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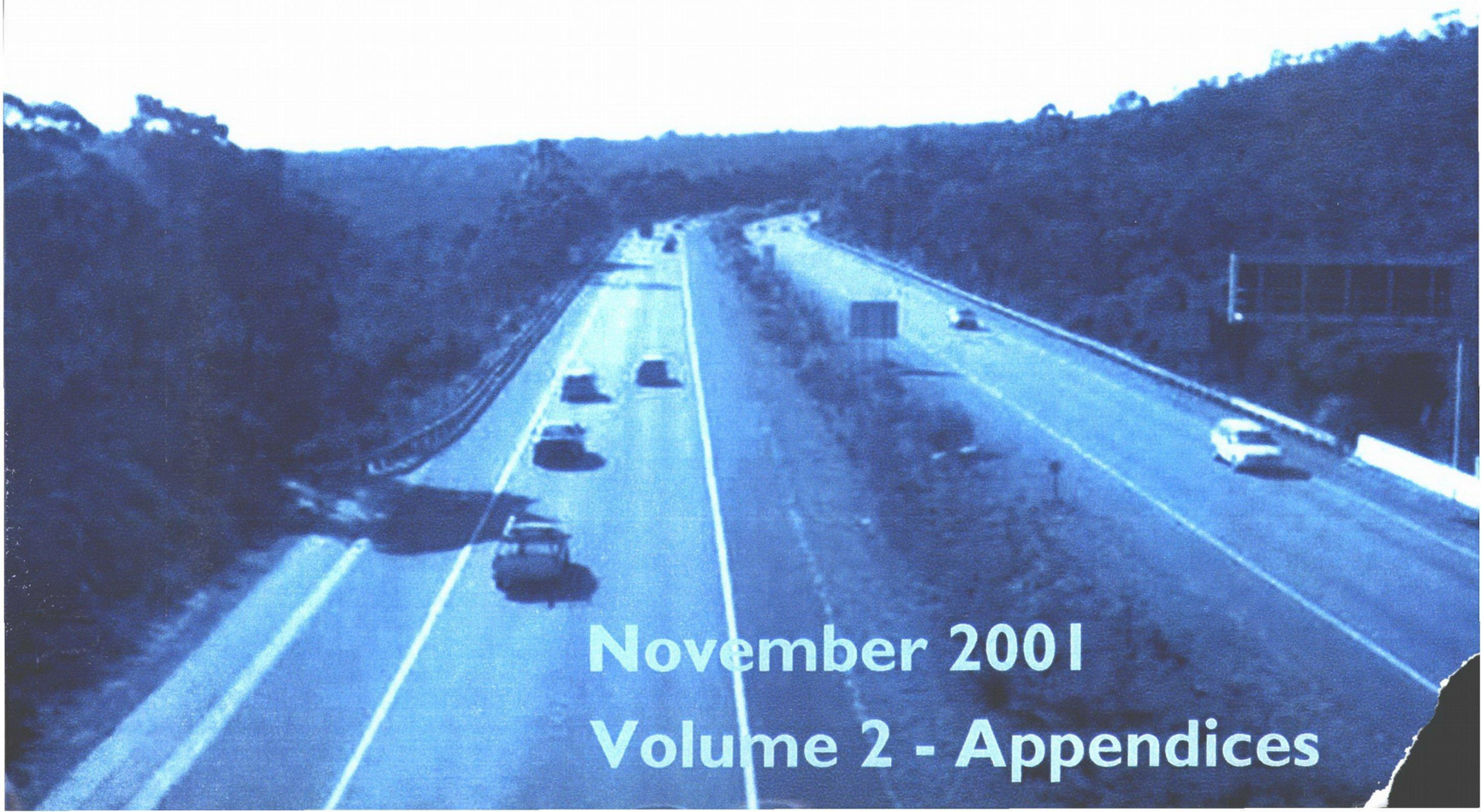
TRANSPORT AND REGIONAL SERVICES

REF

Review of Environmental Factors

F3 Widening

Proposed widening to three lanes in each direction, from 4.2km south of the Mt White Overbridge to 1.0km north of the Calga Interchange, Sydney Newcastle Freeway



November 2001

Volume 2 - Appendices

L045820

Appendices to the REF – in Volume 2

Appendix A - Community Involvement - issues raised by Government agencies and other organisations

Appendix B – Water Quality Assessment

Appendix C – Noise and Vibration Report

Appendix D – Practice Note V11 – "Roadworks outside normal working hours", *Interim RTA Environmental Noise Management Manual*

Appendix E - Ecological Assessment

Appendix F – Visual Analysis

Appendix G – Indigenous and Non-Indigenous Heritage Assessment

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Contents

Glossary i

Overview 1

What is the Proposal? 1

Why is it needed? 1

How would the F3 Widening meet this need? 1

What would be the main environmental impacts? 2

Exhibition of the REF 2

How can I comment on the Proposal? 3

What happens next? 3

1 INTRODUCTION & PLANNING PROCESSES 5

1.1 Introduction and Background 5

1.2 Structure of this REF 6

1.3 Approach to the Proposal 6

1.4 Statutory Processes, Licences & Approvals 7

1.4.1 Planning and Decision Making Process 7

1.5 Statutory Basis for preparing this REF 8

1.6 Other Approvals and Licences 9

1.6.1 Scheduled Activity and EPA Licence requirements 9

2 PROPOSAL DESCRIPTION 10

2.1 Description of site and surroundings 10

2.2 Design Considerations 10

2.2.1 Existing Roads 10

2.2.2 Approach to Proposal Design 11

2.2.3 Land Use 11

2.2.4 Existing and Forecast Traffic 12

2.2.5 Urban and Regional Design 12

2.2.6 Authorised and Emergency Vehicle Access 12

2.3 General features of the Proposal 13

2.4 Details of the Proposal Features 15

2.4.1 Partial Removal of Rock Medians 15

2.4.2 Retaining Walls 15

2.4.3 Pavement Works 15
2.4.4 Bridge Works 15
2.4.5 Drainage 16
2.4.6 Sediment Basins 16
2.4.7 Safety Barriers 16
2.4.8 Utilities 16

2.5 Construction Activities of the Proposal 17
2.5.1 Construction Strategy 17
2.5.2 Construction Methodology 17
2.5.3 Construction Compounds and Stockpile Sites 18
2.5.4 Construction Equipment 18
2.5.5 Earthworks 19
2.5.6 Blasting and Rock Crushing 19
2.5.7 Construction Materials 20
2.5.8 Sediment Basins 20
2.5.9 Traffic Management, Safety & Access 20
2.5.10 Working Hours 21

2.6 Summary of Proposal Specifications 22

2.7 Cost Estimate 24

2.8 Timing 24

3 STATUTORY POSITION 25

3.1 Council Planning 25
3.1.1 Gosford City Interim Development Order 25

3.2 State Environmental Planning Policies (SEPPs) 25

3.3 Regional Environmental Plans (REPs) 26

3.4 NSW Legislation 26
3.4.1 Environmental Planning and Assessment Regulation 2000 26
3.4.2 Native Vegetation Conservation Act 1997 27

3.5 Commonwealth Legislation 27

3.6 Confirmation of Part 5 Position 27

4 COMMUNITY AND STAKEHOLDER INVOLVEMENT 28

4.1 Community Involvement 28
4.1.1 Risk Management Study Workshop 30
4.1.2 Consultation with government agencies and stakeholders 30

4.2 **Outcomes** 32

4.3 **Future Community and Stakeholder Consultation** 32

5 **STRATEGIC PLANNING** 34

5.1 **Need for the proposed activity** 34

5.2 **Consequences of 'No Action'** 37

5.3 **Conclusions** 38

6 **CONCEPT STAGE** 39

6.1 **Objectives** 39

6.2 **Options and Features Considered** 40

6.2.1 Options Considered 40

6.2.2 Consideration of Bicycle Strategy 43

6.2.3 Consideration of Drainage – Mountain Drains 43

6.3 **Conclusion - Preferred Option** 45

7 **DETAILED ASSESSMENT STAGE** 47

7.1 **Environmental Assessment** 47

7.1.1 Landforms and Landform Stability 47

7.1.2 Soils and Erosion 48

7.1.3 Climate 51

7.1.4 Hydrology and Water Quality 52

7.1.5 Air Quality 57

7.1.6 Noise and Vibration Effects 58

7.1.7 Flora 63

7.1.8 Fauna – Terrestrial and Aquatic 67

7.1.9 Visual & Landscape 73

7.1.10 Indigenous Heritage 77

7.1.11 Non-indigenous Heritage 80

7.1.12 Socio-economic considerations 82

7.1.13 Waste Minimisation and Management 84

7.1.14 Cumulative Environmental Effects 87

7.2 **Approach to Ecologically Sustainable Development** 89

7.3 **Matters of National Environmental Significance** 91

7.3.1 World Heritage Properties 91

7.3.2 Wetlands of International Importance 91

7.3.3 Commonwealth Listed Threatened Species and Ecological Communities 91
7.3.4 Commonwealth Listed Migratory Species 93
7.3.5 Nuclear Actions 94
7.3.6 Commonwealth Marine Areas 94
7.3.7 Commonwealth Land 94
7.3.8 Conclusion 94

8 IMPLEMENTATION STAGE 95

8.1 Summary of Proposed Safeguards 95

8.2 Environmental Management 107

8.3 Approvals, Permits and Licences 108

8.4 Summary of Key Issues 109

8.4.1 Summary of Beneficial Effects 109
8.4.2 Summary of Adverse Effects 109

9 OUTCOMES AND JUSTIFICATION 111

10 CHECKLISTS 112

10.1 Clause 228 Checklist 112

10.2 EPBC Checklist (Commonwealth Legislation) 117

11 CERTIFICATION 118

TABLES

Table 2-1. Current and Predicted Average Annual Daily Traffic Volumes 12
Table 2-2. Current and proposed U-Turn Facilities 13
Table 2-3. Specifications of the F3 Widening Proposal 22
Table 3-1. Applicability of Schedule 3 of the EP&A Regulation 26
Table 3-2. Applicability of the Native Vegetation Conservation Act Provisions 27
Table 4-1. Community Involvement Program for F3 Freeway Widening 28
Table 6-1. Summary of Upgrade Options 41
Table 7-1. Water Quality Analysis Results 53
Table 7-2. Noise Levels at Selected Locations 60
Table 7-3. Threatened Species potentially occurring in the Study Area 64
Table 7-4. Plant species of special conservation significance to the region found during the survey 65
Table 7-5. Vulnerable and Threatened Fauna Species likely to occur in the Study Area 69
Table 7-6. Threatened or Vulnerable Fauna Species Recorded in the Study Area 70

Table 7-7. Outline of how ESD Principles have been complied with for the Proposal 89
Table 7-8. Threatened Fauna Species potentially occurring in the Vicinity of the Study Area. 92
Table 7-9. Threatened Flora Species located in the Vicinity of the Study Area. 92
Table 7-10. Terrestrial species covered by migratory provisions of the EPBC Act 93
Table 8-1. Proposed Safeguards 95
Table 8-2. Approval/Licence Requirements for the Project 108

FIGURES

Figure 2-1. Site Locality Map after page 10
Figure 2-2. General Features of the Proposal after page 13
Figure 2-3. Typical Cross Sections after page 13
Figure 6-1. Three Basic Widening Options after page 40
Figure 6-2. Option 10(c) after page 45

APPENDICES

Appendix A - Community Involvement - issues raised by Government agencies and other organisations..
Appendix B – Water Quality Assessment .....
Appendix C – Noise and Vibration Report .....
Appendix D – Practice Note V11 – "Roadworks outside normal working hours", *Interim RTA Environmental Noise Management Manual* .....
Appendix E - Ecological Assessment .....
Appendix F – Visual Analysis .....
Appendix G – Indigenous and Non-Indigenous Heritage Assessment .....

Appendix A

Community Involvement – Issues raised by Government agencies and other organisations

Appendix A

Issues raised by government agencies and other organisations

Government Agency/ Organisations	Issue raised	Relevant section of this REF
Commonwealth Government		
Environment Australia	In accordance with the *EPBC* Act certain actions may have environmental significance and require approval. If a referral needs to be submitted regarding a matter protected under the EPBC Act, it should be done in accordance with Chapter 4 of the EPBC Act.	7.3, 10.2
NSW Government		
Department of Land and Water Conservation (DLWC)	The REF should address at least, but not be limited to:	
	• topography and landform.	7.1.1
	• soil type and soil erodibility.	7.1.2
	• effect on habitat and endangered species.	7.1.8
	• cumulative impact of habitat destruction within and adjacent to the area.	7.1.14
	• likely size and slope of road batters resulting from the works.	2.3
	• drainage works and erosion and sediment control strategies.	2.3, 2.4.5
	• revegetation strategy; possibility of endemic seed or vegetative material collection and the final site rehabilitation.	7.1.9
	• concepts and principles of the Rivers and Foreshores Improvement Act.	8.3
	• a detailed and site specific erosion and sediment control plan should be prepared to the satisfaction of DLWC prior to commencement of works.	7.1.2
	• the plan should include all stages of work as well as details of proposed site stabilisation.	7.1.2
	• stormwater runoff should be considered and designed so as not to cause any scour or erosion of any watercourses or drainage lines.	7.1.2
	• details should be provided of proposed earthworks, including details of disposal of any surplus or waste materials.	2.5.5
NSW Fisheries	Main issues:	
	• 50m buffer from waterways – including healthy and endemic riparian vegetation.	7.1.4
	• Prefer sedimentation basins off the creek line so as not to interfere with fish passage.	N/A
	• Potential Acid Sulphate Soils.	7.1.2

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	• Run-off and sedimentation issues – mitigate increased run-off from the road (there should be no net increase in run-off into the surrounding waterways or increase in erosion/sediment/pollution loads into the waterways).	7.1.2
	• Impact on threatened species – An eight part test needs to be conducted for each threatened species found within the proposal site.	7.1.8
	• Disposal of spoil – keep away from waterways.	7.1.2, 7.1.4
	• A management plan to control weed and pest species should be produced and implemented.	7.1.8
	• Don't remove snags in waterways without NSW Fisheries approval.	7.1.8
	• Any proposals for new or extensions to bridge crossings should follow NSW Fisheries Policy and Guidelines for Bridges, Roads, Causeways etc.	N/A
NSW Heritage Office	• Detailed those issues that should be addressed in the REF's heritage assessment:	7.1.11, Appendix G
	• Heritage significance of the site and any impacts the Proposal may have upon this significance. This should include a consideration of wider heritage impacts in the area surrounding the site.	7.1.10
	• Registers and lists should be consulted to identify any items of heritage significance, including the State Heritage Inventory, NPWS, National Trust, Australian Heritage Commission and the local Council lists.	7.1.10
	• Non-Aboriginal heritage items should be identified by field survey. A statement of significance and an assessment of the impact of the Proposal on the heritage significance of these items are required in accordance with the NSW Heritage Manual.	7.1.10
	• Field survey and assessment must be undertaken by a qualified practitioner/consultant with historic sites experience.	7.1.10
	• Detailed process to be followed if known or potential archaeological relics will be impacted and if unexpected archaeological relics are uncovered during the works.	7.1.10
	• REF to contain an assessment of Aboriginal sites and have regard to any impacts on places, items or relics of significance to Aboriginal people.	7.1.10
NPWS	Recommends that matters referred to within the *NPWS General Guidelines for Impact Assessment* be addressed in the REF.	7.1.7, 7.1.8, 7.1.10
	• If works required in National Parks additional issues would need to be assessed.	N/A

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	• Detail relationship of proposed works including the location of sedimentation basins, access tracks and other infrastructure including water management measures to the NPWS reserve boundaries, including in the REF a clear map showing boundaries of the road reserve and National Park boundaries.	Figure 2-2
	• Explore the potential to restore and reuse existing sedimentation basins wherever possible.	2.4.6
	• Detail any access requirements within NPWS reserves.	2.3
	• Assessment of noise and air impacts on Park users both during construction and operation.	7.1.5, 7.1.6
	• Assessment of potential visual impacts on the Parks.	7.1.9
	• Assessment of potential impacts on water quality and environmental flows within the parks.	7.1.4
	• Assessment of the potential impact of construction and operation works on Park management including pest and weed management programs.	7.1.8
	• Detailed risk assessment to include consideration of the risks of spills and impacts on the Park.	2.5.8, 7.1.4
	• Mitigative measures should be outlined in the REF and should include:	8.1
	– briefing of contractors in relation to National Park boundaries, threatened flora and fauna, and aboriginal sites.	8.1
	– preparation of a maintenance schedule and detailed methodology for on-going maintenance of temporary and permanent sedimentation basins.	8.1
	– consideration of Gross Pollutant Traps or similar devices to be installed to contain litter and other pollutants currently entering the park.	8.1
	– develop and implement a long term water quality monitoring program within the Park.	8.1
	– develop and implement a weed control program in consultation with NPWS.	8.1
	• Signage indicating the location of the National Parks should be installed in easily viewed positions from the F3 and preferably within the road reserve.	2.3
	• Aboriginal Heritage assessment should conform with standards outlined in the NPWS Guidelines for Integrated Development Assessment. Specific issues to be addressed include:	7.1.10
	– assessment of the potential impact of the Proposal on areas or places of cultural significance to the relevant Aboriginal community and taking into account physical sites, landscape features and bush-foods.	7.1.10
	– documentation from the Aboriginal community outlining their assessment and recommendations.	7.1.10
	– assessment of the potential impacts of surface works and	7.1.10

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	infrastructure on areas of cultural and/or archaeological sensitivity, including Aboriginal sites.	
	– assessment of mitigative strategies, including wherever possible the conservation of places of cultural importance to the Aboriginal community.	7.1.10
	– Aboriginal sites affected by the proposal, and for which Section 90 consent would be required must be clearly identified and mapped.	7.1.10
	• In relation to Flora/Fauna/Threatened Species, the following information is considered necessary to assess the potential impact of a proposal:	7.1.7, 7.1.8
	– detailed description and mapping of all vegetation communities in the study area;	7.1.7
	– identification of any vegetation communities or plant species which are of local, regional or state conservation significance (including threatened species, populations, ecological communities or critical habitat listed under the Threatened Species Conservation Act 1995 (TSC Act);	7.1.7
	– description of known or expected fauna assemblages within the study area;	7.1.8
	– identification of fauna habitat likely to be of local, regional or state significance;	7.1.8
	– identification of habitat corridors and linkages between areas of remnant native vegetation which may assist faunal movement through the area and an assessment of the conservation significance of these; and	7.1.7, 7.1.8
	– prediction of the likely impact of the proposal on the above attributes.	7.1.7, 7.1.8
	• The provisions of the TSC Act and related provisions of the *Environmental Planning and Assessment Act* 1979 should be considered when undertaking the assessment of a proposal.	7.1.7, 7.1.8
EPA	• REF should identify the range of potential short and long term environmental impacts associated with the construction and operation of the Freeway project as well as provide details of proposed mitigation measures.	7.1
	Water Quality, Erosion Controls and Spill Containment	
	• Detail planning and control measures to be implemented to prevent pollution and adverse impacts on streams and water quality.	7.1.4
	• Sediment and nutrient controls required to prevent minimal impact of run-off during construction and operation.	7.1.2
	• Recommends preparation of an Erosion and Sediment Control Plan.	7.1.2
	• Sediment control structures to be designed with reference to the 1998 Department of Housing guidelines *Managing Urban*	7.1.2

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	Stormwater: Soils and Construction.	
	• Consider designing sediment control structures that can be used for spill containment purposes during construction and operation.	7.1.2
	Waste Disposal	
	• Waste management hierarchy of waste avoidance, followed by reuse and recycling/reprocessing with disposal as a last resource.	7.1.13
	• Sources of waste material should be identified and the material classified in accordance with the EPA's *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes.*	7.1.13
	• Disposal options for waste material should be identified including re-use on-site.	7.1.13
	• Ensure that contamination does not occur as a result of re-using waste material on-site.	7.1.13
	Dust Generation	
	• Identify sources of dust generation and mitigating measures to manage the level of dust generated during the project.	7.1.5
	• Options such as water carts and regular use of street sweepers should be investigated.	7.1.5
	Noise and Blasting	
	• All sensitive noise receptors should be identified and the noise assessment provide all background assumptions, methods used and the results of data collected.	7.1.6
	• Noise assessments should be undertaken in accordance with Chapter 171 of the EPA's *Environmental Noise Control Manual* for the construction phase of the project.	7.1.6
	• Reference should be made to the EPA's *NSW Industrial Noise Policy* and *Environmental Noise Management Environmental Criteria for Road Traffic Noise.*	7.1.6
	• If blasting is to be undertaken, a detailed blast assessment should be provided including identification of any associated noise and/or vibration impacts.	2.5.6
	• Mitigation methods for both blasting and noise impacts during construction and operation should be outlined and discussed.	7.1.6
	Environment Protection Licence	
	• If the project is scheduled as "Freeway or Tollway construction", an Environment Protection Licence (EPL) will be issued by the EPA. RTA would need to complete and submit a licence application form with associated supporting documentation before any works commenced. The licence might incorporate numerous scheduled activities such as crushing and grinding operations and mobile concrete batching plants/bitumen batching plants.	1.6.1

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	• The licensed premises definition should be limited to the proposed area where construction work is to occur.	1.6, 8.3
NSW Police Service (Brisbane Water Local Area Traffic Command)	• Supports Proposal.	Noted.
	• Questions the location of the introduction of an increased speed limit in the northbound carriageway. This location is only a short distance from where most of the northbound collisions occur. Drivers will commence acceleration well before the speed zone change, which is within an identified crash location.	Noted.
	• Lowering speed limits contributed to "an incredible reduction" in major collisions. The Police Service would respond cautiously to any proposal to increase the speed limit.	Noted.
	• No work should be carried out during morning and evening peak periods, Friday afternoons and evenings and school holiday periods.	2.5.10
	• Access to the Mt White work compound requires vehicles entering the site from the "fast" lane. What provisions will be in place to slow vehicles prior to this location?	2.5.9
	• Supports signposting for cyclists advising them to use the Pacific Highway.	2.3
	• Upon commencement of the road works, the Police Service would appreciate significant advanced notification of the proposed work schedule to task [assign police] vehicles accordingly.	4.3
NSW Fire Brigade	• Supports proposal.	Noted.
	• A lane should be kept open for emergency response vehicles during construction.	2.5.9
	• Should temporary road closures be required, the NSWFB Communication Centre should be notified of such occurrences and the duration of closures.	2.2.6, 4.3
Ambulance Service of New South Wales (Hawkesbury River Station - North Sydney & Central Coast Sector)	• Would construction workers need to use the Ambulance Station amenities [at Mooney Mooney] or would they supply their own?	2.5.3
	• Confirmation required that the work compound at Mooney Mooney would not obstruct the movement of Ambulance vehicles.	2.5.3
	• If emergency turning access points (U-turns) in the median between the carriageways are decreased in size, Officers would be at risk. Ambulance vehicles will intrude into both north and southbound carriageways whilst waiting for a break in the traffic to proceed.	2.2.6, 2.5.9
NSW Rural Fire	• Supports Proposal	Noted.

Government Agency/ Organisations	Issue raised	Relevant section of this REF
Service		
Local Government		
Gosford City Council	• Supports the Proposal.	Noted.
	• At the Calga Interchange Council wants an on-load ramp for northbound traffic.	6.1
	• There are major safety issues which need to be addressed:	
	– elimination of the only bends on the F3 between Wahroonga and the New England Highway with advisory speed signs.	2.2.1, 2.2.2, 6.2
	– provision of a quality cycleway as exists on the M6 between Heathcote and Wollongong.	6.2.2
	– special "extra grip" surfacing on all steep downgrades to reduce braking distances and to facilitate driver control.	On this section of work there are no grades >5%.
	– fog piercing lighting around Mt White as there is a constant fog problem in winter. The system only needs to be switched on when there is a fog and there are few residents nearby.	Not in the scope of this project.
	– upgrading the smoothness of the bottom 1.5m of all rock faces to reduce the severity of crashes. A concrete wall will do.	1.1, 6.2.3, Figure 6-2
	– upgrade the stormwater drainage which has been made less effective by frequent resheets of Asphaltic Concrete.	2.4.5
	• Implementation of safety measures as listed above would provide a major benefit to the many commuters who use the F3 regularly to attend work in Sydney, and for the normal traffic using the route for both pleasure and business.	5.1
Wyong City Council	• Council is concerned about the impact and hence delays to motorists during construction.	2.5.9
	• The RTA should identify working days and hours with special attention to Sundays, and school and public holidays.	2.5.10
	• Is blasting required? If so, when would it occur?	2.5.6
Others		
Darkinjung Local Aboriginal Land Council	• The Darkinjung LALC supports the Proposal.	Noted.
	• Recommended that 2 Aboriginal Heritage Officers monitor the site during the earth moving process.	7.1.10
	• Recommended that Aboriginal persons be employed during all construction stages.	Noted.
Bicycle NSW	No response received.	-
NSW Road Transport Association Inc	• Endorses widening of the F3.	Noted.

Government Agency/ Organisations	Issue raised	Relevant section of this REF
	• Preferable to construct the additional lanes within the central median rather than adjusting the line markings. • Reduction of lane width under 3 metres is not a preferable option.	2 2.6
Refrigerated Warehouse & Transport Association of Australia	• Agrees with comments made by the NSW Road Transport Association. • Supports the proposal.	Noted.
Bus and Coach Association (NSW)	• Supports the project but would prefer more focus on public transport. • No regular bus operations running on F3 except Express/Airport Services, eg Brisbane-Sydney Express, The Entrance - Sydney Airport Shuttle.	5.1 2.2.4

Environment Australia

Department of the Environment and Heritage

Ms Fiona McKay
RTA Environmental Technology, Rosebery
PO Box K198
HAYMARKET NSW 1238

Dear Ms McKay

Thank you for your letter of 10 August 2001 concerning the preparation of a Review of Environmental Factors for a proposal to widen a section of F3 Freeway between Jolls Bridge and your request for my organisation's comments on the proposal.

As you would be aware the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) came into force on 16 July 2000.

Under the EPBC Act, projects that are likely to have a significant impact on a matter of national environmental significance will require assessment and approval by the Commonwealth Minister for the Environment and Heritage. The following summarises those actions potentially requiring approval:

- actions with a significant impact, or likely to have a significant impact, on a declared World Heritage property;
- actions with a significant impact, or likely to have a significant impact, on a declared Ramsar wetland;
- actions with a significant impact, or likely to have a significant impact, on listed threatened species or communities;
- actions with a significant impact, or likely to have a significant impact, on a listed migratory species;
- nuclear actions;
- actions with a significant impact, or likely to have a significant impact, on the Commonwealth marine environment (generally beyond three nautical miles);
- environmentally significant actions involving Commonwealth land; and
- environmentally significant actions by Commonwealth agencies.

GREENHOUSE CHALLENGE MEMBER

GPO Box 787 Canberra ACT 2601 Telephone 02 6274 1111 Facsimile 02 6274 1666
Internet: www.environment.gov.au

INTERNATIONAL ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001 RABA CERTIFIED

Rec'd 27.8.01

Administrative guidelines for determining whether an action has, will have, or is likely to have a significant impact on a matter of national environmental significance under the EPBC Act are available at Environment Australia's internet site at (www.ea.gov.au/epbc).

Should you consider that the proposal is likely to have a significant impact on a matter protected under the EPBC Act, or are unsure, a referral should be submitted to the Department for a decision on environmental significance under the Act. To assist you in preparing a referral under the provisions of the EPBC Act, if required, a copy of the Guide for format, content and submission of referrals under Chapter 4 of the EPBC Act is available at Environment Australia's internet site.

Please note that this Department is unable to advise on the question of environmental significance and whether or not the proposed action should be referred in the absence of a proper referral made in accordance with the Act. In the event that you determine that a referral is needed, you should make a referral in accordance with the guide and form outlined above.

Yours sincerely

Cathy Parsons
Assistant Secretary
Environment Assessment Branch

23 August 2001

your ref: 1M2484
our ref: ER 2907

LAND & WATER CONSERVATION

ROADS & TRAFFIC AUTHORITY (HAYMARKET)
PO BOX K198
HAYMARKET NSW 1238

Rosebery
Environ.

ATTENTION: MS F. McKAY

Wednesday, 26 September 2001

Dear Madam

1M2484 - F3 FREEWAY, WIDENING, BETWEEN JOLLS BRIDGE AND CALGA

I refer to your letter dated 10 August 01 requesting the department's comments in regard to the above proposal. I apologise for the delay, but the department has now reviewed this matter and provides the following information addressing the principal issues:

SOIL CONSERVATION - EIS Issues -

The Department advises that the Environmental Impact Statement (EIS) should address at least, but not be limited to the following issues: -

· topography and landform
· soil type and soil erodibility
· effect on habitat and endangered species
· cumulative impact of habitat destruction within and adjacent to the area
· likely size and slope of road batters resulting from the works
· drainage works and erosion and sediment control strategies

revegetation strategy, including, the comment on possibility of endemic seed or vegetative material collection and the final site rehabilitation

RTA is exempt from requiring a 3A permit and therefore does not need to apply. However the RTA is still required to comply with the concepts and principles of the Rivers and Foreshore Improvement Act.

Prior to commencement of works, a detailed and site specific erosion and sediment control plan should be prepared to the satisfaction of the DLWC. The plan should include all stages of work as well as details of proposed site stabilisation.

Stormwater runoff should be considered and designed so as not to cause any scour or erosion of any watercourses or drainage lines.

Details should be provided of proposed earthworks, including details of disposal of any surplus or waste materials.

I trust the above information is of assistance in regard to your consideration of this proposal. Should there be any further enquiry in this matter, please contact the, Environmental Review Coordinator, at our Newcastle Office on 02 49299847.

Yours Faithfully

L.A. Watt

Lance Watt
Environmental Review Co-ordinator

CORRESPONDENCE RECEIVED 27 SEP 2001 PROPERTY BRANCH

2/10/01

Suite 6 464 King Street Newcastle West NSW 2302 PO Box 2213 Dangar NSW 2309 DX 4335 Newcastle West
Telephone (02) 4929 4346 Facsimile (02) 4929 6364 Email www.dlwc.nsw.gov.au

McKAY Fiona

From: Lesley Diver [diverl@fisheries.nsw.gov.au]
Sent: Wednesday, 29 August 2001 15:12
To: McKAY Fiona
Subject: Proposed widening of F3 freeway between Jolls Bridge and Calga Interchange

Dear Fiona
thank you for requesting our requirements. NSW Fisheries requirements for the above proposal include:
- consideration of aquatic threatened species issues listed under the Fisheries Management Act 1994 (information is available on our website www.fisheries.nsw.gov.au). An eight-part test needs to be conducted for each threatened species found within the site of the proposal. The test should be forwarded to NSW Fisheries to ensure that we concur with the conclusions.
- there should be no net increase in run-off into the surrounding waterways or increase in erosion or sediment or pollution loads into the waterways.
- sedimentation controls should be in place before, during and after works
- detention basins should be off line and not interfere with fish passage
- any proposals for new or extensions to bridge crossings should follow NSW Fisheries Polcy and Guidlines for Bridges, Roads, Causeways etc
- NSW Fisheries require a 50m buffer zone around any waterways including healthy and endemic riparian vegetation.
- Snags should not be removed from the waterway without approval from NSW Fisheries
- fish passage should not be blocked.
- a management plan to control weed and pest species should be produced and implemented
- any works within waterways would require NSW Fisheries approval.

If you require any further information before 18 Septemeber, please contact Scott Carter on 4916 3931 or after 18 Sept you can contact me on 9492 9401.
Yours sincerely
Lesley Diver
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Fax: 61 2 9492 9450
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NSW Heritage Office

Contact: G Mottram
Telephone: 02-9849 9557
mottrag@heritage.nsw.gov.au
File: S90/03597/006
Our Ref : HRL 13266
Your Ref: 1M2484

RTA Environmental Technology
Rosebery
PO Box K198
HAYMARKET
NSW 1238

Attention : Ms Fiona McKay

Dear Ms McKay,

RE: PROPOSED WIDENING OF F3 FREEWAY BETWEEN JOLLS BRIDGE AND CALAGA INTERCHANGE : REVIEW OF FENVIRONMENTAL FACTORS

I refer to your letter of 10 August 2001, requesting comments on heritage requirements for the preparation of the above REF. The REF heritage assessment should address the following issues :

- The heritage significance of the site and any impacts the development may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.
- The Heritage Council maintains the State Heritage Inventory which lists some items protected under the Heritage Act, 1977 and other statutory instruments. This register can be accessed through the Heritage Office home page on the internet (http:/www.heritage.nsw.gov.au), or can be searched by Heritage Office staff by request. You should consult lists maintained by the NSW National Parks and Wildlife Service, the National Trust, the Australian Heritage Commission and the local council in order to identify any identified items of heritage significance in the area affected by the proposal. You should be aware however, that these lists are constantly evolving and that items with potential heritage significance may not yet be listed. Archaeological sites in particular are rarely listed.
- Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment must be undertaken by a qualified practitioner/consultant with historic sites experience.

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AR.

- If any items listed on the State Heritage Register are identified and will be impacted by the proposal, an Integrated Development Approval under the *NSW Environment, Planning and Protection Act, 1979* may be required from the Heritage Council. A full Heritage Impact Statement and where necessary a detailed Archaeological Assessment and Research design should be provided for these items.
- The relics provisions in the Heritage Act require an excavation permit to be obtained from the Heritage Council prior to commencement of works if disturbance to a site with known or potential archaeological relics is proposed. If any unexpected archaeological relics are uncovered during the course of work excavation should cease and an excavation permit obtained.
- If approval is required under the Heritage Act due to the listing of an item or place on the State Heritage Register, or being subject to an Interim Heritage Order, the Heritage Council's approval must be sought prior to an approval being issued by the consent authority under the Environmental Planning and Assessment Act (except where application relates to Integrated Development). In accordance with section 67 of the Heritage Act, an approval given by a consent authority in these cases before the Heritage Council's determination of the application has been notified to the consent authority, is void.

The proposal should have regard to any impacts on places, items or relics of significance to Aboriginal people. Where it is likely that the project will impact on Aboriginal heritage, adequate community consultation should take place regarding the assessment of significance, likely impacts and management/mitigation measures. For guidelines regarding the assessment of Aboriginal sites, please contact the NSW National Parks and Wildlife Service on (02) 9858 6444.

The Heritage Office would be happy to review any further documentation that may address any likely heritage impacts. If you have any questions, please do not hesitate to contact Gillian Mottram on (02) 9849 9557.

Yours sincerely,

Susan Mac

SUSAN MACDONALD
Principal Heritage Officer
NSW Heritage Office

16·08·01

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

Fiona McKay
RTA Environmental Technology, Rosebery
PO Box K198
HAYMARKET NSW 1238

Our ref: 96/69
Your ref:1M2484

Dear Ms McKay

RE: REF requirements for
proposed widening of F3 Freeway, Jolls Bridge to Calga Interchange

Thank you for your letter dated 10 August 2001 in which you seek comment from the National Parks and Wildlife Service (NPWS) on issues to be addressed in the Review of Environmental Factors (REF) for the above project. I note that the NPWS met with the Roads and Traffic Authority on 16 July 2001 for an initial briefing of the project, and more recently on 17 August 2001 to receive a project update and discuss issues of concern.

The NPWS understands that the proposal will involve widening the F3 Freeway from two to three lanes for a length of approximately 10.5km. The additional lanes would be provided for by construction within the central median, or adjustment to line markings. Associated works will include the construction of temporary and/or permanent sediment basins within the road reserve and median area, and the establishment of work compounds. It is understood that it is the RTA's intent not to undertake any construction works (eg: sediment basins, access tracks) within areas of adjoining national park, and this issue is discussed below in further detail.

The NPWS recommends that the matters referred to in the attached guidelines *NPWS General Guidelines for Impact Assessment* be addressed in the REF where appropriate. The NPWS further considers that the following specific issues should be addressed in the REF.

Conservation Programs
& Planning Division
Level 6
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AMcKay

NPWS RESERVES

The proposed section of freeway to be upgraded is bordered by Popran National Park to the west, and Brisbane Water National Park to the east (refer to attached map). During an initial briefing on the project, the RTA indicated its intent to exclude construction works and activities from the national park where possible. However, it was indicated that there may be a requirement to install sediment basins within the park boundaries, subject to more detailed planning and design, and that there may also be a need to gain access to sedimentation basins through the national park. At subsequent meetings the RTA has indicated that it is unlikely that works would be required within park boundaries. The NPWS is strongly supportive of this approach.

As you would be aware, these NPWS reserves are either gazetted to the centre of the earth or to a depth of 150 metres below the surface. For an activity to be permissible under the *National Parks and Wildlife Act 1974*, there needs to be a demonstrated nexus between the purpose of the proposed activity and the purpose for which the reserve was established. It is unlikely that the construction of temporary or permanent sedimentation basins within the reserve would be permissible if the primary purpose of these basins was to manage sedimentation resulting directly from the upgrade project. Similarly, it is unlikely that the construction of new access tracks for the primary purpose of accessing sedimentation basins would be permissible. Furthermore, legislative amendments would be required to enable the project to proceed, if alienation of lands gazetted or reserved under the *NPW Act 1974* was required. It is recommended that legal advice be sought on this matter.

With respect to the issue of utilising existing tracks within the national park to gain access to sedimentation basins, the NPWS advises that it could grant a licence for this purpose in accordance with the *National Parks and Wildlife Land Management Regulations*.

On the assumption that no works will be undertaken within national park boundaries, the NPWS recommends that the REF should:

1. Detail the relationship of the proposed works (including the location of sedimentation basins, access tracks and other infrastructure including water management measures) to the NPWS reserve boundaries, including in the REF a clear map showing boundaries of the road reserve and national park boundaries.
2. Explore the potential to restore and reuse existing sedimentation basins wherever possible, to minimise the need for clearing of bushland (and associated impacts).
3. Detail any access requirements within NPWS reserves, and if access is required, address the issue of responsibility for maintenance of any tracks within NPWS reserves which would be utilised for long or short term access, also taking into account potential usage by other utilities. This is likely to require formal negotiation with NPWS Regional offices.

Assessment of impacts

1. An assessment of noise and air impacts on park users, both during construction works and resulting from the increased capacity of the freeway. Baseline data obtained from

monitoring points within the relevant reserves should be used to undertake these assessments.

2. An assessment of potential visual impacts on the parks as a result of any surface works or infrastructure adjacent to the reserves.
3. An assessment of potential impacts on water quality and environmental flows within the park. The NPWS notes that it is likely to be difficult to determine the impacts from the F3 due to other sources of water pollution. Increased sedimentation of creek lines – Piles Creek, Mooney Mooney Creek, Kellys Creek, Calverts Creek and Marlows Gully have been observed, however no quantitative assessment has been made.
4. An assessment of the potential impact of construction and operation works on park management, including pest and weed management programs. For example, the NPWS advises that increased weed densities within the park have been reported in areas of disturbance, especially along batters located at Mooney Mooney, Calga and Mt White.
5. A detailed risk assessment, to include consideration of the risks of spills and impacts on the park.

Mitigative measures

With respect to potential impacts on the national parks, the NPWS requests that the REF outline mitigative measures to address specific issues raised above, and other issues as appropriate. This should include:

1. Briefing of contractors prior to commencement of any works to clearly indicate the location of national park boundaries, locations of threatened flora/fauna and Aboriginal sites. Where possible these items should also be flagged in on the ground. The NPWS is very concerned that in the event that contractors decide to alter the location of sedimentation basins or other infrastructure, these could inadvertently be located within the park boundaries or in other environmentally sensitive locations.
2. A requirement to prepare a maintenance schedule and detail methodology for the on-going maintenance of temporary and permanent sedimentation basins. The NPWS is concerned that a lack of maintenance of these structures will lead to sedimentation and other management problems within the park.
3. Consideration of the installation of Gross Pollutant Traps or similar devices to assist in containing litter and other pollutants that are currently entering the park. This could be considered as part of the replacement or modification of mountain type drains that is proposed.
4. A requirement to develop and implement a long term water quality monitoring program within the park.
5. A requirement to develop and implement a weed control program, in consultation with the NPWS. Options for a joint program with NPWS should be further explored.

In the event that works within the national park are required, the NPWS requests that the RTA undertake further consultation with the NPWS to discuss additional issues that would need to be assessed.

As an ancillary issue, the NPWS requests that signage indicating the location of the national parks be installed at positions which are easily viewed from the F3 Freeway. This would serve to educate the public about the location of national parks and enhance the value of the F3 Freeway from a tourism perspective for motorists. Signs would ideally be placed at the northern and southern boundaries of Brisbane Water National Park and Popran National Park, preferably within the road reserve where they can be readily viewed by passing motorists. The NPWS would be happy to discuss this issue in further detail with the RTA.

ABORIGINAL HERITAGE

The Aboriginal heritage assessment should conform to the standards outlined in the NPWS Guidelines for Integrated Development Assessment. The following specific issues should be addressed in the Aboriginal heritage assessment:

1. An assessment of the potential impact of the proposal on areas or places of cultural significance to the relevant Aboriginal community/s. This should take into account physical sites, landscape features and bushfoods.
2. Documentation from the Aboriginal community outlining their assessment and recommendations. These must be incorporated into the overall management recommendations for Aboriginal heritage and presented in the EIS.
3. An assessment of the potential impacts of surface works and infrastructure on areas of cultural and/or archaeological sensitivity, including Aboriginal sites. The NPWS notes that the study area has a high potential to contain rock art sites, and a foot survey of the entire proposed route should be undertaken to ensure that all site locations have been identified.
4. An assessment of mitigative strategies, including wherever possible the conservation of places of cultural importance to the Aboriginal community. Aboriginal sites which will be affected by the proposed developments and for which Section 90 consent will be sought must be clearly identified and mapped.

FLORA / FAUNA / THREATENED SPECIES

Those matters outlined in the attached guidelines for flora, fauna and threatened species should be addressed. The NPWS advises that information in the form of detailed reviews of information on species, profiles, EIA guidelines and/or draft Recovery Plans is available for a number of threatened flora species which occur, or have potential to occur in the area. It is suggested that the RTA's ecological consultant may wish to discuss the relevance of, and access to, this information in further detail with the NPWS; the relevant contact is Meagan Ewings, Threatened Species Unit, CPPD-Central ph: (02) 9585 6827.

With respect to the mitigation of impacts on particular species, the NPWS would be interested in exploring opportunities for improving an understanding of the disturbance ecology of flora species (eg: through monitoring programs) and/or rehabilitation experiments for ridge top reptiles which may be impacted by the proposal (eg: rock replacement experiments for the Broad-headed Snake and its prey species). These options could be discussed in further detail during preparation of the REF.

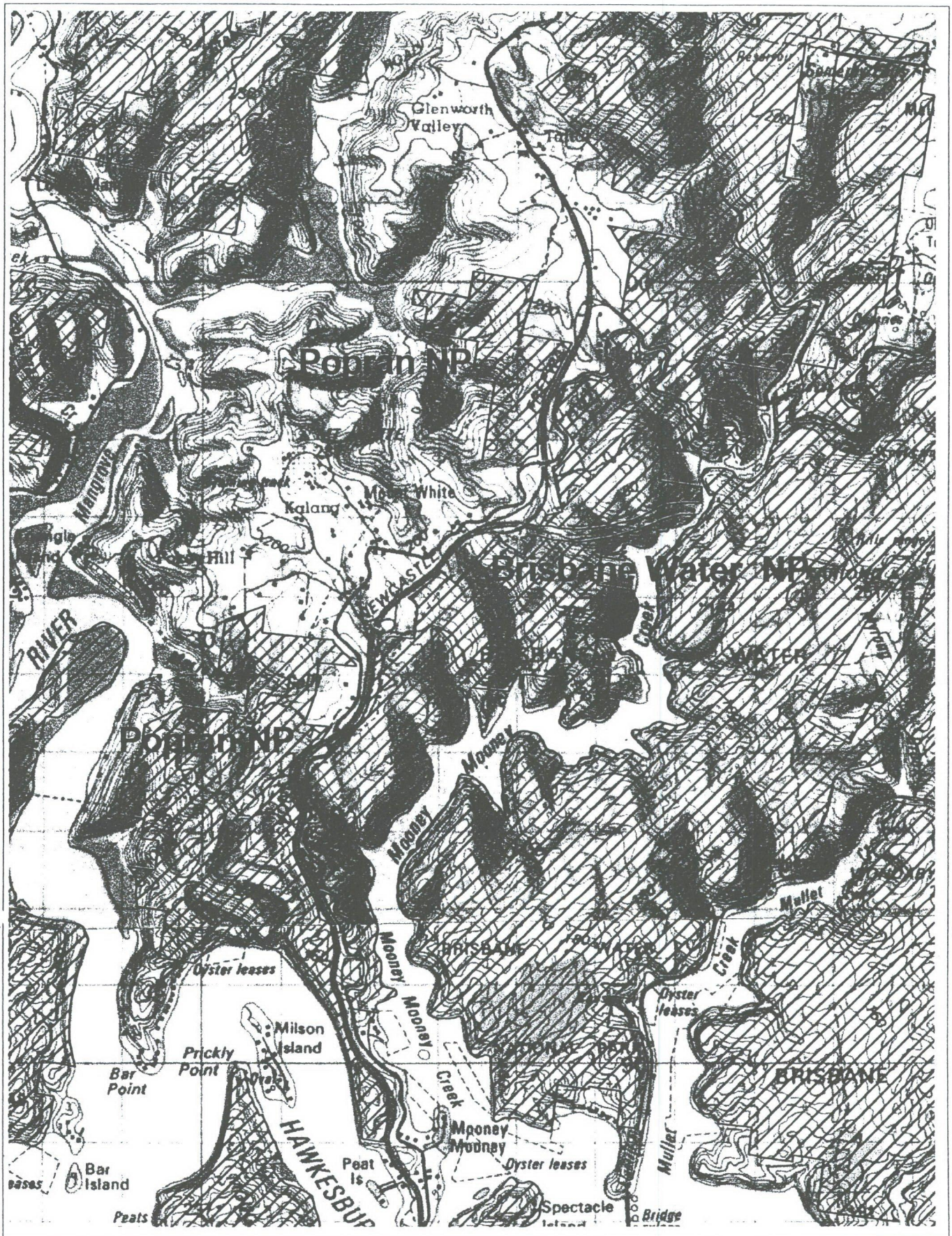
With respect to potential impacts on Red-crowned Toadlet and Giant Burrowing Frogs, the NPWS advises that a research project is currently being undertaken by a post-graduate student from Macquarie University into the disturbance ecology of these species. The work aims to develop best practice guidelines for track creation / upgrading works (ie: drain design and maintenance, timing of earth works, appropriate pre-work assessment). The work is being jointly funded by NPWS, State Forests of NSW and a Commonwealth agency (SPIRT program). Depending on the timing of construction works, these guidelines may be available for use in this project. The relevant contact for further information about this project is Ross Wellington, Threatened Species Unit, CPPD-Central on (02) 9585 6449).

The NPWS appreciates the informative approach that the RTA has taken to involving the NPWS in the development of this project. The NPWS looks forward to continuing working with the RTA to ensure that the environmental values and impacts associated with the project are fully identified and assessed. Please do not hesitate to contact Katharine Sale, Conservation Planning Officer on (02) 9585 6920 if you wish to discuss this further.

Yours sincerely

Lou Ewins 22.08.01.

Lou Ewins
Manager, Conservation Planning Unit
Conservation, Programs and Planning Division
Central Directorate



NPWS Reserve

NPWS Reserves - F3 Freeway Widening Project

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CPPD, Central
20 August 2001
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NSW NATIONAL PARKS AND WILDLIFE SERVICE

GENERAL GUIDELINES FOR IMPACT ASSESSMENT

The National Parks and Wildlife Service (NPWS) has an interest in the potential impacts of proposals on the following:

- areas of native vegetation;
- areas of potential value as habitat for native fauna;
- sites and places of Aboriginal cultural heritage, including areas of archaeological potential; and
- land dedicated under the *National Parks and Wildlife Act 1974* (*NP&W Act*).

If these attributes are anticipated to be present in your study area and / or likely to be impacted, it is recommended that assessments by a suitably qualified person be undertaken to determine the extent of impact. The NPWS suggests that the following basic details be included in the assessments:

- the qualifications and experience of the person undertaking the work; and
- a detailed description of survey methodology including survey design, sampling methods, weather conditions, time and duration of surveys and location of any survey sites and transect lines.

Specific issues that are recommended to be addressed by the assessments are detailed below.

General information

- description of the proposal and the way in which the environment will be modified;
- map(s) placing the proposal in a regional and local setting;
- applicability of Local Environmental Plans, Regional Environmental Plans and State Planning Policies to the proposal;
- information on the current and past land uses of the site and that of the surrounding area; and

- appropriately scaled maps which identify the location and extent of any areas of native vegetation and fauna habitat and Aboriginal cultural heritage value in relation to the area of proposed development.

Impacts

- prediction of the likely impact of the proposal on land dedicated under the *NP&W Act*;
- prediction of the likely impacts of the proposal on areas and items of natural significance, such as native vegetation and fauna habitat, and on Aboriginal heritage sites and areas of cultural significance. This should include consideration of any off-site impacts; and
- assessment of measures available to minimise the impact of the proposal on these attributes, including potential conservation options, alternative development options and monitoring programs, if appropriate.

Native flora, fauna and threatened species

The following information is considered necessary to assess the potential impact of a proposal:

- detailed description and mapping of all vegetation communities in the study area;
- identification of any vegetation communities or plant species which are of local, regional or state conservation significance (including threatened species, populations, ecological communities or critical habitat listed under the *Threatened Species Conservation (TSC) Act*). The criteria for establishing significance should be documented;
- description of known or expected fauna assemblages within the study area;
- identification of fauna habitat likely to be of local, regional or state significance (including habitat of threatened species, populations, ecological communities or critical habitat listed under the *TSC Act*);
- identification of habitat corridors and linkages between areas of remnant native vegetation which may assist faunal movement through the area and an assessment of the conservation significance of these; and
- prediction of the likely impact of the proposal on the above attributes (quantification of the extent of impact where practical).

In addition to these general requirements, there are specific requirements relating to the assessment of a proposal and its potential impact on threatened species, populations, ecological communities, their habitats and critical habitat.

The provisions of the *TSC Act* and related provisions of the *Environmental Planning & Assessment Act* should be considered when undertaking the assessment of a proposal. In addition to the *TSC Act* itself, further information on the provisions of the *TSC Act* may be obtained from the Department of Urban Affairs and Planning Circular

No. A13 (12 December 1995). The NPWS has also produced Information Circulars on the *TSC Act* which may be obtained by contacting the NPWS Information Centre on (02) 9585 6333.

Concurrence provisions

Where a consent authority determines that a proposal is likely to have a significant effect on threatened species or their habitats, a species impact statement (SIS) must be prepared in accordance with the requirements of the Director-General of the National Parks and Wildlife Service. If, after considering the SIS, a consent authority intends to grant approval to a proposal that will have a significant effect on threatened species or their habitats then the concurrence of the NPWS is required. If the Minister for Urban Affairs and Planning is the consent authority the concurrence of the NPWS is not required, but consultation must occur with the Minister for the Environment before development consent is granted.

The process and timeframes for development applications that require concurrence are detailed in Division 2 of the *Environmental Planning and Assessment Regulation 1998.*

Aboriginal heritage

General issues

For the purposes of these guidelines Aboriginal heritage is considered to include "relics" and places of significance to Aboriginal communities.

Under the *NPW Act*, a 'relic' is defined as any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains (as defined within the meaning of the *NPW Act*). Relics are confined to physical evidence. Aboriginal 'relics' are commonly referred to as Aboriginal sites.

An "Aboriginal place" is a place which has been declared so by the Minister for the Environment because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain physical relics.

It should also be noted that there are places in the landscape which have particular meaning for Aboriginal people, for example, spiritual areas or natural mythological areas. Although these areas are not protected under the *NPW Act*, unless they contain physical remains of Aboriginal occupation or have been declared an 'Aboriginal place', it is recommended that the potential impact of proposals on such places also be considered in the assessment process.

Assessment process

It is recommended that an assessment be conducted of the Aboriginal cultural values of the study area if the proposal involves disturbance to substantially unmodified ground surfaces. If the study area is considered to have archaeological potential or cultural significance then it is recommended that a survey and assessment be undertaken in accordance with NPWS guidelines. These guidelines are contained in the NPWS' publication "Aboriginal Cultural Heritage: Standards and Guidelines", which may be purchased by contacting the NPWS' Cultural Heritage Conservation Division on (02) 9585 6571.

Should any Aboriginal archaeological sites be present in the study area, you should consider the requirements of the *NP&W Act* with regard to Aboriginal relics. Under s90 of the *NP&W Act* it is an offence to knowingly damage or destroy relics without the prior permission of the Director-General of the NPWS.

In assessing Aboriginal heritage values, consideration should also be given to whether the study area is likely to contain places of cultural significance to the Aboriginal community. It should be noted that places of cultural significance to the Aboriginal community are not limited to archaeological sites. An assessment of cultural significance should involve consultation with community representatives and if necessary, documentary research to establish whether there are any places of traditional or historic significance to the Aboriginal community.

Integrated Development Assessment

Under recent amendments to the *EP&A Act*, a range of approvals and licences issued by various agencies have been integrated with the development approval process. Section 91 of the *Environmental Planning and Assessment Amendment Act 1997* lists the approvals of agencies which are included in the integrated development assessment (IDA) process.

This includes Section 90 approvals under the *NP&W Act* regarding consent to knowingly destroy, deface or damage or knowingly cause or permit the destruction or defacement of or damage to an Aboriginal relic or Aboriginal place. Where a relic or an Aboriginal place is known to occur on land prior to the lodgement of a development application, and the development proposal will damage, deface or destroy the relic or Aboriginal place, thereby requiring a consent to destroy from the Director-General of the NPWS, the NPWS will become an approval body.

It should be noted that where a relic or Aboriginal place is found to occur on land after a development application is lodged, separate NPWS approval will still be required under Section 90 of the *NP&W Act.*

The NPWS has prepared detailed guidelines to assist councils and applicants in the IDA process (copies available upon request). The guidelines outline the role of the NPWS in the IDA process and describe the information that needs to be submitted in

an integrated development application. In summary, two types of information are required:

- Aboriginal cultural heritage assessment which involves consultation with the Aboriginal community groups. The NPWS is committed to working in partnership with the Aboriginal community groups in the management of Aboriginal sites and requires community assessment of any Aboriginal site management; and
- Archaeological assessment which involves the assessment of Aboriginal sites and their management based on archaeological heritage criteria.

Environmental impact statements

Where an environmental impact statement (EIS) is required to be prepared for an integrated development, the Director-General of the Department of Urban Affairs and Planning (DUAP) must request each approval body to provide their requirements in relation to the EIS. If the approval body does not provide those requirements within 14 days then the Director-General of DUAP must inform the applicant and the applicant must consult with the approval body to obtain its requirements for the EIS.

If an EIS is to be prepared for an integrated development that involves a Section 90 approval under the *NP&W Act*, the NPWS will be requested to provide its requirements for the EIS. In this situation, the NPWS requirements for the EIS are the same as for any IDA proposal that requires a Section 90 approval under the *NP&W Act*. These requirements are detailed in the attached guidelines.

Databases

The NPWS has two GIS databases which may provide information of use to you if you proceed to undertake further assessment. These are:

- Atlas listing of fauna and flora records in NSW;
- Aboriginal Sites register.

The material from these databases is available upon written application and the receipt of the appropriate fee. If you are interested in obtaining access to the Atlas database, please contact the Data Licensing Officer, GIS Division, on (02) 9585-6684. Records from the Aboriginal Sites register may be obtained upon written application to the Registrar, Cultural Heritage Conservation Division, on (02) 9585-6471.

Further Information

For further information please contact:

Manager, Conservation Planning Unit
Conservation Programs and Planning Division
Central Directorate
NPWS
PO Box 1967
Hurstville NSW 2220

Ph - (02) 9585 6674
Fax - (02) 9585 6442

Our Reference : 273143A1; NEF 6653
Contact : Rebecca Scrivener, 02 4926 9968

NSW EPA

Northern Regions

Fiona McKay
RTA Environmental Technology, Rosebery
PO Box K198
HAYMARKET NSW 1238

17 SEP 2001

Dear Madam

RE: PROPOSED WIDENING OF F3 FREEWAY BETWEEN JOLLS BRIDGE AND CALGA INTERCHANGE

I refer to your letter of 10 August 2001 and additional information requesting advice from the Environment Protection Authority (EPA) on issues to be addressed when preparing the Review of Environment Factors (REF) for the above project. I also refer to the meeting held on 15 August 2001, regarding the above project between officers of the Roads and Traffic Authority (RTA) and the EPA

The following information is provided to assist you in the preparation of the REF for the proposed widening of the F3 Freeway between Jolls Bridge and Calga Interchange project. More detailed information that may be considered in the REF is contained within the Department of Urban Affairs and Planning (DUaP) EIS Guideline "*Roads and Related Facilities – Specific requirements for an EIS*" (September 1996).

GENERAL COMMENTS:

The REF should identify the range of potential short and long term environmental impacts associated with the construction and operation of the Freeway project as well as provide details of proposed measures to address those potential environmental impacts. To this end we have prepared several tables to supplement the DUaP guideline that may assist you in preparing the REF to meet specific requirements of the EPA. A copy of those tables are attached for your convenience as "*Appendix: A – Environmental Goals / Targets and Assessment Criteria for Road Construction Projects*" and "*Appendix: B - Additional EPA Issues / Requirements when preparing an EIS/REF for Road Construction*".

We note that some of the documents referred to in the DUaP guideline have been superseded. A revised list of relevant documents is attached for your convenience as "*Appendix: C – List of Relevant EIS / REF Guidance Documents.*"

A copy of the revised minutes of the meeting held on 15 August 2001 that was emailed to Mr Terry Woodham of the RTA on 2 September 2001 is also attached for your information,.

Environment Protection Authority
PO Box 488G Newcastle NSW 2300 Australia Telephone 61 2 4926 9971 Facsimile 61 2 4929 6712
Ground Floor NSW Government Offices 117 Bull Street Newcastle West NSW 2302
ABN 43 692 285 758
www.epa.nsw.gov.au

recd 18.9.01

SPECIFIC PROJECT ISSUES:

The following specific information and issues should be considered in the preparation of the REF.

(a) Water Quality, Erosion Controls and Spill Containment

The REF should detail the planning and control measures to be implemented to prevent pollution of waters and adverse impacts on the water quality on any nearby, local streams. Adequate sediment and nutrient controls should be provided to ensure minimal impact of runoff both during the construction of and after the project works have been completed. The EPA recommends that this information would be best provided by the preparation of an appropriate 'Erosion and Sediment Control Plan'.

The EPA understands it is proposed to install both permanent and temporary sediment basins during the life of the project. Sediment control structures should be designed with reference to the 1998 NSW Department of Housing guidelines, *Managing Urban Stormwater: Soils and Construction.* Consideration should also be given to designing sediment control structures, which can be used for spill containment purposes, both during the construction phase and after the completion of the project as discussed at the meeting on 15 August 2001.

(b) Waste Disposal

The EPA goal for waste management is based on a waste management hierarchy of waste avoidance, followed by reuse and recycling/reprocessing with disposal as a last resource. From discussions on 15 August 2001, I understand that spoil material obtained during the project will be re-used on-site.

The REF should identify sources of waste material and classify the material in accordance with the EPA's *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes.* The REF should also identify disposal options for the waste material, including re-use on-site. The RTA should ensure that contamination does not occur as a result of re-using waste material onsite.

(c) Dust Generation

The EPA understands that crushing and grinding plants will be used during the project. The REF should identify sources of dust generation and mitigating methods to be employed to manage the level of dust generated during the project. Options such as water carts and regular use of street sweepers should be investigated.

(d) Noise and Blasting

The REF should identify all sensitive noise receptors and provide all background assumptions, methods used and results of data collected as part of the noise assessment. From discussions on 15 August 2001, it is understood that one sensitive noise receptor has been identified.

Noise assessments should be undertaken in accordance with Chapter 171 of the *Environmental Noise Control Manual* for the construction phase of the project. Reference should also be made to the EPA's *NSW Industrial Noise Policy* and *Environmental Noise Management: Environmental Criteria for Road Traffic Noise* documents where necessary.

If any blasting is to be undertaken during the project, a detailed blast assessment should be provided including identification of any associated noise and/or vibration impacts. Mitigation

methods for both blasting and noise impacts during the construction and operating phases of the project should be outlined and discussed in the REF.

(e) Environment Protection Licence

The information provided during preliminary discussions suggests the project is scheduled as "Freeway or Tollway construction" and therefore an Environment Protection Licence (EPL) will be issued by the EPA for the Project. The RTA will need to complete and submit a licence application form (available from the EPA's web page (www.epa.nsw.gov.au) by following the links to 'Licensing') with associated supporting documentation before any works commence.

The licensed premises definition should be limited to the proposed area where construction work is to occur. The license may incorporate numerous scheduled activities such as crushing and grinding operations and mobile concrete batching plants/ bitumen batching plants.

Please contact Rebecca Scrivener on 02 4926 9968 should you have any further inquiries.

Yours sincerely

GRAHAME CLARKE
Head Regional Operations Unit

APPENDIX: A - Environmental Goals / Targets and Assessment Criteria for Road Construction Projects:

The following table provide the proponent with the goals / targets the EPA expect to be adopted for the relevant environmental issues when planning the Project.

- Additional EPA issues / requirements when preparing the EIS using DUaP's *EIS Guideline – Roads and Related Facilities.*

Table: 1 – Environmental Goals / Targets and Assessment Criteria

Issue	Goals / Targets / Assessment criteria
Noise and Vibration	· All practical measures be taken to ensure that the existing noise levels do not increase and where it is practicable to achieve lower noise levels, we consider that this should occur. · The target noise level of "background + 10 dB(A)" contained in Chapter 171 *Construction Site Noise* of the EPA's Environmental Noise Control Manual should generally be adopted as target / goals for construction noise. All reasonable endeavours should be made to reduce the level of noise impacts in circumstances where it is identified that the guideline level will not be achieved. · The limits contained in the "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure & Ground Vibration*" (ANZECC) should be adopted when assessing impacts from blasting activities. · The environmental guideline "*Environmental Noise Management: Environmental Criteria for Road Traffic Noise*" should be used when assessing road traffic noise associated with the Project. This document provides specific guidance on the minimum information required by the EPA in any assessment of road traffic noise.
Air Quality	· All construction plant, equipment, vehicles and machinery must be maintained to meet the requirements of the *Protection of the Environment Operations Act, 1997* and associated Regulations. · The generation of particulate on site during construction should be controlled to the greatest extent practicable. · Particulate generated by the project should be contained within the construction site area to the maximum extent practicable. · Construction activities should be managed to minimise adverse effects on the amenity of local residents and sensitive land uses.
Waste Management	· EPA goal is based on a waste management hierarchy of waste avoidance, followed by reuse and recycling/ reprocessing with disposal as a last resort.
Soils	· The assessment of the project site for Potential Acid Sulphate Soils (PASS) and Acid Sulphate Soils (ASS) should be carried out with reference to the ASSMAC Manual (ASSMAC, 1998).

NSW EPA

Table: 1 – Environmental Goals / Targets and Assessment Criteria (Cont'd)

Issue	Goals / Targets / Assessment criteria
Soils (Cont'd)	· Management strategies and procedures adopted for PASS and ASS should be consistent with those described in the ASSMAC Manual. · The temporary erosion and sediment controls proposed for the Project must be designed (stability, location, type and size), constructed, operated and maintained in accordance with the guideline "Managing Urban Stormwater – Soils and Construction, 3rd edition, 1998" produced by the NSW Department of Housing unless otherwise agreed to in writing by the EPA. · A 'design particle' of 0.02 mm and a 'design flow' of one-quarter of the 1 year ARI flow must be adopted when designing the sediment basin(s) if the soil type in the catchment of any temporary sediment basin(s) is confirmed as '*Type C*' soils. · The relevant **80th percentile** Rainfall Depth (mm) value obtained in the "*Table 6.5 – 5 Day Rainfall Events for Sites in NSW*" contained in the guideline "Managing Urban Stormwater – Soils and Construction, 3rd edition, 1998" must be adopted when designing the sediment basin(s) if the soil type in the catchment of the sediment basin(s) is confirmed as '*Type F*' or '*Type D*' soils.
Water Quality	· Waters can include permanent and ephemeral watercourses, wetlands, canals and dams and groundwater. Reference should be made to the definition of "waters" and "pollution" contained in the POEO Act 1997 when preparing the EIS for the Project. · All practical measures should be used to control and treat water leaving construction sites to ensure discharges from the site will not degrade receiving waters. · Additional waterway pollution control measures such as retention basins and gross pollutant traps should be installed in strategic locations to minimise the effects of road spills on waterways. These mitigation measures should be incorporated into the road design, particularly in sensitive receiver environments and areas of higher runoff.
Licensing	· The Protection of the Environment Operations Act, 1997 (the POEO Act) commenced on 1 July 1999. Chapter 3 of the POEO Act requires that an Environment Protection Licence (EPL) be obtained from the EPA by the occupier of any premises use to carry out "scheduled activities". A list of those "scheduled activities" is contained in Schedule 1 of the POEO Act "*Schedule of EPA - licensed activities*". One of the Activities listed in that Schedule is "Freeway or Tollway construction". The POEO Act also has provision for an EPL to be issued for a "*Miscellaneous Discharge to Waters*" where a discharge may occur to waters and the premises is not a scheduled premises. · Any individual items of equipment to be used during construction, which may be scheduled, will need to be operated under the appropriate EPLs. These items could include mobile concrete batching plants, crushing and screening equipment and mobile bitumen batching plants.

APPENDIX: B - ADDITIONAL EPA ISSUES / REQUIREMENTS WHEN PREPARING AN EIS/REF FOR ROAD CONSTRUCTION

The following table provide the proponent with additional EPA issues / requirements that should be addressed when preparing the EIS for the Project using DUaP's *EIS Guideline – Roads and Related Facilities.*

Table: 1 Additional EPA issues / requirements

DUaP Reference	Issue	EPA Requirement
C.1. (c)	Location	The diagrams and mapping should include the location of environmentally sensitive areas such as wetlands (SEPP 14 included), watercourses and water supplies.
C.2. (a)	Rainfall	Discussion of the potential for the rainfall intensity, frequency, duration and seasonal distribution to impact on the timing / staging of works and the potential to increase risks of off site impacts.
E.4. (a)	Existing acoustic environment	The existing acoustic environment should be assessed and reported with reference to the relevant Sections of the EPA's Environmental Noise Management Guidelines, *"NSW Industrial Noise Policy"* and *"Environmental Criteria for Road Traffic Noise"*.
E.4. (a)	High noise level sources	The location of sources of high noise levels such as depots, CBP, BBP, wood chippers, crushers, etc should be clearly identified on any diagrams provided with the noise assessment report.
E.4. (a)	Sensitive receivers	The location of sensitive noise receivers such as schools, residences, hospitals, etc should be clearly identified on any diagrams provided with the noise assessment report (NAR).
E.4. (b)	Sensitive receivers	The predicted noise and vibration levels at all potentially affected sensitive receivers should be included in the NAR.
E.4. (b)	Impact Assessment	The assessment of the noise, vibration and blasting impacts NAR should include any impacts associated with the frequency and duration of intermittent noise on sensitive receivers.
E.4. (b)	Assessment Criteria	The criteria used to develop the proposed mitigation measures to control noise, vibration and blasting impacts caused by construction activities and associated traffic should be included in the NAR.

Table: 1 - Additional EPA issues / requirements (Cont'd)

NSW EPA

DUaP Reference	Issue	EPA Requirement
E.4. (b)	Mitigation Measures	The NAR should include noise and vibration mitigation measures proposed for construction and blasting activities. This includes installation of noise barriers, attenuation treatment of noisy equipment (eg. Piling hammers, concrete saws, tunnel ventilation systems) and programming noisy construction activities to minimise impact on receivers;
E.4. (b)	Mitigation measures	The NAR should identify the maintenance requirements for any mitigation and control measures proposed.
E.5. (b)	Sensitive receptors	The EIS should identify the location of sensitive receptors likely to be impacted by particulate and other air emissions from the Project site (eg: Schools, residents, etc);
E.5. (b)	Mitigation measures	The EIS should identify the maintenance requirements for any mitigation and control measures proposed.
E.6. (b)	Soil constraints	The dispersibility of the soil must also be considered when describing and assessing the potential direct and indirect effects of soils on the project.
E.6. (b)	Soil constraints	The assessment of the soils should include the potential environmental constraints / impacts associated with the soils during construction.
E.6. (c)	ESCP	The Erosion and Sediment Control Plan (ESCP) prepared for the temporary control measures must be consistent with "the Blue Book".
E.7. (a)	Potentially affected waters	The description of the potentially affected waters should include the classification (if applicable) and current use of the waters. The EIS should include the details of the water Quality Monitoring Program (WQMP) carried out to prepare the description.
E.7. (b)	Water Quality	The assessment of water quality impacts should reference the ANZECC guidelines and interim water quality objectives to assist in the description.
E.7. (b)	WQMP	The EIS should include an outline of the proposed construction WQMP to be implemented to monitor discharges from the Project site and construction impacts on potentially affected waters.

Table: 1 - Additional EPA issues / requirements (Cont'd)

DUaP Reference	Issue	EPA Requirement
	Waste Management	The EIS should: · Identify waste streams associated with the construction and operation of the Project in accordance with the EPA document, *Environmental Guideline: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999).* · Detail the proposed waste minimisation and management strategies and procedures that will be adopted for each stream identified; · Identify the potential to use recycled construction materials; and · Discuss the cut / fill earth works balance for the Project.
G.	ECPs	Along with the outline of the EMP the EIS should include an outline of the individual Environmental Control Plans (ECPs) proposed for the Project such as: · Soil and Water Management Plan (S&WMP) including a site rehabilitation / revegetation plan. · Erosion and Sediment Control Plan (ESCP) (including dust suppression initiatives) · Noise and Vibration Management Plan (NVMP) · Waste Management Plan · Water Quality Monitoring Program (for surface and ground water) · Pollution incident management procedures
G.	Method Statements / procedures	Method statements and procedures are an important tool that can be used to assist in managing environmental issues that can arise when carrying out high risk construction activities in sensitive environments (eg: piling in watercourses, constructing temporary watercourse crossings, concrete paving and sawcutting, etc). The EIS should provide details of any proposed method statements / procedures that will be included in the EMP and ECPs for the project.

APPENDIX: C - List of Relevant EIS / REF Guidance Documents

The following documents / maps / manuals should be used (where appropriate):

- To obtain relevant assessment **criteria,**
- As references for appropriate techniques and processors to be used when collecting and analysing data and modelling potential environmental impacts;
- When preparing proposed ameliorative measures to minimise those impacts; and
- As references when discussing exceedances of the assessment criteria.

The following (and other) relevant EPA publications may be referenced on the EPA's web site at www.epa.nsw.gov.au, with copies available by telephoning the EPA's Pollution Line on 131555.

Table: 1 – List of Guidance documents

SOIL & WATER	· *Australian & New Zealand Environment Council - Guidelines for Fresh and Marine Water Quality (2000)* · *Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water Management Committees* (EPA, 1999) · *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (EPA, 1998) · *Managing Urban Stormwater: Soils and Construction* (Dept of Housing, August 1998) *("The Blue Book")* · *Soil Landscape Maps* (Dept Land & Water Conservation) · *Construction* Sites (EPA Manual for Authorised Officers, 1995) · *The Utilisation of Treated Effluent by Irrigation* (EPA, Draft, August, 2000) · *Wetlands for Treating Wastewater* (EPA Manual for Authorised Officers, 1995) · *Environment Matters Series: Using Herbicides Near Water* (EPA's Draft, April, 2000)
ACID SULFATE SOILS	· *Acid Sulphate Soils Manual* (Acid Sulphate Soil Management & Advisory Committee, 1998) · *Acid Sulphate Soils Risk Maps* (Soil Conservation Service of NSW, 1995)

NSW EPA

Table: 1 – List of Guidance documents (Cont'd)

AIR	· *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2000)
NOISE	· *Environmental Noise Management: Environmental Criteria for Road Traffic Noise* (EPA, 1999) · *NSW Industrial Noise Policy* (EPA, 2000) · *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure & Ground Vibration* (ANZECC) · *Environmental Noise Control Manual* (EPA, 1994)
FUEL & CHEMICAL STORAGE	· *Bunding and Spill Management* (EPA Manual for Authorised Officers, 1997)
WASTE AND LITTER	· Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes" (EPA, 1999) · *Concrete Wastes* (EPA Manual for Authorised Officers, 1995) · *Not Too Hard: Minimising Waste -An information and training package for construction workers* (EPA, The Aust. Centre for Construction Innovation, Uni. Of NSW)
CONTAMINATED SITES	· *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites* (ANZECC, 1992) · *Guidelines for Consultants Reporting on Contaminated Sites* (EPA, 1997) · *Guidelines for the NSW Site Auditor Scheme* (EPA, 1998) · *Contaminated Sites - Sampling Design Guidelines* (EPA 1995) · *Contaminated Agricultural Land* (EPA Manual for Authorised Officers, 1995) · *Service Station Site: Assessment and Remediation* (EPA Manual for Authorised Officers, 1995)
LICENSING	· *Guide to Licensing Under the protection of the Environment Operations Act 1997 – Parts A and B* (EPA, 1999)

APPENDIX: D- **PROJECT: F3 FREEWAY WIDENING BETWEEN HAWKESBURY RIVER AND CALGA**

MEETING: EPA MEETING
LOCATION: RTA Hunter Region Office, Newcastle
DATE: 15 August 2001
ATTENDEES: Terry Woodham Project Development Manager, HCS Convenor)

Colin Nunn Development Manager, Hunter Client Services
Diana Loges Manager, Environmental Assessments, RTA Technology

Bernie Chellingworth Project Manager, Blacktown
Peter Ellis Road Design Development Manager, Blacktown

Jim Clarence Acting Head Regional Operations Unit, EPA Hunter Region

Rebecca Scrivener Regional Operations Officer, EPA Hunter Region

Doug Hair District Officer, Gosford, EPA Hunter Region

APOLOGIES: Nil
MINUTES:

1.0 Introductions

1.1 JC – Rebecca looks after licensing and liaison with RTA/ paperwork. Doug does the field work.

2.0 Project Overview

2.1 CN – explained background to the project, options considered. Cost of options range from $160-300M. Originally built 1962-64. Existing culverts flow into the National Parks. Opportunity exists to retrofit and overcome some of these problems of water quality. NPWS has confirmed that it will accept the requirements of the EPA.

3.0 RTA Issues

Erosion Controls and Spill Containment

3.1 TW – there is a need to construct spill containment.
3.2 DH – I notice that there will be both permanent and temporary basins.
3.3 JC – construction sediment controls don't do an effective job of spill control. Need to look at both separately, but roll into one structure.

3.4 DH – two sets of criteria to work to – construction and operation. May need to put in two sets of controls.
3.5 CN – this is a 90km zone. Beer truck curve – hope to improve the curve.
3.6 JC – need to have containment where there is a high probability of spills. 40y/o design. Major principle of control is the Blue Book. Best achievable management practice.
3.7 DL – are you aware of the RTA/ EPA agreed 'Code of Practice' for Water Management?
3.8 JC – no, would like a copy.
3.9 CN – difficult to get agreements to build anything in the Park. Won't be constructing anything in the National Park.
3.10 TW – outside footprint of road will not be moved. The question is, do we do more damage if we put in a sediment basin. Runoff will not dramatically increase.
3.11 JC – there are a range of methods, not just basins. Silt fences etc.
3.12 CN – we don't want to destroy vegetation for a temporary sediment basin.
3.13 DH – what about putting sediment basins in the roadway/ under the roadway?
3.14 CN – how big would they have to be? Swimming pool size would be massively expensive.
3.15 DH – the size of a couple of culverts. This does bring in issues of Hazmat/ confined spaces.
3.16 JC – Charlestown has been a successful example of what can be done with the contours of a road.
3.17 PE – ideally, it would be nice to control sediment totally by other means.
3.18 CN – most of the sediment is contained in the sandstone.
3.19 JC – would you be using any stabilisation agent?
3.20 BC – potential stabilisation with lime.

Waste Disposal

3.21 JC – West Charlestown. Had to issue a number of licenses. Would have been easier to issue one. How much material would be generated? Would there be the potential to dispose of some material?
3.22 BC – likely to be a shortfall of material. Expecting to find some spoil in the abandoned interchange.
3.23 CN – no spoil will leave the site.
3.24 BC – need to improve mountain type drains. Where to dispose of them?
3.25 JC – waste requirements – can dispose of non-hazardous material on site without licence under POEO. It becomes an issue when you've got hotmix.
3.26 BC –waste is an issue. Sydney EPA did not allow waste to be used on site.
3.27 RS – it depends on the quality of the material.
3.28 JC – preferred option is that you recycle the hotmix.
3.29 CN – local councils buy the recycled asphalt for roadbase. Lots of roads in the area were made using coal tar (in the bottom layers). Now expose a volatile carcinogenic substance. At that time bitumen prices were through the roof.

Blasting, dust

3.30 JC - methods of knocking down mohawks. Will blasting we involved?

3.31 BC – can't rule that out. May be able to be ripped with a D10 Rockbreaker/ rockcutters. Gosford quarries have techniques to cut out blocks.

3.32 DH – that would be a low key way of doing things.

3.33 BC – but we don't want to be here for five years.

3.34 RS – interested in dust generation sources/ minimisation.

3.35 BC - Dust scraping across sandstone generates a lot of dust. Crushing and grinders. Will need street sweepers. Keep the site clean.

Noise

3.36 JC – where are the noise receptors? Project to be defined at actual start to allow licence to concentrate on construction noise issues. Best way of dealing with construction noise may be through good community consultation.

3.37 RS – All noise as per the industrial noise data. Chapter 171 of the EPA Environmental Noise Control Manual for construction noise. Will need to see justifications and all workings including graphs.

3.38 DH – should consider noise reflection at night. Inversions and noise reflections. Criteria are at the back of the industrial noise policy.

3.39 CN – part of the noise problem will be traffic slowing down.

Licensing

3.40 DL – what licences required?

3.41 RS – will need a 'freeway' licence under POEO. Licence for rock crushing. RTA needs to go through the schedule and determine exactly what is required and fees involved. EPA has a statutory processing period of 60 days. Will need to undertake ongoing discussions. Will ensure smooth processing if all issues are addressed properly in the REF. Submit draft to EPA?

3.42 DL – are there any good examples of documentation?

3.43 JC – Irwin Perring in Grafton for documentation. Charlestown wasn't too bad.

3.44 JC – with water quality, the issue will be any 'surprises'. At Charlestown they had water coming out of a coal mine and that took time to resolve. As a guide to licensing, wherever you have a sediment basin, with a discharge point, that point needs to be licensed. You will need to put down the coordinates in eastings and northings. With a water discharge licence, you can apply for one, but even if you do, you will be required to demonstrate that all possible engineering solutions have been implemented to minimise pollution before the EPA will consider issuing a water discharge licence.

3.45 PE – what about if we don't have a discharge point, but an overflow.

3.46 JC – an overflow should be cited as a discharge point. Though the limit range for overflow will often reflect expected background water quality levels during wet weather.

3.47 DH – biological monitoring should take into account the 'area of affectation' of overflow and potential sedimentation/ other pollution. Can already see on topographic maps the sediment plumes in the creeks of the Hawkesbury.

Need to show that these existed before the works take place. Take baseline measurements as part of REF. Can use geotextile fabrics to filter out fines.

Risk Management Workshop Issues

3.48 TW – we are having a risk management workshop on the 5-6 September. Would the EPA be able to attend?

3.49 JC – no resources available. But we can flag our issues now.

3.50 RS – issues are:

- water quality
- noise
- air/ dust
- waste disposal

Actions:

- ***DL to forward copy of RTA Code of Practice for Water Quality to EPA (Hunter).***
- ***DL to continue liaison with EPA.***
- ***DL – get copies of good documentation (information for licensing).***
- ***DL – further investigate noise and effects of inversions.***
- ***DL – further investigate water quality and potential impacts re flora/ fauna and movement of sediment.***
- ***DL – make sure that EPA get all working documentation for noise assessment.***
- ***PE – further investigate potential methods of sediment control and spill containment.***

NSW Police Service
Brisbane Water Local Area Command
HIGHWAY PATROL / TRAFFIC SERVICES

RTA Operations

Thursday, 20 September 2001

PROPOSED WIDENING OF THE F3 FREEWAY

Obviously being the persons on the ground when most of the congestion occurs we utterly support the idea of bringing the two-lane section from Hawkesbury River to Calga in line with the remaining freeway section within our command.

I note from your information that speed limits will be adjusted during the road-work process and your comments with regards to following the road-works the speed limit in certain sections would be increased back to the 110 kph. I presume these sections correspond to your design photographs and would question the northbound location where it appears the speed limit will be increased. This location is only a short distance from where most of the northbound collisions occur and human nature being as it is, drivers will commence their acceleration well before the speed zone change, this being well within an identified crash location. (sheet 9, near the border where it joins sheet 8).

Being the unit responsible for collation of all crash data for this command the incredible reduction in major collisions following the reduction in speed limit was evident to us before any other body, we would respond cautiously to any proposal to increase the limit in any of the sections.

We would support that no work be carried out during morning or evening peak periods, Friday afternoons and evenings, school holidays periods.

The proposed work complex located north of the Mt White heavy vehicle checking station. A question is raised regarding the style of vehicles that will be entering and exiting this site. As it would appear they would need to access the freeway from what is traditionally known as the fast lane, what provisions will be in place to slow vehicles prior to this location.

Bicycles:
It is presumed that you infer pushbike and not motorcycle from your reference of cycles. This command like the RTA have a policy of no official sanction of pushbikes on the Freeway, unfortunately this does not preclude the isolated incidents and therefore we would support any signposting advising the use of the Pacific Highway.

Upon commencement of the road works we would appreciate significant advanced notification of the proposed schedule so that we may task vehicles accordingly. This can be faxed to the phone number mentioned in the footer of this document or relayed through the RTA Traffic Commander who has our direct e-mail addresses.

D.G. O'Shea
Senior Constable

Woy Woy Police Station
Blackwall Road, Woy Woy. NSW 2256
PH 43 411385 Fax 43412174

From: Robert Brown [Robert.Brown@nswfire.nsw.gov.au]
Sent: Wednesday, 26 September 2001 16:52
To: McKAY Fiona
Cc: Ray Kelly
Subject: Proposed Widening of F3 Freeway between Joll's Bridge and Calga Interchange.

Fiona,
Thank-you for the information forwarded to this office in regard to this proposal.
The New South Wales Fire Brigades (NSWFB) supports the proposed improvement to this roadway.
We ask that measures be taken during construction work to maintain passage along this road for emergency
vehicles of the NSWFB.
Should temporary closures be required during the construction phase, it is suggested that notification of
such occurrences and the duration of same be given to the Officer in Charge of the NSWFB Communication
Centre in Newcastle in writing (postal address: 44 Union Street Newcastle 2300) prior to the event, or, if
such is not practicable at the time, by telephone : (02) 4927-2553.
This area is within the jurisdiction of the New South Wales Rural Fire Service for the primary role of
fire suppression, the NSWFB however may be responded to this area (or through this area) for Rescue
Incidents and/or Hazardous Materials Incidents.
I trust that this information will be helpful to your organisation in relation to planning for the
completion of this project.
Regards,
Bob Brown.
Inspector.
Sydney Communication Centre.
9318-4354.

*********NSW Fire Brigades Confidentiality Notice**********
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Ambulance Service of New South Wales

SECTOR MANAGER'S OFFICE - NORTH SYDNEY & CENTRAL COAST

P O Box 6087, Gosford West. 2250
Phone: 02 4323 7908 / Fax: 02 4325 4013
Our Ref: Freeway Changes

4 October, 2001

Fiona McKay
Environmental Services Officer
Environmental Technology
P. O. Box K198
HAYMARKET NSW 1238

Dear Fiona

I do apologise for the delay in our reply.

Some concerns I think we need to highlight that have come to our attention from your feasibility study on widening the F3 Freeway to three (3) lanes area:

1. Re : The proposed work complex near the Ambulance Station:
   Will the council be supplying their own amenities or will they be expecting to use the amenities at the Ambulance Station?

2. In and out Access of Ambulance Vehicles:
   Please confirm that the Station will not be effected by equipment and machinery in and around the work compound?

3. The Emergency Turning Access Point:
   Will they be decreased in size with the median strip, between carriageways which I believe will put our Officers at risk when attempting to do a U turn, as the ambulance vehicle will intrude into both North and South bound carriageways whilst they are waiting for break in the traffic to proceed.

   Should you require any further information, please don't hesitate to contact me on 0418 795 262.

Yours faithfully,

Station Officer Stephen Giles
Hawkesbury River Station – North Sydney & Central Coast

Recd 4.10.01

From: Peter Dunn [Peter.Dunn@gosford.nsw.gov.au]
Sent: Thursday, 27 September 2001 15:56
To: McKAY Fiona
Subject: FW: PROPOSED WIDENING OF THE F3 FREEWAY-JOLLS BRIDGE TO CALGA INT ERCHANGE

Fiona

Further to our previous discussions could you please add the following comments to those already forwarded in reply to your recent letter.

It is realised that the period for comment on the preliminary plans for the above works closed on 7 September 2001 however it is considered that major safety issues are required and consequently that the following comments deserve mention.

1.Elimination of the only bends on the F3 with advisory speed signs between Wahroonga and the New England Highway.

2.Provision of a quality cycleway as exist on the M6 between Heathcote and Wollongong.

3.Special "extra grip" surfacing on all steep downgrades to reduce braking distances and to facilitate driver control.

4.Fog piercing lighting around Mount White as there is a constant fog problem in winter. The system needs only to be switched on when there is a fog and there are few human neighbours to bother.

5.Upgrading of the smoothness of the bottom 1.5m. of all rockfaces to reduce the severity of crashes. A concrete wall will do.

6.Upgrade the stormwater drainage which has been made less effective by frequent resheets of AC.

It is considered that the implementation of safety measures as listed would provide a major benefit to the many commuters who have to use the F3 on a regular basis to attend work in Sydney and for the normal traffic using the route for both pleasure and business.

Peter Dunn
Strategic Planning Engineer

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McKAY Fiona

From: Burch, Bob [BurchB@wyong.nsw.gov.au]
Sent: Wednesday, 5 September 2001 14:51
To: McKAY Fiona
Subject: Widening of F3 Freeway between Jolls Bridge and Calga Interchange

Dear Fiona,

Council's main concern is the impact and hence delays to motorists during the period of construction. The REF should identify the working days and hours and the affect/delays to the traffic during these times. Special attention needs to be given to Sundays, School and Public Holidays. Is it necessary to carry out any blasting? When would this operation be carried out?

Regards

Bob Burch

Bob Burch
Strategic Planning - Transportation Engineer.
Wyong Shire Council
P.O. Box 20
WYONG NSW 2259
Tel: +61 2 43 505455
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E-mail: BurchB@wyong.nsw.gov.au
WWW: http://www.wyongsc.nsw.gov.au/

DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL

P.O. BOX 401, WYONG. 2259
SHOP 3, 61 HOWARTH ST, WYONG. 2259

TELEPHONE: (02) 4351 2230
FAX: (02) 4351 2946

Della Yarnold
R.T.A
Locked Bag 50
NEWCASTLE 2300

RE: F3 Widening Hawkesbury River

Dear Della,

I write this letter n behalf of the members and executive of Darkinjung Local Aboriginal Land Council (DLALC), we would like to inform you that we are pleased with the project being carried out, regarding the widening of the F3 between the Hawkesbury River and Calga Interchange as it is long over-due.

DLALC would like to recommend that two Aboriginal Heritage Officers from DLALC be employed as monitors during the earth moving process.

DLALC also strongly recommend that the RTA endeavor to employ Aboriginal persons from DLALC on the workforce during all stages of construction, this could also be in the way of Trainee Ships. DLALC has a CDEP Programme operating with 75 participants, with many who have shown interest to be trained in earth moving and construction industries, if undertaken, this would not only benefit the Aboriginal People from DLALC but also the RTA, as two days wages would be payable from Center Link to the RTA.

Yours truly,

R.P. Sentence

Roger Sentence
Acting Co-ordinator

Rec'd 28/8/
AR

NSW ROAD TRANSPORT ASSOCIATION INC.
Your Road to Success is Our Expertise

3 September 2001

Ms Fiona McKay
RTA Environmental Technology, Rosebery
PO Box K198
HAYMARKET NSW 1238

Dear Ms McKay

Thank you for your correspondence of 10th August regarding the proposed widening of F3 freeway between Jolls Bridge and Calga Interchange.

The NSW Road Transport Association wishes to convey its support endorsing the widening of F3 freeway. The improved traffic flow and travelling times gained from increasing the number of freeway lanes from two to three are of great benefit to the road transport industry and general road user alike.

The Association believes it is preferable to construct the additional lanes within the central median (ie. between the carriageways) rather than the adjustment of line markings. The Association believes a reduction of lane width under 3.0 metres is not a preferable option on a roadway as significant as the F3.

Congratulations and good luck on an important infrastructure development.

Yours sincerely

MARTIN IFFLAND
Executive Director

rec'd 7.9.01 fmckay

CENTRAL OFFICE
Level 4, 162 Goulburn Street
Darlinghurst NSW 2010
Tel: 02 9267 8222 Fax: 02 9267 8388

NORTHERN DIVISION
P.O. Box 318
Broadmeadow NSW 2292
Tel: 02 4969 3133 Fax: 02 4961 5836

Appendix B
Water Quality Assessment

Water Quality Assessment

Proposed Widening of F3 Freeway between Jolls Bridge and Calga Interchange

Prepared for:
RTA Operations
Environmental Technology Branch
Environmental Assessments Section

By:
RTA Operations
Environmental Technology
Level 3, 52 Rothschild Avenue
ROSEBERY NSW 2018
Ph: 9662 5042
Fax: 9662 5045
email: jeffrey_parnell@rta.nsw.gov.au

October 2001

Document controls

Report No G001

Prepared For:	Prepared By:
Ms. Diana Loges Environmental Assessments Environmental Technology Branch 52 Rothschild Avenue Rosebery NSW 2018	Environmental Monitoring Section Environmental Technology Branch 52 Rothschild Avenue Rosebery NSW 2018

Business Unit	Environmental Monitoring		
Project No.	811002/730001	WQM F3 Widening	
Document description	Water Quality Assessment: Proposed Widening of F3 Freeway between Jolls Bridge and Calga Interchange.		
	Name	**Signed**	**Date**
Approving Manager	David Corry		31/10/01

Person managing this document	Person writing this document
Jeff Parnell	Jeff Parnell

Location	CARMS File
G:\PROJECTS\PROJ\0102\8111002\Water\Water_1.DOC	

Client Reference	Status	Date
811002/730002	Final 1.0	29 October, 2001

Quality System
Quality Endorsed Company

RTA Operations Directorate
AS/NZS ISO 9001
QEC 7443
Standards Australia

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Environmental Technology Branch

Proposed Widening of
F3 Freeway

WATER QUALITY ASSESSMENT

October 2001

TABLE OF CONTENTS

1 INTRODUCTION 4

2 STUDY AREA 4

3 DETAILS OF PROPOSED WORKS 7

4 RESULTS 7

5 APPLICATION OF GUIDELINES 8

5.1 pH 8

5.2 Suspended Particulate Matter and Turbidity (SPM) 8

5.3 Nutrients 9

5.4 Aluminium (Al) 9

5.5 Copper (Cu) 9

5.6 Lead (Pb) 9

5.7 Cadmium (Cd) 9

5.8 Zinc (Zn) 10

5.9 Iron (Fe) 10

5.10 Chloride (Cl) 10

6 DISCUSSION 10

7 CONCLUSION 11

APPENDICIES

A Aerial Photography of Study Area

B Laboratory Results

Glossary of Terms

ANZECC	Australian and New Zealand Environment Conservation Council
EPA	NSW Environment Protection Authority
REF	Review of Environmental Factors
RTA	NSW Roads and Traffic Authority

1 Introduction

The RTA is proposing to undertake widening works on the two lane sections of the F3 Freeway between Jolls Bridge, RoadLoc coordinate (6003,1115,B3,4.400) and the Calga Interchange, RoadLoc coordinate (6003,1150,B3,0.635) a distance of approximately 10.75 km. The existing section of Freeway was constructed in the late 1960's. The 3 lane sections of the F3 Freeway would not be affected by the proposal.

Narrowing of the road from 3 lanes to 2 lanes in each direction combined with a series of curves and changes in gradient was believed responsible for a higher than acceptable accident rate. In 1999 the signposted speed limit for this 10.75 km section of road was reduced from 110 km/hr to 90 km/hr as a temporary measure until a satisfactory permanent solution could be developed. Traffic studies have indicated a significant reduction in accident rates was achieved following this reduction in speed limits.

The Proposal involves widening the existing carriageways to provide a uniform 3 lane dual carriageway consistent with adjoining sections of the F3 Freeway. It is proposed that the widening would be achieved by a reduction in lane width from 3.66m to 3.5m and by utilising the existing median. All pavement construction would be carried out within the road reserve and would essentially preserve the existing alignment. It would be expected that up to 5 km of the existing 90 km/hr signposted Freeway would revert to 110 km/hr. Around 35 sedimentation basins (both temporary and permanent are proposed as part of the Proposal.

The object of this study is to identify;

- water courses in the study area;
- ambient water quality;
- potential impacts during Construction;
- the need for further assessment.

Each of these parameters is discussed separately in Sections 4 - 6. A more detailed schedule of works is included in Section 3.

2 Study Area

The study area lies on a section of the F3 Sydney – Newcastle Freeway from north of the Hawkesbury Bridge to the Calga Interchange. The old Pacific Highway crosses the F3 Freeway at several points along this section and is used to provide access to villages, facilities and remote properties. For the most part this section of the F3 Freeway divides the Popran and Brisbane Water National Parks. It is proposed to establish two site compounds at locations which would provide easy access and allow safe traffic movements. The southern compound is proposed for a parcel of land to the west of the F3 and annexed by both the F3 and the old SH1 Pacific Highway adjacent to the Mooney Mooney Ambulance Station. It is proposed to locate the northern compound in the F3 median in the vicinity of the Mount White Heavy Vehicle Checking Station. A topography map contained in Appendix A identified several minor water courses in the study area that have the potential to be impacted

upon by construction activities. All references are made from RTA Plans File Number F3/184.1687, Registration Number 6003.184.FS.0007.

Figure 2.1. shows a map depicting the section of F3 Freeway that is being proposed for the upgrade.

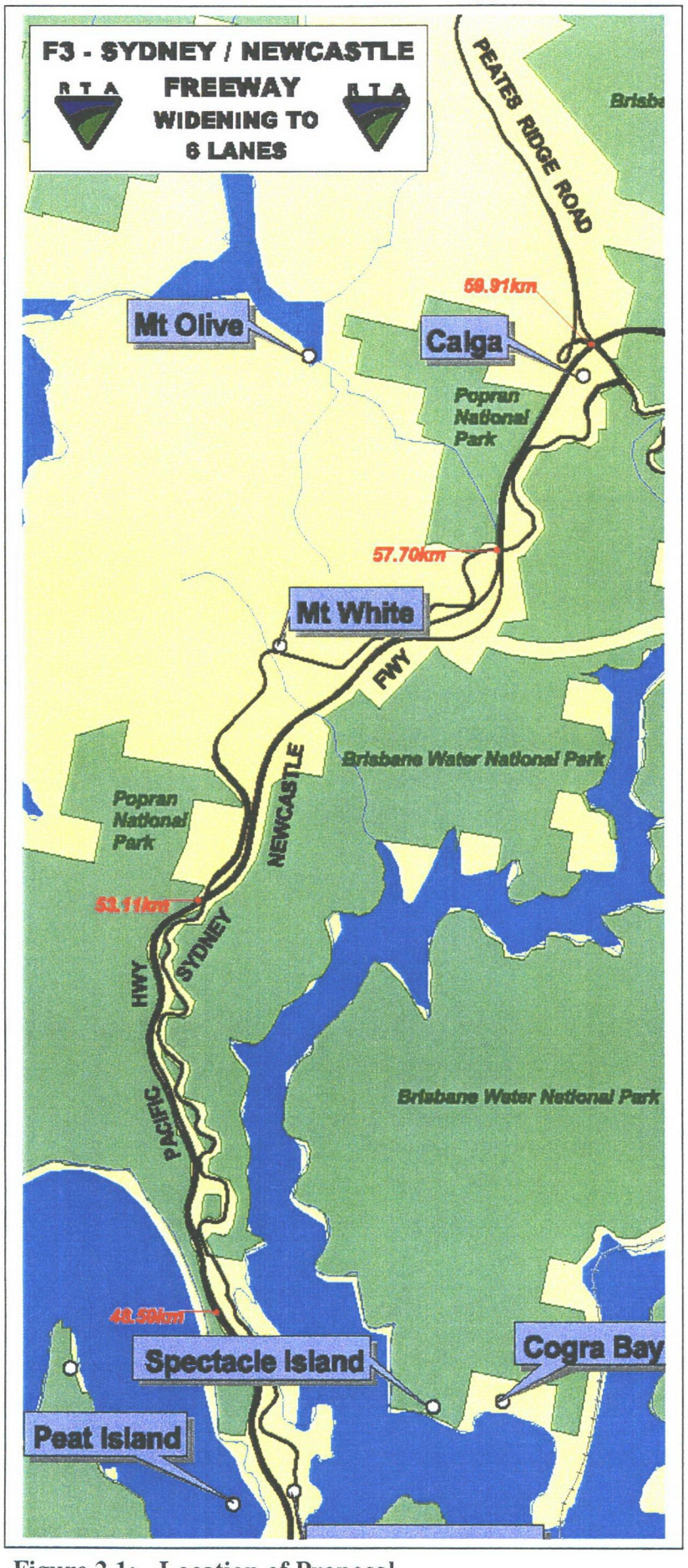


Figure 2.1: - Location of Proposal.

3 Details of Proposed Works

At this stage, no schedule of works has been provided, however, it would be expected that construction would include:
Clearing and Grubbing
Excavation
Earthworks
Transport of material
Stockpiling and Spoil material
Rock Crushing
Drainage work
Paving
Concreting

It is an objective of the project to provide a uniform dense grade asphalt wearing surface consistent with that which already exists. It is also expected that it would be necessary to undertake a large amount of night work.

4 Results

A field inspection along the proposed route was undertaken on 6 August 2001 to identify watercourses which were considered to have the potential to be impacted upon.

Samples were collected from three water courses (F3-1 – F3-3) that pass through the study area and which will allow future comparative assessment. Sampling sites are located in Appendix A.

All three sites are described as low flow and degraded as a result of eutrophication.

Site F3-1
Green Point Gully, downstream of the F3. Water passes under the F3 by means of a culvert and then along a sandstone creek bed before cascading over a 10m waterfall.

Site F3-2
Calverts Creek
Located downstream of the Old SH10 but upstream of the F3. A degraded waterbody, essentially stagnant with algal growth on the surface.

Site F3-3
Small watercourse running west into Marlows Ck from a culvert under the F3 in the vicinity of 11 Old Pacific Hwy, Mt White.

Table 4-1 summarises the water quality results that were determined at AWT West Ryde Laboratories. Full laboratory results are contained in Appendix B.

Table: 4

Analyte	Method	Unit	Result		
			F3-1	F3-2	F3-3
Total Nitrogen	NU57	mg/L	0.55	0.59	0.22
Total Phosphorus	NU57	mg/L	0.007	0.014	0.007
Total Chlorine Lab Test	WC19NS	mg/L	<0.05	<0.05	<0.05
pH	WC34NS	pH Units	7.3	6.9	6.6
Suspended Solids	WC44NS	mg/L	<2	<2	5
Total Solid Residual	WC46NS	mg/L	82.0	100.0	105.0
Total Dissolved Solids	WC62NS	mg/L	74.0	65.0	85.0
Total Aluminium	WTM56TUL	ug/L	105	195	309
Total Iron	WTM56TUL	ug/L	626	348	657
Total Copper	WTM56TUL	ug/L	1	<1	2
Total Zinc	WTM56TUL	ug/L	8	5	15
Total Cadmium	WTM56TUL	ug/L	<1	<1	<1
Total Lead	WTM56TUL	ug/L	<1	<1	2
Flow Rate/5 min			*10-50m*	*1-10m*	*0-1m*

5 APPLICATION OF GUIDELINES

The relevant criteria for assessing water quality in Australia are the ANZECC Australian Water Quality Guidelines (1992) and are recorded in italics. It is expected that new guidelines will be released in October 2001.

While the current guidelines set a range of limits on parameters that affect water quality it is not yet clear how the new guidelines will determine impacts on water quality. It is important to realise that these non - mandatory guidelines represent an ideal scenario which may not represent the natural condition of the body of water being monitored.

5.1 pH

The pH of fresh waters should not be permitted to vary beyond the range 6.5 to 9.0. It is also recommended that changes of more than 0.5 pH units from the natural seasonal maximum or minimum should be investigated.

Results from all 3 sites indicate a neutral pH level.

5.2 Suspended Particulate Matter and Turbidity (SPM)

Increases in SPM should be limited such that the optical guidelines (Section 2.3.1) are maintained and that the seasonal mean nephelometric turbidity does not change by more than 10%.

Levels of suspended solids are low, however there appears to be some dissolved solids present.

5.3 Nutrients

It is not possible to determine national nutrient limits to prevent undesirable algal growths in rivers and streams since some systems cope naturally with relatively high nutrient loads without excessive aquatic plant growth occurring because other factors (eg. poor light, high turbidity) limit the development of nuisance growths.
While site specific studies are required to determine acceptable nutrient loads the ranges are likely to be within:

Total Phosphorous (P)	*10 - 100 ug/L*
Total Nitrogen (N)	*100 - 750 ug/L*

While nitrogen levels are within recommended guidelines they are toward the higher end of acceptability. Given the algal growth it is suspected that these levels may often exceed the recommended levels.

5.4 Aluminium (Al)

The total aluminium concentration in fresh waters should not exceed 5ug/L if the pH is 6.5 or less, and should not exceed 100ug/L if the pH is greater than 6.5.

The recommended levels are low, reflecting a low tolerance that fish have to the effects of aluminium. Fish kills are often a result of Al hydroxides precipitating in the gills of aquatic organisms which then hinders respiration, thereby causing suffocation. A decrease in pH will mobilise heavy metals in soil which often results in elevated levels of Al.

