CLEVE SMITH EXCAVATIONS PTY LTD

MDJ QUARRIES PTY LTD

RINDEAN QUARRY
SOMERSBY, NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT

Volume 1

Coastplan Consulting Pty Ltd and
Frank Downing Environmental Assessment and Management

April 2012

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ENVIRONMENTAL IMPACT STATEMENT

Volume 1

April 2012

Prepared for:	Cleve Smith Excavations Pty Ltd,	620 Wisemans Ferry Rd Somersby NSW 2250 Telephone: (02) 4372 1597
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Submission of Environmental Impact Statement (EIS)

Prepared under Section 78A (8) of the Environmental Planning and Assessment Regulation Act, 1979

EIS prepared by

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In respect of	Development application to operate an extractive industry at the existing Rindean Quarry, Somersby

Development Application

Applicant Name	Cleve Smith Excavations Pty 620 Wisemans Ferry Road, Somersby, NSW 2250
and	MDJ Quarries Pty Ltd PO Box 3304, Erina NSW 2250
Land to be developed: address Lot No. DP vol/ fol etc proposed development	Lot 2 DP:362339, 620 Wisemans Ferry Road, Somersby, NSW

Environmental Impact Statement

✔ An Environmental Impact Statement (EIS) is attached

Certificate

I certify that I have prepared the contents of this Statement and to the best of my knowledge

- It is in accordance with Clauses 72 and 73 of the Environmental Planning and Assessment Act, 1979 and
- It is true in all material particulars and does not, by its presentation or omission of information, material mislead.

Signature

Name Anthony Mark Tuxworth

Date

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EXECUTIVE SUMMARY

Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd have made a development application to the Gosford City Council to operate an extractive industry at Lot 2 DP:362339, No. 620 Wisemans Ferry Road, Somersby, New South Wales, also known as Rindean Quarry. The proposal is for the quarry to reopen and to operate in the manner and within the footprint approved by the Council in 2006 and 2007 to produce up to 150,000 tonnes per annum of washed and unwashed construction sand for Sydney and local markets.

Rindean Quarry was operated as a sand quarry from 1979 to 2003 under a development consent issued by the Gosford City Council to Mr K Fagan on 9 February 1979 in regard to the property. The quarry was operated under this consent by subsequent owners of the property, Rindean Sands Pty Ltd and Cleve Smith Excavations Pty Ltd, and by contractors to the owners.

In October 2001, the Gosford City Council issued an order to the owner to cease operations at the quarry in response to a complaint by a local resident and following removal of vegetation from within the 20-metre buffer of the site boundary. It was clear in subsequent proceedings in the Land and Environment Court that the 1979 consent had not lapsed. The consent remains valid today. However, the only way for the quarry to continue to operate was for the owner to submit to the Gosford City Council a development application accompanied by an environmental impact statement (EIS) to reopen the quarry and to operate an extractive industry on the site.

A Development Application (No 26467/2004) was submitted by Cleve Smith Excavations Pty Ltd in December 2004 seeking to reopen the Rindean Quarry with alterations. After consideration of an environmental impact statement (EIS) dated September 2004, public submissions received regarding the proposal, the report of a mediator and substantial supplementary information submitted by the applicant, the Council issued a deferred consent dated 20 June 2006. This consent was amended by a consent dated 17 September 2007 following the consideration of an application under s96 of the *Environmental Planning and Assessment Act 1979* (the Act) to modify the first consent.

The applicant addressed the consolidated conditions of consent through the submission of a Quarry Management Plan, including a groundwater monitoring and management program, to the Gosford City Council in March 2011. On 7 April 2011 the Gosford City Council advised that, among other things, the Plan of Management had adequately addressed the deferred commencement conditions. In a letter dated 13 May 2011, the NSW Office of Water accepted the Groundwater Monitoring and Management Plan required by the consolidated conditions of consent, subject to certain conditions relating to water testing.

In the time available, however, it was not possible to implement all conditions of the deferred commencement and the consents lapsed on 13 June 2011.

The Development Application and the EIS submitted now are for an extractive industry that will operate in a manner that is identical in most respects with the operation allowed under the consolidated conditions of the consents of 17 September 2007 and 20 June 2006.

The present state of the site is a product of almost 25 years of use for the production of sand and longer use for agricultural and other extractive operations. Little rehabilitation was done during that time and almost two thirds of the site remains in a disturbed state. A rehabilitation program will be conducted as an integral part of the quarry's operation beginning in the south-eastern corner of the property when the new operation starts. The program will aim to rehabilitate the quarry site progressively through structured earthworks and the planting of endemic native species, to reduce the area used for active quarrying to less than a third of the property and to leave the property as native bushland typical of the area once the resource is exhausted.

The quarry will be operated in four stages. Work will continue through a construction period and Stage 1 (Years 1 and 2) to reinstate the property as a working quarry and to establish water storage, water management and dust control systems, and the rehabilitation program. Preliminary works needed to reinstate the quarry, some of which might cause noise exposure goals for adjacent properties to be exceeded, will be conducted during the first 26 weeks of the operation. These works, will include the construction of noise bunds, the relocation of the access road within the site, the construction of a truck wheel wash near the access gate, initial rehabilitation earth works in the south-eastern corner of the property and clean-up work in exposed locations. These operations will be consistent with New South Wales Government's Industrial Noise Policy which allows an additional margin of noise during a 26 week establishment period. Once essential preliminary works have been completed, the quarry will able be to produce a limited range of sand products.

The processing plant will be moved to the quarry floor near the centre of the property during Stage 2 (years 3 to 5) where it will be largely screened from view and cause the least noise exposure at adjacent properties. Quarrying will continue adjacent to the northern boundary to construct a permanent road within the quarry, remove the resource there and to prepare the area for rehabilitation.

The quarrying will begin to move to the west towards Wisemans Ferry Road during Stage 3 (years 6 to 10) and continue throughout Stage 4 (years 11 to 20). The quarry's operations, rehabilitation and impacts on surrounding areas will be monitored throughout.

The main impacts associated with reopening the quarry are predicted to be in regard to groundwater resources, noise exposure, flora and fauna and the visual environment. These matters are examined in detail in the EIS.

Surface seepage of groundwater as springs has long been a natural feature of the area. Ground-water from springs and tapped through bores has become an established source of water for stock, agriculture and domestic purposes. As the quarry has already intercepted the shallow aquifers and will intercept them to a greater extent as it expands, water will continue to seep from these aquifers. Some lowering of the water levels in bores close to the quarry might have occurred already although evidence of this happening was blurred by a natural lowering of the water tables during the drought prior to 2009. Several bores close to the quarry will be deepened at the quarry operator's expense if they are proven to be affected severely by the quarry's operation.

A groundwater management plan was approved by the NSW Office of Water in correspondence of 13 May 2011 and water access licences and allocations have been acquired. These approvals, which are recent and current, were based on the

hydrogeological investigations conducted in 2004 and 2005. No further independent assessment was required.

Background noise is relatively high in the area, especially in the early morning and early evening, because of its proximity to the F3 Freeway and Wisemans Ferry Road. An independent noise assessment conducted in 2004 found that five properties adjacent to the quarry are likely to be affected by the noise of quarry operations although the noise exposure at all of them should, under nearly all circumstances, remain within noise exposure goals set under the New South Wales Government Industrial Noise Policy. The noise of some establishment works may exceed noise exposure goals, although this is permitted during a 26 week construction period. Since that assessment was conducted, there have been no changes to regulatory requirements relevant to the quarry's operation and noise footprint. Current generation equipment to be used in the quarry is significantly quieter than that upon which the 2004 assessment was based. A further independent noise assessment was, therefore, not warranted. Mitigation measures recommended in the earlier assessment will be implemented. Noise exposure will be monitored and consultation will continue throughout with the owners of any affected properties.

A fresh independent flora and fauna study was conducted for this EIS based on amended regulatory requirements. The assessment found that the proposed development would be unlikely to cause significant impacts on any species of conservation significance, but made a number of recommendations to ameliorate the impacts, particularly in regard to resident fauna and protection of down-slope environments. These recommendations have been be adopted. In the long term, rehabilitation will improve the habitat provided by the site.

State and Federal requirements in regard to air quality and greenhouse gas emissions have changed since the 2004 EIS was prepared. Detailed independent assessments were, therefore, required. The air quality assessment found that, based on the predicted results and giving consideration to conservative assumptions, the risk to both human health and the environment from emissions to the air from the proposed sand quarry is likely to be low, provided the recommended controls are implemented at the site. These recommendations have been adopted.

The greenhouse gas assessment concluded that the overall emissions of greenhouse gas for the proposal will be relatively low, and well within the reporting thresholds as defined in the National Greenhouse and Energy Reporting (NGER) requirements. Given the proposed scale and intensity of the proposed sand quarry, there will be limited options available for the mitigation of greenhouse gas emissions. Measures recommended to reduce greenhouse gas emissions from diesel plant and equipment have been adopted.

Requirements in regard to archaeological assessments have changed since the 2004 assessment and a fresh independent assessment in consultation with traditional owners was required. The objective of the assessment was to update the previous 2004 assessment and to consult with the Aboriginal community as per clause 80C of the National Parks and Wildlife Regulation 2009. One isolated artefact was located. Although this was regarded as an introduced item it will require an agreed management response. Otherwise, the property was assessed as having low Aboriginal cultural significance. Should any potential item of Aboriginal heritage or suspected deposit be found during the quarry's operation, work will cease in the area and an archaeologist, registered stakeholder or the relevant authority will be contacted.

There are no items of non-indigenous heritage significance in the immediate area of the quarry property.

The quarry is visible from five adjacent properties and the F3 Freeway although views of the quarry are interrupted by vegetation. The vegetation has grown noticeably and reduced the quarry's visibility since the 2004 EIS was prepared. As noise bunds are constructed and vegetation on them and in rehabilitated areas grows, the visual disturbance caused by the quarry will diminish further. In time, little will be seen of the quarry workings from beyond the property boundary.

Other potential impacts of the quarry's operation will be small. The increase in traffic due to quarry operations will cause only a small incremental increase in traffic volumes and noise on Wisemans Ferry Road. The quarry will not interfere with other land uses in the area. It will contribute to the local economy and help to offset the expected shortage of construction sand in future local and Sydney markets.

The quarry will be operated in accordance with a quarry management plan approved by the Gosford City Council and the requirements of the New South Wales Government in regard to extractive industries. The initial plan for Stages 1 and 2 of the quarry's operation forms Volume 3 of this EIS. The plan will be revised periodically and submitted to the Council for approval.

A program will be maintained throughout the life of the quarry to monitor key indicators of the quarry's performance, including the effects on groundwater, noise exposure and progress with the rehabilitation program. The results of monitoring programs will contribute to the future environmental management of the quarry. Results of the monitoring programs will be included in an annual environmental management report to the Council. The report will be a public document.

1. INTRODUCTION

1.1 PURPOSE OF THE EIS

Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd have made a development application to the Gosford City Council to operate an extractive industry at Lot 2 DP:362339, No. 620 Wisemans Ferry Road, Somersby, New South Wales also known as Rindean Quarry. The proposal is for the quarry to reopen and to operate in the manner and within the footprint approved by the Council in 2006 and 2007 to produce up to 150,000 tonnes per annum of washed and unwashed construction sand for Sydney and local markets. This environmental impact statement (EIS) has been prepared in regard to the application in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (The Act) and Director General's Requirements issued by New South Wales Planning and Infrastructure on 2 August 2011 (*Appendix 1*).

Rindean Quarry was operated as a sand quarry from 1979 to 2003 under a development consent issued by the Gosford City Council on 9 February 1979 in regard to the property to Mr K Fagan. The quarry was operated under this consent by subsequent owners of the property, Rindean Sands Pty Ltd and Cleve Smith Excavations Pty Ltd, and by contractors to the owners.

On 2 October 2001, the Gosford City Council issued an order to the owner to cease operations at the quarry in response to a complaint by a local resident following removal of vegetation from within the 20 metre buffer of the site boundary. An application under s96 of the Act to vary the 1979 consent to accommodate an operation more extensive than was envisaged by that consent was refused by the Council on 21 October 2002. The contractor operating the quarry at the time applied to the Land and Environment Court to have the Council's decision overturned. The Court dismissed the application. In this event, the only way for the quarry to continue to operate was for the owner to submit a development application to the Gosford City Council accompanied by an EIS.

It was clear in the Court's proceedings that the consent had not lapsed and the Court found no reason to address this matter (*Ralf Betts and Cleve Smith Excavations Pty v Gosford City Council, Land and Environment Court of New South Wales Record of Hearing No 10889 of 2002 dated 23 September 2003*, Page 13 to 14). This consent remains valid today.

Development Application No 26467 was submitted by Cleve Smith Excavations Pty Ltd in December 2004 seeking to reopen the Rindean Quarry. After consideration of an environmental impact statement dated August 2004, public submissions received regarding the proposal, the report of a mediator and substantial supplementary information submitted by the applicant, the Council issued a deferred consent dated 20 June 2006. This consent was amended by a consent dated 17 September 2007 following the consideration of an application under s96 of the Act for modification of the first consent. The consolidated conditions of the two consents are at *Appendix 3*.

The applicant satisfied the consolidated conditions of consent through the submission of a Quarry Management Plan, including a groundwater monitoring and management program, to the Gosford City Council in March 2011. On 7 April 2011 the Gosford City Council advised, among other things, that the Plan of Management had adequately addressed the deferred commencement conditions. In a letter dated 13 May 2011, the NSW Office of Water accepted the Groundwater Monitoring and Management Plan required by the consolidated conditions of consent, subject to certain conditions relating to water testing. The respective letters are at *Appendix 2*.

In the time available, however, it was not possible to implement all conditions of the deferred commencement of Development Application No 26467. The consents lapsed on 13 June 2011.

The Development Application submitted now is to operate an extractive industry on the site in a manner that is identical in most respects with the operation allowed under the consolidated conditions of the consents of 17 September 2007 and 20 June 2006.

1.2 LOCATION AND LAND DETAILS

The property containing the Rindean Quarry is located within the Gosford local council area approximately six kilometres north-west of Gosford, two kilometres south-west of the Somersby locality and 350 metres to the west of the Sydney to Newcastle (F3) Freeway.

The quarry is located on a 15 hectare parcel of land known as Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby (the Rindean Quarry property). The land is zoned as *RU1 Primary Production Rural* under Gosford City Council's *Interim Development Order N^{o} 122*. Extractive industry is a permitted with consent. The property is owned jointly by Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd.

1.3. THE REGIONAL CONTEXT

Somersby is located in the hinterland of the rapidly growing New South Wales Central Coast. It is 20 minutes by road from Gosford and less than an hour by road from the northern suburbs of Sydney. A substantial part of the Somersby Plateau and adjacent areas are covered by bushland typical of sandstone plateau areas to the north of Sydney.

Historically, the principal land uses have been relatively small scale grazing, agriculture, horticulture and some resource extraction, principally for construction sands. The Region has in recent years seen an expansion in the subdivision of larger properties and of hobby farm activities. Most of these properties have been purchased by their present owners since the quarry was established in 1979.

The Central Coast is expanding rapidly due to local population growth and migration from Sydney, being seen with its lifestyle benefits, relatively lower priced housing and more affordable living as an alternative to living in Sydney. The forecast population for the Gosford Local Government area for 2011 is 166,875. The population is forecast to grow at an annual rate of 0.44% per annum until 2031 or by 9.13% in total over the period (Gosford City Council). In 2006, the population of the larger Gosford-Wyong Statistical Division was 304,714. In June 2005, the median age was 40.4 years, the highest of any local government area in the Sydney region (Australian Bureau of Statistics). The expansion of infrastructure and the construction of housing to accommodate this growth has created an active construction industry and a high demand for construction materials.

The Somersby Plateau is an important supplier of construction sand for both the Sydney and Central Coast markets. An assessment of the present and future significance of the Somersby Plateau sand resource and these markets can be found in Section 7, Project Justification and Alternatives.

1.4 COMPANY PROFILE

Cleve Smith Excavations Pty Ltd has conducted earth moving and haulage businesses in the Central Coast region for a number of decades. Cleve Smith is the Principal and a Director of Cleve Smith Excavations. Pty Ltd. Cleve Smith Excavations has owned the property on

which Rindean Quarry is located since 1994 and has operated the quarry during that time. The quarry was leased to and operated by Hodgson Contracting Services from 1997 to 2003.

MDJ Quarries Pty Ltd was established in 2010 as a partner in the Rindean Quarry operations and holds a 30% share.

1.5 HISTORY OF PAST OPERATIONS

A sand quarry was developed on the Rindean Quarry property shortly after development consent was granted to Mr K. Fagan by Gosford City Council for an extractive industry. A copy of the consent dated 9 February 1979 is at *Appendix 2*.

Rindean Quarry has been an active quarry producing washed and unwashed sand, sandstone and lateritic aggregate since consent was granted in 1979. Over that time the property has had three owners and a number of operators as owner-operators or lessees.

A brief history of the development and operation of the quarry is summarised below.

- On 9 February 1979, Mr K Fagan was granted Development Consent No.4475 to operate a sand quarry on the property. The quarry operated under this consent under the ownership of Mr Fagan, Rindeans Sands Pty Ltd and Cleve Smith Excavations Pty Ltd until December 2003. This consent is still valid.
- 1979 to 1980 - Management structures such as freshwater and tailings ponds were constructed and an area cleared for the processing plant. During the construction phase approximately 25,000 tonnes of overburden and sand were produced and screened for use as a bedding sand for the Sydney-Newcastle oil and gas pipeline.
- 1980 to 1981 - Robson Excavations was engaged to undertake quarry development. A tailings dam was constructed during this period and approximately 30,000 tonnes of material was ripped and stockpiled on site.
- 1982 to 1985 - The quarry was leased to W. Lawrence and T. Hall, who operated the quarry during this period.
- 1985 to 1989 - The owner, Mr K. Fagan established control of the quarry and managed its operation.
- 1989 to 1994 - The property was owned and operated by Rindean Sands Pty Ltd which was part owned by Cleve Smith Excavations.
- 1994 to 1997 - Cleve Smith Excavations Pty Ltd purchased the quarry outright and managed its operation.
- 1997 to 2003 - Hodgson Contracting Services leased the quarry from Cleve Smith Excavations and operated it until December 2003.
- on 2 October 2001, the Gosford City Council issued a Notice of Intention to give an order under section 12B of the *Environmental Planning and Assessment Act, 1979* to the owner. The notice of intention was in response to a complaint by a local resident following removal of vegetation from within the 20-metre buffer of the site boundary.
- in 2002, Hodgson Contracting submitted an application to the Gosford City Council under s96 of the *Environmental Planning and Assessment Act, 1979* seeking to amend the 1979 development consent to accommodate an operation more extensive than was envisaged by that consent. This application (No 15525/2002) was refused by the Council on 21 October 2002;

- in 2003, Hodgson Contracting Services made application to the Land and Environment Court to have the Council's decision reversed. The matter was heard between 12 and 15 August 2003 and a judgement handed down on 23 September 2003. The Court dismissed the application, upholding the Council's decision;
- Hodgson Contracting walked off the site in December 2003 and relinquished its operating licence in January 2004.
- A deferred development consent and an amending consent were issued on 20 June 2006 and 17 September 2007 respectively to Cleve Smith Excavations Pty to reopen the quarry with modifications. The consents lapsed on 13 May 2011.
- MDJ Quarries Pty Ltd purchased a 30% share in the property in 2010.

1.6 RELEVANT LEGISLATION AND APPROVALS REQUIRED

1.6.1 Environmental Planning and Assessment Act 1979

The proposal is for the extraction, processing and sale of up to 150,000 tonnes per annum of construction sand. It is, therefore, a Designated Development in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* requiring the preparation of an environmental impact statement (EIS) to requirements issued by the Director General of the Department of Planning and Infrastructure (*Appendix 1*).

The proposal has been classified by the New South Wales Department of Planning and Infrastructure as an integrated development under Section 91 of the *Environmental Planning and Assessment Act 1979*.

As the volume is less than 200,000 tonnes per annum, the Gosford City Council will be the determining authority.

1.6.2 Protection of the Environment Operations Act 1997

The proposal is a *Scheduled Activity* under Act and will require an Environment Protection Licence (EPL). The EIS has addressed the requirements of Section 45 of the Act and determined the extent of each impact.

1.6.3 Water Management Act 2000

Approvals have been obtained from the Department of Primary Industries under the *Water Management Act 2000*. Water access licences have been granted in regard to groundwater and surface water usage and are current. The groundwater management plan was approved by the NSW Office of Water, subject to conditions, on 13 May 2011.

1.6.4 Mining Act 1992 and the Mines Inspection Act 1901

The quarry operator (mine holder) will be required to apply to the Department of Trade and Investment, Regional Infrastructure and Services for approval to operate the quarry once a development consent has been issued by the Gosford City Council.

1.6.5 Roads Act 1993

Approval of the Department of Roads and Maritime under the *Roads Act 1993* is required in regard to the construction of the intersection between the quarry access and Wisemans Ferry Road.

1.6.6 Environment Protection Biodiversity Conservation Act 1999

There are no matters of national environmental significance relevant to the reinstatement and operation of the quarry.

1.6.7 Other Statutory Requirements

Matters relevant to other Acts, Regulations, Orders and Guidelines, including the *National Parks and Wildlife Act 1974*, the *Threatened Species Conservation Act 1995* and guidelines relevant to Aboriginal Cultural Heritage, are dealt with in the relevant parts of the EIS and in the reports of external consultants (Volume 2).

1.7 DIRECTOR GENERAL'S REQUIREMENTS

1.7.1 Content of and Responses to the Director General's Requirements

Director General's Requirements issued in accordance with Clause 73 of the *Environmental Planning and Assessment Regulation 2000* and dated 2 August 2011 set down *General Requirements* for the preparation of the EIS, identify *Key Issues* requiring a detailed assessment, list *Environmental Planning Instruments* against which the proposal must be assessed, list *Guidelines* that must be taken into account and set down requirements for *Consultation (Appendix 1)*

A summary of responses to the Director General's Requirements, including the additional requirements and the requirements of the Gosford City Council, are at *Annex 2* which forms part of this EIS.

1.7.2 Additional requirements

The Director General's Requirements note that the requirements are not limited to the matters listed. It was noted that, in particular, the proposal will require approval from:

- the Office of Environment and Heritage under the *Protection of the Environment Operations Act 1997;*
- the Department of Primary Industries under the *Water Management Act 2000*;
- the Department of Trade and Investment, Regional Infrastructure and Services under the *Mining Act 1992 and the Mines Inspection Act 1901; and*
- the Department of Roads and Maritime under that *Roads Act 1993.*

Matters relevant to other Acts, Regulations, Orders and Guidelines, including the *National Parks and Wildlife Act 1974*, the *Threatened Species Conservation Act 1995* and guidelines relevant to Aboriginal Cultural Heritage ,are dealt with in the relevant parts of the EIS and in the reports of external consultants (Volume 2).

1.7.3 Consultation

Relevant agencies have been consulted during the preparation of this EIS (see *Section 8*).

There was extensive consultation with the community, including through a mediator, during the preparation of the 2004 EIS, the 2007 s96 Consent Modification Report and the consideration of the Development Application by the Gosford City Council. The report of the mediator and public submissions received during the exhibition of the 2004 EIS are held by the Gosford City Council. As would be expected, there was no agreement in regard to the

future operation of the quarry at mediation and most public submissions received opposed the reopening of the quarry.

A summary of the public submissions received in response to the public exhibition of the 2004 proposal is at *Appendix 4*

As this proposal is identical in nearly all respects to that which was approved by the Gosford City Council, consultation with the community has been limited during the preparation of the present EIS. Local residents were advised by letter in April 2012 that a fresh development application and EIS were to be submitted to the Council and the reasons for doing so. An open line will be maintained during the public consultation period to answer the community's questions.

2. THE EXISTING ENVIRONMENT

This section provides a brief overview of the existing environment of the region and the site. Detail relevant to the consideration of issues and impacts is provided in the appropriate sections of the report.

2.1 PRESENT STATE OF THE SITE

The present state of the site is a product of its past uses for extractive industry. Quarrying and processing of friable sandstone for the production of construction sand has been conducted over 25 of the past 30 years by a number of operators. Little rehabilitation has been completed in that time. As a result, approximately two thirds of the site remains in a disturbed state. Raw product and overburden heaps are present in a number of areas and two tailings ponds that have reached the end of their useful lives require attention, as do some quarry faces. Embankments that retain tailings ponds in the south-eastern corner of the property have remained stable since repair work was conducted in the early 1990s. An understanding of the present state of the site can be achieved from *Figure 3, Figure 4* and Plates 1 to 6.

Work has been conducted over time to maintain water flows across the property and minimise erosion and siltation. The work possible has been limited by constraints imposed by the Gosford City Council.

It is understood that most of the remainder of the property was disturbed by gravel quarrying operations for road building in the early 20th Century and by past agricultural, horticultural and grazing activities. Although some of the effects of past disturbances are still evident, there are no reliable records of these activities.

2.2 GEO-PHYSICAL ENVIRONMENT

Rindean Quarry is located on the Somersby Plateau which is a part of the extensive, incised Hawkesbury sandstone formations that surround Sydney to the north, west and south. It lies to the north of the Hawkesbury River on the eastern fringe of the Somersby Plateau, to the east of a north-south ridge that divides the catchments of Mooney Mooney Creek and the Hawkesbury River from Narara Creek and Brisbane Water near Gosford. The quarry is underlain by a substantial thickness (of the order of 250m) of coarsely jointed, cross-bedded sandstone that tends to increase in strength with depth. The upper strata, which are weathered and display ironstone, clay and shale bands, dip generally to the east. Lower strata visible in the deeper parts of the quarry dip to the west. The Hawkesbury sandstones support extensive water tables that generally follow the topography.

The weathered sandstone is a valuable source of construction sand. Sandy loam topsoils which overlie clays, gravels and weathered sandstone, and a favourable climate give much of the land of the region its status as agricultural land. The quarry site drains to the east to Narara Creek and Brisbane Water (*Section 5.2*)

2.3 CLIMATE

The Rindean Quarry site is located approximately 15 kilometres from the coast and at an elevation of between 200 and 260 metres above sea level. The climate of the area can be classified as temperate with coastal influences. There is a consistent pattern of rainfall throughout the year although rainfall is higher during the summer months. The driest months are June, July, August and September. Storm events periodically bring episodes of intense rainfall (see also *Section 5.1*).

2.4 FLORA AND FAUNA

The Somersby region has a long history of exploitation and development. As a result, the landscape of the site and of the area within a few kilometres of it to the south, west and north is typically highly disturbed, cleared rural pasture land or land under plantation timbers. Many of the trees along property boundaries and on roadsides are exotic species or planted native species. Some native vegetation is retained although in a modified condition. Land between the quarry property and the F3 Freeway, which passes approximately 350 metres to the west, shows evidence of past clearing and disturbance. East of the Freeway are the extensive areas of native woodland and forest vegetation that form the Strickland State Forest. The natural vegetation is typical of that found on the Hawkesbury sandstone formations north of the Hawkesbury River.

A new flora and fauna assessment conducted in the latter part of 2011 by Consultants Keystone Ecological, is at *Appendix 5*. The report takes into account the flora and fauna reports prepared by *General Flora and Fauna* during 2004 and 2005. The diversity of the flora identified in the assessment was found to be high in spite of the extent of clearing and modification that has taken place in the past, on the site and in surrounding areas. Fauna diversity, however, was found not to be high (*Section 5.7*).

2.5 SOCIO-ECONOMIC ENVIRONMENT

Rindean Quarry is located in an area that has seen the development of hobby farms and rural residential property replacing much of its commercial farming character. Extractive industry has been conducted in the region for many years. The noise and air quality environments of the immediate location of the quarry have the characteristics of a suburban location because of its proximity to the F3 Freeway and Wisemans Ferry Road (*Section 5.5* and *Section 5.13*).

3. THE PROPOSED DEVELOPMENT

3.1 OVERVIEW

The intention is to operate an extractive industry on the site to supply up to 150,000 tonnes of washed and dry screened unwashed sand per annum to local, regional and Sydney markets. The property was the site of an operating quarry from 1979 to 2003. It displays characteristics common in quarries established in that era and an operation that has been conducted for much of the time under leasehold arrangements. Integral parts of the work will be the reinstatement of buffer zones, the construction of noise attenuation buffers and visual screens and the implementation of a rehabilitation program which will begin with the old tailings ponds that have reached the limit of their usefulness. A fully functioning quarry of the capacity proposed with a working life of 20 years will be necessary to fund the extensive rehabilitation programs required.

3.2 AVAILABLE RESOURCE

3.2.1 The Geological Profile

The geological profile of the quarry is visible to a depth of approximately 30 metres in the high-wall left by previous quarry operations and in the core of a bore drilled in the south-western corner of the property adjacent to Wisemans Ferry Road. The profiles at both sites, which are approximately 250 metres apart, are similar although the strength of the upper friable sandstone strata near Wisemans Ferry Road is less than that in strata on the high wall. The record of the core is at Appendix C of the *Hydrological Investigation, RCA Australia, June 2004* (*Appendix 8*).

In those areas of the property that are largely undisturbed, the topsoil is a sandy loam approximately 30cm thick. Subsoils are yellow to orange fine grained clays with included gravels in some areas to a depth of 2.0 to 2.5 metres. The soil profile overlies coarsely jointed horizontally bedded sandstones that are separated by thin horizontal bands of ironstone three to four metres apart vertically. The sandstones vary in colour from orange to white. Shale bands are present in a few locations. The upper 15 metres of sandstone is extremely weathered and friable. Rock strength is low. From 15 to 25 metres, the sandstone is highly weathered and rock strength is low to medium. At lower depths, the degree of weathering is less and rock strength is medium to high. Upper strata exposed in the quarry dip a few degrees to the east. At lower depths within the quarry, some exposed sandstone strata dip to the west at up to 30^0.

3.2.2 Nature of the Available Resource

The sand resource is contained in friable sandstone that is common throughout the Hawkesbury formation which forms the Somersby Plateau. The sandstone can be extracted and crushed with relative ease by a large bulldozer.

3.2.3 Estimates of the Resource

An estimate of the regional extent of the resource is provided in *Section 7.1 2*. An estimated 2 to 3 millions tonnes of product is accessible from the quarry within the design parameters upon which the development application is based.

3.3 QUARRY DESIGN AND PLANNING

3.3.1 Quarry Design and Layout

The quarry is planned as a staged operation over a 20 year life. The quarry layout will be developed and the quarrying operation conducted in accordance with the amended conditions of consent issued by the Gosford City Council in regard to Development Application No 26467 of 2004. These conditions limit, among other things, the footprint for the quarry and require the preparation of quarry management plans for all stages of the quarry's operation.

The design and layout of the quarry will be broadly as depicted in Figures 5 to 8 . These plans are consistent with plans contained in the Section 96 Report dated August 2007 and approved in the amending development consent of 17 September 2007. In particular, the quarry footprint will be determined by:

1) a 100 metre setback of excavation from neighbouring housing;
2) the reinstatement of buffer zones 20 metres wide along the northern, eastern and southern boundaries, except where the 100 metre setback applies where buffers will be wider; and
3) a buffer area along the western boundary approximately 60 metres wide to protect residual native vegetation.

Acoustic bunds will be constructed to reduce noise exposure at adjacent residences. The bunds will be constructed within the buffer zones and where they will also be effective visual barriers. The bunds will be constructed, wherever possible, on already cleared land and to avoid hollow bearing trees. The bunds will be planted with endemic species as they are completed.

A rehabilitation program will begin during the construction phase and continue through the quarry's life. The program will reduce progressively the area of disturbed land within the property with the intention that, by the end of Year 5, there will have been a substantial reduction in the area of disturbed land and by the end of Year 10 a third of the property will be under active rehabilitation (*Section 4*).

The timing of the quarrying and therefore rehabilitation programs will depend to some extent on the demand for product. Although timing for Stages 1 and 2 from the date of approval can be regarded as firm, the timing of subsequent stages must be regarded as estimates that will have less certainty further into the future. Quarrying and rehabilitation plans will be amended over time based on product demand and progress achieved in quarrying operations. The platform for future development and rehabilitation programs will, however, be established in the first five years of operation.

