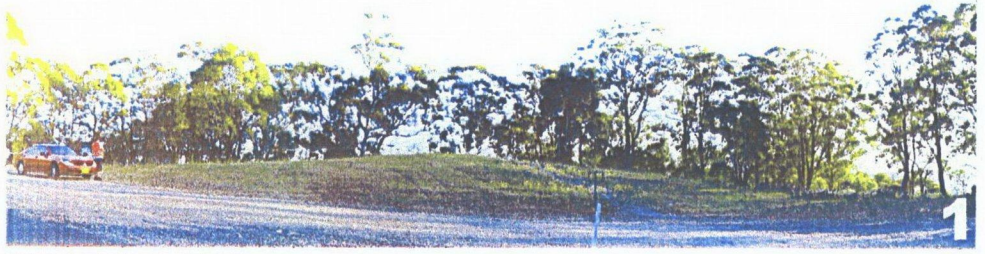
Indicative zone of screen planting

1. Photo location & number

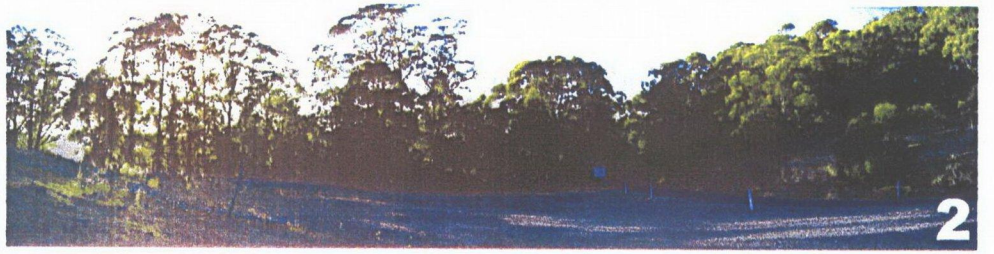
RTA Storage compound

JENOLAN CAVES ROAD

Landscape and Visual Assessment Proforma Sheet



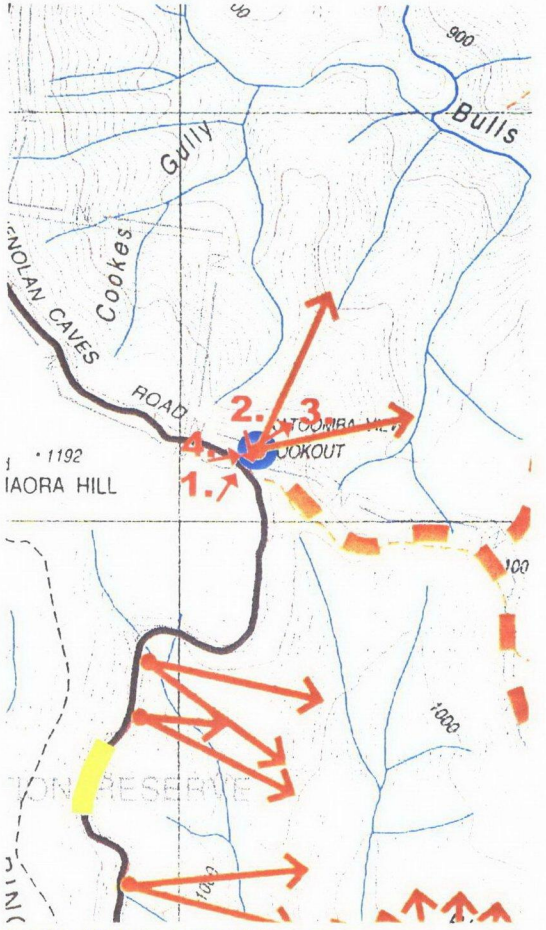
Katoomba Lookout- view east



Katoomba Lookout - view south

Extent of viewshed (Approx 30 degree view corridor)

Katoomba Lookout - facilities



Location: Katoomba Lookout & Photo position

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low, Medium, High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 940 and 1160 metres above sea level. Road overbridge in spans of deep valleys, spread with a system of creeks, ephemeral streams and occasional water bodies. Landscape is mixed to, pastoral, natural, developed and built.	Open forest of up to 18m high trees: *Eucalyptus brevistylis, E. banksiana, Eucalyptus, E. radiata* and *Acacia* species. Understorey of 2m-3m high shrubs, eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 940 and 1160 metres above sea level.	HIGH
Sensitivity to Change/Ability to Absorb the Proposal (Low, Medium, High)	Visual Sensitivity To Alteration By the Proposal (Low/Medium/High)	Significance of Existing Views (Local, State, Regional, National, International)	Notes
LOW	LOW to MEDIUM	National/International	Sitting area require weed eradication program, new furniture and general tidy up.

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

VISUAL IMPACT OF PROPOSAL LOW

NOTE:
An assessment was made of the proposal from the vantage point of this popular lookout in order to establish which, if any, of the proposed works could be seen from this vantage point.
Views out from Katoomba Lookout are framed by existing dense tree foliage to about 30 degrees. None of the proposed works were visible within this view corridor.
However, the Lookout would benefit from the addition of new, and more sensitively sited furniture, and a general tidy up.

Legend

View point & field of view

Extent of visual corridor

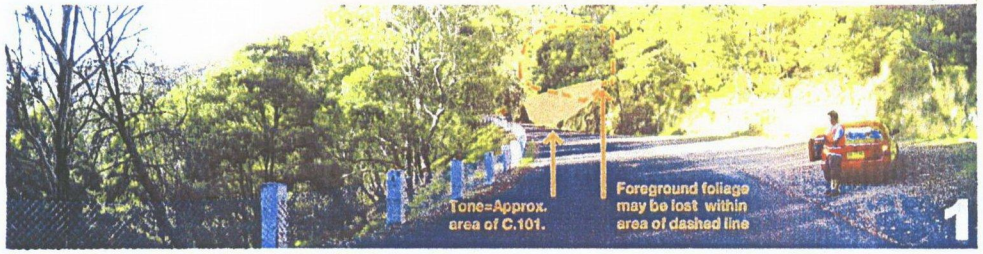
Notes location line

1. Photo location & number

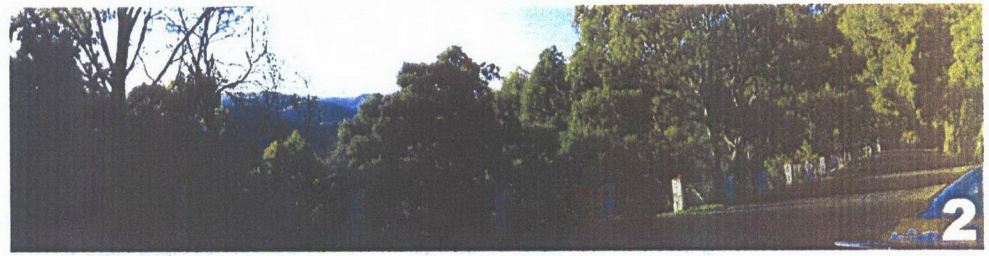
Cut section

Lookout

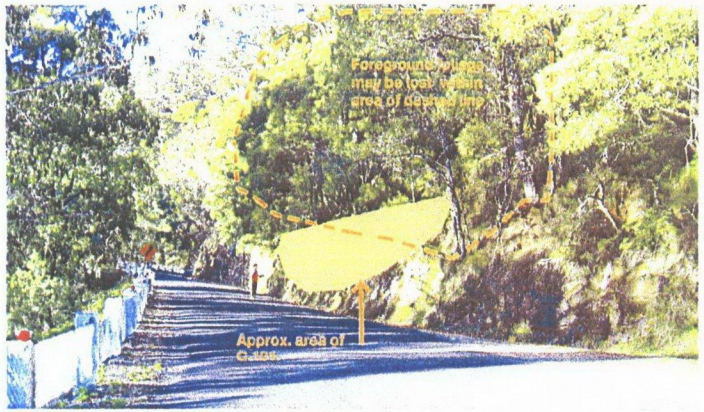
Landscape and Visual Assessment Proforma Sheet



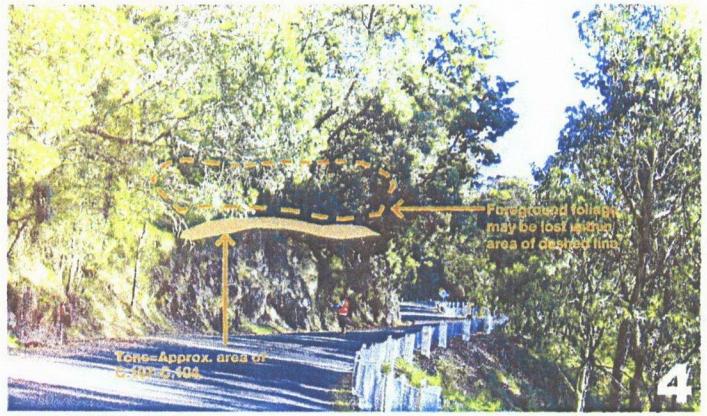
C 1.74- view south along Jenolan Caves Road



C 1.74- partial view to visual catchment (view south along Jenolan Caves Road)



C 1.74- view south along Jenolan Caves Road



C 1.74- view north along Jenolan Caves Road

VISUAL ANALYSIS			
Existing Landscape Quality (refer to Table 1 Guidelines)	Description of Existing Visual Environment (refer to Table 2 Guidelines)	Description of Surrounding Environment	Sensitivity of Existing Landscape (Low, Medium, High)
Scenic Quality: Low/Medium/High Character: Intact/Modified/Disturbed Rarity: Common/Uncommon/Rare Condition: Good/Fair/Poor Diversity: Low/Medium/High	Visual Catchment: Local/Sub-regional/Regional Visual Exposure: Open/Partial/Enclosed Visual Absorption Capability: High/Moderate/Low Visual Distance: Foreground/Middle Ground/Background Visual Elements: Landform, Vegetation, Water, Built Form Visual Contrast: Strong/Moderate/Weak Visual Dominance: Dominant/Co-dominant/Subordinate/Incidental Visual Scale: Intimate/Open/Vast Visual Complexity: Low/Medium/High Visual Unity: Unified/Coherent/Fragmented	Describe the visual setting, including: Scenic Quality, Character, Rarity, Condition, Diversity, Visual Catchment, Visual Exposure, Visual Absorption Capability, Visual Distance, Visual Elements, Visual Contrast, Visual Dominance, Visual Scale, Visual Complexity, Visual Unity	HIGH
Sensitivity of Landscape to Alteration by the Proposal: Low/Medium/High	Visual Sensitivity to Alteration by the Proposal: Low/Medium/High	Degree of Public Visibility/Awareness: Local/Sub-regional/Regional	Rating
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW to MEDIUM	Nature: Unintentional	

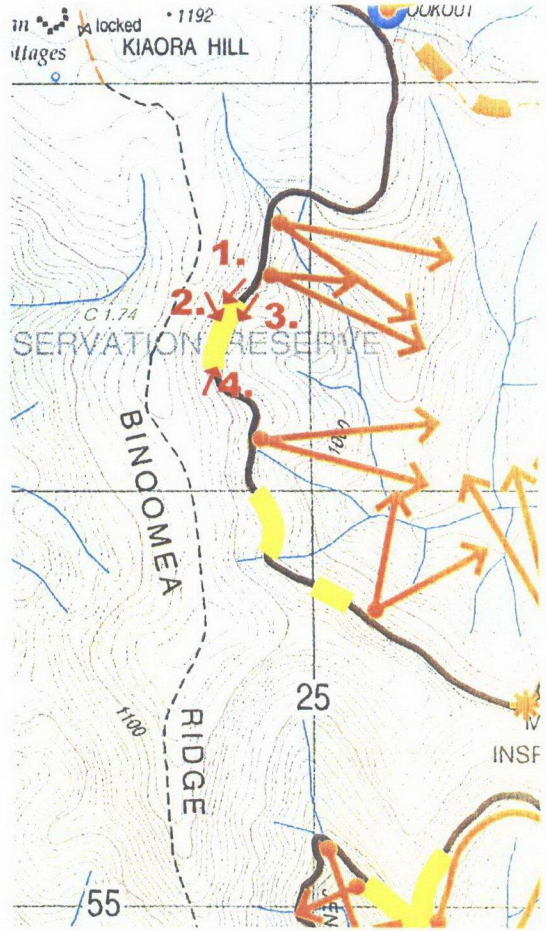
ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

Proposed crest work will remove vegetation along the immediate lip of the cut. However, the depth of vegetation cover behind this is extensive and fairly dense. There is no significant scaling work proposed.

The proposal is therefore unlikely to have a significant long term effect.



Location, C 1.74 & Photo position

Legend

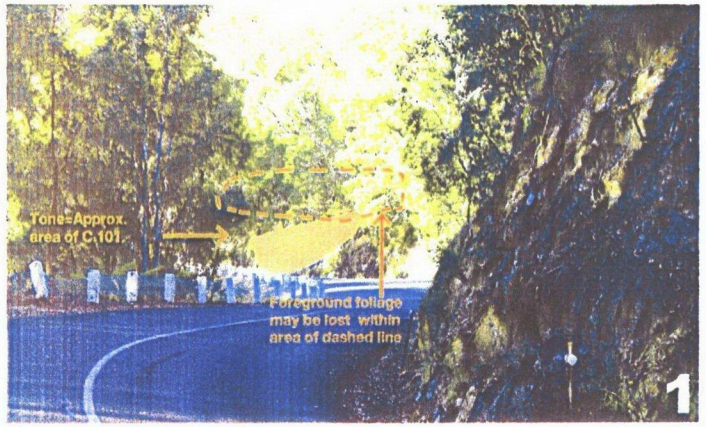
JENOLAN CAVES ROAD

Cut section

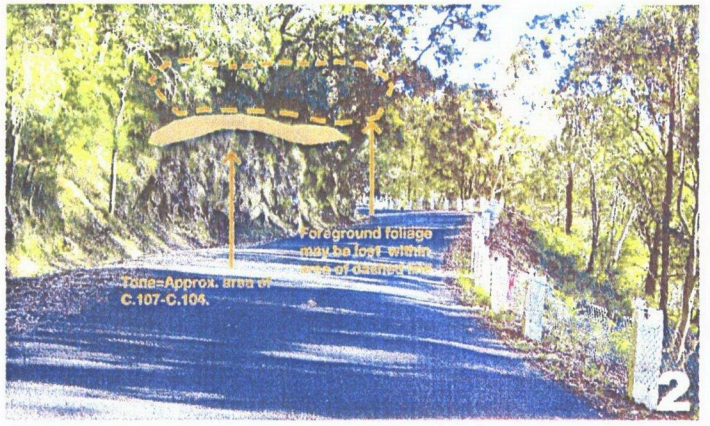
Loading

UDO

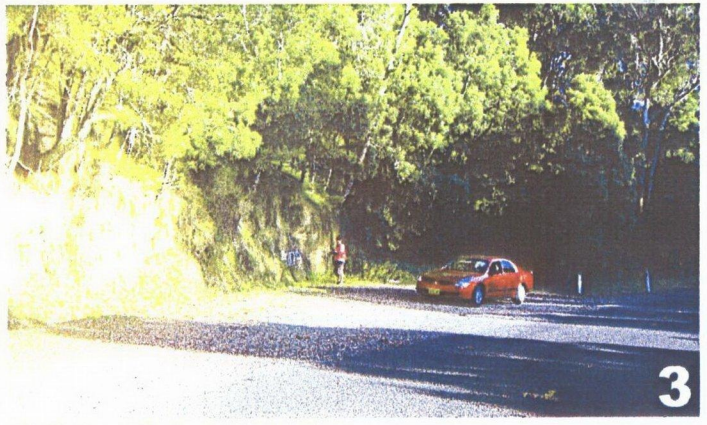
Landscape and Visual Assessment Proforma Sheet



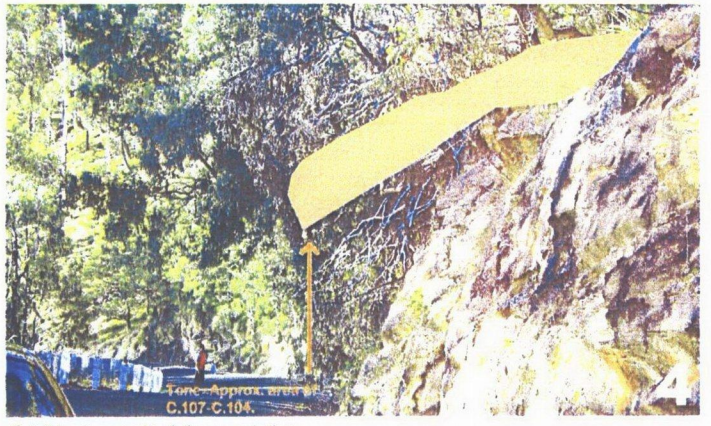
C 1.74- view south onto cut one just above the actual cut section



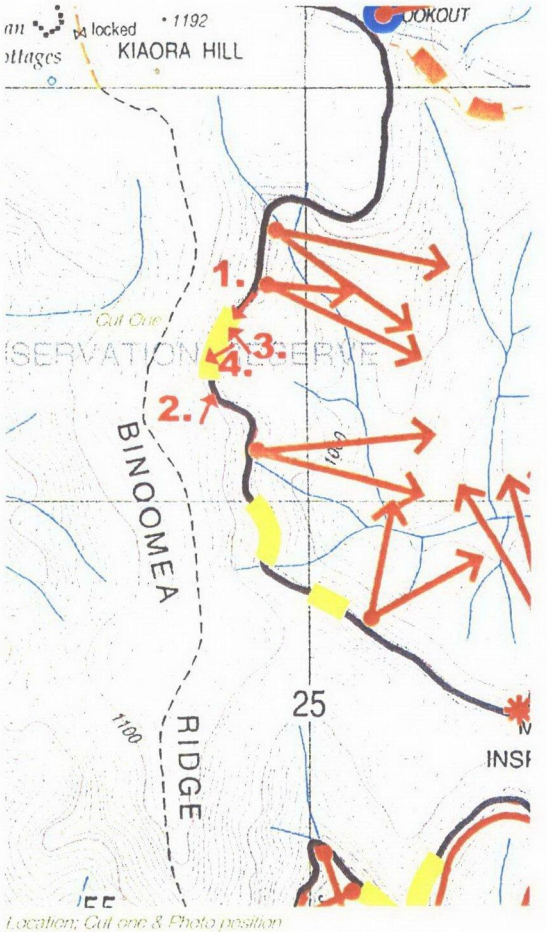
C 1.74- view north onto cut one from just below the actual cut section



C 1.74- view west onto start of cut section



C 1.74- view south- fallen vegetation



Location; Cut one & Photo position

Legend

Extent of visual catchment

Photo location & number

Cut section

JENOLAN CAVES ROAD

UDO

REMEDIATION WORK SUMMARY
CUTTING C1.74
1.740 - 1.860

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
C101	1740	1795	Scale all soils batter and bench	to 500	1000 - 5000	25
C102	1795		Scale all blocks	to 500	5000	<1
C103	1800	1820	Treat Crest Cont.	to 1500	4000 - 6000	5
C104	1820	1847	Treat Treatment / Overhang	to 3000	4000 - 6000	40 - 50
C105	1820		Scale and Wedge	to 300		<1
C106	1830		Remove fallen tree on crest		3000	
C107	1840		Remove tree on crest		4000	
C108	1848	1851	Scale block at crest		3000	<1

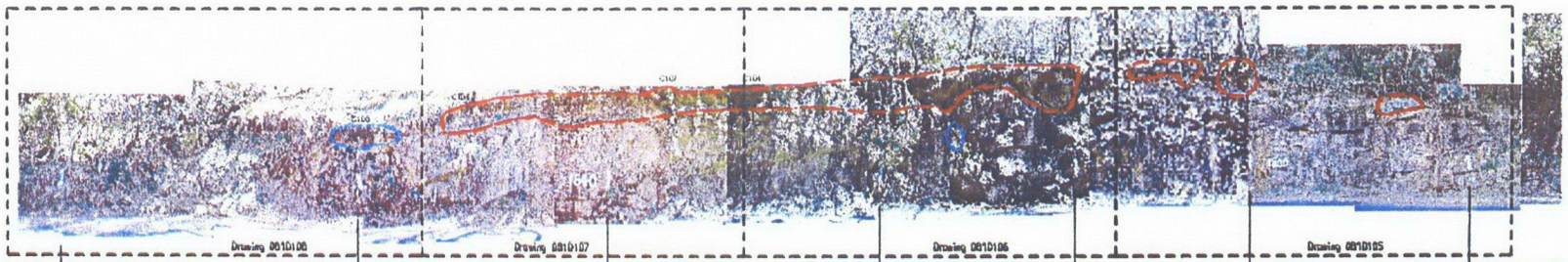
Estimated Quantities

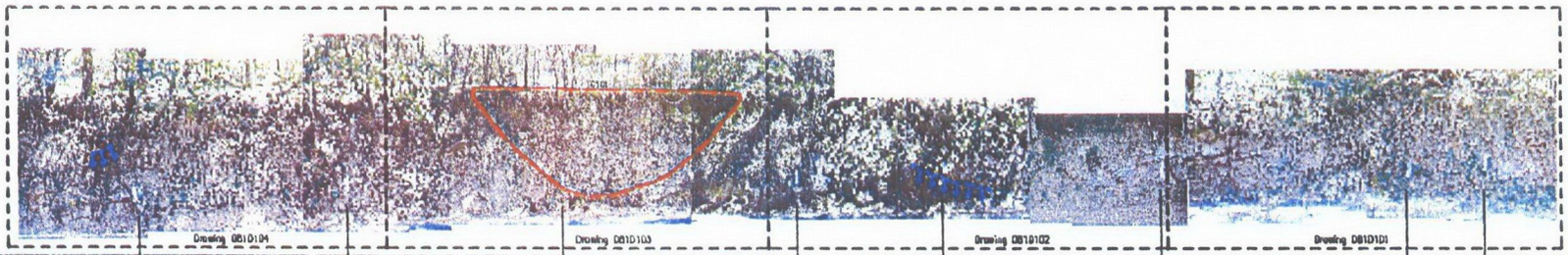
Rock Bolts	-
Crest Treatment / Over Vegetation	70 m^2
Netting of loose blocks	1.0 m2
Mesh Fences	-

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- SEEPAGE





1.0	TENDER ISSUE	GKW	09.02.05	GKS	09.02.05
A	PRELIMINARY ISSUE	GKW	09.02.05	GKS	09.02.05
REVISION	DESCRIPTION	DRN	DATE	CHKD	DATE

RTA

Golder Associates

SYDNEY OFFICE
8 CHARLES STREET
NORTH SYDNEY, NSW 2060, AUSTRALIA
TEL (02) 9425 2600
FAX (02) 9425 2601

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	

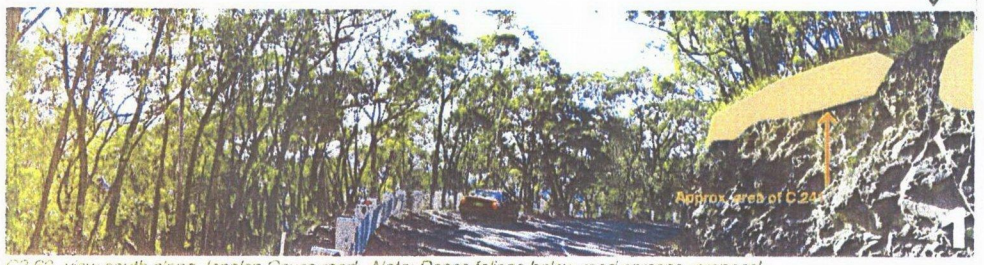
SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C1.74
CHAINAGE 1717.92 - 1860

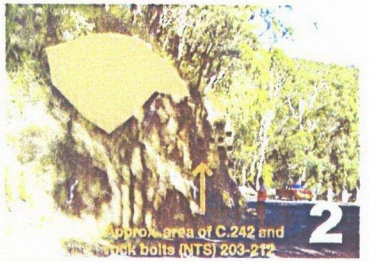
04622081	081D100	T0

GOLDERS WORKSHEET C 1.74

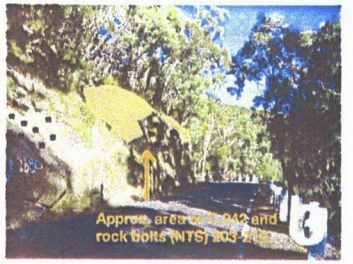
Landscape and Visual Assessment Proforma Sheet



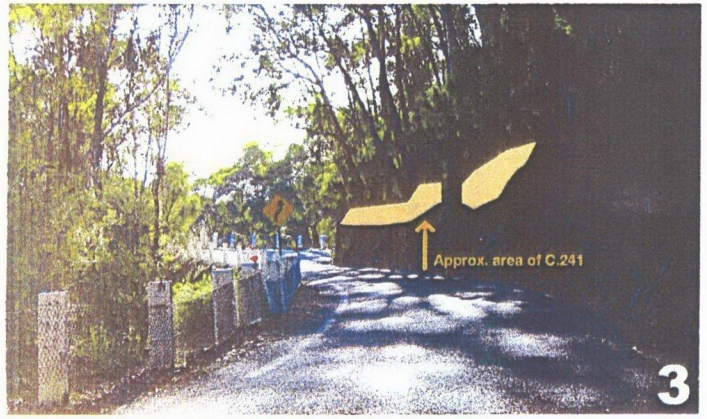
C2.63- view south along Jenolan Caves road . Note: Dense foliage below road screens proposal.



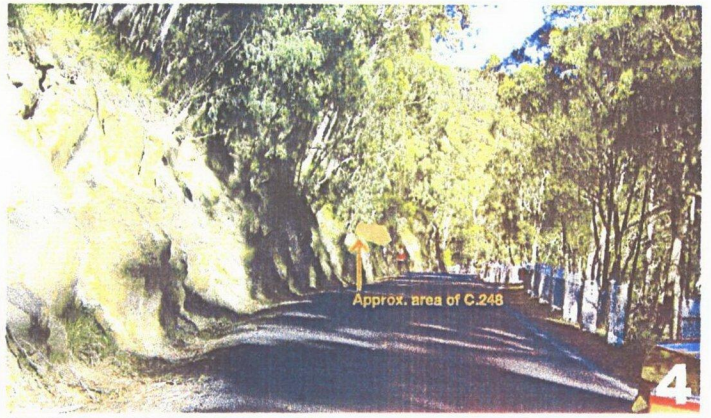
C 2.63- view north along Jenolan Caves road



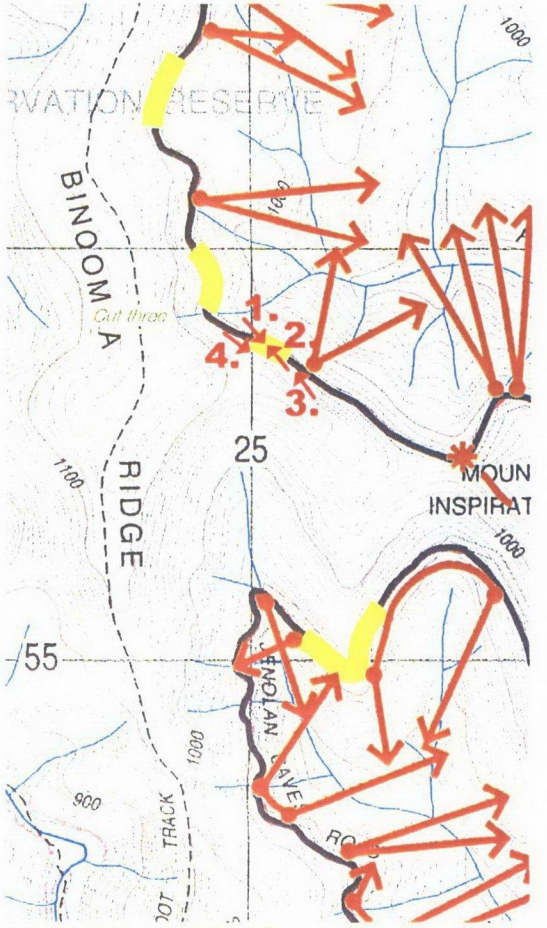
C 2.63- view north along Jenolan Caves road



C 2.63- view south along Jenolan Caves road



C 2.63- view north along Jenolan Caves road



Locations Cut Three & Photo viewing

VISUAL ANALYSIS			
Landform (Undulating, Cliffs/rocks, Ridges/hills/mountains etc/all)	Description of Existing Vegetation (Refer visual descriptions in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level. Road reserve is a mixture of open spaces, exposed with a system of rock walls, retaining structures and constructed water bodies. Landscape dominated by existing natural rock/soil and cliffs.	Open forest of up to 10m high trees: *Eucalyptus blaxlandii, E. viminalis,* and *Acacia melanoxylon* Understorey of 2m-5m high shrubs, eg. Blackthorn, Broad-leaved Hickory Common ground cover species include Lomandra, mat rush, grasses and ferns	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level	HIGH
Significance of Landscape to Area Proposed Low/Medium/High	Visual Sensitivity To Alterations by the Proposal Low/Medium/High	Significance of Existing Views (Local/State/Regional/National/International)	Notes
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

This site is 150m long, and is typical of the rest of the proposed work package. Seen in the context of the scale of the surrounding landscape the proposal presents a low visual impact.
The scale of the proposed rock scaling is small compared with other sites. There are a number of closely grouped rock bolts that could create a moderate to low negative impact in the short term. Over time it is expected that these will take on a neutral patina and not present a long term negative impact.

Legend

View point & cut three

Extent of visual cut zones

Notes/annotations etc

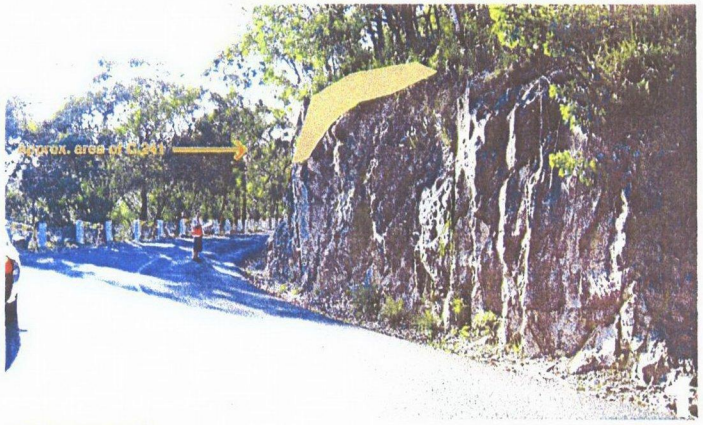
Photo location & number

RTA Storage compound

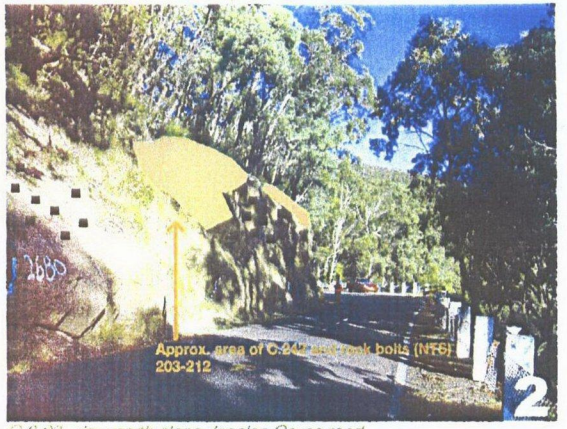
Cut zones

Lookout

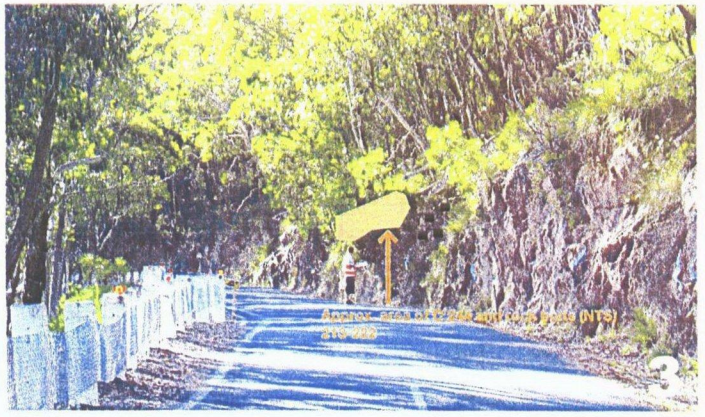
Landscape and Visual Assessment Proforma Sheet



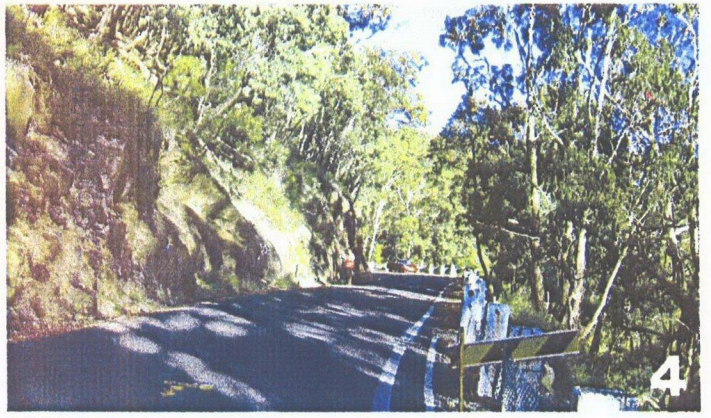
C.2.63- view south



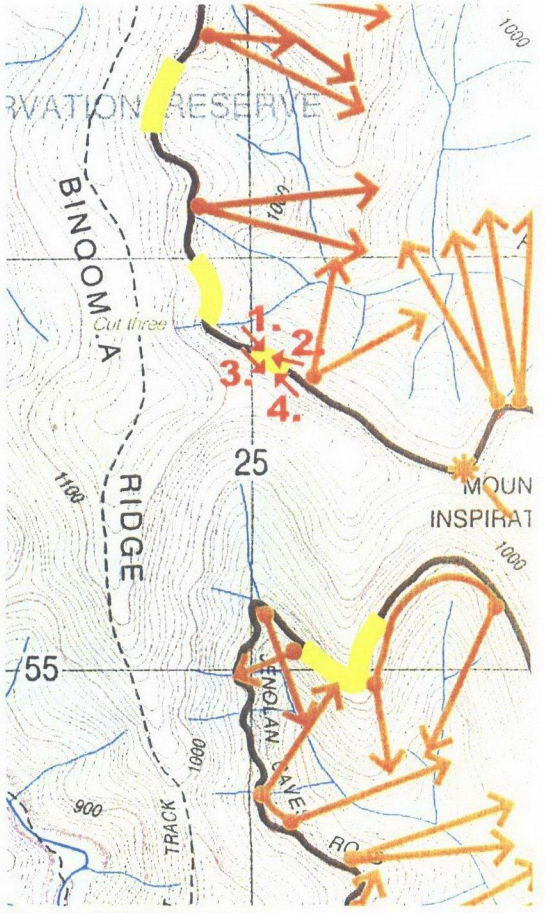
C.2.63- view north along Jenolan Caves road



C.2.63- view south



C.2.63- view north



Location: C.2.63 & Photo position

Legend

Viewpoint & angle of view

Existing Cleared Lookout

Existing Planted Trees

1. Photo location & direction

RTA Strategic components

Cut section

Lookout

REMEDIATION WORK SUMMARY

CUTTING C2.63
2.630 - 2.730

ID	Chainage Start	Chainage Finish	Remediation	Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
S 240	2629	2630	Remove blocks	to 1200	1800 – 3000	3
C 241	2614	2634	Crest Treatment / Shrubs	to 1000	2000 – 3000	30
	2644	2645	2 x Rock Bolt		2000	
	2650		4 x Rock Bolt		3000 – 4000	
	2657	2661	Pattern Rock Bolts		2000 – 3000	
C 242	2663	2670	Remove large boulder at crest	to 2000	2000 – 3000	30
S 243	2672	2674	Remove blocks on toe and above crest	to 1200	3000	1
	2679	2685	Pattern Rock Bolts		2000 – 3000	
C 244	2688	2689	Remove block	to 1000	3000	1
	2693	2697	6 x Rock Bolt		2000 – 4000	
S 245	2697	2700	Remove blocks	to 500	2000 – 4000	2
	2709	2705	8 x Rock Bolts		2000 – 4000	
C 246	2701	2705	Remove blocks above crest	to 500	4000	2
C 247	2711	2715	Scale blocks	to 300	0 – 2000	2
C 248	2725		Remove tree on rock face		3000	

Rock Bolt Details

Unit No.	Length (mm)	Inclination
RB 201	3000	30°
RB 202	3000	30°
RB 203	3000	30°
RB 204	3000	30°
RB 205	3000	30°
RB 206	3000	30°
RB 207	3000	30°
RB 208	3000	30°
RB 209	3000	30°
RB 210	3000	30°
RB 211	3000	30°
RB 212	3000	30°
RB 213	3000	30°
RB 214	3000	30°
RB 215	3000	30°
RB 216	3000	30°
RB 217	3000	30°

Rock Bolt Details... continued...