Natural waters will usually have concentrations below 1 mg/L except in areas with low pH. The recommended limit for drinking water for livestock is 5 mg/L.

Results of laboratory analysis show that Al levels at all monitored sites are well in excess of the recommended limits. Experience has shown that while these levels are high they are not uncommon.

5.5 Copper (Cu)

The concentration of total copper in fresh waters should not exceed 2 - 5 ug/L, depending on water hardness.

Recorded levels are below recommended criteria.

5.6 Lead (Pb)

The concentration of total lead in fresh waters should not exceed 1 - 5 ug/L, depending on water hardness.

Recorded levels are below recommended criteria.

5.7 Cadmium (Cd)

The concentration of total cadmium in fresh waters should not exceed 0.2 - 2 ug/L, depending on water hardness.

Recorded levels are within recommended criteria.

5.8 Zinc (Zn)

The concentration of total zinc in fresh waters should not exceed 5 - 50 ug/L, depending on water hardness.

Recorded levels are within recommended criteria.

5.9 Iron (Fe)

In most bodies of fresh water, it is unlikely that toxic effects will occur at total iron concentrations below around 1000 ug/L. However, if the ferrous iron concentration is above 500ug/L, problems may occur due to floc formation when the ferrous iron is oxidised.

Recorded levels are below recommended criteria.

Where iron levels are elevated in an aquatic system there is the potential for precipitation of iron oxides which may effectively coat aquatic flora reducing the processes of photosynthesis. Systems where this has occurred recently are characterised by brown precipitate on macrophytes below the water line, possible die back or succession by more adapted plant communities. Dissolved oxygen levels will also reduce in line with lower levels of photosynthesis.

5.10 Chloride (Cl)

There are no guidelines for freshwater in recognition of the high ambient levels in Australian waters however the guidelines for raw drinking water suggest,
The concentration of chloride in raw water should not exceed 400 mg/L.

Recorded levels are below recommended criteria.

6 Discussion

Given the topography and hydrology of the study area it is expected that the parameter that would most likely to be impacted by any construction activity would be suspended particle load. The load of suspended particle matter carried by water bodies is important not only because it affects the clarity of the water but also because the particle matter will eventually settle out, often when flow rate is reduced. This will often have deleterious consequences for aquatic life by smothering benthic organisms. Construction activities have the potential to greatly increase the load of particle matter carried by moving water bodies unless appropriate control measures are utilised.

Changes in pH can itself cause significant changes to the aquatic environment, particularly where the pH levels are lowered. Impacts may include death, disease, reduction in reproduction, or may discriminate in favour of particular species. The side effects of a lowering in pH levels can however have more serious consequences

due to the mobilisation of heavy metals. Lowering of pH is usually a result of allowing acidic material to leach into waterways. In areas below 5 m Australian Height Datum (AHD) this is usually occurs due to disturbance of Acid Sulphate Soil (ASS) or as a result of excavation of Potential Acid Sulphate Soil (PASS) which subsequently oxidise to form ASS.

It is not considered that any of the proposed activities have the potential to lower the pH levels. There are no known areas of ASS in the study area and it is unlikely that these areas would exist.

Operational use of roads is known to increase pollution as a result of road runoff pollutants and from litter. While the proposal would increase the impermeable surface area, better water management would improve the velocity and containment of runoff so that the current situation would be improved. Because there is no design increase in traffic volumes, there will not be an increase in the quantity of contaminants contained in road runoff. With better containment devices providing there is the potential to reduce the current levels of heavy metals lost to the environment. Given the object of the widening is to reduce the accident rate it would therefore be expected that the risk of chemical spillage from accidents would be also reduced.

7 Conclusion

Results and field observations show that the water quality of the streams at the time of sampling was not particularly high. While a single monitoring event only gives a "snapshot" of water quality in the study area, it is believed that the results obtained would be typical of ambient conditions. Considerable fluctuations in water quality would be expected as a response to rainfall events. The greatest potential for a deleterious change in water quality would come from a large increase in suspended particle matter as a result of poor sediment control devices and work practices.

It is recommended that a detailed sediment control plan be developed to minimise any effects of construction. Work procedures should state the requirements to protect any construction waste from potentially entering a watercourse. Contingency plans should also be developed to deal with any spills that may occur during construction.

Provided appropriate safeguards are detailed in the EMP it is considered that no impacts should occur to the existing waterways.

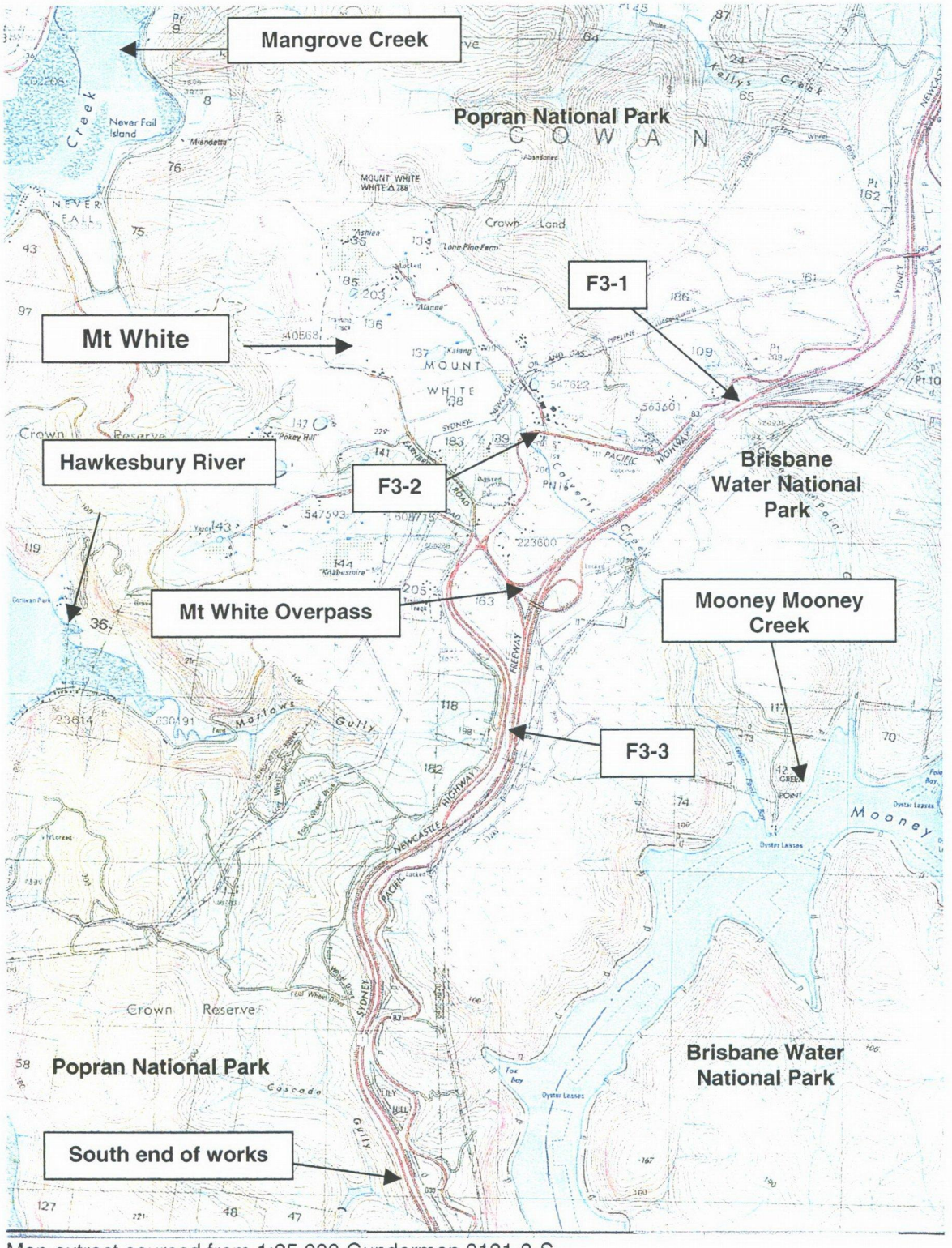
A water quality monitoring program is not considered necessary provided that strict supervision of earthworks by a soil conservationist is provided. Procedures for maintenance of sediment basins should be approved prior to the commencement of earthworks.

Waterborne pollutants associated with operational use of the roadway would not be expected to increase as a result of the proposal but may be reduced from current levels by adoption of better technology

Appendix A

Site Locations

F3 Widening Project – Water Monitoring Locations



Map extract sourced from 1:25 000 Gunderman 9131-3-S

F3-1 **Green Point Gully**

F3-2 **Calverts Creek**

F3-2 **Marlows Creek**

Appendix B

Laboratory Results

Analytical Services
AWT ES&T

RTA-OPERATIONS ENVIRONMENTAL TECHNOLOGY
LEVEL3,52 ROTHSCHILD AVENUE ROSEBERRY NSW 2018
PH:9662 5042
FAX:9662 5045 NSW 2018

Sample ID	Client ID.	Sampled	Received	Authorised	Comments
201049202	F3-1	06/08/01	07/08/01	14/08/2001	
201049203	F3-2	06/08/01	07/08/01	14/08/2001	
201049204	F3-3	06/08/01	07/08/01	14/08/2001	

Analyte	Method	Unit	201049202	201049203	201049204
Total Nitrogen	NU57	mg/L	0.55	0.59	0.22
Total Phosphorus	NU57	mg/L	0.007	0.014	0.007
Total Chlorine Lab Test	WC19NS	mg/L	<0.05	<0.05	<0.05
pH	WC34NS	pH Units	7.3	6.9	6.6
Suspended Solids	WC44NS	mg/L	<2	<2	5
Total Solid Residual	WC46NS	mg/L	82.0	100.0	105.0
Total Dissolved Solids	WC62NS	mg/L	74.0	65.0	85.0
Digestion Charge	WTMHTHRUPUT	DONE	1	1	1
Total Aluminium	WTM56TUL	ug/L	105	195	309
Total Iron	WTM56TUL	ug/L	626	348	657
Total Copper	WTM56TUL	ug/L	1	<1	2
Total Zinc	WTM56TUL	ug/L	8	5	15
Total Cadmium	WTM56TUL	ug/L	<1	<1	<1
Total Lead	WTM56TUL	ug/L	<1	<1	2

Josipa Mates
Customer Liaison Officer

ANALYSED AS RECEIVED
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Water Quality Monitoring
Site Sampling Sheet

Location F3 WIDGIEWA

Site	Water Level	Readings	Storage No's	Time	Grab Sample
F3-1			-		F3-1

Flow Rate per 5min 0 - 1m ☐ 1 - 10m ☐ 10 - 50m ☑ 50 - 250m ☐ 250+m ☐

Comments GROUNDPOINT GULLY Downstream of F3 From culvert 10m below rd. Sandstone bed. goes over 10m waterfall.

Site	Water Level	Readings	Storage No's	Time	Grab Sample
F3-2			-		

Flow Rate per 5min 0 - 1m ☐ 1 - 10m ☑ 10 - 50m ☐ 50 - 250m ☐ 250+m ☐

Comments CALVERTS CK. Upstream of F3, downstream of old SH10. Water moving, some algae + tadpoles.

Site	Water Level	Readings	Storage No's	Time	Grab Sample
F3-3			-		

Flow Rate per 5min 0 - 1m ☑ 1 - 10m ☐ 10 - 50m ☐ 50 - 250m ☐ 250+m ☐

Comments Small watercourse running west from culvert under F3. TO MARLOWS CK

Site	Water Level	Readings	Storage No's	Time	Grab Sample
			-		

Flow Rate per 5min 0 - 1m ☑ 1 - 10m ☐ 10 - 50m ☐ 50 - 250m ☐ 250+m ☐

Comments

Site	Water Level	Readings	Storage No's	Time	Grab Sample
			-		

Flow Rate per 5min 0 - 1m ☐ 1 - 10m ☐ 10 - 50m ☐ 50 - 250m ☐ 250+m ☐

Comments

High Tide _____ am/pm Delay _____ hr Influence _____ m

Last Rainfall > 10mm/24hrs / / Fall _____ mm Data Stored as: _____

Technician _____ Date 6 / 8 / 04

Appendix C
Noise and Vibration Report

Noise and Vibration Assessment

Proposed Widening of F3 Freeway between Jolls Bridge and Calga Interchange

Prepared for:
RTA Operations
Environmental Technology Branch
Environmental Assessments Section

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October 2001

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Report No G001

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Business Unit	Environmental Monitoring		
Project No.	811002	NM F3 Widening	
Document description	Noise and Vibration Assessment: Proposed Widening of F3 Freeway between Jolls Bridge and Calga Interchange.		
	Name	**Signed**	**Date**
Approving Manager	David Corry		31/10/01

Person managing this document	Person writing this document
Jeff Parnell	Jeff Parnell

Location	CARMS File
G:\PROJECTS\PROJ\0102\811002\Noise\Noise_1.DOC	

Client Reference	Status	Date
811002/730001	Final 1.0	29 October, 2001

Quality System
Quality Endorsed Company

RTA Operations Directorate
AS/NZS ISO 9001
QEC 7443
Standards Australia

© Roads and Traffic Authority
Environmental Technology Branch

Proposed Widening of F3 Freeway

NOISE AND VIBRATION ASSESSMENT

TABLE OF CONTENTS

1 INTRODUCTION 1

2 STUDY AREA 1

3 METHODOLOGY 2

4 DETAILS OF PROPOSED WORKS 4

5 TRAFFIC DATA 4

5.1 Traffic Composition 4

6 INSTRUMENTATION 5

7 NOISE MONITORING RESULTS 5

8 OPERATIONAL NOISE 6

8.1 Criteria 6

8.2 Methodology and Assessment 7

9 CONSTRUCTION NOISE 8

9.1 Guidelines 8

9.2 Methodology and construction noise predictions 10

9.3 Construction noise impact 12

9.4 Construction Noise Management 12

10 CONSTRUCTION VIBRATION 14

11 CONCLUSION 15

11.1 Operational Noise 15

11.2 Construction Noise 15

11.3 Construction Vibration 16

12 REFERENCES 17

APPENDICES

A Aerial Photography of Study Area
B Site Data Sheets
C Noise Data
D Noise Modelling
E Calculations
F Out of Hours Work, Practice Note

Glossary of Terms

EPA	NSW Environment Protection Authority
REF	Review of Environmental Factors
RTA	NSW Roads and Traffic Authority
dB	The is the abbreviation used for decibel which is the measure of sound pressure level
dBA	The "A" denotes that the sound pressure level has been A weighted so that the scale approximates the response of the human ear. The ear is less sensitive to high and low frequency sounds than it is to sounds in the midrange. Most community noise is measured in "A" weighted decibels
L_1 dBA	This is the noise level in dBA exceeded for 1% of a specified time period. For a 1 hour period the level would be exceeded for 36 seconds but would be less for the remaining 59 minutes 24 seconds. This is sometimes written as L_{A1}
L_{10} dBA	This is the noise level in dBA exceeded for 10% of a specified time period. For a 1 hour period the level would be exceeded for 6 minutes but would be less for the remaining 54 minutes. This approximates the average maximum noise level and is sometimes written as L_{A10}
L_{90} dBA	This is the noise level in dBA exceeded for 90% of a specified time period. For a 1 hour period the level would be exceeded for 54 minutes but would be less for the remaining 6 minutes. This approximates the average minimum noise level and is often referred to as the background noise level and sometimes written as L_{A90}
L_{eq}	The Leq represents the average noise energy during the measurement period. When the energy level is A weighted it may be written as L_{Aeq}
L_{Aeq} (9 hr)	The logarithmic average of the hourly L_{Aeq} measurements recorded between 10 pm and 7 am. (Current NSW EPA night time objective)
L_{Aeq} (15 hr)	The logarithmic average of the hourly L_{Aeq} measurements recorded between 7 am and 10 pm. (Current NSW EPA daytime objective)

Tenth Percentile Background Noise Level

This is the background L_{90} noise level calculated according to the 10th percentile method described in the NSW EPA *Industrial Noise Policy (2000)* for the proposed construction hours.

1 Introduction

The RTA is proposing to undertake widening works on the two lane sections of the F3 Freeway between Jolls Bridge, RoadLoc coordinate (6003,1115,B3,4.400) and the Calga Interchange, RoadLoc coordinate (6003,1150,B3,0.635). This is a distance of approximately 10.75 km. The existing section of Freeway was constructed in the late 1960's. The 3 lane sections of the F3 Freeway would not be affected by the proposal.

Narrowing of the road from 3 lanes to 2 lanes in each direction combined with a series of curves and changes in gradient was believed responsible for a higher than acceptable accident rate. In 1999 the signposted speed limit for this 10.75 km section of road was reduced from 110 km/hr to 90 km/hr as a temporary measure until a satisfactory permanent solution could be developed. Traffic studies have indicated a significant reduction in accident rates was achieved following this reduction in speed limits.

The Proposal involves widening the existing carriageways to provide a uniform 3 lane dual carriageway consistent with adjoining sections of the F3 Freeway. It is proposed that the widening would be achieved by a reduction in lane width from 3.66m to 3.5m and by utilising the existing median. All pavement construction would be carried out within the road reserve and would essentially preserve the existing alignment. It would be expected that up to 5 km of the existing 90 km/hr signposted Freeway would revert to 110 km/hr.

The object of this study is to identify the potential impacts of:

- Operational Noise
- Construction Noise
- Construction Vibration

which may occur as a result of the Proposal and to:

- Identify the need for further assessment
- Propose a range of suitable noise and vibration mitigation strategies

Each of these parameters is discussed separately in Sections 8 - 10. A more detailed schedule of works is included in Section 4.

2 Study Area

The study area lies on a section of the F3 Sydney – Newcastle Freeway from north of the Hawkesbury Bridge to the Calga Interchange. The old Pacific Highway crosses the F3 Freeway at several points along this section and is used to provide access to villages, facilities and remote properties. For the most part this section of the F3 Freeway divides the Popran and Brisbane Water National Parks. It is proposed to establish two site compounds at locations which would provide easy access and allow safe traffic movements. The southern compound is proposed for a parcel of land to the west of the F3 and annexed by both the F3 and the old SH1 Pacific Highway adjacent to the Mooney Mooney Ambulance Station. It is proposed to locate the northern compound in the F3 median in the vicinity of the Mount White Heavy

Vehicle Checking Station. Aerial photographs contained in Appendix A have identified several potential noise receiver locations in the study area. Information supplied indicates several of these receiver locations are residences. Table 2-1 lists the work being undertaken and the distances to the nearest residences. All references are made from RTA Plans File Number F3/184.1687, Registration Number 6003.184.FS.0007.

Table 2-1 POTENTIALLY IMPACTED RECEIVER LOCATIONS

Location	No. of Receivers Represented	Receiver Type	Sheet No.	Distance from		Potential Noise Source
				Work	Road	
A	1	Ambulance Station[1]	3	20m	15m	Compound
B	2	Mental Hospital	3	300m	300m	Compound
C	10+	Residences	3	300m+	300m+	Compound
D	1	Residence	10	125m	125m	Construction
E	1	Residence[2]	10	100m	100m	Construction
F	1	Residence	12	175m	175m	Construction
G	1	Residence	12	160m	160m	Construction
H	1	Residence	12	140m	140m	Construction
I	1	Residence	12	75m	75m	Construction
J	1	Residence	12	240m	225m	Compound
K	1	Residence	12	190m	175m	Compound
L	1	Residence[3]	12	55m	40m	Compound

1 Monitoring was undertaken in the vicinity of this residence and is recorded as Site 1.
2 Monitoring was undertaken in the vicinity of this residence and is recorded as Site 2.
3 Monitoring was undertaken in the vicinity of this residence and is recorded as Site 3.

3 Methodology

To identify any noise or vibration sensitive receivers, reference was made to Table 2-1. From this table it was determined that noise measurements of ambient conditions should be made in the vicinity of each proposed compound site and one measurement should be made at a residence in the vicinity of construction work. All sites chosen are subjected to existing road traffic noise from the F3 Freeway.

Predictions of operational noise were made with reference to the EPA's "*Environmental Criteria For Road Traffic Noise*" (ECRTN) May 1999 using historical traffic data regarding volume and composition contained in Section 5. These predictions are discussed in Section 8. Modelling was undertaken using the US Federal Highways Association's (FHWA) Traffic Noise Model Lookup Tables.

The effects of construction noise were predicted according to RTA protocols and are discussed in Section 9.

Effects of construction vibration are not considered to be significant for this project due to the isolation of residences from construction activity. Such effects are further discussed in Section 10.

Figure 3-1. shows a map depicting the section of F3 Freeway that is being proposed for the upgrade.

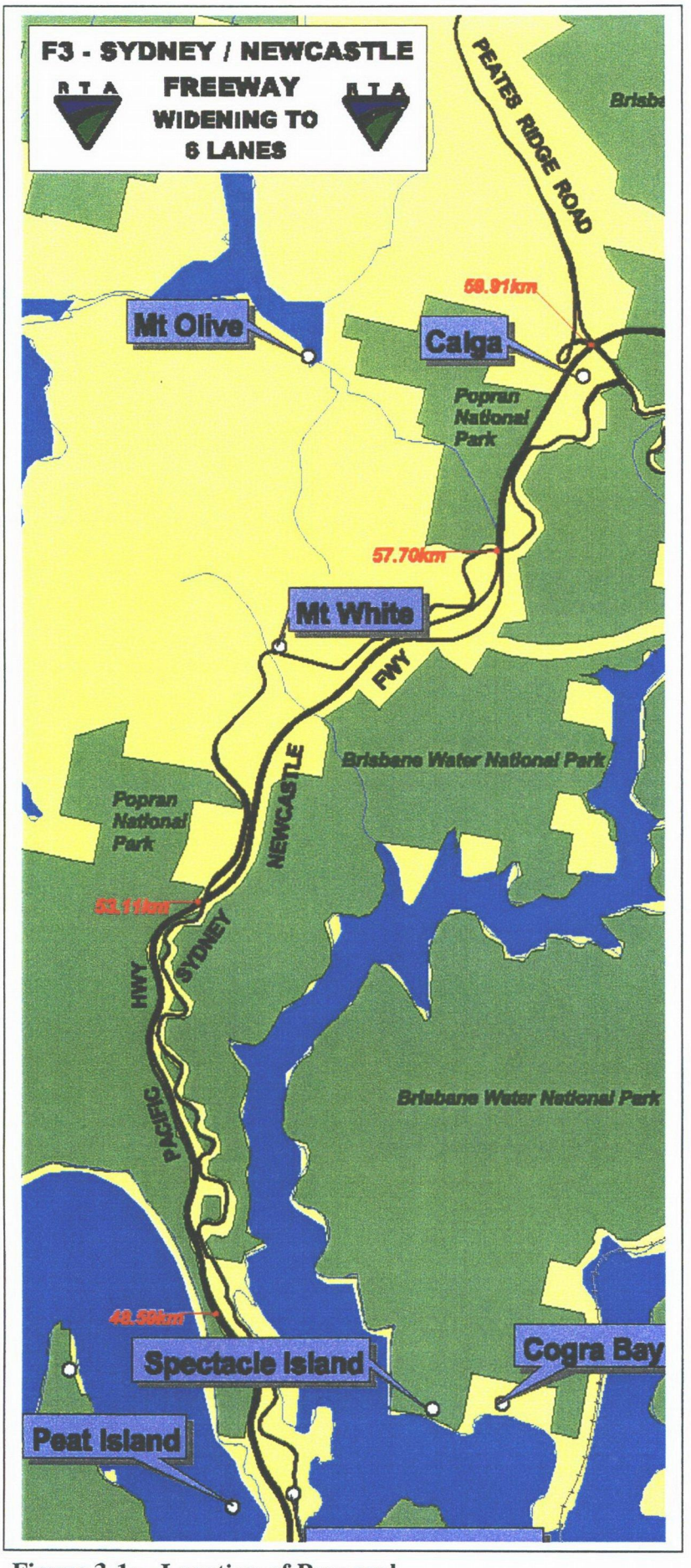

Figure 3-1: - Location of Proposal.

4 Details of Proposed Works

At this stage, no schedule of works has been provided, however it would be expected that construction would include:
Pavers
Excavators
Graders
Vibrating rollers
Rock breakers
Rock crushing
Heavy transport

It is an objective of the project to provide a uniform dense grade asphalt wearing surface consistent with that which already exists. It is also expected that it would be necessary to undertake a large amount of night work to minimise significant potential impacts on traffic flows.

5 Traffic Data

Table 5-1 F3 Freeway Traffic Volumes

Location on F3	Annual Average Daily Traffic			
	1996	1998	2006	2011
South of the Pacific Highway overbridge	na	32,937	44,323	49,305
South of Kuringai Chase Road overbridge	67,468	na-	90,792	100,996
South of Windybanks overbridge	57,568	na-	77,462	86,170
South of Berowra ramps	48,838	na-	64,962	72,265
North of Berowra ramps	na	64,995	80,773	89,402

na not available

For the purpose of this study figures and predictions for north of Berowra Ramps have been used in calculations and assumptions.

5.1 Traffic Composition

The vehicle composition assumed in the Rural Evaluation System (REVS) analysis was:

Table 5.1-1 Traffic Classification

Vehicle Class	Assumed Percentage
Cars	90.5%
Light Commercials	1.0%
Rigid Trucks	3.1%
Semi Trailers	5.1%
B-Doubles	0.3%

6 Instrumentation

Renzo Tonin Environmental Noise Loggers (Serial No's 73, & 79) were used during the monitoring to obtain data at all three sites. These instruments satisfy the requirements of Australian Standard AS1259-1990 for Type 2 instrumentation.

The instruments were operated using the A-weighted setting and RMS detector time set to "fast". Data was collected in 15 minute intervals and reported in 1 hour intervals. The instruments were field calibrated before and after measurements with a Bruel & Kjaer Type 4231 acoustic calibrator (Serial No. 1723759). The field calibration levels were within the acceptable limit of variation of ± 0.5 dBA.

Both the noise loggers and the acoustic calibrator used for field calibration had current NATA calibration. The reference pressure for all sound pressure level measurements is 20 μPa.

7 Noise Monitoring Results

Measurements were obtained at Site1, the Ambulance Station, by placing the noise logger 1 metre away from the closest wall facing the F3 Freeway. Because of dogs at Sites 2 and 3, it was necessary to place the loggers in essentially free field locations between the residences and the F3 Freeway. At these sites a 2.5 dBA road traffic noise facade correction was added to monitored results, in accordance with the ECRTN Technical Note 3. To correct for distance, 0.7 dB was subtracted from the monitored results at Site 2, and 1.2dB subtracted from the monitored results for Site 3 in accordance with calculations performed in Appendix E. In all cases the microphone height was set at 1.5 metres with data collected for a minimum of 7 days. Site Data Sheets are included in Appendix B.

Data was collected during typical traffic flows and meteorological conditions. No extraneous sources of noise that could affect the monitored data were noted. Samuels and Huybregts (1998) found that where road traffic noise is the dominant noise source, a linear relationship exists which approximates to $L_{10} = L_{eq} + 3dB$. Inspection of the collected data using this relationship did not highlight any major discrepancies. All monitored data was therefore deemed valid and acceptable for reporting and as the basis for predictions.

The arithmetic mean of the valid $L_{Aeq(15hr)}$ and $L_{Aeq(9hr)}$ data recorded over the measurement period at each monitoring site is presented in Table 7-1.

The background L_{90} noise level was also recorded for each hour during the monitoring period. The representative background noise level for each site was then calculated by following the "tenth percentile method" described in the *NSW Industrial Noise Policy 2000*. The 'tenth percentile' background noise levels were calculated for the day (7am to 6pm), evening (6pm to 10pm) and night (10pm to 7am) periods and the results are presented -in Table 7-2 below.

The complete hourly measurement results are attached as Appendix C.

Table 7-1 Noise Levels at Selected Locations

Location	Day		Night	
	Corrected Leq(15hr) dBA	EPA Criteria Leq(15hr) dBA	Corrected Leq(9hr) dBA	EPA Criteria Leq(9hr) dBA
Site 1 Adjacent to Ambulance Station	73	60	69	55
Site 2* 11 Old Pacific Hwy, Mt White	62	60	58	55
Site 3* Residence near Mt White Checking Station	66	60	63	55

*Initially measured free field but reported here with corrections for facade and distance

Table 7-2 Tenth Percentile Background Noise Levels L_{90} dBA

Location	Day 7 am –6 pm	Evening 6 pm – 10 pm	Night 10 pm – 7 am
Site 1 Adjacent to Ambulance Station	61	56	41
Site 2 11 Old Pacific Hwy, Mt White	52	50	43
Site 3 Residence near Mt White Checking Station	57	55	46

8 Operational Noise

8.1 Criteria

The NSW Government's "*Environmental Criteria For Road Traffic Noise*" (ECRTN) (May 1999) provides the assessment criteria for road traffic noise in NSW. Tables 1 and 2 of these Criteria contain various classifications of roads structures. According to the definitions supplied, the scope of this proposed project is such that the development would be classified as "Redevelopment of existing freeway/arterial road". For the category of road redevelopment the criteria for the 15 hour day time period (7am to 10pm) and the night time 9 hour period (10pm to 7am) are :

- $L_{Aeq(15hr)}$ = 60 dB
- $L_{Aeq(9hr)}$ = 55 dB

Where these levels are already exceeded by existing road traffic noise, the ECRTN state "in all cases the redevelopment should be designed so as not to increase existing noise by more than 2 dB(A). Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria".

8.2 Methodology and Assessment

Traffic data provided as part of the Economic Analysis being prepared for this project show an Average Annual Daily Traffic (AADT) of approximately 70,000 vehicles per day. Given these extremely high traffic volumes, it would be expected that the ambient noise catchment along this section of the F3 Freeway would be heavily influenced by road traffic noise.

Although the proposed work involves a widening over a 10.75 km stretch of the F3 Freeway, the Proposal would not in itself increase the volume of traffic that flows on either the section that would be upgraded by these works or on the F3 in its entirety.

From a design perspective, all widening would be undertaken by utilising the median or the existing road formation. It can be assumed therefore, that at no point would the F3 be located closer to any noise sensitive receiver as a result of this Proposal such that there would be a consequential increase in road traffic noise.

Modelling undertaken in Appendix D using the FHWA Traffic Noise Model Lookup Tables shows that for a typical F3 scenario, restoration of the speed from the current 90 km/hr to the original design speed of 110 km/hr would result in an increase over the current road traffic noise levels of between 2.1 dBA for receivers located at a distance of 50m to 1.3 dBA for receivers located at a distance of 200m. Increases in road traffic noise of this magnitude are considered minor and would not generally be perceived by the unaided ear.

From Table 7-1 it can be seen that current road traffic noise levels are high and that most receivers within 100m would be likely to be currently in excess of the criteria. In these situations the ECRTN provides allowances over high existing noise levels where it can be justified as neither feasible nor reasonable to reduce noise levels to these criteria.

From Section 5 it can be seen that traffic growth is expect to increase from a current AADT of approximately 70 000 to a predicted AADT of 89 000. Acoustic theory predicts an increase of 1.0 dBA based on a 10 log relationship due to traffic volume increases over a 10 year period. It is expected that these increases would occur regardless of whether the proposed works were undertaken or not.

In conclusion this study has determined that:

- No increase in road traffic noise would occur at any receiver locations due to changes in the design or alignment of the proposed widening.
- There would be no additional increase in traffic volumes or mix as a result of the proposal. Increases in traffic volume would only occur because of natural growth, and therefore there would be no increase in road traffic noise as a result of the proposed widening.
- Restoration of posted speed limits to 110km/hr over 5.0 km of the F3 would result in road traffic noise increasing by between 1.3 and 2.1dBA for receivers up to 200m from the F3 Freeway in a return to levels that would have existed prior to temporary speed reductions being introduced in 1999. There would be no additional increases in road traffic noise as a result of the Proposal compared to the conditions pre-existing the temporary reduction in the posted speed limit. On this basis, and in consideration that the proposed works will be conducted entirely

within the alignment of the existing carriageway, it is considered that noise treatments, such as noise barriers, quieter pavement surfaces or acoustic treatment of individual dwellings, are not warranted.

- Given that most receptors within 100m would be likely to be in excess of criteria, it is pertinent that a recommendation should be made to the local development approval authority to require consideration of acoustic principles in accordance, with the ECRTN, in the design of any new developments within 200m of the road alignment.

9 Construction Noise

9.1 Guidelines

The guidelines for assessment of construction noise are those established by the NSW Environment Protection Authority (EPA) in chapter 171 of the EPA's Environmental Noise Control Manual (1994).

The EPA guidelines for construction noise are as follows:

1. for a construction period of 4 weeks or less, the L_{10} noise level must not exceed the background noise level (L_{90}) during the scheduled daytime hours by more than 20 dBA.
2. for a construction period of between 4 weeks and 26 weeks, the L_{90} level must not be exceeded by more than 10 dBA.
3. for a construction period of greater than 26 weeks, the L_{90} levels must not be exceeded by more than 5 dBA.

Normal (scheduled) working hours are defined as:

- 7:00 am - 6:00 pm Monday to Friday
- 7:00 am - 1:00 pm Saturday if not audible on residential premises, otherwise 8:00 am to 1:00 pm.

No construction work to take place on Sundays or Public Holidays.

It is often recognised that these daytime goals are very stringent and are sometimes unachievable particularly where noise sensitive receptors are located in close proximity to construction works and background noise levels are relatively low. Where daytime goals are likely to be exceeded, a performance approach should be followed that allows the implementation of best management practice in reducing construction noise levels towards the goals.

Total construction time for the project is estimated to be 18 months with some sites such as the work compound being in use for the duration of construction. Pavement works would be staged and therefore would progress incrementally along the 10.75 km length of the upgrade. It would be expected that most stages would be completed in less than 6 months. Therefore while Section 3 of the EPA criteria would apply to areas such as the compound, sections of roadworks would mostly be covered by Section 1, and in rare cases Section 2 of the EPA criteria.

It is likely that a significant proportion of the construction works will be necessarily conducted during the evening and night to minimise impacts on the traffic flow of the F3. This approval is therefore also likely to also involve use of the works compound during these times.

Project specific goals
Between: 6pm and 10pm (Monday to Friday); 1pm and 10pm (Saturday); 7am to 10pm (Sunday).
There are no established guidelines for construction work that is undertaken outside of normal working hours but, for major infrastructure projects operating outside normal working hours the EPA generally the following criterion applies:

- the L_{10} noise level must not exceed the background noise level (L_{90}) by more than 5 dBA.

Exceedance of these goals is only permitted after all feasible and reasonable noise mitigation measures have been exhausted.

Close consultation with the affected community is essential where construction works are proposed outside normal working hours. In addition, where noise goal exceedances are likely and all feasible and reasonable noise mitigation measures have been exhausted, the RTA's out of normal hours construction programming and consultation protocols as described in Appendix F must be followed.

Project specific goals
Between 10pm and 7am.
As described above, the EPA generally applies the criterion of:

- the L_{10} noise level must not exceed the background noise level (L_{90}) by more than 5 dBA.

In addition, the EPA also generally applies the sleep arousal goals provided in the EPA's *Environmental Noise Control Manual (1994).* The EPA sleep arousal guideline requires that "the L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dBA." This goal applies during the night period (10pm to 7am).

As stated above, exceedance of both these goals is only permitted after all feasible and reasonable noise mitigation measures have been exhausted. Close consultation with the affected community is essential where construction works are proposed outside normal working hours. In addition, where noise goal exceedances are likely, and all feasible and reasonable noise mitigation measures have been exhausted, the RTA's out of normal hours construction programming (Appendix F) must be followed. Advice on the community consultation process is given in the RTA Community Involvement Practice Notes and Resource Manual (1998).

For each of the locations identified in Table 2-1, Table 9-2 below lists the measured or estimated tenth percentile background noise level and the corresponding noise goals that would apply for the day, evening and night periods.

Table 9-1 Measured and Predicted Background Noise Levels

Location	Receiver Type	Tenth Percentile Background Noise Level dBA			Project Specific Construction Noise Goals dBA		
		Day (7am - 6pm) L_{90}	Evening (6pm - 10pm) L_{90}	Night (10pm -7am) L_{90}	Day[b] (7am - 6pm) L_{10}	Evening[c] (6pm - 10pm) L_{10}	Night[c,e] (10pm - 7am) L_1 / L_{10}
A	Ambulance Station[1]	61	56	41	76[d]	71[d]	n/a /56[d]
B*	Mental Hospital	47	44	30[a]	52 (47 + 5)	49	45/35
C*	Residences	47	44	37	52 (47 + 5)	49	52/42
D*	Residence	51)	48	41	71 (51 + 20)	53	56/46
E	Residence[2]	52	50	43	72 (52 + 20)	55	58/48
F*	Residence	50	47	40	70 (50 + 20)	52	55/45
G*	Residence	50	47	40	70 (50 + 20)	52	55/45
H*	Residence	50	47	40	70 (50 + 20)	52	55/45
I*	Residence	53	50	43	73 (53 + 20)	55	58/48
J*	Residence	48	45	38	68 (48 + 20)	50	53/43
K*	Residence	50	47	40	70 (50 + 20)	52	55/45
L	Residence[3]	57	55	46	63 (57 + 5)	60	61/51

*Estimated background noise levels based on extrapolations of noise monitoring results from Site A. This site may need to be monitored specifically, as it is unlikely results this low would be recorded.

a) 30 dBA is regarded as the minimum background level and was estimated from Site 1.

b) L_{90} + 5 dB for receivers where work is likely to be > 26 weeks duration.
L_{90} + 20 dB for receivers where work is likely to be < 4 weeks duration.

c) L_{90} + 5 dB for all receivers independent of work duration.

d) This is considered a commercial premises which may not be staffed on a regular basis. An increased allowance of 10 dB is generally considered acceptable at these types of premises and has been added.

e) An L_1 level of L_{90} + 15 dB for all receivers independent of work duration.

9.2 Methodology and construction noise predictions

The schedule of works provided does not have the detail to accurately identify the noisiest activity, however, Table 9-1 lists typical sound power levels of the type of construction plant items likely to be employed (taken from AS 2463 – 1981). Appendix E details calculations determined for receivers at various locations for two scenarios.

- Scenario 1 is calculations performed for a compound site that is used for the duration of the project. For the purposes of calculations assumed equipment being used in this scenario is 2 compressors and 4 trucks.
- Scenario 2 is for construction works that is undertaken in the vicinity of a residence. For the purposes of calculations assumed equipment being used in this scenario is 1 grader, 4 trucks and 2 rollers.

Table 9-2: Typical sound power levels of construction plant items.
(from AS 2436 - 1981)

Item	Sound Power Level dBA
Batch Plant	107 - 121
Excavator	108 - 118
Rock Hammer	110 - 119
Compressor	98 - 100
Vibratory Roller	100 - 104
20t Truck	103 - 108
Grader	114 - 120

Calculations performed in Appendix E using mean values from Table 9-2 for a range of assumed construction equipment for both the construction site and at the compound site were used to predict the sound pressure level at the identified receivers in Table 2-1. Experience shows that the L_{10} is generally between 5 and 12 dB less than the sound pressure level predicted from Sound Power Levels and this can be discounted by a further 2 dB because all equipment will not be working at the same time. Table 9-3 lists the predicted L_{10} values that have been conservatively discounted by a total of 7 dB and compares them against calculated guidelines and project specific criteria for identified receivers.

It is recognised that truck reversing alarms are a common source of complaint, however calculation of noise propagation from construction sites (Appendix E) shows that operation of any one alarm at a time will not increase the noise levels emitted from the compound.

Table 9-3 Guidelines, Recommended Criteria and Predicted Noise Levels during Construction

Location	Guideline dBA L_{10} Day/ L_{10} Evening*/ L_1 Night/* L_{10} Night	Construction L_{10} dBA	Construction L_1 dBA	Compound L_{10} dBA	Compound L_1 dBA
A	76/71/n.a./56	na		71	na
B	52/49/45/35	na		47	54
C	52/49/52/42	na		47	54
D	71/53/56/46	61	68	na	
E	72/55/58/48	63	70	na	
F	70/52/55/45	58	65	na	
G	70/52/55/45	59	66	na	
H	73/55/58/48	60	67	na	
I	68/50/53/43	65	72	na	
J	70/52/55/45	na		49	56
K	70/52/55/45	na		51	58
L	63/60/61/51	na		62	69

* project specific criteria

Due to conservative estimating, the error range is likely to be +2/-5 dB for predictions of noise levels from both the Construction Site and the Works Compound for the assumed equipment use.

9.3 Construction noise impact

Location E is typical of some of the other residences that have been identified as being potentially impacted upon by construction activities in that it is located (at a reduced level) some 20m lower than the existing surface of the F3 Freeway. While this affords significant shielding from road traffic noise it can be seen that the 10th percentile L_{90} background noise is still at a level that is considered high. Because construction activities would be progressive along the length of the F3 Freeway they are not expected to be in the vicinity of any one residence for more than 1 month. Guidelines have been determined with the assumption that receivers D – I would potentially be affected by construction work of less than 4 weeks duration. It is assumed that Receivers A - C and J - L would potentially be affected by compound noise for the duration of the construction work (ie less than 26 weeks).

From the results in Table 9-3 it can be seen that construction work undertaken during the daytime period would not be likely to exceed the EPA guidelines. If the same level of construction activity was continued into the evening and night time period without attenuation then it is likely that project specific criteria would be exceeded.

Use of the works compounds would not be predicted to exceed the guidelines during daytime activities and would only have the potential to marginally exceed project specific criteria for evening work, but it is likely that if the same level of activity was continued into the night time period without attenuation, that project specific criteria would be exceeded. Although ambient noise levels regularly exceed the EPA Sleep Arousal goals, it is predicted that these goals would also be exceeded at all identified sites for the period 10pm – 6am, by 1 - 19 dB.

While daytime construction activities are not predicted to exceed the current EPA Criteria, it is recommended that best practice work methods be adopted to ensure that potential impacts associated with out of hours work would be minimised. A procedure for dealing with complaints should also be developed. Appendix F includes a list of techniques for controlling construction noise which may be included in an Environmental Management Plan along with a protocol for the programming of night work and other activities outside of normal working hours.

9.4 Construction Noise Management

While the following list of noise and vibration management options is not exhaustive, it will assist in reducing impacts. These and any other available options should be considered when planning works, and should be implemented where practical and cost-effective.

Source controls

- **Time constraints**
  Limit work to daylight hours.
- **Scheduling**
  Perform noisy work during less sensitive time periods.
- **Equipment restrictions**
  Select low-noise plant and equipment.
  Ensure equipment has quality mufflers installed.
  Emission restrictions
  Establish stringent noise emission limits for specified plant and equipment.

Implement noise monitoring audit program to ensure equipment remains within specified limits.

- **Substitute methods**
  Use quieter and less vibration emitting construction methods where possible. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration reduction benefits.
- **Limit equipment on site**
  Only have necessary equipment on site.
- **Limit activity duration**
  Where possible, concentrate noisy activities at one location and move to another as quickly as possible.
- **Site access**
  Vehicle movements outside construction hours, including loading and unloading operations, should be minimised and avoided where possible.
- **Equipment maintenance**
  Ensure equipment is well maintained and fitted with adequately maintained silencers which meet the design specifications.
- **Reduced equipment**
- **Power** Use only necessary size and power.
- **Quieter work practices**
  For example, implement worksite induction training, educating staff on noise sensitive issues and the need to make as little noise as possible.
- **Reversing alarms**
  Consider alternatives, such as manually adjustable or ambient noise sensitive types ("smart" reversing alarms). Alternative site management strategies can be developed, in accordance with the *Occupational Health and Safety Plan*, with the concurrence of the Occupational Health and Safety Officer.

Path controls

- **Noise barriers**
  Consider installing temporary construction noise barriers.
  Install any permanent noise barriers required to minimise road traffic noise as early as possible in the construction process.
  Locate equipment to take advantage of the noise barriers provided by existing site features and structures, such as embankments and storage sheds.
- **Enclosures**
  Install noise-control kits for noisy mobile equipment and shrouds around stationary plant, as necessary.
- **Increased distance**
  Locate noisy plant as far away from noise-sensitive receptors as possible.
- **Site access**
  Select and locate site access roads as far away as possible from noise-sensitive areas.

Receptor controls

- **Architectural treatment**
  Upgrade the glazing or window shutters of affected bedrooms.
- **Consultation**
  Community consultation, information, participation and complaint responses are essential aspects of all construction noise management programs. They typically involve:
  - A community information program before construction and/or high risk activities are commenced. This usually involves a leaflet distribution and direct discussions and

negotiations with affected residents, explaining the type, time and duration of expected noise emissions.
- The involvement of affected residents in the development of acceptable noise management strategies.
- A nominated community liaison officer with a contact telephone number.
- A complaints hotline.
- Timely responses to complaints, providing information on planned actions and progress towards the resolution of concerns.

It is recommended that:
- A detailed noise assessment should be undertaken based on a detailed construction workplan when available. As a minimum, the noise assessment should include a discussion of all the noise mitigation options identified above and their associated effect in reducing noise levels.
- Best management practice should be applied in development of a noise and vibration management plan (NVMP).
- Where work is conducted outside normal working hours and noise goal exceedances are predicted, all feasible and reasonable noise mitigation measures should be evaluated and included in the NVMP. If after the application of all feasible and reasonable noise mitigation measures, it is still predicted that there will be noise goals exceedances the RTA's out of normal hours construction programming and consultation protocols should be followed.

10 Construction Vibration

German Standard DIN 4150 (1986) which sets conservative vibration levels for structural damage at 5mm/second is generally recognised as setting the most appropriate criterion for architectural assessment. A lower level of 2mm/second is often adopted for heritage structures. These levels would rarely be exceeded by roadworks, but human perception and comfort levels are usually reached at a much lower level. In this regard the British Standard BS6472 provides the most authoritative criteria for assessment of the impacts of construction vibration on the community as given in Tables 10-1 and 10-2.

Table10-1 Vertical Vibration Levels and Human Perception

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

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

Table 10-2 Vibration Dose Values ($mm/s^{1.75}$) Versus Degrees of Adverse Comment Expected in Residential Buildings

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hour night	0.13	0.26	0.51

With reference to the schedule of works there do not appear to be any techniques that would result in a measurable vibration level. Therefore it is concluded that there would be no effects to any residences at distances greater than 50m from the proposed roadwork activities. It would however reduce the risk of complaint if heavy vibrating activities were restricted to daytime hours. In the case of blasting, separate calculations would need to be undertaken on charge load and it is possible that it may be necessary to undertake dilapidation studies of residences in the vicinity. Should blasting be required, limits of 5mm/second for peak particle velocity and 115 dB for airblast overpressure as recommended in the ANZEC Technical Notes would be adopted as the appropriate guideline to minimise annoyance.

11 Conclusion

This study has been prepared using all available information and is based on an assumed scope of works. The parameters of Operational Noise, Construction Noise and Construction Vibration are summarised separately below.

11.1 Operational Noise

The proposed widening works for the F3 Freeway between Jolls Bridge and the Calga Interchange would not affect traffic volumes or mix and therefore would have no effect on the existing ambient noise conditions for those sections where the posted speed limits would not be altered. For those sections where posted speed limits would revert from 90 km/hr to the pre 1999 limits of 110 km/hr, the noise catchment would also revert to pre 1999 conditions which are predicted to be between 2.1 dBA for receivers located at a distance of 50m to 1.3 dBA for receivers located at a distance of 200m greater than currently experienced. It would not be expected that any mitigation strategies would need to be developed due to direct impacts of this Proposal.

11.2 Construction Noise

Current EPA Criteria for Construction Noise is difficult to apply, and does not provide a satisfactory basis for determining workable limits in a rural environment, but, in the case of this study, the noise catchment is heavily influenced by F3 Freeway traffic and consequently experiences high ambient noise levels. It is not predicted that daytime construction activity will exceed current EPA criteria. It is likely that construction activities or operation of the works compound undertaken in the evening or night time would exceed EPA objectives for out of hours work.

It is recommended that a detailed background noise monitoring program be undertaken in conjunction with a detailed work plan to more closely establish any

construction areas where out of hours work may be undertaken. This background noise study may also be used to establish levels of activity that may be undertaken at the works compounds outside of normal working hours. The EMP should include a strategy for but not be limited to:

- Utilising best practical technology and means to achieve noise mitigation by use of
  - Source controls
  - Path Controls
  - Receptor Controls
- Planning of noisy activities for parts of the day when they will have the least impact.
- Adoption of current RTA protocols where activities are programmed to be undertaken outside of normal working hours and in the vicinity of residences.

11.3 Construction Vibration

Pending a detailed schedule of works, it is not expected that construction vibration experienced at any receiver location would be sufficient to cause adverse comment. The effects of construction vibration are unlikely to be required to be addressed in the EMP or in any mitigation strategies unless blasting is planned in the vicinity of residences or excessive vibratory activities are undertaken outside of normal working hours and also in the vicinity of residences.

12 References

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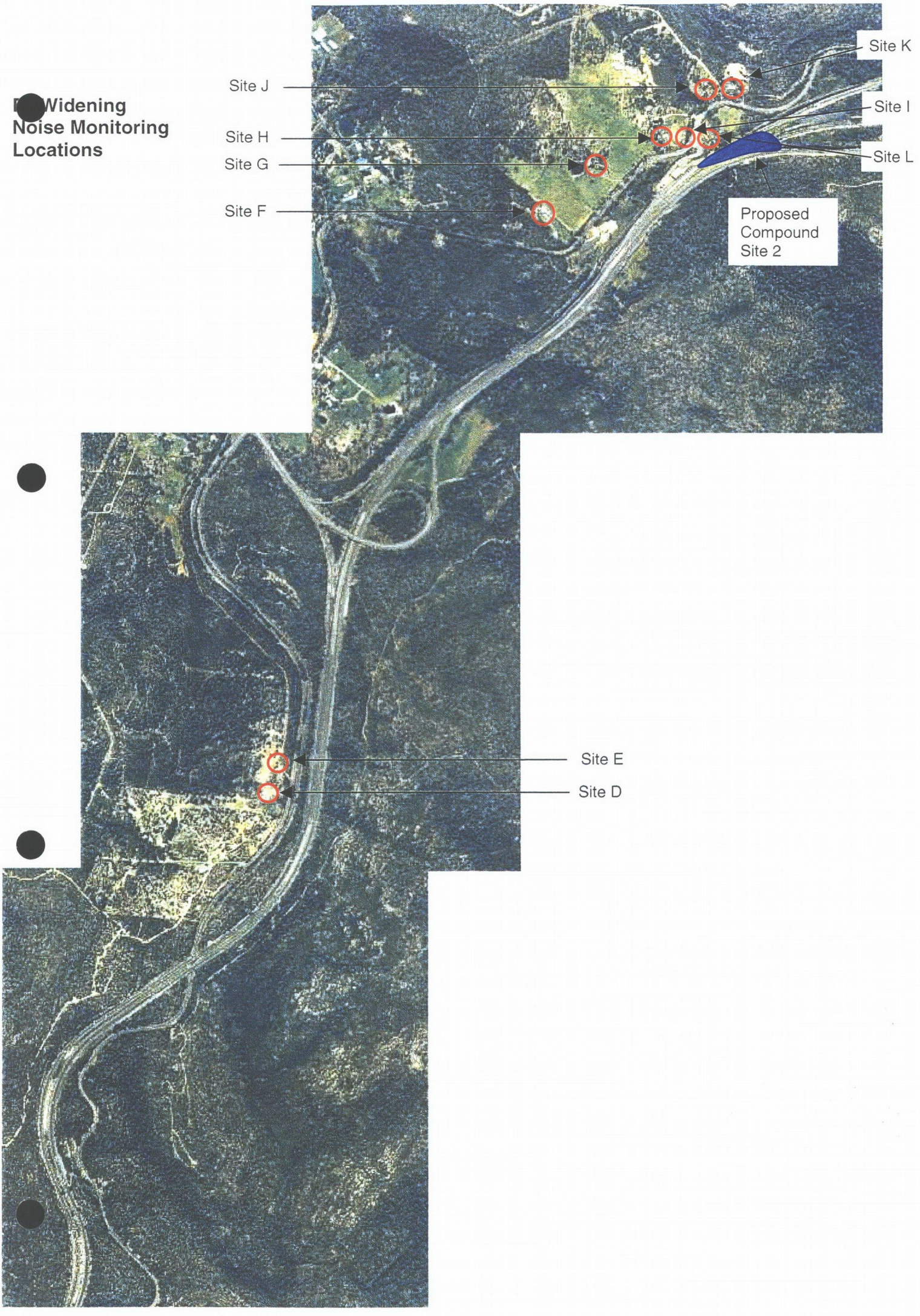
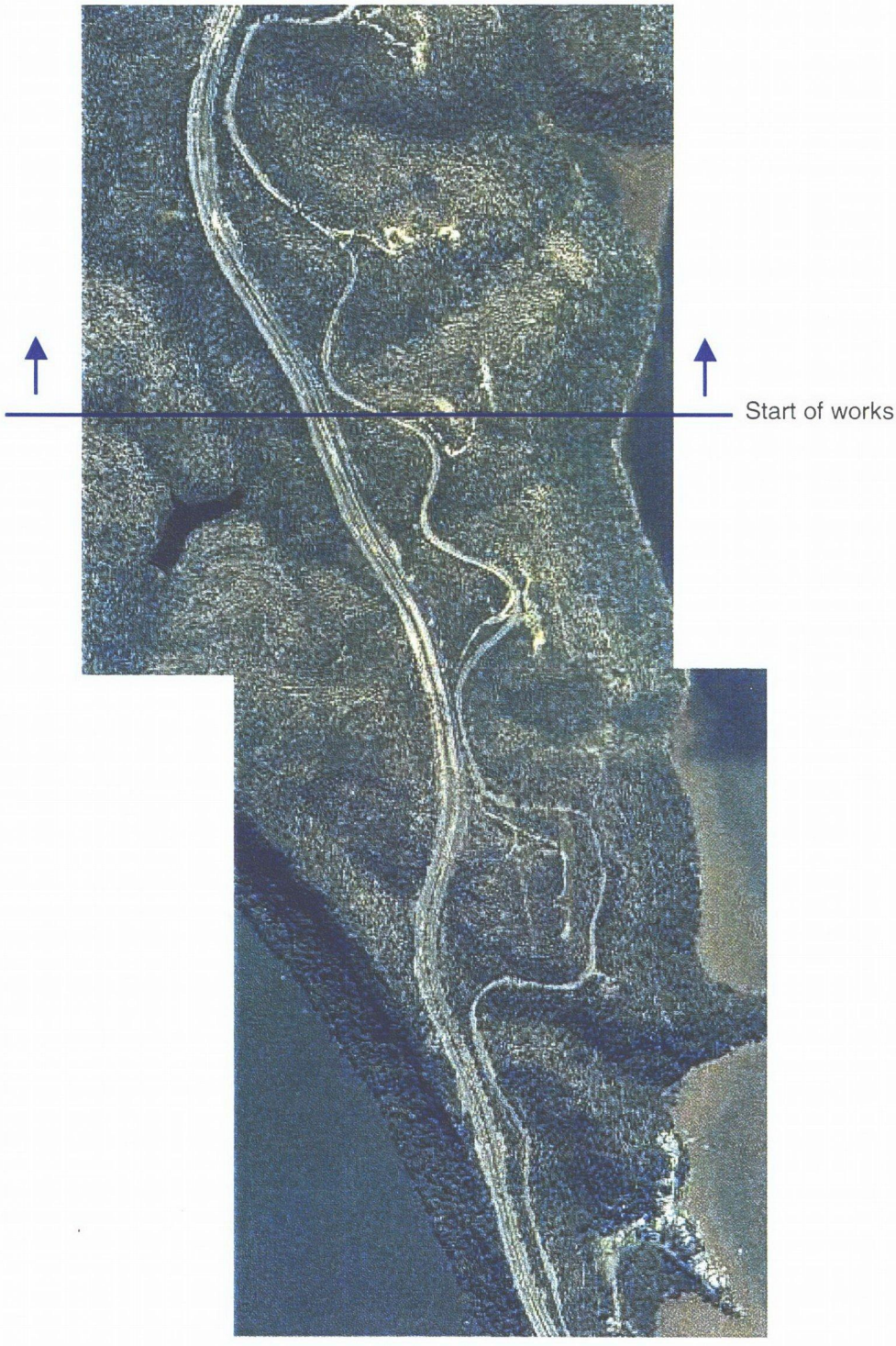
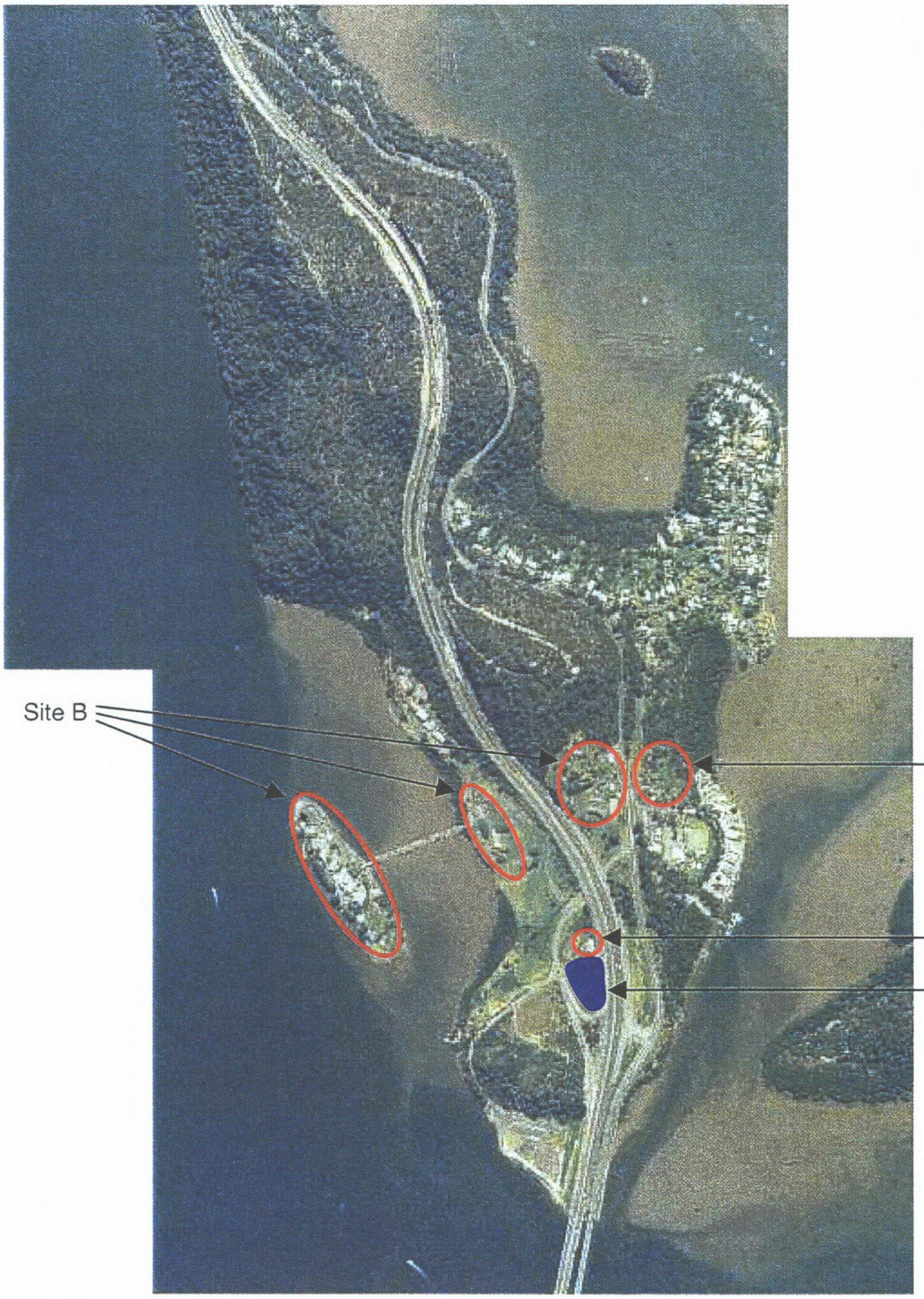
Appendix A

Aerial Photography of Study Area


Widening
Noise Monitoring
Locations
Site J
Site H
Site G
Site F
Site K
Site I
Site L
Proposed
Compound
Site 2
Site E
Site D


Start of works


Site B
Site C
Site A
Proposed
Compound
Site 1

Appendix B

Site Data Sheets

Project: F3 Pacific Hwy

Location: Ambulance Station
Nth Bound C/way

Logger No.	73	Calibrator No.	1795234
Reading Before	94.0	Reading After	94.5

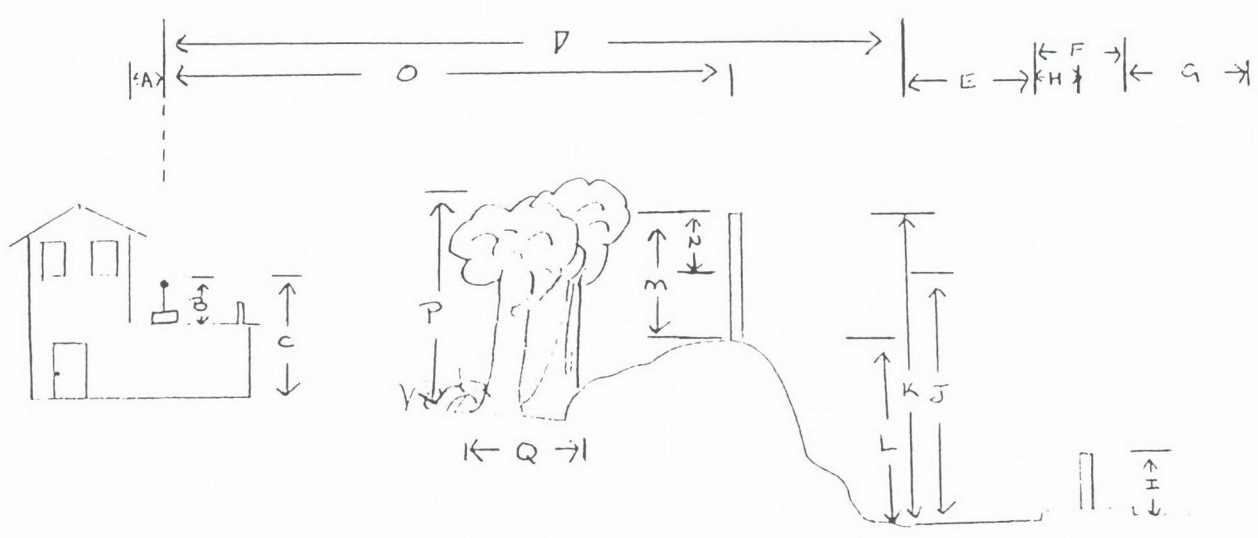
No. of Lanes	1+3+3	7mm Flush Seal	
Grade	—	14mm Flush Seal	✓
Speed	110	Dense Grade	✓
Volume		Open Grade	
% Heavy		Concrete	
Weather	Fine	Other	

Ground Cover

Paved	✓	Technician	JP
Gravel		Date	6/8/01
Lawn		Computer File	F3a1.xls
Field Grass			
Other			

Measurements

A 2	B 1.5	C –	D 15m	E	F
G	H	I	J	K	L
M	N	O	P	Q	



Project: F3 Pacific Highway Widening

Location: 11 Old Pacific Highway, Mt White

Logger No.	073	Calibrator No.	1795234
Reading Before	94.3	Reading After	94.2

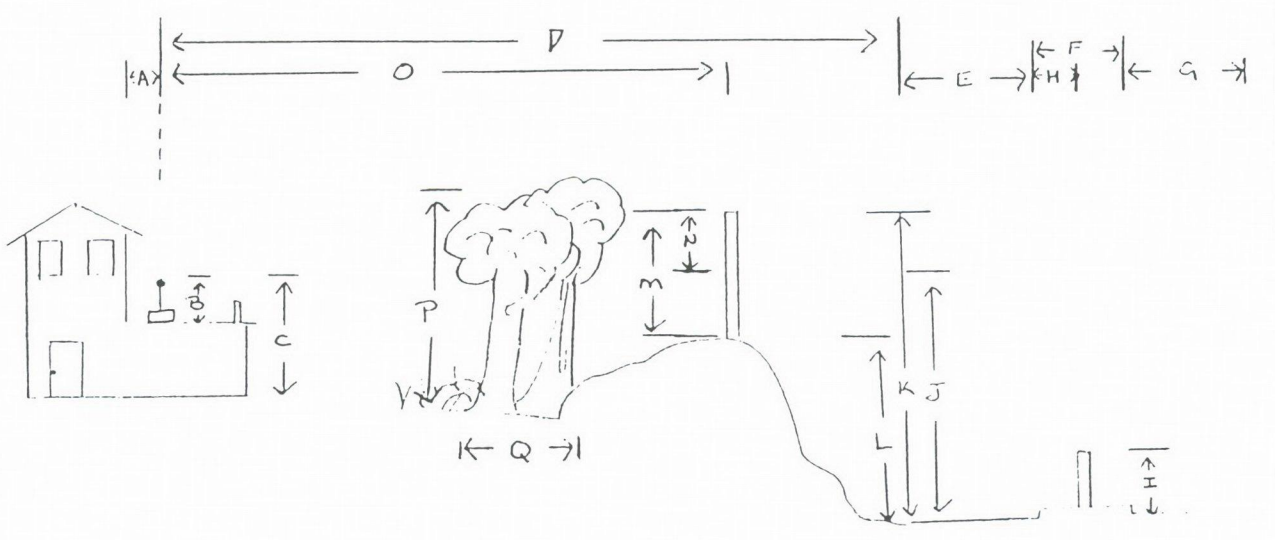
No. of Lanes		7mm Flush Seal	
Grade		14mm Flush Seal	
Speed		Dense Grade	
Volume		Open Grade	
% Heavy		Concrete	
Weather		Other	

Ground Cover

Paved	20	Technician	TC
Gravel		Date	28/8/01
Lawn		Computer File	
Field Grass	40		
Other			

Measurements

A 15m	B 1.5	C –	D ~60m	E	F
G	H	I	J	K	L ~~30m~~ 100
M	N	O	P	Q	



Project: F3 Pacific Hwy - Widening

Location: Near Mt White Heavy Vehicle Checking Station

Logger No.	079	Calibrator No.	1795234
Reading Before	94	Reading After	94.3

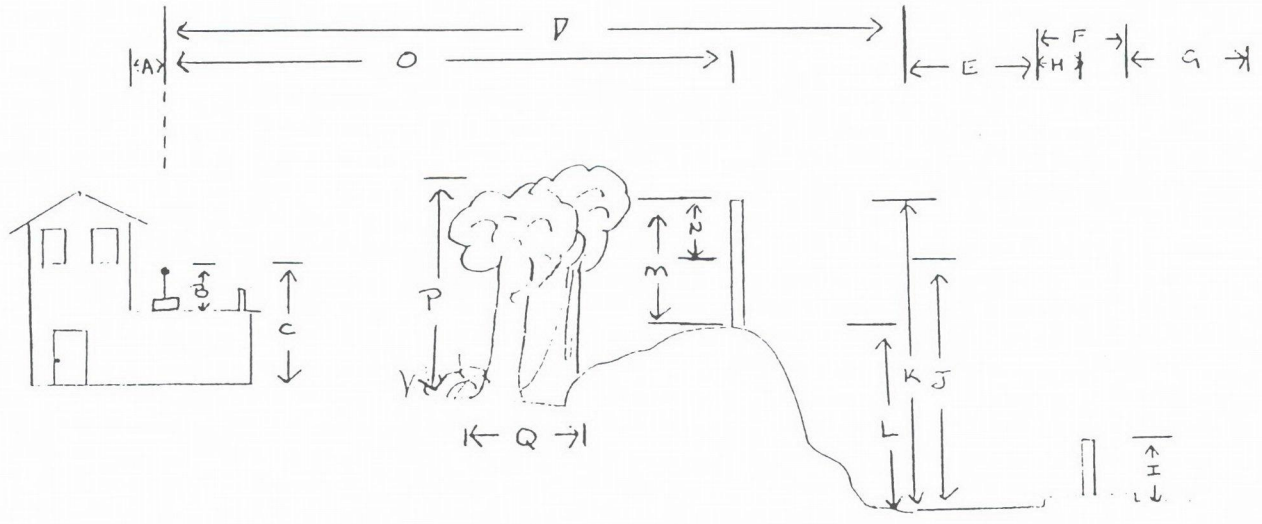
No. of Lanes		7mm Flush Seal	
Grade		14mm Flush Seal	
Speed		Dense Grade	✓
Volume		Open Grade	
% Heavy		Concrete	
Weather		Other	

Ground Cover

Paved		Technician	TC
Gravel		Date	28/08/01
Lawn		Computer File	
Field Grass			
Other			

Measurements

A 10	B 1.5	C	D 30	E	F
G	H	I	J	K	L -3
M	N	O	P	Q	



Appendix C

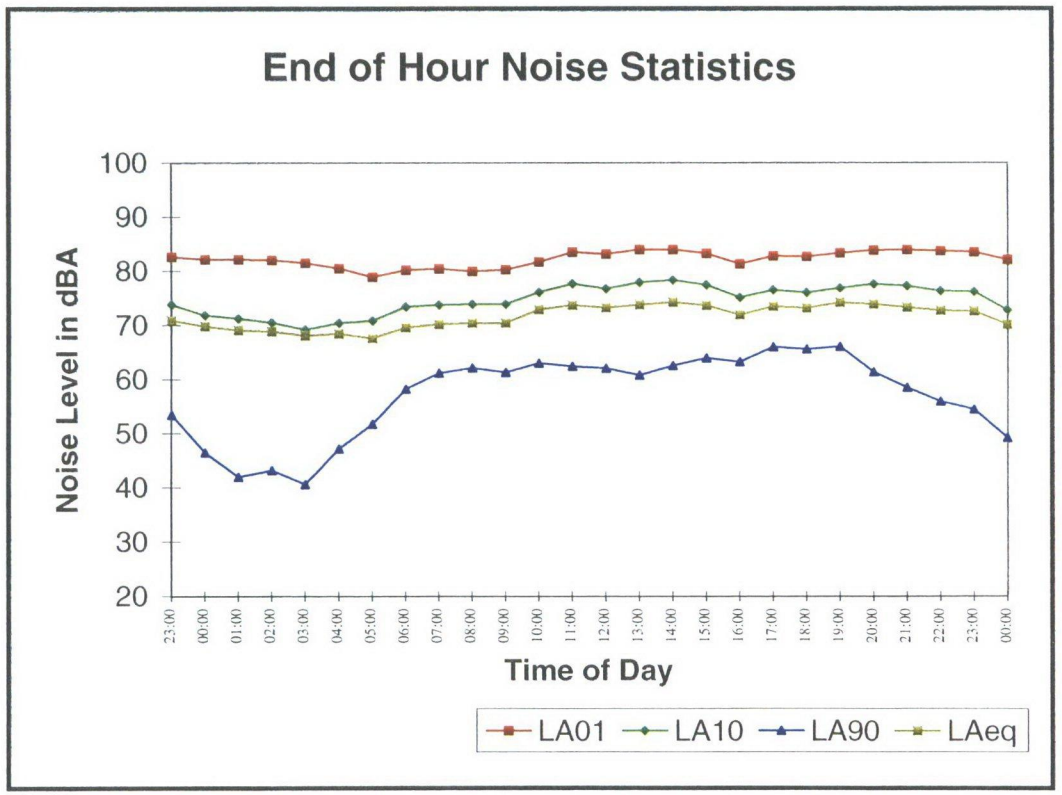
Noise Data

Project Name: F3 Widening
Location: Site 1
Date: 07/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	75.7 dBA
L_{A90} (Background)	07:00 - 18:00	63.1 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	69.3 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	73.2 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	72.2 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	69.2 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	82.7	73.8	53.5	71.0
00:00	82.2	71.9	46.5	69.8
01:00	82.2	71.3	42.0	69.1
02:00	82.1	70.6	43.2	68.9
03:00	81.5	69.2	40.6	68.1
04:00	80.5	70.5	47.2	68.4
05:00	79.0	70.9	51.8	67.7
06:00	80.2	73.5	58.3	69.6
07:00	80.5	73.8	61.3	70.2
08:00	80.0	73.9	62.2	70.5
09:00	80.3	73.9	61.4	70.5
10:00	81.7	76.1	63.1	73.0
11:00	83.6	77.7	62.5	73.8
12:00	83.2	76.8	62.1	73.3
13:00	84.0	77.9	60.8	73.8
14:00	84.0	78.4	62.6	74.3
15:00	83.3	77.5	64.0	73.7
16:00	81.4	75.2	63.3	72.0
17:00	82.9	76.6	66.1	73.6
18:00	82.7	76.1	65.7	73.3
19:00	83.4	76.9	66.1	74.2
20:00	83.9	77.7	61.4	73.9
21:00	84.0	77.3	58.6	73.3
22:00	83.8	76.4	55.9	72.8
23:00	83.5	76.3	54.5	72.6
00:00	82.1	72.8	49.2	70.2

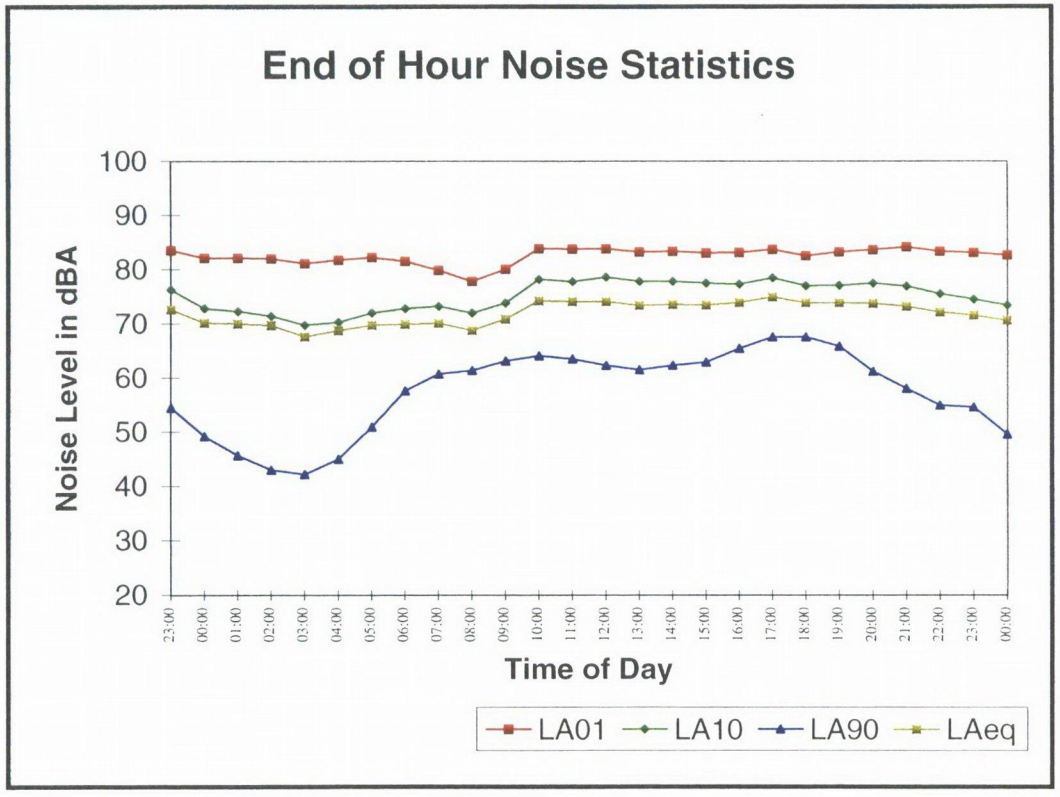


Project Name: F3 Widening
Location: Site 1
Date: 08/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	76.1 dBA
L_{A90} (Background)	07:00 - 18:00	63.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	70.0 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	73.4 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	72.4 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	70.0 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	83.5	76.3	54.5	72.6
00:00	82.1	72.8	49.2	70.2
01:00	82.1	72.3	45.6	70.0
02:00	82.0	71.4	43.0	69.7
03:00	81.1	69.8	42.2	67.7
04:00	81.8	70.3	45.0	68.7
05:00	82.2	72.0	51.0	69.8
06:00	81.6	72.8	57.7	70.0
07:00	79.9	73.3	60.8	70.1
08:00	77.8	72.0	61.4	68.8
09:00	80.1	73.8	63.2	70.9
10:00	83.8	78.2	64.1	74.2
11:00	83.8	77.8	63.5	74.1
12:00	83.9	78.6	62.4	74.1
13:00	83.2	77.8	61.5	73.4
14:00	83.4	77.8	62.3	73.6
15:00	83.1	77.5	63.0	73.5
16:00	83.1	77.3	65.5	73.9
17:00	83.7	78.5	67.6	74.9
18:00	82.5	77.0	67.6	73.9
19:00	83.2	77.1	65.9	73.9
20:00	83.6	77.5	61.2	73.8
21:00	84.2	76.9	58.1	73.3
22:00	83.4	75.5	55.0	72.2
23:00	83.1	74.6	54.6	71.6
00:00	82.7	73.4	49.5	70.7

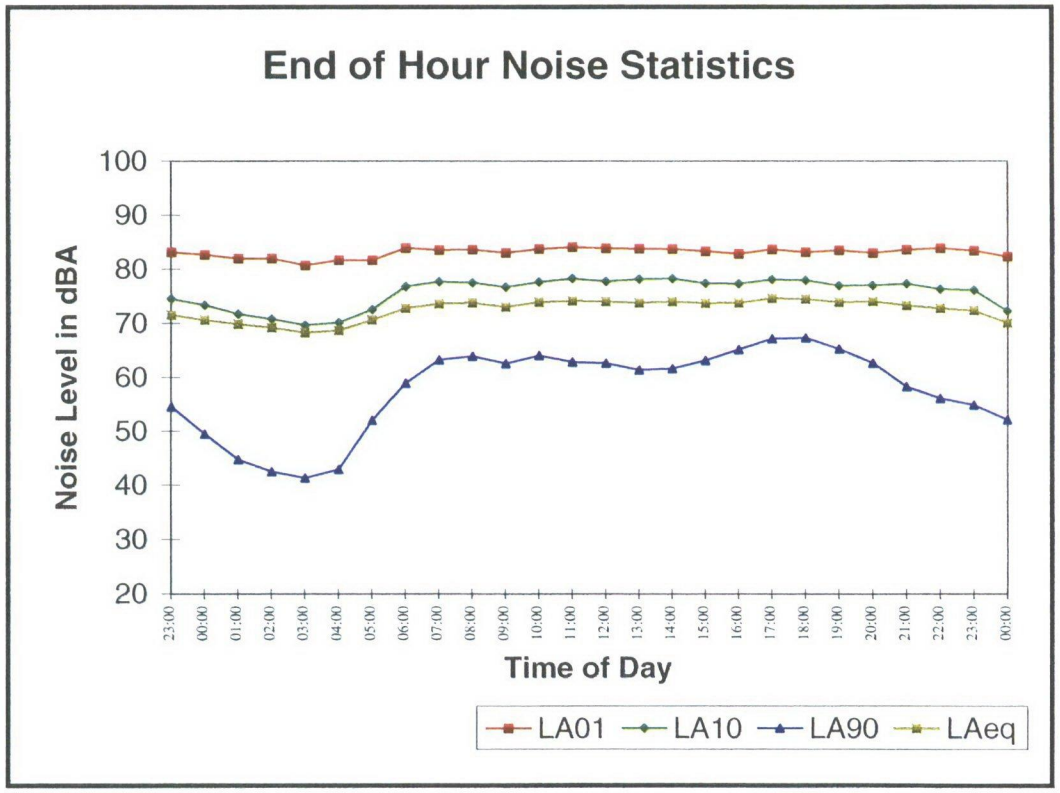


Project Name: F3 Widening
Location: Site 1
Date: 09/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	77.2 dBA
L_{A90} (Background)	07:00 - 18:00	63.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	71.0 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	73.9 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	73.0 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	70.5 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	83.1	74.6	54.6	71.6
00:00	82.7	73.4	49.5	70.7
01:00	82.0	71.8	44.8	69.9
02:00	82.0	70.8	42.5	69.2
03:00	80.7	69.7	41.3	68.3
04:00	81.7	70.2	42.9	68.7
05:00	81.7	72.6	52.1	70.7
06:00	83.9	76.8	58.9	72.8
07:00	83.5	77.7	63.3	73.7
08:00	83.6	77.5	63.9	73.8
09:00	83.0	76.7	62.6	73.1
10:00	83.7	77.7	64.1	74.0
11:00	84.1	78.3	62.9	74.2
12:00	83.8	77.8	62.7	74.1
13:00	83.8	78.2	61.4	73.8
14:00	83.7	78.3	61.7	74.1
15:00	83.3	77.4	63.2	73.7
16:00	82.9	77.4	65.2	73.8
17:00	83.7	78.1	67.2	74.6
18:00	83.1	78.0	67.4	74.5
19:00	83.5	77.0	65.3	74.0
20:00	83.0	77.1	62.7	74.1
21:00	83.6	77.4	58.3	73.4
22:00	83.9	76.3	56.1	72.8
23:00	83.4	76.2	54.9	72.4
00:00	82.3	72.3	52.1	70.1

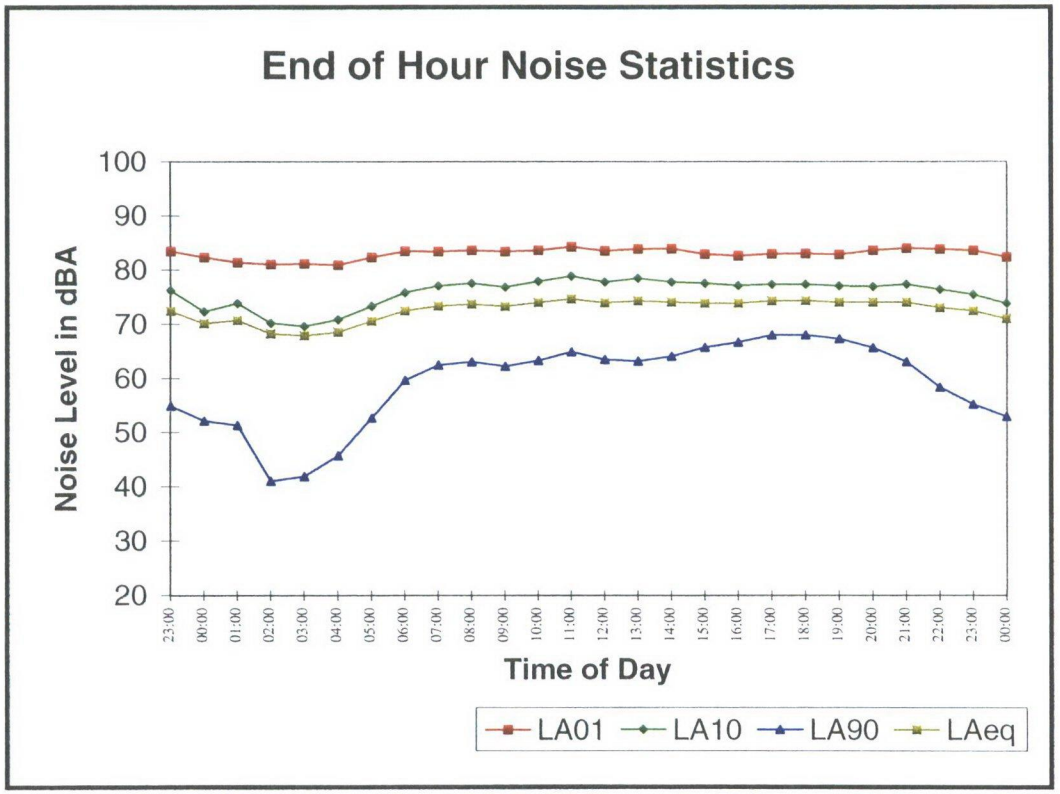


Project Name: F3 Widening
Location: Site 1
Date: 10/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend: YES (Saturday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	77.1 dBA
L_{A90} (Background)	07:00 - 18:00	64.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	70.9 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	74.0 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	73.1 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	70.4 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	83.4	76.2	54.9	72.4
00:00	82.3	72.3	52.1	70.1
01:00	81.3	73.8	51.3	70.7
02:00	81.0	70.2	41.0	68.2
03:00	81.1	69.6	41.9	67.9
04:00	80.9	70.8	45.7	68.5
05:00	82.3	73.3	52.7	70.6
06:00	83.4	75.9	59.7	72.5
07:00	83.4	77.1	62.5	73.4
08:00	83.6	77.6	63.1	73.7
09:00	83.4	76.9	62.3	73.3
10:00	83.6	77.9	63.3	74.0
11:00	84.3	78.8	64.9	74.7
12:00	83.5	77.8	63.5	73.9
13:00	83.9	78.4	63.2	74.3
14:00	83.9	77.8	64.1	74.1
15:00	82.9	77.5	65.7	73.9
16:00	82.6	77.1	66.7	73.9
17:00	83.0	77.3	68.0	74.3
18:00	83.0	77.4	68.0	74.4
19:00	82.8	77.1	67.3	74.1
20:00	83.6	76.9	65.6	74.1
21:00	84.0	77.4	63.1	74.1
22:00	83.8	76.4	58.4	73.1
23:00	83.6	75.5	55.2	72.5
00:00	82.3	73.9	52.9	71.0

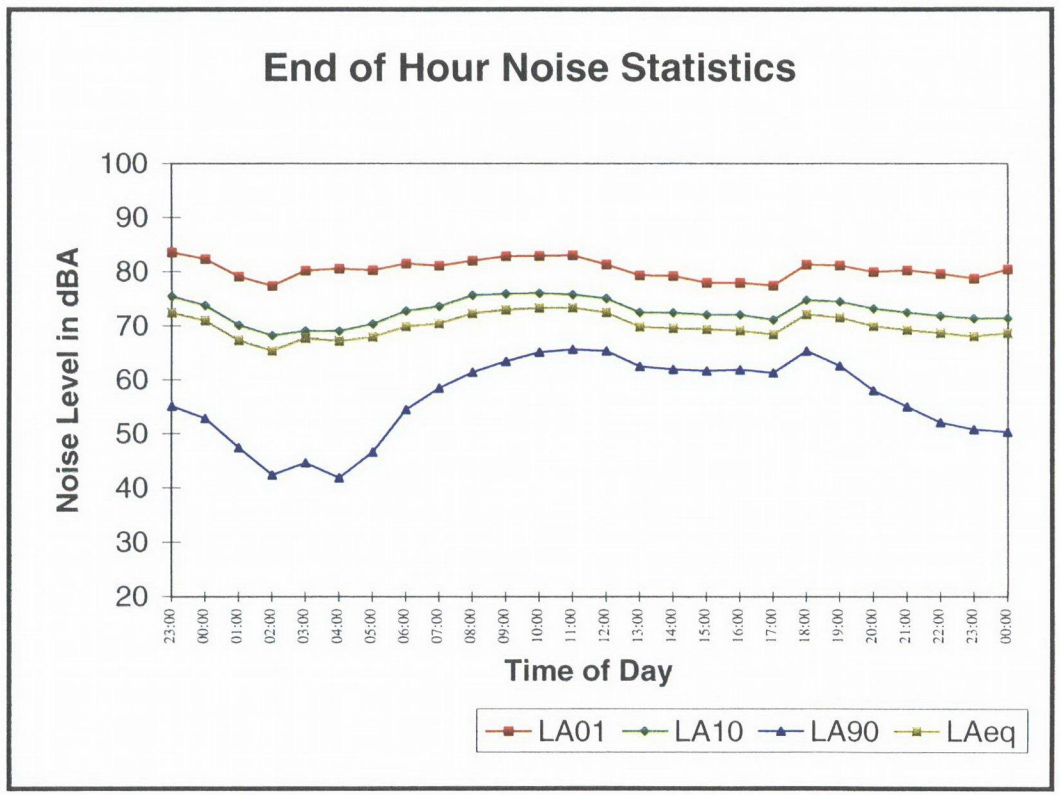


Project Name: F3 Widening
Location: Site 1
Date: 11/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend: YES (Sunday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	74.6 dBA
L_{A90} (Background)	07:00 - 18:00	63.3 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	69.4 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	71.2 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	70.3 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	69.2 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	83.6	75.5	55.2	72.5
00:00	82.3	73.9	52.9	71.0
01:00	79.1	70.2	47.5	67.4
02:00	77.4	68.3	42.4	65.4
03:00	80.2	69.1	44.6	67.7
04:00	80.6	69.1	41.9	67.2
05:00	80.3	70.4	46.6	68.0
06:00	81.5	72.8	54.6	69.9
07:00	81.1	73.7	58.6	70.5
08:00	82.1	75.7	61.5	72.4
09:00	82.9	76.0	63.5	73.0
10:00	82.9	76.1	65.2	73.4
11:00	83.1	75.8	65.7	73.4
12:00	81.3	75.1	65.4	72.5
13:00	79.3	72.6	62.6	69.9
14:00	79.2	72.5	62.0	69.6
15:00	78.0	72.1	61.7	69.4
16:00	78.0	72.1	61.9	69.2
17:00	77.5	71.2	61.4	68.4
18:00	81.3	74.8	65.4	72.2
19:00	81.2	74.5	62.6	71.6
20:00	80.0	73.2	58.1	70.0
21:00	80.3	72.5	55.1	69.3
22:00	79.7	71.9	52.1	68.7
23:00	78.8	71.4	50.9	68.1
00:00	80.5	71.5	50.3	68.7

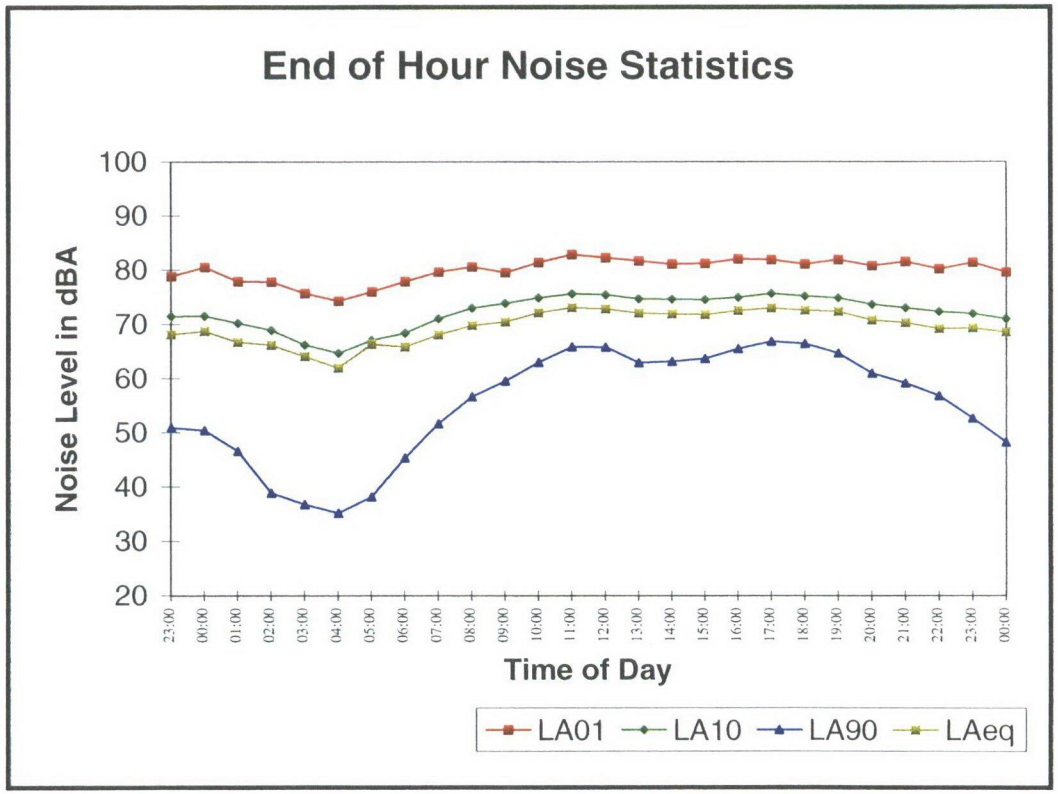


Project Name: F3 Widening
Location: Site 1
Date: 12/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	73.3 dBA
L_{A90} (Background)	07:00 - 18:00	63.5 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	66.6 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	71.8 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	70.5 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	66.4 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	78.8	71.4	50.9	68.1
00:00	80.5	71.5	50.3	68.7
01:00	77.9	70.2	46.5	66.7
02:00	77.8	68.9	38.8	66.2
03:00	75.6	66.2	36.7	64.0
04:00	74.3	64.6	35.1	61.9
05:00	76.0	67.0	38.1	66.3
06:00	77.8	68.4	45.3	65.8
07:00	79.6	71.0	51.6	68.0
08:00	80.5	73.0	56.6	69.8
09:00	79.5	73.9	59.5	70.4
10:00	81.4	74.9	63.0	72.1
11:00	82.8	75.6	65.8	73.1
12:00	82.2	75.4	65.8	72.8
13:00	81.7	74.7	62.9	72.1
14:00	81.1	74.6	63.1	71.9
15:00	81.2	74.5	63.6	71.8
16:00	82.0	74.9	65.5	72.5
17:00	81.9	75.6	66.8	73.0
18:00	81.1	75.2	66.4	72.6
19:00	81.9	74.8	64.7	72.3
20:00	80.8	73.7	61.0	70.7
21:00	81.5	73.0	59.1	70.3
22:00	80.2	72.3	56.8	69.2
23:00	81.4	71.9	52.6	69.3
00:00	79.6	71.0	48.2	68.5

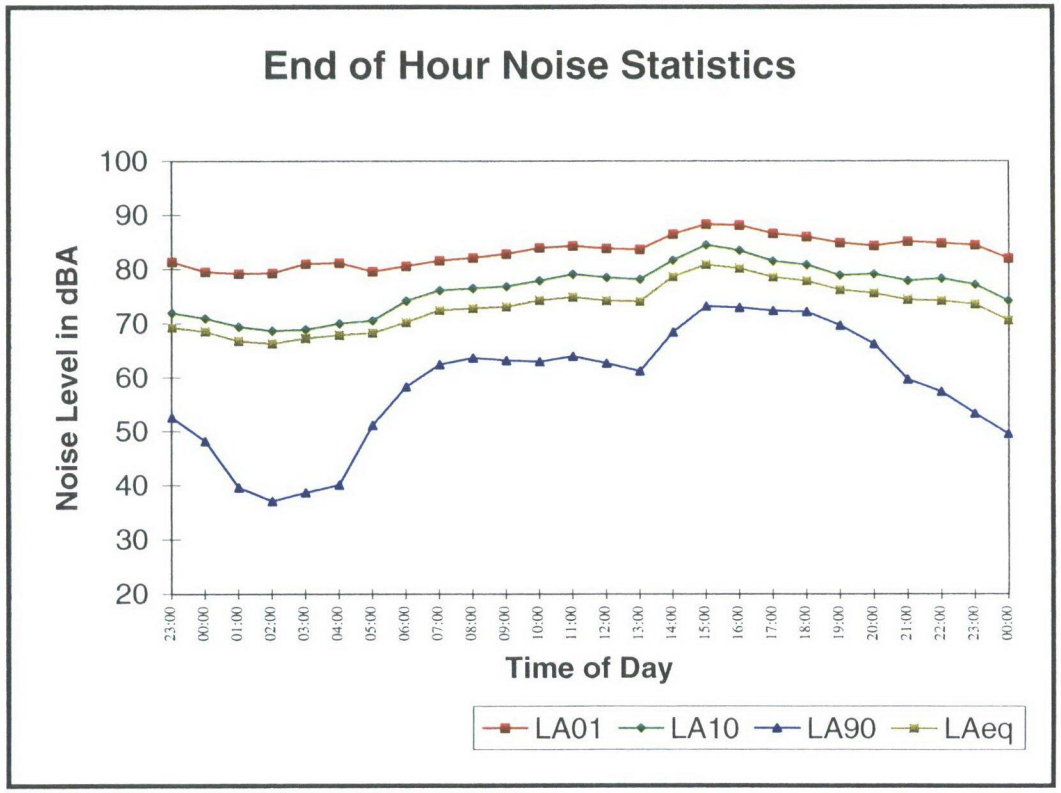


Project Name: F3 Widening
Location: Site 1
Date: 13/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level	
L_{dn}	00:00 - 24:00	77.4	dBA
L_{A90} (Backgroun	07:00 - 18:00	67.0	dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	69.0	dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	76.8	dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	75.3	dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	68.3	dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	81.4	71.9	52.6	69.3
00:00	79.6	71.0	48.2	68.5
01:00	79.2	69.4	39.6	66.8
02:00	79.3	68.6	37.1	66.3
03:00	81.0	68.9	38.7	67.3
04:00	81.2	70.0	40.1	67.9
05:00	79.6	70.5	51.1	68.3
06:00	80.6	74.2	58.3	70.3
07:00	81.6	76.1	62.4	72.5
08:00	82.1	76.5	63.7	72.8
09:00	82.8	76.8	63.2	73.1
10:00	84.0	77.9	62.9	74.3
11:00	84.3	79.1	64.0	74.9
12:00	83.9	78.5	62.6	74.3
13:00	83.7	78.1	61.2	74.1
14:00	86.5	81.7	68.4	78.7
15:00	88.3	84.5	73.2	80.9
16:00	88.1	83.5	72.9	80.2
17:00	86.6	81.5	72.3	78.6
18:00	86.0	80.9	72.2	77.9
19:00	84.9	78.9	69.6	76.2
20:00	84.4	79.1	66.3	75.6
21:00	85.1	77.9	59.7	74.4
22:00	84.9	78.3	57.4	74.2
23:00	84.5	77.2	53.3	73.6
00:00	82.0	74.2	49.5	70.6

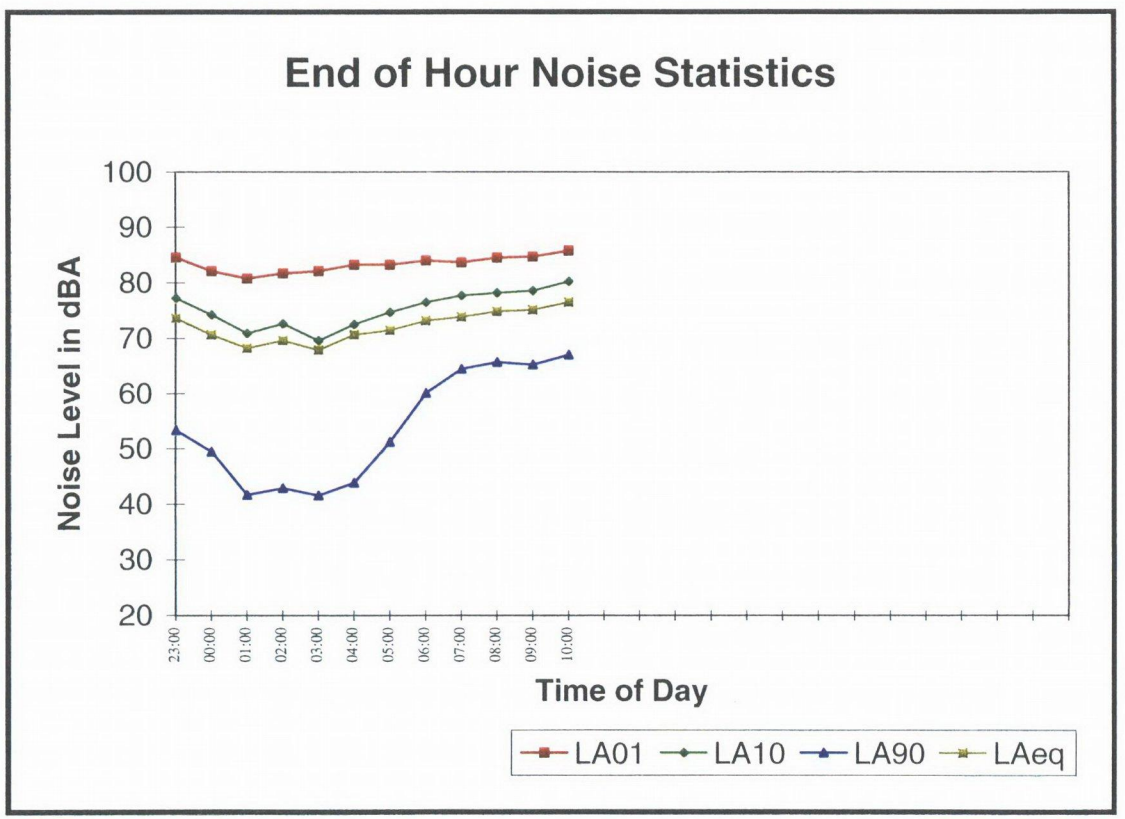


Project Name: F3 Widening
Location: Site 1
Date: 14/08/2001
File Name: F3_1.dta
Weather: Fine
LOGGER No. 073
Comments: Ambulance Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	80.1 dBA
L_{A90} (Background)	07:00 - 18:00	49.4 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	71.5 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	75.5 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	73.0 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	71.1 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	84.5	77.2	53.3	73.6
00:00	82.0	74.2	49.5	70.6
01:00	80.7	70.9	41.7	68.2
02:00	81.6	72.6	42.8	69.6
03:00	82.0	69.5	41.5	67.8
04:00	83.2	72.5	43.8	70.6
05:00	83.1	74.6	51.2	71.4
06:00	83.9	76.4	60.0	73.2
07:00	83.5	77.6	64.4	73.8
08:00	84.4	78.1	65.6	74.8
09:00	84.6	78.5	65.1	75.1
10:00	85.7	80.2	67.0	76.5