The quarry design and layout will evolve as the quarry expands from Stage 1 into Stages 2, 3 and 4 within the overall footprint. Changes that become necessary during this evolution will be dealt with and made public in subsequent management plans. The final landform that will be left at the end of the quarry's life is depicted in *Figure 9.*

3.3.2 Plan of Management

A quarry plan of management was prepared in compliance with the consolidated conditions of the consents of 20 June 2006 and 17 September 2007 and submitted in two volumes to the Gosford City Council in March 2011. Correspondence from the Council date 7 April 2011 (*Appendix 2*) advised that, with minor exceptions, the plan satisfied the relevant conditions of

consent. Those exceptions have since been satisfied and are taken into account in this EIS. A consolidated form of that plan forms Volume 3 of this EIS.

The quarry plan of management plan is a comprehensive document that incorporates a number of individual plans dealing with various elements of the quarry's operation and environmental protection. It prescribes the requirements for operating the quarry, environmental management and protection, rehabilitation and the monitoring of environmental performance. The quarry plan of management is the appropriate vehicle to regulate both the day-to-day and the staged operations of the quarry. In providing the regulators and the community with a benchmark against which to judge, among other things, the quality of operations, achievements in rehabilitation and the effectiveness of environmental protection, it will provide a significant level of control over the conduct of the quarry. It will also provide the flexibility necessary to respond to unpredicted changes in the operation of the quarry and environmental performance.

The first plan of management will deal with the establishment and construction phase and Stages 1 and 2 of the quarry's operation. Separate plans will be prepared for each subsequent stage ahead of its commencement. These plans will build on the experience of operating the quarry in the first two stages and will accommodate the need for change as the quarry develops. This planning sequence is acknowledged by the Council in its letter of 7 April 2011.

The plan of management sets down in detail the requirements for reopening the quarry and for Stages 1 and 2 (the first 5 years) of the quarry's operation. It provides a framework for subsequent plans for the later stages.

3.4 QUARRY STAGING

3.4.1 Preliminary Work and the Construction Period

Preliminary work will be that work necessary to establish the quarry's operation. It will involve, principally, fencing and site security, protection for hollow bearing trees and other significant vegetation, construction of noise barriers, access to Wisemans Ferry Road, construction of a temporary internal access road, construction of the wheel wash and the reinstatement of the sand processing plant (*Figure 10*).

A major part of the preliminary work will be the improvement of the intersection between the access road and Wisemans Ferry Road to a design and specification approved by the Gosford City Council and the Roads and Traffic Authority (*Figures 11* and *Figure 12*). This work will be performed by independent contractors.

The NSW Industrial Noise Policy allow for a 26 week construction period during which noise exposure may exceed the noise exposure targets set down for the project by 10dBA. Within this period, there is a period of 4 weeks during which noise exposure may exceed noise exposure targets by up to 20dBA.

The noise assessment prepared as part of the 2004 EIS predicted that some construction work might generate noise exposure at adjacent residences above the normal limits allowed by the NSW Industrial Noise Policy. Work that might exceed the noise targets by more than 10dBA will be performed during the designated 4 week construction period at times agreed with the most affected residents. This work will include the construction of:

- noise barriers;
- the junction of the access road and Wisemans Ferry Road;

- the internal access road; and
- the wheel wash.

Other preliminary work necessary to establish the quarry's operation will continue throughout the 26 week construction period. This work will include:

- construction of the perimeter fence and other site security;
- protection for hollow bearing trees and other significant vegetation;
- earthworks to clean up the operational areas and obtain materials for the construction of noise barriers;
- earthworks to adjust and construct drains and sediment control infrastructure;
- construction of a temporary internal access roads to the sand processing plant and the quarry floor;
- the reinstatement of the sand processing plant; and
- preliminary rehabilitation work.

Essential earthworks during the construction period will involve the use of a bull dozer, excavator, wheeled loader and between one and three dump trucks.

A site office will be located adjacent to the access road a short distance to the east of the site of the wheel wash.

3.4.2 Staging of the Quarry's Operation

The quarry will be developed and operated in the five stages described below.

Stage 1 *(*Years 1 and 2*)* of the quarry's operation will begin at the end of the construction period described above although there is likely to be some overlap with preliminary work related, for example, to the reinstatement of water management infrastructure and rehabilitation which is likely begin during the construction period. It will involve quarry establishment works, a reinstatement of the quarrying and sand processing operation and a substantial start to the rehabilitation program (*Figure 5*). Sand processing will be a screening process. Sand washing will not begin until *Stage 2*.

The principal activities will be to:

1) decommission and rehabilitate the two former tailings ponds at the eastern end of the property;
2) clean up *Cell 1* and *Cell 2* and establish a quarry floor at a nominal RL (relative level) of 215 metres AHD;
3) tidy up and consolidate plant and product stockpiles in the area of Cell 3;
4) clean up cells 3 and 4 as needed;
5) establish a new tailings pond in a former quarry cell to the east of Cell 1;
6) establish or restore the basic infrastructure for sediment control and water management;
7) construct a new fresh water pond in the north eastern corner of the property and prepare the area for rehabilitation. Viable vegetation in the corner of the property will be retained;
8) begin construction of the storm water retention basin;

9) plant endemic species to establish initially an under story and in time a tree cover on embankments in the south-eastern corner of the site to stabilise the area and create a visual barrier to quarrying operations; and

10) demolish the fibro house within the quarry property to allow quarrying operations to extend to the west. Bench the high wall in this area to profiles consistent with good quarrying practice (Cell 5).

Stage 2 (Years 3 to 5) will see the beginning of significant restructuring of the quarrying operation, the quarrying and preparation for rehabilitation of disturbed areas along the northern boundary of the property and the expansion of the rehabilitation program (*Figure 6*).

The principal activities will be to:

1) realign and regrade the access road to a new alignment adjacent to the northern boundary of the property. The road surface will be lowered, extended and constructed with a constant grade of less than 1 in 10. The regrading and lowering of the road surface and the construction of bunds will reduce the exposure of adjacent properties to truck noise;

2) relocate the plant and product stockpiles into *Cell 2* in the centre of the property;

3) quarry and bench to final levels for rehabilitation *Cell 3* and *Cell 4* along the northern boundary of the property; and

4) complete the rehabilitation of the eastern side of the property by continuing the work in the south-eastern corner started in Stage 1 and extending it into the north-eastern corner.

Stage 3 (Years 6 to 10*)* will involve a significant expansion of the rehabilitation program into Cells 3 and 4 and an expansion of the quarrying operation westwards towards Wisemans Ferry Road into *Cell 6* (*Figure 7*). Topsoil and overburden from *Cell 6* will be used for rehabilitation.

Stage 4 (Years 11 to 19) will involve a progressive extension of the quarrying operation towards Wisemans Ferry Road and the possible establishment of new tailings and fresh water dams. Areas no longer used would be decommissioned and rehabilitated progressively. Present plans for Stage 4 can be regarded as indicative only (*Figure 8*).

Stage 5 (Year 20) will involve the decommissioning and removal of all plant and equipment, the final rehabilitation of the site to the rehabilitation plan and the final inspection of the site by the Council and other relevant authorities. The final form of the quarry after decommissioning is shown in *Figure 9, Indicative Final Landform*.

3.4.3 Reinstating the Operating Base

An initial working quarry floor will be established in Cells 1 and 2 (*Figure 5*) at or near RL215. Cells 3 and 4 will be cleaned up. The sand processing plant will be reinstated and consolidated in Cell 3 together with product stockpiles. These operations will produce a quantity of raw material which will be stockpiled temporarily in Cell 4 and processed progressively into saleable product. Any material recovered that is not suitable for production will be used immediately for the construction of noise barriers or capping of the decommissioned tailings dams.

Water management and erosion control infrastructure and operations will be restored in accordance with the Erosion Sediment Control Plan and Surface Water Monitoring Program (*Figure 17* and Quarry Plan of Management Parts 6.1 and 6.2). A new fresh water storage pond will be constructed in the north-eastern corner of the quarry property with a floor at

RL 211 metres to supplement present process water storage and water conditioning infrastructure. It will be managed in association with the present adjacent fresh water storage pond.

A new tailings pond will be established in a present water storage pond. This pond has, for some years, contained clean surface water that has drained through the site from up-slope or is groundwater seepage from existing quarry faces. The wall of the tailings pond will maintained above the level of the general quarry floor to exclude water from surface runoff and seepage. The water level in the pond will be maintained at least 1.5 metres below the top of the wall to allow for rainfall from a 1% AEP storm event. Little other work should be needed to establish the tailings pond which has been a stable water storage for some time.

The base level for water management will be RL215 which is the level of the spillway of the existing fresh water pond. This level will also provide the base level for the quarry floor. Part of the quarry floor will be excavated to a level two metres below this level (to RL213) to form a storm water retention basin. Water will be pumped, as it collects, from a sump in the basin to the first of the storage ponds to ensure that it remains empty.

3.5 QUARRY OPERATION

3.5.1 Topsoil Stripping and Management

The natural topsoil throughout the site is a sandy loam up to 30cm thick overlaying an overburden horizon approximately 1.5 to 2 metres thick. However, because of the extent of disturbance of the site through past sand quarrying, gravel extraction and agriculture, there are few areas that can be regarded as exhibiting the original soil profile. The amount of topsoil suitable for rehabilitation that is available on the site will be limited and, in the long term, may be insufficient for rehabilitation needs. The need for topsoil will, in most instances, be established ahead of its availability.

As the quarry operation extends into new areas, topsoil will be stripped by an excavator immediately prior to quarrying. Overburden that is not suitable for processing as product will be set aside for use in rehabilitation. All material will be taken directly to rehabilitation areas by truck and, in most instances, spread shortly afterwards. The storage of topsoil other than for short periods will not be required.

Areas to be stripped will be sprayed with a glyphosate herbicide 3 to 4 weeks before topsoil stripping to kill weed growth. Alternatively, areas to be stripped will initially be scalped to remove weed growth if this action is considered necessary by the rehabilitation specialist. Any scalpings will be buried at a depth sufficient to prevent seed germination within an area being rehabilitated.

Existing vegetation will be retained on all areas not required for quarrying or ancillary operations.

The first of the areas to be stripped will be the area identified in *Figure 5* as *Cell 5*. This will occur towards the end of Stage 1 or in Stage 2.

The stripping of topsoil and overburden will be performed using an excavator and a small haul truck or a road truck. The noise of the stripping operation, which previously had anticipated the use of a bulldozer, is likely fall well within the noise goals set for all stages of the quarry's operation.

3.5.2 Resource Extraction

The main resource is horizontally bedded friable sandstone of varying grades of hardness, grain size, clay content and colour interspersed with horizontal bands of ironstone gravel that are typically less than 20cm thick. In a few areas, the continuity of the sandstone is broken with inclined beds of soft shale. A geologist will be consulted as required to advise on the stability of the parent material and the quarry faces and benches.

Both the ironstone gravel and the shale can be regarded as secondary resources although, in the short to medium term, they will be treated as coarse reject material that will be used to establish caps on the decommissioned tailings dams.

The friable sandstone will be extracted from the working face or bench by ripping with a D9 or equivalent bulldozer which is the common practice throughout the industry. An excavator will be used in areas where a bulldozer cannot operate with safety. The Department of Primary Industries (Mineral Resources) advised in 2007 in regard to the Rindean Quarry s96 application to the Council that:

> Discussion with the Department's Mines Inspector for the Gosford area have established that the condition banning ripping as an extraction method effectively sterilises the resource. Ripping is the only method in use on the Somersby Plateau to extract friable sandstone because the material is amendable to this low impact method and avoids the need for techniques such as blasting.

Benches will be established along all quarry faces in accordance with sound industry practice and the requirements of State mining safety authorities. The inclination of quarry faces will vary between 33 and 70^0 depending on the long-term stability of the sandstone.

There will be no blasting.

The primary crushing of the sandstone will be performed by the bulldozer on the quarry floor. Past experience in the quarry has indicated that no other crushing will be necessary prior to the raw material being screened.

Laterite and shale will be extracted separately using similar methods and transported directly to the areas being rehabilitated.

Resource extraction will begin in Cells 1 and 2 and continue there until the final RL for the quarry floor is reached. Material extracted during the construction of the new water storage pond and the stormwater retention basin will be used as product or material for rehabilitation according to its characteristics. Construction of the permanent access road will also produce material suitable as product. Cells 3 and 4 along the northern boundary of the property will be quarried to their final levels and profiles during Stage 2. The working face will be benched along the northern and western boundaries of these cells to the profiles required for final rehabilitation. Extraction will then move into Cell 5 prior to which the quarry house will be removed. This extraction program is expected to be completed within the first five years of operation.

Subsequent resource extraction will be a benched operation continuing in a westerly direction from Cell 5 towards Wisemans Ferry Road. The final profiles of the side walls of these operations and of the final face adjacent to Wisemans Ferry Road will take account of sound quarry practice and the requirements for final rehabilitation.

The final quarry floor will slope progressively from RL217 metres at the western end of the excavation to RL215 metres at the eastern end.

3.5.3 Raw Material Handling

The sandstone varies in colour, texture and hardness in different parts of the quarry. These differences in raw materials lead to different products required by industry. As a general rule, the crushed sandstone will be loaded into a small haul truck and transported directly to the receiving hopper on the screening plant. This approach to raw material handling will avoid double handling, thereby reducing plant operating time, fuel use, carbon emissions and noise emissions

Other than during the initial stages of quarry's operation, it is not intended to stockpile significant amounts of raw material. Some stockpiling of raw sand will be necessary from time to time if, for example, a grade of sand has to be quarried for operational reasons but cannot be processed immediately. Raw material will generally be extracted at a rate consistent with the capacity of the processing equipment and demand for product.

3.5.4 Sand Products

When the quarry is fully operational, it will produce a range of dry screened and washed sand products to satisfy market demand. The principal products that will be sold and the estimated volumes of each are listed in *Table 3.1.* There are growing markets both locally and in Sydney for each of these products.

Table 3.1 - Estimated Annual Production of Product Types

Product	**Tonnes Per Annum at 50% Production (75,000tpa)**	**Tonnes Per Annum at 100% Production (150,000tpa)**
Unwashed sand for construction fill and horticulture	15,000	30,000
Yellow and white graded sand as mortar sand	20,000	40,000
Washed and graded sand for concrete production	35,000	70,000
Coarse reject material and overburden (1)	5,000	10,000
Total Saleable Product	**75,000**	**150,000**
Fine reject material (tailings)	5,000	10,000

(1) A substantial proportion of this material will be used for rehabilitation work.

At a 50% production rate of 75,000 tonnes per annum, the quarry would produce approximately 1,500 tonnes of saleable product per week and an average of 200 tonnes per week of overburden and fine reject material that would be used on site for rehabilitation. At the maximum production rate of 150,000 tonnes per annum, the quarry would produce approximately 3,000 tonnes per week of saleable product and an average of 400 tonnes per week of overburden and fine reject material.

Different grades of sand will be produced to satisfy the specifications for concrete batch mixing, mortar sand or other products. These specifications will be met by selecting suitable raw material for processing, adjusting the washing process or remixing measured amounts of clay fines to washed sand product. The proportions of individual products produced will depend upon demand.

The fine material, consisting of the silt and clay fraction of the raw material with a particle size of generally less than 75 microns, is estimated to be 12 to 15% of the raw material. The

washing process will separate the fine material from the coarse product and the resultant slurry will be disposed of in the tailings dams. The tailings are essentially inert and pose no threat to humans or the environment. They contain residual nutrients from the raw material and will be added to material being used for rehabilitation. Product that is not washed will retain fines.

3.5.5 Sand Processing

Raw material will be fed from the receiving hopper to a vibrating screen by conveyor. Screened material will pass to a hopper below. A proportion of the screened material will be diverted from the processing stream to separate stockpiles to be sold as dry-screened or unwashed product. The remainder will be transported by conveyor to the washing plant. Coarse reject material will be stockpiled nearby for sale as fill or transported to rehabilitation areas.

Unwashed or dry screened sand will be the principal product throughout Stage 1. Accordingly water demand for sand processing is likely to be small.

The main components of the plant for dry screening are:

- a raw material receiving hopper;
- a conveyor feed to a vibrating screen system; and
- a conveyor to transport screened sand to stockpiles.

A portion of the screened sand will pass through a single wash process to remove the majority of the silt and clay fraction from product sand. Washed sand will be dried and stacked on product stockpiles. Additional components of the plant for this process are:

- a conveyor to transport screened sand to the washing plant;
- a washing hopper or constant density tank discharging washed sand product and fine waste at separate outlets;
- a sand pump and feed to a water separating 'cyclone' mounted on a radial stacker;
- a graded product stockpile area;
- a tailings pond;
- a system of catch drains to collect runoff from the processing area and transfer it to a sediment pond and the fresh water pond; and
- a series of pumps to handle clean water and water contaminated by tailings.

The screen will be diesel powered. Other fixed equipment will be powered by mains electricity.

The plant presently available at the quarry has a washed product capacity of approximately 80 tonnes per hour although it will be operated normally at an average of 50 tonnes per hour. Calculations for this assessment have been based on a 50 tonne per hour output. Water use through the plant is expected to average 2,800 litres per tonne of product or 0.14 megalitres of water per hour. This is consistent with industry guidelines. The majority of the water required will be recycled through the washing and tailings management processes. The plant will need to operate for less than 30 hours per week or 6 hours per day to achieve the maximum production of 70,000 tonnes per annum of washed product (*ie,* with the quarry operating at a total output of 150,000 tonnes per annum.

The washing system will consist of a constant density tank that will be fed unwashed graded sand and clean process water. In a constant density tank, coarser sand grains settle out of the slurry that is formed in the tank. The fines are maintained in suspension by the water flow and discharged as a wet slurry near the top of the tank.

A slurry of washed sand product and water will be pumped to one of two cyclones mounted on a radial stacker in the product stockpile area. The cyclones will separate the sand product from the water by a centrifugal operation driven by the water flow. Dewatered sand will fall from the cyclone to a conical stockpile below and extracted water will be collected and conditioned through the water management system for reuse. Separate stockpiles for individual products will be created within the radius of the stacker arm. The stockpile area will be graded to facilitate the collection of residual water draining from the product stockpiles.

Trucks will be loaded with product directly from the stockpiles by a rubber tyred loader.

The slurry containing the fines will be pumped directly to the western end of the tailings pond, forming a beach to facilitate dewatering of the tailings. Past experience in the quarry has indicated that the settling process will occur relatively rapidly due probably to the naturally low pH (slight acidity) of water in the area. A single large tailings or settling pond is, therefore, considered sufficient to separate the fines from the tailings water without the use of flocculants.

Water will be pumped from the surface at the eastern or down-slope end of the tailings pond, directly to the northern fresh water storage pond. A floating pickup and suction hose will ensure that sediment is not picked up by the pump.

Initially in Stage 1, the processing plant and the product stockpiles will remain where they are now below an existing quarry face in *Cell 3*. The receiving hopper will be fed from *Cell 4* which is at a higher level. The plant and stockpiles will be moved to *Cell 2* in the centre of the property during Stage 2 of the operation (*Figure 6*). Plant noise will be contained by locating the processing equipment and product stockpiles initially below a quarry face and subsequently behind a residual bund left on the quarry floor.. The plant will remain towards the centre of the property throughout the later stages of the development although it may be moved to the west with the progression of the quarrying operation.

A plan of the initial layout of the processing plant and stockpiles is at *Figure 15*. The layout of the washing plant will be similar after it is moved to *Cell 2* during Stage 2 of the quarry's operation. *Figure 16* is a schematic diagram of the washing process and water demand.

3.5.6 Product Stockpiling

Product stockpiles will be located within a quarry cell adjacent to the processing plant where the existing quarry faces or a residual bund will be used to screen the noise of the plant and loading operations. The access road will lead directly to the stockpile area.

Stockpiles will have a conical or elongated conical shapes and a natural fall slope of approximately 35^0. Separate stockpiles will be maintained for each sand product.

Stockpiles will be maintained at a level that will provide a buffer against expected demand, the need to stand machinery down for maintenance and inclement weather. It is expected that total stockpile of product will be maintained at approximately 6,000 tonnes or less.

3.6 WATER USE AND MANAGEMENT

3.6.1 Water Use and Management Objectives

The overall objectives for water management are to:

1) recycle and reuse process water for sand washing operations;
2) maintain the highest practicable level of water self sufficiency;
3) collect and manage surface runoff within the site and seepage from the quarry faces. There will be no bores for water extraction on the site;
4) where practicable, divert water from external sources around the quarry site into the unnamed tributary of Narara Creek;
5) ensure that, under normal circumstances, water leaving the site meets all regulatory quality requirements; and
6) maintain a water management system that will cope with a one in 10 year, one hour duration storm event followed by a one in 100 year, one hour duration storm event within a 24 hour period.

Water will be harvested from three sources which, for all practical purposes cannot be separated. They are:

1) runoff from sand processing operations. The amount of water collected will depend on the volume of sand being washed;
2) runoff from rainfall falling within the quarry site. The volume available will vary with rainfall patterns; and
3) seepage from the quarry faces. The volume available will vary with seasonal rainfall.

Water that is excess to needs and runoff from storm events will be released from the site through two water storage and conditioning ponds and an existing rock-lined drain on the eastern boundary of the property.

3.6.2 Runoff from Rainfall

A principal source of process water for the quarry will be runoff from rainfall. Runoff will be collected through a series of bunds and channels and held in on-site storage and conditioning ponds.

The average annual rainfall for the Peats Ridge meteorological station, located approximately 6 kilometres to the north-west, is 1264.3mm (Bureau of Meteorology, Peats Ridge; 1981-2010). Average annual evaporation is 1204.5mm. A typical pattern is for rain to fall in all months of the year, the wetter months to be between November and April, and for there to be periodical storm events.

Typical annual runoff rates for catchments of this type and location are 10 to 30% of annual rainfall (Chiew & McMahon, 1993). A rate of 20% has been adopted for this assessment. This rate takes account of the relatively high permeability of the undisturbed land and the expected mix of bare and vegetated surfaces that will be present in the quarry property over its life. An average of 12.6 megalitres per annum of runoff water will be available from the five hectare working area of the quarry. A water access licence unregulated river has been granted and an allocation of 16 megalitres per annum is being purchased or leased to permit the use of this water.

Up to 38 megalitres of runoff water may be available from the whole of the quarry property although a proportion of this will be from storm events when runoff must be released to prevent flooding. A retention basin will be excavated into the quarry floor to manage stormwater.

Runoff from above the quarry site, namely water from the Wisemans Ferry Road Reserve, some adjacent properties and the western and north-western buffer areas, will be diverted around the quarry site. This water will be directed along existing drains to drainage lines that have developed over the years along the northern and southern sides of the quarry property and into the unnamed tributary of Narara Creek at the eastern end of the property. Some additional drainage works might be needed.

3.6.3 Groundwater Seepage

Surface seepage of groundwater throughout all seasons has been a historical characteristic of this area. Groundwater seepage from the quarry faces, is expected to continue throughout the life of the quarry although it varies quite dramatically with seasonal rainfall patterns. During dry periods there might be no seepage. Although there are no records available of past rates of flow, estimates based on a groundwater evaluation (*Table 5.6*) suggest that, in an average year, between 6 and 21 megalitres of groundwater will seep into the quarry.

It is not practicable to separate this water from surface runoff in the quarry. It will, therefore, become part of the process water supply. A water access licence (aquifer) has been granted and quotas totalling 16ML per annum purchased or leased to use this water.

3.6.4 Water Recovery Systems

With the exception of the main fresh water pond, present water recovery systems on the site are beyond their useful lives. New water recovery infrastructure will be required. This will consist of:

- a new water storage and conditioning pond (FW2) in the north-eastern corner of the site. This will be constructed during the first year of operation;
- the existing fresh water storage pond (FW1). The pond will be cleaned of silt, deepened, reconstructed to a more regular shape and managed as a water storage and conditioning pond. The ponds will be connected at level;
- the present rock-lined drain which discharges water from the existing pond to an un-named tributary of Narara Creek to the east will be retained. The spillway to this drain, at RL215, provides the control level for the construction of the quarry;
- a tailings pond to allow the settling of fines from the washing process. A former quarry cell now used as a temporary water storage adjacent to the southern boundary will be used for this purpose. Water will be pumped or syphoned from the surface of this pond to a settling pond and one of the fresh water ponds for re-use;
- catch drains constructed to collect water from the process and product stockpile areas, the quarry floor, the access road and other cleared and hard surfaces. Other drains will be constructed to collect excess water from vegetated and rehabilitated areas;
- a central settling pond to collect water from the network of drains. Water will be pumped from here to one of the fresh water ponds; and
- a stormwater retention basin within the eastern quarry floor.

The water management infrastructure will change from time to time as the quarry's operational base is established in Stage 1, the processing and product stockpile areas are moved to the centre of the quarry in *Stage 2* and layout of the quarry changes in subsequent stages of the quarry's development. Indicative water management plans for first two stages are shown in *Figure 17* and *Figure 18*. Detailed surface water and groundwater management plans for Stage 1 can be found in the quarry management plan at Volume 3. Detailed plans for subsequent stages will be included in later quarry management plans.

New water storage pond in the north-eastern corner of the quarry will be excavated to RL211 into competent, *in-situ* sandstone to ensure its integrity. The existing freshwater pond will be restored. The tops of the existing embankments to the east of the ponds that are elevated above surrounding land will be three metres wide, the external batters no more than 30^0 and the internal batters no more than 60^0. The ponds will have a minimum freeboard of 1.0 to 1.5 metres to provide a reserve capacity for runoff from storm events.

The new tailings pond will be in an existing water storage pond that has been a secure structure for many years. The walls of the pond will be maintained a metre above the surrounding areas to prevent contamination with runoff. The water level will be maintained at a level at least 1.5 metres below the top of the walls to account for storm rainfall.

Drains will be cut into competent sandstone material wherever possible to minimise erosion. Gradients of drains will be maintained at no more than 2% unless constraints to water flow in the form of sand bags or rock barriers are installed. Vulnerable faces of bunds will be reinforced with coarse material. Water collected will drain to a settling pond adjacent to the water storage ponds. Accumulated silt will be removed from the ponds periodically.

An area at the eastern end of the quarry floor will be excavated to RL213, 2 metres below the spillway outlet on FW1, to form a stormwater retention basin. This basin will have a reserve capacity of approximately 4.5 megalitres, sufficient to ensure that the quarry is able to manage the runoff from a one in ten year, one hour storm event followed by a one in 100 year, one hour storm within a 24 hour period. Accumulated water in the retention basin will be pumped into FW2 to keep the basin in free of standing water. Excess water will be released from FW1 once it meets discharge standards. during larger or longer duration events, water discharge from the site might be unavoidable.

3.6.5 Regulatory Requirements

The licences and approvals required are listed in *Table 3.2*.

Table 3.2: Summary of Water Access Licence and Works Approvals Requirements

Application Details	Estimated Volumes	Purpose	Licence Required
Interception, Storage and usage of groundwater	6 to 21ML/yr	Groundwater entering the site as seepage from quarry faces will be used to supplement the water supply for sand washing.	Water Access Licence (Aquifer) and quota for 16Ml held
Interception, Storage and usage of rainfall run-off	12.6ML	Run-off from the quarry site will be collected and stored to augment the water supply for sand washing. Water entering the property from higher ground will be will diverted past the water management system.	Water Access Licence (Unregulated River) and quota for 16 Ml held
Construction of Bores	N/A	Licensed bores were drilled for hydrological investigations and for groundwater monitoring only.	Licence held

3.6.6 Process Water Demand

The quarry will produce throughout its lifetime dry-screened sand, washed sand and blended sand products to satisfy market demand. The relative proportions of these products shipped from the site will depend on demand and vary both in the short and long term.

The sand washing process requires large volumes of water. Estimates of the demand for water required for sand washing (*Table 3.3*) have been prepared based on:

- the production of 70,000 tonnes and 35,000 tonnes washed sand per annum. These amounts represent the expected production of washed sand product at full production (150,000 tonnes per annum of all products) and 50% production (75,000 tonnes per annum of all products) respectively;
- water usage of between 2,400 and 4,000 litres of water per tonne of product. The average usage is expected to be in the vicinity of 2,800 litres of water per tonne of washed sand product;
- the washing plant operating at a capacity of 50 tonnes per hour of washed sand product; and
- washing plant operating hours of 28 and 14 hours per week respectively.

The water management system will be central to the effective operation of the quarry. The focus of water use will be the recycling and reuse of process water. The system will, through a network of drains and ponds, recover the maximum amount of water possible from the washing process and condition it for reuse through the two water storage ponds which together will have a capacity of 33 megalitres.

Make-up water will be required to replace water lost through percolation, evaporation and water trapped in sand products and clay tailings. Typically between 15 and 30 megalitres of make up water per year will be required, predominantly from surface run-off and water seepage through the site. An assessment of the impact of taking this amount of water from the environment is described in *Section 5.2* and *Section 5.3*.

3.6.7 Water Balance

The ability of the quarry to produce washed sand and blended sand products will depend on the availability of water on the site. If insufficient water is available, the quarry may have to cut production of these products. This constraint will provide significant incentives for the efficient use of water, the effective recovery of water and the construction of well engineered water collection and water storage infrastructure. Achieving a satisfactory water balance will be critical to the quarry's operation. The water balance is described in *Figure 16*.

Table 3.3: Predicted Water Usage

Activity	Production Capacity (75 000 tonnes/yr) ie. 35 000t/yr washed sand	Production Capacity (150 000 tonnes/yr) ie. 70 000t/yr washed sand
Production Weeks per Year	50	50
Hours of washing Plant Operation *(hrs / week*)	14	28
Washing Plant Capacity *(t/hr washed product)*	50	50
Ratio of Water Required: Product	2.8kL water/tonne product	2.8kL water/tonne product
Sand Washing *(kL/week)*	1,960	3,920
Sand Recycled Water *(kL/week)*	-1,666	-3,332
Dust Suppression on Haul Roads and Wheel Wash (1.5L/m^2/hr – for roads) *(kL/week)*	7	
Stockpile Irrigation and Sundry Uses	Incorporated into Sand Washing	
Evaporation, percolation and stockpile retained water (Losses approx.15%)	Incorporated into Sand Washing	
Ablution and drinking *(kL/week)*	3	
Total Week **Year**	294 kL **14.7ML**	598 kL **29.9ML**

3.7 SAFETY

Quarrying operations will be conducted in accordance with relevant State legislation including the *Occupational Health and Safety Act 2000* and Regulations under the Act, the *Mines Inspection Act 1901* and the requirements of Worksafe Australia. The quarry will be required to maintain a current Occupational Health and Safety Plan. The risks associated with quarrying and product processing operations will be documented and within limits that are acceptable for the industry.

Preventing public access to the quarry site is an important safety consideration. A 2 metre high chain wire and barbed wire perimeter fence will be installed around the property at the beginning of the construction period. New gates will be installed at the entrance to the property when the new access to Wisemans Ferry Road is built. Other gates will be installed where necessary for emergency access. The gates will be of a type that will deter unauthorised access. The entrance gates will be locked at all times when the quarry is not open for the delivery of product. Other gates will be kept locked.

Warning signs will be placed on the gates and at 50 metre intervals along the perimeter fence.

Areas of heightened risk within the quarry, such as quarry faces, will be identified with wire and dropper or orange safety fencing. Wire fences will have coloured ribbon attached at intervals for visibility.

All vehicles entering the quarry will be required to report first to the site office which will be adjacent to the wheel wash. Drivers will be briefed about operating rules and safety requirements within the quarry. Areas where road vehicles can operate within the quarry will be clearly identified. Concrete, steel or tyre barriers will be installed where safety is a concern.

Plant operating in the quarry will be equipped with flashing beacons. Reversing alarms will be operated at a reduced volume to avoid the disturbance of neighbours. Plant operators will be required to have current permits relevant to the plant they are operating and will be briefed on operating and safety procedures.

The tailings dams that are being decommissioned will be capped with stable material as soon as practicable to eliminate the risk associated with crusting over a semi-fluid clay base. Warning signs will be maintained at suitable intervals around these areas.

Vehicles entering the site will be required to observe a speed limit of 20 kilometres per hour and to remain within areas designated as traffic areas. These areas will normally be the access road, the surroundings of the site office and the loading area. The access road will be maintained to a safe trafficable standard.

The risks associated with heavy traffic entering Wisemans Ferry Road from the quarry have been assessed by traffic engineers and road works for the intersection of Wisemans Ferry Road and the access road designed (*Figure 11* and *Figure 12*). The design involves, among other things, setting the gate further into the property to allow for the length of a truck-trailer combination and improved road verges. All heavy vehicles leaving the site will be required pass through a wheel wash to remove quarry debris. All vehicles will be required to stop before entering Wisemans Ferry Road.

