Slope Stabilisation on Henry Lawson Drive at Revesby Heights

Review of Environmental Factors

RTA ENVIRONMENTAL TECHNOLOGY

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Approving Manager	Andrew Cook	N Ahens per ACook	28/2/06
Reviewing Officer	Andrew Grainger		28/02/06

Person(s) managing this document	**Person(s) writing this document**
Alison Nash	Alison Nash

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Jay Jaya-Ranjan Project Manager, Program and Performance Sydney Asset Management Floor 2, 83 Flushcombe Rd Blacktown, NSW 2148 T: 8814 2247 F: 8814 2111 E: Jay_Ranjan@rta.nsw.gov.au	Environmental Technology Level 5, Pod D, 99 Phillip Street Parramatta NSW 2150 T (02) 8837 0593 F (02) 8837 0053 E Alison_Nash@rta.nsw.gov.au

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1.4 Introduction

The Roads and Traffic Authority, NSW (RTA) proposes to carry out slope stabilisation on Henry Lawson Drive at Revesby Heights.

This Proforma 1 Review of Environmental Factors (REF) has been prepared by RTA Environmental Technology on behalf of RTA Sydney Asset Management, Sydney 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 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 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 Henry Lawson Drive was initially intended as a scenic route and also to connect the Hume Highway with Woodville Road, Forest Road and Peakhurst. Construction commenced in 1938 and primarily provided relief work for the unemployed. In 1964 the road was extended from Peakhurst to Lansdowne and it was at this time that the rock cuttings east of The River Road were created.

In October 2000, the RTA investigated the condition of the subject rock cuttings (slope identification numbers 1968 and 1969). The assessment was performed in accordance with the RTA Slope Description Record. Recommendations were that the cuttings required regrading and widening.

In April 2001 the assessment was revised and a slope risk analysis was performed in accordance with the RTA's Guide to Slope Risk Analysis (Version 3.1) (Stewart *et* al., 2002), which ranks cuttings based on an Assessed Risk Level (ARL). The slope risk analysis identified that slopes 1968 and 1969 are currently ranked as ARL 1 slopes, which is the highest risk ranking on a scale from 1 to 5.

In September, 2005 GHD Longmac were contracted to identify and delineate the remediation measures required at the subject rock cutting sites to achieve an ARL value of 3 for each cutting.

1.6 Methodology

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

1. A discussion was held with the Project Manager to consider the Proposal.

2. RTA Environmental Technology representative undertook a site visit on the 18th of November, 2005 to provide an overview of the Proposal and to discuss any issues relevant to the completion of the REF.

3. The following agencies and RTA personnel were notified and/or consulted:
   - RTA's Aboriginal Program Consultant, Sydney Region;
   - Bankstown City Council;
   - DEC (NPWS); and
   - Connex Bus Company.

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;
   - DEC Aboriginal Heritage Information Management System (AHIMS);
   - DEC Atlas of NSW Wildlife - Threatened Flora and Fauna Records;

- DEH Protected Matters (EPBC Act) Database;
- DEC Contaminated Land Records;
- DEC Air Quality Records;
- National Pollutant Inventory; and
- DPI Noxious Weeds List.

5. As part of the environmental assessment undertaken for this REF, a flora and fauna specialist study was undertaken to identify the Proposal constraints and to provide environmental safeguards. Details and findings from the investigation are further discussed in Chapter 8 of this REF with a copy of the specialist study included as Appendix A to this REF.

6. A literature review and review of documentation was undertaken with regards to the following:
   - Landform, Geology, and Soils;
   - Bankstown Local Environmental Plan, 2001
   - Regional Environmental Plans;
   - State Environmental Planning Policies; and
   - Council's State of the Environment Report.

2 Description of Proposal Site and Study Area

2.1 Location

The Henry Lawson Drive connects the Hume Highway with Woodville Road, Forest Road and Peakhurst. It provides a ring road around the south eastern suburbs of the Bankstown LGA and provides access to Alfords Point Bridge, which crosses the Georges River.

The road cuttings are located between The River Road and Boomerang Park on Henry Lawson Drive at Revesby Heights. The cuttings are approximately 150m east of The River Road and are situated either side of the Henry Lawson Drive where it cuts through a rocky outcrop (Figure 2.1).

The Proposal site is defined as the area directly impacted by the proposed works. This area includes:

- the face of each cutting;
- a 2m wide zone along the crest of each cutting; and
- the area occupied by drainage channels found on the northern slope crest, including 1m either side of those channels.

A buffer zone of 50m is applied in all directions from the Proposal site. The Proposal site and the buffer zone comprise the study area.

2.2 Description of the Existing Environment

2.2.1 General

The locality is characterised by steep forested hillsides, river flats and residential areas. In the vicinity of the Proposal site there are large areas of open space including playing fields, parkland, picnicking areas and bushland. The Georges River National Park is located to the south and southwest of the Proposal site and mangroves are located south and east of the Proposal site along the Georges River.

Henry Lawson Drive within the Proposal site has the following features:

- An undivided bitumen sealed road with one lane in each direction;
- Lane widths are generally between 3.0 and 3.5m wide;
- A posted speed limit of 70km/h;
- A narrow shoulder of between 0.5-1.5m (Photo 1 Appendix B);
- A narrow bitumen gutter along both sides of the road (Photo 2 Appendix B); and
- Steep rock cuttings located immediately at the shoulder of the road.

The north and south rock cuttings are 105m and 140m long with maximum heights estimated to be 20m and 22m, respectively. They have sparsely regenerated since the initial construction with native vegetation including trees, ferns, grasses and forbs. Large, mature trees are located on the tops of the cuttings, where regeneration is denser. The northern cutting has slope identification number 1968 and the southern cutting has slope identification number 1969.

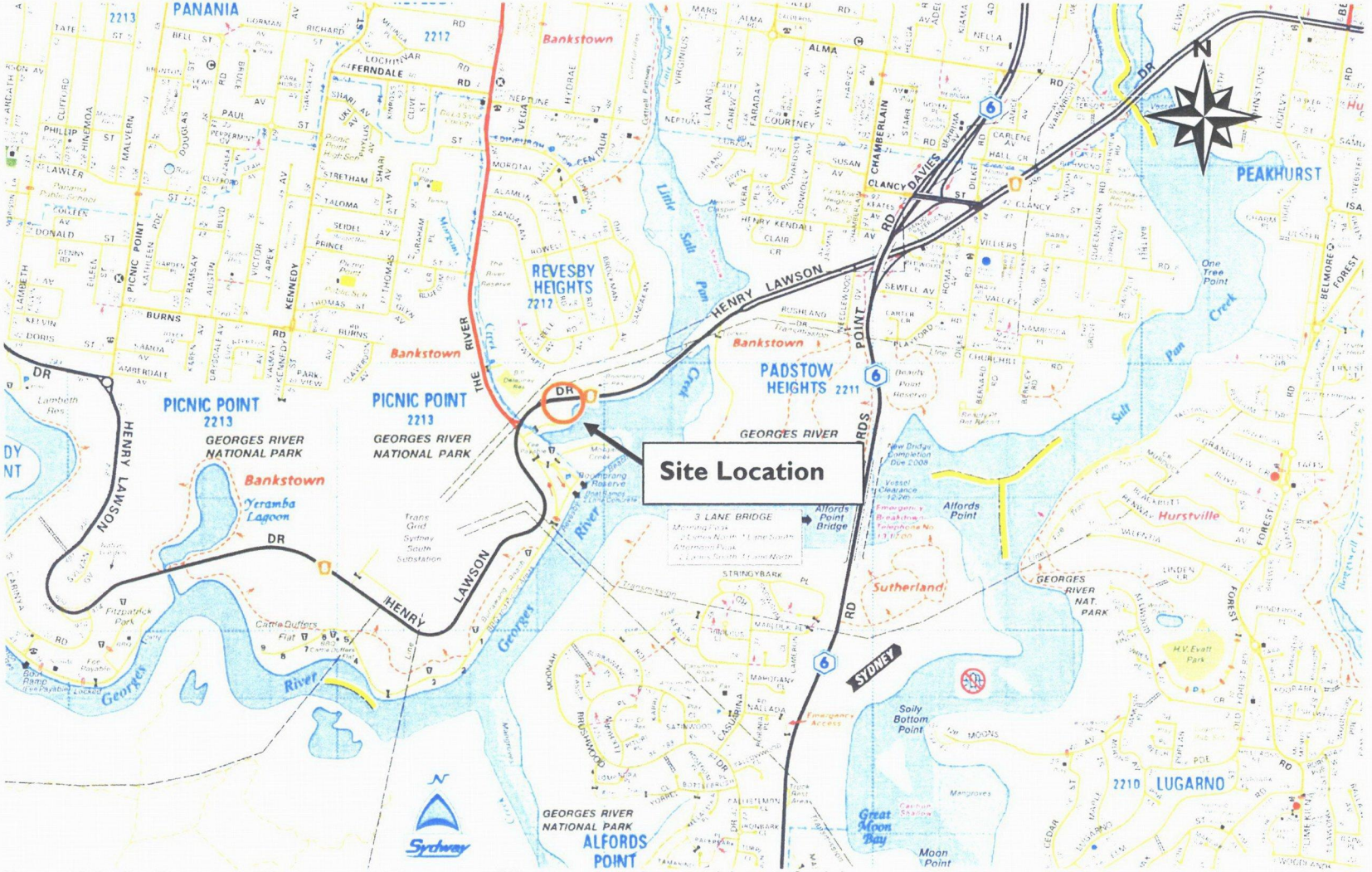

Figure 2.1: Site Location (Map extract Courtesy of Sydway digital maps. Not to Scale)

There is no cycleway or a pathway in the Proposal site. The bus company Connex, NSW provides public and school bus services in the area, however no school or public services run through the Proposal site. No business or commercial accesses are located within the study area. Parks located north of the Henry Lawson Drive to the east and west of the Proposal site are each accessed by a wide verge that is approximately 50m in length and is used for car parking. The main entrance to the Georges River National Park is located approximately 150m east of the Proposal site.

2.2.2 Topography and Landform

The study area is located within an area of rolling to very steep hills. Natural slope gradients around the Proposal site range from 25% to 70% and crests and ridges are convex and narrow (Chapman and Murphy, 1989).

The subject cuttings run through the base of rock outcrop. The cuttings link two flat, narrow valleys located on either side. The valleys and river flats have been largely cleared and grassed and are used as parkland and open space.

The Georges River is located approximately 90m south and 30m south east of the Proposal site. The Proposal site is within an area subject to narrow and confined flooding (Don Fox Planning, 2004). A Flood Sign is located at the western entry to the cuttings, near Boomerang Park to indicate flood levels to road users in case of a flood event (Photo 3, Appendix B).

Landscape limitations include:

- Mass movement hazard;
- Rock fall hazard;
- Steep slopes;
- Severe erosion hazard;
- Rock outcrop; and
- Shallow soils.

Refer to Section 8.3 for assessment of the potential for flooding.

2.2.3 Geology and Soils

The Proposal site is located within an area identified as the Hawkesbury Soil Landscape. The geology is Hawkesbury sandstone comprised of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The rocky outcrops through which the cuttings are created have a blocky appearance distinctive to the Hawkesbury Soil Landscape. Soils are shallow. On crests and ridges soil is expected to be up to 20cm of sandy topsoil overlying bedrock or <30cm of a sandy clay loam subsoil (Chapman and Murphy, 1989).

The cutting faces are cracking and deteriorating, resulting in destabilisation of the cuttings and accumulation of rock particles and soil material on ledges (Photo 4 and 5, Appendix B). Refer to Section 8.2 for assessment of the potential impacts on soils.

2.2.4 Climate

The closest weather recording station is located at Bankstown Airport, approximately 5.5km northwest of the Proposal site. Data from this recording station, sourced from the Commonwealth Bureau of Meteorology website, indicates that Revesby Heights experiences moderate rainfall year round with increased rain from late Summer to early Autumn. The annual average maximum temperature is 23.1°C, with high temperatures progressing through late Spring to early Autumn. The mean annual rainfall is 917mm with 114 rain days per year on average. The driest months of the year are from July to September. The potential for climate to cause environmental impacts as a result of the Proposal is considered limited due to the scope of works and due to safeguards recommended in Section 8.2. Climate is therefore not considered further in this REF.

2.2.5 Drainage, Watercourses and Hydrology

The Proposal site is located within the Georges River Catchment. The Georges River is located approximately 90m south and 30m south east of the Proposal site. Morgans Creek is approximately 120m west and Little Salt Pan Creek is approximately 380m east of the Proposal site.

Runoff from the Proposal site drains to the Georges River or its tributaries via various natural and constructed drainage channels. Drainage from the crest of the southern cutting is undefined and no obvious drainage channels are observed. Drainage from the northern cutting crest is via channels constructed along the length of the crest. The Proposal site is located above the 1 in 100y flood level but would be inundated during a Probable Maximum Flood (PMF) to depths of up to 3m.

The Towra Point Nature Reserve (a Ramsar wetland) is located approximately 12km east, downstream of the Proposal site. Refer to Section 8.3 for assessment of potential impacts on water quality.

2.2.6 Biodiversity

A flora and fauna assessment for the Proposal was undertaken for the RTA by Lesryk Environmental Consultants (refer to Appendix A) and the findings are presented below. The assessment concluded that there are no ecological restraints associated with the Proposal. Refer to Section 8.4 for assessment of the potential impacts on biodiversity as a result of the Proposal.

Existing Environment

The Proposal site is located within an area characterised by National Parks and recreational reserves. The Georges River National Park is separated into parcels and covers an area of 335ha. A small triangular parcel of the Georges River National Park is located immediately south of the Proposal site. Other sections of the Georges River National Park are located approximately100m west of the Proposal site and 500m east across the Georges River.

The Proposal site is adjacent to Council managed recreational parkland located on the northern side of Henry Lawson Drive. These include the Bill Delauney Reserve, which has playing fields and is located immediately northwest and Boomerang Park, which provides picnic facilities and bush walking trails and is located immediately northeast of the Proposal site. These parks are situated within a larger band of waterfront land called the River Reserve. The River Reserve curves around the suburb of Revesby Heights and provides open space along the banks of Morgans Creek, Little Salt Pan Creek and the Georges River.

In addition to these parklands and reserves, the Mill Creek Crown lands and Holsworthy Military Reserve occur approximately 2.4km west of the Proposal site.

Habitat

The Proposal site is comprised of two habitat types. They are sandstone cliff faces and open woodland. No caves or crevices are observed within the sandstone cliff face. The cliff face is essentially bare with sparse vegetation growing where soil has accumulated. None of the trees are observed to have hollows suitable to support the lifecycle of any hollow dependant native species. The open woodland is observed to provide habitat that is regularly recorded throughout the surrounding region including a rock crevice that is located approximately 5m from the crest of the northern cutting.

Flora

The majority of the Proposal site has been disturbed by clearing and development, including creation of the existing rock cuttings. The cuttings have naturally regenerated with native species growing sparsely from the sides of the cuttings and more densely along the top of the cuttings. This regrowth is considered a road safety hazard as the vegetation can loosen and destabilise the cuttings, increasing the likelihood of rocks falling to the road.

Along the crest of the cuttings the ecological community is described as Sydney Sandstone Ridgetop Woodland. A full list of the flora species found during the survey is in Appendix A. Common species include Sydney Red Gum (*Angophora costata*) and Red Bloodwood (*Corymbia gummifera*). The sub canopy is dominated by Forest oak *(Allocasuarina littoralis*) and Old Man Banksia *(Banksia serrata*). Common shrubs include Elderberry Panx (*Polyscias sambucifolia*), Hairpin Banksia (*Banksia spinulosa*), White Tick Bush (*Kunzea ambigua*), Drumsticks (*Isopogon anethifolius*), Sunshine Wattle (*Acacia terminalis*) and Paperbark (*Leptospermum trinervium*). Ground covers include Bracken (*Pteridium esculentum*), Spiny-Fruit Mat Rush (*Lomandra longifolia*), Blady Grass (*Imperata cylindrica*), Wiry Panic (*Entolasia stricta*), Kangaroo Grass (*Themeda australis*), False Bracken Fern (*Calochlaena dubia*), Thyme Spurge (*Phyllanthus hirtellus*), Grass Tree (*Xanthorrhoea arborea*) and Old Mans Beard (*Caustis flexuosa*).

Weed species are also present at the Proposal site and include Crofton Weed (*Ageratina adenphora*), Cobblers Pegs (*Bidens pilosa*), Camphor Laurel (*Cinnamomum camphora*), Paddys Lucerne (*Sida rhombifolia*), Ochna (*Ochna serrulata*) and Lantana (*Lantana camera*). Lantana is listed as a W2 noxious weed in the Bankstown control area.

Six plants of conservation significance have been previously recorded within 5km of the Proposal site. Those listed on both the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act 1999) and the *Threatened Species Conservation Act, 1995* (TSC Act 1995) are:

- *Acacia pubescens* (Downy Wattle);
- *Caladenia tessellate* (Thick Lip Spider Orchid);
- *Deyeuxia appressa*; (no common name)
- *Persoonia nutans* (Nodding Geebung); and
- *Pterostylis saxicola* (Sydney Plains Greenhood).

Listed on the TSC Act 1995 only is:

- *Caesia parviflora var. minor* (Pale Grass Lily).

The closest listings (*Persoonia nutans* and *Pterostylis saxicola*) were previously recorded approximately 1.3km east of the Proposal site.

The Endangered Ecological Community, Shale Sandstone Transition Forest (listed on both the EPBC Act 1999 and the TSC Act 1995) is recorded as occurring north of the Proposal site. The flora assessment concludes that the vegetation present is Sydney Sandstone Ridgetop Woodland and that the Shale Sandstone Transition Forest is not present within or in close proximity to the Proposal site. The Sydney Sandstone Ridgetop Woodland ecological community is common and well represented in the region and is not listed as threatened or endangered on the EPBC Act 1999 or the TSC Act 1995.

The survey targeted flora species listed under the EPBC Act 1999 and the TSC Act 1995 as known or having the potential to occur within the Bankstown LGA. Though targeted, none of these species were observed or were indicated as potentially occurring within the area surveyed.

Fauna

Habitat features that may be used by fauna include bushrock, a crevice and fallen debris comprising leaf litter.

Fauna species recorded during the fauna survey are listed in Appendix A and include the, Australian Pelican (*Pelecanus conspicillatus*), Black-winged Stilt (*Himantopus himantopus*), White faced Heron (*Egretta novaehollandiae*), Royal Spoonbill (*Platalea regia*), Sulphur-crested Cockatoo (*Cacatua galerita*), Rainbow Lorikeet (*Trichoglossus haemotodus*), Lace Monitor (*Varanus varius*) and the Grass Skink (*Lampropholis delicata*).

The Black-winged Stilt (*Himantopus himantopus*) is within a Family of birds that are listed as migratory under the EPBC Act 1999 however this species is not a migratory bird. It is recorded within the study area and is likely to be associated with the mangrove habitat located alongside the Georges River.

The closest previously recorded sighting of threatened fauna is the Powerful Owl (*Ninox strenua*) which is located approximately 800m northeast of the Proposal site.

Feral species recorded during the ecological assessment are the fox (*Vulpes vulpes*) and the Spotted Turtle Dove (*Streptopelia chinensis*).

The survey targeted fauna species listed under the EPBC Act 1999 and the TSC Act 1995 as known or having the potential to occur within the Bankstown LGA. Though targeted, none of these species were observed or were indicated as potentially occurring within the area surveyed.

2.2.7 Noise

The study site is located within an environment that is largely characterised by bushland and is bordered on two sides by rock cuttings approximately 20-22m high. The closest receptors to the Proposal site are parklands used for picnicking and organised sport activities, including Boomerang Park and Bill Delauney Reserve, which are immediately adjacent to the Proposal site. The nearest residential houses are located approximately 100m north of the Proposal site on Fewtrell Avenue, Revesby Heights.

Any noise from the Proposal is expected to have minimal impact on these receptors. It is anticipated that the majority of noise created by the Proposal would be buffered by the rock cuttings and vegetation around the Proposal site and around and within the adjacent parks. The adjacent parklands are of sufficient size to provide areas distanced from noise associated with the Proposal.

The Proposal is not likely to increase traffic (cars and trucks) along the Henry Lawson Drive and would be performed over a short time period. Refer to Section 8.5 for assessment of potential impacts from noise.

2.2.8 Air Quality

Air pollution within the Bankstown City Council area is generally good. The Regional Pollution Index for Bankstown reports Environment Protection Authority (EPA) monitoring data and is low approximately 80% of the time (Bankstown City Council, 2004). Refer to Section 8.6 for assessment of potential impacts to air quality.

2.2.9 Indigenous Heritage

The RTA Aboriginal Program Consultant (APC), Nigel Robinson visited the Proposal site in December 2006 to identify any Aboriginal cultural heritage issues. During the visit the APC identified that the blasting to create the rock cuttings had cause extensive disturbance to the Proposal site. The APC concluded that it was unlikely that Aboriginal cultural heritage items such as grinding grooves or rock engravings had survived previous disturbances. In addition no stone tool artefacts were located at the site. The APC could see no reason why the proposed works should not proceed. Refer to Appendix E for a copy of the correspondence from the APC. Refer to Section 7.1 for a database search of listed Aboriginal Heritage items in the area.

2.2.10 Non Indigenous Heritage

In August 2003 the then Environmental Technology Branch, RTA Operations prepared a heritage assessment on the subject slopes (RTA, 2003) to determine the impact of slope stabilisation works. This report found that the rock cuttings have no heritage significance and thus no recommendations were given for conservation of the Proposal site. Refer to Section 7.1 for the database search results for non-indigenous heritage items in the locality.

2.2.11 Visual Amenity

The study area has a high visual amenity. The Henry Lawson Drive is a gently winding and undulating route through a bushland area. The road affords views of the Georges River and provides outlook to the Georges River National Park. The original section was constructed as a scenic driving route and this visual quality continues through the newer section of the road near the Proposal site The Proposal site is bounded by scenic parkland on all sides including the Georges River National Park and Council managed recreational parks. Land southeast of the Proposal site is a waterfront area of the Georges River and is characterised by a thick stand of mangroves.

The Proposal site has a limited outlook due to the steep rock cuttings located north and south of the road. The outlook is restricted to the east and west and largely consists of a view of the road ahead. Over time, the appearance of the cutting has altered from bare rock to rock sparsely vegetated with shrubs, small trees, ferns and other vegetation. The current appearance of the road cuttings provides some continuation of the bushland aesthetic when driving through.

Refer to Section 8.7 for assessment of potential impact on visual amenity.

2.2.12 Traffic

The RTA Annual Average Daily Traffic (AADT) data from 2002 indicate that the Henry Lawson Drive, in the vicinity of the study area, has an annual average daily total of greater than 15, 500 vehicles. Use of the road has decreased since 1996 by approximately 5, 000 vehicles per day which is attributed to construction of the M5, an east-west running motorway. It is anticipated that the road is primarily used by locals, by traffic accessing the north-south crossing of the Georges River at Alfords Point Bridge and by visitors to the Georges River National Park and surrounding areas. Refer to Section 8.9 for assessment of potential impact on socio-economic conditions.

3 Description of the Proposal

3.1 Description of the Proposal

The Proposal would involve stabilisation of rock cuttings located on Henry Lawson Drive at Revesby Heights. The main features of the proposed works would be:

- Devegetation of the cutting faces;
- Devegetation of the a 2m wide zone along the cutting crests and along the northern cutting drain;
- Mulching of cleared vegetation;
- Scaling, grooming and re-profiling of the cutting faces using either an elevated access scaling crew and hand tools and/or an excavator using either bucket or hammer excavation;
- Scaling, grooming and re-profiling of the cutting crests and along the northern cutting drain;
- Reshaping or re-instatement of the drain on the northern crest where/if required;
- Installation of rockbolts; and
- Installation of mesh re-inforced shotcrete with drainage measures (e.g. strip drain, weep holes).

Refer to Appendix C for a copy of the geological scoping assessment, including photomosaics showing the anticipated scope of the proposed works. All remedial measures identified in the geological scoping report would be subject to review during the proposed works when closer inspection of the rock faces is possible.

3.2 Construction Activities

3.2.1 Construction Processes and Work Methodology

It is anticipated that the Proposal would be undertaken using the following methodology:

Site establishment

- Introduction of measures specified in the Erosion and Sediment Control Plan (ESCP) to mitigate soil erosion;
- Establishment of temporary site compound; and
- Introduction of temporary traffic management controls, including plastic or concrete barriers, advance warning message signs and traffic light controls.

Devegetation

Devegetation of an area of approximately 400m^2 – 600m^2 including:

- Devegetation of the cutting faces using either a truck mounted elevated work crew and/or a long reach excavator and/or rope access;
- Devegetation of the a 2m wide zone along the cutting crests and along the northern cutting drain using either a long reach excavator and/or a specialist tree-cutting contractor operating from the ground and climbing trees as required; and
- Mulching of material and removal of mulch from the site.

Scaling, Grooming and Re-profiling

- Scaling, grooming and re-profiling of the cutting faces using either an elevated access scaling crew and hand tools and/or an excavator using either bucket or hammer excavation;
- Scaling, grooming and re-profiling of the cutting crests and along the northern cutting drain using hand and/or machine excavation; and
- Reshaping or re-instatement of the drain on the northern crest where/if required.

Scaling and grooming would include:

- Scaling and grooming of blocks nominally <0.5m^3;
- Scaling and grooming of ledges including removal of leaf litter, small rock fragments and soil accumulations.

Installation of Stabilisation Measures

- Installation of rockbolts after direct geological assessment of the cutting face using elevated access. All rockbolts shall be installed perpendicular to the cutting face and angled 15° below horizontal, unless otherwise specified onsite by geological assessment; and
- Installation of mesh re-inforced shotcrete with drainage measures (e.g. strip drain, weep holes) following direct geological assessment of the cutting face using elevated access to determine shotcrete extents.

Ongoing Site Tidiness

Material that falls to the road surface from the cuttings would be periodically removed and placing within a designated stockpile at the site compound.

Finishing Works

- Site cleanup;
- Removal of traffic control devices; and
- Decommissioning of safeguards specified in the ESCP when site is suitably stabilised.

3.2.2 Construction Equipment

It is anticipated that typical construction equipment required for the proposed works would include:

- Cherry Picker/Elevated work platform;
- Excavator;
- Front end loader/backhoe/bobcat;
- Mulcher;
- Generators to run lights for night works
- Small machinery and hand held tools including chainsaws;
- Service vehicles;
- Rock drill and compressor;
- Shotcrete equipment including concrete mixer and pump; and
- Haulage trucks/Bogey/single axled tippers.

3.2.3 Access

During construction it is anticipated that equipment and vehicles for the Proposal would access the Proposal site and the site compound using Henry Lawson Drive.

3.2.4 Source of Material

All materials would be sourced locally where possible and no materials currently in short supply would be required for the Proposal.

3.2.5 Additional Truck Movements

Construction activities are likely to generate up to four light truck movements per day. Removal of spoil from the site is likely to require up to ten additional truck movements over five days.

3.2.6 Stockpile and Compound Sites

It is anticipated that the site compound would be located on the northern side of Henry Lawson Drive immediately west of the cuttings, pending consultation with Council. This area is cleared and gravelled and is approximately 25m wide and 50m long. The area is used as secondary parking for the Bill Delauney Reserve.

Regardless of the final location of the site compound, it would be located in an already cleared area and would not be within 50m of any of the nearby waterways including Morgans Creek, Little Salt Pan Creek or the Georges River. It would consist of portable structures including portaloos and site offices and would be used to stockpile crushed sandstone, vegetation and some construction equipment.

3.3 Workforce and Working Hours

The workforce would comprise approximately 25 personnel.

To facilitate the proposed works with minimal disturbance to traffic flow, it is anticipated that works would be performed during standard working hours and that works would also be required at night time. For works performed outside of 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 Commencement of Works

The works are anticipated to commence in June or July, 2006

3.5 Period of Construction

Given ideal working conditions, the period of construction would span approximately 10 weeks. The construction period would include staged works:

- Stage 1: De-vegetation of both cuttings.
- Stage 2: Rock removal, scaling of both cuttings.
- Stage 3: Stabilisation of both cuttings using shotcrete and rock bolts.
- Stage 4: Install/repair back drain on northern cutting.

3.6 Proposal Cost and Source of Funds

The total cost of the Proposal is approximately $1.2 million. The Proposal is state funded.

4 Statutory Position

4.1 Local Environmental Plans

The Proposal is located within the Bankstown City Council Local Government Area (LGA) in which land use is controlled through provisions of the Bankstown City Council Local Environment Plan 2001 (LEP). The proposed works would be undertaken wholly within the road reserve which is unzoned and uncoloured on the LEP map. The road reserve extends approximately 25m north and approximately 10m south from the edges of Henry Lawson Drive.

Part 3, Clause 13, Subclause 4 *Development on unzoned land*, of the LEP states:

> *'Development on land not included in a zone on the map may be carried out only with consent. Consent may be granted only for the carrying out of development that may be carried out in a zone adjoining the land concerned.'*

The Proposal site runs through two zones of adjoining land. Land north of the road reserve is Zone 6(a) Open Space. The objectives of this zone are:

> *'(a) to ensure that there is a sufficient and equitable distribution of open space to meet the recreational needs of residents and to enhance the environment of Bankstown City, and*
>
> *(b) to ensure preservation of significant landscape elements.'*

Land south of the Henry Lawson Drive is Zone 8 National Parks and Nature Reserves. The objectives of this zone are:

> *'(a) to identify existing national parks and nature reserves, and*
>
> *(b) to recognise the administration of this land under the* National Parks and Wildlife Act 1974.'

Part 2, Clause 11 *Development which is allowed or prohibited within a zone* states that development for utility installations is allowed with consent in Zone 6(a) and Zone 8.

However, Part 3, Clause 14 *Development by public authorities*, of the LEP states:

> *'The following are allowed on land without consent:*
>
> *.....(b) development or activities specified in Schedule 3.'*

Schedule 3 Clause 7 Roads, states:

> *'The carrying out of any development required in connection with the construction, reconstruction, improvement, maintenance or repair of any road, except the widening, realignment or relocation of such road'*

In accordance with Part 3, Clause 14 of the LEP, development consent from Bankstown City Council is not required for the purposes of the Proposal.

4.2 Regional Environmental Plans

The following Regional Environmental Plan (REP) applies to the Proposal:

Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment

The Greater Metropolitan Regional Environmental Plan No 2 –Georges River Catchment (REP 2) applies to land within the Bankstown LGA that is within the Georges River Catchment. The Proposal does not have the potential to adversely affect the water quality, river flows, flood regime or ecosystems within the Catchment and as such the specific planning principles as set out within Clause 9 of REP 2 are not applied to the Proposal.

The aims and objectives of REP 2 are found in Part 1, Clause 5 Aims and objectives. The Proposal is not subject to the planning principles of REP 2, however the following relevant aims and objectives are considered.

> *'(2) Environmental Protection and water quality and river flows*
>
> *(a) to preserve and protect and to encourage the restoration or rehabilitation of regionally significant sensitive natural environments such as wetlands (including mangroves, salt marsh and seagrass areas), bushland and open space corridors within the Catchment, by identifying environmentally sensitive areas and providing for appropriate land use planning and development controls,*

No regionally or nationally significant flora or fauna or their populations listed as threatened or endangered would be adversely impacted as a result of the Proposal (refer to Section 2.2.6, Section 8.4 and Appendix A). There are no wetlands within the Proposal site. While the Proposal site is near to a corridor of open space and is within a corridor of bushland, the proposed works are confined to the road reserve and are for the maintenance of a road, which is considered an appropriate use of land for the area due to the proximate urban development and the location within the Sydney Metropolitan Area. The proposed works are of a small scale, are considered to present no ecological constraints and are located within an area that is not considered to be environmentally sensitive.

> *(b) to preserve, enhance and protect the freshwater and estuarine ecosystems within the Catchment by providing appropriate development,*

The Proposal is considered appropriate development as it is for the repair and maintenance of existing road infrastructure to improve road safety and would be performed within the road reserve. It is not considered that the proposed works have the capacity to cause transport of sediment to streams or waterways. The small scope of the works is not considered to provide potential to adversely affect the hydrological characteristics of the Catchment or to impact the existing chemical or biological parameters of the Georges River.

The proposed works are considered appropriate development as they are intended to reduce erosion and destabilisation of the cutting face, thereby improving road safety and reducing associated sedimentation which could impact on the quality of nearby waterways. An Erosion and Sediment Control Plan would be implemented to safeguard against release of sediment from the proposed works and to ensure that the Proposal site is rapidly restabilised. Water quality and catchment integrity would be protected by the use of safeguards provided in Section 8.2 and Section 8.3.

4.3 State Environmental Planning Policies

The following State Environmental Planning Policy or Policies (SEPPs) apply to the Proposal.

State Environmental Planning Policy No 19 – Bushland in Urban Areas

The State Environmental Planning Policy No 19 – Bushland in Urban Areas (SEPP 19) applies to areas and part areas within the Bankstown LGA. SEPP 19 provides that a person shall not disturb bushland zoned or reserved for public open space purposes without development consent (Clause 6). Development consent is not required if the bushland is to be disturbed as part of the construction or maintenance of a "main road" as defined under the Roads Act (as stated in Clause 6(2)(d) of SEPP 19) which applies to the Proposal. The RTA must however take into account the aims of SEPP 19 when it disturbs bushland for that purpose.

In Clause 9, Land adjoining land zoned or reserved for public open space, Subclause (1) states:

> *'This clause applies to land which adjoins bushland zoned or reserved for public open space purposes.'*

The Proposal site is located within unzoned land comprising the road reserve. The proposed works would be performed on land adjacent to land zoned as Open Space to the north and therefore SEPP 19 applies. Clause 9 is considered below:

Clause 9, subclause (2) states:

> *'Where a public authority:*
>
> *(a) proposes to carry out development on land to which this clause applies,*
> *....*
> *The public authority shall not carry out that development or grant the approval or development consent unless it has taken into account:*
>
> *(c) the need to retain any bushland on the land,*

A flora and fauna assessment of the Proposal site prepared by Lesryk Environmental Consultants (refer to Section 2.2.6, Section 8.4 and Appendix A) concluded that there are no ecological constraints to the proposed rock cutting stabilisation works adjacent to Henry Lawson Drive at Revesby Heights. The report concluded that there would be no adverse impacts on any of those plants or animals listed under the EPBC Act 1999 or under the TSC Act 1995 and that the Proposal would not result in any threatened species, their populations, ecological communities or habitats being impacted upon so as to place a viable population at risk of extinction. There are no ecological requirements to retain bushland at the Proposal site.

Retention of bushland would preserve the existing visual amenity however due to the destabilising effect of vegetation growth on the rock cuttings, retaining bushland at the Proposal site would inhibit restoration works that would ensure safe use of the Henry Lawson Drive into the future. A decrease in the safety of the Henry Lawson Drive would impact social amenity by reducing access to the Georges River National Park and Alford Point Bridge, increasing trip times for locals, increasing traffic on other roads and decreasing the quality of a public utility. It is considered that the minor loss of regenerated vegetation is an appropriate compromise to ensure road user safety and to maintain network efficiency.

(d) the effect of the proposed development on bushland zoned or reserved for public open space purposes and, in particular, on the erosion of soils, the siltation of streams and waterways and the spread of weeds and exotic plants within the bushland, and

Removal of vegetation would not be performed immediately adjacent to land zoned Open Space. The road reserve at the Proposal site in the northern cutting (which is adjacent to land zoned as Open Space) is 25m wide. The majority of the road reserve would be unaffected by the Proposal and would provide a buffer between the land zoned as Open Space. Spread of weeds and exotic plants would be managed by safeguards recommended in the flora and fauna assessment and incorporated into this REF (refer to Section 8.4).

The proposed works are intended to reduce erosion and destabilisation of the cutting face, thereby improving road safety and reducing associated sedimentation. An Erosion and Sediment Control Plan would be implemented to safeguard against release of sediment from the proposed works and to ensure that the Proposal site would be rapidly restabilised. It is not considered that the proposed works have the capacity to cause transport of sediment to streams or waterways that may cause siltation or spread of weed seeds. It is considered that the effect of the Proposal on bushland zoned or reserved for public open space purposes and, in particular, on the erosion of soils, the siltation of streams and waterways and the spread of weeds and exotic plants within the bushland would be negligible.

(e) any other matters which, in the opinion of the approving or consent authority, are relevant to the protection and preservation of bushland zoned or reserved for public open space purposes.

The Proposal would not prohibit existing access to the adjacent land zoned as Open Space. The protection and preservation of bushland zoned for public open space purposes would not be compromised as a result of the Proposal.