Unit No.	Length (mm)	Inclination
RB 218	3000	30°
RB 219	3000	30°
RB 220	3000	30°
RB 221	3000	30°
RB 222	3000	30°
RB 223	2400	0°
RB 224	2400	0°
RB 225	2400	0°
RB 226	2400	0°
RB 227	2400	0°
RB 228	2400	0°
RB 229	2400	0°
RB 230	2400	0°
RB 231	2400	0°
RB 232	2400	0°
RB 233	2400	0°
RB 234	2400	0°

Estimated Quantities

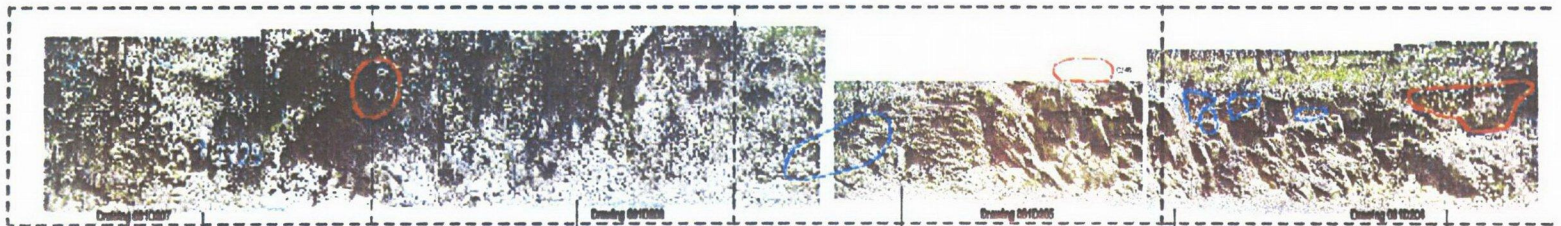
Rock Bolts	34
Crest Treatment / Clear Vegetation	45 m²
Scaling of loose blocks	6 m³
Rock Fence	–

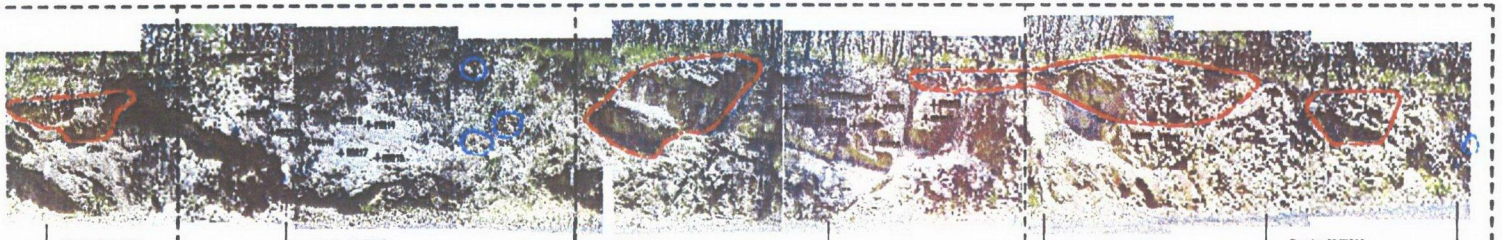
LEGEND:

- CREST TREATMENT/REMOVE VEGETATION/REGRADE
- SCALING OF LOOSE BLOCKS
- + RB221 ROCK BOLT

NOTE: SURVEY DATA SUPPLIED BY RTA

INTERPRETIVE ONLY DO NOT SCALE





Rev	Description	Drawn	Date	Chkd	Date
10	TENDER ISSUE	GKW	09.2.05	SMS	09.2.05
9	PRELIMINARY ISSUE	GKW	24.12.04	SMS	24.12.04

RTA

Golder Associates

SYDNEY OFFICE

ROADS AND TRAFFIC AUTHORITY

NC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

JERVIS BAY/ROAD REHABILITATION (JENOLAN CAVES ROAD)

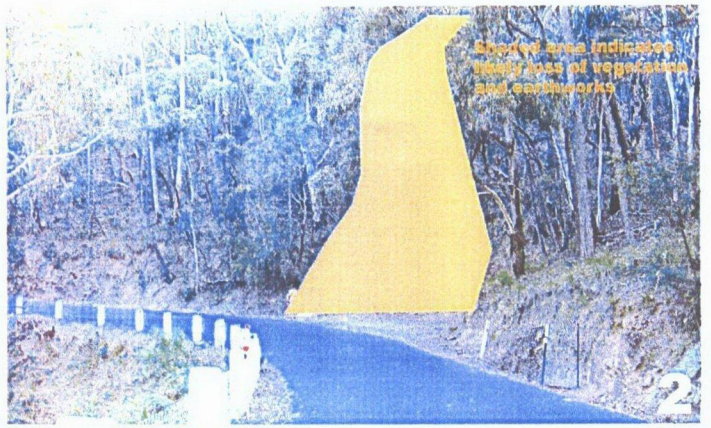
REMEDIATION WORK SUMMARY
CUTTING C2.63
CHAINAGE 2.605 - 2.730

0402200R | 081D200 | T0

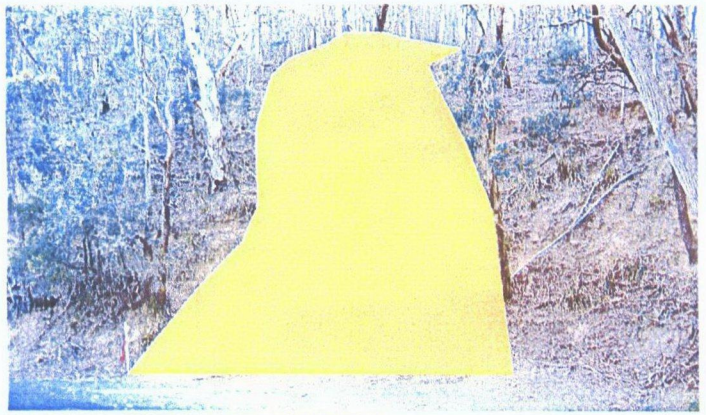
GOLDERS WORKSHEET C 2.63

Landscape and Visual Assessment Proforma Sheet

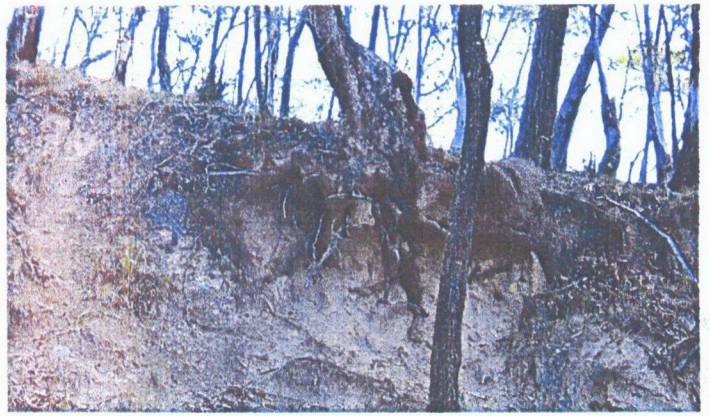
Access track- view south (extent shot 200m)



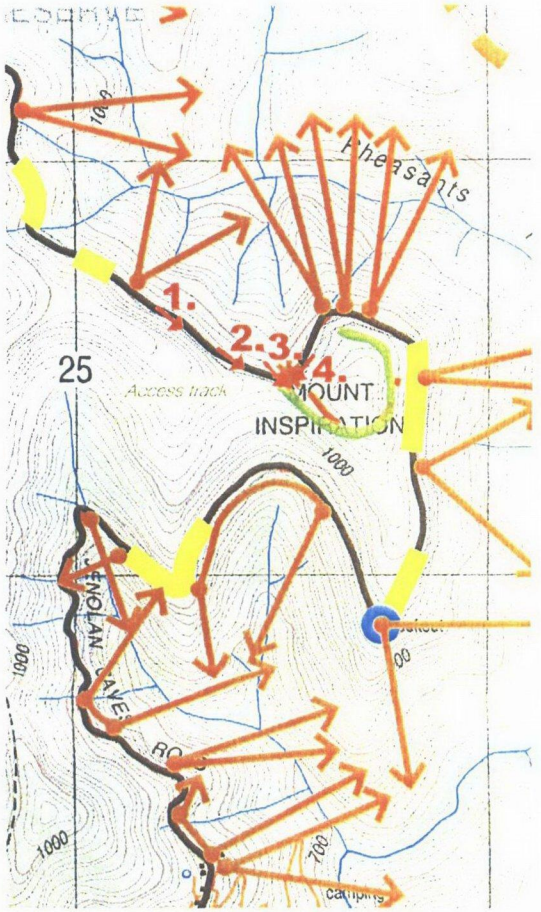
Access track- view south (100m)



Access track- view south- proposed entry point



Access track- view north west- under mined tree



Location: Access track & Photo position

VISUAL EFFECTS			
Existing Physical Characteristics (Natural and Cultural Landscape Elements)	Type and Extent of Existing Vegetation (Native, Exotic)	Description of Edges and Definition	Significance of Existing Landscape (Low-Moderate-High)
Proposed Physical Characteristics (Natural and Cultural Landscape Elements)	Type and Extent of Proposed Vegetation (Native, Exotic)	Edges (Hard, Soft, Clear, Indistinct, Visual Containment, Skyline Definition)	HIGH
Degree of Contrast (Proposed vs Existing) (Form, Line, Colour, Texture)	Degree of Contrast (Proposed vs Existing) (Form, Line, Colour, Texture)	Significance of Existing Views (Local, Regional, Significant, Iconic, Elevated)	Higher
HIGH	HIGH	Subject Dimensions	Proposed Section: Track access track to top of C360 - Assumed width 4.5m

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	H	H	M
MODERATE	H	M	L
LOW	M	L	L

VISUAL ASSESSMENT SUMMARY

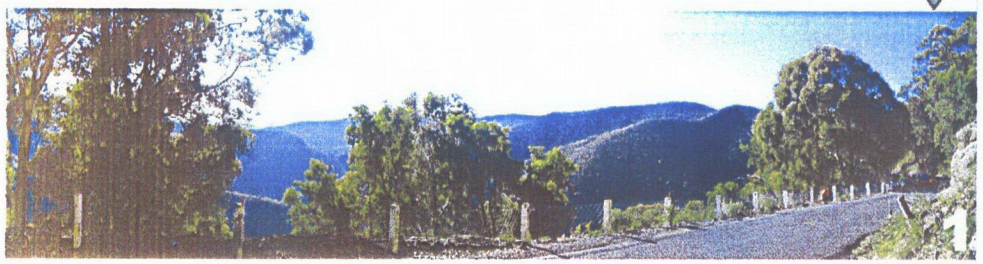
Proposed access track to top of C360 requires major earthworks and loss of vegetation around the spur (elevation 1000m). The track would have substantially more impact than any of the proposed cuts, and impacts would be highly visible to vehicles approaching downhill from 200m+, and uphill from approx. CH 0.00. The degree of visual impact would be (very) High.

Legend

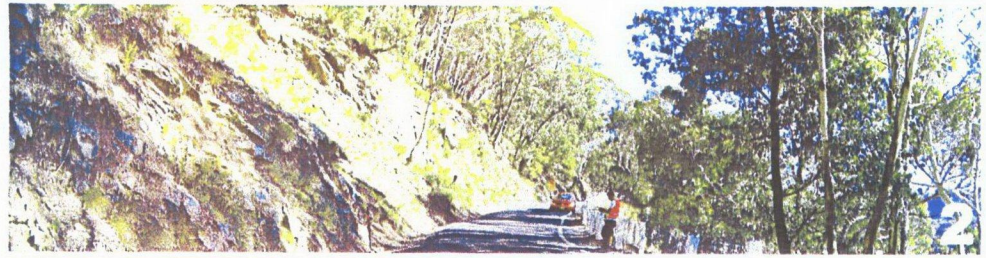
JENOLAN CAVES ROAD

UDO

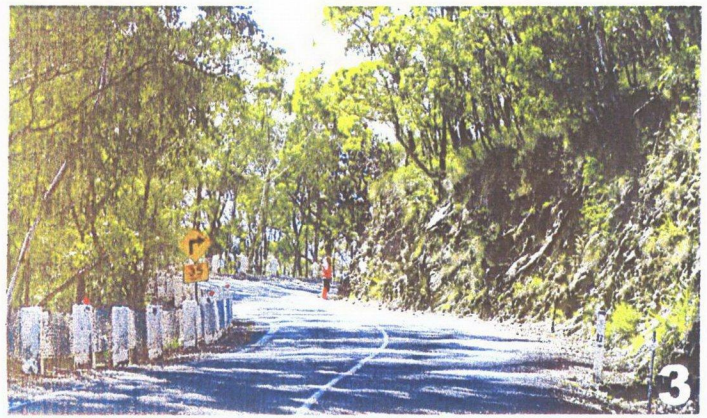
Landscape and Visual Assessment Proforma Sheet



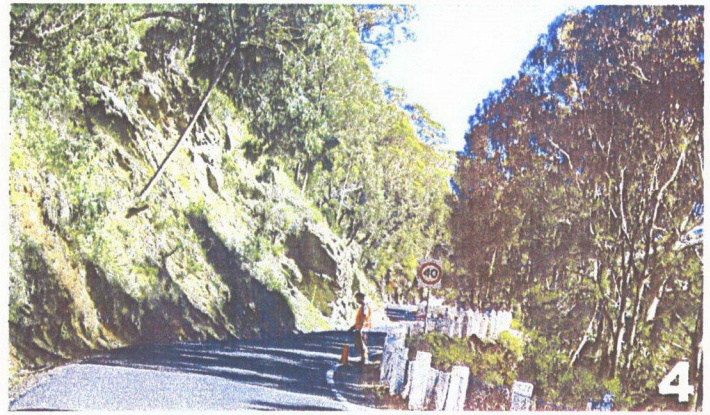
C 3.64- view south-east along Jenolan Caves Road



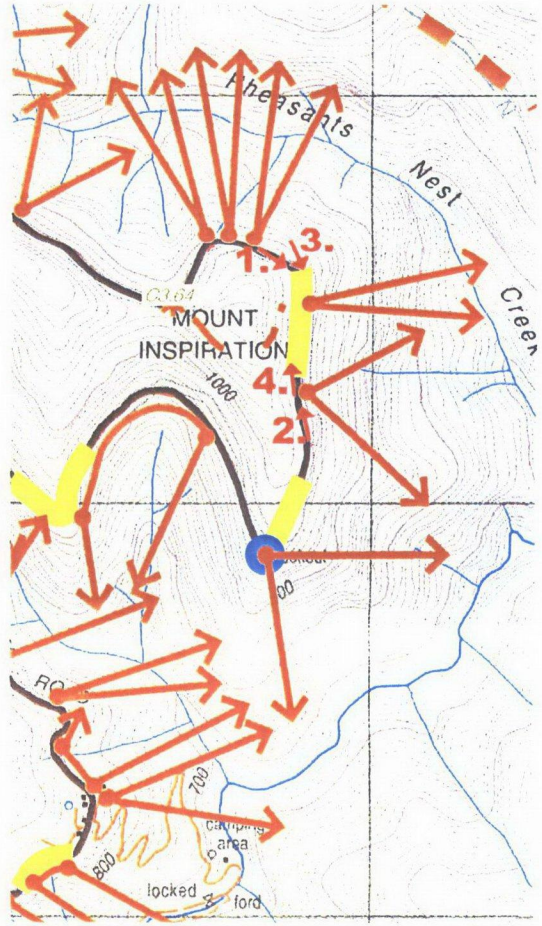
C 3.64- view north along Jenolan Caves Road



C 3.64- view south along Jenolan Caves Road



C 3.64- view north along Jenolan Caves Road



Location C 3.64 & Photo position

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 440 and 1150 metres above sea level. Broad riverbanks a series of deep valleys, incised with a system of tributary watercourses and associated rocky features, contributing to the dramatic landscape.	Open forest of up to 10m high trees; *Eucalyptus Baeuerlenii*, *E. variabilis*, and *Acacia implexa*. Understorey of 2m-3m high shrubs, ex. Blackthorn, Broad-leaved Hickory. Cleared ground cover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 440 and 1150 metres above sea level.	HIGH
Significance of Landscape to Application (refer Figure 4) (Low/Medium/High)	Visual Sensitivity to Modification by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/National/International)	Notes
CONSTRUCTION PHASE: MEDIUM-HIGH OPERATION PHASE: LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT
(High potential Visual Impact in Construction Phase)

At the time of this assessment no details were available for C 3.64. The current proposal assumes that the work will be accessed via a track just to the north of C 3.64. This access track would create a HIGH visual impact and it is strongly recommended that other methods of achieving the necessary work be considered.

For example, the proposed works could be achieved by hand from above the cut, or using light weight bob-cats hoisted up to that position form the road.

Provided the work can accessed in this way the proposal is considered to be of low potential impact.

Legend

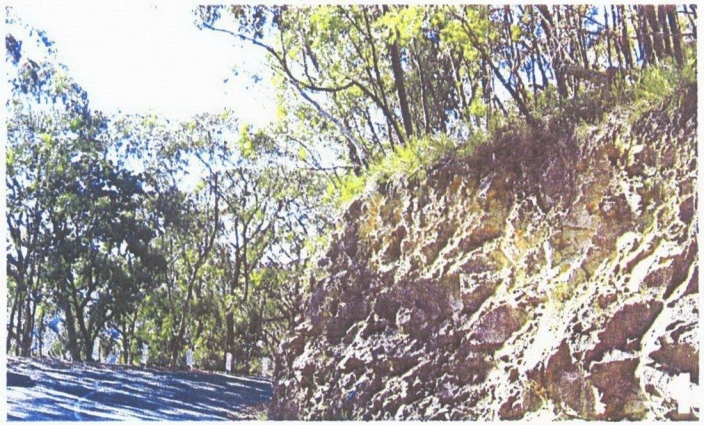
- View point & direction
- Extent of visual catchment
- Potential view line
- 1.→ Photo location & number
- RTA Storage compound
- Cut section
- Lookout

JENOLAN CAVES ROAD

NOTE: No Remediation Drawing was prepared for Works at Cut 3.64

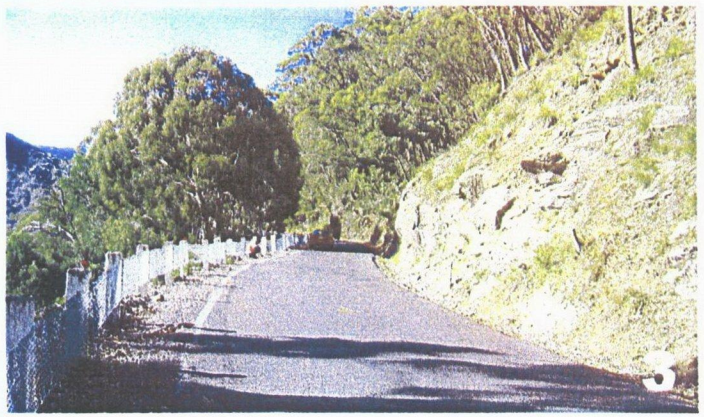
UDO

Landscape and Visual Assessment Proforma Sheet

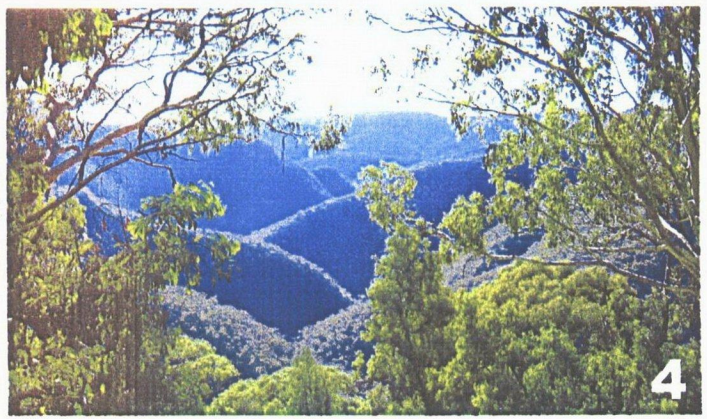


C 3.64 - view south

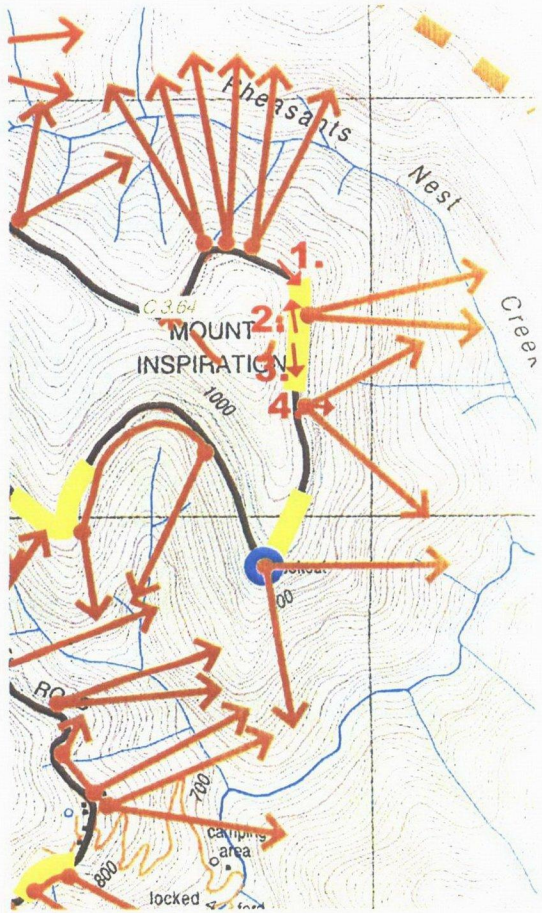
C 3.64 - view north



C 3.64 - view south



C 3.64 - view east



Location: C 3.64 & Photo position

Legend

JENOLAN CAVES ROAD

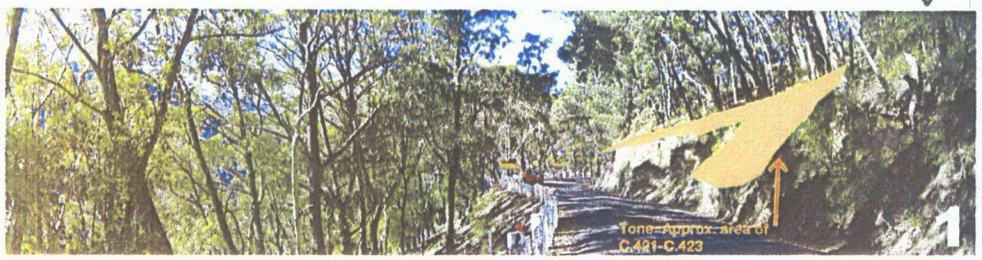
Cut section

Locked

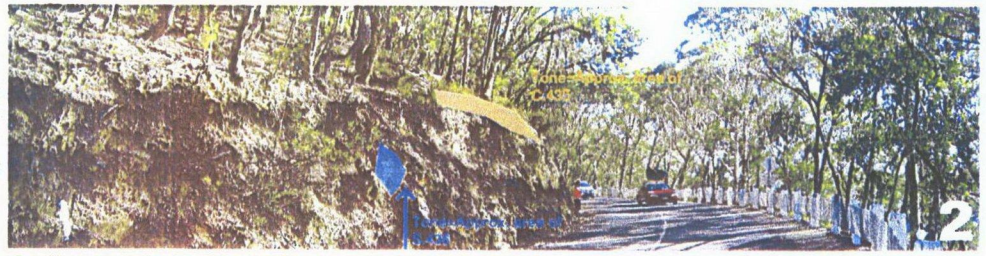
NOTE: No Remediation Drawing has been prepared for Works at Cut 3.64

UDO

Landscape and Visual Assessment Proforma Sheet

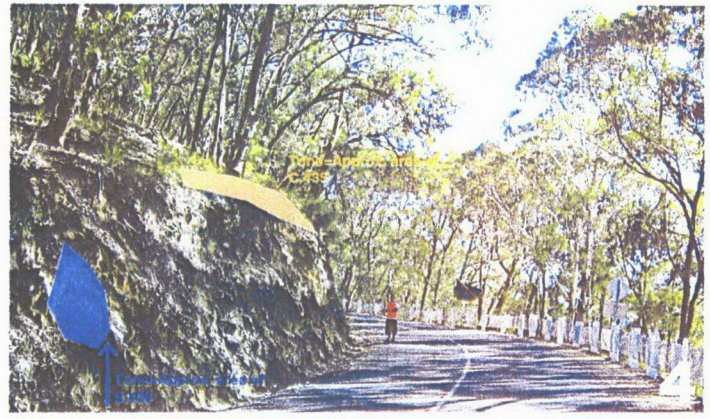


C 4.22- view south along Jenolan Caves road

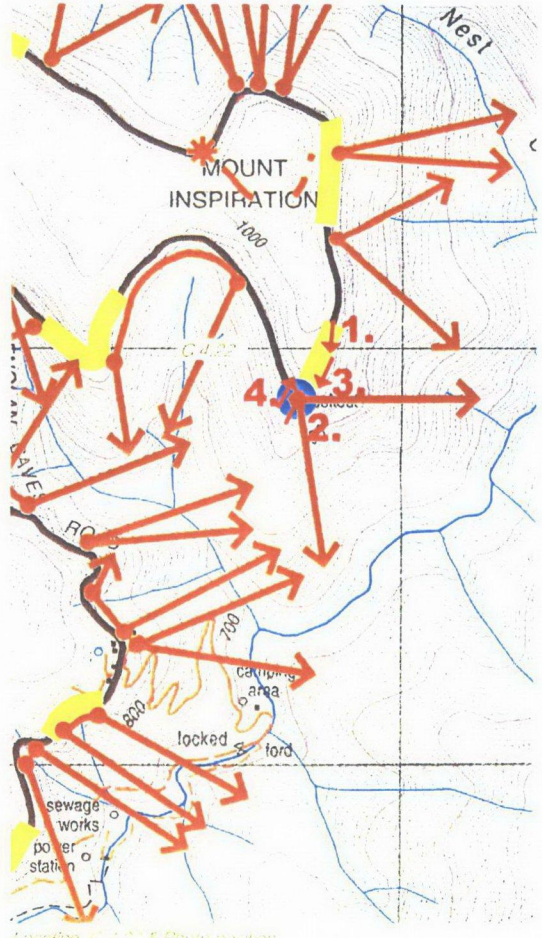


C 4.22- view north along Jenolan Caves road

C 4.22- view south along Jenolan Caves road



C 4.22 - view north along Jenolan Caves road



Location C 4.22 & Photo position

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level. Rapid weathering a series of karst caves, incised with a system of ephemeral ephemeral streams, and associated water bodies. Landscape dominated by dramatic natural escarpment landforms.	Open forest of up to 10m high trees: *Eucalyptus blaxlandii*, *E. viminalis*, and *Acacia implexa*. Understorey of 2m-3m high shrubs; eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level.	HIGH
Visibility of Landscape to Alteration by the Proposal (Low/Medium/High)	Viewer Sensitivity To Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/National/International)	Notes
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

Although this site is 200m long, slightly longer than the average proposal, the scale of the proposal is typical of the whole package of work. Seen in the context of the scale of the surrounding landscape the proposal presents minimal impact. Refer to Photo #3 on Sheet 2 of C 4.2. This image dramatically illustrates the true scale of the Proposal in its context.

Legend

Viewpoint & number

Extent of visual catchment

Right of way/ cave line

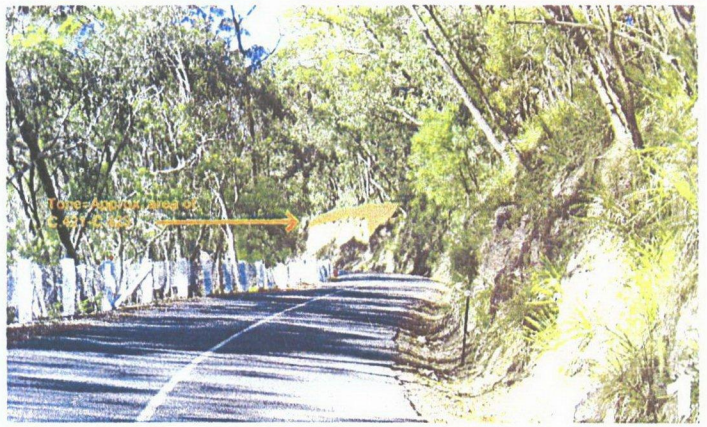
1. → Photo location & number

RTA Storage compound

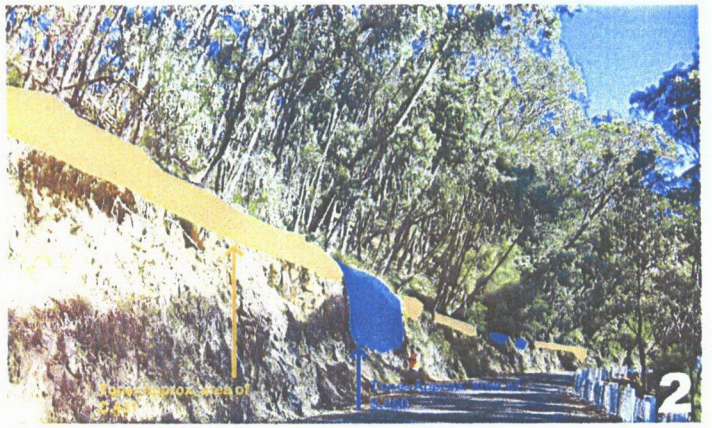
Cut batter

Footpath

Landscape and Visual Assessment Proforma Sheet

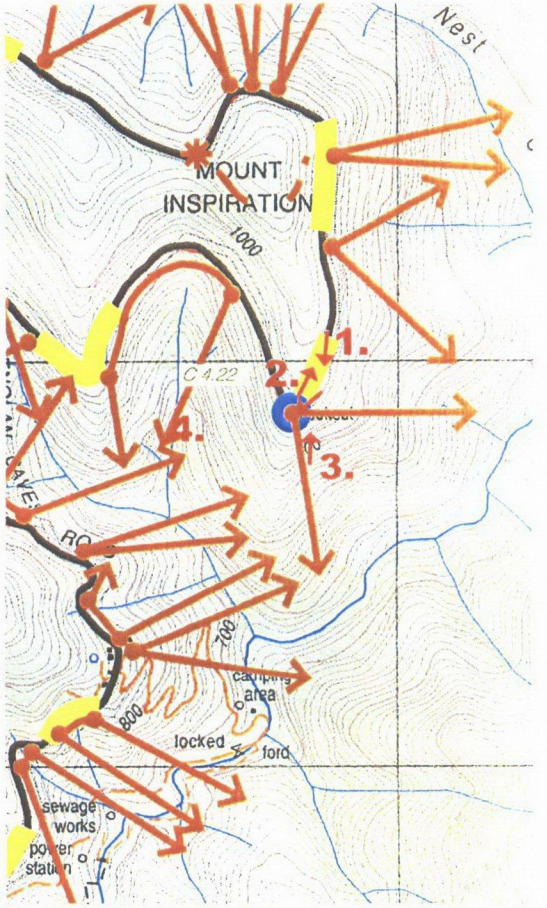


C 4.22 View south (distant view)



C 4.22 View north

C 4.22 View west from Mount Inspiration Lookout



Location: C 4.22 & Photo position

Legend

JENOLAN CAVES ROAD

UDO

CUTTING C4.22
4.220 – 4.370

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
[illegible]			Remove loose block	to 600	2100	C1
[illegible]			Crest treatment		4200 – 4300	20
[illegible]			Scale loose blocks below crest	to 600	1900 – 4300	C1
[illegible]			Scale loose rocks below crest	to 300	1900 – 4300	2
[illegible]			Remove loose blocks	to 600	1900 – 3500	C1
			Pattern Rock Bolts (levels to be coordinated with profile)		2000 – 4200	
[illegible]			Scale loose blocks	to 300	2000 – 3000	2
[illegible]			Scale loose blocks (Provided for RB's after profile)	to 1000	2000 – 4000	3
[illegible]			Scale loose blocks	to 300	2000 – 4000	2
[illegible]			Scale blocks at crest	to 300	4000	2
[illegible]			Remove tree on crest		4000	
[illegible]			Scale dead vegetation and loose blocks	to 600	1000 – 4000	2
[illegible]			Scale loose blocks at crest	to 600	4000	3
[illegible]			Scale dead vegetation and loose blocks	to 600	3700 – 4000	C1
[illegible]			Crest Treatment	to 1000	4000	3
			2 x Rock Bolts		3000	
[illegible]			Remove block	to 600	2100	C1
[illegible]			Scale loose blocks at crest	to 300	4000 – 4300	C1
[illegible]			Scale loose blocks	to 600	1000 – 4000	C1
[illegible]			Scale loose block and set above block	to 300	2100	2

Estimated Quantities

Rock Bolts	15
Crest Treatment / Clear Vegetation	50 m²
Scaling of loose blocks	12 m³
Shot Fibre	-

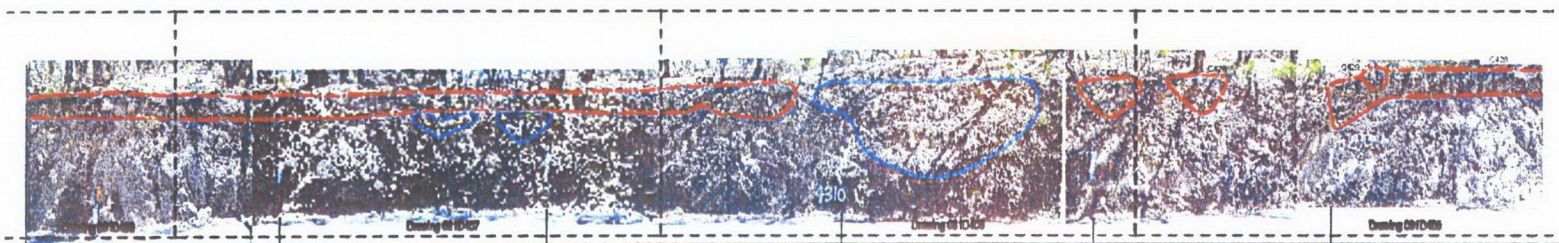
Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 401	2100	20°
RB 402	2100	20°
RB 403	2100	20°
RB 404	2100	20°
RB 405	2100	20°
RB 406	2100	20°
RB 407	2100	20°
RB 408	2100	20°
RB 409	2100	20°
RB 410	2100	20°
RB 411	2100	20°
RB 412	2100	20°
RB 413	2100	20°
RB 414	3000	0°
RB 415	3000	0°

INTERPRETIVE ONLY DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION/REGRADE
- SCALING OF LOOSE BLOCKS
- +RB401 ROCK BOLT



REV	DESCRIPTION	DRAWN	DATE	CHECKED	DATE
10	TENDER ISSUE	GMW	09.2.05	GMS	09.2.05
9	PRELIMINARY ISSUE	GMW	14.12.04	GMS	14.12.04

RTA

SYDNEY OFFICE

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GMW	09.02.05
GMW	09.02.05	GMS	09.02.05
GMS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION JERICHO MOUNTAIN ROAD

REMEDIATION WORK SUMMARY
CUTTING C4.22
CHAINAGE 4.220 - 4.300

081D400 T0

GOLDERS WORKSHEET C 4.22.
Sheet 1 of 2

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

CREST TREATMENT/REMOVE VEGETATION/REGRADE

BOMING OF LOOSE BLOCKS

+ RB401 ROCK BOLT

REMEDIATION WORK SUMMARY
CUTTING C4.22
4.220 - 4.370

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
C 450	4260		Remove loose block	to 600	2500	<1
C 451	4270	4310	Crest treatment		1500 - 3000	20
C 452	4280	4310	Scale loose blocks below crest	to 200	4000 - 5000	<1
C 453	4290	4300	Scale loose rocks below crest	to 200	3500 - 4000	2
C 454	4300	4310	Remove loose blocks	to 400	3000 - 3500	<1
	4310	4340	Pattern Rock Bolts (Needs to be coordinated with station)		1500 - 4000	
C 455	4320	4350	Scale loose blocks	to 300	2500 - 5000	2
C 456	4330	4360	Scale loose blocks (Potential for RB's after results)	to 1000	3500 - 4000	3
C 457	4350	4360	Scale loose blocks	to 200	2500 - 3000	1
C 458	4350	4360	Scale blocks at crest	to 800	4000	2
C 459	4350		Remove tree on crest		4000	
C 460	4350	4370	Scale dead vegetation and loose blocks	to 400	1500 - 3000	2
C 461	4350	4370	Scale loose blocks at crest	to 400	4000	5
C 462	4350	4360	Scale dead vegetation and loose blocks	to 400	3000 - 4000	<1
C 463	4350	4360	Crest treatment	to 1000	4000	7
	4360		1 x Rock Bolt		3000	
C 464	4360		Remove tree		2500	<1
C 465	4360	4370	Scale loose blocks at crest	to 300	3500 - 5000	<1
C 466	4360		Scale loose blocks	to 400	1000 - 2000	<1
C 467	4360		Scale loose block and soil above block	to 300	2500	2

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 400	2400	90
RB 401	2400	90
RB 402	2400	90
RB 403	2400	90
RB 404	2400	90
RB 405	2400	90
RB 406	2400	90
RB 407	2400	90
RB 408	2400	90
RB 409	2400	90
RB 410	2400	90
RB 411	2400	90
RB 412	2400	90
RB 413	2400	90
RB 414	2400	90
RB 415	2400	90

Estimated Quantities

Rock Bolts	16
Crest Treatment / Dead vegetation	50 m^2
Loading of loose blocks	10 m^3
Rock Fence	-

10	TENDER ISSUE	GKW	09.02.05	GKS	09.02.05
P	PRELIMINARY ISSUE	GKW	09.02.05	GKS	09.02.05
EDITION	DESCRIPTION	DES.	DATE	DES.	DATE

Golder Associates

SYDNEY OFFICE
45 BERRY STREET
NORTH SYDNEY, NSW 2060, AUSTRALIA
TEL (02) 9478 2000
FAX (02) 9478 2001

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

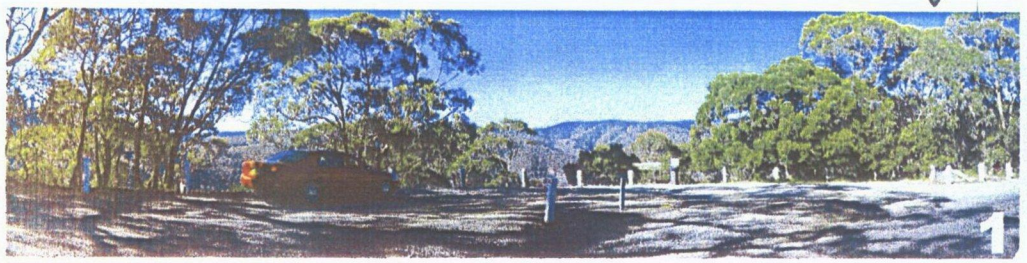
SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C4.22
CHAINAGE 4.300 - 4.390

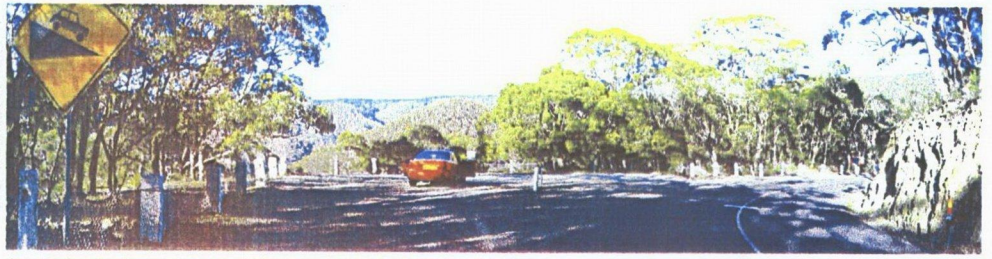
04/22081	081D401	TD

GOLDERS WORKSHEET C 4.22.
Sheet 2 of 2

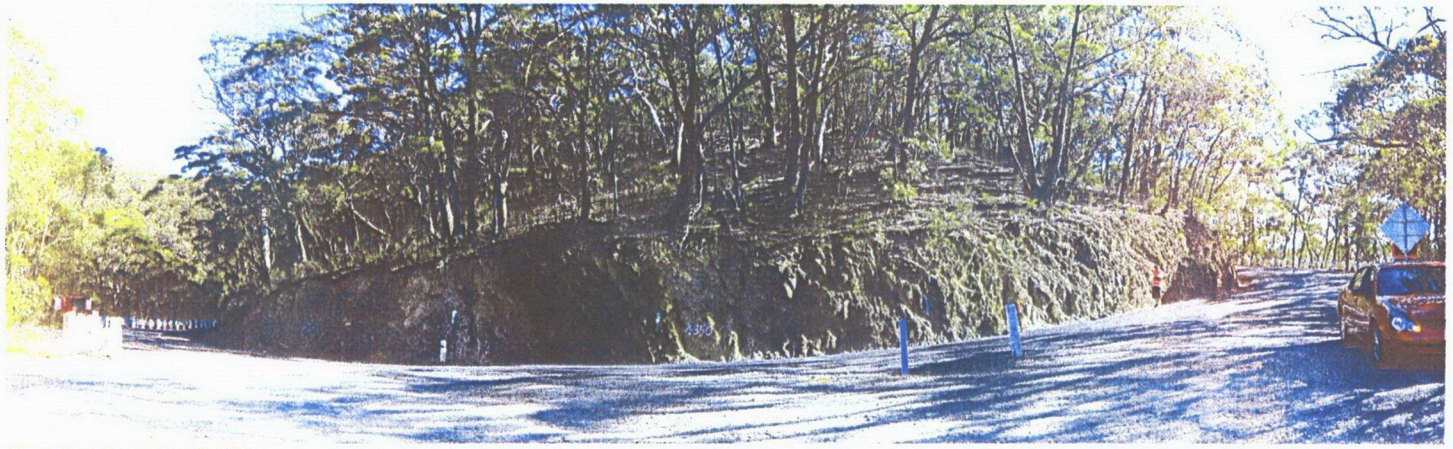
Landscape and Visual Assessment Proforma Sheet



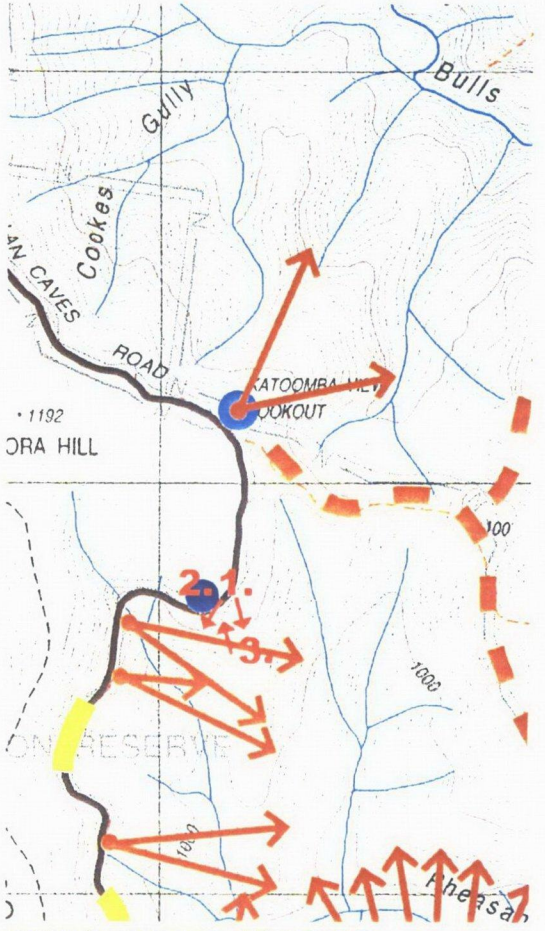
Inspiration Lookout- view southeast



Inspiration Lookout- view south from road approach



Proximity of Lookout to C 4.22



Location Inspiration Lookout & Photo Location

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep side slopes and crests. Elevations between 940 and 1150 metres above sea level. Broad eucalypt forest overstorey with a system of first order, incised with a system of ephemeral streams and associated drainage lines. Landscape character is pastoral/natural eucalypt woodland.	Open forest of up to 10m high trees: *Eucalyptus dicostata, E. blaxlandii, E. cugnacodes , E. ventricata*, and *Acacia mearnsii*. Understorey of 2m-3m high shrubs, eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 940 and 1150 metres above sea level.	HIGH
Sensitivity of Landscape to Alteration by the Proposal (Low/Medium/High)	Views Sensitivity to Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/National/International)	Notes
CONSTRUCTION PHASE: LOW OPERATION PHASE: LOW	LOW to MEDIUM	National/International	Sitting area require weed eradication program, new furniture and general tidy up

ASSESSMENT OF IMPACT			
	MEDIUM SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

NOTE:
An assessment was made of the proposal from the vantage point of this popular lookout in order to establish which, if any, of the proposed works could be seen from this vantage point.
Views out from Inspiration Lookout are framed by existing, dense tree foliage to about 60 degrees. None of the proposed works were visible within this view corridor.
However, the Lookout would benefit from the addition of new, and more sensitively sited furniture, and a general tidy up. (Refer also Site 8)

Legend

View point & sight lines

Extent of visual catchment

Relevant photo line

1.→ Photo location & number

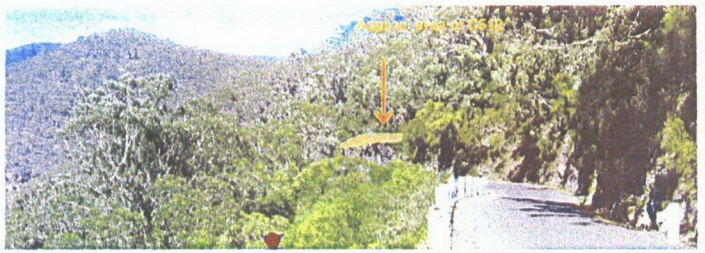
Cut batter

Lookout

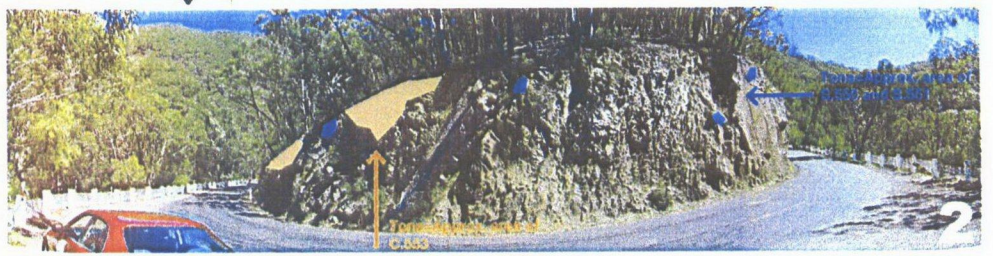
JENOLAN CAVES ROAD

UDO

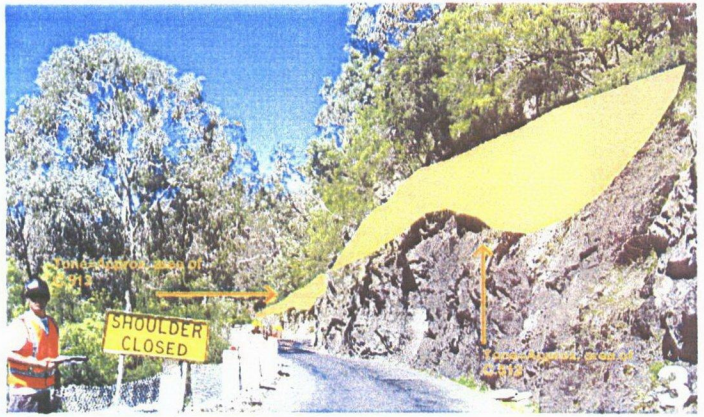
Landscape and Visual Assessment Proforma Sheet



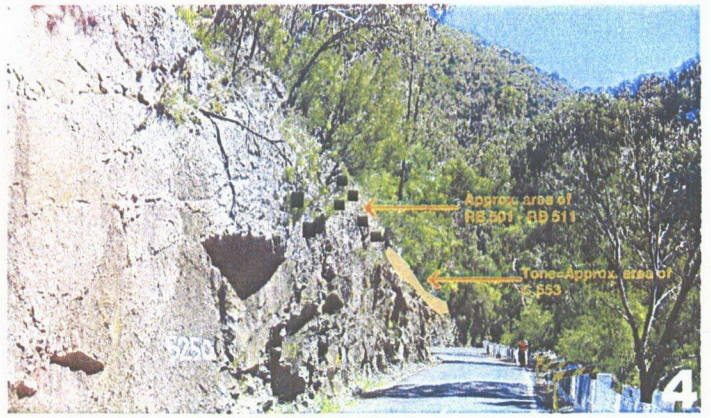
C 5.08 view south along Jenolan Caves Road 100m to cut section



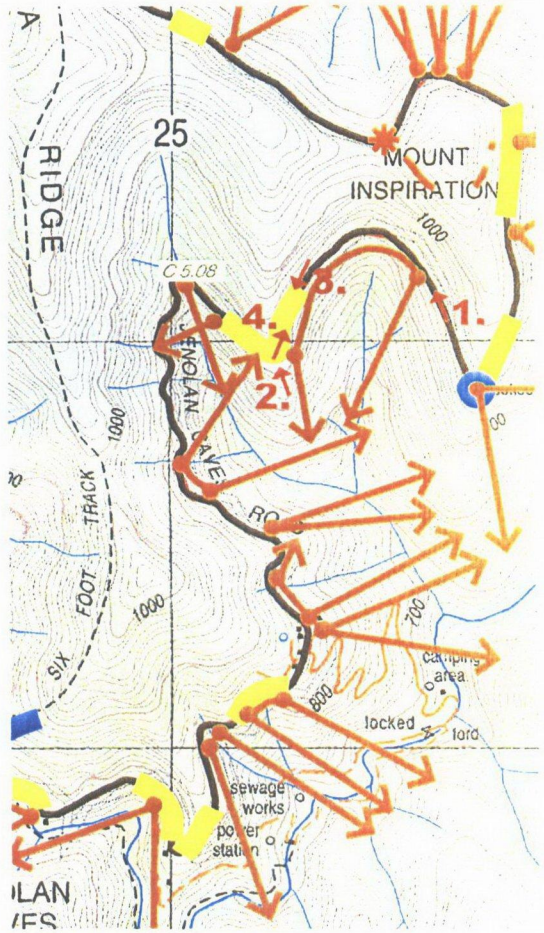
C 5.09 view east around hairpin bend section



C5.09 view south along start of cut section



C 5.061 view north along Jenolan Caves Road



Location: C 5.08 & Photo position

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Landscape Quality (Refer detail description in text)	Description of Surrounding Landscape Context	Significance of Existing Landscape Value/Medium Higher
Scope of work: Scaling, shotcrete, rock bolts, rock fall protection mesh and drainage. Proposed cut sections C5.250 - C5.360 Proposed cut sections C5.250 - C5.360 are not available at the time of the site assessment. This section contains scaling work above the normal line of crest work that could have a Moderate impact, thus raising the overall score from Low, to Moderate to Low. However, if the scaling work is carefully managed to minimise disruption to the vegetation line above the crest the overall impact could be maintained as Moderate to Low.	Vegetation: Eucalypt forest, Blue Gum High Forest and shrubby vegetation. Undistinctive area of little heritage significance. Landform: Steep to very steep slopes, rock outcrops, cliffs and boulders. Landuse: Tourism, guesthouses, restaurants, caves.	Close to Jenolan Caves village, steep rocky slopes, cliffs and boulders. Proposed cut sections C5.250 - C5.360 are not available at the time of the site assessment. This section contains scaling work above the normal line of crest work that could have a Moderate impact, thus raising the overall score from Low, to Moderate to Low. However, if the scaling work is carefully managed to minimise disruption to the vegetation line above the crest the overall impact could be maintained as Moderate to Low.	HIGH
Visual Prominence of Proposed Works: Moderate/High	Visual Quality of Proposed Works: Moderate/High	Visual Absorption Capability of Proposed Works: Moderate	HIGH
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW TO MEDIUM	Refer to Landscape Plans	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

MODERATE TO LOW VISUAL IMPACT

Details of proposed cut section C5.250 - C5.360 were not available at the time of the site assessment. This section contains scaling work above the normal line of crest work that could have a Moderate Impact, thus raising the overall score from Low, to Moderate to Low.
However, if the scaling work is carefully managed to minimise disruption to the vegetation line above the crest the overall impact could be maintained as Moderate to Low.