Wisemans Ferry Road has been used extensively for heavy traffic hauling sand from this and other quarries and servicing the needs of rural properties for many years. The contribution that an operating Rindean Quarry would make to the traffic load and traffic risks in the longer term is assessed in *Section 5.10*.

3.8 TRANSPORT

The transport of sand product from Rindean Quarry will be performed by independent hauliers many of whom will be self-employed owner-drivers. Although the mix of trucks likely to haul from the quarry cannot be determined with certainty, vehicles will commonly be modern rigid tip trucks towing dog trailers hauling average loads of approximately 30 tonnes.

For an annual production of 75,000 tonnes per annum, an average of 10 full load deliveries (approximately 30 tonnes each) would be made per day or approximately one per hour. At full production of 150,000 tonnes per annum the averages would be 20 loads per day or two per hour. The transport of product will continue throughout the day although the frequency of despatches is likely to be greater in the early part of the operating day to meet the demands of markets and to accommodate road congestion. Deliveries to the site will be few, the principal ones being diesel fuel, other consumable products and materials for rehabilitation.

The entrance to Rindean Quarry is from Wisemans Ferry Road, approximately 100 metres south of the intersection of Lackersteens Road and Wisemans Ferry Road. Trucks leaving the quarry with Gosford and Sydney deliveries will generally travel north along Wisemans

Ferry Road to the Pacific Highway or the F3 Freeway. Trucks delivering to Wyong, southern Lake Macquarie and Newcastle areas will travel north along Wisemans Ferry Road to the interchange with Peats Ridge Road and then to the F3 Freeway.

The permanent internal haul road in the quarry will be a formed road generally following the northern boundary. The road will have a constant gradient of approximately one in ten (1:10) to minimise the noise of gear changes as loaded trucks leave. All trucks leaving the quarry will pass through a drive-through wheel wash situated approximately 75 metres inside the gate to prevent the carriage of sand and clay on to Wisemans Ferry Road. The access road will be sealed from the wheel wash to Wisemans Ferry Road. All loads must be covered by law.

A temporary internal access road will be constructed to the present site of the processing plant in cell 3. This will be used throughout Stage 1 of the quarry's operation.

Loading will be conducted by a rubber tyred diesel powered loader from product stockpiles located in a central area of the quarry.

Issues associated with the loading and transport of product are considered in *Section 5.10*.

3.9 ENERGY USAGE AND CARBON IMPRINT

In past operations the quarry has used mains electricity to power fixed pumps and plant, and diesel fuel for mobile pumps and plant. This arrangement will not change although a more efficient and modern diesel-driven screening plant might be used.

There is an existing 11 kV supply to the site with an on-site pole-mounted transformer. It will be necessary to relocate this service within the site as the area of quarrying operations extends to the west.

Diesel operated plant will be refuelled on site by a contractor. Refuelling will be conducted in a location or locations which will be bunded to contain fuel spills and facilitate clean-up. The locations, which will vary as the quarry develops, will be identified in the quarry management plans.

A spill clean-up kit will be located adjacent to the refuelling site or sites. Fuel handling and clean-up procedures will be posted in the site office. Staff will be given appropriate training in fuel handling and clean-up procedures.

A air quality assessment and a greenhouse gas assessment were conducted by Air Noise Environment Pty Ltd in early 2012 (Appendices 5 and 6). The conclusions of these assessments are considered in Section 5.6.

3.10 HOURS OF OPERATION AND WORKFORCE

The operating hours approved by the Gosford City Council will be adopted. They are:

Monday to Friday	7am to 6 pm
Saturday	7am to 1pm
Sundays and Public Holidays	Closed
Maintenance	Saturday 7am to 6pm and Sunday only if critical repairs are necessary.

The first hour of the morning will be restricted to loading and haulage operations. Resource extraction and processing will not begin until 8am.

During the agreed construction period only the hours of operation will be:

Monday to Friday	7am to 5 pm
Saturday	7am to 1pm
Sundays and Public Holidays	Closed

The present pattern of haulage within the sand quarry industry is likely to determine the demand for loading. Locally based hauliers supplying the local market operate throughout the day to meet the requirements of the local construction industry. Locally based hauliers who supply Sydney require loading as early as possible in the morning in order to avoid the morning peak on the F3 and the worst of the early morning Sydney traffic. A few may seek to load in the late afternoon.

Sydney based hauliers who supply the Sydney market leave Sydney at about 5am to miss the morning traffic peak and seek loading from 6am. Hauliers supplying the Sydney market normally haul two loads per day. In exceptionally good traffic conditions three loads per day are occasionally achieved. Early morning (6am) loading will not be possible under the hours proposed and the quarry will be affected in its penetration of the Sydney market.

The quarry is expected to operate with a permanent workforce of three and three additional casual employees for periods when the workload exceeds the capacity of permanent staff. These periods are likely to be in the initial setting up stage, during major rehabilitation earth works and if major orders have to be satisfied.

Sub-contractors will be engaged as required to provide expertise or to supplement quarry staff in the performance of rehabilitation work, the repair and maintenance of plant and equipment and to supplement the quarry's normal resources. Product haulage will be performed by independent contractors. Sub-contractors will be required to meet all regulatory requirements applicable to the quarry's operations.

Table 3.4: Estimated Employment

	Number	**Duties**
Permanent employees		
Manager	1	Oversee the operation of the quarry. Deal with clients, suppliers, authorities and local residents. Operate plant
Plant Operator	1	Operate quarry plant
General Hand	1	Perform general duties. Operate plant
Casual employees		
Plant Operator	0 to 3	Operate plant, general duties, rehabilitation works
Contractors		
Rehabilitation	1	Experts in plant propagation and rehabilitation
Maintenance	1	Maintenance of plant and equipment
Haulage	5-8	Independent hauliers
Fuel and supplies	½	Independent suppliers
Total	10 to 16	

4. VEGETATION MANAGEMENT AND REHABILITATION

4.1 PRESENT STATE OF THE SITE

The Rindean Quarry was operated as a sand quarry from 1979 to 2003. More than half of the 15 hectare property is in a disturbed state from past quarrying, much of it as open quarry cells or carrying the infrastructure of past operations. The balance of the property shows evidence of disturbance for gravel extraction and agricultural use over its history.

Although few if any areas within the property have remained undisturbed, some parts support regrowth of varying ages some of which might be 50 years old or more. Such areas have been found to contain significant habitat both on the ground and in the trees. The best of this habitat occurs in the western and north-western parts of the quarry property and will be retained in buffer areas. A number of mature trees identified during flora and fauna surveys will be protected for their habitat values.

Some parts of the property, in particular the former tailings dams, are in urgent need of rehabilitation. The rehabilitation program will begin, therefore, towards the end of the construction period before the quarry begins production, with the capping of the former tailings dams at the eastern end of the property.

4.2. REVEGETATION HISTORY

The regrowth of vegetation in the past has been through natural processes. There are no recorded attempts at formal revegetation. Regrowth in the recent past has generally been vigorous as would be expected in the local environment. The incidence of exotic plants on the property is relatively low. There are a few examples of native shrubs along the boundaries of the property that are not endemic to the area, including the listed threatened species *Grevillea shiressii* near the north–western boundary. It is likely that these have been planted by persons unknown.

4.3 MANAGEMENT OF THE EXISTING NATIVE VEGETATION

The existing native vegetation along the western and north-western boundaries of the property will be retained as buffer areas, which are identified in the survey plan of the site and the plans for the various stages of the operation of the quarry. They will be left undisturbed apart from the construction of noise mitigation bunds and the perimeter fence. Measures will be taken in the design and construction of noise mitigation infrastructure to minimise the disturbance to existing vegetation. Where disturbance is unavoidable such disturbance will be offset by the planting out of bunds with endemic native species.

Significant trees identified in fauna and flora surveys have been marked on formal survey plans. They will be retained and clearly marked and fenced to protect them from quarrying operations or unintentional removal.

Native regrowth in other parts of the site will be incorporated into the rehabilitation program whenever possible. Although the removal of some native vegetation will be unavoidable, its removal will be more than offset by the extensive plantings that will form a major part of the rehabilitation program. The program will take into account the creation of habitat for the range of species likely to colonise the area. Exotic species, principally pines, will be removed.

Minimal future vegetation management is likely to be needed provided no intervention occurs through bushfire or feral pest (principally deer) activity. Regular inspections for weed species will be conducted and any significant occurrences removed by hand pulling or spraying with an approved herbicide. The property will have a bushfire management plan which will apply to all vegetation on the site.

It is expected that, within 5 years of a rehabilitation area having been established, there should be a full cover of under-story species and tree species would be approaching 6m in height.

4.4 A REHABILITATION PLAN

A Rehabilitation Strategy and Landscape Management Plan was prepared in compliance with the consolidated conditions of consent and approved by the Gosford City Council 2011. That plan, which describes the philosophy, strategy and methodology for rehabilitation and landscape management, will guide the future rehabilitation and vegetation management for the life of the quarry. It forms part of the quarry management plan (Volume 3, Part 6.3).

Rehabilitation and landscape management planning is based on advice from an independent specialist in native flora revegetation (Global Soils). Detail of that advice is contained in the Rehabilitation Strategy and Landscape Management Plan. Other specialists will be engaged, as required, to guide the implementation of the rehabilitation program, monitor the effectiveness of rehabilitation and to advise on the need for changes to the program when and where necessary

4.5. OBJECTIVES AND TARGETS OF THE PLAN

The objectives of the rehabilitation plan are to:

1) to conduct a rehabilitation program progressively throughout the life of the quarry that will leave it when completed as a stable, erosion-free landform consistent with the local environment.
2) rehabilitate areas disturbed by past quarrying operations that are not required for the new operation as a priority;
3) reduce the area of disturbed land in the quarry (ie land not under rehabilitation or not yet used for quarry operations) from almost two thirds of the property (9 hectares) to approximately 6 hectares within Stage 1 of the operation (ie the first two years);
4) reduce the disturbed area of the quarry to approximately 5 hectares by the end of Stage 2 of the operation (ie by year 5);
5) maintain the area of disturbed land within the property at 5 hectares or less for the remaining life of the quarry;
6) use material available on the site, including stockpiles, overburden, topsoil stripped from the site prior to construction works and quarrying and fines from the sand washing process, for rehabilitation work; and
7) rehabilitate the site with a viable mixture of grasses and indigenous plants which will result in a diverse and sustainable ecosystem.

The planting and management of bunds constructed for noise mitigation will follow the principals and practices used for the rehabilitation program. This work will be performed as the bunds are completed.

4.6 THE REHABILITATION PROGRAM

Details of the rehabilitation and landscape management plan are at Volume 3 Part 6.3 of this EIS. A summary of the plan follows.

Years 1 to 5

Rehabilitation of the two former tailings ponds at the eastern end of the site will begin during the first year of operation. The ponds have dried out significantly over the 8 years since they were last used. One has a small area of surface water and the other has none except during prolonged periods of rain. Both have established regrowth of grasses, shrubs and trees.

Each pond will be capped with coarse material and overburden from past quarrying operations sufficient to provide a stable platform for further operations. The profile will be graded to shed runoff water and allow for the settling of the accumulated tailings beneath as they dry. Fine overburden and topsoil will be added to create the final landform and to provide a viable seed bed.

Buffer areas and noise control infrastructure around the perimeter of the property will be established during the first 26 weeks of operation. These works will form part of the long-term rehabilitation of the site.

Attention will then turn to the north-eastern sector of the quarry adjacent to the fresh water ponds. The ponds will be retained for the duration of operations as the primary and sources of process water and as facilities to condition water prior to release from the site. They will be retained as attractive water features in the post quarrying landform. The principal work in this sector, the vegetation of benches constructed as part of the excavation of the ponds, should be complete by the end of year five.

Cell 3 and *Cell 4* along the northern boundary of the property will be quarried in years three to five to finish at levels indicated in *Figure 6*. Quarrying along the northern boundary will leave a benched face. In preparation for rehabilitation the benches will be ripped to create stable rubble slopes. The benches and slopes will be top dressed with a mix of topsoil, fine overburden and quarry fines to create a viable seed bed and planted with a mix of grasses and endemic shrubs and trees, either as seed or tube-stock.

Years 6 to 10

Rehabilitation programs established in Stages 1 and 2 will continue throughout Stage 3 (Years 5 to 10) to extend the area of the quarry under rehabilitation.

Years 11 to 20

During Stage 4 (Years 11 to 20) it is expected that quarrying operation will progress westward towards Wisemans Ferry Road from Cells 1, 2 and 5 (*Figure 7* and *Figure 8*). Rehabilitation will follow the movement of the quarry's operation to ensure that at all times the minimum practicable area remains under active quarrying and ancillary operations.

4.7 SOURCES OF MATERIALS

Materials needed for surface preparation will, as far as possible, be acquired on site. There are at present, stockpiles of an estimated 500 cubic metres of overburden and coarse reject material available for immediate use for rehabilitation and further suitable material will be acquired from the clean-up of the site. This material will be used for the construction of noise bunds and the initial capping and shaping of the two existing tailings dams.

The amount of overburden and coarse reject material available immediately will not be sufficient for initial earthworks because of the requirement to construct all establishment works, where noise goals might be exceeded, within the first 26 weeks. Some clean virgin

material from excavation sites will, therefore, be imported to make up the shortfall. Any material imported will meet the quality standards set by the Gosford Council.

Preparation of new areas for quarrying will produce quantities of topsoil and overburden suitable for rehabilitation. Future quarrying will produce coarse reject material which will be supplemented by approved imported material if required.

Natural regeneration has been quite rapid since the cessation of quarrying in 2003 as would be expected in an area of relatively high rainfall and humidity and a high water table. The natural seed source in adjacent areas and a good seed bed produced by the overburden and quarry fines have contributed to the rapid regrowth. There is, therefore, a high probability of successful rehabilitation.

Fine clays from the sand washing process will be mixed with overburden as it is placed in rehabilitation areas. This will have several benefits. Nutrients that accumulate in the clays in tailings ponds will become available as plant nutrients, the accumulation of fine clay tailings will be reduced, as will the need for tailings pond volume. The risks associated with surface crusting on future tailings ponds will be all but eliminated.

4.8 FINAL LANDFORM

In its final form the property will be an amphitheatre of native forest similar to that found in the adjacent Strickland State Forest. The quarry void will be surrounded to the north, west and south by benched walls that will have been softened and vegetated progressively throughout the life of the quarry. To the east, the present embankment to the original ground level will remain as it is at present but with a cover of endemic vegetation. The water storage ponds, which are providing an environment for birds, frogs and turtles, will be softened in plan and retained as water features. The slope from an RL of 217 metres in the west to 215.5 metres in the east will ensure drainage. The quarry floor will be ripped and planted out with a mix of species as described below. A plan of the indicative final landform is at *Figure 9*

5. ENVIRONMENTAL IMPACTS AND MANAGEMENT

5.1 CLIMATE

5.1.1 Rainfall and Evaporation

The Rindean Quarry site is located on the Somersby Plateau approximately 15 kilometres from the coast and at an elevation of between 200 and 260 metres above sea level. The closest comparable meteorological stations to the site are located at Peats Ridge and Mangrove Mountain, approximately 6 kilometres and 10 kilometres to the north-west, at elevations of 280 metres and 260 metres above AHD. Data from Peats Ridge is used in this EIS with the exception of wind direction data which was derived from Mangrove Mountain records.

The mean annual rainfall for Peats Ridge (1981–2010) is 1264.3mm and the mean annual evaporation is 1204.5mm (Australian Bureau of Meteorology). There is a pattern of consistent rainfall throughout the year with monthly means varying between 67.9mm in July and 158.8mm in February. Mean monthly rainfall exceeds evaporation during 7 months of the year, February to August inclusive. Mean monthly evaporation peaks between October and January, which are months when evaporation exceeds rainfall. Mean wind speeds for 9am and 3pm are 5.9km/hr and 6.8km/hr respectively. In winter, winds are predominantly from the westerly direction, in summer the easterly quadrant is dominant reflecting the maritime influence. Rainfall, temperature, evaporation and wind velocity data from this station for the 29 year period are summarised in *Table 5.1*.

Table 5.1: Climatic Summary - Peats Ridge (Waratah Road) Meteorological Station (1981 – 2010)

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Temperature (^{O}C)													
Mean daily max.	27.1	26.4	24.6	22.1	19.1	16.4	15.8	17.7	20.6	23.0	24.1	26.0	21.9
Mean daily min.	16.3	16.3	14.5	12.0	9.6	7.2	6.0	6.5	8.7	10.9	12.9	14.9	11.3
Rainfall (mm)													
Mean	115.6	158.8	139.8	128.8	98.3	105	67.9	81.1	73.1	93.6	108.1	95.1	1264.3
Relative Humidity (%)													
Mean 9am	78	82	82	78	79	78	75	69	65	65	72	74	75
Mean 3pm	64	66	66	66	67	66	60	55	54	58	61	63	62
Mean Daily Evaporation (mm)													
Mean	4.6	4.1	3.4	2.6	1.9	1.6	1.7	2.5	3.4	4.1	4.4	4.8	3.3
Wind Speed (km/hr)													
Mean 9am	4.9	4.6	5.0	5.3	5.8	6.3	6.6	7.3	7.1	6.8	6.0	5.2	5.9
Mean 3pm	7.3	6.8	6.2	5.6	5.5	5.8	6.6	7.1	8.0	7.7	7.8	7.3	6.8

Source: Australian Bureau of Meteorology

An analysis of the rainfall records for Peats Ridge from October 1981 to 2003 was conducted by the Department of Infrastructure, Planning and Natural Resources (DIPNR) as part of a study of regional groundwater resources. The analysis indicated that average monthly rainfall for the ten years from 1993 to 2003 has been lower than the longer term average monthly rainfall. Changes in the residual rainfall mass curve were compared against changes in bore water levels to examine the link between long term rainfall trends and fluctuations of groundwater levels. DIPNR found that a strong correlation existed between the residual rainfall mass and the groundwater level. (*Groundwater Recharge Investigation Within The Kulnura - Mangrove Mountain Water Source, DIPNR 2004 (unpublished)).*

Rainfall over the past two summers has been above average, particularly so in the summer of 2011/12. This is reflected in the average annual rainfall for the period 1981 to 2012 being higher (1,270.8mm) than for the corresponding period to 2010.

5.1.2 Environmental Impacts and Safeguards

Climatic factors are relevant to the quarrying operation because the operation will rely, as far as possible, on a closed water system. When water losses, principally through evaporation and infiltration, exceed water accumulated on the site through rainfall and associated runoff, it will be necessary to limit the production of washed sand products. Among the aims of the site water management plan (*Section 3.6*) is the collection of runoff as a principal water supply for the operation and the management of runoff from storm events.

In the event of a one in 10 year, one hour duration storm event followed by a one in 100 year, one hour duration storm event, on site storage of 4.5 megalitres will be required. This will be provided by storm water retention basin that will be excavated towards the eastern end of the quarry floor *(Figure 17).*

The tailings pond and the water storage ponds will be maintained with sufficient draft to accommodate water from storm rainfall.

5.2 GROUNDWATER HYDROLOGY

5.2.1 Hydrogeological Studies

RCA Australia was engaged in 2004 to investigate the existing groundwater environment and assess impacts associated with reopening the Rindean Quarry. In the period since there has been no development in the area or other changes that would suggest that this analysis and the conclusions reached would be any different now. The following assessment from the 2004 EIS, with minor changes is included for completeness.

This analysis was the basis of the New South Wales Office of Water issuing a water access licence (aquifer) for the quarry in 2009 and approving the Groundwater Monitoring and Management Plan for the operation in correspondence of 13 May 2011, subject to conditions related to monitoring (*Appendix 2*). These conditions will be satisfied by the implementation of the this plan which forms Part 6.1 of the quarry management plan (Volume 3).

Bores, seepage from the quarry faces and surface runoff will be tested prior to commencement to provide a more up to date baseline for future management. The results will be reported in accordance with the Quarry Management Plan.

RCA Australia prepared two reports, the first based on a 15% recharge rate. As a response to a period of lower than average rainfall at the time and the prospect of this continuing, the Gosford City Council requested a supplementary assessment based on an 11% recharge rate. The reports are at *Appendices 7 and 8.*

The main components of the hydrogeological study were:

- the installation of five monitoring bores to determine water table height, groundwater quality and groundwater contours. Data from an existing bore on the site was also included in the study;
- the review of records of local groundwater bores for drilling details and purpose of use;
- the drilling and coring of the monitoring bore in the south-western corner of the property to a depth of 30 metres;

- a geotechnical study to assess the stability of the quarry; and
- an assessment of the impacts that the future quarry void might have on groundwater levels and mitigation measures that might be necessary.

The analysis was conducted using single layer and multi-layer models. The multi-layer model placed low permeability layers at 50 and 90 metres below the surface to approximate the influence of ironstone bands within the local sandstone strata.

5.2.2 Regional Topography and Geology

The site is within the area of the Kulnura Mangrove Mountain Groundwater Source, which occupies an area of 506 square kilometres to the north of Sydney and inland from Gosford between Mt Simpson, Gosford, Spencer and Pearl Beach. The geology across the Groundwater Source is dominated by Hawkesbury Sandstone which is a relatively flat lying medium to coarse grained sandstone, having a maximum thickness in the order of 250 metres. Groundwater occurs in both porous layers and in fractured zones. The sheet sandstones form the porous aquifers which are the main aquifers used for groundwater extraction.

The groundwater sources are overlain by some groundwater dependent ecosystems that include wetlands, heath scrub and woodland areas. In addition, there are aquifer and cave ecosystems, and a number of river systems that are dependent on the groundwater sources. Approximately 40% of the area is covered by National Park and State Forests and 10% is a water supply catchment reserve. The groundwater sources are used for a range of agricultural and industrial activities, including cut flower, fruit, vegetable and poultry production and the commercial bottling of drinking water.

The site is located on the eastern edge the area classified as the Brisbane Water Groundwater Source (Zone 3) in the *Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources Water Management Act 2000*.

5.2.3 Local Topography and Geology

The Somersby Plateau is located towards the northern part of the Hawkesbury Sandstone formations that underlie the greater Sydney region. The Rindean Quarry property is located on the eastern flank of the Somersby Plateau at an elevation of between 200 to 260m AHD. The site is between the F3 Freeway and a ridge followed generally by the Wisemans Ferry Road that divides the dissected eastern flank of the plateau from the undulating land and the Mooney Mooney Creek catchment to the west. The generally horizontally-bedded sandstones dip approximately two degrees to the east in this area although there are local differences. Evidence within the quarry indicates that deeper sandstone strata locally may dip towards the west. The land on which the quarry is located is in the form of a shallow amphitheatre that slopes down to the east at approximately ten degrees.

5.2.4 Existing Ground Water Environment

The Hawkesbury Sandstone formations support well developed aquifers. Aquifers higher in the sandstone sequence appear to be associated with bands of ironstone within the sandstone formations that act as aquitards (barriers to the movement of water within the geological profile). Aquifer recharge is local from rain falling within the area. Aquifer discharge through surface springs and, in the instance of Rindean Quarry, through quarry faces demonstrates some interaction between surface and ground water.

Groundwater recharge has been estimated as 15% of total annual rainfall. The total recharge of the aquifers that might be affected by the quarry is a function of the total area

over which aquifers are recharged. As an indication of the large volume of water involved, the annual estimated recharge over the 15.7 hectares of the Rindean Quarry site is 30 megalitres.

The lowering of the water table and a reduction in natural surface discharge in the area during drought conditions that developed from 2003 indicate that the height of the water table is influenced in the relatively short term by significant changes in rainfall. Observations by RCA Australia are that the water table can vary in height by up to four metres with seasonal conditions. The elevated aquifers, in particular, respond quite quickly to seasonal and annual variations in rainfall, responses that are reflected in the rate of seepage from the existing quarry walls and, it is understood, the static water levels in adjacent bores.

Monitoring records for a bore on the nearby agricultural research station indicate that locally the variation is in the order of one metre and that the lag between rainfall peaks and peaks in bore water level is four to six months (*Figure 13* and *Figure 14*). These observations and records indicate that changes in water levels in bores due to rainfall variation in the Somersby area differ between sites and that regional variations range between one and four metres.

Drilling records for bores within 1.2 kilometres of the quarry site indicate the presence of aquifers at depths of 10 to 15 metres and 20 to 30 metres below the surface. This is consistent with observed seepage associated with ironstone bands at the quarry face. Available water quality records indicate that water in these aquifers is acidic (pH~4.5) in contrast to water in one deeper bore 500 metres from the quarry which is neutral (pH~7.0).

Groundwater levels were measured at the five monitoring bores installed on the site (*Figure 19* and *Table 5.2*). Groundwater occurred at the time of measurement at relatively shallow depths of between three and ten metres below the surface. The average depth to groundwater was 6.5 metres based upon the standing water level in the bores. The variation of groundwater levels observed was consistent with both the topography and structural geology of the area.

Table 5.2: Height of the Water Table in Monitoring Bores

Monitoring Well	Bore Height (RL @ ground surface)	Depth to aquifer (m below top of casing) 1-2/04/04	Depth to Aquifer (m below top of casing) 11/5/04	Stick Up (m)**	RL of Water Table (mAHD) 1-2/4/04	RL of Water Table (mAHD) 11/5/04
BH1	218.2	5.09	5.4	0.72	212.39	212.08
BH2	247.795	6.18	6.88	0.81	240.81	240.12
BH3	231.383	10.38	10.7	0.7	220.30	219.98
BH4	218.315	3.36	3.35	0.7	214.26	214.27
BH5	262.97	6.2	7.19	0.77	256	255.01

** Height of the top of the casing above the ground level (RL) for the bore

Groundwater contours, flow directions and rates were calculated for the site (*Drawing 2* and *Drawing 33*, *Appendix 8*). The groundwater flow was determined to be in an easterly direction across the site. The average hydraulic gradient was calculated to be 0.08m/m. Groundwater flow rates were estimated to be between 0.89m and 1.48m per year.

Groundwater from three of the monitoring bores on the site was analysed for water quality. Bore BH2 was selected as being representative of up-gradient water quality and BH4 for down-gradient conditions. Water from BH1 was analysed after an odour of effluent was detected during drilling. The locations of the bores are shown in *Figure 5.2*. The results of the sampling are listed in *Table 5.3*.

Water quality in these bores will be retested before work commences to provide a baseline for future monitoring.

Table 5.3: Water Quality Test Results

Water Quality Parameter	**Unit**	**Sample ID and Date Tested**		
		BH4 Down gradient 1/4/2004	**BH2 Up gradient 1/4/2004**	**BH1 Down gradient 2/4/2004**
pH		6.3	5.6	5.8
Conductivity @ 25°C	µS/cm	190	220	140
TDS (calc)	mg/L	120	140	-
Sulphate	mg/L	19	8	8
Chloride	mg/L	22	39	29
Nitrate as N	mg/L	0.72	5.9	0.057
Total Alkalinity	mg/L	30	8	
Bicarbonate	mg/L	30	8	17
Carbonate	mg/L	nd	nd	nd
Hydroxide	mg/L	nd	nd	nd
Sodium	mg/L	20	30	17
Potassium	mg/L	1.2	0.7	1
Calcium	mg/L	11	4	4.4
Magnesium	mg/L	3.4	4.8	2.8
Total Hardness	mg/L	43	30	-
Cation Total	me/L	1.8	1.9	-
Anion Total	me/L	1.6	1.5	-
Ion Balance	%	4	11.2	-
Ammonia as N	mg/L	0.04	nd	0.01
Total Alkalinity	mg/L			17
Biological Water Quality				
E. Coli	col/100mL			<91
BOD_5 - Total	mg/L			18

Source: Hydrological Investigation, Rindean Quarry Somersby, RCA Australia August 2004, Page 15.

The following conclusions can be drawn from the test results:

- pH reading in all three bores, although not as low as previously tested in the seepage from the face of the quarry, indicates slightly acidic groundwater;
- EC readings indicate fresh water with similar concentrations of dissolved solids up-gradient and down-gradient;
- ammonia concentrations are low and are below the ANZECC guideline (0.32mg/L); and
- although BH1 produced an odour of effluent during drilling, it had low concentrations of E.Coli and BOD indicating minimal biological activity. The source of the odour may have been septic tank drainage from adjacent properties.

Groundwater seeps from a number of places on quarry faces left by previous quarrying activity (*Plates 7, 8* and *9*). This seepage is generally associated with horizontal ironstone bands within the sandstone and is consistent with anecdotal evidence of groundwater springs occurring on the property before quarrying began.

The quarry walls were inspected on three occasions between January and May 2004. The earlier observations between January and March recorded seepage occurring from several locations at distinct levels (*Table 5.4*). Over the two months of April and May 2004, the number of locations where seepage was occurring became fewer and the total volume of seepage became visibly less. These observations correlate with the climatic data which confirms low rainfall during this period.

Seepage from the quarry faces in 2011/12 has become active again as would be expected with the above average rainfall.

Table 5.4 Seepage from Existing Quarry Faces

Location of Seepage*	Approximate Depth from Surface (m)	RL of Surface (m)	RL of Seepage (m)	Comments
1	7-8	230	223	An ironstone band below seepage has resulted in an aquitard. Two other bands were identified in this location at approx. 4-5m from surface and 14m
2	10	240	230	Appeared to be occurring through a shale like band.
3	10-12	242	230	Flowing through clay/shale layer
4	10-12	240	230	Clay/shale layer

* See Drawing 1 of the RCA report (Appendix 8)

The analysis of groundwater seepage collected from Location 4 on the quarry face in April 2004 recorded a pH of 4.4 (acidic) and total dissolved solids (TDS) of 152mg/litre. Total suspended solids (TSS) were zero. Water quality of the seepage will be retested before work commences to provide a baseline for future monitoring.

5.2.5 Local Use of Groundwater

Local aquifers are commonly tapped for domestic, stock, irrigation and commercial water supplies. Water from a natural spring on a neighbouring property immediately to the south of the quarry is used to feed a dam on that property. There are, unfortunately, no records of the rates of flow or volumes of water involved.

There were twenty-one (21) registered groundwater bores within a 1.2 kilometre radius of the quarry property in 2004. The locations of those bores relevant to the site are shown in *Figure 20.* Water levels were measured at five local bores on 16 July 2004 and compared with the static water levels in the bore when they were first drilled (Table 5.5). In four instances, the present water levels were 1.3 to five metres below the original level. In the fifth instance, the bore on the Rindean Quarry property, the present water level was 13 metres below the original level. This bore is located, on two sides, a few metres from the 30 metre high quarry face.

Table 5.5: *Bore Data, Rindean Quarry Environs*

Bore Reference	Date of Completion	RL at Surface	Distance from Quarry Centre (km)	Final Depth	SWL on completion (DLWC) (a)	SWL July 04 (a)	Estimated Drawdown RCA 1 (b)	Estimate Drawdown RCA 2 (c)	Comment
GW031948	01/02/70	254	0.1	30.4	6.7	8.01	27.24	23.96	At residence 1. Supply affected, bore may become dry. Redrill.
GW057452	15/03/83	261	0.2	32	9	11.46	15.47	13.79	At residence 2. Supply likely to be affected. Likely redrill..
GW051268	12/12/79	250	0.2	30	5.1	8.53	21.5	22.45	At residence 3. Supply may be affected. Monitor.
GW072503	07/12/ 93	265	0.2	48	18	22.88	21.51	16.13	At residence 4. Supply likely to be affected. Likely redrill.
GW056164	21/04/82	242	Within site	30	6	19.56	17.13	21.75	Bore to be removed
GW023092	01/07/ 65	250	0.8	19.8	6.7	-	3.69	2.19	Supply may be affected. Monitor
GW047597	11/09/80	230	0.6	26	8.0	-	5.77	5.11	Supply may be affected. Monitor
GW058902	20/09/83	250	0.75	30	20	-	5.62	3.31	Supply may be affected. Monitor
GW062690	17/05/86	250	0.75	25	4	-	8.35	5.07	Supply may be affected. Monitor
GW047198	24/10/78	260	0.75	46	6.1	-	4.18	2.23	Significant effect unlikely
GW057995	14/03/83	245	1	46	5	-	3.61	2.02	Significant effect unlikely
GW062121	26/08/83	250	0.9	43	16	-	4.71	2.23	Significant effect unlikely
GW052588	22/08/80	245	0.8	30	7	-	1.89	1.71	Significant effect unlikely
GW056871	13/03/83	270	0.6	34	14	-	1.43	2.40	Significant effect unlikely
GW065610	16/07/88	270	1.0	40	6	-	0.06	0.90	Significant effect unlikely
GW037121	01/01/73	250	1.0	33.5	7.6	-	3.05	0.91	Significant effect unlikely
GW053607	03/12/80	260	1.25	62	15	-	2.18	0.93	Significant effect unlikely
GW064823	23/03/85	250	1.1	40	10.3	-	1.66	0.61	Significant effect unlikely
GW 067551	02/08/89	255	1.25	34	6	-	-0.04	-1.65	Significant effect unlikely
GW101044 (d)	31/12/ 67	250	0.5	67	No details found	-	21.5	10.5	Commercial bore in deep aquifer. Significant effect unlikely.
GW101920	23/07/98			66	20	-			Data incomplete

All dimensions in metres
(a) Static water level in bore
(b) RCA 1 refers to the single layer groundwater model
(c) RCA 2 refers to the multi-layer groundwater model shallow (low permeability at 50 metres)
(d) Somersby Springs commercial bore. probably draws from deeper aquifer

One bore located approximately 500 metres south of Rindean Quarry has a commercial licence issued to a company that operates a commercial water bottling facility. This bore, which has been drilled to a depth of 67 metres, is understood to have different quality characteristics to bores on the quarry property. Those of the bore on the quarry property do

not meet drinking water criteria. The commercial bore appears to extract water from a deeper aquifer that is probably not subject to the influences and fluctuations that affect the shallower aquifers.