4.4 Confirmation of Part 5 Position

All relevant statutory planning instruments have been examined for the Proposal. It is concluded that in accordance with Part 3, Clause 14 of the LEP and within unzoned land adjacent to land zoned 6(a) Open Space and 8 National Parks and Nature Reserves, development consent from Bankstown City Council is not required for the purposes of the Proposal. In addition, all factors for consideration in REP2 and SEPP 19 have been considered 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.

The Proposal would contribute to achieving the objectives set out in the NSW Government's integrated transport plan, *Action for Transport 2010* and the companion document, *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 objectives include:

- Keeping the road network in good order;
- Getting the best out of our system; and
- Preventing accidents and saving lives.

Remediation of the rock cuttings on Henry Lawson Drive would create a safer road and therefore contribute towards achieving the objectives of *Road Safety 2010*.

5.2 Need for the Proposal

Remediation of the rock cuttings is needed to reduce the assessed risk level (ARL) of the rock cuttings from the existing rating of 1 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* (Stewart *et* al., 2002) 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 proposed works are informed by the strategic planning framework identified. The objectives of the Proposal are to:

- maintain the economic and social amenity of the community by assuring the serviceability of the Henry Lawson Drive into the future;
- address public amenity by improving road safety;
- maintain and enhance economic amenity by maintaining a public asset; and
- minimise and avoid detrimental impacts on environmental, social and economic amenity.

6.2 Options Considered

Option 1 – Do Nothing:

The Do Nothing option would result in no works being undertaken to stabilise the rock cuttings within the Proposal site. The rock cuttings are currently rated as high risk (ARL 1). Allowing further deterioration would increase the risk that rocks would fall to the road surface and cause vehicle accidents or damage to vehicles. The Do Nothing option would endanger public safety and would expose the RTA to legal liability. Further deterioration of the rock cuttings would contribute to the ongoing transport of sediment from the Proposal site to downstream areas which would impact upon the quality of local waterways. This option does not satisfy the Proposal objectives and fails to address road safety in accordance with RTA commitments.

Option 2 – Major Structural Treatment

The Major Structural Treatment option would include use of a combination of rock fall shelters, retaining walls, gabion walls, pattern rock bolting, flexible meshing and shotcreting.

This option would address the RTA's commitment to maintain roads and to address road safety, but was considered not suitable. This is because the rock cuttings are narrow and this option would require widening in order to facilitate installation of the retaining walls. Widening would create a large amount of spoil, would increase the environmental impact on the surrounding area and would increase the disturbance to adjacent bushland areas. This option would have an obtrusive appearance and would detract from the visual amenity of the natural bushland setting adjacent to the Georges River National Park.

Option 3 – Local Treatment (Preferred Option)

The Local Treatment option would include the following works:

- Scaling, grooming and re-profiling of loose rocks;
- Vegetation removal and slope regrading;
- Installation of metal rock bolts; and
- Installation of shotcrete.

This option is the preferred option as it best fulfils the objectives informed by the strategic planning frameworks. This option would facilitate ongoing serviceability of the subject section of the Henry Lawson Drive into the future, would improve road safety and would

improve a public asset. This option would reduce erosion of rock from the cutting faces, minimise the amount of vegetation to be removed and minimise the impact on the visual amenity of the locality.

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 D.

Australian Heritage Database

A search of the Australian Heritage Database was undertaken on 17th November, 2005 for sites within the Bankstown LGA. Twelve sites were found within the LGA of which the closest was the Georges River Wetlands, Henry Lawson Drive, Padstow Heights. This listing refers to wetlands, including saltmarsh and mangrove communities, located along the Georges River between the Como Bridge and the Milperra Bridge. The Proposal site is located approximately 30m west from a stand of mangroves that would fall under this listing. The Proposal does not involve clearing or reclamation of wetland areas, however clearing would occur within 30m of wetlands. The potential impact of the Proposal on the stand of Georges River Wetlands is considered in Section 8.2 and Section 8.4 and safeguards are recommended to ensure that there were no impacts on this item.

NSW Heritage Office State Heritage Register/Inventory

A search of the State Heritage Register (SHR) and Inventory was performed on 17th November, 2005 for sites listed within the Bankstown LGA. A total of six items were found on the SHR all of which are located greater than 6km north of the Proposal site. It is not anticipated that the Proposal would impact on any of these items or on any items listed on the SHR. These items are not considered further in this REF.

A search of the Inventory found a total of 77 records. The closest records are Cattle Duffers Flat, located approximately1.2km west of the Proposal site, East Hills Reservoir located approximately 1.5km east of the Proposal site and a Milestone listed only as occurring east of Henry Lawson Drive. The Milestone was not observed within the study area during the site visit. It is not anticipated that there would be any impacts upon any of these items or on any other heritage item listed on the Inventory therefore these listed items are not considered further in this REF.

Bankstown LEP Heritage Listings

A search of Schedule 6 of the LEP was performed on 5th December, 2005 for items of heritage significance. No additional items of heritage significance were found within 1km of the Proposal site and heritage listings in the Bankstown LEP are not considered further in this REF.

RTA Section 170 Heritage and Conservation Register

A search of the RTA Section 170 Heritage and Conservation Register was performed on 17th November, 2005 for listings within the RTA Sydney Region. None of the listed items are relevant to the Proposal and are not considered further in this REF.

NSW DEC Aboriginal Heritage Information Management System (AHIMS)

The DEC AHIMS Register was searched on 1st December, 2005 for a 5km radius around the Proposal site. The search revealed a total of 11 Aboriginal objects and places within the locality, none of which are within the study area. The closest item is located approximately 100m south southwest of the Proposal site and represents the nearest of 10 items in the vicinity located around the Georges River. There is no potential for impacts upon the items listed upon the AHIMS Register as the works would not require excavations, earthmoving or change to landform outside of the Proposal site. Given the history of disturbance at the Proposal site due to the previous construction of the cuttings and the defined scope of works, Aboriginal heritage and those items listed on the AHIMS database are not considered further in this REF.

DEH Protected Matters (EPBC Act) Database

The EPBC Act database was searched on 17th November, 2005 for listed matters of National Environmental Significance known from within 10km of the study area. The results are summarised in Table 2.

Table 2: Summary of EPBC Act Protected Matters Database Search

EPBC Act Protected Matters	From within 10km of the study area
World Heritage Properties	None found
National Heritage Places	None found
Wetlands of International Significance (Ramsar Wetlands)	1 found
Commonwealth Marine Areas	None found
Commonwealth Heritage Places	2 found
Threatened Species	29 potentially occurring
Threatened Ecological Communities	3 potentially occurring
Migratory Species	9 potentially occurring
Listed Marine Species	13 potentially occurring
Commonwealth Lands	8 found
Places on the RNE	8 found
Critical Habitats	None found
Regional Forest Agreements (RFA)	None found

Further discussion of the potential impact on water quality is provided in Section 8.2 and Section 8.3. Refer to Section 8.4 and Appendix A for further discussion and consideration of potential impacts on biodiversity. No Commonwealth Heritage places, Commonwealth lands or Places on the RNE would be impacted as a result of the Proposal and they are not considered further in this REF.

NSW BioNet Database

The NSW Fisheries and National Parks and Wildlife databases were searched via the NSW BioNet database on 6th December, 2005 for the Georges River SCA. The search identified no records for threatened or endangered fish species and they are not considered further in this REF.

NSW DPI Noxious Weeds List

The NSW Department of Agriculture Noxious Weeds list was searched on 6th December, 2005 for the Bankstown control area. Thirty two weed species are declared noxious within this control area. Lantana (*Lantana camera*), a category W2 weed, is identified as present within the Proposal site. Refer to Section 8.4 for further discussion.

NSW DEC Contaminated Land Records

The DEC Contaminated Land Records were searched on 17th November, 2005 for the Bankstown City Council LGA. Five sites are listed on the database, however all sites are greater than 3km from the Proposal site and therefore would not be affected by the proposed works. Contaminated land is not discussed further in this REF.

NSW DEC Air Quality Information

The DEC Air Quality Information website was searched on 6th December, 2005 for the nearest monitoring location, which is Chullora. The 24-hour air quality summary showed that all pollutant concentrations were within the standards set by the National Environmental Protection Measure. Refer to Section 8.6 for further discussion on air quality.

The DEH National Pollutant Inventory

The National Pollution Inventory (NPI) was searched on 17th November, 2005 for air quality in the Bankstown area (as searched by postcode 2212). The NPI indicates that air quality in the area is primarily affected by emissions from motor vehicles and lawn mowing. Other significant sources in the area are domestic/commercial solvents/aerosols, backyard incinerators and motor vehicle refinishing. In all, 34 substances were identified as occurring from 23 sources. The major source, motor vehicles accounts for 2, 700, 000kg/y of Carbon monoxide, 400, 000kg/y of oxides of Nitrogen and 330, 000kg/y of total volatile organic compounds. Air quality is further discussed in 8.6.

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 7.1 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 7.1: Summary of issues raised by government agencies and stakeholders.

Summarised Issues	Section in REF Where Addressed
Bankstown City Council	
A response to the consultation letter dated 30th November, 2005 was not received at the time of writing. Themissim Prodromakis and Lawrence Roukis at Bankstown City Council were consulted by telephone on a number of occasions during December, 2005 and January 2006. Both Council representatives indicated that they could see no concerns as long as traffic control was prepared to normal RTA standards. Both Council representatives recommended consultation with Cameron Lowndes, the Council Weeds Officer who requested that a copy of the final Flora and Fauna report be sent to him. A copy of the Flora and Fauna report was forwarded to Council in February 2006.	
• Traffic Control Plan prepared to normal RTA standards	Section 8.9
National Parks and Wildlife Service	
A response to the consultation letter dated 30th November was not received at the time of writing. The NPWS was last contacted on 16th January, 2006 by telephone and a message left. In a phone conversation with a NPWS Officer on 22nd December it was indicated that the following comment would be included in a formal response from the NPWS.	
• Mulch and brush matting from the devegetation works that is free of weed and weed seed could be stockpiled at a designated area behind the Transgrid site in the Georges River National Park for use in rehabilitation works by the NPWS.	Section 8.4
Connex Bus Company	
The Connex Bus Company was contacted by phone on 2nd December 2005 with regard to the proposed works. Graham Richardson had the following comments:	
• There are no regular or school bus routes through the Proposal site.	Section 2.2.1

7.2.2 Community Consultation and Involvement

Due to the small scale of the Proposal, no community consultation has been undertaken. However in accordance with the RTA's Community Involvement Practice Notes and Resource Manual, 1998 the affected community would be consulted prior to commencement of works through local media, letterbox drop and/or variable message signs used in the area prior to works.

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 Plan) QA Specifications 35, 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, Sydney Region prior to the commencement of work.

8.2 Geology and Soils

Potential Impacts

The Proposal site is located within an area of moderate to steep slopes. The geology of the area is subject to mass movement hazard, rock fall hazard and severe erosion hazard. The Proposal presents a risk that sediment and rock particles may be released and transported to downstream areas during removal of vegetation, removal of loose or detached rock masses and soil accumulations and scaling and grooming of the cuttings.

All material removed would be stockpiled and transported by trucks off site, however there is a risk of inadequate collection of material, spillage during transport to trucks or stockpiles and/or erosion of stockpiles. This presents potential for sediment to be transported to downstream areas.

During construction, there is potential for tracking of mud and particles along Henry Lawsons Drive due to associated truck movements. This risk would be increased during wet weather. There is also a potential that material could be transported to the Georges River Wetlands located 30m east of the Proposal site, which could cause sedimentation ot contamination of this area.

Following construction there would be a risk that soil exposed at the edges of the 2m wide crestal zone and to either side of the 1m cleared zone around the drainage channels on the northern cutting crest, would be loosened and exposed. Exposed soil may be eroded by wind or water and transported to downstream areas, including the Georges River. Whilst natural regeneration of native ground covers and shrubs along this exposed edge is expected to assist with stabilising this area, this would only be effective in the medium to long term.

It is anticipated that the risk of these potential impacts occurring would be minimal and would be further reduced through the implementation of the following safeguards.

Site Specific Safeguards

- An Erosion and Sedimentation Control Plan (ESCP) would be developed and incorporated into the CEMP. The ESCP would be prepared in accordance with Landcoms *Managing Urban Stormwater: Soils and Construction. 4th edition March 2004* (The Blue Book). The ESCP would incorporate use of temporary erosion and sediment control devices and an auditable Inspection and Test Plan and would be reviewed by the RTA's Regional Environmental Adviser, Sydney Region prior to the commencement of works.
- 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).
- Any material transported onto pavement surfaces would be swept and removed as required.
- Where soil is exposed at the edges of the 2m wide cutting crests and within and 1m either side of the drainage channel on the northern cutting crest, the soil would be rapidly re-stabilised using either biodegradable matting, pinned securely, or weed free mulch. This would be undertaken progressively as stages are completed.

8.3 Water Quality and Hydrology

Potential Impacts

The potential for transport of sediment to downstream areas of the Georges River could contribute to an increase in turbidity, temperature, nutrient levels and Biological Oxygen Demand (BOD). This potential is considered limited due to the small amount of soil that would be exposed during and after removal of vegetation, rocks and soil and due to the use of safeguards listed in Section 8.2.

There is potential for spillage of shotcrete material during mixing and application. During installation of rockbolts, there is potential for spillage of grout/epoxy resin and of sludge/material removed from the drill holes. Transport of these materials to downstream areas could contribute to changes in pH and increased turbidity and would constitute pollution of the Georges River.

Use of chemicals, fuels or lubricants for the Proposal would be limited due to the small scale of works. The potential for pollutants from fuel and hydraulic fluid to leak and be transport to downstream areas is considered low and would be further minimised by the safeguards specified below.

The drainage channels on the northern cutting crest would be cleared of vegetation, loose or detached rock masses and soil accumulations within the channel and 1m to either side. This would facilitate better drainage in this area and reduce the volume of water travelling over the northern cutting crest and face and thus reduce the potential for erosion in this area. Runoff from the drainage channels is directed away from the cutting face to well-vegetated areas.

The Proposal site is located outside of the 1 in 100y flood level but within the PMF area. The PMF is the most severe flood that is likely to occur at a particular location. Such a flood would result from the most severe combination of critical meteorological and hydrological conditions. The potential for a PMF to occur during the proposed works is considered

minimal furthermore, works would be performed during June to July when average rainfall events are low.

Flooding would pose a risk to worker safety and could lead to damage of equipment and transport of construction materials and equipment to downstream areas. It is considered that this potential risk can be mitigated by implementation of a Flood Contingency Plan to ensure that all equipment and personnel are removed from the area if a high rainfall event is forecast within the catchment or if a flood alert is issued.

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 of the incident emergency procedures and made aware of the location of where the emergency spill kit would be kept.
- Should a spill occur during construction, the incident emergency spill plan would be implemented, and the Regional Environmental Adviser, Sydney 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 area within the compound site.
- Onsite refuelling and maintenance of equipment would be avoided.
- If onsite refuelling must be undertaken it would be within impervious bunded areas within the compound site or as a minimum the fuelling contractor would be required to have portable bunding and a spill kit.
- Where equipment has broken down on site and cannot be moved and maintenance must be undertaken on site then temporary bunding, catch trays and spill kits would be used.
- Vehicle wash down would not be permitted on site.
- Cement chute washing and shotcrete equipment washing would not be permitted on site.
- Washing of concrete/shotcrete equipment would be performed off site in a designated bunded area. Excess concrete/shotcrete would be scraped off equipment and collected prior to being washed. All concrete/shotcrete residue would be collected and disposed of to a licensed landfill.
- Drop sheets would be used where appropriate during construction to prevent shotcrete/cement slurry, grout/epoxy and drilled material/sludge from entering roadside guttering or waterways.
- Construction materials would be used carefully to avoid spillage.
- Overspray of shotcrete would be avoided.
- All waste material (i.e. grout, epoxy resin, shotcrete, mortar, workers refuse) would be collected and removed at regular intervals.
- Sewage from portable toilets would be disposed of off-site at an appropriately licensed facility.
- A Flood Contingency Plan (FCP) would be developed and would be reviewed by the Regional Environment Officer, Sydney Region before commencement of works. The FCP would include but not be restricted to: a flood equipment and personnel evacuation plan; that weather forecasts and flood alerts are checked at least daily and that all equipment including chemicals would be stored securely and stabilised against flood impact.

8.4 Biodiversity

Potential Impacts

A Flora and Fauna assessment of the Proposal was undertaken by Lesryk Environmental Consultants in January 2006 (Refer to Appendix A for the full report). The Flora and Fauna report concludes that the Proposal would not affect any threatened species, ecological communities or populations listed on the Schedules to the TSC Act 1995 or the EPBC Act 1999 and that the Proposal presents no ecological constraints.

Flora

There is potential for the proposed works to encourage spread of weeds and change in vegetation assemblage due to the disturbance of vegetation and creation of a new edge to the existing vegetation. The Proposal site is located adjacent to the Georges River National Park (to the south) and is in proximity to a previously recorded Endangered Ecological Community (Shale Sandstone Transition Forest) listed on Schedule 1, Part 3 of the TSC Act 1995 and on Schedule 1 of the EPBC Act 1999 (to the north). Note that the Flora and Fauna report (Appendix A) concludes that the Proposal site is not located within the vicinity of Shale Sandstone Transition Forest. It is considered that these potential impacts would be minimised by the scope of works. The works would involve the removal of a small area of regenerated vegetation (maximum of 0.6ha) would be performed within a section of the road reserve that has been previously subject to clearing. A vegetated buffer would be retained to the outer boundary of the road reserve. The road reserve is 25m wide to the north and 10m wide to the south. Potential spread of weeds and change to vegetation assemblage would be managed by the safeguards listed below.

'Clearing of native vegetation' is a key threatening process under the TSC Act 1995, and 'Land clearance' is a key threatening process under the EPBC Act 1999. The Proposal would cause only minor impacts from removal of native vegetation due to the small area of regenerated vegetation to be removed (0.6ha) from sparsely and densely vegetated areas. Similar vegetation assemblages are well represented in the National Parks and Open Space located within the vicinity of the Proposal site.

The Proposal does not have the potential to impair the health of retained vegetation e.g. by causing compaction of root zones, ringbarking, or smothering or waterlogging of vegetation. There would be no fragmentation of or disturbance of movement or dispersal of pollination vectors or corridors. No areas of habitat would become isolated as a result of the Proposal.

The Proposal site has been previously disturbed from creation of the cuttings, weeds and soil and rock movements. Expansion of weed growth within and adjacent to the Proposal site is not expected to occur, however the Proposal has the potential to disturb Lantana (a category W2 weed within the Bankstown LGA).

To minimise potential impacts, removal of vegetation and habitat would be kept to a minimum and all works would be limited to within the road reserve and would largely be restricted to within 2-3m of the cutting crest. The road reserve would retain a buffer of vegetated area to the National Park and the Open Space borders, which are located to the south and the north of the road reserves respectively.

Fauna

The flora and fauna report prepared as part of the environmental assessment concluded that the Proposal would not have the potential to cause significant impact upon The Black-winged Stilt (*Himantopus himantopus*) as the mangrove vegetation with which it is associated is located outside of the Proposal site (30m to the east) and any potential indirect impacts on this area would be mitigated by the safeguards provide in Section 8.2. 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 *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 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 habitats.

It is not anticipated that the Proposal would remove any hollow bearing tree of a capacity to support the lifecycle of any hollow dependant native animal, however there is a potential that hollows were undetected during the site visit and flora and fauna survey due to the constraints of viewing from the ground. Removal of a hollow bearing tree could impact on a protected native species as listed under the *National Parks and Wildlife Act, 1979.*, however this impact would be appropriately mitigated by implementation of the safeguards listed below.

Site Specific Safeguards

Flora

- The W2 noxious weed, *Lantana camera* identified within the Proposal site would be removed from the Proposal site in a manner that prevents it from spreading in accordance with the *Noxious Weeds Act, 1993.*
- Any weed vegetation and weed seed removed from the works would be taken to a licensed landfill facility and would not be used as mulch or mulched with other vegetation. Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licensed landfill facility. Weed infested or contaminated topsoil would not be reused for the proposed works or for revegetation works and would not be stockpiled adjacent to any areas of native vegetation.
- Cleared native vegetation would be mulched and used in rehabilitation works at the Proposal site where practical. Any additional weed free mulch or brush-matting (trimmed native braches) would be offered to the NPWS for use in rehabilitation works in the Georges River National Park.
- Weed growth present within the Proposal site and at the stockpile/compound site would be monitored weekly during the proposed works. Weed growth present would be removed regularly during the construction period to prevent the spread of weeds into adjacent bushland areas.
- Works on the cutting crests would be performed by hand held equipment or by machinery operated from Henry Lawsons Drive. No large equipment would be placed on or operated from the cutting crest.
- 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, Sydney Region would be contacted and consulted to determine the need for further environmental impact assessment.

- The area of disturbance would be minimised including all storage areas and access ways. Storage areas and access ways in the Proposal site would be positioned in areas that contain minimal native vegetation.
- Prior to commencement of any work in the vicinity of the Georges River National Park, all equipment utilised in weedy areas would be cleaned to ensure that weed propagules and foreign materials are removed.
- Work areas would be monitored regularly for up to 3 months following completion of construction works to identify any potential loss of topsoil, change to vegetation assemblages adjacent to the works or spread of weeds. If such changes are noticed a Vegetation Management Plan would be adopted for the area in consultation with the Regional Environmental Advisor, Sydney Region.

Fauna

- Any protected fauna species (as defined under the NPWS Act 1974) found inhabiting areas to be disturbed would be removed by a person licensed under the National Parks and Wildlife Service Act, 1974 (NPWS Act 1974) (e.g. WIRES).
- Should trees containing hollows be removed, they would be first inspected by a qualified ecologist. Should native arboreal species be found inhabiting hollow trees that are proposed to be removed, then compensatory nest boxes and/or relocation would be investigated in consultation with the RTA's Regional Environmental Adviser, Sydney Region.
- During vegetation clearing, woody debris suitable for fauna habitat would be retained and replaced on site, outside of cleared zones, as removal of any dead wood, trees and logs is a Key Threatening Process under the TSC Act, 1995.

8.5 Noise

Operational Noise

The Proposal would not increase the capacity or the operational noise of the Henry Lawson Drive.

Construction Noise

Construction equipment likely to be used would include:

- Cherry Picker;
- Excavator;
- Front end loader or bobcat;
- Mulcher;
- Generators to run lights for night work
- Small machinery and hand held tools including chainsaws;
- Service vehicles;
- Rock drill and compressor; and
- Shotcrete equipment including concrete mixer.

The works would be undertaken between 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.

It is anticipated that the noise levels for the study area and surrounds would be increased during the construction period as a result of use of equipment and tools to perform the proposed works. Generators would be used at the Proposal site to run lights to facilitate night works. However, the tall rock cuttings would provide a natural shield and would act as a noise barrier to minimise impacts to residents and users of nearby parkland.

The closest residence is located approximately 100m north of the Proposal site however the area is adjacent to sensitive areas including the Georges River National Park and Boomerang Park. Boomerang Park provides walking trails and picnic facilities. It is anticipated that noise impacts would be short-term only (based on a 10 week construction period) and would generally be performed outside of peak public usage times of the nearby parks.

In accordance with the DEC guidelines, target noise levels for the Proposal (10 weeks 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, such as the activities 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.

Work would be undertaken outside of standard working hours to minimise impacts on traffic flow. The majority of the night work would be classified as being outside normal working hours. 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.

Site Specific Safeguards

- As works would be required outside standard working hours, the procedures contained in the RTA's *Environmental Noise Management Manual, 2001* "*Practice Notes vii – Roadworks Outside of Normal Working Hours*" would be followed.
- Potentially affected residents would be contacted prior to the commencement of works and would be informed of the proposed works, working hours, and the period of construction. Residents would also be provided with a contact name and number should any complaints wish to be registered.
- 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.*
- Noisy activities, particularly rock breaking with a hydraulic hammer, if required, would be carried out during the day, or early in the evening if required to be undertaken at night.
- All noisy plant, including generators, would be placed in a position to best shield noise impacts to sensitive receptors.
- Short, sharp sounds primarily caused by impacts, would be avoided where possible to minimise sleep disturbance to residents.
- Reversing of vehicles and machinery would be managed to reduce noise impact at night.

8.6 Air Quality

Potential Impacts

The Proposal has a minor potential to deteriorate local air quality from dust caused by earthworks, vegetation removal and stockpile erosion.

Site Specific Safeguards

- Any stockpiles and general areas with the capacity to cause dust would be dampened to suppress dust emissions.
- Any materials transported in trucks would be appropriately covered to reduce dust generation.
- Construction activities that generate high dust levels would be avoided during high wind periods.
- Where winds visibly move dust particles, the frequency of dust suppression such as watering would be increased appropriately.
- Rehabilitation of disturbed surfaces would be undertaken as soon as practicable.
- Fenced boundaries surrounding stockpile sites would be lined with geotextile fabric.

8.7 Visual Amenity

Potential Impacts

There would be a short-term negative impact on the visual amenity of the area during the construction period due to the presence and use of construction equipment. There would be long-term visual impact from the proposed removal of vegetation, scaling and grooming of rocks and permanent addition of shotcrete and rockbolts to the cutting faces. The long-term impact is assessed below.

Operational Phase

The long-term visual impact of the proposed works is determined by evaluating the visual effect of the development in context of the visual sensitivity of the surrounding land use areas from which the proposed development may be visible.

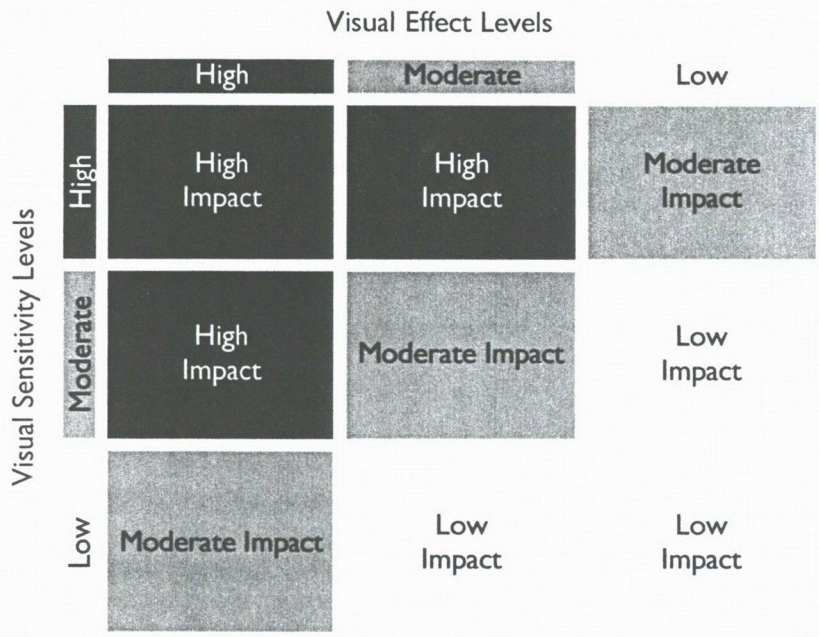

Figure 8.1: Visual Impact Matrix

A visual impact matrix (Figure 8.1) is used to help assess the impact on viewing groups potentially affected by the Proposal. The visual effect of the proposed works is the expression of the level of visual contrast between the development and the visual setting within which it is placed.

Visual Effect

The long-term visual effect is considered with regard to the characteristics of the Proposal in relation to the existing environment. The Proposal would involve removal of vegetation, scaling, re-profiling and use of shotcrete and rockbolts. These changes would provide contrast to the existing vegetated rock cutting.

Removal of vegetation would interrupt the existing continuation of the bushland aesthetic, however as the cuttings are sparsely vegetated in comparison to adjacent bushland, removal of vegetation is considered to be of **Moderate to High** visual effect. The rock scaling works would be limited to small and medium sized well-defined areas. The nature of the scaling work is such that within a short timeframe, the freshly exposed rock would weather to match the existing appearance of the cuttings. The scaling work is generally considered to

contribute **Low** visual effect. The re-profiling works would be performed in large areas, mainly along the crest of the cuttings. The nature of the re-profiling work is such that within a short timeframe, the freshly exposed rock would weather to match the existing appearance of the cuttings. Re-profiling works are considered to be of **Moderate** visual effect. The rock bolts would be constructed of ferrous iron which would quickly weather and take on an organic appearance. The majority of the rockbolts would be installed above eye level. Installation of rockbolts is considered to be of **Low** visual effect. The shotcrete would be applied precisely to unstable sections and would be comprised of small to large areas (refer to photomosaics in Appendix C for approximate locations and extent of shotcrete). The appearance of the shotcrete would be improved by colour matching to the existing rock and sculpting to provide a rock type finish. Installation of shotcrete is considered to be of **High** visual effect.

The overall long-term visual effect of the Proposal is considered to be **High**.

Visual Sensitivity

Visual sensitivity levels are a measure of how critically a change to the existing landscape would be viewed from various use areas. The rock cuttings would not be viewed from the adjacent National Park due to the vegetated buffer comprised of the road reserve and the lack of access to that portion of the Georges River National Park. The rock cuttings are not viewed from the Bill Delauney Reserve due to the angle and setting of the Reserve. Only a small part of the rock cuttings can be viewed from a small front portion of Boomerang Park.

There are two principle viewing groups. They are:

1. Commuters travelling through the Proposal site.
2. Tourists using the adjacent parks including Georges River National Park or enjoying the scenic drive.

Considering the 70km/h speed limit road users would spend approximately 7.2s travelling through the 140m cuttings. Transient road users are exposed to the Proposal site for only a short period of time and there is no road verge within the Proposal site in which motorists may stop. Therefore the long-term visual sensitivity is considered **Low** for transient road users. Persons visiting Boomerang Park are likely to turn away from the road setting to enjoy the bushland and park facilities provided. There are limited areas within the Park from which the cutting faces may be viewed. Therefore the long-term visual sensitivity to persons using Boomerang Park is considered **Low**.

The overall long-term visual sensitivity of the Proposal is considered to be **Low.**

Visual Impact

A combination of High visual effect and Low visual sensitivity results in an **overall Moderate visual impact** as a result of the Proposal. Visual impact is expected to decrease over the medium to long-term as the cuttings become revegetated and as processes of weathering and natural staining facilitate a decrease in contrast between the natural and built materials of the Proposal.

Site Specific Safeguards

- Application of shotcrete would be undertaken in accordance with RTA's *QA Specification B82 Shotcrete Work* and the RTA document, *Shotcrete Design Guidelines to avoid Minimise and Improve the Appearance of Shotcrete.*
- The application of shotcrete and rockbolts would be **avoided** and **minimised** and used only as necessary to achieve stabilisation of the cuttings as informed by close geological inspection during the construction period.
- Shotcrete would be stained where appropriate to match the colour of the existing cutting face and subtly sculpted to provide a rock like finish.
- During construction 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.

8.8 Fire Management

Potential Impacts

The locality has a moderate bushfire risk, dependant on seasonal conditions. Ridgelines, as found in the study area, generally have a high fire risk. Due to the connectivity and proximity of National Parks and Open Space characterised by bushland, a fire within the study area has the potential to cause considerable damage.

During the proposed works the use of machinery near areas of vegetation has the potential to create a fire hazard that may spread to adjoining bushland. However, given the short duration of the proposed works, that the construction period is during winter and the type of construction work necessary, the potential bushfire risk is considered low. The low bushfire risk would be managed through safeguards outlined below.

Site Specific Safeguards

- General-purpose fire extinguishers and one oil/petrol fire extinguisher would be kept onsite at all times.
- No burning of material would be permitted onsite.
- Combustible material such as cleared vegetation would be removed from the vicinity of any hot work or works likely to generate sparks.
- All contractors would observe caution and care if extinguishing and disposing of cigarettes during the proposed works.

8.9 Socio-economic Considerations

Potential Impacts

Henry Lawson Drive within the Proposal site links the south western suburbs of the Bankstown LGA with Peakhurst and beyond. It also provides a direct route to the Alfords Point Bridge crossing of the Georges River and is near to the main entrance of the Georges River National Park. There are no bus routes or cycleways through the Proposal site.

Other roads in the area provide alternative routes around the Proposal site however these are circuitous, lengthier and would impose more traffic in other areas. Due to these factors, the section of the Henry Lawson Drive upon which the works are proposed is considered a vital link for the local community. It is anticipated that the works would not require full closure of the Henry Lawson Drive within the Proposal site.

During construction there would be temporary closure of one lane at a time. This would impose a tidal flow through the Proposal site which would be managed by traffic controls. The Proposal would cause delays to traffic over a short duration (10 weeks). However, works would be undertaken generally during non-standard hours and outside of peak periods to ensure minimal disruption to traffic.

There would a reduction in the area of roadside verge which is also used as a car park for Bill Delauney Reserve, located west of the Proposal site. Pending consultation with Council, a portion of this area would be used to stockpile construction materials and equipment. The Bill Delauney Reserve has alternative access and parking via The River Road.

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

Site Specific Safeguards

- 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 prior notification of any traffic alterations or closures e.g. via roadside signage.
- Access to and from the Georges River National Park would be maintained at all times.

8.10 Waste Minimisation and Management

Potential Impacts

The Proposal would generate the following waste:

- Rock, soil and vegetation material;
- Noxious weed material (*Lantana camera*)
- Metal rockbolts off-cuts;
- Drill cuttings and sludge;
- Grout and epoxy resin;
- Shotcrete;
- Sewage; and
- Workers refuse (e.g. litter, cigarette butts).

The Proposal has the potential to generate material that can be re-used, recycled or sent to landfill. In accordance with the principles of waste management, waste generated would be minimised, recycled or re-used wherever possible and the remainder disposed of in a responsible manner in accordance with the 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.
- Weed free non-millable vegetation and brush-matting would be chipped and used as mulch in re-stabilisation works at the Proposal site where practicable or for use by the NPWS
- There would be no burning of waste.
- All waste comprising noxious weeds and exotic plant species and soil with weed seeds would be bagged and disposed of at a licensed landfill facility and would not be stockpiled near the Georges River National Park.
- All construction materials and other surplus soils and wastes generated from the Proposal would be stockpiled and stored at the 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.
- Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction.
- All rock material generated from the Proposal would be re-used or recycled.

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.

8.11 Summary of Beneficial Effects

The Proposal has the following beneficial effects:

- Remediation of the cuttings would reduce the ARL from 1 to 3 or better and accordingly would improve road safety in accordance with objectives set out in *Road Safety 2010.*
- Improving the long-term serviceability of the Henry Lawson Drive into the future.
- Improving a public asset.

8.12 Summary of Adverse Effects

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

- Short-term disruption of local through traffic that would increase travel times.
- Removal of vegetation that would potentially remove habitat for protected native fauna, however the effect would be minimal due to extensive reserves of that habitat in the area.
- Vegetation removal and minor earthworks have the potential to increase erosion, especially after heavy rain, however this would be mitigated by the scope of works and implementation of safeguards.
- Potential for minor short term noise impacts.
- A long-term moderate impact on the existing 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 QA Specifications – *Environmental Protection (Management Plan) QA Specifications 35, Soil and Water Management (Erosion and Sediment Control Plan) QA Specification G39* and *Clearing and Grubbing QA Specification G40*

Table 9.1: Site Specific Environmental Safeguards.

Impact	Environmental Safeguards
Geology & Soils	• An Erosion and Sedimentation Control Plan (ESCP) would be developed and incorporated into the CEMP. The ESCP would be prepared in accordance with Landcoms *Managing Urban Stormwater: Soils and Construction. 4th edition March 2004* (The Blue Book). The ESCP would incorporate use of temporary erosion and sediment control devices and an auditable Inspection and Test Plan and would be reviewed by the RTA's Regional Environmental Adviser, Sydney Region prior to the commencement of works. • 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). • Any material transported onto pavement surfaces would be swept and removed as required. • Where soil is exposed at the edges of the 2m wide cutting crests and within and 1m either side of the drainage channel on the northern cutting crest, the soil would be rapidly re-stabilised using either biodegradable matting, pinned securely, or weed free mulch. This would be undertaken progressively as stages are completed.
Water Quality & Hydrology	***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.