Legend

Viewpoint & Direction

Photo location & number

RTA Signage (proposed)

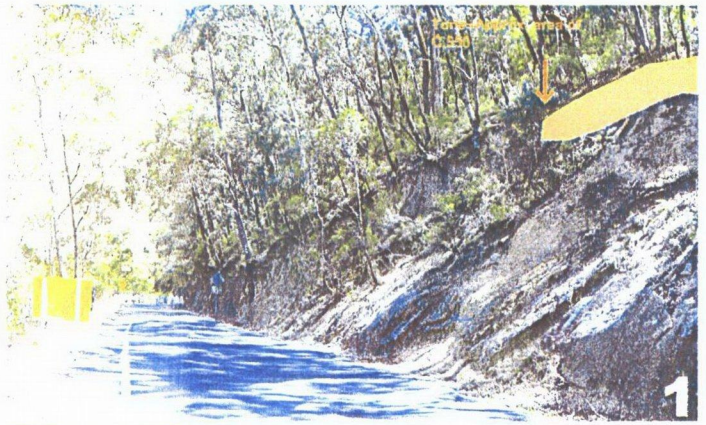
Cut section

Lookout

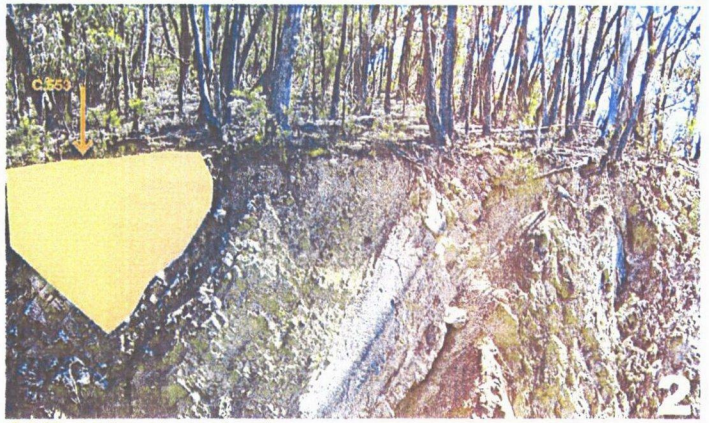
JENOLAN CAVES ROAD

UDO

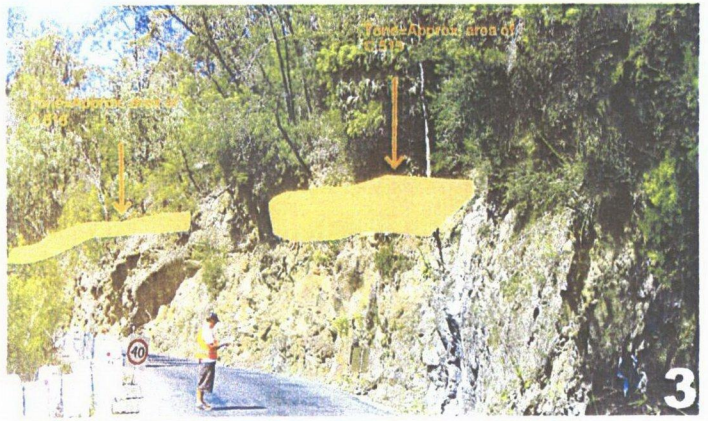
Landscape and Visual Assessment Proforma Sheet



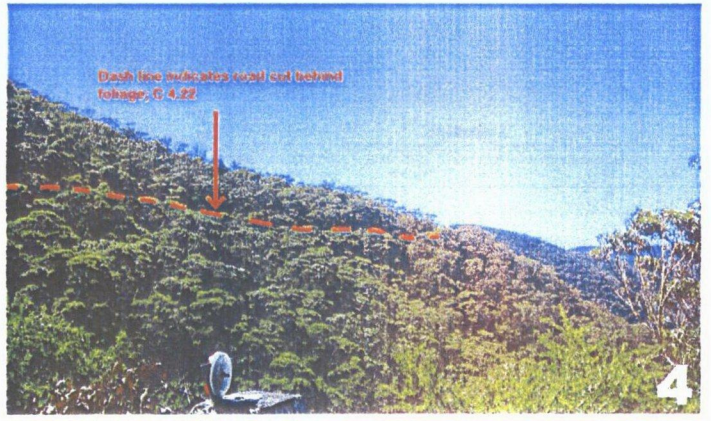
C 5.08- view south- C 5360



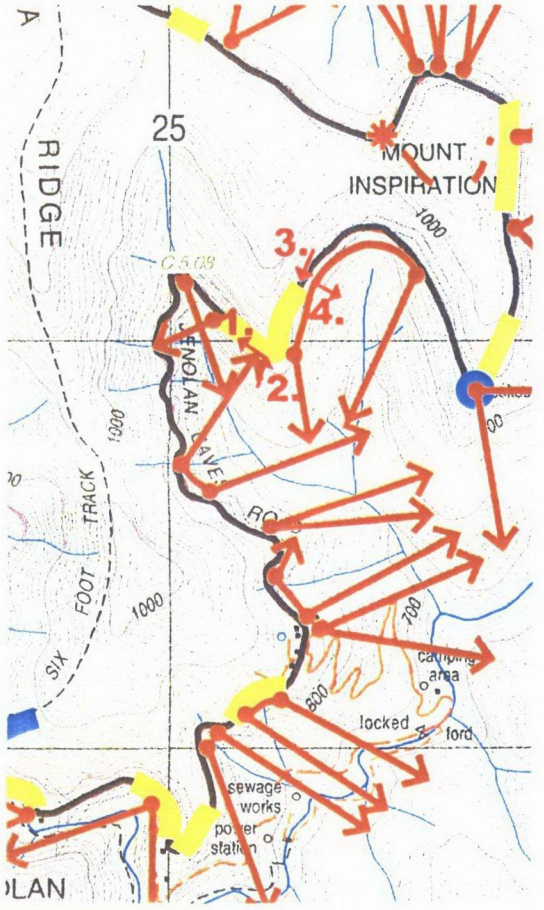
C 5.08- detail west on bend section



C 5.08- view south



C 5.08- view across valley to C 4.22



Location: C 5.08 & Photo position

Legend

- Extent of visual containment
- Photo location & number
- Cut batter
- View point & cardinal lines
- Natural boundary line
- RTA Storage compound
- Culvert

JENOLAN CAVES ROAD

UDO

REMEDIATION WORK SUMMARY

CUTTING C5.08
5080 - 5250

ID	Chainage Start	Chainage Finish	Remediation	Rainwater Mgt. Block Size (mm)	Approx. Weight Iron Ore / Weight to Crest (est)	Volume Estimate (m³)
C513	5080	5100	Retain	to 3000	3000 – 5000	100
C514	5100	5120	Reinstate boulder pack @ 5120	to 1000	2000 – 3000	100
C515	5120	5140	Reinstate boulder pack @ 5135	to 1000	2000	15
C515	5130	5140	Remove blocks	to 500	3000	
	5134	5140	Remove rock above crest	to 1000	2000	3 – 5
C516	5154	5170	Crest treatment and scaling	to 500	0 – 4000	5
C517	5165		Remove tree		2000	
C518	5168		Remove loose blocks		1000 – 3000	4 – 6
C519	5175	5177	Remove block		3000 – 4000	4 – 6
C520	5171	5190	Crest treatment and scaling	to 1000	1000 – 2000	2 – 10
C521	5188		Remove block	to 500	2000	2
C522	5200	5203	Reinstate rock face to correct orientation		2000 – 3000	100
	5207		2 x Rock Bolt		3000	
C523	5217		Remove block 3000 above crest	to 500	2000	5
	5230		2 x Rock Bolt		3000	
C524	5230		Reshape blocks on crest		4000	5
	5230		2 x Rock Bolts		3000	
C525	5235		Remove blocks above rock outlet blocks	to 500	4000 – 5000	
C526	5245		Remove blocks behind tree above crest	to 400	4000 – 7000	
	5245		2 x Rock Bolt		3000	

Estimated Quantities

Rock Bolts	11
Crest Treatment / Clear Vegetation	325 m²
Scaling of loose blocks	20 m³
Rock Fence	-

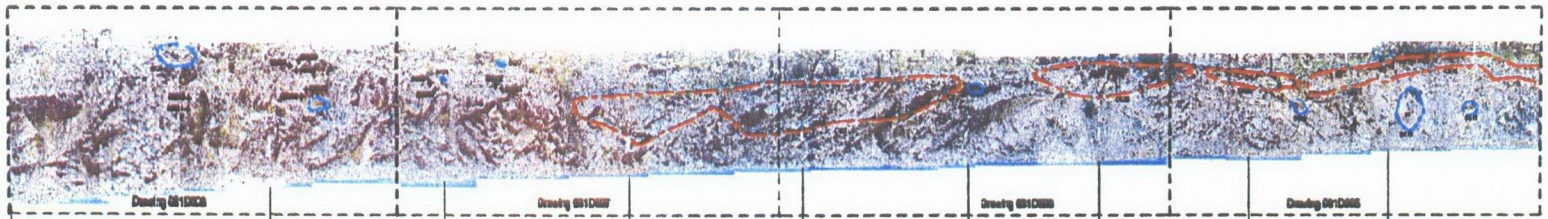
Rock Bolt Details

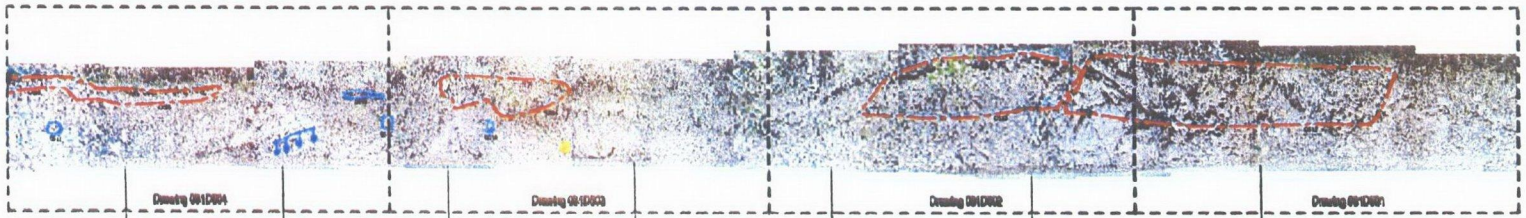
Bolt No.	Length (mm)	Inclination
RB 501	3000	15°
RB 502	3000	15°
RB 503	3000	15°
RB 504	3000	15°
RB 505	3000	15°
RB 506	3000	15°
RB 507	3000	15°
RB 508	3000	15°

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +R2501 ROCK BOLT
- SEEPAGE





TA	TENDER ISSUE	GRW	09.02.05	GRW	09.02.05	
P	PRELIMINARY ISSUE	GRW	17.1.05	GRW	17.1.05	
ISSUES	DESCRIPTION	DRN DATE		CHKD DATE		APPROVED DATE

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GRW	09.02.05
GRW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JERVIS BAY ROAD

REMEDIATION WORK SUMMARY
CUTTING C5.08
CHAINAGE 5080 - 5250

0462209 | 081D500 | T0

GOLDERS WORKSHEET C 5.08

REMEDIATION WORK SUMMARY

CUTTING C5.29
5200 - 5360

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
	5200	5260	Increase drain width till rock catch fence			
5200	5257		Remove blocks	to 500	6000	<1
5251	5258		Remove block	to 500	4000	<1
5253	5275	5275	Remove scarp of rock	to 1000	6000	3
C5253	5255	5300	Remove scarp of blocky rock	to 400	2000 – 6000	5
5254	5260	5300	Remove blocks	to 800	4000 – 6000	3
	5260	5310	Pattern Rock Bolts		2000 – 6000	
C5260	5300	5310	Remove unstable blocks	to 2000	1500 – 4000	5 – 10
C5270	5300	5315	Crest Treatment	to 500	2000 – 4000	5
C5287	5311	5360	Grouting	to 1000	2000 – 6000	15 – 20
C5300	5305	5360	Scale blocks above crest	to 500	4000	5 – 10
	5308		3 x Rock Bolts		2000 – 3000	
C5310	5308	5360	Crest Treatment / Scale blocks above crest		4000	30 – 40

Estimated Quantities

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

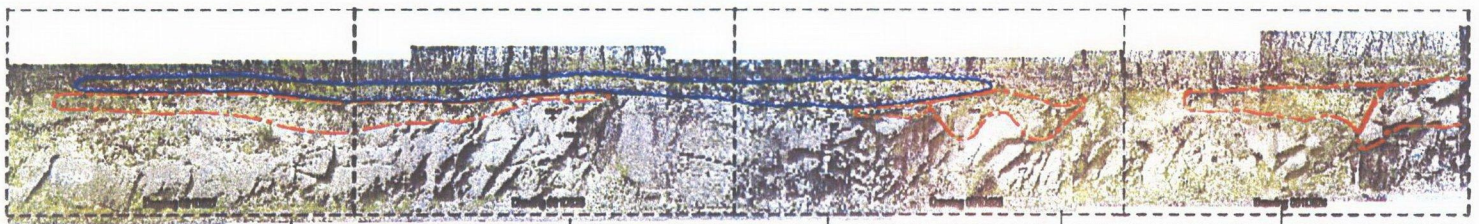
Rock Bolt details

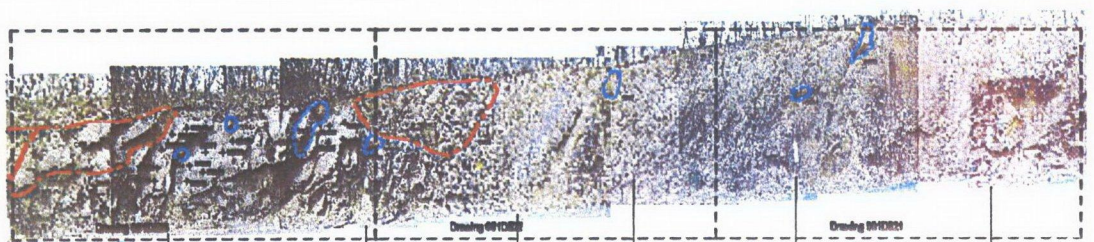
Bolt No.	Length (mm)	Inclination
RB 530	3000	30°
RB 531	3000	30°
RB 532	3000	30°
RB 533	3000	30°
RB 534	2100	30°
RB 535	2100	30°
RB 536	2100	30°
RB 537	2100	30°
RB 538	2100	30°
RB 539	2100	30°
RB 540	2100	30°
RB 541	2100	30°
RB 542	2100	30°
RB 543	2100	30°
RB 544	2100	30°
RB 545	3000	10°
RB 546	3000	10°
RB 547	3000	10°

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- SCALE BLOCK ABOVE CREST
- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +RB545 ROCK BOLT





Rev	Description	Drawn	Date	Chkd	Date
Y6	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05

RTA

Golder Associates

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

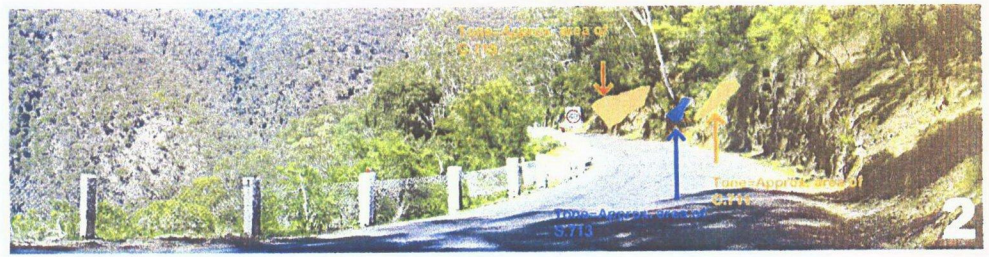
REMEDIATION WORK SUMMARY
CUTTING C5.29
CHAINAGE 5250 - 5360

081D520 T0

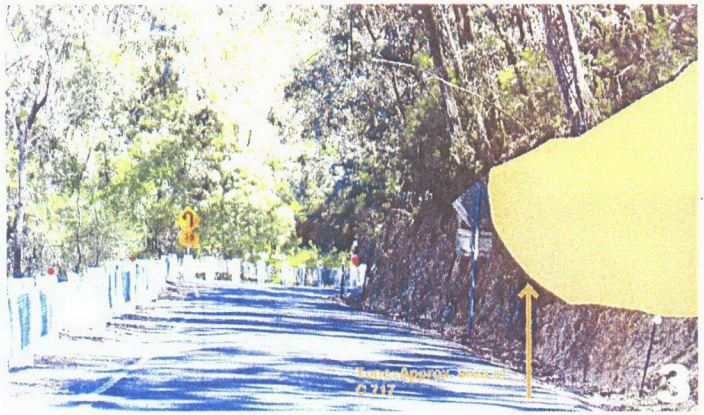
GOLDERS WORKSHEET C 5.29

Landscape and Visual Assessment Proforma Sheet

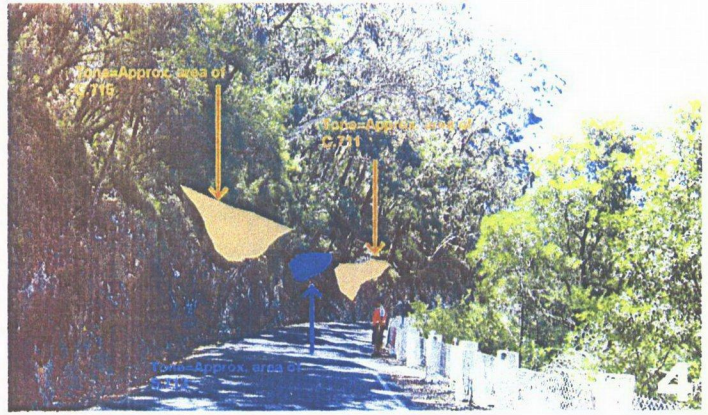
C7.00 - view south along Jenolan Caves Road



C7.02 - view south (east) just below cut section



C7.02 - view south towards cut section (detail)



C 7.02 - view north along Jenolan Caves Road

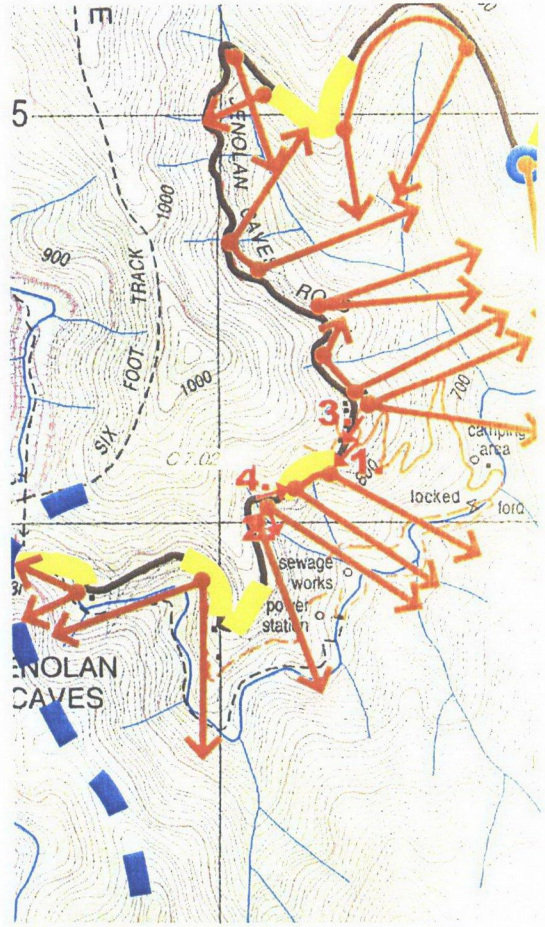
VISUAL ANALYSIS			
Existing Landscape Character (refer to Visual Components sheet)	Description of Existing Landscape (refer to Visual Components sheet)	Description of Project and Location	Significance of Existing Landscape (Low, Medium or High)
[illegible]	[illegible]	[illegible]	HIGH
Significance of Landscape Modification for the Project (Low, Medium or High)	Visual Sensitivity of Viewers for the Project (Low, Medium or High)	Significance of Landscape Modification for the Project (Natural, Environmental, Social)	Impact
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW to MEDIUM	Natural, Environmental	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

The proposed work is crest work at C 7.16 and C 7.17 represents a major work area. However, most of the material to be removed appears to be fairly loose topsoil and herbaceous vegetation. There are a number of trees potentially affected by the work, but as the photographs demonstrate there is sufficient and substantial tree cover to maintain a solid screen of foliage after the proposed works, as is generally the case throughout the proposal.

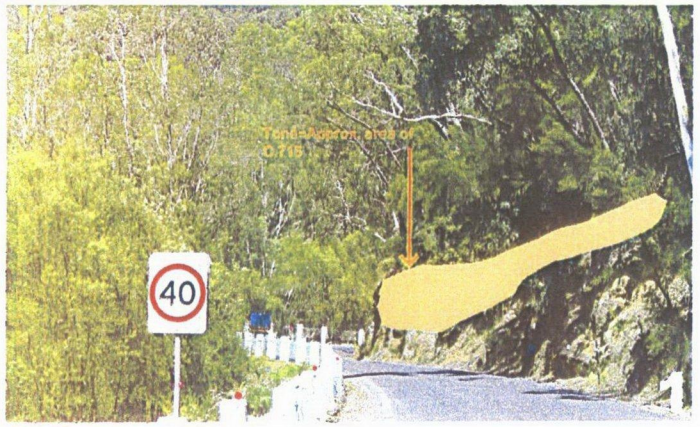


Location; C 7.02 & Photo position

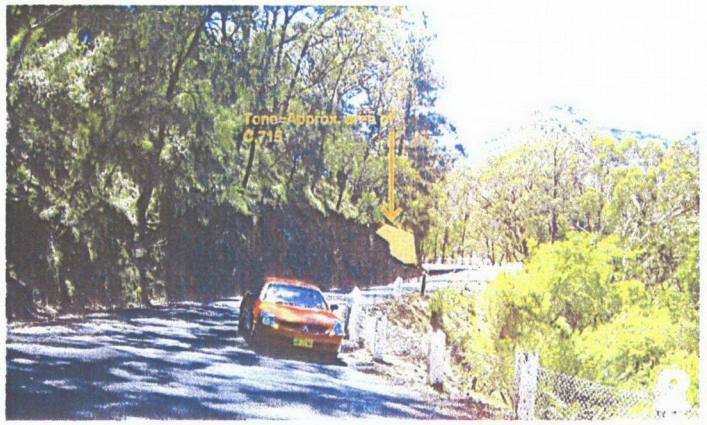
Legend

- Viewpoint & sight lines
- Extent of visual catchment
- Noise Barrier(s) (m)
- 1. Photo location & reference
- RTA Storage compound
- Cut section
- Location

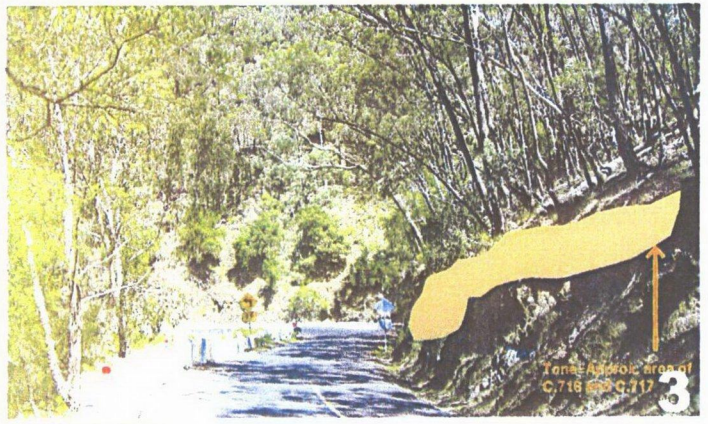
Landscape and Visual Assessment Proforma Sheet



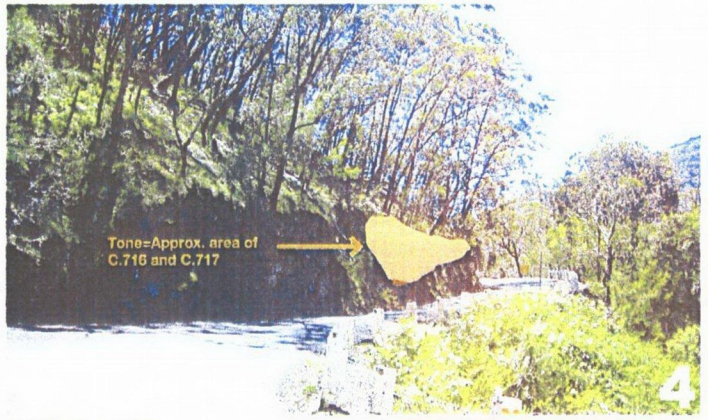
C 7.02- view south



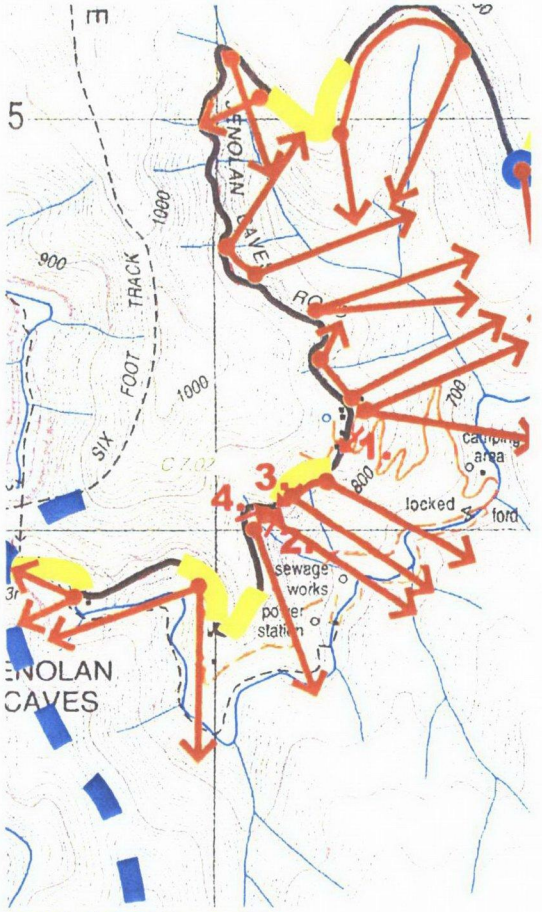
C 7.02- view north



C 7.02- view south



C 7.02- view north



Location, C 7.02 & Photo position

Legend

JENOLAN CAVES ROAD

UDO

REMEDIATION WORK SUMMARY
CUTTING C7.02
7020 - 7120

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
	7010		1 x Rock Bolt		2500 - 3500	
C 710	7030		Remove block	to 1000	5000	<1
C 711	7047	7065	Rock revetation and ensure overall condition		3000 - 5000	
C 712	7061		Remove blocks	to 800	4500 - 5000	<1
C 713	7067	7080	Remove blocks & clean for RB's behind blocks	to 1500	1500 - 2500	5
C 714	7080		Remove RB's		2500	
	7083		1 x Rock Bolt		3500	
C 715	7087	7075	Key with steps in corners and head and notch clean with other clean out debris at C7	to 1000	1500 - 2500	200
C 716	7080	7125	Key with steps in corners and head and notch clean with other clean	to 2000	1500 - 3500	100
C 717	7105	7120	Key with steps in corners and head and notch clean with other clean	to 2000	1500 - 3500	200

Estimated Quantities

Rock Bolts	4
Scrap Treatment / Clear Vegetation	500 m²
Scaling of loose blocks	5 m²
Rock Fence	–

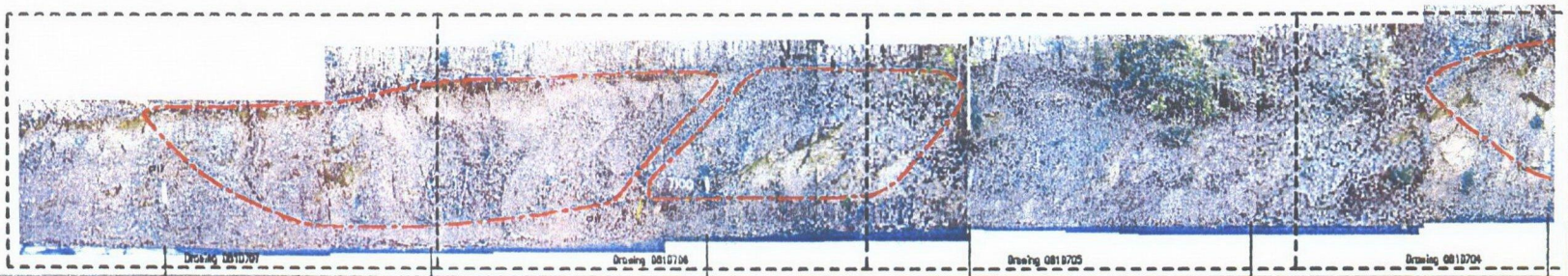
INTERPRETIVE ONLY DO NOT SCALE

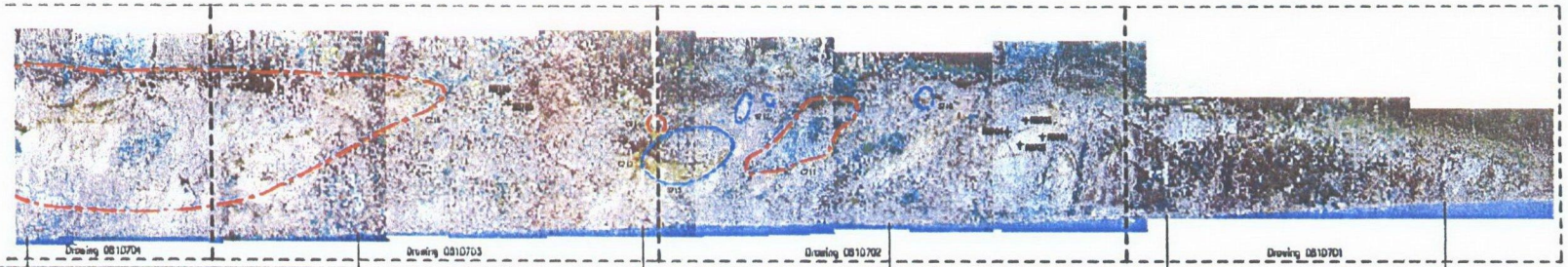
Rock Bolt Details

RB No.	L*DIA* (mm)	EXPANSION
RB 701	3000	17
RB 702	3000	17
RB 703	3000	17
RB 704	3000	17
RB 705	3000	17
RB 706	3000	17
RB 707	3000	17

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +RB703 ROCK BOLT



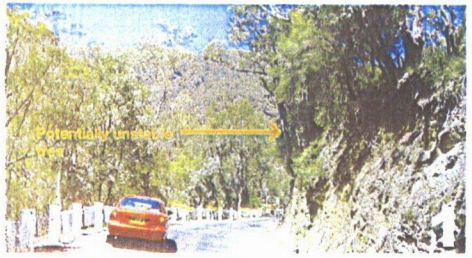


JC	09.02.05	GKW	09.02.05	ROADS AND TRAFFIC AUTHORITY	SLOPE REMEDIATION, JENOLAN CAVES ROAD
GKW	09.02.05	GKS	09.02.05	REMEDIATION WORK SUMMARY CUTTING C7.02 CHAINAGE 7020 - 7120	
GKS	09.02.05	NOT TO SCALE	A1	0462209	081D700 T0

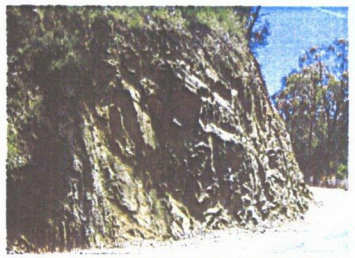
Golder Associates

GOLDERS WORKSHEET C 7.02

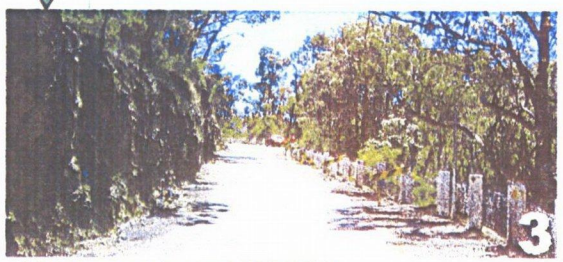
Landscape and Visual Assessment Proforma Sheet



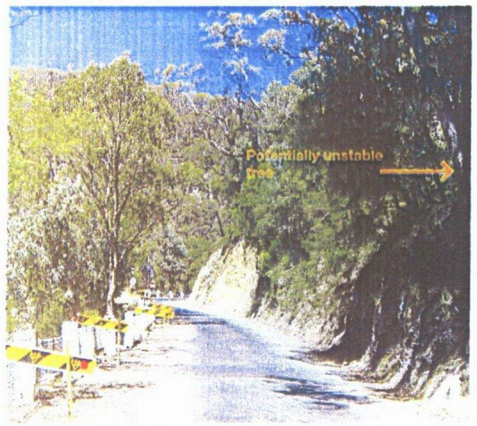
C 7.4- view south from C 7380



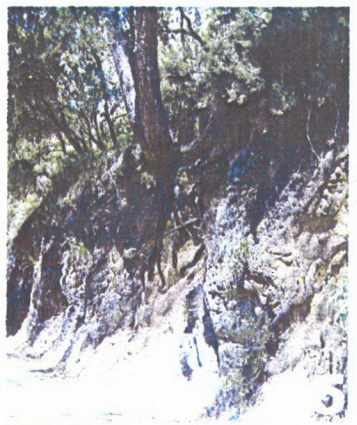
C 7.4- detail of rock face that may require scaling and rock bolts



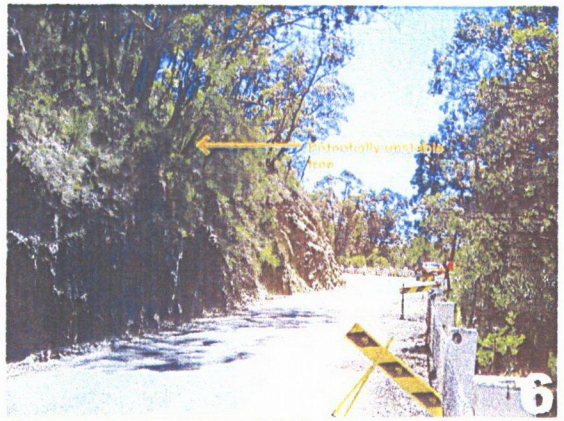
C 7.4- view north from end of Wall 40/41



C 7.4- view south from approx. C 7400



C 7.4- detail of unstable tree that may require removal

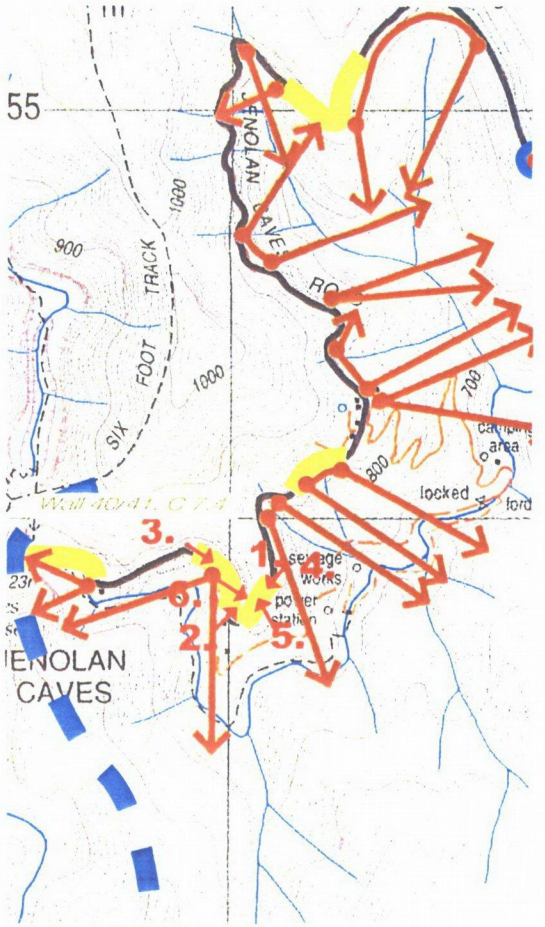


C 7.4 view north from approx. C 7500

VISUAL ANALYSIS			
Existing Landscape Quality (ie: Scenic, Attractive, Ordinary) (Refer detail description on text)	Description of Existing Vegetation (Refer detail description on text)	Description of Adjacent Landform	Significance of Existing Landscape (Low, Medium, High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1140 metres above sea level. Rocky outcrops and areas of bare rock are rare, with a system of natural watershed streams and creeks with some pools. Landscape is characterised by predominately undisturbed bushland.	Open forest of up to 10m high trees, *Eucalyptus piperita, Eucalyptus cypellocarpa* and *Acacia melanoxylon*. Understorey of 2m-3m high shrubs, eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1140 metres above sea level.	HIGH
Sensitivity of Landscape to Alteration by the Proposal (Low, Moderate, High)	Views Sensitivity to Alteration by the Proposal (Low, Moderate, High)	Significance of Existing Views (Local, State/Regional, National/ International)	Notes
LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY
LOW VISUAL IMPACT
At the time of the on site assessment no details were available for Wall 40/41, C 7.4. However, an assessment was made based on the scale of work detailed for the other sites. It was assumed that most of the proposed work would consist of crest work to tidy up and remove unstable material/ vegetation, rock face scaling and rock bolts. This a relatively short section of cut face of only 100m.