Water supply to the proponent's property for domestic purposes is from a bore constructed in 1982. The driller's summary indicates that water bearing zones were encountered at a depth of 11.8 metres and 26.6 metres. This bore will be removed within the first four years of the quarry's operation.

5.2.6 The Availability of Groundwater for Process Needs

A water access licence (aquifer) licence has been obtained for water that seeps from the quarry faces. The granting of the licence and the purchase and lease of quotas for a total of 16 megalitres per annum was based on estimates have been made of the volumes of groundwater likely to seep from the quarry faces for each stage of the quarry's operation (*Table 5.6*). In practice it will be impossible to separate this water from runoff from rainfall.

Calculation of the volumes available used an average porosity of 4%, a mean permeability of 1.7 x 10^{-8}m/s and a hydraulic gradient of 0.08m/m. The average depth to the aquifer was calculated using a 5 metre draw-down effect predicted by RCA Australia in 2004.

Table 5.6: Predicted Maximum Flowrates of Groundwater from Quarry Faces

Parameter	**Existing**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**
Average Depth to Aquifer (m)	5.73	5.73	10.73	10.73	10.73
Average Quarry Face Height (m)	20	20	25	25	30
Effective Saturated Face Height (m)	14.27	14.27	14.27	14.27	14.27
Saturated Face Area (m^2)	5708	5708	10702.5	9989	19264.5
Groundwater Flow Rate (m^3/yr)	6120.25	6120.25	11475.48	10710.45	20655.86
Groundwater Flow Rate (ML/yr)	**6.12**	**6.12**	**11.5**	**10.7**	**20.66**

Groundwater seepage will be collected in the network of drains and ponds that will be maintained for the collection of runoff and process water. The network of drains and storages will change as the quarry develops. No other source of groundwater will be used on the site. The existing bore will be removed.

The Kulnura Mangrove Mountain Groundwater Water Sharing Plan applies to groundwater in the Hawkesbury sandstone within the plan area. Rindean Quarry is situated within Zone 3, the Brisbane Water Groundwater source. *Table 5.7 is a summary of d*ata for this area*.*

Table 5.7: Brisbane Water Groundwater Source

	ZONE 3 **Brisbane Water Groundwater Source**
Average Annual Recharge (ML/yr)	2 616
Reserved Environmental Health (ML/yr)	1 873
Domestic and Stock rights (ML/yr)	129
Requirements for identified extraction under licences (ML/yr)	13
Long term average extraction (ML/yr)	743
Additional Volume available (ML/yr)	**601**

5.2.7 Impacts on Ground Water

Hydrological modelling performed by RCA Australia confirmed that the reinstatement of the quarry will lower surrounding water table levels and may affect the available supply at some bores. The draw-down of the water table will be in the form of a cone which will be deepest at the quarry face tapering to nothing at a distance from the quarry (*Figure 21).*

The initial analysis was based on a recharge rate of 15%. The Gosford City Council requested a revised analysis based on an 11% recharge to reflect the drier conditions being experienced at the time. The revised analysis, Addendum *to the Hydrological Assessment Rindean Quarry, Somersby* dated 4 November 2005 is at *Appendix 9*

The single layer model predicted a 5 metre draw-down at up to 600 metres from the site after a period of 100 years. As this model did not take into account the possibility of low permeability layers such as ironstone bands deeper in the rock profile, it predicted an impact on deeper aquifers. As the deeper aquifers are not expected to be hydraulically linked to the shallower aquifers, the results distorted the potential effects on deeper bores.

The multi layer model predicted that the quarry would cause an average draw-down of 5 metres up to 400 metres from the site after a 100 year period. This model, which took into account the presence of lower permeability ironstone bands within the rock profile, represents the long-term status of the aquifers. In both models, the predicted draw-down effect was greater closer to the quarry and less at the margins of influence (*Figure 21*). Both models are considered to be conservative in their predictions.

Some local residents have claimed that the presence of the quarry has caused a lowering of the water levels in their bores. Although this claim is consistent to some extent with the analysis that was conducted, the effects of lower than average rainfall patterns on the water table and elevated demands on the groundwater source during drought must also be taken into account. The results of the single layer modelling predicted that, in the long term, up to 13 local bores may be affected by the quarry, whilst the multi layer model predicted that 15 local bores may be affected (ie, those bores predicted to have a greater than 10% decline in saturated thickness). Bores situated closer to the quarry will be affected most while those further from the quarry are unlikely to be affected significantly, especially if they are deep enough to accommodate seasonal variations in the water table.

These drawdown effects will be caused by quarry faces cutting into local water tables and the loss of water from aquifers through seepage into the quarry. The prediction of the expected loss of water from aquifers into the quarry provided in *Table 5.6*, is a conservative estimate because it assumes that the total area of any quarry face below the upper saturated rock level would allow seepage. This has not occurred in the past, and is not the case now following higher than average rainfall. The assessment must therefore be regarded as indicating the maximum theoretical flow, well above that which is likely to occur in practice.

Anecdotal evidence suggests that groundwater seepage on the quarry property occurred before quarrying started in 1979 and continued throughout the period of quarrying, and that flow rates varied with variations in average rainfall. Observed substantial reductions in flow rates in the quarry influenced by drought conditions at the time support this conclusion. There is no evidence, however, of the rates of flow. Oral history suggests that surface flows from groundwater seepage have always occurred regardless of seasonal conditions. Water was flowing from surface springs on Elwins Road and above Somersby Falls in July 2004 despite the dry conditions.

Future groundwater seepage into the quarry will, in many respects, be an extension of the natural processes that took place before quarrying began. It is not possible, however, to

apportion total groundwater seepage between quarry-induced seepage and seepage due to natural processes.

The available water supply from three bores at residences identified in *Figure 5* as *R1, R2* and *R4* are likely to be affected significantly by the quarry unless the bores are deepened. These bores will be deepened at Rindean Quarry's expense if a loss of supply due to the quarry is proven.

The quarry should have no effect on the bore from which the commercial bottled water supply is drawn. This bore is substantially deeper than other bores in the area and taps a deeper aquifer. The water quality characteristics that make the water suitable as a commercial drinking water supply are different to those found in shallower bores. There is no evidence of interaction between aquifers at significantly different depths.

The draw-down effect of the water table in the land surrounding the quarry will not affect the growth of trees and vegetation generally in the area. Rainfall infiltration provides the water source for vegetation, rather than the water table which is typically 6.5m or more below the surface. Groundwater dependent vegetation such as the hanging swamps that are fed by springs, should not be affected.

The quality of groundwater is unlikely to be affected by the quarry. Results of water quality tests on down-gradient bores (BH4 and BH1) provide evidence that this statement is valid. No appreciable differences were observed between the water quality characteristics of these bores located where past quarrying would have had an influence and BH2 which is located up-gradient from them.

No toxic or hazardous chemicals will be used in the washing process that might affect either groundwater or surface water. The only significant potential source of hazardous liquid will be diesel fuel. However, machinery will be refuelled in designated areas by contractor and there will be no storage on site. Minor sources of contamination might occur from breakages in the hydraulic or fuel lines of mobile machinery. The amounts involved would be small and would be cleaned up in accordance with established procedures.

Groundwater modelling performed by RCA Australia predicted the effects on groundwater that are likely occur as a result of the reinstatement of the quarry using estimates, experience and the limited data available. Although the predictions can only be regarded as indicative they are valid and provide a sufficient understanding of the possible effects of the quarry on groundwater for this assessment. RCA Australia concluded in regard to the calibration of the model that, "In general, the modelled piezometric heads were higher than those observed, which maximises the impact of the proposed extension on the regional water table and is a conservative approach to calibration" (Hydrological Investigation, RCA Australia, Page 10).

A higher level of confidence can only be achieved by monitoring the real effects once operations commence. It is proposed, therefore, to monitor groundwater levels in surrounding bores to estimate seepage volumes during operation and to use the data collected in calibrating a more accurate model. The results will be included in annual reports when they are available and taken into account in preparing a later review of the quarry's operations.

5.3 SURFACE DRAINAGE

5.3.1 Existing Environment

The quarry is within the catchment of the Narara Creek which flows through the Strickland State Forest and the industrial suburbs of West Gosford to Brisbane Water approximately

seven kilometres to the south east and to Broken Bay at the mouth of the Hawkesbury River. The property drains into an unnamed creek on Agriculture NSW land a few metres to the east of the property boundary. This creek, which is a tributary of Narara Creek, has its source on agricultural, grazing and rural residential lands to the north of the property and drains water from the F3 Freeway corridor. Neither this creek nor the Narara Creek can be regarded as pristine waterways.

Wisemans Ferry Road, which forms the western boundary of the property, follows a ridge-line and is part of the boundary of a small catchment up-slope from the quarry property. Runoff from this catchment is diverted around the site though long-established drains. A drain was constructed many years ago to intercept water along the northern boundary. This drain will remain although some maintenance work may be necessary. A new watercourse has become established along the length of the southern boundary of the property. Both flow intermittently into the unnamed creek.

The present surface drainage within the site is a function of its use for quarrying over the past 30 years. In its original form the site probably had the form of a shallow basin that drained from west to east. It is understood that a watercourse began in the north-western corner and proceeded diagonally across the property to the southern boundary. Although the existence of this watercourse was debated in Land and Environment Court proceedings during 2002, there is little other substantive information available about it. Much of this watercourse was obliterated by early quarrying and nothing of it now remains. Re-establishment of this surface drainage pattern through the existing fresh water dam is a long-term objective of the rehabilitation program.

During heavy rain, most of the runoff water from the more elevated parts of the property drains into quarry Cells 1 or 3. From here it is passed through a small settling pond to the fresh water pond located near the eastern boundary of the property. This pond has a capacity of approximately eight megalitres and has been used in the past as the principal source of process water for sand washing operations. Other drainage within the property, including that from groundwater discharges from quarry faces, is also directed towards this pond. Overflow from this pond flows through a rock-lined drain to the unnamed creek. The overflow structure is understood to have been required and approved by the Environment Protection Authority in regard to past operations.

Elevated wetland areas identified generally by the presence of heath vegetation are relatively common in the area. An example is an area of hanging swamp on an adjoining property near the south-eastern corner of the quarry property which also drains into the creek. Drainage from the quarry does not affect this feature. The establishment of an elevated wetland within the property as a part of the rehabilitation program would be consistent with the natural morphology of the area.

Water samples were collected in April 2004 from a discharge on the quarry face and the unnamed creek upstream form the point of discharge from the quarry. The creek was not flowing when the sample was taken. The results are in *Table 5.8*. Water quality in the creek will be retested before work commences to provide a baseline for future monitoring.

The similarity in the pH and TDS analyses of the samples indicate the general acidic nature of both surface and groundwater in the area and likely interactions between groundwater and surface water.

Table 5.8: Rindean Quarry, Surface Water Quality Analysis

Year of Testing	Location	pH	Total Dissolved Solids (TDS)	Total Suspended Solids (TSS)
2004	Quarry Face	4.4	152	-
2004	Unnamed Creek	4.83	108	6
2011	Quarry Face	4.4	152	-
2011	Unnamed Creek	4.83	108	6

5.3.2 Impacts on Surface Water

The reinstatement of the quarry should cause little change to the present surface water environment. Nevertheless, safeguards will be built into the water management system to ensure that future quarrying operations do not cause significant impacts to surface water downstream of the quarry.

Water management structures are described in *Section 3.6*. A freshwater pond (FW1) presently exists near the eastern boundary of the property. This will be supplemented by a new fresh water pond (FW2) immediately to the north during Stage 1 of the quarry's operation. FW1 will then be restored. Other proposed structures will collect runoff from rainfall and from process and stockpile areas and direct it towards a settling pond immediately to the west of the present fresh water pond. Water will be pumped from the settling pond to FW2 as required.

Water from the tailings pond will be pumped to FW2 to allow additional residence time for a TSS of 100 parts per million or less to be achieved. Water will then be fed by gravity or pumped to FW1 for reuse in the sand washing process. Excess water will be discharged subject to it meeting EPA discharge standards. The capacities of the two ponds (33 megalitres) is expected to be sufficient, when the effects of natural acidity are taken into account, to achieve required water quality standards.

Although a target will be the maximum recovery of water from the washing process, there will be a need for additional water to make up for the losses from evaporation, seepage and retention in the product shipped from the site. The source of this water will be runoff from rainfall and seepage from quarry faces which, for practical purposed, cannot be separated from other runoff from the site (Section 3.6). Water access licences and water allocations have be obtained for the use of this water.

All drains within the site will be constructed to minimise erosion and to contain, as far as practicable, the silt load carried by runoff water. The ponds FW1 And FW2 will play a major part in limiting sediment in discharge water.

The water management structure is designed to cater for a one in ten (1:10) year one hour duration storm event followed by a one in one hundred (1:100) year one hour duration storm event i.e. occurring within a 24 hour period. This will be achieved by storing water temporarily in a basin in the quarry floor to the west of the fresh water dams. The basin which will be maintained in an empty state, will have a capacity of approximately 4.5 megalitres Rainfall that exceeds these limits will produce runoff that is likely to exceed the capacity of the quarry' water management infrastructure. Excessive stormwater will be discharged directly to the creek through the lined drain to protect the quarry's water and tailings management infrastructure. The present drainage system coped with the storm rains of late 2011 and early 2012 without significant damage. It is likely, though, that EPA discharge standards would not be met for such high-volume stormwater discharges.

Water quality standards will be based on the status of the unnamed creek not being a pristine watercourse. The quarry management plan documents water quality standards that must be met, water quality testing regimes and responses required in the event of limits being exceeded.

5.4 SOIL EROSION

5.4.1 Existing Environment

Topsoil on undisturbed areas of the site is a sandy loam, typically 30cm thick. Subsoils are yellow to orange, fine grained clays with included gravels in some areas to a depth of two to two and a half metres. The soils generally have a high erosion potential, high acidity and low fertility. They are quite permeable and allow the infiltration of normal rainfall. Little erosion is evident in those parts of the quarry that have not been disturbed by past quarrying operations.

Disturbed areas of the quarry have penetrated into sandstone of different levels of weathering. Those strata in an undisturbed state are generally not vulnerable to significant erosion in normal weather conditions. Erosion does occur within disturbed sandstone areas within the quarry and basic soil erosion control works must be maintained to prevent a loss of water storage capacity. Present settling and storage ponds have had minimum maintenance since the quarry ceased to operated because of constraints imposed by the Gosford City Council.

5.4.2 Impact Assessment and Mitigation

Erosion control within the quarry will be performed in accordance with the Erosion Sediment Control Plan and Surface Water Monitoring which forms Part 6.2of the Quarry Management Plan (Volume 3).

The greatest environmental risks associated with soil erosion relate to the loss of water storage capacity through the siltation of storage dams, the release of sediment laden water into the downstream creek and the erosion of the embankments around the decommissioned tailings dams in the south-eastern corner of the property.

The risk of erosion of the decommissioned tailings dams was addressed in the past with professionally engineered embankment faces. These faces remain in good condition. These embankments will be protected from future runoff by grading the rehabilitated surfaces towards the centre of the property and directing runoff water from them into the main water management facility. Additional vegetation will be planted on the faces during the initial stages of the rehabilitation program to enhance stability.

The amount of disturbed land will be kept to a minimum and disturbed land that is prone to erosion will be stabilised. It is proposed through the rehabilitation programs to reduce the area of disturbed land to approximately 5 hectares at any one time thereby reducing the potential for soil erosion. Vegetation in the western and north-western parts of the site will be preserved. Runoff from these areas and from Wisemans Ferry Road will be diverted around the quarry.

Surface runoff will be controlled through a system of drains and bunds which will channel water to a central settling pond and then to the fresh water storage ponds. (*Section 3.6*).

The amount of sediment collected in runoff is a function of the velocity of the runoff water over the ground or though earth drains. Proven techniques will be employed to reduce flow velocities and prevent disturbed material, including topsoil, sand, spoil or other sediment,

escaping the site or entering adjacent lands or receiving waters. These techniques include limiting the grades of drains, the lining of drains and placing sandbag or rock barriers. Generally, drains and channels will be constructed on a sandstone base which will reduce sediment loading. Sandstone *in-situ* is not easily eroded and is an ideal base for conveying water. Water control structures will be inspected regularly and after heavy rain to ensure that problems are identified and repaired promptly.

5.5 NOISE

5.5.1 Introduction

The noise associated with quarrying operations, product processing and the transport of sand product from Rindean Quarry is a matter of concern for local residents. The quarry is located in an area where the predominant land use is for rural residential living and people living in such areas commonly have an expectation that there will be little or no intrusive noise from surrounding activities. However, the background noise in the vicinity of the quarry is dominated by traffic on the F3 Freeway and the busy Wisemans Ferry Road.

The noise exposure arising from a particular operation or the operation of a piece of equipment within the quarry that is experienced at different locations outside the quarry will vary widely. Factors influencing noise exposure levels include the nature and characteristics of the noise source, the distance of the receiver from the noise source, the presence of noise barriers, the relationship of the receiver to noise barriers, whether the receiver is inside a building, the characteristics of the building, topographic features and atmospheric conditions. Factors affecting the impact that a particular level of noise will have on an individual include the difference between the background noise and the intrusive noise levels, the characteristics of both sources of noise and the time of day. Standards, guidelines and goals adopted by authorities take these factors into account.

Specialist acoustic consultants Atkins Acoustics Pty Ltd were engaged in 2004 to conduct a noise assessment of the site and the proposed quarry operations and to make recommendations for noise mitigation procedures and infrastructure. The report by Atkins Acoustics is at *Appendix 10*. Methodology adopted for the assessment is explained in the report.

There is no practical requirement for a fresh noise assessment. The noise assessment conducted in 2004 and the noise exposure targets, noise control measures and the noise abatement infrastructure determined then are still valid. There are several reasons for this.

The NSW Interim Construction Noise Guideline 2009 does not apply;

> Examples of noise that is *not* covered by the Guideline are:
>
> - noise from industrial sources (for example, factories, quarrying, mining, and including construction associated with quarrying and mining) – this is assessed under the *NSW Industrial Noise Policy* (EPA 2000). (*NSW Interim Construction Noise Guideline*, P2)

There have been no other changes to the New South Wales noise related legislation or the Industrial Noise Policy since 2004 that would change the requirements for noise abatement. The present proposal is no different to that proposed in 2004 although the footprint of the quarry has been reduced by conditions of consent imposed by the Gosford City Council in 2006 and 2007. The present proposal accounts for the minimum 100 metre setback of excavations from neighbouring residences required by the Gosford City Council to reduce the exposure of those properties to operational noise. Current generation equipment that will be used in the quarry is significantly quieter that that is use 8 years ago when the earlier

assessment was conducted. Background noise has risen slightly since 2004 because of the increased traffic on the F3 Freeway and Wisemans Ferry Road.

A summary of the 2004 assessment is provided below.

5.5.2 Existing Noise Environment

The location of Rindean Quarry does not have a typical rural noise environment. The quarry is located between Wisemans Ferry Road which forms the western boundary of the quarry property and the F3 Freeway which passes within 350 metres of the eastern boundary.

Wisemans Ferry Road, classed as a regional road, carries substantial traffic (*Section 5.10*) including heavy vehicles servicing the local sand extraction and rural industries and the Somersby industrial area. Wisemans Ferry Road turns though a slow corner greater than 90^0 within 75 metres of the quarry gate. All vehicles on the road have to brake to 20 to 30 kilometres per hour for the corner and accelerate from it. Three houses that will be affected by noise associated with the quarry are at a similar or lesser distances from this corner. Noise from the road is frequent although not constant.

The quarry and several surrounding houses are higher than and overlook the F3 Freeway although views of the Freeway are, in most instances, obscured by trees. Noise from the Freeway, which continues day and night, is a significant component of the background noise in the area. Noise levels are higher during the 6am to 8am morning and 5.30pm to 7.30pm afternoon traffic peaks.

Until December 2003, noise associated with Rindean Quarry operations had been, for much of the previous 25 years, part of the noise environment of the area.

Background noise levels were monitored by Atkins Acoustics for a period of seven days at three locations adjacent to the quarry:

- *location 1:* in the north-western portion of the quarry property adjacent to *Residence 1*;
- *location 2:* near the south-western corner of the quarry property approximately 60 metres from *Residence 4*;
- *location 3*: on the southern boundary of the quarry property approximately 90 metres from *Residence 5*.

Monitoring results and aural observations confirmed that the existing noise environment, which was controlled by traffic noise from the F3 Freeway and Wisemans Ferry Road, was typically suburban. Other noise sources identified included the natural sound of wind, birds and cicadas.

The daytime Rating Background Levels (RBL) measures were 42, 39 and 43 respectively for the three monitoring locations (refer to *Appendix 10, Table 4*). RBLs provide the baseline for setting project noise goals.

5.5.3 Sources of Operational Noise

There will be five principal sources of noise associated with the quarry's operations, namely:

1) the extraction and crushing of friable sandstone from the working face of the quarry and the quarry floor by a large bulldozer and excavator;
2) the loading and transport of raw material within the quarry by a loader and small to medium sized dump truck;

3) the screening and washing plant processing raw material into saleable sand product;

4) the loading by loader and the transport of sand product from the quarry by trucks operated by independent hauliers; and

5) heavy equipment conducting primary rehabilitation operations.

No blasting will be conducted.

Noise output levels for each of the items of equipment have been determined from manufacturers specifications or noise levels recorded for similar items of equipment in similar operations. Noise output levels adopted for this assessment are in *Appendix 10, Table 9*.

5.5.4 Impact Assessment

Atkins Acoustics determined noise goals for the operation of the quarry based on the New South Wales Industrial Noise Policy. Goals were identified for the normal operating life of the quarry and for the first 26 weeks of its operation when higher noise exposure limits are permissible. Noise exposures were modelled for affected residences for the principal stages of the quarry's operation. Predicted Operational Noise levels are assessed in *Section 7.2* and *Table 12* of *Appendix 10.* Noise contours for operations at three locations within the quarry are at *Appendix 2* of *Appendix 10*.

In summary, the principal conclusions reached (*Section 8, Appendix 10*) were:

- six residential properties adjacent to the quarry site were identified as being potentially affected by noise from the quarry;
- the existing ambient noise environment for the area would be described as typically suburban as it is controlled by traffic noise on the F3 Freeway. The noise environment is also influenced by local road traffic on Wisemans Ferry Road;
- noise modelling has shown that noise levels are predicted to exceed project assessment goals, mainly during the construction of boundary noise bunding;
- other than for surface works in Cell 7, the modelling results show that predicted noise levels satisfy the recommended project assessment goals;
- noise modelling was performed with all plant and equipment operating simultaneously to cover the worst case scenario; and
- without noise mitigation measures in the form of engineering, site establishment and management controls, the findings of modelling have shown that predicted noise levels from the proposed development could exceed the recommended assessment goals.

5.5.5 Noise Mitigation

The report recommended that the following noise control measures should be adopted and conducted the noise modelling as if they had been implemented (*Appendix 10, Section 7.3*):

- all site plant shall be fitted with residential grade engine exhaust mufflers and engine side covers;
- all site plant and equipment (except the dozer) shall be selected and modified to satisfy the acoustic performance referenced in *Table 9* [predicted quarry plant sound power levels];

- the dozer shall be fitted with engineered secondary noise controls including mufflers, engine covers, cooling fan and lubricated track systems such that the dynamic sound power emission level is less than 107dB(A);
- all site operated trucks shall comply with the noise requirements of Australian Design Rule 28/01;
- where practical all reversing alarms will be removed from mobile plant or replaced with low level alarms and flashing lights;
- acoustic bunding shall be constructed along the site boundaries during the initial site establishment period;
- where practical, working stockpiles shall be positioned to maximise acoustic shielding;
- where practical, the extraction face shall be orientated to minimise reflected noise to residential receivers;
- site operation shall be managed in accordance with the operational scenarios presented in Sections 7.1 and 7.2 [of *Appendix 10*];and
- periodic noise monitoring shall be undertaken to ensure that noise limits are satisfied and assess options to further practical and feasible options to reduce noise emissions from the site operations.

The report (*Appendix 10*) also recommended that a Site Noise Management Plan be established. This plan forms Part 6.4 of the Quarry Management Plan (Volume 3). The plan takes account of the additional noise abatement conditions required by the deferred development consent of September 2007. Some specific matters are considered below.

Noise barriers will be constructed along the boundaries of the site in locations and to heights specified in *Figure 5*, *Appendix 10*. The barriers will be earth mounds topped, if necessary, with colourbond fences. All earth bunds will be planted with endemic native species. As construction of these barriers might exceed operational noise goals, this work will be performed during the first 26 weeks of the quarry's operation or, if required, during the nominated 4 week construction period when noise exposure can exceed background levels by more than 10dBA.

During Stage 1 of the quarry's operation, the sand processing plant and product stockpiles will be located in *Cell 3* in the northern side of the quarry where it is at present. Early in Stage 2 (year 3), the plant will be moved to the quarry floor in the centre of the quarry. Initially the quarry face and later a residual bund around the processing area will contain some noise of the processing and loading operations. (Figures 5, to 8).

Noise modelling was conducted on the basis of all plant and equipment operating simultaneously. In practice, this will be unlikely to occur and, therefore, noise levels should be less than predicted. On occasions when noise-sensitive operations or operations in noise-sensitive areas are necessary, precautions will be taken to keep noise exposure within operational goals. Measure will include shutting down unnecessary equipment, operating equipment at minimum power levels and conducting operations during the least noise-sensitive times of the day.

Those elements of the operation causing the highest noise exposure are expected to be associated with site establishment activities. These activities will be those at or near the natural ground level and will include the construction of noise bunds, preliminary work associated with decommissioning of the old tailings dams, the construction of a new access road and the removal of topsoil and overburden. With the exception of the removal of topsoil

and overburden in areas scheduled for later quarrying (Cells 5, 6 and 7), this work will be performed in the first 26 weeks of the quarry's operation when the L_{A90} background noise level may be exceeded by up to 10 dBA. The work causing most noise exposure (greater than 10dBA will be performed during a designated 4 week period within the construction period as permitted under the Industrial Noise Policy..

Additional precautions will be taken to minimise noise exposure in adjacent areas when clearing and excavation operations close to the natural ground level are undertaken. The precautions will include operating equipment at minimum power levels necessary for the work, conducting the work at the least sensitive times of the day, minimising the number of items of equipment operating at the same time in the quarry and advising residents likely to be affected of the planned work.

5.5.6 Transportation Noise

The noise of trucking operations will be from the arrival of empty trucks at the quarry and the departure of loaded trucks. The noise exposure of these operations is assessed at *Appendix 10 , Section 5.3* and *Section 6.2*.

Noise mitigation provisions that will be imposed or constructed are:

- a speed limit of 20kph on all vehicles within the quarry;
- a requirement for trucks operating from the quarry to comply with current regulatory noise limits;
- a ban on the use of engine or exhaust brakes;
- the construction of the access road at a constant grade of approximately 10% and maintenance of the road in a smooth condition;
- sealing of the first 100 metres of the access road from Wisemans Ferry Road to eliminate the chassis noise of empty trucks passing over a rough surface; and
- the construction of noise barriers to heights specified by in *Appendix 10, Figure 5* between the access road and houses in the north western corner of the property.

Two residences adjacent to the north-western corner of the quarry property (identified as R1 and R2 in *Figure 5*) will be approximately 50m (buffer area and setback) from the entrance to the quarry. Both will be affected to some extent by the noise of trucks entering and leaving the quarry. Both properties and a third property to the north of them (identified as R3) are also affected by the noise of frequent general traffic, including a substantial proportion of heavy traffic, braking, turning and accelerating at the corner of Wisemans Ferry Road and Lackersteens Road. This is a slow 20kph corner turning through more than 90^0.

Noise abatement infrastructure will be constructed and procedures applied in this part of the quarry property to minimise the exposure of residents to the noise of trucks entering and leaving the quarry.

The access from Wisemans Ferry Road has been designed in accordance with Department of Roads and Maritime and the Gosford City Council traffic engineering requirements (*Figure 11 and Figure 12*). Trucks leaving the quarry will be required to stop before entering Wisemans Ferry Road as a safety measure. The majority of trucks operating in the sand trade, particularly on the longer haul Sydney route, are now modern, technologically advanced vehicles that create relatively low noise footprints especially at low speeds. High power reduces the need for gear changes, for example, gear boxes are automatic or semi-automatic, engine management systems control power output, exhaust mufflers effectively control exhaust noise and cooling fans are designed to minimise noise. These technologies

will limit the noise emitted by trucks hauling out of the quarry and starting into Wisemans Ferry Road. Older style trucks that create a noise nuisance are becoming a minority.

Rindean Quarry will operate from 7am to 6 pm from Monday to Friday and from 7am to 1pm on Saturdays for the loading and despatch of sand products (*Section 3.10*). The hours that the quarry will operate are defined by the New South Wales Industrial Noise Policy as daytime hours. Daytime assessment criteria, therefore, apply to the assessment of all operations in the quarry.

5.6 AIR QUALITY

5.1.6 Existing Environment

Atmospheric pollution resulting from quarry operations will come from two principal sources, dust from quarrying and haulage operations and exhaust gasses from diesel-powered vehicles and equipment. Both types of pollution are present in the atmosphere locally.

Dust from local sources includes dust caused by traffic on unsealed roads, unsealed road shoulders, farming and poultry operations. The principal exhaust emissions are from traffic using the F3 Freeway and Wisemans Ferry Road. Periodically, smoke from bush fires and dust from more distant sources increase the pollution load.

The quarry is located in a depression. It is protected from strong westerly and northerly winds by the ridgelines located along the northern and western boundaries although it is exposed to southerly and, in particular, easterly winds. Some eddying can be expected within the quarry because of its size and the presence of benched high walls around the southern, western and northern margins.

North-easterly and south-easterly winds and, to some extent, north-westerly winds are the winds most likely to result in dust generation and fallout to residences located downwind of the quarry in windy conditions.

5.6.2 Particulate Pollution

An analysis of the potential particulate pollution arising from the quarry operation, including modelling, was conducted by Air Noise Environment Pty Ltd in the latter part of 2011. The report of this analysis, which was based on the Director General Requirements issued in July 2011, is at *Appendix 6*.

The conclusions and recommendations of the report are:

> Overall, based on the predicted results and giving consideration to conservative assumptions, the risk of emissions to air from the proposed sand quarry to both human health and environment is likely to be low provided the recommended controls are implemented at the site. It is therefore recommended that these controls are incorporated into the environmental management plan for the site prior to the commencement of operations.

and;

> Dispersion modelling using the Calpuff model has been undertaken to assess potential air quality impacts associated with the Rindean Quarry. The dispersion modelling incorporates a prognostic meteorological dataset for the area (based on TAPM and CALMET), background air quality concentrations and NPI emission factors. Three modelling scenarios have been considered (excavations cells 1, 4 and 7). The modelling considers a throughput of 500 tonnes per day and 75% reduction for water sprays along haul routes (Level 2 water, greater than 2 L/m2/h). The results of the modelling can be summarised as follows:

- compliance for deposited dust, PM10 (annual average), TSP, NO2 (annual average) and CO at all nearest sensitive receptors; and
- non-compliance for PM10 (24-hour average); and
- non-compliance for NO2 (1-hour average).