Location: Site 1
LOGGER No. 073

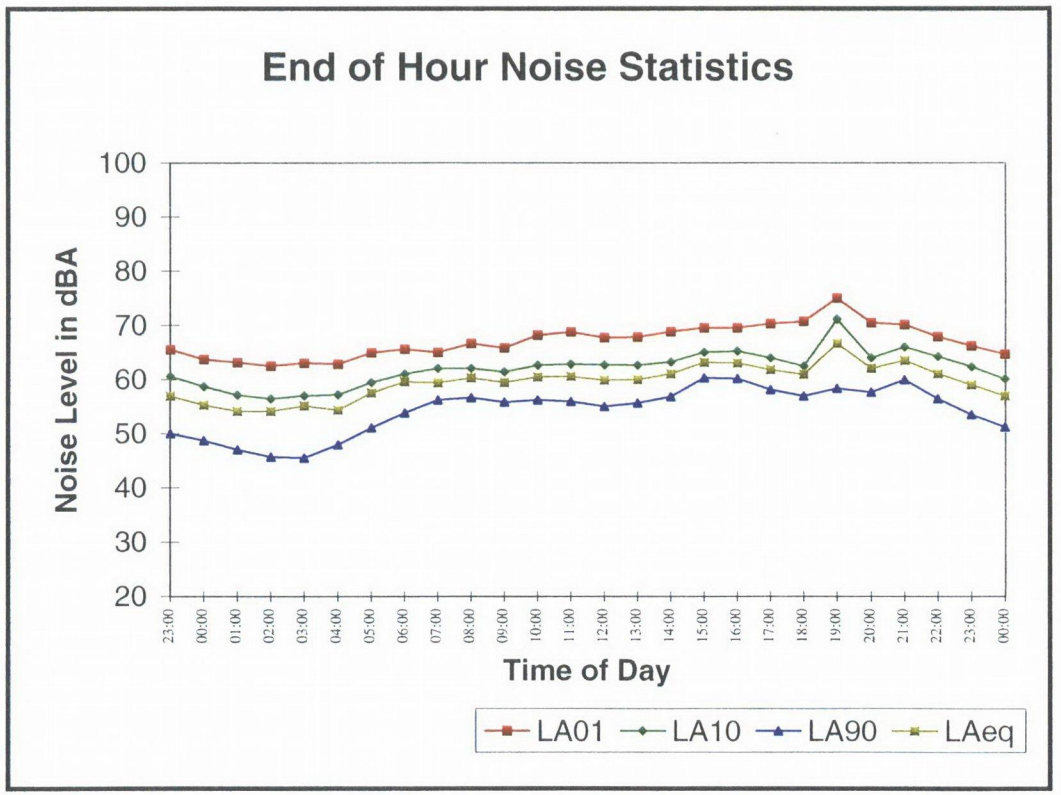
	Day	Date	Leq(8hr)	Leq(9hr)	Leq(15hr)	Leq(24hr)
Day No.1	Tuesday	7/08/2001	69	69	73	72
Day No.2	Wednesday	8/08/2001	70	70	73	72
Day No.3	Thursday	9/08/2001	71	71	74	73
Day No.4	Friday	10/08/2001	70	71	74	73
Day No.5	Saturday	11/08/2001	69	69	71	70
Day No.6	Sunday	12/08/2001	66	67	72	71
Day No.7	Monday	13/08/2001	68	69	77	75
	means		**69**	**69**	**73**	**72**

Project Name: F3 Widening
Location: Site 2
Date: 29/08/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	64.0 dBA
L_{A90} (Background)	07:00 - 18:00	57.0 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	56.8 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	62.1 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	60.8 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	56.3 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	65.6	60.6	50.0	56.9
00:00	63.7	58.7	48.7	55.3
01:00	63.1	57.1	47.0	54.1
02:00	62.5	56.4	45.7	54.1
03:00	63.0	57.0	45.5	55.1
04:00	62.8	57.2	48.0	54.4
05:00	64.9	59.5	51.1	57.5
06:00	65.6	61.1	53.8	59.6
07:00	65.0	62.1	56.2	59.4
08:00	66.7	62.1	56.7	60.3
09:00	65.8	61.4	55.8	59.5
10:00	68.2	62.7	56.2	60.5
11:00	68.8	62.8	56.0	60.6
12:00	67.7	62.7	55.0	59.9
13:00	67.8	62.7	55.6	60.0
14:00	68.8	63.3	56.8	61.1
15:00	69.5	65.1	60.3	63.2
16:00	69.6	65.3	60.2	63.1
17:00	70.3	64.0	58.1	61.8
18:00	70.7	62.5	56.9	61.0
19:00	75.0	71.1	58.3	66.7
20:00	70.5	64.0	57.7	62.1
21:00	70.1	66.0	60.0	63.5
22:00	67.9	64.3	56.4	61.1
23:00	66.2	62.3	53.5	59.0
00:00	64.7	60.1	51.2	57.0

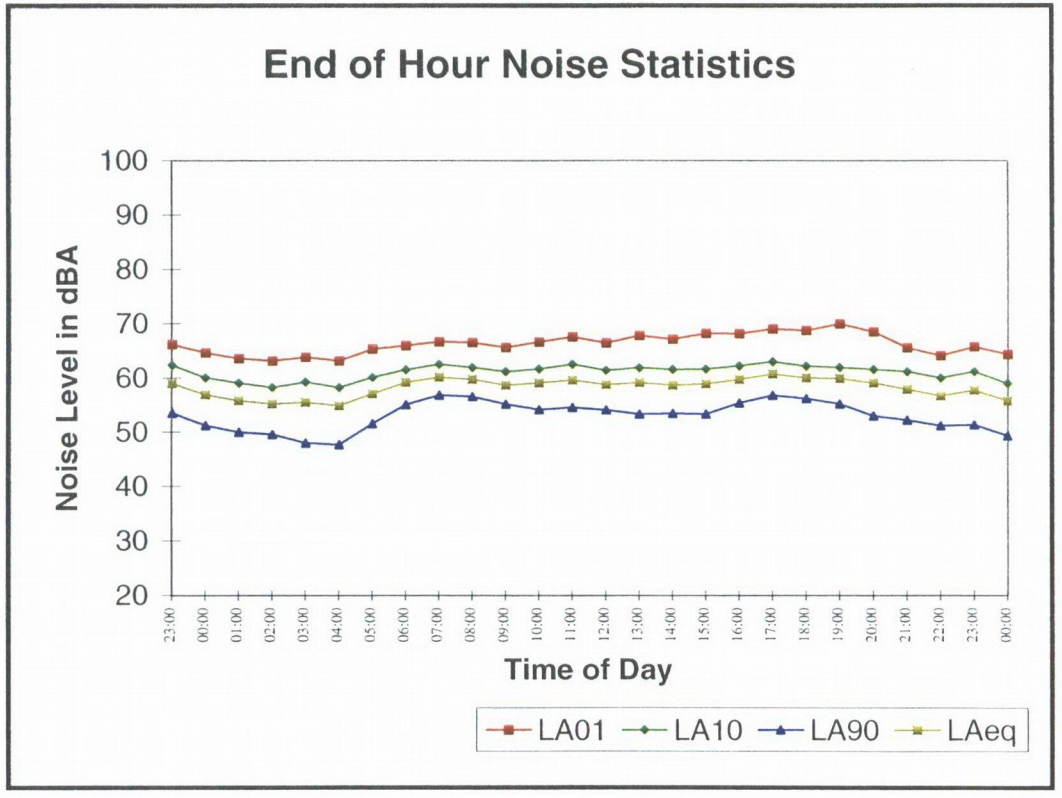


Project Name: F3 Widening
Location: Site 2
Date: 30/08/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	63.3 dBA
L_{A90} (Background)	07:00 - 18:00	54.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	57.5 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	59.2 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	58.6 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	57.0 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	66.2	62.3	53.5	59.0
00:00	64.7	60.1	51.2	57.0
01:00	63.6	59.1	50.0	55.8
02:00	63.2	58.2	49.5	55.2
03:00	63.8	59.2	47.9	55.5
04:00	63.2	58.2	47.6	54.9
05:00	65.4	60.1	51.5	57.1
06:00	66.0	61.5	55.1	59.2
07:00	66.7	62.6	56.9	60.2
08:00	66.5	61.9	56.5	59.7
09:00	65.7	61.2	55.1	58.7
10:00	66.7	61.7	54.1	59.1
11:00	67.6	62.6	54.5	59.7
12:00	66.5	61.4	54.1	58.8
13:00	67.9	61.9	53.3	59.2
14:00	67.2	61.6	53.4	58.7
15:00	68.2	61.7	53.3	59.0
16:00	68.2	62.2	55.4	59.8
17:00	69.1	63.0	56.8	60.7
18:00	68.8	62.2	56.2	60.1
19:00	70.0	61.9	55.2	59.9
20:00	68.5	61.6	52.9	59.1
21:00	65.6	61.2	52.2	57.9
22:00	64.1	60.0	51.1	56.7
23:00	65.8	61.2	51.3	57.7
00:00	64.4	59.0	49.3	55.7

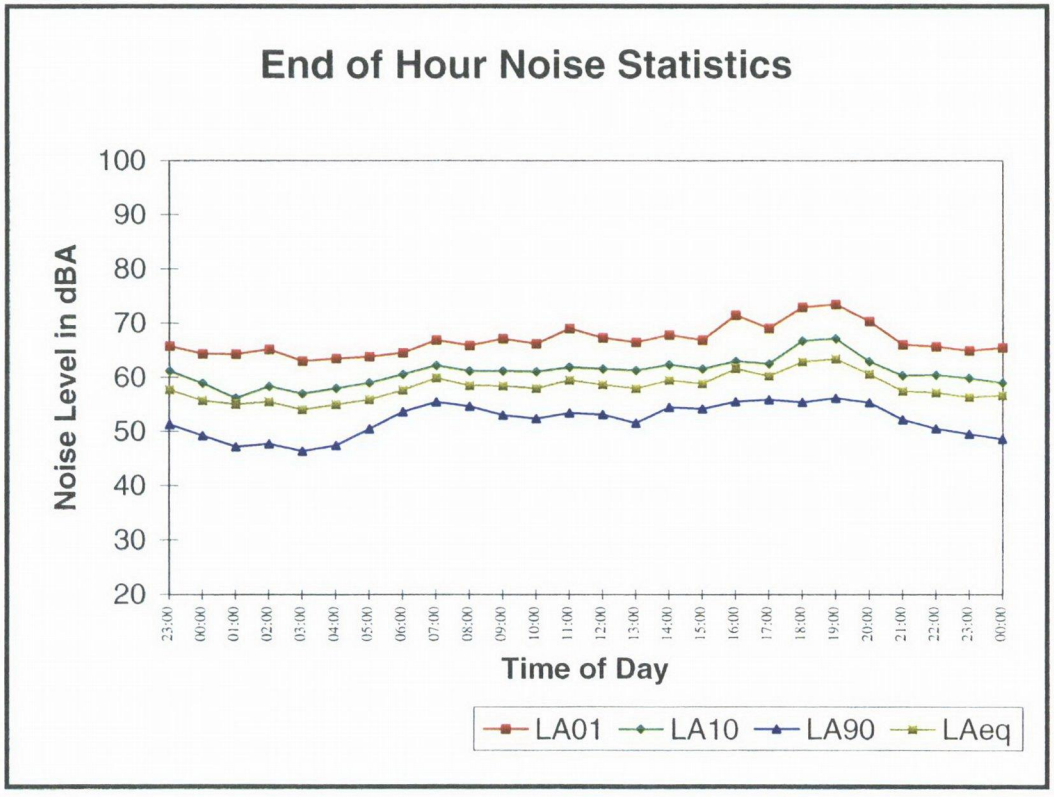


Project Name: F3 Widening
Location: Site 2
Date: 31/08/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend: YES (Saturday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	63.0 dBA
L_{A90} (Background)	07:00 - 18:00	54.0 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	56.7 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	60.0 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	59.0 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	56.0 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	65.8	61.2	51.3	57.7
00:00	64.4	59.0	49.3	55.7
01:00	64.3	56.2	47.2	55.0
02:00	65.2	58.3	47.7	55.5
03:00	63.0	57.0	46.4	54.1
04:00	63.5	58.0	47.4	55.0
05:00	63.8	59.0	50.5	55.9
06:00	64.6	60.6	53.7	57.7
07:00	66.9	62.2	55.5	59.9
08:00	65.9	61.2	54.6	58.5
09:00	67.1	61.2	53.0	58.5
10:00	66.2	61.1	52.3	58.0
11:00	69.0	61.9	53.4	59.5
12:00	67.3	61.6	53.1	58.7
13:00	66.5	61.3	51.6	58.0
14:00	67.8	62.4	54.5	59.5
15:00	66.9	61.6	54.2	58.9
16:00	71.5	63.0	55.6	61.6
17:00	69.1	62.6	55.9	60.3
18:00	72.9	66.8	55.4	62.9
19:00	73.5	67.2	56.2	63.5
20:00	70.4	63.0	55.3	60.7
21:00	66.1	60.4	52.2	57.6
22:00	65.7	60.5	50.6	57.3
23:00	64.9	59.9	49.5	56.4
00:00	65.5	59.0	48.6	56.7

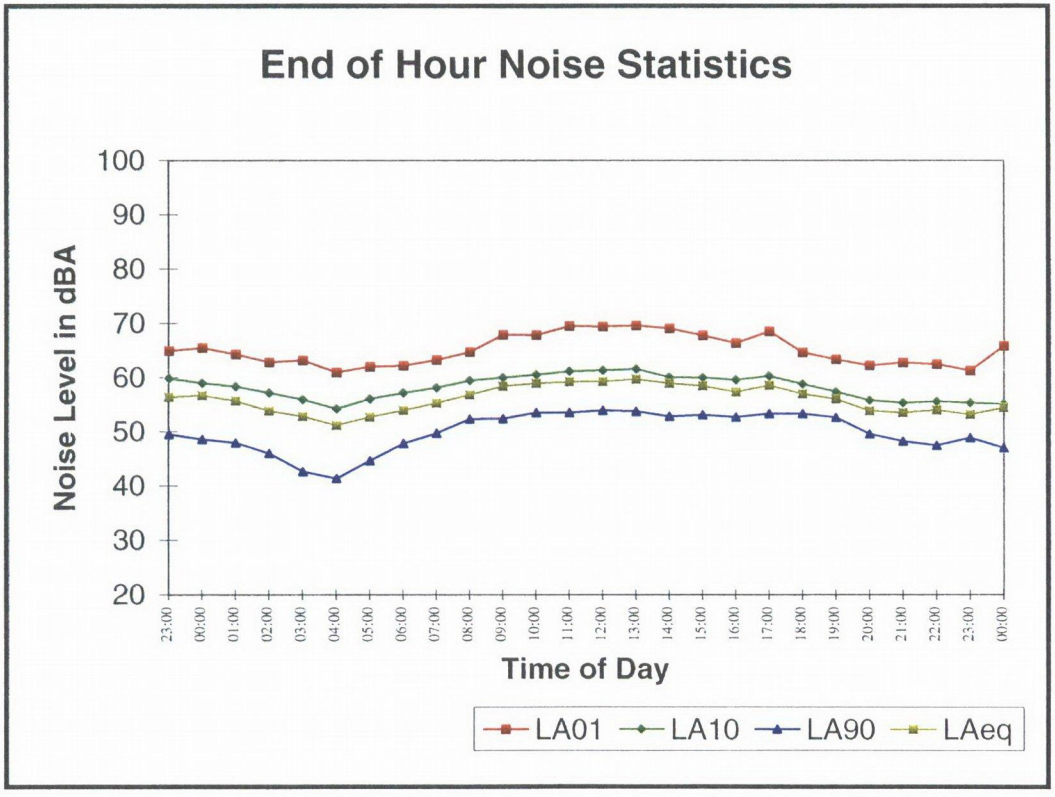


Project Name: F3 Widening
Location: Site 2
Date: 01/09/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend: YES (Sunday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	60.4 dBA
L_{A90} (Background)	07:00 - 18:00	53.2 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	54.6 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	57.8 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	56.7 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	54.5 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	64.9	59.9	49.5	56.4
00:00	65.5	59.0	48.6	56.7
01:00	64.3	58.4	48.0	55.7
02:00	62.8	57.2	46.0	53.8
03:00	63.2	56.0	42.7	52.8
04:00	61.0	54.3	41.4	51.2
05:00	62.0	56.1	44.7	52.7
06:00	62.2	57.2	47.8	53.9
07:00	63.3	58.1	49.7	55.3
08:00	64.7	59.5	52.4	56.8
09:00	67.9	60.0	52.4	58.4
10:00	67.8	60.6	53.6	58.9
11:00	69.5	61.2	53.5	59.2
12:00	69.4	61.3	54.0	59.3
13:00	69.6	61.6	53.8	59.7
14:00	69.1	60.1	52.8	58.9
15:00	67.8	60.0	53.1	58.5
16:00	66.4	59.6	52.7	57.3
17:00	68.6	60.3	53.4	58.6
18:00	64.7	58.8	53.4	57.0
19:00	63.4	57.4	52.6	56.1
20:00	62.3	55.9	49.6	53.9
21:00	62.8	55.3	48.2	53.5
22:00	62.5	55.6	47.5	54.0
23:00	61.3	55.3	48.9	53.2
00:00	65.9	55.1	47.0	54.4

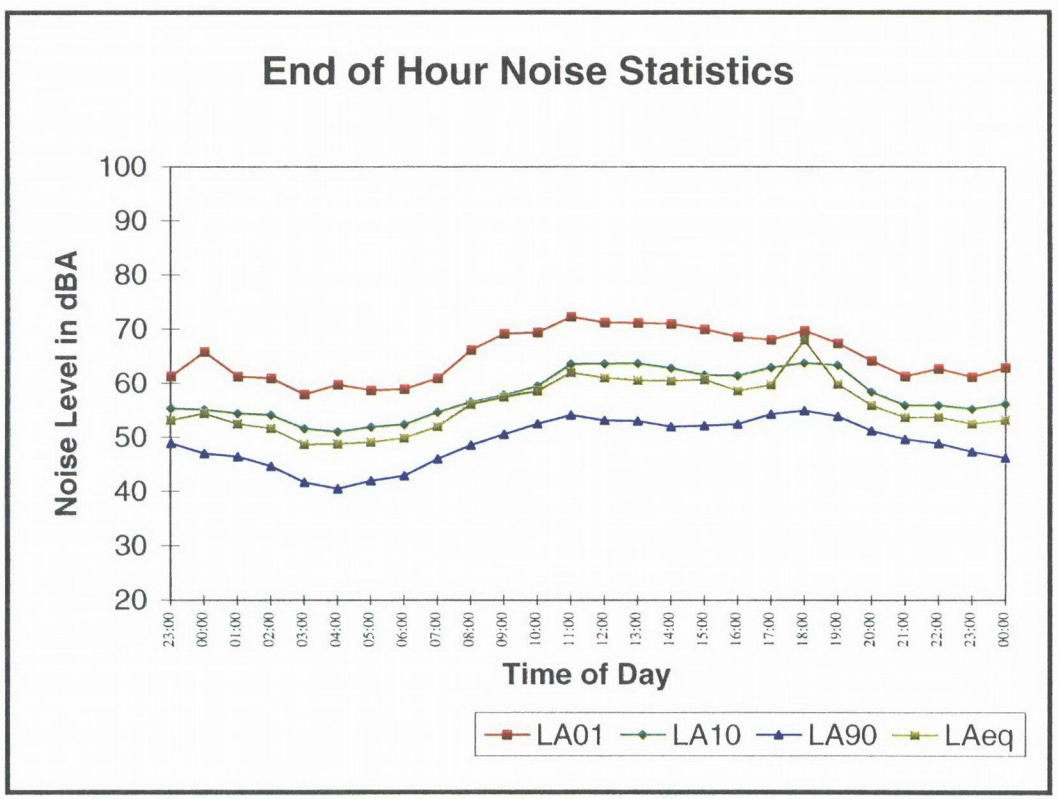


Project Name: F3 Widening
Location: Site 2
Date: 02/09/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	60.4 dBA
L_{A90} (Background)	07:00 - 18:00	52.5 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	51.6 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	60.8 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	59.0 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	51.5 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	61.3	55.3	48.9	53.2
00:00	65.9	55.1	47.0	54.4
01:00	61.3	54.4	46.4	52.5
02:00	60.9	54.1	44.6	51.6
03:00	58.0	51.6	41.7	48.7
04:00	59.8	51.0	40.5	48.7
05:00	58.7	51.9	42.0	49.1
06:00	58.9	52.3	42.9	49.9
07:00	60.9	54.7	46.0	52.0
08:00	66.2	56.6	48.5	56.1
09:00	69.2	57.9	50.5	57.5
10:00	69.4	59.5	52.5	58.6
11:00	72.3	63.6	54.1	62.0
12:00	71.3	63.7	53.1	61.0
13:00	71.2	63.7	53.0	60.6
14:00	71.0	62.8	51.9	60.5
15:00	70.0	61.6	52.1	60.7
16:00	68.6	61.4	52.4	58.7
17:00	68.1	62.9	54.3	59.8
18:00	69.8	63.8	54.9	68.0
19:00	67.4	63.4	53.9	59.9
20:00	64.2	58.4	51.2	56.0
21:00	61.3	55.9	49.7	53.7
22:00	62.7	56.0	48.9	53.8
23:00	61.2	55.3	47.4	52.5
00:00	62.9	56.2	46.3	53.2

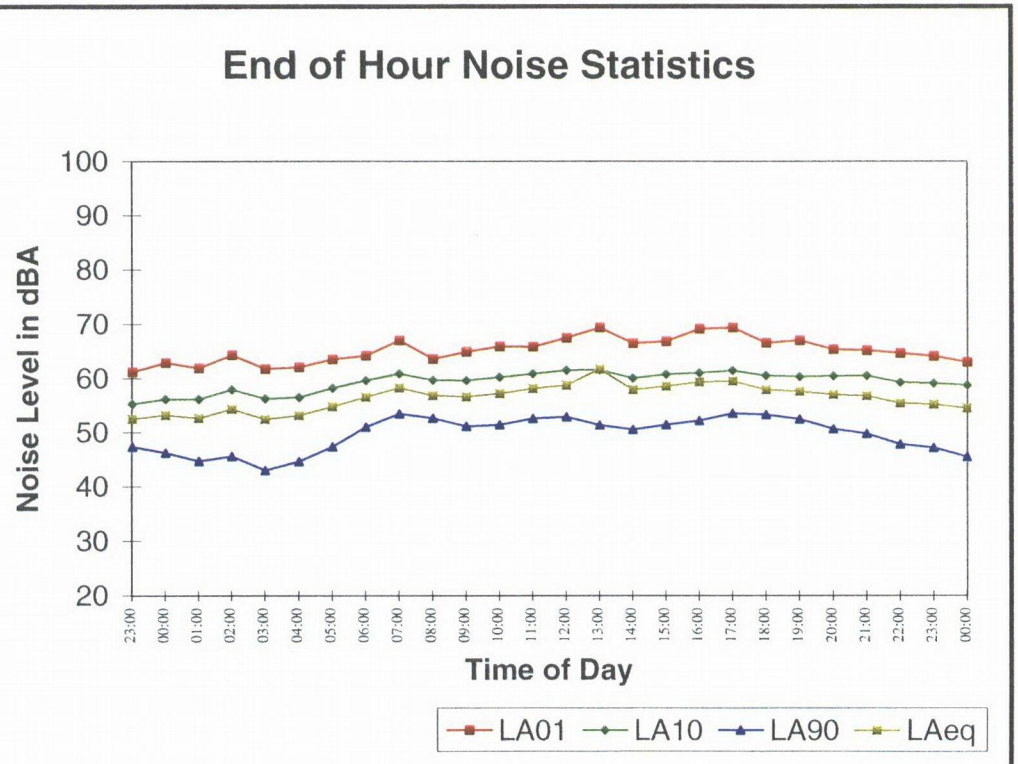


Project Name: F3 Widening
Location: Site 2
Date: 03/09/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend:

Descriptor	Period	Noise Level	
L_{dn}	00:00 - 24:00	61.4	dBA
L_{A90} (Background)	07:00 - 18:00	52.1	dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	54.7	dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	58.3	dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	57.3	dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	53.9	dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	61.2	55.3	47.4	52.5
00:00	62.9	56.2	46.3	53.2
01:00	61.9	56.2	44.7	52.6
02:00	64.3	57.9	45.6	54.3
03:00	61.8	56.3	43.0	52.4
04:00	62.1	56.6	44.6	53.2
05:00	63.6	58.3	47.4	54.8
06:00	64.2	59.7	51.0	56.6
07:00	67.0	60.9	53.5	58.3
08:00	63.6	59.7	52.6	56.9
09:00	64.9	59.7	51.1	56.6
10:00	65.9	60.2	51.4	57.3
11:00	65.8	60.9	52.6	58.2
12:00	67.5	61.6	52.9	58.8
13:00	69.4	61.6	51.4	61.8
14:00	66.5	60.1	50.5	57.9
15:00	66.8	60.8	51.4	58.6
16:00	69.1	61.1	52.2	59.4
17:00	69.4	61.5	53.5	59.5
18:00	66.6	60.5	53.3	58.0
19:00	67.0	60.4	52.5	57.7
20:00	65.4	60.5	50.7	57.0
21:00	65.2	60.5	49.8	56.8
22:00	64.7	59.3	47.8	55.5
23:00	64.1	59.1	47.2	55.2
00:00	63.0	58.8	45.5	54.5

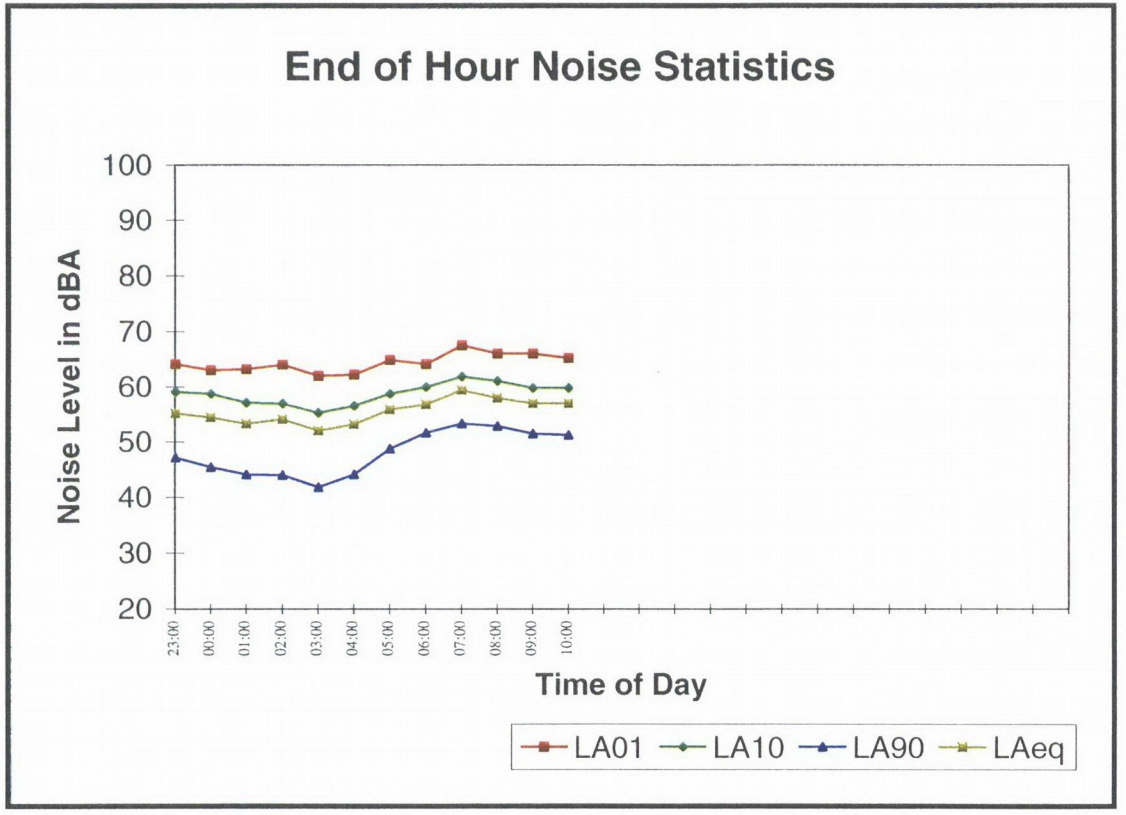


Project Name: F3 Widening
Location: Site 2
Date: 04/09/2001
File Name: F3_2.dta
Weather: Fine
LOGGER No. 073
Comments: 11 Old Pacific Hwy
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	64.4 dBA
L_{A90} (Background)	07:00 - 18:00	38.9 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	55.5 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	57.4 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	56.3 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	54.7 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	64.1	59.1	47.2	55.2
00:00	63.0	58.8	45.5	54.5
01:00	63.2	57.1	44.2	53.4
02:00	64.0	57.0	44.0	54.2
03:00	62.0	55.3	41.9	52.1
04:00	62.2	56.6	44.2	53.2
05:00	64.9	58.8	48.8	55.9
06:00	64.1	60.0	51.7	56.8
07:00	67.5	61.9	53.4	59.4
08:00	66.0	61.1	52.9	58.0
09:00	66.0	59.8	51.5	57.0
10:00	65.2	59.8	51.3	57.1



Location: Site 2
LOGGER No. 073

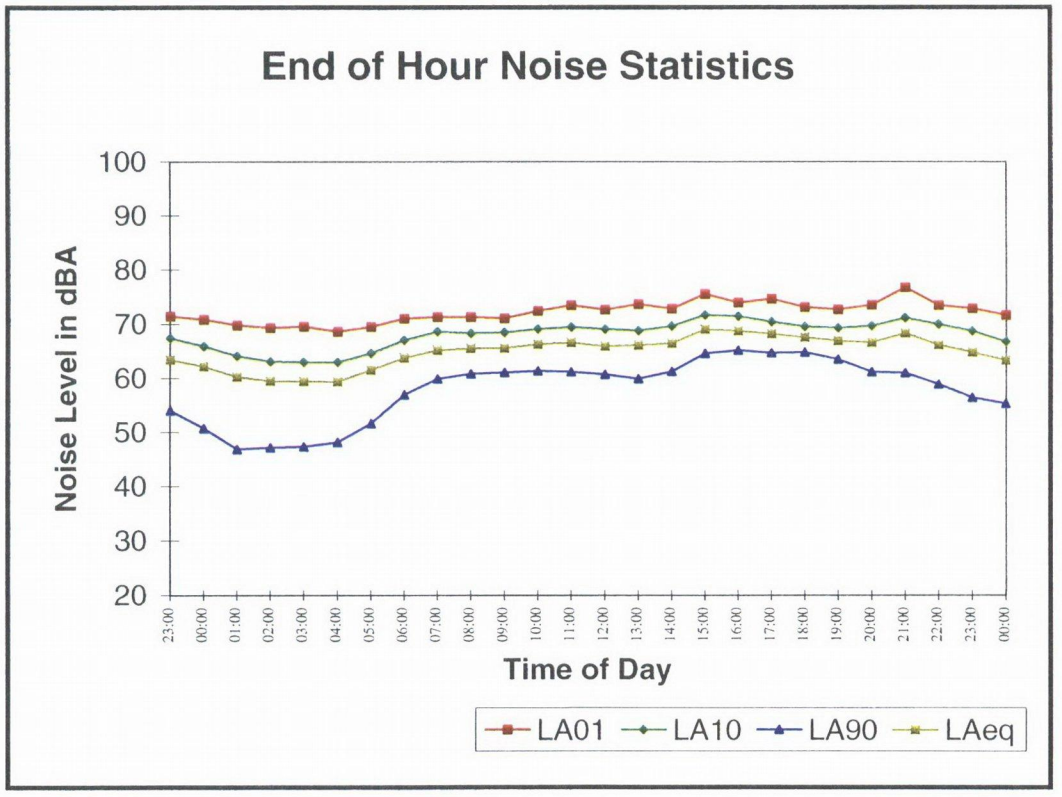
	Day	Date	Date	Leq(8hr)	Leq(9hr)	Leq(15hr)	Leq(24hr)
Day No.1	Wednesday	29/08/2001	08/29/2001	56	57	62	61
Day No.2	Thursday	30/08/2001	30/08/1901	57	58	59	59
Day No.3	Friday	31/08/2001	31/08/1901	56	57	60	59
Day No.4	Saturday	1/09/2001	01/09/1901	55	55	58	57
Day No.5	Sunday	2/09/2001	02/09/1901	52	52	61	59
Day No.6	Monday	3/09/2001	03/09/1901	54	55	58	57
	means			**55**	**56**	**60**	**59**

Project Name: F3 Widening
Location: Site 3
Date: 29/08/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	69.0 dBA
L_{A90} (Background)	07:00 - 18:00	62.3 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	62.2 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	67.2 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	65.9 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	61.6 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	71.4	67.4	54.0	63.5
00:00	70.9	66.0	50.7	62.2
01:00	69.8	64.1	46.9	60.3
02:00	69.3	63.1	47.1	59.5
03:00	69.5	63.0	47.3	59.5
04:00	68.6	63.0	48.1	59.4
05:00	69.5	64.7	51.6	61.6
06:00	71.0	67.1	57.0	63.8
07:00	71.3	68.6	59.9	65.2
08:00	71.3	68.3	60.9	65.6
09:00	71.1	68.5	61.1	65.7
10:00	72.4	69.1	61.4	66.3
11:00	73.5	69.5	61.2	66.6
12:00	72.7	69.1	60.7	66.0
13:00	73.7	68.9	59.9	66.2
14:00	72.9	69.6	61.3	66.5
15:00	75.6	71.7	64.6	69.1
16:00	74.0	71.5	65.2	68.8
17:00	74.7	70.5	64.7	68.3
18:00	73.1	69.6	64.8	67.6
19:00	72.7	69.4	63.5	67.0
20:00	73.5	69.7	61.2	66.7
21:00	76.8	71.2	61.0	68.4
22:00	73.5	70.0	58.9	66.2
23:00	72.9	68.8	56.4	64.9
00:00	71.7	66.8	55.3	63.4

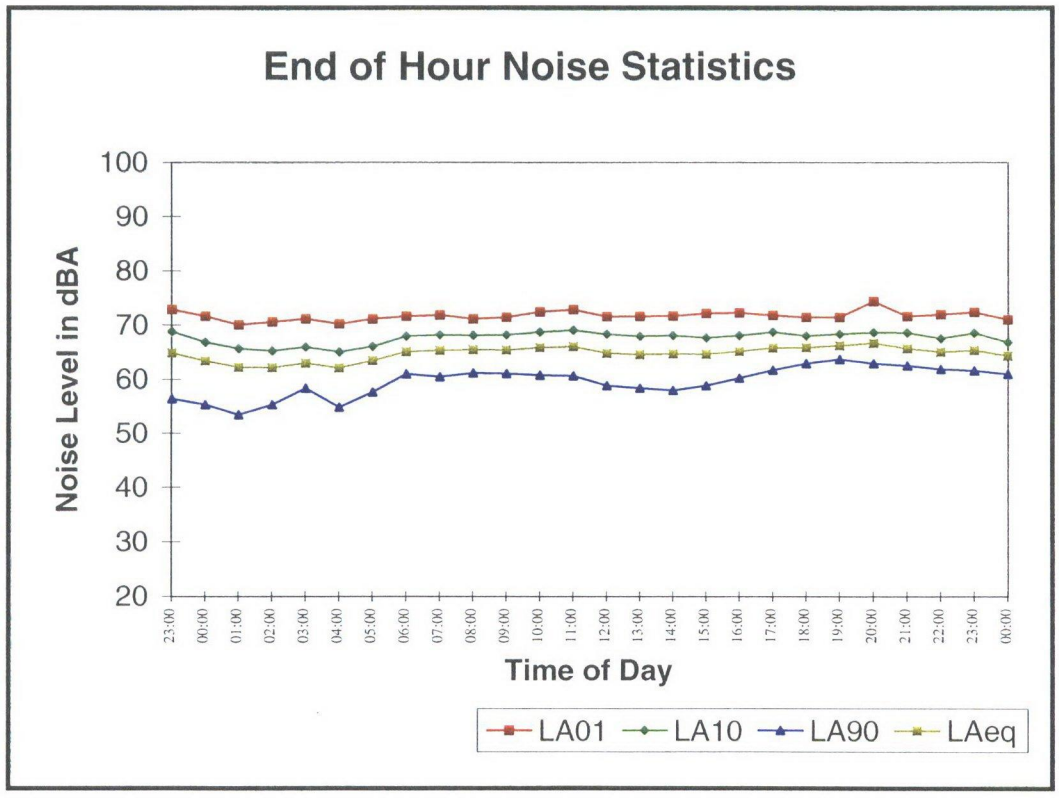


Project Name: F3 Widening
Location: Site 3
Date: 30/08/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	69.6 dBA
L_{A90} (Background)	07:00 - 18:00	60.2 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	63.7 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	65.5 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	65.0 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	63.4 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	72.9	68.8	56.4	64.9
00:00	71.7	66.8	55.3	63.4
01:00	70.1	65.6	53.4	62.2
02:00	70.6	65.3	55.3	62.2
03:00	71.2	66.0	58.4	63.0
04:00	70.2	65.1	54.9	62.1
05:00	71.2	66.1	57.6	63.5
06:00	71.7	67.9	61.0	65.1
07:00	71.9	68.2	60.5	65.3
08:00	71.2	68.1	61.2	65.5
09:00	71.5	68.2	61.1	65.4
10:00	72.5	68.7	60.8	65.9
11:00	72.9	69.1	60.7	66.0
12:00	71.6	68.3	58.8	64.8
13:00	71.6	68.0	58.4	64.6
14:00	71.7	68.1	57.9	64.7
15:00	72.2	67.7	58.8	64.6
16:00	72.3	68.1	60.3	65.2
17:00	71.8	68.7	61.7	65.8
18:00	71.5	68.0	62.9	65.9
19:00	71.5	68.4	63.7	66.2
20:00	74.4	68.6	63.0	66.7
21:00	71.6	68.6	62.6	65.7
22:00	72.0	67.6	61.9	65.1
23:00	72.4	68.5	61.6	65.3
00:00	71.1	66.8	60.9	64.4

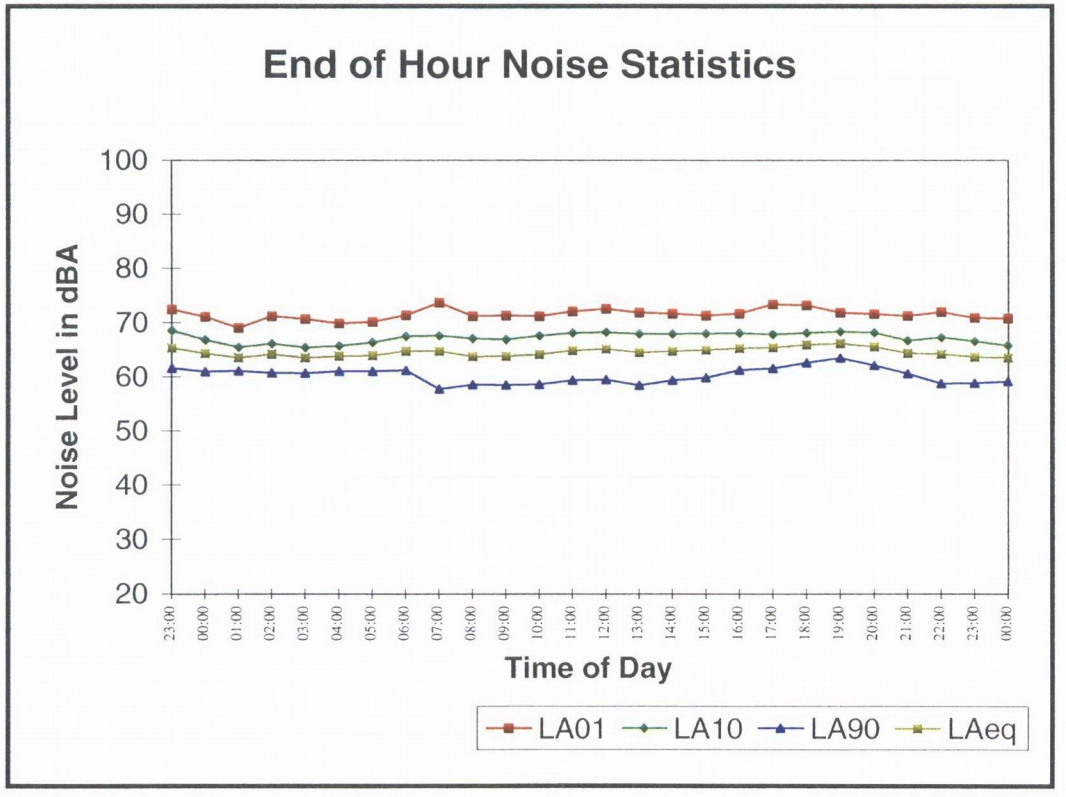


Project Name: F3 Widening
Location: Site 3
Date: 31/08/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend: YES (Saturday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	69.8 dBA
L_{A90} (Background)	07:00 - 18:00	59.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	64.3 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	64.9 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	64.6 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	64.2 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	72.4	68.5	61.6	65.3
00:00	71.1	66.8	60.9	64.4
01:00	69.0	65.5	61.1	63.6
02:00	71.2	66.1	60.7	64.2
03:00	70.6	65.4	60.6	63.6
04:00	69.9	65.7	61.0	63.8
05:00	70.1	66.3	61.0	63.9
06:00	71.4	67.5	61.2	64.8
07:00	73.7	67.6	57.7	64.8
08:00	71.2	67.1	58.6	63.7
09:00	71.3	66.9	58.5	63.8
10:00	71.2	67.6	58.6	64.2
11:00	72.1	68.1	59.4	64.9
12:00	72.6	68.2	59.5	65.2
13:00	71.9	67.9	58.4	64.6
14:00	71.6	68.0	59.4	64.8
15:00	71.3	68.0	59.8	65.0
16:00	71.7	68.1	61.2	65.3
17:00	73.3	67.8	61.6	65.4
18:00	73.2	68.1	62.6	65.9
19:00	71.8	68.4	63.5	66.2
20:00	71.6	68.2	62.1	65.6
21:00	71.2	66.7	60.6	64.4
22:00	72.0	67.3	58.8	64.2
23:00	70.9	66.6	58.9	63.7
00:00	70.8	65.8	59.1	63.5

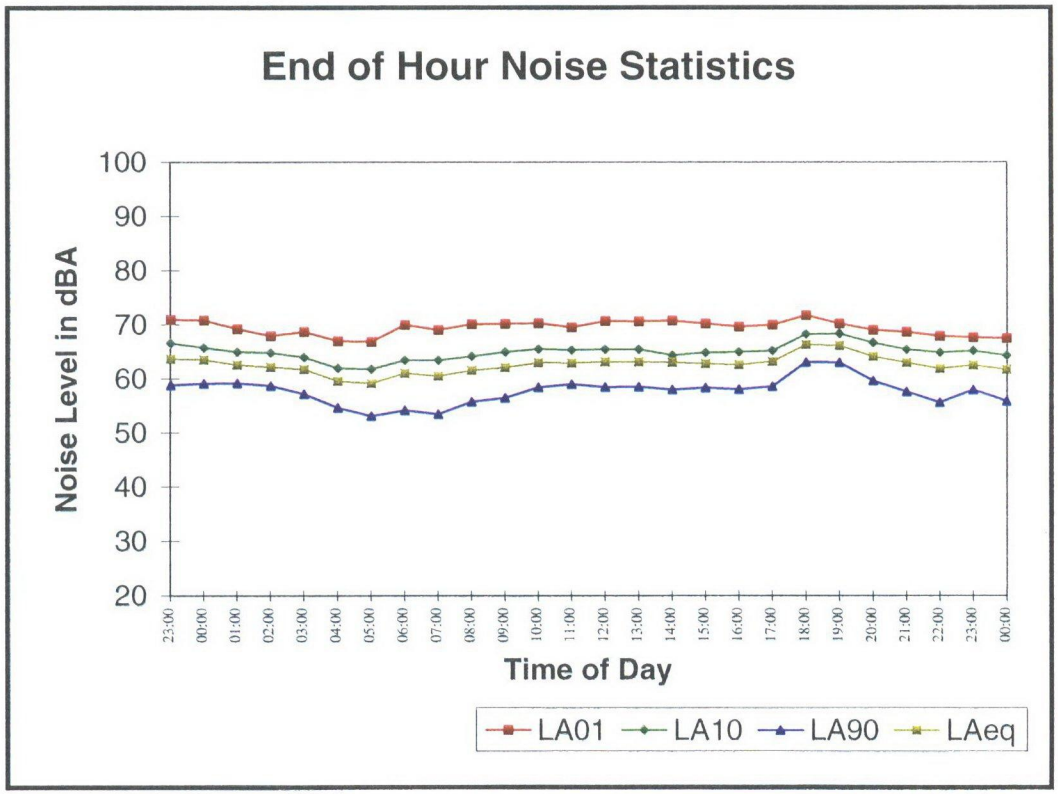


Project Name: F3 Widening
Location: Site 3
Date: 01/09/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend: YES (Sunday)

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	67.3 dBA
L_{A90} (Background)	07:00 - 18:00	58.4 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	61.8 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	63.5 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	62.8 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	62.0 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	70.9	66.6	58.9	63.7
00:00	70.8	65.8	59.1	63.5
01:00	69.2	65.0	59.2	62.6
02:00	67.9	64.8	58.7	62.2
03:00	68.7	64.0	57.2	61.7
04:00	67.0	62.0	54.7	59.6
05:00	66.8	61.9	53.1	59.2
06:00	69.9	63.5	54.2	61.1
07:00	69.0	63.5	53.5	60.5
08:00	70.1	64.2	55.8	61.6
09:00	70.1	65.0	56.5	62.1
10:00	70.2	65.6	58.4	63.0
11:00	69.5	65.3	59.0	63.0
12:00	70.7	65.5	58.5	63.2
13:00	70.6	65.5	58.5	63.2
14:00	70.7	64.4	58.0	63.0
15:00	70.2	64.9	58.3	62.8
16:00	69.6	65.0	58.1	62.6
17:00	70.0	65.2	58.6	63.2
18:00	71.7	68.3	63.1	66.4
19:00	70.2	68.4	63.1	66.2
20:00	69.0	66.7	59.7	64.2
21:00	68.6	65.5	57.7	63.0
22:00	67.9	64.9	55.7	61.9
23:00	67.7	65.2	58.0	62.6
00:00	67.5	64.3	55.9	61.8

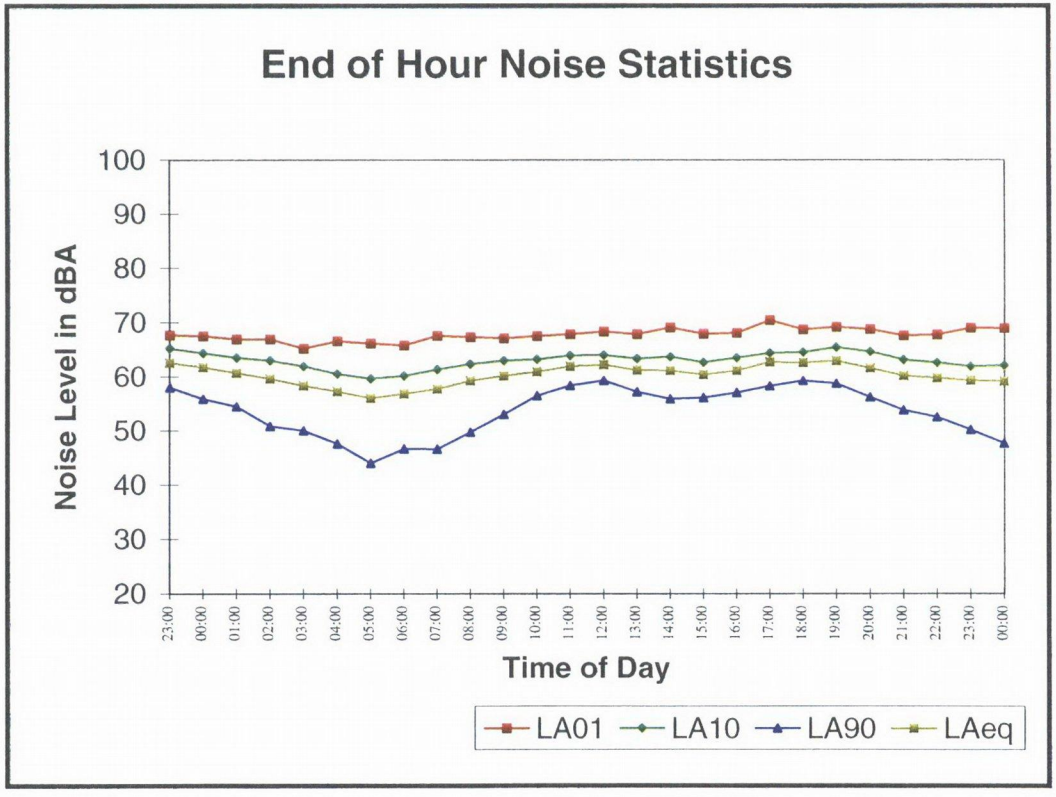


Project Name: F3 Widening
Location: Site 3
Date: 02/09/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	64.7 dBA
L_{A90} (Background)	07:00 - 18:00	56.4 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	59.6 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	61.4 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	60.5 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	59.7 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	67.7	65.2	58.0	62.6
00:00	67.5	64.3	55.9	61.8
01:00	66.9	63.6	54.5	60.7
02:00	66.9	63.0	50.9	59.7
03:00	65.2	62.0	50.0	58.4
04:00	66.6	60.6	47.6	57.3
05:00	66.1	59.6	44.0	56.0
06:00	65.8	60.2	46.6	56.9
07:00	67.6	61.4	46.6	57.8
08:00	67.3	62.4	49.7	59.3
09:00	67.1	63.0	53.0	60.2
10:00	67.5	63.3	56.5	61.0
11:00	67.8	63.9	58.3	61.9
12:00	68.3	64.0	59.3	62.2
13:00	67.8	63.4	57.2	61.2
14:00	69.1	63.7	55.9	61.2
15:00	67.9	62.7	56.1	60.4
16:00	68.1	63.6	57.1	61.2
17:00	70.4	64.4	58.3	62.7
18:00	68.7	64.6	59.3	62.6
19:00	69.2	65.5	58.8	63.0
20:00	68.8	64.7	56.2	61.7
21:00	67.6	63.2	53.8	60.3
22:00	67.8	62.7	52.6	59.8
23:00	69.0	61.9	50.2	59.4
00:00	69.0	62.1	47.6	59.2

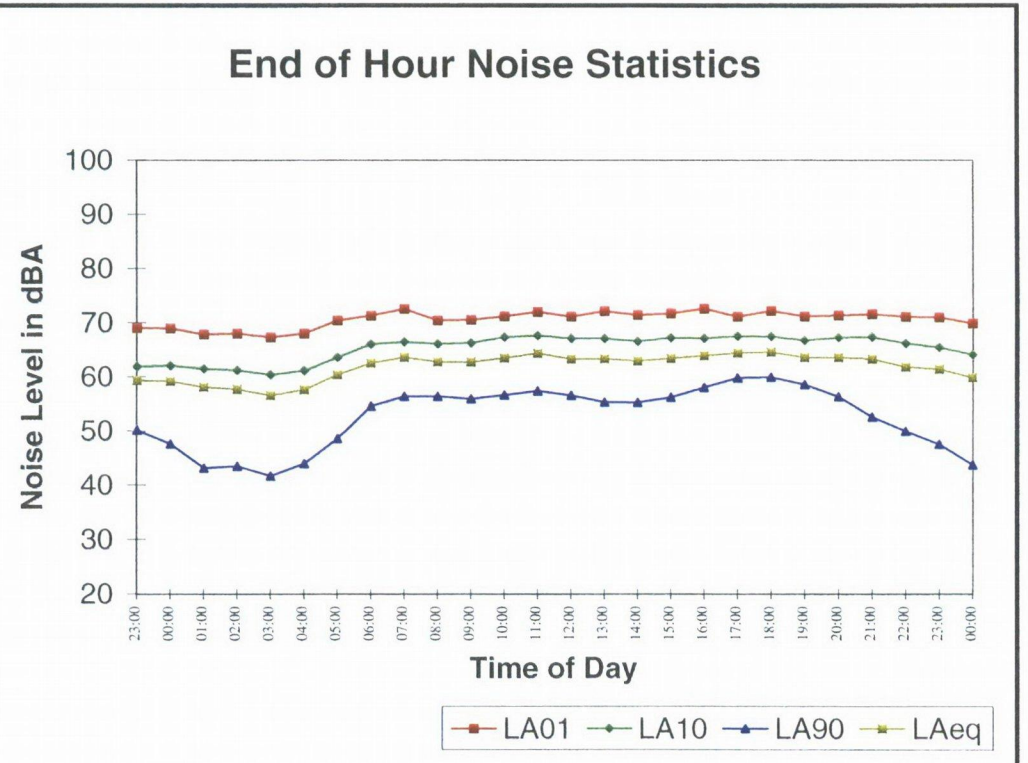


Project Name: F3 Widening
Location: Site 3
Date: 03/09/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	66.7 dBA
L_{A90} (Background)	07:00 - 18:00	57.1 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	60.1 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	63.6 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	62.6 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	59.3 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	69.0	61.9	50.2	59.4
00:00	69.0	62.1	47.6	59.2
01:00	67.8	61.5	43.2	58.1
02:00	68.0	61.3	43.5	57.7
03:00	67.3	60.4	41.7	56.6
04:00	68.0	61.2	44.0	57.6
05:00	70.4	63.7	48.6	60.4
06:00	71.3	66.1	54.7	62.6
07:00	72.6	66.6	56.5	63.7
08:00	70.4	66.2	56.5	62.8
09:00	70.6	66.4	56.0	62.8
10:00	71.2	67.4	56.7	63.5
11:00	72.0	67.7	57.5	64.4
12:00	71.1	67.2	56.6	63.4
13:00	72.1	67.2	55.4	63.4
14:00	71.4	66.7	55.4	63.0
15:00	71.7	67.3	56.3	63.5
16:00	72.6	67.2	58.1	64.0
17:00	71.1	67.6	59.9	64.5
18:00	72.2	67.6	60.0	64.6
19:00	71.2	66.8	58.7	63.7
20:00	71.4	67.3	56.4	63.7
21:00	71.6	67.4	52.7	63.3
22:00	71.1	66.3	50.0	61.9
23:00	71.0	65.6	47.6	61.5
00:00	69.9	64.2	43.8	59.9

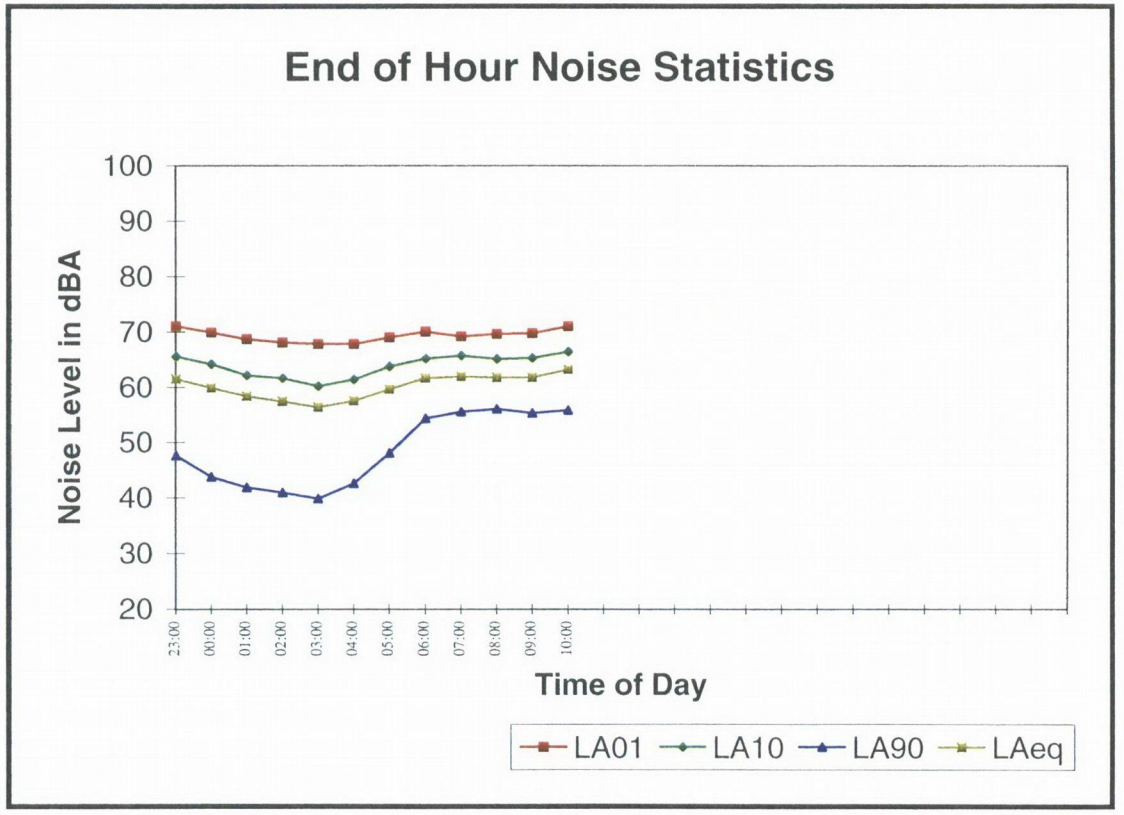


Project Name: F3 Widening
Location: Site 3
Date: 04/09/2001
File Name: F3_3.dta
Weather: Fine
LOGGER No. 079
Comments: adjacent Mt White Checking Station
Weekend:

Descriptor	Period	Noise Level
L_{dn}	00:00 - 24:00	68.3 dBA
L_{A90} (Background)	07:00 - 18:00	41.8 dBA
L_{Aeq} (9 Hours)	22:00 - 07:00	59.8 dBA
L_{Aeq} (15 Hours)	07:00 - 22:00	62.3 dBA
L_{Aeq} (24 Hours)	00:00 - 24:00	60.6 dBA
L_{Aeq} (8 Hours)	22:00 - 06:00	59.5 dBA

End of Hour Noise Statistics in dBA

Hour Ending	L_{A01}	L_{A10}	L_{A90}	L_{Aeq}
23:00	71.0	65.6	47.6	61.5
00:00	69.9	64.2	43.8	59.9
01:00	68.7	62.2	41.9	58.4
02:00	68.1	61.6	41.0	57.4
03:00	67.8	60.2	39.8	56.4
04:00	67.8	61.4	42.6	57.5
05:00	69.0	63.8	48.1	59.7
06:00	70.1	65.2	54.3	61.7
07:00	69.2	65.7	55.6	62.0
08:00	69.6	65.2	56.1	61.8
09:00	69.7	65.3	55.3	61.8
10:00	71.0	66.5	55.8	63.2



Location: Site 3
LOGGER No. 079

	Day	Date	Leq(8hr)	Leq(9hr)	Leq(15hr)	Leq(24hr)
Day No.1	Wednesday	29/08/2001	62	62	67	66
Day No.2	Thursday	30/08/2001	63	64	66	65
Day No.3	Friday	31/08/2001	64	64	65	65
Day No.4	Saturday	1/09/2001	62	62	64	63
Day No.5	Sunday	2/09/2001	60	60	61	61
Day No.6	Monday	3/09/2001	59	60	64	63
	means		**62**	**62**	**65**	**64**

Appendix D

Noise Modelling

* * * * CASE INFORMATION * * * *

F3 Widening 90k/hr

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	1800.0
Average automobile speed (km/h):	90.0
Medium truck volume (v/h):	100.0
Average medium truck speed (km/h):	90.0
Heavy truck volume (v/h):	100.0
Average heavy truck speed (km/h):	90.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

25m Receiver

Distance from centre of roadway (m):	25.0
Hourly Equivalent Sound Level without Barrier (dB):	70.3

DESCRIPTION OF RECEIVER # 2

50m Receiver

Distance from centre of roadway (m):	50.0
Hourly Equivalent Sound Level without Barrier (dB):	65.0

DESCRIPTION OF RECEIVER # 3

100m Receiver

Distance from centre of roadway (m):	100.0
Hourly Equivalent Sound Level without Barrier (dB):	59.5

DESCRIPTION OF RECEIVER # 4

200m Receiver

Distance from centre of roadway (m):	200.0
Hourly Equivalent Sound Level without Barrier (dB):	53.5

* * * * CASE INFORMATION * * * *

F3 Widening 110 km/hr

* * * * TRAFFIC VOLUME/SPEED INFORMATION * * * *

Automobile volume (v/h):	1800.0
Average automobile speed (km/h):	110.0
Medium truck volume (v/h):	100.0
Average medium truck speed (km/h):	110.0
Heavy truck volume (v/h):	100.0
Average heavy truck speed (km/h):	110.0

* * * * TERRAIN SURFACE INFORMATION * * * *

Terrain surface: soft

* * * * RECEIVER INFORMATION * * * *

DESCRIPTION OF RECEIVER # 1

25m Receiver

Distance from centre of roadway (m):	25.0
Hourly Equivalent Sound Level without Barrier (dB):	72.7

DESCRIPTION OF RECEIVER # 2

50m Receiver

Distance from centre of roadway (m):	50.0
Hourly Equivalent Sound Level without Barrier (dB):	67.1

DESCRIPTION OF RECEIVER # 3

100m Receiver

Distance from centre of roadway (m):	100.0
Hourly Equivalent Sound Level without Barrier (dB):	61.4

DESCRIPTION OF RECEIVER # 4

200m Receiver

Distance from centre of roadway (m):	200.0
Hourly Equivalent Sound Level without Barrier (dB):	54.8

Appendix E

Calculations

Noise Propagation

Equation for Attenuation due to hemispherical spreading from a linear source.

Correction = 10 Log (d1/d2) where d1 = monitored distance
d2 = predicted distance

Calculations for Table 7-2
Distance Correction
Site 2
Correction = 10 Log (85/100)
= -0.7dB

Site 3
Correction = 10 Log (30/40)
= -1.2dB

Façade Correction = 2.5 dB

Calculations for Table 9-1 and 9-3
Table A
10th Percentile Background Noise Level of Measured Sites Corrected to 100m

	Day 0700 - 1800			Evening 1800 - 2200			Night 2200 - 0700		
Location	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3	Site 1*	Site 2	Site 3
Distance to F3 m	15	85	30	15	85	30	15	85	30
Distance to Residence m	1	15	10	1	15	10	1	15	10
Measured 10th %	61	52	57	56	50	55	41	43	46
Correction	- 8.2	-0.7	-5.2	- 8.2	-0.7	-5.2	- 8.2	-0.7	-5.2
Corrected Level	53	51	52	48	49	50	33	42	41
Arithmetic Mean	52			49			33	42	

* Results for the night time L_{90} for Site 1 were not averaged because it is believed that the other 2 sites are influence by traffic using the Old Pacific Hwy at night.

Table B

Prediction of 10th Percentile Background Noise Level for Identified Receivers

Location	Receiver Type	Distance from Work/Road Alignment	Change dBA from 100m corrected values
A	Ambulance Station[1]	20m/15m	+7.0
B	Mental Hospital	300m/300m	-4.8
C	Residences	300m+/300m+	-4.8
D	Residence	125m	-1.0
E	Residence[2]	100m	0.0
F	Residence	175m	-2.4
G	Residence	160m	-2.0
H	Residence	140m	-1.5
I	Residence	75m	+1.2
J	Residence	240m/225m	-3.5
K	Residence	190m/175m	-2.4
L	Residence[3]	55m/40m	+4.0

Acoustic Calculations

Noise Propagation from Compound Site

Attenuation due to hemispherical spreading

Assumed equipment

Plant	Sound Power Level	Number	Total Power Level	Cumulative
Trucks	105	4	111	111
Compressor	99	2	102	112

Using data and equations from AS2436

SPL = PWL - 20 log R-8 Where SPL = Sound Pressure Level in dB
PWL = Sound Power Level in dB
R = distance from source to receiver in m

For a PWL = 112 dB

Location	**R**	**- 20 Log R - 8**	**SPL**	**L_{10} (SPL - 7 dB)**
A	20	- 34	78	71
B	300	- 58	54	47
C	300	- 58	54	47
J	240	- 56	56	49
K	190	- 54	58	51
L	55	- 43	69	62

Assume:

1) No barrier attenuation.
2) No ground effect attenuation.

Acoustic Calculations

Noise Propagation from Construction Site

Attenuation due to hemispherical spreading

Assumed equipment

Plant	Sound Power Level	Number	Total Power Level	Cumulative
Grader	117	1	117	117
Trucks	105	4	111	118
Roller	102	2	105	118

Using data and equations from AS2436
SPL = PWL - 20 log R-8 Where SPL = Sound Pressure Level in dB
PWL = Sound Power Level in dB
R = distance from source to receiver in m

For a PWL = 118 dB

Location	**R**	**- 20 Log R - 8**	**SPL**	**L_{10} (SPL - 7 dB)**
D	125	- 50	68	61
E	100	- 48	70	63
F	175	- 53	65	58
G	160	- 52	66	59
H	140	- 51	67	60
I	75	- 46	72	65

Assume:

1) No barrier attenuation.
2) No ground effect attenuation.

Truck reversing alarms
PWL ~ 88 dB
+ 5 dB tonal penalty
+ 5 dB impulsive penalty

Therefore assume 98dB. As cumulative PWL used in calculations was 118, addition of 1 truck reversing alarm will have no additional influence on the predicted noise levels.

Appendix F

Out of Hours Work Practice Note

Roadworks outside normal working hours

An outline of procedures for construction and maintenance works outside normal working hours. This Practice Note should be read in conjunction with Sections 9 and 10.

Background

From time to time local communities raise issues regarding noise and vibrations generated by roadworks outside normal working hours, and particularly works at night. These works are often unavoidable, because of the need to maintain full traffic capacity on the network during peak demand periods.

"Normal working hours" are defined in the EPA's *Environmental Noise Control Manual* as 7 am to 6 pm Monday to Friday and 8 am to 1 pm on Saturdays (or 7 am to 1 pm on Saturdays if the noise is not audible on residential premises).

To minimise community concerns, effective community consultation is essential.

The involvement of affected communities should be sought in the selection and design of noise and vibration treatment measures, where possible.

Where practical, noise and vibration impacts should be minimised by applying stringent roadworks programming restrictions for work conducted outside normal working hours.

Minimum roadworks programming requirements

If roadworks are proposed and it is likely that sensitive receptors will be affected by noise and vibration above guideline levels, and/or receivers are within minimum distance setbacks set out in the *CEMP*,

- Program the work so that noise and vibration at night will not affect any single dwelling or group of dwellings, flats, units and other places of residence on more than two consecutive nights, or on more than a total of six nights over a period of one calendar month.
    - When night work is programmed in stages to comply with this requirement, the periods of work should be separated by not less than one week.

Appendix D

Practice Note vii

"Roadworks outside normal working hours",

Interim RTA Environmental Noise Management Manual

Practice Note vii

Roadworks outside normal working hours

An outline of procedures for construction and maintenance works outside normal working hours. This Practice Note should be read in conjunction with Sections 9 and 10.

Background

From time to time local communities raise issues regarding noise and vibrations generated by roadworks outside normal working hours, and particularly works at night. These works are often unavoidable, because of the need to maintain full traffic capacity on the network during peak demand periods.

"Normal working hours" are defined in the EPA's *Environmental Noise Control Manual* as 7 am to 6 pm Monday to Friday and 8 am to 1 pm on Saturdays (or 7 am to 1 pm on Saturdays if the noise is not audible on residential premises).

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The involvement of affected communities should be sought in the selection and design of noise and vibration treatment measures, where possible.

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Minimum roadworks programming requirements

If roadworks are proposed and it is likely that sensitive receptors will be affected by noise and vibration above guideline levels, and/or receivers are within minimum distance setbacks set out in the *CEMP*,

- Program the work so that noise and vibration at night will not affect any single dwelling or group of dwellings, flats, units and other places of residence on more than two consecutive nights, or on more than a total of six nights over a period of one calendar month.
    - When night work is programmed in stages to comply with this requirement, the periods of work should be separated by not less than one week.

- If programmed night work is postponed for any reason, the work should be re-programmed and the programming requirements described above apply again.
- Very noisy activities should be programmed for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11:00 pm.
- Where practicable, work should be scheduled to avoid major student examination periods and times when students are studying for examinations, such as before and during the Higher School Certificate and at the end of higher education semesters.

If it is not practical to apply these minimum programming requirements, extra care will need to be taken in selecting and applying alternative and effective noise and vibration management measures.

The *CEMP* must be regularly revised to account for changes in noise and vibration management strategies.

Consultation and procedural requirements

- Evaluate all available, feasible and reasonable noise and vibration management measures and include the preferred management measures in the *CEMP*.
    - RTA environmental protection quality assurance specifications outline a range of measures, including minimum noise and vibration management requirements, that should be included in a *CEMP*. *Section 5* also outlines a range of construction and maintenance noise and vibration management measures which could be adopted. Source control is generally the most effective strategy.
- Apply for a *Road Occupancy or Road Development Licence* from the RTA's Transport Management Centre (Sydney region) or the Regional Traffic Commander (remainder of NSW).
    - Road construction or maintenance works must not commence until a *Road Occupancy or Road Development Licence* has been granted.
- On the *Road Occupancy or Road Development Licence* application form, include an "after hours" contact name and telephone number for the work. This person should have the power to issue directions concerning the commencement, performance or termination of the work. The "after hours" contact person must be accessible during the course of work.
- If the work is the subject of an Environment Protection Licence, contact the EPA and advise the work proposed to be undertaken, its location, the days and dates of the work, the hours involved and the "after hours" contact name and telephone number.
- Update the *CEMP* to include any additional noise and vibration management strategies and any additional EPA requirements.

- Contact the local community potentially affected by the proposed out-of-hours noise/vibration (residents, businesses, etc) and inform them by letter of the proposed work, the location and type of work, the day(s) and date(s) of work and the hours involved.
    - This contact should be made five days before the proposed commencement of the work.
    - It is preferable to over-estimate the hours of work, rather than aggravate people by extending the work hours for longer than anticipated.
    - A standard *Letter of Advice* can be found at the end of this *Practice Note* (below).
- If the night work will also involve significant disruption to traffic, a suitable advertisement should be placed in local papers. This advertisement should include a reference to night noise/vibration.
- Notify the TMC or Regional Traffic Commander, as applicable, prior to the commencement of work and again upon completion, in accordance with traffic management procedures.
    - It may also be beneficial to notify the affected community and other organisations (e.g. Police and Council), to assist effective complaint management.
- Notify the RTA Environmental Adviser for the region before the commencement of work.
- Manage any noise and vibration complaints in accordance with *Practice Note IX*.

Sample letter of advice

Dear resident,

[***Road name, suburb/town***]
Roadworks

The Roads and Traffic Authority (RTA) will soon be carrying out urgent road works on [***road name***] between [***point A***] and [***point B***], [***suburb/town***].

These works are programmed to commence on [***date***], weather permitting. It is expected that the work will take [***number***] nights to complete.

Unfortunately, because of the high traffic volumes in the area, the work must be carried out outside normal working hours, in order to limit traffic disruptions. It is therefore planned to work between the hours of [***state hours and relevant dates***].

The work will involve activities such as [***state nature of works e.g. the removal of failed pavement and its replacement***]. The effect on you is likely to be limited to noise [***and vibration, if relevant***] associated with this activity. Every attempt will be made to minimise the effect of this work on residents.

If you have any questions, please contact [***name***] on phone [***number***], or after hours the RTA Transport Management Centre on 131 700.

Yours faithfully,

[***Name***]
[***Position***]
[***Region/organisation***]
[***Date***]

Appendix E
Ecological Assessment

ROADS AND TRAFFIC AUTHORITY

ECOLOGICAL ASSESSMENT
WIDENING PROPOSAL FOR F3 FREEWAY

JOLLS BRIDGE TO CALGA

Robert Payne – Ecological Surveys & Management
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UMINA BEACH
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SEPTEMBER 2001

Table of Contents

		Page Number
1.0	INTRODUCTION	1
2.0	LITERATURE REVIEW AND DATABASE CHECKS	1
3.0	LIMITS TO THE STUDY AREA	3
4.0	SURVEY METHODOLOGY	4
4.1	Sediment Basin Sites and the Gorge	4
4.2	Other Sediment Basin Sites and Compound Sites	6
4.3	Aquatic Survey	6
4.4	Mapping	6
4.5	Targeted Survey for Broad-headed Snake	7
4.6	Median Areas	7
5.0	EXISTING CHARACTERISTICS	7
5.1	Description of Primary Survey Sites	8
6.0	RESULTS	9
6.1	Weather Conditions	9
6.2	Fauna at Primary Survey Sites	9
6.3	Fauna Attributes at Secondary Survey Sites	12
6.4	Flora	13
6.5	Aquatic Habitats	14
6.6	Median Survey	15
6.0	IMPACT ASSESSMENT	15
7.0	EIGHT-PART TEST	17
7.1	The Red-crowned Toadlet	17
7.2	The Giant Burrowing Frog	18
7.3	The MaskedOwl	19
7.4	The Heath Monitor	20
7.5	The Spotted-tailed Quoll	21
7.6	The Common Bent-wing Bat	22
7.7	The Black-eyed Susan	23
7.8	*Ancistracne maidenii*	24
7.9	*Caladenia tessellata, Crytoslis hunteriana Eucalyptus camfieldii, Kunzea rupestris and Micromyrtus blakeyi*	25
7.10	Adams emerald dragonfly	26
7.11	Summary	27
8.1	COMMONWEALTH LEGISLATION	28
8.1	Vulnerable Species	29
8.2	Listed Migratory Species	30
9.0	CONCLUSIONS AND RECOMMENDATIONS	30

REFERENCES 32

APPENDIX 1 AQUATIC SPECIES LIST 35
APPENDIX 2 FAUNA SPECIES LIST 36
APPENDIX 3 BIRD SPECIES LIST 37
APPENDIX 4 PLANT SPECIES LIST 39

Table 1 Threatened Species likely to occur 3
Table 2 Water conditions in creeks 7
Table 3 Weather Conditions 9
Table 4 Small Mammal Results 10
Table 5 Small Bat Results 12
Table 6 Threatened Fauna Attributes at Secondary Survey Sites 12
Table 7 Plant Species of Regional Significance 13
Table 8 Water Quality Data of creeks 15

1.0 INTRODUCTION

The Roads and Traffic Authority (RTA) has engaged Robert Payne – Ecological Surveys and Management to undertake an ecological assessment (flora and fauna) to assess the impact of the F3 widening proposal (The Proposal). The Proposal involves widening of the F3 Freeway, 4.2km south of the Mount White Overbridge to 1.0km north of the Calga Interchange.

The aims and objectives of the assessment are to:

- Identify the presence or potential presence of threatened flora, fauna and aquatic species, endangered populations and endangered ecological communities, within and in the vicinity of the study area, by field survey.

- Determine the impact on threatened flora and fauna and aquatic species that are likely to occur within the study area and provide mitigation measures to reduce the extent of impacts on habitat.

- Determine the impact on flora and fauna, particularly critical habitats, threatened species, populations or ecological communities or their habitats and determine whether a Species Impact Statement (SIS) needs to be prepared.

Discussions were held with the NSW National Parks and Wildlife Service as to the specific requirements for the census. As a result of these discussions, targeted surveys were requested for threatened flora species along with an assessment for threatened fauna (Red-crowned Toalet *Pseudophryne australis*, Giant Burrowing Frog *Heleioporus australiacus)* based upon habitat attributes.

For the purpose of the stabilisation works, the RTA is the proponent and the determining authority under Part V of *the Environmental Planning and Assessment Act, 1979*. The Ecological Assessment describes the flora and fauna of the study area and the associated environmental impacts. In doing so, this ecological assessment will partly fulfil the requirements of Part V, Section 111(4a & b) *of the Environmental Planning and Assessment Act*. The results of the Ecological Assessment will be considered when assessing:

- The significance of any impact on threatened species as defined by *the Threatened Species Conservation Act, 1995,* and the *Fisheries Management Act, 1994*, in accordance with Section 5A of the *Environmental Planning Assessment Act, 1979*, and therefore the requirement for a Species Impact Statement (SIS).

The significance of the Proposal on the matters of national environmental significance will be assessed under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999,* using the guidelines provided by Environment Australia (Anon, 2000) and those published by Gosford City Council (Anon, 2001).

Discussions were held with the NSW National Parks and Wildlife Service and NSW Fisheries as to more specific requirements. As a result of these discussions, methods and targeted surveys for threatened flora and fauna (Red-crowned Toadlet *Pseudophryne australis*, Giant Burrowing Frog *Heleioporus australiacus* and Adams Emerald Dragonfly *Archaephyla adamsi*) were requested along with a flora survey and preparation of species lists. In particular, any mitigation measures proposed, will need to have regard to protection of the drainage lines and prescribed marine vegetation that is present within Mooney Mooney Creek, using guidelines prepared by Fairfull & Carter (1999).

The New South Wales National Parks and Wildlife Service in a letter to the Roads and Traffic Authority regarding this project, has expressed a view that the work should involve some research work on the Broad-headed Snake. Collectors and those collecting bush rock have removed the Broad-headed Snakes and their winter habitat from the large rock outcrops in the study area. Further discussions with the NSWNPWS suggested the research work could involve re-instating winter habitat for the Broad-headed Snake on top of the rock cuttings, which have a western and northwestern aspect. Two types of rock could be used in the research program. Small suitable sandstone rock slabs, which have been cut away from the rock faces and median, could be strategically placed on top of the rock cutting and a monitoring program undertaken to establish if the Broad-headed Snake will colonise the outcrops beneath the rock slabs. As an alternative, artificial rocks could also be used to determine a similar use by the Broad-headed Snake.

2.0 LITERATURE REVIEW AND DATABASE CHECKS

Douglas (1999) has reviewed the threatened flora and fauna and their habitats along the F3 corridor between Wahroonga and Kariong. Tables are included in the document detailing habitat attributes for each species. The author states that the F3 corridor is highly sensitive for flora species that are considered to be of 'special conservation significance to the region'. Douglas (1999) emphasises the importance of the laterite ridgetops for these species because of its restricted distribution and specific chemistry, which may support relict species. Only one location is known for this geology, between Jolls Bridge and Calga, which is at Mount White. In contrast to this, the Hawkesbury Sandstones are the least sensitive, unless deep gullies are present. In gully habitats both *Leptospermum deanei and Persoonia mollis ssp. maxima* may be encountered, but it should be noted that both species are only known, at this stage, south of the Hawkesbury River. In the deeper gullies, such as Mooney Mooney Creek, Narrabeen Group geology outcrops, where populations of *Grevillea shiressii* are known and where the grass *Ancistrachne maidenii* is likely to occur.

It appears there are no 'threatened species populations' listed for the section between Jolls Bridge to Calga but Douglas (1999) does note that Shale/Sandstone Transition Forest, which is listed as an 'endangered ecological community', may occur along the Cowan to Wahroonga section. It is also noted that *Eucalyptus camfieldii x Eucalyptus capitellata* had been found at Hornsby and it is stated that the species does not have to be addressed under the *Threatened Species Conservation Act, 1995.* A more recent find of a large population of this species in the Gosford Local Government area (Payne, 2000) and further advice from the NSW Scientific Committee indicates this species is to be addressed under the act, if the morphological attributes show more of an affinity towards *E. camfieldii. E. capitellata x E. camfieldii* has a high reproductive potential, as shown by the Forresters Beach population.

Threatened fauna attributes are also included by Douglas (1999) and are considered to be relatively accurate. However, the fact that the Giant Burrowing Frog is a ridgetop specialist, has been omitted. This species utilises dams or creek lines on ridges for breeding and tadpoles are often found at certain times of the year, in many of the creeks, that flow through Hawkesbury Sandstone geology to lower slopes. It is noted, however, that the Oxford Falls Soil Landscape Unit is stated to be a likely habitat for the Giant Burrowing Frog and Red-crowned Toadlet. This soil landscape unit occurs at three locations north of the Hawkesbury River but it is our experience that both species are not specific to this soil landscape unit and are found throughout most areas of Hawkesbury Sandstone.

Clarke & Benson (1987) undertook the broad scale vegetation survey of the Mount White area. Subsequently the vegetation of the region was modelled (see Anon, 2000a) and along the route of the freeway corridor, the vegetation has been classified as Hawkesbury Plateau Banksia Scrub, Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland. This information is available in Geographical Information Format (GIS) and the information shows that these vegetation units make up the majority of vegetation found in Popran and Brisbane Water National Parks. For the purposes of this study, this information has been utilised and transposed onto the relevant mapping database (Figure 2).

Earlier studies have shown that both the Greater Broad-nosed Bat *Scoteanax rueppellii* and the Eastern Chestnut Mouse *Pseudomys gracilicaudatus* have been located alongside the Pacific Highway at Somersby (Payne, 1997), but these records may represent their southern limits of distribution for the region. It would also appear, from updated surveys this year by the NSW National Parks and Wildlife Service, that the 'endangered' Somersby Mintbush is still known to be restricted to the Somersby-Kulnura Plateau but the vulnerable Adams emerald dragonfly could very well be found in the study area. The latter is a very rare species also and has only been collected in very low numbers. Only five locations are known for this species, which are Somersby Falls Creek, Floods Creek, Berowra Creek, Hungry Way Creek in Wollemi National Park and Bedford Creek in the Blue Mountains. Recent collections are from Tunks Creek and Somersby Falls Creek, but these creeks are becoming polluted from agricultural and industrial activities (Chapman, 2000).

The Register of the National Estate identifies two sites near Mooney Mooney Creek, which are located just north of the study area, as being significant for insects and aboriginal engravings (Figure 2). Known as site No. 019187, the Mooney Mooney Creek Insect Site contains an unusually diverse and rich fly fauna and are particularly important as a habitat for the two winged flies, *Diptera.* The site is the locality where six fly species have been first recorded and described. As a type or reference locality it is important to the taxonomy and classification of flies. The site is also the habitat of many undescribed species, and is likely to become the type locality, for these species when they are named. One of the unnamed flies, a species of *periscelis*, which is only known from four locations, is of considerable scientific and evolutionary importance as the sole Australian representative of a fly family, which is mainly found in Europe and the Americas. Two uncommon species of primitive scorpion flies, *Taechorista pallida* and *Tytthobittacus macalpinei* and an uncommon member of the wasp family (an *Orossobaius* species), are also found in the area and are of importance to evolutionary and

biogeographic studies. Some of the fly species collected at Mooney Mooney are not known elsewhere and many are very seldom collected anywhere.

The Mooney Mooney insect site extends for 500 metres along a semi-permanent creek and gully. The creek drains into an estuarine section of Mooney Mooney Creek, which forms the southern boundary. From the mangroves on the southern boundary the tributary creek rises to an elevation of 50 metres. The underlying geology is predominantly Hawkesbury sandstone, with intrusions of Narrabeen Shale. The rich soil washed from the shale supports a small area of rainforest along the creek. The rainforest is a simple semi-evergreen notophyll vine thicket. Most of the area is wet sclerophyll eucalypt forest, in which ferns are prominent. There is a small area of cleared land. The site is well sheltered and occurs between a loop of the Old Gosford to Sydney Road. The area has been the site of invertebrate collecting activities by the Australian Museum staff since 1957. The location has been more thoroughly investigated for two winged flies, *Diptera* than for other insect types. The site is of high integrity except for one small cleared area.

The National Herbarium of NSW have also advised that two new species of Wattles have been described for the Kulnura Plateau, but as yet the descriptions have not yet been published. The new species *are Acacia kulnuriensis* and *Acacia alaticaulis* and their distribution may extend further south towards the study area.

Database checks of threatened flora and fauna species, through the NSW National Parks and Wildlife Service wildlife atlas database, are shown on Figure 2. The species recorded previously are the Spotted-tailed Quoll, the Giant Burrowing Frog and the Glossy Black Cockatoo. A number of these species and some additional species are listed on the Commonwealth *Endangered Species Protection and Biodiversity Act, 1999*. These latter species are shown in tabular form in Appendix 1, but those fauna species, for which habitat attributes are present, are the Giant Burrowing Frog, the Large Pied Bat *Chalinolobus dwyeri* and the Spotted-tailed Quoll *Dasyurus maculata*. Plant species, for which habitat attributes are present, are *Caladenia tessellata, Cryptostylis hunteriana, Eucalyptus camfieldii, Kunzea rupestris* and *Micromyrtus blakelyi*. There are also a number of migratory species listed, which includes the White-bellied Sea Eagle *Haliaeetus leucogaster*, the White-throated Needletail, *Hirundapus caudacutus*, the Rufous Fantail, *Rhipidura rufiforns*, the Satin Flycatcher, *Myiagra cyanoleuca* and the Black-faced Monarch, *Monarcha melanopsis*. The White-bellied Sea Eagle is present and it is likely that the Rufous Fantail, the Satin Flycatcher, the White-throated Needletail and Black-faced Monarch could occur. The latter three species are migratory along the Australian coast and return to southern coastal areas in spring. A summary of threatened species likely to occur in the study area is given in Table 1.

Table 1 – Threatened Species likely to occur in the Study Area.

Common Name	Latin Name	Relevant Act & Status	
Spotted-tailed Quoll	*Dasyurus maculata*	TSC & EPBC Act	Threatened
Giant Burrowing Frog	*Heleioporus australiacus*	TSC & EPBC Act	Threatened
Red-crowned Toadlet	*Pseudophryne australis*	TSC Act	Threatened
Glossy Black Cockatoo	*Calyptorhynchus lathami*	TSC Act	Threatened
Common Bent-wing Bat	Miniopterus shreibersii	TSC Act	Threatened
Large Pied Bat	*Chalinolobus dwyeri*	TSC & EPBC Act	Threatened
Thick-lipped Spider Orchid	*Caladenia tessellata*	TSC & EPBC Act	Threatened
Leafless Tongue Orchid	*Cryptostylis hunteriana*	TSC & EPBC Act	Threatened
Camfield's Stringybark	*Eucalyptus camfieldii*	TSC & EPBC Act	Threatened
Black-eyed Susan	*Tetratheca glandulosa*	TSC & EPBC Act	Threatened
	Kunzea rupestris	TSC & EPBC Act	Threatened
	Micromyrtus blakelyi	TSC & EPBC Act	Threatened
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Migratory EPBC Act	
White-throated Needletail	*Hirundapus caudacutus*	Migratory EPBC Act	
Rufous Fantail	*Rhipidura rufiforns*	Migratory EPBC Act	
Satin Flycatcher	*Myiagra cyanoleuca*	Migratory EPBC Act	
Black-faced Monarch	*Monarcha melanopsis*	Migratory EPBC Act	
Adams emerald dragonfly	*Archaephyla adamsi*	FM Act	Threatened

3.0 LIMITS TO THE STUDY AREA

The study area was limited to an area of interest defined by the following criteria:

- An area within a 50 metre radius of the 35 sediment basins and associated access tracks.
- An area within a 50 metre radius of the two works compounds.
- A corridor of 30 metres, measured from the pavement edge, inside both the northbound and southbound carriageways in the area known, as "The Gorge".

- All the remaining median areas between Jolls Bridge and the Calga Interchange.

4.0 SURVEY METHODOLOGY

Censuses were undertaken by Robert Payne, Wildlife Ecologist aided by Tim Smpson, Assistant Ecologist. The assessment involved the following:

- A literature review
- Database checks from the Register of the National Estate, the NSW National Parks and Wildlife Service wildlife atlas records and records from Environment Australia.
- Site surveys to establish the presence of threatened species.
- Mapping to show the distribution of threatened species, which have been recorded from past surveys and found during the current survey (Figure 2).
- Documentation of survey results and preparation of eight part tests under *the Threatened Species Conservation Act, 1995* and compliance with the commonwealth *Environment Planning and Biodiversity Conservation Act, 1999.*
- Searching habitat of the Broad-headed Snake as predicted by the model from the NSW National Parks and Wildlife Service.

The survey methodology for flora and fauna is described below. The methodology employed to carry out the census for the project was according to standard procedures set down by Wyong Shire Council (Mamouney, 1998) and Lake Macquarie City Council (Murray, 1998) but with some modifications to suit the habitat and site conditions. The targeted survey for Adams emerald dragonfly was suggested by State Fisheries. The two published documents mentioned above, are the only ones available, at the present time, detailing flora and fauna census methodology.

4.1 Sediment Basin Sites and 'The Gorge'

For the construction of the Freeway widening Proposal, 35 sediment basins and two compound sites will be required and each site requires a census, within a radius of 50 metres. The design of the survey took this into account and the following procedure was adopted:

- Nine primary survey sites were chosen, which included some sediment basin sites, and were used as the main flora and fauna census sites. These sites are biased in their selection and are located at SB2B, SB3B, SB4S, SB5B, SB6B, SB7B, SB7S, SB10B and SB13B. At these sites the census area was one ha. (100m x 100m) and within these sites a full census was undertaken. All of these sites are designated on the maps as Primary Survey Site (PSS) 1-9, with 'The Gorge' being identified as PSS2 (Figure 2).

Within the one-hectare area at the nine primary census sites, the following procedure was adopted:

Birds

Birds were censused using two methods. Point centred surveys (Recher, 1987) were firstly undertaken over nine days, whereby the observer sits quietly for a period of 30 minutes and all the bird species are recorded from calls and observations within the one ha. quadrat area. Secondly, opportunistic observations of additional bird species are recorded during the inspections for other sections of the survey. Surveys were undertaken mainly in the morning, but some surveys were also undertaken just prior to dusk to try and detect the more cryptic species such as Cuckoos.

Small Mammals

Within the designated one ha. area, at sites PSS 1-9, two lines of small mammal traps were set fifty metres apart. Each trap, within the trapline, was set ten metres apart and baited with a mixture of peanut butter, honey and rolled oats. The size of the quadrat is based on a method used for arboreal mammal trapping (see Smith, 2000). All traps were out for a period of three days at each site and the animals captured were identified and released each morning.

At some sites, where it was possible, quadrats were selected parallel and adjoining the Freeway. At this location rock embankments provide many areas of shelter that may be utilised by small mammals. Where it was possible, one line of traps was set at the base of the rock embankment whilst the other line was set in the vegetation.

Small Bats

Harp traps were not set to census small bat species because the narrow band of vegetation beside the Freeway generally lacks suitable flyways for bats. Instead at census sites PSS 1-9, an ultrasonic detector was used and small bats were censused either on the Pacific Highway, close to the survey site or on the closest vehicular access track. These areas were considered to be the only suitable flyways. An Anabat II ultrasonic detector, delay device and temperature-humidity meter were used to record echolocation calls of small bat species, which were later analysed using computer techniques. Lower flying bats were censused first,using the detector set at an angle of 10°, whilst higher flying bats, were censused using the detector set at 45°. Each census totalled one hour and the method was considered adequate to census both high flying and low flying bats in particular habitats. Small bats were included in the census because they can inhabit small hollows and loose bark in eucalypts, roost in sandstone caves and intercises and feed over water bodies, such as Mooney Mooney Creek.

Nocturnal Animals

Nocturnal animals were censused using a handheld spotlight at census sites PSS 1-9. A search was made for nocturnal animals through the census area and along access tracks and beside the Pacific Highway. It was considered too dangerous to undertake a night spotlighting census from beside the Freeway. A handheld 50-watt spotlight was used for this task. As the study sites are only small, each census only lasted for a period of one hour and was undertaken during the small bat census. This task was undertaken on nine evenings.

Large Owls

Large Owls were censused together with the bat surveys at sites PSS 1-9. This was undertaken by playing a pre-recorded CD Rom of the calls of the Powerful Owl, the Masked Owl and the Barking Owl. The Sooty Owl and Eastern Grass Owl were not censused because their habitat was not considered to be present in the study area. Each call was played separately, allowing 15 minutes between each call, which was followed by a period of quite listening. Calls were played through a 'faunatech' loudhailer and the aim was either to initiate response calls or to attract owls to the census site. This task was undertaken on nine evenings.

Amphibians

Amphibians were censused during the night and day at sites PSS 1-9. The task was accomplished by listening for calls or undertaking searches, using a headlamp spotlight for evening surveys. A targeted search was also made for the Giant Burrowing Frog and the Red-crowned Toadlet. Searches were made within the vegetation in the vicinity of seepage zones, when calls were detected of the Red-crowned Toadlet. These surveys were made during both the night and day because the Red-crowned Toadlet was heard calling at both times. Searches were also made for the Giant Burrowing Frog by inspecting pools in drainage lines and searching for ground burrowing holes beside drainage lines during the day. Nine evenings were spent on this task.

Since the Giant Burrowing Frog is such a cryptic species, detection of its presence is achieved more successfully by finding tadpoles. Although targeted surveys were undertaken, they were repeated during the aquatic flora and fauna surveys. In this case, censuses were carried out, using a dipnet within pools, within Calverts Creek, Marlows Creek, Green Point Gully, Kellys Creek and at 'the Gorge'.

Reptiles

There was a specific search carried out for reptiles at sites PSS 1-9, in conjunction with the botanical survey but the timing for the survey was considered unseasonal to detect many species. Within each quadrat set out for the botanical census a search was conducted for reptiles amongst grass and beneath fallen bark and logs, where they were found to be present. Secondly, opportunistic observations of reptiles were recorded during other parts of the census.

Koala Survey

Within Hawkesbury Sandstone habitats, the shale outcrops support Grey Gum *Eucalyptus punctata*, which is known to be a preferential browse species for the Koala *Phascolarctos cinereus*. Furthermore, the shale outcrops and cliff edges also support the Sydney Peppermint *Eucalyptus piperita*. Scribbly Gum *Eucalyptus haemastoma*, is also present as a dominant tree within the study area and the two latter species are also known to be utilised by Koalas, but less preferentially, on the Hawkesbury Sandstone (Williams, 1997). A Koala colony is also known from the Pearl Beach-Patonga-Little Wobby region and, isolated Koalas have been seen as far as Kariong, in the vicinity of the Freeway. Thus the survey targeted the presence of the Koala on the main two identified browse tree species; Scribbly Gum

and Grey Gum, using the method of Phillips and Callaghan, (1995). These two tree species are also listed on State Environmental Planning Policy No. 44 – Koala Habitat Protection.

Within each quadrat searches were made for the presence of Koala scats. The ground litter layer was removed from the base of trees and a search made for the presence of Koala scats, where possible. The root system and trunks of the trees were often found to be growing amongst rock outcrops and this prevented an efficient search. Notes were also made of the scratch marks on trees, which may also indicate the presence of the Koala.

Flora

The flora census involved selection of quadrats at each main census site (PSS 1-9). Each quadrat was 20m x 20m ($400m^2$) and within each quadrat, site structural and floristic information of the overall vegetation community was compiled, which included recording details of all layers of vegetation and their floristic component. All plant species found within the quadrat area were recorded and scored using a Braun Blanquet scale.

A further targeted search was undertaken within the required radius of 50 metres for threatened plant species and threatened fauna species habitat, known to occur within the vicinity of the Proposal. This procedure involved walking through the vegetation and inspecting the area, taking note of any attributes such as drains, seepage zones, creeks and rock slabs. Further searches were made in creeks for tadpoles of the Giant Burrowing Frog and beneath rock slabs for the Broad-headed Snake.

Weather Conditions

The weather conditions were recorded during the nocturnal fauna survey. Temperature, humidity, wind and moon conditions were all noted. The temperature was recorded during the bat and nocturnal surveys every hour with an 'Ecoscan' temperature meter, whilst humidity is recorded each hour through the Anabat detector and the recorded information is then transposed onto a tape.

4.2 Other Sediment Basin Sites and Compound Sites

The census involved selection of quadrats at all other census and compound site (SSS A-O) and a targeted survey for threatened plant species and threatened fauna species attributes. Each flora quadrat was 20m x 20m ($400m^2$) and within each quadrat, site structural and floristic information of the overall vegetation community was compiled, which included recording details of all layers of vegetation and their floristic component. All plant species found within the quadrat area were again recorded and scored using a Braun Blanquet scale. Additional targeted searches were then made for threatened plant species, by traversing the required area, where sediment basin and compound works are proposed.

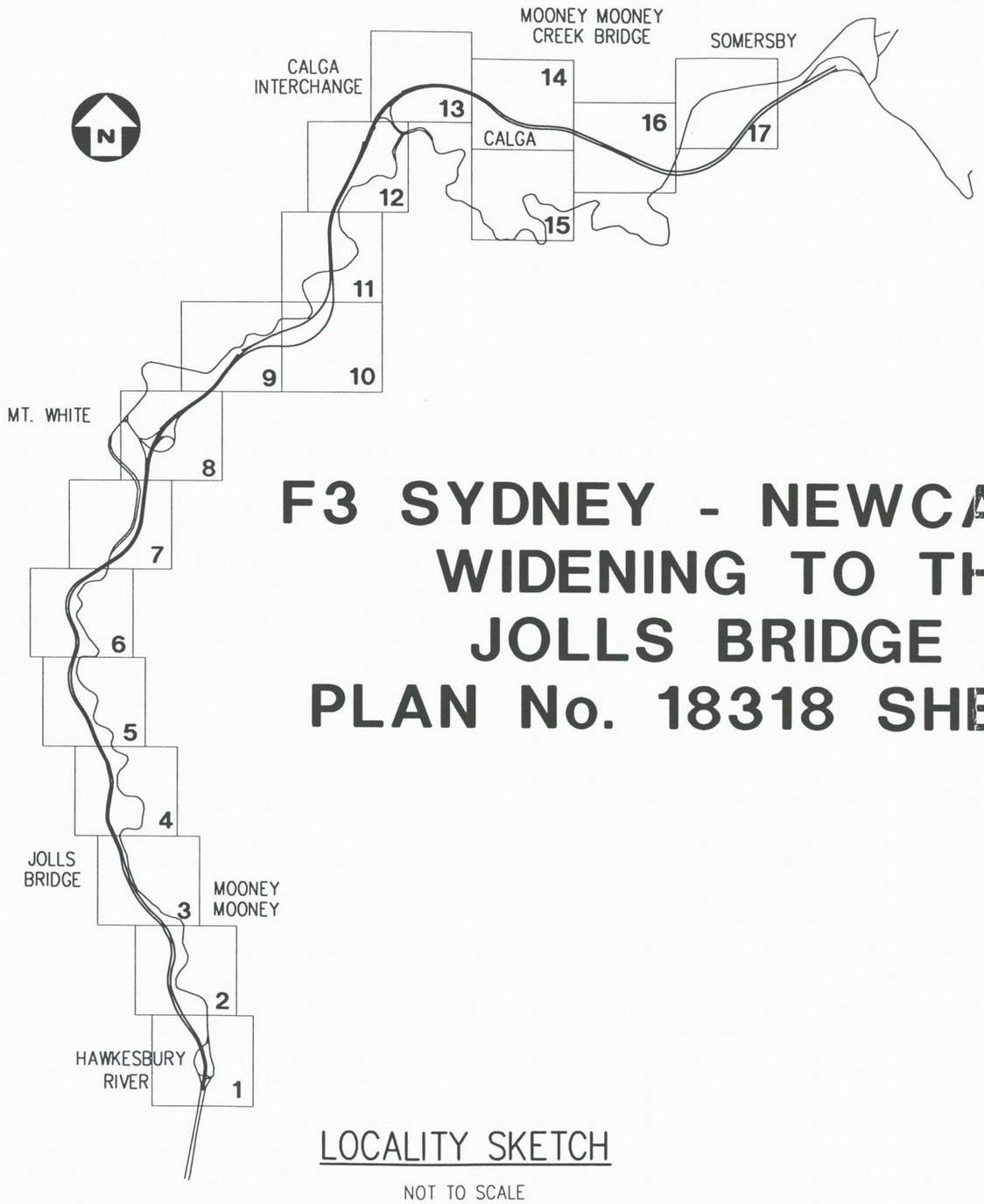
A targeted fauna attribute survey was undertaken for all of these sites. Habitat attributes present at each site were assessed for the potential presence of threatened fauna species. Their presence was based upon the presence of creeks, seepage zones, hollows, termite mounds, winter flowering tree and shrub species, caves and intercises.

4.3 Aquatic Survey

A further fifteen sites in drainage lines were censused for aquatic flora and fauna. These included Marlow Gully, Calverts Creek, Green Point Gully and Kellys Creek. However, only three of the sites were used to target Adams emerald dragonfly, because most of the drainage lines lacked adequate water pools. All of these sites are known as Aquatic Survey Sites (ASS) 1-15 (Figure 2 & Table 2).

Freshwater organism surveys were conducted at the 15 sites shown on the attached plans (ASS 1-15). A 15-minute search was undertaken at each site and, involved the sweeping of edges, pools and crevices; collection of leaf litter; and the examination of creek rocks. A large dip net was used to capture organisms living in moderately deep water. The dimensions of the net were 43 cm long and 19 cm wide. Smaller dip nets were used to capture fauna in shallow water. These nets were 25 cm long and 17 cm wide. Both nets had mesh sizes of 1 mm. After capture, organisms were placed into a white bucket or ice cream container filled with water. They were then sorted and identified to Family level or to Order and were counted and released. Sampling occurred between the 6th to 7th August 2001.

During this procedure, targeted surveys were undertaken for Adams emerald dragonfly, which is listed as vulnerable on the Fisheries Management Act, 1994. Those creeks, which held water, were targeted, using the habitat attributes identified by NSW Fisheries. Chapman (2000) notes that Adams emerald dragonfly larvae occur on rocks or beneath leaf litter along stream margins. In Tunks Creek it was found in narrow riffles with medium to large boulders with cobbles, gravel and sand. The ripples were mainly shady with moss coverage.