Location C 7.4 & Photo location

Legend

Viewpoint & field of view

Extent of visual catchment

Photo location & number

REMEDIATION WORK SUMMARY
CUTTING C7.44
7440 - 7490

ID	Chainage Start	Chainage Finish	Remediation	Estimate Maj. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
C743	7443	7515	Rockfall	to 500	1500 - 4000	<20
	7490	7444	2 x Rock Bolt		3000	
C744	7490	7497	Rockfall	to 500	4000 - 5000	5

Estimated Quantities

Rock Bolts	2
Crest Treatment / Clear vegetation	20 m²
Scaling of loose blocks	–
Rock Fence	–

INTERPRETIVE ONLY
DO NOT SCALE

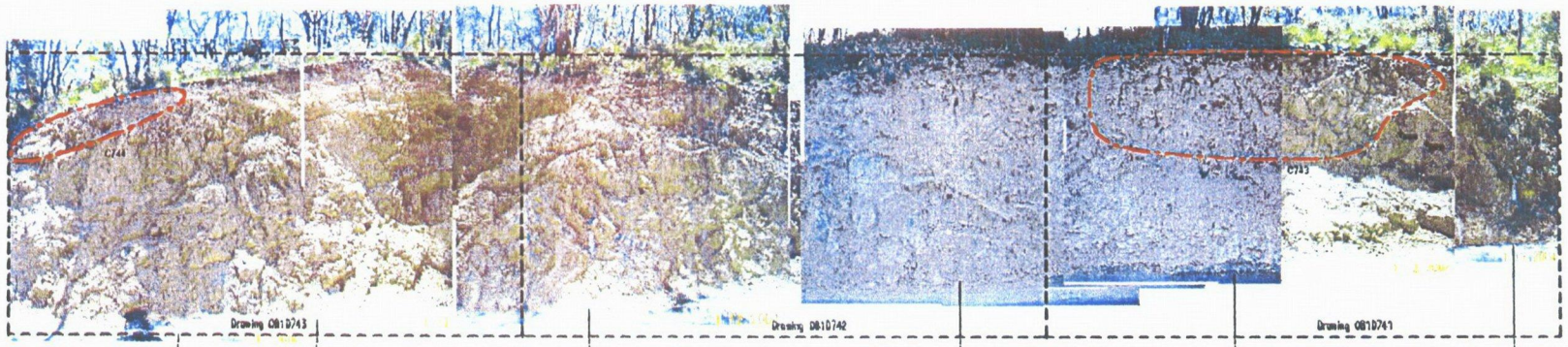
Rock Bolt Details

Bolt No.	Length (mm)	Diameter
RB741	7.5m	32
RB742	7.5m	32

NOTE: EXCAVATION OF OVERHANG IS TO ENSURE STABILITY OF ROCK OPEN FACE LOWER OF CUTTING. EXTENTS AND DEPTH OF CUTS OF OPEN IS 500 mm AND 3000 mm.

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- + RB740 ROCK BOLT



1a	TENDER ISSUE	GRW	09.02.05	GRS	09.02.05
P	PRELIMINARY ISSUE	GRW	07.11.05	GRS	07.11.05
ISSUED	DESCRIPTION	DRAWN	DATE	CHECKED	DATE

RTA

Golder Associates

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GRW	09.02.05
GRW	09.02.05	GRS	09.02.05
GRS	09.02.05	NOT TO SCALE	A1

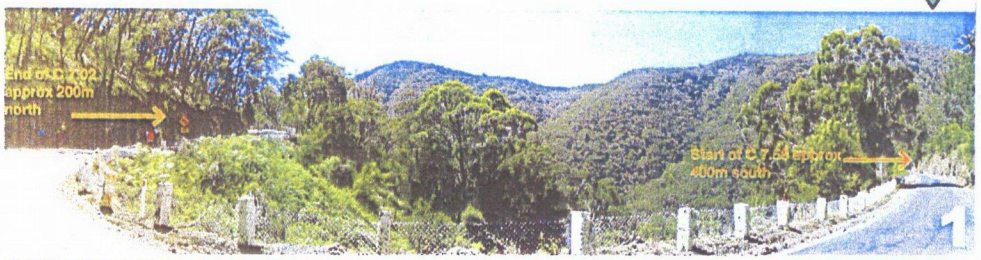
SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C7.44
CHAINAGE 7440 - 7490

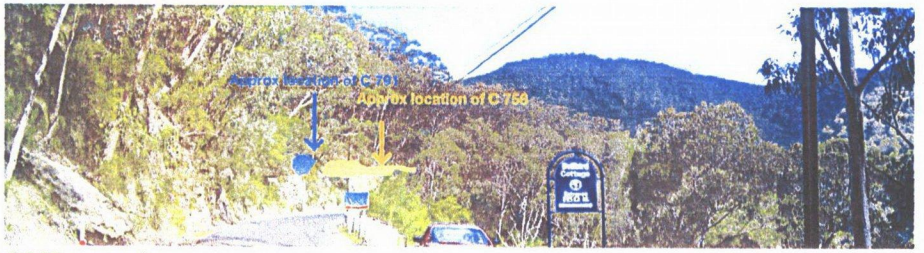
04022001 | 081D740 | T0

GOLDERS WORKSHEET C 7.4

Landscape and Visual Assessment Proforma Sheet



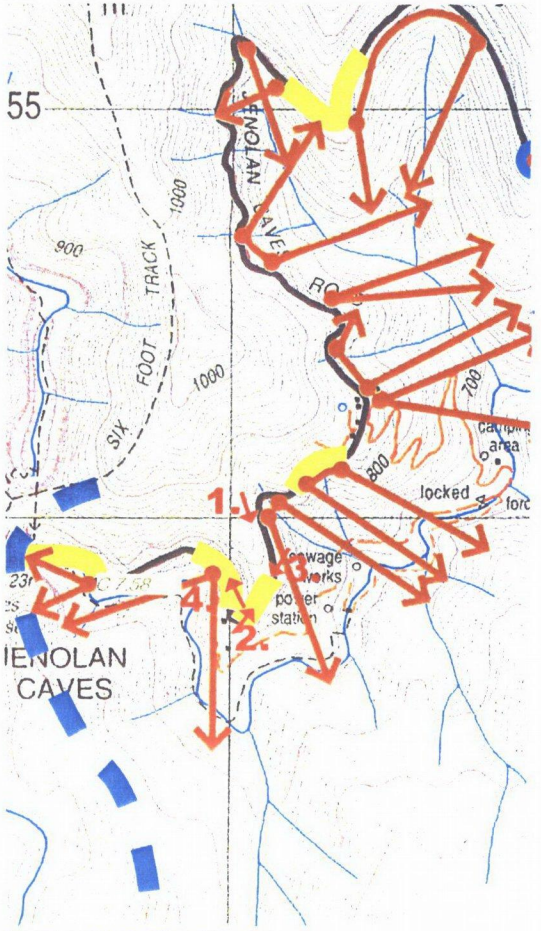
C 7.58- view east towards visual catchment



C 7.58- view north

C 7.58- view south towards cut section

C 7.58- view north along Jenolan Caves Road



Location, C 7.58 & Photo position

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level. Broad sclerophyll forests of these areas, mixed with a system of natural open-mid streams, and associated water bodies. Landscape is generally, pristine natural undisturbed condition.	Open forest of up to 10m high trees: *Eucalyptus brevistyla, Eucalyptus* , and *Acacia oxleyi*. Understorey of 2m-5m high shrubs: eg. Urtikithem, Broad-leaved Hickory. Common groundcover species include Lomandra, native grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1150 metres above sea level.	HIGH
Landscape Character to Absorb the Proposal (Low/Medium/High)	Visual Sensitivity to Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/National/ International)	Notes
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

This section is longer than the average at 220m and the cut faces are quite high. However, the proposal, which consists of rock bolts, crest and scaling works, is comparatively small in scale when compared with the landscape context. The apparently large areas of scaling in Photograph 1 above would have little impact as they will effectively have the same appearance of bare rock on completion.
As with the other cuts, the net result of the proposal will be to slightly alter the existing combination of elements rather than make a major change.

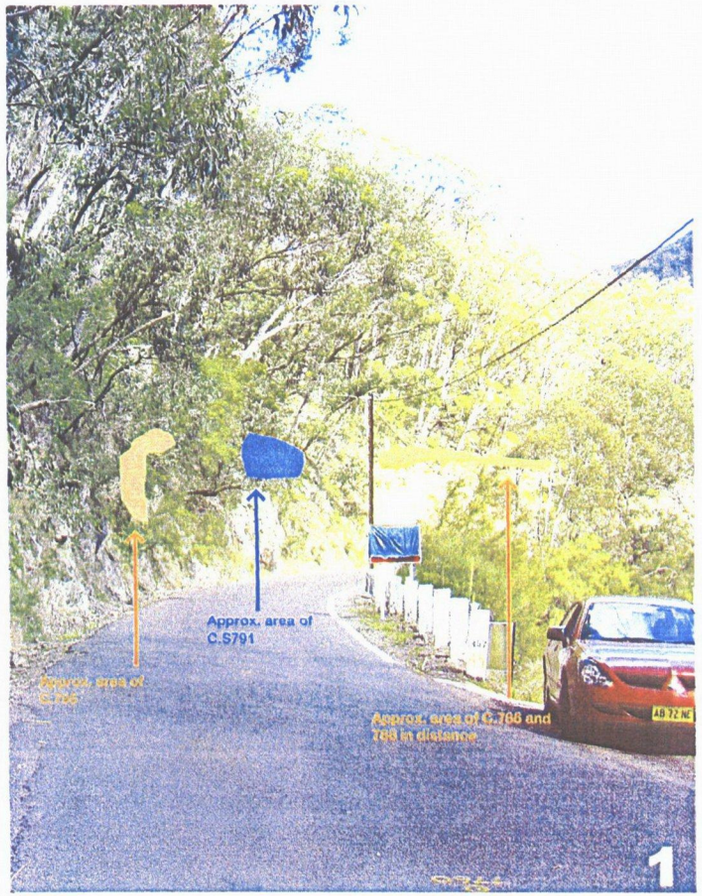
Legend

View point & path lines — Extent of visual cut impact — Noticeable other cut — 1.→ Photo location & number — RTA Storage compound — Cut surface — Location

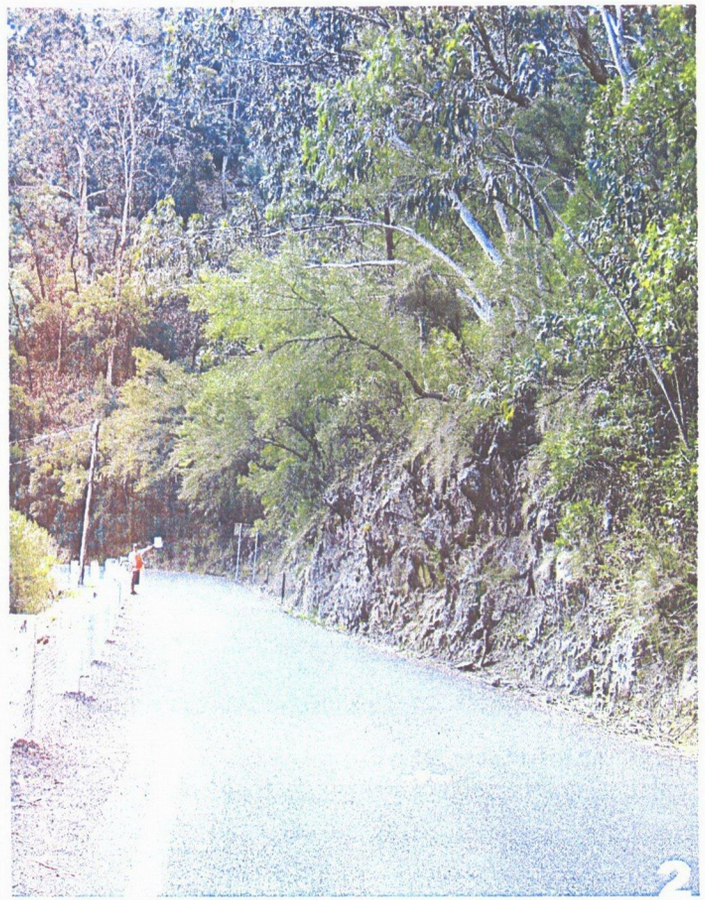
JENOLAN CAVES ROAD

UDO

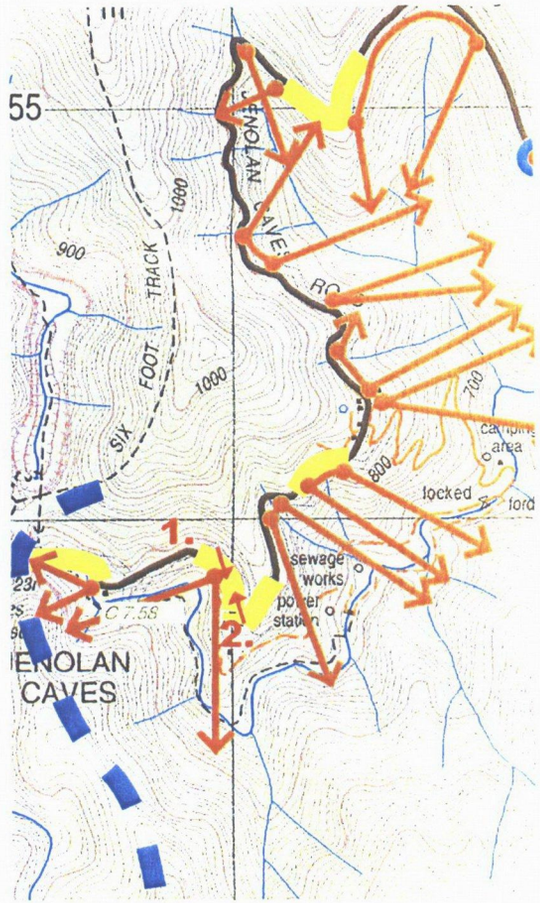
Landscape and Visual Assessment Proforma Sheet



C 7.58 view north from C 7760



C 7.58 view south from C 7770 . No work details available at time of assessment



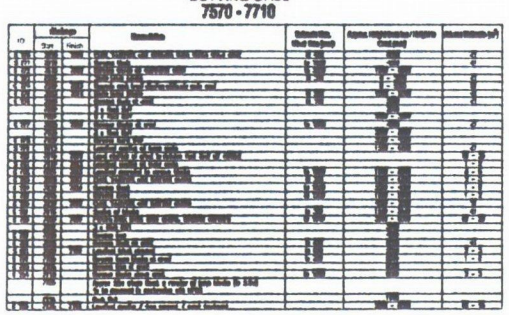
Location: C 7.58 & Photo position
(Not to Scale)

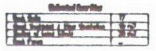
Legend

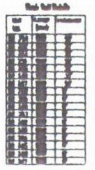
JENOLAN CAVES ROAD

UDO

REMEDIATION WORK SUMMARY
CUTTING C7.58
7570 - 7710



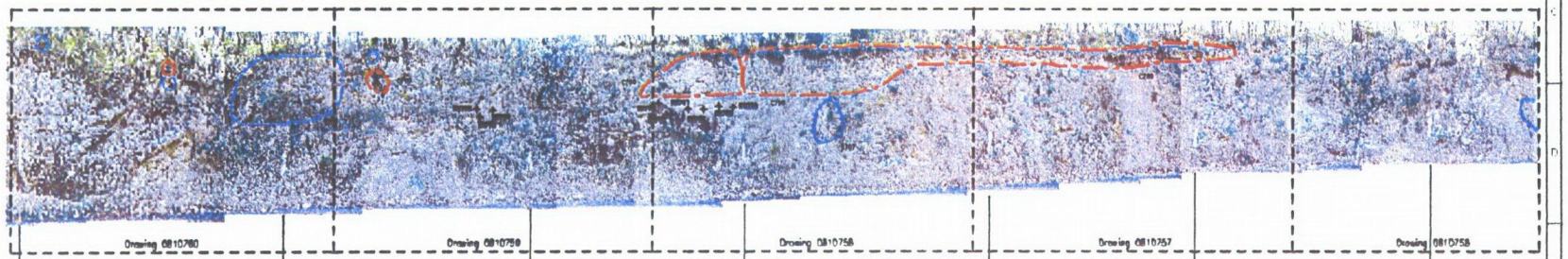


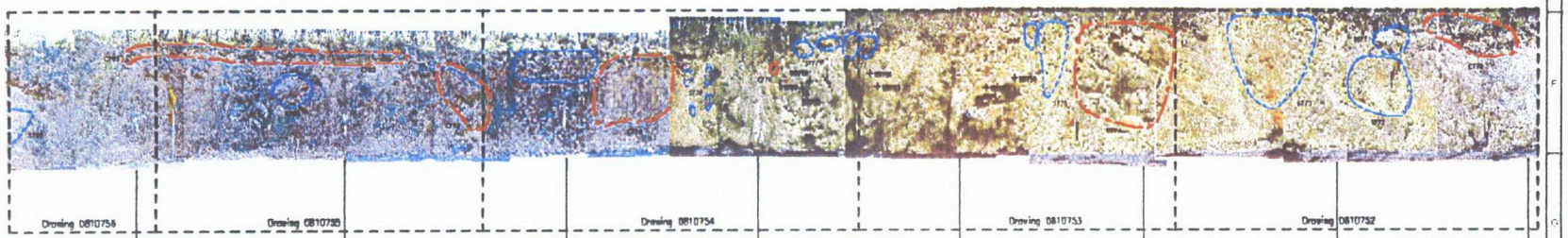


INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +RB758 ROCK BOLT





REV	DESCRIPTION	DRAWN	CHECKED	APPROVED
T0	TENDER ISSUE	GKW 09.2.05	GRS 09.2.05	
P	PRELIMINARY ISSUE	GKW 17.1.05	GRS 17.1.05	

Golder Associates

GOLDER ASSOCIATES PTY. LTD.

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GRS	09.02.05
GRS	09.02.05	NOT TO SCALE	A1

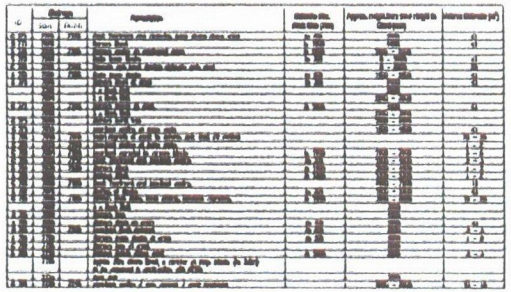
SLOPE REMEDIATION, BERRY'S CANYON

REMEDIATION WORK SUMMARY
CUTTING C7.58
CHAINAGE 7570 - 7710

045209R | 081D750 | T0

GOLDERS WORKSHEET C 7.58
SHEET 1 of 2

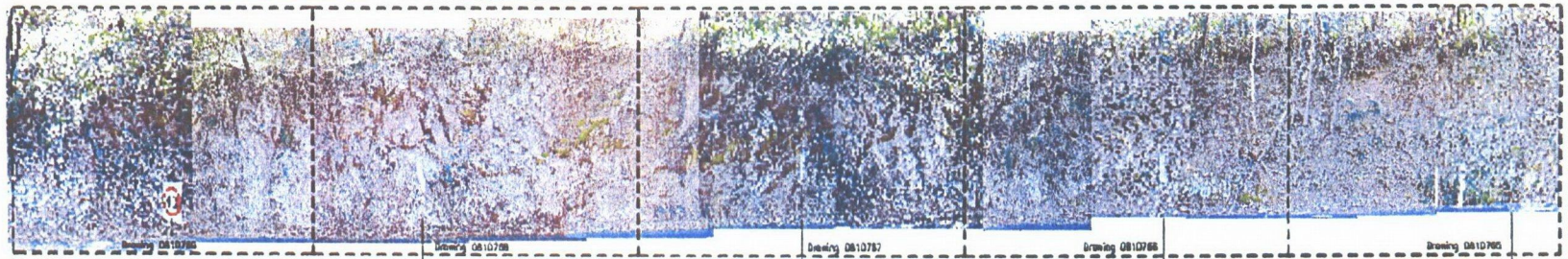
REMEDIATION WORK SUMMARY
CUTTING C7.58
7035 - 7120

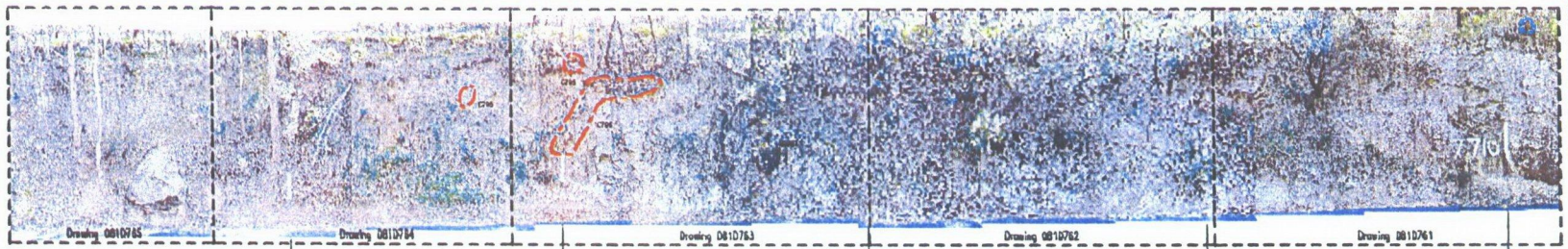


INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +RB501 ROCK BOLT





ROADS AND TRAFFIC AUTHORITY				SLOPE REMEDIATION, JENOLAN CAVES ROAD	
JC	09.02.05	GKW	09.02.05	REMEDIATION WORK SUMMARY CUTTING C7.58 CHAINAGE 7710 - 7800	
GKW	09.02.05	GKS	09.02.05		
GKS	09.02.05	NOT TO SCALE	A1	0422001	081D751 T0

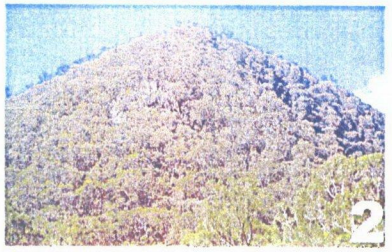
Golder Associates

GOLDERS WORKSHEET C 7.58
SHEET 2 of 2

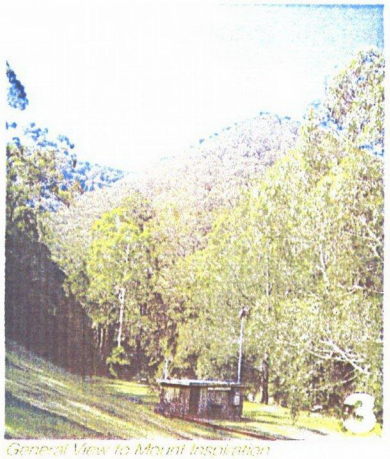
UDO

Landscape and Visual Assessment Proforma Sheet

General View to Mount Inspiration Lookout



View to Mount Inspiration Lookout - distal



General View to Mount Inspiration

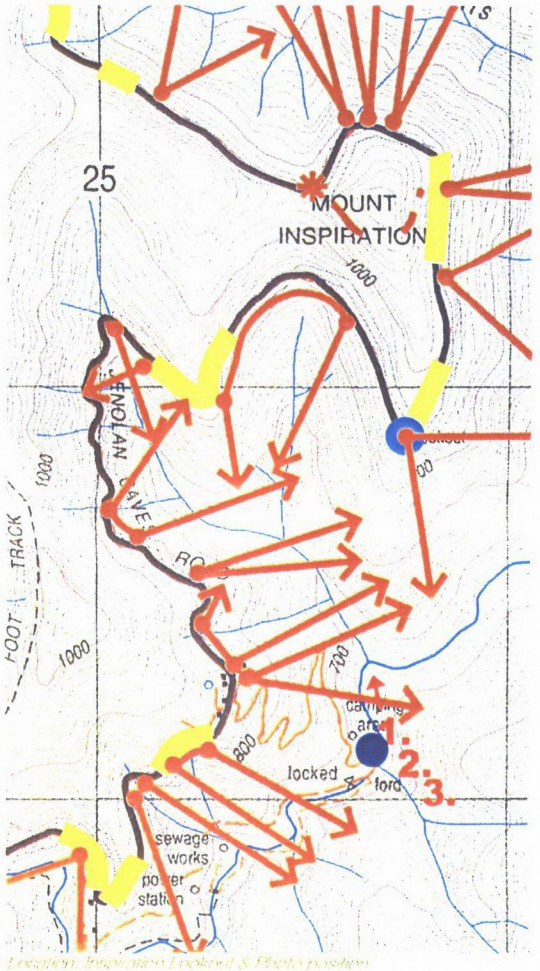
VISUAL ANALYSIS			
Section C: Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Steep to very steep valleys, steep ridges and crests. Elevations between 740 and 1160 metres above sea level. Road overlooks a series of deep valleys, incised with a system of tributary ephemeral streams and permanent water bodies. Landscape consist of predominantly natural eucalypt woodlands.	Open forest of up to 10m high trees: *Eucalyptus levopidia, E.eugenioides , E. veluntis,* and *Acacia implexa.* Understorey of 2m-3m high shrubs: eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, natives grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1160 metres above sea level.	HIGH
Sensitivity of Landscape to Alteration by the Proposal (Low/Medium/High)	Viewer Sensitivity To Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/ National/ International)	Notes
CONSTRUCTION PHASE: LOW OPERATION PHASE: LOW	LOW to MEDIUM	National/International	Sitting area require weed eradication program, new furniture and general tidy up.

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

VISUAL IMPACT OF PROPOSAL

The campsite is approx. 150m below C. 7000.
An assessment was made of the proposal from the vantage point of this popular campsite in order to establish which, if any, of the proposed works could be seen from this vantage point.
Views out from the campsite are framed by existing , dense tree foliage to about 60 degrees. None of the proposed works were visible within this view corridor.

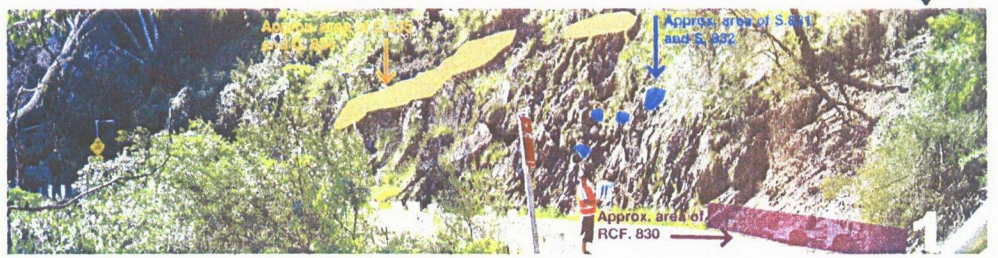


Location, Inspiration Lookout & Photo position

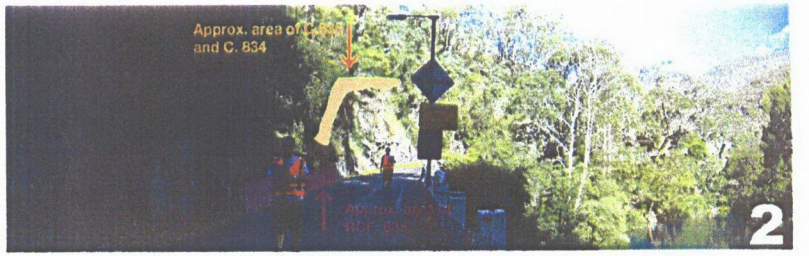
Legend

View point & cone lines
Extent of visual catchment
Noticeable view-line
1. Photo location & number
RTA Storage compound
Cut section
Lookout

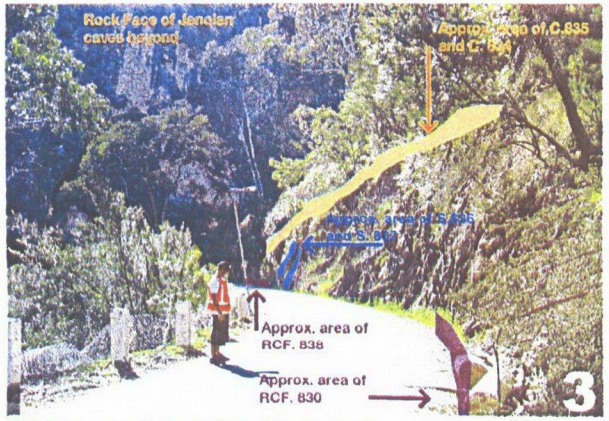
Landscape and Visual Assessment Proforma Sheet



C 8.13- view south towards Jenolan Caves



C 8.13- view north along Jenolan Caves road



C 8.13- view south towards start of cut section

C 8.13- view north to start of cut section

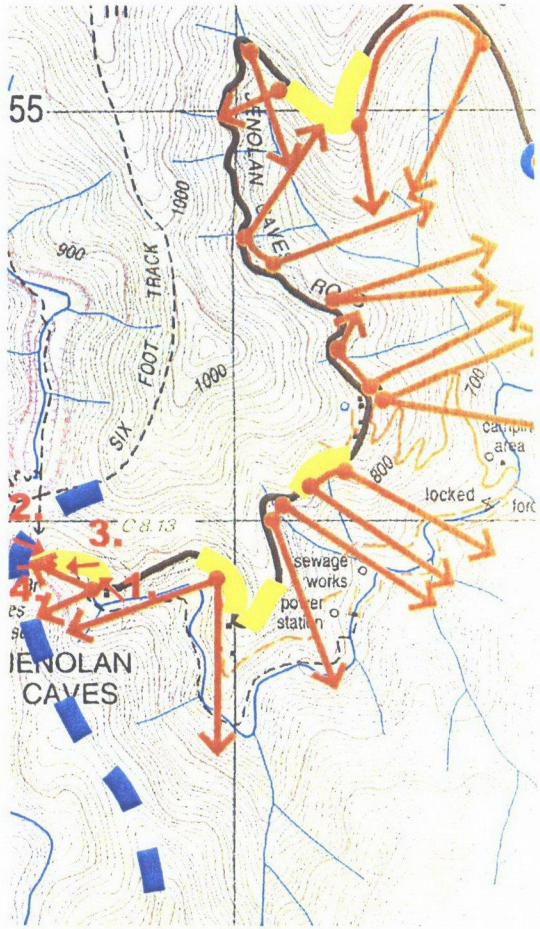
VISUAL ANALYSIS			
Description of the Visual Catchment (Extent and Visual Description of Area)	Description of Existing Vegetation (Nature and Characteristics of Vegetation)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Moderate/High)
Views to the south within the Jenolan Caves Road corridor are restricted to the immediate foreground due to the steep rock faces and dense vegetation on either side of the road. Views to the north are also restricted due to the steep rock face on the eastern side of the road. Views to the west are restricted by the steep rock face and dense vegetation on the western side of the road. Views to the east are restricted by the steep rock face and dense vegetation on the eastern side of the road. Views to the north and south are restricted by the steep rock face and dense vegetation on the eastern side of the road. Views to the west are restricted by the steep rock face and dense vegetation on the western side of the road.	Vegetation on the eastern side of the road is dense and consists of a mix of native trees and shrubs. Vegetation on the western side of the road is also dense and consists of a mix of native trees and shrubs. Vegetation on the eastern side of the road is dense and consists of a mix of native trees and shrubs. Vegetation on the western side of the road is also dense and consists of a mix of native trees and shrubs.	The landform is steep and rocky. The road is cut into the hillside. The landform is steep and rocky. The road is cut into the hillside.	HIGH
Sensitivity of Landscape Affected by the Proposal (Low/Medium/High)	Visual Sensitivity of the Proposal (Low/Medium/High)	Significance of Existing Visual Impacts	Notes
CONSTRUCTION PHASE: LOW - MEDIUM OPERATION PHASE: LOW	LOW TO MEDIUM	Minimal disturbance	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY

LOW VISUAL IMPACT

At the time of the on site assessment a number of recently felled trees were noted within the site area with no apparent loss of visual quality or apparent impact upon the landscape character of the site. (It was also noted that it may would be beneficial to trim back or remove selected trees in order to open up views to certain landscape features -in particular the views up to the Carlotta Arch.
Photographs 2 and 4 on Sheet #2 illustrate this.



Location: C 8.13 & Photo position

Legend

JENOLAN CAVES ROAD

UDO

REMEDIATION WORK SUMMARY

CUTTING C8.13
8.100 - 8.210

ID	Castings: Shown	Castings: Finish	Remediation	Estimate Min. Rock Size (mm)	Approx. Height from toe / height to Crest (mm)	Volume Estimate (m³)
[illegible]	[illegible]	[illegible]	Rock catch fence			
B 8.100	[illegible]		Scale loose rock	to 300	1600 - 3000	<1
	[illegible]	[illegible]	Pattern Rock Bolts		1500 - 3000	
B 8.000	[illegible]	[illegible]	Rock Bolts	to 1000	3000 - 7000	<1
C 8.000	[illegible]	[illegible]	Remove loose and fractured rocks at crest	to 300	3400	<1
	[illegible]		1 x Rock Bolt		2400	
	[illegible]		2 x Rock Bolt			
C 8.000	[illegible]	[illegible]	Remove blocks at crest	to 300	6200 - 10000	3
C 8.000	[illegible]	[illegible]	Clear vegetation and rock from blocks and crest			
B 8.000	[illegible]		Remove blocks & over stressed bars		400 - 3000	<1
B 8.000	[illegible]		Scale loose blocks	to 1000	3000 - 7000	<1
	[illegible]		1 x Rock Bolt		3400	
B/C 8.000	[illegible]	[illegible]	Rock pattern Rocks			
C 8.000	[illegible]	[illegible]	Scale loose/over stress blocks at crest	to 300	3400 - 4400	3
	[illegible]	[illegible]	Pattern Rock Bolts with mesh attached / localised meshing		1500 - 4000	
B 8.000	[illegible]		Remove rock mesh	to 1000	3000 - 7000	3
	[illegible]		2 x Rock Bolt		3400	
B 8.000	[illegible]	[illegible]	Secure mesh rock bolt	to 300	3000 - 7000	3
C 8.000	[illegible]	[illegible]	Clear vegetation and rock from blocks and crest	to 300	1600 - 3000	<1

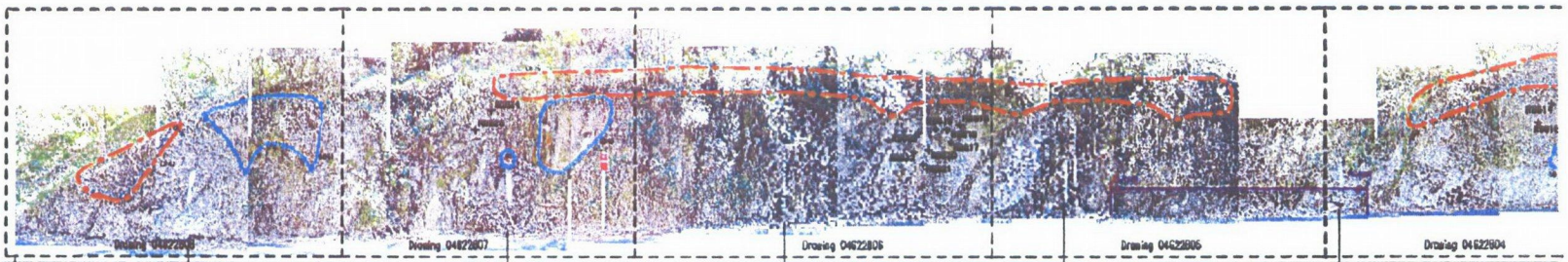
Bolt No.	Length (mm)	Inclination
[illegible]	[illegible]	[illegible]

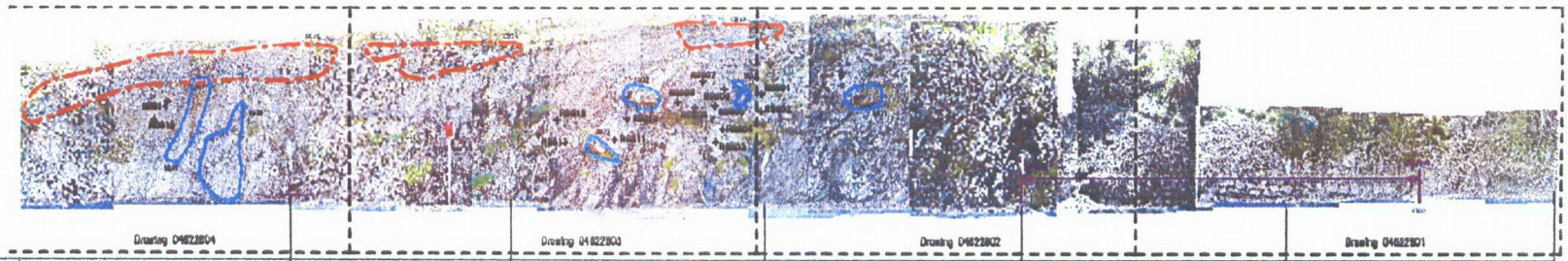
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- RB805 + ROCK BOLT
- CREST TREATMENT/CLEAR VEGETATION
- SCALING OF LOOSE BLOCKS
- ROCK CATCH FENCE





TO	TENDER ISSUE	GRW	09.02.05	GKS	09.02.05
P	PRELIMINARY ISSUE	GKS	14.12.04	GKS	14.12.04
ISSUED	DESCRIPTION	DRAWN	DATE	APPROVED	DATE

RTA

Golder Associates

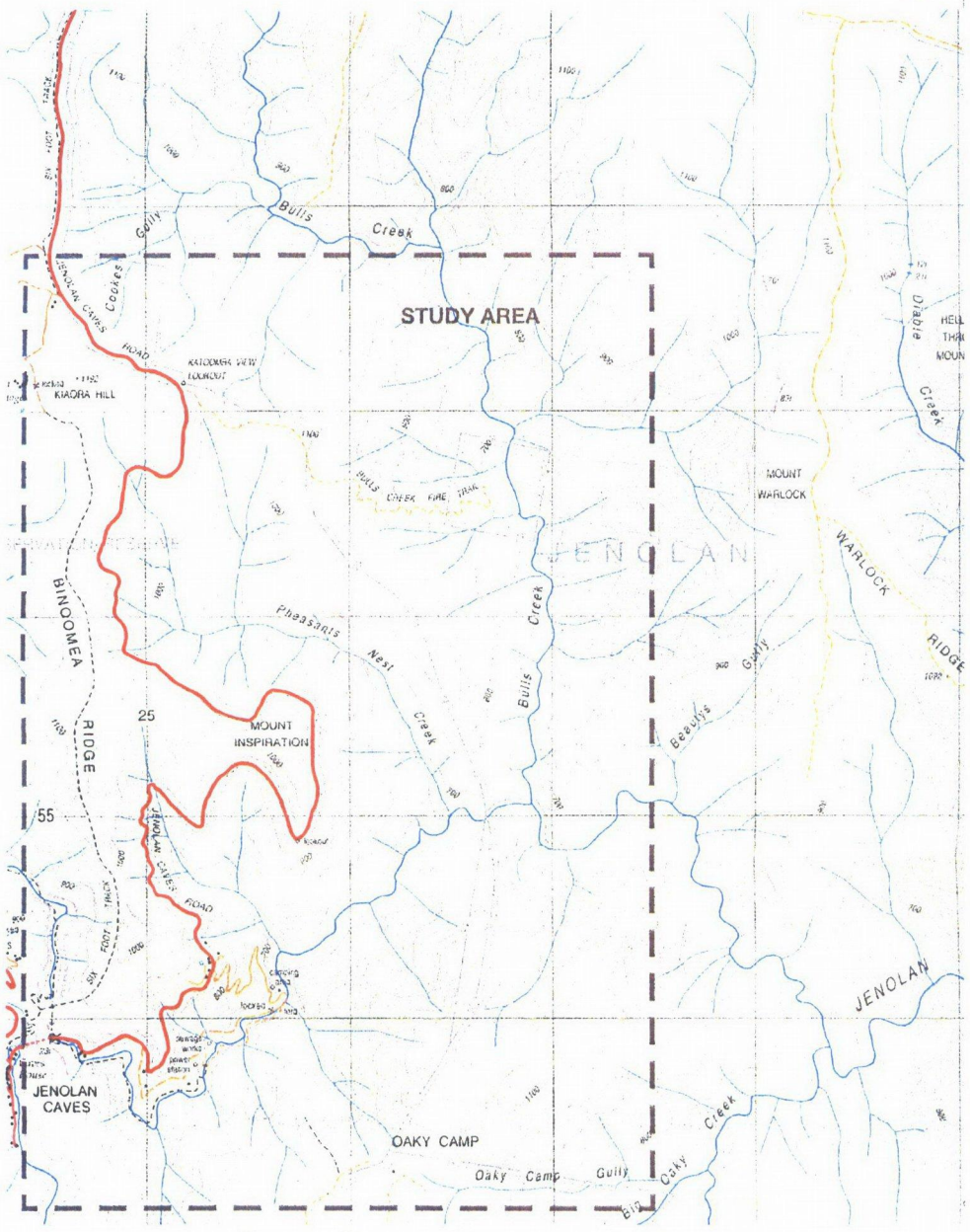
PRINT INTEE
[illegible]
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 2500
FX (02) 9478 2501

ROADS AND TRAFFIC AUTHORITY					
JC	09.02.05	GRW	09.02.05		
GRW	09.02.05	GKS	09.02.05		
GKS	09.02.05	NOT TO SCALE	A1	04622801	081D800	T0