Impact	Environmental Safeguards
	• All staff would be inducted of the incident emergency procedures and made aware of the location of where the emergency spill kit would be kept. • Should a spill occur during construction, the incident emergency spill plan would be implemented, and the Regional Environmental Adviser, Sydney 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 area within the compound site. • Onsite refuelling and maintenance of equipment would be avoided. • If onsite refuelling must be undertaken it would be within impervious bunded areas within the compound site or as a minimum the fuelling contractor would be required to have portable bunding and a spill kit. • Where equipment has broken down on site and cannot be moved and maintenance must be undertaken on site then temporary bunding, catch trays and spill kits would be used. • Vehicle wash down would not be permitted on site. • Cement chute washing and shotcrete equipment washing would not be permitted on site. • Washing of concrete/shotcrete equipment would be performed off site in a designated bunded area. Excess concrete/shotcrete would be scraped off equipment and collected prior to being washed. All concrete/shotcrete residue would be collected and disposed of to a licensed landfill. • Drop sheets would be used where appropriate during construction to prevent shotcrete/cement slurry, grout/epoxy and drilled material/sludge from entering roadside guttering or waterways. • Construction materials would be used carefully to avoid spillage. • Overspray of shotcrete would be avoided. • All waste material (i.e. grout, epoxy resin, shotcrete, mortar, workers refuse) would be collected and removed at regular intervals. • Sewage from portable toilets would be disposed of off-site at an appropriately licensed facility. • A Flood Contingency Plan (FCP) would be developed and would be reviewed by the Regional Environment Officer, Sydney Region before commencement of works. The FCP would include but not be restricted to: a flood equipment and personnel evacuation plan; that weather forecasts and flood alerts checked at least daily and that all equipment including chemicals would be stored securely and stabilised against flood impact.
Biodiversity	*Flora* • The W2 noxious weed, *Lantana camera* identified within the Proposal site would be removed from the Proposal site in a manner that prevents it from spreading in accordance with the

Impact	Environmental Safeguards
	Noxious Weeds Act, 1993. • Any weed vegetation and weed seed removed from the works would be taken to a licensed landfill facility and would not be used as mulch or mulched with other vegetation. Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licensed landfill facility. Weed infested or contaminated topsoil would not be reused for the proposed works or for revegetation works and would not be stockpiled adjacent to any areas of native vegetation. • Cleared native vegetation would be mulched and used in rehabilitation works at the Proposal site where practical. Any additional weed free mulch or brush-matting (trimmed native braches) would be offered to the NPWS for use in rehabilitation works in the Georges River National Park. • Weed growth present within the Proposal site and at the stockpile/compound site would be monitored weekly during the proposed works. Weed growth present would be removed regularly during the construction period to prevent the spread of weeds into adjacent bushland areas. • Works on the cutting crests would be performed by hand held equipment or by machinery operated from Henry Lawsons Drive. No large equipment would be placed on or operated from the cutting crest. • 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, Sydney Region would be contacted and consulted to determine the need for further environmental impact assessment. • The area of disturbance would be minimised including all storage areas and access ways. Storage areas and access ways in the Proposal site would be positioned in areas that contain minimal native vegetation. • Prior to commencement of any work in the vicinity of the Georges River National Park, all equipment utilised in weedy areas would be cleaned to ensure that weed propagules and foreign materials are removed. • Work areas would be monitored regularly for up to 3 months following completion of construction works to identify any potential loss of topsoil, change to vegetation assemblages adjacent to the works or spread of weeds. If such changes are noticed a Vegetation Management Plan would be adopted for the area in consultation with the Regional Environmental Advisor, Sydney Region. ***Fauna*** • Any protected fauna species (as defined under the NPWS Act 1974) found inhabiting areas to be disturbed would be removed by a person licensed under the National Parks and Wildlife

Impact	Environmental Safeguards
	Service Act, 1974 (NPWS Act 1974) (e.g. WIRES). • Should trees containing hollows be removed, they would be first inspected by a qualified ecologist. Should native arboreal species be found inhabiting hollow trees that are proposed to be removed, the use of compensatory nest boxes and/or relocation would be investigated in consultation with the RTA's Regional Environmental Adviser, Sydney Region. • During vegetation clearing, woody debris suitable for fauna habitat would be retained and replaced on site, outside of cleared zones, as removal of any dead wood, trees and logs is a Key Threatening Process under the TSC Act, 1995.
Noise	• As works would be required outside standard working hours, the procedures contained in the RTA's *Environmental Noise Management Manual, 2001* "*Practice Notes vii – Roadworks Outside of Normal Working Hours*" would be followed. • Potentially affected residents would be contacted prior to the commencement of works and would be informed of the proposed works, working hours, and the period of construction. Residents would also be provided with a contact name and number should any complaints wish to be registered. • 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*. • Noisy activities, particularly rock breaking with a hydraulic hammer, if required, would be carried out during the day, or early in the evening if required to be undertaken at night. • All noisy plant, including generators, would be placed in a position to best shield noise impacts to sensitive receptors. • Short, sharp sounds primarily caused by impacts, would be avoided where possible to minimise sleep disturbance to residents.
Air Quality	• Any stockpiles and general areas with the capacity to cause dust would be dampened to suppress dust emissions. • Any materials transported in trucks would be appropriately covered to reduce dust generation. • Construction activities that generate high dust levels would be avoided during high wind periods. • Where winds visibly move dust particles, the frequency of dust suppression such as watering would be increased appropriately. • Rehabilitation of disturbed surfaces would be undertaken as soon as practicable. • Fenced boundaries surrounding stockpile sites would be lined with geotextile fabric.

Impact	Environmental Safeguards
Visual Amenity	• Application of shotcrete would be undertaken in accordance with RTA's *QA Specification B82 Shotcrete Work* and the RTA document, *Shotcrete Design Guidelines to avoid Minimise and Improve the Appearance of Shotcrete.* • The application of shotcrete and rockbolts would be **avoided** and **minimised** to that necessary to achieve stabilisation of the cuttings as informed by close geological inspection during the construction period. • Shotcrete would be stained where appropriate to match the colour of the existing cutting face and subtly sculpted to provide a rock like finish. • During construction 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.
Socio-Economic Considerations	• 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 prior notification of any traffic alterations or closures e.g. via roadside signage. • Access to and from the Georges River National Park would be maintained at all times.
Waste Management & Minimisation	• 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. • Weed free non-millable vegetation and brush-matting would be chipped and used as mulch in re-stabilisation works at the Proposal site where practicable or for use by the NPWS • There would be no burning of waste. • All waste comprising noxious weeds and exotic plant species and soil with weed seeds would be bagged and disposed of at a licensed landfill facility and would not be stockpiled near the Georges River National Park. • All construction materials and other surplus soils and wastes generated from the Proposal would be stockpiled and stored at the 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. • Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction. • All rock material generated from the Proposal would be re-used or recycled.

Impact	Environmental Safeguards
	In addition, the Resource Management Hierarchy principles of the WARR Act would be adopted as follows: 4. Avoid unnecessary resource consumption as a priority; 5. Avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery); and 6. Disposal is undertaken as a last resort.

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?	
During construction there would be short-term negative impacts on the community due to disruption of traffic, delays and increase in noise. These would be managed by safeguards in Section 8.9 and Section 8.5.	Short-term -ve
After construction the community would benefit through the provision of a safer road and facilitation of ongoing use of the existing route.	Long-term +ve
b) Any transformation of a locality?	
The Proposed works would include removal of native vegetation, scaling and re-profiling and installation of shotcrete and rockbolts. This would cause a long-term moderate visual impact as discussed in Section 8.7. However it is considered that the proposed works are of a small scale and would not result in transformation of a locality.	Nil
c) Any environmental impact on the ecosystem of the locality?	
The Proposal would require removal of native vegetation and exotic species, including a noxious weed (*Lantana camera*). As discussed in Section 8.4 native vegetation that would be removed is common within the area and does not provide any critical habitat or support any threatened species or endangered populations. The proposal provides no ecological constraints (refer to Appendix A).	Nil
d) Any reduction of the aesthetics, recreational, scientific or other environmental quality or value of a locality?	
There would be no long-term reduction in the recreational, scientific or other environmental quality or value of a locality.	Nil
The Proposal would have an immediate moderate aesthetic impact on the locality as a result of removal of vegetation and use of shotcrete and rockbolts. This impact would be managed by the safeguards provided in Section 8.7. Over the medium to long-term, visual impact would be decreased as a result of regeneration of vegetation and processes of	Minor Long-term -ve

Clause 228(2) Factors	Impact
weathering and natural staining.	
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There would be no effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations (refer to Sections 2.2.10, 8.4 and 8.7).	Nil
f) Any impact on habitat of any protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? A small area of the habitat of protected fauna would be removed from the Proposal site (0.6ha). This habitat is common in the locality and the potential impact on protected species from removal of this habitat would be managed by the safeguards provided in Section 8.4.	Minor -ve
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The Proposal would not endanger any species of animal, plant or other form of life whether living on land, in water or in the air (refer to Appendix A and Section 8.4).	Nil
h) Any long-term effects on the environment? The Proposal is not expected to cause any long-term negative effects on the environment.	Nil
i) Any degradation of the quality of the environment? The Proposal is not expected to degrade the quality of the environment in the long-term. There may be some medium long-term impact on visual amenity, however this would be managed via the safeguards listed in Section 8.7 and would be a result of safety works.	Medium long-term -ve
j) Any risk to the safety of the environment? There would be no long-term risk to safety of the environment. The Proposal would result in a long-term positive increase to the safety of road users.	Long-term +ve
During construction there would be short-term risks to safety of the environment due to the potential for spillage of construction materials and risk of fire.	Short-term -ve
k) Any reduction in the range of beneficial uses of the environment? There would be no reduction in the range of beneficial uses of the environment.	Nil
l) Any pollution of the environment? There is a minor risk that sediment from cleared areas and/or	Nil

Clause 228(2) Factors	Impact
chemicals/fuels from the proposed works could be discharged to the environment as a result of the activity. However, with implementation of safeguards detailed in Section 8.2, 8.3, 8.6 and 8.10 it is not anticipated that any pollution of the environment would occur as a result of the Proposal.	
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 licensed waste disposal sites and managed in accordance with the Resource Management Hierarchy of the WARR Act. Refer to 8.10.	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.	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 Henry Lawson Drive. There are no known existing or likely future activities that would contribute to a cumulative effect from the Proposal.	Nil

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?** There are no World Heritage properties present within 10km of the Proposal site. There would be no environmental impact on any World Heritage property.	Nil
b) **Any environmental impact on National Heritage places?** There are no National Heritage places present within 10km of the Proposal site. There would be no environmental impact on any National Heritage places.	Nil
c) **Any environmental impact on wetlands of international importance?** The Towra Point Nature Reserve is listed as a Ramsar wetland, which is of international significance. This wetland is located approximately 12.5km south west of the Proposal site. Due to the small scale of works, and provided that the safeguards recommended in this REF are implemented, the Proposal does not have the potential to cause adverse impact to any Ramsar listed wetlands.	Nil
d) **Any environmental impact on Commonwealth listed threatened species or ecological communities?** There are 28 threatened species and 3 threatened ecological communities listed as potentially occurring within 10km of the Proposal site. The Proposal would not reduce the habitat of any of the listed threatened species or ecological communities nor cause any detrimental impact.	Nil
e) **Any environmental impact on Commonwealth listed migratory species?** There are 9 Commonwealth listed migratory species listed as potentially occurring within 10km of the Proposal site. The proposed works would not impede any migratory path and does not represent any habitat used by migratory species.	Nil
f) **Does any part of the Proposal involve nuclear action?** No part of the Proposal involves nuclear action.	Nil
g) **Any environmental impact on a Commonwealth Marine area?** There are no Commonwealth Marine areas within 10km of the Proposal site. There would be no impact upon any Commonwealth Marine area.	Nil

In addition: Any impact on Commonwealth Land?	
There are 8 Commonwealth lands within 10km of the Proposal site. There would be no impact upon Commonwealth land either directly or indirectly as a result of the 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.

Alison Nash
Environmental Officer
Date: 28/02/06

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

Jay Jaya-Ranjan
Project Manager
Date: 01/03/2006

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Appendix A

Site Photos

Photo 1: Narrow shoulder on Henry Lawson Drive at the subject rock cuttings, eastbound.

Photo 2: Gutter on Henry Lawson Drive at the subject rock cuttings, eastbound.

Photo 3: Area prone to flooding, as indicated by Flood Sign. View is looking westbound.

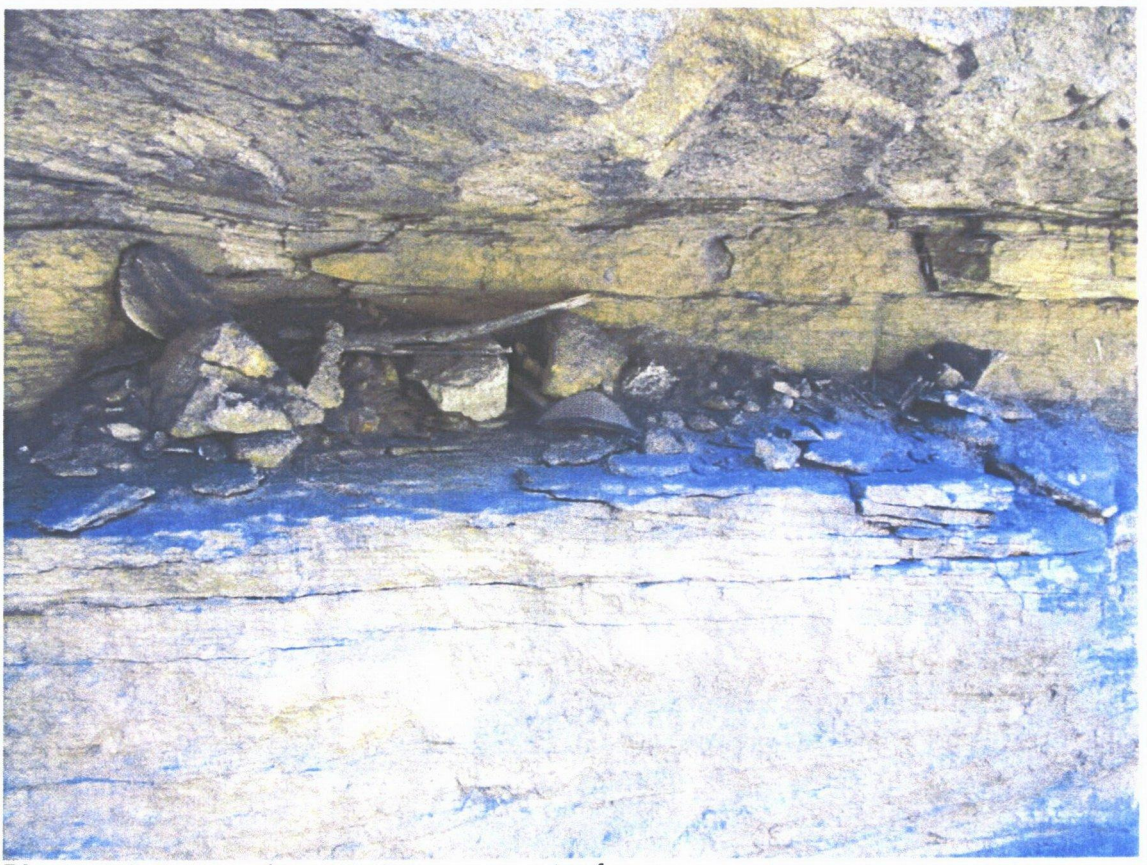

Photo 4: Soil and rock accumulations on cutting face

Photo 5: Cracks in cutting face causing instability

Appendix B

Flora and Fauna Report

Flora and fauna survey, proposed rock cutting stabilisations works.

January 2006

Henry Lawson Drive,
Revesby Heights

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.

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Photographic record of study area *Pages 4 & 5*

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1. Introduction.

This report presents the findings of a vascular flora and vertebrate fauna survey of the lands that occur within, and in-close proximity to, two sandstone rock cuttings (Slope ID's 1968 and 1969). These rock cuttings are located either side of Henry Lawson Drive at Revesby Heights, NSW. The survey has been carried out as the NSW Roads and Traffic Authority (RTA) is proposing to reduce the safety risk posed by the two cuttings, the stabilisation works including:

- The complete removal of any vegetation that has established on the cuttings (i.e. on their faces);
- The removal of loose and/or detached rock masses;
- The removal of soil accumulations;
- The installation of rock bolts and shotcrete to stabilise the existing cuttings;
- The removal of vegetation from the crestal area of each cutting for a distance of 2m from the existing face; and
- The removal of vegetation from within, and 1m either side of, the crestal drainage channels that are located atop of, and run the length of, the north cutting.

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

For the purpose of the current investigation, where access was physically possible, and giving consideration to the safety of researchers, the area surveyed encompassed all the lands that occur on top of the rock embankments themselves and for a distance of 15 metres (m) beyond the cutting faces. For ease of reference, unless a specific component of this area is discussed, the areas surveyed will be referred to as the 'study area', whilst the surrounding lands will be referred to as the 'study region'.

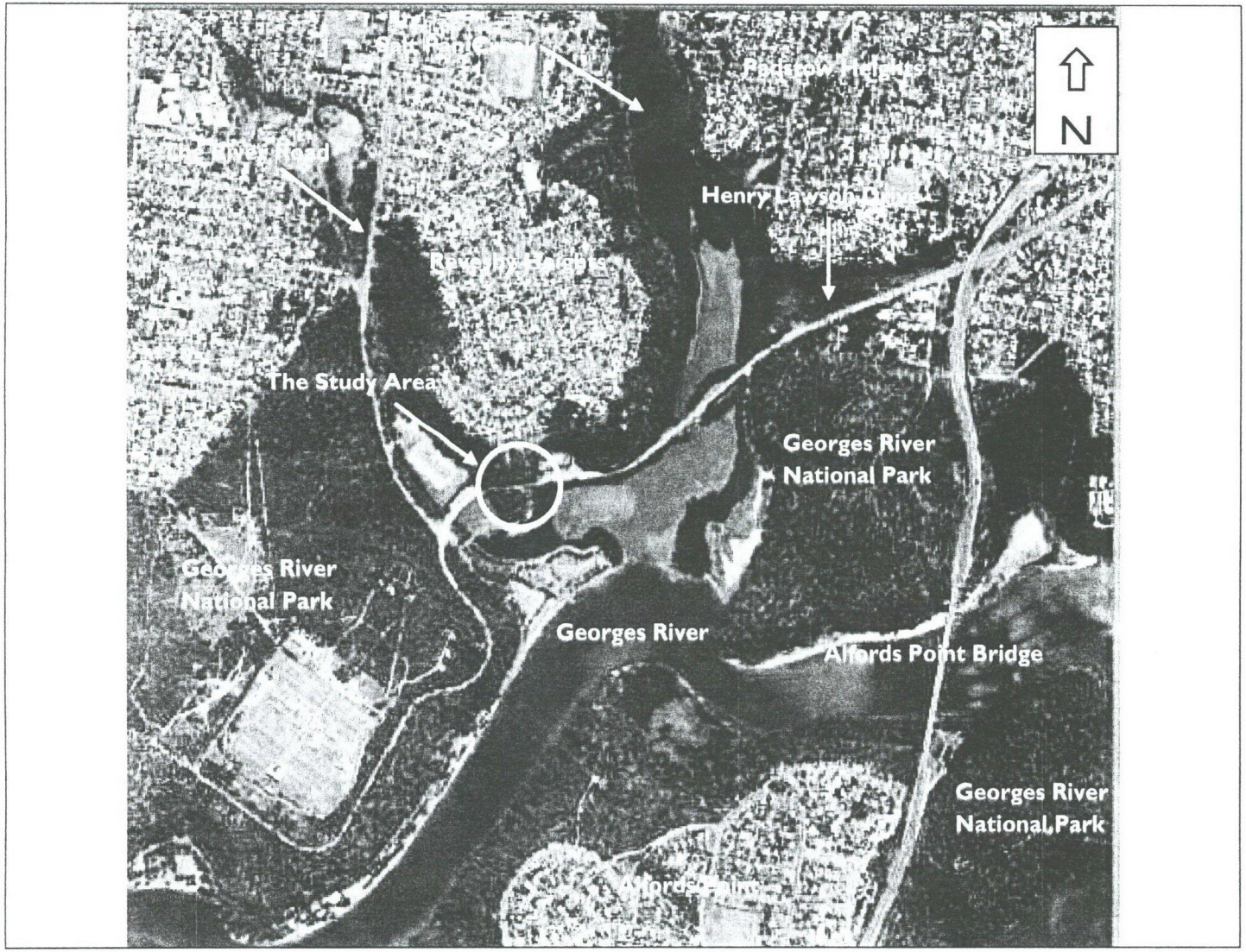
The rock embankments occur within the Henry Lawson Drive road reserve and are located approximately 150m east of The River Road. For reference, the study location and areas surveyed are provided in Figure 1.

The assessment of possible impacts associated with the proposed embankment stabilisation works is based on a field survey of the study area, a literature review of previous studies undertaken in the Bankstown Local Government Area, the consultation of standard databases and the consideration of the objectives of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the New South Wales *Environmental Planning and Assessment Act 1979*, NSW *National Parks and Wildlife Act 1974* and NSW *Threatened Species Conservation Act 1995*.

2. Environmental setting.

The study area is located within the Sydney suburb of Revesby Heights, within the Bankstown Local Government Area. The rock embankments, which occur to the north and south of Henry Lawson Drive, commence approximately 150m east of The River Road and are 105m and 140m long respectively. Each embankment is described separately below, while a photographic record has also been provided for reference. The embankments are located within a landscape that is characterised by rolling to steep sandstone hills, these mainly being encompassed within the surrounding regions conservation reserves and other protected areas.

The southern embankment at its highest point is approximately 20m high. The upper section of the rock cutting, starting at around 5m high, has a number of benches these being approximately 1m in height. The gradient of the upper section of the southern rock cutting is approximately 60 degrees, with the lower section being near vertical. The southern rock cutting is generally bare, consisting mainly of cliff lines, open sandstone faces, boulders and some overhangs. Some vegetation has established on the cliff face, this mainly being observed in association with those benches present. Where present, particularly above the rock cuttings, the vegetation comprises both mature and juvenile trees, occasional shrubs and isolated forbs and grasses.



Not to scale

Figure 1: Study location and area.

PHOTOGRAPHIC RECORD OF THE STUDY AREA

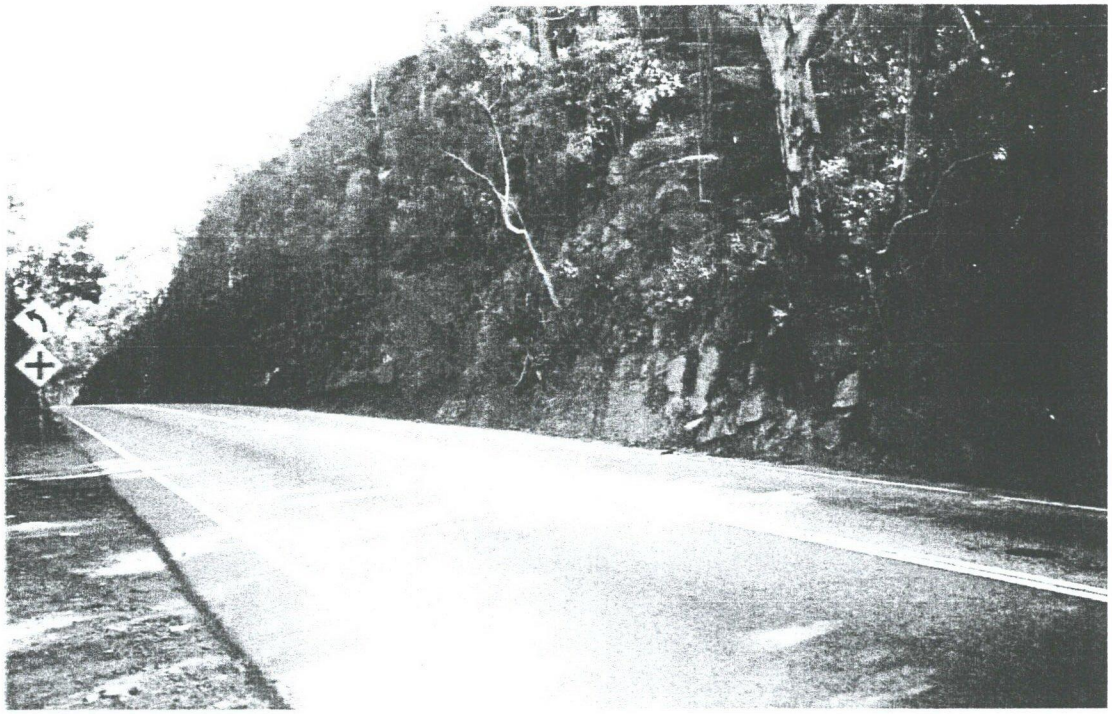


Photo 1: Structure of the northern batter. Photograph taken looking westward.

Photo 2: Structure of the northern batter. Photograph taken looking eastward.

Photo 3: Structure of the southern batter. Photograph taken looking eastward.

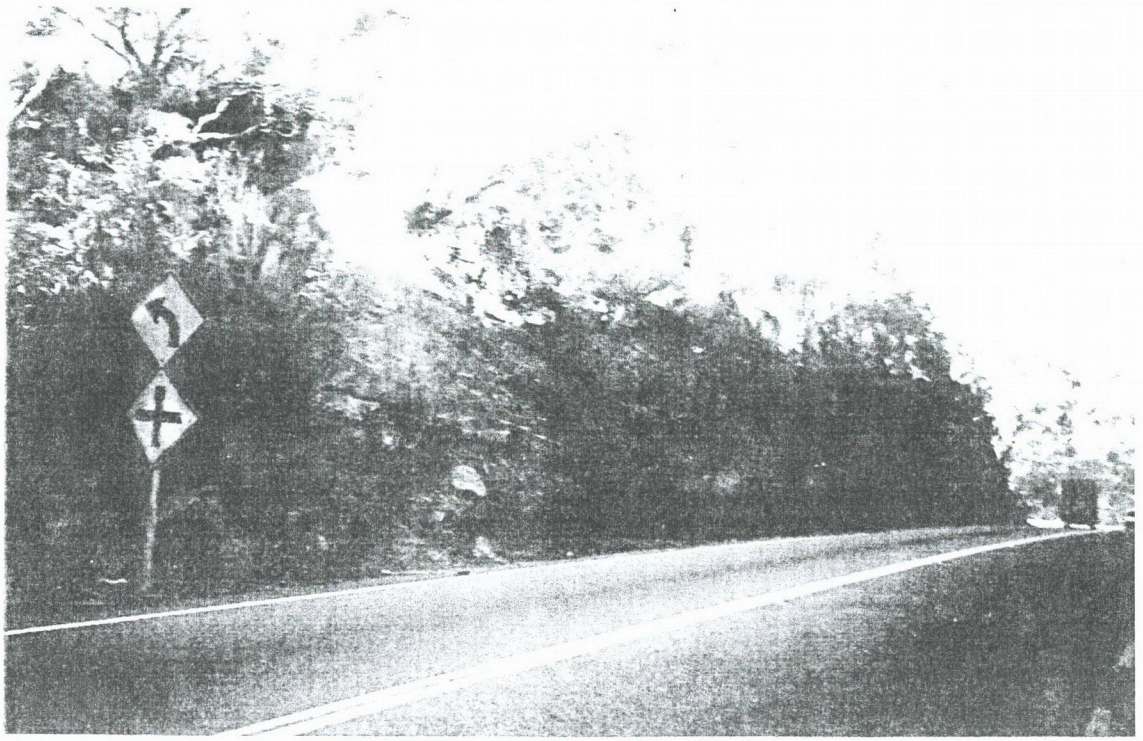


Photo 4: Structure of the southern batter. Photograph taken looking westward.

The maximum height of the northern embankment is approximately 22m. The rock cutting has a southerly aspect and, due to this, the face of the cutting was moist and damp. Within the eastern portion of the study area, this cutting slopes down at an angle of 70°, whilst the cutting is near vertical face on the western side. The cutting is sparsely vegetated however some semi mature trees, regenerating saplings and grasses are present both on, and above, the batter face. Mature trees are also present on top of the cutting.

Runoff across the southern embankment is undefined, no drainage lines being present. The crest of the northern embankment has an established form of a crestal drain, this running the length of the cutting.

Both embankments are the result of past activities associated with the construction of Henry Lawson Drive.

Based on a worst case scenario, the proposed stabilisations works would require the removal of a maximum of 0.3 hectares (ha) of vegetation from each of the rock embankments (i.e. a total of 0.6ha of native vegetation would be cleared).

Soils of the study area have been mapped as Hawkesbury Sandstone, consisting of the Hawkesbury Soil Landscape Unit (Chapman and Murphy 1989). The soils of this unit are shallow, discontinuous Lithosols and Siliceous Sands, these usually occurring in association with rocky outcrops (Chapman and Murphy 1989). These soils are highly permeable, with low fertility, severe water erosion hazard and rockfall hazard (Chapman and Murphy 1989). The Hawkesbury Sandstones are mapped as being widely distributed throughout the surrounding region.

Natural elevations within the study area range between 5 and 15m Australian Height Datum. The annual average rainfall in the region is 917 millimetres with the greatest falls being experienced during the summer months (Bureau of Meteorology 2006). Average temperatures range between a winter low of 17.1°C and a summer high of 27.9°C (Bureau of Meteorology 2006).

Conservation reserves, or other protected lands, that occur in the vicinity of the study area include the Georges River National Park, this covering an area of 335ha, and a number of smaller, council managed reserves, such as Boomerang, Lambath St, Beauty Point and Alfords Point Reserves. In addition to these, the Mill Creek crown lands and Holsworthy Military Reserve occur to the south west of the study area.

3. Field survey methods.

A survey of the study area was undertaken by Peter Hawkins (BE.Env HONS) and Karen Visman (B.Env.Sc.HONS) on the 30th of May 2003. The investigation of the study area involved foot traverses across the top and bottom of each rock cutting, and where possible, on the batter faces themselves. During the field survey, the diversity of plants and animals present within, adjacent to and beyond the limits of each of the rock cuttings were recorded. For the purposes of the investigation, to consider the likely direct and indirect impacts of the works, where possible, the survey of the study area incorporated the rock cuttings themselves, and a distance of up to 15m beyond the top of each rock batter.

Survey methods employed during the field investigation were:

- The direct observation of any fauna species present within, or adjacent to, the two rock cuttings;
- The identification of all plants within the areas of likely disturbance, including both direct and indirect impacts;
- The identification of any indirect evidence that would suggest the presence of any fauna species within the study area;
- The identification of the structure of those vegetation communities and fauna habitats present; 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.

The purpose of the field investigations was to locate within the areas surveyed any plants, animals or vegetation communities that are of state and/or national conservation significance. When conducting the field investigations, the 'Random Meander Method' (as per Cropper 1993) 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.

The weather conditions experienced during the field investigations were clear skies, warm to mild temperatures (20^0C) and slight westerly breezes.

By the completion of the field surveys, approximately two 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 Bankstown Shire Local Government Area, no limitations based on seasonal conditions and survey timings were encountered.

The field investigation consisted entirely of diurnal work. This is due to the small scale of the works and the limited number of resources available to the sheltering or breeding needs of any nocturnal fauna species. Given the lack of any habitats important to nocturnal species, including those animals of state and national conservation significance known to occur within the Bankstown Local Government Area (NPWS 2003), it was not considered necessary to undertake any nocturnal work. As such, no nocturnal work was undertaken.

4. Literature review and field guides.

Prior to undertaking any fieldwork, previous studies conducted in the region and known databases were consulted to identify the diversity of flora and fauna species known for, or potentially occurring in, the study region. The identification of known, or potentially occurring, native species within Bankstown Shire Local Government Area, particularly those listed under the Schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Threatened Species Conservation Act 1995*, thereby permits the tailoring of the field survey strategies to the detection of these animals and plants, their vegetation communities and necessary habitat requirements. By identifying likely species, particularly any threatened animals or plants, the most appropriate species-specific survey techniques may be selected should their associated vegetation communities/fauna habitats be present. The undertaking of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any plants and animals that are of regional, state or national conservation concern.

The studies, reports and databases referred to include:

- A flora and fauna survey undertaken for the proposed widening of Henry Lawson Drive (LesryK Environmental Consultants 1995);
- The National Park's Western Sydney Urban Bushland Biodiversity Report (NSW National Parks and Wildlife Service [NPWS] 1997);
- Bankstown City Council's State of the Environment Report (Bankstown City Council 2004);
- The Department of the Environment and Heritage (DEH) Online Database (DEH January 2006);
- The Department of Environment and Conservation (DEC) Atlas of NSW Wildlife (DEC January 2006);
- The Australian Museum Database (Australian Museum 2005); and
- The BioNet Database (NSW Government 2006).

Other reports and documents referred to are provided within the bibliography section of this report.

When accessing the DEH and DEC databases, the search area specified was 5km^2 centred on the study site, whilst the Bankstown LGA was used when investigating the Australian Museum and BioNet databases.

All these databases and reports were reviewed and drawn upon where relevant. While reviewing these documents, particular attention was paid to identifying records of species listed under the Schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Threatened Species Conservation Act 1995*, animals, plants and vegetation communities that have been recorded in the region and may occur within, or in the vicinity of, the study area.

Field guides and standard texts used were:

- Harden (1992, 1993, 2000 and 2002) and Robinson (1994) – used for the identification of plants;
- Cogger (2000) – reptiles and frogs;
- Simpson and Day (1999) – birds;
- Strahan (1995) – mammals; and
- Triggs (1996) – identification of scats, tracks and markings.

The naming of those species recorded or known to occur within the region follows the nomenclature presented within either these texts or under the *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Threatened Species Conservation Act 1995*.

The conservation significance of those plants, animals and vegetation communities recorded is made with reference to:

- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- The NSW *Threatened Species Conservation Act 1995*;
- A publication on Australia's Rare or Threatened Plants (ROTAP) (Briggs and Leigh 1996);
- The National Parks and Wildlife Service Urban Bushland Biodiversity Report (NPWS 1997); and
- Bankstown City Council's State of the Environment Report (Bankstown City Council 2004).

5. Results

5.1 Botanical survey.

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 region.

By the completion of the field survey, no species of national or state conservation significance, as listed on the Schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* or the NSW *Threatened Species Conservation Act 1995*, had been recorded. All of the species recorded are considered to occur frequently within similar habitats throughout the surrounding region.

Consultation of the DEC database (DEC 2005) identified 10 plants of conservation significance that have been previously recorded in the study region (Table 1). Though targeted during the field investigation, none of these plants were recorded within or in close proximity to the boundaries of the proposed stabilisation works.

Shale Sandstone Transition Forest, an Endangered Ecological Community listed on Schedule 1, Part 3 of the NSW *Threatened Species Conservation Act 1995* and on Schedule 1 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, has been identified just north of the study area (NPWS 2002). Although this is the case, the vegetation within the study area does not conform

to the final determination for this Endangered Ecological Community. As such, this community is not considered to be present within, or in close proximity to, the limits of the proposed stabilisation works. No other vegetation communities listed under either the NSW *Threatened Species Conservation Act 1995* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as an Endangered Ecological Community have been previously identified within the vicinity of the study area.

TABLE 1. Plant species of conservation significance previously recorded in the district.

Legislation
EPBC Act – Environment Protection and Biodiversity Conservation Act 1999.
TSC Act – Threatened Species Conservation Act 1995.

Common and Scientific Name	Legislation	Habitat Requirements
Acacia pubescens (Downy Wattle)	*EPBC Act* *TSC Act*	A shrub to 1 – 5m high. It mainly grows in dry sclerophyll forests and woodlands on clay soil from Bilpin to the Georges River area (Harden 2002).
Caesia parviflora var. *minor* (Pale Grass Lily)	*TSC Act*	A herbaceous perennial that is usually < 20 cm in height. It grows in heath, woodland and dry sclerophyll forest on sandstone-derived soils, south from Corindi area (Harden 1993).
Caladenia tessellata (Thick Lip Spider Orchid)	*EPBC Act* *TSC Act*	A terrestrial herb that grows on clay loam or sandy soils. Known to occur south from Swansea (Harden 1993).
Deyeuxia appressa	*EPBC Act* *TSC Act*	An erect perennial grass to 0.9m in height. It grows on wet ground, generally in the Hornsby Area (Harden 1993).
Grevillea parviflora ssp. *parviflora*	*EPBC Act* *TSC Act*	A shrub up to 1m high that grows in heath or shrubby woodland, in sandy or light clay soils usually over thin shales. This species mainly occurs in the Prospect area and lower Georges River to Camden, Appin and Cordeaux Dam area; with disjunct populations near Putty, Cessnock and Cooranbong (Harden 2002).
Melaleuca deanei (Deane's Melaleuca)	*EPBC Act* *TSC Act*	A shrub up to 3m high which grows in wet heath on sandstone from Berowra to Nowra (Harden 2002).
Persoonia hirsuta ssp. *evoluta*	*EPBC Act* *TSC Act*	A spreading to decumbent shrub that grows in woodlands to dry sclerophyll forests on sandstones. It is known to occur from the Putty area, to Glen Davis to Hill Top at altitudes of 350-600m (Harden 2002).
Persoonia nutans	*EPBC Act* *TSC Act*	An erect to spreading shrub that grows in woodland to dry sclerophyll forest on laterite and alluvial sand (Harden 2002).
Pimelea spicata (Spiked Rice-flower)	*EPBC Act* *TSC Act*	A slender decumbent or erect shrub to 50cm high. This species grows in a wide variety of habitats between Landsdowne and Shellharbour, and inland to Penrith (Harden 2000).
Pterostylis saxicola (Sydney Plains Greenhood)	*EPBC Act* *TSC Act*	A terrestrial herb that grows in shallow soil over sandstone sheets, often near streams. It occurs from Picnic Point to Picton area (Harden 1993; listed as *Pterostylis* sp E.).