LOCALITY SKETCH

NOT TO SCALE

F3 SYDNEY - NEWCASTLE FREEWAY
WIDENING TO THREE LANES
JOLLS BRIDGE TO CALGA
PLAN No. 18318 SHEETS A01 - A17

REV No.	REMARKS	DATE
	AMENDMENTS	
A	ISSUED	11.9.01

CLIENT:

Robert Payne
Ecological Surveys & Management

15 MOUNTAIN ASH WAY
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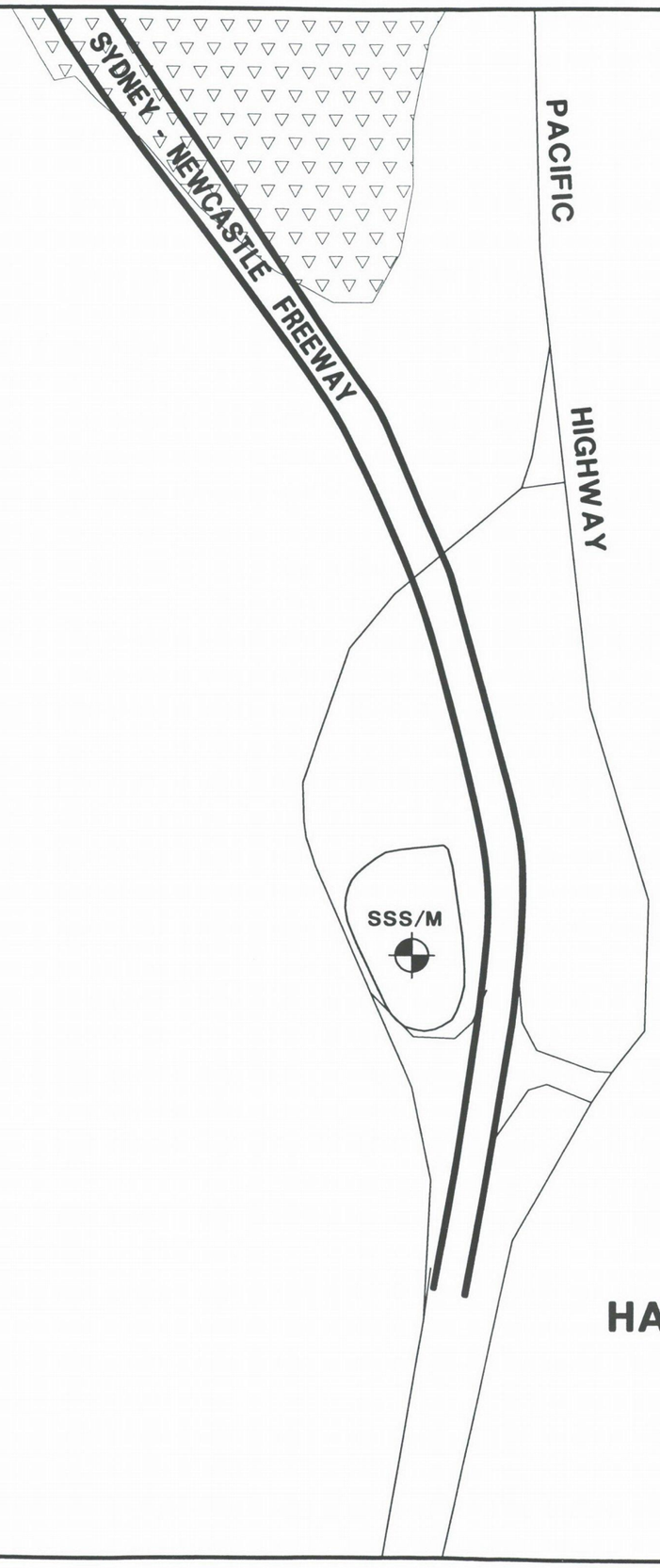
FIGURE 2

ADJOINS DRAWING A02

AQUATIC SURVEY SITES		
No.	EASTING	NORTHING
1	334590	6299060
2	334250	6297950
3	333510	6296950
4	333410	6296780
5	332670	6296200
6	332730	6296130
7	332020	6294980
8	332100	6294970
9	332000	6294780
10	332080	6294760
11	331740	6291450
12	331640	6291040
13	331730	6291000
14	331900	6290670
15	332420	6289290



NOTE:

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4. LOCATION OF NATIONAL HERITAGE TRUST SITES ARE INDICATIVE ONLY.
5. THESE DRAWINGS ARE BASED ON THE AMG CO-ORDINATES SYSTEM (AGD66) ZONE 56.
6. NO FIELD SURVEY OR MEASUREMENT HAS BEEN CARRIED OUT TO VERIFY THE LOCATION OF INFORMATION SHOWN ON THESE DRAWINGS.

N

SURVEY SITES

- AQUATIC SURVEY SITE (ASS)
- PRIMARY SURVEY SITE (PSS)
- SECONDARY SURVEY SITE (SSS)

VEGETATION

- HAWKESBURY DRY SHELTERED WOODLAND
- HAWKESBURY EXPOSED WOODLAND
- HAWKESBURY BANKSIA SCRUB

REV No.	REMARKS	DATE
A	ISSUED	11.9.01
	AMENDMENTS	

CLIENT:

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DRAWING TITLE

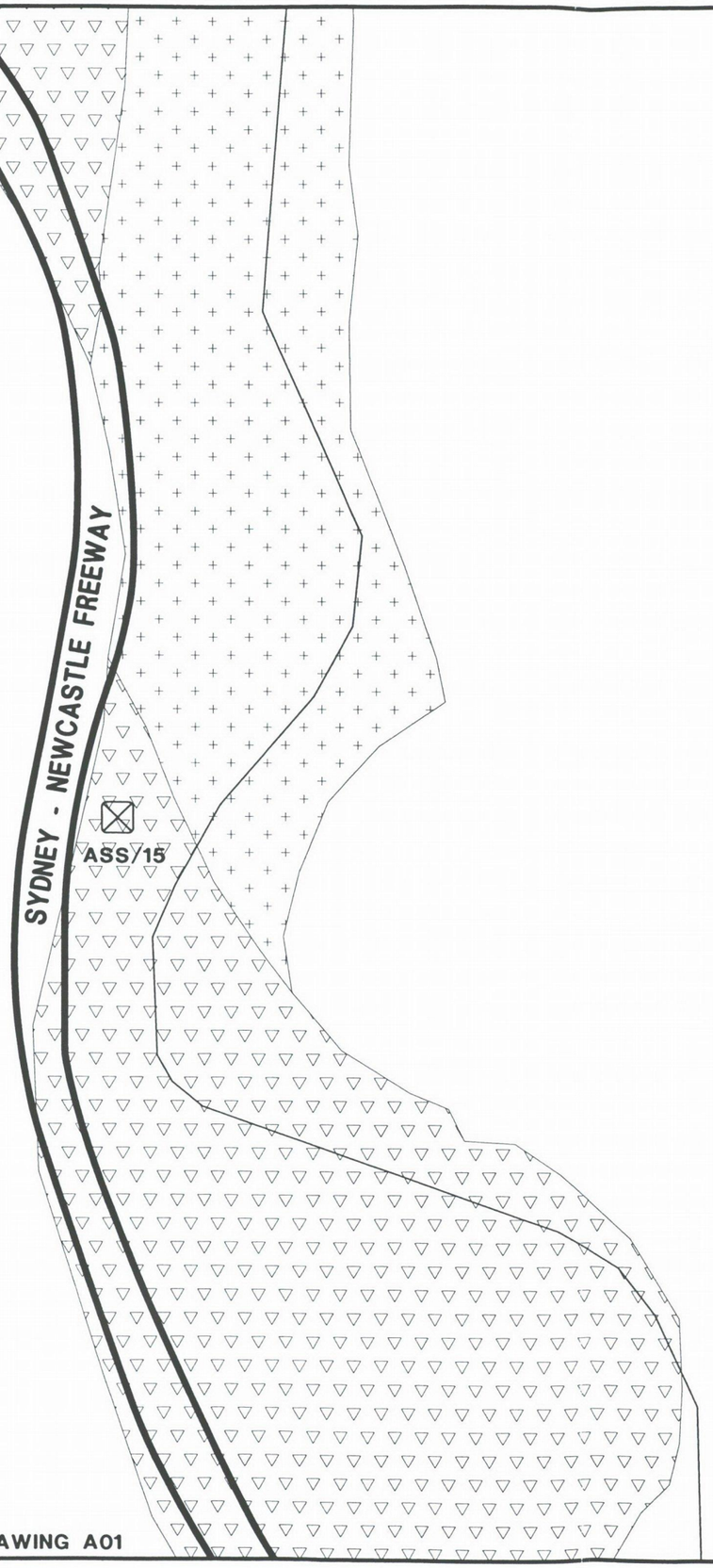
PLAN SHOWING VEGETATION AND THREATENED SPECIES FOR FREEWAY WIDENING, JOLLS BRIDGE TO CALGA.

DATE:	11/9/01	DATUM:	-
SURVEY:	-	F.BOOK:	-
DRAWN:	S.H.	APPROVED:	M.N.
CHECKED:	M.N.	CAD FILE:	18318A01A
SCALE:	1: 4000	No. in SET:	17

FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A01	A

ADJOINS DRAWING A03



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ADJOINS DRAWING A01

REV No.	REMARKS	DATE
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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER 18318

DRAWING No A02

REVISION A

ADJOINS DRAWING A04

ASS/14

JOLLS BRIDGE

SYDNEY - NEWCASTLE FREEWAY

MOONEY MOONEY

SPOTTED TAILED QUOLL ●

ADJOINS DRAWING A02

N

REV No.	REMARKS	DATE
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DRAWING TITLE

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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER 18318

DRAWING No A03

REVISION A

ADJOINS DRAWING A05

SYDNEY - NEWCASTLE FREEWAY

PACIFIC HIGHWAY

ASS/11

PSS/8

POPULATION OF TETRATHECA GLANDULOSA

GIANT BURROWING FROG TADPOLES IN STREAM.

ASS/12

ASS/13

PSS/9

ADJOINS DRAWING A03

N

NOTE:

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SCALE:	1:4000	No. in SET:	17

FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
18318	A04	A

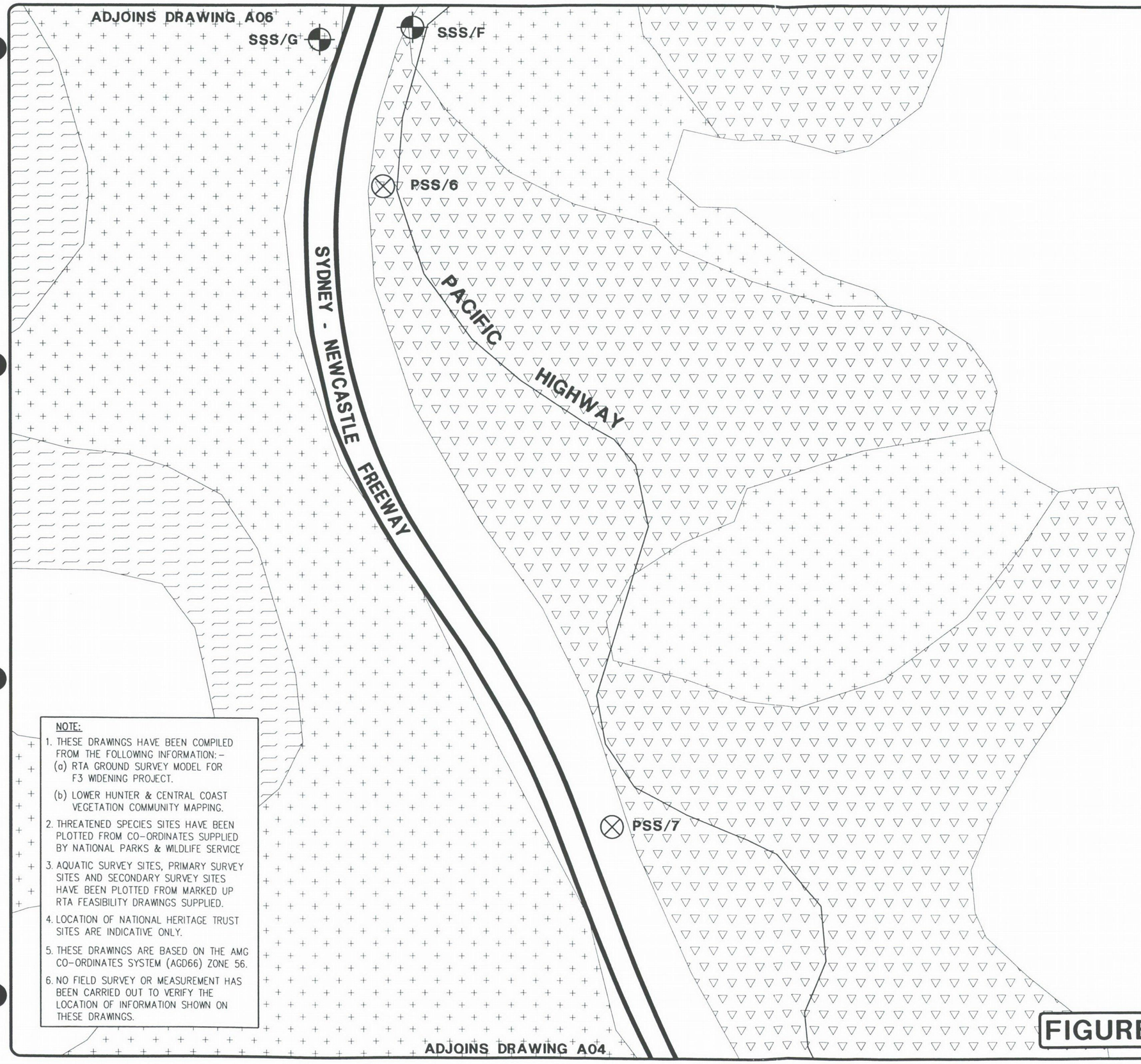

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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
18318	A05	A

ADJOINS DRAWING A07

SSS/L

SYDNEY - NEWCASTLE FREEWAY

SSS/I

SSS/H

PACIFIC HIGHWAY

ADJOINS DRAWING A05

NOTE:

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FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A06	A

ADJOINS DRAWING A08

SSS/O

ASS/8

ASS/7

RED CROWNED TOADLET &
SPOTTED TAILED QUOLL

ASS/9

ASS/10

PACIFIC HIGHWAY

SYDNEY - NEWCASTLE FREEWAY

SSS/D

POPULATION OF TETRATHECA GLANDULOSA

PSS/5

RED-CROWNED TOADLET
IN DENSE LEAF LITTER
IN SEEPAGE ZONES

SSS/E

SSS/J

ADJOINS DRAWING A06

NOTE:

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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
18318	A07	A

ADJOINS DRAWING A09

ASS/5

ASS/6

PSS/3

SYDNEY - NEWCASTLE FREEWAY

SSS/B

RED-CROWNED TOADLET
BESIDE STREAM IN
RANK VEGETATION

MASKED OWL RECORDED
IN CLEARED PADDOCK AREA

POPULATION OF
TETRATHECA GLANDULOSA

SSS/K

MT. WHITE

PACIFIC HIGHWAY

COMMON BENT-WING BAT

PSS/4

SSS/C

ADJOINS DRAWING A07

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REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
18318	A08	A

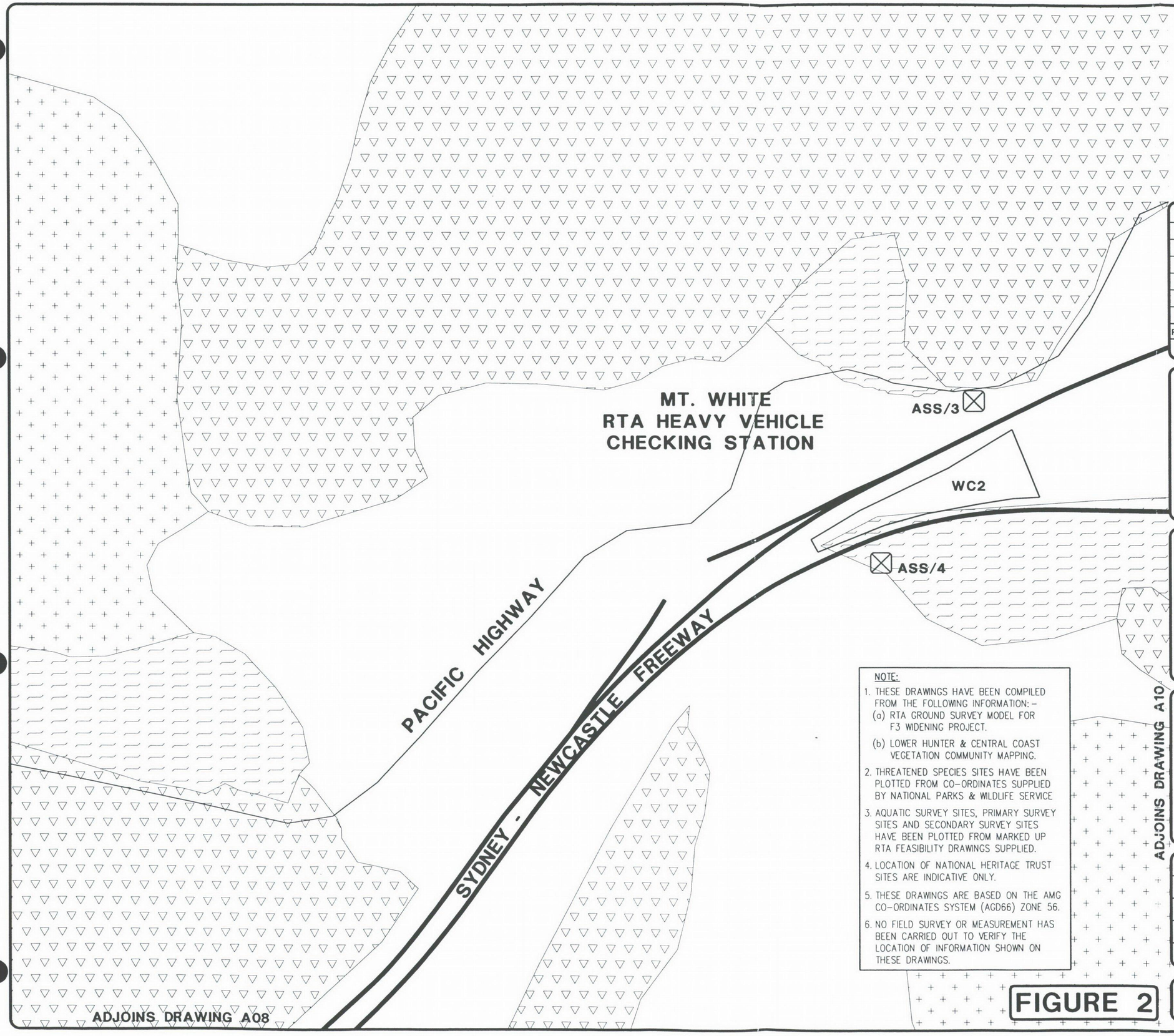

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FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A09	A

ADJOINS DRAWING A11

COMMON BENT-WING BAT

COMMON BENT-WING BAT

PSS/2
RED-CROWNED TOADLET
AMONGST DENSE CORALFERN

SSS/N/1

SSS/N/2

ADJOINS DRAWING A09

NOTE:

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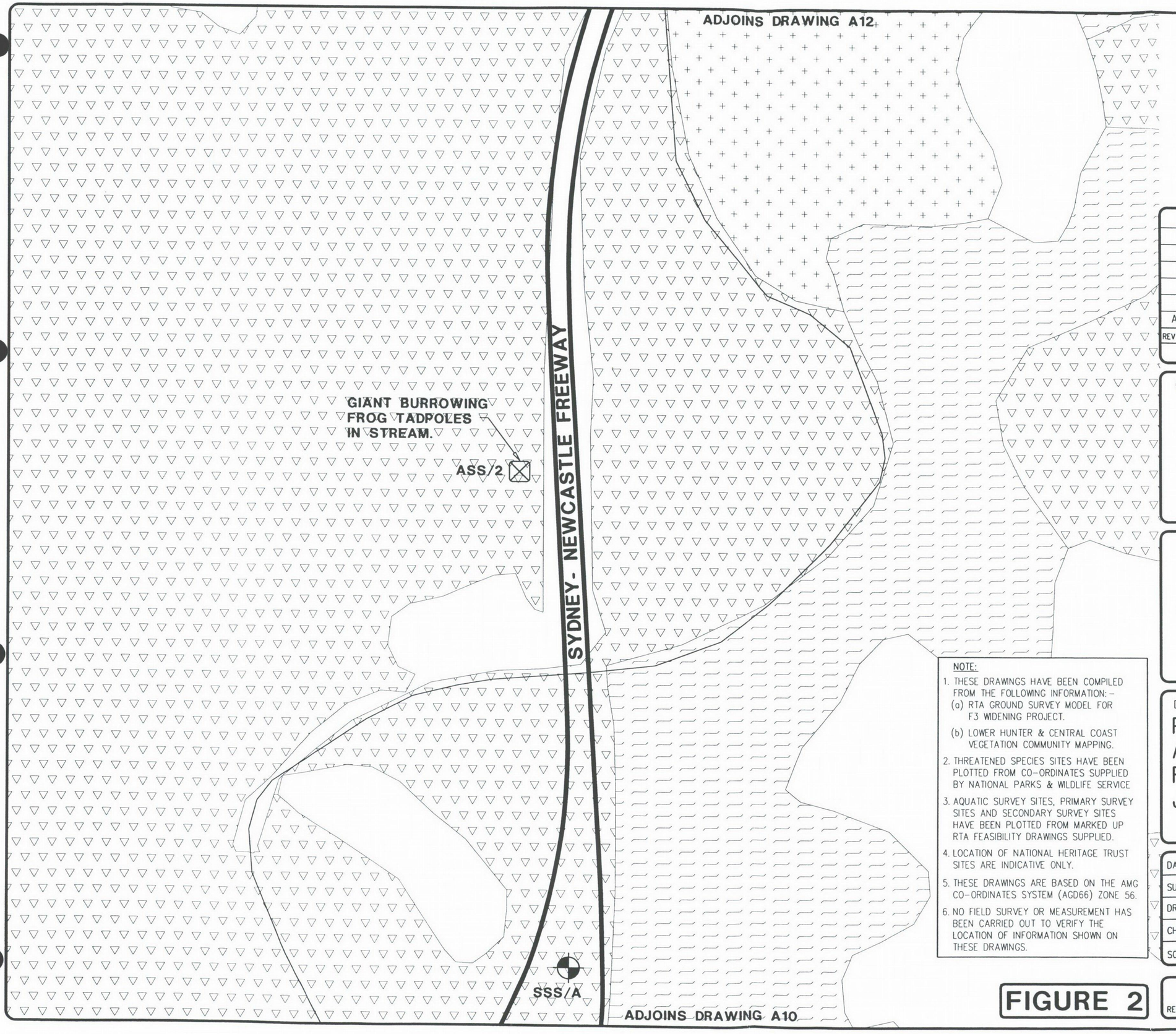
REGISTERED SURVEYOR DATE

PROJECT NUMBER 18318

DRAWING No A10

REVISION A

FIGURE 2



N

REV No.	REMARKS	DATE
A	ISSUED	11.9.01
	AMENDMENTS	

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DRAWING TITLE

PLAN SHOWING VEGETATION AND THREATENED SPECIES FOR FREEWAY WIDENING, JOLLS BRIDGE TO CALGA.

DATE:	11/9/01	DATUM:	–
SURVEY:	–	F.BOOK:	–
DRAWN:	S.H.	APPROVED:	M.N.
CHECKED:	M.N.	CAD FILE:	18318A01A
SCALE:	1:4000	No. in SET:	17

FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A11	A

ADJOINS DRAWING A13

LARGE POPULATION OF
DARWINIA GLAUCOPHYLLA

ASS/1

GIANT BURROWING FROG &
GLOSSY BLACK COCKATOO

SYDNEY - NEWCASTLE FREEWAY

RED-CROWNED TOADLET
BESIDE STREAM IN
RANK VEGETATION

PSS/1

ADJOINS DRAWING A11

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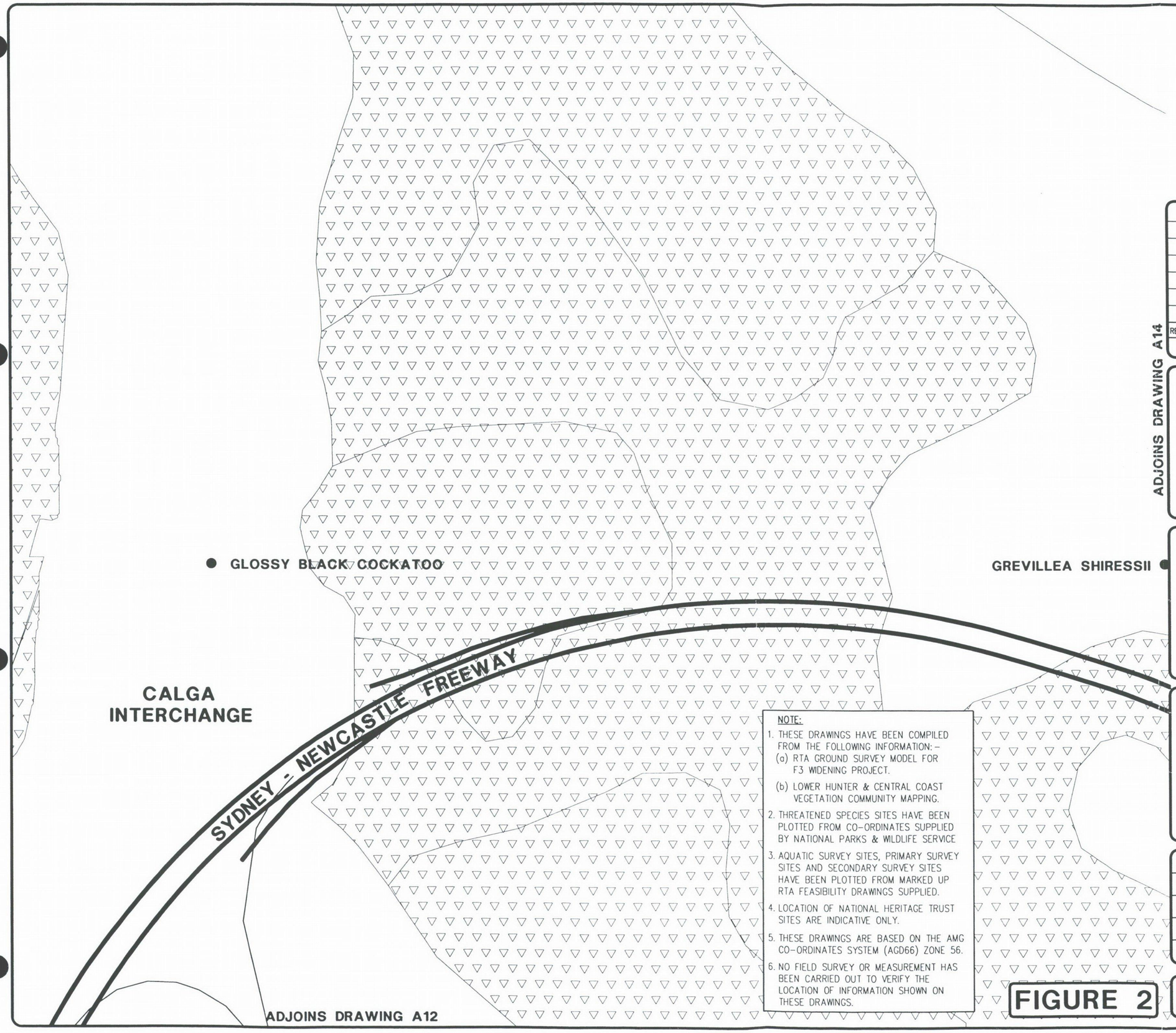
FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A12	A



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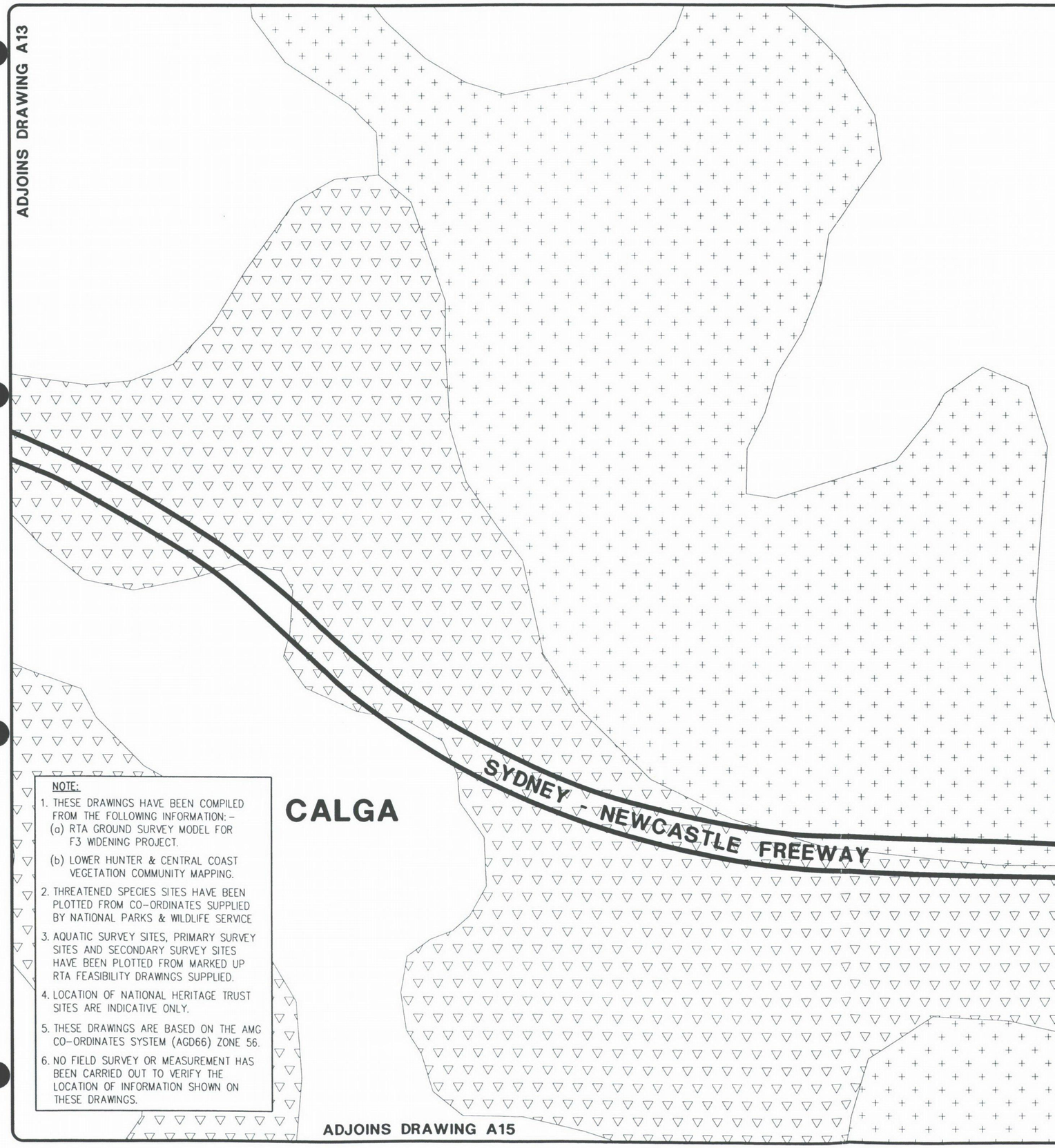
REGISTERED SURVEYOR	DATE	PROJECT NUMBER	DRAWING No	REVISION
		18318	A13	A

ADJOINS DRAWING A13



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ADJOINS DRAWING A15

ADJOINS DRAWING A16

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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER	DRAWING No	REVISION
18318	A14	A

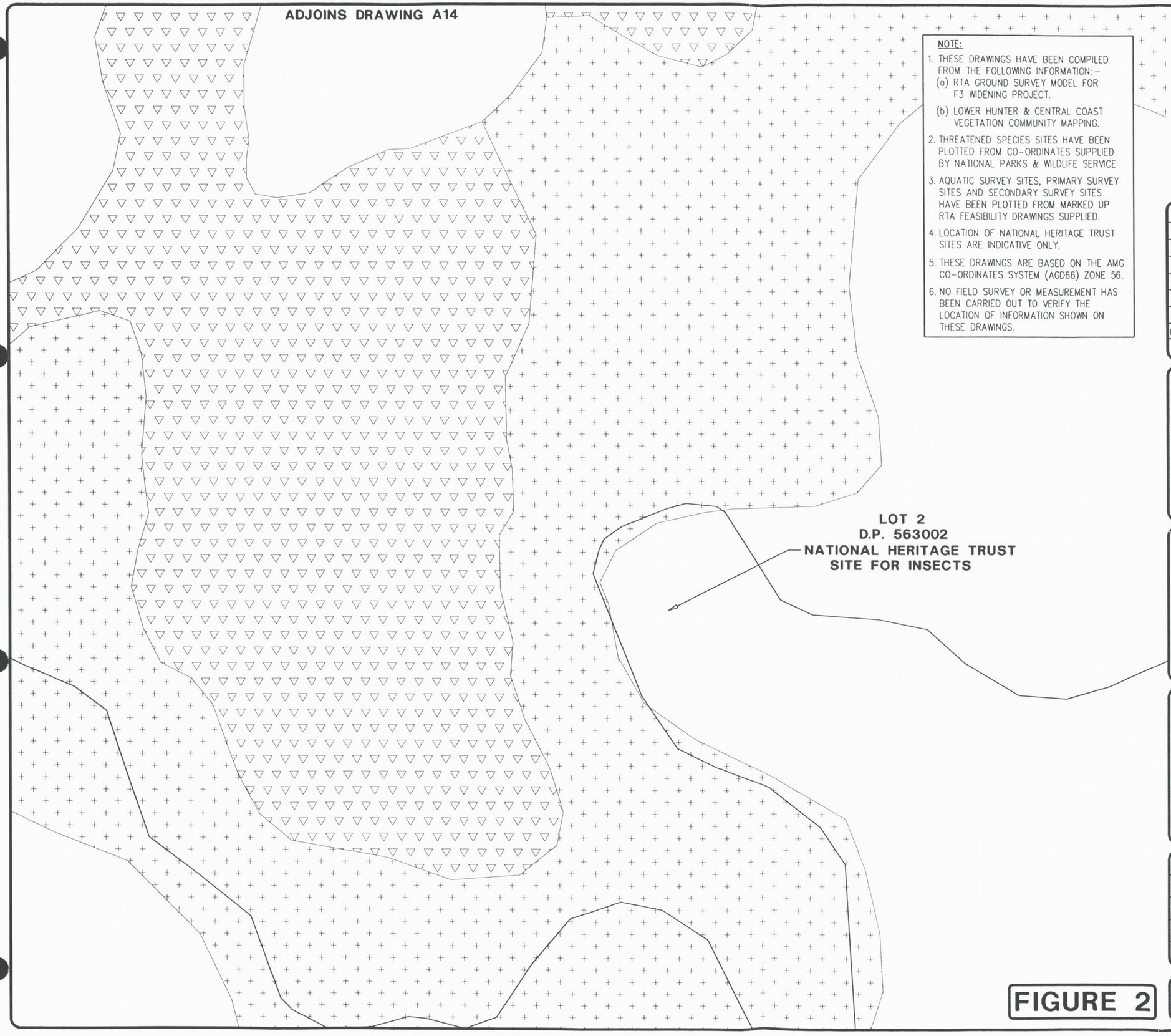

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FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A15	A

ADJOINS DRAWING A14

ADJOINS DRAWING A17

MOONEY MOONEY
CREEK BRIDGE

SYDNEY - NEWCASTLE FREEWAY

N

REV No.	REMARKS	DATE
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FIGURE 2

REGISTERED SURVEYOR DATE	PROJECT NUMBER	DRAWING No	REVISION
	18318	A16	A

LOT 175
D.P. 257027
NATIONAL HERITAGE
TRUST SITE FOR
ABORIGINAL RELICS

SOMERSBY

PACIFIC HIGHWAY

SYDNEY - NEWCASTLE FREEWAY

ADJOINS DRAWING A16

N

REV No.	REMARKS	DATE
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FIGURE 2

REGISTERED SURVEYOR DATE

PROJECT NUMBER 18318

DRAWING No A17

REVISION A

Table 2 – Water conditions for sites censused for aquatic organisms.

Site	Details	Remarks
ASS 1	Kellys Creek north	Clear calm water reddish – very low flow
ASS 2	Kellys Creek south	Water clear – very low flows
ASS 3	Green Point Gully – north flowing	Very low flows
ASS 4	Green Point Gully – south flowing	Low flows
ASS 5	Calverts Creek – north flowing	Low flows
ASS 6	Calverts Creek – south flowing	Low flows
ASS 7	Marlows Gully north – north flowing	No flow
ASS 8	Marlows Gully north – south flowing	Very low flows
ASS 9	Marlows Gully south – north flowing	Very low flows
ASS 10	Marlows Gully south – south flowing	No flows
ASS 11	Unnamed Creek – south flowing	No water
ASS 12	Unnamed Creek – south flowing	Very low flows
ASS 13	Unnamed Creek – south flowing	Very low flows
ASS 14	Unnamed Creek – south flowing	No water
ASS 15	Unnamed Creek – south flowing	No water

4.4 Mapping

Trehy, Ingold & Neate, using the graphics program 'Autocad', prepared plans for the Proposal. The RTA supplied base mapping and survey grid co-ordinates for the study area and additional layers were created for the presence of threatened species and survey census sites. Data on threatened species were obtained from the wildlife atlas records supplied by the NSW National Parks and Wildlife Service. Environment Australia does not hold specific locations for threatened Species and State Fisheries holds only generalised locations for threatened aquatic species. Environment Australia also holds records of the National Estate with cadastral descriptions. Thus, those sites listed on the register of the national estate were plotted (Figure 2).

4.5 Targeted Survey for the Broad-headed Snake

Computer modelling from the regional Broad-headed Snake Survey (Wellington, Payne & Wells, in prog.) was also used to predict locations of the Broad-headed Snake. A computer-generated map was produced through the computer of the NSW National Parks and Wildlife Service and areas of high quality habitat were targeted for the presence of the Broad-headed Snake (Figure 1). One afternoon (27 August 2001) was spent searching large rocky outcrops at two locations near Mount White. The procedure involved inspecting rock crevices and lifting rock slabs on western and northwestern aspects over the rocky outcrops, identified on the maps.

4.6 Median Areas

During the census for the sediment basin sites and the cutting stabilisation survey (Payne, 2001)

5.0 EXISTING CHARACTERISTICS

The study area, adjoining the F3 Freeway, is comprised entirely of Hawkesbury Sandstone Geology. Hawkesbury Sandstone consists of massive coarse-grained blocks of sandstone, which erode or fall away along joint planes. These features lead to stepped cliffed benches and steep escarpments. Often the massive Hawkesbury Sandstone blocks are separated by shale lenses, which can be seen in "The Gorge". Where these shale lenses outcrop at the surface, impeded drainage occurs and in some cases "hanging swamps" form. These "hanging swamps" are often important habitats because they support several threatened species.

Hawkesbury Sandstone gives rise to poor soils and Eucalypt woodlands on the ridgetops dominated by Scribbly Gum. Quite often these woodlands are interspersed by dense thickets of *Banksia ericifolia* and *Hakea teretifolia* in drier impeded drainage sites. The escarpment edges of the plateau support taller woodlands, often dominated by the Sydney Peppermint, *Eucalyptus piperita* and the Sydney Red Gum, *Angophora costata* (Benson & Howell, 1990).

Murphy (1993) has prepared soil Landscape Mapping and, the Lambert Soil Landscape Unit in the north and the Hawkesbury Landscape Unit in the south dominate the study area. There is a pocket of the Oxford Falls Landscape Unit near Mt. White and a pocket of the Somersby Landscape Unit near "The Gorge". All of these soil landscape units give rise to very poor soils.

5.1 Description of Primary Survey Sites

For a description of the natural characteristics in the study area, data was gathered at each major survey site (PSS 1-9). Each site has different attributes and therefore a different potential for threatened species to occur. A description of each is given hereunder.

Site PSS/1 (SB13B)

The site chosen at this location was on the southern tributary of Kellys Creek which is found at Gunderman 1:25 000 map sheet, grid co-ordinates $_{3}$ 34 220E, $_{62}$ 98 050N. Dense vegetation occurs below the existing freeway embankment and a large clear pool has formed on the tributary. This pool was considered optimal breeding habitat for the Giant Burrowing Frog and so this site was chosen to target this species. Access to this site was gained via the natural gas pipeline trail.

Site PSS/2 (SB9B)

This site is known as 'The Gorge' and is a previously disturbed area, from previous freeway construction. Vegetation has since colonised the area and construction activity has left the area particularly moist from drains and seepage. There is also a large drain on top of the northern cutting. There is a possibility that this area is potential habitat for the Red-crowned Toadlet and the Giant Burrowing Frog. This site can be found on the Gunderman 1:25 000 topographic mapsheet at grid co-ordinates $_{3}$ 34 016E, $_{62}$ 96 932N. Access to this site is gained from the existing freeway through a locked gate.

Site PSS/3 (SB7B)

Much of the area, identified for the sediment basin, lies close to cleared land and so the site chosen for the census site was amongst dense vegetation along Calverts Creek. It is believed that this land is partly Brisbane Water National Park and the actual site can be located at Gunderman 1:25 000 map sheet grid co-ordinates $_{3}$ 32 450E, $_{62}$ 96 100N. Calverts Creek, whilst it is relatively fast flowing, is murky and may be too polluted to support any breeding habitat of the Giant Burrowing Frog. The vegetation is also weed infested with large concentrations of Small-leaved Privet, *Ligustrum sinense* and Crofton Weed, *Ageratina adenophora.* Native vegetation, without weeds, occurs away from the creek. No particular threatened species were targeted at this location.

Access to this site was gained through the property of Mr. G. Loxley, beside the Mount White village store.

Site PSS/4 (SB6B)

Site SB6B is located in sandstone country with stepped cliffed benches. Part of the site was once an old quarry. It can be located on the Gunderman 1:25 000 map sheet grid co-ordinates $_{3}$ 31 950E, $_{62}$ 95 400N.

Almost the whole site supports native vegetation, but significant seepage zones are evident flowing over the rock outcrops. Soaks are therefore prominent and there is a clear pool on the drainage line. Habitat is present for the Giant Burrowing Frog, the Red-crowned Toadlet and the herbaceous undershrub *Gonocarpus salsolioides.* These three species were targeted during the census.

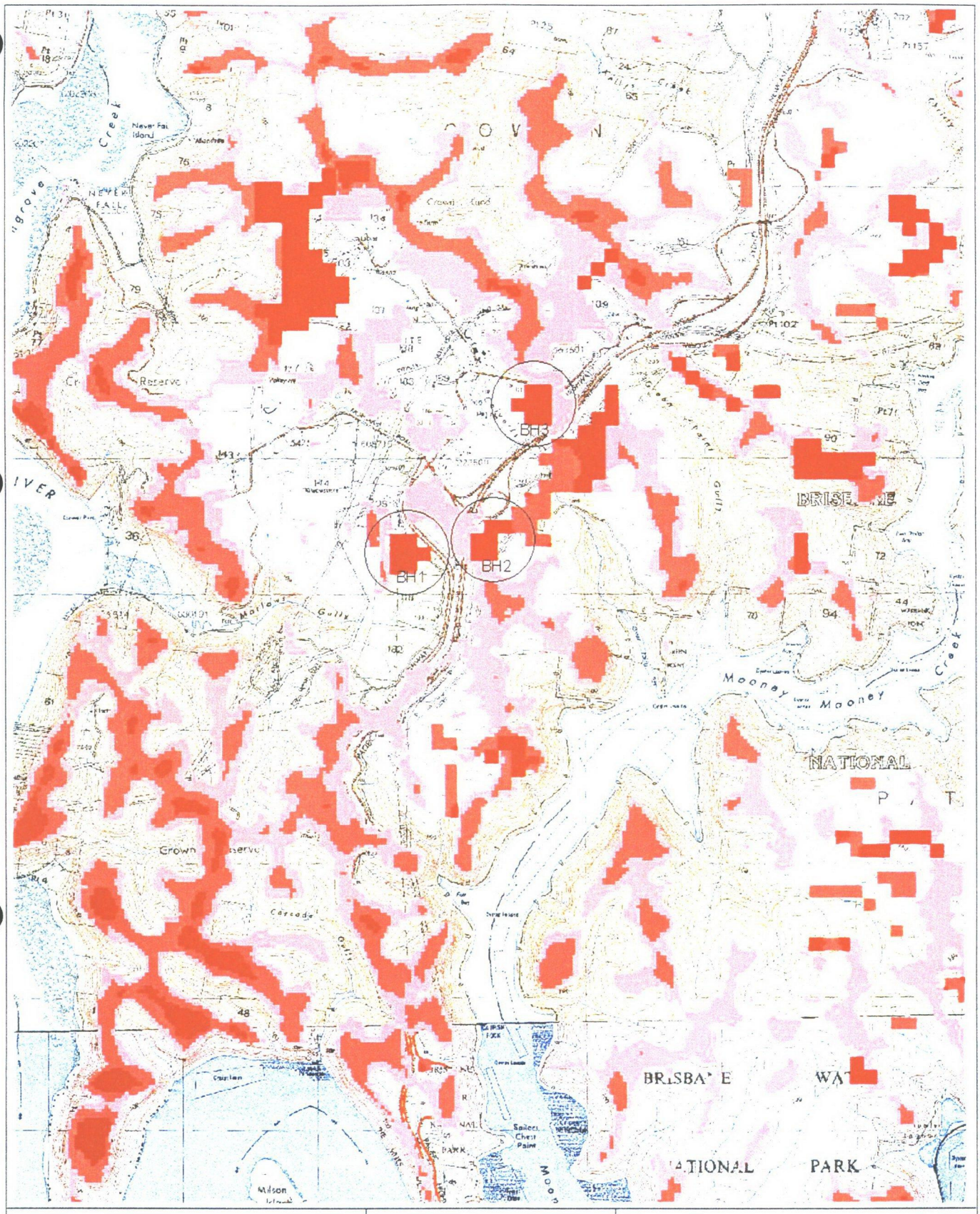
Access to this site was gained from the Pacific Highway.

Site PSS/5 (SB5B)

This survey site occurs on a drainage line and is very sheltered. Seepage zones are also predominant in the vicinity on the sideslopes. The site has potential habitat for both the Red-crowned Toadlet and Giant Burrowing Frog. On the Gunderman 1: 25 000 topographic map sheet it can be located at grid co-ordinates: $_{3}$ 31 900E, $_{62}$ 94 370N. Access to this site is through Brisbane Water National Park.

Site PSS/6 (SB2B)

Site PSS/6, known as Lily Hill, is located adjacent to the freeway and would be considered to be a rather dry habitat. As shown by the dense regeneration of Native Hop Bush *Dodonaea triquetra*, part of the site has been recently burnt and there is evidence of termite mounds. This suggests potential habitat for the Heath Monitor, *Varanus rosenbergi*. The remainder of the site on Lily Hill is densely vegetated with native species. It can be located a grid co-ordinates $_{3}$ 31 257E, $_{62}$ 93 015N.



Broadheaded Snake GAM Model Predicted Habitat

Predicted Habitat Quality

- High
- Medium
- Low

Figure 1.

F3 Freeway Widening Proposal

Copyright NSW National Parks and Wildlife Service, August 2001
This map is not guaranteed to be free from error or omission.
The NSW National Parks and Wildlife Service and its employees disclaim liability for any act done or omission made on the information in the map and any consequences of such acts or omissions

N

270 0 270 540 Meters

Map produced by
Central Directorate TSU
CPPD

28 August 2001

Site PSS/7

Site PSS/7 is located on a ridge and is also densely vegetated with native species. Termite Mounds are also present, which are considered habitat for the Heath Monitor. On the Cowan 1:25 000 topographic mapsheet this site can be found at co-ordinates $_3$ 31 558E, $_{62}$ 92 156N.

Site PSS/8

This site is also located on a ridge but there is an existing vehicular access track present. Whilst the site is naturally vegetated and some rock outcrops are present there appears to be poor quality habitat for the Broad-headed Snake. Habitat for the Heath Monitor is present but the cave shelters are poor quality habitat for the Common Bent-wing Bat *Miniopterus shreibersii*. . On the Cowan 1:25 000 topographic mapsheet this site can be found at co-ordinates $_3$ 31 757E, $_{62}$ 91 520N.

Site PSS/9

Site PSS/9 is situated between the old Pacific Highway and the freeway, on a major drainage line. The two roads have created a small catchment between two rock wall batters. Rock pools amongst sandstone outcrops are present and the slopes are densely vegetated. Giant Burrowing Frog breeding ponds and Red-crowned Toadlet habitat may be present. Access is from the Pacific Highway and the site can be found on the Cowan 1: 25 000 mapsheet at grid co-ordinates: $_3$ 31 720E, $_{62}$ 92 040N.

6.0 RESULTS

6.1 Weather Conditions

The census was conducted between the 1 August thorough to the 31 August 2001. Weather conditions encountered during the survey were warm sunny days with cool nights at the beginning of the survey but in the latter part of the second week strong winds were encountered, sometimes up to 100 kph. Cold nights were then encountered and these conditions led to limited results, particularly for the bat and bird censuses. Rain occurred during the third and fourth week also with strong wind gusts. Days were generally sunny. Table 3 summarises the weather conditions for the nocturnal fauna surveys.

Table 3 – Weather conditions encountered during the nocturnal fauna surveys (Temperatures in degrees celcius)

Site	Weather Conditions	Temp. 1730 hrs.	Temp. 1830 hrs.	Moon
PSS 1	1.8.01; sheltered, cold & foggy	7.4	7.1	Third quarter rising
PSS 2	2.9.01; westerly wind	16.4	15.6	Full moon
PSS 3	2.8.01; sheltered & mild	10.5	10.1	Third quarter rising
PSS 4	3.8.01; cool	12.6	11.6	Full moon
PSS 5	20.8.01; sheltered & mild	15.8	13.7	New moon
PSS 6	22.8.01; windy & cool	12.8	11.5	First quarter
PSS 7	1.9.01; Intermittent rain & thunder	14.7	13.9	Full moon
PSS 8	23.8.01; cold southerly wind	11.5	9.7	First quarter
PSS 9	6.9.01; hot strong northerly wind	20.9	18.9	Full moon waning

5.2 Fauna at Primary Survey Sites

Birds

Forty-eight bird species were recorded. Most of the species are typical of Hawkesbury Sandstone habitats and would be considered to be common in the bioregion. Almost all of the species were common forest birds. However, the Yellow-tailed Black Cockatoo *Calyptorhynchus funereus*, an uncommon species was observed a number of times and this is because feeding habitat is abundant in the study area. The species is known to feed on seeds of *Hakea sericea* and other *Hakea sp.* and *Banksia integrifolia* and to withdraw grubs from the trunks of *Allocasuarina littoralis* (Payne, 2000). Its rarer cogener *C. lathami* was not recorded during the survey, but the habitats throughout the study area lack suitable feeding trees for this species. The White-bellied Sea-Eagle *Haliaeetus leucogater* was also recorded, which was perched high on top of the cutting, in a tree, beside the Freeway at the Calga Interchange and hovering above sites PSS/8 and PSS/9. The White-bellied Sea-Eagle is listed as a migratory species on the commonwealth *Environment Protection and Biodiversity Act, 1999.*

The bird species list is presented in Appendix 2 and one species that is listed on schedule 2 of the NSW *Threatened Species Conservation Act, 1995* was recorded. This was the Masked Owl *Tyto novaehollandiae,* which was recorded near Calverts Creek on the 2 August 2001 (site no. PSS/3). The Masked Owl responded to the playback recordings and was recorded in the open paddock area behind the Mount White Village Store.

It is likely that this area is feeding habitat for the Masked Owl for there are no very large trees with hollows considered suitable as roosting and denning sites. Most of the trees are small and lack hollows, except for occasional spouts. It is more likely the owl would roost in one of the gullies draining into the Hawkesbury River, where the trees have been noted to be much larger.

Mammals

The spotlight surveys revealed the presence of the Red-necked Wallaby *Macropus rufogriseus,* the Swamp Wallaby *Wallabia bicolor* and the Northern Brown Bandicoot *Isoodon macrourus.* The Red-necked Wallaby is uncommon in the study area whilst the Swamp Wallaby was noted to be relatively abundant. Evidence of diggings suggests the Northern Brown Bandicoot is similarly abundant and this species was confirmed at site SSS/B.

The Common Wombat *Vombatus ursinus* was not observed but evidence of the species presence was found at one site (PSS/1). At site PSS/1, a burrow beneath the bridge rock batter, with high activity, was observed. It is obvious that the Common Wombat is using this area for access beneath the Freeway.

There were no sightings of the Common Brushtail Possom *Trichosurus vulpecula*, the Common Ringtail Possum *Pseudocheirus peregrinus* or the Sugar Glider *Petaurus breviceps* although notch marks were observed on the trunk of several trees of Red Bloodwood *Corymbia gummifera.* Whilst these species are expected to be present, their abundance may be low due the general lack of trees with hollows and lack of large stands of Melaleucas. No sightings were recorded of the Spotted-tailed Quoll *Dasyurus maculatus.*

The presence of Grey Gum, *Eucalyptus punctata* is only apparent where shales lenses outcrop amongst the Hawkesbury Sandstone. As a result, this tree species is uncommon in this section of Brisbane Water National and Popran National Parks. No Koala scats were recorded from the base of these trees or Scribbly Gum *Eucalyptus haemastoma* and no scratch marks were evident on the trunks, which would indicate the likely presence of the Koala.

The Koala is known from Brisbane Water National Park but mainly in the vicinity of the Pearl Beach-Patonga-Little Wobby localities, where Grey Gum is more abundant and access to Swamp Mahogany *Eucalyptus robusta* on the alluvial sandplains is possible. Both species are probably primary browse species for the Koala in this type of habitat (Williams, 1997; Smith & Smith, 2000).

Small Mammals

Table 4 – Results of the small mammal survey

Site	Trap Nights	Common Bush Rat	Swamp Rat	Brown Antechinus	New Holland Mouse	Habitat
PSS/1	42	11	0	4	0	Drainage line
PSS/2	60	0	2	1	0	Seepage zones
PSS/3	30	4	0	2	1	Drainage line
PSS/4	48	10	3	8	0	Seepage zones
PSS/5	57	7	0	8	0	Drainage line
PSS/6	57	15	1	11	0	Dry ridge
PSS/7	48	18	3	0	0	Dry ridge
PSS/8	54	30	0	3	0	Dry ridge
PSS/9	54	17	0	2	0	Drainage line
TOTAL	**450**	**112**	**9**	**39**	**1**	

The results of the small mammal survey were highly successful with an overall capture rate of 35.8%. Small mammal activity is obviously high in Hawkesbury Sandstone habitats, which probably reflects the abundance and diversity of the vegetation and insects associated with the vegetation. Part of their habitat includes the rock batter of the Freeway, which has been colonised by these species since construction. Both seeds and insects are used as a food source by these small mammals, with the Brown Antechinus *Antechinus stuartii* feeding on insects. The Common Bush Rat *Rattus fuscipes* and New Holland Mouse *Pseudomys novaehollandiae* feed on fruits and seeds of various plant families particularly Fabaceous plants. Seeds and roots from the plant family Cyperaceae form part of the diet of the Swamp *Rat Rattus lutreolus* (See Plant Species List Appendix 3).

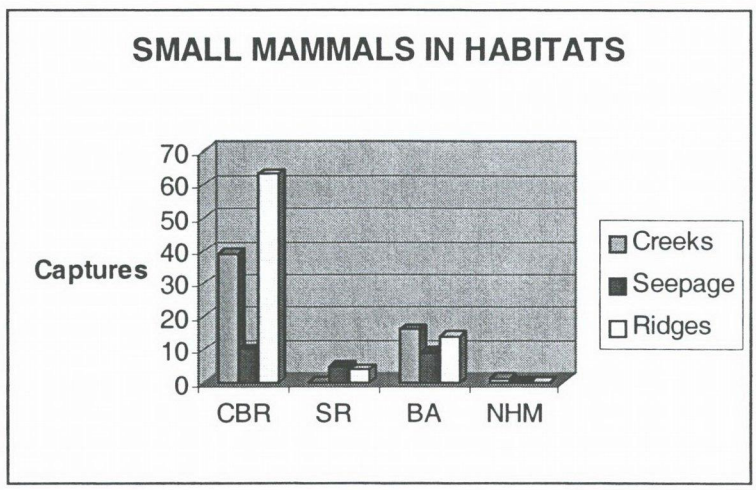


Figure 3 – The Common Bush Rat is the most abundant small mammal in the study area with a preference for both creeks and ridges. Key: CBR=Common Bush Rat; SR=Swamp Rat; BA=Brown Antechinus; NHM=New Holland Mouse.

Most of the small mammal species recorded are considered to be common at a local and regional scale, with the exception of the New Holland Mouse. This species is considered to be of regional significance although it is well represented in the Hawkesbury Sandstone National Parks.

Reptiles and Amphibians

The timing of the survey, being late winter, was too early to detect many species of reptiles and amphibians. Nevertheless, the Common Eastern Froglet *Crinia signifera* was detected in most drainage lines and seepage zones. Although tadpoles of the Giant Burrowing Frog were not detected by inspection during the flora and fauna surveys, they were collected using a dipnet at three sites, during the aquatic survey (Appendix 1). Those sites were ASS/4, ASS/12 and ASS/13 and tadpoles were found in pools.

The Red-crowned Toadlet was detected a four sites during the fauna survey. It was found and confirmed beside Kellys Creek (site PSS/1) and heard calling from beside Calverts Creek (site PSS/3), in seepage zones at site PSS/5 and at 'The Gorge' (PSS/2). At Kellys Creek the species was found amongst rank vegetation beside the creek, whilst at Calverts Creek and 'The Gorge' it could be heard calling from amongst very dense moist vegetation. At site PSS/5 the Red-crowned Toadlets were heard in seepage zones associated with a dense cover of leaf litter. *Uperolaea fusca* was also recorded at 'The "Gorge'.

Both the Giant Burrowing Frog and the Red-crowned Toadlet are listed on the schedule of the *Threatened Species Conservation Act, 1995*, whilst the former is also listed on *the Environment Protection and Biodiversity Conservation Act, 1999.*

Only three species of reptiles were recorded which were the Common Skink, *Lampropholis delicata,* the Eastern Water Skink, *Sphenomorphous quoyii* and Lesueur's Velvet Gecko *Oedura lesueurii.* All of these species are common at a local and regional scale. However, it should be noted that Lesueur's Velvet Gecko was only found in the predicted areas of high quality Broad-headed Snake habitat and it is believed that this species is a food source for the Broad-headed Snake. Both species are found in association with each other in the rocky outcrop habitats. No Broad-headed Snakes were found.

Small Bats

The results of the small bat survey are given in Table 5. With the exception of the Common Bent-wing Bat Miniopterus schreibersii, all species recorded are common at a local and regional scale. The Common Bent-wing Bat is listed on schedule 2 of the Threatened Species Act, 1995 but is well represented and conserved in the Hawkesbury Sandstone National Parks.

The main conservation concern with these species is the protection of its maternal sites, which are usually in caves. No such sites were found during the survey. At both locations, where this species was recorded (The Gorge and at Mount White), the time was about 1840 hrs., indicating the bats had probably flown a considerable distance. It is more than likely that their roost sites are found in one of the escarpment areas and not within the study area. However, it is possible that at The Gorge, the bats may roost beneath the Freeway bridge as such artificial structures are known to be utilised by this species.

Table 5 – Small Bat species recorded from the Primary Survey Sites

Location	Common Name	Latin Name	Status
PSS/1	No calls		
PSS/2	Common Bent-wing Bat	*Miniopterus schreibersii*	Definite
PSS/3	No calls		
PSS/4	Common Bent-wing Bat	*Miniopterus schreibersii*	Probable
PSS/5	Eastern Forest Bat Chocolate Wattled Bat	*Vespadalus vulturnis* *Chalinolobus morio*	Probable Possible
PSS/6	No calls		
PSS/7	Gould's Wattled Bat	*Chalinolobus gouldii*	Definite
PSS/8	No calls		
PSS/9	Gould's Wattled Bat	*Chalinolobus gouldii*	Definite

6.3 Fauna Attributes for Secondary Survey Sites

Fauna attributes for the Secondary Survey Sites (SSS/A-O) was based upon the findings and attributes present at the Primary Survey Sites. Table 6 sets out the details of the predicted attributes for the Secondary Survey Sites.

Table 6 – Predicted Fauna Attributes for Secondary Survey Sites

Site	Threatened Species Attributes
SSS/A	No particular attributes
SSS/B	Potential Koala habitat – Grey Gum present
SSS/C	No particular attributes
SSS/D	Giant Burrowing Frog and Red-crowned Toadlet – seepage zones
SSS/E	Giant Burrowing Frog and Red-crowned Toadlet – seepage zones
SSS/F	No particular attributes
SSS/G	No particular attributes
SSS/H	No particular attributes
SSS/I	Potential Koala habitat – Grey Gum present
SSS/J	Giant Burrowing Frog and Red-crowned Toadlet – seepage zones
SSS/K	No particular attributes
SSS/L	Potential Koala habitat – Grey Gum present
SSS/M	No particular attributes
SSS/N//1	Red-crowned Toadlet – seepage zones
SSS/N/2	Red-crowned Toadlet – seepage zones
SSS/O	Red-crowned Toadlet – Sandstone drained filled with leaf litter

Those locations investigated show that where threatened species habitat is present it is mainly for the Giant Burrowing Frog and the Red-crowned Toadlet. This is due to the presence of seepage zones with 'hanging swamp' vegetation or constructed sandstone drains, which have become filled with leaf litter. There is potential Koala habitat present at most sites at a broader scale because of the presence of Scribbly Gum *Eucalyptus haemastoma*, which is a dominant tree throughout the study area. However, Williams (1997) found that Koalas were associated with both Grey Gum *Eucalyptus punctata* and the Sydney Peppermint *Eucalyptus piperita*. Further examination of both of these tree species and the associated leaf litter failed to reveal any evidence of Koalas.

6.4 Flora

Over 230 plant species were recorded during the survey, which is shown in Appendix 4. No species was recorded that is listed on schedule 2 of the Threatened Species Conservation Act 1995 but there were some species recorded of 'regional significance' (Table 7). The number of plant species recorded is far less than what is conserved in Brisbane Water National Park and Popran National Park because the survey involved only quadrats throughout the area of impact, which is only small and within restricted types of habitats. It is known that over 600 plant species are present in Brisbane Water National Park (Benson & Fallding, 1981).

Table 7 – Plant species of special conservation significance to the region found during the survey

Species	Locations	Relevant Acts & Lists
Darwinia glaucophylla	PSS/1	Briggs & Leigh (1995), Benson (1986)
Doryanthes excelsa	SSS/B,SSS/C,SSS/H, SSS/I,PSS/3	Gosford City Council
Grevillea diffusa ssp. filipendula	SSS/A,SSS/C,SSS/D, SSS/E,SSS/F,SSS/G,SSS/H, SSS/I,SSS/J,SSS/L,SSS/O, PSS/1,PSS/2,PSS/3,PSS/4, PSS/5	Benson (1986).
Lomandra brevis	SSS/C,SSS/J	Briggs & Leigh (1995)
Leucopogon amplexicaulis	PSS/9	Benson (1986)
Persoonia isophylla	SSS/A,SSS/F,SSS/J,PSS/1,PSS/4	Clarke & Benson (1987)

The six plant species, considered to be of regional significance are shown in Table 7. *Darwinia glaucophylla*, which is particularly restricted in distribution, although well represented in Brisbane Water National Park, was found at one location. At this location, it was associated with a seepage zone over rocks. The Gymea Lily *Doryanthes excelsa* was considered to be relatively common.

Grevillea diffusa ssp. filipendula, is a more recently described species as a result of the revision of the *Grevillea capitellata* complex and was noted to be also very common. It is suggested that it is a pioneer species, which likes to colonise disturbed habitats, although the stronghold for this species is the Mount White-Calga area. The location of *Lomandra brevis*, which should only be considered as a tentative location due to the lack of fertile parts, was recorded twice but it is known from just south of the Hawkesbury River. *Leucopogon amplexicaulis* was found in the drainage line at site PSS/9 and is also considered to be very restricted species because of its preference for specific habitats.

Persoonia isophylla was found to be relatively common at this location and it is known to be restricted to the Hornsby- Hunter Plateau. The Black-eyed Susan *Tetratheca glandulosa,* was not recorded during this survey but was recorded for the cutting stabilisation works (Payne, 2001). This is the only plant species found during the overall survey that is listed as vulnerable on the *Threatened Species Conservation Act, 1995* and the *Environment Protection and Biodiversity Conservation Act, 1999*. There are previous records for the species found in Brisbane Water National Park and Popran NationalPark.

According to the REMS mapping there are three vegetation communities present in the vicinity of the Proposal, which are mapped on Figure 2. The descriptions of these communities are provided hereunder, from quadrat data gathered during this survey, for Hawkesbury Plateau Banksia Scrub, Sheltered Dry Hawkesbury Woodland and Exposed Hawkesbury Woodland. All three vegetation communities are well conserved regionally, being well represented in Brisbane Water, Popran and Ku-ring-gai National Park.

Hawkesbury Plateau Banksia Scrub

Structure: Open cover of trees between 12-15 metres high with a denser midstorey (cover abundance > 40%) of shrubs between 5-8 metres high and a dense understorey (cover abundance > 70%) of smaller shrubs, monocotyledons and occasionally grasses up to two metres high.

Main Species Present
Trees: *Eucalyptus haemastoma, Corymbia gummifera* and *Corymbia eximia*

Taller Shrubs:
Banksia ericifolia and *Hakea teretifolia.*

Shrubs and Small Trees:
Kunzea capitata, Leptospermum trinervium, Personia lanceolata, Petrophile pulchella, Boronia ledfolia, Acacia ullicifolia and *Angophora hispida*

Monocotyledons:
Cyathochaeta diandra and *Ptilothrix deusta.*

Grasses: *Entolasia stricta.*

Remarks: Site PSS/1/2, PSS/4/1, PSS/5 are examples of this vegetation unit.

Sheltered Dry Hawkesbury Woodland

Structure: Open cover of trees between 15-18 metres high (cover abundance >30%) with a sparse cover of lower trees (cover abundance > 20%) between 5-8 metres high. Understorey mid-dense and up to three metres high comprising of shrubs, ferns, monocotyledons and grasses.

Main Species Present:
Trees: *Angophora costata* and *Eucalyptus piperita.*

Lower Trees: *Acacia decurrens* and *Acacia elata.*

Shrubs: *Doryanthes excelsa, Acacia oxycedrus, Pomaderris intermedia, Leptospermum trinervium* and *Leptospermum polygalifolium.*

Ferns: *Pteridium esculentum.*

Monocotyledons:
Gahnia sieberiana.

Grasses: *Themeda australis.*

Remarks: This vegetation community would appear to be rare in the area and is only found at PSS/3/1and PSS/9.

Exposed Hawkesbury Woodland

Structure: Open cover of trees between 12-15 metres high (cover abundance >15%) with a sparse cover of lower trees (cover abundance > 5%) between 5-8 metres high. Understorey dense and up to three metres high comprising shrubs and monocotyledons.

Main Species Present:
Trees: *Corymbia gummifera* and *Eucalyptus haemastoma.*

Lower Trees: *Banksia serrata.*

Shrubs: *Lambertia formosa, Leptospermum trinervium, Acacia linarrifolia, Phyllota phylliciodes, Allocasuarina litoralis* and *Acacia suaveolens.*

Remarks: Found at sites PSS/7 and PSS/8.

6.5 Weeds

There is only one major weed species present in the area of interest. This species is Crofton Weed *Ageratina adenophora,* which is regarded by Gosford City Council as a nuisance weed. Crofton Weed is present along many of the drainage lines and old sediment basin sites and as a result, has the potential to wash down and spread into Brisbane Water National Park.

6.5 Aquatic Habitats

Of the 15 sites investigated, three had a dry creek bed. All other sites had low to no flows at the time of sampling (Appendix 1). Organisms representing twenty-seven taxa were found in the study area (Appendix 1). The super families Leptophlebioidea and Baetoidea represented the mayflies. Two families of damselfly (Megapodagrionidae and Lestidae), two caddisfly (Leptoceridae and

Helicopsychidae) and at least three families of beetle were also found during the survey. The number of frog species in the area was not determined because the majority of tadpoles caught had just emerged. However, the tadpoles of the Giant Burrowing Frog were found at three sites, ASS/2, ASS/12 and ASS/13 (Figure 2).

The dominant taxon was Leptophlebioidea, which was found at nine sites. Chironomidae (found at 5 sites), Mesoveliidae (found at seven sites), and Dytiscidae (found at six sites) were also found in large numbers. The sites with the greatest number of organisms were ASS6, ASS8, ASS1 and ASS3. Organism diversity and number was a reflection of the amount of water present on the day of sampling.

The water quality variables for each site during the time of sampling are shown in Table 8.

Table 8- Water Quality Profile of F3 Freeway Sites taken during the aquatic survey

site	date	time	dep	tem	cond	cond	sal	DO	DO	pH	orp	turb
ASS			m	C	ms/cm	us/cm	ppt	%sat	Mg/l		mv	ntu
1	6.8.	0649	-0.2	10.6	0.1	124	0.04	72.7	8.1	6.7	-77	34.3
2	6.8	10.24	-0.1	9.9	0	76	0.02	93.0	10.5	5.99	118	3.0
3 & 4	6.8	11.10	-0.2	12.7	0	80	0.02	77.2	8.2	5.57	103	17.5
5	6.8	12.47	-0.1	11.7	0.1	129	0.04	97.9	10.6	6.18	85	6.2
6	6.8	13.19	-0.2	11.7	0.1	129	0.04	89.9	9.8	6.29	3	6.4
7	7.8	0724	-0.4	8.43	0.1	182	0.07	74.0	8.7	7.25	104	3.4
8	6.8	1412	-0.3	10.3	0.1	142	0.06	66.6	7.5	6.63	82	32.6
9	7.8	0750	-0.4	8.88	0.2	199	0.09	59.2	6.9	6.83	-134	3.8
10												
11												
12	7.8	0633	-0.2	9.35	0.1	151	0.06	44.6	5.1	4.81	255	1.1
13	7.8	0843	-0.2	9.14	0.1	165	0.06	87.7	10.1	6.62	15	1.1
14												
15												

6.6 Median Survey

The results of the median survey, for threatened species, proved negative. No plant species that are listed on the *Threatened Species Conservation Act, 1995* could be found and there are no streams present likely to support Adams emerald dragonfly. In many places the median is devoid of vegetation and the rock is breaking up. Whilst the rock crevices is likely to be ideal habitat for a number of reptile species none were recorded because of the late winter timing of the survey and it is not expected that the Heath Monitor would ocurr in this habitat. In conclusion the median area is unlikely to support threatened species.

6.0 IMPACT ASSESSMENT

The impact assessment of the proposed widening of the Freeway, in respect of threatened species, mainly concerns habitats within creeks, seepage zones and sandstone drains. These habitats have been identified as having attributes mainly for the Giant Burrowing Frog, the Red-crowned Toadlet and Adams emerald dragonfly, which are listed on the *Threatened Species Conservation Act, 1995* and the *Fisheries Management Act, 1994.* Within the wider downstream 'sphere of influence' of Mooney Mooney Creek, there is habitat for the Grey Nurse Shark, which is also listed on the *Fisheries Management Act, 1994.* All of these species depend on high quality water for breeding, larval development, feeding and shelter. Thus, to protect the habitat of these species and the species themselves, it will be important to maintain a high water quality, which is free of fine sediment particles. Fine sediment particles have the potential of killing, smothering or abrading these organisms, especially their motile parts and respiratory organs. Furthermore, sediment moving into receiving waters can smother aquatic animals their food resources.

The Giant Burrowing Frog, in particular, utilises the freshwater sandstone creeks and ridgetops, where soaks and dams are present. They may construct burrows in the muddy and sandy sediments beside the dams or in the sandy banks along the streams, which they inhabit. At certain times of the year they emerge from their burrows to breed and deposit their eggs in dams or in the streams. Tadpoles emerge and spend their life in these habitats until they develop into frogs. On the other hand, the Red-crowned Toadlet may inhabit smaller soaks, rock slabs on top of moist earth or moist areas with leaf litter. They do, however, require small soaks for breeding, which are found along the edges of the streams. Adams emerald dragonfly larvae occur on rocks or beneath leaf litter along stream margins. It has also been

found in narrow riffles with medium to large boulders with cobbles, gravel and sand in the streams. Adults spend their life on the wing but will come back to the stream margins to feed. With these habitats in mind and the fact that tadpoles of the Giant Burrowing Frog were found in three streams as well as the Red-crowned Toadlet, it may be expected that the waterways are important to the lifecycle to these three species.

The maintenance of high water quality will depend upon the trapping of fine sediment particles to avoid damage to aquatic species or those species, which partly depend upon water to complete part of their lifecycle. To introduce measures to protect these species, sediment basins and sediment traps should be sized and designed according the procedures detailed by Hunt (1992). This procedure involves the incorporation of particle size analysis of soils into the design, for sizing basins to trap fine soil material. The calculations also incorporate the settling velocity of the design particle size. In addition to this, flocculation may have to be used as a mitigation measure when the sediment basins have an enhanced fine silt or high clay content during their operation and after storm events. Basins will need to be regularly inspected particularly after storm events.

By retaining a high water quality standard for the streams during construction, the impact on threatened fauna species that depend on the waterways would be a temporary one and would not incur a longterm significant impact. Some impact would last for the duration of the construction, after which, the water quality should return to normal over time. To make a more accurate judgement as to the expected water quality suitable for these species, the water turbidity data for sites ASS 2, ASS 12 and ASS 13 should be used as indicators (Table 7). The figures recorded at the time the Giant Burrowing Frogs were found all show low turbidity levels and less than 3.0 ntu's .

The National Heritage Trust site, shown on Figure 2, is outside the study area for this project and will not be impacted by the Proposal. In addition, there is other threatened fauna species, which will not be significantly impacted. Those species would include the Common Bent-wing Bat, the Heath Monitor, the Spotted-tailed Quoll and the Broad-headed Snake. All species are listed on *the Threatened Species Conservation Act, 1995* with the Broad-headed Snake being listed on schedule 1 as endangered. Potential Broad-headed Snake habitat (Figure 2) lies outside the area of interest, whilst the Common Bent-wing Bat and the Spotted-tailed Quoll are both wide ranging species utilising a variety of habitats. Although the Heath Monitor would be more restricted in its range, its habitat is so widespread in Brisbane Water National Park that any reptile present would be able to cope with the alteration of habitat.

It should be noted that provision of the additional vehicular lanes for the freeway will incur removal of the median and some selective widening on each side of the existing carriageways. In terms of threatened species habitat the impact from this construction work is not expected to be great. Most of the impacts will occur at the sediment basin sites because of their larger size and the need to remove native bushland and threatened species habitat. This has already been discussed above.

Habitat for the Giant Burrowing Frog and Red-crowned Toadlet could also be re-instated to offset any loss of existing habitat. Sediment ponds could be made permanent structures and as shown by the fire dams in Brisbane Water National Park, may become permanent burrowing and breeding sites. If drains are required on top of the sandstone cuttings, then they could be cut into the existing sandstone bedrock, where possible, rather than constructing concrete drains. The Red-crowned Toadlet is an inhabitant of acid habitats and colonises these sandstone drains, once they become moist and filled with leaf litter.

The Black-eyed Susan *Tetratheca glandulosa* was not found during this survey but it was found during the survey for the cutting stabilisation works (Payne, 2001). Nevertheless, the species will have to be addressed under the eight-part test. With respect to the eight-part test for the Proposal, the local population of the Black-eyed Susan is unknown. Until such time that further research work is completed for this Black-eyed Susan species, a population may be defined as a "geographically or otherwise distinct groups between which there is little genetic exchange, typically less than one migration per year" as set down by the IUCN. Keith et. al. (1997) have stated that where plants are concerned this involves movement of pollen and seed propagules and without adequate information a 'rule of thumb' distance of one kilometre should be used.

It should be noted, the Black-eyed Susan *Tetratheca glandulosa,* has similar morphological characteristics for its fertile parts to its co-gener *Tetratheca juncea.* Those characteristics are poricidal anthers, where the pollen is held in a basal sac with a mulberry coloured oily fluid. In such cases it is believed that the pollen has to be actively removed by bees capable of anther sonication (Payne, 1998; Bartier et. al., 2001). The presence of the tapetal fluid also supports this hypothesis, whereby gradual dehydration of tapetal fluid assists with the time release of pollen by sonicating bees (King & Buchman, 1996).

If in fact the sonicating bee is responsible for pollination of *Tetratheca glandulosa*, then the area of the local pollination may be less than the one kilometre range, outlined by Keith et.al., (1997). Sonicating bees have a maximum range of 0.5 kilometres and the transfer of pollen by outcrossing and genetic exchange would only be accomplished within this range. Thus for *Tetratheca glandulosa* a range of 0.5 kilometres would be sufficient for establishing the extent of the local population.

7.0 EIGHT PART TEST

There were four vulnerable flora and fauna species recorded for the study area during this survey and the survey for the cuttings (Payne, 2001); The Black-eyed Susan *Tetratheca glandulosa*, the Masked Owl, the Giant Burrowing Frog, the Common Bent-wing Bat and the Red-crowned Toadlet. The NSW wildlife atlas records do reveal several other threatened species in the local area but these species were not found. These species include the Powerful Owl, the Heath Monitor, the Koala, the Spotted-tailed Quoll, the Broad-headed Snake, the Somersby Mint-bush and Adams emerald dragonfly. Most species have been recorded in the more extensive area of Brisbane Water National Park. Whilst it is recognised that these species may be found in the area, the microhabitat attributes suggest that only the Red-crowned Toadlet, the Giant Burrowing Frog, the Masked Owl, the Heath Monitor, the Spotted-tailed Quoll and *Tetratheca glandulos.* The grass *Ancistrachne maidenii* , *Caladenia tessellata, Cryptostylis hunteriana, Eucalyptus camfieldii, Kunzea rupestris* and *Micromyrtus blakelyi* may all occur along the route and will also be included.

Under Section 5A of the *Environmental Planning and Assessment Act 1979*, eight factors must be addressed to determine whether any proposed development will have a significant impact on threatened species or habitats, populations or ecological communities. The factors relating to the eight-part test require decision-makers to consider known and potential habitat, biological and ecological factors as well as the local and regional significance of individual populations. Both *the Threatened Species Conservation Act 1995* and *Fisheries Management Act, 1994* apply to the threatened species and the eight factors to be addressed can be found in Section 5A of *the Environmental Planning & Assessment Act, 1979* and Section 220ZZ of the *Fisheries Management Act, 1994.*

7.1 The Red-crowned Toadlet

The Red-crowned Toadlet *Pseudophryne australis* is a small amphibian, which is restricted to habitats on Hawkesbury Sandstone geology within the Sydney Basin. As a general rule it occurs on ridgetops sheltering beneath rock slabs, amongst leaf litter in depressions and channels and occurring in upland swamp habitats, which are sometimes known as 'hanging swamps". It requires small rock pools for breeding purposes, which sometimes can be found, associated with streams on sandstone ridges and slopes. Within the study area, there is habitat along the route at several locations. The species was detected during the survey at four sites and four secondary survey sites (Tables 5 & 6).

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The proposal will require considerable earthworks for a number of sediment basin sites upslope of the streams and seepage zones where there is actual and potential habitat for the Red-crowned Toadlet. The impact on any population will be dependant upon putting in place adequately designed and constructed soil-erosion and sediment control works. These details have been outlined above in the discussion and it is expected that a sediment-erosion control plan will be prepared for the proposal and that the conditions detailed in this document will be put into practice to safeguard their habitat. It should be noted that the original freeway construction would have disturbed their habitat and since that time the Red-crowned Toadlet has returned to colonise suitable areas. If such conditions for controlling downslope wash of fine sediment are implemented, then it is unlikely that a significant impact would occur to any local population. There is likely to be a temporary impact but over time the species would be expected to recolonise the habitats. It is unlikely that the species will be placed at the risk of extinction.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Red-crowned Toadlet is not an example of an endangered population.

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

The area of habitat is large within the study area and within Brisbane Water National Park. In terms of the regional distribution the species is found as far north as Kulnura, west into the Blue Mountains and as far south as Heathcote. The modification that could occur from this proposal in relation to its regional distribution would be expected to be minor.

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

As a result of additional vegetation clearing that is to be expected to occur to accommodate access by machinery and construction of sediment basins, there is expected to be some small additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Red-crowned Toadlet by the NSW National Parks and Wildlife Service.

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

The Red-crowned Toadlet is adequately represented in conservation reserves in the bioregion in some areas. In other areas it appears to have declined and recent surveys have failed to find the species where it previously occurred. Fire is believed to be a cause of this decline and overall this question cannot be adequately answered for the bioregion. It is found in Blue Mountains, Brisbane Water, Dharug, Garigal, Heathcote, Kuring-gai Chase, Lane Cove, Marramarra, Morton, Popran, Royal, Sydney Harbour, Wollemi and Yengo National Parks.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Red-crowned Toadlet by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Red-crowned Toadlet is not at its southern limit of distribution at Calga because it occurs as far south as Heathcote and as far north as Kulnura.

7.2 The Giant Burrowing Frog

The Giant Burrowing Frog *Heleioporus australiacus* is a large amphibian reaching up to 100 mm in length. It is a burrowing species spending much of its time underground. The species may have a wide range and as much as 200-300 metres. They are sometimes associated with Yabbie burrows and burrows are found in the banks of streams and in dams. Eggs are sometimes laid in burrows, which are flushed out by the rain into streams. In Brisbane Water National Park the eggs have observed to be laid directly into the pond. Tadpoles complete their lifecycle within ponds or streams and are sometimes subjected to desiccation during drought. The tadpoles of the Giant Burrowing Frog was found at three locations and habitat is potentially present at a further nine sites (Tables 5 & 6).

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The proposal will require considerable earthworks for a number of sediment basin sites upslope of the streams and seepage zones where there is actual and potential habitat for the Giant Burrowing Frog. The impact on any population will be dependant upon putting in place adequately designed and constructed soil-erosion and sediment control works. These details have been outlined above in the discussion and it is expected that a sediment-erosion control plan will be prepared for the proposal and that the conditions detailed in this document will be put into practice to safeguard their habitat. It should be noted that the original freeway construction would have disturbed their habitat and since that time the Giant Burrowing Frog is again utilising suitable areas. If such conditions for controlling downslope wash of fine sediment are implemented, then it is unlikely that a significant impact would occur to any local population. There is likely to be a temporary impact but over time the species would be expected to recolonise the habitats. It is unlikely that the species will be placed at the risk of extinction.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Giant Burrowing Frog is not an example of an endangered population.

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

The area of habitat is large within the study area and within Brisbane Water National Park. In terms of the regional distribution the species is found as far north as Wollemi, west into the Blue Mountains and as far south as Nadgee. The modification that could occur from this proposal in relation to its regional distribution would be expected to be minor.

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

As a result of additional vegetation clearing that is to be expected to occur to accommodate access by machinery, construction of sediment basins and cutting maintenance there is expected to be some small additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Giant Burrowing Frog by the NSW National Parks and Wildlife Service.

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

The Giant Burrowing Frog is not adequately represented in conservation reserves in the bioregion because it occupies such narrow niches and the populations are well separated and becoming isolated. It is reserved in Ben Boyd, Biamanga, Blue Mountains, Booderee, Brisbane Water, Buderoo, Dharug, Royal, Heathcote, Garigal, Jervis Bay, Kuring-gai, Marramarra, Morton, Mount Imlay and Yengo National Parks.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Giant Burrowing Frog by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Giant Burrowing Frog is not at its southern limit of distribution at Calga because it occurs as far south as the Southern Highlands and as far north as Kulnura.

7.3 The Masked Owl

The Masked Owl, *Tyto novaehollanndiae* is a large owl that feeds in woodland and forest but also occasionally in cleared areas adjacent to forests. It also breeds in large tall forest trees with a hollow and quite often the species will occupy the tallest tree in the area. Rats and mice will form a major component of its diet but it will also feed on reptiles. The species has a large territorial range and will occupy an area as large as 600 km^2. Previous records for the Masked Owl include a road kill at Warnervale (Payne & Murray, 2001), a known individual bird at St. Johns Road Wyong and other known birds from the Lake Macquarie local government area.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The Masked Owl was recorded behind the Mount White village store and it would be expected that this area would be used for feeding. The census of the study area (Table 4) showed that small mammal activity is high which would be important as feeding habitat for the Masked Owl. The proposal will only

impact a small area of the habitat in the study area and the removal of that area of habitat is unlikely to cause the Masked Owl to be placed at the risk of extinction. The adjacent habitat type within Brisbane Water National Park and Popran National Park is vast, which would provide ample feeding habitat in the area. They are no known roost trees in the area.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Masked Owl is not an example of an endangered population.

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

The area of habitat in the area is vast being represented in Brisbane Water National Park. As a comparison to the expected disturbance of the habitat in the region this would be expected to be minimal. However, this statement must be qualified in that there are very few records for the Masked Owl around the Gosford area, although there are records for the Wyong – Lake Macquarie area. Thus prime habitat for the Masked Owl, on a regional basis, is well separated but even so the disturbance to its habitat is not expected to be significant on a regional basis.

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

As a result of minor disturbance that is to be expected there should be no significant isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Masked Owl by the NSW National Parks and Wildlife Service.

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

The Masked Owl is not adequately represented in conservation reserves in the bioregion. Most of its known reserved habitat involves state forests in the west of the bioegion.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Masked Owl by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Masked Owl is not at its southern limit of distribution at Calga because it occurs all around coastal and sub-coastal New South Wales.

7.4 The Heath Monitor

The Heath Monitor *Varanus rosenbergii* is a large reptile, of which an isolated population occurs, in coastal New South Wales that is restricted to the Hawkesbury Sandstone. It is known to shelter in burrows, hollow logs and rock crevices and to utilise termite mounds to lay its eggs. Typical habitat occurs for this species along the entire route for the freeway widening.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The proposal will require considerable earthworks for a number of sediment basin sites. Many of the sites will disturb Heath Monitor habitat but the extent of habitat in the adjacent area is very large. It is unlikely the low degree of expected disturbance of habitat that any Heath Monitor population will be

placed at risk of extinction. The Heath Monitor is also a wider ranging species and has the ability of moving away from areas that will be disturbed.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Heath Monitor is not an example of an endangered population.

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

At present there are a few sites known for this species in the bioregion. These sites include a few around Sydney, on the south coast and on the central coast. The bioregional population is therefore not large. The species is known to occur in Popran, Brisbane Water and Georges River National Park and of the known regional areas, a significant area of habitat will not be modified on a regional basis.

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

As a result of minor disturbance that is to be expected there should be no significant additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Heath Monitor by the NSW National Parks and Wildlife Service.

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

The Heath Monitor is not adequately represented in conservation reserves in the bioregion. Most of its known habitat is in Brisbane Water, Popran and Georges River National Parks.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Heath Monitor by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Heath Monitor is not at its southern limit of distribution at Calga because south coast of Sydney but it would be near its northern limit of distribution.

7.5 The Spotted-tailed Quoll

The Spotted-tailed Quoll is a wide-ranging species utilising a variety of habitats. It also depends upon a variety of foods being both carnivorous and frugivorous. The species shelters in caves hollow logs or even tree hollows. There are a number of records for this species in Brisbane Water National Park including Staples Lookout, Pearl Beach and Little Wobby.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The proposal will require considerable earthworks for a number of sediment basin sites. Many of the sites will disturb Spotted-tailed Quoll habitat but the extent of habitat in the adjacent area is very large. It is unlikely the low degree of expected disturbance of habitat that any Spotted-tailed Quoll population will be placed at risk of extinction. The Spotted-tailed Quoll is also a wider ranging species and has the ability of moving away from areas that will be disturbed.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Spotted-tailed Quoll is not an example of an endangered population.

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

At present there are a number of sites known for this species in the bioregion. These sites include a few around Sydney, on the south coast and on the central coast. The bioregional population is probably relatively large. It is unlikely that this proposal will cause a significant impact on a regional basis.

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

As a result of minor disturbance that is to be expected there should be no additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Spotted-tailed Quoll by the NSW National Parks and Wildlife Service.

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

The Spotted-tailed Quoll is not adequately represented in conservation reserves in the bioregion. However, it is known to be represented in Brisbane Water National Park and Ku-ring-gai Chase National Park.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Spotted-tailed Quoll by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Spotted-tailed Quoll is not at its southern limit of distribution at Calga because it occurs on the south coast of NSW and north coast of NSW in large forested habitats.

7.6 The Common Bent-wing Bat

The Common Bent –wing Bat is a species that occupies a wide range of habitats in the region. It has been found in Hawkesbury Sandstone Woodland, Heathlands, Moist Forests and Wetlands. It appears to be absent in the Rainforests. Most of these habitats are feeding areas. Roosting sites have been found in caves, culverts, beneath bridges and in one case a Power Station. The species has a very wide distribution in the bioregion, but its maternity sites are very restricted. These sites are the main concern for this species and where they are found they need to be protected.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The study area would only be a feeding area for the Common Bent-wing Bat and its feeding habitat is well represented in the adjacent Brisbane Water and Popran National Parks. Any local population of this species is unlikely to be placed at the risk of extinction because adequate feeding habitat is still available.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Common Bent-wing Bat is not an example of an endangered population.

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

The area of habitat is large within the study area and within Brisbane Water National Park. In terms of the regional distribution the species is found all throughout the bioregion. The modification that could occur from this proposal in relation to its regional distribution would be expected to be minor.

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

As a result of additional vegetation clearing that is to be expected to occur to accommodate access by machinery, construction of sediment basins and cutting maintenance there is expected to be some small additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Common Bent-wing Bat by the NSW National Parks and Wildlife Service.

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

The Common Bent-wing Bat is adequately represented in Conservation Reserves in the bioregion. It occurs in most of the Hawkesbury Sandstone National Parks and State Forest Areas.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Common Bent-wing Bat by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Common Bent-wing Bat is not at its southern limit of distribution at Calga because it occurs as far south as the Victorian border and as far north as the Queensland border.

7.7 The Black-eyed Susan

The Black-eyed Susan *Tetratheca glandulosa* is a low growing undershrub, which is generally confined to ridgetops and sideslopes. Its distribution may be related to rainfall in the area of interest for it tends to occur in the drier parts of the rainfall belt and is absent from the wetter parts. Very little is known regarding the biology of the species but its pollination may well depend on sonicating bees. Its presence may also be related to the presence of soil mycorrhiza and if so, fire becomes an important mechanism for management of this species.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The Black-eyed Susan is not found during this survey but is likely to be present. It is unknown if any population of this species will actually be impacted without final design plans. However, it is believed the impact locally would not be significant because the species is well represented in Popran National Park. However, in this case the impact on any local population becomes complicated because knowledge of locations of local populations is poor. Nevertheless, it is believed the overall local population in the study area would not be placed at the risk of extinction.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The Black-eyed Susan is not an example of an endangered population.

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

At present there are a number of sites known for this species in the bioregion. These sites include Popran National Park, Kulnura, Dharug, Kuring-gai, Terry Hills, Baulkham Hills and Duffys Forest. The bioregional population is considerably large. Therefore it is concluded that the regional population is unlikely to be impacted thus resulting in no impact to the regional population.

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

As a result of minor disturbance that is to be expected from the widening Proposal there should be minimal additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the Black-eyed Susan by the NSW National Parks and Wildlife Service.

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

The Black-eyed Susan is adequately represented in conservation reserves in the bioregion north of the Hawkesbury River. South of the Hawkesbury River it is found in Kuring-gai National Park, Berowra Valley Regional Park and Marramarra National Park.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the Black-eyed Susan by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The Black-eyed Susan is not at its southern limit of distribution at Calga because it occurs as far south as Ryde and as far north as Sampson's Pass in Yengo National Park.

7.8 *Ancistrachne maidenii*

The habitat and biology of *Ancistrachne maidenii* is relatively unknown. At this stage all that is known is that the species occurs on sandstone derived soils north of Sydney in the Central Coast botanical bioregion. It does grow on ridges but it may also occur along alluvial flats at the bottom of Hawkesbury Sandstone escarpments.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

Ancistrachne maidenii is an endangered species.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

Ancistrachne maidenii was not found during the survey but habitat is present. It is unknown if any plants will actually be impacted. However, it is believed that the habitat within the local area will only be minimally impacted. Thus any local population is unlikely to be impacted and would not be placed at the risk of extinction.

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

At present there are only a low number of sites known for this species in the bioregion. These sites are found south of the Hawkesbury River near the area of interest. As detail on this species is very limited the impact on the regional distribution of habitat is unknown.

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

As a result of minor disturbance that is to be expected from the cutting maintenance there should be minimal additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for *Ancistrachne maidenii* by the NSW National Parks and Wildlife Service.

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

Ancistrachne maidenii would not be adequately represented in conservation reserves in the bioregion.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for *Ancistrachne maidenii* by the NSW National Parks and Wildlife Service.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The northern and southern limit for *Ancistrachne maidenii* is really unknown.

7.9 Caladenia tessellata, Cryptostylis hunteriana, Eucalyptus camfieldii, Kunzea rupestris and Micromyrtus blakelyi.

All of these species form a suite of species that can occur on low nutrient soils on Hawkesbury Sandstone. They have been previously recorded within a 10-kilometre range of the study area. There are no known specific habitat attributes for the species, except for *Kunzea rupestris*, which prefers shallow soils on rock outcrops. The orchid species may be related to a particular type of soil mycorrhiza or pollinator and quite often, rare orchid species, will appear the year following a fire. Therefore, the habitat attributes for this suite of species, can only be addressed in general terms, rather than be specific. None of the species were recorded during the survey although all are listed as vulnerable under the Act.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

Habitat for the above suite of species occurs in the vicinity of the Proposal. However, the habitat is extensive in the vicinity and would amount to well over 1000 Ha being found in Brisbane Water and Popran National Parks. As the habitat is extensive and the habitats for these species are localised, the minor intrusion into these habitats is unlikely to place any local population of any of the species at a risk of extinction. For the widening survey a targeted search was undertaken for threatened species and none of these species were recorded during the survey.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

The suites of species are not examples of an endangered population.

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

The suite of species are all restricted to the low nutrient Hawkesbury Sandstone soils. Most of the species are found in the northern Sydney area around Hornsby, Ku-ring-gai and extending as far as Maroota. *Eucalyptus camfieldii, Caladenia tessellata* and *Cryptostylis hunteriana* are exceptions in that they extend further north and south of Sydney. The former two species are found in Royal National Park and as far as Newcastle to the north, but *Cryptostylis hunteriana* is found on the far north coast. Given the extensive range of all these species and the unlikelihood of the species occurring in the study area, it is doubtful whether a significant area of known habitat will be modified at a regional scale.

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

As a result of minor disturbance that is to be expected from the cutting maintenance there should be minimal additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for the suite of threatened species by the NSW Scientific Committee.

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

None of the threatened species would be considered adequately represented in Conservation Reserves. *Eucalyptus camfieldii* is found in Brisbane Water, Ku-ring-gai Chase, Royal and Sydney Harbour National Parks. *Kunzea rupestris* occurs in Ku-ring-gai Chase and Marra Marra National Park, whilst *Micromyrtus blakelyi* occurs only in Marra Marra National Park. *Cryptostylis hunteriana* is found in Gilbraltar Range, Ku-ring-gai Chase, Ben Boyd, Croajingalong and William Hunter National Parks. *Caladenia tessellata* is not known to occur in any National Park.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for the suite of species by the NSW Scientific Committee.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

Camfield's Stringybark is found between Royal National Park and Forresters Beach on the Central Coast of New South Wales. *Cryptostylis hunteriana* is found on the south coast of New South Wales and extends to the far north coast. *Caladenia tessellata* is also found south of Sydney and occurs as far north as the Hunter District. However, *Kunzea rupestis* and *Micromytus blakelyi* have a distribution only within the north Sydney area and the study area could be considered the northern limits of their distribution.

7.10 Adams Emerald Dragonfly

Adams emerald dragonfly is a threatened species and the eight factors to be addressed can be found in Section 5A of *the Environmental Planning & Assessment Act, 1979* and Section 220ZZ of the *Fisheries Management Act, 1994.*

Adams emerald dragonfly is a very rare species and has was collected in very low numbers. Only five locations are known for this species, which are Somersby Falls Creek, Floods Creek, Berowra Creek, Hungry Way Creek in Wollemi National Park and Bedford Creek in the Blue Mountains. Recent collections are from Tunks Creek and Somersby Falls Creek, but these creeks are becoming polluted from agricultural and industrial activities.

Chapman (2000) notes that Adams emerald dragonfly larvae occur on rocks or beneath leaf litter along stream margins. In Tunks Creek it was found in narrow riffles with medium to large boulders with cobbles, gravel and sand. The ripples were mainly shady with moss coverage. Adults spend their life on the wing but will come back to the stream margins to feed.

- **In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a local population of the species is likely to be placed at risk of extinction.**

The proposal will require considerable earthworks for a number of sediment basin sites upslope of the streams where there is potential habitat for Adams emerald dragonfly. The impact on any population will be dependant upon putting in place adequately designed and constructed soil-erosion and sediment control works. These details have been outlined above in the discussion and it is expected that a sediment-erosion control plan will be prepared for the proposal and that the conditions detailed in this document will be put into practice to safeguard their habitat. If such conditions for controlling downslope wash of fine sediment are implemented, then it is unlikely that a significant impact would occur to any local population. There is likely to be a temporary impact but over time the species would be expected to recolonise the habitats. It is unlikely that the species will be placed at the risk of extinction if they are present.

- **In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

Adams emerald dragonfly is not an endangered population.

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

At present there are only a low number of sites known for this species in the bioregion. These sites are found north of the Hawkesbury River near the area of interest. As detail on this species is very limited the impact on the regional distribution of habitat is unknown.

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

As a result of minor disturbance that is to be expected from the widening Proposal there should be minimal additional isolation from currently interconnecting or proximate areas of habitat.

- **Whether critical habitat will be affected.**

There has not been any critical habitat identified for Adams emerald dragonfly by the NSW State Fisheries.

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

Adams emerald dragonfly is not adequately represented in conservation reserves in the bioregion.

- **Whether the development or activity proposed is a Class of Development or Activity that is recognised as a threatening process.**

There have been no threatening processes listed for Adams emerald dragonfly by the NSW State Fisheries.

- **Whether any threatened species, population or ecological community is at the limit of its known distribution.**

The northern and southern limit for Adams emerald dragonfly is really unknown.

7.11 Summary

The eight-part test of significance indicates that the areas of main concern are the stream habitats. This is because two threatened frog species are present and possibly a third aquatic species. There is likely to be a temporary impact on the frog species and following the construction work habitats should return to normal. The impact is not expected to be long term and significant based on the fact that both species have colonised the habitats following previous construction work. These impacts mainly relate to the construction of sediment basins and the impacts water quality may have on the downstream

habitats. There is unlikely to be any impacts on the wider ranging species such as the Heath Monitor, the Common Bent-wing Bat, the Masked Owl and the Spotted-tailed Quoll.

8.0 COMMONWEALTH LEGISLATION

Threatened species and communities listed in the *Environmental Protection Biodiversity Conservation Act, 1999* are considered to be a matter of national environmental significance. Under the commonwealth *Environment Protection & Biodiversity Conservation Act 1999*, an action will require the approval of the Commonwealth Minister for the Environment. This is in addition to any State or Local Government approval, if the action will have, or is likely to have, a significant impact on a matter of national environmental significance.

The *Environment Protection Biodiversity Conservation Act, 1999* criteria for determining whether a significant impact on a threatened species or community is likely, differ from those applied under the NSW Environmental Assessment Process (ie s5A of *the Environmental Protection and Assessment Act, 1979*). If the proposed action is likely to have a significant impact on a nationally listed threatened species or community (according to the commonwealth criteria), the matter must be referred to the Commonwealth Minister for the Environment for consideration. If the Minister decides that a significant impact is likely, the *Environmental Protection Biodiversity Conservation Act, 1999* environmental assessment procedure will apply (in addition to that of any State or Local Government process and approval, subject to any bilateral agreement between the Commonwealth and the State). The Commonwealth Minister may decide to either approve or reject the application to conduct the action.

According to this legislation the Giant Burrowing Frog, the Large Pied Bat *Chalinolobus dwyeri* and the Spotted-tailed Quoll *Dasyurus maculata* are listed on the schedules. Plant species that are listed, for which habitat attributes are present, are the Black-eyed Susan and the orchids. There are also a number of migratory species listed, which include the White-bellied Sea Eagle *Haliaeetus leucogaster*, the White-throated Needletail, *Hirundapus caudacutus*, the Rufous Fantail, *Rhipidura rufiforns*, the Satin Flycatcher, *Myiagra cyanoleuca* and the Black-faced Monarch, *Monarcha melanopsis*. The White-bellied Sea Eagle is present and it is likely that the Rufous Fantail, the Satin Flycatcher, the White-throated Needletail and Black-faced Monarch could all occur.

8.1 Vulnerable Species

According to the administrative guidelines (Anon, 2000b) the following questions must be addressed for vulnerable species:

- **An action has, will have or is likely to have a significant impact on a vulnerable species, if it does, will, or is likely to:**

- Lead to a long-term decrease in the size of an important population of a species, or
- Reduce the area of occupancy of an important population, or
- Fragment an existing important population into two or more populations, or
- Adversely affect habitat critical to the survival of a species, or
- Disrupt the breeding cycle of an important population, or
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat, or
- Interferes substantially with the recovery of the species.

The survey revealed the presence of only one vulnerable species, which is the Black-eyed Susan, *Tetratheca glandulosa,* during the survey for the cutting stabilisation works (Payne, 2001). However, there is habitat of several other species such as the orchids *Caladenia tessellata, Cryptostylis hunteriana*, Camfield's Stringybark, *Eucalyptus camfieldii, Kunzea rupestris,* and *Micromyrtus blakelyi.* As the proposal involves widening at several locations, it is unlikely that the habitat of these species will be significantly impacted. A targeted search was also undertaken for these species and only the Black-eyed Susan could be located. In conclusion, the targeted survey suggests that only the Black-eyed Susan occurs and the remainders of the vulnerable species, listed above, are unlikely to occur.

The Black-eyed Susan populations occur at three known locations and it is unlikely that the widening Proposal will impact these populations. Therefore, it is concluded that the works will not lead to a long-term decrease of these populations, or reduce their area of occupancy. In terms of the latter, the populations of the Black-eyed Susan are found amongst substantial tracks of native vegetation and provided this vegetation persists, the Black-eyed Susan is likely to continue to survive. This is because of the pollination processes involved. By retaining a diverse population of native species in any area, it

provides many different types of flowers, in particular, plants from the family Fabaceae. Such diverse habitats attract native bees and whilst these plants survive, they provide the 'keystone' habitat component for pollination to occur. Due to the increased likelihood for native bees to visit plant communities, with a diverse array of plants, there is the increase potential of the Black-eyed Susan to be pollinated by specialised native bees, which increases its chance of survival. This will ensure that the breeding cycle is also maintained. The adjoining Brisbane Water and Popran National Parks will provide this habitat.