Non-compliances are predicted at the receptors directly adjacent to the proposed quarry (up to 4 receptors) during worst-case wind directions. Actual concentrations are likely to be lower in view of the following factors:

- conservative emission factors for the haul route (main contributor to particulate emissions) have been used in the absence of site specific data. The proposed haul road is to be gravelled (while emission rates are based on roads neither sealed nor gravelled);
- conservative emission factors for diesel equipment. While, emission rates are based on NPI documents, which is a standard procedure, it is noted that the factors are derived from US EPA data published between 1985 and 1996. The proponent intends to utilise Best Available Technology during the life of the quarry, resulting in lower emission rates;
- it is noted that a vegetative buffer (up to 65 metres) is proposed between the nearest excavation cells (Cell 4 and 7) and the north-western sensitive receptors. Though difficult to quantify, the vegetative buffer is likely to provide some benefit in reducing particulate concentrations at these receptors. Some studies have indicated between a 35% and 56% removal of particulates; and
- the modelling assumes an excavator, haul truck, dozer and loader are operating simultaneously in a 1-hour period. In practice, machine usage will be intermittent and continuous operation will not be required.

There are a number of measures (in addition to those mentioned in Section 2) that can be implemented to assist in the management of air emissions. These include the following:

- regular use of water truck (greater than 2 L/m2/h) on exposed areas of ground, particularly unpaved haul routes;
- ensure sufficient water truck capacity is available on site at all times;
- regular maintenance of the gravelled haul route;
- maintenance of vegetative buffer;
- regular maintenance of diesel equipment.

5.6.3 Greenhouse Gas Assessment

A Greenhouse Gas Assessment was conducted for the proposal by Air Noise Environment Pty Ltd in the latter part of 2011. The report of this analysis, which was based on the Director General's Requirements issued in July 2011, is at *Appendix 7*. The following extracts from the report contain a summary of the emissions and recommended greenhouse gas mitigation options and the emissions inventory used in arriving at these conclusions and recommendations.

4 EMISSIONS INVENTORY

4.1 SCOPE 1 EMISSIONS

Scope 1 emissions included in the inventory include estimates of emissions as a result of:

- Construction and rehabilitation of the sand mine (including clearing and fencing, site clean up, construction of access roads, wheel wash and preparation of access road).

- Extraction of raw material and site maintenance (including stripping overburden, ripping and crushing raw material and internal road maintenance).
- Processing of product (including dry screening, stacking product and loading product onto trucks)
- Water, fines and dust management (including dust suppression, draining of settling ponds and water retention ponds and desilting of tailings and settling ponds).

Data upon which the summary of Scope 1 emission is based can be found in Table 4.1 of *Appendix 7*, estimated fuel (diesel) usage for each of the identified activities over the 20 year expected life of the sand mine.

4.2 SCOPE 2 EMISSIONS

Scope 2 emissions for the project are primarily related to energy consumed by the wash plant proposed for the site. Other energy uses on the site are expected to be immaterial against total site emissions.

See Table 4.3 of *Appendix 7* which presents a summary of estimated Scope 2 emissions for the life of the proposed sand mine.

4.3 SCOPE 3 EMISSIONS

Scope 3 emissions represent GHG emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction and production of purchased materials, transportation of purchased fuels, and employee business travel and commuting.

Scope 3 emissions are not routinely reported by companies because:

- Emissions are difficult to estimate accurately;
- The company does not have effective control of the emissions sources; and
- A company's Scope 3 emissions will be reported elsewhere by a second company as their Scope 1 emissions. As an example, emissions from combustion of diesel fuel by trucks (owned and operated by the Company receiving the product) delivering raw materials to site will be reported by the receiving company as one of its Scope 1 emissions.

It is noted that these emissions are an optional reporting class under the Greenhouse Gas Protocol.

"For this project, Scope 3 emissions associated with the following sources have been investigated:

- transport of mined product to client sites (independent truck operators); and
- construction of the road junction at the main entrance to the site.

The transport of finished product to client sites is to be undertaken by independent contractors and is dependent on demand. To provide an indication of the potential emissions from these activities, the following assumptions have been applied:

- all deliveries undertaken using heavy road truck and trailer combinations;
- average of 2,000 local trips (approximately 30 km each way) and 2,500 Sydney trips (approximately 80 km each way) per year which is equivalent to 520,000 km per annum;
- average truck fuel consumption of 28.9 L / 100 km***4***;

Based on the above assumptions, fuel usage for delivery of finished product to client sites is estimated to be 150,200 L of diesel per annum. This is equivalent to 401,034 kg of CO2-e per annum or 8,020,680 kg CO2-e over the 20 year life of the project.

Emissions from the construction of the new road junction are unable to be estimated at this time. This work is to be undertaken by independent contractors and as such details such as equipment requirements, the source for raw materials (gravel, bitumen etc.) and the construction methodology to be adopted is unknown. Therefore, for the purposes of this assessment, this component of the construction phase of the project has not been included in the GHG inventory. *[4 CSIRO (October 2008) 'Modelling the Road Transport Sector, Appendix to Australia's Low Pollution Future, The Economics of Climate Change Mitigation' prepared on behalf of Treasury]*

4.4 SUMMARY OF EMISSIONS

Table 4.4 below presents a summary of the estimated total scope 1, 2 and 3 emissions over the 20 year life of the proposed sand quarry project.

TABLE 4.4: ESTIMATED TOTAL GHG EMISSIONS OVER LIFE OF PROJEC

Type of Emissions	Estimated GHG Emissions Over Project Life
Scope 1	6,149 tonne CO2-e
Scope 2	658 tonne CO2-e
Scope 3	8,021 tonne CO2-e
Total	14,828 tonne CO2-e

This is equivalent to an estimated 4.9 kg CO2-e per tonne of sand produced. It is noted that a literature review did not identify any best practice guidance for GHG emissions per unit of production for sand quarrying operations.

TABLE 4.5: ESTIMATED ANNUAL GHG EMISSIONS OVER LIFE OF PROJECT

Year	Estimated Scope 1 Emissions (tonne CO2-e)	Estimated Scope 2 Emissions (tonne CO2-e)	Total of Estimated Scope 1 and Scope 2 GHG Emissions Over Project Life (tonne CO2-e)
1	137.07	-	137.07
2	192.92	8.90	201.82
3	340.10	38.18	378.28
4	340.10	38.18	378.28
5	341.72	38.18	379.90
6	340.10	38.18	378.28
7	340.10	38.18	378.28
8	340.10	38.18	378.28
9	340.10	38.18	378.28
10	340.10	38.18	378.28
11	340.10	38.18	378.28
12	340.10	38.18	378.28
13	340.10	38.18	378.28
14	340.10	38.18	378.28
15	340.10	38.18	378.28
16	340.10	38.18	378.28
17	340.10	38.18	378.28
18	340.10	38.18	378.28
19	340.10	38.18	378.28
20	35.75	-	35.75

Based on the estimated emissions presented in Table 4.5, the proposed sand quarry is not expected to trigger the NGER reporting threshold of 25 kilotonnes CO2-e (25,000 tonnes CO2-e) of Scope 1 and 2 greenhouse gases for a single facility.

Similarly, data presented in Table 4.3 indicates that the proposed facility it not expected to exceed the 200 terajoules energy trigger level for NGER reporting based on energy usage alone.

5 GHG MITIGATION OPTIONS

Whilst this assessment has demonstrated that the overall emissions of GHG for the proposal are relatively low, and well within the reporting thresholds as defined in the NGER requirements, the Director General requires that mitigation options such as offsets are considered for the project.

Given the proposed scale and intensity of the proposed sand quarry, there are limited options available for the mitigation of greenhouse gas emissions. Power consumption is expected to be minimised as far as practicable with only two significant users of grid supplied power identified (the wash plant and associated water pump) hence further reduction of these emissions is expected to be impractical.

"The remainder of GHG emissions identified are the result of the combustion of diesel by plant and equipment operating on site. Measures with the potential to reduce GHG emissions for these plant and equipment items include:

- investigation of the use of biofuels in plant and equipment (it is noted that this may not be possible given the geographical location of the site and specific fuel requirements of the plant and equipment);
- turning off idle machines where ever possible;
- where possible stockpile all overburden on site (rather than shipping to off-site locations)
- where possible select plant and equipment that are fuel efficient (ie generally newer modern plant and equipment); and
- where possible source supplies locally (thereby minimising transportation emissions to get product to site)."

5.6.4 Greenhouse Gas Reporting Requirements

The greenhouse gas assessment concluded that, based on the estimated emissions, the proposed sand quarry is not expected to trigger the NGER reporting threshold of 25 kilotonnes CO2-e (25,000 tonnes CO2-e) of Scope 1 and 2 greenhouse gases for a single facility.

Similarly, data presented indicates that the proposed facility it not expected to exceed the 200 terajoules energy trigger level for NGER reporting based on energy usage alone.

5.6.5 Proposed Air Quality Management and Pollution Mitigation

Most fixed plant in the quarry will be powered by mains electricity. Mobile plant and trucks engaged in haulage will be diesel powered.

A number of factors and management initiatives are proposed to minimise the pollution load and the impacts of the quarry affecting nearby properties. They are:

- existing vegetation will be retained and new vegetation planted along the boundaries of the quarry, providing shelter from strong winds;
- the quarry will be excavated below ground level which will reduce wind disturbance within the quarry and hence the creation of dust;

- once quarrying is below the weathered zone, the porous sandstone will retain a high level of moisture and the sand will remain in a damp state;
- the operational safeguards will include the watering of haulage roads and machinery manoeuvring areas, water sprays to the stockpiles, the wheel wash near the entrance to the site and sealing the access road from the wheel wash to Wisemans Ferry Road. A water cart of sufficient capacity will be available on site at all times. Internal haul roads will be maintained in good condition;
- trucks carrying product from the site are required legally to have their loads covered at all times;
- overburden will normally be transported directly to rehabilitation areas where it is to be used to avoid double handling. In the rare event that stockpiling is necessary, this will be done on site;
- the use of fuel efficient equipment and the regular maintenance of diesel equipment is vital to contain the large overhead of fuel costs. Modern current generation machinery will be used throughout the site. Machinery will be turned off when it is not in use;
- the use biofuels in plant and equipment will be considered if it is available and compatible with the high standard of machinery being used;
- a proportion of the stockpiled sand product will have been screened and washed to remove all or some of the fine (less than 75 micron) fraction;
- clay fines which make up the tailings from the washing process will be stored under water in tailings dams. When tailings are being worked into material for rehabilitation, precautions will be taken to prevent the generation of dust; and
- where possible supplies will be sourced locally to minimise transportation emissions.

The quarry will make only an incremental contribution to vehicle pollution load in the locality. A conservative estimate is less than 10%. The principal sources will remain traffic on the F3 Freeway and Wisemans Ferry Road at the eastern and western boundaries of the site respectively. Diesel exhaust fumes from plant and vehicles may be noticeable within the quarry, although they are expected to dissipate rapidly. The operation of the quarry is unlikely to result in a deterioration of existing air quality levels beyond the property boundaries.

5.7 FLORA AND FAUNA

5.7.1 Existing Environment

More than two thirds of the 15 hectare site is land that is highly disturbed as a result of almost 25 years of quarrying operations. Much of the remaining third has been disturbed by earlier extractive industry and agriculture although it now supports areas of mostly regrowth native vegetation of varying quality and age. Approximately 3ha of the native vegetation could be regarded as being in reasonable condition.

The eastern portion of the site has been almost entirely cleared and highly modified by past quarrying and ancillary activities. Most of the vegetation there now appears to have been self introduced or brought to the site by vectors such as wind or birds or on equipment. Exotic grasses have been planted in the past for soil stabilisation. This area covers approximately one third of the site.

The western third of the site contains remnant vegetation fragmented by complete or partial clearing for power lines, agriculture, access, and possibly past gravel extraction. This area, which contains some trees with hollows, may provide a significant corridor for the north-south passage of fauna.

Much of the land adjacent to the quarry property has been cleared or partially cleared for past agricultural and grazing activity. Much of this is now occupied by rural residential properties and hobby farms. Substantial areas of native vegetation remain adjacent to the eastern boundary which extend, beyond the F3 Freeway, into the Strickland State Forest. Areas of hanging swamp with associated vegetation are present in these areas including an area adjacent to the south-eastern corner of the property. A 20 metre wide road easement follows the northern boundary, which apparently has never been developed and supports mostly undisturbed natural vegetation.

Weeds are found in most parts of the site although they are only an obvious problem at the edge of vegetation abutting Wisemans Ferry Road. Radiata pine trees are scattered throughout the site and, in some areas, are the dominant trees.

5.7.2 Buffer Areas

The proposal is to retain or develop and maintain buffer areas of varying widths around the perimeter of the quarry having regard to the present state of vegetation along the quarry perimeter, the significance of vegetation and habitat along the perimeter, plans for rehabilitation and the requirement to protect adjacent properties from the impacts of quarrying operations. The following buffer areas will be retained or developed and maintained:

1) a buffer area in the north-western corner of the property so that no excavation for product can occur within 100 metres of the two adjacent residences. A vegetated bund will be constructed between these residences and the operating areas of the quarry. The purposes of the bund, which will be vegetated with endemic shrubs and trees, will be to control noise and create a visual barrier to the quarry that will complement existing vegetation in the area.

   The 2006 and 2007 conditions of consent issued by the Gosford City Council required that this bund, a 6 metre high earth structure with a base approximately 18 metres wide, be constructed though vegetation adjacent to the access road, an area that contains relatively undisturbed vegetation and a number of trees with hollows that provide potential habitat for some species of birds and mammals *Figure 5* and *Figure 10*.

   Keystone Ecological in its report recommended that the bund be constructed along the cleared path of a former access road to minimise damage to established vegetation between this former road and the present access road. If this alternative was to be adopted, the adjacent residents in R1 and R2 (*Figure 5*) would need to be consulted, the bund would have to be of the form of a 3 to 4 metre high earth bund topped by a fence to maintain access to the power lines which follow the road and the Council would have to accept this change to the former conditions that it issued;

2) a buffer of existing vegetation 60 metres wide along the western boundary that abuts Wisemans Ferry Road. This area has been identified as being important as a wildlife corridor and because it contains significant habitat in the form of remnant trees with hollows. This area cannot be regarded as pristine, however, because of the extent of past disturbances;

3) the rehabilitation area along the eastern boundary of the property and along the eastern end of the southern boundary which will begin in *Year 1* and be established by the end of stage two (Year 5);

4) a 20 metre wide buffer area along the remaining part of the southern boundary which will take into account existing vegetation and topography, noting that an electricity transmission line easement follows the length of the southern boundary and the sealed right of way follows approximately two thirds of the boundary. The buffer will be established with plantings of endemic species to fill gaps and through natural regeneration processes, which have proven to be quite active on the property;

5) a 20 metre wide buffer along the balance of the northern boundary much of which was cleared in past operations. There is no residential development adjacent to this boundary that requires protection from quarrying activities and an undeveloped road easement with relatively undisturbed native vegetation follows its length. Plantings and natural regeneration will ensure that past disturbances along this boundary are rectified.

5.7.3 Landscaping And Wetland Construction

The presence of ponds on the site has generated an artificial environment that is attractive to a number of native species including threatened mammals. The present water body, that is identified as the fresh water pond will be supplemented by a second adjacent pond. Both will be retained throughout future operations and will be integrated into rehabilitation as permanent features on the site. Once these ponds are no longer required as a supply of water for the processing plant, attention will be given to improving the habitat, in particular edge habitat, that they offer.

Tailings ponds will be capped as they are decommissioned to remove the risks associated with wet, unconsolidated fine sediments and revegetated in accordance with the rehabilitation program.

5.7.4 Independent Flora and Fauna Assessments

Flora and fauna assessments was conducted in April 2004 and 2005 by *General Flora and Fauna*. The assessment concluded that the proposed development was unlikely to have a significant impact on threatened species, populations or ecological communities or their habitats if the recommended safeguards are followed.

A second assessment was conducted in 2011-2012 by Keystone Ecological to the new standards for flora and fauna assessment. The report is at *Appendix 5*.

The survey results presented by Keystone Ecological are recorded in the report as:

> In total, 205 locally-native species and 71 introduced species were observed within the subject site. A species list is provided in Table 1.1 in Appendix 1. Because of the high degree of similarity between the flora observed in this survey and the previous survey in 2004, the species list provided is a composite of the two.
>
> These 278 species are representative of 88 families, with the dominant families being Poaceae (36 species), Proteaceae (25 species), Fabaceae / Mimosaceae (20 / 12 species), Asteraceae (17 species) and Myrtaceae (11 species). The sedges and rushes (Juncaceae, Cyperaceae and Restionaceae) were represented by 12 species and the ferns were also a dominant group, with 15 species across 9 families.
>
> This high diversity is typical of this vegetation type and typical of sandstone communities in general.

The site contains a number of important weeds, with 8 listed noxious species and many environmental weeds. This pattern is typical of bushland and disturbed vegetation in such a setting.

No species of conservation significance were recorded, but three individual *Grevillea shiressii* had been reported near the northern boundary in the previous survey. As this area is within a retained buffer and the plants were almost definitely horticultural plantings, great effort was not expended trying to locate them.

Keystone Ecological came to similar conclusions as had General Flora and Fauna in the earlier assessments. The conclusions of Keystone ecological are:

This Flora and Fauna Impact Assessment has considered the likely impacts of the proposed development at Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby upon species, populations and communities of conservation significance.

The impact was assessed for nationally and state listed threatened species, populations or ecological communities, or their habitats.

The site is partially naturally vegetated, situated at the edge of the Somersby Plateau. The site has been an active quarry since 1979 and the proposed works area will be buffered from adjacent habitat by retained vegetation. Only 0.88 hectares of Somersby Plateau Forest will be removed for the project and 5 or 6 hollow-bearing trees may also be removed. Their loss will be ameliorated by the installation of nest boxes.

There is potential for two small patches of hanging swamps to become drier over a long period, but the modelling predicting this outcome relies on the aquifers being connected and there is no evidence that this is the case. Overland flow to these downslope off site areas will remain intact.

The site provides potential habitat for a number of threatened species of flora and fauna and several threatened fauna species were recorded on and near the site, principally bats:

- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Pteropus poliocephalus* Grey-headed Flying-fox'
- *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat
- *Myotis macropus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle

The impact of this proposal on threatened species and endangered ecological communities of interest is likely to be minimal as it is concentrated mainly in the existing development footprint of the site.

The assessment of the criteria under the Commonwealth EPBC Act (1999) concluded that a referral to the Department of Sustainability, Environment, Water, Population and Communities is not required.

The assessment of likely impact under the New South Wales TSC Act (1995) concluded that a significant impact is not likely to occur upon any state listed threatened species, populations or endangered ecological communities. Therefore a Species Impact Statement is not recommended to be prepared for the proposal.

While it is judged that there will be no significant impact wrought by the proposed development on any species of conservation significance, the following recommendations are provided in order to ameliorate any impacts in relation to the proposal, particularly in regard to resident fauna and protection of downslope environments.

1. Consideration should be given to moving the bund near the entrance so that it impacts on already disturbed ground rather than cut into intact forest vegetation.
2. Lights to be used on site should be of a type that reduces spill and glare so that foraging by microbats is not further disrupted.

3. Clearing should be timed so that the felling of hollow-bearing trees can occur in a season that is least disruptive to resident breeding animals.
4. Hollow-bearing trees must only be removed with Council's permission and under supervision of a suitably-qualified and experienced ecologist or wildlife handler/rescue service (such as WIRES).
5. Prior to felling, a number of nest boxes of a variety of types should be erected in retained trees in order for animals to relocate or be relocated.
6. Ultimately, boxes should compensate for lost hollows at a ratio of at least 1:1. Supplementary boxes may need to be installed after the felled trees are inspected and the numbers and characteristics of the hollows properly determined.
7. It is important that the nest boxes are designed and built to provide thermal stability and so should the walls should be no thinner than 19 mm.
8. Plant species used for rehabilitation should be restricted to locally-native species and/or those introduced species that do not have the potential to become environmental weeds.
9. Unless it poses a safety hazard, fallen timber should not be removed from the site.
10. Sediment controls should be strictly observed throughout the life of the quarry.

The major conclusion arising from this Flora and Fauna Impact Assessment is that the proposed works are unlikely to result in a significant impact on any listed species or communities. Therefore, in accordance with the EPBC Act (1999), EPA Act (1979), TSC Act (1995) and FM Act (1994), a referral to the Department of Sustainability, Environment, Water, Population and Communities is not required, and nor is a Species Impact Statement required.

5.7.5 Planned Mitigation Measures

The recommendations made by Keystone Ecological will be implemented in their entirety noting that the recommendation relating to the acoustic bund in the north-western corner cannot be acted upon until there further consideration has been given to it by adjacent residents, the applicant and the Gosford City Council.

The manner in which these recommendations will be addressed is considered in other sections of this EIS and in the Quarry Management Plan (Volume 3).

Future development of the quarry will require the removal of the remaining vegetation on the site except for that which will be retained in buffer areas along the site boundaries and in the rehabilitation area in the east of the property. The amount of vegetation that will require removal will be relatively small because of the extent of past disturbances. The areas to be removed will cause some impacts in a local context but are not considered to be critical in regional terms. The areas of vegetation that will be removed will be more than offset by the substantial rehabilitation of disturbed areas that is an integral and major part of this proposal. Established techniques will be employed to ensure that disturbances and impacts are kept to a minimum.

5.7.6 Habitat Retention And Managing Displaced Fauna

The most significant habitat on the site that warrants retention comprises the 25 or so older trees with hollows identified on the property. The habitat that these trees provide for mammals and birds will be replaced by rehabilitation in the long term.

Possibly three of the seven trees located in the north-western corner of the property will require removal within the first year of operation. The report by Keystone Ecological identified 5 or 6 habitat trees that might require removal and recommended precautions that should be taken to protect wildlife using them.

Procedures adopted before the removal of trees containing significant bird and mammal habitat will be those recommended by the National Parks and Wildlife Service. They will include:

- targeted expert surveys of the trees prior to felling;
- expert capture and relocation of animals found;
- felling trees outside the breeding seasons of species likely to inhabit the trees;
- inspection of hollows prior to sectioning the trees; and
- removal of hollow logs to a rehabilitated area to provide alternative habitat.

5.7.7 Control of Exotic Species

No exotic plant species will be used in rehabilitation. As far as possible, only native species endemic to the area grown from seed collected in the area will be used.

About 66 introduced species were identified on the site. These ranged from grasses that had been introduced as pasture, plants that had probably grown from seed blown on to the site or introduced by birds, to trees including *Pinus radiata* that had been planted or grown through the accidental transmission of seed. The level of weed infestation varies throughout the site. Weed and introduced tree species identified included Lantana, Bitou Bush, Radiata Pine and Liquidambar.

Procedures will be implemented to remove existing weed infestations and prevent the spread of weed species around the site as part of the rehabilitation program. Regular inspections will be conducted in the course of day-to-day operations. Hand pulling, ripping and controlled spraying will be the preferred methods for removal. Liquidambar trees will be removed and the stumps ripped to prevent regrowth. Logs and stumps will be burnt or buried.

Regrowth areas will be inspected regularly, every 3 to 6 months, for the growth of exotic species and pulling, ripping or controlled spraying used to remove and control them.

Care will be taken to ensure that weed species are not introduced with landscaping materials. There will be a shortage of topsoil within the site for rehabilitation purposes and the use of all that is available will be desirable. The preferred approach will beto use available topsoil and mulch from the site and to control weeds in rehabilitation areas by the control methods referred to above and by the establishment of a shrub or tree canopy as soon as possible to discourage the growth of grasses. The conduct and management of rehabilitation is considered in *Section 4* and in Part 6.3 Quarry Management Plan *(Volume 3)*.

Exotic fauna do not present a significant problem at present although the local fox would provide a threat to ground-dwelling mammals and reptiles. Rabbit numbers are also low at present. Eradication action will be taken if numbers increase in accordance with recommendations of the Pastures Protection Board.

5.8 ARCHAEOLOGY

5.8.1 Surveys and Assessments Conducted

Insite Heritage was engaged to conduct an Aboriginal heritage assessment of the Rindean property in 2004. The report of the assessment, which was conducted in consultation with the Darkinjung Local Aboriginal Land Council, established that:

- Aboriginal cultural sites either exist or have existed in the locality and are therefore tangible evidence of Aboriginal occupation of the locality;
- the subject property contained no evidence or archaeological material; and
- the site had been used in a manner which indicated that it was unlikely that subsurface cultural material might be present.

The report concluded that there were no archaeological constraints to the proposed development and, as a result, no recommendations pertaining to the management of Aboriginal cultural material were applicable.

Insite Heritage was engaged to conduct a fresh assessment in 2011 to take into account new requirements for Aboriginal archaeological assessments. This second assessment was conducted in association with the Darkinjung Local Aboriginal Land Council Inc and the Guringai Tribal Link Corporation.

A fresh field survey was conducted as part of the assessment. The purpose of the survey was to identify any Aboriginal objects or sites that might be impacted by the proposed development, consult with those stakeholder representatives selected for fieldwork and to develop appropriate management strategies if required. The report *(Appendix 11)* addressed the requirements of the Director General's Requirements for both Aboriginal cultural heritage and non indigenous heritage.

Insite Heritage reported that:

> The study area was reinspected in 2012 and found greatly unchanged from the 2004 site inspection. The site was inspected twice, once with Gringai Tribal Link and on a second day with Darkinjung LALC. A foot inspection was conducted over the site, particularly utilising any areas of exposure. The survey avoided the void area for safety reasons however any undisturbed land surfaces around the voids were inspected. The site was found to be unchanged from the 2004 survey, probably due to the poor skeletal soils where these are in-situ which prevents thick vegetation growth. In addition the large part of the site that has been subject to previous quarrying remains as it was in 2004.

5.8.2 Aboriginal Archaeological Context

Somersby is located on Hawkesbury sandstone, a landform unit renowned for its rock engravings and art. The Grants Road Aboriginal Reserve contains numerous engravings and is located about 4 kilometres south-west of the study area. An additional engraving of a human figure was located in 2007 at Grants Road sand quarry on Grants Road in the course of a quarry expansion assessment. The figure was to be avoided and retained in-situ. The figure was located about 500m from the Grants Road Reserve site, both of which are located on the central plateau of the sandstone ridge. The Rindean Quarry is located on the eastern slope of the plateau.

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted for an area of 18 sq km around the study area. A total of 43 sites were located. The site types recorded on the Somersby plateau are the site types dependant upon a suitable sandstone soil landscape. This area is in contrast to most areas of NSW where open camp sites are the most common site type in general. There are no open campsites recorded in this area which indicates a probable ceremonial use of the escarpment rather than a generalised occupation area. The preservation of common site types in this area is likely to be dependant upon intact horizontal sandstone surfaces. The two areas of Potential Archaeological Deposit (PAD) recorded in the area are closed sites – that is the deposits within rock shelters.

The sandy shallow topsoil of the area is not conducive to the preservation of occupation sites in an open context.

In applying the predictive model, Insite Heritage reached the following conclusions:

Artefact scatters/open camp sites	These sites comprise stone artefacts deposited in the course of tool manufacture, occupation of a camp site or transient use of the landscape. These objects are unlikely to occur on the subject site due to disturbance and landscape context which demonstrates a paucity in this site type.
Burials	Human remains tended to be placed in hollow trees, caves or sand deposits. Therefore this site type is unlikely to occur in the study area due to the level of vegetation clearing, surface disturbance and lack of sand deposits of more than a few mm depth.
Grinding grooves	Grinding grooves are formed in stone where stone hatchet or axe 'blanks' have had their edges ground sharp. Sandstone is generally preferred, as the sand particles have excellent abrasive qualities particularly when water is introduced onto the grindstone. Whilst grinding grooves are common in the general area their survival in the study area is unlikely due to the existing disturbance to the site.
Art – pigment or engraved	Art that is known in the general area includes representations of animals, anthropomorphic figures and symbolic art. This site type may occur in undisturbed parts of the study area. The survival of this site type is unlikely to occur due to the degree of disturbance. An extensive engraved art site is located within the Reserve on Grants Road several km to the north east.
Scarred/modified trees	Scarred trees contain scars caused by the removal of bark for use in manufacturing canoes, containers, shields or shelters. Mature trees and remnants of stands of the original vegetation have the potential to contain scars. These are unlikely to occur on this site as the majority of the area has been cleared

5.8.3 Survey Results

The results of the survey reported by Insite Heritage were:

> In general the survey area was found to be highly disturbed from the rural and industrial history of the site. The survey coverage details remain unchanged from the 2004 survey. The variation was found with one isolated find within survey unit 3d – the orchard area, described as a highly modified, levelled and depressed topography in comparison to the surrounding area. The isolated find located on the track in this unit is highly likely to have been introduced to the site.
>
> An isolated broken artefact was located in cell 7 in a highly disturbed context. The artefact was located on a vehicle track that traversed an area that has been levelled and modified; therefore it is not in-situ and may have been introduced in road base. The isolated artefact was located on a track in an area of heavy disturbance. The location appeared on the margins of a cut and fill area. The artefact was located on a track 2m wide.
>
> No area of PAD (Potential Archaeological Deposit), was identified within the impact zone of the proposal.

One previously unrecorded broken stone flake was located on a track within the proposed Cell 7. The isolated find was considered by Insite Heritage to be of low scientific significance given the lack of context in its location and the artefact type/material's commonality in open

sites in the region. The object is of low cultural heritage significance in comparison to other sites in the area.

The Aboriginal representatives in the field indicated that the collection of the object was an acceptable management option. It is proposed to manage the item under an Aboriginal Heritage Impact Permit (AHIP) to relocate the artefact from the area of impact to the vegetation buffer zone located about 100 meters to the north in consultation with the registered Aboriginal stakeholders.

5.8.4 Consultation and Aboriginal Involvement

In accordance with Office of Environment and Heritage guidelines, Aboriginal persons or groups who may have information that would assist the assessment process were identified by the process outlined in clause 80C of the NPW Regulation.

The field survey was conducted in association with the Darkinjung Local Aboriginal Land Council and the Gringai Tribal Link Corporation and with representatives of the Council and the Corporation present. The reports received from their inspections can be seen at Appendix C of the Insite Heritage report.

5.8.5 Assessment of Non-Indigenous Historical Archaeological Potential

A search of the Somersby area on the NSW Heritage Office database which includes Gosford City Council's Local Environment Plan did not identify any historic items on or near the study area. The buildings within the study area appear to date to the 1960's in style and materials. The buildings include a cottage, sheds and animal pens. As no heritage items were identified by the survey, a significant assessment is not required.

5.9 VISUAL ENVIRONMENT

5.9.1 Existing Environment

On a regional basis, the Somersby Plateau is considered to have a diverse agricultural landscape of small cultivated fields interspersed with natural vegetation (NSW Planning and Environment Commission, 1975). In the Commission's landscape and environmental analysis, the valley areas to the east and west of Somersby Plateau were considered to represent areas of visual significance, rather than the Plateau itself.

Rindean Quarry, being located on the eastern fringe of the plateau, is within an area of visual significance. The property is in a shallow basin that slopes at 10° to the east from Wiseman Ferry Road which is on a ridgeline and is surrounded by bushland and rural/residential properties. Although two-thirds of the 15 hectare site is in a highly disturbed state, existing vegetation around the quarry site generally obscures views from surrounding properties and Wisemans Ferry Road. However, a substantial part of the quarry is visible from two of the six neighbouring residences around the perimeter of the site (identified as R5 and R6).

Vegetation within the quarry and its surrounds has grown since the assessment was conducted in 2004. Visibility of the quarry is now less. The quarry is now almost completely obscured from traffic using the F3 Freeway by roadside vegetation for all but the tallest vehicles.

5.9.2 Basis for Assessment

Visual impact can be described as a perceived change to the existing aesthetic environment, which causes a loss of amenity to surrounding properties, residents or recreational viewers.

Such impacts may include distractive lighting from security or night-time operations, vegetation clearing, location or size of stockpiles, the form and bulk of the plant, the location of roads and fences and the orientation of the quarry relative to sight lines.

The visual impacts of the reinstatement of the Rindean Quarry will relate to the changing views from three of the residences and the F3 Freeway as the quarry operation progresses. Generally, the visibility of the quarry from these locations will diminish over time and, once quarrying and rehabilitation have finished, there should be little obvious visual evidence of its presence.