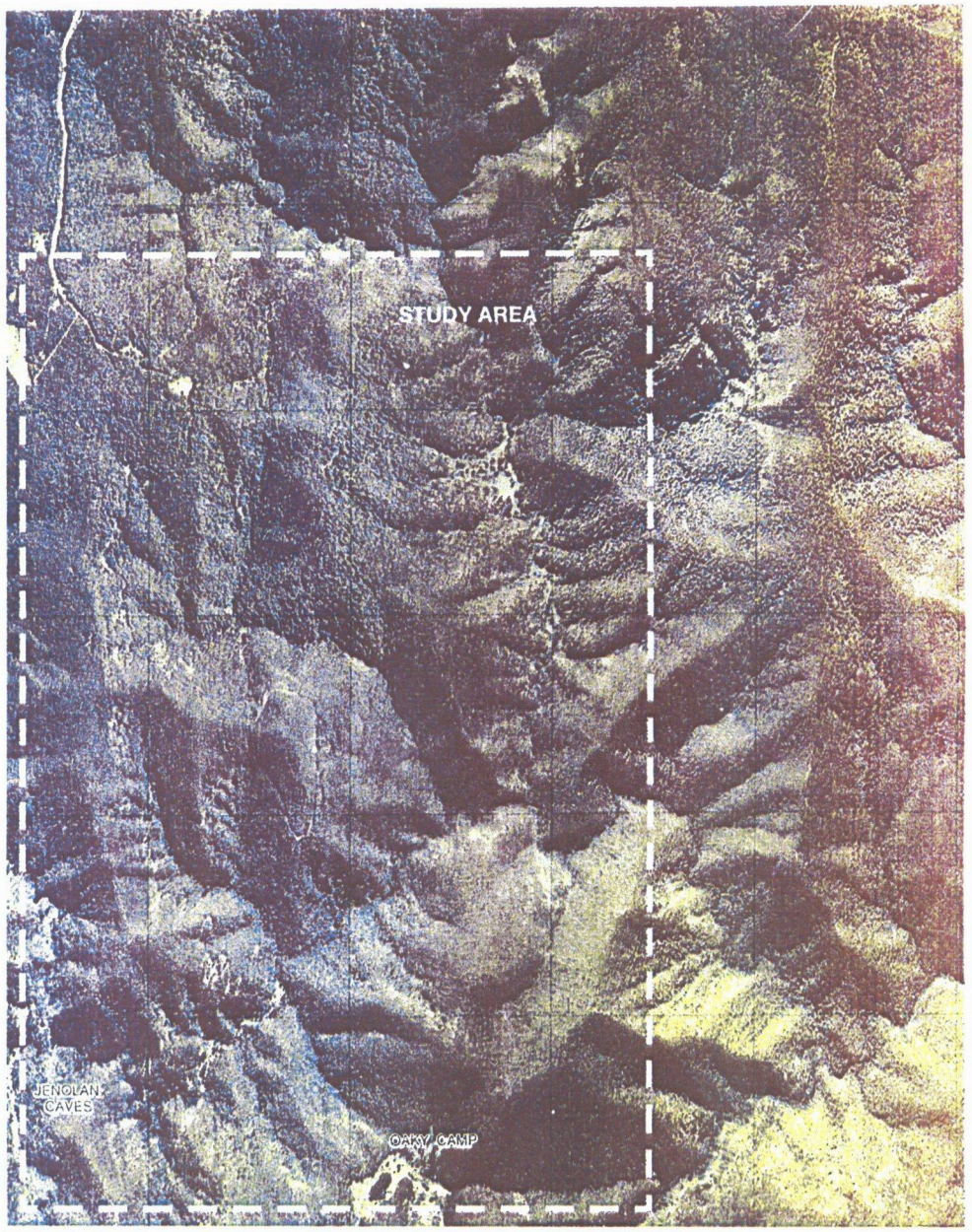
SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C8.13
CHAINAGE 8.100 - 8.210

GOLDERS WORKSHEET C 8.13

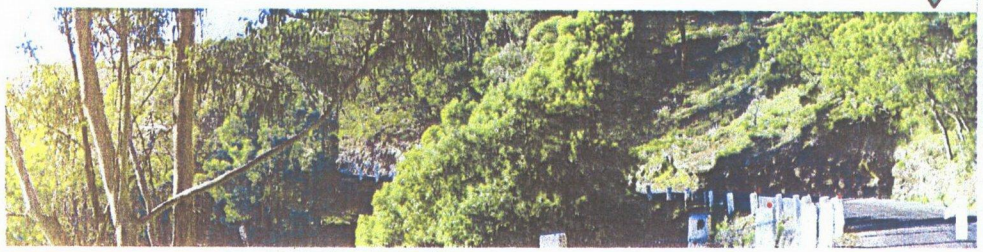


Topographic Map of Study Area

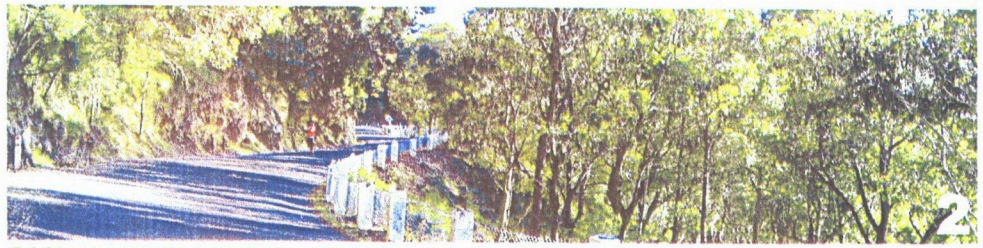


Orthophoto Map of Study Area

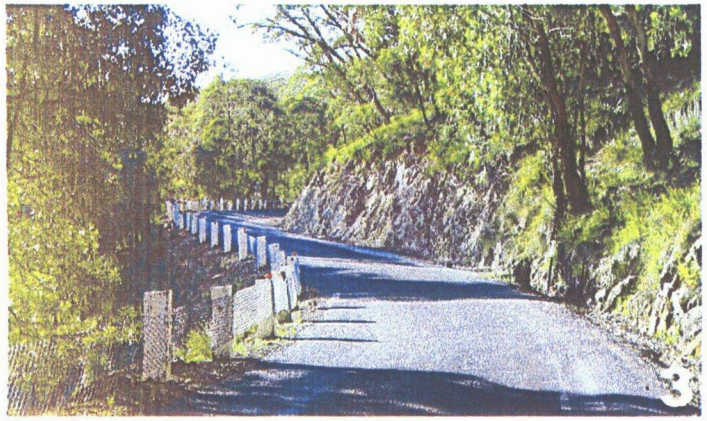
Landscape and Visual Assessment Proforma Sheet



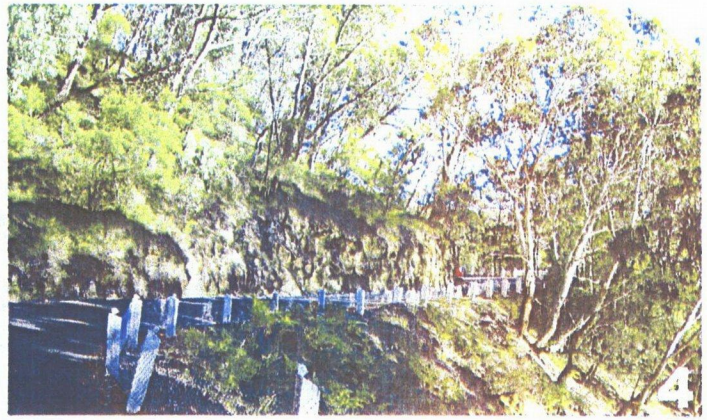
C.2.26- view south along Jenolan Caves Road



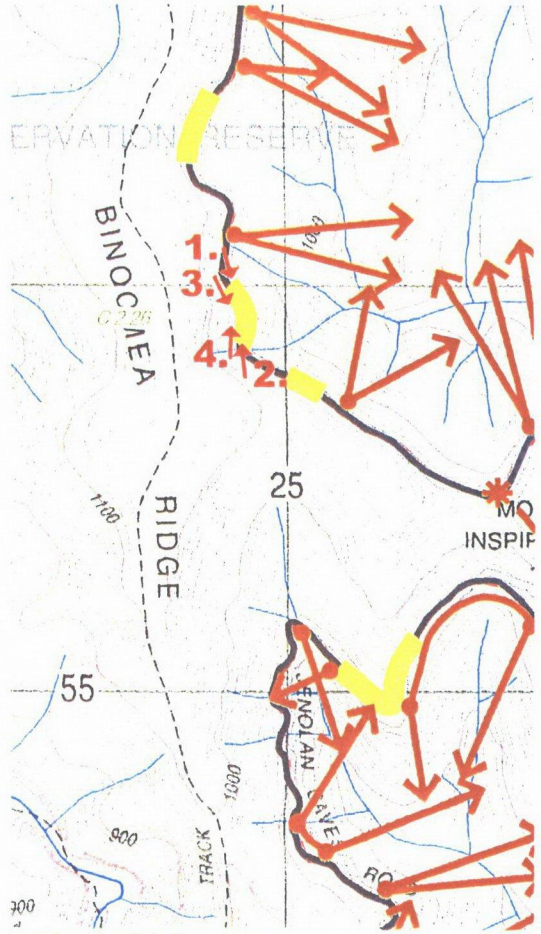
C.2.26- view north along Jenolan Caves Road



C.2.26- view south along Jenolan Caves Road



C.2.26- view north along Jenolan Caves Road



Location C.2.26 (Not to scale)

VISUAL ANALYSIS			
Existing Landscape Character (Refer detail description in text)	Description of Existing Vegetation (Refer detail description in text)	Description of Adjacent Landform	Significance of Existing Landscape (Low/Medium/High)
Mountainous, steep valleys, steep rocky slopes and crests, elevations between 740 and 1160 metres above sea level. Road overlooks a series of steep valleys, crossed with a system of natural watercourses and drainage lines. Landscape is covered by pristine natural eucalypt forests.	Open forest of up to 10m high trees: *Eucalyptus blaxlandii*, *E. viminalis*, and *Acacia implexa*. Understorey of 2m-3m high shrubs, eg. Blackthorn, Broad-leaved Hickory. Common groundcover species include Lomandra, natives grasses and ferns.	Steep to very steep valleys, steep rocky slopes and crests. Elevations between 740 and 1160 metres above sea level.	HIGH
Sensitivity of Landscape to Alteration (By the Proposal) (Low/Medium/High)	Viewer Sensitivity To Alteration by the Proposal (Low/Medium/High)	Significance of Existing Views (Local/State/Regional/ National/ International)	Notes:
LOW	LOW to MEDIUM	National/International	

ASSESSMENT OF IMPACT			
	VISUAL SENSITIVITY		
VISUAL EFFECT	HIGH	MODERATE	LOW
HIGH	High	High	Moderate
MODERATE	High	Moderate	Low
LOW	Moderate	Low	Low

VISUAL ASSESSMENT SUMMARY
LOW VISUAL IMPACT
At the time of the on site assessment no details were available for Wall 1. C.2.26. However, an assessment was made based on the scale of work detailed for the other sites. It was assumed that most of the proposed work would consist of crest work to tidy up and remove unstable material/vegetation, rock face scaling and rock bolts. This a relatively short section of cut face of only 140m.

Legend

Viewpoint & visual line

Extent of visual catchment

Non-sight visual line

1. Photo location & number

RTA Storage compound

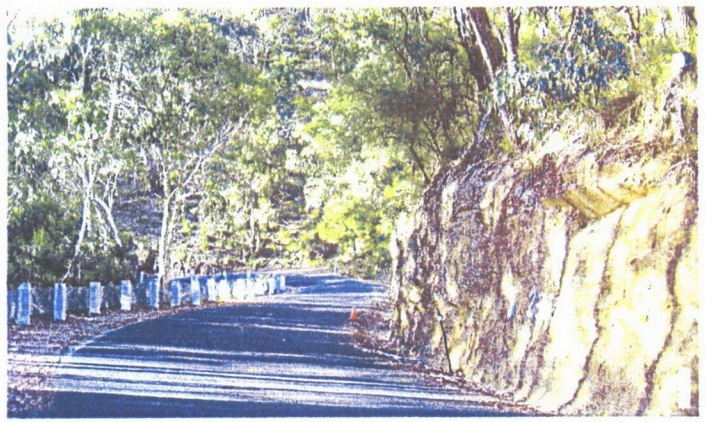
Cut batter

Culvert

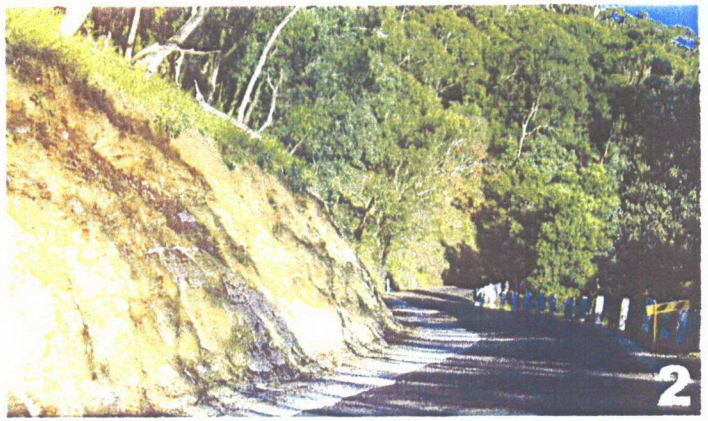
JENOLAN CAVES ROAD

UDO

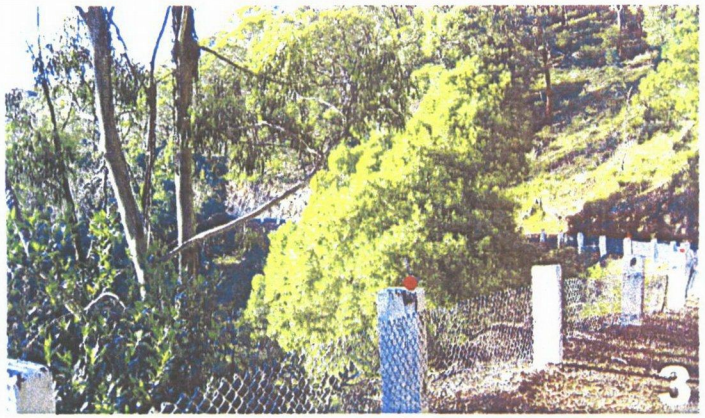
Landscape and Visual Assessment Proforma Sheet



C.2.26 - view south - chainage 2990

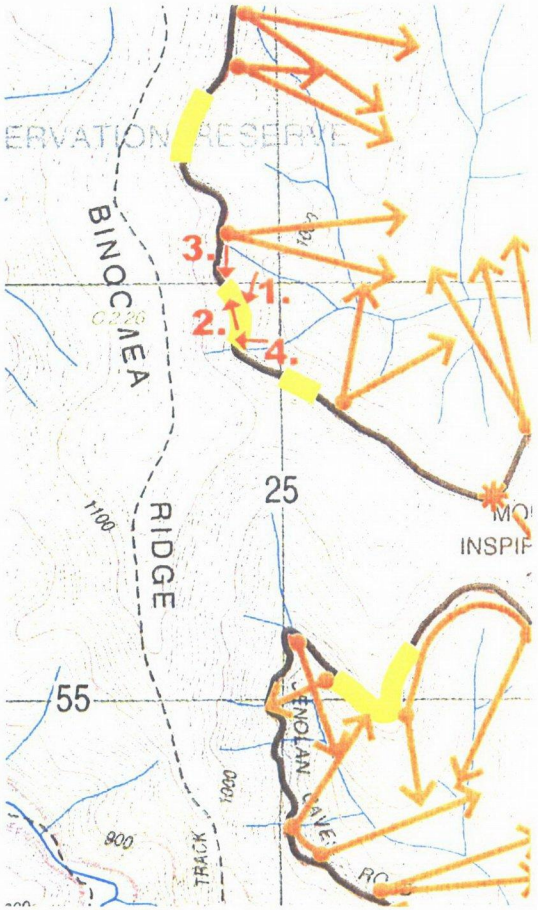


C.2.26 - view north



C.2.25 - detail view south onto cut section

C.2.26 - view west - typical vegetation



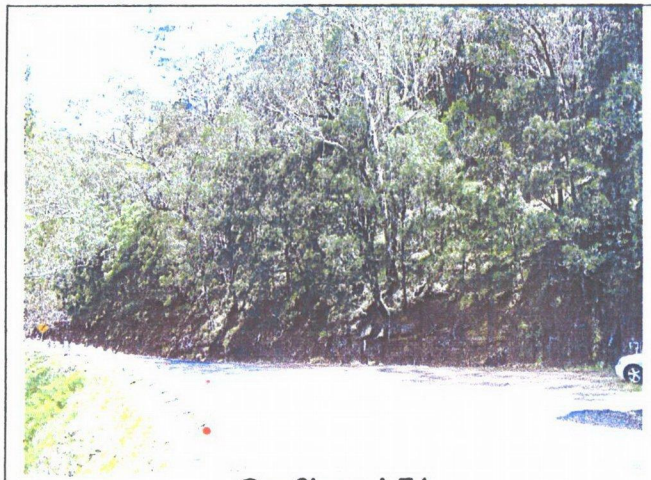
Location C.2.26 & Photo position

Legend

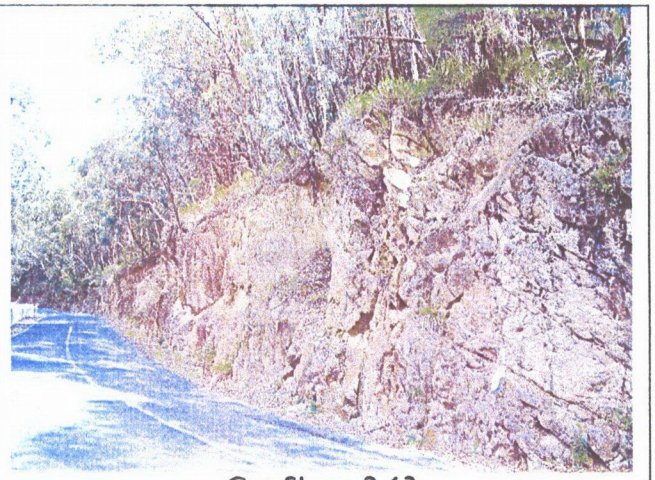
JENOLAN CAVES ROAD

Appendix C Photographs of Proposal site

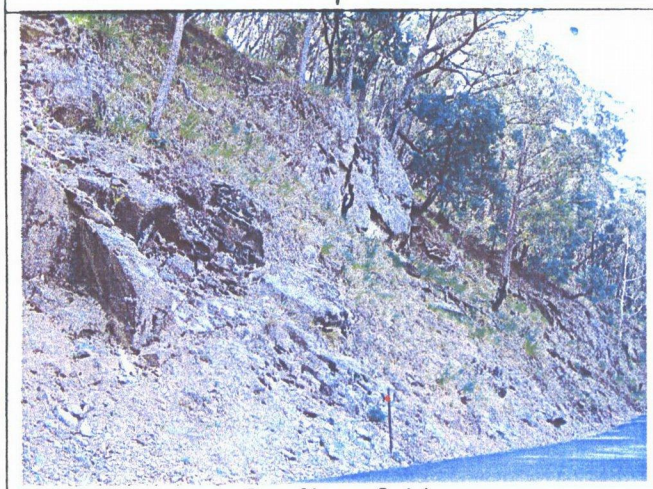
SITE PHOTOGRAPHS – JENOLAN CAVES ROAD



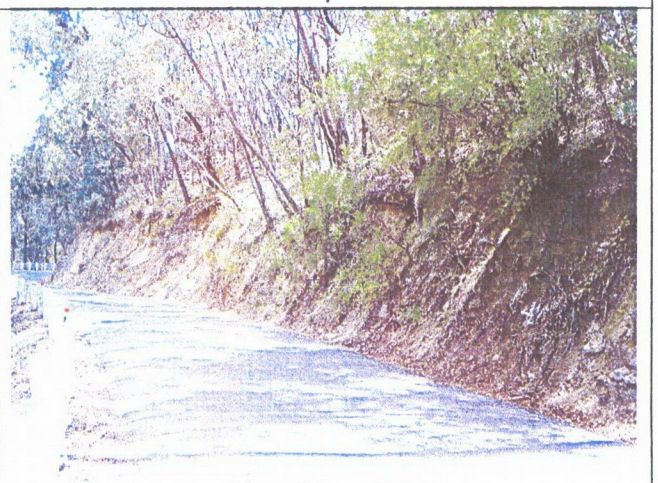
Cut Slope 1.74



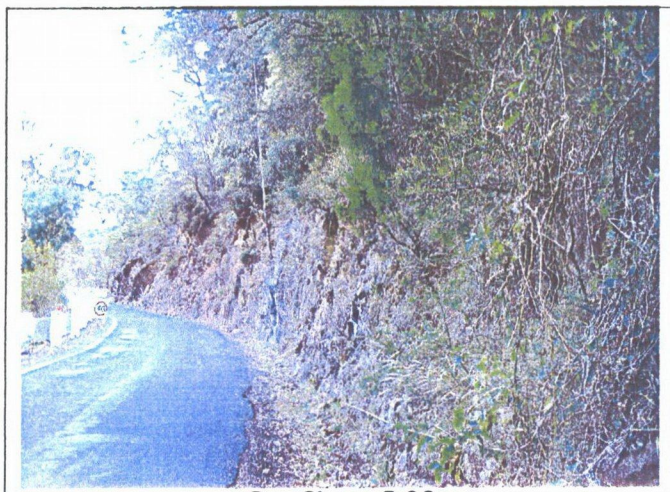
Cut Slope 2.63



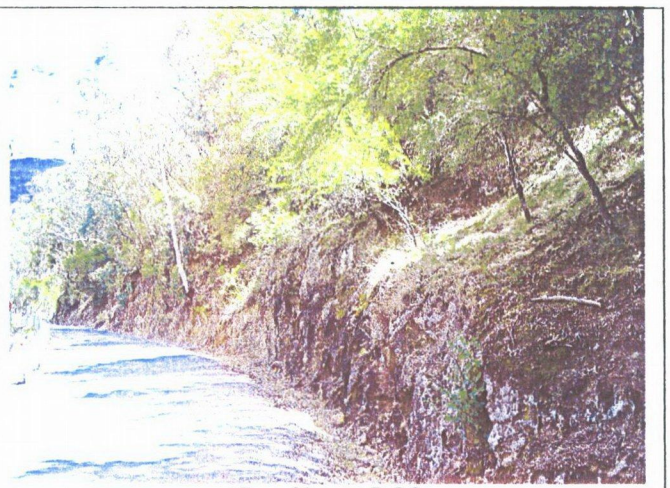
Cut Slope 3.64



Cut Slope 4.22

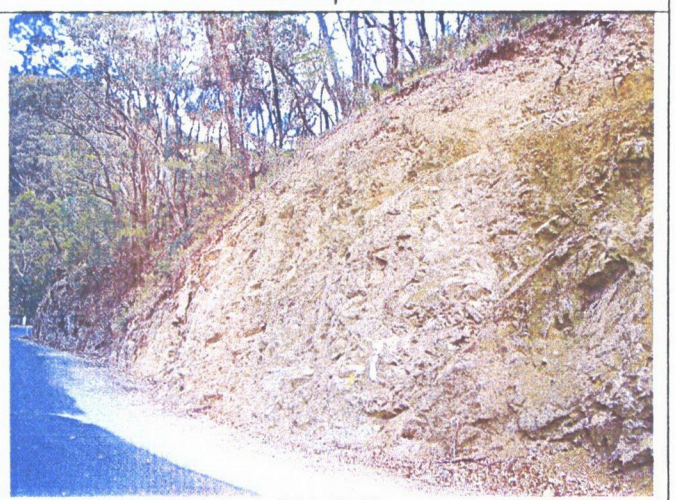


Cut Slope 5.08



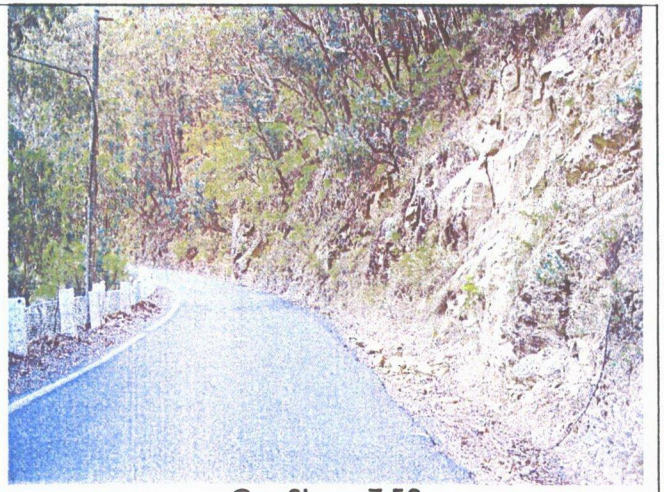
Cut Slope 5.29

Cut Slope 7.02

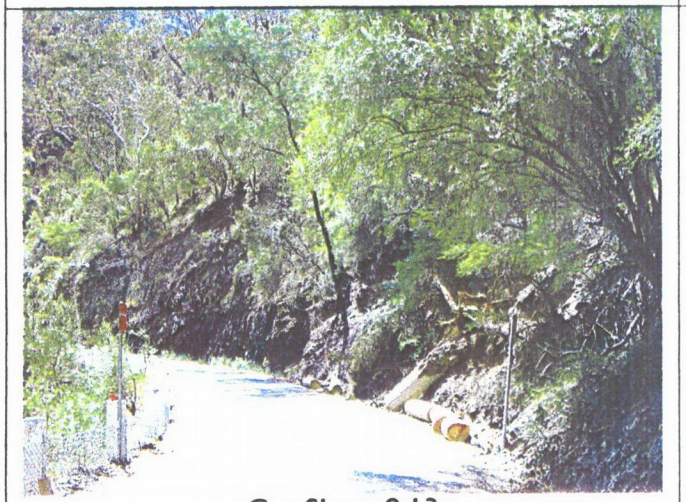


Wall 40

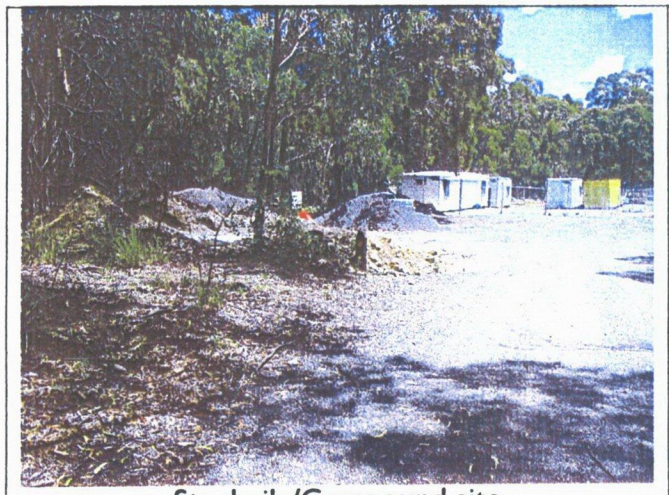
Wall 41



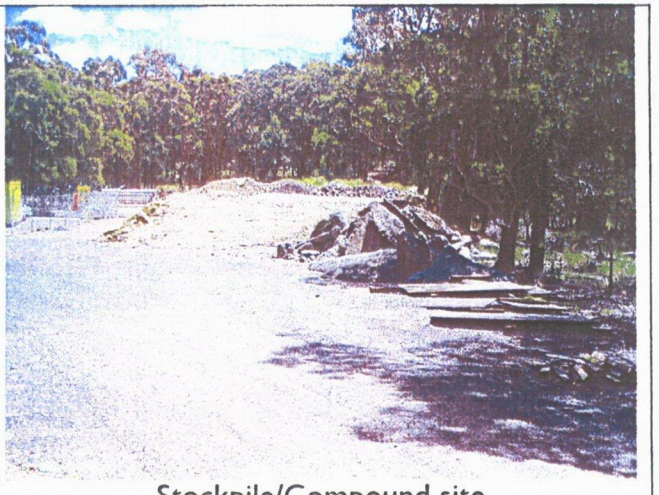
Cut Slope 7.58



Cut Slope 8.13



Stockpile/Compound site



Stockpile/Compound site

Appendix D Concept Design

Golder Associates Pty Ltd
A.B.N. 64 006 107 857

88 Chandos Street
St Leonards, NSW 2065, Australia
(PO Box 1302, Crows Nest, NSW 1585)
Telephone (02) 9478 3900
Fax (02) 9478 3901
http://www.golder.com

DRAFT REPORT ON

DESIGN OF SLOPE REMEDIATION WORKS MR 253 JENOLAN CAVES ROAD

Submitted to:

Roads and Traffic Authority
Western Region
15-33 Cooerwul Road
Bowenfels NSW 2790

DISTRIBUTION:

2 Copies - Roads and Traffic Authority (electronic)
1 Copy - Golder Associates Pty Ltd

18 February 2005 04622081/007 (draft)

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF DRAWINGS

A list of drawings is provided on Drawing no. 081D001 which follows the text of this report

1.0 INTRODUCTION

This report describes the development of the detailed design of proposed slope remediation works for nine rock cuts along MR253 Jenolan Caves Road. The designs are presented on a series of drawings presented with this report.

The remediation is to be undertaken as part of an ongoing program of improving the Assessed Risk Level (ARL) of selected cuttings and embankments along Jenolan Caves Road to ARL 3 or better. The work is along a section of Jenolan Caves Road known as "5 Mile Hill".

The design work was carried out by Golder Associates in accordance with the RTA brief issued by email dated 24 May 2004 and our proposal 03622122/005 dated 4 June 2004. The work was authorised by PJ Dearden in a letter dated 21 July 2004.

This report addresses the detailed design of nine cuttings, referenced C1.74, C2.63, C4.22, C5.08, C5.29, C7.02, C7.44, C7.58 and C8.13. These nine cuttings were selected following slope risk assessments (SRA) carried out by Golder Associates in 2002 and 2005 (C7.44). Eight of these cuts had an ARL of 2, one an ARL of 1 (C5.29). The SRAs were in accordance with the RTA's Slope Risk Analysis Manual Version 3.1. The location of the rock cuts is illustrated in Drawing 081D001.

The SRAs carried out in 2002 were presented in Golder Associates' report ref. 02622010/011 dated September 2002. Additional SRAs were carried out in January 2005 for two cuttings (C2.27 and C7.44) recently regraded by the RTA (2004) as part of the remediation works of drystone retaining walls along Jenolan Caves Road. An ARL of 2 to 3 was assigned to C7.44. The SRA indicated an ARL of 4 or better for C2.27, and hence remediation of C2.27 is not required. The 2005 SRAs are presented in Golder Associates' report ref. 04622081/08 dated February 2005.

In addition to the eight cuts included as an outcome of the SRAs in 2002 an additional cut (C3.64) is also to be remediated. C3.64 has an ARL of 1 but is significantly larger than the other cuts and is to be addressed in a separate design package.

In 2003 Golder Associates carried out concept designs for the nine rock cuts assessed in 2002 (Concept Design, Remediation Work For Rock Cuts, MR253 Jenolan Caves Rd, December 2003, report ref. 03622122/02). The concepts were discussed at a Value Management Workshop held at Jenolan Caves in January 2004.

The reference system for cut sites used by Golder Associates was described in our report ref. 02622010/011 dated September 2002. The reference refers to the distance of the uphill end of the cut from the top of 5 Mile Hill (in kilometres) measured in relation to chainage markers installed by the RTA.

2.0 METHODOLOGY

The methodology for the development of the slope remediation designs of the nine rock cuts is described in this section of the report.

2.1 Survey

As requested by Golder Associates, the RTA set out chainage markers along the centre line of the road at 10 m intervals at each of the cuttings to be remediated. The chainages are referenced in relation to the white chainage markers at the edge of the road installed several years ago by the RTA. Chainage 0 is at the top of the section known as "5 Mile Hill". In addition, the RTA sprayed chainage marks on the cuttings at 10 m intervals.

Golder Associates has also used longitudinal sections and plans developed by the RTA from a survey carried out by the RTA in 2004.

2.2 Photography

A geotechnical engineer photographed each of the cuttings with a digital camera. The objective of the photographs was to develop a base on which to illustrate the proposed remediation works.

The photographs were taken perpendicular to the face. As the distance between the cuttings and the far edge (downslope edge) of the road was generally not more than about 6 m, a series of photographs were taken to cover the extents of each of the cuttings. These photographs were then spliced together to form photomosaics.

To assist in the detailed design oblique aerial photographs of each of the cuttings were obtained from a helicopter. The photographs were taken using a high resolution digital camera by a professional photographer subcontracted by Golder Associates. The photographs have previously been provided to the RTA on a CD.

2.3 Remediation Assessment

Geotechnical engineers and engineering geologists from Golder Associates visited each of the cuttings and based on the slope risk assessments, assessed by visual observation geotechnical hazards requiring remediation to limit the ARL to 3 or better. Proposed remediation works to treat these hazards were plotted onto the photomosaics of the cuttings.

2.4 Additional Geotechnical Investigations

No additional geotechnical works were undertaken for the design of remediation of the nine cuts in this design package.

2.5 Engineering Analyses and Design

For each of the geotechnical hazards, the effectiveness of proposed remediation strategies to reduce the ARL to 3 or better was assessed. Where required, engineering analyses were carried out for the design of structural elements of the slope remediation, such as rock bolts.

2.6 Design Documentation

The proposed remediation works are documented on design drawings included with this design report. The drawings are based on the survey data provided by the RTA and the photomosaics developed by Golder Associates. The drawings illustrate indicative extents and types of remediation work. In some cases, actual treatments could be more or less extensive than illustrated depending on the actual conditions encountered.

The design drawings for each cutting includes an overview plan on A1 size paper showing the entire length of the cutting. Subsequent drawings (A3 size) illustrate the proposed remediation works along sections of the cut, and the extent of each drawing is shown on the overview. A list of the drawings is included on Drawing 081D001. General notes about the proposed treatment works are also shown on Drawing 081D001.

The proposed remediation work for the cuttings are summarised in a table on each drawing. Each individual section of proposed remediation works has been assigned a unique reference number, which is included in the summary table. Likewise, each rock bolt or catch fence has been assigned a unique reference number.

The summary table includes the chainage and location of the proposed work on the cutting, the unique reference number, an estimate of the maximum block size expected to be encountered and an estimate of the volume to be removed for crest treatment and scaling work. An additional table presents details for rock bolts (length, angle below horizontal).

2.7 Remediation Works Cost Estimates

An estimate of the cost of the proposed works is presented separately.

2.8 Co-ordination meetings with RTA

During the development of the remediation works, design co-ordination meetings have been held with the RTA. This has included site visits to discuss survey requirements and to meet the RTA geotechnical representative to review the proposed remediation strategies.

3.0 DESIGN APPROACH

3.1 Design Objectives

The objective of the remediation works is to reduce the ARL of the nine cuts to 3 or better. In achieving this objective, it needs to be recognised that the ARL is a temporal indication of the geotechnical risk of the cutting. Due to ongoing geological and environmental processes, it is possible that the ARL can change with time. With this in mind, an attempt has been made to incorporate into the remediation geotechnical hazards that are currently ARL 3 or 4, but which have the potential to develop into ARL 1 or 2 in the short term.

Some of the works proposed are intended to improve the appearance of cuttings which visually appear to present a risk to road users but are in the ARL 3 or better categories. These are typically cuts with loose rock on the surface. These works do not have an overall bearing on the ARL of the cuttings. The extent of these works is limited in relation to the overall works required and expected to involve relatively little effort, with the benefit of a better visual impression of the completed works.

3.2 Design Constraints and Philosophy

The design has considered the constraints imposed as a consequence of the physical and environmental site conditions. These include the limited site access, restricted work times, night work hours, safety and the high scenic quality of the area.

Where feasible the designs use solutions intended to have a relatively low visual impact (such as limiting 'non' natural works such as shotcreting).

3.3 Design Life

The required design life of the remediation works, other than structural components, has not specified by the RTA. For activities such as crest treatment, regrading and scaling, we would expect that the remediation works will result in achieving an ARL 3 or better for a period of at least 10 years following the completion of the proposed works.

Rock bolts are to have a design life of 100 years.

Rock catch fences are to have a design life of 50 years.

The proposed designs are based on the premise that a maintenance plan for the cuts will be developed after completion of the remediation works. The maintenance plan should document the frequency of reassessment of the ARL and inspections of the performance of the structural elements.

3.4 Types of Remediation

The proposed remediation works consists of:

- **Crest treatment / regrading of cuttings** – Involves removal of geotechnically unstable soil and rock along the crest of the cutting and reprofiling of cutting faces. Structural support elements, such as rock bolts and shotcrete, are not intended as part of these works. The regrading is intended to create a reasonably smooth, stable face, where possible along natural discontinuities in the rock. The regrading is not to create overhangs. Tolerances for batter surface variations are given in the design specification. Manual (hand tools) and mechanical tools will be required for the crest treatment and regrading works.
- **Scaling** – Involves the removal of selected soil and rock from the face of the cutting. The scaling is typically limited to soil and rock which is detached from the main rock mass and can be removed using hand tools.
- **Rock Bolting** – Involves the installation of rock bolts to stabilise individual blocks or areas of the cutting.
- **Drainage** – in general, the designs have not included significant drainage works. However, the remediation of Cut C7.44 requires that a catch drain is incorporated at the toe of the cut when the road surface is reinstated.
- **Rock Catch Fence** – Involves the installation of a rock catch fence along the toe of selected lengths of the cutting to prevent soil and rock debris from reaching the road. The fence is generally to be installed at road level.

The extent of the types of treatment described above are indicated on the design drawings. The work quantities are indicative only and will depend on actual conditions exposed once the work commences.

3.5 Tree Hazard

Trees located on the cuttings and at or behind the crest of cuttings have only been identified for removal if they currently present a geotechnical risk. This risk usually arises due to root jacking which results in opening of joints and block detachment.

Other trees along the cuttings may not pose a geotechnical risk but are a potential risk if they fall onto the road. The requirement for tree removal for other than geotechnical purposes should be assessed by a tree specialist.

4.0 CONSTRUCTION WORKS

4.1 Client's Geotechnical Representative

An experienced geotechnical engineer (representing the RTA) will be available to provide guidance to the contractor during the remediation works. The geotechnical engineer will have the authority to direct changes to the work, as required, depending on actual conditions.

The geotechnical engineer is to be qualified to carry out RTA Slope Risk Assessments. This is critical to understand the intent behind the proposed remediation works and make adjustments to the remediation depending on conditions revealed during the works.

4.2 Management Plans

The Contractor is to prepare plans to demonstrate work procedures. Plans to be submitted are:

- Site Safety Management Plan;
- Environmental Management Plan;
- Work Method Statements, incorporating health, safety and environmental considerations.

The plans may be generic for each of the types of remediation. However, in some cases the Client's Representative may request that a specific plan is developed for a particular activity. This may be necessary to account for the specific physical and environmental conditions at different locations along the road.

4.3 Standards and Specifications

The designs described in this report are to be implemented in accordance with:

- Relevant RTA specifications;
- Relevant Australian Standards, and where those standards do not exist an alternative international standard to be approved by RTA; and
- Project Specifications.