The vegetation in the study area is characteristic of the plant community complex mapped by Benson and Howell (1994) as Map unit 10ar Sydney Sandstone Ridgetop Woodland. This vegetation unit is described as "being found on the more exposed ridges and plateau tops with shallower soils interrupted by outcrops of rock" and together with the Sydney Sandstone Gully Forest complex is the most common vegetation type occurring in the sandstone areas of the Sydney region. Both of these communities are widely distributed, adequately conserved and neither is listed, or currently being considered for listing, as an Endangered Ecological Community under the NSW *Threatened*

Species Conservation Act 1995 or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Three sub-units are recognised within the Sydney Sandstone Ridgetop Woodland map unit of which sub-unit (i) Woodland/Low Woodland is the most accurate description of the community occurring within the study site.

For reference, a detailed description of this community, along with its dominant plants, is provided below.

Sydney Sandstone Ridgetop Woodland

Occurrence:
On top of each of the rock cuttings surveyed. Scattered plants on ledges on both of the rock cutting faces.

Structure:
Canopy trees to 12m in height forming a moderate cover. Sparse sub-canopy layer to 8m in height. Shrub layer is moderate to sparse, reaching a height of 4m. The groundcover consists of a moderately dense layer of predominantly native grasses and herbs, these reaching up to 1m in height.

Common Species (* = exotic species):
Canopy:
Common trees include Sydney Red Gum (*Angophora costata*) and Red Bloodwood *(Corymbia gummifera)*.

Sub-canopy:
The sub-canopy is dominated by Forest Oak (*Allocasuarina littoralis*) and Old Man Banksia (*Banksia serrata*).

Shrubs:
Common shrubs include Elderberry Panax (*Polyscias sambucifolia*), Old Man Banksia (*Banksia serrata*), Hair-pin Banksia (*Banksia spinulosa*), White Tick Bush (*Kunzea ambigua*), Drumsticks (*Isopogon anethifolius*), Sunshine Wattle *(Acacia terminalis)* and Paperbark *(Leptospermum trinervium)*.

Groundcovers:
Common groundcovers include Bracken (*Pteridium esculentum*), Spiny-fruit Mat Rush (*Lomandra longifolia*), Blady Grass (*Imperata cylindrica*), Couch (*Cynodon dactylon**), Wiry Panic *(Entolasia stricta)*, Kangaroo Grass (*Themeda australis*), Wiry Panic (*Entolasia stricta*), False Bracken Fern (*Calochlaena dubia*), Thyme Spurge (*Phyllanthus hirtellus*), Grass Tree (*Xanthorrhoea arborea*) and Old Man's Beard *(Caustis flexuosa)*.

5.2 Fauna survey.

A variety of native species were recorded during the field investigation (Table 2), none of which are listed (or currently being considered for listing i.e. Preliminary Determinations) under the Schedules to either the NSW *Threatened Species Conservation Act 1995* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Although this is the case, one of the species recorded, the Black-winged Stilt *Himantopus himantopus*, is listed as occurring within a Family (Family as in the Taxonomic classification system) of birds listed as migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The Black-winged Stilt is a wetland bird that was recorded beyond the limits of the study area in association with those mudflats that occur adjacent to the Georges River. Although listed as occurring within a Family of migratory birds, within Australia, the Black-winged Stilt is not considered to be migratory. Furthermore it is not considered that the proposed rock cutting stabilisation works would affect any wetland or estuarine habitats likely to be used by this species. As such, the proposed rock cutting works would not have an effect on the Black-winged Stilt or its necessary habitat areas.

TABLE 2. Fauna species recorded during the field investigation.

Key

– species present within a Family of wetland birds that are listed as migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

* - indicates introduced species.

Common Name	Scientific Name
MAMMALS	
	Canidae
* Fox	*Vulpes vulpes*
BIRDS	
	Pelecanidae
Australian Pelican	*Pelecanus conspicillatus*
	Ardeidae
White-faced Heron	*Egretta novaehollandiae*
	Threskiornidae
Royal Spoonbill	*Platalea regia*
	Recurvirostridae
# Black-winged Stilt	*Himantopus himantopus*
	Columbidae
* Spotted Turtle-dove	*Streptopelia chinensis*
	Cacatuidae
Sulphur-crested Cockatoo	*Cacatua galerita*
	Psittacidae
Rainbow Lorikeet	*Trichoglossus haematodus*
Crimson Rosella	*Platycercus elegans*
	Meliphagidae
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Golden Whistler	*Pachycephala pectoralis*
	Dicruridae
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Magpie Lark	*Grallina cyanoleuca*
	Artamidae
Grey Butcherbird	*Cracticus torquatus*
REPTILES	
	Varanidae
Lace Monitor	*Varanus varius*
	Scincidae
Grass Skink	*Lampropholis delicata*

The remaining fauna species recorded during the field investigation are all protected, as defined under the NSW *National Parks and Wildlife Act 1974*, but considered to be common to abundant throughout their distribution ranges. The animals recorded are considered to be associated with sandstone communities and wetlands, thereby providing an indication of the diversity of other fauna species that may be detected at other times of the year. The sandstone associated species observed would be regularly recorded in the surrounding region in association with their documented habitat types. In relation to the wetland species detected, these were all recoded either flying over the study area or observed within those wetlands that occur adjacent to the study area. In regards to these waterbirds, it is noted that they are known to be present throughout the surrounding estuarine areas. None of the species recorded would be solely dependant upon the resources provided by the study area, such

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

Based on the consultation of the DEC, Australian Government and DEH databases, combined with the results of previous ecological studies conducted in the region, thirty two terrestrial fauna species listed under the Schedules to either the NSW *Threatened Species Conservation Act 1995* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are known, or have the potential to be recorded, within this part of the Bankstown City Local Government Area (Table 3). Though targeted, none of these threatened species were observed or indicated as occurring as a locally viable population on, or in the vicinity of, the proposed works. Similarly, no indirect evidence to suggest a viable population of these animals, and no habitats critical to their occurrence, were recorded.

Two habitat types are present within the study area, these being the sandstone cliff faces and proximate areas of open woodland. For reference, descriptions of each of these habitat types are provided below, along with an indication of their locations and their value for native species.

Sandstone Cliff Face

The sandstone cliff faces occur north and south of Henry Lawson Drive. Within these rock faces are a number of overhangs, ledges, sandstone floaters and boulders that are of varying sizes. No exfoliated material was observed on top of any of the sandstone benches investigated, though some small weathered rocks were present. Within the sandstone cliff faces no caves or crevices were observed, most of the structures present being open and "too exposed".

The rock faces are essentially bare, or, where benches are present, support several trees that are to 10m in height. None of the trees investigated were observed to support any hollows suitable for the life cycle requirements of any hollow-dependant native species. Several isolated native shrubs, these being around 3m in height, are also present on the cliff face, as are a number of isolated forbs, grasses and seedlings. All of the plants observed have established where soil has accumulated.

Runoff across the southern embankment is undefined, no drainage lines being present. The crest of the northern embankment has an established form of a crestal drain, this running the length of the cutting.

The sandstone cliff faces are not considered to be of any value to those fauna species recorded or potentially occurring within the surrounding bushland. The resources offered by the study area are not unique to this site, this environment being regularly recorded in the surrounding region, including the adjacent Georges River National Park. The resources provided by the rock cuttings, in comparison with the surrounding vegetation, are considered to be minimal. None of the resources present on the rock cuttings would be significant to the local occurrence of any of the fauna species recorded, such that the removal or further disturbance of these would threaten the occurrence of these animals. No native species would be disturbed or significantly affected by the undertaking of the proposed works, such that the region's biodiversity would be reduced.

Open Woodland

The open woodland is present to the north and south of Henry Lawson Drive. The woodland supports the occasional mature and semi-mature native tree this being to a maximum height of 12m. The understorey consists of native shrubs and saplings these to a maximum height of 4m. The density of the understorey varies from low in the southern portion of the study area to medium in the northern. The ground cover is comprised of isolated native grasses and ferns these being to a height of 1m. Within the open woodland leaf litter and ground debris is present, whilst urban refuse was also observed in the northern section of the study area.

TABLE 3. Fauna species of conservation significance previously recorded in the district.

* - habitat requirements were generally extracted from Frith (1997), Cogger (2000), Strahan (1995), NPWS (1999) and the NSW Scientific Committee (2005), with other references used being identified in the bibliography.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
BIRDS			
Great Egret (*Ardea alba*)	*EPBC Act*	The Great Egret is a solitary and territorial waterbird that forages within waters up to 30 centimetres deep. The Great Egret is found throughout Australia in association with lakes, swamps, rivers and dams. Though listed under the international migratory bird agreement, the Great Egret is a sedentary bird that does not migrate northwards during the winter months. Breeding occurs between the months of October and December and March to May, the Great Egret constructing a stick nest within trees at a height of up to 15m.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Black Bittern (*Ixobrychus flavicollis*)	*TSC Act*	The Black Bittern requires terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Feed at dusk and during the night on invertebrates, reptiles, fish and so on. Roosts during the day in trees or on the ground amongst dense reeds. Builds its nests on a branch overhanging water. When not breeding, generally solitary.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Australasian Bittern (*Botaurus poiciloptilus*)	*TSC Act*	The Australasian Bittern requires shallow, vegetated freshwater or brackish swamps, usually dominated by tall, dense reed beds of *Typha* sp, *Juncus* sp and *Phragmites* sp. Nests on platforms of reeds and rushes, usually built over water in dense cover. Feeds on aquatic invertebrates, small fish and frogs, usually caught in shallow water or wet mud.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Bush-stone Curlew (*Burhinus grallarius*)	*TSC Act*	The Bush-stone Curlew is a ground living bird, which feeds on invertebrates such as beetles and grasshoppers. The Favourite habitat consists of grassy woodland or lightly timbered open country. Breeding occurs July to January and nests are made on bare ground by scraping a small clearing and are usually located near cover.	This species may traverse over the study area on occasion. However 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.
Latham's Snipe (*Gallinago hardwickii*)	*EPBC Act*	The Latham's Snipe is a migratory bird that enters Australia in August and have left again by April. Their preferred habitat consists of wet treeless tussocky grassland, short grasses and marshes along freshwater streams and channels. They feed within soft ground eating beetles insects, invertebrates and plant material. Breeding occurs between June and July in Japan where nests are made from a depression lined with grass and moss.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Painted Snipe (*Rostratula benghalensis*)	*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.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Osprey (*Pandion haliaetus*)	*EPBC Act* *TSC Act*	The Osprey is a large, coastal, fish eating raptor. This species normally builds a huge stick nest either in a large, dead tree, on a rocky outcrop or on the ground, though artificial structures have also been known to be utilised. Breeding birds are usually loyal to the same nest sites, utilising and building upon these for a number of years.	This species may traverse over the study area on occasion. Given the large home range of this species and the 335 ha of more suitable habitat within the nearby conservation reserve, the loss of a maximum of 0.6ha of bushland, is not considered to significantly reduce the extent of potential foraging or roosting sites available to this eagle.
White-bellied Sea-eagle (*Haliaeetus leucogaster*)	*EPBC Act*	Found throughout coastal Australia and large lowland rivers and lakes. Feeds on fish, tortoises, rabbits and nestlings. Breeding usually occurs from May through to October with nest constructed in inland water systems being located in tall live or dead trees of which River Red Gums, Forest Red Gum and Southern Mahogany are commonly used.	This species may traverse over the study area on occasion. Given the large home range of this species and the 335ha of more suitable habitat within the surrounding conservation reserves the loss of a maximum of 0.6ha of bushland, is not considered to significantly reduce the extent of potential foraging or roosting sites available to this eagle.
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	*TSC Act*	The Glossy Black-Cockatoo requires *Eucalypt* woodland and feeds almost exclusively on Casuarina fruit. Within its range it is tied to groves of its food trees, *Casuarina* spp. & *Allocasuarina* spp. Nesting and roosting in hollows of large eucalypt trees this bird can spend up to 88% of each day foraging.	No crushed casuarinas were observed during the field survey. Given that 335ha of more suitable habitat occurs within the nearby conservation reserve the loss of a maximum of 0.6ha of bushland is not considered to significantly reduce the extent of potential foraging sites available for this bird.
Swift Parrot (*Lathamus discolor*)	*EPBC Act* *TSC Act*	The Swift Parrot over-winters on the mainland and breeds in Tasmania in spring/summer. The Swift Parrot inhabits eucalypt forests, feeds on eucalypt nectar, and possibly lerps, and breeds in the hollows of mature and senescent trees. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species, communities of which it will often return to regularly.	This species may traverse over the study area on occasion. However 0.6ha of bushland compared to the 354ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.
Turquoise Parrot (*Neophema pulchella*)	*TSC Act*	The Turquoise Parrot shelters in the dense cover provided by grassy woodlands and forest edges. This bird nests in eucalypt hollows, stumps and even fence posts. Feeding occurs in open grassy areas, where the Turquoise Parrot spends most of its time on the ground searching for grass seeds and herbaceous plants. A wide variety of exotic weeds are also fed upon.	Within the study area no areas of dense vegetation are present. However 0.6ha of bushland compared to the 335ha within the surrounding conservation reserves is not considered to significantly reduce the resources available for this bird.
Speckled Warbler (*Chthinicola sagittata*)	*TSC Act*	The Speckled Warbler 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 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 traverse over the study area on occasion. However 0.6ha of bushland compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.
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 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 August to January.	This species may traverse over the study area on occasion. However 0.6ha of bushland compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Black-chinned Honeyeater (*Melithreptus gularis*)	*TSC Act*	The Black-chinned Honeyeater occupies drier open eucalypt woodland. In New South Wales it is typically found in woodlands containing box-ironbark associations and Red River Gum. This species spends most of its day searching for insects in the foliage of eucalypts, but also feeds on honey dew (particularly in summer) and blossom nectar. They breed between July and December.	This species may traverse over the study area on occasion. However 0.6ha of bushland compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.
Pink Robin (*Petroica rodinogaster*)	*TSC Act*	The habitat of the Pink Robin consists of shady undergrowth in temperate rainforest and wet sclerophyll forests. They forage amongst the forest floor by perching on a branch and waiting for their prey, which consist of insects, beetles, bugs and spiders. The Pink Robin nests in a deep cup of moss bound with cobweb and camouflaged on the outside with lichen. The Pink Robin breeds between September and January.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Hooded Robin (*Melanodryas cucullata*)	*TSC Act*	The Hooded Robin inhabits lightly timbered country from eucalypt and open woodlands to acacia shrublands. Most frequently it occupies areas of dead and fallen timber. It also forages along the bare ground and amongst leaf litter for insects. Foraging ranges are often extended to cleared land during winter. Establishes pairs which keep a home range of 10 to 20ha, and is not known to form flocks. Species appears to be unable to survive in woodland areas less than 100-200ha in size.	The loss of a maximum of 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the extent of potential foraging sites available for this animal.
Rufous Fantail (*Rhipidura rufifrons*)	*EPBC Act*	The Rufous Fantail occurs within mangroves, fringing vine scrubs, rainforests and wet sclerophyll forests. This species forages within scrubby understorey and take insects and spiders. This species migrates in March/April to northern Queensland and New Guinea and returns September/October.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Satin Flycatcher (*Myiagra cyanoleuca*)	*EPBC Act*	The Satin Flycatcher breed within tall wet eucalypt forest on rolling plains and steep gullies, however rainforests are avoided. After fledging they relocate and forage in drier more open forest. This species migrates in March/April as far as New Guinea and returns September/October.	Given the large home range of this species and the 335ha of more suitable habitat within the nearby conservation reserve, the loss of a maximum of 0.6ha of bushland is not considered to significantly reduce the extent of potential foraging or roosting sites available for this bird.
Black-faced Monarch (*Monarcha melanopsis*)	*EPBC Act*	The Black-faced Monarch prefers wet eucalypt forest and rainforest. They nest in sheeted gullies or within rainforest foraging within the middle storey layers. This species migrates in March/April as far as New Guinea and returns September.	The habitat requirements of this species do not occur within the study area. As such this species is not likely to be present.
Powerful Owl (*Ninox strenua*)	*TSC Act*	The Powerful Owl favours wet to dry eucalypt forests with a dense understorey. Nesting in large hollows, nearly always in the trunk or top of a mature eucalypt. When not breeding, this bird will roost during the day within the shelter provided by a dense understorey, such as a bushy eucalypt or vine forest, usually clutching the remains of the previous evenings meal.	Within the study area no dense understorey occurs. Given the large home range of this species and the 335ha of more suitable habitat within the nearby conservation reserve, the loss of a maximum of 0.6ha of bushland is not considered to significantly reduce the extent of potential foraging sites available for this Owl.
White-throated Needletail (*Hirundapus caudacutus*)	*EPBC Act*	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.	This species may traverse over the study area on occasion. However 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the resources available for this bird.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
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 considerably large with males travelling up to 15 km^2/night, and females between 3-4 km^2/night. The quoll preys on a wide variety of terrestrial and arboreal vertebrates, including rabbits, brush-tail and ringtail possums.	The loss of a maximum of 0.6ha of bushland compared to the 335ha within the nearby conservation reserve is not considered to significantly reduce the extent of potential foraging sites available for this animal.
Long-nosed Potoroo (*Potorous tridactylus*)	*EPBC Act* *TSC Act*	The Long-nosed Potoroo requires dense vegetation cover for diurnal sheltering sites and protection from predators while foraging occurs more often in adjacent, open areas. Within the dense vegetation cover, the Long-nosed Potoroo forms a shallow depression under grass tussocks, next to logs or in dense grassy patches in which to shelter.	Within the study area no areas of dense vegetation are present, similarly no suitable Potoroo foraging habitat occurs. As such this species is not likely to be present.
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.	No evidence, such as characteristic scats or tracks were observed within the study area. The further disturbance of a maximum of 0.6ha of bushland, compared to the 335ha of habitat within the nearby conservation reserve is not considered to significantly reduce the extent of potential foraging or roosting sites for this mammal.
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 5,000 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 and 70 km from camps.	The loss of 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve, is not considered to significantly reduce the extent of potential foraging sites for this bat.
Large-eared Pied Bat (*Chalinolobus dwyeri*)	*EPBC Act* *TSC Act*	The preferred habitat for the Large-eared Pied Bat is timbered woodland and dry sclerophyll forest. This species roosts in caves, tunnels, mines if available or even the abandoned nests of Fairy Martins.	No caves suitable for the roosting or breeding needs of this species were recorded within the study area. The disturbance of a maximum 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve, is not considered to significantly reduce the extent of potential foraging areas available to this microchiropteran.
Common Bentwing Bat (*Miniopterus schreibersii*)	*TSC Act*	The Common Bentwing Bat uses a variety of woodland habitats. This species relies on caves and suitable cave substitutes in which it roosts and breeds. Breeding occurs between October and February.	No caves suitable for the roosting or breeding needs of this species were recorded within the study area. The disturbance of a maximum 0.6ha of bushland, compared to the 335ha within the nearby conservation reserve, is not considered to significantly reduce the extent of potential foraging areas available to this microchiropteran.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
REPTILES			
Broad-headed Snake (*Hoplocephalus bungaroides*)	*EPBC Act* *TSC Act*	The Broad-headed Snake is confined to the Hawkesbury Sandstone formations within the wider Sydney basin. The Broad-headed Snake shelters under exfoliated material, also in rock crevices and caves during the day, and hunts at night, usually feeding on small lizards, geckos and frogs.	The presence of this species was targeted due to the orientation, geology and vegetation associations exhibited by the rock cutting. Although this is the case, no suitable exfoliated rock was observed, and the investigation of the weathered rock material present only revealed the occurrence of skinks. Based on the results of the field survey, this species is not considered to be present within the study area.
AMPHIBIANS			
Giant Burrowing Frog (*Heleioporus australiacus*)	*EPBC Act* *TSC Act*	The Giant Burrowing Frog is mostly restricted to areas of Hawkesbury Sandstone. This association with sandstone outcrops appears to be quite important feature of this species ecology. This species lives in small semi-permanent to slightly flowing streams, breeding in sandy river bank burrows during the summer and autumn months. Breeding is also known to occur in man-made depressions, ditches and dams, though these must be in a non-polluted condition. Giant Burrowing Frogs are not found in creeks affected by stormwater or other pollutants, and this species of frog is not found in urbanised areas.	In a recent frog study conducted by Bankstown City Council this species was not recorded. Within the study area no drainage lines occur. As such the study area is not considered to constitute breeding habitat. Similarly, it is not considered that the further disturbance of 0.6ha of bushland compared to the 335ha of adjacent habitat will have a significant impact on the potential foraging sites for this species.
Stuttering Frog (*Mixophyes balbus*)	*EPBC Act* *TSC Act*	The Stuttering Frog is a terrestrial inhabitant of rain, artic birch and wet sclerophyll forests. Usually found near permanently running water, the Southern Barred Frog lays its eggs on rocks or gravel near the edge of flowing streams. This species feed on insects and smaller frogs.	In a recent frog study conducted by Bankstown City Council this species was not recorded. The habitat requirements of this species do not occur within the study area. As such this species would not be present within the study area.
Green and Golden Bell Frog (*Litoria aurea*)	*EPBC Act* *TSC Act*	The Green and Golden Bell Frog's habitat requirements include water bodies with a lack of well developed emergent vegetation, free of chemical contamination and no introduced fish species. The Green and Golden Bell Frog has several specific habitat requirements including the presence of diurnal shelter, basking sites and refuge sites for hibernation over winter (non-mown areas or other dense vegetation in which to shelter), feeding areas, aquatic breeding and spawning areas.	In a recent frog study conducted by Bankstown City Council this species was not recorded. No suitable water bodies present within, the study area. As such this species would not be present within the study area.
Littlejohns Tree Frog (*Litoria littlejohni*)	*EPBC Act* *TSC Act*	The habitat of Littlejohn's Tree Frog consists of dams creeks and lagoons. It favours higher altitude woodland areas within the Sydney region.	In a recent frog study conducted by Bankstown City Council this species was not recorded. The study area constitutes low altitude geography. As such this species would not be present within the study area.

Sandstone floaters and rock outcrops are common within the open woodland and within the northern section of the study area one rock crevice was observed. This rock crevice is located within 5m of the sandstone cliff face approximately 30m from the eastern limit of the study area. The crevice has an opening of approximately 100 millimetres. Investigations of this crevice did not reveal any sheltering animals, or any evidence to suggest the former occupation of this site. No caves suitable for cave dwelling native species are therefore considered to occur within the open woodland.

The open woodland extends north and south of the study area.

The open woodland is considered to be of some use for those native fauna species recorded or potentially occurring within the surrounding bushland. However the resources offered by the study area itself are not unique to this site, this environment being regularly recorded in the surrounding region. The removal of a maximum 0.6ha of bushland, in comparison with the extent of similar resources in the adjacent conservation reserve and other protected areas, is not considered to have an adverse impact on the local or regional occurrence of any native species. As such, the proposed works can proceed as planned without significantly altering the regions biodiversity.

6. Ecological Assessments.

6.1 Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999.*

The Black-winged Stilt *Himantopus himantopus*, a wetland bird that occurs within a Family of birds listed as migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, was recorded in the vicinity of the study area during the field investigation. Although this is the case, the Black-winged Stilt is not a migratory bird. This species was recorded in association with those mudflats that occur adjacent to the Georges River well beyond the limits of the study area. This environment would not be directly or indirectly affected by the works, and therefore the proposed stabilisation works would not have an impact on this "listed" species.

By the completion of the field investigations, no plants or animals listed as threatened under the Schedules to the *Environment Protection and Biodiversity Conservation Act 1999* had been recorded within the limits of the proposed rock cutting stabilisation works (including both direct and indirect impacts). Similarly, no endangered ecological communities or populations had been recorded. 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 and Heritage for further consideration and/or approval.

6.2 State - *Environmental Planning and Assessment Act 1979.*

Though targeted, no plants, animals, endangered ecological communities or populations listed under the Schedules of the NSW *Threatened Species Conservation Act 1995* were recorded or indicated as occurring within the study area. Giving consideration to the life cycle requirements and habitat needs of those species previously recorded in this part of the Bankstown Local Government Area, none are likely to occur as a viable local population within, or adjacent to, the proposed rock cutting stabilisation works. The vegetation communities and fauna habitats present within the area surveyed are not unique to this location, these being commonly recorded thorough out the surrounding bushland areas, including the nearby Georges River National Park, and would not be of value for any protected, or threatened, native species.

Giving consideration to the assessment criteria listed under Section 5A of the *Environmental Planning and Assessment Act 1979* (these commonly being referred to as the 'seven part test'), the undertaking of the proposed rock cutting stabilisation works within the area surveyed would not have a significant effect on any threatened plants or animals, their populations, ecological communities, or habitats. The development of this portion of the study region would not result in the removal of any regionally significant areas of habitat for any threatened animals or plants, similarly it would not isolate or further fragment any areas important to these species or their interbreeding populations. No threatened plants or animals occur at the limits of their distributions in the vicinity of the study area and, though the clearing of native vegetation is listed as a Key Threatening Process under Schedule 3

of the NSW *Threatened Species Conservation Act* 1995, as no native plants, threatened species or endangered ecological communities were recorded, none would be affected as a result of the undertaking of the proposed rock cutting stabilisation works. As such, it is not considered necessary that the preparation of a Species Impact Statement, which further considers the impacts of the proposed rock cutting stabilisation works on any threatened plants, animals or endangered ecological communities, would be required.

7. Conclusions.

Based on the results of the flora and fauna surveys, and a review of known literature and database sources, it is not considered that there are any ecological constraints to the proposed rock cutting stabilisation works, adjacent to Henry Lawson Drive, Revesby Heights, NSW, proceeding as planned. The proposed stabilisation of the two rock cuttings surveyed during the current investigation 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.

The proposed rock cutting stabilisation 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*. Therefore, it is not considered that the matter would require referral to the Federal Minister for the Environment and Heritage for further consideration or approval.

Within the areas of likely disturbance, the habitats and vegetation communities present are considered to be of low to minimal ecological value. These areas would not be important for any of the threatened species listed under the NSW *Threatened Species Conservation Act 1995* that have been previously recorded in the study region. The proposed rock cutting stabilisation works would not result in any of these threatened species, 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 movement or dispersal 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.

8. Recommendations.

It is noted that Georges River National Park is located in close proximity to the proposed works. To ensure no significant ecological degradation is caused to these adjacent lands, based on the principles of Ecologically Sustainable Development as identified in Schedule 2 of the Environmental Planning and Assessment Regulations, the following recommendations are provided:

- Minimise the area of disturbance, including all storage areas and accessways. Where possible, such ancillary works should be positioned in areas that contain minimal native vegetation.

- Unstable surfaces should be stabilised as soon as practicable to minimise the amount of soil movement.

- 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 further erosion.

- No weedy topsoil should be stored or dumped in the vicinity of the National Park. All removed weedy soils should be transported to an appropriate storage area that is isolated from areas of native vegetation.

- Prior to the commencement of any work in the vicinity of the adjacent National Park, all equipment utilised in weedy areas should be washed to ensure weed propagules and foreign materials are removed.

- A site inspection should be undertaken several months after the works are completed to ensure it has not been infested by weeds. If such infestations are noted, a weed control program should be adopted for the area.

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APPENDIX 1: Plant species list, Henry Lawson Drive rock cuttings, Revesby Heights.

KEY

* = Introduced species.

FAMILY	Species	Common Name
FILICOPSIDA		
Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Dicksoniaceae	*Calochlaena dubia*	False Bracken Fern
Schizaeaceae	*Cheilanthes sieberi* ssp. *sieberi*	Mulga Fern
CYCADOPSIDA		
Zamiaceae	*Macrozamia communis*	Burrawang
Zamiaceae	*Macrozamia spiralis*	
DICOTYLEDONES		
Apiaceae	*Actinotus helianthi*	Flannel Flower
Apiaceae	*Foeniculum vulgare**	Fennel
Apiaceae	*Platysace linearifolia*	Carrot Tops
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Asteraceae	*Ageratina adenophora**	Crofton Weed
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Ozothamnus diosmifolius*	Dogwood
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine
Casuarinaceae	*Allocasuarina littoralis*	Forest Oak
Casuarinaceae	*Casuarina glauca**	Swamp Oak
Convolvulaceae	*Ipomea cairica**	Coastal Morning Glory
Crassulaceae	*Bryophyllum delagoense**	Mother of Millions
Cunoniaceae	*Ceratopetalum gummifera*	Christmas Bush
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Epacridaceae	*Astroloma pinifolium*	
Epacridaceae	*Brachyloma daphnoides*	Daphne Heath
Epacridaceae	*Leucopogon ericoides*	Bearded Heath
Euphorbiaceae	*Breynia oblongifolia*	Breynia
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Fabaceae: Faboideae	*Bossiaea heterophylla*	Variable Bossiaea
Fabaceae: Faboideae	*Dillwynia retorta*	Heathy Parrot Pea
Fabaceae: Faboideae	*Kennedia rubicunda*	Dusky Coral Pea
Fabaceae: Faboideae	*Pultenaea daphnoides*	Bush Pea
Fabaceae: Mimosoideae	*Acacia longifolia*	Sydney Golden Wattle
Fabaceae: Mimosoideae	*Acacia myrtifolia*	Myrtle Leaved Wattle
Fabaceae: Mimosoideae	*Acacia suaveolens*	Sweet-scented Wattle
Fabaceae: Mimosoideae	*Acacia terminalis*	Sunshine Wattle
Fabaceae: Mimosoideae	*Acacia ulicifolia*	Prickly Moses
Goodeniaceae	*Goodenia hederacea*	Ivy-leaved Goodenia

FAMILY	Species	Common Name
Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort
Lauraceae	*Cinnamomum camphora**	Camphor Laurel
Lobeliaceae	*Pratia purpurascens*	White Root
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Myrtaceae	*Angophora bakeri*	Narrow-leaved Apple
Myrtaceae	*Angophora costata*	Sydney Red Gum
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint
Myrtaceae	*Kunzea ambigua*	White Tick Bush
Myrtaceae	*Leptospermum trinervium*	Paperbark
Ochnaceae	*Ochna serrulata**	Ochna
Pittosporaceae	*Billardiera scandens*	Apple-berry
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Proteaceae	*Banksia serrata*	Old Man Banksia
Proteaceae	*Banksia spinulosa*	Hair-pin Banksia
Proteaceae	*Grevillea sericea*	Pink Spider Flower
Proteaceae	*Grevillea robusta**	Silky Oak
Proteaceae	*Hakea sericea*	Bushy Needlebush
Proteaceae	*Isopogon anethifolius*	Drumsticks
Proteaceae	*Lambertia formosa*	Mountain Devil
Proteaceae	*Lomatia silaifolia*	Crinkle Bush
Proteaceae	*Persoonia lanceolata*	Geebung
Proteaceae	*Persoonia levis*	Broad Leaved Geebung
Proteaceae	*Persoonia linearis*	Narrow Leaved Geebung
Proteaceae	*Persoonia pinifolia*	Pine Leaved Geebung
Proteaceae	*Petrophile sessilis*	Conestick
Rosaceae	*Cotoneaster glaucophyllus**	Cotoneaster
Rutaceae	*Correa reflexa*	
Rutaceae	*Eriostemon myoporoides*	Long-leaved Wax Plant
Rutaceae	*Eriostemon scaber*	Wax Plant
Santalaceae	*Exocarpus cupressiformis*	Cherry Ballart
Solanaceae	*Solanum nigrum**	Black Nightshade
Thymelaeaceae	*Pimelea linifolia*	Rice Flower
Verbenaceae	*Lantana camara**	Lantana
Verbenaceae	*Lantana bonariensis**	Purple Top
MONOTYLEDONES		
Asparagaceae	*Asparagus asparagoides**	Bridal Creeper
Cyperaceae	*Caustis flexuosa*	Old Man's Beard
Cyperaceae	*Lepidosperma concavuum*	Sword-sedge
Cyperaceae	*Lepidosperma laterale*	Sword-sedge
Lomandraceae	*Lomandra confertifolia* ssp. *rubiginosa*	Mat Rush
Lomandraceae	*Lomandra longifolia*	Spiny-fruit Mat Rush

FAMILY	Species	Common Name
Lomandraceae	*Lomandra obliqua*	Fish Bones
Orchidaceae	*Acianthus fornicatus*	Pixie Orchid
Orchidaceae	*Caladenia catenata*	White Fingers
Orchidaceae	*Pterostylis acuminata*	Greenhood
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily
Phormiaceae	*Dianella revoluta*	Blue Flax Lily
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Aristida ramosa* var. *ramosa*	Purple Wiregrass
Poaceae	*Cynodon dactylon**	Couch
Poaceae	*Ehrharta erecta**	Panic Veldt Grass
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Imperata cylindrica*	Blady Grass
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Meadow Grass
Poaceae	*Pennisetum clandestinum**	Kikuyu
Poaceae	*Themeda australis*	Kangaroo Grass
Smilacaceae	*Smilax glyciphylla*	Native Sarsaparilla
Xanthorrhoeaceae	*Xanthorrhoea arborea*	Grass Tree

Appendix C

Geological Report – Scoping Assessment

Roads and Traffic Authority

Scoping Assessment
Slope Stabilisation Requirements

Henry Lawson Drive, Revesby Heights,
Slope Nos: 1968 & 1969

Report

September 2005

GHD LongMac
Consulting geotechnical engineers and geologists

7 October 2005

Roads and Traffic Authority
83 Flushcombe Road
Blacktown NSW 2148

Our ref: 21/14200/-/AW587.doc

Attn: Neil Forrest

Dear Mr Forrest

Scoping Assessment of Slope Stabilisation Remediation Works
Henry Lawson Drive, Revesby Heights, Slope Nos: 1968 & 1969

Please find herein the results of our field assessments for delineating cutting stabilisation treatment requirements on Slope ID No's 1968 & 1969 on Henry Lawson Drive, between Boomerang Reserve and The River Road, Revesby Heights. The assessment has been carried out in accordance with our proposal of 6 September 2005 (Our Ref: AW529).

The subject sites comprise opposite north and south facing cuttings. In accordance with the brief we have identified and delineated the remediation measures required at the rock cutting sites in order for the cuttings to achieve an improved ARL (Assessed Risk Level) of 3, based on Version 3.1 of the RTA's "Guide to Slope Risk Assessment".

The geotechnical information is presented herein within the overall report and the attached Appendices, which relate to each of the cuttings. Each appendix contains tables detailing Stabilisation Requirements & Prioritisation, Summary of Quantities, Estimated Costings and a set of Colour Photomosaic Plates. The photomosaics constitute a record of the current condition of the rock cutting, as well as enabling the locations of the recommended stabilisation works to be shown.

Please note that although we have delineated the recommended geotechnical works, this document does not comprise a technical specification. Similarly, the scope of this report does not incorporate urban design aspects of the cutting treatments.

Should you require any further information regarding any aspect of the stabilisation works required at the subject sites, please do not hesitate to contact either of the undersigned.

Yours faithfully
GHD-LongMac

Prepared by:
Daniel Jones
Senior Engineering Geologist

Reviewed by:
Gregory P Kotze
Chief Engineering Geologist

GHD LongMac
A division of GHD Pty Ltd
ABN 39 008 488 373

57 Herbert Street
Artarmon NSW 2064
Australia

Locked Bag 2727
St Leonards NSW 1590
Australia

T 61 2 9462 4700
F 61 2 9462 4710
E longmac@ghd.com.au
W www.ghd.com.au

Controlled Document No. 5

SCOPING ASSESSMENT

at

HENRY LAWSON DRIVE, REVESBY HEIGHTS, SLOPE NOS: 1968 & 1969

for

ROADS AND TRAFFIC AUTHORITY

REF: 21/14200/-

DATE: 7 October 2005 Rev No. 0

CONTROLLED DOCUMENT
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Document History

Revision No.	Revision Date	Description
0	07/10/2005	Initial Issue

Issued by: G.P. Hoty

Date: 12/10/2005

Contents

Attachment Sheet

Appendices

1. Introduction

Please find herein the results of our field assessments for delineating cutting stabilisation treatment requirements on Slope ID No's 1968 & 1969 on Henry Lawson Drive, between Boomerang Reserve and The River Road, Revesby Heights.