The visual impact assessment was undertaken by considering changes to the visual field from five locations outside the boundaries of the property. These points are identified in *Table 5.9* and *Figure 22*. Sight-line sections from each of the locations were used to identify visible features for relevant stages of quarry's operation. Photographs were taken to show the existing views from each of the locations.

Table 5.9: View Points for Visual Impact Assessment

View Point	Position
View Point 1 (*Figure 23*)	Nearest neighbours SE of the quarry site (R5 and R6). Elevation 222 to 225m AHD. Two new residences located approximately 75m from the boundary of the quarry property.
View Point 2 (*Figure 24*)	Sydney-Newcastle Freeway (F3) along eastern boundary. Elevation approximately 187m AHD. Located approximately 350m from the boundary of the quarry property.
View Point 3 (*Figure 25)*	Nearest neighbours adjacent to the NW buffer area (R1 and R2). Elevation 257m AHD. Located approximately 15m from the boundary of the quarry property.
View Point 4 (*Figure 24)*	Wisemans Ferry Road, west of the site. Elevation approximately 260metres AHD. Located on boundary of quarry property.
View Point 5 *(Figure 26)*	Nearest neighbours SW of the quarry site (R4). Elevation approximately 265m AHD. Located approximately 30m from the SW corner of the quarry property.

5.9.3 Impact Assessment and Mitigation

The quarry will be below the natural ground level except for the area in the south-eastern corner occupied by decommissioned tailings dams. This area, which will be rehabilitated during Stage 1, will receive substantial plantings of native vegetation. The washing plant which is approximately 8 to 10 metres high and the sand stockpiles (five to six metres high) will be located initially in *Cell 3* approximately 20 metres below the adjacent ground surface. The plant and stockpiles will be relocated to the quarry floor of *Cell 2* at about RL216 early in Stage 2 (Year 3) where they will be less visible.

Quarry faces will be worked initially along the exposed northern boundary and later from the centre of the quarry towards the west. These working areas will be progressively rehabilitated as the quarry develops.

Noise mitigation bunds being constructed around much of the property will also influence some visual outlooks. These bunds will be vegetated with native species.

The quarry's operation will not involve night-time work or the use of lights. If security lights are necessary, they will be low powered and located and directed to avoid impacts on surrounding areas.

View Point 1: Two residences (R5) and (R6) near this location have clear views across the eastern portion of the quarry site over the elevated banks of the existing tailings dams and water control structures, the quarry faces along the northern boundary and the washing plant and stockpile areas. This will be the view most affected by the quarry as much of this view-scape will be of disturbed land within the quarry (*Figure 23).*

This view will change significantly over the first 5 years of the operation as

- noise bunds are constructed;
- the south-eastern corner of the property is rehabilitated;
- a new fresh water pond is constructed;
- quarrying operations then preparatory work for rehabilitation extend along the northern boundary; and
- the washing plant is moved to a less visible location within a tidier quarry complex.

A new noise bund to be constructed along the southern boundary during the construction period will be planted with native species. The bund will reduce the visibility of the quarry immediately and its vegetation will soften the southern aspect of the quarry property in the longer term.

The view will change progressively to one that has a greater level of order and substantial areas of new vegetation. Over time, the visibility of quarry operations will become less and evidence of the quarry will be replaced with native bushland typical of the area.

View Point 2: The visibility of the quarry from the F3 Freeway has diminished since the Freeway was constructed as trees have grown on its western side and the median strip. In 2004, only glimpses of the upper part of the present quarry high wall and the higher parts of the north-western corner were possible from moving traffic (*Figure 24).*

The visual field will change over the life of the quarry mainly through the gradual exposure of disturbed rock surface as the Stage 2, 3 and 4 high walls takes shape. The exposure of quarry faces will be offset, however, by the growth of vegetation along the freeway and the eastern boundary of the quarry property. The growth of roadside vegetation since 2004 has all but obliterated visibility of the quarry from the F3.

View Point 3**:** There are three residences (R1, R2 and R3) near this location the views from which, potentially, could be affected by the development of the quarry. Parts of the quarry can be seen through trees from Residence R1 at present although the quarry is unobtrusive. The quarry cannot be seen from Residences R2 and R3 at present at present because of intervening vegetation, although it may be possible to see parts of the quarry from the eastern portion of the property on which R3 is situated. This part of the property is undeveloped and well away from the property's residence (*Figure 25).*

Present native vegetation will be retained in a 100 metre wide buffer area adjacent these residences. The buffer will be supplemented by a noise mitigation bund which will also be planted with endemic species. The retained vegetation and the vegetated bund will continue to block views of the quarry, including views of the relocated access road, throughout its operational life.

View Point 4: The only part of the quarry that can be seen from Wisemans Ferry Road at present is the entrance gate (Figure 24). The existing tree cover and topographic slope that currently shield all views into the quarry will remain unchanged. The design of the new gate will be different and probably more visible from the road.

***View Point 5*:** At present the quarry cannot be seen from this location because of the existing tree cover on the quarry property and along its southern boundary. This may change progressively as quarrying operations move towards Wiseman Ferry Road in Stage 4 of the development and the quarry face along the northern boundary and the access road becomes visible (*Figure 25*).

A four metre high noise bund will be constructed along the southern boundary adjacent to this viewing location during the construction period. This bund and adjacent areas will be planted with endemic species which, by the time Stage 4 begins, should have grown sufficiently to block or substantially block views of the northern face of the quarry. Care will also be taken not to remove existing vegetation along the southern boundary that might lead to the quarry being exposed from this location.

5.10 TRAFFIC

5.10.1 Introduction

A new access into the quarry from Wisemans Ferry Road was designed in the latter part of 2010 to traffic engineering requirements of the Department of Roads and Maritime and the Gosford City Council (*Figure 11* and *Figure 12*). The assessment from 2004, which was the basis for this work and approval, is included below. Information on traffic volumes has been brought up to date where possible.

5.10.2 Existing Environment

Access to the Rindean Quarry has been from Wisemans Ferry Road throughout its 25 year operating life. Wisemans Ferry Road has a north-south orientation and is straight for the length of the quarry property. It turns through a tight corner of more than 90^0 at its junction with Lackersteens Road, approximately 100 metres north of the quarry gate. All traffic is forced to a low speed to negotiate this corner. Wisemans Ferry Road turns through a gentle bend to the south near the south-western corner of the quarry property.

Visibility is clear to the north and south from the junction of the access road and Wisemans Ferry Road for vehicles emerging from the quarry. Vehicles travelling from the north will be travelling relatively slowly after negotiating the sharp bend. Those travelling from the south should be in the braking zone for the bend. The speed limit on this section of road is 80 kilometres per hour.

The access road from the shoulder of Wisemans Ferry Road to the gate is a formed gavel road with generous fillets to allow ample scope for trucks to turn left or right. It is not a smooth surface and might, therefore, cause chassis noise from empty trucks, in particular those with trailers, entering the quarry.

This section of the road services the active rural area to the west of the F3 Freeway between the growing Somersby Industrial Area and Peats Ridge Road. Vehicles using the road, range from private cars, tractors and service vehicles to heavy truck and tailer combinations servicing the local sand quarrying industry. As traffic data is not available for this section of Wisemans Ferry Road, there are no available estimates for either the total volume of traffic or the mix of traffic using this road. At best, data taken at other sites (*Table 5.9*) indicates that the volume of traffic on roads in the region has increased substantially over the past 15 years.

Traffic observations made at the gate of Rindean Quarry on Wisemans Ferry Road are:

- light vehicular traffic is common and continues throughout the day. Vehicles include passenger cars and light commercial vehicles servicing local economic pursuits including trades and rural activities;

- heavy traffic is common and continues throughout the day. Vehicles include truck and trailer combinations hauling sand from local quarries, tray-top trucks and semitrailers and miscellaneous heavy traffic (tractors, cranes etc);

- in many instances, it was not possible to determine whether the traffic was servicing local needs or through traffic from Gosford or the Somersby Industrial area;

- heavy traffic associated with sand haulage from other local quarries begins before 6am from Monday to Saturday inclusive.

Table 5.10: Traffic Volume Data (AADT) for Wisemans Ferry Road

Year	Wisemans Ferry Road MR225, Central Mangrove - Wisemans Ferry	Pacfic Highway SH10, Kariong - East Of Wisemans Ferry Road
1988	467	21337
1990	-	25519
1992	819	27291
1995	-	-
1998	-	33872
2001	-	39473

Source: RTA 2001

5.10.3 Impact Assessment

Until December 2003 when the previous quarry operation ceased, between five and ten loads of sand per week day were hauled from the quarry. This involved 10 to 20 tuck movements through the quarry gate. Some quarry traffic occurred on Saturday mornings.

Overall, the noise impacts of truck movements are likely to be similar to or slightly greater than those of the past. The new quarry operation is expected to create up to 10 loads per week-day at a production rate of 75,000 tonnes per annum and 20 loads per week-day at the maximum production rate of 150,000 tonnes per annum. This will involve 20 and 40 truck movements through the gate respectively. Saturday morning movements are expected to be approximately half of the week-day rate.

Trucks will operate with greater frequency than prior to December 2003, although the majority of trucks in future can be expected to be modern, larger and quieter vehicles. Improvements to the access road will mean less chassis noise from empty vehicles. Other vehicular traffic into the quarry will be relatively infrequent and of significantly lesser impact. The local road network has adequate physical capacity to cater for the additional traffic (*pers. comm.* A. Snelson, Gosford City Council).

The spread of vehicle movements across the day is also likely to be similar to past operations. There will be a peak in the earlier part of the morning with a lower frequency of movements through the rest of the day. This pattern will be driven by market demand.

On leaving the quarry, most trucks are expected to turn right on to Wisemans Ferry Road as this provides the most direct route to the F3 Freeway. Some with Somersby industrial area and Gosford destinations will turn to the left.

The increase in traffic on local roads will be incremental and relatively small. The increase is likely to be between 20 and 30 movements per day at full production above the pre-December 2003 movement rate. A dilapidation report for the road was prepared for and is held by the Gosford City Council.

Access to the quarry will be improved during the construction period. The improvements will include (Figures 11, 12 and 14):

- strengthening of the Wisemans Ferry Road shoulder and sealing of the access road from the road shoulder, including the fillets;
- construction of a drive-through wheel wash approximately 75 metres inside the gate and sealing of the access road to prevent sand and clay being carried on to the Wisemans Ferry Road;
- installation of a new gate to deter unauthorised after hours access. The gate will be set back from the road to allow clearance for a truck trailer combination to stop with ample clearance; and
- installation of stop signs at the quarry entrance for traffic leaving the quarry.

The wheel wash will be a drive-through facility located approximately 75 metres from the gate. Trucks leaving the quarry will be required to stop before entering Wisemans Ferry Road as a safety measure. As visibility from the quarry entrance is clear in both directions and road traffic speeds should be relatively low, road safety should not be an issue. All trucks loaded with materials likely to generate wind blown dust must be covered by law.

The internal haul road in the quarry will be a formed road with a coarse, non-skid surface. A temporary road to the present site of the process plant and product stockpiles will be constructed for Stage 1 of the quarry's operation. A permanent road will be constructed generally following the northern boundary as part of the excavation of cells 3 and 4. The road will have a constant gradient of approximately one in ten (1:10) to minimise the noise of gear changes as loaded trucks leave. The road will be graded periodically to maintain an even surface to minimise the chassis noise of empty trucks. The noise levels of haulage operations were considered in *Section 5.5*.

5.11 WASTE MANAGEMENT AND CLEANER PRODUCTION

5.11.1 Introduction

The site is at present in an untidy state as a result of its prior occupation by a contract operator. The intention is to clean up the site during the initial stages of the quarry's operation and to conduct future operations in accordance with sound quarry management practices.

All materials produced as a result of quarrying operations will be sold as product or used in rehabilitation. Waste from the quarry site will be limited, therefore, to materials associated with the maintenance of plant and equipment, rubbish from a site cleanup, waste materials from the demolition of a house and outbuildings on the property, and putrescible and human waste associated with the occupation of the site.

5.11.2 Dealing with Present Waste

The site at present has a scattering of waste materials associated with past quarrying activities. These materials include plant and equipment parts, tyres and concrete. Metallic materials will be taken to a scrap yard for recycling. Concrete will be crushed and used as a

stabilising material on the site. Old tyres will be used as road markers or stockpiled prior to disposal in the required manner.

An old house and outbuildings on the property will be demolished during Stage 1 or early in Stage 2 of the quarry operation to make way for future quarrying. These buildings are principally of timber frame and fibro sheet construction. Because of the age of the buildings, the fibro sheet is likely to contain asbestos. Those materials that have a future use will be considered for recycling. Other materials will be dumped at the local Council waste facility.

The fibro sheet will be removed from the structure, handled in the required manner and disposed of by a contractor licensed to remove asbestos materials.

5.11.3 Dealing with Future Waste

Waste and recyclable materials will be managed in accordance with good management practice. As far as practicable, the disposal of waste from the servicing of plant and equipment, in particular tyres, will be the responsibility of the service contractors. Waste that remains the responsibility of the quarry will be collected in bins for recycling or disposal at a local facility. Hydrocarbon contamination of soil will be avoided through the proper handling of fuels and oils and maintenance of plant and equipment. Hydrocarbon contaminated soil will be treated on site on a case by case basis.

The use of portable serviced toilets or composting toilets will eliminate problems associated with a septic system. Putrescible waste will be collected in separate covered bins and disposed of regularly at a Gosford Council facility.

5.11.4 Cleaner Production

The proposal will generate wastes typical of quarry operations, including used oil and grease, used packaging, cleared vegetation, construction debris, sewage, overburden and fines. The quarry will operate in accordance with the principles of the *Protection of the Environment Operations (Waste) Regulation, 199*6. Waste minimisation practices will be adopted throughout the quarry's operating life. These practices will include the conservation of energy, avoiding spills, reusing surplus materials and using recycling facilities. Particular measures that will be adopted by the quarry will include:

- purchasing and contract practices that include environmental and waste considerations;
- separating recyclable materials from the mixed waste stream where practicable;
- collecting used oils and grease separately for recycling off-site;
- collecting residual wastes separately and disposal at the nearest Council landfill;
- using cleared vegetation where appropriate for timber or to enhance habitat in rehabilitation areas; and
- using surplus overburden and fines in the rehabilitation of the site.

Equipment will be selected to ensure maximum energy efficiency in order to minimise greenhouse gas emissions. Most fixed plant will be powered by electricity.

5.12 LAND USE AND TENURE

5.12.1 Existing Environment

The Somersby Plateau is occupied by a mix of commercial horticulture, poultry farms, grazing, extractive industry, educational, tourist and recreational facilities, hobby farms, rural/residential properties, plantations, transport corridors and bushland, including that in State forests and national parks. Land use in the vicinity of the site is for rural/residential, an educational and tourist facility, experimental horticulture and forestry purposes (*Figure 27*). Extractive industry has been conducted at the Rindean Quarry for 25 of the past 30 years and in the region for considerably longer.

The small rural 'village' of Somersby is approximately 1.8 kilometres north-north-west of the quarry. The Brisbane Water National Park is approximately 3.5 kilometres south-west of the quarry and Strickland State Forest is 500 metres to the east. There are several other active sand quarries on the Somersby Plateau.

The area can only be regarded as semi-rural. The influence of the F3 Freeway, for example, leads to the classification of the noise environment of the area under the Industrial Noise Policy as "suburban".

5.12.2 Impact Assessment

The reopening of the Rindean Quarry will have no effect on present or likely future land uses of the area. It is neither a new use of the property nor a new land use on the Somersby Plateau. The quarry is relatively small compared with major quarries in the area and its expansion will render it only a middle-sized operation. Its reopening will not prevent present uses or likely developments on adjoining properties, even for rural-residential living.

The additional safeguards being introduced through this development application and EIS will protect the existing values of the area. Details of these safeguards are in other sections of this EIS. The final use planned for the property is as bushland of the type typical of the region.

5.13 SOCIO-ECONOMIC IMPACTS

5.13.1 Existing Environment

The socio-economic environment of the Somersby Plateau is similar to that of other coastal hinterlands adjacent to larger population and commercial centres. Grazing and commercial agricultural properties are being subdivided into smaller rural-residential properties and hobby farms, the nature of small business is changing and the rural lifestyle is becoming a semi-urban lifestyle. Most employment is out of the area as the populations grow and local employment opportunities do not keep pace. Many services are supplied from outside the immediate area because of greater mobility.

5.13.2 Contribution to the Local and Regional Economies

Rindean Quarry will contribute to the local economy in several ways. It will employ up to three full time, permanent plant operators and general hands who will operate excavation, processing and loading plant, conduct rehabilitation earthworks, maintain water management infrastructure and equipment and carry out the miscellaneous tasks associated with a quarrying operation. Additional casual or contract personnel will be engaged from time to time to meet peak demands, conduct rehabilitation work and undertake the maintenance of

machinery and equipment. A large part of wages payments, estimated to be up to $200,000 to 300,000 per annum at present values, is likely to go to local employees.

Additional indirect employment will result from the use of independent hauliers, some of who will be Sydney based and most of whom will be self-employed. Fuel and other supplies required for the quarrying operation will, wherever possible, be obtained from local suppliers. Indirect employment arising from the quarry's operation has been estimated to be equivalent to eight to twelve full-time jobs.

The output value from the quarry ranges from $1.85 million to $3.85 million per annum at average production rates of 75,000 and 150,000 tonnes per annum respectively, or up to $77 million for the life of the quarry. Direct annual expenditure by Rindean Quarry will be in wages, taxes, materials and services. Much of the expenditure will be with local businesses. Increased overall employment and expenditure resulting from the development of the project will occur through both indirect and induced multiplier effects.

The increased availability of a range of sand products will increase trade with Sydney construction markets as other present Sydney supplies are exhausted. It will also assist the local building industry. As competition from the large and expanding Sydney markets increases and quarries become tied to major industries as is happening, the availability of product to the smaller local market is likely to become restricted. Increasing the number of local suppliers will ensure the availability of sand product locally.

5.14 SAFETY

5.14.1 Public Safety

Public safety considerations have been taken into account throughout the planning of the proposed quarrying operation and these are described in *Section 3.7*. Quarrying is an extractive industry that engages heavy equipment and, therefore has inherent risks. In the type of operation proposed for Rindean Quarry the risks, apart from those associated with the transport of product and supplies on public roads, are contained entirely within the quarry site. There will be no blasting, for example, and, therefore, no risk of fly rock.

Although the quarry operators will have a duty of care to minimise the risks associated with quarrying and to protect the public to a reasonable extent, the public also has a responsibility not to trespass on the property.

The perimeter of the property will be delineated by a 2 metre high chain wire and barbed wire fence. Warning signs will be erected at the quarry gate and at intervals of approximately 50 metres along the perimeter fence. Warning signs and protective fencing will be placed on areas of significant risk within the property. The access road, office and loading areas will be sign-posted as will no-go areas. Surveillance of the property will be maintained.

The general public will not be permitted in the quarry. Anyone entering the quarry on business will be required to register first at the site office. Small volume sales will be made to assist local businesses and property owners. Purchasers will be required to adhere strictly to the rules of the quarry, to remain on the designated access road and to load in a designated area.

Action will be taken within the rehabilitation program to ensure that the risks associated with many abandoned quarries are minimised. Two elements of the final landscape potentially will carry an elevated risk, the quarry faces and wet areas including remaining dams.

Final quarry faces will be benched, broken down to the extent practicable by ripping and revegetated after quarrying is completed to minimise the extent of any remaining high walls. All remaining walls and slopes will be left in a stable form Wet areas will be drained and capped, including any remaining tailings storage. Water supply ponds that remain in the quarry after operations cease will be integrated into the final landscape to provide valuable wildlife habitat.

5.14.2 Road Safety

Road safety is considered in *Section 5.10, Traffic*.

5.15 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Ecologically Sustainable Development (ESD) relates to the use, conservation and enhancement of "the community's resources so that ecological processes are maintained and the total quality of life, now and in the future, can be increased". The Environmental Planning and Assessment Regulation 2000, lists the four principles of ESD as:

The Precautionary Principle

The *Environmental Planning and Assessment Act, 1979*, states that "if there are threats of serious or irreparable damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation".

Rindean Quarry is an existing quarry that has been operated for 25 of the past 30 years. More than 50% of the site is disturbed. The development program includes rehabilitation of disturbed areas and the area that will be disturbed in the future. Threats to natural processes within the site will be small and threats beyond the site minimal.

Social Equity

Significant issues of social equity relate to visual amenity, noise and resource access.

Visual amenity and noise will be addressed through appropriate management measures throughout the life of the quarry.

The quarry contains an important resource for regional and Sydney economies in a site that is already in a significantly disturbed state.

Conservation of Biological Diversity

There are issues related to the conservation of biological diversity. The flora and fauna study concluded that the development is unlikely to have any significant impact on threatened species, populations or ecological communities or their habitats provided that certain safeguards are followed. Fresh habitat consistent with the natural bushland of the area will be created by rehabilitation.

Valuation of Environmental Resources

The quarry contains a significant resource of construction material that far outweighs the value of the natural resources on this already disturbed site. The quarry will not affect the value of adjacent environmental resources. Rehabilitation will restore the site.

5.16 BUSH FIRE MANAGEMENT

The potential for Rindean Quarry to act as a source of or as a propagating agent for fire presents a low risk for the surrounding neighbours. The low risk of fire is related to the nature of the operations and, of the cleared and highly disturbed nature of the Rindean Quarry site. Quarry operations generally have a low number of potential ignition sources that

are usually confined within the quarry pit and floor areas away from the existing vegetated areas.

Local and regional fire risks are associated with hot, dry winds from the west around to the north of the quarry during the warmer months of the year. Rindean Quarry is sited to the east of the north-south trending ridgeline, and is sheltered to some degree from westerly winds. Most probable source of fire would be one blown into the quarry from this direction, but its path would be affected by the presence of the active quarry areas which provide little fuel for fire propagation. However, this risk will potentially increase in time as rehabilitation programs expand.

Principle sources of fire within the quarry will be equipment fires, vehicle fires and litter or rubbish fires.

The internal management by Rindean Quarry will, at all times, aim for the prevention or mitigation of any fire and source of fire on site. Bush fire management strategies to be employed at the quarry are:

- a reduction of excessive fire fuel loads within regrowth vegetation, buffers and rehabilitation;
- avoiding build up of litter or rubbish;
- the construction and maintenance of fire breaks along boundaries where the need is identified;
- a ban on unauthorized fires on site; and
- maintenance of basic fire fighting capacity i.e. extinguishers for equipment fires, a pump and hose on the water cart and knapsack sprays on quarry vehicles for other fires.

The risk of fire is elevated for the north-western corner of Rindean Quarry property. This area consists of woodland vegetation with some weed species which continues across the shared boundaries with the two neighbouring residences. In this corner, a six metre wide fire break will be cleared from the boundary into the buffer to contain the spread of fire and to provide access along this boundary for fire fighting.

Protection of threatened species and tree hollows will be observed during any clearing in the this area. Removal of weeds will help minimise the potential fuel loads from introduced species i.e. Lantana *(Lantana camara)* and Bitou Bush (*Chrysanthemoides monilifera ssp rotundata*).

5.17 SUMMARY OF IMPACTS

In general, the potential environmental impacts of the proposal are low. They are low because of the present state of the site, the nature and relatively small scale of the project, mitigations measures that will be put into place and the decision to conduct a progressive rehabilitation program which will address past damage and restore areas that will be quarried in the future. The principal matters of concern relate to the effects on groundwater and the noise exposure that the quarry will generate. Both matters have been addressed comprehensively by consultants, who are specialists in these fields.

Table 5.11 below contains a summary of the principal environmental impacts that are predicted and the mitigation measures that are proposed. It also addresses the key issues identified in the Director Generals Requirements (*Annex 2*).

Table 5.11: Summary of Environmental Risks and Mitigation Measures

Environmental Factor	Environmental Risk Potential	Mitigation Measures
CLIMATE		
Major storm event	Low	• Water management system is designed to accommodate major storm events (*Section 5.1.2*). • Site designed for water discharge through the freshwater ponds to reduce sediment load and existing lined channel to adjacent un-named creek.
GROUNDWATER		
Lower water-table and reduced capacity in water supply bores in adjacent properties.	Medium	• Selected bores will be monitored on properties adjacent to the quarry for evidence of falling water levels and change in water quality. • Bores identified as being affected significantly by the quarry (possibly three) will be deepened at Rindean Quarry expense. • A groundwater monitoring program approved by the NSW Office of Water will be followed.
Changes in groundwater quality.	Low	• No materials will be used in quarrying or water management that might affect water quality. • Refuelling of plant will be by contractor at designated points. Only small quantities of fuel will be stored on site.
SURFACE WATER		
Release of contaminated water into Narara Creek.	Low	• Under normal conditions water released from the site will be water conditioned in the storage ponds. (see Water Management Plan). • Stormwater management will minimise sediment contamination in discharge.
Inadequate treatment of stormwater runoff prior to discharge.	Low	• A stormwater retention basin on the quarry floor will supplement other water storage during major storms. It will have sufficient capacity to manage water from a design storm event and act as an temporary settling pond for stormwater. • Where possible, water to be discharged after storm events will be held on site to allow sediment to settle out. • All water discharges will pass through the freshwater ponds. The residence time of water in the basin and ponds will reduce sediment loads of water prior to discharge. • Discharges of sediment contaminated water will occur only during rare extreme storm events.
Sedimentation of runoff water.	Low	• Erosion control measures will limit suspended sediment loads in runoff water. • Surface runoff including that from work areas will be staged through settling ponds to remove sediment. • Runoff will be minimized through land management and rehabilitation programs. • Soil conservation works will be designed to minimise erosion.
Reduced surface water flow to Narara Creek catchment	Low	• Surface waters from above the quarry will be diverted around the quarry site. • The quarry is only a small part of the Narara Creek catchment.
SOIL EROSION		
Erosion of south-eastern embankments	Low	• Runoff will be drained towards the center of the quarry. • Embankments will be planted with native species to stabilise them.

Erosion associated with dam construction, road works, quarry operations and rehabilitation.	Low	• Areas of bare soil will be kept to a minimum. • A system of drains will be constructed to control surface water flow. Gradients of drains will be maintained at 2% or less and sand bags or rock barriers will be used to limit flow rates. Drains will be formed in competent sandstone where possible. • Rehabilitation and revegetation will begin early in the quarry's redevelopment (*Section 4*). • Erosion-prone land will be stabilised. • Sediment traps will be installed around areas to be disturbed. • A Erosion and Sediment Control and Surface Water Monitoring Plan has been prepared (Volume 3, Part 6.2).
		NOISE
Excessive noise impacts at adjacent residences.	Low to Medium	• The noise of quarrying and transportation operations is expected to remain within operational noise goals set for the quarry in accordance with the NSW Industrial Noise Policy. • An exception may be during the first 26 weeks when initial establishment operations will be conducted (construction of bunds and the access road). • Noise mitigation will be an integral part of the management of the quarry. • Noise control bunds will be constructed in critical areas of the quarry's perimeter at the beginning of the program. Bunds will be vegetated. • Quarry faces will be used to mitigate noise. • The access road will have constant gradient of 1:10 to minimise noise levels associated with gear changes of trucks leaving the site. • The first 80m of the access road will be sealed to eliminate chassis noise of empty trucks. The access road will be maintained free of potholes and corrugations. • Constraints will be placed on the operation of trucks: eg no use of exhaust brakes. • All plant and equipment will be selected to meet acoustic performance criteria. The principal criterion will be to meet operational noise goals. • A Noise Management Plan has been prepared (Volume 3, Part 6.4). All employees and contractors will be briefed on the requirements to minimize noise. • Noise monitoring to be conducted as a part of environmental audits and following valid complaints.

AIR QUALITY		
Dust affecting neighbouring properties	Low	• Precautions recommended by the air quality consultant will be taken to minimize the generation of dust. • Substantial parts of the quarry will remain damp due to seepage. • Fines removed from washed sand will be stored under water in tailings dam. • Quarry will be excavated below ground level. Wind speeds within the quarry should generally be low. • The exposed area of the quarry will be reduced to and maintained at approximately 5 hectares by rehabilitation and quarry management programs.. • The access road and loading areas will be maintained in a damp condition. The wheel wash will eliminate dust near the access gate. • Stockpiles and other loose materials will be maintained in a damp condition. • Vegetation along the quarry boundary will provide shelter from high winds and minimize the carriage of dust beyond the property.
Green house gas	Low	• The greenhouse gas assessment determined that the quarry would be well below reporting thresholds.
FLORA AND FAUNA AND REHABILITATION		
Risk to threatened species, populations or ecological communities or their habitat	Low	• The risk of impacts has been determined as being low by a specialist consultant provided safeguards are implemented. • Vegetated buffers of varying widths will be maintained around the quarry. • The clearing of native vegetation will be kept to a minimum. Habitat trees will be retained wherever possible. • Weed and feral pest control programs will be maintained. • Rehabilitation programs will establish new habitat on the site which will offset vegetation that will be removed for quarrying. Endemic species will be used in rehabilitation wherever possible.
ARCHAEOLOGY		
Disturbance of archaeological material	Nil	• The property was found to be of low Aboriginal cultural significance. On isolated artefact found will be relocated in an approved manner. • There are no sites of non-indigenous heritage..
VISUAL IMPACTS		
Reduced visual amenity in areas surrounding the quarry	Low	• Buffers will be maintained around the property. Vegetation in buffers and on noise bunds will reduce or eliminate views of operational quarry areas. • Rehabilitation programs will restore native vegetation in buffers, presently disturbed areas and operational areas once they are decommissioned. • Rehabilitation will include extensive tree planting programs. • The washing plant and stockpiles to be relocated to quarry floor where their visibility should be minimal..

TRAFFIC		
Increased traffic risks at the entrance to the quarry	Low	• All vehicles leaving site will be required to stop before entering Wiseman Ferry Road. • The intersection of the access road and Wisemans Ferry Road has been designed in accordance with the requirements of State authorities and the Council. • The access road will be maintained to safe trafficable standard. • Wheel wash located 70m inside gate will eliminate the carriage of dust and sand on to Wisemans Ferry Road.
Increased traffic risks on Wisemans Ferry Road	Low	• Quarry traffic will add only a small increment of traffic to a road which carries a substantial volume of heavy traffic daily.
CLEANER PRODUCTION AND WASTE MANAGEMENT		
Risk of site contamination	Low	• All waste materials will be stored correctly in suitable areas. • Refuelling of plant will be performed by a contractor. Only small amounts of fuel will be stored on site. • Fuel handling and clean up procedures to be posted. Spill clean up kits will be placed in locations where they are required and staff will be trained in their use. • Few chemicals and no hazardous chemicals will be used on the site. • Material from the demolition of old buildings will be disposed of in the manner required by waste management regulations. • Waste minimization will be practised.
HAZARDS AND RISKS		
The quarry will be a public risk	Low	• The quarry is not a public place. • A security fence and signage will be constructed around the site boundary when construction starts. • There will be no activities within the site, such as blasting, which will cause public risk beyond the site boundary. • Operating risks within the site will be managed in accordance with extractive industry safety regulations..
UTILITIES AND SERVICES		
Public utilities and services will be affected by the quarry	Low	• Mains electricity is an established supply which will not change for Stage 1 and 2. The supply may be relocated for later stages of the quarry. • Town water and sewage will not be connected.
LAND USE AND TENURE		
The quarry will constrain future land uses and values in the area.	Low	• The quarry has operated since 1979, and its reinstatement will not prevent present or likely future uses from occurring.. • The safeguards proposed in the EIS and rehabilitation will reduce the impacts of the quarry and any effect it may have had on the values of the surrounding area.
BUSHFIRE MANAGEMENT		
The quarry is a fire risk.	Low	• Quarrying has an inherently low fire risk. Operations will be conducted in cleared areas away from boundaries. • A fuel reduction program will be maintained in areas of native vegetation and in rehabilitation areas. • Fire breaks will be constructed and maintained in consultation with neighbours where they are considered necessary. • Appropriate fire extinguishers and fire fighting equipment will be installed.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING

6.1 QUARRY MANAGEMENT PLAN

6.1.1 Commitment To Prepare And Maintain A Plan

The Rindean Quarry will be operated throughout its remaining life in accordance with an approved quarry management plan incorporating an environmental management plan. A Quarry Management Plan for initial construction work and Stages 1 and 2 (years 1 to 5) of the quarry's operation forms Volume 3 of this EIS. Plans for subsequent stages will be submitted to the Gosford City Council for consideration prior to the respective stages commencing.