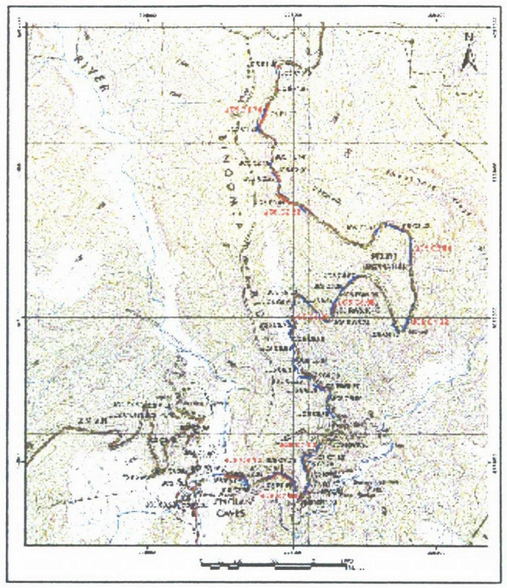
GOLDER ASSOCIATES PTY LTD

Glenn Wilson
Geotechnical Engineer

Graham Scholey
Associate

\\SYD1-S-FILE01\JOBS\04PROJ\051-100\04622081_RTA_SLOPES_JCR\081W007R_DRAFT_DESIGN_REPORT.DOC

MR253 - JENOLAN CAVES ROAD
SLOPE REMEDIATION



SITE LOCALITY MAP

Scale 1 : 20,000

DRAWING SCHEDULE

Drawing Number	Size	Title Description
081D001	A1	Cover Sheet, Drawing Schedule and Construction Notes
081D100	A1	Cutting C1.74 Chainage 1717 - 1880
081D101	A3	Cutting C1.74 Page 1 of 8 Chainage 1717 - 1730
081D102	A3	Cutting C1.74 Page 2 of 8 Chainage 1730 - 1743
081D103	A3	Cutting C1.74 Page 3 of 8 Chainage 1743 - 1756
081D104	A3	Cutting C1.74 Page 4 of 8 Chainage 1756 - 1768
081D105	A3	Cutting C1.74 Page 5 of 8 Chainage 1768 - 1810
081D106	A3	Cutting C1.74 Page 6 of 8 Chainage 1810 - 1835
081D107	A3	Cutting C1.74 Page 7 of 8 Chainage 1835 - 1852
081D108	A3	Cutting C1.74 Page 8 of 8 Chainage 1847 - 1880
081D200	A1	Cutting C2.63 Chainage 2330 - 2730
081D201	A3	Cutting C2.63 Page 1 of 7 Chainage 2330 - 2500
081D202	A3	Cutting C2.63 Page 2 of 7 Chainage 2500 - 2588
081D203	A3	Cutting C2.63 Page 3 of 7 Chainage 2588 - 2663
081D204	A3	Cutting C2.63 Page 4 of 7 Chainage 2663 - 2700
081D205	A3	Cutting C2.63 Page 5 of 7 Chainage 2700 - 2715
081D206	A3	Cutting C2.63 Page 6 of 7 Chainage 2713 - 2728
081D207	A3	Cutting C2.63 Page 7 of 7 Chainage 2724 - 2730
081D400	A1	Cutting C4.22 Chainage 4220 - 4300
081D401	A1	Cutting C4.22 Chainage 4300 - 4380
081D402	A3	Cutting C4.22 Page 1 of 10 Chainage 4220 - 4238
081D403	A3	Cutting C4.22 Page 2 of 10 Chainage 4238 - 4288
081D404	A3	Cutting C4.22 Page 3 of 10 Chainage 4288 - 4271
081D405	A3	Cutting C4.22 Page 4 of 10 Chainage 4279 - 4297
081D406	A3	Cutting C4.22 Page 5 of 10 Chainage 4297 - 4318
081D407	A3	Cutting C4.22 Page 6 of 10 Chainage 4318 - 4334
081D408	A3	Cutting C4.22 Page 7 of 10 Chainage 4334 - 4354
081D409	A3	Cutting C4.22 Page 8 of 10 Chainage 4353 - 4375
081D410	A3	Cutting C4.22 Page 9 of 10 Chainage 4374 - 4385
081D411	A3	Cutting C4.22 Page 10 of 10 Chainage 4383 - 4384
081D300	A1	Cutting C3.08 Chainage 3080 - 3430
081D501	A3	Cutting C5.08 Page 1 of 5 Chainage 5080 - 5100
081D502	A3	Cutting C5.08 Page 2 of 5 Chainage 5101 - 5120
081D503	A3	Cutting C5.08 Page 3 of 5 Chainage 5120 - 5138
081D504	A3	Cutting C5.08 Page 4 of 5 Chainage 5138 - 5161
081D505	A3	Cutting C5.08 Page 5 of 5 Chainage 5161 - 5185
081D506	A3	Cutting C5.08 Page 6 of 5 Chainage 5185 - 5210
081D307	A3	Cutting C3.08 Page 7 of 8 Chainage 3210 - 3230
081D308	A3	Cutting C3.08 Page 8 of 8 Chainage 3230 - 3280
081D520	A1	Cutting C5.29 Chainage 5280 - 5370
081D521	A3	Cutting C5.29 Page 1 of 7 Chainage 5250 - 5295
081D522	A3	Cutting C5.29 Page 2 of 7 Chainage 5295 - 5290
081D523	A3	Cutting C5.29 Page 3 of 7 Chainage 5290 - 5305
081D524	A3	Cutting C5.29 Page 4 of 7 Chainage 5303 - 5320
081D525	A3	Cutting C5.29 Page 5 of 7 Chainage 5320 - 5335
081D526	A3	Cutting C5.29 Page 6 of 7 Chainage 5333 - 5345
081D527	A3	Cutting C5.29 Page 7 of 7 Chainage 5343 - 5380
081D700	A1	Cutting C7.02 Chainage 7080 - 7125
081D701	A3	Cutting C7.02 Page 1 of 7 Chainage 7024 - 7032
081D702	A3	Cutting C7.02 Page 2 of 7 Chainage 7032 - 7049
081D703	A3	Cutting C7.02 Page 3 of 7 Chainage 7049 - 7064
081D704	A3	Cutting C7.02 Page 4 of 7 Chainage 7064 - 7078
081D705	A3	Cutting C7.02 Page 5 of 7 Chainage 7078 - 7094
081D706	A3	Cutting C7.02 Page 6 of 7 Chainage 7094 - 7110
081D707	A3	Cutting C7.02 Page 7 of 7 Chainage 7110 - 7120
081D740	A1	Cutting C7.44 Chainage 7044 - 7060
081D741	A3	Cutting C7.44 Page 1 of 3 Chainage 7499 - 7455
081D742	A3	Cutting C7.44 Page 2 of 3 Chainage 7483 - 7470
081D743	A3	Cutting C7.44 Page 3 of 3 Chainage 7474 - 7490
081D780	A1	Cutting C7.58 Chainage 7680 - 7720
081D751	A1	Cutting C7.58 Chainage 7720 - 7800
081D752	A3	Cutting C7.58 Page 1 of 18 Chainage 7574 - 7580
081D753	A3	Cutting C7.58 Page 2 of 18 Chainage 7599 - 7609
081D754	A3	Cutting C7.58 Page 3 of 18 Chainage 7596 - 7629
081D755	A3	Cutting C7.58 Page 4 of 18 Chainage 7633 - 7649
081D764	A3	Cutting C7.58 Page 5 of 18 Chainage 7648 - 7666
081D757	A3	Cutting C7.58 Page 6 of 18 Chainage 7658 - 7679
081D758	A3	Cutting C7.58 Page 7 of 18 Chainage 7678 - 7685
081D759	A3	Cutting C7.58 Page 8 of 18 Chainage 7685 - 7696
081D760	A3	Cutting C7.58 Page 9 of 18 Chainage 7696 - 7719
081D761	A3	Cutting C7.58 Page 10 of 18 Chainage 7716 - 7733
081D762	A3	Cutting C7.58 Page 11 of 18 Chainage 7729 - 7736
081D763	A3	Cutting C7.58 Page 12 of 18 Chainage 7733 - 7743
081D764	A3	Cutting C7.58 Page 13 of 18 Chainage 7743 - 7755
081D765	A3	Cutting C7.58 Page 14 of 18 Chainage 7755 - 7765
081D766	A3	Cutting C7.58 Page 15 of 18 Chainage 7765 - 7775
081D767	A3	Cutting C7.58 Page 16 of 18 Chainage 7773 - 7784
081D768	A3	Cutting C7.58 Page 17 of 18 Chainage 7784 - 7793
081D769	A3	Cutting C7.58 Page 18 of 18 Chainage 7793 - 7800
081D800	A1	Cutting C8.13 Chainage 8100 - 8210
081D801	A3	Cutting C8.13 Page 1 of 8 Chainage 8100 - 8015
081D802	A3	Cutting C8.13 Page 2 of 8 Chainage 8115 - 8130
081D803	A3	Cutting C8.13 Page 3 of 8 Chainage 8130 - 8145
081D804	A3	Cutting C8.13 Page 4 of 8 Chainage 8140 - 8158
081D805	A3	Cutting C8.13 Page 5 of 8 Chainage 8158 - 8172
081D806	A3	Cutting C8.13 Page 6 of 8 Chainage 8174 - 8186
081D807	A3	Cutting C8.13 Page 7 of 8 Chainage 8186 - 8195
081D808	A3	Cutting C8.13 Page 8 of 8 Chainage 8195 - 8210

REMEDIATION NOTES

1 GENERAL NOTES

1.1 These notes apply to all drawings listed in the Drawing Schedule unless noted otherwise.
1.2 Survey information provided by RTA.
1.3 All levels are in metres to Australian Height Datum (AHD).
1.4 All Chainages and Elevations are in metres unless noted otherwise.
1.5 All dimensions are in millimetres unless noted otherwise.
1.6 Dimensions shall not be scaled off drawings.
1.7 Quantities shown on drawings are indicative only and the contractor shall satisfy themselves as to the actual quantities.
1.8 All work is to be in accordance with approved Site Safety Management Plans/Work Method Statements. The decision reports in relation to the RTA's Review of Environmental Factors/ and an approved Environmental Management Plan.
The work is not be commence until the Contractor has submitted a Site Safety Plan which addresses each of the individual treatments shown on the drawings.
1.9 Treatment categories include Crest Treatment, Regrading, Scaling, Rock Bolting and Rock Catch Fences. Notes for each of the categories are included below.
1.10 All remediation works where crest treatment, regrading, scaling and/or rock bolts are in close proximity are to be scheduled to limit the potential for further geotechnical hazards to develop.
1.11 The objective of the works shall be to reduce the Assessed Risk Level (ARL) of slopes from ARL 1 or ARL 2 to ARL 3 or better.

2 DEFINITIONS

To be developed in conjunction with RTA.

3 CREST TREATMENT / REGRADING

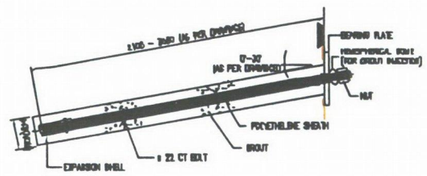
3.1 Crest treatment at each location is as shown on the drawings and to be confirmed on site by the Principals Authorised Representative.
3.2 General crest treatment is to involve selected removal of identified geotechnical hazards (blocks and soil) unless noted otherwise.
3.3 Blocks that can be removed without excessive use of force using a scaling bar shall be removed.
3.4 Where regrading of rock cuttings is undertaken, the angle of the cut is to be as directed by the Principals Authorised Representative. Where existing geotechnical defect planes are identified as a likely failure plane (as specified by the Principals Authorised Representative), the cutting is to be cut along or below this plane.
3.5 Where the residual layer at the crest is cut during regrading, it shall be cut at near vertical and selected blocks removed as per CL3.2.
3.6 Care shall be taken to limit the removal of grass and foliage cover above the crest.
3.7 In areas with remediation involving the clearing of blocks above the crest, the zone of clearing shall extend 5 m from the crest.
3.8 Trees present along the crest are not to be removed unless they present a geotechnical hazard (ie. root jacking blocks).
3.9 In the course of optional crest treatment works, trees along the crest that present an OH&S risk may be removed following approval by the Principals Authorised Representative.
3.10 Remediation tolerances will be as per set out in the specification.

4 SCALING

4.1 The extent of scaling at each location is as shown on the drawings and to be confirmed on site by the Principals Authorised Representative.
4.2 Scaling is to involve the selected removal of blocks that represent a geotechnical hazard. In general this includes blocks which are detached from the rock mass and have moved from their original in-situ location.
4.3 Blocks that can be removed without excessive use of force using a scaling bar shall be removed.
4.4 Large blocks identified (by the Principals Authorised Representative) as being loose can be carefully removed by an excavator.
4.6 In areas where large areas of scaling are proposed (ie. areas of root jacking), an excavator can be used.

5 ROCK BOLTS

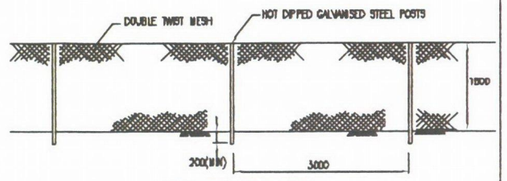
5.1 Rock Bolts shall be CT Bolts supplied and installed in accordance with the specification.
5.2 Typical Rock Bolt Detail below.



TYPICAL ROCK BOLT DETAIL
N.T.S

6 ROCK CATCH FENCE

6.1 Fencing shall be supplied and installed in accordance with the specification.
6.2 Typical Rock Catch Fence Detail (below).



TYPICAL ROCK FENCE DETAIL
Scale 1:50

REVISION	DESCRIPTION				
		CHECKED		APPROVED	
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
		INITS	DATE	INITS	DATE

RTA

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3800
FAX (02) 9478 3801

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

COVER SHEET, DRAWING SCHEDULE AND REMEDIATION NOTES

04622081	081D001	T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-0001a.dwg

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

REMEDIATION WORK SUMMARY

CUTTING C1.74
1.740 – 1.860

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
C101	1752	1764	Scale off area being root jacked	to 500	1000 – 5000	25
S102	1794		Scale off block	to 500	3000	<1
C103	1800	1820	Crest treatment	to 1200	5000 – 6000	5
C104	1820	1847	Crest Treatment / Regrade	to 3000	5000 – 6000	40 – 50
S105	1826		Scale out blocks	to 300		<1
C106	1830		Remove fallen tree on crest		5000	
C107	1838		Remove tree on crest		5000	
S108	1848	1851	Scale block at crest		3000	<1

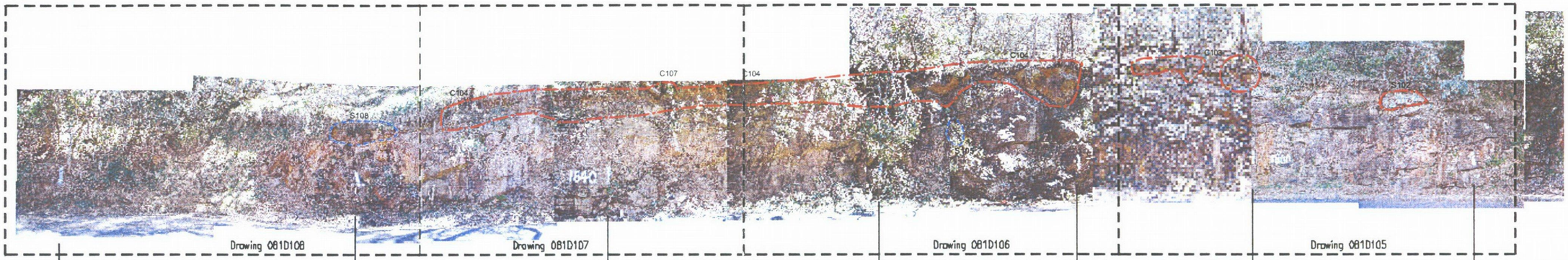
Estimated Quantities

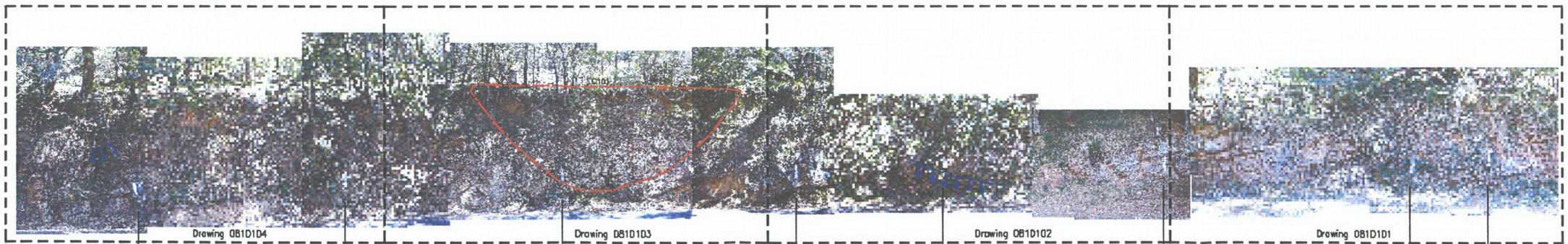
Rock Bolts	–
Crest Treatment / Clear Vegetation	70 m^3
Scaling of loose blocks	1.0 m^3
Rock Fence	–

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- SEEPAGE





REVISION	DESCRIPTION	INITIALS	DATE	INITIALS	DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	24.12.04	GKS	24.12.04

CHECKED | APPROVED

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3800
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C1.74
CHAINAGE 1717.92 - 1860

04622081 | 081D100 | T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D100-108.dwg

REMEDIATION WORK SUMMARY

CUTTING C2.63
2.630 - 2.730

ID	Chainage Start	Chainage Finish	Remediation	Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
S 240	2629	2630	Remove blocks	to 1200	1500 - 3000	3
C 241	2634	2656	Crest Treatment / Regrade	to 1000	2500 - 5500	50
	2644	2645	2 x Rock Bolt		2500	
	2655		2 x Rock Bolt		3500 - 4500	
	2657	2662	Pattern Rock Bolts		2000 - 5000	
C 242	2663	2670	Remove large boulders at crest	to 2000	2500 - 5000	30
S 243	2673	2674	Remove blocks on face and above crest	to 1200	8000	1
	2675	2685	Pattern Rock Bolts		2000 - 5000	
C 244	2688	2689	Remove block	to 1000	3000	1
	2692	2697	6 x Rock Bolt		2000 - 4000	
S 245	2697	2700	Remove blocks	to 500	2000 - 4000	2
	2700	2705	6 x Rock Bolts		2000 - 4000	
C 246	2701	2705	Remove blocks above crest	to 500	4500	2
C 247	2711	2715	Scale blocks	to 300	0 - 2500	2
C 248	2725		Remove tree on rock face		2000	

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 201	3600	20°
RB 202	3600	20°
RB 203	3600	20°
RB 204	3600	20°
RB 205	3600	20°
RB 206	3600	20°
RB 207	3600	20°
RB 208	3600	20°
RB 209	3600	20°
RB 210	3600	20°
RB 211	3600	20°
RB 212	3600	20°
RB 213	3600	30°
RB 214	3600	30°
RB 215	3600	30°
RB 216	3600	30°
RB 217	3600	30°

Rock Bolt Details... continued...

Bolt No.	Length (mm)	Inclination
RB 218	3600	30°
RB 219	3600	30°
RB 220	3600	30°
RB 221	3600	30°
RB 222	3600	30°
RB 223	2400	0°
RB 224	2400	0°
RB 225	2400	0°
RB 226	3600	0°
RB 227	2400	0°
RB 228	3600	0°
RB 229	2400	0°
RB 230	2400	0°
RB 231	2400	0°
RB 232	2400	0°
RB 233	2400	0°
RB 234	2400	0°

Estimated Quantities

Rock Bolts	34
Crest Treatment / Clear Vegetation	85 m^3
Scaling of loose blocks	8 m^3
Rock Fence	–

LEGEND:

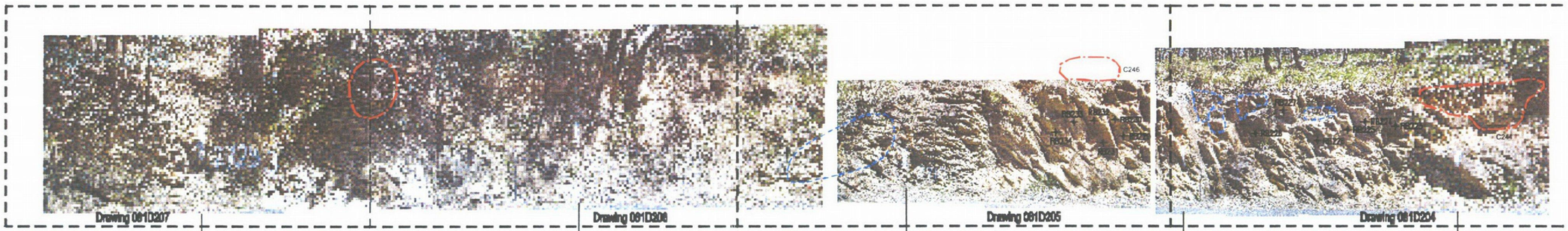
CREST TREATMENT/REMOVE VEGETATION/REGRADE

SCALING OF LOOSE BLOCKS

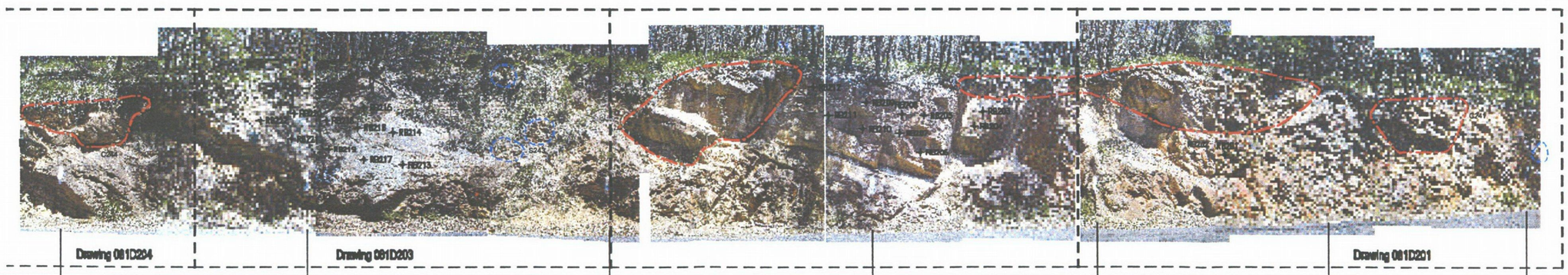
+ RB221 ROCK BOLT

NOTE: SURVEY DATA SUPPLIED BY RTA

INTERPRETIVE ONLY
DO NOT SCALE



CREST OF ROCKFACE - RL (m)																								
TOE OF ROCKFACE - RL (m)																								
CHAINAGE (m)	2763				2720				2680				2640				2600				2560			



CREST OF ROCKFACE - RL (m)	1054.70				1050.60				1046.70				1042.60				1038.50				1034.40			
TOE OF ROCKFACE - RL (m)	1041.95				1041.87				1041.40				1041.50				1041.50				1041.65			
CHAINAGE (m)	2760				2720				2680				2640				2600				2560			

T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05	
P	PRELIMINARY ISSUE	GKW	24.12.04	GKS	24.12.04	
REVISION	DESCRIPTION	INITS	DATE	INITS	DATE	
		CHECKED		APPROVED		

RTA

Golder Associates

SYDNEY OFFICE
8B CHANNON STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3900
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C2.63
CHAINAGE 2.605 - 2.730

04622081	081D200	T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D200-208.dwg

CUTTING C4.22
4.220 – 4.370

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
S 420	4224		Remove loose block	to 500	2500	<1
C 421	4225	4230	Crest Treatment		1500 – 5000	20
C 422	4230	4237	Scale loose blocks below crest	to 500	4000 – 5000	<1
C 423	4239	4252	Scale loose rocks below crest	to 500	3500 – 4500	2
S 424	4243	4244	Remove loose blocks	to 400	3000 – 3500	<1
	4249	4252	Pattern Rock Bolts (Needs to be coordinated with scaling)		1500 – 4500	
S 425	4249	4252	Scale loose blocks	to 300	2500 – 5000	2
S 426	4253	4257	Scale loose blocks (Potential for RB's after scaling)	to 1000	2000 – 4000	5
S 427	4260	4264	Scale loose blocks	to 300	2500 – 4000	1
C 428	4280	4300	Scale blocks at crest	to 500	4000	2
C 429	4289		Remove tree on crest		4000	
S 430	4302	4311	Scale dead vegetation and loose blocks	to 400	1500 – 5000	2
C 431	4312	4347	Scale loose blocks at crest	to 400	4500	5
S 432	4320	4326	Scale dead vegetation and loose blocks	to 400	3000 – 4000	<1
C 433	4351	4360	Crest Treatment	to 1000	4500	3
	4358		2 x Rock Bolts		3000	
S 434	4360		Remove block	to 600	2500	<1
C 435	4373	4377	Scale loose blocks at crest	to 300	2500 – 3000	<1
S 436	4382		Scale loose blocks	to 400	1000 – 2000	<1
C 437	4386		Scale loose block and soil above block	to 300	2500	2

Estimated Quantities

Rock Bolts	15
Crest Treatment / Clear Vegetation	50 m^3
Scaling of loose blocks	12 m^3
Rock Fence	–

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 401	2100	20°
RB 402	2100	20°
RB 403	2100	20°
RB 404	2100	20°
RB 405	2100	20°
RB 406	2100	20°
RB 407	2100	20°
RB 408	2100	20°
RB 409	2100	20°
RB 410	2100	20°
RB 411	2100	20°
RB 412	2100	20°
RB 413	2100	20°
RB 414	3000	0°
RB 415	3000	0°

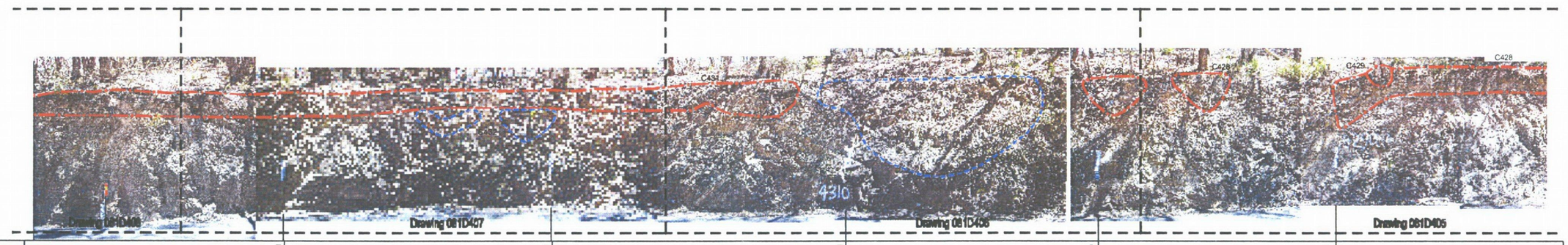
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

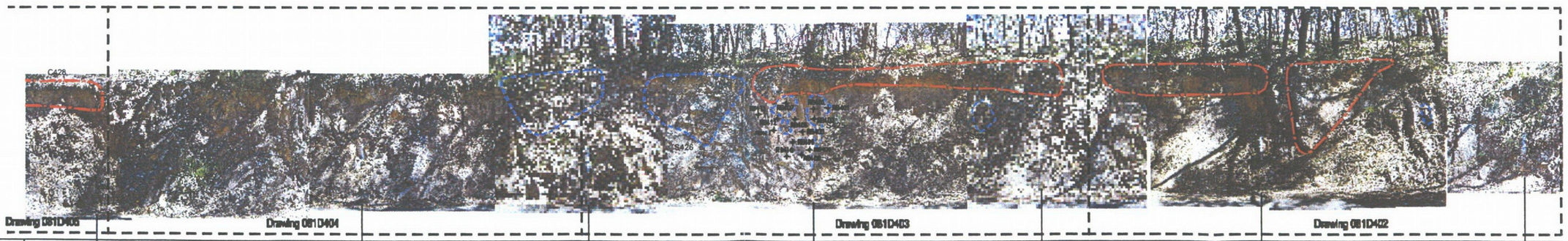
CREST TREATMENT/REMOVE VEGETATION/REGRADE

SCALING OF LOOSE BLOCKS

+RB401 ROCK BOLT



CREST OF ROCKFACE - RL (m)	97.20		97.50		97.50		96.10		95.20		
TOE OF ROCKFACE - RL (m)	88.71		88.80		88.80		87.30		86.40		
CHAINAGE (m)	4320		4330		4340		4350		4360		



CREST OF ROCKFACE - RL (m)	97.50		97.70		97.70		97.50		97.30		97.50
TOE OF ROCKFACE - RL (m)	93.10		93.25		93.10		93.00		93.30		93.00
CHAINAGE (m)	400		410		420		430		440		450

REVISION	DESCRIPTION	DRAWN INITIALS	DRAWN DATE	CHECKED INITIALS	CHECKED DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	24.12.04	GKS	24.12.04

RTA

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3900
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05		

NOT TO SCALE | A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C4.22
CHAINAGE 4.220 - 4.300

04622081 | 081D400 | T0

FILENAME: J:\[04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D400-411.dwg

INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

CREST TREATMENT/REMOVE VEGETATION/REGRADE

SCALING OF LOOSE BLOCKS

+ RB401 ROCK BOLT

REMEDIATION WORK SUMMARY
CUTTING C4.22
4.220 - 4.370

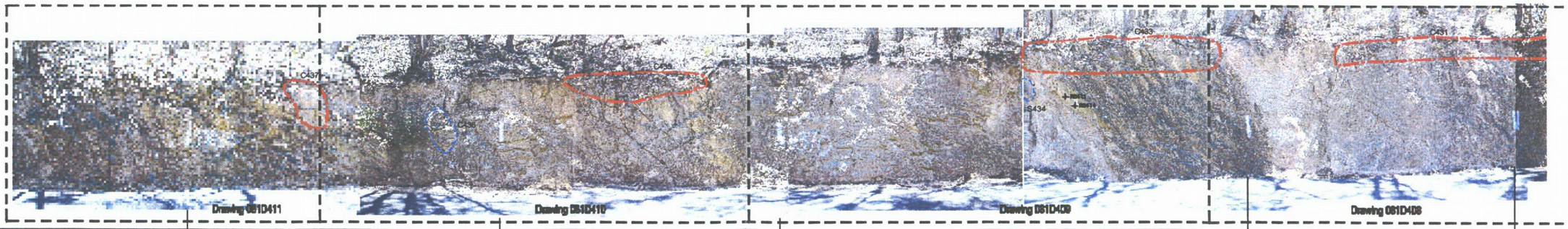
ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
S 420	4224		Remove loose block	to 500	2500	<1
C 421	4225	4230	Crest Treatment		1500 - 5000	20
C 422	4230	4237	Scale loose blocks below crest	to 500	4000 - 5000	<1
C 423	4239	4252	Scale loose rocks below crest	to 500	3500 - 4500	2
S 424	4243	4244	Remove loose blocks	to 400	3000 - 3500	<1
	4249	4252	Pattern Rock Bolts (Needs to be coordinated with scaling)		1500 - 4500	
S 425	4249	4252	Scale loose blocks	to 300	2500 - 5000	2
S 426	4253	4257	Scale loose blocks (Potential for RB's after scaling)	to 1000	2000 - 4000	5
S 427	4260	4264	Scale loose blocks	to 300	2500 - 4000	1
C 428	4280	4300	Scale blocks at crest	to 500	4000	2
C 429	4289		Remove tree on crest		4000	
S 430	4302	4311	Scale dead vegetation and loose blocks	to 400	1500 - 5000	2
C 431	4312	4347	Scale loose blocks at crest	to 400	4500	5
S 432	4320	4326	Scale dead vegetation and loose blocks	to 400	3000 - 4000	<1
C 433	4351	4360	Crest Treatment	to 1000	4500	3
	4358		2 x Rock Bolts		3000	
S 434	4360		Remove block	to 600	2500	<1
C 435	4373	4377	Scale loose blocks at crest	to 300	2500 - 3000	<1
S 436	4382		Scale loose blocks	to 400	1000 - 2000	<1
C 437	4388		Scale loose block and soil above block	to 300	2500	2

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 401	2100	20°
RB 402	2100	20°
RB 403	2100	20°
RB 404	2100	20°
RB 405	2100	20°
RB 406	2100	20°
RB 407	2100	20°
RB 408	2100	20°
RB 409	2100	20°
RB 410	2100	20°
RB 411	2100	20°
RB 412	2100	20°
RB 413	2100	20°
RB 414	3000	0°
RB 415	3000	0°

Estimated Quantities

Rock Bolts	15
Crest Treatment / Clear Vegetation	50 m3
Scaling of loose blocks	12 m3
Rock Fence	-



CREST OF RESERVOIR + RL (m)						
TOE OF RESERVOIR + RL (m)						
CHAINAGE (m)						

REVISION	DESCRIPTION	CHECKED		APPROVED	
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	24.12.04	GKS	24.12.04
		INITIAL	DATE	INITIAL	DATE

RTA

Golder Associates

SYDNEY OFFICE
231 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3900
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C4.22
CHAINAGE 4.300 - 4.390

04622081	081D401	T0

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D400-411.dwg

REMEDIATION WORK SUMMARY

CUTTING C5.08
5080 - 5250

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
C512	5080	5108	Regrade	to 2000	2000 – 5000	100
C513	5108	5120	Regrade towards gully @ 5120	to 1000	2000 – 5000	100
C514	5135	5140	Regrade towards gully @ 5135	to 1000	2500	15
S515	5138	5146	Remove blocks	to 500	2000	
	5150	5160	Remove block above crest	to 1000	5000	1–2
C518	5154	5176	Crest treatment and scaling	to 500	0 – 4500	5
S517	5165		Remove tree		2000	
S518	5189		Remover loose blocks		1000 – 3000	4 – 5
S519	5174	5177	Remove block	to 500	3000 – 4000	4 – 5
C520	5178	5196	Crest treatment and scaling	to 1000	4000 – 8000	5 – 10
S521	5200		Remove block	to 500	5000	
C522	5200	5223	Regrade rock face to remove overhangs		2000 –5000	100
	5227		2 x Rock Bolt		5000	
S523	5227		Remove block 3000 above crest	to 500	5000	< 1
	5230		2 x Rock Bolt		3500	
S524	5230		Remove blocks on crest		4000	< 1
	5238		5 x Rock Bolts		5000	
S525	5238		Remove blocks around rock bolted blocks	to 500	4000 – 5000	
S526	5243		Remove blocks behind tree above crest	to 400	4000 – 7000	
	5243		2 x Rock Bolt		2000	

Estimated Quantities

Rock Bolts	11
Crest Treatment / Clear Vegetation	325 m^3
Scaling of loose blocks	20 m^3
Rock fence	–

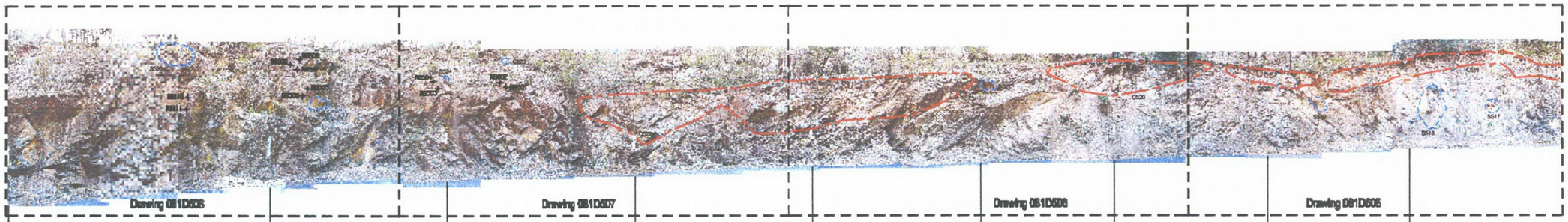
Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 501	3000	20°
RB 502	3000	20°
RB 503	3000	20°
RB 504	3000	20°
RB 505	3000	20°
RB 506	3000	20°
RB 507	3000	20°
RB 508	3000	20°
RB 509	3000	20°

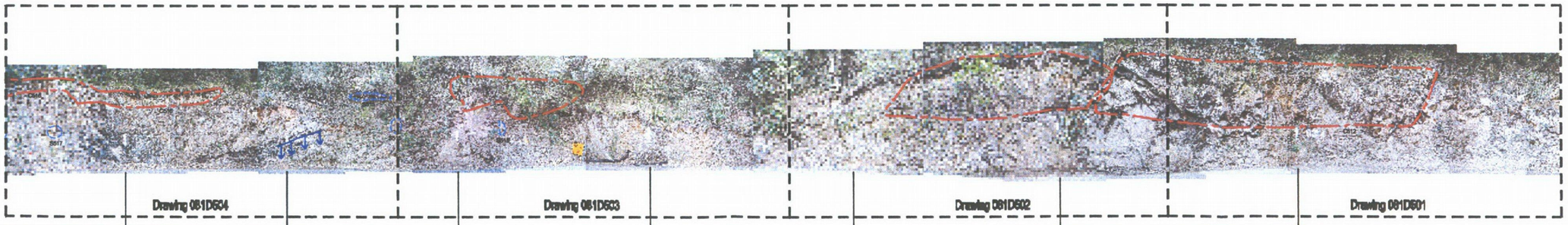
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- RB501 ROCK BOLT
- SEEPAGE



	Drawing 081D606	Drawing 081D607	Drawing 081D608	Drawing 081D605
CREST OF ROCKFACE - RL (m)	659.39	659.36	659.29	659.24	659.29	659.39	659.46	659.44	659.44
TOE OF ROCKFACE - RL (m)	654.66	654.56	654.56	655.24	655.41	654.67	654.74	654.79	654.78
CHAINAGE (m)	5080	5090	5100	5110	5120	5130	5140	5150	5160



	Drawing 081D604	Drawing 081D603	Drawing 081D602	Drawing 081D601
CREST OF ROCKFACE - RL (m)	659.46	659.49	659.41	659.36	659.35	659.23	
TOE OF ROCKFACE - RL (m)	654.50	654.45	654.50	654.68	657.28	657.77	654.68	
CHAINAGE (m)	5160	5170	5180	5190	5200	5210	5220	

REVISION	DESCRIPTION	INITS	DATE	CHECKED INITS	CHECKED DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05

RTA

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 5800
FAX (02) 9478 5801

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C5.08
CHAINAGE 5080 - 5250

04622081	081D500	T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D500-527.dwg

REMEDIATION WORK SUMMARY

CUTTING C5.29
5290 - 5350

ID	Chainage		Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
	Start	Finish				
	5250	5290	Increase drain width DR rock catch fence			
S550	5257		Remove blocks	to 500	6000	<1
S551	5258		Remove block	to 500	4000	<1
S552	5275	5275	Remove wedge of rock	to 1000	6000	2
C553	5280	5288	Remove wedge of blocky rock	to 400	2000 – 6000	5
S554	5290	5300	Remove blocks	to 600	4500 – 5000	1
	5290	5310	Pattern Rock Bolts		2000 – 4000	
C555	5300	5310	Remove unstable blocks	to 2000	1500 – 4500	5 – 10
C556	5300	5315	Crest Treatment	to 500	2500 – 4500	5
C557	5318	5328	Regrade	to 1000	2500 – 4500	15 – 25
C558	5323	5339	Scale blocks above crest	to 500	4500	5 – 10
	5338		3 x Rock Bolts		2000 – 3000	
C559	5338	5360	Crest Treatment / Scale blocks above crest		4000	30 – 40

Estimated Quantities

Batters	m^2
Cut Volume Excavation	m^3
Benching Excavation	m^3
Total Cut	m^3

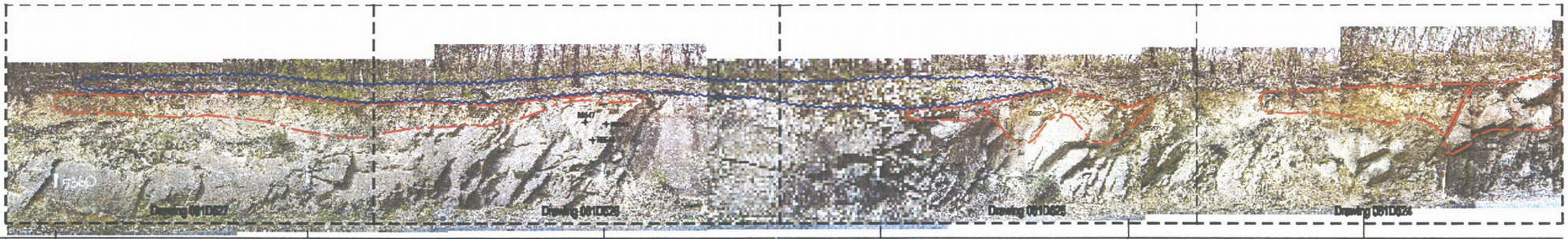
Rock Bolt details

Bolt No.	Length (mm)	Inclination
RB 530	3000	30°
RB 531	3000	30°
RB 532	3000	30°
RB 533	3000	30°
RB 534	2100	30°
RB 535	2100	30°
RB 536	2100	30°
RB 537	2100	30°
RB 538	2100	30°
RB 539	2100	30°
RB 540	2100	30°
RB 541	2100	30°
RB 542	2100	30°
RB 543	2100	30°
RB 544	2100	30°
RB 545	3600	10°
RB 546	3600	10°
RB 547	3600	10°

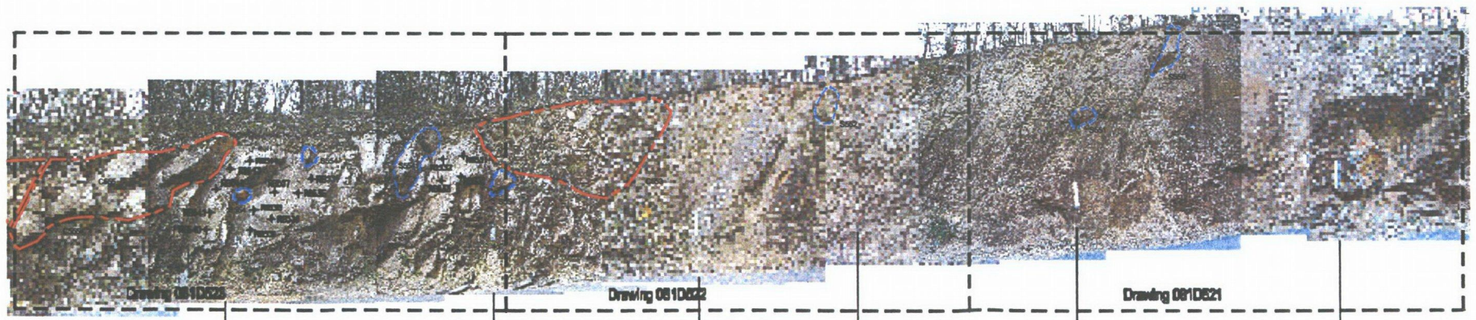
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- SCALE BLOCK ABOVE CREST
- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- +RB545 ROCK BOLT



CREST OF ROCKFACE - RL (m)							
TOE OF ROCKFACE - RL (m)							
CHAINAGE (m)							



CREST OF ROCKFACE - RL (m)						
TOE OF ROCKFACE - RL (m)						
CHAINAGE (m)						

REVISION	DESCRIPTION	INITS	DATE	INITS	DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05
		CHECKED		APPROVED	

RTA

Golder Associates

SYDNEY OFFICE
86 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3600
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C5.29
CHAINAGE 5250 - 5360

04622081	081D520	T0

FILENAME: J:\D4Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D500-527.dwg

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

REMEDIATION WORK SUMMARY
CUTTING C7.02
7020 - 7120

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
	7035		4 x Rock Bolt		2500 - 3500	
S 710	7039		Remove block	to 1000	5000	<1
C 711	7042	7045	Clear vegetation and assess exposed conditions		2000 - 5000	
S 712	7046		Remove blocks	to 500	4500 - 5000	<1
S 713	7047	7050	Remove blocks & allow for RB's behind blocks	to 1500	1500 - 2500	5
C 714	7050		Remove tree		2500	
	7053		2 x Rock Bolt	to 1200	2500	
C 715	7057	7075	Regrade slope to remove rock knoll and match sides with either side. Cut slope estimate at 65°	to 2000	1500 - 7000	200
C 716	7090	7105	Regrade slope to remove rock knoll and match sides with either side	to 2000	1000 - 5500	100
C 717	7105	7120	Regrade slope to remove rock knoll and match sides with either side	to 2000	1000 - 5000	200

Estimated Quantities

Rock Bolts	6
Crest Treatment / Clear Vegetation	500 m^3
Scaling of loose blocks	5 m^3
Rock Fence	–

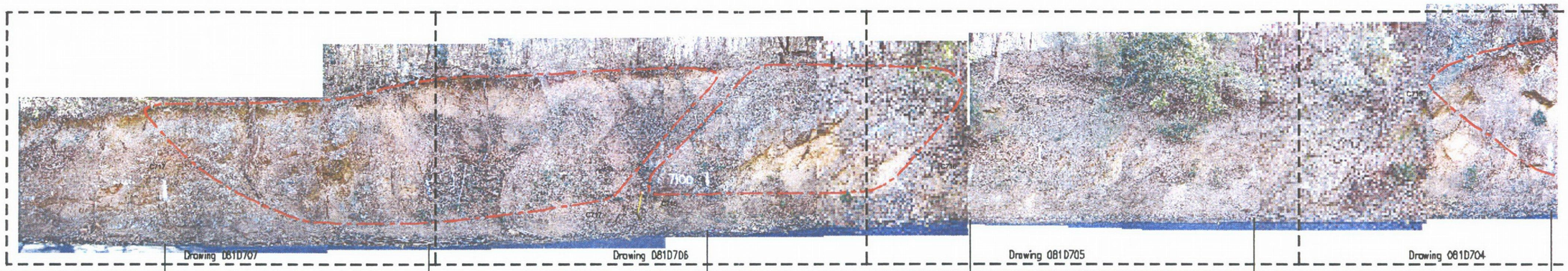
Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB 701	3000	10°
RB 702	3000	10°
RB 703	3000	10°
RB 704	3000	10°
RB 705	2400	20°
RB 706	2400	20°

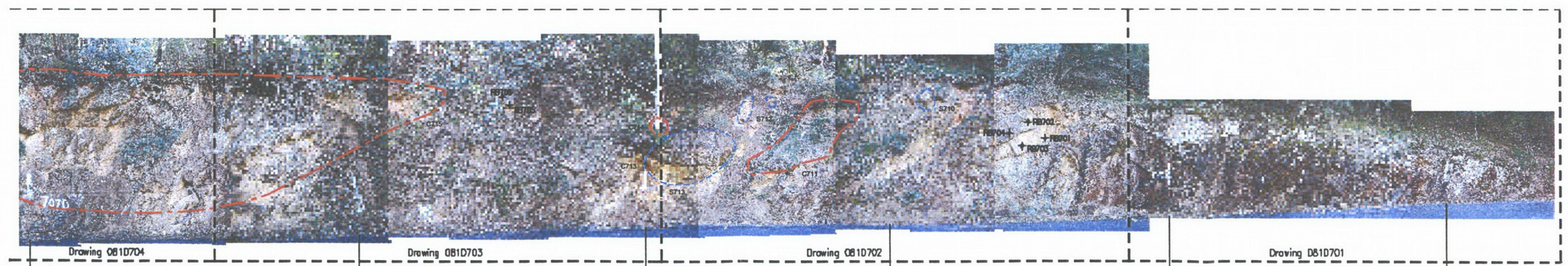
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- RB703 ROCK BOLT



CREST OF ROCKFACE - R1 (m)		818.60			819.70			820.15			822.48			825.31			826.86						
TOE OF ROCKFACE - R1 (m)	814.92			818.34			818.26			818.95			817.78			819.34						
CHAINAGE (m)	7120			7110			7105			7100			7095			7090			7085			7075			7070



CREST OF ROCKFACE - R1 (m)	818.60			824.71			824.30			823.58			821.17			820.16						
TOE OF ROCKFACE - R1 (m)	818.34			818.40			820.20			820.51			821.24			821.40						
CHAINAGE (m)	7070			7065			7060			7050			7045			7040			7035			7025			7020

REVISION	DESCRIPTION	INITIALS	DATE	INITIALS	DATE
				CHECKED	APPROVED
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05

RTA

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3800
FAX (02) 9478 3801

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C7.02
CHAINAGE 7020 - 7120

04622081	081D700	T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_ICR\Drawings\04622081-D700-707.dwg

REMEDIATION WORK SUMMARY
CUTTING C7.44
7440 - 7490

ID	Chainage		Remediation	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
	Start	Finish				
C743	7443	7445	Regrade	to 500	1500 – 4000	<20
	7443	7444	2 x Rock Bolt		2000	
C744	7486	7492	Regrade	to 500	4000 – 5000	5

Estimated Quantities

Rock Bolts	2
Crest Treatment / Clear Vegetation	25 m^3
Scaling of loose blocks	–
Rock Fence	–

INTERPRETIVE ONLY
DO NOT SCALE

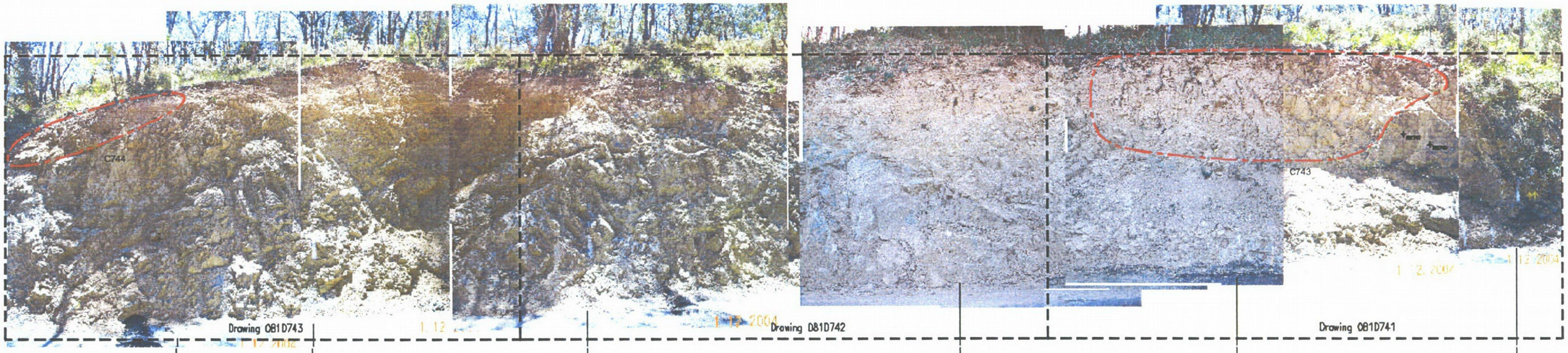
LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- RB740 ROCK BOLT

NOTE: RECONSTRUCTION OF PAVEMENTS IS TO INCLUDE PROVISION OF TOE DRAIN ALONG LENGTH OF CUTTING. ESTIMATED WIDTH OF DEPTH OF DRAIN IS 1000 mm AND 3000 mm.