The assessments have been carried out in accordance with your brief (Ref: 99M5370) received 19 August 2005, our proposal of 6 September 2005 (Our Ref: AW529), and your approval received 20 September 2005 (Your Ref: 99M5370).

Based on the provided RTA Slope Risk Analyses, carried out by others on 12 October 2000, we understand that the existing two road cuttings are currently ranked as ARL 1 slopes. In accordance with the brief, we have identified and delineated the remediation measures required at the subject rock cutting sites in order for each cutting to achieve an ARL value of 3 in accordance with version 3.1 of the RTA's "Guide to Slope Risk Assessment".

2. Methodology & Assessment

The cuttings range in length from 105m to 140m with maximum heights estimated to range from 20m to 22m. The results of our assessment for each individual cutting are presented in Appendices A and B.

Chainages were marked at 10m intervals at the toe of each cutting. The chainages were measured with a measuring wheel and marked on the cutting with spray paint. The subject cuttings were digitally photographed from the crest of the opposite cutting. The digital photographs were then spliced together.

The variable slope angle and geometry of the rock cuttings unavoidably results in parallax effects and some localised distortion of photomosaic plates. We have utilised advanced proprietary photographic software to partially compensate for any distortion caused by the above factors. However, the detailed locations of nominated treatment zones and any associated area/volume determinations should be confirmed in the field.

On completion of digital image splicing, hard copies of the images were taken into the field and the cuttings were subject to engineering geological mapping from a combination of the cutting crest and toe areas and by observation from the opposite cutting crest. Relevant geological and geotechnical mapping data was documented and assessed. Nominated treatment areas were marked, and quantities for the remediation works estimated. Each treatment area has been identified with a feature number on the photomosaic. This number corresponds to Feature Descriptions presented in Tables A1 & B1. These tables provide chainage, height, description, dimensions and recommended remedial actions for each feature.

As requested in the brief, we have notionally categorised the required remediation works into three priority levels based on the nominated time frames of "within the next year", "one to three years" and "three to ten years". Whilst such classification can provide some indication of urgency for treatment, they are based on what is distantly visible only, without direct face access to the specific rock masses concerned. They should therefore be regarded as generalised guides only, which require verification when direct face access is possible. We also point out that the full schedules of stabilisation works identified in Tables A1 and B1 require implementation in order for the cutting sites to achieve the required improvement from ARL 1 to ARL 3. Accordingly, the quantities and costings presented in Tables A2, B2 and A3, B3 are based on the full schedules of Tables A1, B1 being addressed.

To avoid extensive repetition on tables A1 & B1 we have assumed the following (common) works will be carried out as a matter of course during the initial stabilisation works. These features may be delineated on the photomosaics, but have not necessarily been assigned a Feature Number.

- Removal of all trees and shrubs on cutting face and immediate crestal area. (Note that where trees are currently jacking out blocks or where tree trunks are larger than ~400mm Ø, they have typically been assigned a feature number that has been included on the photomosaics and tables).

- Scaling & grooming of blocks nominally <0.5m^3. (Note that blocks larger than the nominated size, have typically been assigned a feature number and are included on the photomosaics and tables).
- Scaling & grooming of ledges including removal of leaf litter, small rock fragments and soil accumulations.

The colour images and accompanying tables, with the delineated stabilisation works, are presented within the Appendices for each cutting.

Given the restriction of access to the cutting face, we note that the remedial measures as identified shall be subject to review once elevated access is provided for closer inspection during physical works.

3. General Notes on Stabilisation Works

3.1 General

The treatment areas nominated on the accompanying photomosaics have been identified by engineering geological mapping from the crestal and toe areas of the cuttings in October 2005.

Immediately prior to and/or at the time of implementation of cutting treatment works, the cutting faces shall be directly accessed and subject to engineering geological review to confirm the extent of the nominated treatment works and to mark out the work locations. Some variations in quantities or works details may be identified at that time.

The implementation of the specialist stabilisation works shall be carried out in accordance with geotechnical specifications for the work. The works shall be carried out under engineering geological supervision.

3.2 Devegetation, Scaling, Grooming and Re-profiling

Areas identified on the cutting that require selective devegetation and scaling / grooming are shown on the attached photomosaics. All vegetation and loose or detached rock masses and soil accumulations shall be removed from the face of the cutting and from the immediate crestal area.

Unless otherwise specified, and subject to geotechnical confirmation on site at the time of the works, a 2m wide crestal buffer zone across the top of the cutting or the area between the cutting face and crest drain shall be devegetated, scaled and groomed. During the works, additional areas that require localised scaling and/or grooming may be identified and treated. During or immediately after the completion of devegetation, scaling and grooming, and prior to the time of implementation of other cutting treatment works, the cutting faces shall be directly accessed and subject to engineering geological review to ensure that all necessary material has been removed from the cutting face and crest. Provision of full time engineering geological supervision to identify and direct the location and extent of all scaling works, particularly to avoid adverse over-excavation, is recommended.

To assist with the quantities and costing estimate as provided herein, we have nominated typical methodologies for devegetation, scaling & grooming, as summarised below:

3.2.1 Devegetation

- Elevated access devegetation crew – Specialist tree-cutting contractor operating a chainsaw, or equivalent, typically from a truck mounted elevated work platform/basket. This typically requires a cutter at height plus a ground support crew including mulcher.
- Rope access devegetation crew - Specialist contractor operating a chainsaw and hand tools via rope access. This generally requires a minimum of two qualified climbers plus a ground support crew including mulcher.

- Crest & cut-off drain devegetation crew – Specialist tree-cutting contractor operating a chainsaw, or equivalent, typically from ground and climbing trees as required. This typically requires a cutter plus a support crew including mulcher, etc
- Excavator (Long Reach) – This will be used in areas where the entire root mass can be removed without adversely affecting the cutting stability. The excavator can be used from the cutting toe, or crest where accessible, to remove vegetation with the excavator bucket.

3.2.2 Scaling, Grooming and Re-profiling

- Elevated Access scaling crew (2 labourers + hand tools) – Elevated access by a suitably sized boom lift or cherry picker providing access to the cutting face for scaling with hand tools including crow bars, pinch bars, rakes, pelican picks, jack hammers, etc.
- Excavator (Bucket + Hammer) – Suitably sized excavator used to remove and reshape unstable rock masses to a stable geometry using either bucket or hammer excavation.
- Crest cut-off drain cleaning/grooming (2 man crew + hand tools/small excavator) – Hand or machine excavation of silt, rock and leaf litter accumulation within the crest drain. May also include reshaping or reinstatement works where the drain requires repair.

3.3 Crestal Drainage

On Slope No 1969 the natural cross-fall is away from the cutting face so limited to no drainage works are required. Slope No 1968 has an established form of crestal drainage, with construction varying along the length of the cutting, including

- Channels excavated into soil,
- Channels excavated into rock, and
- Shaped drainage cross fall.

The drainage facilities are commonly filled with silt and vegetation and are locally damaged or breached. In order to minimise the destabilising potential of a failed drainage system to the rock cutting face, the following works are recommended during the stabilisation works:

- Remove all vegetation (including trees) within the drainage channel and to at least 1 metre either side of the defined drainage works, to prevent channel blockages and root jacking damage to the drains.
- Clear drains of all leaf litter, soil and rock debris.
- Repair locally damaged areas of the drainage system.
- Redefine drainage cross fall where erosion or silt accumulation has adversely affected performance

3.4 Rockbolts

Locations identified on the cuttings that require rock-bolting are shown on the photomosaics included in the Appendices. Prior to the installation of rockbolts, each rockbolt location shall be subject to direct geological assessment via elevated access to the cutting face, where actual location, length and orientation of each rockbolt shall be confirmed and marked. Unless otherwise specified on site, all rockbolts shall be installed perpendicular to the cutting face and angled 15° below horizontal.

Please note that rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, and further geological assessment. During the works, additional sites that require rockbolting may be identified and treated, subject to geological assessment.

3.5 Shotcrete

Locations identified on the cuttings that require treatment with mesh-reinforced shotcrete are shown on the photomosaics included in the Appendices. All areas identified for shotcrete shall be subject to devegetation and scaling prior to commencement of any installation works.

Prior to installation of mesh reinforcement and shotcrete the subject areas shall be subject to direct geological assessment to enable review of shotcrete extents, and mark up of dowel reinforcement and drainage measures (eg strip drain, weep holes).

4. Provisional Quantities & Costings

The quantities as shown on the photomosaics are summarised for each cutting in the provisional quantities summary table contained within each of the cutting Appendices. The quantification of some remediation components such as number and length of rockbolts, shotcrete area, number of dowels etc as is contained in this report must be regarded as preliminary. Our scoping assessment has been carried out by visual mapping of the existing cutting face before the required initial scaling and grooming works are carried out. It is not always possible to fully predict how much material will be removed during the scaling works and how many rock masses will remain to be rock bolted. Therefore, it should be anticipated that some variations to the predicted remediation quantities would occur, when the conditions that actually exist on the cutting face are physically negotiated during the remediation works programme.

The cost estimates, as provided in the Appendices, include specific rates for the geotechnical components of the stabilisation works. These rates are provisional and are based on recent experience on road cutting projects. It is emphasised however that budget estimates should be confirmed through appropriate (current) quotation processes using suitably experienced contractors. We have also included an estimated logistics allowance for items such as traffic control, site management and consumables. We have estimated this allowance to be an additional 50% of the site-specific specialist geotechnical costs. The logistics percentage allowance should be considered by the RTA for calibration against other recent RTA projects in the area.

The assessment of provisional quantities and costings for devegetation, scaling and grooming has considered typical methods utilised for these works on similar cuttings. The allowance assumed considers unrestricted access to the cuttings during the works. That is, no allowance has been made for reduced production rates resulting from logistical issues such as reduced work site geometry, limited traffic stoppages, etc.

The unit rates and charges are representative of Contractors rates on similar projects in Sydney at the time of writing. We point our that contracting rates can vary markedly from time to time, dependant upon individual Contractor work loads and market availability. We therefore suggest that the allowances presented on the costing tables be considered a guide and specific quotations should be sought from suitably experienced Contractors for budget planning purposes.

5. Conclusion

We have appreciated the opportunity to assist the RTA on this project. We would be pleased to provide the necessary mark-up, fieldwork review and geotechnical supervision services that will be required at the time of the works implementation. Please contact us should you require any additional assistance or information.

Attachment Sheet

General Notes

GENERAL NOTES

CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS
57 Herbert Street, Artarmon, NSW. 2064
Tel: (02) 9462 4700 Fax: (02) 9462 4710
Email: longmac@ghd.com.au
GHD-LONGMAC

The report contains the results of a geotechnical investigation conducted for a specific purpose and client. The results should not be used by other parties, or for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water levels presented on the test hole logs are the levels of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater level may differ from this recorded level depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this level could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate instrumentation techniques and monitoring programmes.

Ref: DS5.5.1 Issue 1.3 Date: 23/06/05

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in the generalised ground conditions do occur in the natural environment, particularly between discrete test hole locations. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural forces.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to this firm for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system or to conduct monitoring as a result of this natural variability. Allowance for verification by geotechnical personnel accordingly should be recognised and programmed during construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

REPRODUCTION OF REPORTS

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions should include at least all of the relevant test hole and test data, together with the appropriate standard description sheets and remarks made in the written report of a factual or descriptive nature.

Appendix A

Rock Cutting – Slope ID No. 1968

Table A1 – Prioritised Stabilisation Works

Table A2 – Stabilisation Works Provisional Quantities

Table A3 – Stabilisation Works Provisional Costings

Colour Photomosaic Plates

Slope No 1968 - Prioritised Stabilisation Works

Table A1

Feature No	*Chainage*	*Height*	*Description*	*Remedial Action*	*Devegetation*	*Hand Scaling*	*Excavator Scaling*	*Long Reach Scaling*	*Rockbolting*	*Shotcrete Application*	*Buttress Construction*	*Reprofile*
Highest Priority (nominally <1 year)												
3	CH 9 to 12	0.0 to 4.0 m	Fractured sandstone rock mass bounded by a subvertical joint plane, with tree growth in joint. (4 x 2.5 x 0.7m)	Machine scale rock mass and remove tree	☑	☐	☑	☐	☐	☐	☐	☐
8	CH 22 to 24	9.0 to 10.0 m	2 x fracture bound sandstone blocks at crest of cutting. (1 x 0.8 x 0.5m each)	Hand scale	☐	☑	☐	☐	☐	☐	☐	☐
10	CH 30 to 34	4.0 to 5.0 m	Fractured sandstone rock mass on bench of cutting, with 2x trees located directly at crest of cutting face and jacking out rock. (4 x 1.5 x 0.5m)	Remove trees and hand/machine scale bench	☑	☑	☑	☐	☐	☐	☐	☐
11	CH 34 to 37	0.0 to 4.0 m	Sandstone wedge, bounded by subvertical open orthogonal joints. (2 x 4 x 1.5m)	Hand/machine scale bench	☐	☑	☑	☐	☐	☐	☐	☐
17	CH 41 to 42	13.0 to 14.0 m	Sandstone rock mass bounded by a subvertical joint plane, with tree growth in joint. (1.5 x 1 x 0.6m)	Hand scale rock mass and remove tree	☐	☐	☐	☐	☐	☐	☐	☐
18	CH 46 to 49	15.0 to 17.0 m	Sandstone rock mass bounded by open fracture, with tree growth in joint. (2 x 2 x 1m)	Hand scale rock mass and remove tree	☑	☑	☐	☐	☐	☐	☐	☐
19	CH 45 to 46	4.0 to 4.0 m	Tree growth fracturing sandstone rock mass (0.5 x 0.5 x 0.5m)	Hand or machine scale rock mass and remove tree	☑	☑	☑	☐	☐	☐	☐	☐
29	CH 60 to 61	17.0 to 18.0 m	Open orthogonal joint bound sandstone blocks. (2 x 0.5 x 0.5m). Small trees on crest of cutting.	Hand scaling. Remove vegetation	☑	☑	☐	☐	☐	☐	☐	☐
31	CH 74 to 75	22.0 to 22.0 m	Fractured rock mass, with tree growth in joint/fracture (1 x 0.5 x 0.5m).	Hand scale rock mass and remove tree	☑	☑	☐	☐	☐	☐	☐	☐
33	CH 81 to 82	17.0 to 18.0 m	Fractured rock mass on ledge, with tree growth in joint above (2 x 1 x 0.7m)	Hand scale rock mass and remove tree. Install rockbolts in adjacent rockmass (RB 2 x 3m)	☑	☑	☐	☐	☑	☐	☐	☐
39	CH 98 to 99	15.0 to 18.0 m	Fractured sandstone rock mass (3 x 0.7 x 0.7m)	Hand scaling	☐	☑	☐	☐	☐	☐	☐	☐
43	CH 99 to 101	16.0 to 17.0 m	Tree growth in joint fractured sandstone rock mass. (2 x 1 x 0.7m)	Hand scale rock mass and remove tree	☑	☑	☐	☐	☐	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
44	CH 103 to 104	16.0 to 17.0 m	Tree growth in joint fractured sandstone rock mass. (2 x 0.7 x 0.5m)	Hand scale rock mass and remove tree	☑	☑	☐	☐	☐	☐	☐	☐
46	CH 105 to 106	18.0 to 19.0 m	Fractured sandstone rock mass (2 x 1 x 0.5m)	Hand scale	☐	☑	☐	☐	☐	☐	☐	☐
47	CH 109 to 112	16.0 to 17.0 m	Colluivial soil with sandstone cobbles and boulder floaters on crestal area of cutting, tree located directly at crest jacking out soil and rock .	Hand scale, groom slope, and remove tree.	☑	☑	☐	☐	☐	☐	☐	☐
High Priority (nominally 1-3 years)												
2	CH 3 to 3	1.5 to 1.5 m	Large gum tree (>500mm Ø) located directly at crest of cutting face and jacking out soil and rock.	Remove tree, including poisoning / removal of the stump.	☑	☐	☐	☐	☐	☐	☐	☐
4	CH 13 to 13	3.0 to 3.0 m	Large gum tree (>500mm Ø) located directly at crest of cutting face and jacking out soil and rock.	Remove tree, including poisoning / removal of the stump.	☑	☐	☐	☐	☐	☐	☐	☐
5	CH 17 to 20	2.0 to 5.0 m	Fractured sandstone rock mass bounded by a subvertical joint plane, with tree growth in joint. (2 x 2 x 1m)	Machine scale rock mass and remove tree	☑	☐	☑	☐	☐	☐	☐	☐
7	CH 22 to 22	1.5 to 1.5 m	Fractured sandstone rock mass bounded by a subvertical joint plane, with tree growth in joint. (0.5 x 0.5 x 0.5m)	Machine scale rock mass and remove tree	☑	☐	☑	☐	☐	☐	☐	☐
12	CH 25 to 28	6.0 to 10.0 m	Sandstone wedge, bounded by subvertical orthogonal joints and locally undercut. (2.5 x 4 x 1.5m)	Combination of long reach scaling and/or hand scaling with rockbolting (RB 5x 2m and 2 x 3m)	☐	☑	☐	☑	☑	☐	☐	☐
13	CH 35 to 37	5.0 to 7.0 m	Sandstone rock mass, bounded by open subvertical joint and locally undercut. (3 x 2 x 1.2m)	Long reach scaling or rockbolting (RB 1x 3m and 3 x 2m)	☐	☐	☐	☑	☑	☐	☐	☐
14	CH 34 to 35	7.0 to 8.0 m	Sandstone boulder perched on bench. (2 x 1.5 x 1m)	Long reach scaling.	☐	☐	☐	☑	☐	☐	☐	☐
16	CH 39 to 41	14.0 to 15.0 m	Fractured sandstone rock mass on crest of cutting. (1 x 2 x 0.5m)	Hand scale	☐	☑	☐	☐	☐	☐	☐	☐
20	CH 46 to 50	4.0 to 4.0 m	Ledge covered with vegetation and loose sandstone fragments. Possible subvertical joint plane behind block. (4 x 1 x 0.8m)	Machine scale rock mass and remove vegetation	☑	☐	☑	☐	☐	☐	☐	☐
21	CH 48 to 50	5.5 to 7.0 m	Joint bound sandstone block. (2 x 1.5 x 0.5m)	Hand or Long Reach scaling and rockbolting (RB 2 x 1.5m)	☐	☑	☐	☑	☑	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
22	CH 51 to 52	5.5 to 6.5 m	Fractured sandstone rock mass on cutting face. (1 x 1 x 0.5m)	Long Reach scaling	☐	☐	☐	☑	☐	☐	☐	☐
23	CH 36 to 40	5.0 to 8.0 m	Stacked open joint bound sandstone blocks. (2.5 x 4 x 2m)	Long Reach scaling	☐	☐	☐	☑	☐	☐	☐	☐
24	CH 54 to 55	19.0 to 20.0 m	3 x trees (>400mm Ø) located directly at crest of cutting face and jacking out soil and rock.	Remove trees, including poisoning / removal of the stump, and hand scale loose soil and rock	☑	☑	☐	☐	☐	☐	☐	☐
25	CH 50 to 54	17.0 to 18.0 m	Undulating shale lens, with fractured sandstone rock mass. (4 x 0.5m)	Application of mesh reinforced shotcrete (4 x 0.5m)	☐	☐	☐	☐	☐	☑	☐	☐
26	CH 54 to 59	4.0 to 7.0 m	Persistent subvertical open joint behind sandstone rock mass (4.5 x 3 x 1m)	Scale with long reach or rockbolt (RB 4 x 3m, 2 x 2m)	☐	☐	☐	☑	☑	☐	☐	☐
27	CH 54 to 73	3.0 to 5.0 m	Dense fern vegetation growing from a distinct bed, inferred to be associated with seepage from a shale horizon.	Remove vegetation with excavator or long reach and assess condition of rock mass behind. Possibly require treatment with mesh reinforced shotcrete (19 x 1.5m)	☑	☐	☑	☑	☐	☑	☐	☐
28	CH 57 to 58	18.0 to 20.0 m	Joint bound sandstone block (2.5 x 1.5 x 1m)	Install rockbolts (RB 2 x 3m)	☐	☐	☐	☐	☑	☐	☐	☐
30	CH 67 to 69	17.0 to 18.0 m	Fractured rock mass on ledge, with tree growth in joint above (2 x 1 x 0.7m)	Hand scale rock mass and remove tree	☑	☑	☐	☐	☐	☐	☐	☐
34	CH 76 to 77	5.0 to 8.0 m	Subvertical joint behind rock mass (2.5 x 1.5 x 0.7m)	Rockbolting (RB 2 x 2m)	☐	☐	☐	☐	☑	☐	☐	☐
35	CH 79 to 84	18.0 to 20.0 m	Orthogonal jointing, producing a series of large sandstone blocks. (5 x 2 x 1)	Rockbolt rock mass (RB 4 x 3m and 3 x 2m)	☐	☐	☐	☐	☑	☐	☐	☐
37	CH 86 to 90	15.0 to 20.0 m	Joint bound wedge comprising fractured rock mass. (4 x 4 x 1.5m)	Preferable to machine scale from crest. Rockbolt remaining rock masses (RB 4 x 3m and 2 x 2m).	☐	☐	☑	☐	☑	☐	☐	☐
38	CH 95 to 98	15.0 to 18.0 m	Joint bound wedge comprising fractured rock mass, with tree growth in joint. (4 x 4 x 1.5m)	Devegetate. Preferable to machine scale from crest. Rockbolt remaining rock masses (RB 4 x 3m and 4 x 2m).	☑	☐	☑	☐	☑	☐	☐	☐
40	CH 90 to 113	0.0 to 1.5 m	Slaking shale bed at toe of cutting, undercutting sandstone blocks above.	Application of mesh reinforced shotcrete. (23 x 1.5m)	☐	☐	☐	☐	☐	☑	☐	☐
41	CH 95 to 97	18.0 to 20.0 m	Fractured sandstone rock mass (3 x 2 x 0.5m)	Rockbolt rock mass (RB 3 x 1.5m).	☐	☐	☐	☐	☑	☐	☐	☐
42	CH 99 to 100	17.0 to 18.0 m	Joint bound sandstone wedge and planar joint bound block.	Preferable to machine scale from crest. Rockbolt remaining rock masses (RB 2 x 1.5m).	☐	☐	☑	☐	☑	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Butress Construction	Reprofile
45	CH 95 to 120	6.0 to 7.0 m	Shale bed predominantly obscured by leaf litter and vegetation. Localised slaking undercutting sandstone blocks. (25 x 1m)	Devegetate and scale with long reach. May require shotcrete, subject to assessment following scaling works.	☑	☐	☐	☑	☐	☑	☐	☐
48	CH 111 to 115	14.0 to 16.0 m	Sandstone rock mass bounded by open joints	Rockbolting (RB4 x 3m and 1 x 4m)	☐	☐	☐	☐	☑	☐	☐	☐
50	CH 118 to 119	8.0 to 8.0 m	Large gum tree (~600mm Ø) located directly at crest of cutting face and jacking out soil and rock.	Remove tree, including poisoning / removal of the stump.	☑	☐	☐	☐	☐	☐	☐	☐
51	CH 123 to 126	5.0 to 7.0 m	Colluvial soil with sandstone boulder floaters on crestal area of cutting. Ongoing erosion of colluvial soils is undercutting sandstone boulder. (3 x 2 x 3m)	Remove sandstone boulders and locally reprofile colluvial soils.	☐	☐	☐	☑	☐	☐	☐	☐
53	CH 131 to 131	2.0 to 2.0 m	Large gum tree (~500mm Ø) located directly at crest of cutting face and jacking out soil and rock.	Remove tree, including poisoning / removal of the stump.	☑	☐	☐	☐	☐	☐	☐	☐
54	CH 108 to 109	17.0 to 19.0 m	Large gum tree (~500mm Ø), located on scarp near crest of cutting face and jacking joint bound rock mass below.	Remove tree, including poisoning / removal of the stump. Install rockbolts into dislodged rock mass below (6 x 3m)	☑	☐	☐	☐	☑	☐	☐	☐
Medium Priority (nominally 3-10 years)												
1	CH 0 to 20	0.0 to 5.0 m	Residual soil and extremely weathered sandstone on crestal 1 to 1.5m of cutting. Current batter, at approximately 76°, is too steep for this material. (20 x 1.5 x 2m)	Reprofile crestal soils and EW sandstone (~1.5m) to a batter of approximately 35° or less	☐	☐	☐	☐	☐	☐	☐	☑
6	CH 16 to 21	5.0 to 5.0 m	Highly weathered, weak silty sandstone seam/lens.	May require shotcrete, subject to assessment following adjacent reprofiling works (Feature No 1). (5 x 2m)	☐	☐	☐	☐	☐	☑	☐	☐
9	CH 27 to 29	1.0 to 3.0 m	Fractured sandstone rock mass. (2 x 2 x 1m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
15	CH 39 to 41	11.0 to 14.0 m	Sandstone wedge, bounded by tight subvertical orthogonal joints and undercut. (3 x 2 x 1.5m)	Rockbolting (RB 3 x 2m and 1 x 3m)	☐	☐	☐	☐	☑	☐	☐	☐
32	CH 55 to 105	20.0 to 22.0 m	Residual soil to very weak extremely weathered sandstone on crestal 1 to 1.5m of cutting. Current batter, at approximately 76°, is too steep for this material. (55 x 1.5 x 2m)	Reprofile crestal 1.5m to a batter of approximately 35° or less. Possibly access crest with small excavator to undertake works.	☐	☐	☐	☐	☐	☐	☐	☑

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
36	CH 83 to 86	6.0 to 10.0 m	Large joint bound sandstone block. (3 x 3 x 1.5m)	Rockbolting (RB 2 x 4m, 2 x 3m and 1 x 2m)	☐	☐	☐	☐	☑	☐	☐	☐
49	CH 113 to 130	0.0 to 2.5 m	Shale bed at toe of cutting, adjacent to Feature No 40, with limited slaking and undercutting (17 x 2.5m).	Application of mesh reinforced shotcrete (17 x 2.5m)	☐	☐	☐	☐	☐	☑	☐	☐
52	CH 116 to 140	0.0 to 9.0 m	Colluvial soil with sandstone floaters on crestal 2m of cutting. Current batter, at approximately 76°, is too steep for this material. (24 x 2 x 2.5m)	Reprofile crestal colluvial soils (~2m thick) to a batter of approximately 35° or less	☐	☐	☐	☐	☐	☐	☐	☑

Slope No 1968

Table A2

Stabilisation Works Provisional Quantities (October 2005)

Treatment Type	Quantity	Unit	Unit Rate $	Amount $
Devegetation				
Elevated access devegetation crew (1 tree cutter, 1 EWP)	1	nights		
Rope Access devegetation crew (2 climbers)	1	nights		
Crest Drain devegetation crew (1 climber)	1	days		
Grooming & Scaling				
Elevated access scaling crew (2 labour + hand tools)	5	nights		
Excavator (bucket + hammer)	1	nights		
Excavator (long reach)	1	nights		
Crest Cut-off drain cleaning/grooming (2 man crew + small excavator)	2	days		
Reprofiling				
Excavator (bucket)	3	nights		
Estimated material quantity (haulage & tipping)	345	m^3		
Supply and Installation of Grouted Rock Bolts				
Drilling rockbolt holes, 1.5m - 6m long	181	m		
Rock Bolts: Supply, assemble, install				
1.5	7	Each		
2	25	Each		
3	36	Each		
4	3	Each		
6	0	Each		
Face Plate:- Supply, Install, Disguise	71	Each		
Reinforced Shotcrete Treatment - Supply & Install				
Dowels - 16mm 400Y, 2m bent	106	Each		
Steel Reinforcement	164	m^2		
Weepholes. Slotted PVC Drainage Tube (30mm dia x 1.0m)	33	Each		
Drainage Strip	106	m		
Shotcrete	164	m^2		

Notes:

i) Maximum crest height is approximately 22m

Slope No 1968

Table A3

Stabilisation Works Provisional Costings (October 2005)

Treatment Type	Quantity	Unit	Unit Rate $	Amount $
Devegetation				
Elevated access devegetation crew (1 tree cutter, 1 EWP)	1	nights	$8,547	$8,547
Rope Access devegetation crew (2 climbers)	1	nights	$8,877	$8,877
Crest Drain devegetation crew (1 climber)	1	days	$4,422	$4,422
Grooming & Scaling				
Elevated access scaling crew (2 labour + hand tools)	5	nights	$8,415	$42,075
Excavator (bucket + hammer)	1	nights	$7,337	$7,337
Excavator (long reach)	1	nights	$9,262	$9,262
Crest Cut-off drain cleaning/grooming (2 man crew + small excavator)	2	days	$5,280	$10,560
Reprofiling				
Excavator (bucket)	3	nights	$6,737	$20,211
Estimated material quantity (haulage & tipping)	345	m^3	see note (iv)	
Supply and Installation of Grouted Rock Bolts				
Drilling rockbolt holes, 1.5m - 6m long	181	m	$260	$46,930
Rock Bolts: Supply, assemble, install				
1.5	7	Each	$330	$2,310
2	25	Each	$465	$11,625
3	36	Each	$560	$20,160
4	3	Each	$755	$2,265
6	0	Each	$1,040	$0
Face Plate:- Supply, Install, Disguise	71	Each	$140	$9,940
Reinforced Shotcrete Treatment - Supply & Install				
Dowels - 16mm 400Y, 2m bent	106	Each	$300	$31,800
Steel Reinforcement	164	m^2	$145	$23,780
Weepholes. Slotted PVC Drainage Tube (30mm dia x 1.0m)	33	Each	$120	$3,960
Drainage Strip	106	m	$52	$5,512
Shotcrete	164	m^2	$275	$45,100
TOTAL PROVISIONAL GEOTECHNICAL COSTS				**$314,673**
Estimated Logistics Allowance (see below) - additional 50% on costs				$157,337
Contigency Allowance - 25% of Total				$118,002
SUGGESTED GEOTECHNICAL BUDGET FOR CUTTING: (Rounded)				**$590,000**

Notes:

i) Cost estimates are inclusive of GST.

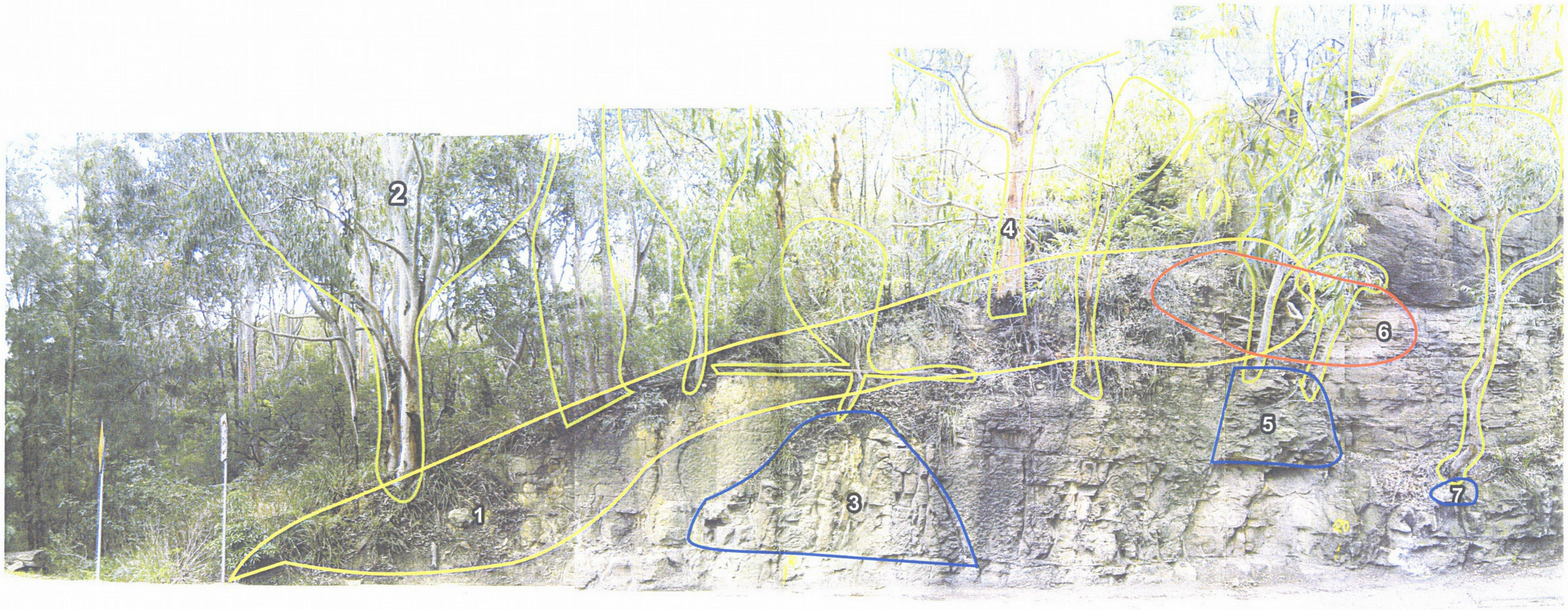
ii) Cost estimates should be confirmed through appropriate quotation processes using suitably experienced contractors.

iii) It has been assumed that multiple site activities will occur concurrently.

iv) Logistics allowances typically include traffic control, site management, consumables etc., but are exclusive of haulage and tipping fees

v) Maximum crest height is approximately 22m

Colour Photomosaic Plates



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LM 2114200-00_LTN_01.cdr

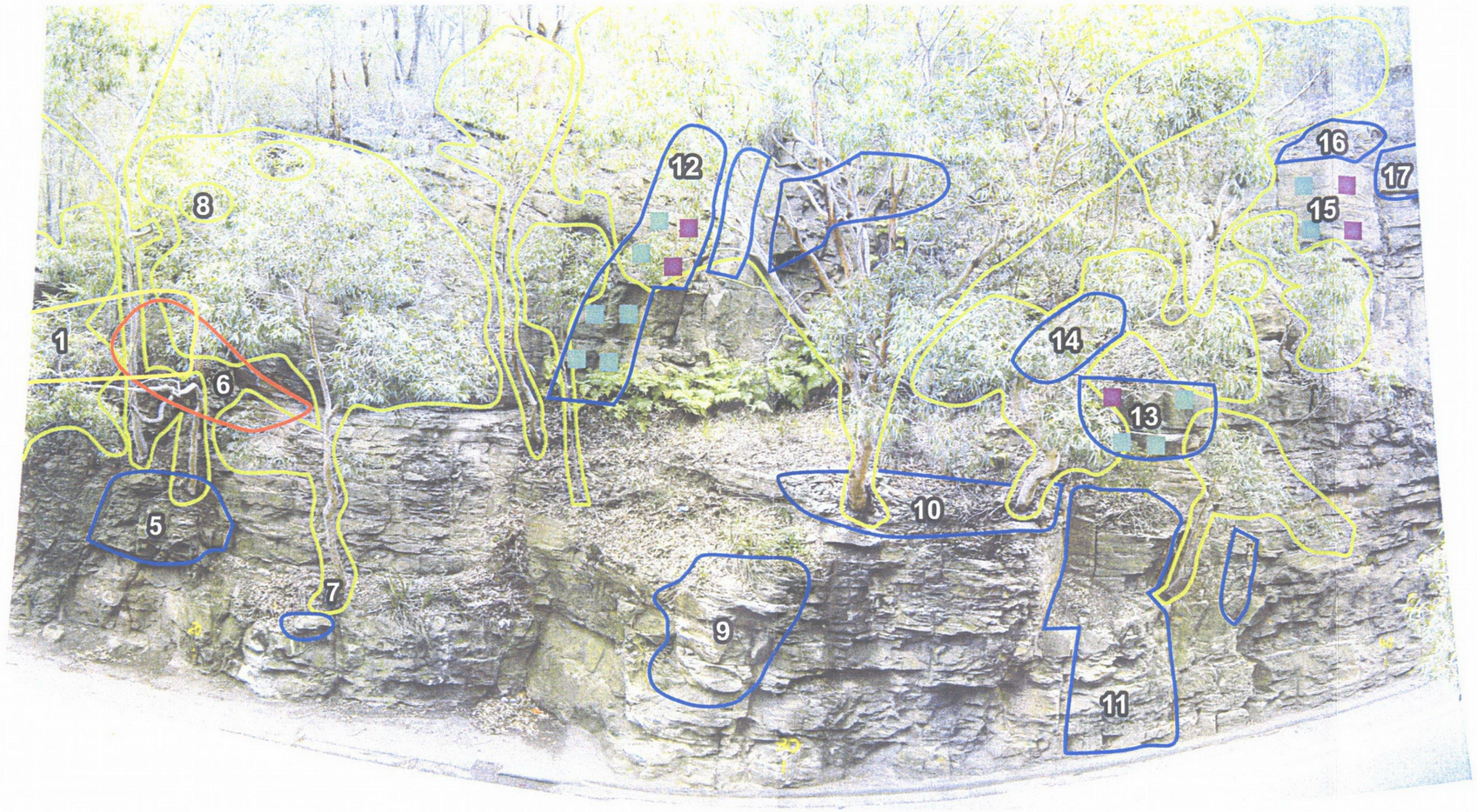
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	1 of 7



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30

ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or detached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LAM 2114200-00_LTN_02.cdr

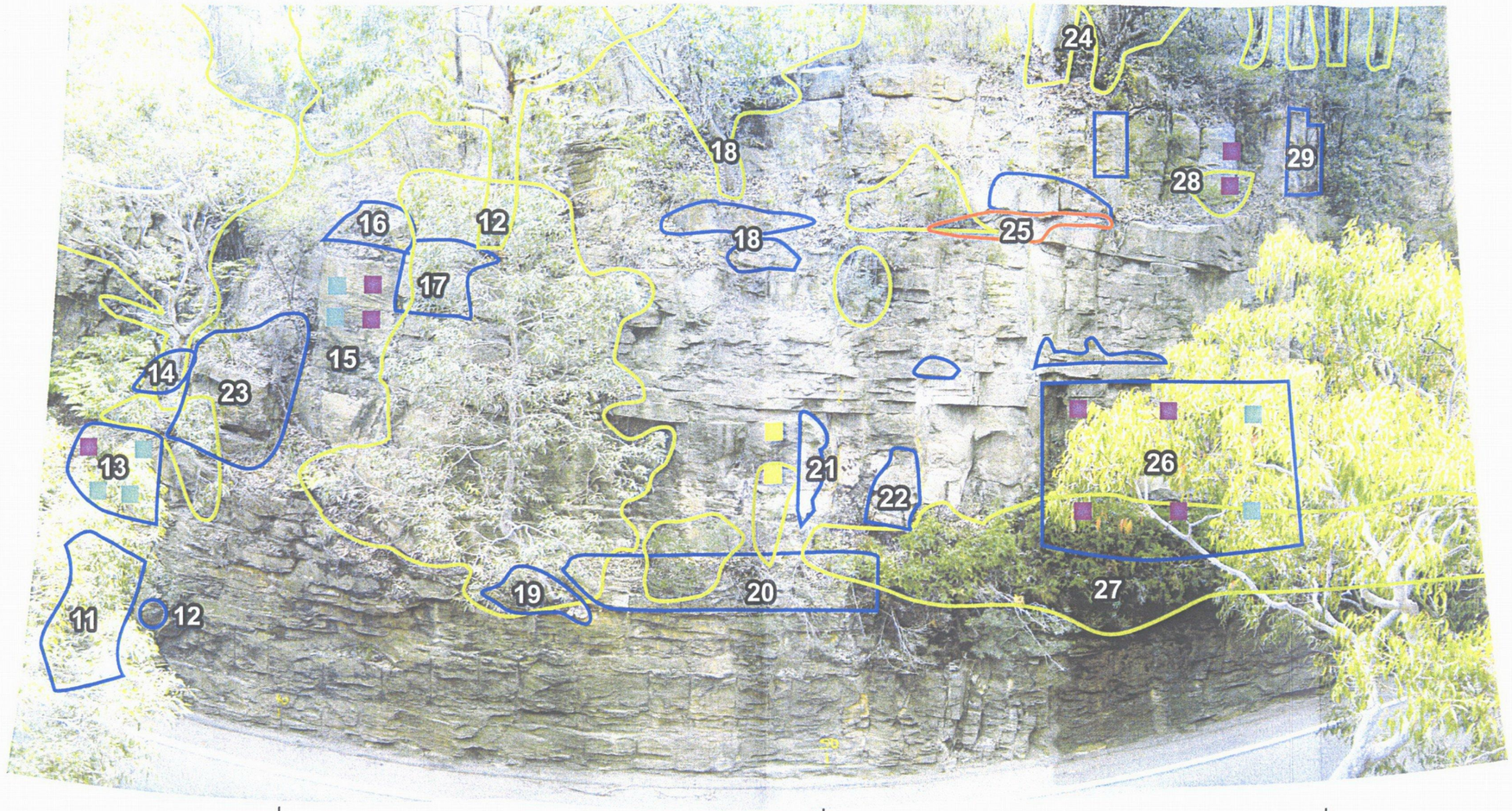
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	2 of 7



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.