The widening works will disrupt or modify the quality of the habitat to a minor extent. However, this modification is not expected to be significant, and is not expected to cause the population of the Black-eyed Susan to decline. Based on the targeted survey along the route it was noted that the degree of weed invasion was minimal. This is because the soils, derived from Hawkesbury Sandstone, are very low in nutrient content and do not have the capability to support many weed species, except along the drainage lines. The Black-eyed Susan populations, in this study area, are found on the ridgetops and, therefore it is expected that any infiltration by invasive species would be minimal. On this basis, the widening works are not expected to interfere with any recovery of the Black-eyed Susan, caused by weed invasion.

The Black-eyed Susan population, in the context of this study area, could also be regarded as an important population under the guidelines (Anon, 2000b). This is because the population is at its northeastern most extremity of its range.

The fauna species that are listed as 'vulnerable' are highly mobile species with large territorial ranges. They also require varied resource needs, which is one of the reasons for their larger territorial range. The widening works are unlikely to lead to any long-term decrease in their populations. Given that Brisbane Water National Park and Popran National Park are located adjacent to the study area, there are ample resource needs available to support the lifecycle of these fauna species. Based on this judgement, the area of occupancy of these populations would be reduced by a minimal amount and the degree of fragmentation would be similarly reduced.

There is no critical habitat, as far, as can be determined, for these species in the study area and it is unlikely that the breeding cycle would be disrupted because of their high mobility. The small area, proposed for the widening works, would not decrease significantly the availability or quality of habitat to cause a decline in any population.

Weed invasion is also expected to be minimal and the Proposal and is unlikely to interfere with any recovery of any population of these species.

8.2 Listed Migratory Species

An action will require the approval from the Minister for the Environment if the action has, will have, or is likely to have a significant impact, on listed migratory species.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- Result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

Two of the listed migratory species, the White-bellied Sea Eagle and the White-throated Needle-tail would not be affected by the proposal because they spend most of their time either on the wing or soaring above the study area. The White-bellied Sea Eagle was in fact recorded during the survey. The other species being the Rufous Fantail, the Satin Flycatcher and the Black-faced Monarch are species, which inhabit moister environments, including gullies. Therefore, the vegetation in the study area would be mainly used for movement purposes between appropriate habitats. They are also highly mobile species.

The Proposal is unlikely to substantially modify the habitat of these species because they could be expected to utilise Brisbane Water National Park and Popran National Park to traverse to favoured gully areas to feed and temporarily live. The Proposal is also unlikely to alter nutrient cycles or destroy significant areas of habitat of these species and result in the invasion of these habitats by weeds. Thus, the lifecycle of these species is unlikely to be affected by this Proposal.

Other questions relating to this proposal are:

- **Are there any World Heritage Areas present?**

There are no world heritage areas present in the study area or likely to be affected by the Proposal.

- **Are there any wetlands of international importance present?**

There are no wetlands of international importance present in the study area or likely to be affected by the Proposal.

- **Is there any Commonwealth marine area present?**

There are no Commonwealth marine areas present.

- **Are there any additional matters of National Environmental Significance present?**

There is one site listed on the National Estate, which is found to the north along Mooney Mooney Creek (Figure 2). It is located outside the study area and is unlikely to be impacted by the Proposal.

9.0 CONCLUSIONS AND RECOMMENDATIONS

A flora and fauna and aquatic survey was undertaken along the F3 freeway between Jolls Bridge and Calga. The detailed investigation was undertaken for the widening whilst secondary investigation was undertaken at a number of smaller sediment basin sites and the median. The results of the survey revealed that:

- Tadpoles of the Giant Burrowing Frog were present in three streams and were recorded using the dipnet technique rather than by visual inspection.
- The Red-crowned Toadlet was present at four sites after being confirmed at the initial site.
- The Common Bent-wing Bat was recorded at 'The Gorge' and at Mt. White.
- A Masked Owl was present at the Mount White interchange and
- The Black-eyed Susan, *Tetratheca glandulosa* was not found during this survey.

An Eight-Part Test was conducted on these threatened species and it was concluded that there would not be any significant impact. The most obvious impact from the proposal will occur in the several streams, where it is expected that downslope run-off will carry fine sediment particles. These fine sediment particles will cause the most damage to the two threatened frog species and other aquatic species found in the streams. They may also impact on the habitat of Adams emerald dragonfly. To protect the streams and the habitats from the impacts of these fine soil particles it is recommended that the design and sizing of sediment basins be calculated by taking into consideration the settling velocity of these fine sediment particles. It is also recommended that regular inspections are undertaken of the sediment basins during construction and when the water is enhanced with sediment content, a flocculent is applied.

To offset the temporary loss or impact on amphibian habitat, it is also recommended that the sediment basins constructed for soil control purposes be made permanent structures, which can serve as breeding habitats for the Giant Burrowing Frog.

Crofton Weed has seriously invaded many of the streams and this weed has the potential to wash down into Popran and Brisbane Water National Park and colonise these areas. It is a serious weed and time consuming to remove. It is recommended that this weed be removed from the drainage lines, withih RTA land, to protect our National Park areas.

If all of the above recommendations are adopted for the proposal, then a Species Impact Statement should not be prepared and the Proposal should proceed. Furthermore, the Species Impact Assessment need not be submitted to Environment Australia for further notification and assessment.

The NSW National Parks and Wildlife Service recommended a research and monitoring program, for the Broad-headed Snake. Liaison should take place with the NSW National Parks and Wildlife Service, to prepare and implement restoration of habitat for the Broad-headed Snake on the top of the rock

cuttings, which having a north and northwestern aspect. This would involve replacement of rock slabs suitable as shelter habitat for the Broad-headed Snake on top of rocky cutting areas. From time to time these rock slabs should be monitored to establish any utilisation, if any, by the Broad-headed Snake.

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Appendix 1 Aquatic Species List

Table 1 RTA Freshwater Aquatic Organism Study (August 2001)

(VLF - Very Low Flow; LF - Low Flow; NF - No Flow; NW - No Water)

Taxa	Common Name	ASS 1 VLF	ASS 2 VLF	ASS 3 VLF	ASS 4 LF	ASS 5 LF	ASS 6 LF	ASS 7 NW	ASS 8 VLF	ASS 9 VLF	ASS 10 NF	ASS 11 NW	ASS 12 VLF	ASS 13 VLF	ASS 14 NW	ASS 15 NW	Total
P: Nematoda	Nematod			3													3
O: Isopoda	Slatter				5												5
C: Oligochaeta	Aquatic Worm						4										4
F: Lymnaeidae	Snail						1										1
F: Planorbidae	Snail					1											1
Helelioporus australiacus	Giant Burrowing Tadpole		4										1	4			9
	Tadpole		1	5	17		5			13							41
F: Gripopterygidae	Stonefly Larvae	1	1			1											3
S.F: Baetoidea	Mayfly Larvae		7	1		4	69										81
S.F: Leptophlebioidea	Mayfly Larvae	64	19	42	14	32	44		3				2	1			221
F: Leptoceridae	Caddisfly Larvae		1				2										3
F: Helicopsychidae	Caddisfly Larvae					50	7										57
F: Megapodagrionidae	Damselfly Larvae	1					4										5
F: Lestidae	Damselfly Larvae		1	6			2										9
S.O: Anisoptera	Dragonfly Larvae	1	2	16		1	9		1	2			3	1			36
F: Hygrobiidae	Screech Beetle			1			9										10
F: Dytiscidae	Diving Beetle	3		5			107				2		4	1			122
F: Gyrinidae	Whirligig Beetle						40										40
F: Corydalidae	Dobsonfly Larvae						1		1								2
	W.boatman short arm			3			10						3				16
F: Corixiodae	Waterboatman			6	2		16										24
F: Notonectidae	Backswimmer			2			84						5	8			99
F: Gerridae	Greater W. Strider												3	7			10
F: Mesoveliidae	Lesser W. Strider	93	12		4		1		5		6			7			128
F: Culicidae	Mosquito Larvae			2			2		88		6						98
F: Chironomidae	Blood Worm			29	12		57		77				2				177
	Larvae	2					1		1								4
	Frogs eggs				24		6		3	14							47
	Total	165	48	121	78	89	481	0	179	29	14	0	23	29	0	0	

APPENDIX 2 – FAUNA SPECIES LIST

COMMON NAME	LATIN NAME
Mammals	
Red-necked Wallaby	*Macropus rufogriseus*
Swamp Wallaby	*Wallabia bicolor*
Northern Brown Bandicoot	*Isoodon macrourus*
Common Wombat	*Vombatus ursinus*
Small Mammals	
Brown Antechinus	*Antechinus stuartii*
Common Bush Rat	*Rattus fuscipes*
Swamp Rat	*Rattus lutreolus*
New Holland Mouse	*Pseudomys novaehollandiae*
Reptiles	
Common Skink	*Lampropholis delicata*
Water Skink	*Sphenomorphous quoyii*
Lesueur's Velvet Gecko	*Oedura lesueurii*
Amphibians	
Red-crowned Toadlet	*Pseudophryne australis*
Giant Burrowing Frog	*Heleioporus australiacus*
Common Eastern Froglet	*Crinia signifera*
Dusky Toadlet	*Uperolaea fusca*
Bats	
Common Bent-wing Bat	*Miniopterus schreibersii*
Eastern Forest Bat	*Vespadalus vulturnis*
Chocolate Wattled Bat	*Chalinolobus morio*
Gould's Wattled Bat	*Chalinolobus gouldii*

APPENDIX 2 - BIRD SPECIES LIST

001	Emu			
008	Australian Brush-turkey			
009	Stubble Quail			
011	Brown Quail			
199	Magpie Goose			
205	Plumed Whistling-Duck			
204	Wandering Whistling-Duck			
217	Musk Duck			
214	Freckled Duck			
203	Black Swan			
207	Australian Shelduck			
202	Australian Wood Duck			
948	Mallard			
208	Pacific Black Duck			
212	Australasian Shoveler			
211	Grey Teal			
210	Chestnut Teal			
213	Pink-eared Duck			
215	Hardhead			
[illegible]	Australasian Grebe			
[illegible]	Hoary-headed Grebe			
060	Great Crested Grebe			
005	Little Penguin			
069	Wedge-tailed Shearwater			
072	Flesh-footed Shearwater			
071	Short-tailed Shearwater			
068	Fluttering Shearwater			
104	Australasian Gannet			
101	Darter			
100	Little Pied Cormorant			
099	Pied Cormorant			
097	Little Black Cormorant			
096	Great Cormorant			
106	Australian Pelican			
188	White-faced Heron			
185	Little Egret			
191	Eastern Reef Egret			
189	White-necked Heron			
187	Great Egret			
186	Intermediate Egret			
977	Cattle Egret			
193	Striated Heron			
[illegible]	Nankeen Night Heron			
[illegible]	Glossy Ibis			
179	Australian White Ibis			
180	Straw-necked Ibis			
181	Royal Spoonbill			
182	Yellow-billed Spoonbill			
183	Black-necked Stork			
241	Osprey			
234	Pacific Baza			
232	Black-shouldered Kite	A		
229	Black Kite			
228	Whistling Kite			
227	Brahminy Kite			
226	White-bellied Sea-Eagle	A		
218	Spotted Harrier			
219	Swamp Harrier			
221	Brown Goshawk			

220	Grey Goshawk			
222	Collared Sparrowhawk			
224	Wedge-tailed Eagle			
225	Little Eagle			
239	Brown Falcon			
235	Australian Hobby			
237	Peregrine Falcon			
240	Nankeen Kestrel			
046	Buff-banded Rail			
045	Lewin's Rail			
050	Baillon's Crake			
049	Australian Spotted Crake			
051	Spotless Crake			
058	Purple Swamphen			
056	Dusky Moorhen			
059	Eurasian Coot			
014	Painted Button-quail			
168	Latham's Snipe			
152	Black-tailed Godwit			
153	Bar-tailed Godwit			
150	Whimbrel			
149	Eastern Curlew			
159	Marsh Sandpiper			
158	Common Greenshank			
160	Terek Sandpiper			
157	Common Sandpiper			
155	Grey-tailed Tattler			
129	Ruddy Turnstone			
165	Great Knot			
164	Red Knot			
162	Red-necked Stint			
978	Pectoral Sandpiper			
163	Sharp-tailed Sandpiper			
161	Curlew Sandpiper			
171	Comb-crested Jacana			
130	Pied Oystercatcher			
131	Sooty Oystercatcher			
146	Black-winged Stilt			
148	Red-necked Avocet			
8006	Pacific Golden Plover			
143	Red-capped Plover			
140	Double-banded Plover			
139	Lesser Sand Plover			
144	Black-fronted Dotterel			
132	Red-kneed Dotterel			
135	Banded Lapwing			
133	Masked Lapwing	A		
128	Arctic Jaeger			
125	Silver Gull			
111	Gull-billed Tern			
112	Caspian Tern			
115	Crested Tern			
114	White-fronted Tern			
953	Common Tern			
117	Little Tern			
110	Whiskered Tern			
109	White-winged Black Tern			
957	Rock Dove			
028	White-headed Pigeon			

989	Spotted Turtle-Dove	A		
029	Brown Cuckoo-Dove	A		
033	Emerald Dove			
034	Common Bentwing			
035	Brush Bronzewing	A		
043	Crested Pigeon	A		
030	Peaceful Dove			
032	Bar-shouldered Dove	A		
044	Wonga Pigeon			
025	Wompoo Fruit-Dove			
027	Topknot Pigeon			
265	Glossy Black-Cockatoo			
267	Yellow-tailed Black-Cockatoo	B		
268	Gang-gang Cockatoo			
273	Galah	A		
272	Long-billed Corella			
271	Little Corella			
269	Sulphur-crested Cockatoo			
254	Rainbow Lorikeet	A		
256	Scaly-breasted Lorikeet			
258	Musk Lorikeet			
260	Little Lorikeet			
281	Australian King-Parrot			
282	Crimson Rosella	A		
288	Eastern Rosella	A		
295	Red-rumped Parrot			
302	Turquoise Parrot			
337	Pallid Cuckoo			
339	Brush Cuckoo			
338	Fan-tailed Cuckoo	A		
342	Horsfield's Bronze-Cuckoo			
344	Shining Bronze-Cuckoo			
347	Common Koel			
348	Channel-billed Cuckoo			
349	Pheasant Coucal			
248	Powerful Owl			
242	Southern Boobook			
313	Tawny Frogmouth			
330	White-throated Nightjar			
317	Australian Owlet-nightjar			
334	White-throated Needletail			
335	Fork-tailed Swift			
319	Azure Kingfisher			
322	Laughing Kookaburra	A		
326	Sacred Kingfisher			
329	Rainbow Bee-eater			
318	Dollarbird			

OTHER NON-PASSERINES

Masked Owl	A	#	

Unusual Observation Report (UOR) may be required; please make field notes

____	NoisyPitta			
350	Superb Lyrebird	A		
355	Rufous Scrub-bird			
558	White-throated Treecreeper			
560	Red-browed Treecreeper			
555	Brown Treecreeper			
529	Superb Fairy-wren	B		
536	Variegated Fairy-wren	A		
541	Red-backed Fairy-wren			
526	Southern Emu-wren			
565	Spotted Pardalote	A		
976	Striated Pardalote			
505	Rockwarbler			
493	Yellow-throated Scrubwren			
488	White-browed Scrubwren	A		
494	Large-billed Scrubwren			
498	Chestnut-rumped Heathwren			
504	Speckled Warbler			
465	Weebill			
454	Brown Gerygone	A		
460	Mangrove Gerygone			
463	Western Gerygone			
453	White-throated Gerygone			
475	Brown Thornbill	B		
484	Buff-rumped Thornbill			
486	Yellow-rumped Thornbill			
471	Yellow Thornbill			
470	Striated Thornbill	A		
466	Southern Whiteface			
638	Red Wattlebird	C		
637	Little Wattlebird	B		
585	Striped Honeyeater			
645	Noisy Friarbird	A		
646	Little Friarbird			
603	Regent Honeyeater			
641	Blue-faced Honeyeater			
633	Bell Miner			
634	Noisy Miner	A		
605	Lewin's Honeyeater	A		
614	Yellow-faced Honeyeater	B		
617	White-eared Honeyeater	A		
619	Yellow-tufted Honeyeater			
613	Fuscous Honeyeater			
625	White-plumed Honeyeater			
580	Black-chinned Honeyeater			
583	Brown-headed Honeyeater			
578	White-naped Honeyeater			
597	Brown Honeyeater			

630	Crescent Honeyeater			
631	New Holland Honeyeater	A		
632	White-cheeked Honeyeater	D		
593	Tawny-crowned Honeyeater			
591	Eastern Spinebill	A		
586	Scarlet Honeyeater			
448	White-fronted Chat			
377	Jacky Winter	A		
380	Scarlet Robin			
381	Red-capped Robin			
382	Flame Robin			
384	Rose Robin			
385	Hooded Robin			
396	Pale-yellow Robin			
392	Eastern Yellow Robin	B		
434	Logrunner			
443	Grey-crowned Babbler			
445	White-browed Babbler			
421	Eastern Whipbird	B		
436	Spotted Quail-thrush			
549	Varied Sittella			
416	Crested Shrike-tit			
405	Olive Whistler			
398	Golden Whistler	A		
401	Rufous Whistler	B		
408	Grey Shrike-thrush	B		
373	Black-faced Monarch			
375	Spectacled Monarch			
365	Leaden Flycatcher			
369	Restless Flycatcher			
415	Magpie-lark			
362	Rufous Fantail			
361	Grey Fantail	B		
364	Willie Wagtail	A		
673	Spangled Drongo			
424	Black-faced Cuckoo-shrike	B		
425	White-bellied Cuckoo-shrike			
429	Cicadabird			
430	White-winged Triller			
431	Varied Triller			
671	Olive-backed Oriole			
432	Figbird			
543	White-breasted Woodswallow			
544	Masked Woodswallow			
545	White-browed Woodswallow			
547	Dusky Woodswallow			
702	Grey Butcherbird	A		

700	Pied Butcherbird			
705	Australian Magpie	A		
694	Pied Currawong	B		
686	Paraidse Riflebird			
930	Australian Raven	A		
868	Forest Raven			
692	Torresian Crow			
693	White-winged Chough			
676	Green Catbird			
684	Regent Bowerbird			
679	Satin Bowerbird	A		
648	Singing Bushlark			
993	Skylark			
647	Richard's Pipit			
995	House Sparrow			
653	Zebra Finch			
655	Double-barred Finch			
661	Plum-headed Finch			
662	Red-browed Finch			
652	Diamond Firetail			
657	Chestnut-breated Mannikin			
996	European Goldfinch			
564	Mistletoebird			
358	White-backed Swallow			
357	Welcome Swallow			
359	Tree Martin			
360	Fairy Martin			
990	Red-whiskered Bulbul			
524	Clamorous Reed-Warbler			
523	Tawny Grassbird			
522	Little Grassbird			
509	Rufous Songlark			
508	Brown Songlark			
525	Golden-headed Cisticola			
574	Silvereye	B		
779	Bassian Thrush			
780	Russet-tailed Thrush			
991	Common Blackbird			
999	Common Starling			
998	Common Myna			

OTHER PASSERINES

	#		
	#		
	#		
	#		

Unusual Observation Report (UOR) may be required; please make field notes

INSTRUCTIONS: This record sheet lists the species more likely to be found. Additional space is provided for reporting any species not listed.. Use the approximations in the first column; **A** = 1-5 birds present, **B** = 6-20 birds, **C** = 21-50 birds, **D** = 51-100 birds, **E** = over 100 birds, **X** = not counted, **H** = heard only. Species, in the second column, which appear on the List of Threatened & Endangered Species for NSW ("Schedule 1&2") are indicated in **Bold** - observation reports of these species may assist in development of management strategies for NSW.

BREEDING RECORDS: In the third column, please indicate any observed breeding behaviour, using the abbreviations **ny** = nest with young, **ne** = nest with eggs, **fs** = fecal sac, **on** = bird on or seen leaving nest, **nb** = nest building, **cf** = carrying food, **dy** = dependent young, **ih** = inspecting hollow, **di** = display, **co** = copulation.

APPENDIX 3 – PLANT SPECIES LIST

CAPS Number	Family	Display Name	Freq
Acac	Mimosaceae	Acacia	1
3723	Mimosoideae	Acacia brownii	3
3762	Mimosaceae	Acacia decurrens	2
3768	Mimosaceae	Acacia elata	2
3771	Mimosaceae	Acacia falcata	3
3777	Mimosaceae	Acacia floribunda	2
3814	Mimosaceae	Acacia linifolia	11
3816	Mimosaceae	Acacia longifolia	3
3821	Mimosaceae	Acacia maidenii	1
3834	Mimosaceae	Acacia myrtifolia	6
3844	Mimosaceae	Acacia oxycedrus	22
3881	Mimosaceae	Acacia suaveolens	21
3885	Mimosaceae	Acacia terminalis	9
3893	Mimosaceae	Acacia ulicifolia	14
1094	Apiaceae	Actinotus helianthi	1
1095	Apiaceae	Actinotus minor	15
1255	Asteraceae	Ageratina adenophora	6
1256	Asteraceae	Ageratina riparia	2
2010	Casuarinaceae	Allocasuarina distyla	3
2012	Casuarinaceae	Allocasuarina littoralis	8
2017	Casuarinaceae	Allocasuarina torulosa	4
4748	Poaceae	Andropogon virginicus	8
3970	Myrtaceae	Angophora costata	15
3972	Myrtaceae	Angophora hispida	8
4749	Poaceae	Anisopogon avenaceus	9
2770	Fabaceae	Aotus ericoides	6
2773	Fabaceae	Aotus subglauca	1
4773	Poaceae	Aristida vagans	1
1201	Araliaceae	Astrotricha floccosa	2
3982	Myrtaceae	Austromyrtus tenuifolia	1
3986	Myrtaceae	Baeckea brevifolia	3
3993	Myrtaceae	Baeckea diosmifolia	3
5342	Proteaceae	Banksia ericifolia	23
5345	Proteaceae	Banksia oblongifolia	18
5347	Proteaceae	Banksia robur	1
5348	Proteaceae	Banksia serrata	7
5349	Proteaceae	Banksia spinulosa	10
2268	Cunoniaceae	Bauera rubioides	5
2302	Cyperaceae	Baumea rubiginosa	1
1283	Asteraceae	Bidens pilosa	1
4671	Pittosporaceae	Billardiera scandens	5
8052	Blechnaceae	Blechnum cartilagineum	1
8058	Blechnaceae	Blechnum nudum	1
8063	Blechnaceae	Blechnum wattsii	1
5740	Rutaceae	Boronia floribunda	5
5744	Rutaceae	Boronia ledifolia	21
2778	Fabaceae	Bossiaea ensata	6
2789	Fabaceae	Bossiaea scolopendria	12
2270	Cunoniaceae	Callicoma serratifolia	1

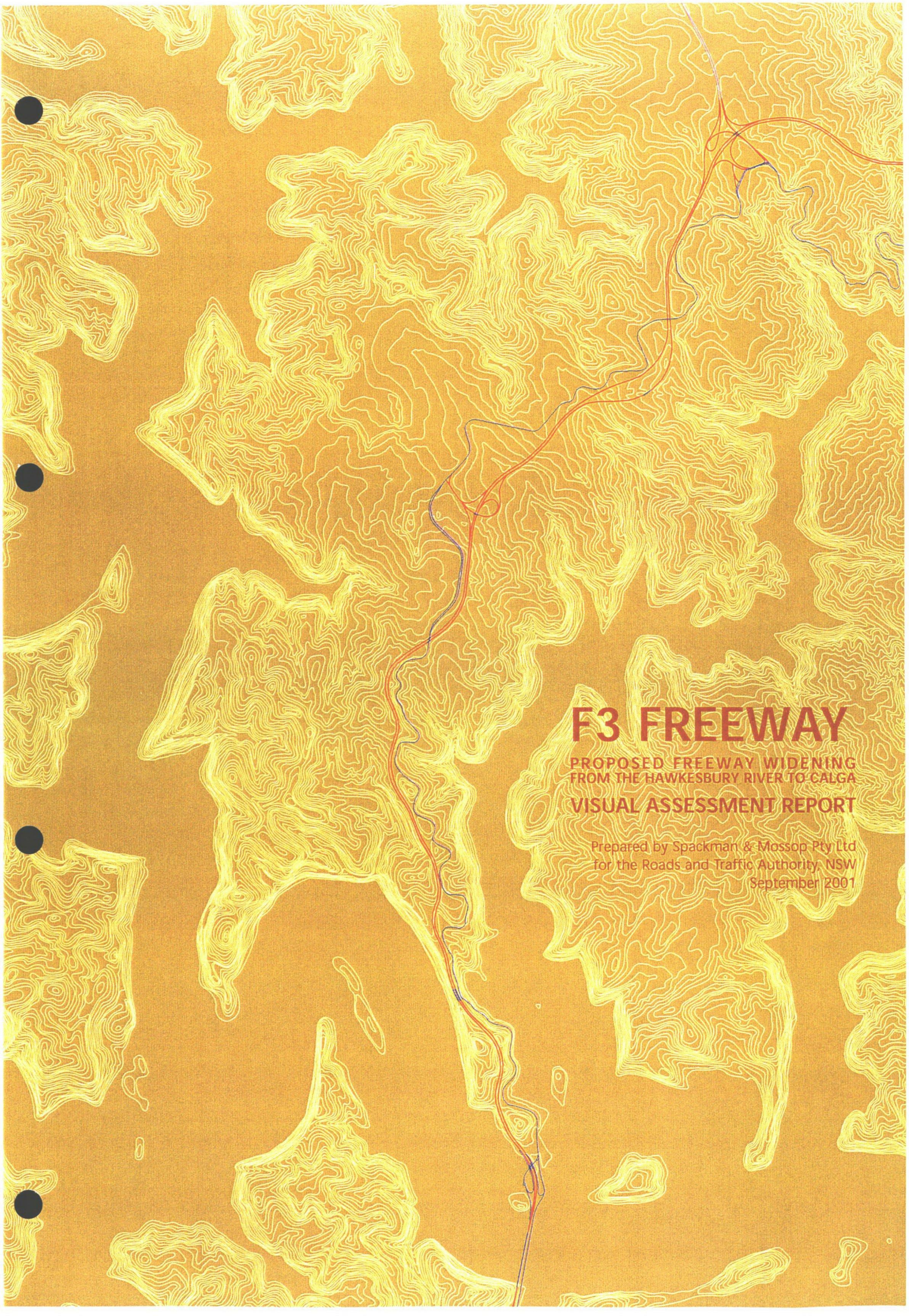
4004	Myrtaceae	Callistemon citrinus	2
4008	Myrtaceae	Callistemon linearis	1
8341	Dicksoniaceae	Calochlaena dubia	3
3469	Lauraceae	Cassytha pubescens	8
2341	Cyperaceae	Caustis flexuosa	4
2272	Cunoniaceae	Ceratopetalum gummiferum	7
4831	Poaceae	Chloris gayana	1
2345	Cyperaceae	Chorizandra sphaerocephala	2
3471	Lauraceae	Cinnamomum camphora	1
6283	Vitaceae	Cissus hypoglauca	1
6484	Verbenaceae	Clerodendrum tomentosum	1
5253	Polygalaceae	Comesperma ericinum	1
9976	Proteaceae	Conospermum ericifolium	2
5351	Proteaceae	Conospermum longifolium	9
Cony	Asteraceae	Conyza	1
1409	Asteraceae	Coreopsis lanceolata	1
5772	Rutaceae	Correa reflexa	1
Cory	Orchidaceae	Corybas	1
9743	Myrtaceae	Corymbia eximia	3
9687	Myrtaceae	Corymbia gummifera	18
9692	Myrtaceae	Corymbia maculata	2
8076	Cyatheaceae	Cyathea cooperi	1
2347	Cyperaceae	Cyathochaeta diandra	15
6540	Poaceae	Cynodon dactylon	2
3172	Goodeniaceae	Dampiera purpurea	4
3174	Goodeniaceae	Dampiera stricta	4
Dant	Poaceae	Danthonia	2
4028	Myrtaceae	Darwinia glaucophylla	2
4032	Myrtaceae	Darwinia procera	1
2827	Fabaceae	Daviesia ulicifolia	1
3540	Phormiaceae	Dianella caerulea	2
3542	Phormiaceae	Dianella revoluta	3
3543	Phormiaceae	Dianella tasmanica	5
Digi	Poaceae	Digitaria	2
2843	Fabaceae	Dillwynia floribunda	22
5911	Sapindaceae	Dodonaea triquetra	5
1019	Agavaceae	Doryanthes excelsa	9
2556	Droseraceae	Drosera auriculata	2
2557	Droseraceae	Drosera binata	1
5532	Restionaceae	Empodisma minus	3
4947	Poaceae	Entolasia stricta	25
2599	Epacridaceae	Epacris microphylla	5
Erag	Poaceae	Eragrostis	2
5776	Rutaceae	Eriostemon australasius	8
4097	Myrtaceae	Eucalyptus globoidea	3
4104	Myrtaceae	Eucalyptus haemastoma	12
4141	Myrtaceae	Eucalyptus oblonga	1
4156	Myrtaceae	Eucalyptus piperita	9
4165	Myrtaceae	Eucalyptus punctata	7
4182	Myrtaceae	Eucalyptus sieberi	1
4196	Myrtaceae	Eucalyptus umbra	6

2432	Cyperaceae	Gahnia clarkei	1
2442	Cyperaceae	Gahnia sieberiana	5
7138	Gleicheniaceae	Gleichenia dicarpa	7
7866	Euphorbiaceae	Glochidion ferdinandi	1
4466	Orchidaceae	Glossodia minor	2
2860	Fabaceae	Glycine clandestina	1
2865	Fabaceae	Gompholobium grandiflorum	17
2866	Fabaceae	Gompholobium latifolium	2
3243	Haloragaceae	Gonocarpus micranthus	1
3247	Haloragaceae	Gonocarpus tetragynus	1
3248	Haloragaceae	Gonocarpus teucrioides	9
6441	Proteaceae	Grevillea australis	1
5364	Proteaceae	Grevillea buxifolia	22
8992	Proteaceae	Grevillea diffusa	1
8994	Proteaceae	Grevillea diffusa ssp. filipendula	25
5399	Proteaceae	Grevillea sericea	7
10616	Restionaceae	Guringalia dimorpha	1
5409	Proteaceae	Hakea dactyloides	12
5421	Proteaceae	Hakea propinqua	3
5425	Proteaceae	Hakea sericea	4
5427	Proteaceae	Hakea teretifolia	22
2873	Fabaceae	Hardenbergia violacea	2
3376	Lamiaceae	Hemigenia purpurea	3
2526	Dilleniaceae	Hibbertia acicularis	14
2535	Dilleniaceae	Hibbertia empetrifolia	1
2539	Dilleniaceae	Hibbertia linearis	4
2540	Dilleniaceae	Hibbertia monogyna	6
2546	Dilleniaceae	Hibbertia rufa	2
2547	Dilleniaceae	Hibbertia saligna	7
7271	Dennstaedtiaceae	Histiopteris incisa	1
2875	Fabaceae	Hovea lanceolata	2
8788	Asteraceae	Hypochaeris radicata	3
5533	Restionaceae	Hypolaena fastigiata	1
7749	Dennstaedtiaceae	Hypolepis muelleri	3
8511	Poaceae	Imperata cylindrica var. major	2
5433	Proteaceae	Isopogon anemonifolius	12
6839	Proteaceae	Isopogon anethifolius	1
3340	Juncaceae	Juncus planifolius	3
2898	Fabaceae	Kennedia rubicunda	2
4204	Myrtaceae	Kunzea ambigua	5
4207	Myrtaceae	Kunzea capitata	14
5440	Proteaceae	Lambertia formosa	12
6139	Sterculiaceae	Lasiopetalum ferrugineum	6
3556	Anthericaceae	Laxmannia gracilis	2
8379	Cyperaceae	Lepidosperma elatius	3
6402	Cyperaceae	Lepidosperma laterale	13
2475	Cyperaceae	Lepidosperma urophorum	5
5534	Restionaceae	Leptocarpus tenax	1
4213	Myrtaceae	Leptospermum arachnoides	3
4221	Myrtaceae	Leptospermum juniperinum	1
7245	Myrtaceae	Leptospermum polygalifolium	8

8486	Myrtaceae	Leptospermum trinervium	23
5541	Restionaceae	Lepyrodia scariosa	12
Leuc	Epacridaceae	Leucopogon	1
2610	Epacridaceae	Leucopogon amplexicaulis	1
2616	Epacridaceae	Leucopogon ericoides	7
2629	Epacridaceae	Leucopogon microphyllus	12
4313	Oleaceae	Ligustrum sinense	1
6406	Lindsaeaceae	Lindsaea linearis	7
6401	Lindsaeaceae	Lindsaea microphylla	2
3588	Loganiaceae	Logania albiflora	2
6296	Lomandraceae	Lomandra brevis	4
6302	Lomandraceae	Lomandra filiformis	1
6304	Lomandraceae	Lomandra glauca	11
6308	Lomandraceae	Lomandra longifolia	9
8802	Lomandraceae	Lomandra multiflora ssp. multiflora	5
6312	Xanthorrhoeaceae	Lomandra obliqua	5
5445	Proteaceae	Lomatia silaifolia	5
4242	Myrtaceae	Lophostemon confertus	1
10641	Lycopodiaceae	Lycopodiella cernua	1
6409	Lycopodiaceae	Lycopodium deuterodensum	1
4254	Myrtaceae	Melaleuca hypericifolia	1
2646	Epacridaceae	Melichrus urceolatus	1
2736	Euphorbiaceae	Micrantheum ericoides	7
3595	Loganiaceae	Mitrasacme polymorpha	2
2649	Epacridaceae	Monotoca scoparia	5
5697	Rubiaceae	Opercularia aspera	3
1740	Bignoniaceae	Pandorea pandorana	1
5093	Poaceae	Paspalum urvillei	1
4643	Passifloraceae	Passiflora edulis	2
3303	Iridaceae	Patersonia sericea	12
5096	Poaceae	Pennisetum clandestinum	1
8414	Proteaceae	Persoonia isophylla	12
5460	Proteaceae	Persoonia lanceolata	10
5462	Proteaceae	Persoonia levis	11
5463	Proteaceae	Persoonia linearis	1
5479	Proteaceae	Petrophile pulchella	13
10577	Rutaceae	Philotheca buxifolia	3
5831	Rutaceae	Philotheca salsolifolia	1
8216	Euphorbiaceae	Phyllanthus hirtellus	12
2958	Fabaceae	Phyllota phylicoides	19
6058	Solanaceae	Physalis peruviana	1
6182	Thymelaeaceae	Pimelea linifolia	12
4661	Pinaceae	Pinus radiata	1
4685	Pittosporaceae	Pittosporum undulatum	2
4699	Plantaginaceae	Plantago lanceolata	1
1145	Apiaceae	Platysace linearifolia	21
7979	Rhamnaceae	Pomaderris intermedia	3
6403	Dennstaedtiaceae	Pteridium esculentum	11
8956	Cyperaceae	Ptilothrix deusta	7
2985	Fabaceae	Pultenaea daphnoides	6
2992	Fabaceae	Pultenaea ferruginea	12

2993	Fabaceae	Pultenaea flexilis	8
3005	Fabaceae	Pultenaea paleacea	6
3015	Fabaceae	Pultenaea rosmarinifolia	21
3023	Fabaceae	Pultenaea villosa	9
2759	Euphorbiaceae	Ricinocarpos pinifolius	2
3208	Goodeniaceae	Scaevola ramosissima	1
2491	Cyperaceae	Schoenus apogon	1
2492	Cyperaceae	Schoenus brevifolius	4
2495	Cyperaceae	Schoenus ericetorum	14
2500	Cyperaceae	Schoenus melanostachys	1
8187	Selaginellaceae	Selaginella uliginosa	1
3673	Malvaceae	Sida rhombifolia	1
6022	Smilacaceae	Smilax glyciphylla	5
2654	Epacridaceae	Sprengelia incarnata	2
8428	Menispermaceae	Stephania japonica var. discolor	1
6160	Stylidiaceae	Stylidium productum	1
2660	Epacridaceae	Styphelia triflora	3
6205	Tremandraceae	Tetratheca glandulosa	2
6212	Tremandraceae	Tetratheca shiressii	7
6214	Tremandraceae	Tetratheca thymifolia	3
5219	Poaceae	Themeda australis	2
3097	Fabaceae	Vicia sativa	1
3105	Fabaceae	Viminaria juncea	1
6272	Violaceae	Viola hederacea	1
2664	Epacridaceae	Woollsia pungens	19
8771	Xanthorrhoeaceae	Xanthorrhoea fulva	6
6318	Xanthorrhoeaceae	Xanthorrhoea macronema	1
9942	Xanthorrhoeaceae	Xanthorrhoea resinifera	19
1162	Apiaceae	Xanthosia pilosa	10
1163	Apiaceae	Xanthosia tridentata	10
5841	Rutaceae	Zieria laevigata	1

Appendix F
Visual Analysis



F3 FREEWAY

PROPOSED FREEWAY WIDENING FROM THE HAWKESBURY RIVER TO CALGA

VISUAL ASSESSMENT REPORT

Prepared by Spackman & Mossop Pty Ltd
for the Roads and Traffic Authority, NSW
September 2001

Contents

Introduction	1
Background	2
The locality	3
The existing situation	3
The study area	6
The visual character of the Freeway	7
The proposed works	10
Description	10
Visual effects of the proposed widening	10
Visual sensitivity	12
Visual impact	13
Mitigation measures	15
Design vision	15
Design principles	15
Conclusion	17

Introduction

This report has been prepared to document the visual assessment of the proposed widening of the F3 Freeway between the Hawkesbury River and Calga. It has been prepared by Spackman & Mossop for the Roads and Traffic Authority for inclusion in the Review of Environmental Factors (REF) for the Freeway Widening project.

The visual impact assessment identifies the potential visual impacts of the proposed works from the surrounding areas and on the motorists' experience of the Freeway. It also addresses the options to mitigate any impacts that are identified.

Study method

This study is based on the design concept developed for the F3 Sydney to Newcastle Freeway: Hawkesbury River to Calga Interchange Widening to Three Lanes Feasibility Study. The preparation for this report has involved:

- site investigations, including a bus trip with members of the RTA project team
- discussions with the RTA project team and consultants to identify the range of possible issues relating to the proposed works
- a review of relevant documents and literature relating to the site and the proposed works.

The visual impact assessment involves the analysis of the study area in terms of the visual quality of the Freeway and its setting, the range of surrounding landuses and the visual character and prominence of the proposed upgrade. Based on this analysis, any potential visual impacts are defined and any necessary impact mitigation measures are recommended.

Background

The F3 Sydney-Newcastle Freeway provides the principle road connection between Sydney and Newcastle. It is a road which traverses a landscape that has considerable natural and scenic values, with spectacular views to the Hawkesbury River, Popran National Park and Brisbane Water National Park. The Freeway also offers a dramatic driving experience through enormous sandstone cuttings, long bridges and high embankments.

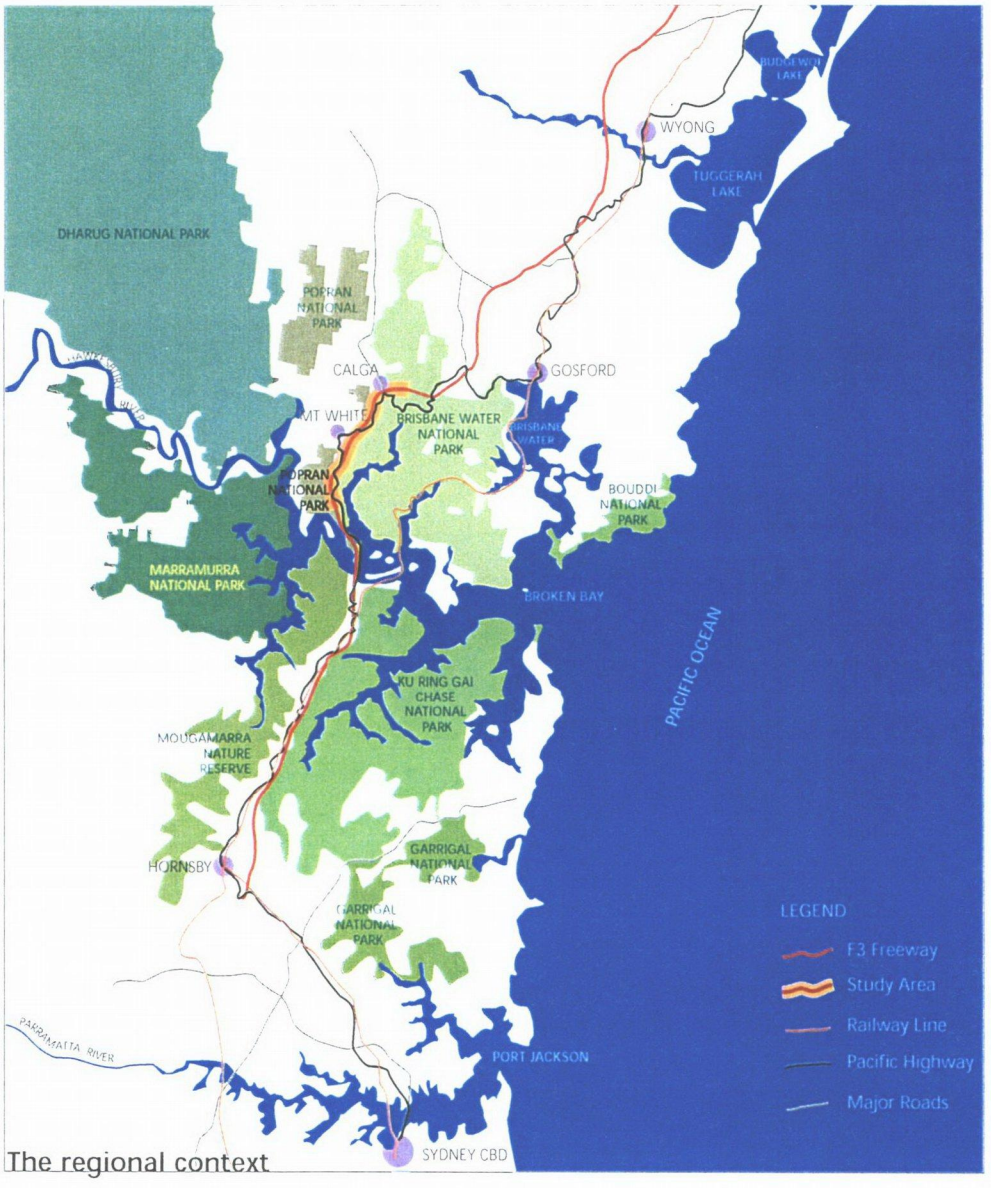
Since its completion, the Freeway has been recognised by government and professional institutions as a prime example of excellent road design, combining functional amenity with environmental sensitivity. The F3 Freeway received a Civic Design Award from the NSW Chapter of the Royal Australian Institute of Architects in 1969 for 'a work of outstanding environmental design'. It is also the only infrastructure project cited in the Urban Design Charter of NSW (2000) as an example of good urban design practice.

The rapid increase in development and consequent population growth in the Hunter Valley and Central Coast has placed increasing pressure on the transport systems in the region. One of the most significant regional transport issues is that more than 46,000 people travel outside the region to work, mainly commuting between Sydney and the Central Coast. This has placed considerable pressure on the capacity of the F3, particularly in the remaining two-lane carriageway sections. Consequently, the RTA has undertaken to increase the efficiency and safety of the Freeway by widening the two lane sections between the Hawkesbury River and Calga to three lanes. These works would be funded by the Commonwealth Government to a sum of $80M.

The existing situation

The locality

The study area is situated approximately 37km from the Sydney CBD, within the Gosford City Council Local Government Area. For much of the study area, the Freeway directly separates the environmentally sensitive areas of Popran National Park in the west from Brisbane Water National Park in the east. The other land uses in the area include undeveloped Crown Land and rural/residential development in the towns of Mount White and Calga. As the Freeway route was planned to bypass urban developments, the towns of Mount White and Calga do not have direct access to the Freeway.

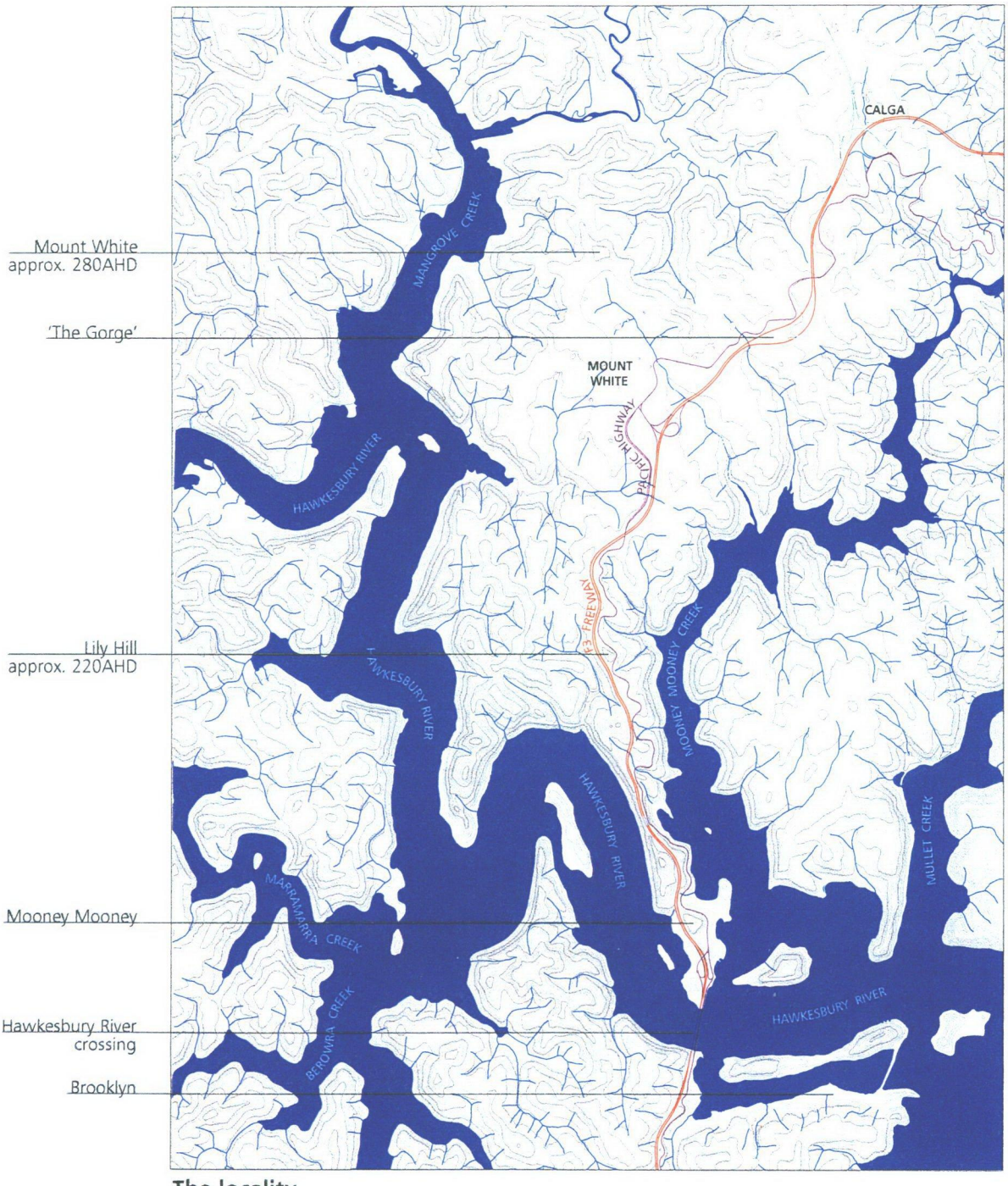


The regional context

North of the Hawkesbury River crossing, the F3 Freeway ascends the spectacularly rugged sandstone landscape of the Hawkesbury Valley, entering the Somersby Plateau at the southern end of the study site. The Somersby Plateau, an extension of the Hornsby Plateau north of the Hawkesbury River, is an undulating plateau of Hawkesbury Sandstone bounded by the Macdonald Ranges in the west and the Watagan Mountains in the east. Within the study area, the sandstone is intermittently interbedded with fine-grained siltstone and shale/mudstone. The topography of the study area consists of winding, narrow valleys and rolling hilltops of similar elevation; local high points include Lily Hill at approximately 220AHD and Mount White at approximately 280AHD.

Within the study area, the F3 Freeway generally traverses the ridge separating the Mooney Mooney Creek catchment in the east from the Mangrove Creek catchment in the west. Both creeks are tributaries of the Hawkesbury River, the main arm of which is located in the south and west of the study area. A number of small creeks dissect the area, flowing east through the environmentally sensitive areas of the Brisbane Water National Park into Mooney Mooney Creek and west through Popran National Park to the Hawkesbury River.

Vegetation within the study area consists almost entirely of undisturbed natural bushland within the National Parks and in conservation areas. Within the road corridor, native vegetation has been planted or has regenerated in disturbed areas along the pavement edges and has been planted in the medians. Native vegetation has also regenerated within 'The Gorge', north of the Mount White Heavy Vehicle Checking Station. Cleared agricultural and residential areas around the Mount White and Calga townships provide the only cultural landscape in the area.



The locality

The study area

The study area comprises the two-lane carriageway section of the F3 Freeway from 4.2km south of the Mount White Overbridge to 1km north of the Calga interchange, a distance of about 10.7km. The sections of Freeway adjoining the study site to the north and south consist of three-lane carriageways. Two grade separated interchanges are located within the study area at Mount White and Calga, and an RTA Heavy Vehicle Checking Station is located north of the Mount White interchange on the north-bound carriageway.



Aerial view of the Study Area

Due to topographical constraints, the horizontal alignment of the two carriageways is parallel for much of the study route. The median is of variable width along the study route, and consists of a combination of open grassed drainage areas, revegetated areas and raised sandstone areas left unexcavated during the original construction (the 'mohawk' cuttings). The one exception to this general arrangement occurs north of the RTA Heavy Vehicle Checking Station, where the two carriageways are substantially separated in plan. An abandoned Freeway cutting, known as 'The Gorge', is situated between the carriageways here and contains substantial regenerated native vegetation. The southbound carriageway spans The Gorge on a bridge structure.

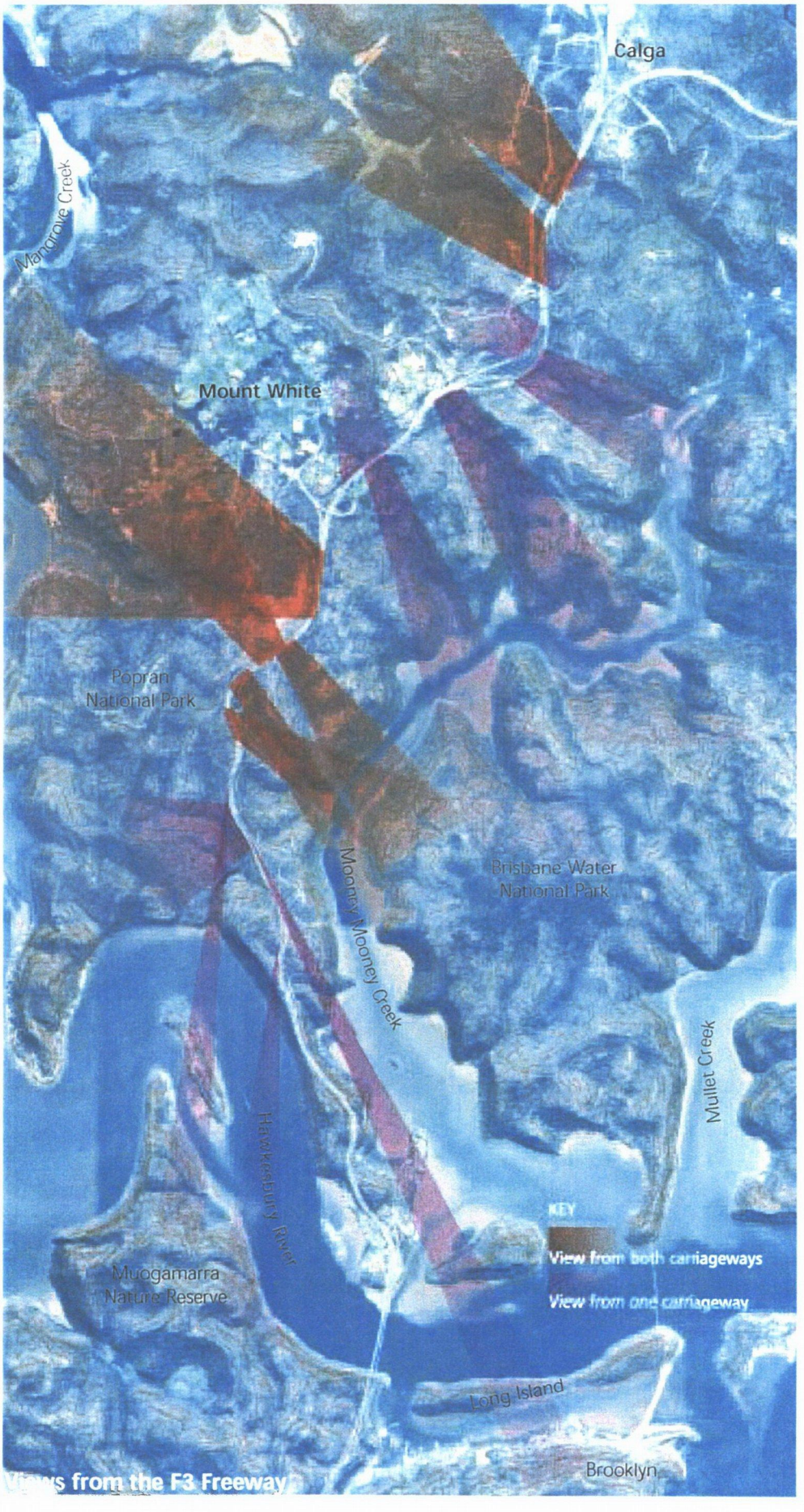
The visual character of the Freeway

The Freeway experience is not one of travelling through an ever-changing sequence of different landscapes, but rather a reiteration of a number of distinct landscape types as the Freeway moves through a series of cut and fill situations. For most of the study route, the Freeway directly adjoins areas of National Park and townships of Mount White and Calga are not perceptible from the Freeway; as such, views to the surrounding landscape consist solely of bushland. However, much of the Freeway traverses deep cuttings which isolate the motorist from the wider landscape. Consequently, the cuttings themselves provide a distinct and important visual experience.

Views to the surrounding National Parks are an important visual feature of the Freeway, and are characteristic of the exposed situations along the journey. Views east often extend beyond Mooney Mooney Creek to Brisbane Water National Park, while the views west encompass Popran National Park. Some of the westerly views extend over the Hawkesbury River to Dharug National Park and Marramarra National Park.



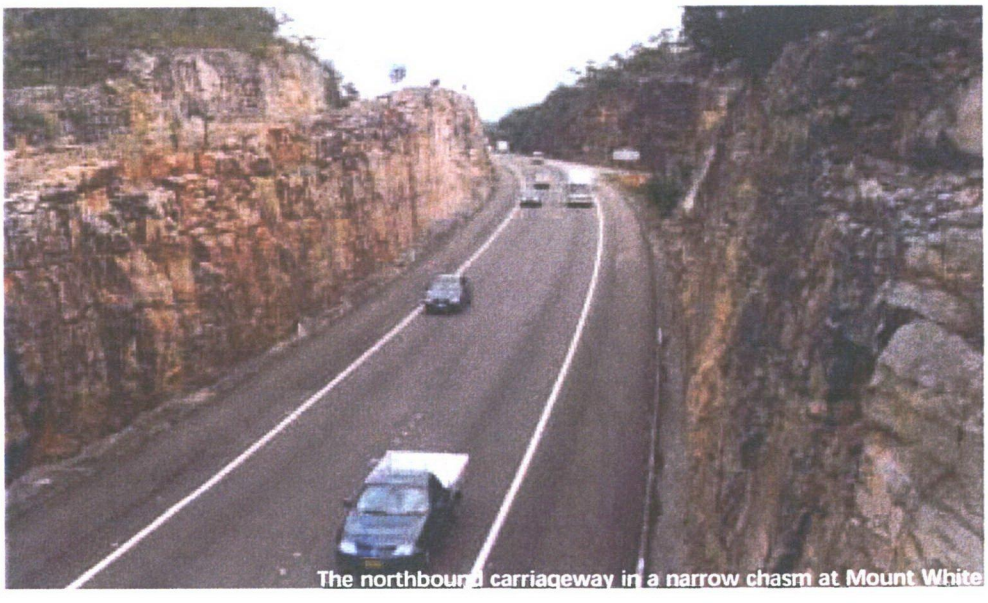
View to National Park from the Freeway



Views from the F3 Freeway

The most important visual feature within the Freeway corridor is the sandstone geology of the landscape. The dramatic visual effect of the sandstone is created by the sheer cuttings which enclose portions of the Freeway, and the sandstone 'mohawk' cuttings retained in the median. Important visual aspects of the sandstone cuttings are their form, their rough, faceted surface texture and the direct visual relationship between the base of cuttings and the road edge. The cuttings provide two visual conditions:

- Narrow chasm: where the median consists of a tall mohawk cutting. Consequently, each carriageway is enclosed by deep sandstone cuttings on either side and the opposite carriageway is not visible to the motorist.
- Wide chasm: the two carriageways are enclosed by deep cuttings at the outer shoulders; the median treatment—either a mohawk cutting or planting—does not completely obscure the presence of the other carriageway.



The northbound carriageway in a narrow chasm at Mount White

The visual separation of the two carriageways is also an important characteristic of this section of the Freeway. The independent grading of the carriageways has produced substantial vertical and horizontal separation in some areas. Even where the two carriageways are of similar elevation, minor but noticeable differences in the grading and substantial revegetation of the wide medians provides a visual impression of the carriageways as two separate roads.

The proposed works

Description

The primary objective of the project is to provide three, 3.5 metre wide, travelling lanes in both directions, with a design speed of 90 to 110 kilometres per hour. No realignment of the existing curves is proposed. In some areas, the provision of three lanes can be achieved by adjusting the line markings; however, for most of the site, construction of the third lane would require widening into the median. It is anticipated that the construction of the third lanes would require the provision of a work area in the median and existing inside lanes. This would be achieved by utilising the outside shoulders of the Freeway as temporary traffic lanes during construction. Modification of the bridges within the study area would generally be limited to raising the height of the railings to 1.4 metres above the pavement level. However, the central pier of the Mount White Overbridge may require stabilisation.

Visual effects of the proposed widening

Modification of the mohawk cuttings

Some of the mohawk cuttings in the medians would be affected by the road widening. In one instance, a low mohawk is likely to be completely removed; in other locations the mohawks would be narrowed and may consequently require stabilisation, including lowering the overall height of the sandstone.

Preliminary geotechnical investigations indicate that some of the mohawks are currently potentially hazardous and many would require some form of stabilisation, especially the one under the Mount White Overbridge. The condition of the mohawks varies enormously and is dependent upon a range of factors, including the stratigraphy, original method of excavation, aspect and drainage conditions of each individual cutting. Consequently, the method of stabilisation would be different for each cutting, but would probably require a combination of some or all of the following techniques:

- the treatment of erodible seams, such as shale beds. This would generally involve the removal of loose rock and shotcreting the seam;
- the treatment of unstable blocks of sandstone, which would generally be achieved by excavation or rockbolting.

Modification of the cutting-road interface

As traffic would be travelling directly adjacent to the rock batters in the cuttings during the construction period, the safety of the mountain drains and rock cuttings becomes an important issue. It is anticipated that some form of safety measures would need to be undertaken to ensure the safety of vehicles during the construction period, and to improve the safety of the 'crash zone' over the long term. Possible treatment options identified in the Mountain Drains and Related Issues Workshop Report (2001) include:

- shaving off the 'snag points' on the cuttings within the 'crash zone';
- filling in large depressions in the rock face with shotcrete;
- providing temporary protection of the cuttings/snag points with a physical barrier.

Modification of the medians due to road widening

Much of the road widening would involve the reclamation of part of the median to provide the extra lanes. While the medians would not be completely removed by the new lanes, in many cases the existing visual and physical separation of the carriageways would be reduced. The width of the mohawk cuttings would generally be reduced, and in some instances, the mohawk may be completely removed. Replanting of the median vegetation may also be required in most areas.

Increased sight distance requirements due to the higher traffic design speed

Due to the traffic speed increase from 90 kilometres per hour to 110 kilometres per hour over almost half of the study area, there would be increased sight distance requirements on the Freeway, especially within the medians. This would have implications for the space available for revegetation in the median, and may also require removal of the mohawks beyond what is required for the provision of the extra lanes.

Visual sensitivity

There are two types of viewers of the Freeway to be considered:

- motorists, who view the Freeway and the surrounding landscape from within the road corridor, and;
- people in the surrounding areas, including bushwalkers and rangers within the National Parks, people in the towns of Mount White and Calga, and people on the rivers.

Views of this section of the Freeway for people outside the road corridor are distant to very distant. Although viewers in the adjoining areas are likely to be sensitive to visual changes in this very scenic landscape, the distance and relatively small scale works proposed would render any changes difficult to perceive. As the proposed works would generally be confined to widening into the median, the changes would be mostly imperceptible to these viewers.

The type of motorists on the Freeway range from truck drivers to commuters, tourists and local residents. The high scenic value of the surrounding National Parks, which are often visible from the Freeway, suggests that the visual sensitivity of the motorists would be high. Additionally, the visual quality of the Freeway itself, especially with respect to the rock cuttings, is an important consideration.

The perceptibility of the motorists is also an important factor. Travelling at high speed, they are unlikely to perceive small details; however, long, horizontal elements, such as the mountain drains, barriers and rock cuttings create a strong visual impression. Additionally, the vehicle limits the motorists' field of vision. The motorists' primary field of vision is generally within the first five metres above the viewer; elements occurring above this primary visual zone would be less visible in extent and detail.

Visual impact

As the proposed works are generally limited to widening the road pavement to a maximum of 3.5 metres (but in most cases much less than this), the overall visual impression of the Freeway is unlikely to change. The Freeway would retain the same geometry, and the long regional views would remain, as would the enclosure afforded by the large outside cuttings.

The visual impacts of the proposed works can be categorised as either short term or long term. Short term visual impacts would include:

- the construction activities, which would be of finite duration;
- the initial colour of the freshly cut rock faces, which would either become darker with time or could be mitigated by 'pre-ageing' the colour of the cuts;
- the initial colour of any shotcrete, as the concrete is generally made brighter than the surrounding rock to allow it to weather with time;
- the introduction of rock bolts into the sandstone, which should be relatively imperceptible in the scale of the cuttings and the speed of passing traffic;
- the removal of vegetation from the medians, which would be replaced in most instances; and
- the use of temporary, or possibly permanent, crash barriers.

Long term visual impacts would include the wider carriageways, the narrower medians and any permanent crash barriers.

Given that the Freeway itself is to some degree visually subservient to the surrounding landscape, and that the core visual experience of the Freeway journey is of the natural environment, the visual impact of the proposed works in the context of the overall visual character of the Freeway is likely to be low.

The perceptible changes would be limited to the changes in the character of the median, and the relationship of the road edge to the base of the cuttings. As all of the proposed works are likely to utilise elements of road infrastructure that are currently used in other sections of the Freeway, these changes are extremely unlikely

to be perceptible to viewers other than the motorists, who constitute the vast majority of the potential viewers of the Freeway. Successful mitigation of the visual impacts of these changes would involve the careful integration of engineering and visual objectives in the design of the changes, rather than the installation of additional objects within the road corridor to hide the changes. As such, the visual impacts are considered to be low, due to the relatively small degree of alteration to the existing Freeway environment.

Mitigation measures

The most important mitigation measure would be procedural—the integration of the engineering objectives with urban and landscape objectives to produce a design outcome that has high visual quality. The design team includes engineers and urban designers to ensure that the operational and safety objectives of the Freeway widening are achieved using visually appropriate solutions. To this end, a Design Directions working paper is being prepared to set the basis for the integrated design process, with an aim to ensure that the proposed work maintains the high level of design quality and environmental sensitivity currently exhibited by the Freeway. The following design vision and design principles are the key recommendations of the Design Directions Paper.

Design vision

To provide a safe and efficient regional road that provides a motoring experience which maximises the spectacular natural and scenic qualities of its location.

Design principles

- To maintain as much sandstone in the medians as possible.
  - limit the trimming of the mohawk cuttings to the minimum necessary for the safe operation of the Freeway
- To maintain, as far as practicable, the existing character and surface texture of the rock cuttings.
  - provide physical barrier at the base of the cuttings in preference to smoothing out the problem areas
  - provide a rough, faceted surface to the modified rock cuttings, with appropriate safety barrier if necessary
- To ensure that the stabilisation works to the mohawk cuttings is visually unobtrusive. It is anticipated that the final treatment solution would differ for each cutting in order to achieve geotechnical and visual objectives, however, the following strategies are recommended:
  - investigate the possibility of using sculpted shotcrete in areas of high visibility
  - ensure that all shotcrete is colour matched to the surrounding sandstone in each location it is to be used

- ensure that the concrete colour is matched to the sandstone face before any rock removal occurs, in order to provide colours that approximate the final weathered appearance of the sandstone
- where large areas of rock are to be removed, investigate the possibility of treating the freshly exposed rock to provide an aged appearance to reduce the colour contrast with the adjoining faces.

• To maintain, as far as practicable, the current visual relationship between the base of the cuttings and the edge of the roadway.

- investigate possibility of alternatives to the use of the full height Type F as a physical barrier to the rock cuttings and the mountain drains. A more visually permeable alternative that meets the safety requirements would be ideal.

• To maintain the experience of driving through a natural bushland environment.

- maintain and protect of existing vegetation wherever possible
- revegetate using species of local provenance
- ensure that the built works are low-key and avoid big design statements

Conclusion

A key factor of the memorable experience of driving on the Freeway is that the Freeway itself does not compete with the natural environment for the attention of the motorists. The visual character of the surrounding bushland and the Freeway's sandstone cuttings are the primary visual experience of the journey through this area. As the scale of the proposed works is relatively small in comparison to the scale of the Freeway, the visual impact of the proposed widening is likely to be low. While the overall visual character of the Freeway journey is unlikely to be diminished by the widening, any potentially negative visual effects of the alterations would be mitigated by the integration of engineering and visual objectives in the design of the proposed works.

The design approach adopted for the proposed upgrade endeavours to maintain the high visual quality of the Freeway experience through a synthesis of engineering and urban design. This approach maintains the reputation of the F3 Freeway as an example of good design practice. The Urban Design Charter for New South Wales (2000) commends the F3 Freeway for demonstrating the incorporation of collaborative urban design in project planning and delivery, a consideration of natural systems and a response to local characteristics. It is these key considerations that inform the design approach for the proposed widening works.

Appendix G
Indigenous and Non-Indigenous Heritage Assessment

A Heritage Study of the impacts of the widening of the F3 Freeway from Jolls Bridge to Calga, including the locations of the proposed sedimentation basins, the utilisation of the median area and the impact of the project on known heritage sites.

Commissioned by the Environment Technology Branch of the RTA.

September 2001

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Table of Contents

Executive Summary 5

1. Details of Development Proposal and Consultancy Brief 8
    1.1 Development Proposal
    1.2 Consultancy Brief
    1.3 Impacts
        1.3.1 Previous impact to the area
        1.3.2 Recent Impacts

2. Aboriginal Consultation 9

3. Study area 10
    3.1 Location
    3.2 Environmental Observations

4. Indigenous Heritage Assessment 10
    4.1 Archival Searches
        4.1.1 Register of the National Estate
        4.1.2 Native Title Tribunal
        4.1.3 NPWS Site Register

5. Archaeological Context 11
    5.1 Predictive models for site type and distribution in the survey area
    5.2 Predicted Archaeological Landform Sensitivity

6. Field Survey Methods 13
    6.1 Pre-field Survey Investigations
        6.1.1 Archival Searches
    6.2 Pre-Field Survey Assessment
    6.3 Landscape Classification
    6.4 Survey Strategy
    6.5 Field Recording Methods
    6.6 Surface Visibility
    6.7 Field Survey Methods and Coverage Data
    6.8 Surface Exposure

6. Survey Results and Discussion 11
    6.1 General Discussion of Results
    6.2 Indigenous Heritage
    6.3 Non-indigenous Heritage

7. Indigenous Heritage Survey Results and Discussion 16
    7.1 Median Area of the Freeway
        7.1.1 The Mistake
    7.2 Sedimentation Basins
        7.2.1 Description of sedimentation basins in sensitive landform areas
        7.2.2 Results of Indigenous Heritage Assessment of the Sedimentation Basins.

    7.3 Work Compound Sites
        7.3.1 Work Compound Site WC1
        7.3.2 Work Compound Site WC2

7.4 Investigations of Indigenous Heritage Sites identified from NPWS AMG co-ordinates to be in the vicinity of the F3.
7.4.1 Archival Research
7.4.2 Field Assessment

8. Significance assessment of indigenous sites and PAD areas located during the survey 21
8.1 Criteria for Significance Assessment
8.2 Ranking Procedures used to assess scientific significance

9. Description and significance statements for sites identified in the survey 21
9.1 Site CC-GG-1
9.2 Site MW-E-1
9.3 Site MW-E-2
9.4 Site MW-E-3
9.5 Rockshelter with midden
9.6 Summary of Indigenous heritage results from all surveyed areas

10. Non-indigenous Heritage 29
10.1 Archival Searches
10.1.1 Australian Heritage Commission
10.1.2 State Heritage Register of the NSW
10.1.3 Register of the National Trust
10.1.4 Gosford City Council LEP Heritage Schedules
10.1.5 RTA S170 Heritage Schedules.

11. Results and Discussion of Non-indigenous Field Survey. 30
11.1 Median Area
11.2 Sedimentation Basins
11.3 Work Compounds
11.3.1 Work Compound WC1
11.3.2 Work Compound WC2
11.4 Investigation of exact locations of known non-indigenous heritage sites in the vicinity of the F3 works
11.4.1 George Peats Inn and Lone Grave of Frances Peat
11.4.2 Mount White Cemetery

12. Site Management Recommendations for both indigenous and non-indigenous heritage sites identified by the survey 33

13. Legal Requirements and Obligations 35

References

Appendices

1. Maps

Map 1: Location of F3 Road Widening Program
Map 2: Location of work compound WC1 and sedimentation basins
Map 3: Location of sedimentation basin SB1B
Map 4: Location of sedimentation basins SB1S, SB2B, SB2S, SB3S, SB4S, SB5S, SB7S
Map 5: Location of sedimentation basin SB7S, SB8S, SB9S, SB3B, SB4B, SB5B, SB10S, SB11S
Map 6: SB11S, SB12S, SB13S, SB14S, SB6B
Map 7: SB15S, SB7B, SB8B, SB16S, SB17S
Map 8: SB18S, Work compound WC2
Map 9: SB9B, SB10B, SB11B and "The Gorge"
Map 10: SB12B, SB14B
Map 11: SB13B, SB19S, SB20S, SB15B
Map 12: SB16B
Map 13: Cross section of Hawkesbury soil landscape illustrating the occurrence and relationship of the dominant soil types.
Map 14: Native Title Boundary Map
Map 15: Calga Aboriginal Place
Map 16: Crown Reserve No 65572
Map 17: Boundary of RTA Land and Reserve No.65572
Map 18: Location of George Peat's Inn and the lone Grave of Frances Peat.
Map 19: Location of Mount White Cemetery.
Map 20: Location of Mount White Cemetery.
Map 21: Location of Mount White Cemetery.

2. Tables

Table 1: AHC Registered Sites in the Gosford LGA.
Table 2: Total numbers and percentages of indigenous site types in the Gosford LGA
Table 3: Surface Visibility Criteria
Table 4: Sedimentation Basins Coverage Data
Table 5: Work Camp Locations Coverage and landform Data
Table 6: Crown Reserve Coverage and landform Data
Table 7: Effective Coverage for surveyed area
Table 8: Data relating to Sites identified from NPWS Site Register located immediately adjacent to the F3 easement.
Table 9: Shell data from Site MW-RS-1
Table 10: Summary of Indigenous heritage results

3. Sketches

Sketch 1: SB4B
Sketch 2: SB10S
Sketch 3: SB12S
Sketch 4: SB13S
Sketch 5: SB6B
Sketch 6: SB17S
Sketch 7: SB10B, SB11B
Sketch 8: Location of Site CC-GG-1
Sketch 9: Site CC-GG-1

Sketch 10: Approximate locations of Sites MW0E-1, MW-E-2, MW-E-3
Sketch 11: MW-E-1
Sketch 12: MW-E-2
Sketch 13: Location of items at Site MW-E-3
Sketch 14: MW-E-3
Sketch 15: MW-E-3
Sketch 16: Location of Site MW-RS-1
Sketch 17: Plan and Cross section drawings of MW-RS-1
Sketch 18: Sedimentation Basin SB3B

4. Photographs

Photo 1: Impact to tops of cuttings in the median area
Photo 2: Impacts to crests of cuttings in the median area
Photo 3: Outcrops of sandstone in archaeologically sensitive landform areas
Photo 4: Outcrops of sandstone in archaeologically sensitive landform areas
Photo 5: Example of vegetation cover where visibility was less than 5%
Photo 6: Example of vegetation cover where visibility was less than 5%
Photo 7: Looking east from Pacific Highway bridge over Calverts Creek
Photo 8: Grinding Grooves location
Photo 9: Examples of griding grooves at the site
Photo 10: Examples of Grinding Grooves at the site
Photo 11: Site MW-E-1
Photo 12: Site MW-E-1
Photo 13: Site MW-E-2
Photo 14: MW-E-3
Photo 15: MW-E-3
Photo 16: Location of MW-RS-1
Photo 17: Shelter MW-RS-1
Photo 18: Sample of midden material at site MW-RS-1
Photo 19: Location of SB3B
Photo 20: Memorial Cross at SB3B

5. Correspondence and statement from the Darkinjung LALC.
6. Gazetteer of previously recorded sites
7. Non-indigenous Heritage Records from Heritage Registers.
8. Native Title Records
9. NPWS Site Cards for sites MW-GG-1, MW-E-1, MW-E-2, MW-E-3, MW-RS-1

Executive Summary

The NSW Roads and Traffic Authority (RTA) proposes to widen the F3 Freeway between Jolls Bridge and Calga Interchange from 2 lanes to three lanes on both the northbound and southbound carriageways. The RTA commissioned Robynne Mills, Archaeological and Heritage Services, to conduct a heritage assessment of the F3 from Jolls Bridge to Calga where there would be impacts from the proposed widening program. Impacts would result from the following proposed activities.

The utilising of the current F3 median strip from Jolls Bridge to Calga, including the area known as the Mistake

Construction of two work compounds, one at Mooney Mooney south of the Ambulance Station and the second in the median south of the "The Gorge" and opposite the Heavy Vehicle Checking Station at Mount White.

The installation of 35 sedimentation basins and their related access tracks.

The RTA also requested that the exact locations of indigenous and non-indigenous heritage items identified in a desktop audit conducted for the F3 by Mills 2000 be identified by field inspection.

All proposed works are within the Darkinjung Local Aboriginal Land Council (LALC) area. The survey was carried out over four days in August and September 2001 by the consultant and two representatives of the Darkinjung LALC. A report from the LALC is included as Appendix 5.

This report provides details of local environmental observations relevant to the archaeological sensitivity of the study area. It identifies all known indigenous and non-indigenous heritage sites in the vicinity of the F3 widening, as recorded in the site registers of the Australian Heritage Commission the NSW National Parks and Wildlife Service (NPWS), NSW Heritage Office, National Trust and the LEP Heritage Schedules of Gosford City Council.

Survey methods and significance assessments are in accordance with NPWS and Heritage Office guidelines. Where appropriate, the report recommends site management options to minimise impact on areas of heritage sensitivity and items within the study area.

Results of the heritage assessment of the Median Strip.
No indigenous or non-indigenous heritage sites were identified in the full survey of the median strip from Jolls Bridge to Calga. This assessment included the tops of all cuttings.

Results of the heritage assessment of the Work Compounds
No indigenous or non-indigenous heritage sites or areas of potential archaeological sensitivity were identified in the survey of the two work compounds (WC1, WC2) at Mooney Mooney and in the median area south of "The Gorge" at Mount White. The proposed work compound would not impact upon the two identified non-indigenous heritage sites (George Peats Inn and Frances Peats Grave) at Mooney Mooney Reserve.

Results of the heritage assessment of the 35 Sedimentation basin sites.
No non-indigenous sites were identified in the survey. However a memorial "cross" was identified within the boundaries of sedimentation basin No SB3B. The cross was located approximately 16m east of the F3 Freeway and 26m south of the Pacific Highway. This memorial is of recent origin and there does not appear to be an associated burial. However it is recommended that additional investigation be conducted to ensure that this conclusion is in fact the case.

No indigenous sites were identified in areas proposed as sedimentation basin sites.

Nine sedimentation basins are located in archaeologically sensitive areas. These sedimentation basins include: SB4B, SB10S, SB12S, SB13S, SB6B, SB17S, SB10B, SB11B and SB13B. In all cases, this sensitivity relates to the fact that exposed sandstone outcrops are present in the area and they could not be adequately assessed during the survey because of the density of the vegetation. It is recommended that hand clearing be undertaken at all sedimentation basin sites in sensitive areas so that an adequate examination of the impact from the proposed sedimentation basins can be identified. In three cases, relocation of the sedimentation basins to adjacent low sensitivity areas has been recommended (SB4B, SB10S and SB17S). If the sites are relocated then an assessment of the new locations should be undertaken.

Results of verification of the location of sites in the immediate vicinity of the F3 Freeway identified in a database search by Mills 2000.

The RTA identified eight sites for which exact locations were required. These sites included:

The Calga Aboriginal Place registered on the National Estate Register maintained by the Australian Heritage Commission.

NPWS Sites #45-3-0157, #45-3-0158, #45-3-0631, #45-3-0150, #45-3-0151, #45-3-0369

George Peats Inn and Frances Peats Lone Grave listed on the Gosford LEP Heritage Schedules. These sites are in the same location.

Prior to the field assessment, site cards and recording details were obtained from NPWS, Australian Heritage Commission and Gosford City Council. This was followed by a field assessment by the consultant and representatives of the Darkinjung LALC.

The location of the site of George Peat's Inn and the lone Grave of Frances Peat have been determined by reference to Gosford City Council Development Application Plans and historical searches by the Gosford City Local Studies Librarian, Geoff Potter. These items can now be accurately plotted and protected from any future works on the F3. It has been determined that neither item would be impacted by the proposed F3 work.

Geoff Potter also identified the location of Mount White Cemetery and stated that although the item was not listed on the Gosford LEP Schedules, it is of historical interest. The cemetery was used for the burial of inmates of the Peat Island Mental Institution. Maps supplied to the consultant by Mr Potter indicate that the cemetery may be under the northbound carriageway of the Pacific Highway. RTA should be aware of this potential heritage constraint on any future works on the Pacific Highway in this area.

The following facts have been determined by reference to the site cards and discussions with the NPWS Site Registrar.

- NPWS Sites #45-3-0150 (rock engraving and axe grinding grooves) and Site #45-3-0151 (Rock engraving) were destroyed by the construction of the Freeway.
- NPWS Site #45-3-0369 (a rock shelter with deposit) was incorrectly plotted on the computer generated maps prepared from NPWS database records. This site was located south of the Hawkesbury River and was salvaged prior to the installation of the Eastern Gas Pipeline.
- NPWS Sites #45-3-0157 and #45-3-0158 are located on the western side of the Pacific Highway approximately 500m north from Ashbrookes Road, Mount White. These sites are included in the Designated Aboriginal Reserve No R63201/2. These sites are in excess of 800m from the F3 Freeway and would not be affected by the road-widening program.
- NPWS Site #45-3-0631 appears from both the location and site description to refer to NPWS site $45-3-0157.
- Registered Aboriginal Place at Calga is within Popran National Park and 3km west of the F3 Freeway.

During the search to locate NPWS Sites #45-3-0157 and #45-3-0158, discussions were held with Mr Graham Bliim, the landowner of the property on which these sites are located. Mr Bliim took the consultant and Darkinjung LALC representatives to site #45-3-0157 and indicated that he was aware of the location of site #45-3-0158 and other sites on his property which he would willingly show to the LALC representatives at a later date when he had time available. He was also aware of the locations of unrecorded sites in the land to the east of the Pacific Highway (ie between the Highway and the F3) which he thought was owned by the RTA.

The consultant and LALC representatives conducted a limited survey of the area indicated by Mr Bliim and during this assessment five sites were recorded. These sites included three engraving sites referenced as MW-E-1, MW-E-2, MW-E-3 (one with grinding grooves), one rock shelter with midden material (MW-RS-1) and one large grinding groove site on Calverts Creek (CC-GG-1) which had in excess of 80 grooves. All sites were recorded and NPWS Site cards prepared.

Subsequent investigations at the RTA Properties Division in Newcastle, Maitland Land Titles Office and DLWC revealed that the Land on which the sites are located is Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora. The land is currently under the control of NPWS. RTA Land abuts the northern end of the Reserve.

This survey concludes that there is no archaeological reason why the proposed F3 widening program should not proceed as planned, providing the recommendations set out in Section 12 of this report are implemented by the RTA (in conjunction with any additional requirements imposed by NPWS).

1. Details of the Development Proposal and Consultancy Brief.

1.1 Development Proposal

The Roads and Traffic Authority (RTA) is proposing to widen the F3 to three lanes from Jolls Bridge to Calga (Map 1). Works associated with this widening include:

- Impact to the median strip from Jolls Bridge to Calga including the area known as "The Gorge"
- The establishment of two works compounds, one at the south of the Ambulance Station on the northern side of the Hawkesbury River and another within the median to the south of "The Gorge".
- The construction of thirty-five (35) sedimentation basins. Of these twenty (20) are small, covering an area approximately 50m x 20m and located immediately adjacent to the F3 carriageway. Fifteen (15) are large, covering an area approximately 200m x 100m and located at varying distances from the carriageway. Of these sedimentation basins, 16 are located adjacent to the northbound carriageway, 6 within the median strip and 13 on the southbound carriageway between Jolls Bridge and Calga (Maps 2-12).

1.2 Consultancy Brief

Indigenous Heritage:

RTA required the assessment of indigenous heritage to include:

- A review of archaeological literature applicable to the area
- A field survey to identify sites which may be impacted by the widening proposal including the investigation of:
    - the median strip (Jolls Bridge to Calga),
    - all sedimentation basin locations
    - two proposed works compounds
    - the verification of exact locations of known sites identified in a desktop assessment of the NPWS Site Register for the F3 by Mills 2000. These sites included: The Aboriginal Place at Calga and 6 NPWS Registered sites (#45-3-0157, 0158, 0631, 0150, 0151, 0369)
- A written report summarising findings of the above, the significance value of sites and recommendations in relation to preservation. This report should generally satisfy the requirements of National Parks and Wildlife Service (NPWS) and Darkinjung LALC. The report shall include measures to mitigate actual and potential direct and indirect impacts if necessary and assess the likely effectiveness of these measures.
- Consultation with the Darkinjung LALC throughout the study
- Recommendations for approvals and licences as required.

Non-indigenous Heritage

RTA required the assessment of non-indigenous heritage to include

- Investigation of the locations of all known sites in the vicinity of the F3 Freeway to ensure that there is no impact to these items from the proposed works. Known sites include the remains of George Peat's Inn and the burial site of Frances Peat at Mooney Mooney.
- An update of the heritage registers of the Australian Heritage Commission, State Heritage Council, National Trust and Gosford City Council should be undertaken.
- A full survey of the impact areas and recording of all heritage items identified in the survey.
- Where relics are identified a preliminary statement of significance to be prepared
- Measures to mitigate actual and potential direct and indirect impacts if necessary and assess the likely effectiveness of these measures.
- The preparation of a written report which conforms to Heritage Office Guidelines

1.3 Impacts

1.3.1 Previous impacts to the proposed road widening areas.

Initial F3 construction has had major impacts upon the proposed road widening areas. These impacts include:

- The entire median strip has been impacted by road construction. A major drainage system has been installed along much of the median strip area excluding the cutting area. Works associated with these drainage systems have destroyed the integrity of the entire median area from Jolls Bridge to Calga. The tops of all cuttings in this section of the F3 have been stripped of their original surface (Photos 1, 2). The area referred to as "The Gorge" has been heavily impacted along the shoulders of the F3 (approximately 20m) for its entire distance. The northern section has been severely damaged by road construction. The remaining central area has suffered minimal disturbance.
- The "shoulder" and the road and the easement from the road edge to the edge of the easement as identified by the boundary fence has been heavily impacted by the construction of the Freeway. In many cases the roadway is constructed on artificial embankment.

1.3.2 Impacts from the installation of existing sedimentation basins.

A series of drainage pipes, drains and traps have been installed adjacent to the existing Freeway in most areas where additional sedimentation basins are proposed. This existing drainage system consists of large concrete "traps" which collect water from the roadway and water channelled from the drainage system within the median strip. The water from the "trap" is directed away from the roadway down the hill slopes in open drains lined with concrete or cut into existing sandstone bedrock. It is anticipated that these drains would be utilised to direct water into the proposed sedimentation basins.

2. Aboriginal Consultation

The survey area is located within the area administered by the Darkinjung (LALC). The LALC was consulted prior to the survey. This consultation involved supplying the LALC with maps of the proposed project for their consideration. The consultant requested that details of the proposal be discussed by the local Aboriginal Community and the consultant informed of any issues or concerns they wished to raise with regard to the proposed development. The Aboriginal Community did not identify any issues of concern (Appendix 5).

LALC participated in the field survey and at the conclusion of the survey details of survey results and recommendations were discussed. A summary of these recommendations was drafted for consideration by the LALC. The LALC was advised that it would be provided with a copy of the final report and was requested to provide a written Statement of Involvement in the survey.

3. Study Area.

3.1 Location

The F3 widening program extends from Jolls Bridge to the Calga Interchange, a distance of approximately 10 km in each direction, an overall distance of approximately 20km (Map 1).

3.2 Environmental Observations.

The area in which the works are located is broadly defined as the Hornsby Plateau.
The major geological formation of the Hornsby plateau is described as Hawkesbury (ha) (Chapman and Murphy 1989). This geological formation is characterised by steep, rolling to very steep hills on Hawkesbury sandstone.

Hawkesbury sandstone consists of medium to coarse-grained quartz sandstone with minor shale and laminite cross-bedded sheet faces with vertical or sub-vertical joint sets. The combination of bedding planes and widely spaced joints gives the sandstone outcrops a distinctive blocky appearance. Local relief varies from 40m to 200m and slope gradients from 25% to 70%. Crests and ridges are convex and narrow. Slopes are moderately inclined to precipitous. Rock outcrops occur as horizontal benches and broken scarps up to 10m high. Boulders and cobbles cover up to 50% of the ground surface. Valleys are narrow and incised (Map 13).

The area adjacent to the F3 is mostly uncleared and the vegetation consists of low, open woodland with stringy barks, scribbly gum, banksia and black she-oaks. The understorey is dominated by scrub species of the families Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Many of the cutting crests have been seeded with native shrubs and small tree species to inhibit erosion.

The Hawkesbury sandstone area is mostly dedicated National Park including the Poporan and Brisbane Water National Parks. The F3 Freeway route passes through several small areas of Lucas Heights (lh), Oxford Falls (of) and Gymea (gy) landscapes (Chapman and Murphy 1989 p:44-46)

4. Indigenous Heritage.

Register searches were conducted of the Australian Heritage Commission, Native Title Tribunal and the National Parks and Wildlife Service.

4.1 Archival Searches

4.1.1 Register of the National Estate at the Australian Heritage Commission

There are four Registered Indigenous Places in the Gosford Local Government. Restricted details of these "Places" are set out in Table 1. None of these sites is within the vicinity of the proposed F3 works.

Table 1: AHC Registered Sites in the Gosford LGA.

"Place Name"	Registration No	Limited Details
Calga indigenous Place	007690	Listed on NPWS as Site No 45-3-1114
Kariong Indigenous Place	015904	Recorded by Sims 1968
Somersby Indigenous Place	015906	Recorded by McCarthy

No maps have been supplied for these sites and details can be obtained from the NPWS or the Darkinjung LALC. None of these sites is in the vicinity of the proposed widening.

4.1.2 Native Title Tribunal

A search of the Native Title Tribunal identified two claims in the Gosford Shire Council area. Claim NC95/13 applies to Norah Head and is therefore outside the current development area.

Claim NC/98/8 (Map 14, Appendix 8) was lodged by Stephen Seiver and Evelyn Chatterton. The claimants describe themselves as the "Boongarri Clan of the Darkinjung Country People". The claim applies to "Darkinjung Country" and covers the area bounded by the North Head of Port Jackson on the south to the Hunter River and about 96 km inland from the coast. This includes Lake Macquarie (Awaba), Hawkesbury River, Broken Bay, Mount Yango (to the west) etc. This claim covers land within the proposed F3 widening works.

Claimants request that the native title rights and interests be recognised and protected by all parties and that the descendants in Darkinjung country be involved in its management and protection.

4.1.3 NPWS Site Register

A search of the National Parks and Wildlife Service (NPWS) register identified 118 sites.

Table 2: Total numbers and percentages of indigenous site types in the Gosford LGAs

Site Type	Total number of Sites of this type	% of total sites
Rock Engravings	55	46.6%
Axe Grinding Grooves	40	33.98%
Shelter with Deposit	2	1.69%
Shelter with Art	11	9.32%
Shelter with Midden	2	1.69%
Midden	4	3.38%
Scarred Trees	3	2.54%
Stone Arrangement	1	0.84%
Total Sites	**118**	**100%**

5. Archaeological Context

Sites identified in the Gosford Ourimbah site register search are representative of the suite of site types which are generally associated with Hawkesbury sandstone and to a lesser degree Narrabeen sandstone geological areas. The specific attributes of Hawkesbury sandstone geomorphological environments were utilised by Aboriginal people in the following ways. Sandstone overhangs and shallow caves provided shelter. The walls of these shelters were often decorated with paintings and engravings. The ridge lines provided good, level access for movement of people between the sea and inland areas. The sandstone outcrops were in some cases associated with Dreamtime stories and/or ceremonial activities and were often identified by stone arrangement sites. Axes were sharpened for hunting on outcrops of sandstone near water or water holes and this activity resulted in the creation of "grinding grooves" in the soft sandstone. Many rock engravings decorate flat, sandstone outcrops.

Large numbers of "sandstone sites" have been recorded in sandstone regions to the North of Port Jackson. Much of the early recording of sites, particularly of art sites by people such as Campbell, McCarthy and Sim, and more recently Taplin, Bluff and Guider was undertaken on a site by site basis and tends to highlight sites representative of the particular interests of the individual recorders. Site information gathered in this way is limited in scientific value. It can be used to identify the range of sites in a particular region and thereby give an indication of site types which consistently occur in particular landform units. However, only data from a relatively large surveyed area can provide a data

base on which meaningful statements about the distribution of sites across an area can be made (Koettig 1988).

Intensive surveys of the Sydney Basin and Hawkesbury River areas have been undertaken by Vinnicombe (1980), Attenbrow (1981, 1987, 1994), Lough (1981), McDonald (1988) and McDonald and Smith (1984). These archaeological studies and sub-surface excavations provide a basis for meaningful statements about the distribution of sites across the study area. Koettig conducted a heritage study of the Ku-ring-gai Chase National Park, Municipality of Ku-ring-gai (1988) and the Hornsby Shire (1989).

McDonald's (1985, 1988 and 1990) studies of the Sydney Basin contain an extensive range of information about rock engravings and shelter art sites in the study area.

Work undertaken by Vinnicombe (1980, 1984) involved a series of intensive, systematic field assessments of three ecologically different areas (Brisbane Water, Bouddi Peninsula, lower and upper Mangrove Creek). Vinnicombe recorded 243 sites of which 126 were rock shelters. Sixty-six of these shelters contained art. The remainder of the sites included 55 axe grinding sites, 12 rock engraving sites and 50 open camp sites. Vinnicombe made the following observations: water in streams was not a critical factor in site location; the rarity of open sites is explained to some degree by the fact that they are no longer visible in aggrading areas. There was a preference for shelters facing in a northerly or north-westerly direction. The majority of rock shelters were on steep valley slopes in Hawkesbury Sandstone areas. Shelters occur to a lesser extent in Narrabeen Sandstone areas. Rock shelter habitation sites are more likely to occur near the valley floor while art sites, which can occur anywhere on the slope, tend to be in the larger shelters immediately below the ridge tops/plateau. The majority of rock engravings are located on Hawkesbury sandstone ridges and plateaus (Grinsberg 1995 p14-15). Grinding grooves were mainly associated with exposures of Hawkesbury sandstone and occur in creek beds at the heads of gullies, especially on the tops of waterfalls, around rock pools, on ridge tops and on rock platforms near seepage areas.

Vinnicombe (1980) documented a very wide range of plant and animal resources (marine and terrestrial) which were used by Aboriginal people of the region. These include kangaroo, wallaby, possum, bandicoot, koalas, echidnas, wombats, fruit bats, snakes, lizards, insects, emu, duck, pigeons, brush turkey, lyre birds, fish, eels, crayfish, shellfish, yams, bulbs, tubers and roots of various plants, berries, fruits and seeds, honey and nectar from flowers.

Attenbrow (1994) carried out an analysis of the NPWS data base for sandstone plateau sites in the Sydney Region. As a result of this study Attenbrow distinguished between Aboriginal sites and archaeological traits. Attenbrow defined 10 archaeological traits which occurred in the study area. These traits included rock shelters with archaeological deposit (including shell middens); rock shelters with images; rock engravings; stone arrangements; axe grinding grooves; abraded grooves (channels); water holes; open camp sites; open shell middens; bora/ceremonial sites; carved trees; stone quarries; burials; other.

A recent study of the Somersby Industrial area to the north-east of the study area has been undertaken by the Australian Museum (report in preparation). Discussions with LALC indicated that several grinding groove and engraving sites had been recorded within the proposed industrial area.

5.1 Predictive Models for site type and distribution in the survey area.

From the maps provided by RTA, it appears that the median strip has been heavily impacted during the construction of the F3 and that all central cuttings have been lowered by the removal of the sandstone tops of the cuttings. Therefore it is considered unlikely that any sites would be located in the median strip, with the exception of "The Gorge" where there appear to be areas of relatively undisturbed ground. Also the location of the small sedimentation basins immediately adjacent to the

carriageways would imply that these areas had also been heavily disturbed during Freeway construction. The sites of the larger sedimentation basins appear to be in less disturbed locations.

However if sites are to be located, previous studies described above would indicate that the site types most likely to occur in these topographic areas would be:

- rock shelters in areas with sandstone overhangs
- rock engraving sites, wells/ water holes and axe grinding grooves on exposed sandstone outcrops
- stone arrangements on the tops of ridge line areas
- scarred tree sites in areas of old growth timber

5.2 Predicted Archaeological Sensitivity

Based on an assessment of site types and distribution patterns in the immediate area and the identification of landscape units present within the proposed development area, it is predicted that the most archaeologically sensitive micro-landform units in the study area would be associated with sandstone outcrop areas where previous impact has been minimal and creeklines.

6. Field Survey Methods

6.1 Pre-field Survey Investigation

Initial investigations carried out prior to the field survey included site and archival searches of the NPWS site data base, and the Register of the National Estate, Canberra and consultation with representatives of the Darkinjung LALC.

61.1 Archival searches

There were no Aboriginal sites listed on the Register of the National Estate or the NPWS database within the proposed cutting stabilisation area.

6.2 Pre-Field Survey Assessment

Prior to the commencement of the field survey, a desktop study of landform and archaeological land systems in the survey area was conducted. As a result of this assessment, a site prediction model was developed (Section 4.4) in conjunction with a strategy for survey area coverage (Section 5.4).

6.3 Landscape Classification

There are two micro-landform units within the proposed cutting stabilisation area. These include approximately 1220m x 15m of steep hill slope area and 6803m x 15m of ridge crest and hill top areas. Archaeological land systems correspond to these landform units.

6.4 Field Survey Strategy

A 'total coverage' survey strategy was adopted for the proposed development area. This involved three on-foot transects, approximately 5m wide at the proposed works sites.

6.5 Field Recording Methods

The field survey was conducted using the Gundermann 1:25,000 topographic map sheet and maps supplied by the RTA. Where sites were present, site details, landform and environmental conditions relating to the detectability of sites were recorded on data sheets developed for the survey. Where appropriate, copies of site/artefact recording forms are provided and copies of NPWS site forms with relevant field notes attached. Photographs were taken of all sites.

6.6 Surface visibility

Surface visibility within an archaeological context generally refers to the degree of impediment to surface observation of archaeological material. The main factor to affect visibility is vegetation cover, although features such as rock outcrops and other natural or man-made obstructions on the landscape can also affect surface visibility. Surface visibility can be expressed as a percentage of the surface which is visible (Bonhomme 1986:11).

Table 3: Surface Visibility Criteria

a	Nil soil visibility	0-5%
b	Occasional glimpses of bare ground	5-20%
c	Frequent patches of bare ground	20-50%
d	Approximately 50% bare surface	50-75%
e	>70% bare surface	75-100%

Surface visibility varied within and between landform areas and these differences are shown in Tables 5, 6. The clearance of vegetation and soil from the crest of the cutting gave a high degree of visibility. Heavy vegetation cover at most of the sedimentation basin sites made access difficult and restricted visibility.

6.7 Field Survey Methods and Coverage Data

The total survey area has been assessed to be approximately 28.65ha. *'Effective coverage'* of the areas surveyed has been calculated in Tables 4, 5 and 6 and formalised in Table 7.

Table 4: Sedimentation Basins Coverage Data

Name	**Location**	**Survey area in m**	**Access Track in m**	**Survey area in ha**	**Visibility**	**Landform unit**				
						Hill slope	Artificial Embank-ment	Creek line	Steep Gully	Ridge Crest
SB1B	Median	100x 30	Nil	6	60%	*				
SB2B	Southbound	100 x 100	20 x 10	1.2	20%	*				
SB1S	Northbound	50 x 20	Nil	0.1	20%	*				
SB2S	Southbound	50 x 20	Nil	0.1	20%		*			
SB3S	Northbound	50 x 20	Nil	0.1	20%	*				
SB4S	Northbound	50 x 20	Nil	0.1	5%	*				
SB5S	Southbound	50 x 20	Nil	0.1	20%		*			
SB6S										
SB7S	Southbound	50 x 20	Nil	0.1	20%	*				
SB8S	Northbound	50 x 20	Nil	0.1	20%		*			
SB9S	Southbound	50 x 50	Nil	0.1	20%	*				
SB3B	Northbound	100 x 100	Nil	1.0	20%	*				
SB4B	Northbound	100 x 100	20m x 10	1.02	20%	*				
SB5B	Southbound	100 x 100	50m x 10	1.05	20%			*		
SB10S	Southbound	50 x 20	Nil	0.1	5%	*				
SB11S	Northbound	50 x 20	Nil	0.1	5%	*				
SB12S	Southbound	50 x 20	Nil	0.1	5%			*	*	
SB13S	Southbound	50 x 20	Nil	0.1	5%	*				
SB14S	Northbound	50 x 20	Nil	0.1	20%		*			

SB6B	Southbound	100 x 100	Nil	1.0	5%				*	
SB15S	Southbound	50 x 20	Nil	0.1	20%	*				
SB7B	Northbound	100 x 100	Nil	1.0	20%			*		
SB8B	Southbound	200 x 100	100 x 50	2.5	20%					*
SB16S	Northbound	50 x 20	Nil	0.1	20%	*				
SB17S	Southbound	50 x 20	Nil	0.1	5%	*				
SB18S	Median	50 x 20	Nil	0.1	20%					*
SB9B	Median	100 x 100	Nil	2.0	20%	*				
SB10B	Southbound	100 x 100	100 x 20	2.02	5%			*		
SB11B	Southbound	100 x 100	100 x 20	2.02	5%			*		
SB12B	Median	100 x 100	100 x 20	2.02	20%				*	
SB14B	Southbound	100 x 100	100 x 20	2.02	20%	*				
SB13B	Northbound	100 x 100	200 x 20	2.02	5%	*				
SB19S	Northbound	50 x 20	Nil	0.1	20%		*			
SB20S	Southbound	50 x 20	Nil	0.1	20%	*				
SB15B	Median	100 x 20	Nil	0.4	20%		*			
SB16B	Median	100 x 20	Nil	0.4	20%		*			
Total Area				**102.76**						

Table 5: Work Camp Locations Coverage and Landform Data

Name	**Location**	**Survey area in m**	**Total area Surveyed in ha**	**Visibility**	**Landform unit**	
					River Terrace	Hillslope
WC1	South of Ambulance Station Mooney Mooney	150 x 150	2.25	40%	2.25	
WC2	Median Area north of Heavy Vehicle Checking Station	280 x 50	1.40	60%		1.4
Total			**3.65**		**2.25**	**1.4**

Table 6: Crown Reserve Coverage and landform Data

Name	**Location**	**Survey area in m**	**Surveyed area in ha**	**Visibility**	**Landform unit**	
					Creek Line	**Hillslope**
Reserve 65572	Between Mount White and the Heavy Vehicle Checking Station west of the northbound carriageway	500 x 500	25	60%	500 x 20	480 x 500
Total			**25**		**1ha**	**24ha**

Site detectability varied over the survey area and was determined by factors such as surface visibility (see Table 1), geomorphology and the type of sites present. The measurement of site detectability is difficult given the range of factors which may influence site detection, some of which are mentioned above.

Effective coverage assessment can be determined by the interpreted accuracy of a field investigation (Witter 1990). For the current study, a method of coverage analysis was used where effective coverage was adapted from Boot (1996) pers com. where the following applies:

Survey Coverage Assessment formula
L x W x % of visible ground surface = effective survey coverage
where L is the length of the of the survey area/unit/transect in metres, W is the width of the survey unit/area/transect in metres.

Table 7: Effective Coverage for surveyed area

Landform Unit	Survey area (LxB approx in m)	Survey area in ha	Coverage method	% vis.	Effective Coverage In ha	% area effect surveyed
Steep hill slopes	480 x 500 280 x 50	25.4	Foot	60	15.24	53.2
Ridge crests and hill tops	150 x 150	2.25	Foot	40	0.9	3.1
Creeklines	500 x 20	1.0	Foot	60	0.6	2.1
Totals		28.65			16.74	58.4

Therefore the total survey area was approximately 28.65 ha of which 16.74 ha or 58.4% was effectively surveyed.