6.1.2 Content Of The Quarry Management Plan

The quarry management plan for Stages 1 and 2 sets down the objectives for each issue relevant to the Rindean Quarry and the potential impacts associated with the operation at the quarry. Control measures and safeguards will incorporate management options for the quarry's day to day management to ameliorate any impacts on the surrounding environment and neighbours.

The Quarry Management Plan consists of six parts, namely:

- Part 1, the introduction, deals with the authority for the quarry's operation, details of the property, information about the operating company, community consultation and security deposits;
- Part 2 sets the parameters for the preliminary works required to reinstate the quarry's operation and the hours of operation;
- Part 3 describes the stages of the quarry operation and sets down a work program for, Stages 1 and 2;
- Part 4 describes the design and operation of the quarry to provide the community with an understanding of how it will function and as background to the plan generally;
- Part 5 describes the auditing and reporting requirements;
- Part 6 contains environmental management plans for eight separate elements of the quarry's operation, namely:
    - 6.1 Groundwater Monitoring and Management Plan
    - 6.2 Erosion and Sediment Control Plan and Surface Water Monitoring Program
    - 6.3 Rehabilitation Strategy and Landscape Management Plan
    - 6.4 Noise Management Plan
    - 6.5 Air Quality Management Plan
    - 6.6 Safety, Hazard and Waste Management Plan
    - 6.7 Transport and Traffic Management Plan
    - 6.8 Water Supply and Sewerage Plan

6.2 ENVIRONMENTAL MONITORING PROGRAMS

6.2.1 Commitment To Maintain Independent Monitoring Programs

Key indicators of the environmental performance of the quarry will be monitored periodically throughout the life of the quarry as described in the Quarry Management Plan (Volume 3). Results against these indicators will be recorded in an annual report to the Gosford Council. The results will be used to determine whether short-term environmental changes are occurring and whether changes are necessary to management practices. They will be taken into account in audits that might be required by authorities from time to time and in the preparation of the revised management plans for subsequent stages of the quarry's operations.

6.2.2 Criteria To Be Monitored

The criteria to be monitored are identified in the Quarry Management Plan (Volume 3).

6.3 ENVIRONMENTAL REVIEW AND REPORTING

An annual report of the quarry's operations will be prepared for consideration by the Gosford Council and the relevant New South Wales Government authorities. The report will be submitted to authorities within four weeks of the anniversary of the approval of the quarry management plan in force at the time. The report will be a public document.

The report will contain:

- data on the output of the quarry;
- a summary of the results of monitoring key indicators of environmental performance;
- an assessment of progress with the rehabilitation program; and
- a summary of complaints received from the public and responses taken in regard to complaints.

7 PROJECT JUSTIFICATION AND ALTERNATIVES

7.1 PROJECT JUSTIFICATION

7.1.1 Overview

An earlier assessment of the demand for construction sand (Pienmunne & Whitehouse, 2001) concluded that the Sydney and local sand markets would experience a shortage of construction sand within approximately 10 years unless new resources are developed. This is becoming the case. The Somersby Plateau has been identified as an area that is strategically located to markets and has substantial resources of construction sand. It makes both economic and environmental sense to work established sand quarries to the limits of their economic lives ahead of establishing new quarries on green-field sites. Rindean Quarry provides one such opportunity.

The Land and Environment Court considered the broader public interest associated with the continued operation of the Rindean Quarry. The Court accepted that, "there is a broader public interest in the continued availability of the sand resource from the site." (*Land and Environment Court of NSW, Record of Hearing Number 10889 of 2002*, Page 30)

Rindean Quarry has operated as an extractive industry for much of the past 33 years since the original development consent was issued. The present condition of the site reflects this use by successive owner-operators and lessees. Reopening the quarry in the manner proposed provides the best opportunity to rehabilitate the site to a visually acceptable and safe area.

The environmental and economic cases for the reopening of Rindean Quarry are well established.

7.1.2 Supply and Demand for Sand Products

The Sydney Planning Region consumes nearly 7 million tonnes of construction sand annually, 85% of which is sourced from within the region (Pienmunne & Whitehouse, 2001). The main present sources of construction sand within the region, which extends from Wyong in the north, to Wollondilly in the south, and to the Blue Mountains in the west, have been Kurnell Peninsula, the Penrith Lakes area and the Somersby Plateau. Pienmunne & Whitehouse (2001) estimated that, in the short-term until 2010 (now past), the demand for sand could be met from these existing sources and operations. However, it was understood that, production from Kurnell would cease leading potentially to a short-term shortfall in fine to medium grade construction sand. It was also predicted that in about 2010 production of sand from the Penrith Lakes Development Scheme will cease leading to a shortfall of approximately 2.2 million tonnes of medium to coarse-grained sand annually.

Although the lives of other sources of sand have been extended, when sand from these sources becomes unavailable, the shortfalls will have to be made up either from other resources within the region or from outside of the region. The costs of transporting sand into the region and demands for improved infrastructure for doing so will be felt both by the construction industry and Sydney Region development.

The Somersby Plateau is underlain by an estimated 300 square kilometres of friable sandstone (Pecover, 1984). This material is easily crushed and can produce most types of construction sand. This area, which is within the Sydney Planning Region, has been estimated to contain a potential resource of 9,000 million tonnes of construction sand

although only 30 million tonnes of this resource are available to current operations due mainly to planning constraints (Pienmunne & Whitehouse, 2001).

A letter from the Department of Minerals and Energy dated 14 August 2003 was tabled at the Land and Environment Court hearing as evidence. A portion of the letter was quoted in the Court's Record of Hearing, namely:

> The Somersby Plateau contains extensive resources of friable sandstone. Owing to land use and environmental constraints, however, much of this resource is unlikely to be available for extraction thus restricting the potential to extend existing operations or develop new sand extraction operations in the area.
>
> In the Departments opinion the quarry makes an important contribution to the construction sand supply of the Central Coast, this amount of material would otherwise have to be obtained from neighbouring areas which would lead to increased transportation costs which would ultimately have to be borne by the consumers, the resulting increased truck traffic, will also have attendant adverse impacts on the wider community. Furthermore the quarry has the potential to become a supplier of sand to the Sydney market.
>
> Provided that extraction can be undertaken in an environmentally acceptable manner, the Department considers Rindean quarry to be an appropriate use of a valuable resource.

Much of the Somersby Plateau land is classed as prime agricultural land by the *Sydney Regional Plan No.8 – Central Coast Plateau Areas* (SREP 8), which was introduced to protect the agricultural capacity of the area from the encroachment of other land uses (Spackman, 1992). However, debate is continuing within Government with a view to determining an appropriate land use balance between the conservation of prime agricultural land and access to the important mineral resources. While this is continuing, it will be important to maintain and develop those resources that are not directly affected by planning constraints. The Rindean Quarry is one such resource.

The proximity of the Rindean Quarry is ideally located to supply construction sands for residential, commercial and industrial developments and supporting infrastructure in both the Central Coast and Sydney markets. Rindean Quarry can produce both yellow and white clayey mortar sand and washed sand for concrete batching as its principal products. It could, therefore, be developed as an alternative to the Kurnell and Penrith Lakes operations as an important supplier of these products to the Sydney market.

7.1.3 Other Regional Sand Mining Operations

There are currently three significant producers of construction sand products in the Somersby Plateau. They are:

- Hanson Quarries, Somersby;
- Grants Road Sands, Somersby;
- Rocla Quarry Products, Calga;

Hanson Quarries and Grants Road Sands are the closest quarries to Rindean Quarry, located 2.5 km and 3.5 km respectively to the southwest.

7.2 ALTERNATIVES

7.2.1 Not Proceeding

Opportunities to contribute to market demand from an established quarry would not be achieved. The structured rehabilitation of a site that has been extensively disturbed by 25 years of quarrying could not be achieved. Employment and income opportunities would be lost.

7.2.3 Quarrying Methods

The quarrying methods to be used are consistent with good management and operating practice in the sand extraction industry in the region.

7.2.4 Access Modes And Routes

Routes for the transport of quarry product, as well as those for nearby quarries and other economic activities, are well established. Loaded trucks will turn left or right into Wisemans Ferry Road from the quarry depending on the destination of the loads. There are no feasible alternatives available.

The access to the quarry has been designed in consultation with the Gosford Council and the Department of Roads and Maritime. It was moved to its present location some years ago. The only alternative access route into the quarry would be from the unmade road that follows the northern boundary of the property. The impacts of using this route would be significant.

7.2.5 Water Management Practices

Water management will be conducted in accordance with the water management plan which has been prepared to meet all regulatory requirements. Water use and management practices will be developed to ensure the greatest practicable efficiency in the conservation and reuse of available water. Water management practices will be kept under review to ensure that these targets are met.

7.2.6 Final Landform

The final landform will be determined by the local topography, the quarrying profile, the treatment of water storages and drainage and the rehabilitation program. Because of the relatively small size of the site, practical alternatives within the final landform will be few.

7.2.7 Product Transportation

There are no alternatives to road haulage of sand product from the quarry. Because of the nature of the products and the locations of markets, haulage contractors generally use modern high powered vehicles that meet all road safety and noise emission requirements.

8. CONSULTATION

8.1 CONSULTATION WITH GOVERNMENT AUTHORITIES

The Environmental Impact Statement published in December 2004 was the subject of extensive consultation with government authorities, the Gosford City Council and the community prior to a deferred development consent being issued by the Gosford City Council on 20 June 2006 and an amending consent being issued on 17 September 2007.

Because of delays in meeting the conditions of the deferred commencement, the consents lapsed in June 2011. A fresh development application became necessary to reopen the quarry and Director General's Requirements for a new EIS to accompany the development application were requested of the Department of Planning in July 2011.

The development proposal described in this EIS is identical in most respects with the 2004 proposal as amended by the development consents. The content of this EIS a composite of past public documents prepared, the 2004 EIS, the 2007 s96 report to modify the 2006 consent and the quarry management plan approved by the Council in April 2011. Therefore, consultation during the preparation of this EIS has been limited to those matters that differ from previous work or matters that have carried through from the earlier consents, such as the water access licences.

During the preparation of the EIS and the submission of a fresh development application the principal people and organisations have been consulted are:

- the Gosford City Council regarding the process to be followed, the content of the EIS and timing of the development application;
- the Department of Planning regarding fresh Director General's Requirements which were issued on 2 August 2011 and the application of those requirements;
- the NSW Office of Water regarding water licences and the acquisition of allocations;
- NSW Office of Environment and Heritage, Heritage Branch regarding requirements for a heritage assessment;

8.2 COMMUNITY CONSULTATION

The initial proposal was the subject of consultation with the members of the community likely to be affected by reopening the quarry.

1) Local residents were advised of the proposal to reopen of the quarry through an information sheet and attached location map that was distributed to residences within approximately 800 metres of the site on 17 March 2004. The information sheet advised that further information would be provided once initial investigations had been completed. Where opportunities presented, residents were invited to contact either Mr Cleve Smith or former consultant, Pacrim Environmental, to discuss issues.
2) A second information sheet was distributed to all residences within approximately one kilometre of the site during August 2004. This information sheet provided greater detail about the proposed development and the public consultation and assessment processes that were to follow.
3) The EIS was placed on public exibition for a period of four weeks during 2005 and 25 submissions were received by the council from members of the public and

community organisations. These submissions were taken into account by the Council in making the deferred development consent of 20 June 2006.

4) Mediation was conducted in November 2005.

5) A Section 96 application to modify the June 2006 consent was placed on exhibition in 2007 and six public submissions were received. These submissions were taken to account by the Council in making the amending development consent of 17 September 2007.

6) Local residents were advised by letter in April 2012 that a fresh development application and EIS were to be submitted to the Council and the reasons for doing so.

8.3 COMPLAINT MANAGEMENT

A system will be set up to receive and respond to complaints from the public about operations associated with the quarry. The complaints system will be established and maintained in the following manner:

1) complaints will be received by phone, fax or email to the Quarry's site office. When the phone is unattended, incoming calls and messages will be recorded;

2) complainants will be asked to provide information about the nature of the complaint, to state the date and time of the event and the complaint and to provide contact details for a response;

3) Rindean Quarry will respond to all complainants within 48 hours if telephone contact details are provided by the complainant. In instances where it is possible only to provide a written response, the response will be made within seven days of the complaint being recorded;

4) details of all complaints received and follow up action taken will be recorded in the complaints register;

5) the complaints register will be available at any time for inspection by authorised Gosford Council or State Government officials;

6) a schedule of complaints received will be included in any annual report.

It is Rindean Quarry's intention to operate in a manner that is consistent at all times with all of the requirements of the development consent and operating licence issued for the quarry. Circumstances that might lead to complaints being registered should, therefore, be infrequent. Rindean Quarry will avoid wherever possible causing any inconvenience to the community through its operations and will, therefore, respond to all complaints seriously.

ANNEX 2

SUMMARY OF RESPONSES TO THE DIRECTOR GENERAL'S REQUIREMENTS

1. Requirements Identified by the Department of Planning And Infrastructure

Director General's Requirements issued in accordance with Clause 73 of the *Environmental Planning and Assessment Regulation 2000* and dated 2 August 2011 (Appendix 1) set down *General Requirements* for the preparation of the EIS, identify *Key Issues* requiring a detailed assessment, list *Environmental Planning Instruments* against which the proposal must be assessed, list *Guidelines* that must be taken into account and set down requirements for Consultation.

1.1 General Requirements

These requirements are satisfied by the form and content of the EIS:

- an Executive Summary — Provided
- a full and detailed description of the proposal — Section 3
- conclusions justifying the development — Section 7
- a signed declaration from the author of the proposal — Provided

1.2 Key Issues

The key issues were identified in the Director General's Requirements. Each is addressed in a specific section of the EIS. The assessments of the major issues are supported by assessments by external consultants which can be found in the appendices to this EIS (Volume 2).

Issue	Reference in EIS
Soil and Water	Section 3.6, 5.1 to 5.4 and Quarry Management Plan
Traffic and Transport	Sections 3.8 and 5.10 and Quarry Management Plan
Noise and Blasting	Section 5.5 and Quarry Management Plan
Air Quality	Section 5.6 and Quarry Management Plan
Flora and Fauna	Section 4 and Quarry Management Plan
Rehabilitation	Section 4 and Quarry Management Plan
Heritage	Section 5.8
Visual Amenity	Section 5.9

Issue	Reference in EIS
Waste Management	Section 5.11 and Quarry Management Plan
Hazards and Risks	Sections 3.75.14, 5.16 and Quarry Management Plan
Utilities and Services	Section 3.6 and Quarry Management Plan
Social and Economic Impacts	Section 5.13

1.3 Environmental Planning Instruments

Environmental planning instruments identified in the Director General's Requirements are taken into account in the relevant parts of the EIS or in consultants' reports.

- ***State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007***

  The aims of this Policy are, in recognition of the importance to New South Wales of mining, petroleum production and extractive industries:

  (a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and

  (b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and

  (c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

  Response: The quarry will be operated under a management plan (Volume 3) requiring management in accordance with relevant mining and environmental protection legislation.

- ***State Environmental Planning Policy No 55 – Remediation of Land***

  The object of this Policy is to provide for a Statewide planning approach to the remediation of contaminated land. In particular, this Policy aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment . . .

  Response: A core part of the proposal is the progressive rehabilitation of the property following the quarrying operations beginning with land affected by past operations. There is no known contaminated land

- ***State Environmental Planning Policy No 33 – Hazardous and Offensive Development***

  This Policy aims;

  a) to amend the definitions of hazardous and offensive industries where used in environmental planning instruments, and

  (b) to render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this Policy, and

  (c) to require development consent for hazardous or offensive development proposed to be carried out in the Western Division, and

(d) to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account, and

(e) to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact, and

(f) to require the advertising of applications to carry out any such development.

Response: Hazards relating to the quarry's operation are documented in the EIS and will be managed in accordance with legislated mine and occupational safety requirements. It will not be an offensive development in terms if the policy.

- ***State Environmental Planning Policy No 44 – Koala Habitat Protection***

  This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

  Response: The independent flora and fauna assessment (*Appendix 5)* concluded that, as no recognised food trees occur on the site, the likely presence of koalas is low.

- ***Sydney Region Environmental Plan No 8 – Central Coast Plateaus Area***

  The general aims of this plan are, among other things:

  a) to provide for the environmental protection of the Central Coast plateau areas and to provide a basis for evaluating competing land uses;

  b) to encourage the use of land having a high agricultural capability for that purpose and, as much as possible, to direct development for non-agricultural purposes to land of lesser agricultural capability; and

  c) to protect regionally significant mining resources and extractive materials from sterilization.

  Response: The proposal is to operate an extractive industry in regard to a resource determined to be of State significance on a property degraded by past operations. Environmental protection and rehabilitation are integral parts of the proposal.

- ***Sydney Regional Environmental Plan No 9 (Extractive Industry No.2 – 1995)* (SREP 9)**

  A deemed SEPP from July 2009. This plan aims, among other things, to facilitate the development of extractive resources in proximity to the population of the Sydney Metropolitan Area by identifying land which contains extractive material of regional significance.

  Response: The proposal is consistent with this policy.

- ***Gosford Interim Development Order Gosford Interim Development Order 122***

  The objectives of Zone No. 1(a) are:

  (a) to identify and provide suitable land for agricultural use; and

  (b) to protect the agricultural potential of land identified as suitable for agricultural use; and

(c) to prevent the fragmentation of prime agricultural land; and

(d) to enable uses which are complementary to, and compatible with, the use of land for agriculture; and

(e) to protect the rural landscape quality of the area; and

(f) to protect water catchments, water quality, soil conditions, and important eco-systems such as streams, estuaries, and wetlands, from inappropriate development and land management practices.

Clause 4 of IDO 122 requires that council must take into consideration the objectives of the zone and the objectives of the Local Government Act 1993 relating to ecological sustainable development.

Clause 5 of IDO 122 requires that council must take into consideration the character of the development site and the surrounding area.

Clause 38A of IDO 122 relates to heritage conservation.

Response: Interim Development Order No 122 (IDO 122) applies to the proposed development. The quarry property is within zone No.1(a) rural (Agriculture) under the provisions of IDO 122. The use of the land for an Extractive Industry is permitted with the consent of council.

The use of the property for an extractive industry will be consistent with the objectives of the zone and the local government area provided it is carried out in accordance with the EIS prepared for the proposed development (Clause 4).

The locality has a rural character with a mixture of agricultural uses and lot sizes. The proposed development will not detract from the character of the locality and, when the extraction of material is completed, the land will be rehabilitated (Clause 5).

The aboriginal heritage assessment prepared for the proposed development indicates that there are no sites of aboriginal heritage significance located on the property (Clause 38A).

The property does not contain any heritage items that are listed in IDO 122. A heritage item is located on the opposite side of Wisemans Ferry Road. This item is located some considerable distance from the proposed quarry and will not be impacted by the proposed development (Clause 38A).

- **Draft Gosford Local Environment Plan 2009 (LEP) and relevant development control plans and section 94 plans.**

The objectives of Zone RU1 are:

b) To encourage sustainable primary production by maintaining and enhancing the natural resource base;

c) To encourage diversity in primary industry enterprises and systems appropriate to the area;

d) To minimise the fragmentation and alienation of resource lands

e) To minimise conflict between land uses within the zone and within adjoining zones.

f) To ensure development is compatible with the desired future character of the area covered by this zone.

g) To protect biodiversity, water catchments, water quality, soil conditions and important ecosystems such as streams (and associated riparian areas), sedgelands, estuaries and wetlands from inappropriate development and land management practices.

h) To ensure the plateau remains free from landuses that may sterilise sustainable primary production and natural resource use and minimise potential incompatible landuses.

Clause 7.10 – Natural Resource Sensitivity – Biodiversity (Local) of the Draft LEP is also applicable to the proposed development as the site is identified as Natural Resource Sensitivity Biodiversity. Under the provisions of sub-clause 3, Development Consent must not be granted for the development on land to which this clause applies unless the consent authority has the considered the impact of the development on;

a Native flora and fauna and its habitat, and

b Threatened species, communities, populations and their habitats, and

c Regionally significant species and flora and fauna and their habitats, and

d A habitat corridor, waterways, riparian land or wetlands.

Response: The Gosford Draft LEP 2009 had been adopted by the Council. However, it will not take affect until after the LEP is made by the Minister for Planning and Infrastructure.

The quarry property is zoned RU1 Primary Production under the provisions of the Draft Gosford LEP 2009. Extractive industries and mining are permitted with consent in this zone.

The proposed development requires the removal of native vegetation. The Flora and Fauna Assessment prepare by Keystone Environmental concluded that the proposal is unlikely to have any impact on native flora and fauna and its habitat, threatened species, communities, populations and their habitats and regionally significant flora and fauna and their habitats or any habitat corridor, waterway, riparian land or wetland (Clause 7.10).

1.4 Guidelines

Guidelines identified in the Director General's Requirements are taken into account in the relevant parts of the EIS or in consultants' reports.

- ***New South Wales Groundwater Protection Policy***

  It is the policy of the NSW Government to encourage the ecologically sustainable management of the State's groundwater resources, so as to:

  - slow and halt, or reverse any degradation of groundwater resources;
  - ensure sustainability of groundwater dependent ecosystems;
  - maintain the full range of beneficial uses of these resources;
  - maximise economic benefit to the Region, State and Nation.

  Response: A Groundwater Monitoring and Management Plan approved by the NSW Office of Water forms Part 6.1 of the Quarry Management Plan (Volume 3) of this EIS.

- ***Industrial Noise Policy (EPA 2001)***

  The overall aim is to allow the need for industrial activity to be balanced with the desire for quiet in the community. The specific policy objectives are:

  • to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;

- to use the criteria as the basis for deriving project specific noise levels;
- to promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.

Response: An independent noise assessment (*Appendix10*) was based on a larger operation and older generation plant. The assessment determined that noise exposure would be within noise exposure goals determined under the Policy except during some preliminary construction work. Such work would be conducted in accordance with the policy.

- ***Soils and Construction: Managing Urban Stormwater (Landcom 2004)***

The document describes:

- principles of soil and water management and an outline of the principle of ecologically sustainable development (ESD);
- guidelines on identifying and addressing constraints and opportunities for soil and water management;
- soil and water management aspects of the clearing of land, stripping and stockpiling of soil materials, and the management and reuse of topsoil for site rehabilitation;
- practical erosion control information covering both sheet and concentrated water flow conditions;
- information relating to the control of waste and sediment pollution from both water and wind;
- soil conservation aspects for vegetative stabilisation of recently disturbed lands;
- maintenance aspects of erosion and sediment control measures.

Response: Erosion control will be an integral part of the operation. Soil conservation practices consistent with the guideline will be adopted in the progressive rehabilitation program (Volume 3 Parts 6.2 and 6.3)

- ***Approved Methods for Modelling and Assessment of Air Pollutants (DEC)***

This document lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in the state.

Response: This guideline was followed by the independent air quality consultant (*Appendix 6*).

- ***Approved Methods for Sampling and Analysis of Air Pollutants (DEC)***

This document lists the methods to be used for the sampling and analysis of air pollutants in New South Wales for statutory purposes. The document covers:

- pollutant emissions from stationary sources
- pollutant emissions from motor vehicles
- components in and properties of petroleum products
- pollutants in ambient air.

Response: This guideline was followed by the independent air quality consultant (*Appendix 6*).

- ***Agricultural Issues for Extractive Industries on Rural Lands (I&I 2010)***

  Guiding principles for consent authorities when planning for sustainable agriculture and extractive industries;

  - Extractive industry developments are consistent with strategic plans and zone objectives.
  - Extractive industry developments are designed and sustainably managed to minimise environmental impacts.
  - Land use conflicts are minimised, amenity values are protected and the expectations of local communities are managed.
  - Rehabilitation is undertaken progressively and any permanent changes to productive capacity are clearly justified.
  - Proposals are clearly justified in a regional context and identify the merits and community benefit of the proposal.
  - Development Applications duly consider the following potential impacts and identify suitable mitigatory responses for:
    - impacts on Agricultural Resources;
    - impacts on Fish and Fish habitats;
    - transport and access changes;
    - Rehabilitation plans;
    - consultation with rural stakeholders;
    - mitigation and monitoring

  Response: The proposal is allowed subject to consent under land use zoning. The EIS describes the operation, how environmental impacts, transport matters and consultation will be managed and provides justification for the proposal. Progressive rehabilitation is an integral part of the proposal.

- ***EIS Guideline – Extractive Industries – Quarries***

  The purpose of this guideline is to present a clear and comprehensive statement of the matters which may need to be included in an environmental impact statement (EIS), to fulfil the information requirement for the assessment and determination of quarry or excavation proposals. It deals with the information requirements for an EIS for quarries or other excavation proposals which are not located close to or within rivers, streams, other waterbodies or wetlands.

  Response: The contents of the EIS are evidence that this guideline was followed.

1.5 Consultation

Relevant agencies have been consulted during the preparation of this EIS.

There was extensive consultation with the community, including through a mediator, during the preparation of the 2004 EIS, the 2007 s96 Consent Modification Report and the consideration of the Development Application by the Gosford City Council. The report of the mediator and public submissions received during the exhibition of the 2004 EIS are held by the Gosford City Council. A summary of the public submissions received in regard to the earlier proposal is at *Appendix 4.*

As would be expected, there was no agreement in regard to the future operation of the quarry at mediation and most public submissions received opposed the reopening of the quarry.

As this proposal is identical in nearly all respects to that which was approved by the Gosford City Council, consultation with the community has been limited during the preparation of the present EIS. A letter was sent to neighbours of the quarry when the new Development Application was lodged and an open line will be maintained during the public consultation period to answer the community's questions.

2. Additional requirements

The Director General's Requirements noted that the requirements are not limited to the matters listed above.

2.1 Additional Requirements of the Office of Environment and Heritage, Environment Protection and Regulation, Regional Operations - Hunter

The 63 Acts, Regulations and Guidelines in the list below were identified as requiring attention.

Item	No of items	If addressed and where
Relevant Legislation	8	
Environment Protection and Biodiversity Conservation Act 1999 (Comm)		Consultant's report on flora and fauna (Appendix 5)
Contaminated Land Management Act 1997		Not relevant. Specific reference not made
Environmentally Hazardous Chemicals Act 1985		Not relevant
Environmental Planning and Assessment Act 1979		Reference made throughout
National Parks and Wildlife Act 1974		Flora and Fauna consultant' report (Appendix 5) Archaeology consultant's report (Appendix 11
Protection of the environment Operations Act 1997		See above
Threatened Species Conservation Act 1995		Flora and fauna consultant's report (Appendix 5)
Water Management Act 2000		EIS, Hydrogeological consultant's reports Appendices 7 and 8, Quarry Management Plan Parts 6.1 and 6.2 (Vol 3)
Licensing	1	See above
Aboriginal Cultural heritage	4	Consultant's report (Appendix 11)
Air Quality	2	Consultants report (Appendix 6)
Greenhouse Gas	5	Consultant's report (Appendix 7)
Biodiversity	13	Consultant's report (Appendix 5)
Noise and Vibration	8	Consultants report 2004 (Appendix 10). The *Interim Construction Noise Guideline* (DECC 2009) and references to vibration and rail infrastructure are not applicable.
Waste	3	EIS and Quarry Management Plan Part 6.6 (Vol 3).
Acid Sulphate Soils	3	Not addressed and not relevant

Item	No of items	If addressed and where
Contaminated Sites Assessment and Remediation	5	Contaminated waste addressed although specific reference to items not made. Site rehabilitation dealt with in detail in EIS and Quarry Management Plan Part 6.3 (Vol 3).
Flooding and Coastal erosion	1	Not addressed and not relevant
Soils general	6	EIS and Quarry Management Plan Part 6.2 (Vol 3). Partial reference to items
Water	4	EIS, Hydrogeological consultant's reports Appendices 7 and 8, Quarry Management Plan Parts 6.1 and 6.2 (Vol 3)
	63	

2.2 Additional Requirements of the Office and Environment and Heritage, Heritage Branch

Matter Identified by Heritage Branch	Response
Environmental Planning and Assessment Regulation 2000, Clause 73	Requirement to obtain Director General's requirements – complied with in full.
Heritage Act 1977	Archaeology consultants report Appendix 11
Lists maintained by the Office of Environment and Heritage, the National Trust of Australia (NSW) and the Australian Government.	Addressed in Archaeology consultants report Appendix 11
Environment Protection and Biodiversity Act 1999	There are no matters of national environmental significance – consultant's report Appendix 5.

2.3 Additional requirements of the Gosford City Council

The Council requires the following matters to be included/addressed in the EIS:

SREP No. 20: Hawkesbury–Nepean River (No. 2 1997)

This policy aims to protect the Hawkesbury-Nepean River System from the impacts of future land use and to ensure that decisions are made in the regional context.

Response: The proposal is consistent with State and Gosford City Council intentions for the Somersby Plateau.

Matter Identified by Council	Response
A. Executive Summary	Provided
B The Proposal	Details under the relevant headings in the EIS and quarry management plan
C The location	Detail provided in EIS
D Identification and prioritisation of issues	Key issues identified by the Department of Planning and Infrastructure and Gosford City Council are addressed in the EIS.
E The environmental issues	Addressed in the EIS
F List of approvals and licences required	Below
G Compilation of mitigative measures	EIS Section 5.17

Matter Identified by Council	Response
H Justification for the proposal	Addressed in the EIS
I What works, control measures etc outstanding	None outstanding
J Details of public objections to the previous proposal approved under Development Consent 26467/2004 and proposed measures to mitigate impacts on adjoining nearby residents.	Summary of submissions received at Appendix 11. Measures to mitigate impacts are identified in the EIS
K Legislative Planning Instruments	All of the instruments listed are referred to in the EIS or consultants' reports. Also see reference to SREP20 below.
L Traffic/engineering	Approval required for the intersection of the quarry access and Wisemans Ferry Road. Quarry engineering is subject to approval under the *Mining Act 1992 and the Mines Inspection Act 1901*
M All environmental factors previously considered under the last EIS	All matters have been addressed in this EIS.

3. Approvals and Licences Required

Licence or Approval	Authority	Status
Environmental Protection Licence	Protection of the Environment (Operations Act)	Apply after consent
Water Access (Aquifer) Licence	Water Management Act 2000	Issued 2009 and quota obtained
Water Access (Unregulated River) LIcence	Water Management Act 2000	Issued 2009 and quota obtained
Construction Certificate	Gosford City Council	Apply after consent
Aboriginal Heritage Impact Permit (AHIP) to relocate the artefact from the area of impact	National Parks and Wildlife Service	Apply before commencement of Stage 3



Plate 1: Towards the south-west. Freshwater Dam in the foreground and former workings including the high wall and the property residence beyond (2012).



Plate 2: Towards the west. Old Tailings Dam in the foreground and former central workings, high wall and vegetation near Wisemans Ferry Road beyond (2004)



Plate 3: Towards the south-west. Existing processing plant and stockpile area. Property residence beyond (2012).



Plate 4: Typical vegetation in the north-western corner showing the electricity easement along the original access road (2012)



Plate 5: Towards the south-east. Fresh water Dam in the foreground, tailings dams and residences R5 and R6 beyond. F3 Freeway to the left (2012).



Plate 6: Towards the north-west. Old Tailings Dam in the foreground, processing plant and vegetation in the NW corner near closest residences R1 and R2 beyond (2012).



Plate 7: Existing Quarry face showing ironstone and sandstone bands.



Plate 8: Close up view of ironstone bands groundwater seepage from an existing quarry face.



Plate 9: Close up view of ironstone bands groundwater seepage from an existing face.