1. Cutting reference chainages are marked at 10m intervals along base of cutting.
2. See accompanying report for treatment details and provisional quantities.
3. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
4. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
5. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.
6.

GHD LMA 2114200-00_LTN_03.cdr

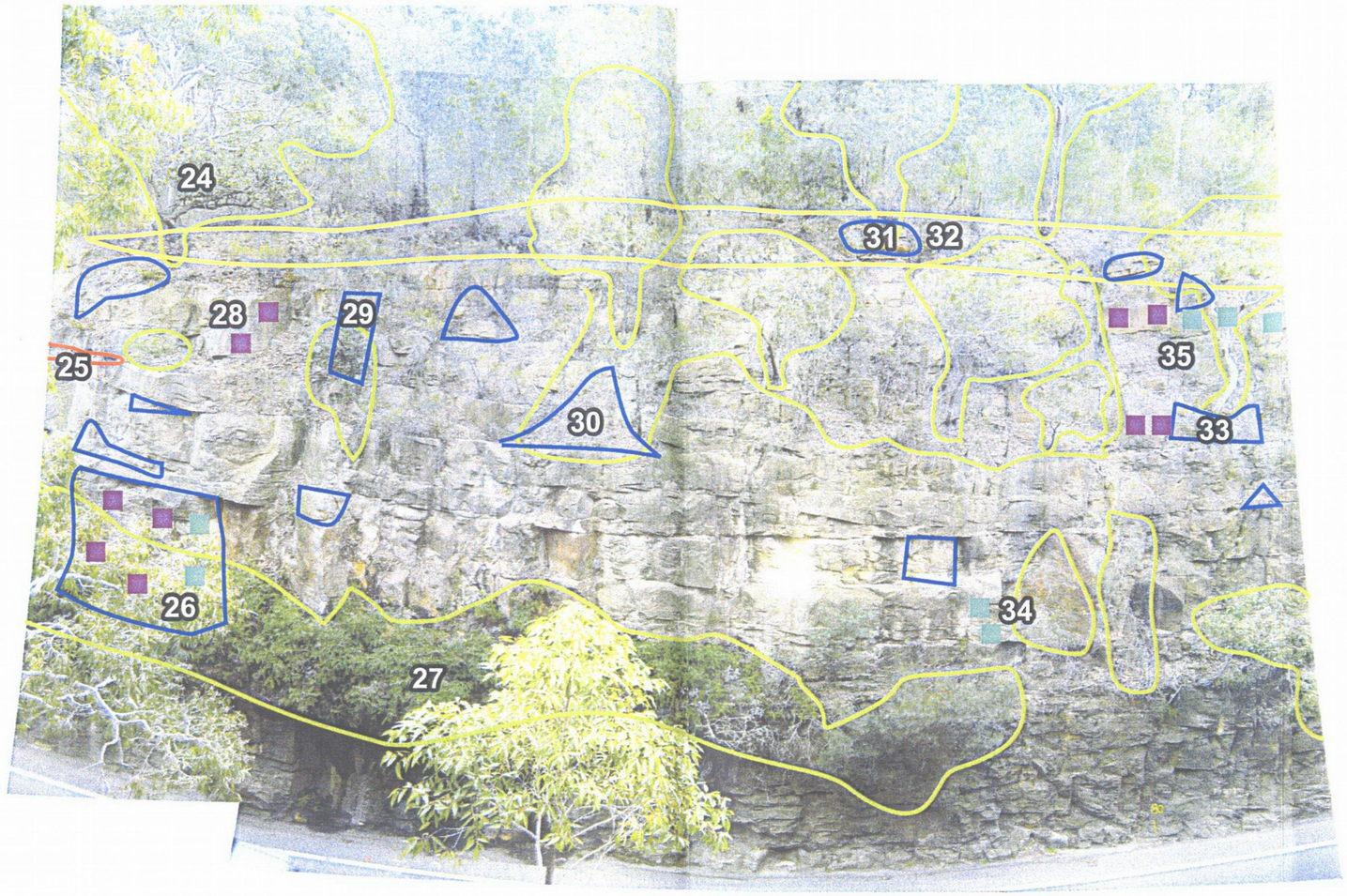
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	3 of 7



60 70 80

ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LAA 2114200-00_LTN_04.cdr

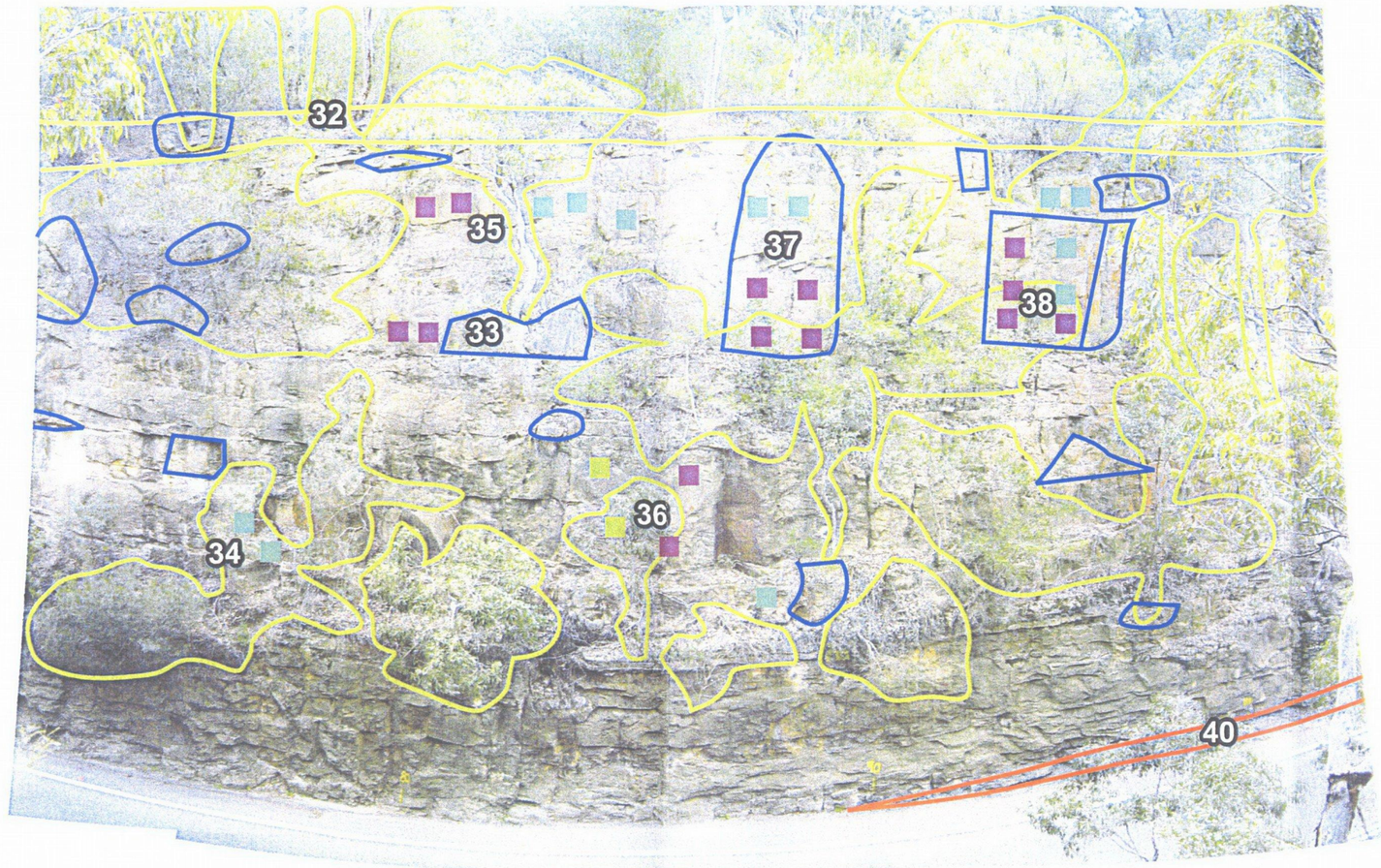
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	4 of 7



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LM 2114200-00_LTN_05.cdr

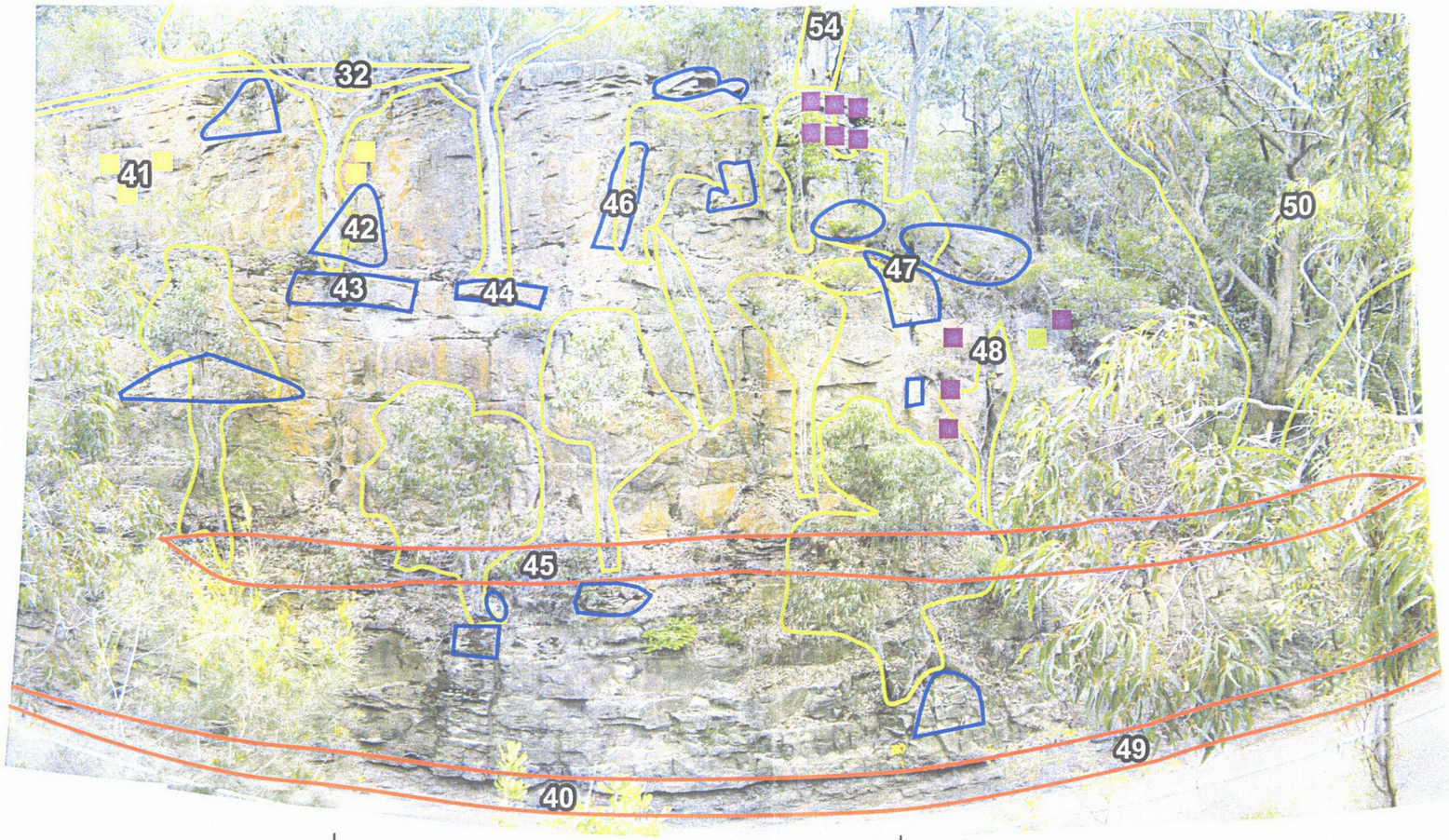
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	5 of 7



100

110

ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

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DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

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5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LM 2114200-00_LTN_06.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
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Plate No:	6 of 7

110 120 130 140

ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
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GHD LAM 2114200-00_LTN_07.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1968

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
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Appendix B

Rock Cutting – Slope ID No. 1969

Table B1 – Prioritised Stabilisation Works

Table B2 – Stabilisation Works Provisional Quantities

Table B3 – Stabilisation Works Provisional Costings

Colour Photomosaic Plates

Slope No 1969 - Prioritised Stabilisation Works

Table B1

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
Highest Priority (nominally <1 year)												
4	CH 8 to 10	9.0 to 10.0 m	Colluvial soil with sandstone boulder floaters on crestal area of cutting. Ongoing erosion of colluvial soils is undercutting sandstone boulder. (2 x 1 x 1m)	Remove sandstone boulders and locally reprofile colluvial soils.	☐	☑	☐	☑	☐	☐	☐	☐
5	CH 10 to 11	11.0 to 12.0 m	Colluvial soil with sandstone boulder floaters on crestal area of cutting. Ongoing erosion of colluvial soils is undercutting sandstone boulder. (2 x 2 x 1m)	Remove sandstone boulders and locally reprofile colluvial soils.	☐	☑	☐	☑	☐	☐	☐	☐
8	CH 15 to 20	8.0 to 9.0 m	Sandstone rock mass bounded by open fractures, with tree growth jacking blocks out. (5 x 1 x 0.7m)	Machine/hand scale rock mass and remove tree.	☑	☑	☐	☑	☐	☐	☐	☐
10	CH 16 to 18	1.5 to 2.0 m	Fracture bound sandstone block, undercut by slaking shale bed below. (2.5 x 1 x 1m).	Machine/hand scale or install rockbolts (RB 2 x 3m)	☐	☑	☑	☐	☑	☐	☐	☐
11	CH 28 to 31	12.0 to 14.0 m	Sandstone rock mass bounded by open fractures, with tree growth jacking blocks out. (2.5 x 1 x 0.7m)	Machine/hand scale rock mass and remove tree.	☑	☑	☐	☑	☐	☐	☐	☐
15	CH 44 to 46	10.0 to 12.0 m	Joint bound (open) wedge comprising fractured sandstone rock mass, undercut by shale erosion below. (3 x 2 x 1.5m)	Scale by hand or with long reach and rockbolt any remaining rock mass (RB 2 x 3m and 2 x 2m)	☐	☑	☐	☑	☑	☐	☐	☐
17	CH 54 to 56	1.0 to 5.0 m	Joint bound (open) stack comprising fractured sandstone rock mass. (2 x 4 x 1.5m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
19	CH 59 to 61	17.0 to 19.0 m	Gum tree (~500mm Ø), located on cutting face and jacking joint bound and highly fractured rock mass below.	Hand scale rock mass and remove tree, including poisoning / removal of the stump.	☑	☑	☐	☐	☐	☐	☐	☐
20	CH 62 to 63	8.0 to 10.0 m	Orthogonal jointing producing sandstone block, undercut by shale erosion below. (1.5 x 1 x 0.7m)	Scale by hand or with long reach.	☐	☑	☐	☑	☐	☐	☐	☐
22	CH 65 to 66	10.0 to 12.0 m	Orthogonal jointing producing sandstone block, undercut by shale erosion below. (2 x 1 x 1.5m)	Scale by hand or with long reach and rockbolt any remaining rock mass (RB 2 x 3m and 2 x 1.5m).	☐	☑	☐	☑	☑	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Butress Construction	Reprofile
23	CH 66 to 67	10.0 to 10.0 m	Gum tree (~400mm Ø), located on cutting face and jacking fracture bound and rock mass below.	Hand or long reach scale rock mass and remove tree, including removal of the stump.	☑	☑	☐	☑	☐	☐	☐	☐
26	CH 71 to 73	9.0 to 10.0 m	Orthogonal jointing producing sandstone block, undercut by shale erosion below. (1.5 x 1 x 1m)	Hand scale	☐	☑	☐	☐	☐	☐	☐	☐
High Priority (nominally 1-3 years)												
1	CH 0 to 7	0.0 to 7.0 m	Highly weathered sandstone with extensive closely spaced subparallel joints. (7 x 7 x 3m)	Undertake reprofiling works. May require application of mesh reinforced shotcrete, subject to assessment following reprofiling .	☐	☐	☐	☐	☐	☑	☐	☑
2	CH 7 to 47	0.0 to 1.5 m	Slaking shale bed at toe of cutting, undercutting sandstone blocks above. (40 x 1.5m)	Hand/machine scale loose undercut sandstone rock masses. Application of mesh reinforced shotcrete to shale bed (40 x 1.5m).	☐	☑	☑	☐	☐	☑	☐	☐
3	CH 7 to 105	7.0 to 9.0 m	Slaking shale bed on cutting face, undercutting sandstone blocks above. (100 x 1.2m)	Hand/machine scale loose undercut sandstone rock masses. Application of mesh reinforced shotcrete to shale bed (100 x 1.2m).	☐	☑	☐	☑	☐	☑	☐	☐
6	CH 11 to 14	11.0 to 13.0 m	Colluvial soil with highly weathered sandstone cobbles on crestal area of cutting. (3 x 1 x 0.5m)	Remove sandstone cobbles and locally hand groom colluvial soils.	☐	☑	☐	☐	☐	☐	☐	☐
9	CH 17 to 18	3.0 to 5.0 m	Joint bound blocks (2.5 x 2 x 1m)	Rockbolting (RB 2 x 3m)	☐	☐	☐	☐	☑	☐	☐	☐
12	CH 30 to 31	14.0 to 16.0 m	Joint bound sandstone blocks (2 x 1 x 0.7m)	Rockbolt (RB 2 x 2m)	☐	☐	☐	☐	☑	☐	☐	☐
13	CH 32 to 36	20.0 to 21.0 m	Colluvial soil with highly weathered sandstone cobbles on crestal area of cutting. (3 x 1 x 0.5m)	Remove sandstone cobbles and locally hand groom colluvial soils.	☐	☑	☐	☐	☐	☐	☐	☐
14	CH 26 to 33	6.0 to 7.0 m	Shaly sandstone lens slaking and undercutting sandstone blocks above.	Hand scale/groom, assess and possibly install mesh reinforced shotcrete (7 x 1.5m)	☐	☑	☐	☐	☐	☑	☐	☐
16	CH 50 to 55	9.0 to 11.0 m	Joint bound wedge comprising fractured sandstone rock mass, undercut by shale erosion below. (5 x 2 x 1.5m)	Scale by hand or with long reach and rockbolt any remaining rock mass (RB 2 x 4m, 2 x 3m, 3 x 2m and 2 x 1.5m).	☐	☑	☐	☑	☑	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
18	CH 55 to 57	9.0 to 11.0 m	Orthogonal jointing producing sandstone blocks, undercut by shale erosion below. (1.5 x 2 x 0.5m)	Scale by hand or with long reach and rockbolt any remaining rock mass (RB 2 x 1.5m).	☐	☑	☐	☑	☑	☐	☐	☐
21	CH 61 to 64	1.5 to 2.0 m	Ledge near toe of cutting with accumulation of slaked shale debris and tree jacking fractured rock mass below.	Hand/machine scale rock mass and remove tree.	☑	☑	☑	☐	☐	☐	☐	☐
24	CH 67 to 69	9.0 to 10.0 m	Fracture bound sandstone blocks undercut by eroding shale bed (2.5 x 1 x 1m).	Rockbolt rock mass (RB 2 x 3m).	☐	☐	☐	☐	☑	☐	☐	☐
25	CH 67 to 75	1.0 to 6.0 m	Orthogonal jointing producing series (3) of sandstone blocks/stacks near toe of cutting, (4 x 2 x 1.5m each)	Machine scale rock mass.	☐	☐	☑	☐	☐	☐	☐	☐
28	CH 76 to 77	11.0 to 12.0 m	Jointing bound sandstone block. (3.5 x 2 x 1m)	Rockbolt (RB 3 x 3m)	☐	☐	☐	☐	☑	☐	☐	☐
29	CH 76 to 79	1.0 to 5.0 m	Jointed and fractured sandstone rock mass, with tree growth	Machine scale rock mass including removal of the tree. Re-assess, possibly install rockbolts (RB 2 x 4m) and shotcrete (3 x 4m)	☐	☐	☑	☐	☑	☑	☐	☐
30	CH 76 to 105	0.5 to 2.0 m	Thin slaking shale bed near toe of cutting, undercutting sandstone blocks above.	Application of mesh reinforced shotcrete. (29 x 0.5m)	☐	☐	☐	☐	☐	☑	☐	☐
31	CH 83 to 84	1.0 to 2.0 m	Orthogonal jointing producing sandstone block, undercut by shale erosion below. (1 x 1 x 0.5m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
32	CH 88 to 90	1.0 to 2.0 m	Orthogonal jointing producing sandstone block, undercut by shale erosion below. (1.5 x 1.5 x 1m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
33	CH 92 to 94	1.0 to 7.0 m	Orthogonal jointing (open) producing sandstone stack. (2 x 6 x 1.5m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
34	CH 94 to 95	1.5 to 5.0 m	Orthogonal jointing (open) producing sandstone stack. (1 x 4 x 0.5m)	Machine scale	☐	☐	☑	☐	☐	☐	☐	☐
Medium Priority (nominally 3-10 years)												
7	CH 20 to 30	17.0 to 20.0 m	Multiple dislocated sandstone rock masses sitting on cross-bed plane dipping out the face at ~26°. (6 x 2 x 2m)	Remove (machine) or secure sandstone boulders with vertical dowels/rockbolts.	☐	☐	☑	☐	☑	☐	☐	☐
27	CH 72 to 74	11.0 to 14.0 m	Jointing bound sandstone block. (3.5 x 2 x 1m)	Rockbolt (RB 3 x 3m)	☐	☐	☐	☐	☑	☐	☐	☐

Feature No	Chainage	Height	Description	Remedial Action	Devegetation	Hand Scaling	Excavator Scaling	Long Reach Scaling	Rockbolting	Shotcrete Application	Buttress Construction	Reprofile
35	CH 84 to 105	0.0 to 9.0 m	Residual soil and extremely weathered sandstone on crestal 1 to 1.5m of cutting. Current batter, at approximately 76°, is too steep for this material. (21 x 1.5 x 2m)	Reprofile crestal soils and EW sandstone (~1.5m) to a batter of approximately 35° or less	☐	☐	☐	☐	☐	☐	☐	☑

Slope No 1969

Table B2

Stabilisation Works Provisional Quantities (October 2005)

Treatment Type	Quantity	Unit	Unit Rate $	Amount $
Devegetation				
Elevated access devegetation crew (1 tree cutter, 1 EWP)	1	nights		
Rope Access devegetation crew (2 climbers)	1	nights		
Crest Drain devegetation crew (1 climber)	0	days		
Grooming & Scaling				
Elevated access scaling crew (2 labour + hand tools)	5	nights		
Excavator (bucket + hammer)	1	nights		
Excavator (long reach)	1	nights		
Crest Cut-off drain cleaning/grooming (2 man crew + small excavator)	0	days		
Reprofiling				
Excavator (bucket)	2	nights		
Estimated material quantity (haulage & tipping)	210	m^3		
Supply and Installation of Grouted Rock Bolts				
Drilling rockbolt holes, 1.5m - 6m long	93	m		
Rock Bolts: Supply, assemble, install				
1.5	6	Each		
2	7	Each		
3	18	Each		
4	4	Each		
6	0	Each		
Face Plate:- Supply, Install, Disguise	35	Each		
Reinforced Shotcrete Treatment - Supply & Install				
Dowels - 16mm 400Y, 2m bent	204	Each		
Steel Reinforcement	307	m^2		
Weepholes. Slotted PVC Drainage Tube (30mm dia x 1.0m)	45	Each		
Drainage Strip	125	m		
Shotcrete	307	m^2		

Notes:

i) Maximum crest height is approximately 20m

Slope No 1969

Table B3

Stabilisation Works Provisional Costings (October 2005)

Treatment Type	Quantity	Unit	Unit Rate $	Amount $
Devegetation				
Elevated access devegetation crew (1 tree cutter, 1 EWP)	1	nights	$8,547	$8,547
Rope Access devegetation crew (2 climbers)	1	nights	$8,877	$8,877
Crest Drain devegetation crew (1 climber)	0	days	$4,422	$0
Grooming & Scaling				
Elevated access scaling crew (2 labour + hand tools)	5	nights	$8,415	$42,075
Excavator (bucket + hammer)	1	nights	$7,337	$7,337
Excavator (long reach)	1	nights	$9,262	$9,262
Crest Cut-off drain cleaning/grooming (2 man crew + small excavator)	0	days	$5,280	$0
Reprofiling				
Excavator (bucket)	2	nights	$6,737	$13,474
Estimated material quantity (haulage & tipping)	210	m^3	see note (iv)	
Supply and Installation of Grouted Rock Bolts				
Drilling rockbolt holes, 1.5m - 6m long	93	m	$260	$24,180
Rock Bolts: Supply, assemble, install				
1.5	6	Each	$330	$1,980
2	7	Each	$465	$3,255
3	18	Each	$560	$10,080
4	4	Each	$755	$3,020
6	0	Each	$1,040	$0
Face Plate:- Supply, Install, Disguise	35	Each	$140	$4,900
Reinforced Shotcrete Treatment - Supply & Install				
Dowels - 16mm 400Y, 2m bent	204	Each	$300	$61,200
Steel Reinforcement	307	m^2	$145	$44,515
Weepholes. Slotted PVC Drainage Tube (30mm dia x 1.0m)	45	Each	$120	$5,400
Drainage Strip	125	m	$52	$6,500
Shotcrete	307	m^2	$275	$84,425
TOTAL PROVISIONAL GEOTECHNICAL COSTS				**$339,027**
Estimated Logistics Allowance (see below) - additional 50% on costs				$169,514
Contigency Allowance - 25% of Total				$127,135
SUGGESTED GEOTECHNICAL BUDGET FOR CUTTING: (Rounded)				**$636,000**

Notes:

i) Cost estimates are inclusive of GST.

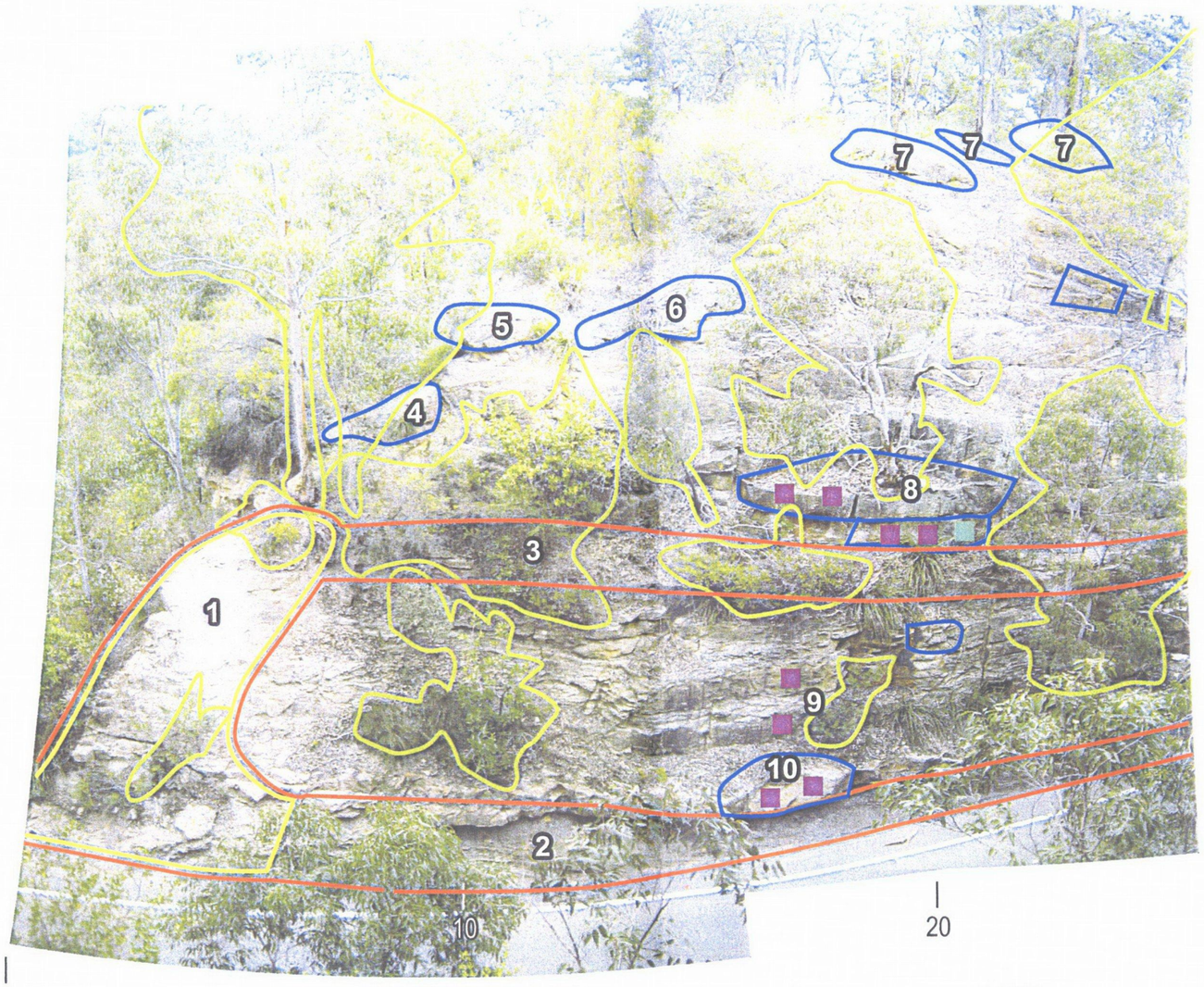
ii) Cost estimates should be confirmed through appropriate quotation processes using suitably experienced contractors.

iii) It has been assumed that multiple site activities will occur concurrently.

iv) Logistics allowances typically include traffic control, site management, consumables etc., but are exclusive of haulage and tipping fees

v) Maximum crest height is approximately 20m

Colour Photomosaic Plates



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

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SCALING & GROOMING

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SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

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6.

GHD LAM 2114200-00_LTN_08.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
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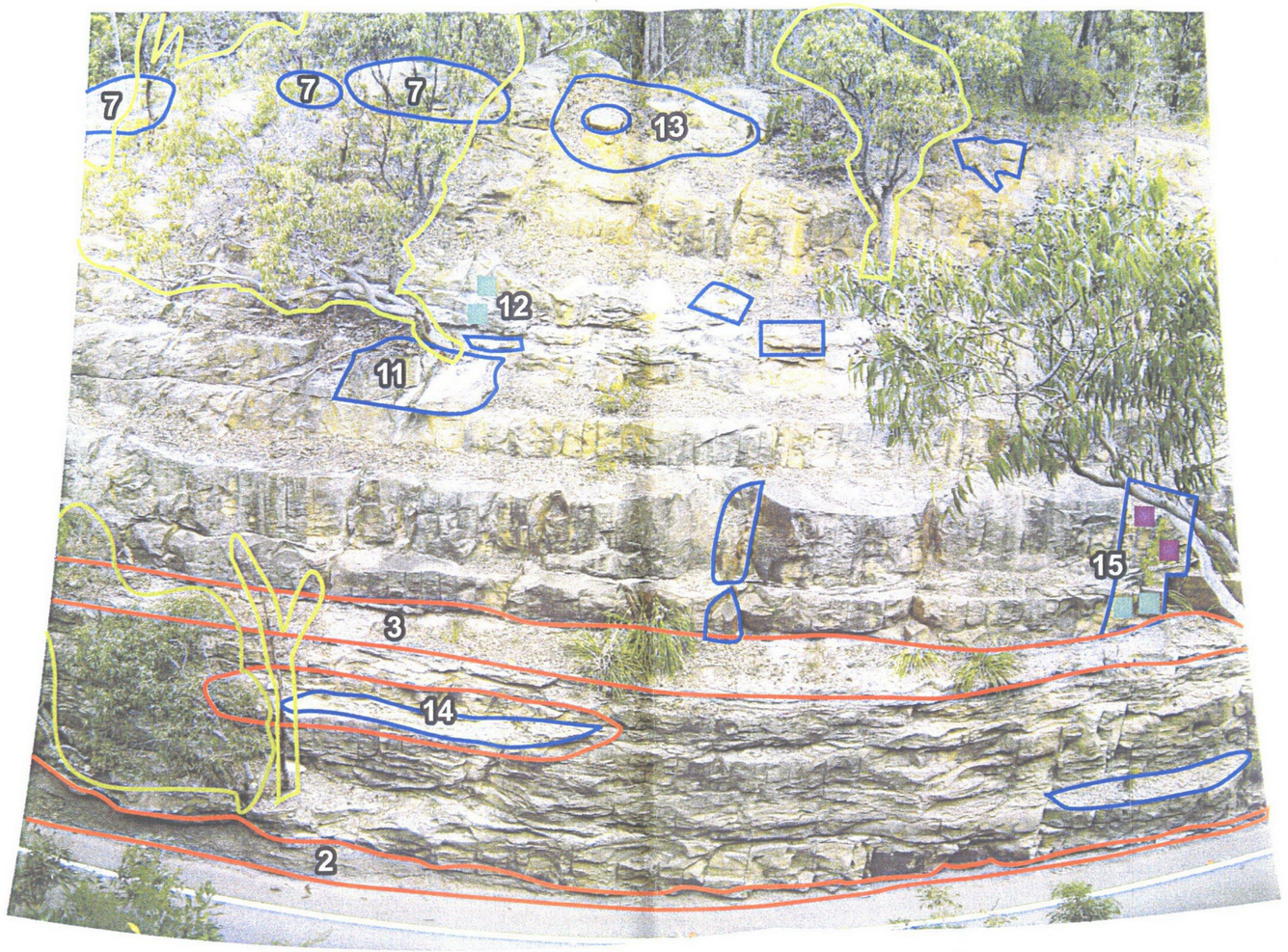
Plate No:	1 of 6



30 40

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6.