6.8 Surface Exposure

Surface exposure of archaeological sites refers to the effects of geomorphic and physical processes on archaeological deposits. For example, a level of exposure of archaeological materials may occur due to wind, rain or other erosive agents. The major factor in site detectability in this area was the removal of soil from the cutting edges and water erosion.

7. Indigenous Heritage Survey Results and Discussion.

Survey results and discussion are presented in four parts. The survey of the median strip of the F3 Freeway from Jolls Bridge to Calga including the area identified as "The Gorge"; the survey of the thirty five sedimentation basins; the survey of the two work stations and the investigations associated with the location of the NPWS Sites #45-3-0157, #45-3-0158, #45-3-0631.

7.1 Median Area of the Freeway

The median area of the Freeway varied in width from less than a metre to over 800m in the area known as "The Gorge". The median area had been heavily transformed from its original landform type by major works conducted as part of the F3 construction.

With the exception of sections that were narrow cuttings, the median areas had been shaped to slope into the centreline and in this low central channel a concrete drainage line had been constructed. Damage from road construction had been extreme.

The narrow cuttings which were present in the median, corresponded to the cuttings on the northern and southern carriageways. These median cuttings were narrow and steep and in all cases the height of the cutting had been modified to a level lower than the cutting heights on the outer edges of the carriageways. In all cases the tops of the cutting had been removed during road construction and no original surfaces remained (Photos 1, 2).

7.1.1 "The Gorge"

The section of median referred to as "The Gorge" is located immediately north of the Heavy Vehicle Checking Station at Mount White. "The Gorge" is approximately 1.2km long and 200m wide at its broadest width (Map 9). The area to be surveyed was identified by the RTA as a 15m wide strip on the inside edges of both the northbound and southbound carriageways of the F3. This strip of ground for its entire length, had been heavily disturbed by the construction of the F3 alignment and a second unused alignment which passes through the centre of "The Gorge" and under the southbound carriageway. A full on foot assessment was made of the identified areas. Sites # 45-3-0150 and #45-3-0151, both engraving sites, were located in the path of the southbound carriageway and destroyed during F3 construction (Sketch 7). These sites would have been associated with a large rock outcrop located in the central and southern section of "The Gorge" area. Damage to this sandstone area from the construction of the F3 has been severe.

No sites or areas of Potential Archaeological Deposit (PADs) were identified in the assessment of the median area of the F3 including "The Gorge".

7.2 Sedimentation Basins

A total of thirty-five (35) proposed sedimentation basin locations were surveyed. Of these, seventeen (17) are adjacent to the southbound carriageway, six (6) are in the median, eleven (11) are adjacent to the north bound carriageway and two (2) are adjacent to the Pacific Highway. There are two designs of sedimentation basins. One design is for a small structure, approximately 30m x 20, located immediately adjacent to the carriageway. The second design is a larger basin, approximately 50m x 50m set back from the Freeway.

A full on foot assessment of all sedimentation basin areas was conducted. The dimensions of the survey area for the small sedimentation basins was approximately 50m x 30m and the larger basins 100m x 100m.

No indigenous sites were identified in proposed sedimentation basin sites.

7.2.1 Description of sedimentation basins in sensitive landform areas.

SB4B: This large sedimentation basin (50m x 50m) is located in an area of extensive ledges and Outcrops (Map 5, Sketch 1). Extensive sandstone ledges and outcrops were present across the proposed sedimentations basin area. The dense, high vegetation cover across the area created difficulties for the identification of sandstone outcrops and the high degree of leaf litter on the sandstone surfaces made the detection of possible engraving sites difficult to determine. An area 180m north of the road marking has been identified as an area of low archaeological sensitivity and may be suitable as an alternative location.

SB10S: This small sedimentation basin (2m x 20m) is located adjacent to the southern F3 carriageway, approximately 1.5km south of the Mount White overpass. The proposed basin site is in an area of exposed sandstone ledges and outcrops. Visibility at the site was poor, less than 5% . It is recommended that the location be moved 30m to the south where there are no sandstone outcrops (Map 5, Sketch 2) .

SB12S: This is a small sedimentation basin (20m x 20m). There are no heritage issues associated with the site itself, however the presence of sandstone overhangs and outcrops surrounding the site make access to the basin an issue. The degree of impact to the area from the construction of drainage lines and vehicle access for construction should be identified and the site reassessed (Map 6, Sketch 3) .

SB13S: This small sedimentation basin (20m x 20m) located adjacent to the southern carriageway of the F3 south of the Mount White overpass is located in an archaeologically sensitive landform. An existing drain is present at the site and access to that drain has been cut through exposed sandstone. Sandstone outcrops, ledges and benches as present in the area. Visibility was poor, less than 5%. Heavy deposits of leaf litter and moss covered much of the exposed sandstone surfaces and it was not possible to adequately access these features (Map 6, Sketch 4).

SB6B: This large sedimentation basin (50m x 50m) is located between the Pacific Highway and the F3 Freeway south of Mount White, approximately 300m south of the Mount White off ramp. Access to the proposed sedimentation basin is from the Pacific Highway (Map 12, Sketch 5). A deep drainage channel has been cut parallel with the Pacific Highway and the areas surrounding this drain have been heavily disturbed. An artificial retaining wall has been constructed on the F3 to the south of the site. Exposed sandstone ledges and outcrops are present in the north eastern section of the site and extend into the identified sedimentation basin area. Visibility across the area was extremely low. Vegetation cover was thick and high and restricted not only visibility, but movement around the survey area. All visible sandstone areas were examined and no sites identified, however due to the extreme density of the vegetation it has been concluded that unidentified sandstone areas may be present (Map 6, Sketch 5).

SB17S: This small sedimentation basin is located on the southern carriageway of the F3 approximately 250m north of the Mount White off ramp. The shoulder of the F3 has been impacted by the construction of an embankment and artificial drainage line. Sandstone outcrops, benches and overhangs are present in the proposed basin area. All visible sandstone areas were investigated, however due to extremely poor visibility and a heavy covering of leaf litter on the sandstone outcrops, it was considered that undetected engraving sites may be present in the area. No sandstone is present in the area 50m south of the identified location (Map 7, Sketch 6).

SB10B and SB11B: These large sedimentation basins are located to the south of the southern carriageway in the area referred to as "The Gorge". The sedimentation basins are located to the south of the sandstone exposure through which the unused roadways were cut. The area has been extremely disturbed by the excavation of the two unutilised carriageways. However there are large areas of sandstone present in the area and a permanent spring fed creek. NPWS Sites #45-3-0150 and 0151, both engraving sites were located in this area and destroyed during the construction of the F3 Freeway. Visibility in the area was extremely poor, less than 5% and it was considered that there may be sites present in the area which were not detected due to the density of the vegetation cover which made movement through the area difficult (Map 9, Sketch 7).

SB13B: This large sedimentation basin is located on the northern carriageway of the F3 approximately 600m north of "The Gorge". The land falls away steeply from the Freeway in a series of sandstone benches. At the time of the survey what appeared to be a permanent spring fed creek was present in the area. Its flow is obviously augmented by the current run off from the roadway. The vegetation cover was extremely dense and it was difficult to determine the boundaries of the basin area as the basin had not been surveyed. However it did appear that the basin area itself was free from sandstone outcrops, although additional investigation would be required to determine that this is in fact the case. Access to the area from the Freeway would impact on an extremely sensitive landform (Map 11).

7.2.2 Results of Indigenous Assessment of the Sedimentation Basins.

No sites were identified within the boundaries of the sedimentation basins. However nine (9) sedimentation basins are located in archaeologically sensitive areas. These sedimentation basins include: SB4B, SB10S, SB12S, SB13S, SB6B, SB17S, SB10B, SB11B and SB13B. In all cases this sensitivity relates to the fact that exposed sandstone outcrops which are present in the area could not be adequately assessed during the survey because of the density of the vegetation. It is recommended that hand clearing be undertaken at all sedimentation basin sites in sensitive areas so that an adequate examination of the impact from the proposed sedimentation basins can be identified. In three cases relocation of sedimentation basins to adjacent low sensitivity areas has been recommended. Sedimentation basins where relocation has been recommended include: SB4B, SB10S and SB17S. If the sites are relocated then a reassessment of the alternative locations should be undertaken.

7.3 Work Compound Sites.

There were two work compound sites surveyed. These were WC1, south of the Ambulance Station at Mooney Mooney and WC2, south of "The Gorge" at the Heavy Vehicle Checking Station at Mount White.

7.3.1 Work Compound WC1 (Map 2)

This work compound covers an area approximately 150m x 150m. The proposed work site is located immediately south of the Ambulance Station at Mooney Mooney. The area has been cleared of vegetation and is currently covered with long grass. The perimeter of the site, with the exception of the northern boundary is delineated by the F3 on ramp. The northern boundary is immediately adjacent to the Ambulance Station. The area has been heavily disturbed by previous road works associated with construction of the F3, Pacific Highway on ramp and the Toll Stations which have now been demolished. Regrowth timber has been planted along the western boundary of the site.

7.3.2 Work Compound WC2 (Map 8)

This proposed compound area is located within the median, immediately south of "The Gorge". The area covered by the compound is approximately 180m x 150m (at its broadest point). The landform of the area has been completely transformed by F3 roadworks including the excavation of the two unused carriageways and current access roads between the dual carriageways. Sections of the area are currently used as a work compound and much of the area is covered by road base and spoil storage dumps. This area has no archaeological potential.

No sites or areas of potential archaeological deposit were identified by the survey.

7.4. Investigation of Indigenous Heritage Sites identified from NPWS AMG Co-ordinates to be in the vicinity of the F3 (Mills 2000)

The RTA identified seven indigenous heritage sites for which exact locations were required. These sites included:

- The Calga Aboriginal Place registered on the National Estate Register maintained by the Australian Heritage Commission.
- NPWS Sites #45-3-0157, #45-3-0158, #45-3-0631, #45-3-0150, #45-3-0151 and #45-3-0369.

7.4.1 Archival Research.

The following facts which relate to indigenous sites in question were determined through reference to the NPWS site cards and archaeological reports and discussions with the NPWS Site Registrar.

- NPWS Sites #45-3-0150 (rock engraving and axe grinding grooves) and Site #45-3-0151 (Rock engraving) were destroyed by the construction of the Freeway (Sketch 7).

- NPWS Site #45-3-0369 (a rock shelter with deposit) was incorrectly plotted on the computer generated maps prepared from NPWS database records. This site was located south of the Hawkesbury River and was salvaged prior to the installation of the Eastern Gas Pipeline.
- NPWS Sites #45-3-0157 and #45-3-0158 are located on the western side of the Pacific Highway approximately 500m north from Ashbrookes Road, Mount White. These sites are included in the Designated Aboriginal Reserve No R63201/2. These sites are in excess of 800m from the F3 Freeway and would not be affected by the road-widening program.
- NPWS Site #45-3-0631 appears from both the location and site description to refer to NPWS site $45-3-0157.
- The Registered Aboriginal Place at Calga is within Popran National Park and 3km west of the F3 Freeway (Map 15).

Table 8: Sites identified from NPWS Site Register to be immediately adjacent to the F3 easement.

NPWS Site No	Site Type	Location	Comments
45-3-0157	Rock Engraving	Located on the western side of the Pacific Highway north from Mount White Village.	This site is part of Aboriginal Reserve R63201/2 and in the care of property owner Mr G. Bliim.
45-3-0158	Rock Engravings	Located in association with site 45-3-0157	Mr Bliim knows the exact location and would be prepared to have the location surveyed
45-3-0631	Rock Engraving	Description of this site and location implies that it could be site #45-3-0157	Confirmation cannot be confirmed from NPWS records due to lack of information recorded on the site form
45-3-0150	Rock engraving and axe grinding grooves	Vicinity of the Southern carriageway of the F3 at the Mistake.	Site destroyed during the construction of the F3 Freeway
45-3-0151	Rock Engraving	Site destroyed during the construction of the F3 Freeway	Within the area referred to as "The Gorge"
45-3-0369	Rock Shelter with deposit	AMG Coordinates wrong for this site which is located south of the Hawkesbury River	Seems to have been confused with site #45-3-039 at Somersby.

7.4.2 Field Assessment

The following field strategy was developed to identify the locations of Site #45-3-0157 and #45-3-0158 and confirm whether or not site #45-3-06313 was the same site as #45-3-0157.

Directions given on Site Card #45-3-01588 were followed and after questioning several landholders, it was confirmed that the site was on the property of Mr Graham Bliim. Mr Bliim agreed to take the consultant and LALC representatives to the site, which was located approximately 30m from the Pacific Highway. Reference to the site cards confirmed that the site was in fact Site 45-3-0157 rather than 45-3-0158. Mr Bliim stated that he knew the locations of several other sites on his property, of which one appeared to be Site 45-3-0158. He indicated that he would willingly show the LALC representatives these sites at a later date when he had time available.

Mr Bliim also stated that he knew of the location of unrecorded sites in the land to the east of the Pacific Highway (ie between the Highway and the F3) which he thought was owned by the RTA. The consultant and LALC representatives conducted a limited survey of the area indicated by Mr Bliim. During this limited assessment four sites were recorded.

The area inspected was heavily vegetated by high, dense and spiky vegetation. The vegetation was so dense that it restricted movement through the area and cut visibility to almost zero. The many large

exposures of sandstone were difficult to locate. Less than 1% of the area was adequately surveyed and the four sites identified in the survey may be but a small selection of sites, located in the area.

The locations of sites identified were made on directions given by Mr Bliim. These sites included three engraving sites, MW-E-1, MW-E-2, MW-E-3 (one with grinding grooves), one rock shelter with midden material (MW-RS-1). One large grinding groove site which had in excess of 80 grooves was located on Calverts Creek (CC-GG-1).

Subsequent investigations at the RTA Properties Division in Newcastle, Maitland Land Titles Office and DLWC revealed that the Land on which the sites are located is Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. RTA Land abuts the northern end of the Reserve (Map 17).

8. Significance assessment of indigenous sites and PAD areas located during the survey

8.1 Criteria for Significance Assessment

A statement of significance has been prepared for all indigenous sites and PAD areas identified during this survey. The significance of a site is determined by a number of criteria, which in their broadest terms and under NPWS guidelines include consideration of scientific and educational value, as well as giving consideration to the value of a site to the Aboriginal community.

Scientific Significance: requires an assessment of the site's integrity, preservation, contents, location, uniqueness, representativeness and potential for future scientific research.

Educational Value/Public significance: assesses the potential of the site as an educational resource. It is important to acknowledge that this potential would not be the same for all groups which include educational institutions, the general public and Aboriginal communities.

Aboriginal Value: The Aboriginal community places a range of values on sites. Aboriginal values can often vary from those held by the non-Aboriginal community. In some instances, the archaeological significance of a site is considered by an Aboriginal community to be a secondary consideration when they assess a site's significance. The Aboriginal community may place a greater emphasis on the socio-cultural significance of a site, or upon its educational value, (particularly for teaching community members about the lifestyles of their ancestors) and the value of a site in providing a 'link' with living community members and their ancestors. It appears that in many cases, Aboriginal communities tend to place far greater significance on sites relating to contemporary Aboriginal Heritage and historic events, for example mission sites and fringe camp sites. However the reverence for burial or sacred sites is never compromised.

8.2 Ranking procedures used to assess scientific significance of sites

The assessment of the scientific significance of archaeological sites is based on evaluation of the potential of sites to contribute information to the archaeological data base (ie their ability to contribute to scientific knowledge). The significance assessment of all sites is dependent upon various attributes of the site. These attributes include site integrity, preservation, contents, location, uniqueness, representativeness and potential for future scientific research. Few sites will present all attributes. However sites which are assigned **a high scientific significance rating** are those sites which have the potential to provide a high level of scientific information. This information may be represented by the presence of undisturbed archaeological deposit, or the presence of rare or unusual stone materials/artefacts etc or the location of a site in an unusual landform (ie not representative of the usual or established pattern of site distribution in a particular landform). On the other hand, sites

of **low scientific significance** would be those sites which for a variety of reasons can contribute little to the known archaeological record. This lack of knowledge potential may indicate that the site has been heavily disturbed by previous landuse, erosion etc, or contains artefactual material which is similar to that contained in well preserved sites in similar landform and geographical areas. Sites of **moderate scientific significance** are those sites which have limited potential to contribute to the scientific data base (eg the site may have been disturbed but still retains limited areas of in-situ material).

9. Description and significance statements for Sites identified in the survey.

A total of five sites were identified within the Crown Reserve No 65572 (Map16). It should be noted that none of these sites would be directly or indirectly impacted by the proposed F3 widening project. However details of the sites should be noted by RTA so that there is no impact to these sites from any future road related activities.

9.1 Site CC-GG-1 (Map 16 , Sketches 8, 9, Photos 7, 8, 9, 10)

Only a preliminary recording was made of this site as it is outside the area of impact from the proposed F3 works and would have taken at least a day to accurately record the locations and dimensions of the grooves.

Location: This grinding groove site is located on Calverts Creek, Mount White approximately 80m south of the Pacific Highway (AMG 332094E/ 6296535N).

Context: The site is located in a section of the creek bed where there is a large flat outcrop of sandstone across which water from the spring fed creek flows, year round (Mount White Store Keeper pers com). The creek bed contains deeper pools beside which the grooves are located. Vegetation is growing on the edges of the exposed sandstone and it is possible that additional grooves may be located under the moss and vegetation.

Description: The grooves extend across an area of exposed sandstone approximately 10m long and 8m wide. Within that area there are in excess of 80 grinding grooves. The majority of the grooves are located within and on the edge of the main water flow area, while a smaller number are associated with two deep pools 2m and 4m respectively to the south of the main stream (Sketches 8, 9). The majority of the grooves are within the range of 200-240mm in length and 100-120mm in width and 5mm-10mm in depth. However overall they vary in length from 320mm to 400mm and in width from 100mm to 150mm and in depth from 5mm 35mm.

Potential for Development Related Impact

This site is located on Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. Therefore the site is not under threat from development. However NPWS should be aware of the location of the site and ensure that it is adequately managed.

Scientific Significance: The scientific significance of the site has been assessed as high.

There are grinding groove sites identified in the immediate vicinity of this site at Sites #45-3-0157, #45-3-0158 and MW-E-3. These grinding groove sites are associated with engraving sites and are located in association with spring fed isolated water holes or a series of water holes within sandstone outcrops and not associated with actual creek lines. Therefore this site is a rare example of this site type in the Mount White area. The number of grooves is also an indication of the importance of the site to the Aboriginal inhabitants of the area and scientific data retrieved from this site would be of significance for academic study of grinding groove sites across all sandstone environments. This site

is part of a broad complex of engraving sites which extends through the Central Coast from the Hawkesbury River to Somersby. Similarities in engraving techniques and motif collection provide extensive research data. The site is in pristine condition.

Significance of the site to the Aboriginal Community: Representatives of the Darkinjung LALC who were involved in the survey located this site. The LALC representatives were excited to identify the site and the site was obviously of great significance to them. As this site is within the Crown Reserve, the sites should be readily accessible to the Aboriginal Community. A statement from the LALC is included in Appendix 5 of this report.

9.2 Site MW-E-1 (Map 16, Sketches, 10, 11, Photos 11, 12)

Location: This engraving site is located approximately 20m from the verge of the F3 roadway and 10m from the easement fence. (AMG 332724E/ 6296295N).

Context: This site is an isolated upturned sandstone boulder which is resting against a sandstone bench which extends for over 100m parallel to the F3 (Sketch 11).

Description: The site is a triangular rock approximately 85cm x 140cm in which an "eye" has been pecked out. The pecking has removed the outer edge of the circle and left the centre of the "eye" raised.The "eye" is located approximately 19cm from the eastern end of the rock and central to it. It would appear that the "eye" has been placed to give the impression of an animal head.

Potential for Development Related Impact
This site is located on Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. Therefore the site is not under threat from development. However NPWS should be aware of the location of the site and ensure that it is adequately managed.

Scientific Significance: Additional investigation would be required to establish whether or not this engraving is of Aboriginal origin, particularly as the site is so close to the Freeway and the fact that geological testing samples are of a similar dimension. However, the site is located in association with two other engraving sites and a rock shelter which would indicate that Aboriginal people were most certainly creating art work in the immediate vicinity. If the site is Aboriginal in origin it will be of **high scientific significance,** both for its individual contribution to the database of Aboriginal engravings and its contribution to the large body of engraving works in the immediate vicinity.

Significance of the site to the Aboriginal Community: Representatives of the Darkinjung LALC who were involved in the survey located this site. The LALC representatives identified the site as having importance for the local LALC and community. As this site is within a Crown Reserve, the site should be readily accessible to the Aboriginal Community and provide them with unrestricted access to the site. A statement from the LALC is included in Appendix 5 of this report.

9.3 Site MW-E-2 (Map 16, Sketches Sketch 10, 12 Photo 12)

Location: This engraving site is located approximately 17m east of Site MW-E-1 and within Crown Reserve No 65572 at Mount White.

Context: This site is located on an extensive sandstone outcrop which extends over an area approximately 100m x 200m. Mosses and native heaths are growing in circular "holes" in the rock shelf which have been filled with soil. (Photo 12)

Description: The site is composed of two circular depressions in the rock surface. This basic circular shape occurs on sandstone outcrops in the Mount White area and appears to be a natural phenomenon. However, some of the circle shapes appear to have been deliberately cut deeper into the surface. Similar shapes were seen by the consultant and LALC representatives in the Somersby Industrial area, Bulgandry Aboriginal Site and at nearby Site #45-3-0157. A geological investigation would be required to determine the origin of these shapes.

Scientific Significance: If this engraving type is of Aboriginal origin, then this site would be important for providing comparative data for the analysis of similar sites in the Mount White area. Therefore the site may have **high scientific significance** both for its individual contribution to the

database of examples of this engraving technique and for its contribution to the large body of engravings works in the immediate vicinity.

Potential for Development Related Impact
This site is located on Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. Therefore the site is not under threat from development. However NPWS should be aware of the location of the site and ensure that it is adequately managed.

Significance of the site to the Aboriginal Community: Representatives of the Darkinjung LALC who were involved in the survey located this site. The LALC representatives identified the site as having importance for the local LALC and community. As this site is within a Crown Reserve, the sites should be readily accessible to the Aboriginal Community and provide them with unrestricted access to the site. A statement from the LALC is included in Appendix 5 of this report.

9.4 Site MW-E-3 (Map 16, Sketches 10, 13, 14, 15, Photos 14, 15)

Location: This engraving site is located approximately 15m east of Site MW-E-2 (AMG 332711E/6296322N) within Crown Reserve No 65572 at Mount White.

Context: This complex of engravings, water holes and grinding grooves is located on the same rock outcrop as site MW-E-2. The edges of the site are overgrown with mosses and low scrubby vegetation which has taken root in the water holes which are now filled with soil and provide sufficient sustenance to support the vegetation. It is most likely that the mosses and vegetation cover additional engravings at this site.

Description: The site has two identified engravings and two sets of grinding grooves each associated with natural, circular, deep rock pools eroded into the sandstone surface (Sketch 10). Poor light and moss and lichen cover of the sandstone surface made identification of engravings difficult. It is considered that more motifs may be identified in better light conditions.

One engraving consists of a pecked circle with a diameter of 220mm and a pecked line from the circle which could be traced for approximately 2 metres and then its direction was obscured by lichen which had grown across the rock and hampered the identification of the direction of the "line" (Sketch 15, Photo 14).

Approximately 4m to the south east of the end of the "line", a second engraving was identified. This engraving was a pecked line elliptical in shape. The southern/lower section of the ellipse appeared to be covered with moss and vegetation (Sketches 13, 14, Photo 15) The upper/northern section of the ellipse measured 1500mm north/south and 1150mm east/west. The top of the ellipse was pecked out in an arc, 400mm x 230mm (Sketch 14). Approximately 300mm below the arc was a deep water hole, 400mm x 100mm filled with soil and moss. Approximately 100mm south of the water hole were three grinding grooves (a pair on the south-eastern side of the water hole and a single groove on the south western side). A second water hole was recorded approximately 1600mm from the eastern side of the elliptical engraving. The water hole has two associated grinding grooves to the north of the hole (Sketches 15). This association between the waterhole and the location of grinding grooves was similar to the relationship seen at site #45-3-0157 and at sites at the Somersby Industrial Area.

Potential for Development Related Impact
This site is located on Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. Therefore the site is not under threat from development. However NPWS should be aware of the location of the site and ensure that it is adequately managed.

Scientific Significance: This complex of sites has been identified as having **high scientific significance.** This site has high research potential and data collected from this site would provide valuable comparative data for use in the analysis of engravings in the Gosford and Mount White area. **Significance of the site to the Aboriginal Community**: Representatives of the Darkinjung LALC who were involved in the survey identified the site as having importance for the local LALC and community. As this site is within a Crown Reserve, the sites should be readily accessible to the Aboriginal Community and provide them with unrestricted access to the site. A statement from the LALC is included in Appendix 5 of this report.

9.5 Rockshelter with midden material (Map 16, Sketches 16, 17, 18, Photos 16, 17, 18).

Location: This site is located approximately 150m south east of the Pacific Highway and 200m south-west of Site MW-E-3 (AMG 332687E/629693N).

Context: The rock shelter is associated with a large sandstone outcrop, the top of which provides excellent views across sites MW-E-1, 2, and 3 and Calvert's Creek. The rock shelter is on the north-eastern side of the outcrop.

Description: the rock outcrop is approximately 3.5m high and covers an area approximately 13m x 20m (Photo 16). The rock outcrop has only one area of overhang, the remainder of the edge of the outcrop either slopes gently or steeply to the ground with no eroded overhangs. The shelter is 450cm long and has a maximum roof height of 120cm (Photo 17, Sketch 17). The area is relatively cramped and would have provided shelter for only a small number of people. Shells characteristic of those usually associated with middens (Bowdler in Connah 1983) were identified on the floor of the shelter. Shells were whole and there seemed little evidence of recent use of the shelter by people or animals. The central floor area of the shelter has potential sub-surface deposit (PAD), the depth of which is unknown

Between 30 and 50 shells were visible on the floor of the shelter (Photo 18). A sample of 30 shells was recorded. These shells included oyster (both upper and lower sections), anadarra and welks. Details of shell type and size were recorded for the sampled shells. The results of this recording are presented below.

Table 9: Shell data from Site MW-RS-1

Shell Species (Whole shells only sampled)	Number in sample	Size in cm	Comments
Oyster	6 Top	Sizes were in the range 6.0 x 2.5 to 4.0 x 3.0	Only whole shells were sampled. There was evidence of crushed oyster shell present.
	13 Bottom	Sizes were in the range 6.0 x 5.0 to 4.5 x 4.0	These were the dominant shell species at the site
Welks	3	Sizes were in the range 7.5 x 3 to 3.5 x 2.0	Shells were well preserved.
Anadarra	8	3.5 x 3.0 to 2 x 2.0	Measurements of these shells were from the hinge to the outside edge and across the body of the shell.

Mr Bliim presented details for this site to NPWS Sydney Office in person about 4 years ago. No details of the site are currently recorded in the NPWS Data base. Mr Bliim states that after the 1999 fires it was possible to identify three mounds in the vicinity of the shelter. These mounds were not

located in this assessment because of the density of the vegetation which made movement difficult away from the base of the rock outcrop containing the shelter. Mr Bliim has photographs of the site taken after the fires and would allow the consultant to make copies of this photographic evidence for presentation to NPWS.

Potential for Development Related Impact
This site is located on Crown Reserve No 65572 which was designated in 1935 for Public Recreation and Native Flora (Map 16). The land is currently under the control of NPWS. Therefore the site is not under threat from development. However NPWS should be aware of the location of the site and ensure that it is adequately managed.

Scientific Significance
This site has been assessed as having **high scientific significance**. This assessment is based on the fact that there appear to be few recorded shelter sites in the area. The sub-surface deposit within the shelter is likely to contain in situ deposit which could be excavated to reveal additional scientific information about the site and its occupants.

Significance of the site to the Aboriginal Community: Representatives of the Darkinjung LALC who were involved in the survey identified the site as having importance for the local LALC and community. As this site is within a Crown Reserve, the sites should be readily accessible to the Aboriginal Community and provide them with unrestricted access to the site. A statement from the LALC is included in Appendix 5 of this report.

9.6 Summary of Indigenous heritage results for the surveyed areas.

Table 10: Summary of Indigenous heritage results

Area surveyed	Indigenous heritage items identified	Impact from proposed RTA F3 Freeway Work	Comments
Median strip from Jolls Bridge to Calga	No sites or PAD areas identified	Nil	No additional archaeological investigations recommended.
Work Compounds WC1, WC2	No sites or PAD areas identified	Nil	No additional archaeological investigations recommended.
Sedimentation Basins	SB4B	Potential Impact	It is recommended that the basin be relocated 180m north and the area resurveyed. The current location is within an archaeologically sensitive area which could not be adequately assessed owing to the density of the vegetation. Therefore if this site is to be used, the exact location of the basin should be marked, the area cleared by hand and the site resurveyed.
	SB10S	Potential Impact	It is recommended that the basin be relocated 30m south and the area resurveyed. The current location is within an archaeologically sensitive area which could not be adequately assessed owing to the density of the vegetation. Therefore if this site is to be used, the exact location of the basin should be

			marked, the area cleared by hand and the site resurveyed.
	SB12S	Potential Impact	There are no heritage issues associated with the sedimentation basin site. However access to this site from the Freeway is through an area of high archaeological sensitivity. The exact alignment should be pegged and resurveyed.
	SB13S	Potential Impact	This sedimentation basin site is within an archaeologically sensitive area. The area could not be adequately assessed owing to the density of the vegetation. Therefore the exact location of the basin should be marked, the area cleared by hand and the site resurveyed.
	SB6B	Potential Impact	This sedimentation basin site is within an archaeologically sensitive area. The area could not be adequately assessed due to the density of the vegetation. Therefore the exact location of the basin should be marked, the area cleared by hand and the site resurveyed.
	SB17S	Potential Impact	It is recommended that the basin be relocated 53m south and the area resurveyed. The current location is within an archaeologically sensitive area which could not be adequately assessed owing to the density of the vegetation. Therefore if this site is to be used, the exact location of the basin should be marked, the area cleared by hand and the site resurveyed. .
	SB10B and SB11B	Potential Impact	These sedimentation basin sites are within an archaeologically sensitive area. NPWS Sites #45-3-0150, #45-3-0151 were in the vicinity of these basins and were destroyed during the construction of the Freeway. The area could not be adequately assessed due to the density of the vegetation. Therefore the exact location of the basin should be marked, the area cleared by hand and the site resurveyed.
	SB13B	Potential Impact	There are no heritage issues associated with the sedimentation basin site. However access to this site from the Freeway is through an area of high archaeological sensitivity. The exact alignment should be pegged and resurveyed.
Crown Reserve No65572	Site CC-GG-1	Outside the impact of the current works program. However any changes to the water flows from Pacific Highway	NPWS who are the managers of the Crown lease area, in co-operation with the Darkinjung LALC should ensure that this site is fully surveyed and recorded and adequately protected from any future works in the Crown lease area. RTA should assist with the surveying of the site so that adequate records can be kept of the site

		road works at the Calverts Creek crossing has a potential to impact the site.	to ensure that there are no adverse impacts to the site from road works on the Pacific Highway.
	Site MW-E-1	This site is 10m west of the F3 easement. Site location should be surveyed to ensure that the location is known and avoided by all future F3 works.	NPWS who are the managers of the Crown lease area, in co-operation with the Darkinjung LALC should ensure that this site is fully surveyed and recorded and adequately protected from any future works. As this site is only 10m outside the easement of the F3 Freeway, RTA should assist with the surveying of the site so that adequate records can be kept of the site to ensure that there are no adverse impacts to the site from road works on the Freeway
	Site MW-E-2	Nil impact	NPWS who are the managers of the Crown lease area, in co-operation with the Darkinjung LALC should compare the results of the geological report on the origin of similar engraving motifs in the Somersby Industrial estate to determine the status of this site.
	Site MW-E-3	Nil impact	NPWS who are the managers of the Crown lease area, in co-operation with the Darkinjung LALC should ensure that this site is fully surveyed and recorded and adequately protected from any future works within the Crown lease area.
	Site MW-RS-1	Nil Impact	NPWS who are the managers of the Crown lease area, in co-operation with the Darkinjung LALC should ensure that this site is fully surveyed and recorded and adequately protected from any future works within the Crown lease area. NPWS should hold discussion with Mr Bliim who has done extensive recording of this site and its surrounding mounds. RTA may wish to assist in the use of x-ray equipment to determine the nature of the mounds.

10. Non-Indigenous Heritage

The registers of the National Estate, NSW Heritage Council, National Trust and RTA S170 heritage registers were reviewed.

10.1 Archival Searches

10.1.1 Australian Heritage Commission, Canberra

The Australian Heritage Commission maintains the Register of the National Estate. This register lists both indigenous and non-indigenous heritage sites and is organised by both Local Government Area and Locality. Places on this list are classified as:

"Indicative Places": not on the register, but identified as important
"Interim Places": currently being evaluated for inclusion on the Register
"Registered Places": listed

A total of thirty-five sites are listed on the register for the Gosford LGA, of which 25 are registered. None of the registered sites is in the immediate vicinity of the proposed widening of the F3. One registered and one indicative site are listed in the vicinity of the F3 work. The registered site is the Mooney Mooney Insect site, located 2km east-south-east of Calga. The indicative site is the Lone Grave of Frances Peat at Mooney Mooney Creek. This site is located approximately 400m south-west of Mooney Mooney Point Ambulance Station (Map 18) .

10.1.2 State Heritage Register of the NSW Heritage Council.

The Heritage Council of NSW maintains the State Heritage Register. The Register was created in April 1999 by amendments to the Heritage Act 1977. Only those items which are of state significance in NSW are listed on the Register. The Register replaces the old system of permanent conservation orders as a means of listing items of state significance. Listing on the State Heritage Register controls activities such as alteration, damage, demolition and development. The focus of heritage protection has changed considerably since the Heritage Act (1977) when the Heritage Council was the principal body involved in the statutory listing of heritage items to the present time when local government has a major role and responsibility for managing heritage in NSW. The principal tools which guide local government decisions are the heritage study and the Local Environmental Plan (LEP) which are prepared in accordance with principles laid down in the Environmental Planning & Assessment Act, 1979.

A total of ten (10) items are listed on the NSW State Heritage Register in the Gosford Local Government area. Of these, only 1 is in the vicinity of the F3. This site is the Hawkesbury River Rail Bridge at Brooklyn. The proposed works would not impact this item.

10.1.3 Register of the National Trust

The National Trust of Australia (NSW) is a non-government, community organisation which promotes the conservation of both built and natural heritage. The Trust maintains a register of landscapes, townscapes, buildings, industrial sites, cemeteries and other items or places which the Trust determines have heritage significance and are worthy of conservation. Items listed in the Trust's Register are said to be classified. The listing of a place in the Trust's Register has no legal force, however the Trust does encourage owners of listed places to respect their heritage significance. The Trust often helps local councils in the preparation of Local Environmental Plans and encourages local councils to refer development applications affecting properties listed on the Register for advice and comment by the Trust's Architectural Advisory Committee.

There are 7 items listed in the Gosford LGA. None of these is within the area of the proposed F3 widening.

10.1.4 Gosford City Council

Under the NSW Environmental Planning and Assessment Act (1979), local Councils and the Department of Urban Affairs and Planning (DUAP) are required to prepare local and regional environmental planning instruments (LEPs and REPs), to give statutory force to planning controls. These plans incorporate provisions for the conservation and management of archaeological sites and heritage items. Consultation on site location details was undertaken with Tracy Sharp, Gosford Heritage Planner and Gosford City Local Studies Librarian, Geoff Potter.

There are two heritage items listed in the vicinity of the proposed Freeway widening program. These are LEP items 150 and 151. Item 150 is the remains of George Peats Inn and is a potential archaeological site. This site is located 400m south-west of the Mooney Mooney Ambulance Station. Item 151 is the Lone Grave of Frances Peat. The grave is surrounded by a picket fence in bushland on top of a hill overlooking the Hawkesbury River, adjacent to the expressway. The grave has an east-west orientation with simple headstone and footstone and stone flagging between (Map 6) .

10.1.5 RTA S170 Heritage Listings

A search of the RTA S170 Register identified forty (40) sites in the Sydney Region of which one is in the Central Coast Region. This item is the Peat's Ferry Bridge which is the old bridge across the Hawkesbury River to the east of the Freeway. There are no sites listed in the vicinity of the surveyed F3 widening area (Appendix 7)

11. Non-indigenous Field Investigations Survey Results and Discussion

Survey results and discussion are presented in four parts. The survey of the median strip of the F3 Freeway from Jolls Bridge to Calga, including the area identified as "The Gorge"; the survey of the thirty five sedimentation basins; the survey of the two work stations and investigations associated with the location of the remains of George Peats Inn and the Lone Grave of Frances Peat at Mooney Mooney.

A full on foot survey of all impact areas was conducted in conjunction with the indigenous heritage assessment. This survey was designed to:

- identify areas of possible heritage significance within the study area
- make a brief assessment of the heritage significance of sites where possible.
- recommend additional investigations if required.

A site prediction model for the site type and distribution patterns for heritage items in the survey area was developed from a review of the records of the Australian Heritage Commission, NSW Heritage Council and Gosford City Council LEPs. The most likely heritage items to be identified in this survey would be associated with the growth and development of settlements in the Mooney Mooney, Mount White and Calga areas. It was concluded that Heritage items could be standing structures or archaeological sites associated with the early settlement of the Mooney Mooney, Mount White, Peats Ridge and Calga areas and remnants of early road construction. In view of the fact that all work is being conducted immediately adjacent to the F3 Freeway, the likelihood of standing structures and archaeological sites is remote as damage to the surrounding area from original F3 construction has been considerable.

11.1 Median Area of the Freeway

The median area of the Freeway varied in width from less than a metre to over 800m in the area known as "The Gorge". The median area had been heavily transformed from its original landform type by major works conducted as part of the F3 construction.

With the exception of sections that were narrow cuttings, the median areas had been shaped to slope into the centreline and in this low central channel a concrete drainage line had been constructed. Damage from road construction has been extreme.

The narrow cuttings, which were present in the median, corresponded to the cuttings on the northern and southern carriageways. These median cuttings were narrow and steep and in all cases the height of the cutting had been modified to a level lower than the cutting heights on the outer edges of the carriageways. In all cases the tops of the cutting had been removed during road construction and no original surfaces remained (Photos 1, 2)

"The Gorge"

The section of median referred to as "The Gorge" is located immediately north of the Heavy Vehicle Checking Station at Mount White. "The Gorge" is approximately 1.2km long and 200m wide at its broadest width (Sketch). The area to be surveyed was identified by the RTA as a 15m wide strip on the inside edges of both the northbound and southbound carriageways of the F3. This strip of ground had been heavily disturbed for its entire length by the construction of the F3 alignment and a second unused alignment, which passes through the centre of "The Gorge" and under the southbound carriageway. A full on foot assessment was made of the identified areas.

No heritage items were identified in the assessment of the median area of the F3 including "The Gorge".

11.2 Sedimentation Basins

A total of thirty-five (35) sedimentation basin locations were surveyed. Of these seventeen (17) are on the southbound carriageway, six (6) are in the median, eleven (11) are on the north bound and two (2) on the Pacific Highway.

A full on foot assessment of all sedimentation basin areas was conducted. The dimensions of the survey area for the small sedimentation basins was approximately 50m x 30m and the larger basins 100m x 100m.

No non-indigenous sites were identified in the survey. However a memorial "cross" was identified within the boundaries of sedimentation basin No SB3B (Map 5, Sketch 18, Photo 19, 20). The cross is approximately 600mm high and 500mm wide. The cross was located approximately 16m east of the F3 Freeway and 26m south of the Pacific Highway and may be a memorial for an accident victim on either of these roadways. This memorial is of recent origin and there does not appear to be an associated burial. However it is recommended that additional investigation be conducted to ensure that this conclusion is in fact the case.

11.3 Field Assessment of the Work Compound Sites.

There were two work compound sites surveyed. These were WC1 south of the Ambulance Station at Mooney Mooney and WC2 south of "The Gorge" at the Heavy Vehicle Checking Station at Mount White.

11.3.1 Work Compound WC1 (Map 2)

This work compound covers an area approximately 150m x 150m. The proposed work site is located immediately south of the Ambulance Station at Mooney Mooney. The area has been cleared of

vegetation and is currently covered with long grass. The perimeter of the site with the exception of the northern boundary is delineated by the F3 on ramp. The northern boundary is immediately adjacent to the Ambulance Station. The area has been heavily disturbed by previous road works associated with construction of the F3, Pacific Highway on ramp and the Toll Stations which have now been demolished. Regrowth timber has been planted along the western boundary of the site.

11.3.2 Work Compound WC2 (Map 8)

This proposed compound area is located within the median, immediately south of "The Gorge". The area covered by the compound is approximately 180m x 150m (at its broadest point). The landform of the area has been completely transformed by F3 roadworks including the excavation of the two carriageways which were not used and current access roads between the dual carriageways. Sections of the area are currently used as a work compound and much of the area is covered by road base and spoil storage dumps. This area has no archaeological potential.

No non-indigenous sites or relics were identified by the survey.

11.4. Investigation of exact locations of known Non-Indigenous Heritage Sites in the vicinity of the proposed F3 upgrades

The RTA identified two non- indigenous heritage sites for which exact locations were required. These sites included:

- The remains of George Peats Inn at Mooney Mooney
- The lone Grave of Frances Peat, Mooney Mooney.

11.4.1 George Peat's Inn and the Lone Grave of Frances Peat.

Prior to the field assessment site details were obtained from the Australian Heritage Commission and Gosford City Council. As there appeared to be conflict between the locations indicated by these two bodies, additional assistance was sought from the local Studies Librarian at Gosford Library.

The location of the site of George Peat's Inn and the lone Grave of Frances Peat indicated on Map 18 was determined by reference to Gosford City Council Development Application Plans and historical searches by the Gosford City Local Studies Librarian, Geoff Potter. These items can now be accurately plotted and protected from any future works on the F3. Site locations were confirmed by a site visit.

There would be no impact to either of these items from the proposed F3 works program.

11.4.2 Mount White Cemetery.

The local studies librarian, Geoff Potter identified the location of Mount White Cemetery and stated that although the item was not listed on the Gosford LEP Schedules, it is of historical interest. The cemetery was used for the burial of inmates of the Peat Island Mental Institution. RH Creighton Funeral Parlour records show that there were at least two burials in the cemetery between 1940-1950. Maps supplied to the consultant by Mr Potter indicate that the cemetery may be under the northbound carriageway of the Pacific Highway DP Lot 93089 (Maps 19, 20, 21).

12. Site Management Recommendations for both indigenous and non-indigenous heritage sites identified by the survey.

The RTA, as a developer, has an obligation under the National Parks and Wildlife Act 1974, the NSW Heritage Act 1975 and the EP& A Act 1979, to determine if their proposed widening of the F3 Freeway would impact upon indigenous and non-indigenous heritage and where required, implement recommended management actions. The following recommendations have been developed to minimise the potential impact of the development on indigenous and non-indigenous heritage items and places and ensure that the proposed development is accommodated within a management framework endorsed by NPWS and the NSW Heritage Office and which includes consultation with the Darkinjung LALC.

This survey concludes that there is no archaeological reason why the proposed F3 widening program should not proceed as planned, providing the following recommendations are adhered to by the RTA (in conjunction with any additional requirements imposed by NPWS).

Indigenous Heritage Recommendations.

Recommendation 1
It is recommended that the RTA Legal Branch contact the Native Title Tribunal to determine whether any actions are required by the RTA with regard to the claim.

Recommendation 2
No further archaeological investigation is required in the Median of the F3 between Jolls Bridge and Calga as identified in Maps 2-12.

Recommendation 3
No further archaeological investigation is required at work compound areas WC1 and WC2 as shown in Maps 2 and 8 respectively.

Recommendation 4: Applies to Sedimentation sites SB4B, SB10S and SB17S.
These sedimentation basins are in areas of high archaeological sensitivity. Alternative locations in less sensitive archaeological landforms have been identified for each basin site
SB4B: relocate 180m north
SB10S: relocate 29m south
SB17S: relocate 53m south
It is recommended that should the RTA decide to relocate these basins to the identified locations, then the new location should be pegged and surveyed by an archaeologist and representative of the Darkinjung LALC to ensure that there are no sites present.

If the RTA proceed with the placement of the sedimentation basins at the surveyed location, then the impact area of the basin should be pegged; the vegetation cleared by hand with minimum disturbance to the topsoil and the area reassessed by an archaeologist and representatives of the Darkinjung LALC to ensure that there are no sites present.

Recommendation 5

Applies to Sedimentation Sites SB12S, SB13S, SB6B, SB10B and SB11B, SB13B

These sedimentation basins and their access tracks are in sensitive archaeological landforms at which visibility is extremely poor. If the RTA proceeds with the placement of the sedimentation basins at the surveyed location, then the impact area of the basins should be pegged, the vegetation cleared by hand with minimum disturbance to the topsoil and the area reassessed by an archaeologist and representatives of the Darkinjung LALC to ensure that there are no sites present.

Recommendation 6

It is recommended that the RTA assist the NPWS and Darkinjung LALC in the surveying of the locations of sites 43-3-0157, 43-3-0158 and 43-3- 631 to ensure that the exact locations of these sites in relation to the Pacific Highway and the F3 are known so that the sites can be managed and protected from any impacts which may result from any future RTA works on these roadways.

Recommendation 7

It is recommended that the RTA assist the NPWS and Darkinjung LALC in the surveying of the locations of sites CC-GG-1, MW-E-1, MW-E-2, MW-E-3 and MW-RS-1 to ensure that the exact locations of these sites in relation to the Pacific Highway and the F3 are known so that the sites can be managed and protected from any impacts which may result from any future RTA works on these roadways.

Recommendation 7.1

RTA should be aware that any changes to the flow of water through Calvert's Creek at the Pacific Highway, Mount White has the potential to impact upon the Grinding groove site.

Recommendation 8

In the unlikely event that Aboriginal heritage items are exposed during the F3 upgrade, all work in that area should cease and the RTA's liaison officer, NPWS and Darkinjung LALC contacted to develop a plan of management for the identified heritage items.

Non-indigenous Heritage Recommendations.

Recommendation 9

No further archaeological investigation is required in the Median of the F3 between Jolls Bridge and Calga as identified in Maps 2-12.

Recommendation 10

No further archaeological investigation is required at work compound areas WC1 and WC2 as shown in Maps 2 and 8 respectively.

Recommendation 11

Additional investigation should be conducted at the site of the memorial "cross" identified at Sedimentation Basin SB3B. This investigation should ensure that there is no associated burial present. This would best be achieved by the use of x-ray techniques undertaken by the RTA Heritage Surveyor, Bill Evans.

Recommendation 12

Exact locations of the site of Peat's Inn and the lone grave of Frances Peat should be surveyed onto F3 Plans so that these sites can be adequately protected from any future RTA works in the Mooney Mooney Point area.

Recommendation 13
Additional investigations should be undertaken to identify the exact location of the Mount White Cemetery to determine whether or not the Pacific Highway duplication has been constructed on top of the cemetery. This investigation should include archival investigations of the Crown Cemetery Lease through Maitland Land Titles Office and a review of the record of the funeral director and Peat Island Institution Records.

12. Legal Requirements and Obligations

All non-indigenous heritage items are protected by the NSW Heritage Act (1975 and the EP & A Act (1979). All indigenous relics (sites and objects), other than those made for sale, are protected under the New South Wales National Parks and Wildlife Act 1967 (amended 1974). Archaeological sites are a non renewable resource, valued for the information they can provide on the lifestyles of people in the past, and are also valued by local communities who maintain cultural links with the past through these sites and places.

It is illegal to damage or destroy a site or relic without the prior consent of the Director of NSW NPWS and/or DUAP. Any such disturbance requires a permit from the Director. The NPW Act requires that relics recovered under such a permit come under the custody of the Australian Museum in Sydney or the LALC if an application has been made by that group for a Care and Control Permit.

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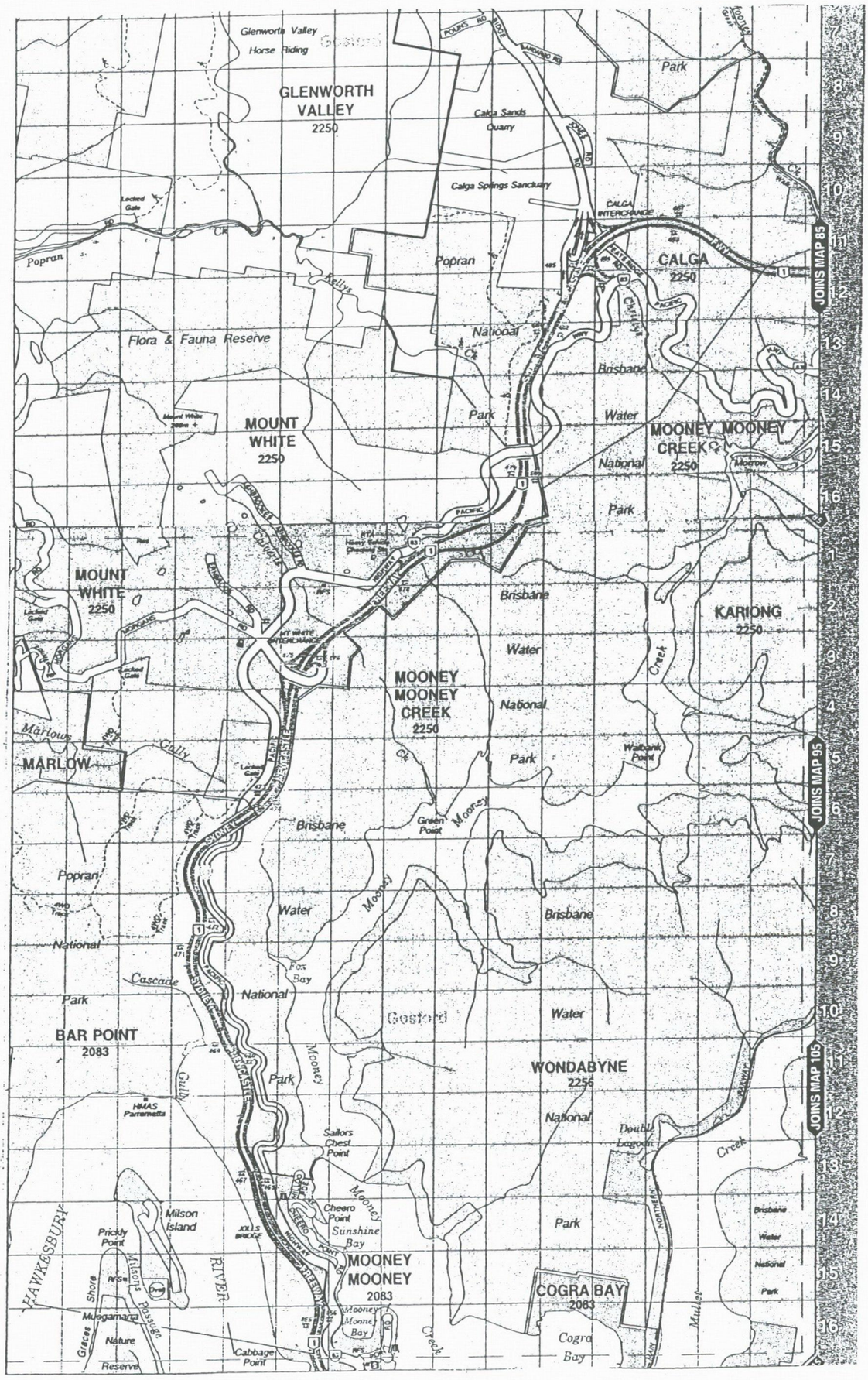
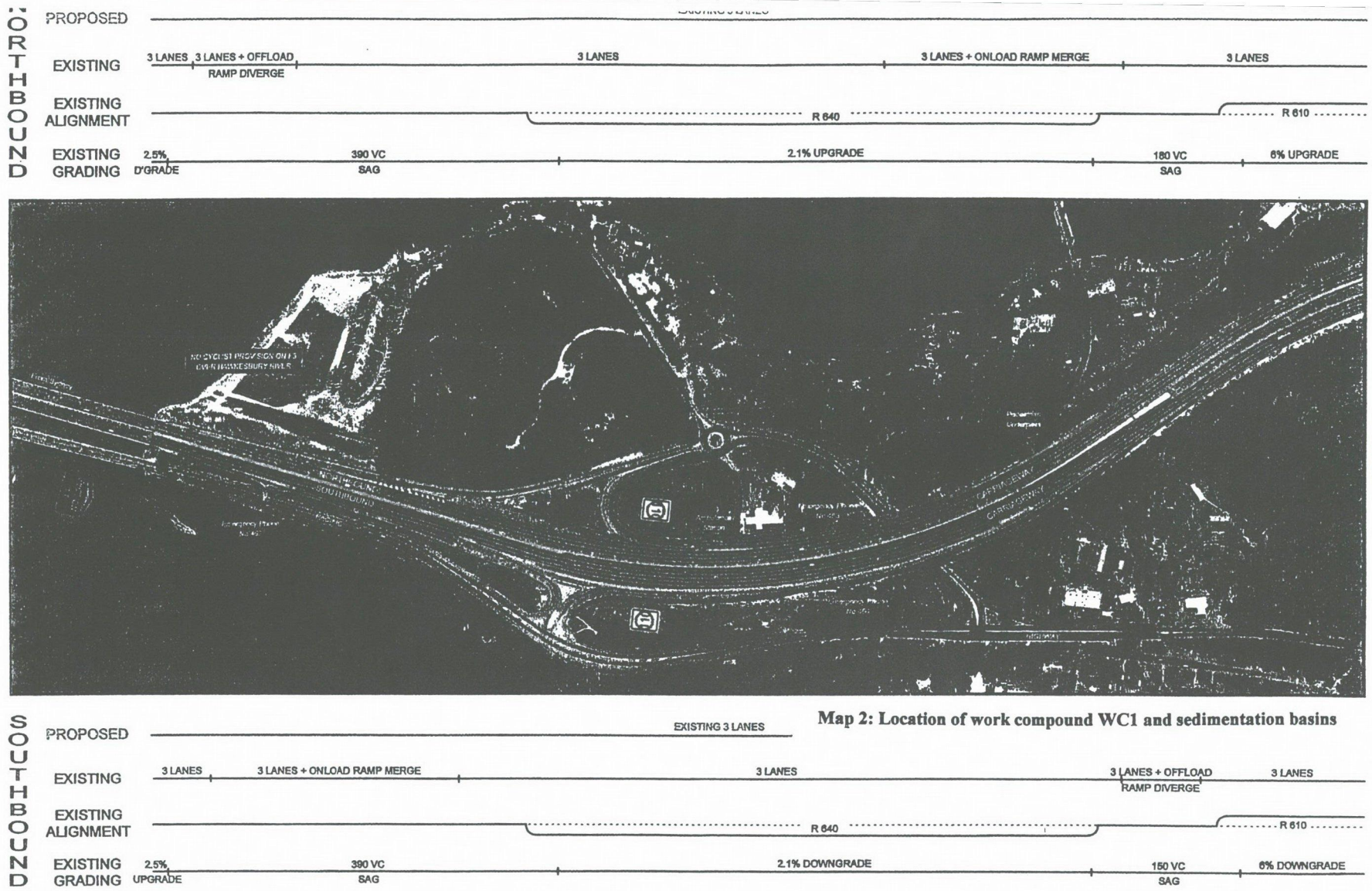
NPWS Site No	Site Type	Location	Comments
45-3-0157	Rock Engraving	Located on the western side of the Pacific Highway north from Mount White Village.	This site is part of Aboriginal Reserve R63201/2 and in the care of property owner Mr G. Bliim.
45-3-0158	Rock Engravings	Located in association with site 45-3-0157	Mr Bliim knows the exact location and would be prepared to have the location surveyed
45-3-0631	Rock Engraving	Description of this site and location implies that it could be site #45-3-0157	Confirmation cannot be confirmed from NPWS records due to lack of information recorded on the site form
45-3-0150	Rock engraving and axe grinding grooves	Vicinity of the Southern carriageway of the F3 at the Mistake.	Site destroyed during the construction of the F3 Freeway
45-3-0151	Rock Engraving	Site destroyed during the construction of the F3 Freeway	Within the area referred to as "The Gorge"
45-3-0369	Rock Shelter with deposit	AMG Coordinates wrong for this site which is located south of the Hawkesbury River	Seems to have been confused with site #45-3-039 at Somersby.

Appendix 1: Maps

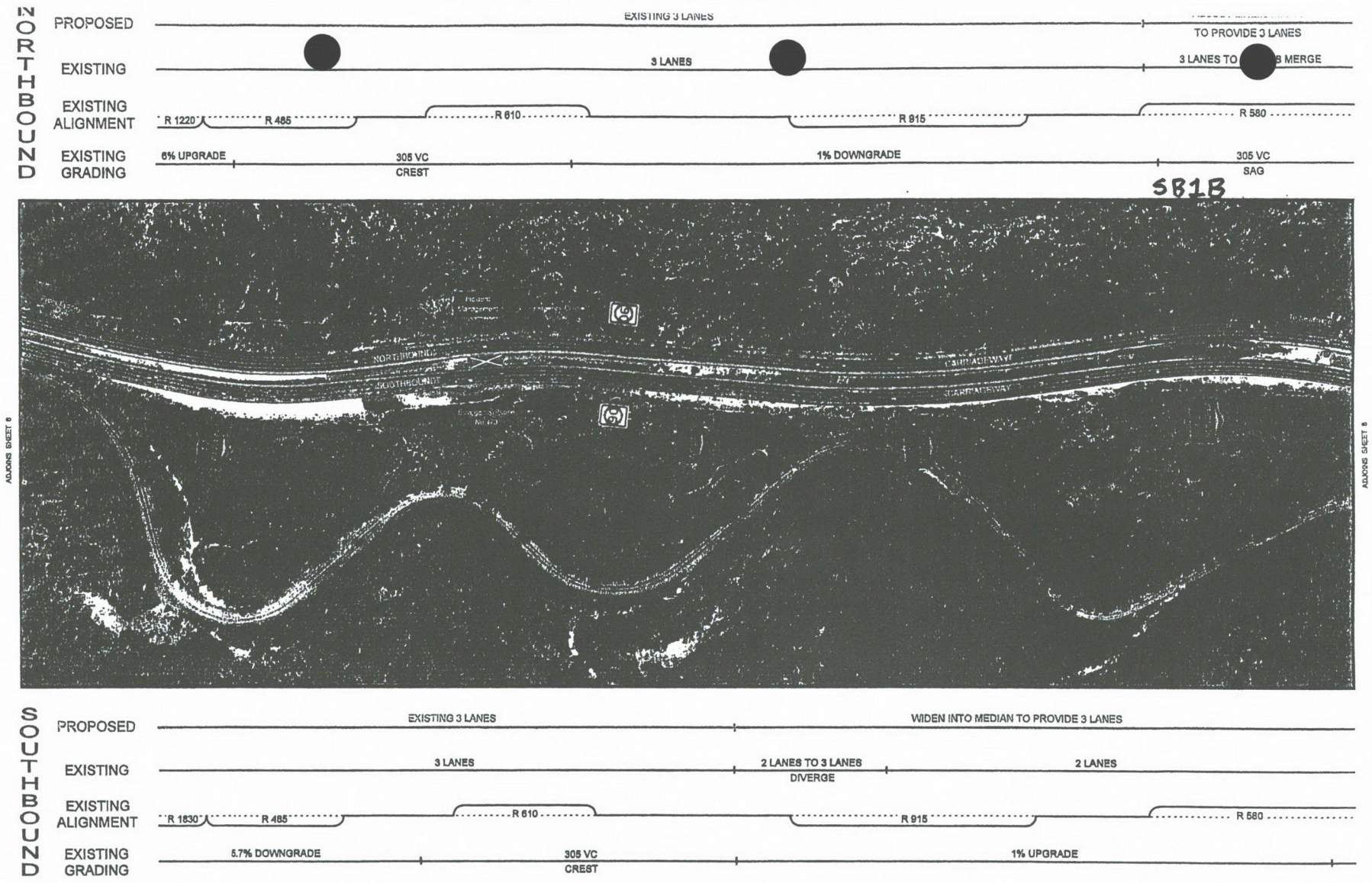
Map 1: Location of F3 Road Widening Program



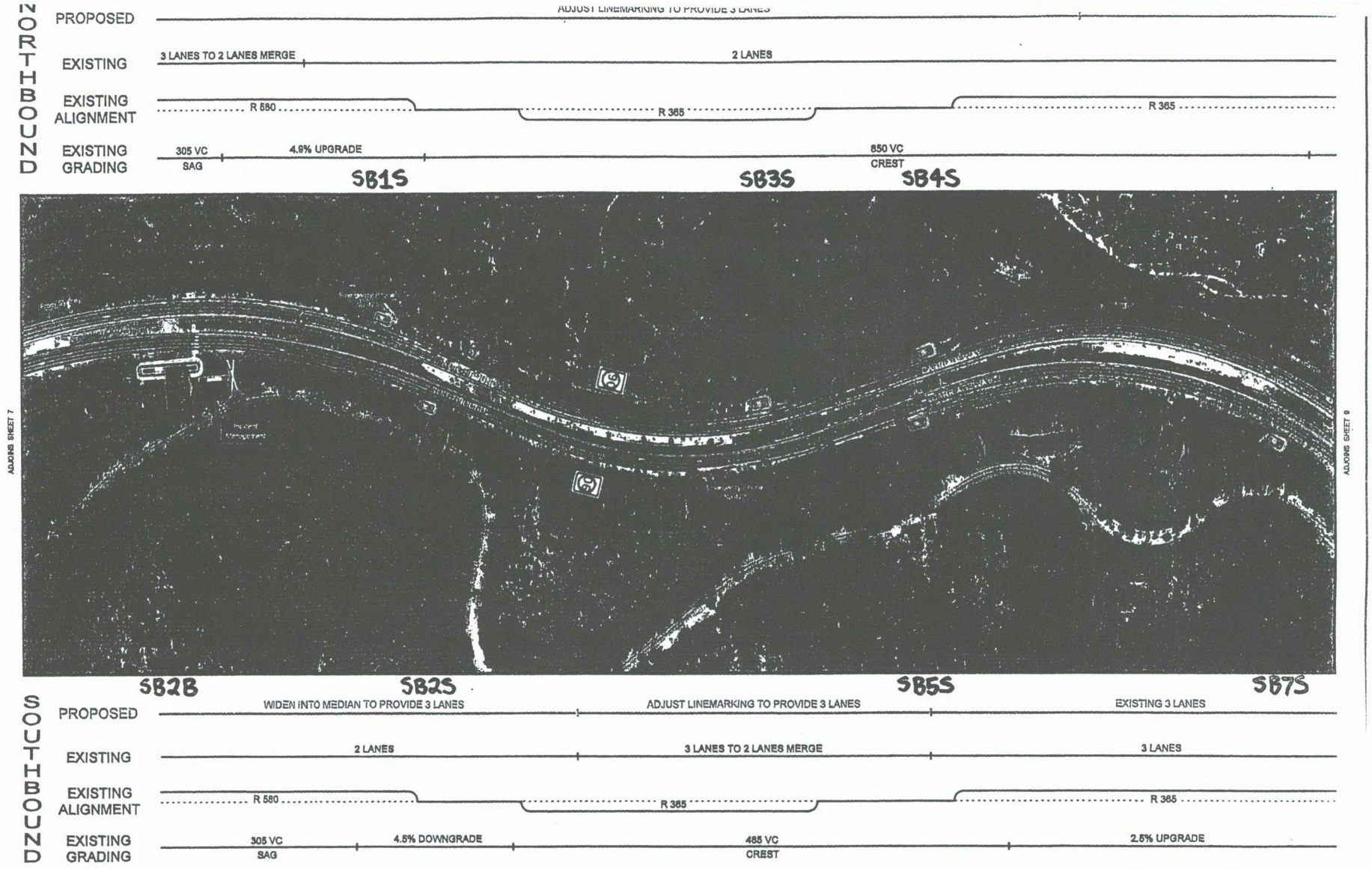


Map 2: Location of work compound WC1 and sedimentation basins

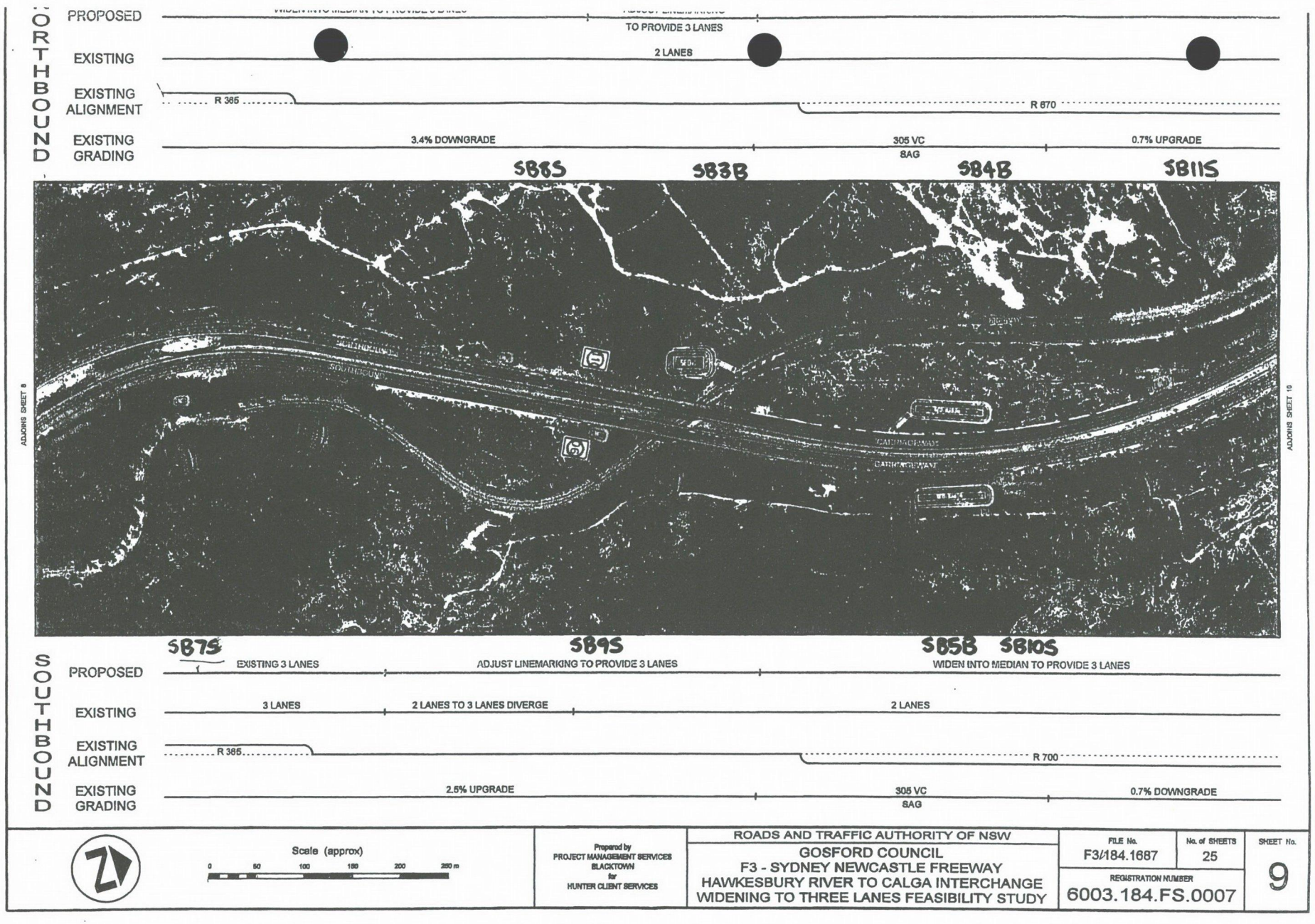
Map 2: Location of work compound WC1 and sedimentation basins



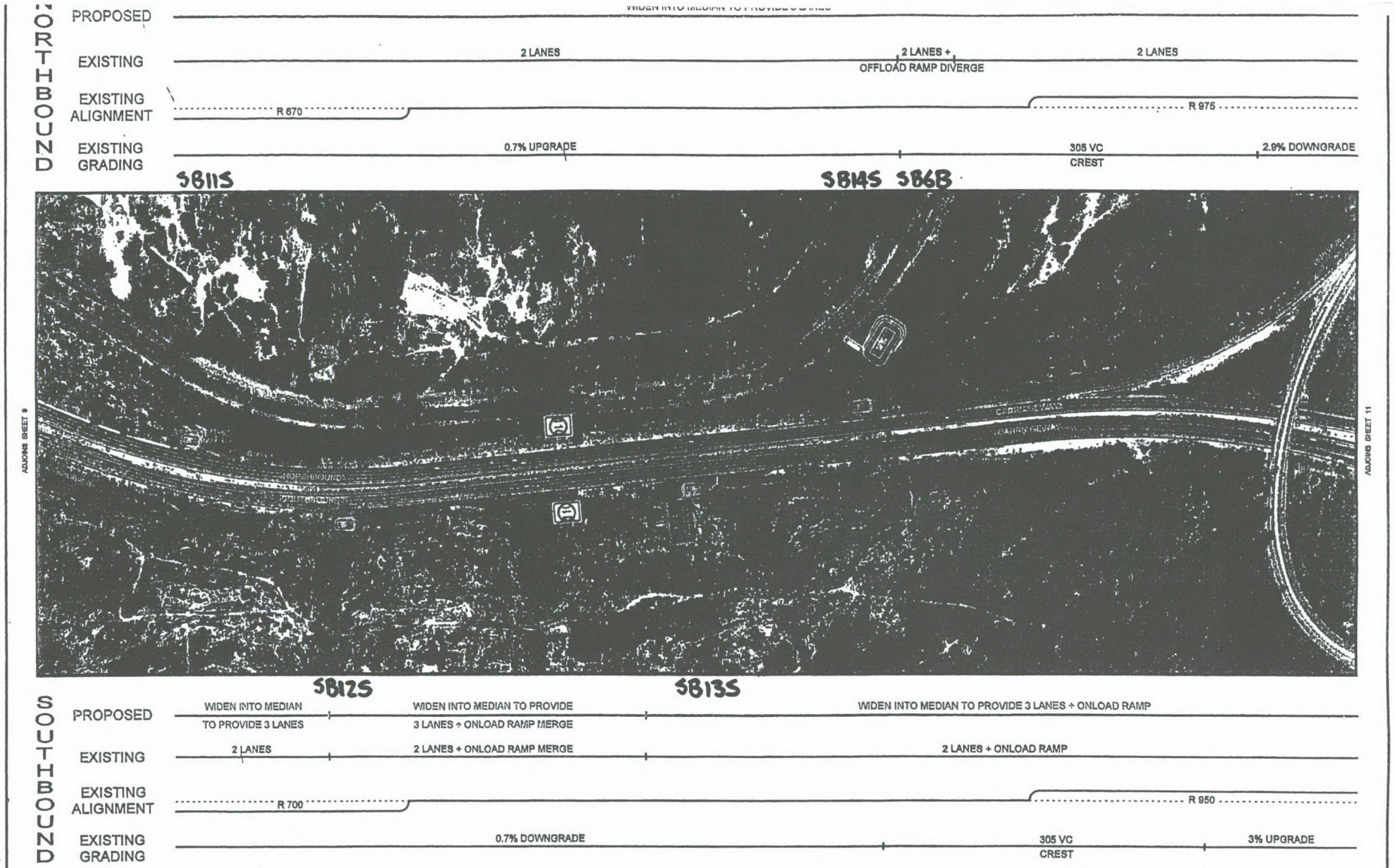
Map 3: Location of sedimentation basin SB1B



Map 4: Location of sedimentation basins SB1S, SB2B, SB2S, SB3S, SB4S, SB5S, SB7S



Map 5: Location of sedimentation basin SB7S, SB8S, SB9S, SB3B, SB4B, SB5B, SB10S, SB11S



Scale (approx)

0 50 100 150 200 250 m

Prepared by
PROJECT MANAGEMENT SERVICES
BLACKTOWN
for
HUNTER CLIENT SERVICES

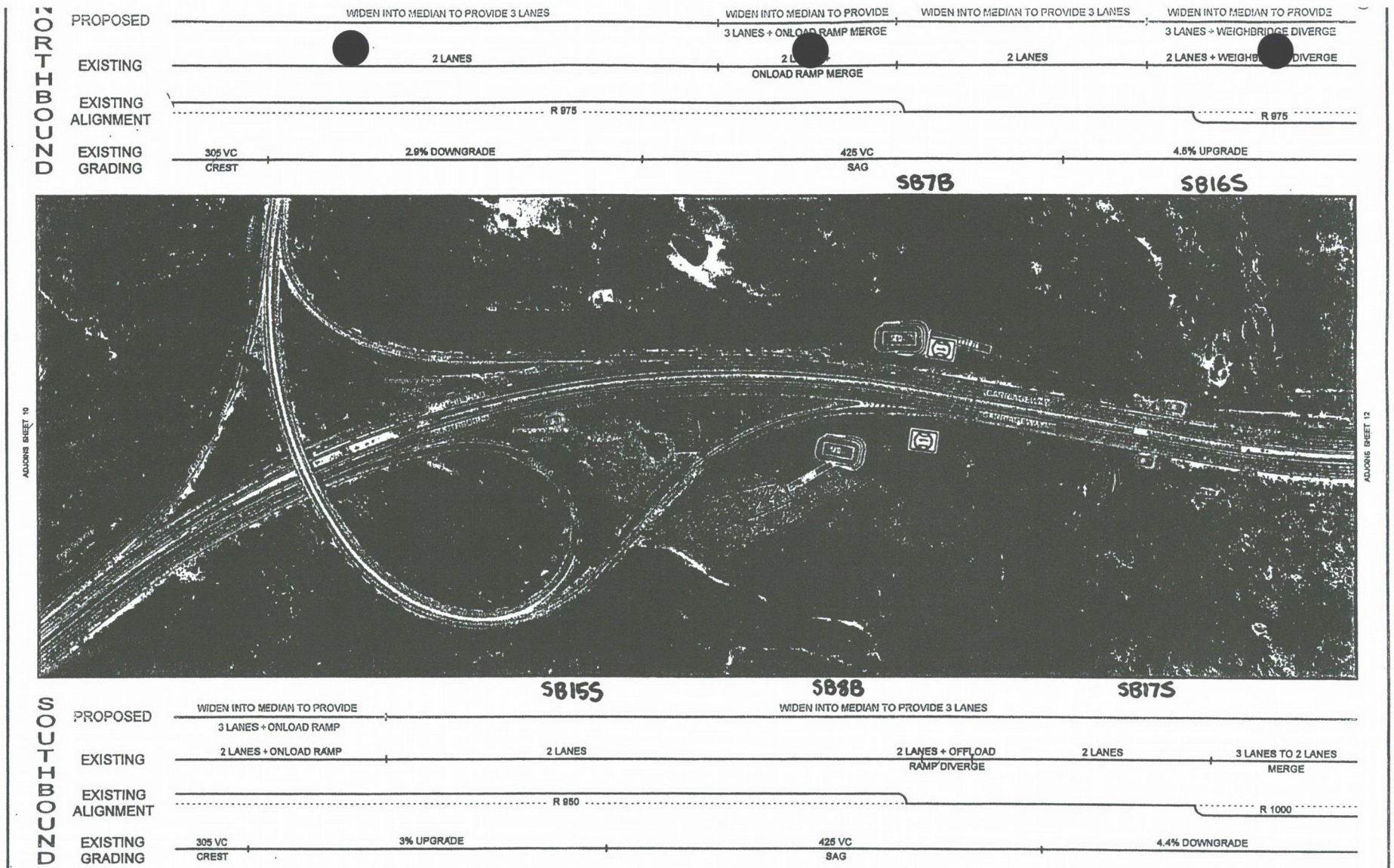
ROADS AND TRAFFIC AUTHORITY OF NSW

GOSFORD COUNCIL
F3 - SYDNEY NEWCASTLE FREEWAY
HAWKESBURY RIVER TO CALGA INTERCHANGE
WIDENING TO THREE LANES FEASIBILITY STUDY

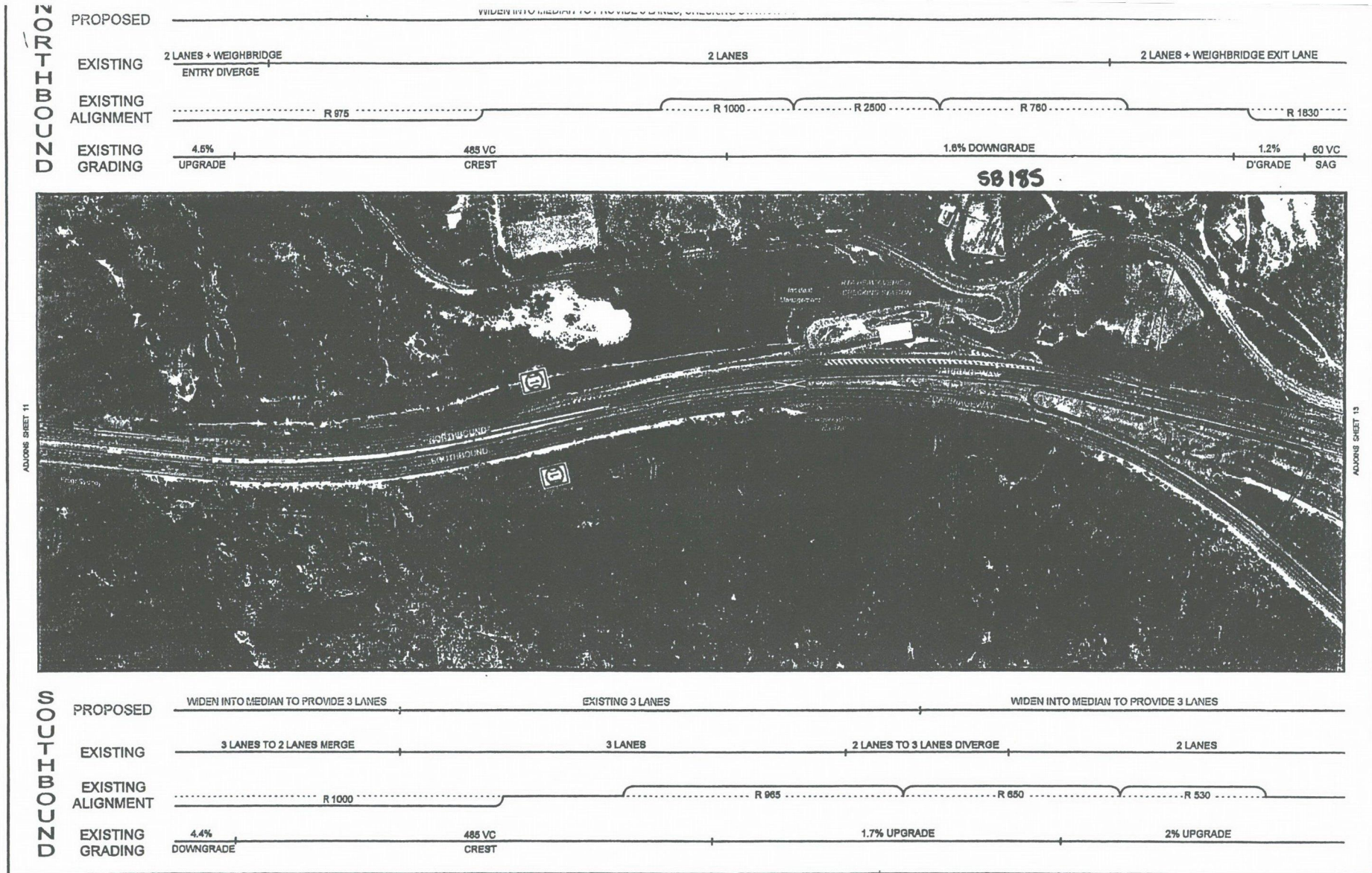
FILE No.	No. of SHEETS	SHEET No.
F3/184.1687	25	10

REGISTRATION NUMBER
6003.184.FS.0007

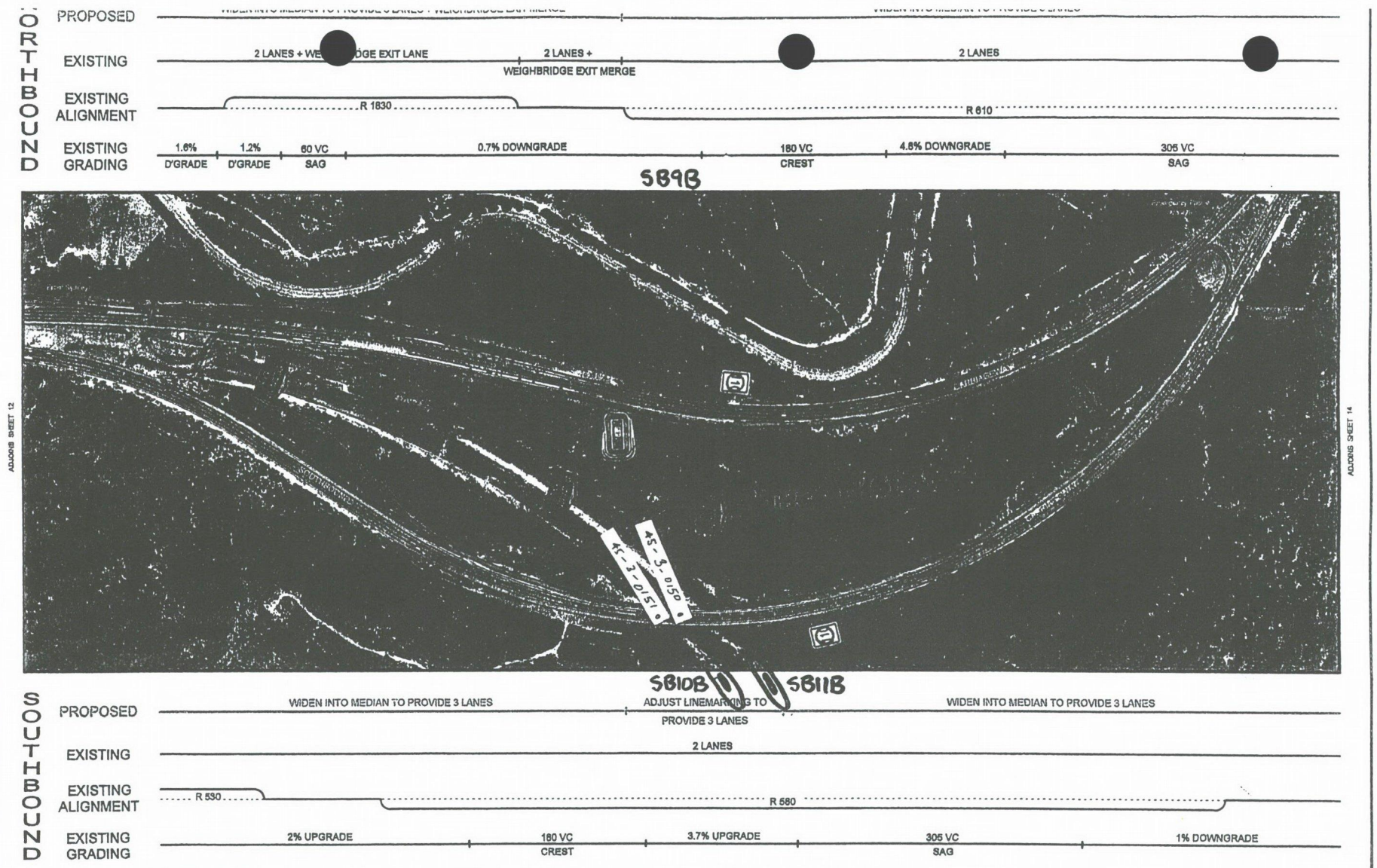
Map 6: SB11S, SB12S, SB13S, SB14S, SB6B



Map 7: SB15S, SB7B, SB8B, SB16S, SB17S



Map 8: SB18S, Work compound WC2



Map 9: SB9B, SB10B, SB11B and "the Mistake"

NORTHBOUND

PROPOSED — WIDEN INTO MEDIAN TO PROVIDE 3 LANES

EXISTING — 2 LANES

EXISTING ALIGNMENT — R 610 | R 840

EXISTING GRADING — 4.8% D'GRADE | 305 VC SAG | 1% UPGRADE | 240 VC SAG



ADJOINS SHEET 13

ADJOINS SHEET 15

SB12B

SB14B

SOUTHBOUND

PROPOSED — WIDEN INTO MEDIAN TO PROVIDE 3 LANES

EXISTING — 2 LANES

EXISTING ALIGNMENT — R 580 | R 820

EXISTING GRADING — 1% DOWNGRADE | 240 VC SAG

Scale (approx)

0 50 100 150 200 250 m

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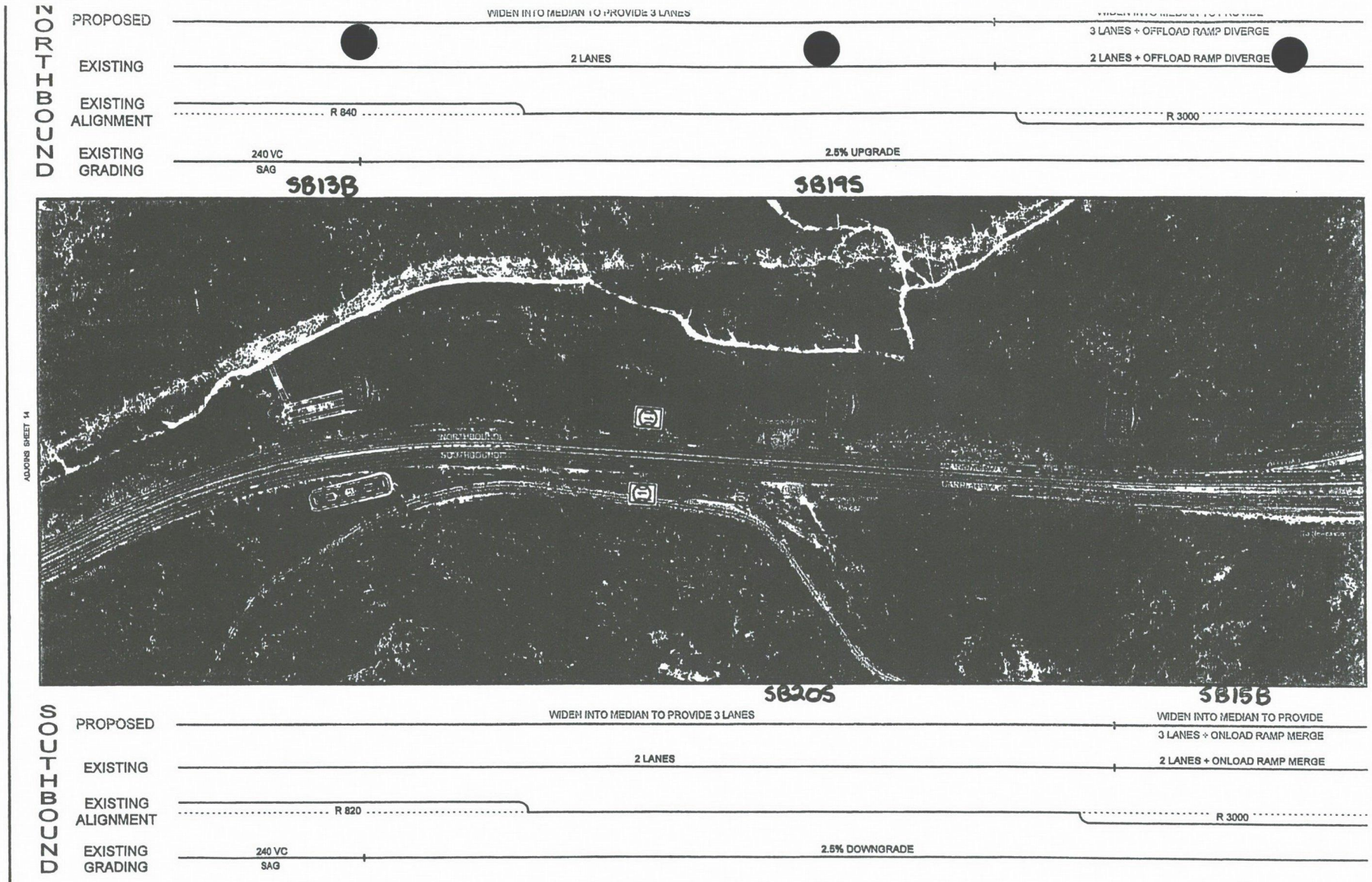
WIDENING TO THREE LANES FEASIBILITY STUDY

FILE No.	No. of SHEETS	SHEET No.
F3/184.1687	25	14

REGISTRATION NUMBER
6003.184.FS.0007

Map 10: SB12B, SB14B



Map 11: SB13B, SB19S, SB20S, SB15B

NORTHBOUND

PROPOSED	WIDEN INTO MEDIAN TO PROVIDE 3 LANES			
EXISTING	2 LANES			2 LANES + ONLOAD RAMP
EXISTING ALIGNMENT	R 3000	R 870		
EXISTING GRADING	2.5% UPGRADE	200 VC CREST	1% UPGRADE	1200 VC CREST

ADJOINS SHEET 16



ADJOINS SHEET 17

SB16B

SOUTHBOUND

PROPOSED	WIDEN INTO MEDIAN TO PROVIDE 3 LANES + ONLOAD RAMP MERGE	WIDEN INTO MEDIAN TO PROVIDE 3 LANES	ADJUST LINEMARKING TO PROVIDE 3 LANES + OFFLOAD RAMP DIVERGE	
EXISTING	2 LANES + ONLOAD RAMP MERGE	2 LANES	3 LANES TO 2 LANES MERGE	3 LANES + OFFLOAD RAMP DIVERGE
EXISTING ALIGNMENT	R 3000	R 870		
EXISTING GRADING	2.5% DOWNGRADE	200 VC CREST	1% DOWNGRADE	1200 VC CREST

Scale (approx)

0 50 100 150 200 250 m

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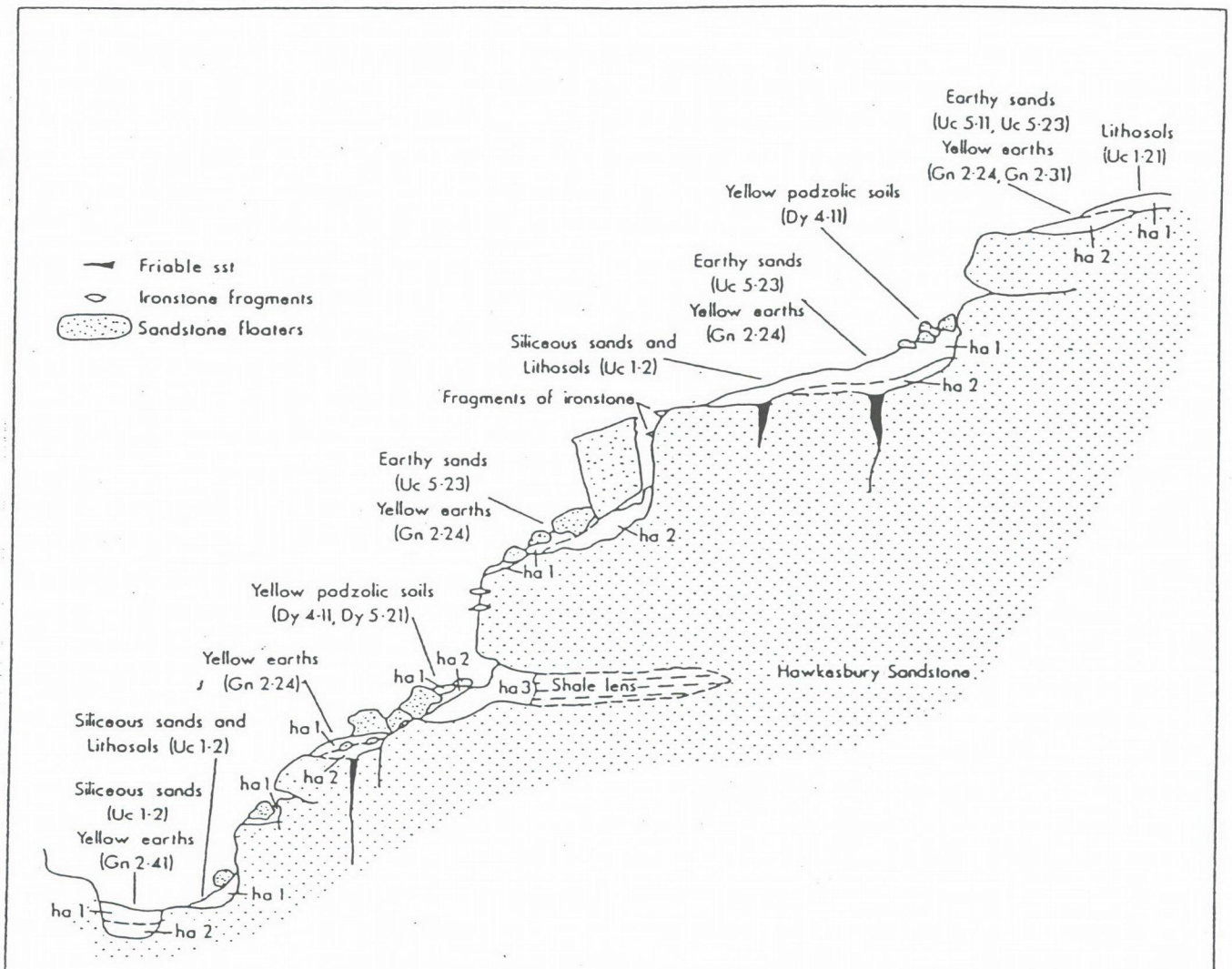
F3 - SYDNEY NEWCASTLE FREEWAY
HAWKESBURY RIVER TO CALGA INTERCHANGE
WIDENING TO THREE LANES FEASIBILITY STUDY

FILE No.	No. of SHEETS	SHEET No.
F3/184.1687	25	16

REGISTRATION NUMBER
6003.184.FS.0007

Map 12: SB16B

Map 13: Cross section of Hawkesbury soil landscape illustrating the occurrence and relationship of the dominant soil types.



■ *Schematic cross section of Hawksbury soil landscape illustrating the occurrence and relationship of the dominant soil materials.*

NC98/8

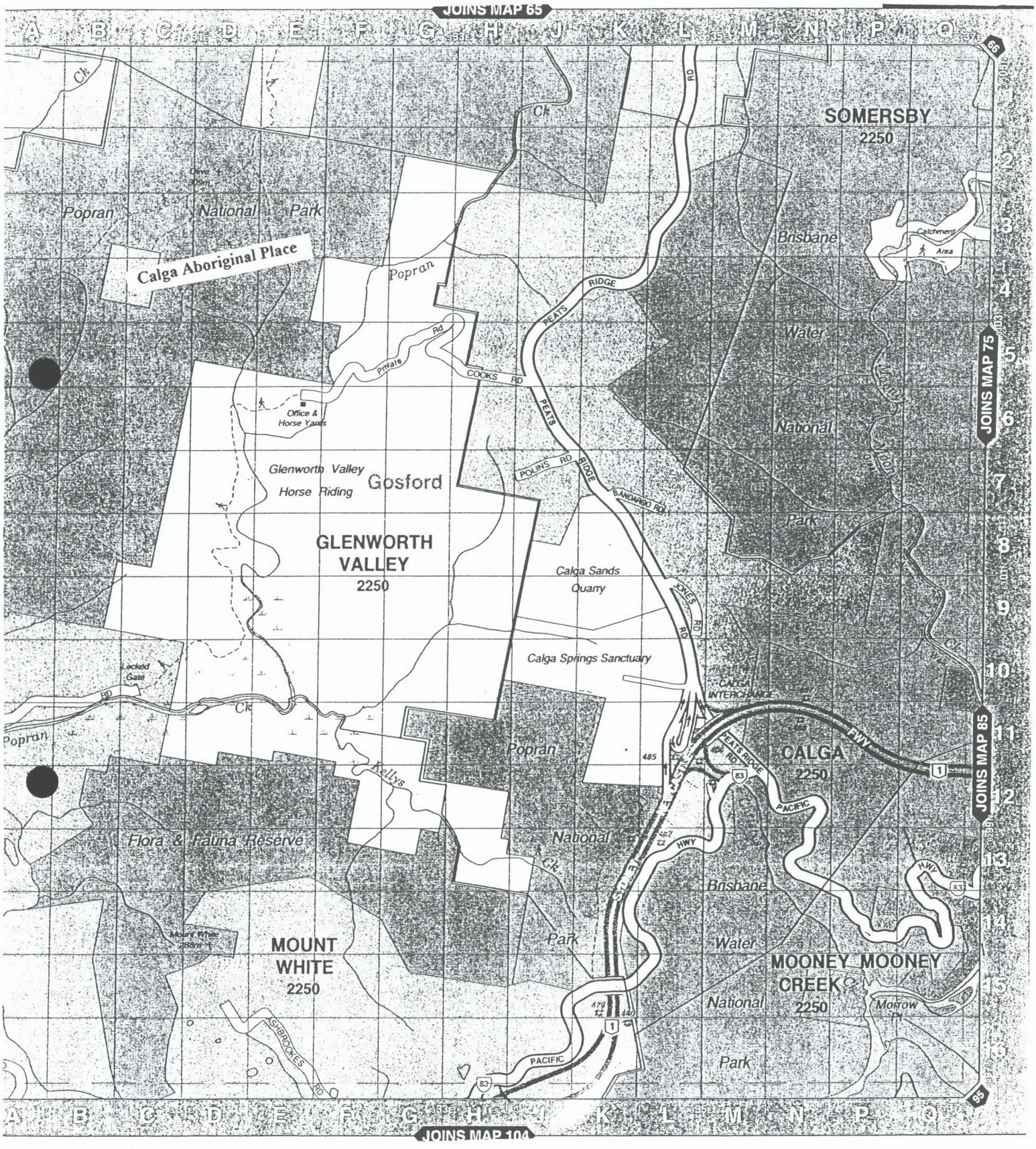
Attachment A: General locality of application (provided by applicant)

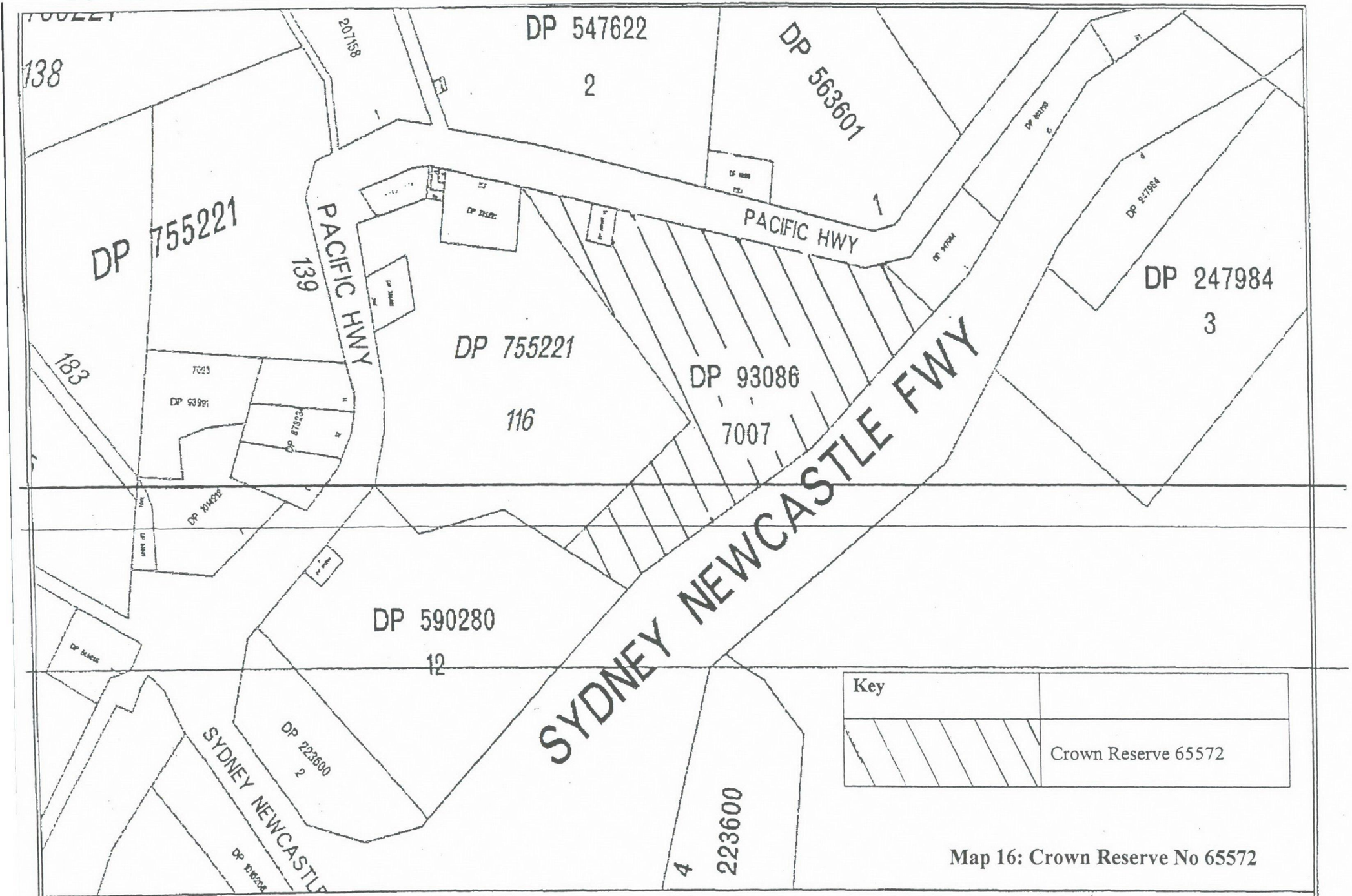
1 A4 page added 16.11.98

Map 14: Native Title Boundary Map



Map 15: Calga Aboriginal Place





Map 16: Crown Reserve No 65572

The Crown information shown has not been validated and may contain errors and omissions. Verification of Crown information should be made through the Departmental office shown below. This is a diagrammatic representation only.