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB741	2400	10°
RB742	2400	10°



CREST OF ROCKFACE - RL (m)												
TOE OF ROCKFACE - RL (m)												
CHAINAGE (m)	7400	7410	7420	7430	7440	7450	7460	7470	7480	7490	7500	7510

REVISION	DESCRIPTION	DRAWN	DATE	CHECKED	DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3900
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C7.44
CHAINAGE 7440 - 7490

04622081	081D740	T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-0740-743.dwg

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

REMEDIATION WORK SUMMARY
CUTTING C7.58
7035 - 7120

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Block Size (mm)	Approx. Height from Toe/ Height to Crest (mm)	Volume Estimate (m³)
C 779	7320	7375	Crest Treatment and removing loose blocks above crest	to 400	5000	<1
S 777	7540		Remove Block	to 1800	4800	<1
I 776	7545	7550	Remove section on northbound slope	to 1800	1800 - 3600	
I 775	7554		Scale loose blocks	to 300	0 - 3600	<1
C 774	7598	7652	Remove rock bolt/ shotcrete/ chain/ cable/ anchor head		0 - 7000	20
S 773	7580	7598	Scale loose blocks	to 300	1800 - 5000	<1
S 771	7699		Remove Block at crest	to 700	1800	<1
	7697		2 x Rock Bolt		2000	
	7695		2 x Mesh Bolt		2540 - 3800	
C 777	7608	7638	Remove blocks at crest	to 1800	1800	<1
	7639		3 x Rock Bolt		2540 - 3500	
C 776	7638		Remove burnt tree		3000 - 4800	
S 775	7673		Localised scaling of loose rocks		1800 - 4800	<1
S 788	7613	7679	Local regrade of crest to remove rock that will not be retained			25 - 35
S 787	7617	7632	Localised scaling of loose blocks			1 - 2
C 787	7654	7730	Localised regrade to remove blocks	to 1800	1800 - 3600	4 - 6
C 786	7624	7717	Crest Treatment and localised scaling	to 300	1800 - 4800	2 - 3
S 784	7633	7653	Remove Block	to 1800	3000 - 4800	1 - 2
S 785	7643		Remove Block	to 1800	1800 - 3600	1 - 2
C 783	7657	7680	Crest Treatment and localised scaling		4000 - 7600	18
S 782	7679		Scaling of blocks	to 300	1800 - 3600	<1
C 780	7687	7695	Pattern Rock Bolts, local scaling, localised regrading	to 1800	3000 - 6800	10 - 20
	7687		3 x Rock Bolt		3800	
S 781	7691		Remove tree		1800	
S 780	7699		Remove block on crest	to 400	5000	<1
R 781	7708	7730	Localised Scale removal	to 800	1800	2 - 3
S 788	7720		Remove loose blocks at crest	to 300	5000	1 - 2
C 791	7705		Remove tree at crest		1800	
S 791	7726		Remove blocks above crest	to 1800	1800	2 - 3
	7725		Against 30m above Road, a number of large blocks (to 3.5m) to be removed in conjunction with NPWS			
	7704		Rock Bolt		1400	
C 789	7730	7745	Localised scaling / tree removal / crest treatment		3600 - 6800	10 - 15

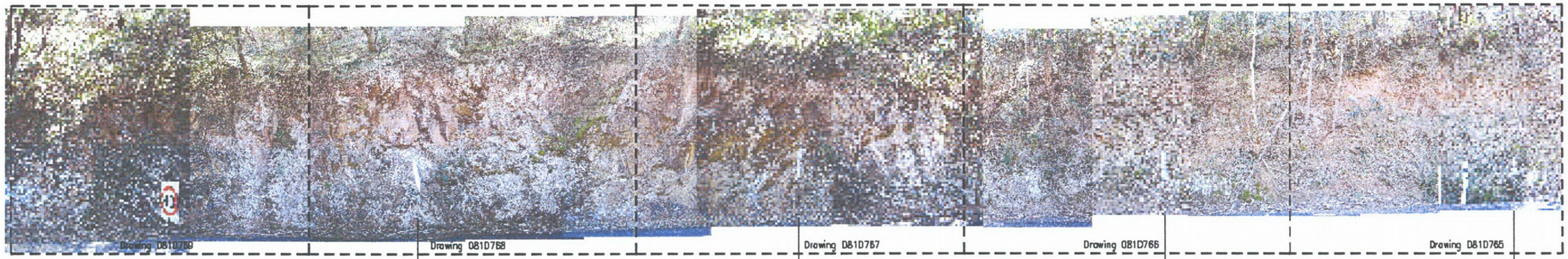
Estimated Expenditure	
Scaffolds	-
Rock Excavation Crew required	- No
Ecological Consultants	- No

Rockfall Details		
Block No.	Length (mm)	Protection
RB 7731	3000	RB7
RB 7692	3000	RB7
RB 7735	3000	RB7
RB 7741	3000	RB7
RB 7743	3000	RB7
RB 7668	3000	RB7
RB 7671	3000	RB7
RB 7746	3000	RB7
RB 7698	3000	RB7
RB 7674	3000	RB7
RB 7753	3000	RB7
RB 7682	3000	RB7
RB 7743	3000	RB7
RB 7694	3000	RB7
RB 7693	3000	RB7
RB 7680	3000	RB7
RB 7671	3000	RB7

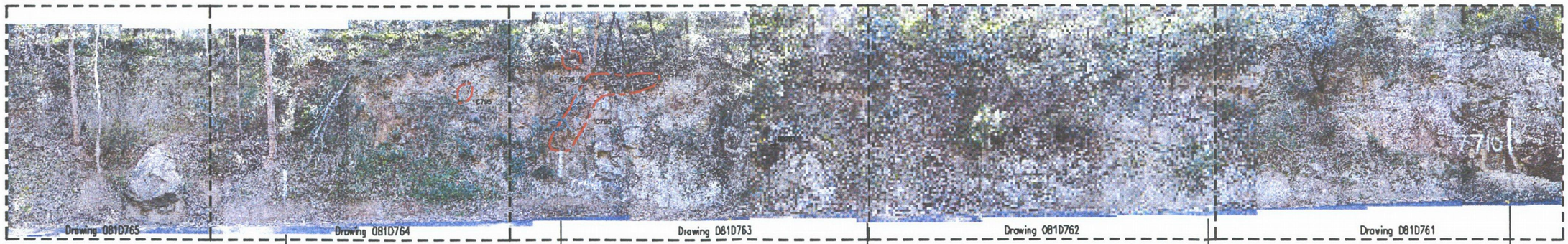
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- RB501 ROCK BOLT



CREST OF ROCKFACE – RL (m)						
TOE OF ROCKFACE – RL (m)						
CHAINAGE (m)	7800	7795	7790	7785	7780	7775	7770	7765	7760



CREST OF ROCKFACE – RL (m)						
TOE OF ROCKFACE – RL (m)						
CHAINAGE (m)	7760	7755	7750	7745	7740	7735	7730	7725	7720	7715	7710

REVISION	DESCRIPTION	INITIALS	DATE	CHECKED INITIALS	CHECKED DATE	APPROVED INITIALS	APPROVED DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05		
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05		

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 2900
FAX (02) 9478 2601

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C7.58
CHAINAGE 7710 - 7800

04622081	081D751	T0

NOTE: THE * BESIDE THE TYPED INITIALS DENOTES THE ORIGINAL DRAWING ISSUE WAS SIGNED OR INITIALLED BY THAT RESPECTIVE PERSON.

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D750-768.dwg

REMEDIATION WORK SUMMARY
CUTTING C7.58
7570 - 7710

ID	Chainage Start	Chainage Finish	Remedials	Estimate Max. Block Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m³)
S 776	7670	7676	Crest Treatment and remove loose blocks above crest	to 500	6000	<1
S 771	7578		Remove block	to 1000	4000	<1
S 777	7678	7684	Remove wedge at overhang crest	to 2500	1000 - 5000	
S 772	7581		Scale loose blocks	to 300	0 - 3000	<1
C 774	7588	7593	Regrade rock fall debris sidelong onto road		0 - 5000	28
S 778	7693	7701	Scale loose blocks	to 300	1000 - 8000	<1
S 773	7588		Remove block at crest	to 700	3000	<1
	7589		3 x Rock BLT		2500	
	7604		3 x Rock BLT		2500 - 3500	
S 777	7600	7609	Remove blocks at crest	to 1000	4500	<1
	7608		3 x Rock BLT		2500 - 3500	
S 776	7609		Remove burnt tree		3500 - 4500	
S 779	7613		Localised scaling of loose rocks		1500 - 4000	<1
S 780	7615	7619	Local regrade of crest to remove rock lined off vertical			20 - 25
S 781	7619	7624	Localised scaling of loose rocks			1 - 5
S 782	7624	7627	Localised regrade to remove blocks	to 1000	1000 - 3000	3 - 5
S 783	7629	7647	Crest Treatment and localised scaling	to 300	1000 - 4000	2 - 3
S 784	7632	7638	Remove Block	to 1000	3000 - 4000	1 - 2
S 785	7643		Remove Block	to 1200	1000 - 2500	1 - 2
S 785	7638	7666	Crest Treatment and localised scaling		4500 - 7000	10
S 787	7676		Scaling of blocks	to 300	1500 - 2500	<1
S 786	7660	7663	Pattern Rock Bolts, local scaling, localised regrading	to 1000	3000 - 6000	10 - 20
	7662		3 x Rock BLT		3000	
S 788	7688		Remove tree		4500	
S 789	7688		Remove block at crest	to 400	6000	<1
S 787	7698	7700	Localised block removal	to 800	5000	2 - 3
S 790	7705		Remove loose blocks at crest	to 300	6000	1 - 2
S 790	7700		Remove tree at crest		6000	
S 794	7710		Remove blocks above crest	to 1000	8000	2 - 3
	7725		Approx 30m above Road, a number of large blocks (to 3.0m) to be assessed in conjunction with RFNS			
	7734		Rock Bolt		1000	
S 795	7735	7743	Localised scaling / tree removal / crest treatment		2000 - 6000	10 - 15

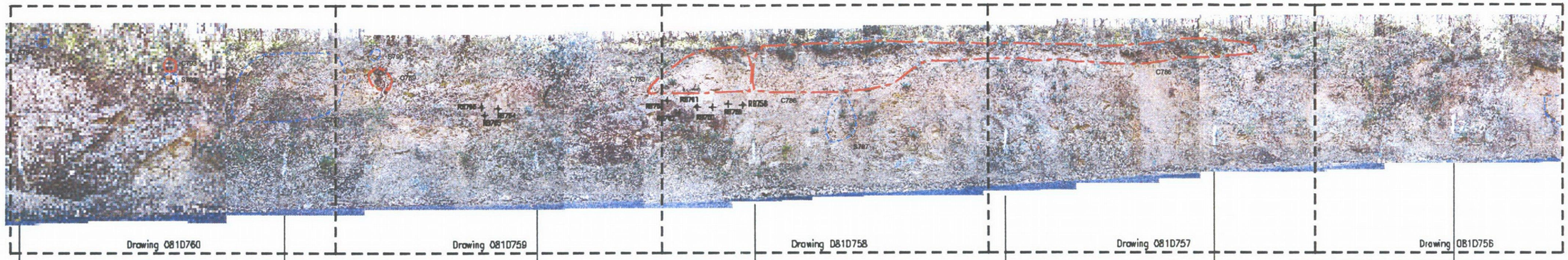
Estimated Quantities	
Rock Bolts	17
Crest Treatment / Clear Vegetation	70 m²
Scaling of loose blocks	30 m²
Rock Fence	–

INTERPRETIVE ONLY
DO NOT SCALE

Rock Bolt Details		
Bolt No.	Length (mm)	Orientation
RB 751	6000	90°
RB 752	6000	90°
RB 753	6000	90°
RB 754	6000	90°
RB 755	6000	90°
RB 756	6000	90°
RB 757	6000	90°
RB 758	6000	90°
RB 759	6000	90°
RB 760	6000	90°
RB 761	6000	90°
RB 762	6000	90°
RB 763	6000	90°
RB 764	6000	90°
RB 765	6000	90°
RB 766	6000	90°
RB 767	6000	90°

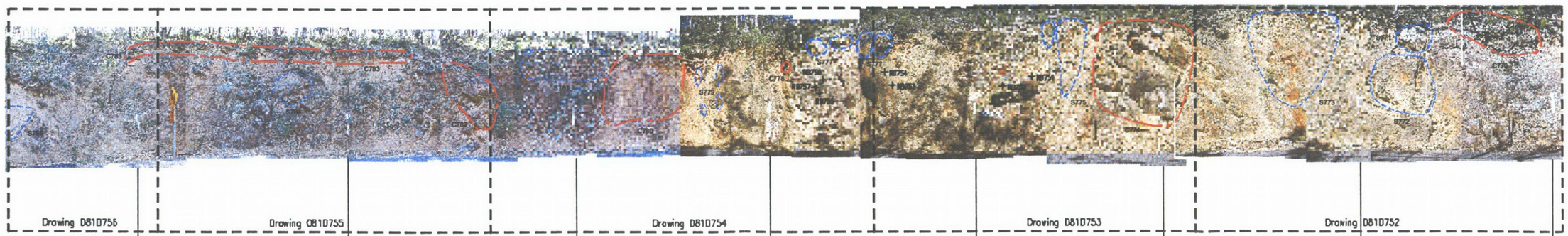
LEGEND:

- CREST TREATMENT/REMOVE VEGETATION
- SCALING OF LOOSE BLOCKS
- RB75B ROCK BOLT



Drawing 081D760 | Drawing 081D759 | Drawing 081D758 | Drawing 081D757 | Drawing 081D756

	7570	7585	7590	7595	7600	7605	7610	7615	7620	7625	7630	7635	7640	7645	7650	7655	7660	7665	7670	7675	7680	7685	7690	7695	7700	7705	7710
CREST OF ROCKFACE – RL (m)	779.07																										
TOE OF ROCKFACE – RL (m)	765.52	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	765.50	767.07	767.07	767.07	767.07	765.52	765.52	765.52	765.52	765.52
CHAINAGE (m)	7710	7705	7700	7695	7690	7685	7680	7675	7670	7665	7660	7655	7650	7645	7640	7635	7630	7625	7620	7615	7610	7605	7600	7595	7590	7585	7570



Drawing D810756 | Drawing 081D755 | Drawing D810754 | Drawing D810753 | Drawing D810752

	7635	7640	7645	7650	7655	7660	7665	7670	7675	7680	7685	7690	7695	7700	7705
CREST OF ROCKFACE – RL (m)	784.14														
TOE OF ROCKFACE – RL (m)	768.50	768.88	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00	769.00
CHAINAGE (m)	7635	7640	7645	7650	7655	7660	7665	7670	7675	7680	7685	7690	7695	7700	7705

REVISION	DESCRIPTION	INITIALS	DATE	CHECKED INITIALS	CHECKED DATE	APPROVED INITIALS	APPROVED DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05		
P	PRELIMINARY ISSUE	GKW	17.1.05	GKS	17.1.05		

RTA

Golder Associates
SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3800
FAX (02) 9478 3801

ROADS AND TRAFFIC AUTHORITY

JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C7.58
CHAINAGE 7570 - 7710

04622081 | 081D750 | T0

FILENAME: J:\04Proj\051-100\04622081_RTA_Slopes_JCR\Drawings\04622081-D750-769.dwg

REMEDIATION WORK SUMMARY

CUTTING C8.13
8.100 - 8.210

ID	Chainage Start	Chainage Finish	Remediation	Estimate Max. Rock Size (mm)	Approx. Height from toe / Height to Crest (mm)	Volume Estimate (m^3)
RCF B30	B100	B120	Fence across gully			
S B31	B120		Scale blocks	to 200	4000 - 9000	<1
	B130	B135	Pattern Rock Bolts		1500 - 3500	
S B32	B130	B136	Scale blocks	to 1000	3000 - 5000	<1
C B33	B130	B133	Remove tree and localised scaling at crest	to 200	5500	<1
	B136		2 x Rock Bolt		2000	
	B138		2 x Rock Bolt			
C B34	B140	B148	Remove blocks at crest	to 800	6000 - 10000	2
C B35	B148	B158	Clear vegetation and scale loose blocks and crest			2
S B36	B152		Remove block in near vertical face		500 - 3000	<1
S B37	B153		Scale loose blocks	to 400	2000 - 3000	<1
	B153		2 x Rock Bolt		3000	
RCF B38	B158	B168	Rock catch fence			
C B39	B184	B190	Scale localised loose blocks at crest	to 400	3000 - 4000	5
	B174	B178	Pattern Rock Bolts with mesh attached / localised scaling		1000 - 4000	
S B40	B188		Remove rock lineil	to 1000	2000 - 3000	2
	B191		2 x Rock Bolt		3000	
S B41	B195	B200	Resecure small rock lusil	to 500	2000 - 3500	2
C B42	B201	B205	Clear vegetation and scale loose blocks and crest	to 500	1000 - 3000	<1

Rock Bolt Details

Bolt No.	Length (mm)	Inclination
RB B01	3600	10°
RB B02	3600	10°
RB B03	2400	10°
RB B04	2400	10°
RB B05	2400	10°
RB B06	3600	10°
RB B07	3600	10°
RB B08	2400	10°
RB B09	2400	10°
RB B10	2400	20°
RB B11	2400	20°
RB B12	3600	0°
RB B13	3600	0°
RB B14	3600	0°
RB B15	3600	0°
RB B16	2100	0°
RB B17	2100	0°
RB B18	2100	0°
RB B19	2100	0°
RB B20	2100	0°
RB B21	2100	0°
RB B22	2100	0°
RB B23	2100	0°
RB B24	2400	20°
RB B25	2400	20°

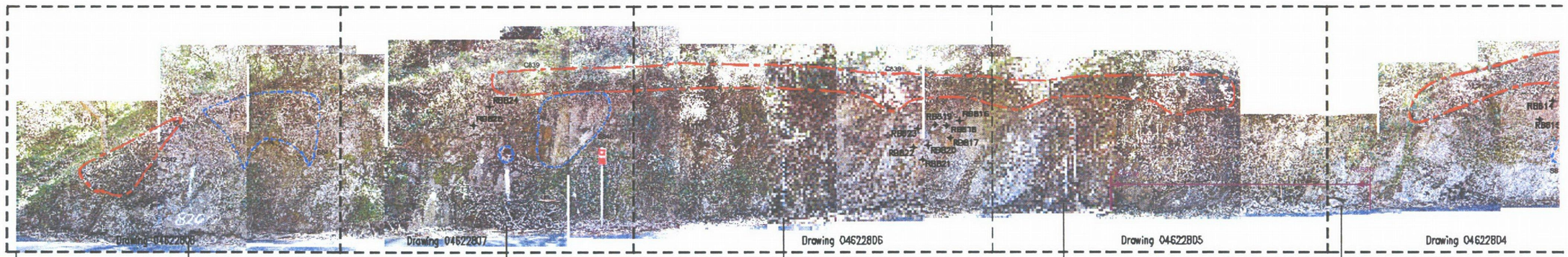
Estimated Quantities

Rock Bolts	32
Crest Treatment / Clear Vegetation	11 m^3
Scaling of loose blocks	3 m^3
Rock Fence	25 m

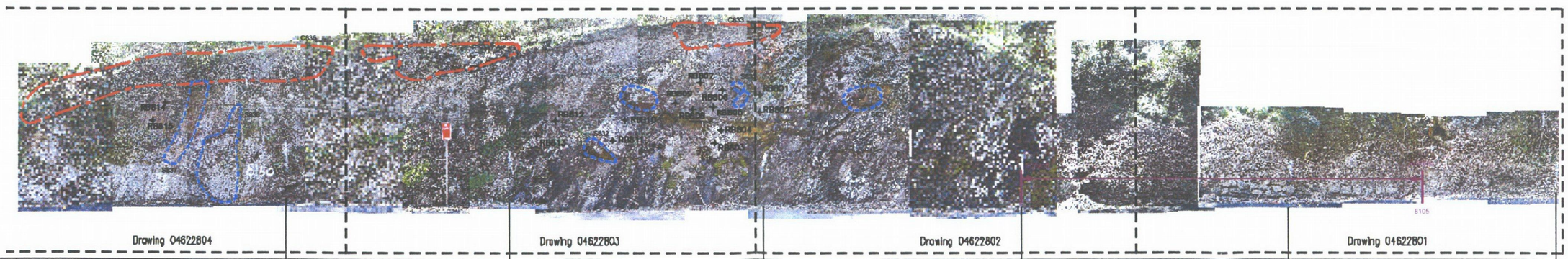
INTERPRETIVE ONLY
DO NOT SCALE

LEGEND:

- RB805 + ROCK BOLT
- CREST TREATMENT/CLEAR VEGETATION
- SCALING OF LOOSE BLOCKS
- RCF ROCK CATCH FENCE



CREST OF ROCKFACE - R.L. (m)	787.58		784.44		771.10	768.97	765.30
TOE OF ROCKFACE - R.L. (m)	784.50	784.00	781.00	765.95	764.10	761.18
CHAINAGE (m)	8200	8190	8180	8170	8160	8150



CREST OF ROCKFACE - R.L. (m)	771.94		771.41		770.10	767.40	-
TOE OF ROCKFACE - R.L. (m)	768.82	768.40	767.18	767.30	767.40	767.60
CHAINAGE (m)	8150	8140	8130	8120	8110	8100

REVISION	DESCRIPTION	INITIALS	DATE	CHECKED INITIALS	DATE
T0	TENDER ISSUE	GKW	09.2.05	GKS	09.2.05
P	PRELIMINARY ISSUE	GKW	24.12.04	GKS	24.12.04

RTA

Golder Associates

SYDNEY OFFICE
88 CHANDOS STREET
ST LEONARDS, NSW 2065 AUSTRALIA
PH (02) 9478 3900
FAX (02) 9478 3901

ROADS AND TRAFFIC AUTHORITY			
JC	09.02.05	GKW	09.02.05
GKW	09.02.05	GKS	09.02.05
GKS	09.02.05	NOT TO SCALE	A1

SLOPE REMEDIATION, JENOLAN CAVES ROAD

REMEDIATION WORK SUMMARY
CUTTING C8.13
CHAINAGE 8.100 - 8.210

04622081	081D800	T0

FILENAME: J:\04Proj\091-100\04622081_RTA_Slopes_JCR\Drawings\04622081-U800-808.dwg

Appendix E Results of Database Searches

Your Ref: H/43094
Our Ref: AHIMS #9706

Rta Environment Technology
Level 5, Pod D, 99 Phillip Street
Parramatta NSW 2150

Friday, 30 April 2004

Attention:

Dear Sir or Madam:

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 841 387 27

Re: AHIMS Search for the following area at Jenolan Caves
Zone 56 Eastings: 222000-228000 Northings: 6250000-6260000

I am writing in response to your recent inquiry in respect to Aboriginal objects and Aboriginal places registered with the NSW National Parks and Wildlife Service (NPWS) at the above location.

A search of the NPWS Aboriginal Heritage Information Management System (AHIMS) has shown that 18 Known Aboriginal objects and Aboriginal places are recorded in or near the above location. Please refer to the attached report for details.

The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.

The following qualifications apply to an AHIMS search:

- AHIMS only includes information on Aboriginal objects and Aboriginal places that have been provided to NPWS;
- Large areas of New South Wales have not been the subject of systematic survey or recording of Aboriginal history. These areas may contain Aboriginal objects and other heritage values which are not recorded on AHIMS;
- Recordings are provided from a variety of sources and may be variable in their accuracy. When an AHIMS search identifies Aboriginal objects in or near the area it is recommended that the exact location of the Aboriginal object be determined by re-location on the ground; and
- The criteria used to search AHIMS are derived from the information provided by the client and NPWS assumes that this information is accurate.

All Aboriginal places and Aboriginal objects are protected under the *National Parks and Wildlife Act 1974* (NPW Act) and it is an offence to destroy, damage or deface them without the prior consent of the NPWS Director-General. An Aboriginal object is considered to be known if:

- It is registered on AHIMS;
- It is known to the Aboriginal community; or
- It is located during an investigation of the area conducted for a development application.

Head Office
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

If you are considering undertaking a development activity in the area subject to the AHIMS search, NPWS would recommend that an Aboriginal Heritage Assessment be undertaken. You should consult with the relevant consent authority to determine the necessary assessment to accompany your development application.

Yours Sincerely

Paul Houston
Aboriginal Information Officer
Information Systems Unit
Cultural Heritage Division
Phone: (02) 9585 6471
Fax: (02) 9585 6094

National Native Title Tribunal

Printer-friendly versio

keywords

NATIVE TITLE APPLICATIONS

Claimant application summary

Application name:	Gundungurra Tribal Council Aboriginal Corporation #6
Application type:	Claimant application
State/Territory:	New South Wales
Date filed:	29/04/1997
Register of Native Title Claims status:	Registered
Federal Court file no.:	NG6060/98
Tribunal file no.:	NC97/7
Status:	Active
Area description:	South of Katoomba to Goulburn
ATSIC region (s):	Binaal Billa Regional Council Queanbeyan Regional Council Sydney Regional Council
Representative A/TSI Body area(s):	NSW Native Title Services Ltd
Local government region(s):	Bathurst City Council Blayney Shire Council Blue Mountains City Council Camden Council City of Lithgow Cowra Shire Council Eastern Capital City Regional Council Greater Argyle Council Liverpool City Council Oberon Council Penrith City Council Upper Lachlan Council Wingecarribee Shire Council Wollondilly Shire Council
Applicants' representative:	Murray Craddock Nuemann

About the Tribunal

Native Title Applications
- Overview
- Information material
- Maps and spatial data
- How to apply
- Tribunal assistance
- Registration test
- Procedures and guidelines
- Sample clauses and agreements
- Search applications
- Browse determinations
- National Native Title Register
- Register of Native Title Claims
- Other organisations
- Contact for applications

Indigenous Land Use Agreements

Future Acts

Registers

What's New

Current Projects

Media Centre

Information and Publications

For definitions of specific native title words and terms see the Glossary.

Notification status:	Notification Complete
Notification closing date:	14/02/2001
In mediation:	Yes
Case manager:	Nicole Maher
Member:	G Sculthorpe

National Native Title Tribunal

Search results

Your search for native title applications using the criteria: in the local government region of oberon* lodged between January 1994 and January 2005 returned **5** results. Showing **1 to 5**. Search again

Date filed	Application name	Application type	Status	State/ Territory	Tribunal file no.	Federal Court file no.
25/11/1996	Gundungurra Tribal Council Aboriginal Corporation #4	Claimant application	Active	New South Wales	NC96/36 --	NG6050/98
26/11/1996	Wiradjuri (Oberon)	Claimant application	Finalised Dismissed	New South Wales	NC96/37 --	NG6051/98
29/04/1997	Gundungurra Tribal Council Aboriginal Corporation #6	Claimant application	Active	New South Wales	NC97/7 --	NG6060/98
30/04/1999	Kim Moran #3	Claimant application	Finalised Dismissed	New South Wales	NC99/3 --	N6006/99
31/08/1999	Molong Tribe	Claimant application	Finalised Discontinued	New South Wales	NC99/5 --	N6013/99

Page: **1**

About the Tribunal

Native Title Applications
- Overview
- Information material
- Maps and spatial data
- How to apply
- Tribunal assistance
- Registration test
- Procedures and guidelines
- Sample clauses and agreements
- Search applications
- Browse determinations
- National Native Title Register
- Register of Native Title Claims
- Other organisations
- Contact for applications

Indigenous Land Use Agreements

Future Acts

Registers

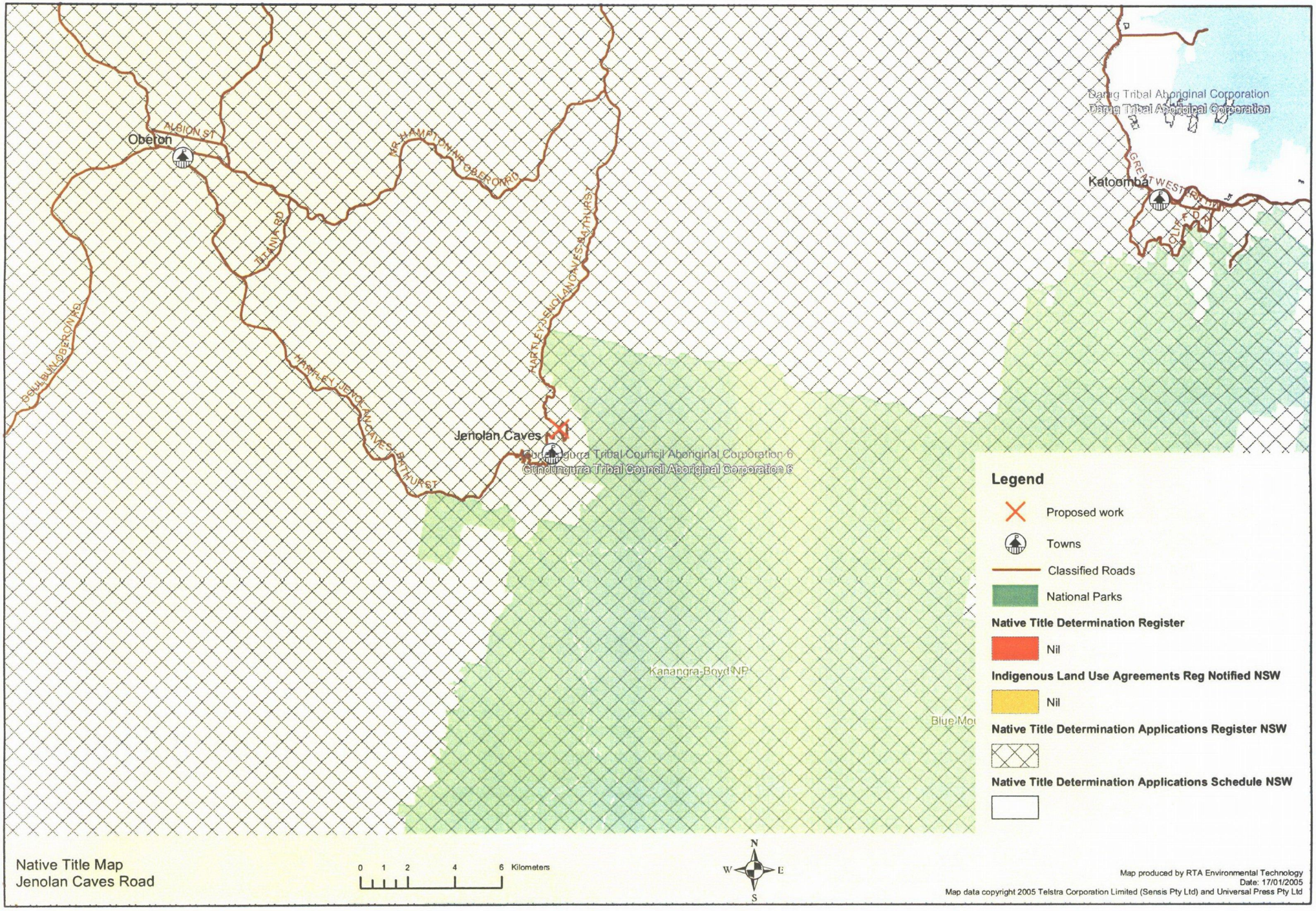
What's New

Current Projects

Media Centre

Information and Publications

For definitions of specific native title words and terms see the Glossary.


Oberon
ALBION ST
BELLBIRD OBERON RD
JENOLAN RD
MR HAMPTON OBERON RD
HARTLEY JENOLAN CAVES BATHURST
HARTLEY JENOLAN CAVES BATHURST
Jenolan Caves
Gundungurra Tribal Council Aboriginal Corporation 6
Gundungurra Tribal Council Aboriginal Corporation 6
Darug Tribal Aboriginal Corporation
Darug Tribal Aboriginal Corporation
Katoomba
GREAT WESTERN HWY
Kanangra-Boyd NP
Blue Mou
Legend
Proposed work
Towns
Classified Roads
National Parks
Native Title Determination Register
Nil
Indigenous Land Use Agreements Reg Notified NSW
Nil
Native Title Determination Applications Register NSW
Native Title Determination Applications Schedule NSW
Native Title Map
Jenolan Caves Road
0 1 2 4 6 Kilometers
N
W E
S
Map produced by RTA Environmental Technology
Date: 17/01/2005
Map data copyright 2005 Telstra Corporation Limited (Sensis Pty Ltd) and Universal Press Pty Ltd

FISH FILES Search Results

NSW Fisheries Home | About FISH FILES | Need Assistance? | Disclaimer

Download as PDF Download as CSV (spreadsheet)

View Map Search Again

Scientific Name: Bidyanus bidyanus
Common Name: Silver perch
Family: Terapontidae
CAAB: 37321008
NSW Threatened Status: Vulnerable
Protected Status: (N/A)

Catch Record ID	Nearest Town	Bioregion	Basin Name	River or Dam	Sighting Date	No. Observed	Source
134838	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	3	Freshwater Fish Research Database

Scientific Name: Macquaria australasica
Common Name: Macquarie perch
Family: Percichthyidae
CAAB: 37311088
NSW Threatened Status: Vulnerable
Protected Status: (N/A)

Catch Record ID	Nearest Town	Bioregion	Basin Name	River or Dam	Sighting Date	No. Observed	Source
53338	Kurrajong	Sydney Basin	HAWKESBURY	Wheeny Creek	2001	1	Community
134635	Wollongong	Sydney Basin	HAWKESBURY	Cordeaux River	2001	1	Freshwater Fish Research Database
53733	Appin	Sydney	HAWKESBURY	Glenbrook	2002	7	Freshwater Fish Research

		Basin		Creek			Database
134719	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	1	Freshwater Fish Research Database
134723	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	1	Freshwater Fish Research Database
134728	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	1	Freshwater Fish Research Database
134731	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	2	Freshwater Fish Research Database
134734	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	1	Freshwater Fish Research Database
134735	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	2	Freshwater Fish Research Database
134736	Glenbrook	Sydney Basin	HAWKESBURY	Glenbrook Creek	2002	1	Freshwater Fish Research Database
134825	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	5	Freshwater Fish Research Database
53732	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	37	Freshwater Fish Research Database
134822	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	1	Freshwater Fish Research Database
134827	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	9	Freshwater Fish Research Database
134830	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	3	Freshwater Fish Research Database
134832	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	7	Freshwater Fish Research Database
134833	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	1	Freshwater Fish Research Database
134834	Appin	Sydney Basin	HAWKESBURY	Cataract Dam	2002	10	Freshwater Fish Research Database
134839	Appin	Sydney	HAWKESBURY	Cataract Dam	2002	3	Freshwater Fish Research

		Basin				Database
134842	Appin	Sydney Basin	HAWKESBURY Cataract Dam	2002	7	Freshwater Fish Research Database
134844	Appin	Sydney Basin	HAWKESBURY Cataract Dam	2002	1	Freshwater Fish Research Database
134846	Appin	Sydney Basin	HAWKESBURY Cataract Dam	2002	2	Freshwater Fish Research Database
134848	Appin	Sydney Basin	HAWKESBURY Cataract Dam	2002	1	Freshwater Fish Research Database
134819	Appin	Sydney Basin	HAWKESBURY Cataract Dam	2002	2	Freshwater Fish Research Database
134974	Wollongong	Sydney Basin	HAWKESBURY Cordeaux River	2002	2	Freshwater Fish Research Database
134972	Wollongong	Sydney Basin	HAWKESBURY Cordeaux River	2002	2	Freshwater Fish Research Database
53653	Bargo	Sydney Basin	HAWKESBURY Cordeaux River	2002	1	Community

View Map | Search Again

Download as PDF Download as CSV (spreadsheet)

NSW DEPARTMENT OF PRIMARY INDUSTRIES | AGRICULTURE

Noxious weed declarations in NSW

Upper Macquarie County Council

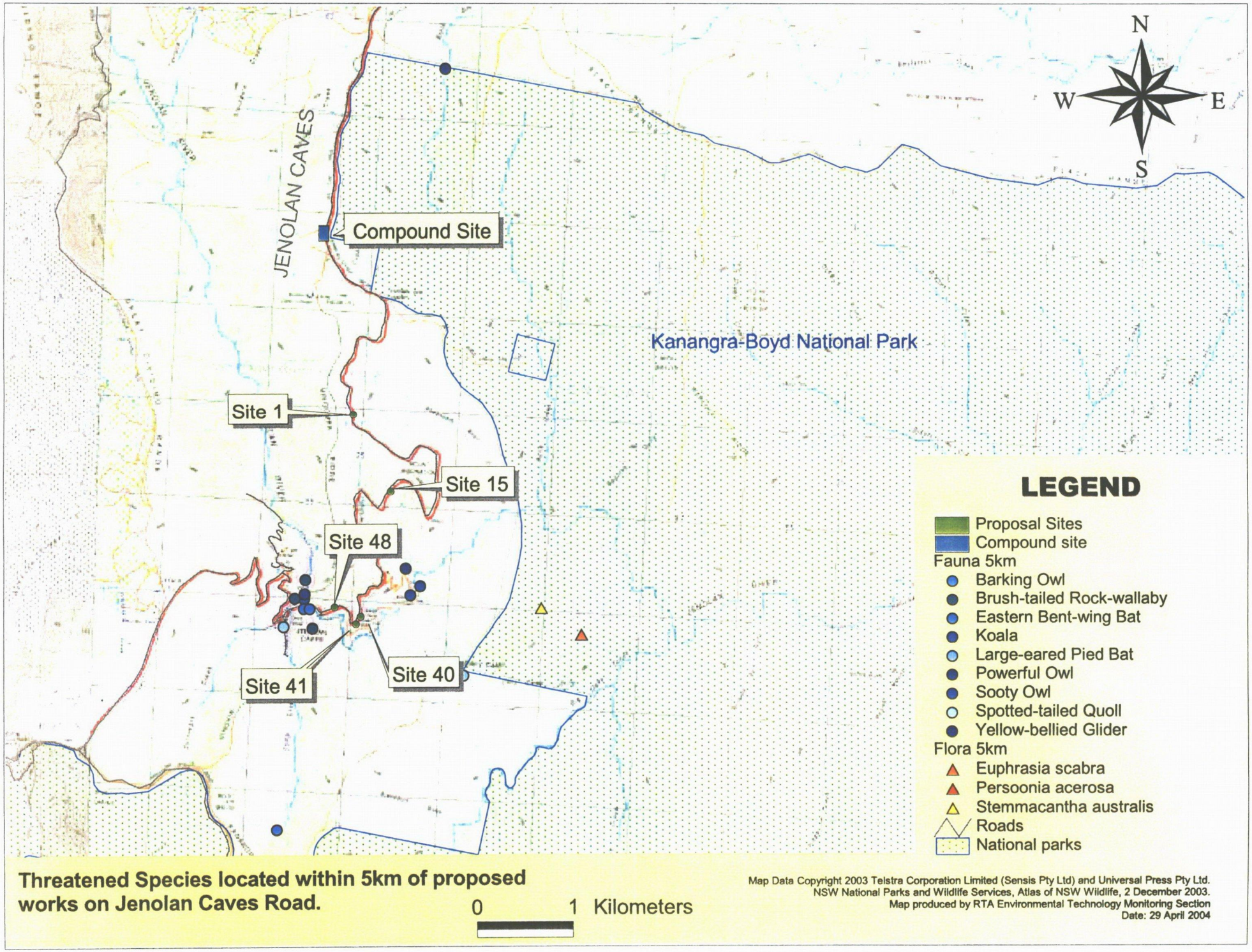
The following weeds are declared noxious in the Upper Macquarie County Council control area **(including Bathurst, Blayney, Evans, Lithgow and Oberon council areas)**. The 'details' link on each listing provides further information on the legal requirements of the weed's listing and any variation in status within the local control area. A complete list of all weeds in all control areas is also available as a PDF document.