GHD LAM 2114200-00_LTN_09.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September
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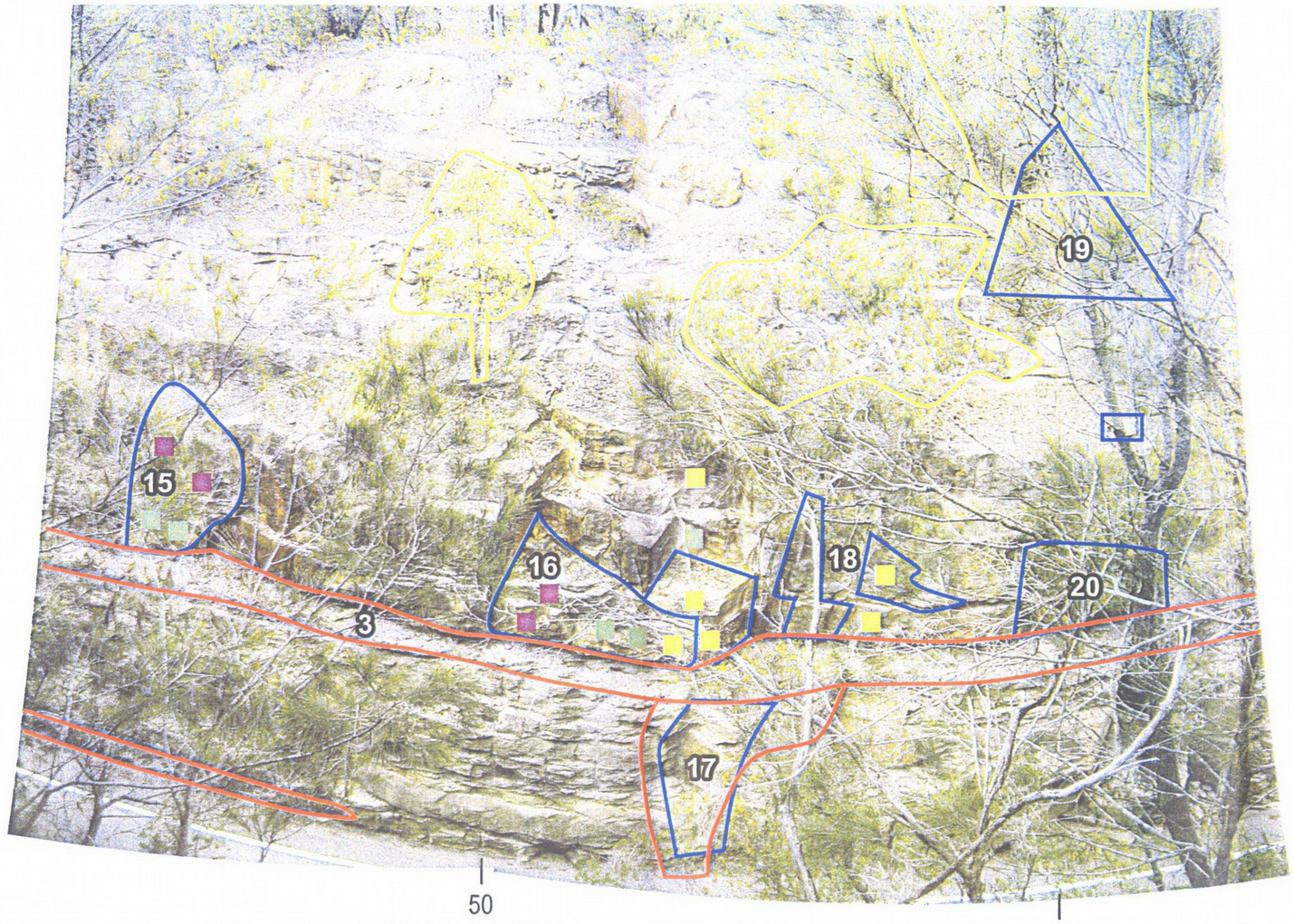

ROCKBOLTS

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- 2.0m LENGTH
- 3.0m LENGTH
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GHD LAA 2114200-00_LTN_10.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	3 of 6

60

70

ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LAM 2114200-00_LTN_11.cdr

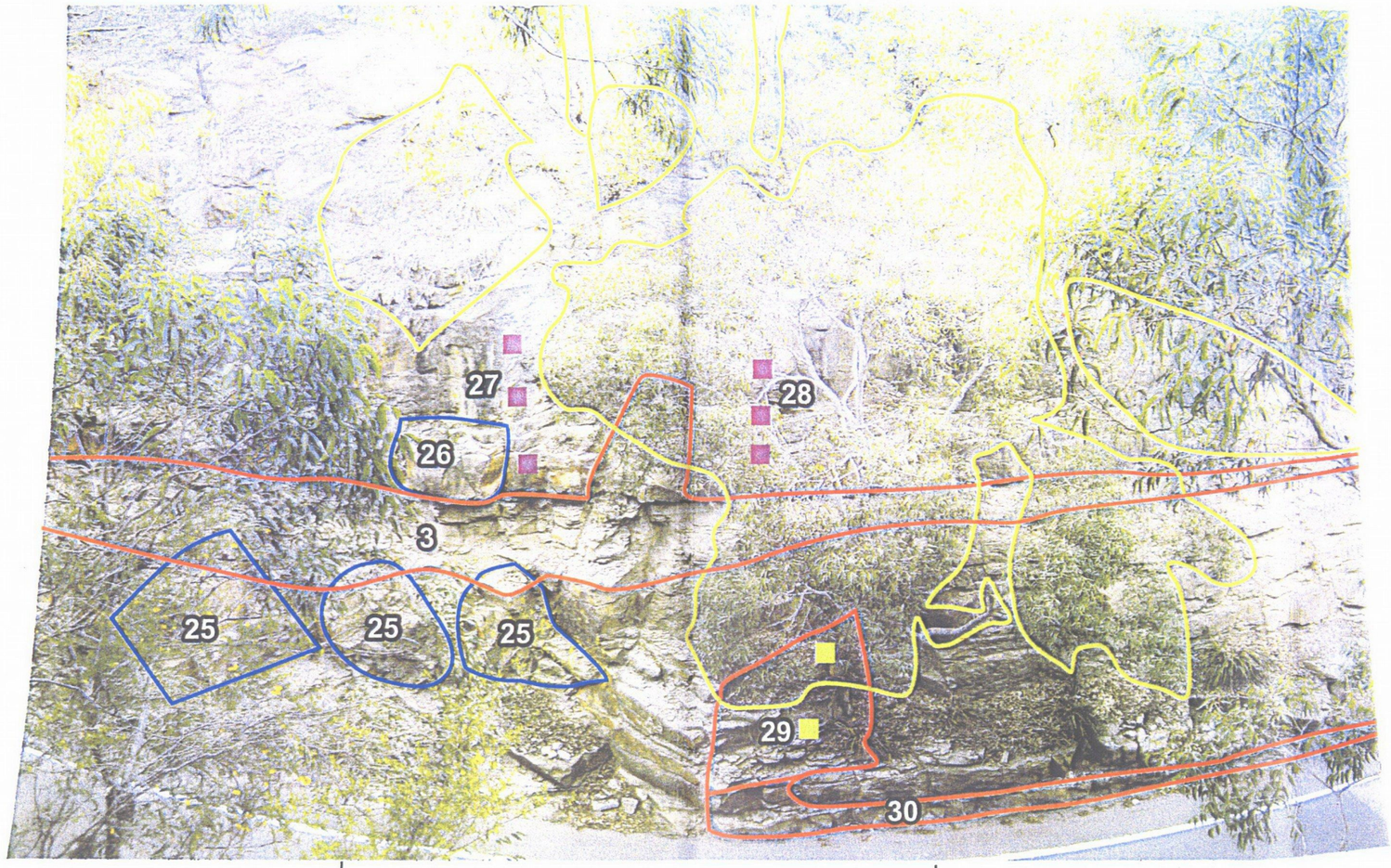
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	4 of 6



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

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Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

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1. Cutting reference chainages are marked at 10m intervals along base of cutting.
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3. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
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5. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.
6.

GHD LAM 2114200-00_LTN_12.cdr

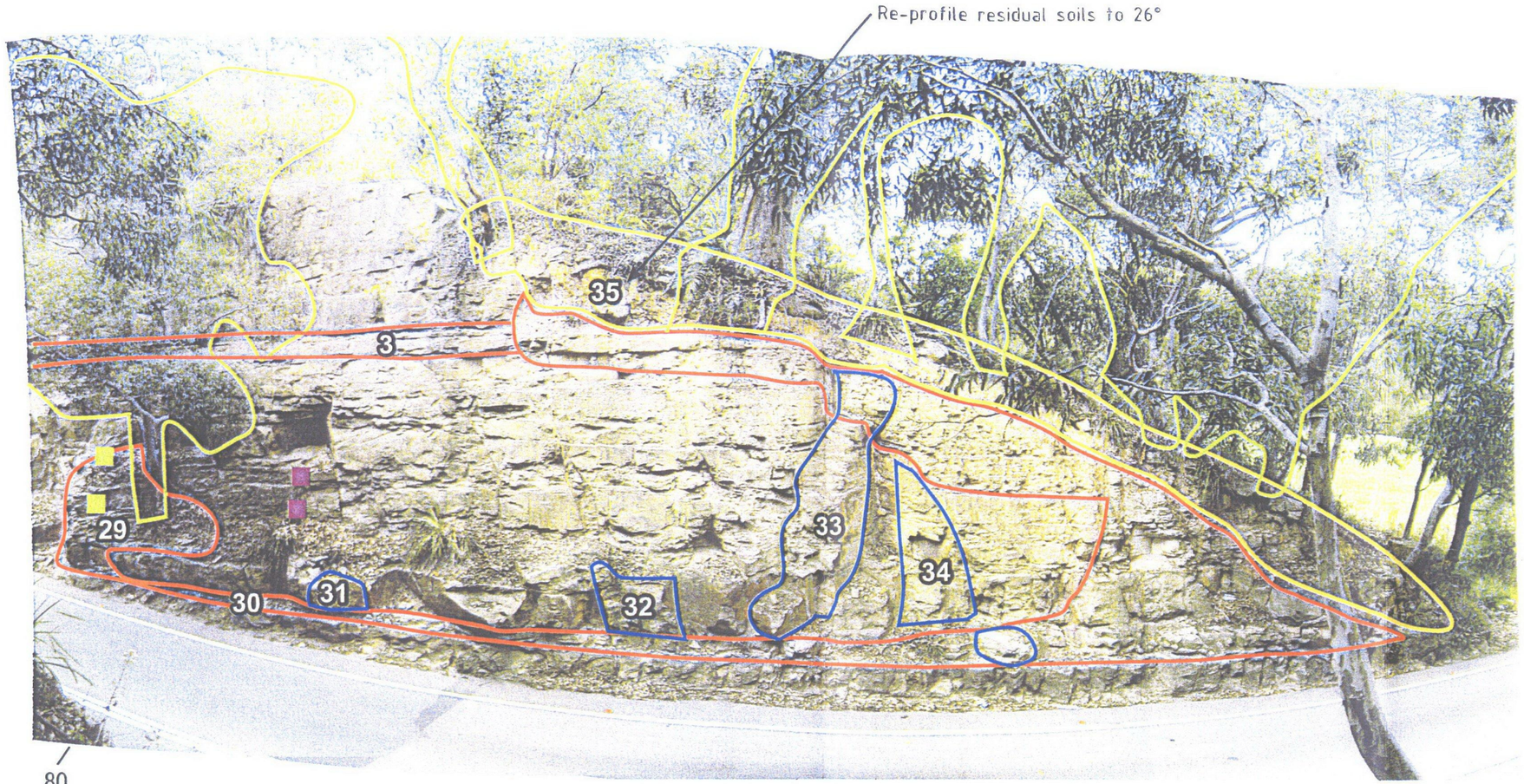
ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	5 of 6



ROCKBOLTS

- 1.5m LENGTH
- 2.0m LENGTH
- 3.0m LENGTH
- 4.0m LENGTH

Unless specified otherwise on site, all rockbolts to be installed perpendicular to cutting face and angled 15° below horizontal.

SCALING & GROOMING

Areas requiring selective devegetation and scaling/grooming as directed to remove loose or defached rock masses and soil accumulatons.

SHOTCRETE

Locations requiring application of mesh reinforced shotcrete with drainage pipes and/or strip drain provisions, for rock support and protection purposes. See accompanying report text.

DEVEGETATION

Areas requiring devegetation.

REPROFILING

Areas requiring reprofiling works to batter soil and/or weathered rock slopes to approx 35° or less as directed.

NOTES:

1. WARNING - Parallax distortion effects. Do not scale. Works boundaries are approximate.
2. Cutting reference chainages are marked at 10m intervals along base of cutting.
3. See accompanying report for treatment details and provisional quantities.
4. Areas that are delineated for shotcrete are to be scaled and groomed prior to shotcrete applications.
5. Rockbolts that are shown within areas that are delineated for scaling and grooming may be modified after hand and/or machine scaling, subject to geological assessment.
6. All stabilisation works are to be delineated, marked up and supervised by suitably experienced geotechnical personnel.

GHD LAM 2114200-00_LTN_13.cdr

ROADS & TRAFFIC AUTHORITY

HENRY LAWSON DRIVE, REVESBY HEIGHTS

ROCK CUTTING ID No. 1969

STABILISATION TREATMENT REQUIREMENTS

Job No:	21/14200
Revision No:	0
Photomosaic Date:	28 September 2005
Mark-up Date:	October 2005
Plate No:	6 of 6

Appendix D

Database Search Results

Australian Heritage Database

Search Results

edit search | new search | about the Australian Heritage Database | Heritage home | Australian Heritage Council home

12 results found.

Bankstown Airport Airport Av	Bankstown Airport, NSW	(Indicative Place) Register of the National Estate
Bankstown Elevated Reservoir No 7 Rosedale Av	Greenacre, NSW	(Indicative Place) Register of the National Estate
Bankstown Urban Conservation Area	Bankstown, NSW	(Indicative Place) Register of the National Estate
Georges River Wetlands Henry Lawson Dr	Padstow Heights, NSW	(Indicative Place) Register of the National Estate
Pipehead to Potts Hill Water Supply Woodville Rd	Guildford, NSW	(Indicative Place) Register of the National Estate
Potts Hill Reservoirs Rookwood Rd	Potts Hill, NSW	(Indicative Place) Register of the National Estate
Punchbowl Urban Conservation Area	Punchbowl, NSW	(Indicative Place) Register of the National Estate
Sefton Urban Conservation Area	Sefton, NSW	(Indicative Place) Register of the National Estate
The Homestead 1a Lionel St	Georges Hall, NSW	(Registered) Register of the National Estate
The Pressure Tunnel	Potts Hill Waterloo, NSW	(Indicative Place) Register of the National Estate
Villawood Immigration Centre Miowera Rd	Villawood, NSW	(Registered) Register of the National Estate
Villawood Immigration Centre Miowera Rd	Villawood, NSW	(Listed place) Commonwealth Heritage List

Report Produced: Thu Nov 17 12:57:07 2005

Australian Heritage Database

Place Details

edit search | new search | about the Australian Heritage Database | Heritage home | Australian Heritage Council home

Send Feedback

Georges River Wetlands, Henry Lawson Dr, Padstow Heights, NSW

Photographs: None
List: Register of the National Estate
Class: Natural
Legal Status: Indicative Place
Place ID: 18397
Place File No: 1/16/035/0011

Nominator's Statement of Significance:
The wetland areas of the Georges River corridor between the Milperra and Como bridges are remnants of the wetland system within the river prior to the widespread development on the banks of the river. These areas presently provide an important habitat resource for both native and migratory birds. The migratory birds recorded in the area listed in international agreements for their protection include waders: eastern golden plover (pluvalis DOMINICA), wimbrel (NUMENIUS PHAEOPUS), eastern curlew (N MADAGASCARIENSIS), grey tailed tattler (TRINGA brevibes), knot (caldris cantutus), sharp tailed sandpiper (C ACUMINATA), red necked stint (C RUFICOLLIS), curlew sandpiper (C ferrugines), bar tailed godwit (LIMOSA LAPPONICA), white egret (EGRETTA ALBA), ringed plover (C HIATICULA), Mongolian dotterel (C MONGOLUS), large dotterel (C LESCHENAULTII), Oriental dotterel (C ASIATICUS), grey plover (PLUVIALIS squatorola), little whimbrel (NUMENIUS MINUTUS), common sandpiper (TRINGA HYPOLEUCUS), terek sandpiper (XENUS CINEREUS), great knot (CALIDRIS teneuirostris), Baird's SANDPIPER (C BAIRDII), long toed stint (C Subminuata), sanderling (C ALBA), buff breasted sandpiper (TRYNGITES SUBRUFICOLLIS), broad billed sandpiper (LIMICOLA FALCINELLUS), black tailed godwit (LIMOSA LIMOSA); and birds of freshwater wetlands: cattle egret (ardeola IBIS), Japanese snipe (GALLINAGO harwickii), greenshank (TRINGA NEBULARIA), pectoral sandpiper (caldris MELANOTOS), ruff (PHILOMACHUS PUGNAX). The vegetation of the freshwater/brackish saltmarsh, reed swamps, casuarina and paperbark swamps include significant communities of the saltmarsh species JUNCUS KRAUSSII, existing only in the Georges River and Quibray Bay, but which were formerly more widespread in the Botany Bay area and two uncommon species: the sedge GAHNIA FILUM, previously unknown further north of Jervis Bay and WILSONIA BACKHOUSEI only found elsewhere in the region at Homebush Bay. The remnant wetlands provide important and accessible secondary and tertiary education teaching and research sites, which provide scope for long term comparative studies of ecological change, as well as supporting areas with a high visual significance of the urban component of the visual landscape. The aesthetic values of these remnant areas are rivalled only by the less accessible wetlands of the Hawkesbury/Nepean River System.

Official Values: Not Available

Description:

The Georges River corridor is made up of wetland areas of mangrove and saltmarsh communities. Almost every bay and inlet along the length of the river, below the limit of

tidal influence, supports at least a stand of mangroves and often saltmarsh/brackish wetlands as well. The soils of the wetland areas are made up generally of sand, loamy sand (in the JUNCUS saltmarshes) and silty loam (PHRAGMITES saltmarsh). Further up the river, the saltmarsh becomes tidally inundated. In the past many areas of saltmarsh and mangrove communities on the river have been lost to road construction, garbage disposal, developed parkland, residential areas, golf courses and industrial development. Little Cantello Reserve Estuarine area, including brackish wetlands on estuarine sediments and shallow marine to tidal flat areas. Williams Creek Estuarine areas, with alluvial quartz, lithic sand/clay of an abandoned channel. Voyager Point Floodplain wetland with black/dark shale and claystone/siltstone laminate lenses. Deepwater Park Floodplain wetland, on estuarine sediments and shallow marine tidal flat areas. Kelso Creek Estuarine area, on estuarine sediments and medium to coarse quartz sandstone. Stockade Reach Floodplain wetland, on quartz lithic sand/clay sediments. Deadman's Creek Estuarine area, on estuarine sediments and medium to coarse quartz sandstone. Yeramba Lagoon Estuarine area, silty to peaty quartz sand, silt and clay with medium to coarse quartz sandstone. Little Salt Pan Creek Estuarine area, silty to peaty quartz sand, silt and clay with black/dark grey shale laminate. Salt Pan Creek Estuarine area on silty to peaty quartz sand, with silt, clay and shell layers, as well as areas of black/grey shale, laminate with shallow marine to tidal flats. The creek supports large areas of mangroves (39.5ha) and some small areas of saltmarsh. Lugarno Foreshore Estuarine area, made up of sandy mud and muddy tidal flats. Edith Bay Estuarine area, made up of sandy mud and muddy tidal flats. Lime Kiln Bay Estuarine area, made up of sandy mud and muddy tidal flats. Gungah Bay Estuarine area, with silty to peaty quartz sand, silt and clay. No 225 Estuarine area, with silty to peaty quartz sand, silt and clay. No 226 Estuarine area, with silty to peaty quartz sand, silt and clay. Mill Creek Estuarine area, silty to peaty quartz sand, silt and clay with black/dark grey shale laminate. Mickey's Point Estuarine area, with silty to peaty quartz sand, silt and clay. Near Alford's Point Estuarine area, made up of sandy mud and muddy tidal flats. Little Moon Bay Estuarine area, made up of sandy mud and muddy tidal flats. Hurstville Bay Estuarine area, with silty to peaty quartz sand, silt and clay. Mangrove Island Estuarine area, made up of sandy mud and muddy tidal flats.

History: Not Available

Condition and Integrity:

Generally little or no disturbance to the wetland areas, some areas have limited clearing of margins or some reclamation.

Location:

Wetlands recognised in the Sydney Region Wetland Study between the Como Bridge and the Milperra Bridge on the Georges River.

Bibliography:

NATURE CONSERVATION COUNCIL (1989). WETLAND OF THE SYDNEY REGION - STAGE 1, NATIONAL ESTATE GRANTS PROGRAM.

MITCHELL, M.L. (1988). MANGROVES AND SALTMARSH BOUNDARIES ALONG THE GEORGES RIVER NSW. BSc (Hons) THESIS, SCHOOL OF BIOLOGICAL SCIENCES (BOTANY), NSW.

COLLINS, I.M. (1921). ON THE MANGROVE & SALTMARSH VEGETATION NEAR SYDNEY, NSW WITH SPECIAL REFERENCE TO CABBAGE TREE CREEK, PORT HACKING PROC. LINN. SOC NSW, 46: 376-92.

GOODKICK, G. (1970). A SURVEY OF WETLANDS OF COASTAL NSW. CSIRO DIV. OF WILDLIFE RESEARCH. TECH MEM NO 5.

PERKINS, B. (ED) (1986). EARLY SETTLERS OF THE ST GEORGE DISTRICT, VOL 1 & 2. ST GEORGE HISTORICAL SOCIETY.

SPCC (1978). WATER AND WADING BIRDS OF THE BOTANY BAY ESTUARY. BOTANY BAY SERIES NO 18.

SPCC (1979). WETLANDS OF BOTANY BAY AND ITS TIDAL WATER, BOTANY BAY

SERIES NO 6.

Report Produced: Thu Nov 17 12:58:58 2005

Click on the BACK button of your browser to return to the search.

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)	Listed Under Heritage Act
Bankstown Reservoir (Elevated)	Beresford Avenue	Bankstown	Bankstown	Yes
Homestead, The	1a Lionel Street	Georges Hall	Bankstown	Yes
Lansdowne Bridge	Hume Highway	Lansvale	Fairfield	Yes
Potts Hill Reservoirs 1 & 2 and Site	Cooper Street	Yagoona	Bankstown	Yes
Pressure Tunnel and Shafts		Potts Hill	Bankstown	Yes
Pressure Tunnel Shaft No.1 & associated infrastructure	Rookwood Road	Bankstown	Bankstown	Yes

There were **6** 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)
Accommodation House (Former)	109 Bankstown City Plaza	Bankstown	Bankstown	LGOV
Arches, The	33 Catherine Street	Punchbowl	Bankstown	LGOV
Bankstown Aerodrome	Marion Street	Georges Hall	Bankstown	LGOV

Bankstown Civic Centre	375 Chapel Road	Bankstown	Bankstown	LGOV
Bankstown Footbridge	At Station	Bankstown	Bankstown	SGOV
Bankstown Hotel	102 Bankstown City Plaza	Bankstown	Bankstown	LGOV
Bankstown Parcels Office (Former)	144B South Terrace	Bankstown	Bankstown	LGOV
Bankstown Primary School	61 Restwell Street	Bankstown	Bankstown	LGOV
Bankstown Railway platform building	143 North Terrace	Bankstown	Bankstown	LGOV
Bankstown Railway Platform Terminus Building	143 North Terrace	Bankstown	Bankstown	LGOV
Bankstown Reservoir (Elevated) (WS 0007)	Beresford Avenue	Bankstown	Bankstown	SGOV
Cairds Wharf		East Hills	Bankstown	LGOV
Campsie (Duke Street) Footbridge	Sydney Side Of Station At Duke Street	Campsie	Bankstown	SGOV
Campsie Footbridge	At Station	Campsie	Bankstown	SGOV
Cattle Duffers Flat	925 Henry Lawson Drive	Revesby	Bankstown	LGOV
Chester Hill Railway Station Group		Chester Hill	Bankstown	SGOV
Chullora Workshops		Chullora	Bankstown	SGOV
City Tunnel	Potts Hill Reservoir to Waterloo Pumping Station	Potts Hill To Waterloo	Bankstown	SGOV
City Tunnel	Potts Hill Reservoir to Waterloo Pumping Station	Potts Hill To Waterloo	Marrickville	SGOV
East Hills Reservoir (Elevated) (WS 0042)	Dilke Road	Padstow Heights	Bankstown	SGOV
Greenacre Public School	Waterloo Road	Greenacre	Bankstown	LGOV
Homestead, The	1a Lionel Street	Georges Hall	Bankstown	LGOV
House	59 Johnson Road	Bass Hill	Bankstown	LGOV
Hudson's Design Cottage	25 Old Kent Road	Greenacre	Bankstown	LGOV
Interwar brick house	525 Chapel Road	Bankstown	Bankstown	LGOV
Jackson's Royal Arms Inn (site)	2/2A Liverpool Road	Chullora	Bankstown	LGOV
Johnston Farmhouse site	Beatty Parade	Georges Hall	Bankstown	LGOV
Lakemba Footbridge	At Station	Lakemba	Bankstown	SGOV

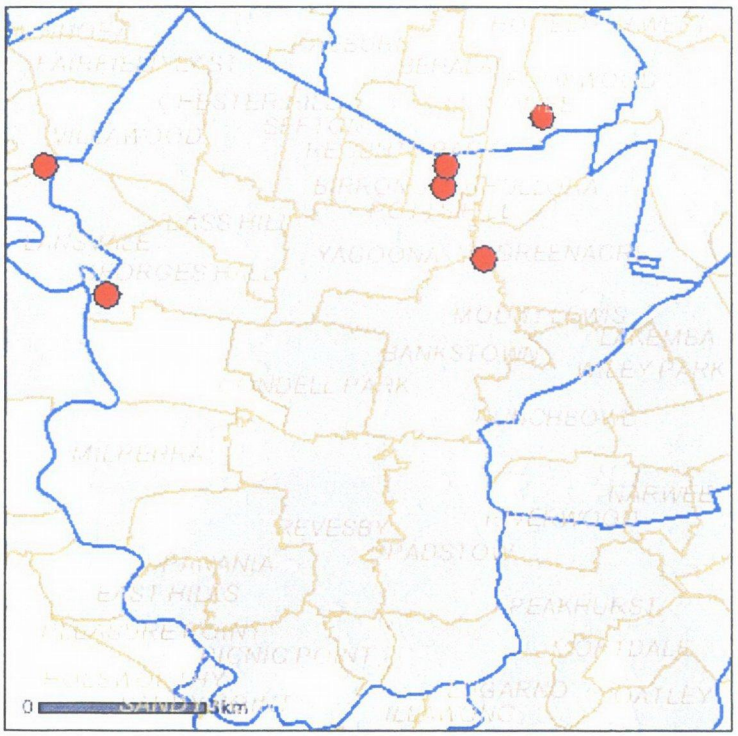
Lansdowne Bridge	Hume Highway	Lansvale	Bankstown	LGOV
Leightonfield Footbridge	At Station	Leightonfield	Bankstown	SGOV
Leightonfield Station Group		Leightonfield	Bankstown	SGOV
Methodist Hall	2 Mimosa Road	Greenacre	Bankstown	LGOV
Milestone	East of Henry Lawson Drive		Bankstown	LGOV
Milestone	South side Liverpool Road		Bankstown	LGOV
Milperra Soldier Settlement (Roads)		Milperra	Bankstown	LGOV
Nest, The	22 Vimy Street	Bankstown	Bankstown	LGOV
Padstow Station		Padstow	Bankstown	SGOV
Pah, The	4 Tompson Road	Revesby	Bankstown	LGOV
Panania Station		Panania	Bankstown	SGOV
Pipehead to Potts Hill Pipelines	Frank Street (Pipehead) to Cooper Road (Potts Hill)	Guildford West To Birrong Via Sefton	Bankstown	SGOV
Pipeline (water)		Potts Hill	Bankstown	LGOV
Potts Hill - Crown St 48"/42" Mains	Pipeline easement	Potts Hill To Waterloo (Via Greenacre,ashfield,pet	Sydney	SGOV
Potts Hill Booster Station (WP0004)	Rookwood Road	Potts Hill	Bankstown	SGOV
Potts Hill Pumping Station (remains)	Rookwood Road	Potts Hill	Bankstown	SGOV
Potts Hill Reservoir	146 Rookwood Road	Yagoona	Bankstown	LGOV
Potts Hill Reservoirs Site	Cooper Street	Birrong	Bankstown	SGOV
Pressure Tunnel and Shafts	Potts Hill Road to Waterloo Pumping Station	Potts Hill To Waterloo	Bankstown	SGOV
Pugh's Crooked Billett Inn (Site)	724-736 Liverpool Road	Yagoona	Bankstown	LGOV
Punchbowl Footbridge	At Station	Punchbowl	Bankstown	SGOV
Ranah/The Ranch (Site)	Allder Park	Sefton	Bankstown	LGOV
Regents Park Footbridge	At Station	Regents Park	Bankstown	SGOV
Regents Park Public School	Bagdad Road	Regents Park	Bankstown	LGOV
Revesby Public School	84 The River Road	Revesby	Bankstown	LGOV

Click on the BACK button of your browser to return to the search.

Items listed on the State Heritage Register

Use these tools to zoom in & out and navigate around the map.

Approximate Distance km



The items matching your search criteria are shown as red dots in the map.

Move your mouse over a red dot to see the name of the item.

Click on a red dot in the map, or a name in the list below, to see the information page for that item.

Legend
- SHR Item location
- LGA Boundaries
- Suburb Boundaries
- Land Parcels

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)	SHR Number (sort)
Bankstown Reservoir (Elevated)	Beresford Avenue	Bankstown	Bankstown	01316
Homestead, The	1a Lionel Street	Georges Hall	Bankstown	00448
Lansdowne Bridge	Hume Highway	Lansvale	Fairfield	01472
Potts Hill Reservoirs 1 & 2 and Site	Cooper Street	Yagoona	Bankstown	01333
Pressure Tunnel and Shafts		Potts Hill	Bankstown	01630
Pressure Tunnel Shaft No.1 & associated infrastructure	Rookwood	Bankstown	Bankstown	01334

Road

There was a total of **6** records matching your search criteria.

Note: The Heritage Office seeks to keep the State Heritage Register (SHR) up to date, however the latest listings may not yet be included. Always check with the NSW Heritage Office for the most recent listings.

Schedule 6

Bankstown Local Environmental Plan 2001

Schedule 6 Heritage items

(Schedule 1)

Note. An asterisk (*) identifies an archaeological site.

No	Street	Suburb	Lot	DP No	Description
77	Anderson Avenue	Panania	A, B and C	35652	Schwarzel Monument, 1937, in library grounds
2a	Bagdad Road	Regents Park	12 1 1 2 1 83–85	733976 121450 794886 794490 794886 8962	Regents Park Primary School, 1899
102	Bankstown City Plaza	Bankstown	A and B	343521	Bankstown Hotel, 1922
109	Bankstown City Plaza	Bankstown	1	119533	Shop—original Accommodation House, 1908
143 (Railway land)	Bankstown City Plaza	Bankstown	20	873506	Bankstown Railway Station Platform
143 (Railway land)	Bankstown City Plaza	Bankstown	20	873506	Bankstown Railway Platform Building, 1908
144B	Bankstown City Plaza	Bankstown	1	182368	Bankstown Parcels Office
(Road)	Bullecourt Avenue, Fleurbaix Avenue, Ashford Avenue	Milperra			Former Milperra Soldier Settlement
33	Catherine Street	Punchbowl	40 Y	8422 393602	"The Arches", Arts and Crafts Bungalow
346	Chapel Road	Bankstown	1–3	102240	Rosen Chambers, 1922
375	Chapel Road	Bankstown	6	777510	Council Chambers, 1960's
525	Chapel Road	Bankstown	1 51, Section A	314457 7058 SP 58821	Interwar brick house, 1922
574	East Hills Park	East Hills	C	10546–2030	Caird's Wharf*
	Edith Street	Lansdowne	277	11759	"Landsdowne", house
31	Ferndale Road	Revesby	1	212354	"Ferndale Cottage", house
925	Henry Lawson Drive	Revesby	45–47 Section 10 Part Portion 86	Volume 7345 Folio 63	Cattle Duffer's Flat* in Georges River State Recreation Area
49	Hill Road	Birrong	B	400155	"Allder's Farmhouse", house
2A	Hume Highway	Chullora	1	547215	Site of Jackson's "Royal

2			12	834734	Arms Inn"*
300	Hume Highway	Bankstown	1 1 and 2	744542 834597	Water Reservoir, at Stacey Street intersection*
321	Hume Highway	Bankstown	3–5 A and B	703355 347099	Site of Colls' "Speed the Plough Inn" Wood Park*
347A (Cemetery)	Hume Highway	Bankstown	12 1 1 and 2	132512 132513 726443	St Felix Cemetery*
361	Hume Highway	Bankstown	5	9522	Shop—Meredith Street corner, 1919
363	Hume Highway	Bankstown	3	9522	Shop—Meredith Street corner, 1919
401	Hume Highway	Yagoona	D	392202	Formerly J.B. Brancourt's garage First car showroom, 1924
656	Hume Highway	Yagoona		SP 60927	Site of the "Globe Inn"*
724–734	Hume Highway	Yagoona	25–38	13125	Site of Pugh's "Crooked Billet Inn"*
885	Hume Highway	Bass Hill	259	230871	Milestone south side, east of Farrell Street (east) "Sydney XV Liverpool VI"
(Milestone)	Hume Highway	Villawood		11759	Milestone south side, east of Henry Lawson Drive "Sydney XVI Liverpool V"
59	Johnson Road	Bass Hill	2A	405520	House, c 1900 in grounds of Crest Baptist Church
1A	Lionel Street	Georges Hall	101	827530	Johnston Farmhouse site*
1A	Lionel Street	Georges Hall	101	827530	Early Georgian stone house "The Homestead"
76	Miller Road	Chester Hill	1	538474	Westbridge Migrant Hostel 1949
345	Milperra Road	Georges Hall	1–3	623875	Bankstown Aerodrome
2	Mimosa Road	Greenacre	1	170971	Methodist hall, 1920's
25	Old Kent Road	Greenacre	A	350074	House
76–78	Powell Street	Yagoona	5	25154	House, formerly a convent and police station
	Regents Park Station	Regents Park	12	10007007	Sefton Junction Sub-station and signal box, c 1924
61	Restwell Street	Bankstown	1 2–7, Section 1	516930 13167	Bankstown Primary School, 1920's
201 (Allder Park)	Rodd Street	Sefton	2 and 3824	430031	Site of Tower's "Ranah/The Ranch"*
50	Rookwood Road	Yagoona	C	365541	"Carinya", house
146	Rookwood Road	Yagoona	2	225818	Potts Hill Reservoir including Reservoirs Nos 1 and 2, 1880's–1922
290	South Terrace	Bankstown	6	525238	First floor shop facade
26	Stanley Street	Bankstown	1	5993050	Brick Baptist Church, 1920
2	Sussman Avenue	Bass Hill	27	31109	"Carysfield Hall", house
84	The River Road	Revesby	17, 18, 21–24	2343	Revesby Primary School

			and 45–48, Section 10 1 1 2	122996 181955 122996	
4	Tompson Road	Revesby	1	777621	"The Pah" Victorian house rendered brick, c 1896
10	Vimy Street	Bankstown	46	13055	WSHC house "Weymouth"
22	Vimy Street	Bankstown	40	13055	WSHC house "The Nest"
105	Waterloo Road	Greenacre	1 303 39–44 and 357	169574 820522 11603	Greenacre Public School
357	Waterloo Road	Greenacre	4	601166	Site of Liebentritt's Pottery*
65	William Street	Condell Park	A	403745	Corner Store
141	William Street	Bankstown	100	792380	West Bankstown Public School
Pipeline	1A Woodville Road/ 1 Campbell Hill Road/61A, 61B and 61C Priam Street/ 7 Hector Street/ 1 and 2A Chisholm Road/ 1A Auburn Road/ 227 Rookwood Road	Bankstown	Part 1 Part 1 A and B 2 and Part 3 Part 1 Part 1 Part 1 Part 1	225815 225816 328385 225816 623945 225817 610313 745651	Water pipeline along northern boundary 1885*

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Sydney region

Sydney Region

Aerial Camera Equipment	4309002
Aerial Camera Negatives and Viewer	4309022
Automatic Level	4309011
Berowra Creek Bridge	4309509
Blaze Tree	4300718
Boundary Marker	4300731
Bridge No. 3 over Middle Creek	4309503
Bronze Bracketed Lanterns	4300730
Calliper Gauge Equipment	4309008
Circumferentor	4300715
Commemorative Key and Signatures	4309005
Continuous Thermometer	4309010
CTS 4 1/2 Inch Vernier Theodolite	4300716
Deadmans Creek Bridge	4309505
Decorative Glass Butter Dish	4300712
Deep Creek Bridge	4309504
Dial Gauge	4300725
Digital radar recorder	4309004
DMR Film Library	4300710
DMT Rosebery Plaque	4309018
Door	4309021
Draughting Machine	4300722
Drawing Equipment	4300720
Eastern Creek Bridge	4309513
ER Watts Abney Level	4300717
Fifty Link Gunter's Chain	4300714
Framed Notice	4309017
Framed Portrait Photo Series	4309029
Ganger's Timebook	4300705
Gasworks Bridge over Parramatta River	4301684
Gillespie's Land Surveying - Book	4300707
Gladesville Bridge	4300309
Glebe Island Bridge	4301666
Gwawley Bay Landscape Conservation Area	4309050
Handwritten Notebooks	4300706
Hawkesbury River Bridge	4309511
Historic Photographs	4309023
Honour Board	4309028
Honour Rolls	4302670
House - 164 Ramsay St, Haberfield	4301006
House - 46 Martin Street, Haberfield	4301007
House - Thalia	4309662
Interactive Model	4309016

In This Section
- Hunter region
- Northern region
- South West region
- Southern region
- Sydney region
- Western region

Department of
Environment
and Conservation (NSW)

Your reference : Henry Lawson Drive
Our reference : AHIMS #14495

RTA - Environment Technology/Parramatta
Po Box 3035
Parramatta NSW 2150

Thursday, 01 December 2005

Attention: Alison Nash

Dear Sir or Madam:

Re: AHIMS Search for the following area at Henry Lawson Drive between the River Road and Boomerang Park at Revesby Heights;Z:56;E:316935.86;N:6239055.16

I am writing in response to your recent inquiry in respect to Aboriginal objects and Aboriginal places registered with the NSW Department of Environment and Conservation (DEC) at the above location.