0 50 100 150 200
Metres

Printed by: Peter Allen
Date printed: 10/09/2001

LAND & WATER CONSERVATION

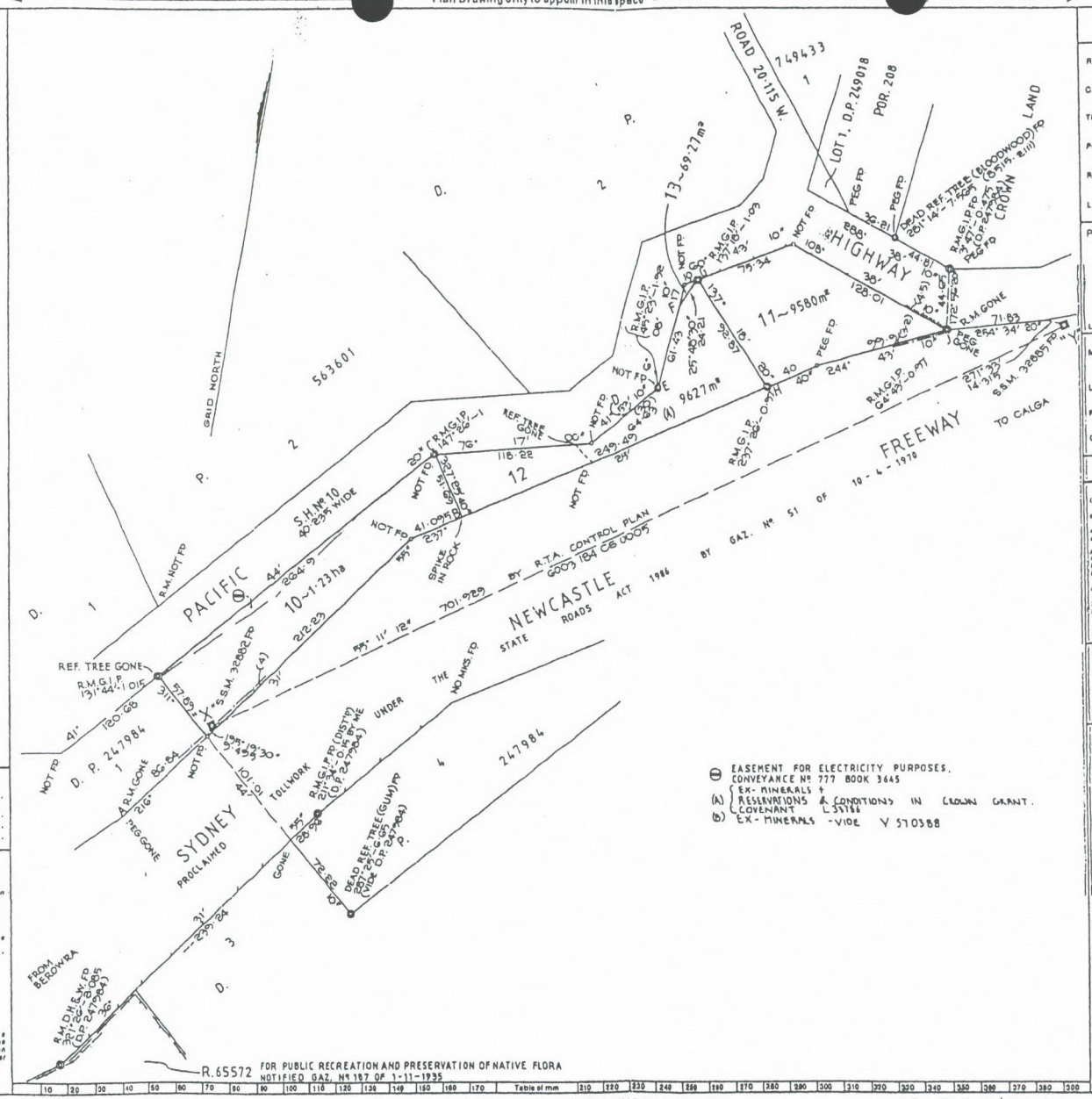
Crown Estate Copyright Dept. Land & Water Conservation NSW

PLAN F[illegible]2

Plan Drawing only to appear in this space

OFFICE USE ONLY

SIGNATURES, SEALS AND STATEMENTS of intention to dedicate public roads or to create reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.



⊖ EASEMENT FOR ELECTRICITY PURPOSES, CONVEYANCE No 777 BOOK 3645

(A) EX-MINERALS + RESERVATIONS & CONDITIONS IN CROWN GRANT. COVENANT L 35786

(B) EX-MINERALS -VIDE V 570388

DP 802793

Registered: GBW 28-5-1990

C.A:

Title System: TORRENS AND OLD SYSTEM

Purpose: PA 61944

Ref. Map: Ph: NORTHUMBERLAND

Last Plan: DP 247984 + DP 520935

PLAN OF SUBDIVISION OF LOT 2, D.P. 247984 AND LOT 1, D.P. 520935 FOR THE PURPOSES OF THE STATE ROADS ACT, 1986.

Lengths are in metres. Reduction Ratio 1: 2000

Mun./Shire City: GOSFORD

Locality: MT. WHITE

Parish: COWAN

County: NORTHUMBERLAND

This is sheet 1 of my plan in ~~sheets.~~ (Delete if inapplicable).

I, ANTHONY JOHN VETTER of ROADS AND TRAFFIC AUTHORITY

a surveyor registered under the Surveyors Act, 1928, as amended, hereby certify that the survey represented in this plan is accurate and has been made in accordance with the Survey Practice Regulations, 1933 and any special requirements of the Department of Lands, and was completed on

6 MARCH, 1990

Signature: [signature] 8.5.90

Surveyor registered under Surveyors Act, 1928, as amended.

Datum Line of Azimuth. 'X' - 'Y'

Finish date of survey.

F.B. 6003 184 FP 5540 / 5541 (FOIL)

Plans used in preparation of survey/compilation.

PANEL FOR USE ONLY for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to user. J.R.W. 147

LOT 12 IS REQUIRED FOR FREEWAY UNDER DIVISION 2 PART 3 OF THE STATE ROADS ACT, 1986.

ACCESS WILL BE DENIED ACROSS THE BOUNDARIES MARKED A-B-C-D AND E-F-G-H-J.

LOTS 10-13 INCLUSIVE ARE OWNED BY THE ROADS AND TRAFFIC AUTHORITY

LOT 13 IS TO BE DECLARED PUBLIC ROAD.

LOTS 10 & 11 ARE TO BE DISPOSED OF.

APPROVED:

D. Eckstein

CHIEF SURVEYOR

ROADS AND TRAFFIC AUTHORITY

Crown Lands Office Approval

PLAN APPROVED .....

Authorised Officer

Land District .....

Paper No. .....

Field Book ..... pages .....

Council Clerk's Certificate

I hereby certify that —

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

*(b) the requirements of Part 3 Division 2 of the † Water Board Act 1987 and † Water Supply Authorities Act 1987

have been complied with by the applicant in relation to the proposed .....

(insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. .....

Date .....

(Signature) .....

Council Clerk

Council File No. .....

*This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Metropolitan Water Sewerage and Drainage Board and the Hunter District Water Board.

† Delete if inapplicable.

SURVEYOR'S REFERENCE:

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

R.T.A. FILE: F3/184·1810 R.T.A. PLAN: 6003 184 SS 0301

This negative is a photo[illegible] record of a document i[illegible] Registrar General this day. 29th May, 1990

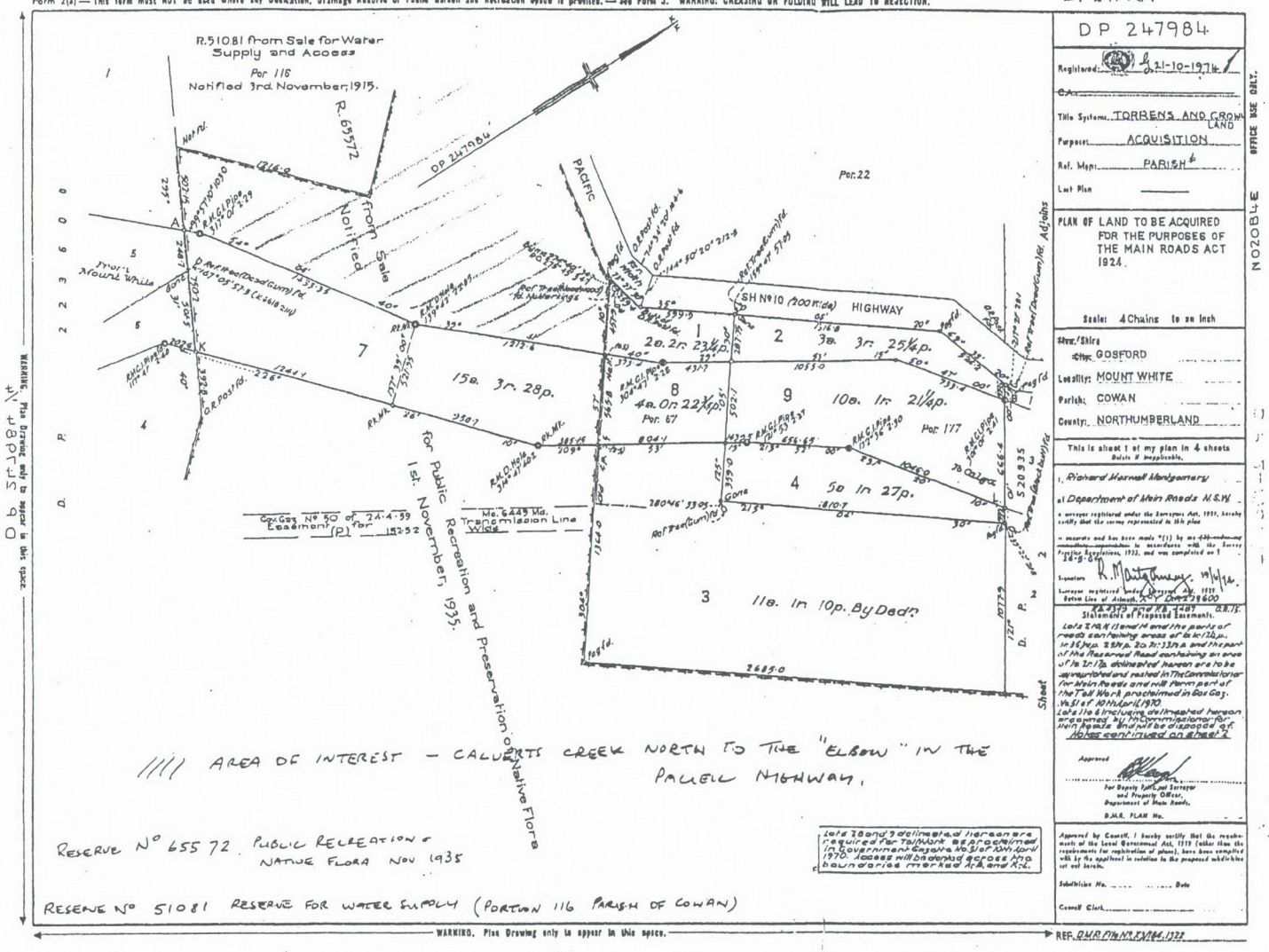
10	20	30	40	50	60	70 Table of mm	110	120	130	140

Map 17: Boundary of RTA Land and Reserve No.65572

Ref: Roads & Traffic Authority of NSW /Src:P

Form 2(a) — This form must NOT be used where any Dedication, Drainage Reserve or Public Garden and Recreation Space is provided. — See Form 3. WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION.

DP 247984



DP 247984

Registered: 21-10-1974

CA:

Title System: TORRENS AND CROWN LAND

Purpose: ACQUISITION

Ref. Map: PARISH

Last Plan:

PLAN OF LAND TO BE ACQUIRED FOR THE PURPOSES OF THE MAIN ROADS ACT 1924.

Scale: 4 Chains to an inch

Shire/Shire City: GOSFORD

Locality: MOUNT WHITE

Parish: COWAN

County: NORTHUMBERLAND

This is sheet 1 of my plan in 4 sheets
Delete if inapplicable.

I, Richard Mervell Montgomery

of Department of Main Roads N.S.W.

a surveyor registered under the Surveyors Act, 1929, hereby certify that the survey represented in this plan

is accurate and has been made *(1) by me/by me/under my supervision in accordance with the Survey Practice Regulations, 1933, and was completed on 1 24-9-74

Signature: R. Montgomery 19/9/74.

Surveyor registered under the Surveyors Act, 1929

Datum Line of Azimuth: A-Y Orig. 279600

R.A. 2319 and R.A. 2481 C.R.T.S.

Statement of Proposed Easements.

Lots 1 to 4 inclusive and M and the parts of roads containing areas of 1a 1r 12½p. 1a 3r 33½p. 2a 1r 33½p. and the part of the Reserved Road containing an area of 1a 2r 17½p. delineated hereon are to be appropriated and vested in The Commissioner for Main Roads and will form part of the Toll Work proclaimed in Gov. Gaz. No 81 of 31st July 1970.

Lots 1 to 6 inclusive delineated hereon are required by the Commissioner for Main Roads and will be disposed of.

Notes continued on sheet 2

Approved

for Deputy Chief Land Surveyor and Property Officer, Department of Main Roads.

D.M.R. PLAN No.

Approved by Council. I hereby certify that the requirements of the Local Government Act, 1919 (other than the requirements for registration of plans), have been complied with by the applicant in relation to the proposed subdivision set out hereon.

Subdivision No. ..... Date

Council Clerk

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 247984 SH 1/4

LINKS	METRES
0.5	0.101
2.27	0.457
2.28	0.459
2.29	0.461
2.3	0.463
2.4	0.483
2.41	0.485
2.5	0.503
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22.85	4.597
20.1	5.683
33.05	6.649
34.7	6.981
40.2	8.087
57.05	11.477
57.3	11.527
65.65	13.207
92.35	18.578
93.2	18.749
103	20.720
143.95	28.958
152.52	30.682
184.6	37.136
200	40.234
202.6	40.757
212.5	42.748
248.7	50.030
259.4	52.183
287.75	57.886
359	72.219
373.4	75.116
380.15	77.480
392.0	79.019
431.7	86.044
457.9	92.116
501.5	100.886
502.1	101.006
502.15	101.017
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526.2	105.855
565.8	113.821
599.9	120.681
656.65	132.097
666.4	134.058
733.4	147.537
750.2	150.916
804.1	161.759
923.5	185.779
957.7	192.659
958.7	192.860
1046	210.422
1055	212.232
1077.9	216.839
1212.6	243.936
1216	244.620
1244.1	250.273
1316.8	264.890
1364	274.393
1438.35	288.344
1810.7	364.255
2685	540.136

AC	RD	P	HA
2	2	28 1/4	1.07
3	3	25 1/4	1.581
4	-	22 3/4	1.676
5	1	27	2.193
10	1	21 1/4	4.2
11	1	10	4.578
15	3	28	6.445

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of August, 1977

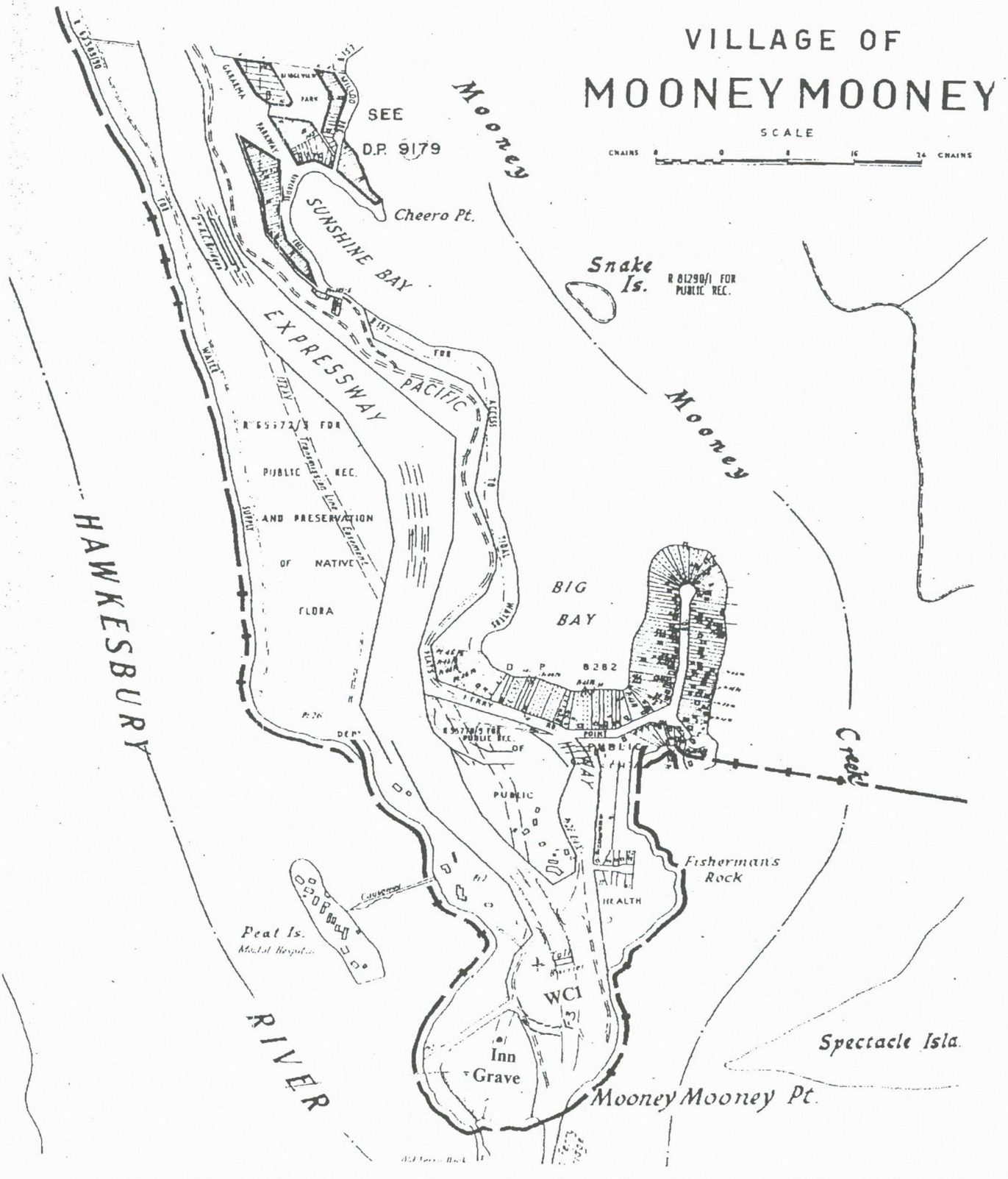
1

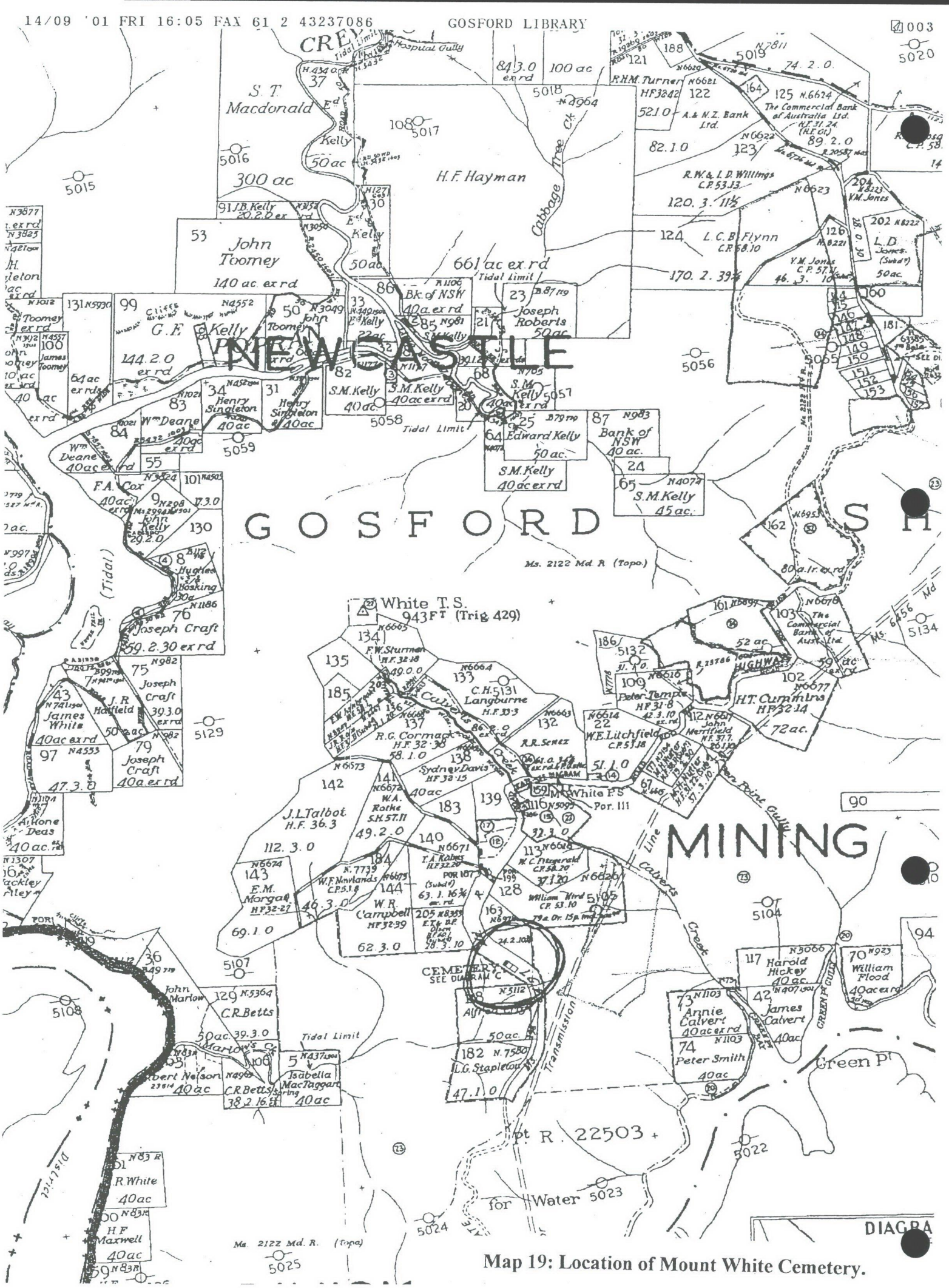
FA 0249348 417

VIRGINIA GRAY.

equest: rp00z3n / Document: dp 0247984 PLAN / Revision: 16 Jun 1992 / Status: OK / Printed: 27-Aug-1998 17:04 / Images: 4
lient Reference: Road Traffic Authority / Source: P

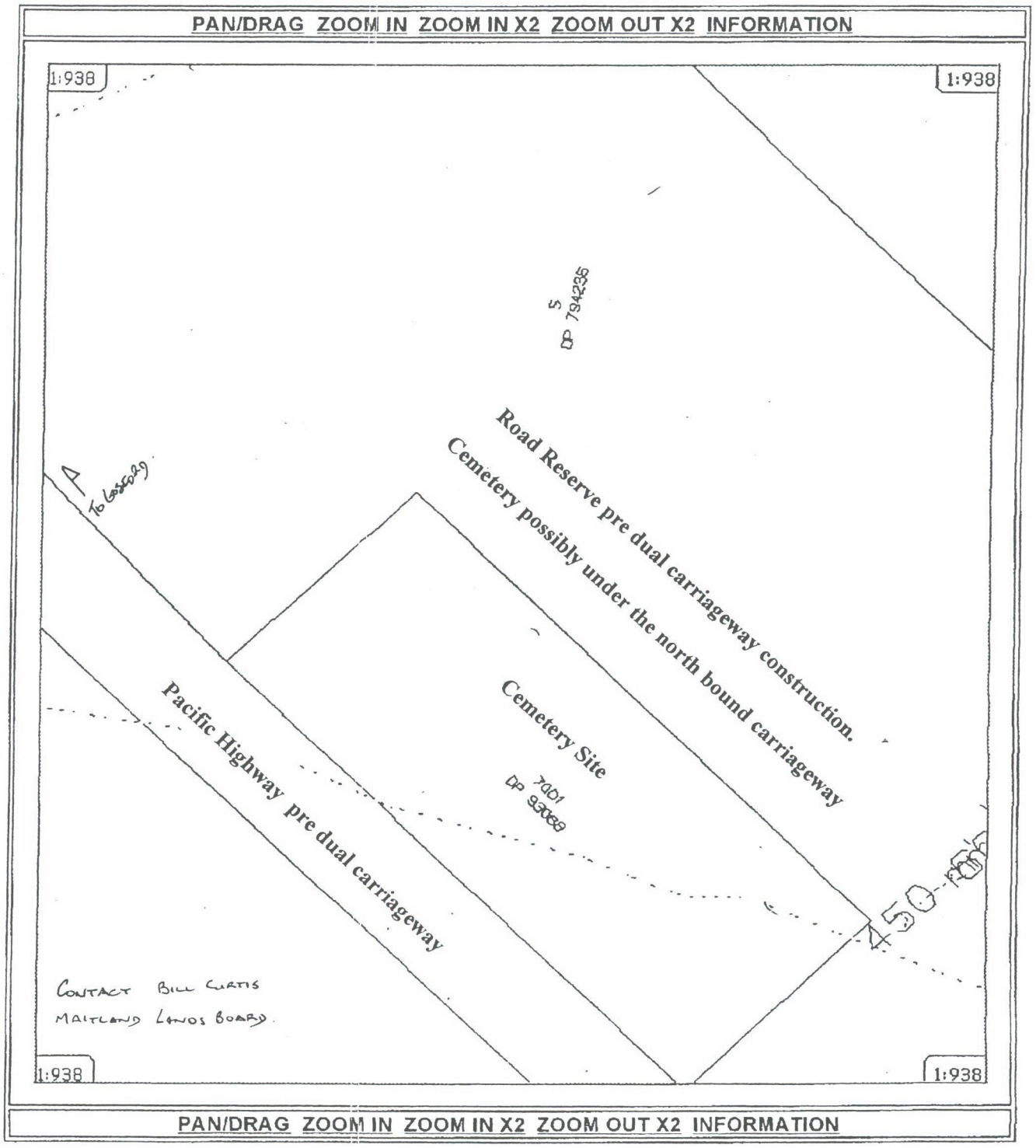
Map 18: Location of George Peat's Inn and the lone Grave of Frances Peat.



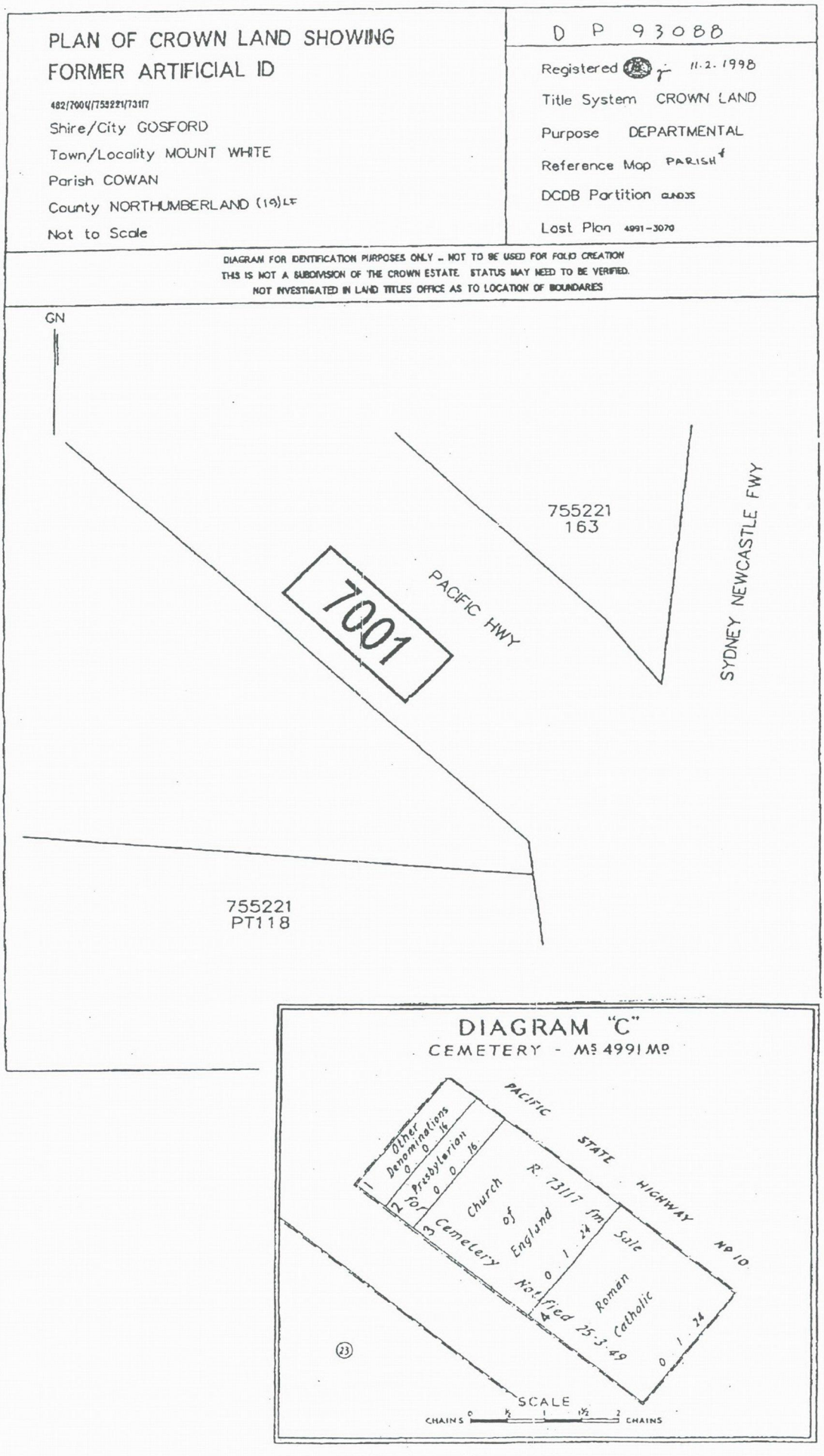


Map 19: Location of Mount White Cemetery.

Map 20: Location of Mount White Cemetery.



Map 21: Location of Mount White Cemetery.



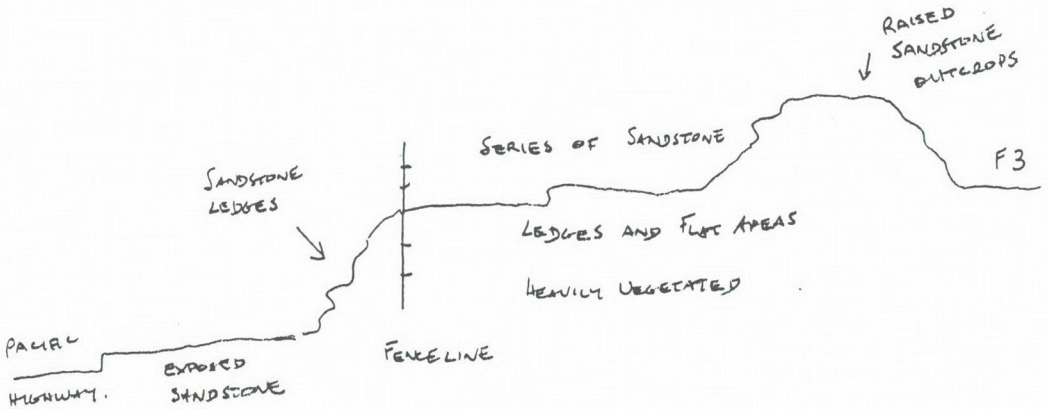
Parish Map of Cowan 1962

Appendix 2: Tables

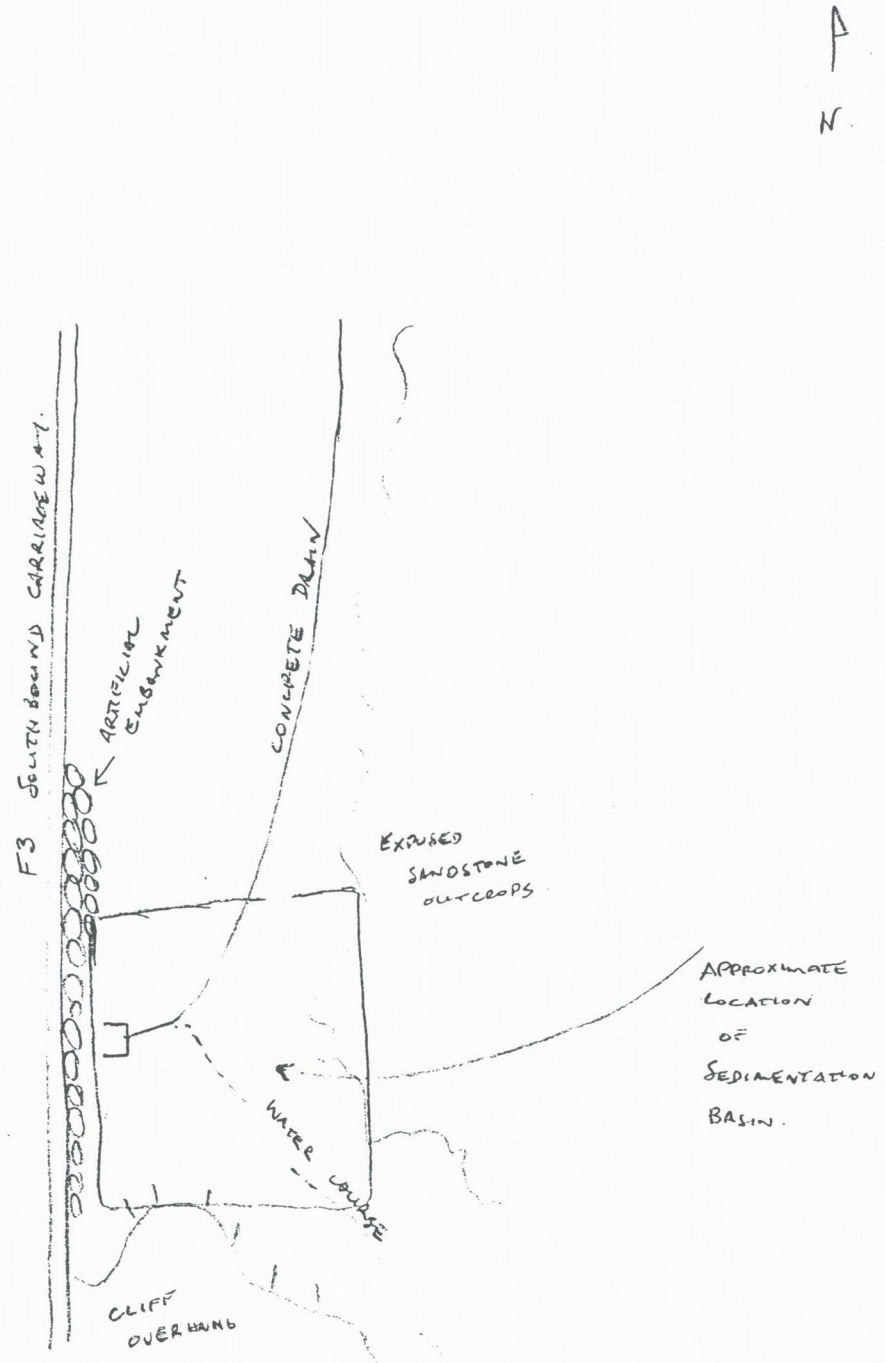
Table 1: AHC Registered Sites in the Gosford LGA
Table 2: Total numbers and percentages of indigenous site types in the Gosford LGA
Table 3: Surface Visibility Criteria
Table 4: Sedimentation Basins Coverage Data
Table 5: Work Camp Locations Coverage and landform Data
Table 6: Crown Reserve Coverage and landform Data
Table 7: Effective Coverage for surveyed area
Table 8: Data relating to Sites identified from NPWS Site Register located immediately adjacent to the F3 easement.
Table 9: Shell data from Site MW-RS-1
Table 10: Summary of Indigenous heritage results

Appendix 3: Sketches

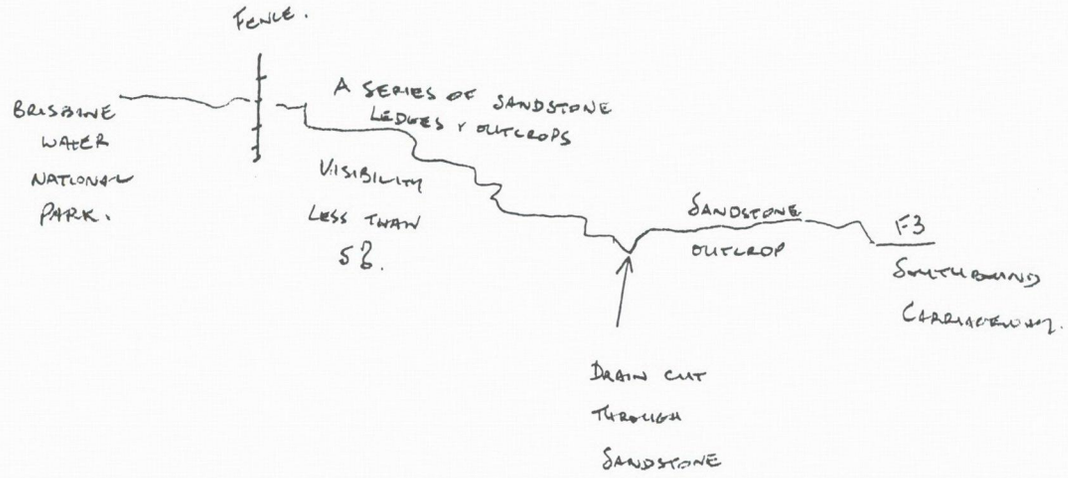
Sketch 1: SB4B



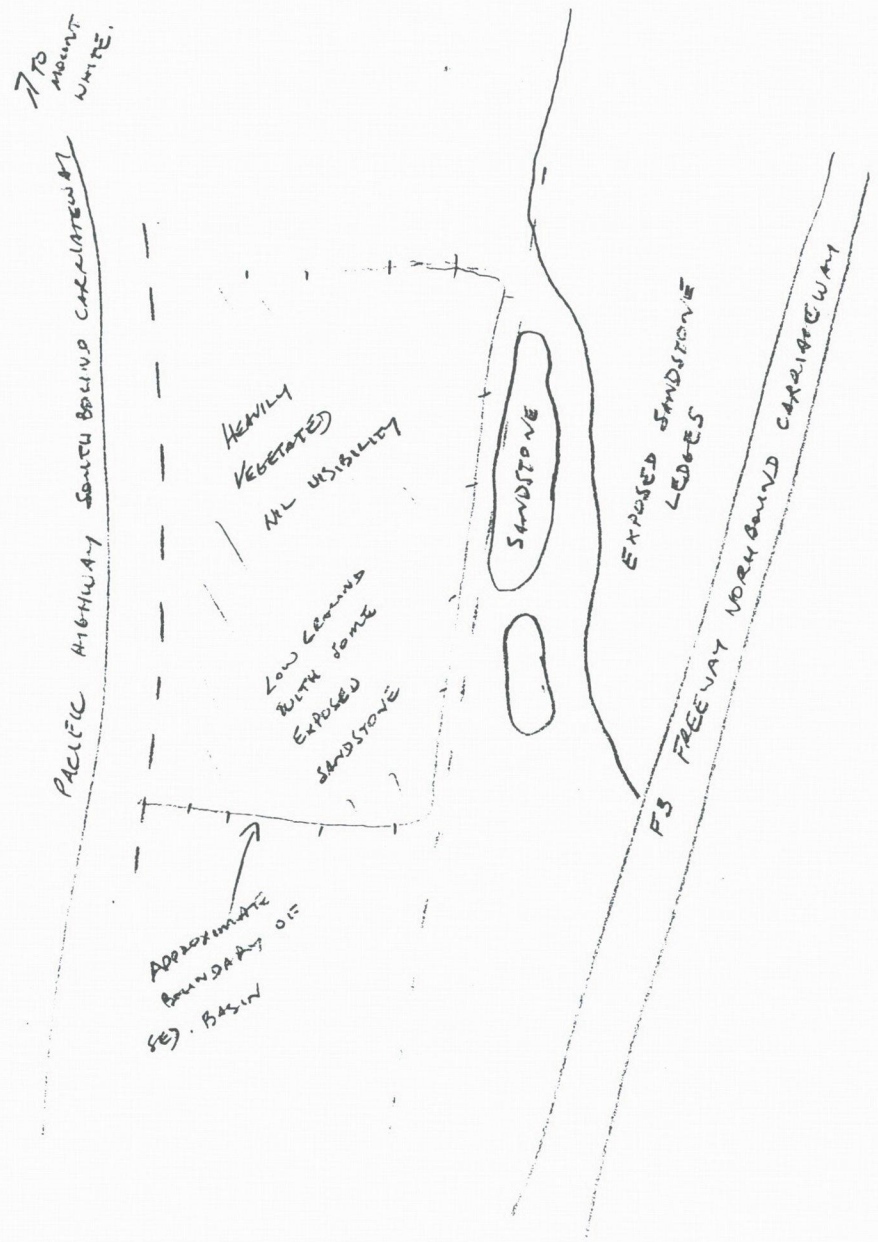
Sketch 3: SB12S



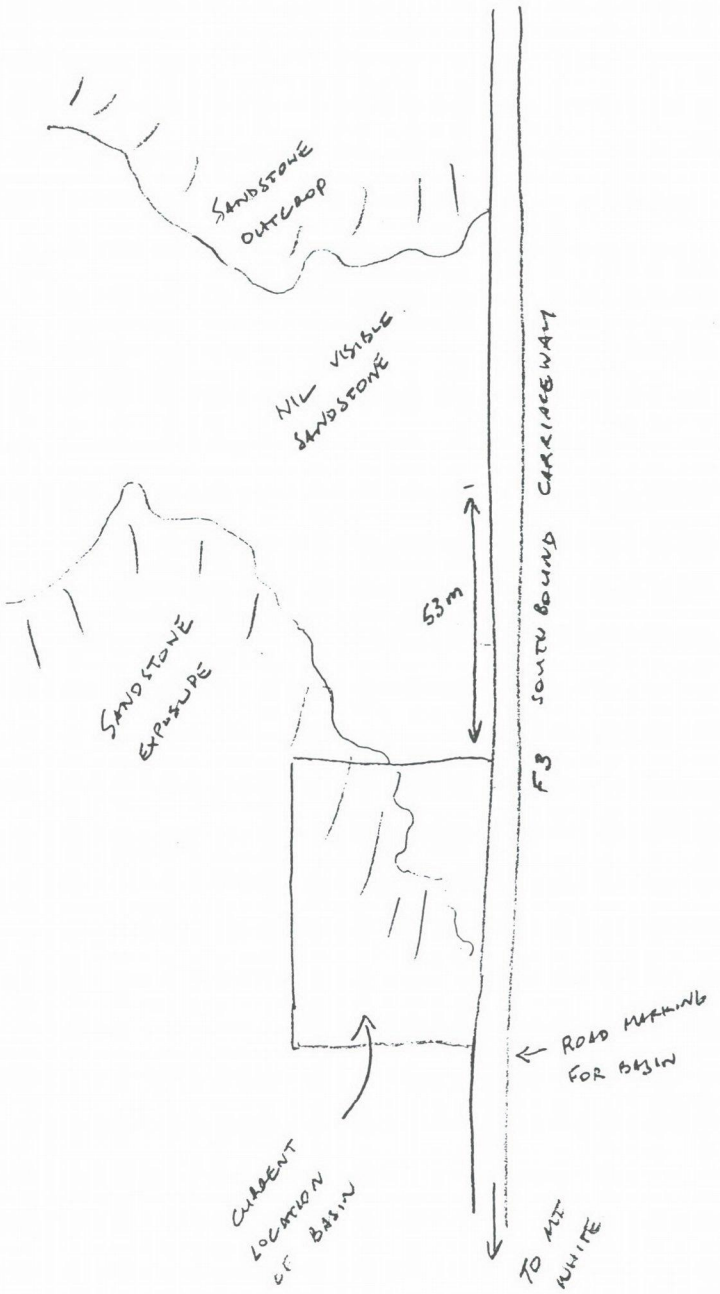
Sketch 4: SB13S



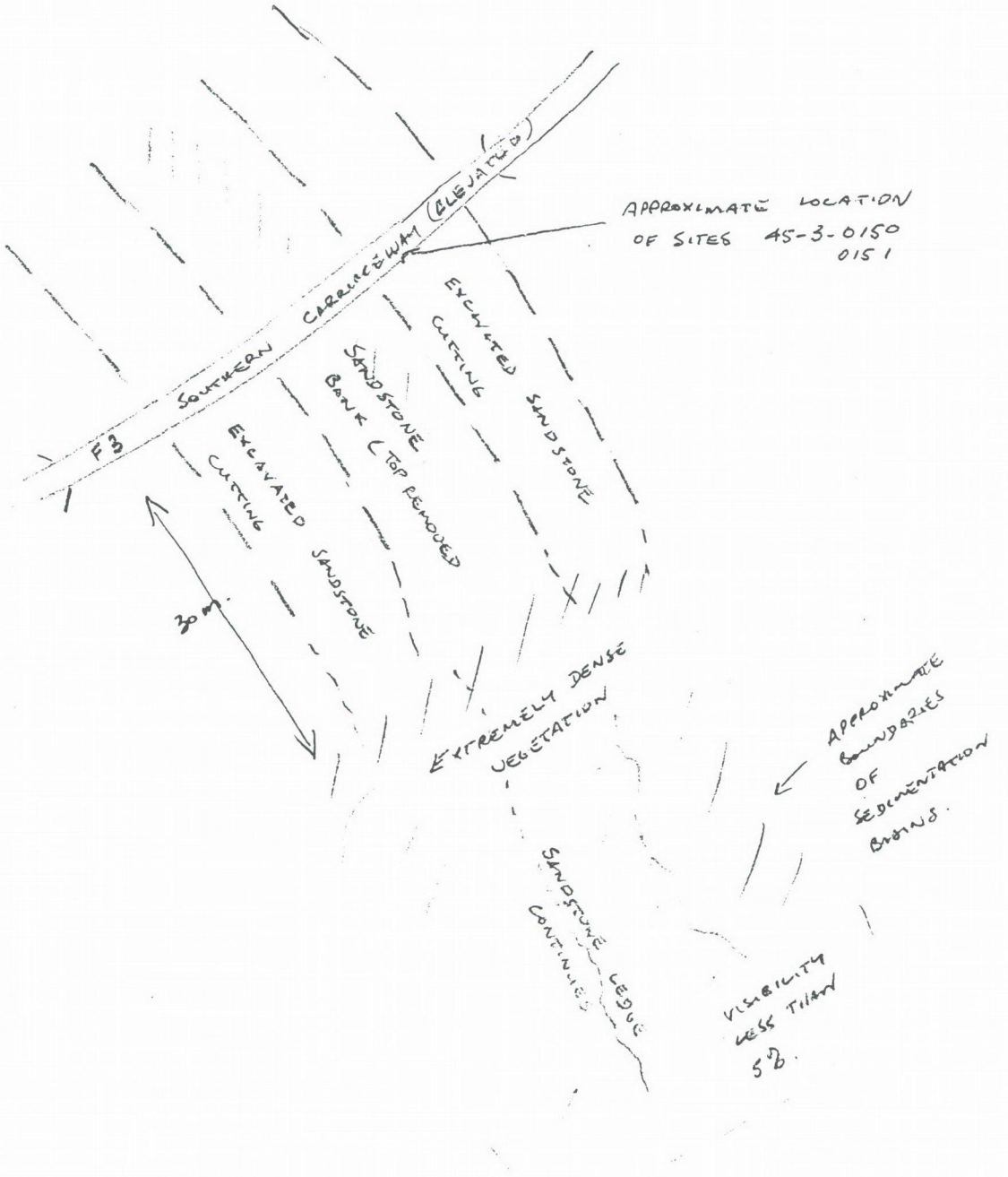
Sketch 5: SB6B



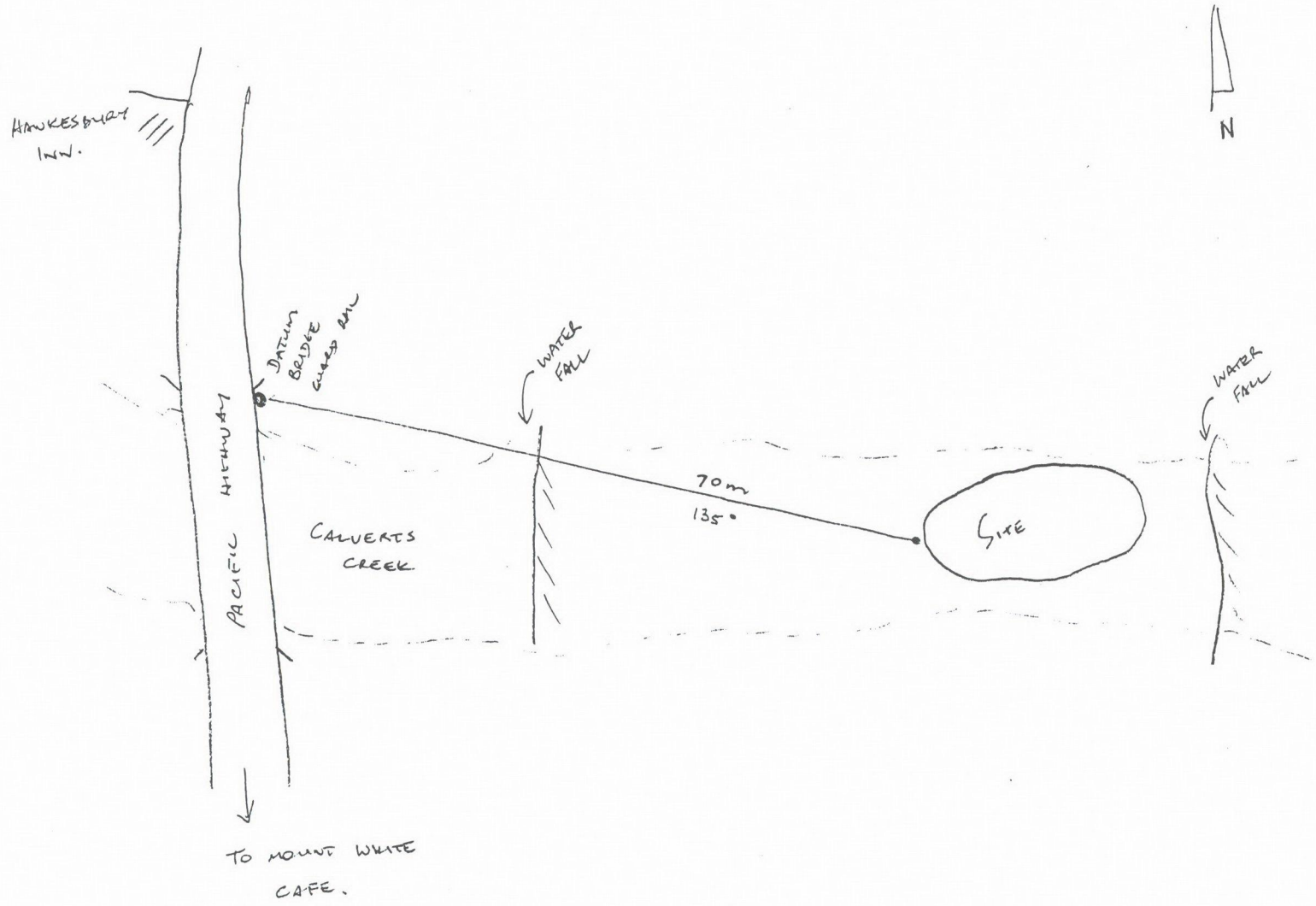
Sketch 6: SB17S



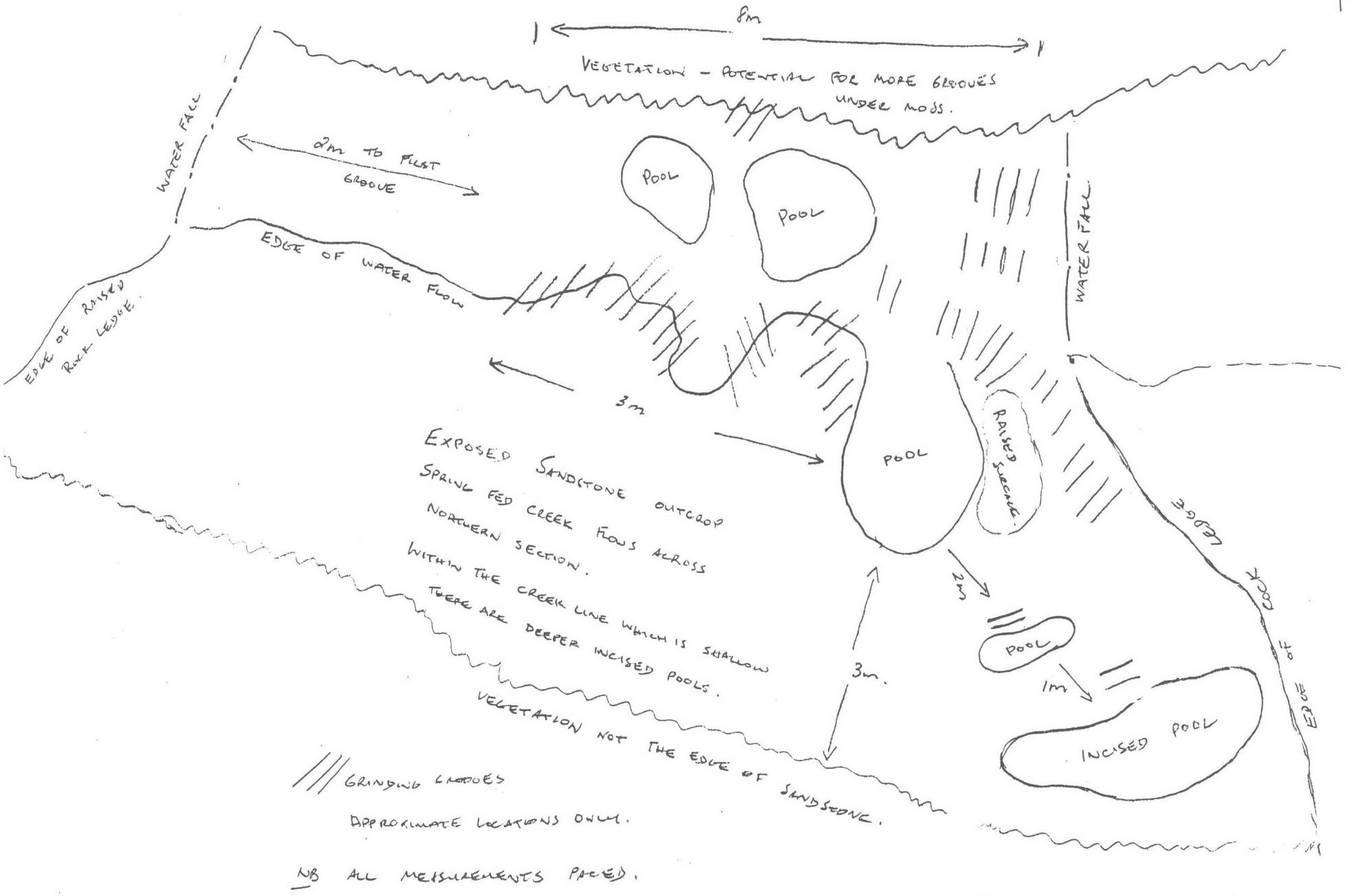
Sketch 7: SB10B, SB11B



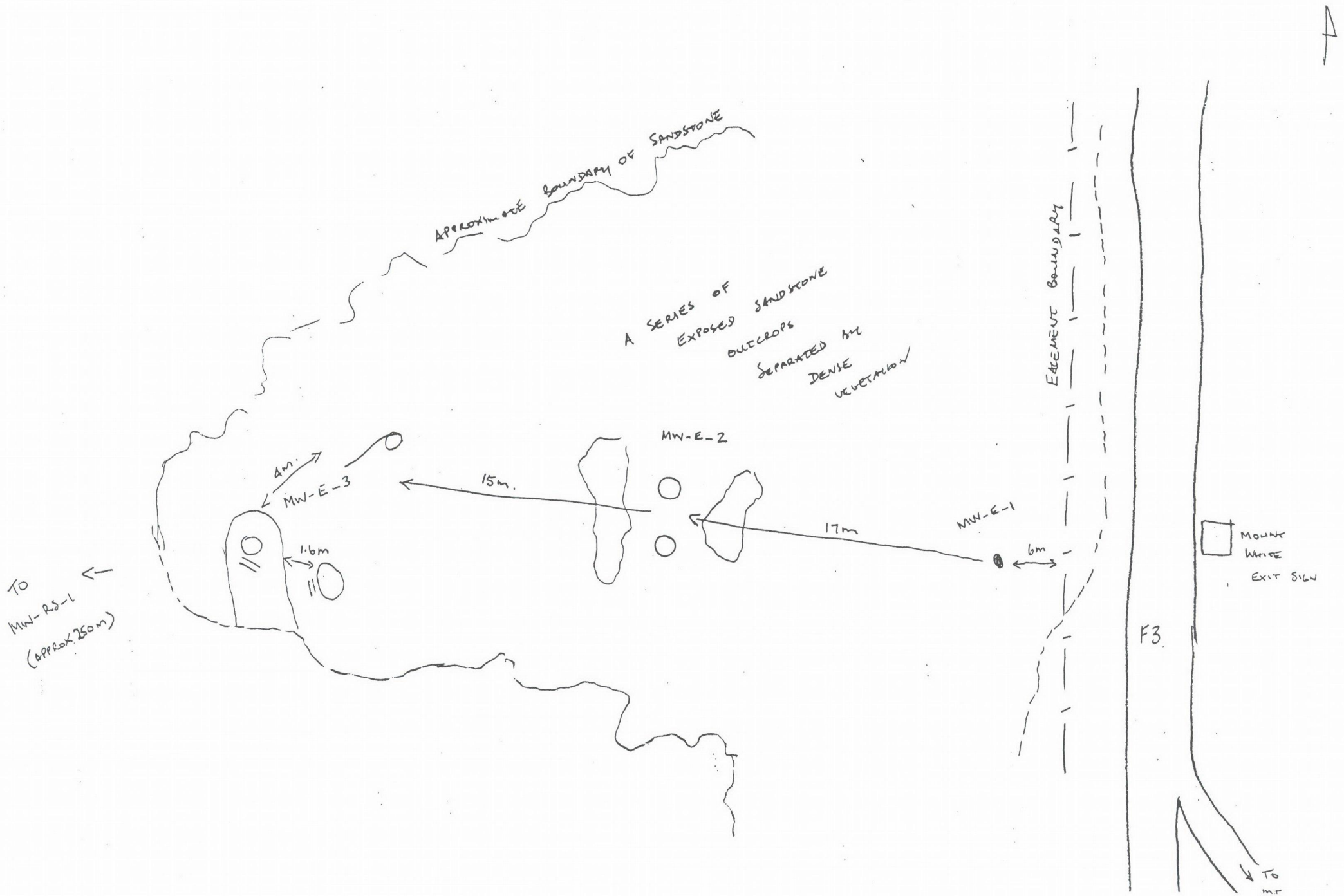
Sketch 8: Location of Site CC-GG-1



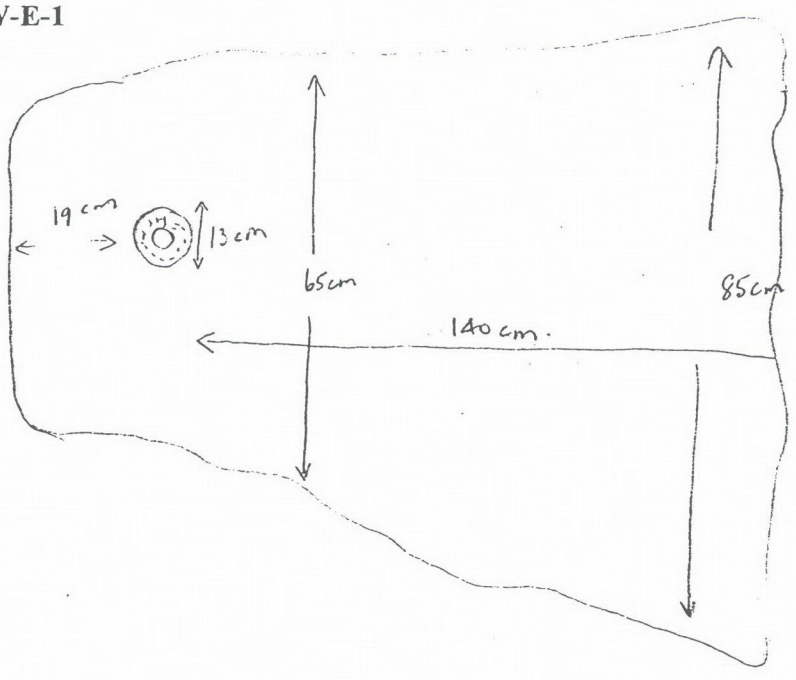
Sketch 9: Site CC-GG-1



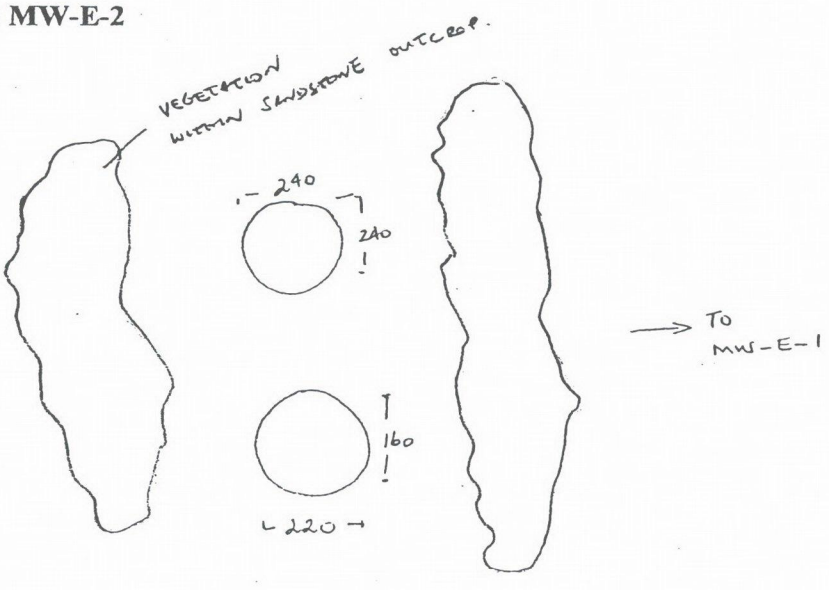
Sketch 10: Approximate locations of Sites MW-E-1 , MW-E-2, MW-E-3



Sketch 11: MW-E-1

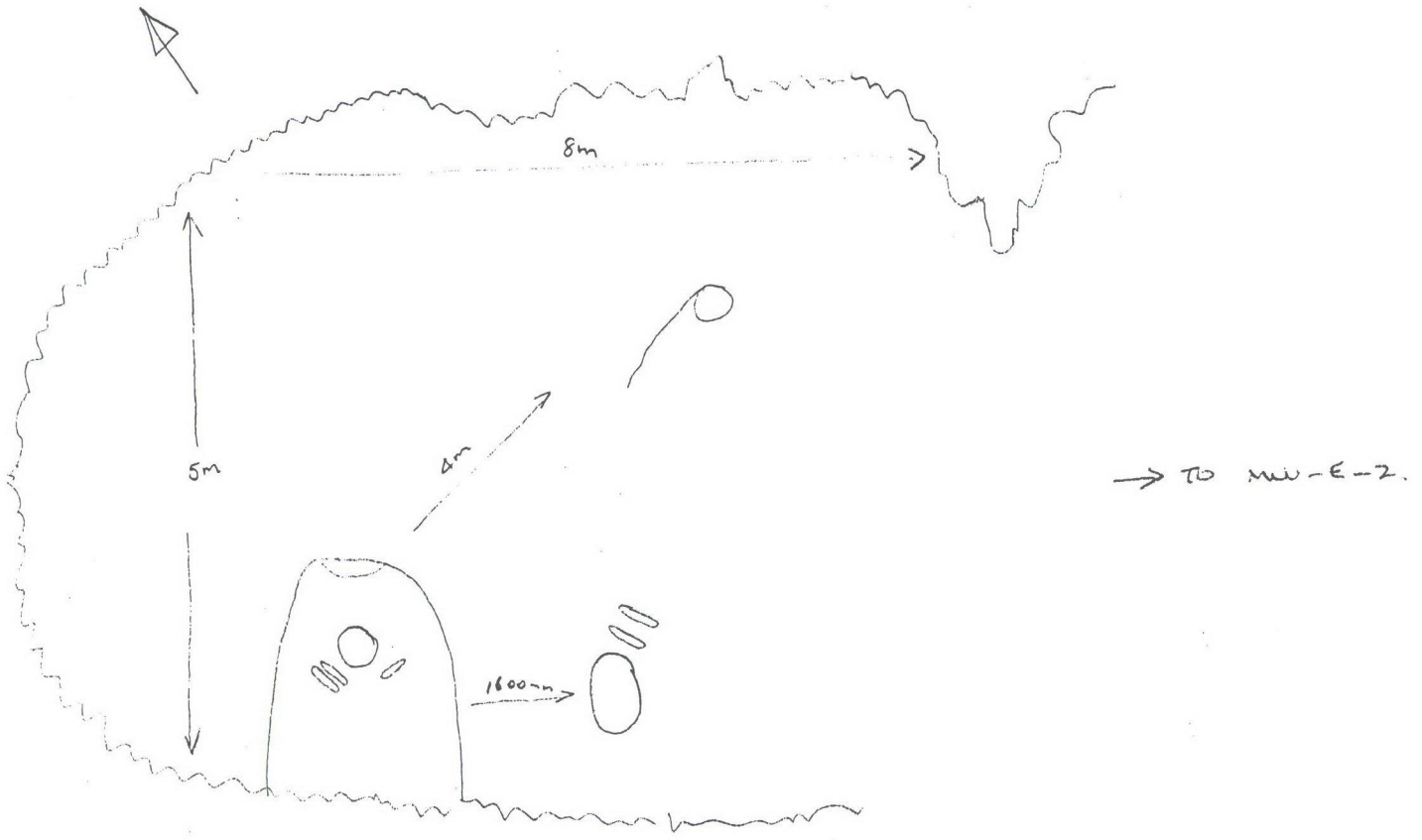


Sketch 12: MW-E-2



TWO ENCISED CIRCLES
0.2mm DEEP. OF POTENTIAL ABORIGINAL ORIGIN

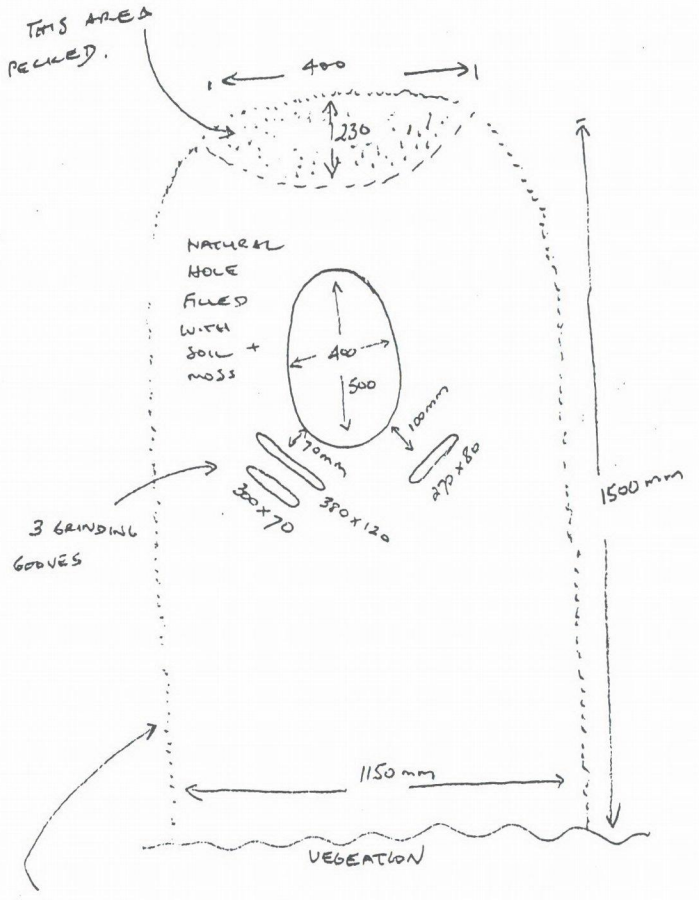
Sketch 13: Location of items at Site MW-E-3



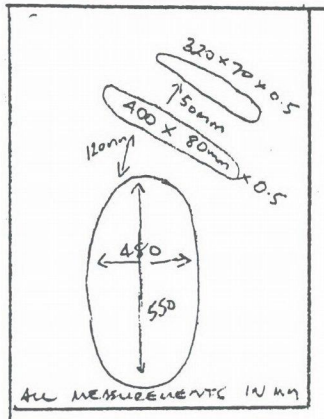
APPROXIMATE LOCATIONS OF
ITEMS AT MW-E-3

NB DIMENSIONS OF SANDSTONE SURFACE
IS DELINEATED BY VEGETATION GROWTH AND
POSSIBLY EXTENDS BEYOND BOUNDARY OF VEG.
ADDITIONAL SITES MAY BE LOCATED BELOW
VEGETATION WHICH IS OF RECENT ORIGIN.

Sketch 14: MW-E-3



ALL MEASUREMENTS IN MM.



ALL MEASUREMENTS IN MM

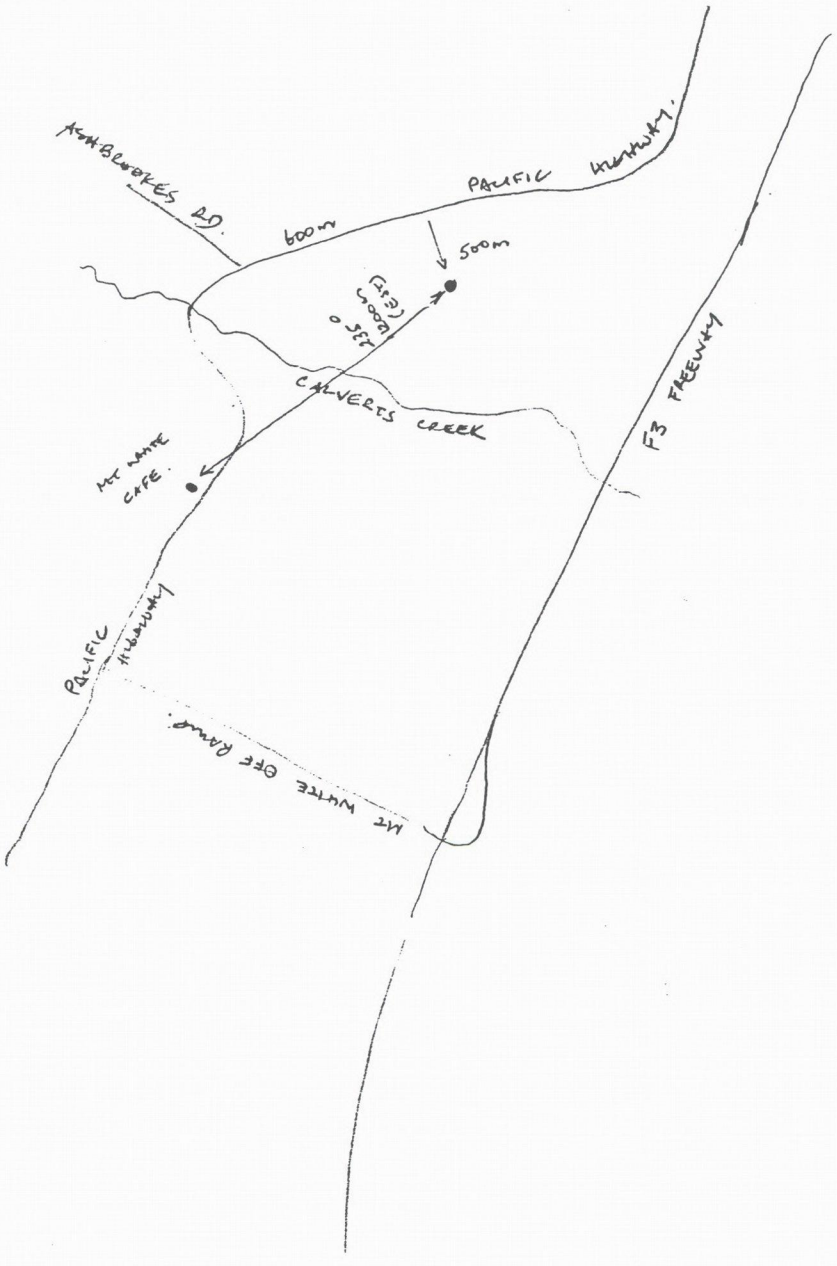
Sketch 15: MW-E-3



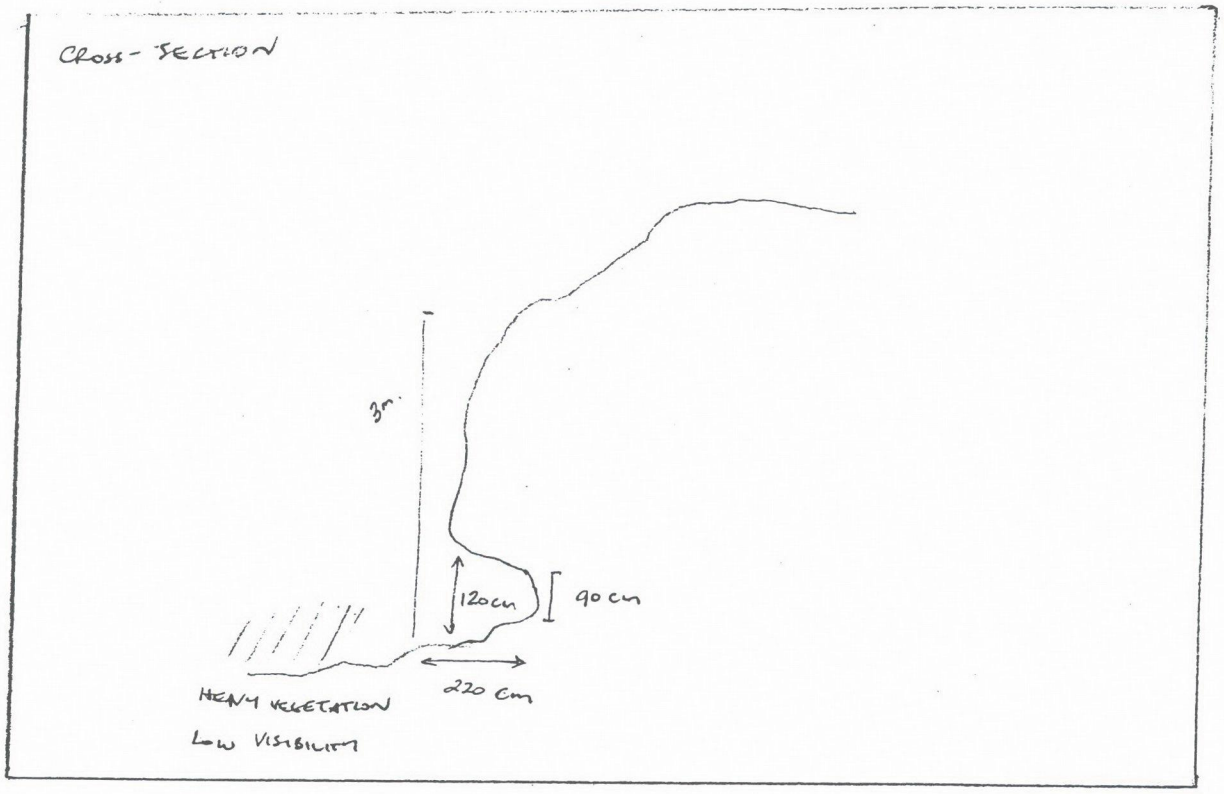


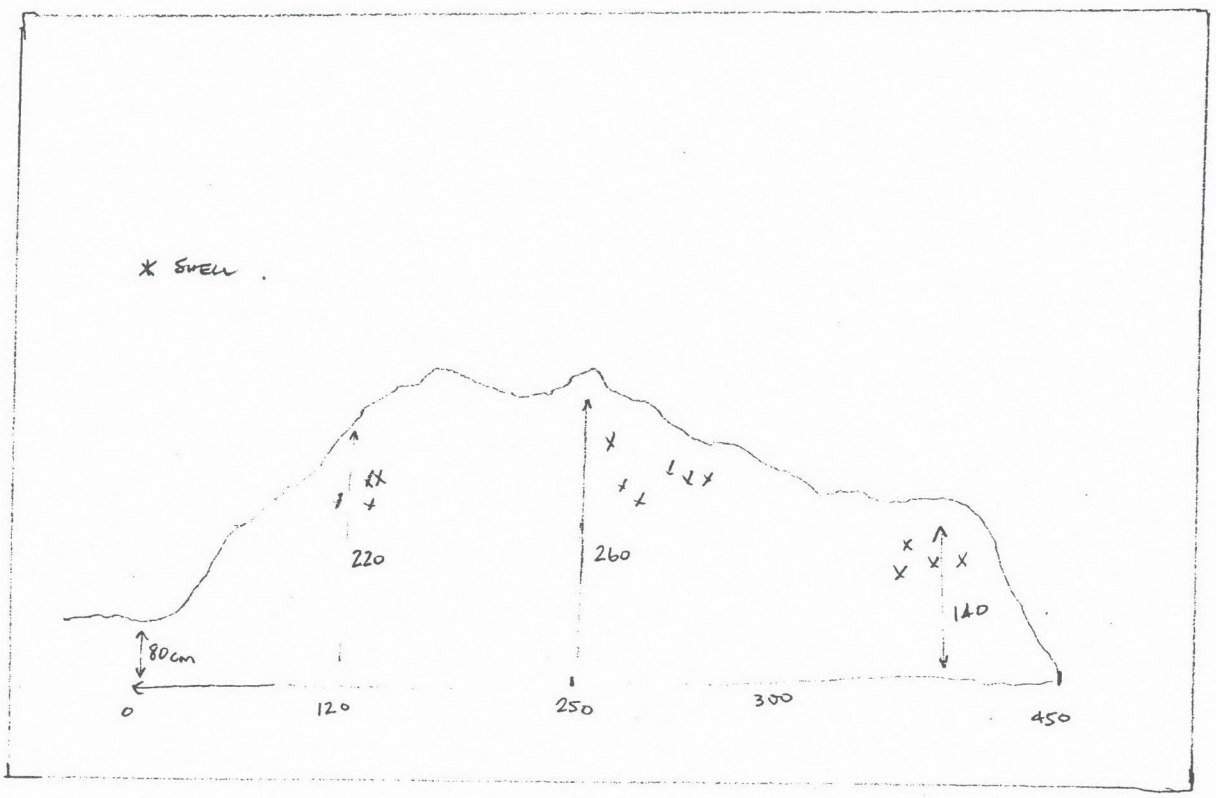
DIRECTION OF THE LINE INDISTINCT BUT POSSIBLY ADDITIONAL PARTS TO THIS ENGRAVING WHICH WOULD BE IDENTIFIED UNDER BETTER LIGHT CONDITIONS.

Sketch 16: Location of Site MW-RS-1

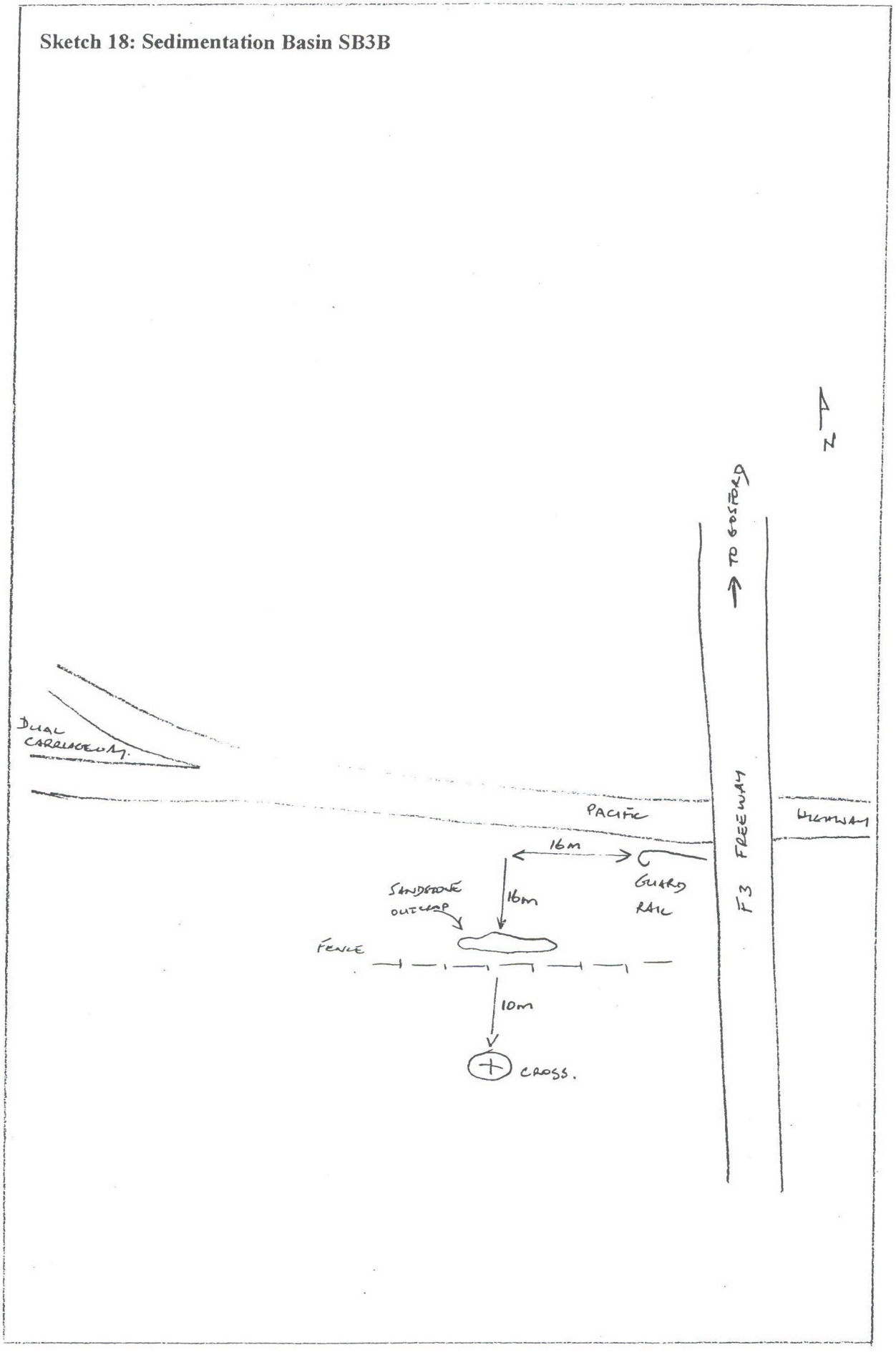


Sketch 17: Plan and Cross section drawings of MW-RS-1





Sketch 18: Sedimentation Basin SB3B



Appendix 4: Photographs

Photo 17: Shelter MW-RS-1



Photo 18: Sample of midden material at site MW-RS-1

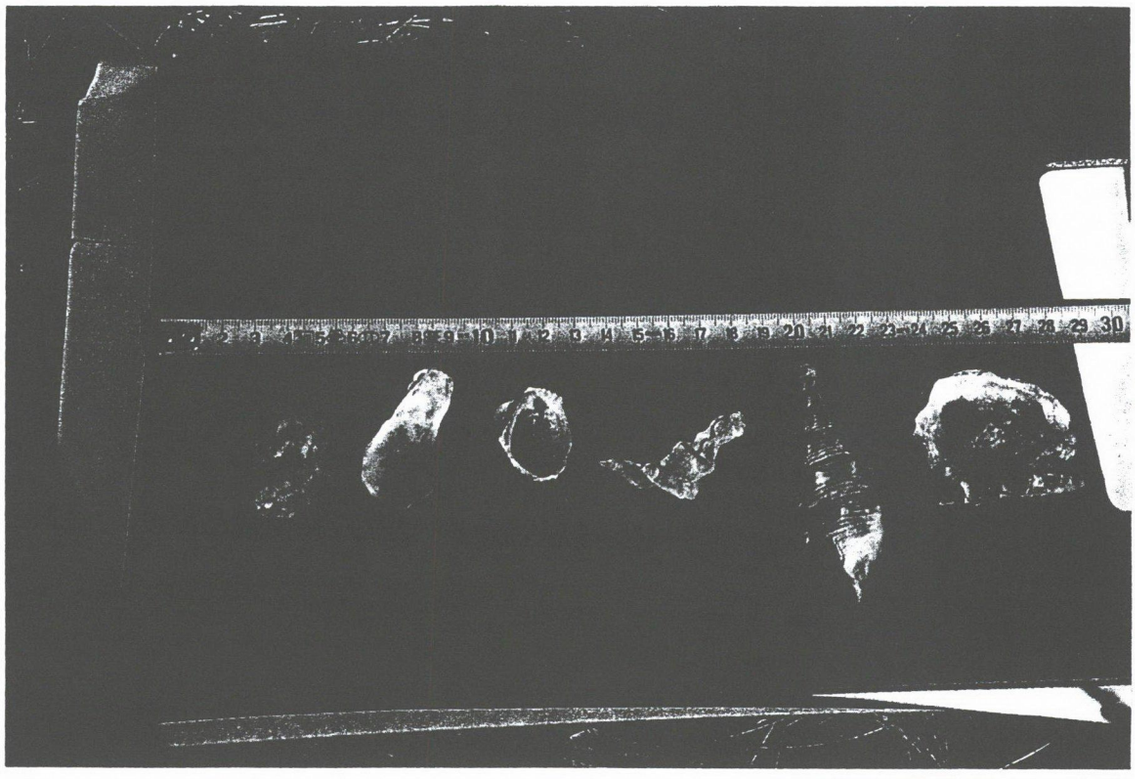


Photo 19: Location of SB3B

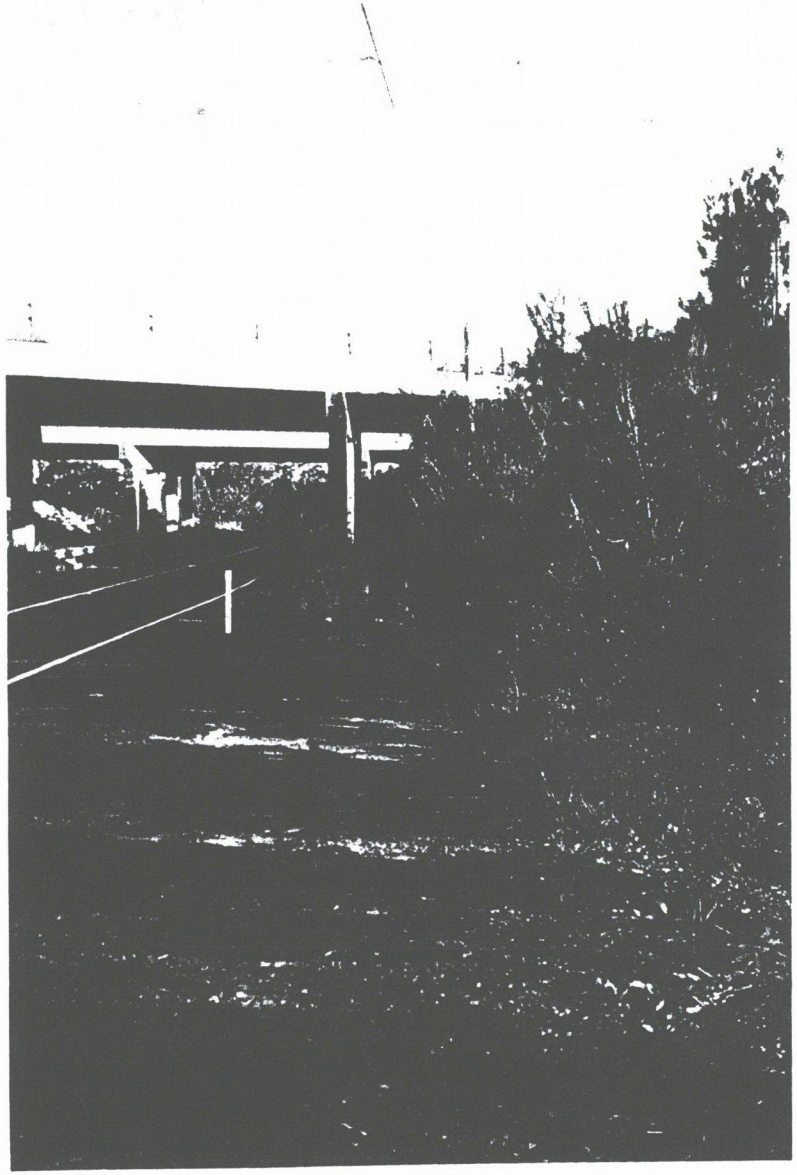


Photo 20: Memorial Cross at SB3B



Photo 15: MW-E-3

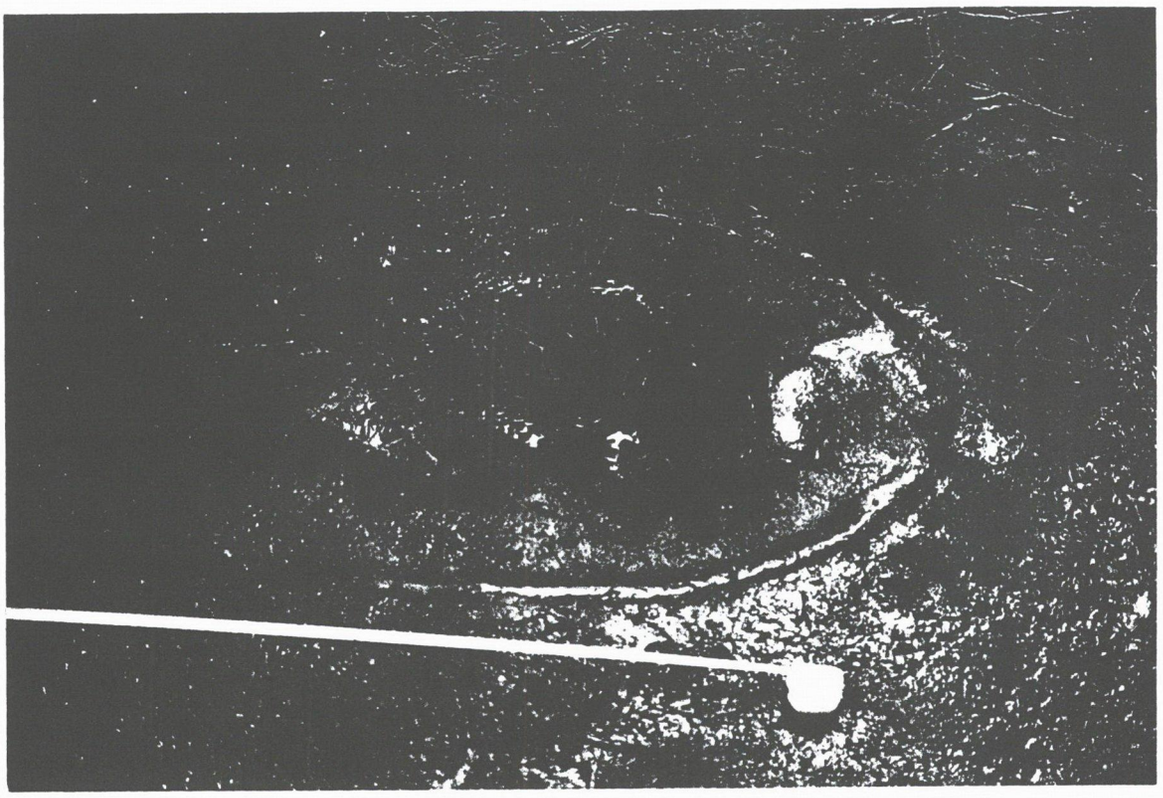


Photo 16: Location of MW-RS-1



Photo 13: Site MW-E-2

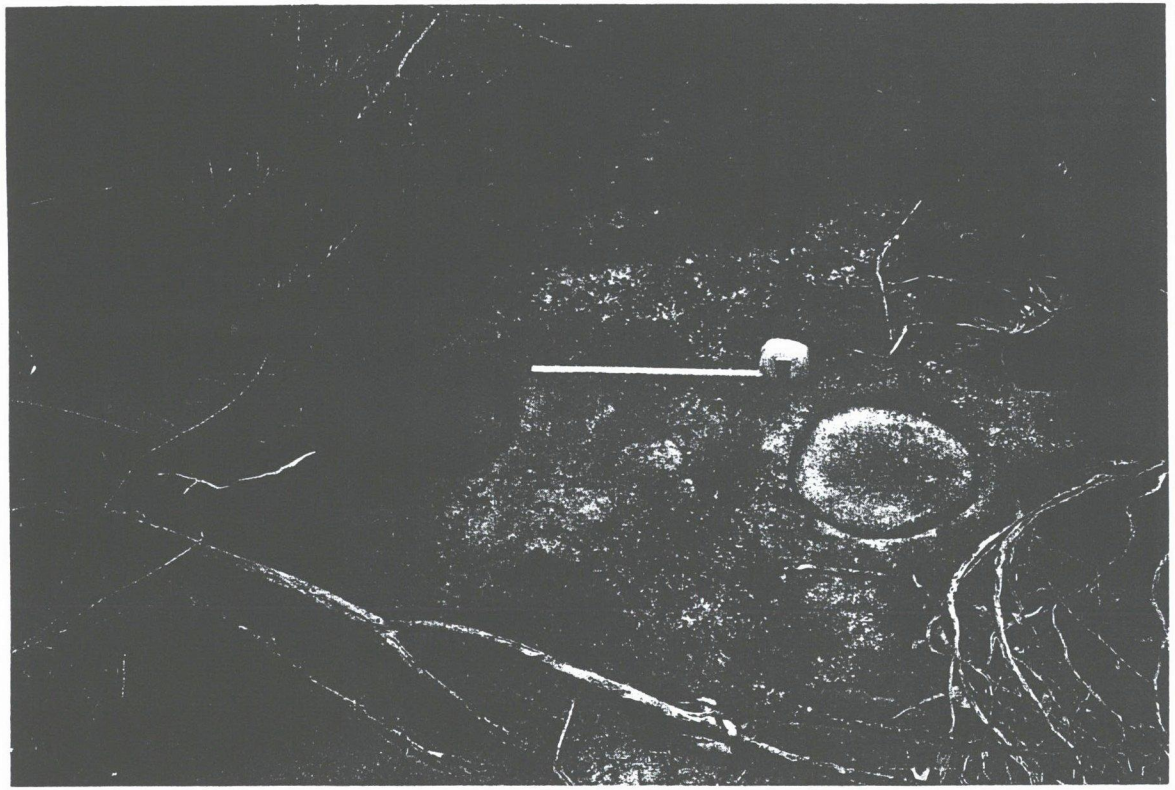


Photo 14: MW-E-3



Photo 3: Outcrops of sandstone in archaeologically sensitive landform areas



Photo 4: Outcrops of sandstone in archaeologically sensitive landform areas



Photo 1: Impact to tops of cuttings in the median area



Photo 2: Impacts to crests of cuttings in the median area



Photo 5: Example of vegetation cover where visibility was less than 5%



Photo 6: Example of vegetation cover where visibility was less than 5%



Photo 7: Looking east from Pacific Highway bridge over Calverts Creek



Photo 8: Grinding Grooves location



Photo 9: Examples of griding grooves at the site

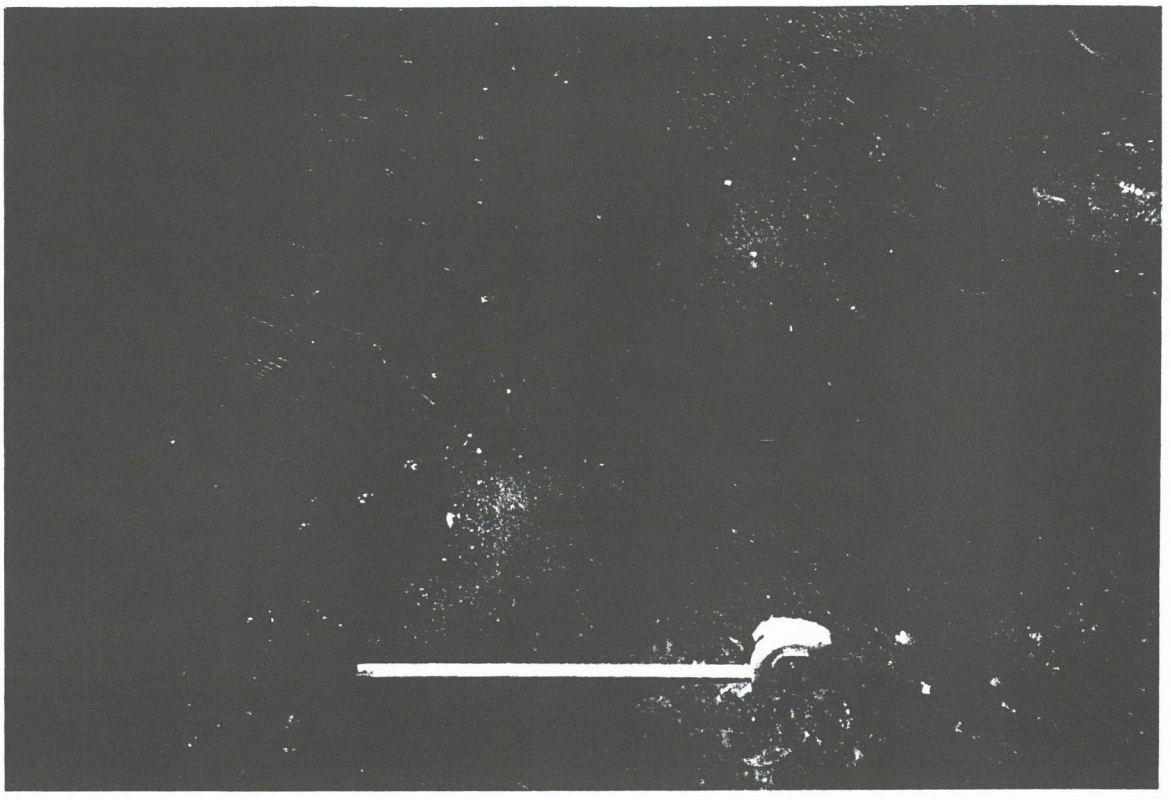


Photo 10: Examples of Grinding Grooves at the site

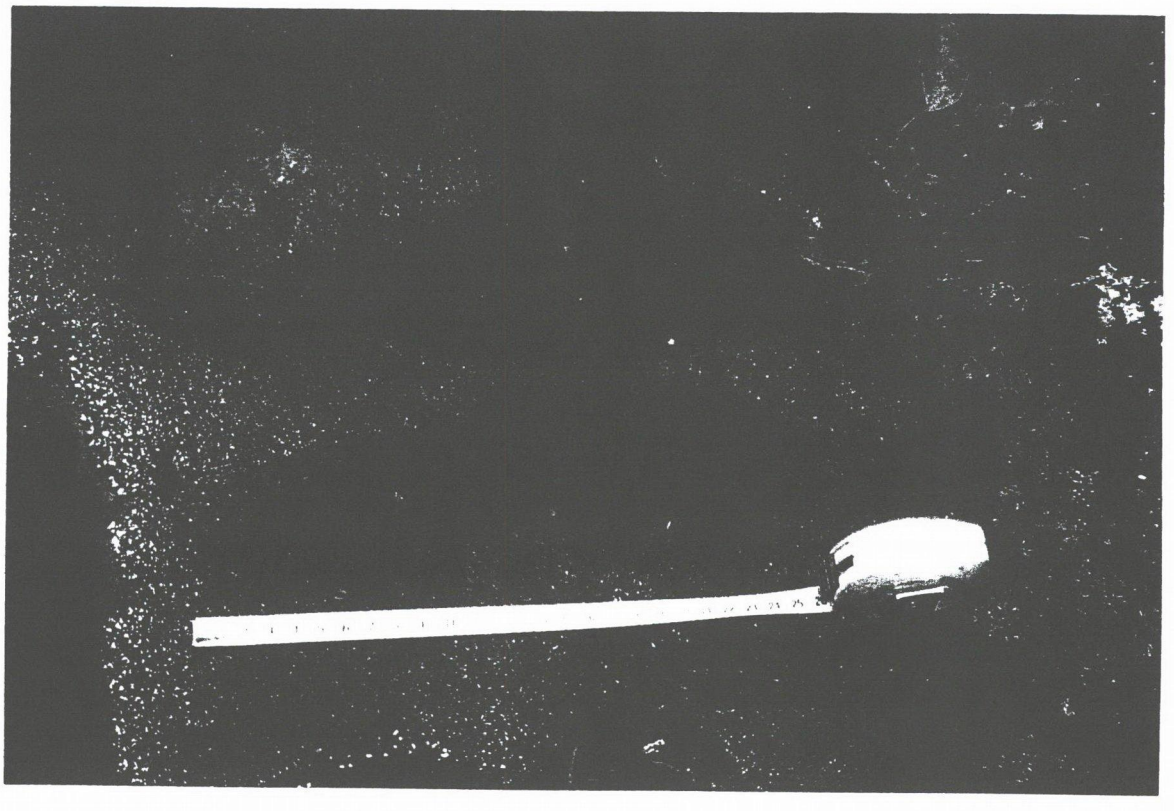


Photo 11: Site MW-E-1



Photo 12: Site MW-E-1



Appendix 5

Correspondence and Statement of involvement from Darkinjung LALC.

Aboriginal Site Survey

RTA
Robynne Mills

Conducted by
Mr Jason Taylor and
Neil Duncan

Cultural Heritage Report

Pacific highway-Mount White

R.T.A. Widening of F3 freeway

Report for sedimentation basins

-SB7S
-SB3B
-SB6B
-SB13B

Author – Jason Taylor
Darkinjung local aboriginal lands council
Shop 3, 61 Howarth Street, Wyong
P.O. box 401, Wyong 2259
Phone: 0243 512 930

1. SUMMARY

An aboriginal heritage assessment was carried out for the sedimentation basins for the sedimentation basins for the drainage of water from the F3 freeway at four separate basin sites located at Mount White between the F3 Freeway and the pacific highway located within close proximity to the R.T.A. weighbridge.