Common name	Scientific name	Category	
African boxthorn	*Lycium ferocissimum*	W2	details
African love grass	*Eragrostis curvula*	W3	details
Alligator weed	*Alternanthera philoxeroides*	W1	details
Bathurst Noogoora Californian Cockle burrs	*Xanthium spp.*	W2	details
Black knapweed	*Centaurea nigra*	W1	details
Blackberry	*Rubus fruticosus (agg. spp.)*	W3	details
Broomrape	*Orobanche spp.*	W1	details
Cabomba	*Cabomba spp.*	W4g	details
Columbus grass	*Sorghum x almum*	W2	details
Dodder	*Cuscuta campestris*	W2	details
Gorse	*Ulex europaeus*	W2	details
Green cestrum	*Cestrum parqui*	W2	details
Harrisia cactus	*Harrisia spp.*	W4f	details
Hawkweed	*Hieracium spp.*	W1	details

Hemlock	*Conium maculatum*	W2	details
Horsetail	*Equisetum spp.*	W1	details
Johnson grass	*Sorghum halepense*	W2	details
Karroo thorn	*Acacia karroo*	W1	details
Kochia	*Kochia scoparia*	W1	details
Lagarosiphon	*Lagarosiphon major*	W1	details
Longstyle feather grass	*Pennisetum villosum*	W2	details
Mexican feather grass	*Nassella tenuissima syn Stipa tenuissima*	W1	details
Miconia	*Miconia spp.*	W1	details
Nodding thistle	*Carduus nutans*	W3	details
Pampas grass	*Cortaderia spp.*	W2	details
Parthenium weed	*Parthenium hysterophorus*	W1	details
Prickly pears	*Opuntia spp.*	W4f	details
Privet - broadleaf	*Ligustrum lucidum*	W4b	details
Privet - narrowleaf	*Ligustrum sinense*	W4b	details
Rhus tree	*Toxicodendron succedaneum*	W2	details
Salvinia	*Salvinia molesta*	W1	details
Scotch English broom	*Cytisus scoparius*	W2	details
Scotch Illyrian Stemless thistles	*Onopordum spp.*	W3	details
Senegal tea plant	*Gymnocoronis spilanthoides*	W1	details
Serrated tussock	*Nassella trichotoma*	W3	details
Siam weed	*Chromolaena odorata*	W1	details
Silverleaf nightshade	*Solanum elaeagnifolium*	W2	details
Spiny burrgrass	*Cenchrus incertus*	W2	details
Spiny burrgrass	*Cenchrus longispinus*	W2	details
Spotted knapweed	*Centaurea maculosa*	W1	details
St John's wort	*Hypericum perforatum*	W3	details

Star thistle	*Centaurea calcitrapa*	W2	details
Sweet briar	*Rosa rubiginosa*	W3	details
Tree of heaven	*Ailanthus altissima*	W2	details
Water hyacinth	*Eichhornia crassipes*	W1	details
Water lettuce	*Pistia stratiotes*	W1	details
Wild radish	*Raphanus raphanistrum*	W2	details
Willows	*Salix spp.*	W4g	details

Return to start page



Threatened Species located within 5km of proposed works on Jenolan Caves Road.

0 1 Kilometers

Map produced by RTA Environmental Technology Monitoring Section
Date: 29 April 2004

Australian Government
Department of the Environment and Heritage

Protected Matters Search Tool

You are here: DEH Home > EPBC Act > Search

17 January 2005 12:25

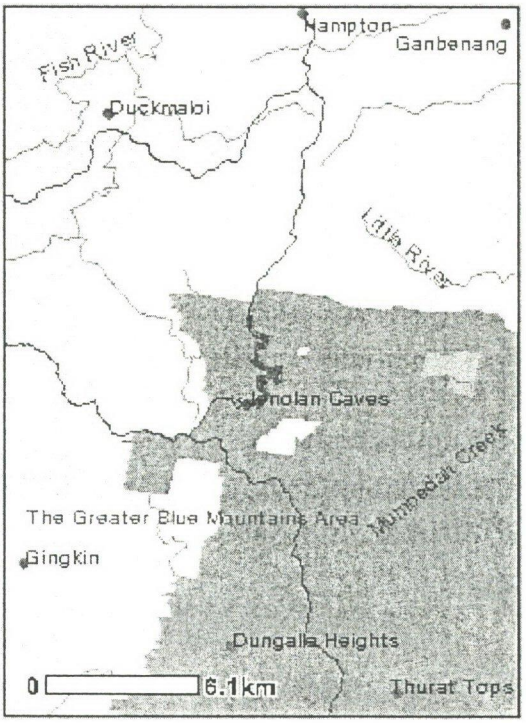
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.deh.gov.au/epbc/assessmentsapprovals/index.html

---



Search Type: Area

Buffer: 10 km

Coordinates: -33.78118,150.02404, -33.78567,150.02389, -33.78927,150.02718, -33.79076,150.03048, -33.79301,150.03093, -33.79271,150.02808, -33.80154,150.02583, -33.80604,150.03452, -33.80783,150.03033, -33.80768,150.02853, -33.81247,150.02868, -33.81577,150.03122, -33.81816,150.02868, -33.81831,150.02269, -33.82041,150.02284, -33.82131,150.02868, -33.82026,150.03078, -33.81637,150.03407, -33.80963,150.02973, -33.81083,150.03212, -33.80813,150.03452, -33.81142,150.03706, -33.81008,150.03886, -33.80334,150.03886, -

33.80304,150.03661, -33.80439,150.03452, -33.80050,150.02898, -33.79526,150.02943, -33.79511,150.03227, -33.78972,150.03347, -33.78762,150.02808, -33.78537,150.02613, -33.7816,150.02628

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.deh.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	1
National Heritage Places:	None
Wetlands of International Significance: **(Ramsar Sites)**	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	18
Migratory Species:	8

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC

Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.deh.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.deh.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Places on the RNE:	2
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Other Commonwealth Reserves:	None
Regional Forest Agreements:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Dataset Information]

The Greater Blue Mountains Area NSW

Wetlands of International Significance [Dataset Information]
(Ramsar Sites)

MACQUARIE MARSHES NATURE RESERVE	Within same catchment as Ramsar site

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Lathamus discolor Swift Parrot	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area

Xanthomyza phrygia Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Fishes		
Maccullochella peelii peelii Murray Cod, Cod, Goodoo	Vulnerable	Species or species habitat may occur within area
Macquaria australasica * Macquarie Perch	Endangered	Species or species habitat may occur within area
Prototroctes maraena * Australian Grayling	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus * Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat likely to occur within area
Nyctophilus timoriensis (South-eastern form) Eastern Long-eared Bat	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Hoplocephalus bungaroides * Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants		
Acacia flocktoniae *	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus pulverulenta Silver-leaved Mountain Gum, Silver-leaved Gum	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus	Migratory	Species or species habitat may

White-throated Needletail		occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area

Migratory Wetland Species

Birds

Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis	Listed -	Breeding may occur within area

Black-faced Monarch	overfly marine area	
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Transport and Regional Services - Airservices Australia

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Natural

Jenolan Caves and Reserve NSW

Kanangra Boyd National Park (1977 boundary) NSW

Extra Information

State and Territory Reserves [Dataset Information]

Jenolan Karst Conservation Reserve, NSW

Kanangra-Boyd National Park, NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and

point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. Environment Australia acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium

- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCLIM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Last updated:

Department of the Environment and Heritage
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

Australian Heritage Database

Search Results

edit search | new search | about the Australian Heritage Database | Heritage home | Australian Heritage Council home

---

25 results found.

Brisbane Valley Catholic Cemetery	Brisbane Valley via Essington, NSW	(Indicative Place) Register of the National Estate
Catholic Cemetery	Black Springs, NSW	(Indicative Place) Register of the National Estate
Duckmaloi Geological Places Hampton Rd	Duckmaloi via Oberon, NSW	(Registered) Register of the National Estate
Hazelgrove Cemetery Tarana Rd	Hazelgrove, NSW	(Indicative Place) Register of the National Estate
Indigenous Place	Kanangra Walls via Jenolan Caves, NSW	(Registered) Register of the National Estate
Indigenous Place	Oberon, NSW	(Indicative Place) Register of the National Estate
Jenolan Caves and Reserve Jenolan Caves Rd	Jenolan Caves, NSW	(Registered) Register of the National Estate
Kanangra Boyd National Park (1977 boundary) Kanangra Rd	Kanangra, NSW	(Registered) Register of the National Estate
Kanangra Wilderness Area Kanangra Rd	Oberon, NSW	(Indicative Place) Register of the National Estate
Lone Grave (Delaney)	Honeysuckle Flat via The Meadows, NSW	(Indicative Place) Register of the National Estate
Lone Grave (Hogan) Oberon St	Oberon, NSW	(Indicative Place) Register of the National Estate
Lone Grave on Springvale Black Springs Rockley Rd	Springvale via Black Springs, NSW	(Indicative Place) Register of the National Estate
O'Connell Settlement Bathurst - Oberon Rd	O'Connell, NSW	(Registered) Register of the National Estate
O'Connell Settlement (redefinition) Bathurst - Oberon Rd	O'Connell, NSW	(Indicative Place) Register of the National Estate
Oberon General Cemetery Black Springs Rd	Oberon, NSW	(Indicative Place) Register of the National Estate
Private Cemetery on Mary Vale Oberon Goulburn Rd	Porters Retreat, NSW	(Indicative Place) Register of the

St Barnabas Anglican Church Cemetery Ross St	Oberon, NSW	National Estate (Indicative Place) Register of the National Estate
St Peters Anglican Church Cemetery Lowes Mount Rd	Mutton Falls via Tarana, NSW	(Indicative Place) Register of the National Estate
St Thomas Anglican Church Beaconsfield - O'Connell Rd	O'Connell, NSW	(Registered) Register of the National Estate
St Thomas Anglican Church Group Beaconsfield - O'Connell Rd	O'Connell, NSW	(Registered) Register of the National Estate
St Thomas Anglican Rectory (former) Beaconsfield - O'Connell Rd	O'Connell, NSW	(Registered) Register of the National Estate
Sydmouth Valley Homestead Carlwood Rd	Sydmouth Valley via Tarana, NSW	(Registered) Register of the National Estate
The Blue Mountains	Katoomba, NSW	(Indicative Place) Register of the National Estate
The Cliff Beaconsfield - O'Connell Rd	Wisemans Creek, NSW	(Indicative Place) Register of the National Estate
The Greater Blue Mountains Area Geat Western Hwy	Katoomba, NSW	(Declared property) World Heritage List

Report Produced: Mon Jan 17 12:44:40 2005

Oberon Local Environmental Plan 1998

Schedule 2 Heritage items

(Clause 6 (1))

Part 1 Archaeological sites

List of sites	Study reference No
Jenolan Caves	—
Kanangra Boyd National Park	900
Wisemans Creek	901
Lowes Mount Road	902
Oberon Area	903

Part 2 European heritage items

List of items	Study reference No or Property description
Rowes Homestead	Lot 49 DP 728898
Limestone Bridge (near Grand Arch)	Lot 49 DP 728898
Tarana—Oberon Rail Line	202 & 602
Sidmouth Valley—O'Connell Road	Pt Lot 73 DP 757058
Phills Falls	601
Old Bathurst—Sydney Road	603
The Six Foot Track	604
Brisbane Valley Creek—Gold Diggings	Lot 85 DP 757039
Lone Grave on "Springvale"	—
Jenolan Caves House	Lot 39 DP 728898
Hazelgrove Cemetery	Pt Lot 1 DP 544230
National Australia Bank, Oberon Township	Lot 5 Sec 21 DP 2418
Ramsgate (house), Oberon Township	Pt Lot 2A Sec 21 DP 427257
Malachi Gilmore Hall—Oberon Township	Lot 6 Sec 21 DP 17887
O'Connell Hotel	Lot 1 DP 783230
O'Connell Road Store Group:	
Store	Lot 1 DP 783230
Pise Barn	Lot A DP 418324
Slab Barn	Lot A DP 418324
O'Connell Roman Catholic Church Group:	
Roman Catholic Church	Lot 1 DP 621591
School House	Lot 2 DP 621591
Post Office	Lot A DP 418324
Shop	Lot A DP 418324
Cottage	Lot A DP 418324
St Thomas' Anglican Church Group:	
St Thomas' Anglican Church	Lots 81 & 82 DP 854881 & Lot 1 DP 119280
Former Rectory	Lots 81 & 82 DP 854881 & Lot 1 DP 119280
Ruins: Pise Chapel	Lots 81 & 82 DP 854881 & Lot 1 DP 119280
Stable	Lots 81 & 82 DP 854881 & Lot 1 DP 119280
Bolton Vale, Oberon Road, O'Connell	Lots 22 DP 852574

Part 3 Heritage conservation areas

Jenolan Caves Reserve Conservation Area
O'Connell Urban Conservation Area

Listing Heritage Items

› State Heritage Inventory Search Results

Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into two sections.

- Section 1. contains items listed by the **Heritage Council** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 130 of the NSW Heritage Act. This information is provided by the NSW Heritage Office.
- Section 2. contains items listed by **Local Councils & Shires and State Government Agencies**. This section may also contain additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

The search results can be re-sorted by clicking on the **(sort)** option at the top of each column.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	State Heritage Register
Jenolan Caves Reserve	Caves Road	Jenolan	Oberon	Yes
Malachi Gilmore Memorial Hall	124 Oberon Street	Oberon	Oberon	Yes
Oberon Railway Station group	Tarana-Oberon railway	Oberon	Oberon	Yes

There were **3** records in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Information Source (sort)
Bolten Vale	Oberon Road	O'Connell	Oberon	LGOV
Brisbane Valley Creek Gold Diggings		Oberon	Oberon	LGOV
Cooerwull (Lithgow) Footbridge	On Top Of Up Side Cutting On Display	Cooerwull	Oberon	SGOV
Cooerwull, Lithgow Footbridge	Over Main West, West Of Lithgow Station	Lithgow	Oberon	SGOV
Cottage	O'Connell Road	Oberon	Oberon	LGOV
Hazelgrave Cemeterey		Oberon	Oberon	LGOV
Jenolan Caves		Oberon	Oberon	LGOV
JENOLAN CAVES		Oberon	Oberon	LGOV
Jenolan Caves Reserve Conservation Area		Oberon	Oberon	LGOV
Kanangra Boyd National Park		Oberon	Oberon	LGOV
Limestone Bridge (near Grand				

Arch)		Oberon	Oberon	LGOV
Lone Grave on Springvale		Oberon	Oberon	LGOV
Lowes Mount Road		Oberon	Oberon	LGOV
Malachi Gilmore Hall		Oberon	Oberon	LGOV
National Australia Bank		Oberon	Oberon	LGOV
O'Connell Hotel		Oberon	Oberon	LGOV
O'Connell Road Store Group		Oberon	Oberon	LGOV
O'Connell Roman Catholic Church Group	O'Connell Road	Oberon	Oberon	LGOV
O'Connell Urban Conservation Area		Oberon	Oberon	LGOV
Oberon Station Group		Oberon	Oberon	SGOV
Oberon Area		Oberon	Oberon	LGOV
Oberon Fire Station (not to be included at this stage)	7 North Street	Oberon	Oberon	SGOV
Old Bathurst	Sydney Road	Oberon	Oberon	LGOV
Phills Falls		Oberon	Oberon	LGOV
Pise Barn	O'Connell Road	Oberon	Oberon	LGOV
Pise Chapel Ruins		Oberon	Oberon	LGOV
Post Office	O'Connell Road	Oberon	Oberon	LGOV
Ramsgate		Oberon	Oberon	LGOV
Rectory (former)		Oberon	Oberon	LGOV
Roman Catholic Church	O'Connell Road	Oberon	Oberon	LGOV
Rowes Homestead		Oberon	Oberon	LGOV
School House	O'Connell Road	Oberon	Oberon	LGOV
Shop	O'Connell Road	Oberon	Oberon	LGOV
Sidmouth Valley	O'Connell Road	Oberon	Oberon	LGOV
Slab Barn	O'Connell Road	Oberon	Oberon	LGOV
St Thomas Anglican Church Group		Oberon	Oberon	LGOV
St Thomas' Anglican Church		Oberon	Oberon	LGOV
Stable		Oberon	Oberon	LGOV
Store	O'Connell Road	Oberon	Oberon	LGOV
Tarana Oberon Rail Line		Oberon	Oberon	LGOV
The Six Foot Track		Oberon	Oberon	LGOV
Wiseman's Creek		Oberon	Oberon	LGOV

There were **42** records in this section matching your search criteria.

There was a total of **45** records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

Note: The Heritage Office seeks to keep the State Heritage Inventory (SHI) up to date, however the latest listings in Local and Regional Environmental Plans (LEPs and REPs) may not yet be included. Always check with the relevant Local Council or Shire for the most recent listings.

| Home | Terms of Use | Site Map

Western region

Western Region

Abercrombie Bridge over the Abercrombie River	4300162
Beryl Bridge over Wyaldra Creek	4300167
Bitumen Kettle	4300728
Boonanga Bridge over Barwon River	4300171
Brewarrina Bridge over Barwon River, The	4301660
Bridge over Turon River at Wallaby Rocks	4300155
Holman Bridge over Lachlan River at Gooloogong	4300132
Iron Bridge over Lachlan River at Forbes	4301694
Iron Bridge over Namoi River near Boggabri	4301682
Ironpot Creek Bridge	4309537
Lagoon Creek (Centre) Bridge	4309530
Limestone Creek Bridge	4309560
Marara Creek Bridge	4309546
Marrangaroo Creek Bridge	4309519
Masonry Well	4302669
McKanes Falls Bridge, Lithgow	4300003
Mudgee Overpass Road Cutting	4301022
Mulyandry Creek Bridge	4309544
Mungindi Bridge over Barwon River at Mungindi	4300159
Paytens Bridge over Lachlan River at Colletts Crossing	4300166
Queen Charlottes Bridge over Vale Creek, Perthville	4301693
Rawsonville Bridge over Macquarie River	4300182
Road Grader	4300727
Road Plough	4300726
Sandstone Culvert - Great Western Highway	4300478
Scabbing Flat Bridge over Macquarie River	4300179
Spring Creek Bridge	4309520
Stone Culvert & Retaining Wall near 'Emoh', Old Bowenfels	4301026
Victoria Pass Mitchell's Pass	4301023
Warroo Bridge over the Lachlan River	4300178
Yamble Bridge over Cudgegong River	4300180
Yaminba Creek Bridge	4309528

In This Section

- Hunter region
- Northern region
- South West region
- Southern region
- Sydney region
- Western region

Back to top

Emission report

8 February 2005 15:06

Substance Emission Details - Reporting Facilities: Oberon (A), NSW

Industrial facilities are required to report emissions to the NPI if they use more than a certain amount of one or more substances on the NPI reporting list, or consume more than a specified amount of fuel or electric power, or emit more than a certain amount of nitrogen or phosphorus to water. Emissions are estimated using techniques outlined in industry handbooks and related manuals - see further details on industry reporting. Note that toxicity of listed substances varies, and a small amount of a highly toxic substance may be of more concern than a larger emission of a less toxic substance.

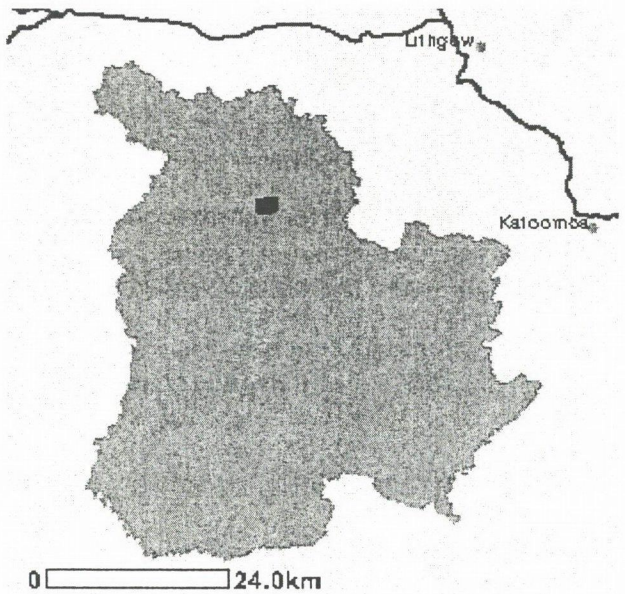
Reporting Year: 2003 - 2004

This report includes:

- Emissions from facilities in **Oberon (A), NSW**.
- Top substances emitted by each facility.
- Ranking for each substance emission - 1=lowest; 100=highest.

Explanation of rankings: Individual substance emissions from each facility are compared against the maximum emission of that substance from all of the facilities reported on the NPI, on a scale of 1-100 (from lowest to highest) - if the total emission of a substance is 10% of the maximum reported to the NPI, the emission ranking would be **10**; if the total emission is 95% of the maximum, the ranking would be **95**. A score of 100 means that the facility is the highest facility emitter of that substance - in some cases many facilities may score 100, due to rounding. Top substances are those substance emissions that are ranked highest for any individual facility.

For example, a small rural sewage treatment plant may report a very small Total nitrogen emission in comparison with a large metropolitan facility. If the rural facility reported an emission that is 7% of the maximum Total Nitrogen emission in Australia it would attract a ranking of 7. This ranking tells you that there are many other facilities that have much larger emissions of Total Nitrogen. On the other hand a metropolitan sewage treatment plant may have a very large Total Nitrogen emission and therefore attracts a ranking of 100 for this substance. This only means that this particular



Map of Oberon (A), NSW:
Selected NPI facilities are shown as ■

facility has approximately the largest individual emission of that substance in Australia.

Facilities (alphabetic order)	**Top Substance Emissions and Rankings** Rankings are shown as: ◔ =0-25; ◐ =26-50; ◕ =51-75; ● =76-100. [actual rankings are shown in brackets: 1=lowest; 100=highest]				
Carter Holt Harvey Wood Products Australia Pty Limited (Carter Holt Harvey MDF Oberon facility, Oberon NSW)	Formaldehyde (methyl aldehyde)	Polychlorinated dioxins and furans	Total Volatile Organic Compounds	Particulate Matter 10.0 um	Polycyclic aromatic hydrocarbons
	◐ [Medium - 31]	◔ [Low - 14]	◔ [Low - 2]	◔ [Low - 1]	◔ [Low - 1]
Carter Holt Harvey Wood Products Australia Pty Limited (Structaflor Oberon, Oberon NSW)	Formaldehyde (methyl aldehyde)	Polychlorinated dioxins and furans	Particulate Matter 10.0 um	Total Volatile Organic Compounds	Polycyclic aromatic hydrocarbons
	◔ [Low - 12]	◔ [Low - 3]	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]
Highland Pine Products Pty Limited (Highland Pine Products Oberon Sawmill, Oberon NSW)	Polychlorinated dioxins and furans	Particulate Matter 10.0 um	Polycyclic aromatic hydrocarbons	Oxides of Nitrogen	Chromium (VI) compounds
	◔ [Low - 20]	◔ [Low - 2]	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]
Jeld Wen Fibre of Australia (Jeld Wen Fibre Oberon, Oberon NSW)	Formaldehyde (methyl aldehyde)	Total Volatile Organic Compounds	Particulate Matter 10.0 um	Oxides of Nitrogen	Carbon monoxide
	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]
Woodchem Australia Pty Ltd (Woodchem Australia Oberon, Oberon NSW)	Methanol	Formaldehyde (methyl aldehyde)	Total Volatile Organic Compounds	Phenol	
	◔ [Low - 6]	◔ [Low - 1]	◔ [Low - 1]	◔ [Low - 1]	

The disclaimer has further information about the use of NPI data.

NPI Home | Make a Map | Substances Background | Download Data | Data Changes

Top | About us | Advanced search | Contact us | Information services | Publications | What's New

Accessibility | Disclaimer | Privacy | © Commonwealth of Australia

Department of the Environment and Heritage
GPO Box 787 Canberra ACT 2601 Australia
Telephone: (02) 6274 1111

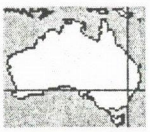
Emission report

You are here: NPI Home > Database Search

31 January 2005 17:29

Substance Emissions - All Sources : Oberon (A), NSW

The NPI holds data reported by larger industrial facilities, and aggregated emission data for smaller facilities and mobile and non-industrial sources, collected by participating jurisdictions. Accuracy of data varies along with estimation techniques - see explanation of data below. The listed substances span a wide range of toxicities, and a small amount of a highly toxic substance may be of more concern than a larger emission of a less toxic substance. This report includes data for industrial facilities and aggregated emission data (if available for this area).



Reporting Year: 2003 - 2004 (for facilities only)

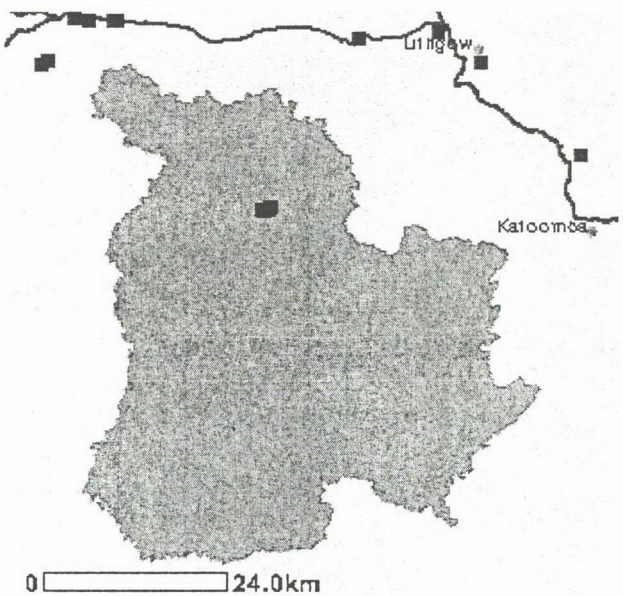
Data Source: All sources - Reporting Facilities + Aggregated Emission Data
(click to exclude Aggregated Emission Data)

This report includes:

- Summary of emission sources for this area - **Oberon (A), NSW**.
- Top sources for each substance, and amounts emitted.
- Explanation of data and calculations.

See also other reports on:

- Facility emission details for this area (new window).

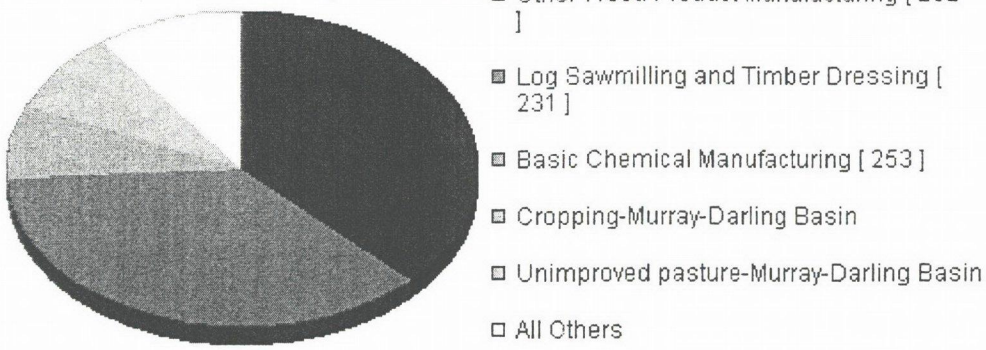


Map of Oberon (A), NSW: NPI facilities are shown as ■

Source Summary - Oberon (A), NSW

- 20 substances from 21 sources were found.
- 5 facilities reported to the NPI.
- Additional aggregated emission data was collected for 18 sources.
- Indicative top sources for this region are shown in the pie chart. Note that only substances listed on Table 1 were used in the calculation - these substances were required to be reported for the first three reporting years.

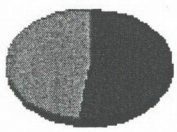
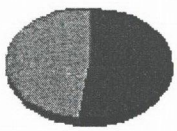
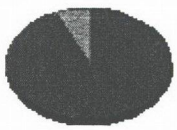
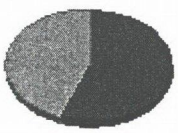
Indicative Top Sources (Table 1 Substances Only)

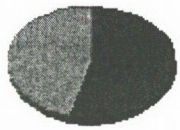
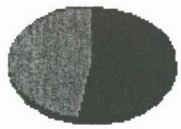
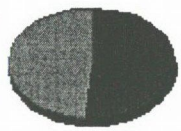
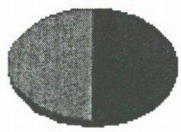
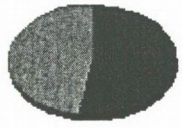
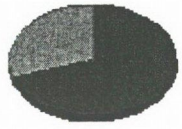
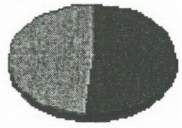


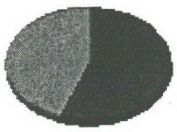
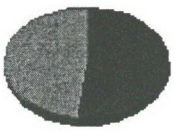
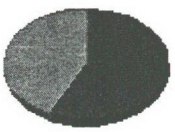
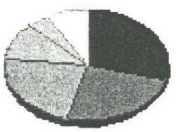
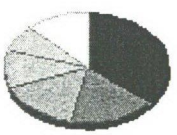
The indicative top sources, a broad snapshot of all emissions reported in this area, are derived by converting each emission into proportional units, and then pooling those proportional units. This calculation does not account for any variation in toxicity or ground level concentration of these substances - see further explanation below. For more accurate information, refer to individual substance information in the table below under Top Sources By Substance.

Top Sources by Substance - Oberon (A), NSW

The table shows emissions of all substances in this area, and the top sources for each substance. All emission amounts have been rounded to two significant figures. Note that totals may differ from the sum of the individual amounts because of this rounding. Source names for reporting facilities are shown as ANZSIC Groups; source names for any aggregated emission data are marked with *. See explanation for information on NPI data, or click on the source name.

Substance (sort by total emission)	**Total Emissions** (kg)	**Emission Sources**		
		Distribution (pie chart)	**Name** (Aggregated Data Source * or ANZSIC Group)	**Sub-total** (kg)
Arsenic & compounds (Table 1)	10		Log Sawmilling and Timber Dressing [231]	5.2
			Other Wood Product Manufacturing [232]	4.8
Cadmium & compounds (Table 1)	2.5		Log Sawmilling and Timber Dressing [231]	1.3
			Other Wood Product Manufacturing [232]	1.2
Carbon monoxide (Table 1)	520,000		Other Wood Product Manufacturing [232]	480,000
			Log Sawmilling and Timber Dressing [231]	34,000
Chromium (III) compounds	18		Log Sawmilling and Timber Dressing [231]	10
			Other Wood Product Manufacturing [232]	8
			Log Sawmilling and Timber	2.8

			Dressing [231]	
Chromium (VI) compounds (Table 1)	5.2		Other Wood Product Manufacturing [232]	2.4
Copper & compounds	44		Log Sawmilling and Timber Dressing [231]	23
			Other Wood Product Manufacturing [232]	21
Formaldehyde (methyl aldehyde)	37,000		Other Wood Product Manufacturing [232]	37,000
			Basic Chemical Manufacturing [253]	200
Lead & compounds (Table 1)	39		Log Sawmilling and Timber Dressing [231]	20
			Other Wood Product Manufacturing [232]	19
Mercury & compounds (Table 1)	0.60		Other Wood Product Manufacturing [232]	0.30
			Log Sawmilling and Timber Dressing [231]	0.30
Methanol (Table 1)	13,000		Basic Chemical Manufacturing [253]	13,000
Nickel & compounds	7.6		Log Sawmilling and Timber Dressing [231]	4
			Other Wood Product Manufacturing [232]	3.6
Oxides of Nitrogen (Table 1)	190,000		Log Sawmilling and Timber Dressing [231]	140,000
			Other Wood Product Manufacturing [232]	58,000
Particulate Matter 10.0 um (Table 1)	670,000		Log Sawmilling and Timber Dressing [231]	340,000
			Other Wood Product Manufacturing [232]	320,000

Phenol	2.2		Basic Chemical Manufacturing [253]	1.2
			Other Wood Product Manufacturing [232]	1
Polychlorinated dioxins and furans	0.0054		Log Sawmilling and Timber Dressing [231]	0.0030
			Other Wood Product Manufacturing [232]	0.0024
Polycyclic aromatic hydrocarbons (Table 1)	450		Log Sawmilling and Timber Dressing [231]	230
			Other Wood Product Manufacturing [232]	220
Sulfur dioxide (Table 1)	3,200		Log Sawmilling and Timber Dressing [231]	1,900
			Other Wood Product Manufacturing [232]	1,400
Total Nitrogen (Table 1)	510,000		Unimproved pasture-Murray-Darling Basin *	160,000
			Cropping-Murray-Darling Basin *	130,000
			Bushland-Hawkesbury-Nepean River *	120,000
			Improved pasture-Murray-Darling Basin *	56,000
			Unfertilised grazing-Hawkesbury-Nepean River *	24,000
Total Phosphorus (Table 1)	43,000		Cropping-Murray-Darling Basin *	17,000
			Bushland-Hawkesbury-Nepean River *	8,000
			Unimproved pasture-Murray-Darling Basin *	7,300
			Improved pasture-Murray-Darling Basin *	5,200
			Unfertilised grazing-Hawkesbury-Nepean River *	3,700
Total Volatile Organic Compounds	720,000		Other Wood Product Manufacturing [232]	720,000
			Basic Chemical Manufacturing [253]	3,800
			Log Sawmilling and Timber Dressing [231]	1,600

Explanation of Data and Calculations

The NPI reports on emissions of chemical substances and where and from what sources they are generated. The ultimate fate of these substances and therefore exposure to humans and the environment as pollution cannot be determined from the NPI. Numerous factors such as height of emission (high stacks versus ground level vehicle exhausts), nature of receiving environment, chemical reactivity of the substance and prevailing meteorological conditions determine whether an emission is felt as ground level pollution. Since NPI does not attempt to collect these parameters, the data can only reflect pollutant generation at source.

The NPI holds emission data reported by industrial facilities, and aggregated emission data collected by participating jurisdictions. Industrial facilities are required to report emissions to the NPI if they use more than a certain amount of one or more substances on the NPI reporting list, or consume more than a specified amount of fuel or electric power, or emit more than a certain amount of nitrogen or phosphorus to water. Aggregated data include smaller facilities that are not required to report, and mobile and non-industrial sources such as transport, domestic activities and for water catchments and land use type (see further details on NPI data).

The techniques used to estimate emissions in the NPI have been variously approved by Commonwealth, State and Territory environment agencies but it is important to note that the accuracy of these estimates is likely to vary according to the technique used. For the aggregated emissions data in particular, comparative analysis of the data may be misleading, because jurisdictions may have used different approved estimation techniques. Industrial facilities estimate emissions using a technique described in an appropriate NPI handbook, or else otherwise approved.

The listed substances span a wide range of toxicities. A small number may not necessarily imply an insignificant emission; for example, a small emission of a highly toxic substance may be of more concern than a larger emission of a substance of relatively lower toxicity. All emission amounts reported here have been rounded to two significant figures - totals may differ from the sum of the individual amounts on these reports because of this rounding. Some minor discrepancies may also occur with catchment and airshed data, particularly when queried at a fine spatial resolution such as a postcode. This is because these data are collected at varying spatial resolutions.

Indicative top sources are derived by converting each emission into proportional units - this provides an equal weighting for each substance, and does not consider any variation in hazard or possibility of exposure to substances. The following worked example illlustrates the calculation of equivalent percentage units in a queried area: If the total emission of Chromium (VI) compounds is 4.4kg, and motor vehicles emit 3.7kg, the proportional units for motor vehicles for Chromium (VI) compounds are calculated as (3.7/4.4)X 100 = 80.8. Similarly, if the total reported emission for Benzene is 30,000kg, and motor vehicles emit 28,000kg, the proportional units for motor vehicles for Benzene (28,000/30,000) X 100 =94.1. This calculation is repeated for each substance/source combination, and the proportional units for a source are then summed to provide a total contribution of that source to the emission profile for this area.

Substance	Total Emissions	Motor Vehicles		Repeat for all sources
		Emission	Proportional Emission Units [(Emission/Total)*100]	. . .
Benzene	30,000kg	28,000kg	(28,000/30,000) *100=94.1	. . .

Chromium (VI) compounds	4.4kg	3.7kg	(3.7/4.4)*100=80.8	. . .
Repeat for all substances	. . .	. . .	. . .	. . .
Total proportional units			**Sum for each source**	

The disclaimer has further information about the use of NPI data.

NPI Home | Make a Map | Substances Background | Download Data | Data Changes

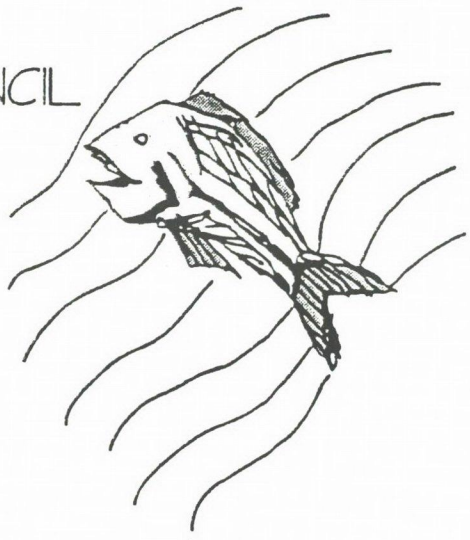
Top | About us | Advanced search | Contact us | Information services | Publications | What's New

Accessibility | Disclaimer | Privacy | © Commonwealth of Australia

Department of the Environment and Heritage
GPO Box 787 Canberra ACT 2601 Australia
Telephone: (02) 6274 1111

Appendix F: Pejar LALC and Gundungurra Tribal Council

PEJAR LOCAL ABORIGINAL LAND COUNCIL
PO Box 289 Goulburn NSW 2580
Phone (02) 4822 3552 • Fax (02) 4822 3551
email address: pejar@goulburn.net.au
ABN: 72 662 632 151



26 May 2004

Chris Barnett
RTA
15 – 33 Cooerwull Rd
Bowenfells NSW 2790
Fax: 02 – 63528915

Dear Chris

RE: SECTION 1 AND SECTION 2 JENOLAN CAVES RD

Mr Patrick Little, a representative from this organisation, recently carried out an Aboriginal site inspection on the above proposal. Upon inspection nothing of Aboriginal Significance could be located. Therefore, the Pejar LALC have no objections with the proposal going ahead, our only recommendation is that:

- If any Aboriginal Objects are located during the development, then work is to cease immediately and Department of Environment and Conservation along with ourselves, are to be contacted as soon as possible.

- If there is any further information that you may require, then please do not hesitate to contact me on the above numbers.

Yours sincerely

Delise Freeman

Delise Freeman
CO-ORDINATOR

Approved to pay.

Gundungurra Tribal Council Aboriginal Corporation
14 oak Street KATOOMBA 2780
Phone 02 4782 9354 Fax 02 4782 9354 ABN 84 578 695 549

Friday, May 28, 2004

Chris Barnett
Technical Services Manager
Western Region
RTA
Cooerwell Rd
Lthgow 2790

Chris,

The Gundungurra Tribal Council has no objection to the proposed treatment program for the retaining walls on Jenolan Caves Road.

My inspection with yourself on the 21st May 2004 showed that the works are urgently needed and we only too pleased to allow any ground disturbance in the area so the road will be safe to use for any traffic that travels that road.

Yours truly,

Bill Hardie chairperson.