A search of the DEC Aboriginal Heritage Information Management System (AHIMS) has shown that *11* 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 DEC;
- 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 DEC 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 DEC Director-General. An Aboriginal object is considered to be known if:

- It is registered on AHIMS;
- It is known to the Aboriginal community; or

PO Box 1967 Hurstville NSW 2220
43 Bridge Street Hurstville NSW 2220

Telephone (02) 9585 6345
Facsimile (02) 9585 6094

ABN 30 841 387 271
ahims@environment.nsw.gov.au
www.environment.nsw.gov.au

- It is located during an investigation of the area conducted for a development application.

If you considering undertaking a development activity in the area subject to the AHIMS search, DEC 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

Wright, David
Administrator
Information Systems Section
Cultural Heritage Division
Phone: 02 9585 6471
Fax: 02 9585 6094

Australian Government
Department of the Environment and Heritage

Protected Matters Search Tool

You are here: DEH Home > EPBC Act > Search

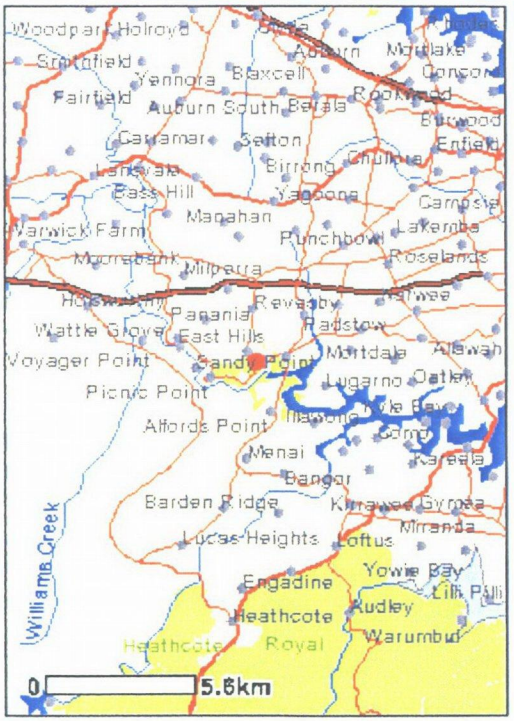
17 November 2005 13:32

EPBC Act Protected Matters Report

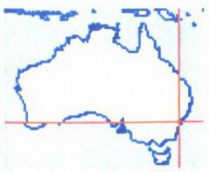
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the 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:	Point
Buffer:	10 km
Coordinates:	-33.9731,151.01910



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:	None
National Heritage Places:	None
Wetlands of International Significance: **(Ramsar Sites)**	1
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	3
Threatened Species:	28
Migratory Species:	9

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:	8
Commonwealth Heritage Places:	2
Places on the RNE:	8
Listed Marine Species:	13
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

Wetlands of International Significance [Dataset Information] (Ramsar Sites)		
TOWRA POINT NATURE RESERVE		Within 10 km of Ramsar site
Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Cumberland Plain Woodlands	Endangered	Species or species habitat likely to occur within area
Shale/Sandstone Transition Forest	Endangered	Species or species habitat likely to occur within area
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically Endangered	Species or species habitat likely to occur within area
Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Neophema chrysogaster * Orange-bellied 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		
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
Litoria aurea * Green and Golden Bell Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus * Stuttering Frog, Southern Barred Frog (in Victoria)	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
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 bynoeana * Bynoe's Wattle, Tiny Wattle	Vulnerable	Species or species habitat likely to occur within area
Acacia pubescens * Downy Wattle, Hairy Stemmed Wattle	Vulnerable	Species or species habitat likely to occur within area
Astrotricha crassifolia *	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
Cryptostylis hunteriana * Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Deyeuxia appressa *	Endangered	Species or species habitat likely to occur within area
Eucalyptus camfieldii * Camfield's Stringybark	Vulnerable	Species or species habitat likely to occur within area
*Grevillea parviflora subsp. parviflora**	Vulnerable	Species or species habitat likely to occur within area
Melaleuca deanei *	Vulnerable	Species or species habitat likely to

Deane's Melaleuca		occur within area
Persoonia nutans *	Endangered	Species or species habitat likely to occur within area
Pimelea spicata *	Endangered	Species or species habitat may occur within area
Pterostylis saxicola * Sydney Plains Greenhood	Endangered	Species or species habitat likely to occur within area
Thesium australe * Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Migratory	Species or species habitat may 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 Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Listed - overfly marine area	Species or species habitat may 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]

Commonwealth Trading Bank of Australia

Communications, Information Technology and the Arts - Australian Postal Corporation

Communications, Information Technology and the Arts - Telstra Corporation Limited

Defence

Defence - Defence Housing Authority

Education, Science and Training - Australian Nuclear Science and Technology Organisation

Transport and Regional Services - Airservices Australia

Unknown

Commonwealth Heritage Places [Dataset Information]

Cubbitch Barta National Estate Area NSW

Old Army / Internment Camp Group Holsworthy NSW

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

Como Rail Bridge NSW

Old Army / Internment Camp Group Holsworthy NSW

The Homestead NSW

Indigenous

Cubbitch Barta National Estate Area NSW

Woronora Area NSW

Natural

Enfield Brickpits NSW

Royal National Park (1977 boundary) NSW

Voyager Point NSW

Extra Information

State and Territory Reserves [Dataset Information]

Georges River National Park, NSW

Royal 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

search & map species | taxonomic search | feedback

BioNet

Tools

Zoom In
Zoom Out
Center Map
Specimen Info
Area Info
Full Screen Map
Redraw Map

Map Scale 1:145782

Map Groups

Show Open

- [x] Map Group 1
  - Carcharias taurus(AMPub)
  - Paraplesiops bleekeri (AMPub)

All Groups: Open/Close

Record Visibility

- ( ) All NSW records
- (•) SUTHERLAND only

Layers

Active	Show	
	[ ]	Sat Image
	[x]	Topographic
	[ ]	NSW Boundary
(•)	[ ]	Bioregions
( )	[ ]	Botanic Subdiv
( )	[ ]	Mapsheets
( )	[x]	LGA
( )	[ ]	Nat Parks
( )	[ ]	State Forest
( )	[ ]	CMA
( )	[ ]	Rivers
( )	[ ]	Roads
( )	[ ]	Towns

Collections

Show

- [x] Aust Museum
- [x] Nat Parks
- [x] Fisheries
- [x] State Forests
- [ ] Botanic Gardens

search & map species | taxonomic search | feedback

Bio

Add species to map groups

Selected Area: National Park - GEORGES RIVER SCA
Search Type: Fauna
Agencies: NSW Fisheries, National Parks & Wildlife Service
Search Term: Fish

No collections records for the species you searched for were found. Please return to the previous

Go Back

NSW DEPARTMENT OF PRIMARY INDUSTRIES | AGRICULTURE

Noxious weed declarations in NSW

Bankstown

The following weeds are declared noxious in the Bankstown control area. The 'details' link on each listing pro information on the legal requirements of the weed's listing and any variation in status within the local control list of all weeds in all control areas is also available as a PDF document.

Common name	Scientific name	Category	
Alligator weed	*Alternanthera philoxeroides*	W1	details
Bitou bush Boneseed	*Chrysanthemoides monilifera*	W3	details
Black knapweed	*Centaurea nigra*	W1	details
Blackberry	*Rubus fruticosus (agg. spp.)*	W2	details
Broomrape	*Orobanche spp.*	W1	details
Cabomba	*Cabomba spp.*	W4g	details
Castor oil plant	*Ricinus communis*	W2	details
Green cestrum	*Cestrum parqui*	W2	details
Harrisia cactus	*Harrisia spp.*	W4f	details
Hawkweed	*Hieracium spp.*	W1	details
Horsetail	*Equisetum spp.*	W1	details
Karroo thorn	*Acacia karroo*	W1	details
Kochia	*Kochia scoparia*	W1	details
Lagarosiphon	*Lagarosiphon major*	W1	details
Lantana (Pink flowered)	*Lantana camara*	W2	details
Lantana (Red flowered)	*Lantana camara*	W2	details
Ludwigia	*Ludwigia peruviana*	W2	details
Mexican feather grass	*Nassella tenuissima syn Stipa tenuissima*	W1	details
Miconia	*Miconia spp.*	W1	details
Pampas grass	*Cortaderia spp.*	W2	details
Parthenium weed	*Parthenium hysterophorus*	W1	details
Pellitory	*Parietaria judaica*	W3	details
Prickly pears	*Opuntia spp.*	W4f	details
Rhus tree	*Toxicodendron succedaneum*	W2	details
Salvinia	*Salvinia molesta*	W1	details
Senegal tea plant	*Gymnocoronis spilanthoides*	W1	details
Siam weed	*Chromolaena odorata*	W1	details
Spotted knapweed	*Centaurea maculosa*	W1	details
St John's wort	*Hypericum perforatum*	W2	details
Water hyacinth	*Eichhornia crassipes*	W1	details
Water lettuce	*Pistia stratiotes*	W1	details

Willows	*Salix spp.*	W4g	details

Return to start page

Management overview
Site auditor scheme
Guidelines under the CLM Act
Record of EPA notices
Engaging a consultant
Information for the assessment of former gasworks sites
Frequently asked questions
More information about land

Search results

Your search for: LGA: Bankstown City Council Matched 13 notices relating to 5 sites.

SearchAgain RefineSearch

Suburb	Address	Site Name	Notices related to this site
Chester Hill	127 Orchard Road	Former Orica Factory - Chester Hill	1 current
Revesby	33 Violet Street	Bituminous Products	1 current
Revesby	21 Marigold Street	Mirotone Pty Ltd	1 current
Villawood	49-59 Miowera Road	Former Westinghouse Factory	1 current and 7 former
Villawood	2 Christina Road	Orica Villawood Plant	2 current

Page 1 of 1

Print-friendly version

17 November 2005

Air

Air home

What's new

Air quality

- Air quality data
- Regional pollution index
- 24-hour summary
- Historical RPI data
- Air quality monitoring reports
- Monitoring sites
- NSW Ambient Air Quality Monitoring Plan
- About No Burn notices
- Woodsmoke

Air toxics

Emissions monitoring

Odour

Pesticides

Reporting pollution & smoky vehicles

24-hour summary

of pollutant concentrations measured at air quality monitoring sites

Previous day's 24-hour summary
Map: air quality monitoring site network
About the 24-hour summary and how the data are calculated

Monday 5 December 2005 00:00 - 23:00

Pollutant concentrations that exceed the standard or goal are highlighted.

	Ozone	Nitrogen dioxide	Visibility	Carbon monoxide	Sulfur dioxide	Particles PM_{10}
Measured concentrations	**maximum 1-hour average**	**maximum 1-hour average**	**maximum 1-hour average**	**maximum 8-hour average**	**maximum 1-hour average**	**24-hour average**
Standard or goal	**10 pphm**	**12 pphm**	**2.1 B_{sp}**	**9 ppm**	**20 pphm**	**50 µg/m^3**
Central East Sydney						
CHULLORA	3.8	2.6	0.5	0.2	0.3	41.6
EARLWOOD	3	2.7	0.5			37.5
RANDWICK	3	2.8	0.6		0.2	34.4
ROZELLE	3.4	1.9	0.4	0.2		40.3
North West Sydney						
RICHMOND	4.9	1.7	0.4		0.3	24
ST MARYS	3.9	2.1	0.4			37.9
VINEYARD	4.8	1.6	0.4		0.3	28.3
South West Sydney						
BARGO	3.5	2.3	0.6		0.2	
BRINGELLY	4.5	0.8	0.4		0	30.2
LIVERPOOL	4.1	2.3	0.4	0.2		36.4
MACARTHUR	4.1	2.5	0.4	0.2	0.2	30.4
OAKDALE	5.4	0.5	0.4			28.8
Illawarra						
KEMBLA GRANGE	3.4	1.9	0.3			35.4
WARRAWONG						

	2.7	2.3	0.8		3.3	46.4
WOLLONGONG	2.9	0.9	0.5	0.2	0.1	34.9
Lower Hunter						
BERESFIELD	1	1.9	0.3			25.4
WALLSEND	6.2	1.7	0.4		1.4	23.9
Central Tablelands						
BATHURST	3.8					
South West Slopes						
ALBURY						23.3
WAGGA WAGGA						28
North West Slopes						
TAMWORTH						14.9

Disclaimer: The data used in the compilation of this page have undergone only preliminary quality assurance checks. These data may require modification during final stages of validation as a result of calibration changes, power failures, instrument failures etc.

Definitions:

- **Standard or goal** - are the standards set by the National Environment Protection Measure (NEPM), except for visibility which uses a goal set by the NSW EPA.
- **PM_{10}** = particles less than 10 micrometers in diameter
- **B_{sp}** = coefficient of light scattering due to particles. The lower the Bsp value, the lower the level of suspended particles and the better the visibility. The EPA one-hour visibility goal, 2.1 B_{sp}, corresponds to a visual distance of approximately 9 kilometres.
- **ppm** = parts per million by volume, i.e. parts of pollutant per million parts of air
- **pphm** = parts per hundred million by volume, i.e. parts of pollutant per hundred million parts of air
- **µg/m^3** = micrograms per cubic metre, i.e. mass of pollutant per volume of air

7 December 2001




Send feedback
Service charter

Emission report

You are here: NPI Home > Database Search

17 November 2005 13:20

NPI location report - All sources: Postcode 2212

The National Pollutant Inventory (NPI) has pollutant emissions from various industrial facility sources, and diffuse sources. Diffuse sources are from small facilities, transport and households.

This report includes data for industrial facilities and diffuse sources (if available for this region) for the 2003 - 2004 NPI reporting year for the region selected.

Detail

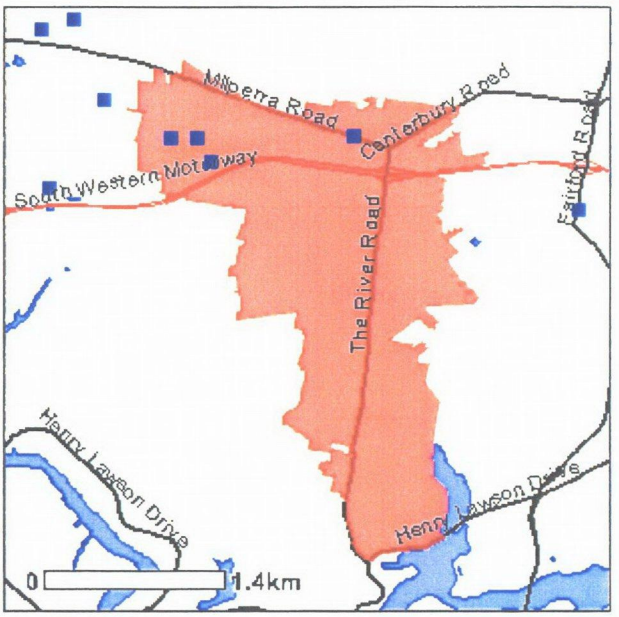
- Summary
- Top sources by substance

Other reports for this region are below.

- Location report for industry facility sources only
- Location report for diffuse sources only (if available)
- Emissions from individual facilities

How we live impacts pollutant emissions. There are actions we can all take to decrease pollution.

- What you can do to decrease pollution
- Using and interpreting NPI data
- Disclaimer has further information about the use of NPI data.

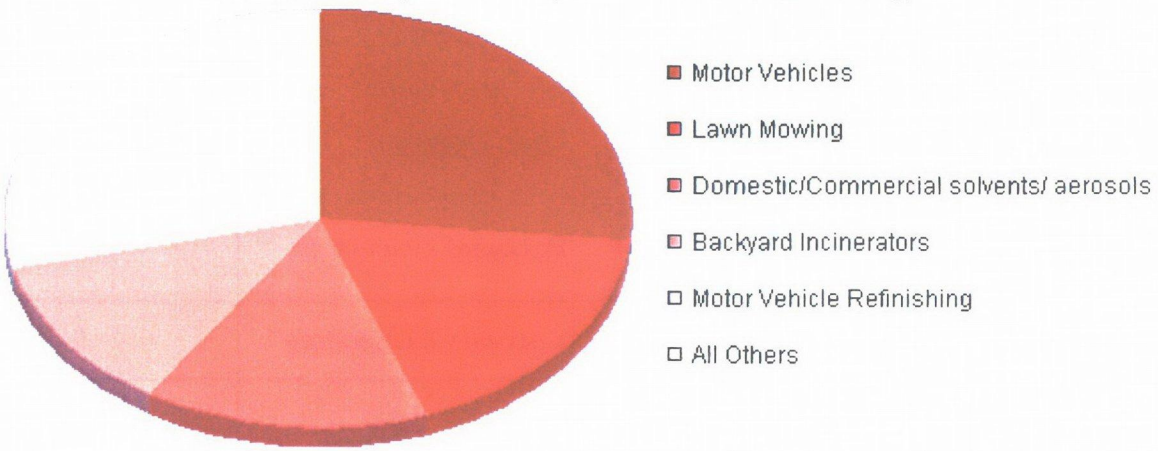


Map of Postcode 2212
NPI facilities are shown as ■

Summary

- 34 substances from 23 sources were found.
- 4 facilities reported to the NPI.
- Diffuse data was collected for 19 sources.
- Indicative top sources 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 during the first three reporting years.
- Table 1 substances that industrial reporters had to consider for the first three reporting years

Indicative Top Sources (Table 1 Substances Only)

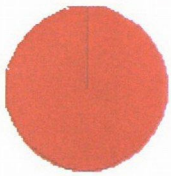
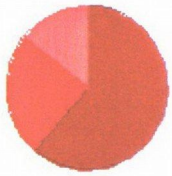
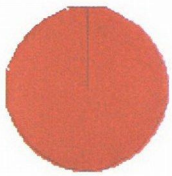
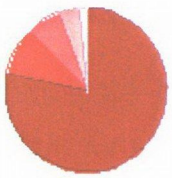
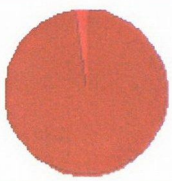


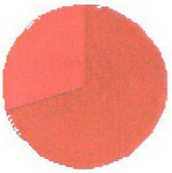
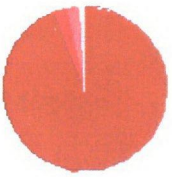
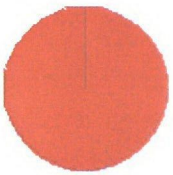
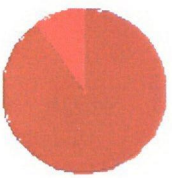
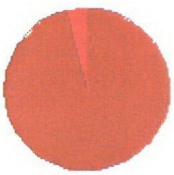
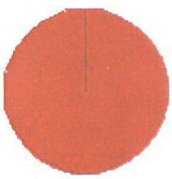
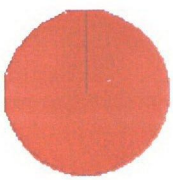
The top sources pie chart above gives a broad snapshot of NPI emissions in this region. The chart is derived by converting each emission into proportional units and then summing the proportional units. This calculation does not account for any variation in toxicity or ground level concentration of these substances.

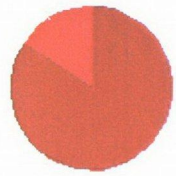
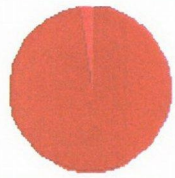
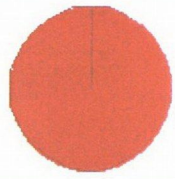
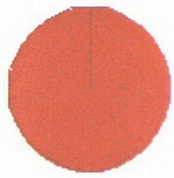
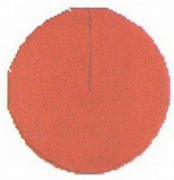
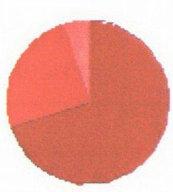
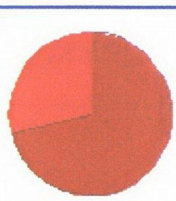
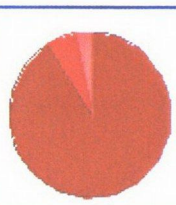
For more information, refer to individual substances in the table below.

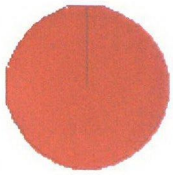
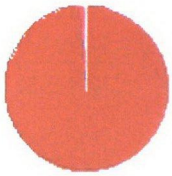
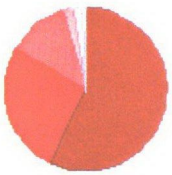
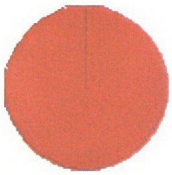
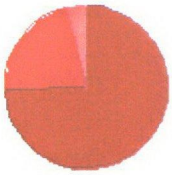
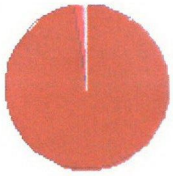
Top sources by substance - Postcode 2212

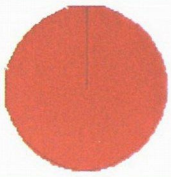
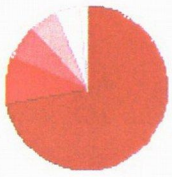
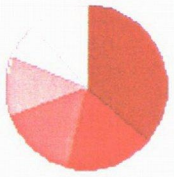
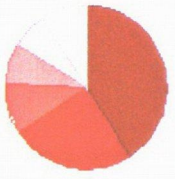
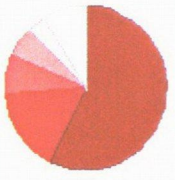
The table shows emissions of all NPI substances in this region, and the top sources for each substance. All emission amounts have been rounded to two significant figures. Note that totals may differ from the sum of the individual amounts because of this rounding. Source names for industrial reporting facilities are shown as ANZSIC Groups; source names for diffuse data are marked with *. Click on the source name for more information about that source for this region.

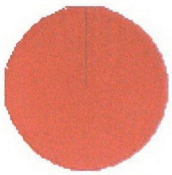
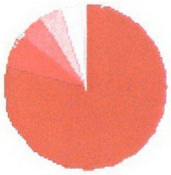
Substance (sort by total emission)	Total Emissions (kg/year)	Emission Sources		
		Distribution (pie chart)	Name (Diffuse Data Source * or ANZSIC Group)	Sub-total (kg/year)
Acetic acid (ethanoic acid)	23		Other Chemical Product Manufacturing [254]	23
Acetone (Table 1)	1,100		Motor Vehicles *	660
			Motor Vehicle Refinishing *	260
			Burning(fuel red., regen., agric.)/ Wildfires *	160
Arsenic & compounds (Table 1)	0.0040		Backyard Incinerators *	0.0040
Benzene (Table 1)	13,000		Motor Vehicles *	9,900
			Lawn Mowing *	1,100
			Solid fuel burning (domestic) *	840
			Service stations *	550
			Burning(fuel red., regen., agric.)/ Wildfires *	210
1,3-Butadiene (vinyl ethylene) (Table 1)	150		Lawn Mowing *	150
			Backyard Incinerators *	3.5
Cadmium & compounds (Table 1)	0.098		Backyard Incinerators *	0.069
			Solid fuel burning	

			(domestic) *	0.029
Carbon monoxide (Table 1)	2,900,000		Motor Vehicles *	2,700,000
			Solid fuel burning (domestic) *	90,000
			Lawn Mowing *	69,000
			Burning(fuel red., regen., agric.)/ Wildfires *	21,000
			Backyard Incinerators *	6,800
Chlorine	120		Other Chemical Product Manufacturing [254]	120
Chromium (III) compounds	0.012		Structural Metal Product Manufacturing [274]	0.012
Chromium (VI) compounds (Table 1)	0.33		Lawn Mowing *	0.30
			Backyard Incinerators *	0.034
			Solid fuel burning (domestic) *	0.00026
Cobalt & compounds (Table 1)	0.31		Lawn Mowing *	0.30
			Backyard Incinerators *	0.012
Copper & compounds	0.0031		Structural Metal Product Manufacturing [274]	0.0031
Ethanol	13		Other Chemical Product Manufacturing [254]	13
Ethylene glycol (1,2-			Domestic/Commercial solvents/ aerosols *	240

ethanediol) (Table 1)	290		Architectural Surface Coatings *	44
Lead & compounds (Table 1)	2.8		Lawn Mowing *	2.7
			Backyard Incincerators *	0.057
			Service stations *	0.0030
Manganese & compounds	1.7		Structural Metal Product Manufacturing [274]	1.7
Mercury & compounds (Table 1)	0.014		Backyard Incincerators *	0.014
Methanol (Table 1)	4,200		Domestic/Commercial solvents/ aerosols *	4,200
Methyl ethyl ketone (Table 1)	1,200		Motor Vehicle Refinishing *	870
			Domestic/Commercial solvents/ aerosols *	300
			Solid fuel burning (domestic) *	67
Methyl isobutyl ketone (Table 1)	160		Motor Vehicle Refinishing *	110
			Domestic/Commercial solvents/ aerosols *	45
Nickel & compounds	0.33		Lawn Mowing *	0.30
			Backyard Incincerators *	0.020
			Structural Metal Product Manufacturing [274]	0.010
Nitric acid	5.7		Other Chemical Product Manufacturing [254]	5.7

				
Oxides of Nitrogen (Table 1)	400,000		Motor Vehicles *	400,000
			Paper and Paper Product Manufacturing [233]	2,800
			Non-Ferrous Basic Metal Product Manufacturing [273]	1,800
			Solid fuel burning (domestic) *	1,100
			Burning(fuel red., regen., agric.)/ Wildfires *	500
Particulate Matter 10.0 um (Table 1)	35,000		Motor Vehicles *	20,000
			Solid fuel burning (domestic) *	9,000
			Burning(fuel red., regen., agric.)/ Wildfires *	4,200
			Backyard Incinerators *	730
			Lawn Mowing *	500
Phosphoric acid	0.97		Other Chemical Product Manufacturing [254]	0.97
Polycyclic aromatic hydrocarbons (Table 1)	280		Solid fuel burning (domestic) *	210
			Lawn Mowing *	60
			Burning(fuel red., regen., agric.)/ Wildfires *	11
			Paper and Paper Product Manufacturing [233]	0.019
Sulfur dioxide (Table 1)	14,000		Motor Vehicles *	14,000
			Solid fuel burning (domestic) *	210
			Burning(fuel red., regen., agric.)/ Wildfires *	83
			Lawn Mowing *	25
			Non-Ferrous Basic Metal Product	14

			Manufacturing [273]	
Tetrachloroethylene (Table 1)	1,100		Dry Cleaning *	1,100
Toluene (methylbenzene) (Table 1)	29,000		Motor Vehicles *	21,000
			Domestic/Commercial solvents/ aerosols *	2,600
			Lawn Mowing *	1,900
			Service stations *	1,700
			Motor Vehicle Refinishing *	1,400
Total Nitrogen (Table 1)	1,700		Urban residential-Botany Bay *	600
			Industrial and commercial-Botany Bay *	290
			Bushland-Botany Bay *	270
			Unimproved grassland-Botany Bay *	200
			Urban parks and golf courses-Botany Bay *	120
Total Phosphorus (Table 1)	300		Urban residential-Botany Bay *	120
			Industrial and commercial-Botany Bay *	73
			Unimproved grassland-Botany Bay *	30
			Bushland-Botany Bay *	24
			Disturbed land and special uses-Botany Bay *	20
Total Volatile Organic Compounds	580,000		Motor Vehicles *	330,000
			Non-Ferrous Basic Metal Product Manufacturing [273]	93,000
			Domestic/Commercial solvents/ aerosols *	47,000
			Solid fuel burning (domestic) *	34,000
			Lawn Mowing *	20,000
Trichloroethylene (Table 1)	2.9		Domestic/Commercial solvents/ aerosols *	2.9

				
Xylenes (individual or mixed isomers) (Table 1)	26,000		Motor Vehicles *	21,000
			Service stations *	1,600
			Lawn Mowing *	1,400
			Domestic/Commercial solvents/ aerosols *	1,200
			Motor Vehicle Refinishing *	1,100

- More information about using and interpreting NPI data

Make a map | Substances background | Download data | Data changes

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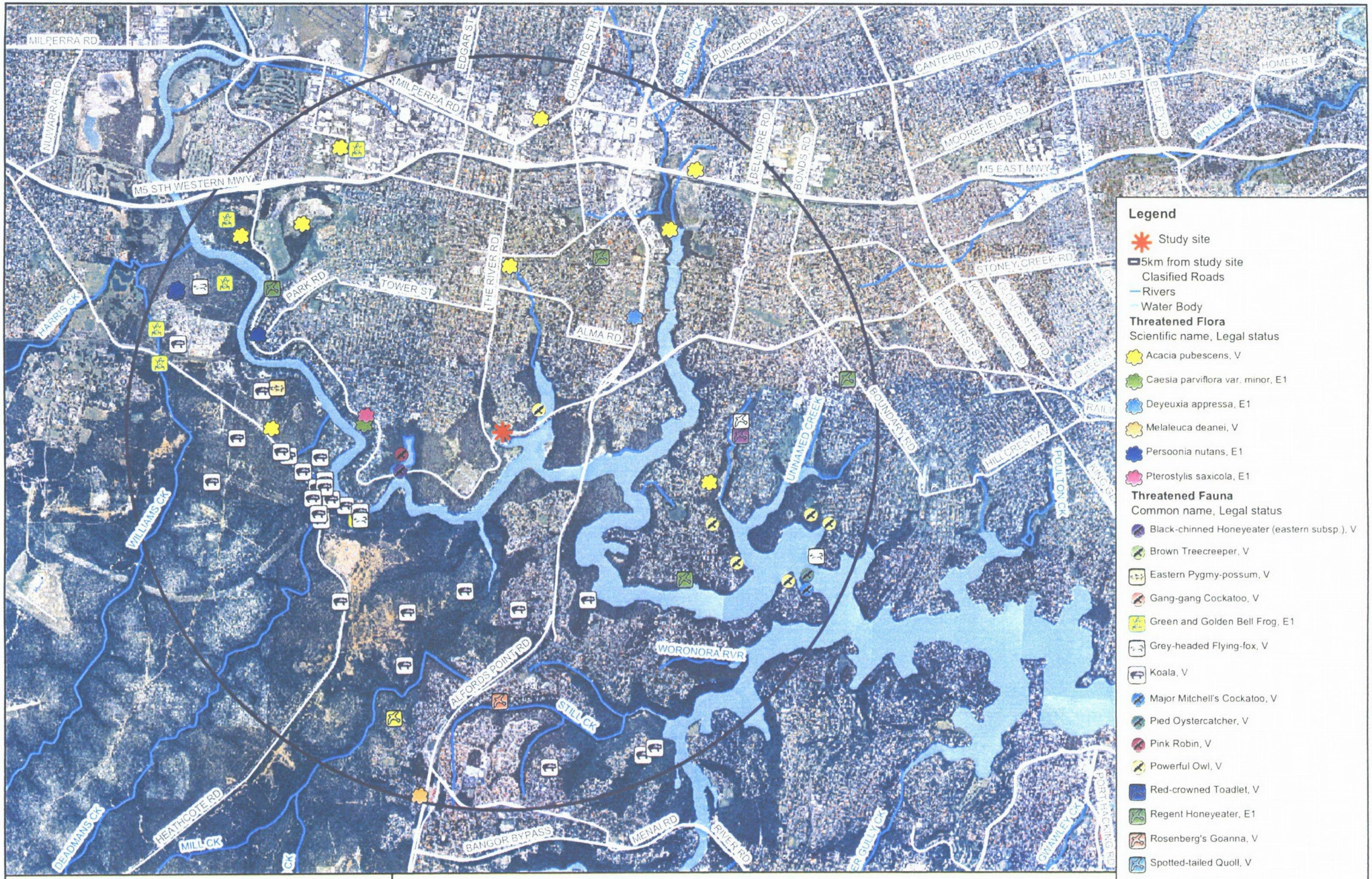
GPO Box 787 Canberra ACT 2601 Australia
Telephone: (02) 6274 1111



Threatened Fauna and Flora Species in the vicinity of study site on Henry Lawson Dr, Revesby Heights

N
W E
S

0 0.5 1 Kilometers

Map produced by RTA Environmental Technology
Date: 23/11/05
OrthoView aerial photography under licence to RTA by Lands Department NSW

Legend

- Study site
- 5km from study site
- Clasified Roads
- Rivers
- Water Body

Threatened Flora
Scientific name, Legal status

- Acacia pubescens, V
- Caesia parviflora var. minor, E1
- Deyeuxia appressa, E1
- Melaleuca deanei, V
- Persoonia nutans, E1
- Pterostylis saxicola, E1

Threatened Fauna
Common name, Legal status

- Black-chinned Honeyeater (eastern subsp.), V
- Brown Treecreeper, V
- Eastern Pygmy-possum, V
- Gang-gang Cockatoo, V
- Green and Golden Bell Frog, E1
- Grey-headed Flying-fox, V
- Koala, V
- Major Mitchell's Cockatoo, V
- Pied Oystercatcher, V
- Pink Robin, V
- Powerful Owl, V
- Red-crowned Toadlet, V
- Regent Honeyeater, E1
- Rosenberg's Goanna, V
- Spotted-tailed Quoll, V
- Superb Fruit-Dove, V
- Swift Parrot, E1
- Yellow-bellied Glider, V