An investigation was undertaken at the four sedimentation basins to locate aboriginal sites and relics that may be impacted upon by the proposed basins. No known aboriginal sites or relics were found during this investigation. The reports findings suggest that there is a high potential for aboriginal sites and relics to be present on the sandstone outcrops but no sites or relics were located.

2. INTRODUCTION

On the 15-8-2001 an aboriginal heritage assessment was carried out at four

Sedimentation basins along the F3 Freeway. I was accompanied on the survey

By Robynne Mills (archaeological and heritage services) as we assessed sedimentation

Basins.

-SB7S

-SB3B

-SB6B

-SB13B

No known sites or relics were located during the investigation. The investigation was

Carried out by

Jason Taylor – Darkinjung local aboriginal lands council.

Robynne Mills – Archaeological and heritage services.

3. OJECTIVES OF ASSESSMENT

The objectives of the assessment is to:
* Assess the proposed developments for the impact on aboriginal sites and relics and
Cultural heritage to allow for the development of the proposed sedimentation basins along the F3 freeway at Mount White.

- Protect and preserve aboriginal heritage and cultural sites if found.

4. PREVIOUS LANDUSE IMPACTS

The previous land use impacts for each of the four sedimentation basins are as follows

SB7S- The previous land use impacts for SB7S are the land on this site has been heavily disturbed by freeway construction and there is an existing basin and concrete drain located on the site.
SB3B- Previous disturbance by pacific highway construction and also from freeway construction. Minimal impact on sedimentation basin area. A memorial cross\burial was also located within the basin area (see appendix A) it had a name plaque but it was recently removed.
SB6B-Disturbance by artificial rock wall for F3 freeway. Artificial drain made on the pacific highway side. Minimal impact to the rest of the area.
SB13B-Narrow artificial hill slope between the F3 freeway and the pacific highway.
Artificial concrete drain also located within the study area.

5. ENVIROMENTAL SETTING

The environmental setting for each of the sites for the sedimentation basins are as follows,

SB7S- this area is characterised by an artificial sandstone rock wall for the F3 freeway, a concrete drain and basin with a small amount of native scrub at the area surrounding the drain and basin. This area also has natural sandstone formations to the north - west. The area continues down a hill slope to the pacific highway. (See appendix B)
SB3B- This area is characterised by a hill slope going down to a small sandstone outcrop consisting of several large rocks at the bottom is a flat valley floor located on the valley floor was a wooden memorial cross in the basin area (see appendix B) the native plants in the area are extremely thick.
SB6B- This area consisted of an artificial wall of large sandstone rocks set in place for the F3 freeway, below the artificial wall is a series of natural sandstone ledges (see appendix E) there is a small gully with an artificial drain next to the pacific highway the ground visibility on this site was around 5% (see appendix D).
SB13B- this area is characterised by a steep hill slope between the F3 freeway and pacific highway growing on the hill slope is an artificial concrete drain the hill slope is artificial (see appendix F).

6. SITE PREDICTION

According to archaeological records the most common aboriginal sites found in the area is the open surface scatter of stone artefacts, along with scarred trees, axe grinding grooves on the sandstone out crops as well as axe grinding grooves on the exposed areas of sandstone one can also find shelters with rock art and burials.
Only two of the sites had any potential for these sites had any potential these were SB7S and SB6B.

7. METHODOLOGY

The field investigation was carried out by myself (Jason Taylor) and Robynne mills on foot over the entire area of the four sedimentation basin sites. We got to each of the sites by driving on the pacific highway to the four markings on the road made by the R.T.A.
All natural and man-made erosion was closely inspected for aboriginal sites and relics.

8. SURFACE VISABILITY

The location of sites depends on the surface visibility, which is the measure of the bare ground visible during the investigation to detect sites and relics. Visibility at the four sedimentation basin sites was 5% due to the grassy ground cover.

9. RESULTS OF INVESTIGATION

No aboriginal sites or relics were located during the investigation for the aboriginal heritage assessment for the proposed sedimentation basins.
The sandstone outcrops and exposed sandstone areas are known to have a very high potential for unseen sites and relics to exist. If any disturbance is to occur in these areas, Then disturbance works will have to be monitored for aboriginal site and relics.

10. DISCUSSION

No aboriginal sites or relics were found during the investigation mainly due to poor ground visibility and the amount of disturbance caused by the F3 freeway to detect archaeological materials. The areas of the four basins have been cleared then imported soil brought in to level the F3 freeway and artificial walls of sandstone have been constructed to support the freeway, artificial drains and basins made of concrete have been constructed at most of the sites, much of the landscape has been changed or altered as a result of the freeway and pacific highway. In the four sites there is a small amount of natural sandstone, these are the areas that are most likely to contain aboriginal sites and relics.

11. RECOMMENDATIONS

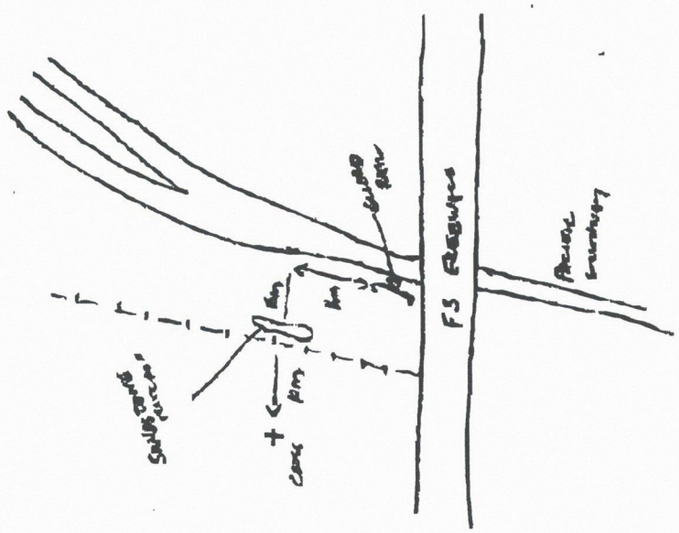
1) The national parks and wildlife service do not object on aboriginal heritage grounds to the above development.
2) Any ground disturbance at the sedimentation basin site SB6B during construction of the sedimentation basin is monitored by the Darkinjung local aboriginal lands council for aboriginal sites and relics.
3) If any sites or relics are unearthed during the development works at the four proposed sedimentation basin sites, then the national parks and wildlife service be notified immediately and all works to cease.
4) Investigate memorial cross\burial? On site number SB3B.
5) Minimal clearing of all sandstone surfaces.

Appendix (A)

A

SKETCH FOR SB 38.

N



Appendix (B)

B

JASON.

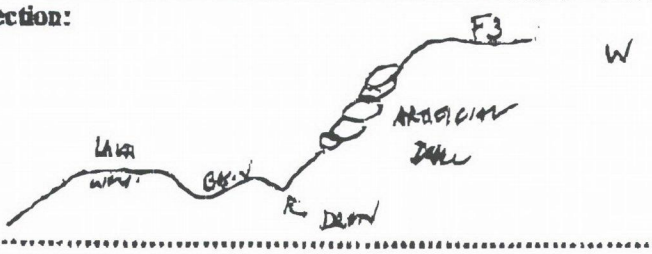
Survey Report for Sedimentation Ponds and Work Compounds on the F3 Freeway

1. **Item No:** SB 75.

2. **Landform Unit:**

HILL SLOPE

3. **Cross-Section:**



4. **Vegetation:** SCRUB,

5. **Impacts:**

EXISTING BASIN CONCRETE DRAIN
HEAVILY DISTURBED BY ROAD CONSTRUCTION.

6. **Heritage Issues Identified:**

NIL Natural Sandstone to the North-west edge

7. **Recommendations:**

Avoid Natural sandstone outcrops

NIL

Appendix (C)

C. JOSON.

Survey Report for Sedimentation Ponds and Work Compounds on the F3 Freeway

1. **Item No:** SB 3B

2. **Landform Unit:**

HILL SLOPE / GULLY

3. **Cross-Section:**



4. **Vegetation:**

NATIVE SCRUB

5. **Impacts:**

PREVIOUS HIGHWAY / FREEWAY CONSTRUCTION

MINIMAL IMPACT TO SEDIMENTATION POND AREA.

6. **Heritage Issues Identified:**

NIL INDIGENOUS HERITAGE

MEMORIAL CROSS / EMBLEM IDENTIFIED IN BASIN AREA.
(PLAQUE REMOVED).

7. **Recommendations:**

NIL INDIGENOUS

INVESTIGATE "CROSS".

Appendix (D) D

VISION

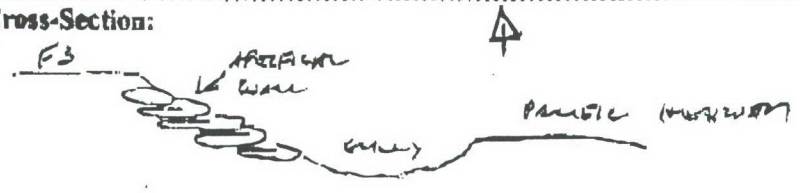
Survey Report for Sedimentation Ponds and Work Compounds on the F3 Freeway

1. **Item No:** SB 6 B.

2. **Landform Unit:**

SANDSTONE LEDGES. ABOVE GULLY

3. **Cross-Section:**



4. **Vegetation:**

NATIVE VEG.

5. **Impacts:**

ROCK CONSTRUCTION
CONTAMINATION OF ROCK WALL FOR
F3 - DRAIN LAY ON SIDE OF ALIGNMENT.

6. **Heritage Issues Identified:**

SANDSTONE LEDGES TO THE EAST OF THE AREA
AREAS OF EXPOSED SANDSTONE PRESENT.
VISIBILITY LESS THAN 5%.

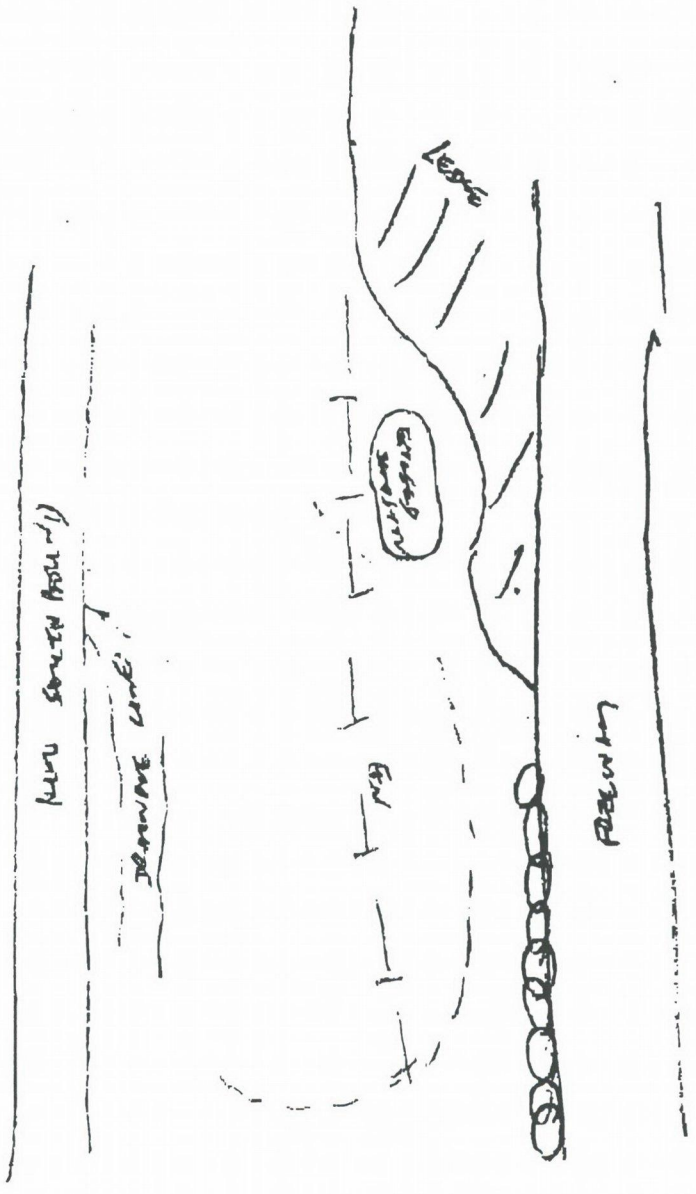
7. **Recommendations:**

MONITORING OF CLEARING
RE ASSESSMENT

SKETCH FOR SB 6 B.

Appendix (E)

E



Appendix (F) F

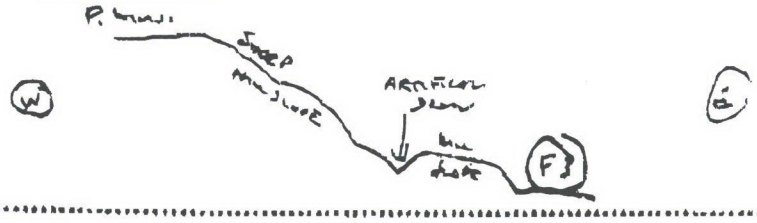
Survey Report for Sedimentation Ponds and Work Compounds on the F3 Freeway

1. **Item No:** SB 13 B

2. **Landform Unit:**

STEEP HILLSLOPE

3. **Cross-Section:**



4. **Vegetation:**

REGROWTH SILVER OAK.

5. **Impacts:**

NARROW ISOLATED HILLSLOPE BETWEEN F3 & MOTORWAY

6. **Heritage Issues Identified:**

NIL

7. **Recommendations:**

NIL.

Appendix (G)

Summary Table: Sedimentation Ponds and Works Compounds on the F3 Freeway

Item No	Heritage issues	Recommendations
SB7S	Nil. Natural sandstone outcrops to the west below the Freeway no sites identified	Nil- avoid natural sandstone outcrops in the vicinity
SB3B	Memorial Cross/Burial? Sandstone outcrops adjacent to road	Investigate cross Nil indigenous issues
SB6B	Sandstone outcrops, ledges etc present in the area. Visibility low less than 5%	Peg out impact area, minimal clearing of all sandstone surfaces, reassessment
SB13B	Nil	Nil

R.T.A SURVEY F3

Site CC-66-1
Grinding Grooves Site
CARDIN CREEK, Mt WHITE

G.P.S 332094 / 6296535 N

This site is situated on the old Pacific Highway at Mt WHITE.
It is located 2.5 KM Nth, of the mount White Roadhouse Cafe.

You will come to a sweeping right hand bend that goes over
Cardin Creek.

Following the creek downstream for approximately 150 Meters
brings you to the site.

This site has over 100 grinding grooves condensed into a small area.

Given the close proximity of possible surrounding sites, initial thoughts are that this area may have been used as a meeting place.

Recommendations:

1. This site and its surrounds should be further investigated, as we believe it is of great significance to Aboriginal people.

2. Site protection where possible.

3. Potential use of this site for educational purposes.

R.T.A SURVEY F3

SITE MW-E-1
EYE IN ANIMAL HEAD SITE
G.P.S ~~332724 E / 6296295 N~~

SITE MW-M-1
ROCK SHELTER AND MIDDEN SITE
G.P.S ~~332687 E / 6296393 N~~

SITE MW-E-2
CIRCLES, GINDING GROOVES AND LINES
G.P.S 332711 E / 6296322 N

These sites are located on R.T.A or Crown Land adjacent to Mr BLIIMs property.

They spread across to the F3 and down to Cardin Creek.

In this area (see diagrams attached) their is evidence of a rock shelter containing shell middens.
There is a covering of thirty (30) to forty (40) shells on the surface.

Upon further investigation of the land a number of grinding grooves were found scattered over a large area and what appear to be an eye engraved strategically on a rock to resemble an animal's head.

Also found were circles carved into the sandstone.
In particular a cluster of five (5) circles within a 1-meter radius.

The further we looked the more engravings we found.

Recommendations.

1. These sites and their surrounds be further investigated.
2. Site protection where possible.
3. Discussions with R.T.A re management and accurate recording of sites.
4. Universities be invited to study areas.

R.T.A SURVEY: F3

Property Owner:
Mr Graham BLIIM
RMB 1158
289 Pacific Highway
Mount WHITE
Ph: 0243 701132

N.P.W.S Site No: 45-3-0157
G.P.S: 332615 E 6296520 N

This property has an Aboriginal Reserve placed on the title and deeds, which prevents the owner from destroying site.

Aboriginal Reserve No: R..63201/2.

Situated on Mr BLIIMs property is a large sandstone plateau which has numerous engravings spread over a vast area.

Due to deterioration of site, some engravings are not visible – (refer to attached diagrams.)

Engravings that are clearly visible are Kangaroos, paw prints, grinding grooves, and circles.

This site was possibly recorded in 1926, as this date, 18/12/26, along with these initials,VD and FE, are carved quite prominently into the sandstone rock.

Recommendations:

1. A more thorough investigation is carried out on this site working closely with Mr BLIIM.
2. A letter of recognition and thanks be written to Mr BLIIM as he has for the past thirty (30) years, steadfastly protected this site.

Appendix 6

Gazetteer of Indigenous Heritage Sites (NPWS and AHC)

ASR Site Search Criteria

SiteID (like):		Zone:	56	District:	
AMGE:	342000	to	352000	SiteType1:	
AMGN:	6306000	to	6310000	SiteType2:	
Name(like):				SiteType3:	
Recorder:				SiteType4:	
Date from:		to		SiteType5:	
LGA:					
Local ALC:					

ASR Standard Site List - 6712(wyong)

30/10/00 17:10:15

ASR Site Search Criteria

SiteID (like): | Zone: 56 | District:

AMGE: 342000 to 352000 | SiteType1:

AMGN: 6306000 to 6310000 | SiteType2:

Name(like): | SiteType3:

Recorder: | SiteType4:

Date from: to | SiteType5:

LGA:

Local ALC:

ASR Standard Site List - 6712(wyong)

20/10/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-0054	Sommersby;		56	342265	6306971		Rock Engraving		1/01/76	
45-3-0055	Sommersby;		56	342813	6306981		Rock Engraving			
45-3-0056	Dog Trap Gully;		56	344800	6306240		Axe Grinding Groov	Lough, J.C.	1/01/76	
45-3-0056	Dog Trap Gully;		56	344800	6306240		Rock Engraving	Lough, J.C.	1/01/76	
45-3-0523	Mangrove Road;Dog		56	345292	6306480		Axe Grinding Groov	Kelly A	1/01/77	
45-3-0560	Niagara Park;Dog Tra		56	345027	6306018		Axe Grinding Groov	Webb	1/01/75	
45-3-0560	Niagara Park;Dog Trap Rd;		56	345027	6306018		Rock Engraving	Webb	1/01/75	
45-3-0898	Ourimbah Shield Tree;Ourimbah;		56	343850	6308250		Scarred Tree			
45-3-0899	Dog Trap Road;		56	342050	6307420		Axe Grinding Groove			
45-3-0994	Footes Gully;		56	346470	6309920		Axe Grinding Groov	Hennalan	5/12/79	
45-3-0994	Footes Gully;		56	346470	6309920		Shelter with Art	Hennalan	5/12/79	
45-3-1131	Ourimbah;		56	344790	6307200		Rock Engraving			
45-3-1379	Dog Trap Road;		56	344980	6306270		Rock Engraving			
45-3-1393	Dog Trap Road;K-O-47;		56	344740	6306690		Rock Engraving			
45-3-1395	Dog Trap Road;K-O-50;		56	344680	6306830		Rock Engraving			

This report is not guaranteed to be free from error or omission

ASR Standard Site List - 6712(Gosford)

20/10/99 12:09:33

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-1371	Narara Creek;		56	342318	6304228		Axe Grinding Groove			
45-3-1383	Narara Creek;		56	344280	6305950		Axe Grinding Groove			
45-3-1383	Narara Creek;		56	344280	6305950		Rock Engraving			
45-3-1384	Niagra Park;		56	344230	6305890		Axe Grinding Groove			
45-3-1397	Narara Creek;K-O-53;		56	342309	6304685		Axe Grinding Groove			
45-3-1419	Niagara Park;		56	345030	6305970		Axe Grinding Groove			
45-3-1419	Niagara Park;		56	345030	6305970		Rock Engraving			
45-3-1455	Old Gosford Road;Gosford Racecourse;		56	343880	6300590		Midden			
45-3-1456	Old Gosford Road;Gosford Racecourse;		56	344030	6300680		Midden			
45-3-1495	Narara Creek;site 243;		56	342250	6300010		Rock Engraving			
45-3-1865	Strictland State Forest 1;		56	345180	6305500		Shelter with Art	Bluff, W.T.	1/10/89	c-1333
45-3-1866	Strictland State Forest 2;		56	345260	6305450		Rock Engraving	Bluff, W.T.	1/10/89	c-1333
45-3-1943	Strickland S.F.;		56	343180	6301810		Axe Grinding Groov	Bluff, W.T.	1/05/91	C-1333
45-3-1944	Strickland S.F.;		56	343420	6302240		Axe Grinding Groov	Bluff, W.T.	1/04/91	C-1333
45-3-1945	Strickland S.F.;		56	343860	6302210		Axe Grinding Groov	Bluff, W.T.	1/04/91	C-1333
45-3-1946	Strickland S.F.;		56	343200	6301690		Rock Engraving	Bluff, W.T.	1/05/91	C-1333
45-3-1947	Strickland State Forest;		56	343340	6301910		Rock Engraving	Bluff, W.T.	1/05/91	C-1333
45-3-1948	Niagara Park;		56	345720	6305600		Shelter with Art	Stone, G. J.	1/06/91	C-1333
45-3-1949	Strickland State Forest;		56	343450	6302200		Shelter with Art	Bluff, W.T.	1/04/91	C-1333
45-3-1951	Strictland State Forest;		56	342910	6301500		Shelter with Art	Bluff, W.T.	1/05/91	C-1333
45-3-2067	BWNP;		56	345800	6305500		Rock Engraving	O'Brien, D.	2/07/92	C-1333

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ASR Standard Site List - 6712(Gosford)

20/10/99 12:09:33

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-0553	Narara;		56	343717	6302792		Rock Engraving	Dyall, L.K.	1/01/66	
45-3-0556	Narara;		56	343916	6301973		Shelter with Art			
45-3-0558	Gosford;Narara Ck;		56	344033	6300603		Midden	Edwards	1/01/58	
45-3-0561	Gosford;		56	345012	6301994		Axe Grinding Groov	Dyall, L.K.	1/01/66	
45-3-0561	Gosford;		56	345012	6301994		Shelter with Deposit	Dyall, L.K.	1/01/66	
45-3-0611	Old Gosford Road;		56	342845	6300580		Rock Engraving	McKenzie		
45-3-0619	Old Gosford Road;		56	342474	6300848		Rock Engraving			
45-3-0619	Old Gosford Road;		56	342474	6300848		Stone Arrangement			
45-3-0620	Old Gosford Road;		56	342012	6301113		Rock Engraving			
45-3-0901	Narara Creek;Reeves Road;		56	342820	6303340		Rock Engraving	Attenbrow, V.	1/01/79	
45-3-1313	Mt Penang;		56	342370	6301486		Axe Grinding Groove			
45-3-1313	Mt Penang;		56	342370	6301486		Rock Engraving			
45-3-1314	Mt Penang;		56	343284	6301503		Axe Grinding Groove			
45-3-1315	Mt Penang;		56	343284	6301503		Axe Grinding Groove			
45-3-1315	Mt Penang;		56	343284	6301503		Rock Engraving			
45-3-1316	Mt Penang;		56	343320	6299675		Axe Grinding Groove			
45-3-1316	Mt Penang;		56	343320	6299675		Shelter with Midden			
45-3-1317	Mt Penang;		56	342406	6299658		Rock Engraving			
45-3-1318	Mt Penang;		56	343302	6300589		Rock Engraving			
45-3-1319	Mt Penang;		56	342388	6300572		Rock Engraving			
45-3-1321	Mt Penang;		56	343302	6300589		Axe Grinding Groove			
45-3-1341	Mt Elliot;Maidens Brush Road 1;		56	350042	6301999		Axe Grinding Groove			
45-3-1342	Mt Elliot;Maidens Brush Road 2;		56	350137	6301818		Rock Engraving			
45-3-1343	Mt Elliot;Maidens Brush Road 3;		56	350224	6302003		Rock Engraving			

This report is not guaranteed to be free from error or omission

ASR Standard Site List - 6712(wyong)

20/10/99 12:10:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-1399	Narara Crk;K-O-55;		56	342760	6306280		Axe Grinding Groove			
45-3-1412	Narara Creek;Dog Trap Road;		56	344830	6306170		Rock Engraving			
45-3-1417	Narara Creek;Dog Trap Road;		56	344350	6306030		Rock Engraving			
45-3-1418	Narara Creek;Dog Trap Road;		56	344310	6306070		Axe Grinding Groove			
45-3-1418	Narara Creek;Dog Trap Road;		56	344310	6306070		Rock Engraving			
45-3-1858	Ourimbah creek;		56	343360	6307950		Shelter with Art	Bluff, W.T.	1/01/90	c-1333
45-3-1858	Ourimbah creek;		56	343360	6307950		Shelter with Midden	Bluff, W.T.	1/01/90	c-1333
45-3-2967	Strickland 1;S1;		56	344550	6306180		Axe Grinding Groove	Welsh, B. & Britton, A.	26/06/96	
45-3-2969	Strickland S.F/Mangrove Road;SSF/MR;		56	344900	6306200	2	Rock Engraving	Welsh, B., Duncan, K.	16/07/96	

(9) /

NSW National Parks and Wildlife Service

*** End of Report *** Site Count: 19

5600

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ASR Site Search Criteria

SiteID (like):		Zone: 56	District:
AMGE:	342000 to 352000		SiteType1:
AMGN:	6299000 to 6306000		SiteType2:
Name(like):			SiteType3:
Recorder:			SiteType4:
Date from:	to		SiteType5:
LGA:			
Local ALC:			

ASR Standard Site List - 6712(Gosford)

20/10/99 12:09:33

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-0031	Piles Creek;		56	342397	6300115		Midden			
45-3-0031	Piles Creek;		56	342397	6300115		Rock Engraving			
45-3-0032	Old Gosford Road;Kendall's Rock;		56	343128	6300129		Rock Engraving			
45-3-0033	Old Gosford Road;Go		56	342980	6300800		Axe Grinding Groov	Sim, I.M.	1/01/83	1587
45-3-0033	Old Gosford Road;Gosford 10;		56	342980	6300800		Rock Engraving	Sim, I.M.	1/01/83	
45-3-0034	Piles Creek;		56	342950	6300850		Axe Grinding Groove			
45-3-0034	Piles Creek;		56	342950	6300850		Rock Engraving			
45-3-0035	Piles Creek;		56	342397	6300115		Rock Engraving	Sim, I.M.		
45-3-0042	Old Gosford Road;Pil		56	342400	6303150		Axe Grinding Groov	Koettig, M.	1/01/76	
45-3-0042	Old Gosford Road;Piles Creek;		56	342400	6303150		Rock Engraving	Koettig, M.	1/01/76	
45-3-0043	Old Gosford Road;Piles Creek;		56	342112	6300658		Rock Engraving	Sim, I.M.	1/01/76	
45-3-0044	Old Gosford Road;Piles Creek;		56	342365	6301760		Axe Grinding Groove		1/01/76	
45-3-0045	Old Gosford Road;Piles Creek;Strickland S.F.;		56	342930	6301540		Axe Grinding Groove	Sim, I.M.	1/05/91	

This report is not guaranteed to be free from error or omission

ASR Standard Site List - 6712(Gosford)

20/10/99 12:09:33

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-0045	Old Gosford Road;Piles Creek;Strickland S.F.;		56	342930	6301540		Rock Engraving	Sim, I.M.	1/05/91	
45-3-0045	Old Gosford Road;Piles Creek;Strickland S.F.;		56	342930	6301540		Shelter with Art	Sim, I.M.	1/05/91	
45-3-0046	Narara Creek;Strickla		56	343550	6302160		Axe Grinding Groov	Simm	1/05/91	C-1333
45-3-0046	Narara Creek;Strickland S.F.;		56	343550	6302160		Rock Engraving	Simm	1/05/91	C-1333
45-3-0048	Narara Creek;		56	343715	6302883		Axe Grinding Groov	Sim, I.M.	1/01/76	
45-3-0048	Narara Creek;		56	343715	6302883		Rock Engraving	Sim, I.M.	1/01/76	
45-3-0049	Narara Creek;		56	342801	6302866		Rock Engraving			
45-3-0050	Narara Creek;		56	343158	6303330		Rock Engraving			
45-3-0057	Dog Trap Gully;		56	345130	6305380		Axe Grinding Groove		1/01/76	
45-3-0057	Dog Trap Gully;		56	345130	6305380		Rock Engraving		1/01/76	
45-3-0304	KG 1;Kariong;		56	342330	6299110		Rock Engraving	McDonald	1/01/84	
45-3-0305	KG 2;Kariong;		56	342310	6299500		Scarred Tree	McDonald	1/01/84	
45-3-0306	KG 3;Kariong;		56	342670	6299960		Axe Grinding Groov	McDonald	1/01/84	
45-3-0307	KG 4;Kariong;		56	342940	6299920		Scarred Tree	McDonald	1/01/84	
45-3-0520	Narara Creek;		56	343995	6302614		Axe Grinding Groov	Kelly A	1/01/77	
45-3-0520	Narara Creek;		56	343995	6302614		Rock Engraving	Kelly A	1/01/77	
45-3-0521	Narara Creek;		56	343893	6303161		Axe Grinding Groov	Kelly A	1/01/77	
45-3-0522	Mangrove Road;		56	345410	6305111		Axe Grinding Groov	Kelly A	1/01/77	
45-3-0524	Narara Creek;		56	343715	6302883		Axe Grinding Groov	Kelly A	1/01/77	
45-3-0524	Narara Creek;		56	343715	6302883		Rock Engraving	Kelly A	1/01/77	
45-3-0527	Point Clare;		56	342783	6299025		Axe Grinding Groov	Sim, I.M.	1/01/69	
45-3-0527	Point Clare;		56	342783	6299025		Rock Engraving	Sim, I.M.	1/01/69	
45-3-0549	Narara;		56	343815	6302428		Rock Engraving	Malone	1/01/74	
45-3-0549	Narara;		56	343815	6302428		Shelter with Art	Malone	1/01/74	
45-3-0550	Narara Creek;		56	343815	6302428		Axe Grinding Groov	Malone	1/01/74	
45-3-0550	Narara Creek;		56	343815	6302428		Shelter with Art	Malone	1/01/74	

This report is not guaranteed to be free from error or omission

ASR Standard Site List - 6712(Gosford)

20/10/99 12:09:33

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
45-3-2435	Kangoo Rd.;		56	342810	6300310		Rock Engraving	Welsh, B.		?
45-3-2436	Debenham Rd.;		56	343230	6300240		Shelter with Deposit	Welsh, B.		?
45-3-2437	Kangoo Rd;		56	342800	6300150		Rock Engraving	Welsh, B.		?
45-3-2875	Mangrove Road 1;		56	345250	6305700		Axe Grinding Groov	English, A.J.	28/02/96	
45-3-2875	Mangrove Road 1;		56	345250	6305700		Rock Engraving	English, A.J.	28/02/96	
45-3-2875	Mangrove Road 1;		56	345250	6305700		Shelter with Art	English, A.J.	28/02/96	
45-3-2968	Strickland 4;S4;		56	344580	6305950		Axe Grinding Groove	Welsh, B. & Britton, A.	26/06/96	
45-6-1598	Un-named;		56	342620	6300260		Rock Engraving	Hanrahan	1/11/83	
45-6-1599	Un-named;		56	342760	6300270		Rock Engraving	Lough, J.C.	1/03/80	
45-6-1600	Un-named;		56	342830	6300380		Rock Engraving	Lough, J.C.	1/03/80	

10

NSW National Parks and Wildlife Service

*** End of Report *** Site Count: 71

2875
0057
0520

This report is not guaranteed to be free from error or omission

Appendix 7
Non-indigenous Heritage Records

Nyah Bridge over Murray River	17673
Prince Alfred Bridge, Gundagai	5172
Robinvale Bridge over Murray River	807
Speewa Ferry - Murray River	17685
Swan Hill - Murray River Road Bridge	17678
Tintaldra Bridge over Murray River	17473
Tocumwal Bridge over Murray River	1335
Tooleybuc Bridge over Murray River	17674
Towong Bridge over Murray River	17472
Union Bridge over Murray River	7025
Wee Jasper Bridge over Goodradigbee River	4300140
Wymah Ferry over Murray River	17475

Sydney Region

Alfords Point Bridge	15046
Box Girder Bridge over Nepean River, Penrith	12852
Cable Ferry - Mortlake	14052
Cable Ferry, Wisemans Ferry	4300311
Captain Cook Bridge Taren Point, (1965), southern approach	14978
De Burghs Bridge, Macquarie Park	14050
Disused section of MR 181 adjacent to Portion 32	5856
Gladesville Bridge	4300309
Glebe Island Bridge	8791
Hawkesbury River Road Bridge, North Richmond	5481
House - 164 Ramsay St, Haberfield	770
House - 1d River Road, Woronora	15243
House - 46 Martin Street, Haberfield	771
House - 48 Kingston Street, Ashfield	650
Knapsack Viaduct, Lapstone	1584
Lansdowne Bridge	4253
Lennox Bridge, Parramatta	4300301
Macquarie Street Gate House, Parramatta	12597
Milestone - Liverpool Road near corner of Badminton Road, Croydon	2753
Milestone - Parramatta Road near Cheltenham Road	2756
Milestone - Parramatta Road, Stanmore	10321
Old Windsor Road, Seven Hills to Kellyville	1385
Pearces Creek Bridge, Galston Gorge	4300009
Peats Ferry Bridge Crown land	4300308
Pyes Creek Bridge, Cherrybrook	4300310
Queen Anne House, London Terrace, Enmore	10287
Remains of Figtree Bridge	7378
Remains of Wandella and garden, Hunters Hill	7473
Ryde Bridge	14049
Site of Figtree Tea Rooms & Aquatic Tea Rooms	7380
Site of Figtree Wharf and Boatshed	7386
Slab Cottage western end - Neeve Street, Prospect	1365

Register of the National Estate Database

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Found 35 records:

- **Bouddi National Park (1981 boundary)**, Hawke Head Dr, Killcare, [Gosford City], NSW (Registered)
- **Bouddi National Park Marine Section**, Killcare Heights, [Gosford City], NSW (Registered)
- **Brisbane Water County Council Building (former)**, 50 Mann St, Gosford, [Gosford City], NSW (Indicative Place)
- **Brisbane Water National Park (1981 boundary)**, Pacific Hwy, Gosford, [Gosford City], NSW (Registered)
- **Broken Bay Entrance Foreshores**, Ettalong, [Gosford City], NSW (Indicative Place)
- **Cottages**, Dark Corner, Patonga, [Gosford City], NSW (Indicative Place)
- **Creighton Funeral Parlour**, 37 Mann St, Gosford, [Gosford City], NSW (Indicative Place)
- **Dharug National Park (1978 boundary)**, Wisemans Ferry Rd, Spencer, [Gosford City], NSW (Registered)
- **Gosford Courthouse**, 45 Mann St, Gosford, [Gosford City], NSW (Registered)
- **Gosford Hills Landscape Conservation Area**, Gosford, [Gosford City], NSW (Indicative Place)
- **Great Northern Road - Extension**, Great Northern Rd, Wollombi, [Gosford City], NSW (Registered)
- **Hawkesbury River Rail Bridge**, Brooklyn, [Gosford City], NSW (Registered)
- **Holy Cross Catholic Church and Graveyard**, Humphreys Rd, Kincumber South, [Gosford City], NSW (Registered)
- **Indigenous Place**, St Albans, [Gosford City], NSW (Registered)
- **Indigenous Place**, Daleys Point, [Gosford City], NSW (Registered)
- **Indigenous Place**, Somersby, [Gosford City], NSW (Registered)
- **Indigenous Place**, Narara, [Gosford City], NSW (Registered)

- **Indigenous Place**, Calga, [Gosford City], NSW (Registered)
- **Indigenous Place**, Mangrove Mountain, [Gosford City], NSW (Registered)
- **Indigenous Place**, Kariong, [Gosford City], NSW (Registered)
- **Indigenous Place**, Somersby, [Gosford City], NSW (Registered)
- **Indigenous Place**, Woy Woy Bay, [Gosford City], NSW (Registered)
- **Lion Island Nature Reserve**, Pearl Beach, [Gosford City], NSW (Registered)
- **Lone grave of Frances Peat**, Pacific Hwy, Mooney Mooney, [Gosford City], NSW (Indicative Place)
- **MacDonald Valley / Wollombi Valley Area**, St Albans, [Gosford City], NSW (Indicative Place)
- **Mooney Mooney Creek Site**, Pacific Hwy, Calga, [Gosford City], NSW (Registered)
- **Mulholland Farm**, 9 Pixie Av, Green Point, [Gosford City], NSW (Indicative Place)
- **Rileys Island and Pelican Island Nature Reserves**, Woy Woy, [Gosford City], NSW (Registered)
- **Somersby Geological Site**, Somersby, [Gosford City], NSW (Destroyed)
- **Spectacle Island Nature Reserve**, Mooney Mooney, [Gosford City], NSW (Registered)
- **St Josephs Educational and Spiritual Centre**, 8 Humphreys Rd, Kincumber South, [Gosford City], NSW (Indicative Place)
- **St Pauls Anglican Church**, Empire Bay Dr, Kincumber, [Gosford City], NSW (Registered)
- **The Grange**, Renwick St, Wyoming, [Gosford City], NSW (Registered)
- **Wamberal Lagoon Nature Reserve**, Ocean View Dr, Wamberall, [Gosford City], NSW (Registered)
- **Wyoming Cottage and Helys Grave**, Pacific Hwy, Wyoming, [Gosford City], NSW (Registered)

The Register of the National Estate has been compiled since 1976. The Commission is in the process of developing and/or upgrading official statements of significance for places listed prior to 1991.

Report produced : 10/9/2001
RNEDB URL : http://www.erin.gov.au/heritage/register/easydatabase/database.html

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Register of the National Estate Database

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Indigenous Place, Calga NSW



Class: Indigenous
Legal Status: Registered (22/06/1993)

Database Number: 007690
File Number: 1/10/052/0021

Nominator's Statement of Significance :

Description :

Condition and Integrity :

Location :

Bibliography:
N.S.W. N.P.W.S. PROPOSED ABORIGINAL AREA
LISTED ON N.S.W. N.P.W.S. ABORIGINAL SITES REGISTER (NO. 45-3-1114).

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Indigenous Place, Somersby NSW

Class: Indigenous
Legal Status: Registered (21/03/1978)

Database Number: 001479
File Number: 1/10/052/0008

Nominator's Statement of Significance :

Description :

Condition and Integrity :

Location :

Bibliography:
MCCARTHY, F. 1947. "RECORDS OF THE ROCK ENGRAVINGS IN THE SYDNEY

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Indigenous Place, Somersby NSW



Class: Indigenous
Legal Status: Registered (14/05/1991)

Database Number: 015906
File Number: 1/10/052/0019

Nominator's Statement of Significance :

Description :

Condition and Integrity :

Location :

Bibliography:
McCARTHY,F.1983. "CATALOGUE OF ENGRAVINGS OF THE SYDNEY-HAWKESBURY

The Register of the National Estate has been compiled since 1976. The Commission is in the process of developing and/or upgrading official statements of significance for places listed prior to 1991.

Report produced : 7/9/2001
RNEDB URL : http://www.ahc.gov.au/heritage/register/easydatabase/database.html

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Indigenous Place, Kariong NSW

Class: Indigenous
Legal Status: Registered (21/03/1978)

Database Number: 015904
File Number: 1/10/052/0022

Nominator's Statement of Significance :

Description :

Condition and Integrity :

Location :

Bibliography:
SIM I M, 1968 "RECORDS OF THE ROCK ENGRAVINGS OF THE SYDNEY DISTRICT"

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Report produced : 7/9/2001
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Mooney Mooney Creek Site, Calga NSW

Class: Natural
Legal Status: Registered (28/05/1996)

Database Number: 019187
File Number: 1/10/052/0025

Statement of Significance : The Mooney Mooney Insect Site contains an unusally diverse and rich fly fauna and is particularly important as a habitat for two winged flies (DIPTERA)(Criterion A.3). The site is the locality where six fly species have been first recorded and described. As a type or reference locality it is important to the taxonomy and classification of flies. The site is also the habitat of many undescribed species, and is likely to become the type locality, for these species when they are named (Criterion C.1). One of the unnamed flies, a species of periscelis, which is only known from four specimens, is of considerable scientific and evolutionary importance as the sole Australian representative of a fly family, which is mainly found in Europe and the Americas. Two uncommon species of primitive scorpion flies, TAECHORISTA PALLIDA and TYTTHOBITTACUS MACALPINEI, and an uncommon member of the wasp family (an orossobaius species), are also found in the area and are of importance to evolutionary and biogeographic studies (Criteria A.1, B.1 and C.1). Some of the fly species collected at Mooney Mooney are not known elsewhere and many are very seldom collected anywhere (Criterion B.1).

Description : The Mooney Mooney insect site extends for 500m along a semipermanent creek and gully. The creek drains into an estuarine section of Mooney Mooney Creek, which forms the southern boundary. From the mangroves on the southern boundary the tributary creek rises to an elevation of 50m. The underlying geology is predominantly Hawkesbury sandstone, with intrusions of Narrabeen Shale. The rich soil washed from these shales supports a small area of rainforest along the creek. The rainforest is a simple semievergreen notophyll vine thicket. Most of the area is wet sclerophyll eucalypt forest, in which ferns are prominent. There is a small area of cleared land. The site is well sheltered and occurs between a loop of the old Gosford to Sydney road. The area has been the site of invertebrate collecting activities by Australian Museum staff since 1957. The location has been more thoroughly investigated for two winged flies (DIPTERA) than for other insect types.

Condition and Integrity : The site is of high integrity except for one small cleared area. (Condition assessed 1993).

Location : About 15ha, 2km east-south-east of Calga, comprising Lot 2 DP 563002.

Bibliography:

McAlpine, D.K. (unpub), Insects at the Proposed Mooney Mooney Creek Site, Notes Prepared for the Australian Museum, Division of

Entomology
Mullins, B. (1983), Hawkesbury National Parks: Dharug, Brisbane Water Bouddi, Canberra, NPWS.

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Report produced : 7/9/2001
RNEDB URL : http://www.ahc.gov.au/heritage/register/easydatabase/database.html

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Lone grave of Frances Peat, Mooney Mooney NSW

Class: Historic
Legal Status: Indicative Place

Database Number: 101167
File Number: 1/10/052/0031

Nominator's Statement of Significance : The lone grave of Frances Peat documents a member of the pioneer Peat family who settled in the vicinity of the area today known as Brooklyn in 1836. The family gave its name to several local features in the area including Peat's Bight, Peat's Ridge and Peat's Ferry.

In addition to documenting the early occupation of the area by the Peat family, this grave-site also typifies the pattern of isolated settlement along the Hawkesbury during the first half of the nineteenth century, and the monument pre-dates Civil Registration.

Description : The lone grave of Frances Peat is situated within a public reserve on the northern side of a small hill adjacent to the Pacific Highway at Mooney Mooney Point. A winding access track leads to the grave from the north. There are views to the north of the expressway and native vegetation. The monument, a sandstone stele, faces east and is set amongst native bushland. A modern timber picket fence surrounds the monument and a recent concrete plinth with metal plaque has been erected within the grave plot.

Frances Peat was the daughter of George and Frances Peat who owned the nearby inn, no longer in existence. Both the grave and in site are included in Gosford City Council's Draft Local Environment Plan (Heritage Items 151 and 150 respectively). On 8 April 1986 Gosford City Council recommended a Permanent Conservation Order be placed on Frances Peat's Grave.

George Peat marked out a road from the Brisbane Waters District to Sydney in 1844, incorporating his ferry crossing of the Hawkesbury River. This road was later combined with the existing Maitland Road to form the Pacific Highway from Sydney to Kangy Angy. George Peat owned land on both sides of the Hawkesbury River and his punt (ferry crossing) was originally designed to transport stock back and forth across the river. When the road came into use in 1844 he converted his home into an inn, the site of which is recognised as an Heritage Item by Gosford City Council. The grave of his daughter, Frances Peat is adjacent to the Inn site.

Condition and Integrity :

Location : Off Pacific Highway, Mooney Mooney, 400 metres south-west of Mooney Mooney Point Ambulance Station.

Bibliography:

Storm, Beryl, 'Gosford/Wyong - History and Heritage', Gosford District Historical Research & Heritage Association, 1982.

The Register of the National Estate has been compiled since 1976. The Commission is in the process of developing and/or upgrading official statements of significance for places listed prior to 1991.

Report produced : 7/9/2001
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Heritage Listings Back

State Heritage Inventory Search Results

Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that currently there may be several entries for the same heritage item in the database.

Your search results have been divided into two sections.

The first section contains items listed on the State Heritage Register, covered by an Interim Heritage Order or protected under section 130 of the NSW Heritage Act. This information is provided by the NSW Heritage Office.

The second section 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.

Item Name	Address	Suburb	LGA	State Heritage Register
Boora Boora	Avoca Drive	Green Point	Gosford City	Yes
Foreshore land and structures	9 Pixie Avenue	Green Point	Gosford City	Yes
Great North Road, The	Between Devine's Hill & Mount Manning	Wiseman's Ferry	Cessnock City	Yes
Hawkesbury River rail bridge	Main Northern railway	Brooklyn	Gosford City	Yes
Hely's Grave	Pacific Highway	Wyoming	Gosford City	Yes
Lower Hawkesbury Wesleyan Chapel and site	Wisemans Ferry Road	Gunderman	Gosford City	Yes
Mulholland's Farm	9 Pixie Avenue	Green Point	Gosford City	Yes
Rosemount	36 Steyne Road	East Saratoga	Gosford City	Yes
The Grange	Renwick Street	Wyoming	Gosford City	Yes
Wyoming Cottage	Pacific Hwy	Wyoming	Gosford City	Yes

There were 10 records in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

Item Name	Address	Suburb	LGA	Information Source
Bay View Hotel	The Boulevarde	Woy Woy	Gosford City	GAZ
Belbourie and			Gosford	

Outbuildings	Howes Road	Somersby	City	GAZ
Belltrees	Wisemans Ferry Road	Somersby	Gosford City	GAZ
Cable Ferry - Wisemans Ferry		Wisemans Ferry	Gosford City	GAZ
HMAS Parramatta wreck	Cascade Gully	Hawkesbury River	Gosford City	GAZ
Holy Cross Roman Catholic Church and Cemetery	Humphreys Road	Kincumber	Gosford City	HGA
Holy Trinity Roman Catholic Church, graveyard & wharf	Wisemans Ferry Road	Spencer	Gosford City	GAZ
House	Collington Road	Spencer	Gosford City	GAZ
Mona Vale	Frederick Street	East Gosford	Gosford City	GAZ
Old Christ Church Anglican Church	3 Mann Street	Gosford	Gosford City	GAZ
Pylons, Old Hawkesbury River Railway Bridge			Gosford City	GAZ
Roma	45 The Boulevarde	Woy Woy	Gosford City	GAZ
Ruins of Greengrove Creek Wharf		Mangrove Creek	Gosford City	GAZ
Site of George Peat's Inn & grave of Frances Peat		Mooney Mooney Point	Gosford City	GAZ
Tidal Mill remains	Mill Creek Road		Gosford City	GAZ
Wesleyan Chapel	Wisemans Ferry Road	Gunderman	Gosford City	GAZ
Wharf & house, formerly The Greenman Inn		Marlows Creek	Gosford City	GAZ
Woodbury House		Tarby Creek, Spencer	Gosford City	GAZ
Woy Woy Hotel	The Boulevarde	Woy Woy	Gosford City	GAZ

There were 19 records in this section matching your search criteria.

There was a total of 29 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

Note: The Heritage Office seeks to keep the State Heritage Inventory (SHI) up to date, however the latest listings in Local and Regional Environmental Plans (LEPs and REPs) may not yet be included. Always check with the relevant Local Council or Shire for the most recent listings.

Home Back

Helping the community to conserve our heritage

Heritage Listings

State Heritage Inventory - Item View

Site of George Peat's Inn & grave of Frances Peat

Item

Name of Item: Site of George Peat's Inn & grave of Frances Peat
Address: Mooney Mooney Point
Parish: Cowan
Local Government Area: Gosford City

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Regional Environmental Plan			21 Oct 97		
Local Environmental Plan		00020	08 Sep 89	093	6868
National Trust of Australia register			01 Feb 96		

Criteria for listing on the State Heritage Register (SHR)

References

None

Source of information for this entry

Name: Statutory Listings from NSW Gazette
Email: watters@heritage.nsw.gov.au
Web Page: www.heritage.nsw.gov.au

Administration

Heritage Database Number: 4442

Every effort has been made to ensure that information contained in the State Heritage Inventory is correct. If you find any errors or omissions please send your comments to the Database Manager.

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Helping the community to conserve our heritage

NSW Heritage Office

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Fax No (02) 4324 8509
Web Site www.gosford.nsw.gov.au
Email goscity@gosford.nsw.gov.au

FACSIMILE TRANSMISSION

REGULATORY OPERATIONS

Fax Number	9517 9860
Organisation	
Attention	ROBYN MILLS
From	TRACY SHARP
Internal Reference	Heritage Enquiry
Date	10.9.01
Subject	Heritage Item No 150 - Site of George Peats Inn, Pt Por 2, Parish of Cowan. Public Reserve, Mooney Mooney Point and Heritage Item No 151 - Grave of Frances Peat, Pt Pn 2, Parish of Cowan, Public Reserve, Mooney Money Point.
Number of pages	8 (including this header page)

MESSAGE / COMMENTS

Robyn

Please find attached the information as discussed.

Regards

Tracy

ITEM	Isolated grave	ITEM TYPE	REF. NO.
NAME	Frances Peat's Grave	☐ Architectural	
LOCATION	Public Reserve Mooney Mooney Point	☐ Landscape	151
GROUP		☒ Archaeological	

SURVEY BY GBA
DATE OF SURVEY 09/07/1997
DATE AMENDED 07/11/1997
CATEGORY Archaeological resource
SUB CATEGORY Grave

DESCRIPTION

Isolated grave surrounded by picket fence in bushland on top of hill overlooking the Hawkesbury River, adjacent to the Expressway. The grave has east/west orientation with simple headstone and footstone with stone flagging between.

HERITAGE LISTINGS

- ☐ Register of the National Estate (AHC) - Register
- ☐ Register of the National Estate (AHC) - Interim
- ☒ Register of National Trust (NSW)
- ☐ Within National Trust Conservation Area
- ☐ Register of Significant Twentieth Century Architecture (RAIA)
- ☐ Department of Public Works Heritage and Conservation Register
- ☐ Heritage Council Register - Permanent Conservation Order
- ☐ Heritage Council - Interim Conservation Order
- ☐ Heritage Council Register - Section 130 Order
- ☒ Heritage Council Register - Nomination
- ☐ NSW Government Department Heritage Register (S170 Heritage Act)
- ☐ NP & WS Historic Sites Register
- ☐ Institute of Engineers (NSW) Heritage Register
- ☐ Regional Environmental Plan Heritage Schedule
- ☐ Local Environmental Plan Heritage Schedule
- ☐ Local Environmental Plan Heritage Schedule - Conservation Area
- ☒ Other Listings :

  Bicentennial Heritage Inventory,
  Gosford City Council Draft LEP Schedule, Items of the Environmental Heritage.

EXTERNAL MATERIALS

Stone

MODIFICATIONS / CONDITION

Largely intact.

INTERNAL MATERIALS

N/A

STYLES

N/A

HISTORY

Grave of Frances Peat, the daughter of George and Frances Peat. George Peat ran an Inn (Item 150) and punt nearby, across the Hawkesbury River. This is the earliest identified grave in the immediate area.

HISTORICAL THEMES - STATE

HISTORICAL THEMES - LOCAL

Access and early roads.

DATE 1842
PERIOD Access & early roads
ARCHITECT / DESIGNER N/A
BUILDER N/A

SOURCES

Bicentennial Heritage Inventory.

STUDY TEAM : Kim Ketelbey

GOSFORD HERITAGE REVIEW

ITEM	Isolated grave
NAME	Frances Peat's Grave
LOCATION	Public Reserve Mooney Mooney Point
GROUP	

ITEM TYPE
- ☐ Architectural
- ☐ Landscape
- ☒ Archaeological

REF. NO. 151

STATEMENT OF SIGNIFICANCE

Frances Peat's Grave in the Public Reserve of Mooney Mooney Point has local historic significance as the earliest identified grave in the area around Mooney Mooney and one of the earliest in the region. It has regional historic significance for its association with George Peat, her father, and is indicative of an isolated settlement not associated with a village . Peat established a punt across the Hawkesbury River just below this site, providing a link between Sydney and the north. Although not visible from the road or reserve, it remains an important feature of the area.

REAL DESCRIPTION

Part Portion 2
Parish of Cowan

MAP REFERENCE

RECOMMENDATIONS

Recommend for inclusion on the Gosford City Council LEP. Heritage Report required prior to any proposals for alterations or additions which may adversely impact on the significance of the grave and its curtilage. All future works should consider the retention of the character of the grave, its curtilage and its association with the punt and inn site (Item 150). A conservation precinct should be established to conserve the character of the site and maintain the association between the grave, George Peat's Inn and the foreshore.

PHOTOGRAPH

EVALUATION OF SIGNIFICANCE

	Rare
Historic	Local
Aesthetic	
Social	
Scientific	
Other	

	Representative
Historic	Regional
Aesthetic	
Social	
Scientific	
Other	

STUDY TEAM : Kim Ketelbey

ISOLATED GRAVE - FRANCES PEAT

PROMINENT LOCATION ON PUBLIC RESERVE. CAN BE SEEN FROM EXPRESSWAY.

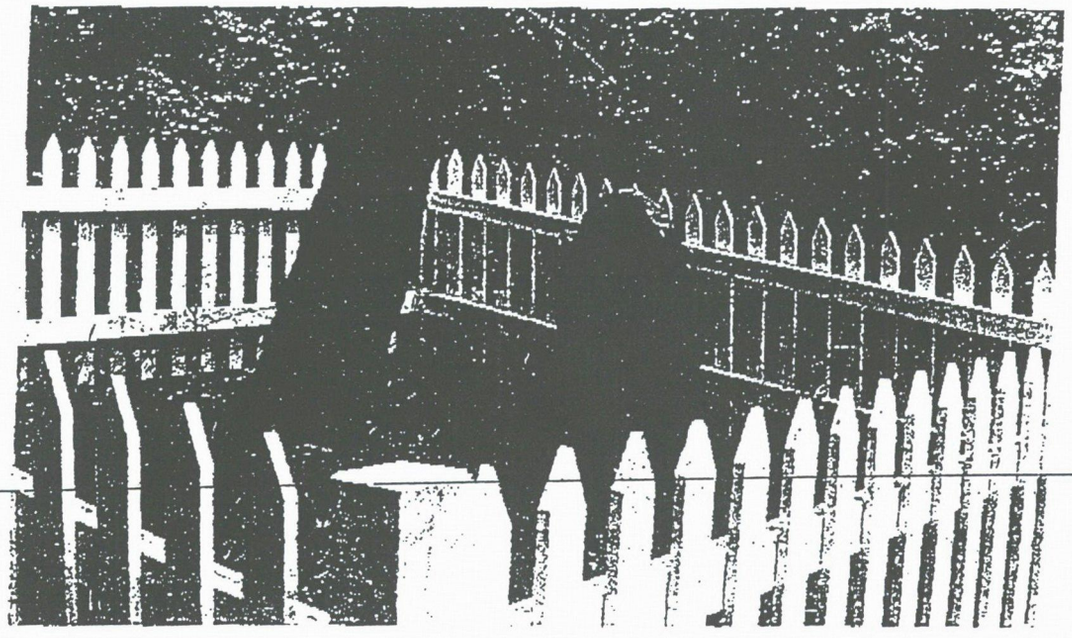


Photo: GOSFORD CITY COUNCIL



ITEM	Inn (site)	ITEM TYPE	REF. NO.
NAME	George Peat's Inn Site	☐ Architectural	
LOCATION	Mooney Mooney Point Public Reserve	☐ Landscape	150
GROUP		☒ Archaeological	

SURVEY BY GBA
DATE OF SURVEY 09/07/1997
DATE AMENDED 20/10/1997
CATEGORY Archaeological resource
SUB CATEGORY Inn (site)

DESCRIPTION

Little evidence of the original inn remains and the site is hard to establish. The site is on the knoll of Mooney Mooney Reserve which is rocky and overgrown

HERITAGE LISTINGS

- ☐ Register of the National Estate (AHC) - Register
- ☐ Register of the National Estate (AHC) - Interim
- ☐ Register of National Trust (NSW)
- ☐ Within National Trust Conservation Area
- ☐ Register of Significant Twentieth Century Architecture (RAIA)
- ☐ Department of Public Works Heritage and Conservation Register
- ☐ Heritage Council Register - Permanent Conservation Order
- ☐ Heritage Council - Interim Conservation Order
- ☐ Heritage Council Register - Section 130 Order
- ☐ Heritage Council Register - Nomination
- ☐ NSW Government Department Heritage Register (S170 Heritage Act)
- ☐ NP & WS Historic Sites Register
- ☐ Institute of Engineers (NSW) Heritage Register
- ☒ Regional Environmental Plan Heritage Schedule
- ☒ Local Environmental Plan Heritage Schedule
- ☐ Local Environmental Plan Heritage Schedule - Conservation Area
- ☒ Other Listings :

  Bicentennial Heritage Inventory.

MODIFICATIONS / CONDITION

Retains nothing of its original style.

EXTERNAL MATERIALS

N/A

INTERNAL MATERIALS

N/A

HISTORY

George Peat, shipbuilder, settler and farmer was granted land either side of the Hawkesbury River at Kangaroo Point and at Mooney Mooney, first in 1836 and later in 1840. He operated a small punt for the carriage of his stock across the river at the point where the Pacific Highway now crosses and was the Sydney-Wollombi route. As one of two routes ascending Mt White, "Peats line" was chosen by the District Council as the easiest route for the building of a public road. The road from Pearce's Corner to Kangaroo Point on the southern side of the Hawkesbury along the track established by Peat to the crossing was surveyed by the government in 1849 .Peat established a ferry service across the river in 1844 and his residence "Fairview", at what is now Mooney Mooney Point, was to become known for its comfortable accommodation house. Peat was also known as a builder of small vessels on the river.

STYLES

N/A

HISTORICAL THEMES - STATE

HISTORICAL THEMES - LOCAL

Access and early roads.

DATE 1840
PERIOD Access & early roads
ARCHITECT / DESIGNER N/A
BUILDER N/A

SOURCES

Bicentennial Heritage Inventory.
Strom, B. "Gosford/Wyong History and Heritage."
"The Establishment of Direct Road Communication between Sydney and Newcastle". Department of Main Roads.

STUDY TEAM : Kim Ketelbey

GOSFORD HERITAGE REVIEW

ITEM	Inn (site)	ITEM TYPE	REF. NO.
NAME	George Peat's Inn Site	☐ Architectural	
LOCATION	Mooney Mooney Point Public Reserve	☐ Landscape	150
GROUP		☒ Archaeological	

STATEMENT OF SIGNIFICANCE

George Peat's Inn Site on the Mooney Mooney Point Reserve on the north foreshore of the Hawkesbury River, adjacent to the Pacific Highway has historic and social significance for its association with early access across the Hawkesbury River between Sydney and Brisbane Water. It has historic significance for its association with George Peat, settler and farmer of the area. Although little evidence of the site remains, this does not diminish the site's significance and the precinct is an important feature of the landscape both from the water and the Pacific Highway.

REAL DESCRIPTION

Part Portion 2
Parish of Cowan

MAP REFERENCE

RECOMMENDATIONS

Recommend retention on the Gosford City Council LEP. Consideration should be given for requirement of an Assessment of Heritage Impact prior to any proposals for works to the site which may adversely impact on the significance of the inn site. A Conservation Zone should be established in association with Frances Peat's Grave (Item 151) to conserve the character of the sites. Archeological assessment of the site should be made to establish curtilage of site and allow public interpretation.

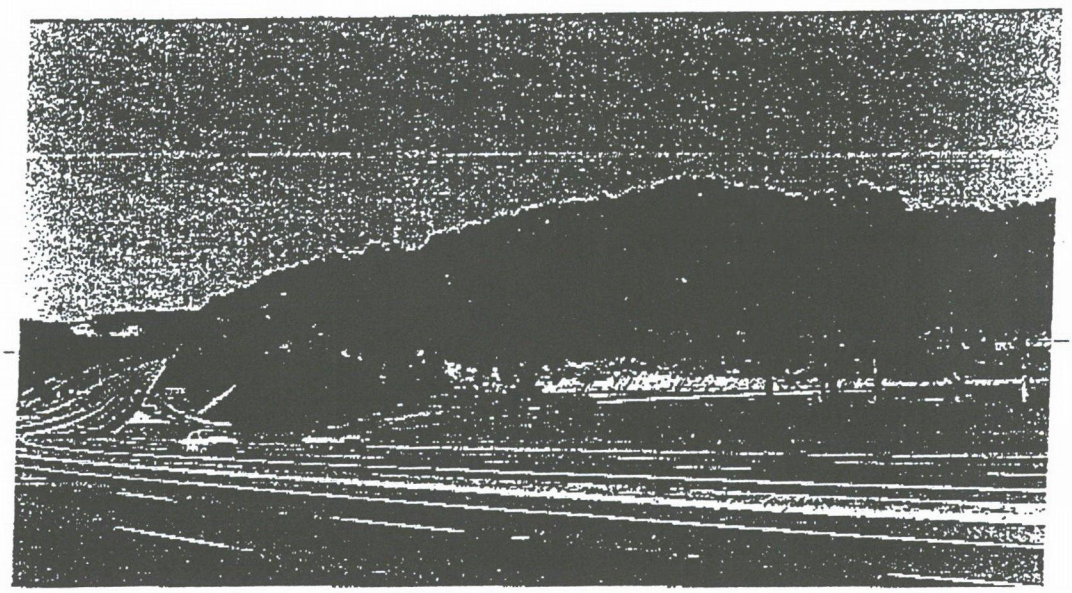
PHOTOGRAPH

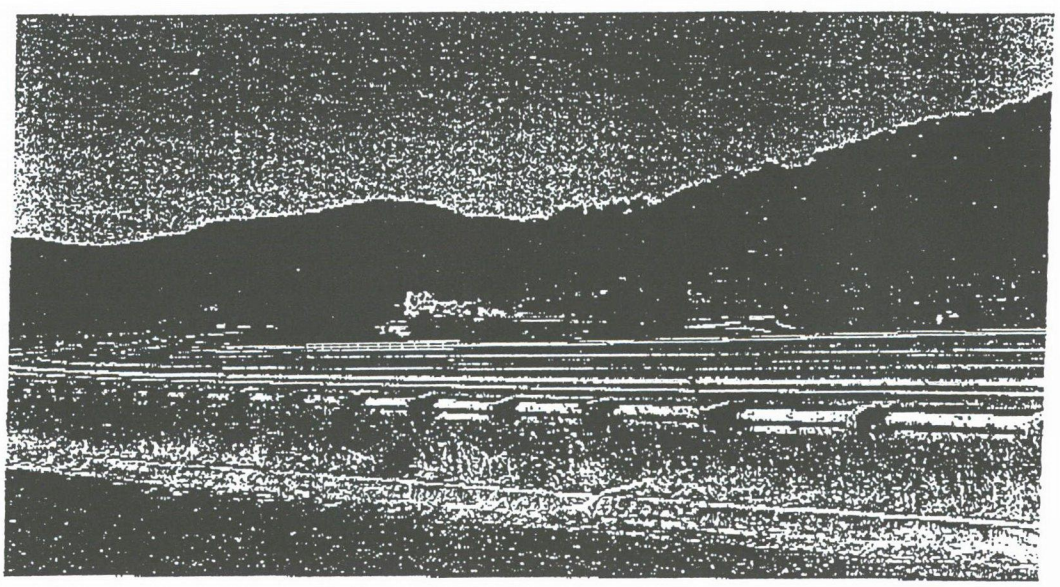
EVALUATION OF SIGNIFICANCE

	Rare	Representative
Historic		Regional
Aesthetic		
Social		Regional
Scientific		
Other		

STUDY TEAM : Kim Ketelbey

GEORGE PEATS IN SITE.





Appendix 8
Native Title Records

Register of Native Title Claims

Note: This application has been amended and the amended application is pending registration testing. Contact the Case Management Unit of your local registry for further details.

NNTT File Number: NC98/8

Registration Number: C00753

Body Application Lodged With: National Native Title Tribunal **Ref.No.:** NG6097/98

Date Filed: 31 March 1998

Date Registered: 31 March 1998

Status: Referred to Presidential Member **Date:** 1 April 1998

Registered Native Title Claimant(s): Stephen Seiver and Evelyn Chatterton on behalf of the Boongarri Clan of the Darkungung Country People

Address for Service: C/- .
8 Cambridge Drive
GARDEN SUBURB NSW 2289

Description of Persons Claimed to Hold Native Title:
Boongarri Clan of the Darkungung Country People

Area Covered

State(s): New South Wales

ATSIC Region(s) or TSRA: Binaal Billa Regional Council, Sydney Regional Council, Many Rivers Regional Council

Local Government Area(s): Baulkham Hills Shire Council, Blacktown City Council, Blue Mountains City Council, Cessnock City Council, Gosford City Council, Greater Lithgow City Council, Hawkesbury City Council, Holroyd Shire Council, Hornsby Shire Council, Hunter's Hill Municipal Council, Ku-ring-gai Municipal Council, Lake Macquarie City Council, Lane Cove Municipal Council, Maitland Shire Council, Manly Municipal Council, Mosman Municipal Council, Newcastle City Council, North Sydney Municipal Council, Parramatta City Council, Penrtih City Council, Pittwater Municipal Council, Port Stephens Shire Council, Ryde City Council, Rylstone Shire Council, Singleton Shire Council, Warringah Shire Council, Willoughby City Council, Wollondilly Shire Council, Wyong Shire Council

Description: Lot 375 DP 752017-and 'Darkungung Country' covering the area bounded by the North Sydney (North Head) of Port Jackson on the south to the Hunter River and about 96 km inland from the coast. This includes Lake Macquarie (Awaba), Hawkesbury River, Broken Bay, Mount Yango (to the west) etc.

Land and/or Waters: Land and Waters

Draft Determination of Native Title Sought: *(In this section, the applicants provide a draft of the determination of native title they seek. Any determination*

will be subject to existing laws and existing legal rights.)
That the native title rights and interests by recognised respected and protected by all parties and that the descendants in Darkingung country be involved in its management and protection.
Further draft determination to be forwarded by Mr S Seiver.

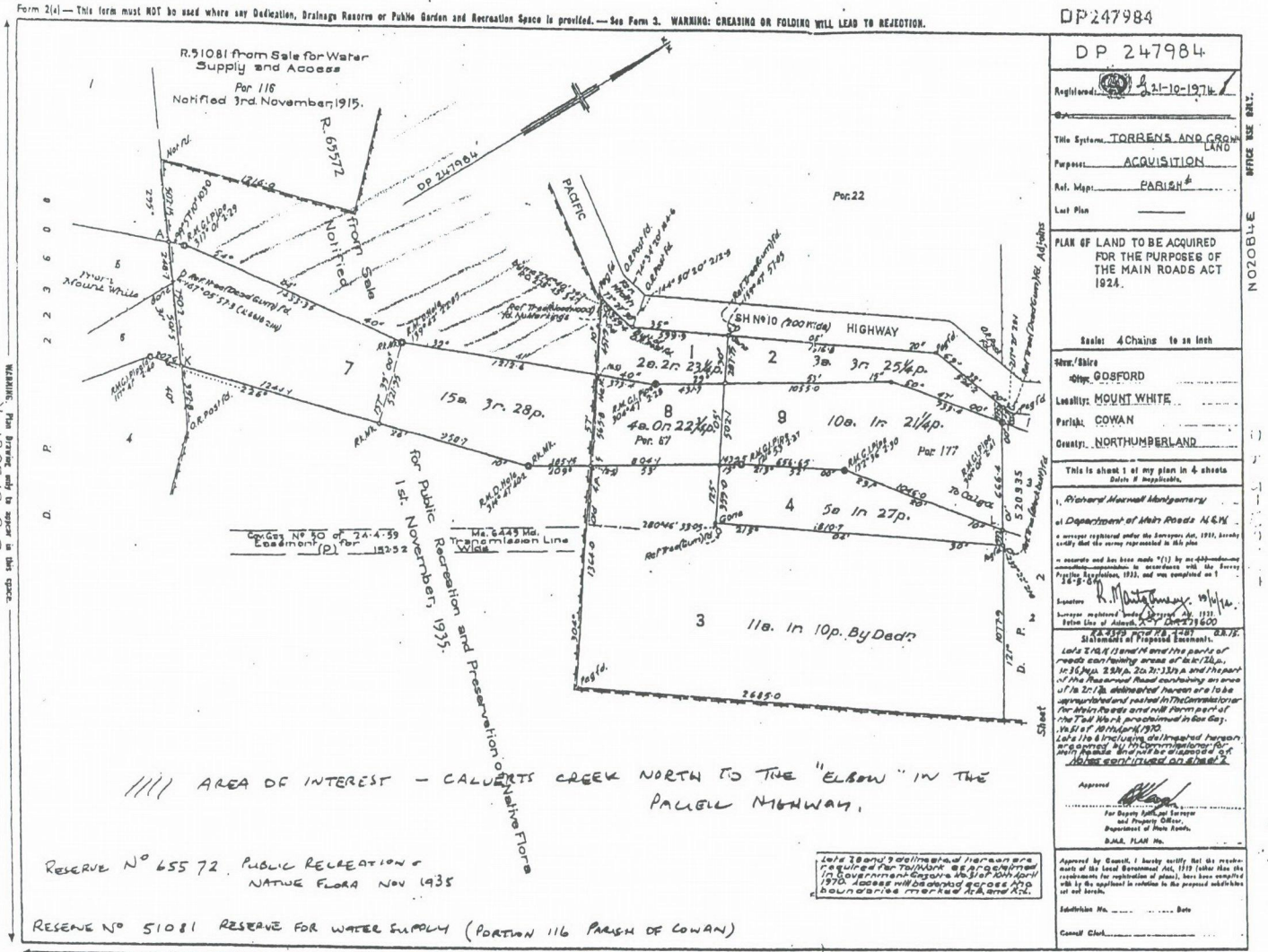
Details of Native Title Rights and Interests Possessed Under Traditional Laws and Customs: *(In this section, the applicants describe their traditional rights to an area. These may be more extensive than the native title rights to which recognition is claimed through the determination.)*
The rights and interests possessed under traditional law as acknowledged and the traditional customs observed by Aboriginal and/or Torres Strait Island people.
Hunting gathering fishing rights and interests.
Traditional care taking role.
Spiritual connection to land and ancestors.
Genealogy Direct link to 'Margaret' and 'Ned' (Edward White).
Right to negotiate access to impacts on traditional land.

Attachments:
Attachment A; General area of claim provided by applicants; 1 A4 page; added 16/11/1998.
(If not attached these are available at NNTT Registries in each Capital City or by phoning 1800 640 501)

End of Entry for NC98/8

Form 2(a) — This form must NOT be used where any Dedication, Drainage Reserve or Public Garden and Recreation Space is provided. — See Form 3. WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION.

DP247984



DP 247984

Registered: 21-10-1974

Title System: TORRENS AND CROWN LAND

Purpose: ACQUISITION

Ref. Map: PARISH

Last Plan: ———

PLAN OF LAND TO BE ACQUIRED FOR THE PURPOSES OF THE MAIN ROADS ACT 1924.

Scale: 4 Chains to an Inch

Area/Shire: GOSFORD

Locality: MOUNT WHITE

Parish: COWAN

County: NORTHUMBERLAND

This is sheet 1 of my plan in 4 sheets
Delete if inapplicable.

I, Richard Maxwell Montgomery of Department of Main Roads N.S.W. a surveyor registered under the Surveyors Act, 1929, hereby certify that the survey represented in this plan is accurate and has been made *(1) by me/by a person under my supervision/supervision in accordance with the Survey Practice Regulation, 1933, and was completed on 1 28-8-74

Signature: R. Montgomery 19/10/74

Surveyor registered under the Surveyors Act, 1929

Datum Line of Azimuth: X-Y Ore 219600

Reference Plan: DP 247984 D.M.R.

Statement of Proposed Easements.

Lots 1 N/A 13 and 14 and the parts of roads containing areas of 1a 1r 12½p., 1a 3r 24½p., 2a 2r 23½p. and the part of the Pacific Road containing an area of 1a 2r 12p. delineated hereon are to be appropriated and vested in The Commissioner for Main Roads and will form part of the Trail Work proclaimed in Gazette of 10th April, 1970.

Lots 1 to 6 inclusive delineated hereon are agreed by the Commissioner for Main Roads and will be disposed of.

Notes continued on sheet 2

Approved: For Deputy Chief Surveyor and Property Officer, Department of Main Roads.

D.M.R. PLAN No.

Approved by Council. I hereby certify that the requirements of the Local Government Act, 1919 (other than the requirements for registration of plans), have been complied with by the applicant in relation to the proposed subdivision set out hereon.

Subdivision No. ——— Date

Council Clerk

Lots 7 and 9 delineated hereon are required for Tollwork Agreements in Government Gazette No 31 of 10th April 1970. Access will be obtained across the boundaries marked A, B and C.

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 247984 SH 1/4

LINKS	METRES
0.5	0.101
2.27	0.457
2.28	0.459
2.29	0.461
2.3	0.463
2.4	0.483
2.41	0.485
2.5	0.503
21.8	4.385
22.85	4.597
28.1	5.653
33.05	6.649
34.7	6.981
40.2	8.087
57.05	11.477
57.3	11.527
65.65	13.207
92.35	18.578
93.2	18.749
103	20.720
143.95	28.958
152.52	30.682
184.6	37.136
200	40.254
202.6	40.757
212.5	42.748
248.7	50.030
259.4	52.183
287.75	57.886
359	72.219
373.4	75.116
385.18	77.480
392.0	79.019
431.7	86.844
487.9	98.118
501.6	100.886
502.1	101.006
502.15	101.017
521.95	105.000
526.2	105.855
565.8	113.821
599.9	120.681
636.65	132.097
666.4	134.058
733.4	147.537
750.2	150.916
804.1	161.759
923.5	185.779
957.7	192.659
980.7	192.860
1046	210.422
1055	212.232
1077.9	216.089
1212.6	243.936
1216	244.620
1244.1	250.273
1316.8	264.890
1364	274.393
1435.35	288.344
1810.7	364.235
2685	540.136

AC	RD	P	HA
2	2	23 1/4	1.07
3	3	25 1/4	1.581
4	-	22 3/4	1.676
5	1	27	2.193
10	1	21 1/4	4.2
11	1	10	4.578
15	3	28	6.445

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 31st day of August, 1977

FA 02493 17

VIRGINIA GRAY.

Request: rp00z3n / Document: dp 0247984 PLAN / Revision: 16 Jun 1992 / Status: OK / Printed: 27-Aug-1998 17:04 / Images: 4
Client Reference: Road Traffic Authority / Source: P

Appendix 9
NPWS Site Cards

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet:

AMG Grid reference 332920 mE 6269290 mN

250K 25K 250K 5/6 25K

Full reference - please include leading digits

GDA (Please Circle) Yes/No

Scale of map used for grid reference [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

Please use largest scale available

1:25K, 50K, 100K map name: GUNDERMAN

HEAD OFFICE USE ONLY:

NPWS Site no:

Site types:

Accessioned by: Date:

Data entered by: Date:

Owner/Manager:

Address:

Site name: MW - E - 2

Locality/property name.

NPWS District:

Region:

Reason for investigation

F3 WIDENING PROGRAM - JOLLS BRIDGE TO CALGA.

Portion no:

Parish:

Photos taken? ✓

How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

ACCESS FROM NORTHBOUND CARRIAGEWAY OF THE F3 APPROXIMATELY 600m NORTH FROM MT WHITE ON RAMP.

Other sites in locality? YES

Are sites in NPWS Register? YES

Site Types include: ENGRAVINGS, ROCKSHELTER - WITH MIDDEN GRINDING GROOVES.

Have artefacts been removed from site? NO

By whom?

When?

Deposited where? /

Is site important to local Aborigines? YES

Give contact(s) name(s) + address(es)

Contacted for this recording? DARKINJUNG LALC - DAVID PROST

(Attach additional information separately) If not, why not? 02 4351 2930.

Verbal/written reference sources (including full title of accompanying report)

NPWS Report Catalogue #

A HERITAGE STUDY OF IMPACTS OF THE WIDENING OF THE F3 FREEWAY FROM JOLLS BRIDGE TO CALGA.

Checklist surface visibility, damage/disturbance/threat to site

Condition of site

SITES HAVE DETERIORATED FROM EXPOSURE TO SEEPAGE & GROWTH OF MOSS - LICHEN.

Recommendations for management & protection (attach separate sheet if necessary)

SITE IS WITHIN CROWN LEASE UNDER NPWS CUSTODIANSHIP.

NPWS & LALC MAY CONSIDER MANAGEMENT OPTIONS TO PROTECT THE SITE

Site recorded by:

Address/institution: R. MILLS
60 WATKIN ST
NEWTOWN 2042

Date: SEPTEMBER 2001.

SITE POSITION & ENVIRONMENT

OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc:

b. site aspect:

c. slope:

d. mark on diagram provided *or* on your own sketch the position of the site:



e. Describe briefly:

HIGH GROUND ABOVE CAVERTS CREEK

f. Local rock type: SANDSTONE

g. Land use/effect: CROWN LEASE

2. Distance from drinking water: 1 Km. Source: CAVERTS CREEK

3. Resource Zone associated with site (estuarine, riverine, forest etc): FOREST

4. Vegetation: NATIVE BUSHLAND (REGENERATED).

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL

7. Other exploitable resources (river pebbles, ochre, etc): NIL

Site type:

ENGRAVING.

CHECKLIST TO HELP:
length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth

QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate

DESCRIPTION OF SITE & CONTENTS.

Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.



Location: This engraving site is located approximately 17m east of Site MW-E-1 and within Crown Reserve No 65572 at Mount White.

Context: This site is located on an extensive sandstone outcrop which extends over an area approximately 100m x 200m. Mosses and native heaths are growing in circular "holes" in the rock shelf which have been filled with soil. (Photo 12)

Description: The site is composed of two circular depressions in the rock surface. This basic circular shape occurs on sandstone outcrops in the Mount White area and appears to be a natural phenomenon. However, some of the circle shapes appear to have been deliberately cut deeper into the surface. Similar shapes were seen by the consultant and LALC representatives in the Somersby Industrial area, Bulgandry Aboriginal Site and at nearby Site #45-3-0157. A geological investigation would be required to determine the origin of these shapes.

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet:

AMG Grid reference 250K 332710 mE 250K 6296320 mN

Full reference - please include leading digits 25K 5/6 25K

GDA (Please Circle) Yes/No

Scale of map used for grid reference [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

Please use largest scale available

1:25K, 50K, 100K map name: GUNDERMAN

HEAD OFFICE USE ONLY:

NPWS Site no:

Site types:

Accessioned by: Date:

Data entered by: Date:

Owner/Manager:

Address:

Site name: MW - E - 3

Locality/property name.

NPWS District:

Region:

Reason for investigation

RTA WIDENING OF F3 PROJECT.

Portion no:

Parish:

Photos taken? ✓

How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

ACCESS FROM THE NORTHBOUND CARRIAGEWAY OF THE F3 APPROXIMATELY 600 m NORTH FROM MT WHITE ON RAMP (SEE ATTACHED MAP).

Other sites in locality? YES

Are sites in NPWS Register? YES

Site Types include: GRINDING GROOVES, ROCK SHELTER ENGRAVINGS.

Have artefacts been removed from site? NO

By whom?

When?

Deposited where? /

Is site important to local Aborigines? YES.

Give contact(s) name(s) + address(es)

DARKINJUNG LALC - DAVID PROST

Contacted for this recording?

(Attach additional information separately) If not, why not? 02 4351 2930.

Verbal/written reference sources (including full title of accompanying report)

NPWS Report Catalogue #

A HERITAGE STUDY OF IMPACTS OF THE WIDENING OF THE F3 FREEWAY FROM VOLLS BRIDGE TO CALGA ....

Checklist: surface visibility, damage/disturbance/threat to site

Condition of site:

SITE HAS DETERIORATED FROM EXPOSURE TO SEEPAGE & GROWTH OF MOSS & LICHEN.

Recommendations for management & protection (attach separate sheet if necessary)

SITE IS WITHIN CROWN RESERVE UNDER NPWS CONTROL.

∴ ALL SITES SHOULD BE PROTECTED AND MANAGED BY THE SERVICE.

Site recorded by: R. MILLS

Address/institution: 60 WATKIN ST NEWTOWN.

Date: SEPTEMBER 2001.

SITE POSITION & ENVIRONMENT

1. Land form a. beach/hill slope/ridge top, etc:

d. mark on diagram provided *or* on your own sketch the position of the site.



e. Describe briefly:

HIGH GROUND ABOVE CALVERTS CREEK

f. Local rock type: SANDSTONE

g. Land use/effect: CROWN LEASE.

2. Distance from drinking water: 1.00 KM. Source: CALVERTS CREEK.

3. Resource Zone associated with site (estuarine, riverine, forest etc): FOREST.

4. Vegetation: BUSH (NATIVE REGENERATION)

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL

7. Other exploitable resources (river pebbles, ochre, etc): NIL

Site type:

ENGRAVING.

Location: This engraving site is located approximately 15m east of Site MW-E-2 (AMG 332711E/6296322N) within Crown Reserve No 65572 at Mount White.

Context: This complex of engravings, water holes and grinding grooves is located on the same rock outcrop as site MW-E-2. The edges of the site are overgrown with mosses and low scrubby vegetation which has taken root in the water holes which are now filled with soil and provide sufficient sustenance to support the vegetation. It is most likely that the mosses and vegetation cover additional engravings at this site.

Description: The site has two identified engravings and two sets of grinding grooves each associated with natural, circular, deep rock pools eroded into the sandstone surface (Sketch 10). Poor light and moss and lichen cover of the sandstone surface made identification of engravings difficult. It is considered that more motifs may be identified in better light conditions.

One engraving consists of a pecked circle with a diameter of 220mm and a pecked line from the circle which could be traced for approximately 2 metres and then its direction was obscured by lichen which had grown across the rock and hampered the identification of the direction of the "line" (Sketch 15, Photo 14).

Approximately 4m to the south east of the end of the "line", a second engraving was identified. This engraving was a pecked line elliptical in shape. The southern/lower section of the ellipse appeared to be covered with moss and vegetation (Sketches 13, 14, Photo 15) The upper/northern section of the ellipse measured 1500mm north/south and 1150mm east/west. The top of the ellipse was pecked out in an arc, 400mm x 230mm (Sketch 14). Approximately 300mm below the arc was a deep water hole, 400mm x 100mm filled with soil and moss. Approximately 100mm south of the water hole were three grinding grooves (a pair on the south-eastern side of the water hole and a single groove on the south western sid). A second water hole was recorded approximately 1600mm from the eastern side of the elliptical egraving. The water hole has two associated grinding grooves to the north of the hole [illegible] and the location of grinding grooves was

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits)

250K: 3 3 2 6 9 0 mE (25K) — 250K: 6 2 9 6 9 3 0 mN (5/6 | 25K)

GDA (Please Circle) Yes/No

Scale of map used for grid reference [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

Please use largest scale available

(1:25K) 50K, 100K map name: GUNDERMAN

HEAD OFFICE USE ONLY:

NPWS Site no: _____

Site types:

Accessioned by: _____ Date: _____

Data entered by: _____ Date: _____

Owner/Manager:

Address:

Site name: MW-RS-1 Locality/property name.

NPWS District: Region:

Reason for investigation

F3 WIDENING PROGRAM - JOLLS BRIDGE TO CALGA.

Portion no:

Parish:

Photos taken? ✓

How many attached? (1)

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

ACCESS FROM PACIFIC HIGHWAY - 500m PAST ASHBROOKES RD.

LAND BETWEEN PACIFIC HIGHWAY & F3.

Other sites in locality? YES Site Types include: ENGRAVINGS, GRINDING GROOVES,

Are sites in NPWS Register?

Have artefacts been removed from site? NO When?

By whom? Deposited where? /

Is site important to local Aborigines? DARKINJUNG LALC.

Give contact(s) name(s) + address(es)

Contacted for this recording? DAVID PROST 02 4351 2930.

(Attach additional information separately) If not, why not?

Verbal (written) reference sources (including full title of accompanying report) NPWS Report Catalogue #

A HERITAGE STUDY OF IMPACTS OF THE WIDENING OF THE F3 FREEWAY FROM JOLLS BRIDGE TO CALGA.

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site:

SOME DISTURBANCE TO FLOOR DEPOSIT FROM ANIMALS BUT GENERALLY IN FAIR CONDITION - IN SITU

Recommendations for management & protection (attach separate sheet if necessary) DEPOSIT POTENTIAL

SITE IS WITHIN A CROWN LEASE UNDER NPWS CARE. THEREFORE THE SITE SHOULD BE "SAFE" FROM DEVELOPMENT PRESSURES.

Site recorded by: Date: SEPTEMBER 2001.

Address/institution: R. MILLS

60 WATKIN ST

NEWTOWN

SITE POSITION & ENVIRONMENT

OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: b. site aspect: c. slope:

d. mark on diagram provided *or* on your own sketch the position of the site:



e. Describe briefly:

SANDSTONE OUTCROP ABOVE CAWEATS CREEK.

f. Local rock type: SANDSTONE g. Land use/effect: CROWN LEASE.

2. Distance from drinking water: 1·2 KM. Source: CAWEATS CREEK.

3. Resource Zone associated with site (estuarine, riverine, forest etc): FOREST.

4. Vegetation: NATIVE BUSHLAND

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL

7. Other exploitable resources (river pebbles, ochre, etc): NIL

Site type:

ROCK SHELTER WITH MIDDEN.

CHECKLIST TO HELP:
length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

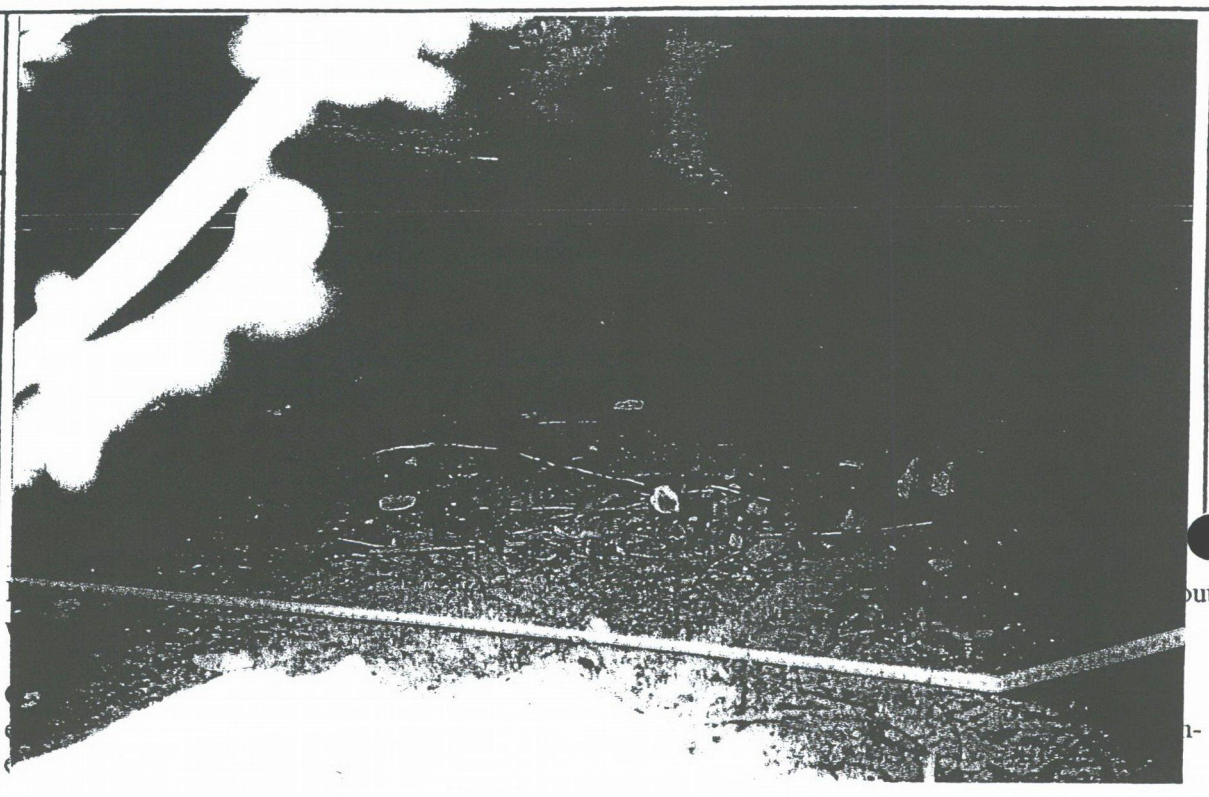
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth

QUARRIES: rock type, debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, bora rings, mia mias), mythological sites, rock holes, engraved groove channels, contact sites (missions massacres cemeteries) as appropriate



Description: the rock outcrop is approximately 3.5m high and covers an area approximately 13m x 20m (Photo 16). The rock outcrop has only one area of overhang, the remainder of the edge of the outcrop either slopes gently or steeply to the ground with no eroded overhangs. The shelter is 450cm long and has a maximum roof height of 120cm (Photo 17, Sketch 17). The area is relatively cramped and would have provided shelter for only a small number of people. Shells characteristic of those usually associated with middens (Bowdler in Connah 1983) were identified on the floor of the shelter. Shells were whole and there seemed little evidence of recent use of the shelter by people or animals. The central floor area of the shelter has potential sub-surface deposit (PAD), the depth of which is unknown

Between 30 and 50 shells were visible on the floor of the shelter (Photo 18). A sample of 30 shells was recorded. These shells included oyster (both upper and lower sections), anadarra and welks. Details of shell type and size were recorded for the sampled shells.

r art sites.

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits)

250K: 3 3 2 7 2 0 mE (25K) — 250K: 6 2 6 9 2 9 0 mN (5/6 | 25K)

GDA (Please Circle) Yes/No

Scale of map used for grid reference (Please use largest scale available) [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

1:25K, 50K, 100K map name: GUNDERMAN

HEAD OFFICE USE ONLY:

NPWS Site no: _____

Site types:

Accessioned by: _____ Date: _____

Data entered by: _____ Date: _____

Owner/Manager:

Address:

Site name: MW-E-1 Locality/property name.

NPWS District: Region:

Reason for investigation

F3 WIDENING PROGRAM - JOLLS BRIDGE TO CALGA.

Portion no:

Parish:

Photos taken? ✓

How many attached? (1)

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

ACCESS FROM NORTHBOUND CARRIAGEWAY OF THE F3 APPROXIMATELY 600m NORTH OF MOUNT WHITE ON RAMP.

Other sites in locality? YES

Are sites in NPWS Register? YES

Site Types include: ENGRAVINGS, ROCKSHELTER GRINDING GROOVES.

Have artefacts been removed from site? NO

By whom?

When?

Deposited where? /

Is site important to local Aborigines? YES

Give contact(s) name(s) + address(es)

DARKINUNG LAKE - DAVID PROST.

Contacted for this recording?

(Attach additional information separately) If not, why not? 02 4351 2930.

Verbal (written) reference sources (including full title of accompanying report)

A HERITAGE STUDY OF IMPACTS OF THE WIDENING OF THE F3 FREEWAY FROM JOLLS BRIDGE TO CALGA.

NPWS Report Catalogue #

Checklist surface visibility, damage/disturbance/ threat to site

Condition of site

PRISTINE.

Recommendations for management & protection (attach separate sheet if necessary)

SITE IS WITHIN CROWN RESERVE UNDER NPWS CONTROL

∴ ALL SITES SHOULD BE PROTECTED - MANAGED BY THE SERVICE.

Site recorded by: Date:

Address/institution:

SITE POSITION & ENVIRONMENT

OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: b. site aspect: c. slope:

d. mark on diagram provided *or* on your own sketch the position of the site:



e. Describe briefly: HIGH GROUND ABOVE CALVERTS CREEK.

f. Local rock type: SANDSTONE g. Land use/effect: CROWN LEASE.

2. Distarice from drinking water: 1.2 KM. Source: CALVERTS CREEK.

3. Resource Zone associated with site (estuarine, riverine, forest etc): FOREST.

4. Vegetation: NATIVE BUSH.

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL

7. Other exploitable resources (river pebbles, ochre, etc): NIL

Site type: ENGRAVING

DESCRIPTION OF SITE & CONTENTS.

Note state of preservation of site & contents. Do NOT dig, disturb, damage site or contents.



CHECKLIST TO HE
length, width, depti
height of site, shelt
deposit, structure,
element eg. tree sc
grooves in rock.

DEPOSIT: colour,
texture, estimated
depth, stratigraphy
contents-shell, bon
stone, charcoal, de
& distribution of th
stone types, artefa
types.

ART: area of surfac
decorated, motifs,
colours, wet, dry
pigment, technique
engraving, no. of
figures, sizes,
patination.

BURIALS: number
condition of bone,
position, age, sex,
associated artefact

TREES: number, all
dead, likely age, sci
shape, position, size
patterns, axe marks,
regrowth

QUARRIES: rock typ
debris, recognisable
artefacts, percentage
quarried.

OTHER SITES EG.
structures (fish traps,
stone arrangements,
bora rings, mia mias),
mythological sites, ro
holes, engraved groo
channels, contact site
missions massacres
cemeteries) as
appropriate

Location: This engraving site is located approximately 20m from the verge of the F3 roadway and 10m from the easement fence. (AMG 332724E/ 6296295N).

Context: This site is an isolated upturned sandstone boulder which is resting against a sandstone bench which extends for over 100m parallel to the F3 (Sketch 11).

Description: The site is a triangular rock approximately 85cm x 140cm in which an "eye" has been pecked out. The pecking has removed the outer edge of the circle and left the centre of the "eye" raised. The "eye" is located approximately 19cm from the eastern end of the rock and central to it. It would appear that the "eye" has been placed to give the impression of an animal head.

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet:

AMG Grid reference 330940 mE 6296540 mN

250K 25K 250K 5/6 25K

Full reference - please include leading digits

GDA (Please Circle) Yes/No

Scale of map used for grid reference [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

Please use largest scale available

1:25K, 50K, 100K map name: GUNDERMAN

HEAD OFFICE USE ONLY:

NPWS Site no:

Site types:

Accessioned by: Date:

Data entered by: Date:

Owner/Manager:

Address:

Site name: MW-66-1

Locality/property name.

NPWS District:

Region:

Reason for investigation

RTA WIDENING OF THE F3 PROJECT.

Portion no:

Parish:

Photos taken? ✓

How many attached? 1

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

HEAD NORTH ALONG THE PACIFIC HIGHWAY FROM THE F3 OFF RAMP. CALVERTS CREEK IS APPROXIMATELY 800m NORTH OF MT. WHITE VILLAGE. SITE IS 80m EAST OF THE BRIDGE OVER CALVERTS CK.

Other sites in locality? YES

Are sites in NPWS Register?

Site Types include: ENGRAVINGS, ROCKSHELTER, GRINDING GROOVES

Have artefacts been removed from site? NO

By whom?

When?

Deposited where? /

Is site important to local Aborigines? YES

Give contact(s) name(s) + address(es)

Contacted for this recording? DARKINJUNG LALC.

(Attach additional information separately) If not, why not? DAVID PROST.

Verbal/written reference sources (including full title of accompanying report)

NPWS Report Catalogue #

A HERITAGE STUDY OF THE IMPACTS OF THE WIDENING OF THE F3 FROM JOLLS BRIDGE TO CALGA.

Checklist, surface visibility, damage/disturbance/threat to site

Condition of site

PRISTINE.

Recommendations for management & protection (attach separate sheet if necessary)

SITE IDENTIFIED TO RTA, NPWS, LALC. SITE SHOULD BE PROTECTED FROM ALL FUTURE IMPACTS.

Site recorded by:

Address/institution: R. MILLS

60 WATKIN ST

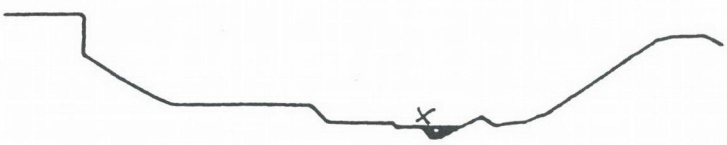
NEWTOWN 2042

Date: SEPTEMBER 2001.

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: b. site aspect: c. slope:

d. mark on diagram provided *or* on your own sketch the position of the site:



e. Describe briefly:

GROOVE ON SANDSTONE OUTCROP IN CREEK BED.

f. Local rock type: SANDSTONE g. Land use/effect: NIL

2. Distance from drinking water: 0 Source: CALVERTS CREEK (SPRING FED)

3. Resource Zone associated with site (estuarine, riverine, forest etc): RIVERINE, OPEN FOREST

4. Vegetation: OPEN FOREST.

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL BUT WOULD BE PRESENT.

7. Other exploitable resources (river pebbles, ochre, etc): NIL.

Site type:

GRINDING GROOVES.

CHECKLIST TO HELP:
length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock.

DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types.

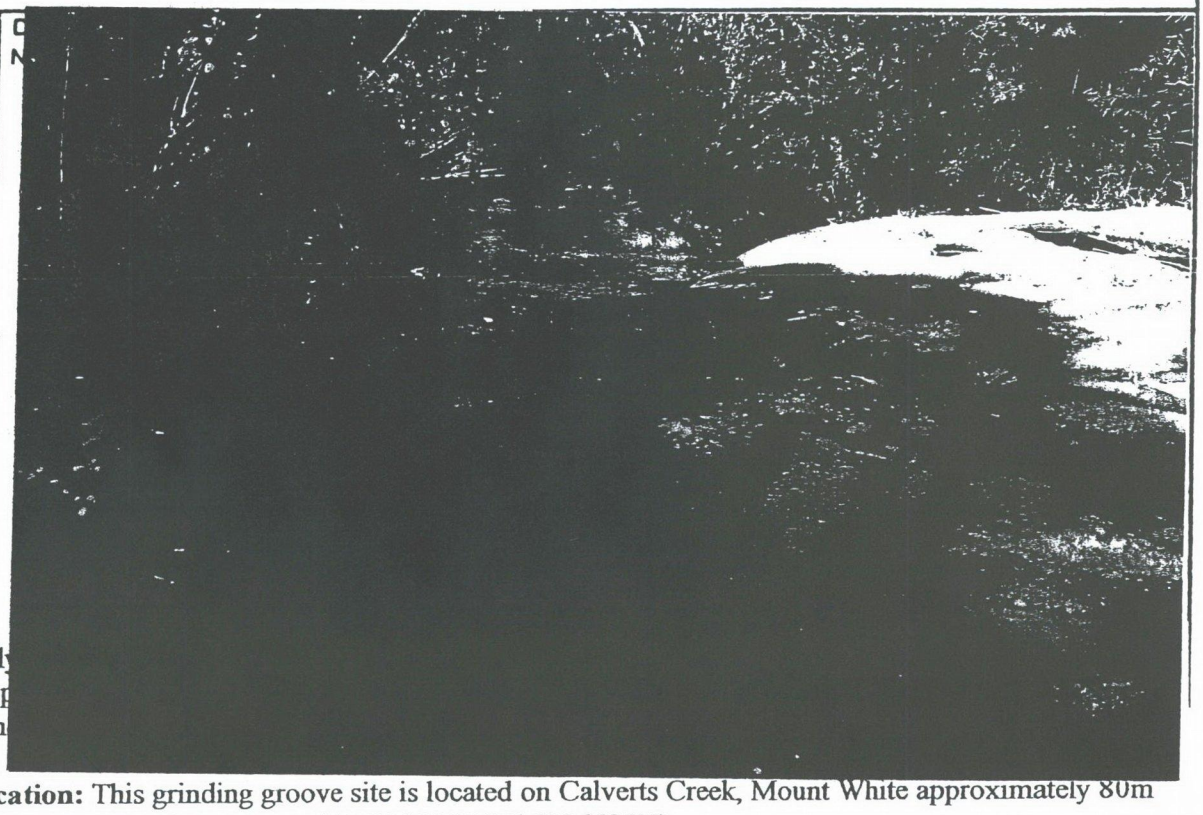
ART: area of surface decorated, motifs, colours, wet, dry pigment, technique of engraving, no. of figures, sizes, patination.

BURIALS: number & condition of bone, position, age, sex, associated artefacts.

TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth

QUARRIES: rock type debris, recognisable artefacts, percentage quarried.

OTHER SITES EG. structures (fish traps, stone arrangements, ora rings, mia mias), mythological sites, rock holes, engraved grooves channels, contact sites missions massacres cemeteries) as appropriate



Only
prop
dim

Location: This grinding groove site is located on Calverts Creek, Mount White approximately 80m south of the Pacific Highway (AMG 332094E/ 6296535N).

Context: The site is located in a section of the creek bed where there is a large flat outcrop of sandstone across which water from the spring fed creek flows, year round (Mount White Store Keeper pers com). The creek bed contains deeper pools beside which the grooves are located. Vegetation is growing on the edges of the exposed sandstone and it is possible that additional grooves may be located under the moss and vegetation.

Description: The grooves extend across an area of exposed sandstone approximately 10m long and 8m wide. Within that area there are in excess of 80 grinding grooves. The majority of the grooves are located within and on the edge of the main water flow area, while a smaller number are associated with two deep pools 2m and 4m respectively to the south of the main stream (Sketches 8, 9). The majority of the grooves are within the range of 200-240mm in length and 100-120mm in width and 5mm-10mm in depth. However overall they vary in length from 320mm to 400mm and in width from 100mm to 150mm and in depth from 5mm 35mm.