Annex 1

Rindean Quarry, Somersby NSW

Environmental Impact Statement, April 2012

FIGURES

Figure 1	Rindean Quarry - Location
Figure 2	Rindean Quarry Local Setting
Figure 3	Satellite Photograph of the Quarry dated December 18 2006
Figure 4	Survey plan of the present form of the quarry showing significant features as required by the Gosford City Council
Figure 5	Rindean Quarry Plan Stage 1 – Years 1 to 2
Figure 6	Rindean Quarry Plan Stage 2 – Years 3 to 5
Figure 7	Rindean Quarry Plan Stage 3 – Years 5 to 10
Figure 8	Rindean Quarry Plan Stage 4 – Years 11 to 19
Figure 9	Rindean Quarry Plan - Indicative Final Landform
Figure 10	Survey plan showing preliminary work to be performed and the ultimate limits of the quarry's footprint.
Figure 11	Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby - Site Plan
Figure 12	Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby - 19m Semi Trailer Design Vehicle Movements
Figure 13	Proposed Bund Design, Rindean Quarry
Figure 14	Proposed Wheelwash, Rindean Quarry
Figure 15	Schematic Plan and Elevation of Processing Plant
Figure 16	Rindean Quarry, Flow Diagram – Sand Washing Process, Fines Management System and Water Balance
Figure 17	Rindean Quarry Plan Stage 1 – Water Management Infrastructure
Figure 18	Rindean Quarry Plan Stage 2 – Water Management Infrastructure
Figure 19	Groundwater [Test] Bore Locations, Rindean Quarry, Somersby (from EIS Appendix 4, Hydrological Investigation, RCA Australia)
Figure 20	Rindean Quarry, Locations of Local Water Supply Bores (from EIS 2004, Figure 5.4)
Figure 21	Predicted Groundwater Drawdown at 100 Years
Figure 22	View Points and Viewing Arcs
Figure 23	Lines of Sight from View Point 1
Figure 24	Lines of Sight from View Point 2 and View Point 4
Figure 25	Lines of Sight from View Point 3
Figure 26	Lines of Sight from View Point 5
Figure 27	Land Use

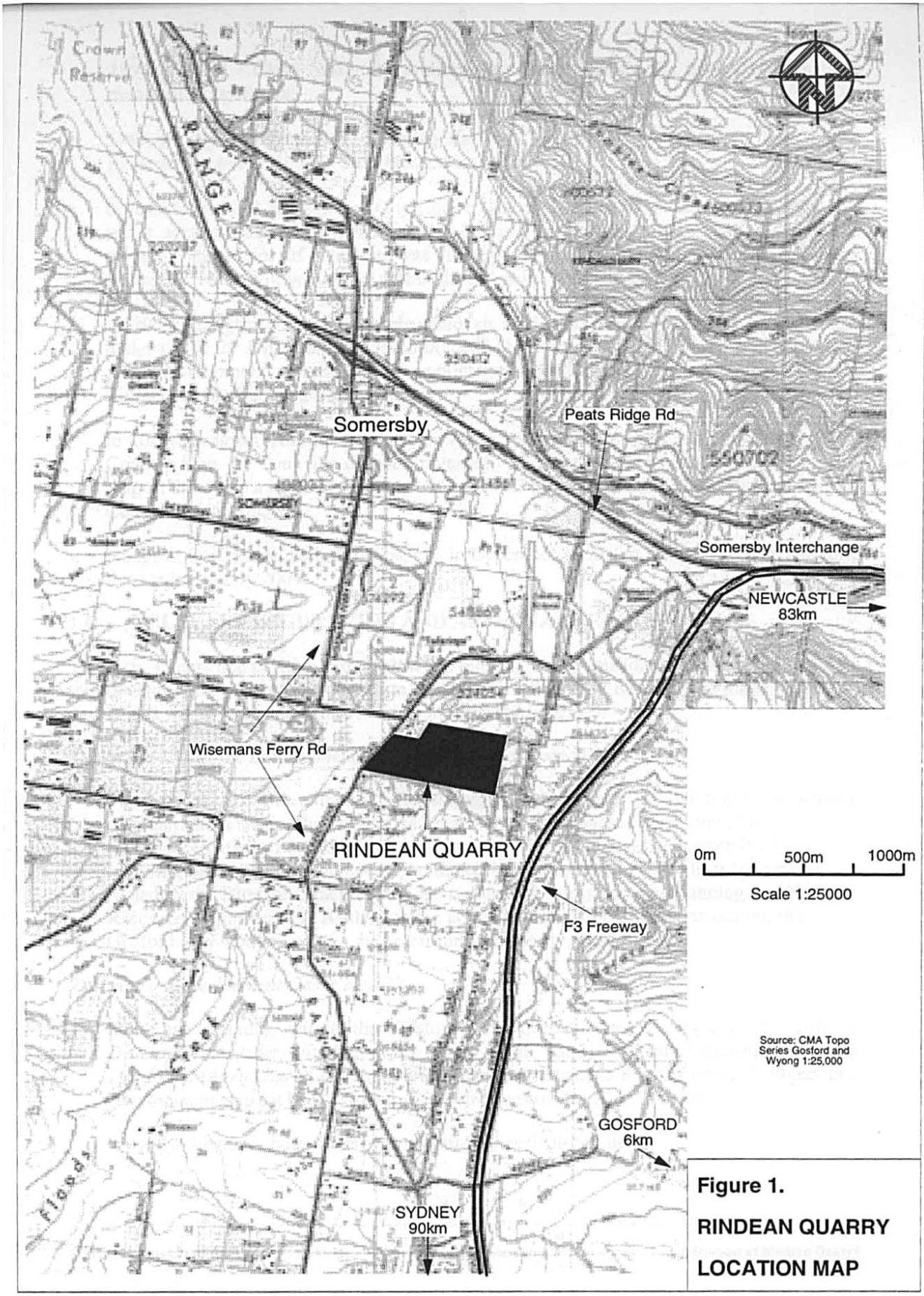
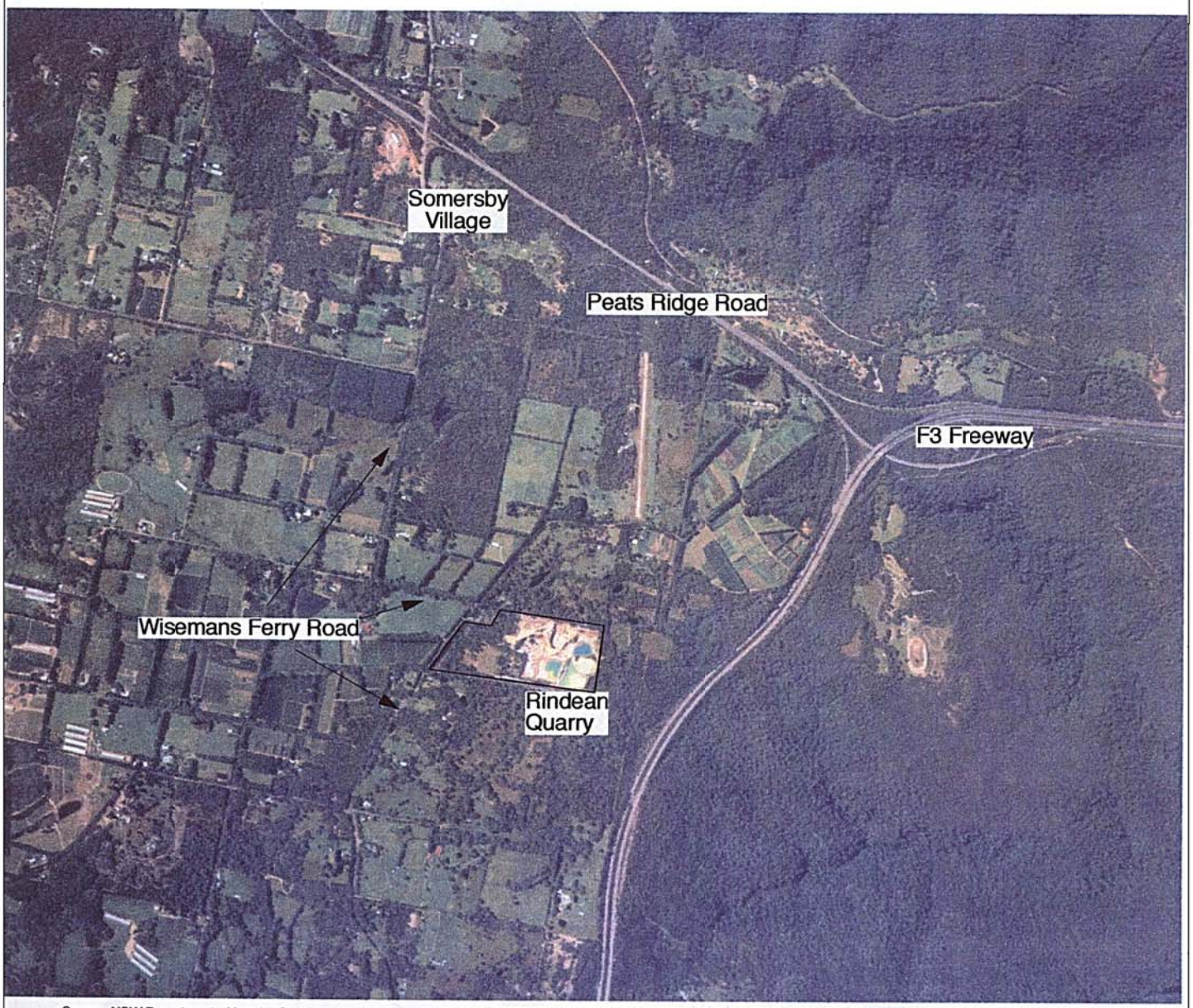


Figure 1.

RINDEAN QUARRY

LOCATION MAP



Source: NSW Department of Lands, Order No: 14610, Date: 16/03/2004

0m 500m 1000m 1500m 2000m

Scale 1:25000

Figure 2.

LOCAL SETTING


N
Image © 2010 Sinclair Knight Merz
© 2010 Whereis® Sensis Pty Ltd
©2010 Google
Imagery Date: Dec 18, 2006
33°22'32.09" S 151°17'39.62" E elev 810 ft
Eye alt 2907 ft

Figure 3

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EXISTING ENVIRONMENT

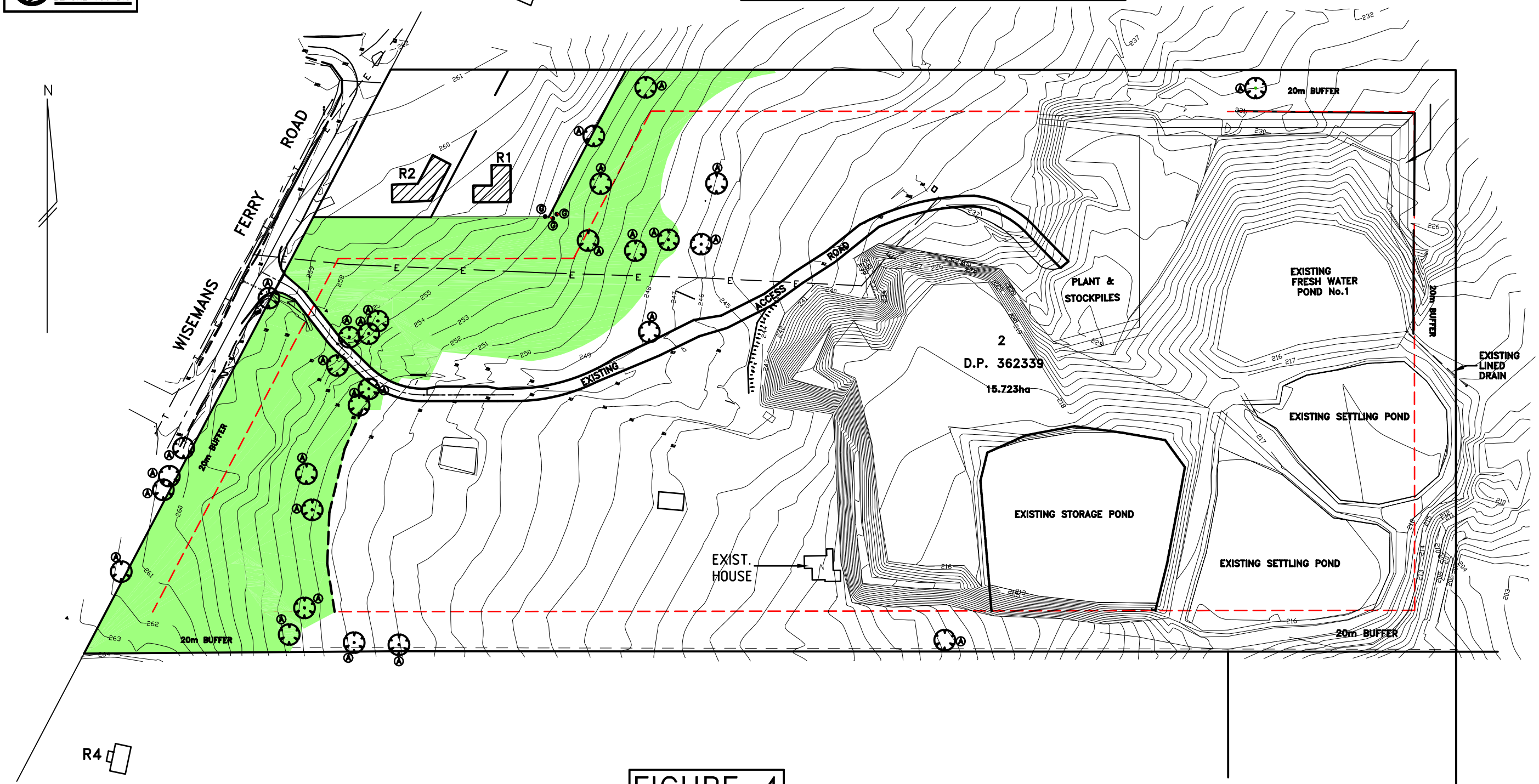


FIGURE 4

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REFERENCE: 6175.000

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

STEPHEN THORNE AND ASSOCIATES
CONSULTING SURVEYORS
SUITE 8, 42 MANN STREET, GOSFORD. 2250
Phone (02)4323-1255 Facsimile (02)4324-2226
P.O. BOX 1315 GOSFORD NSW 2250
A.C.N. 057 514 860 A.B.N. 51 057 514 860

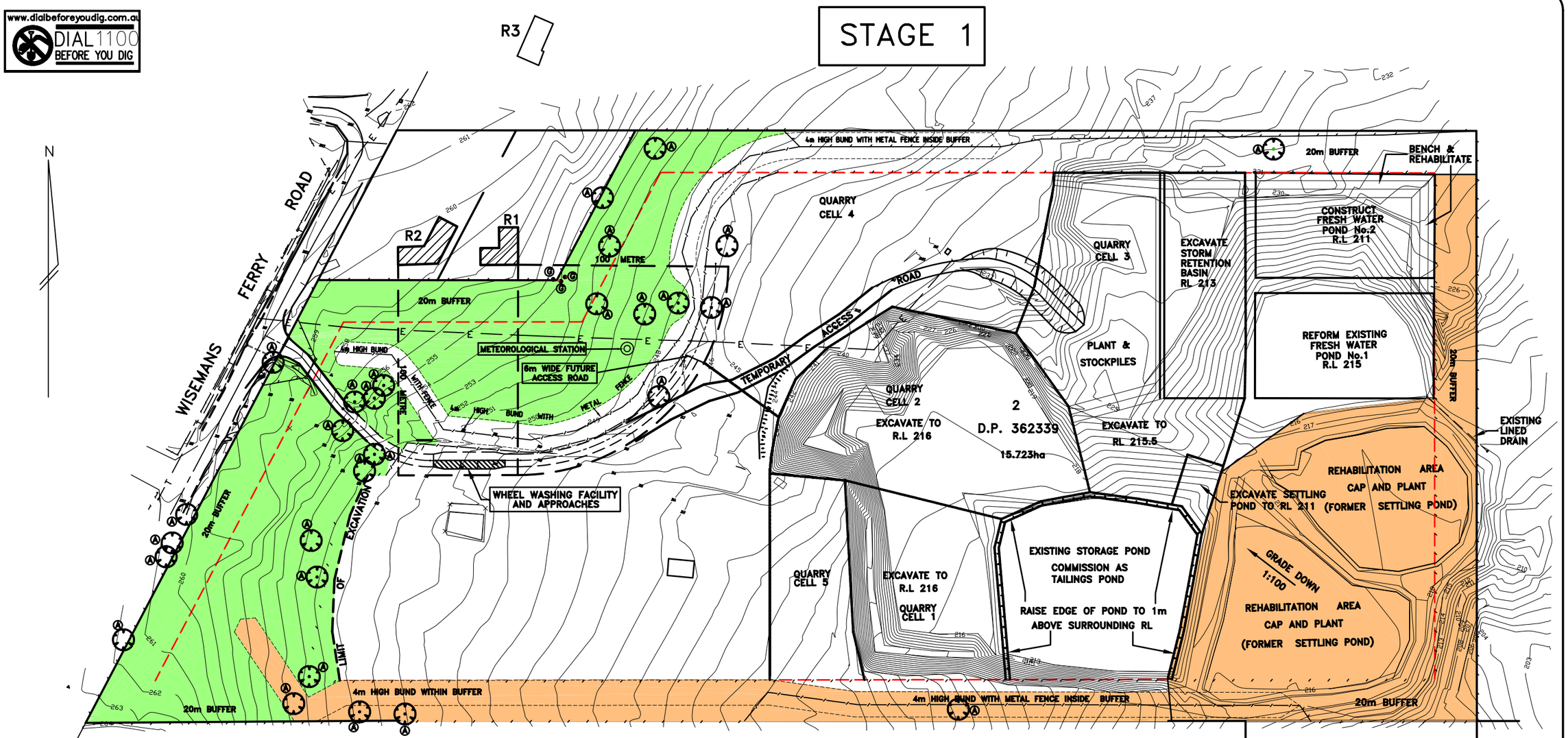
SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 05/04/2012

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STAGE 1



– DENOTES HOLLOW BEARING TREE
– DENOTES Grevillea shiressii
– DENOTES LIMIT OF BUFFER ZONE
– DENOTES REHABILITATION AREA
– DENOTES EXISTING VEGETATION

40 0 40 80 120 160 200
SCALE OF METRES 1:2000

FIGURE 5

CAD FILE: 6175_STAGE 1.dwg
THIS PLOT: 01-03-2011 14:53
REFERENCE: 6175.000

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

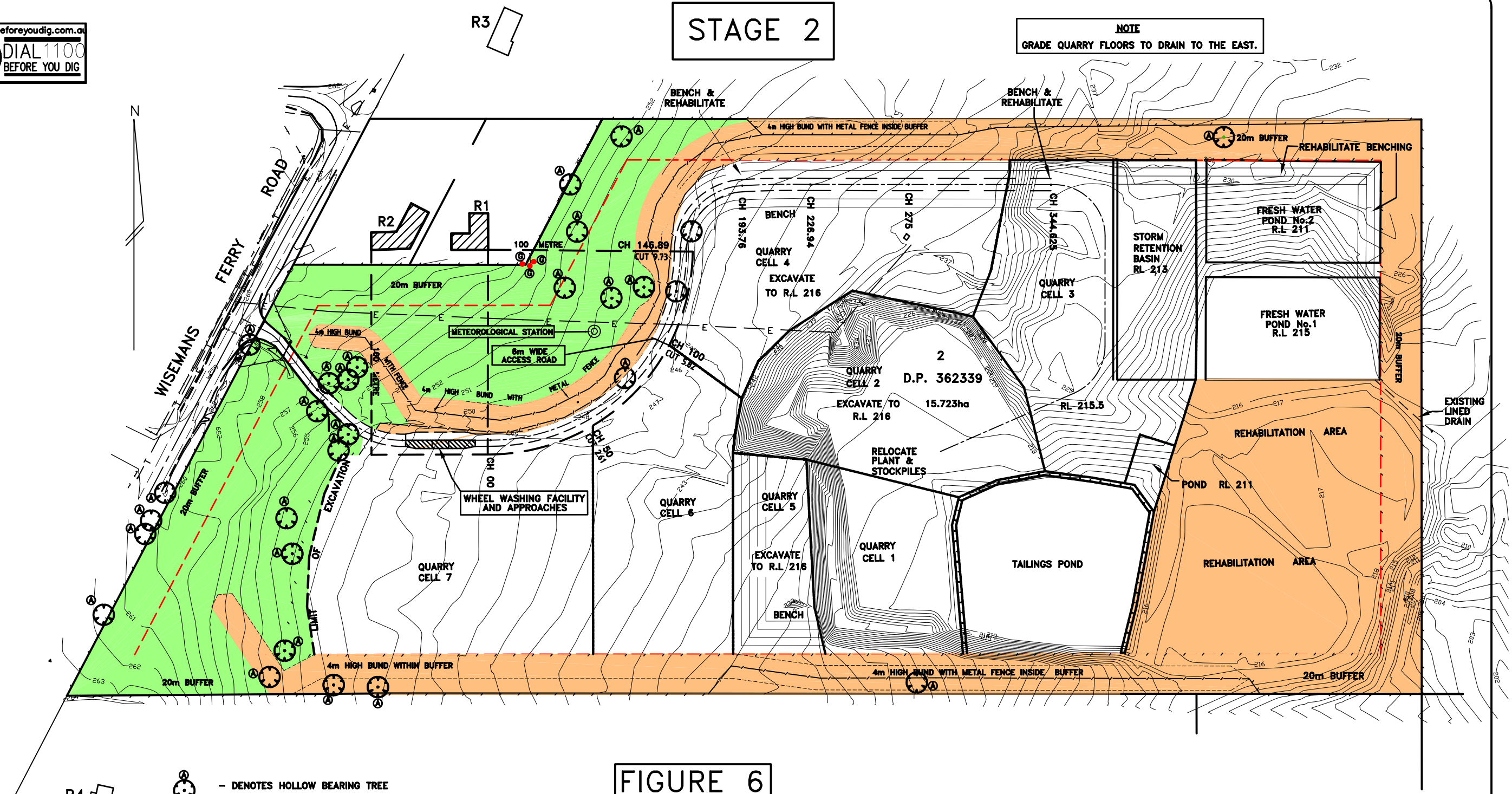
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SCALE: 1:2000
Australian Height Datum
REFERENCE: 6175 ISSUE: D 05/04/2012

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STAGE 2

NOTE
GRADE QUARRY FLOORS TO DRAIN TO THE EAST.



– DENOTES HOLLOW BEARING TREE

– DENOTES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

FIGURE 6

40 0 40 80 120 160 200
SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

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REFERENCE: 6175

QUARRY PLAN – STAGE 2 – YEARS 3 TO 5
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: E 10/04/2012

STAGE 3

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N

R3

R2

R1

DETAILS AS PER STAGE 1 PLAN

REHABILITATE

REHABILITATE

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

ACCESS TRACK

BENCH

FERRY ROAD

WISEMANS

100 METRE

20m BUFFER

METEOROLOGICAL STATION

6m WIDE ACCESS ROAD

4m HIGH BUND

100 METRE WITH FENCE

4m HIGH BUND WITH METAL FENCE

BENCH

CH 00

WHEEL WASHING FACILITY AND APPROACHES

EXCAVATION LIMIT OF

20m BUFFER

QUARRY CELL 4
R.L 216

QUARRY CELL 3
RL 215.5

STORM RETENTION BASIN
RL 213

FRESH WATER POND No.2
R.L 211

FRESH WATER POND No.1
R.L 215

20m BUFFER

EXISTING LINED DRAIN

QUARRY CELL 2
R.L 216

2
D.P. 362339
15.723ha

PLANT & STOCKPILES

SETTLING POND RL 211

REHABILITATION AREA

QUARRY CELL 6

EXCAVATE TO R.L 216 & BENCH

QUARRY CELL 5

QUARRY CELL 1

TAILINGS POND

QUARRY CELL 7

BENCH

20m BUFFER

4m HIGH BUND WITHIN BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

R4 – DENOTES HOLLOW BEARING TREE

– DENOTES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

R6

R5

CAD FILE: 6175_STAGE 3_REV D.dwg
THIS PLOT: 10-04-2012 14:01
REFERENCE: 6175.000

FIGURE 7

RINDEAN QUARRY PLAN – STAGE 3 – YEARS 6 TO 10
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 07/03/2011

STAGE 4

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N

R3

R2

R1

DETAILS AS PER STAGE 1 PLAN

WISEMANS FERRY ROAD

100 METRE

20m BUFFER

METEOROLOGICAL STATION

6m WIDE FUTURE ACCESS ROAD

4m HIGH BUND WITH METAL FENCE

4m HIGH BUND WITHIN BUFFER

EXCAVATION LIMIT

WHEEL WASHING FACILITY AND APPROACHES

QUARRY CELL 7

EXCAVATE TO R.L 217 & BENCH

QUARRY CELL 6

RL 216 – 217

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

ACCESS TRACK

REHABILITATION AREA

REHABILITATION AREA

2 D.P. 362339.

QUARRY CELL 2

15.723ha

STORM RETENTION BASIN RL 213

FRESH WATER POND No.2 R.L 211

FRESH WATER POND No.1 R.L 215

20m BUFFER

EXISTING LINED DRAIN

REHABILITATION AREA

PLANT & STOCKPILES

SETTLING POND RL 211

TAILINGS POND

REHABILITATION AREA

20m BUFFER

4m HIGH BUND WITHIN BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

– DENOTES HOLLOW BEARING TREE

– DENITES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

R4

FIGURE 8

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY (NOT TO SCALE)

R6

R5

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REFERENCE: 6175

RINDEAN QUARRY PLAN – STAGE 4 – YEARS 11 TO 19
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 10/04/2012

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INDICATIVE FINAL LANDFORM

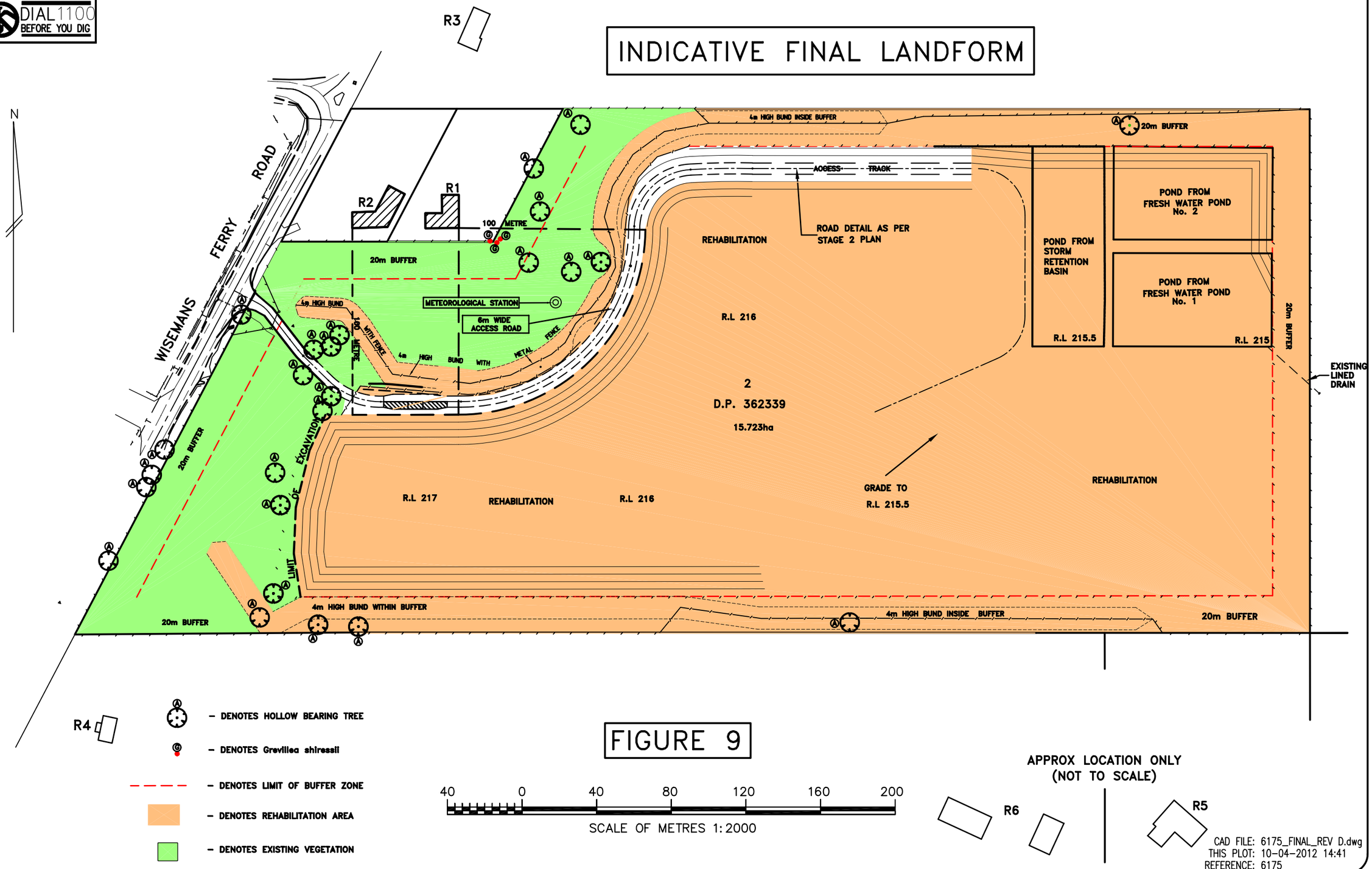


FIGURE 9

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RINDEAN QUARRY PLAN – INDICATIVE FINAL LANDFORM
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

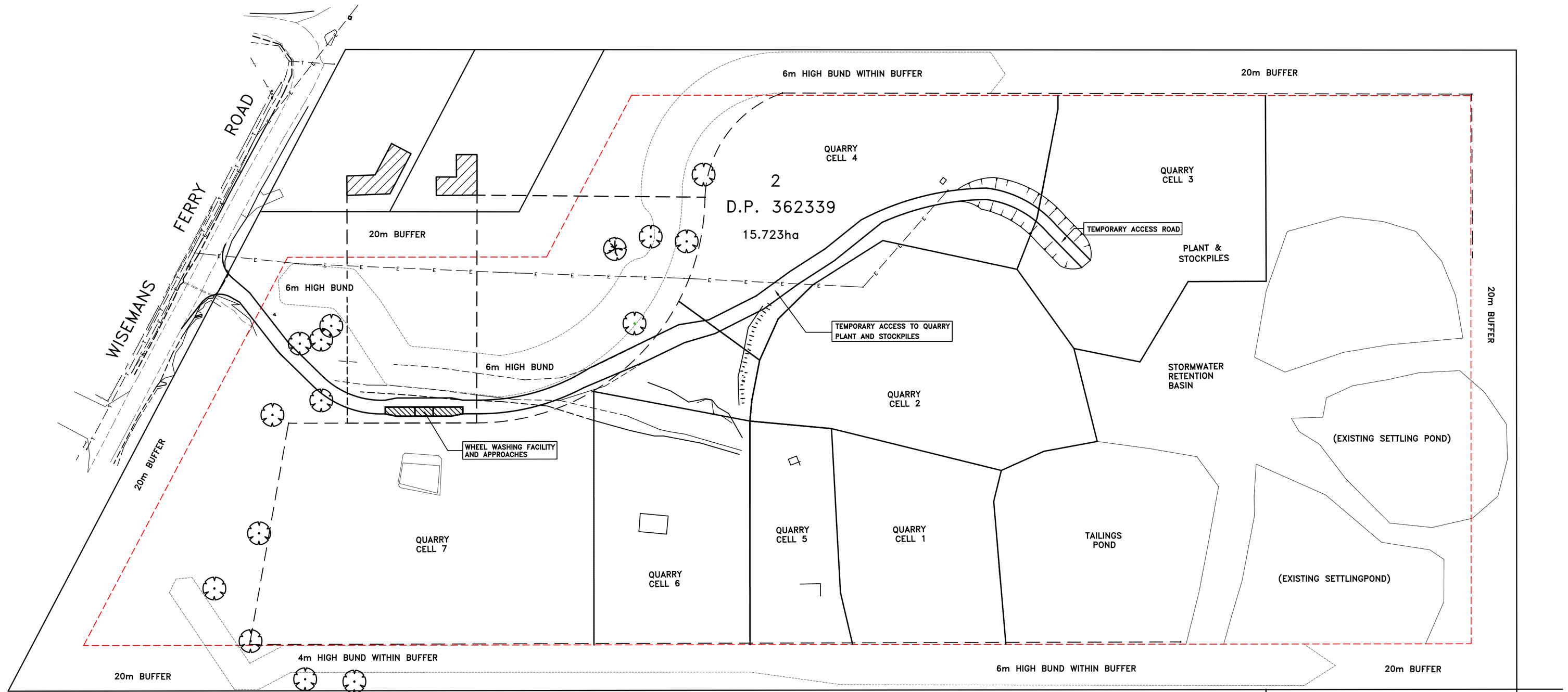
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SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 10/04/2012

PRELIMINARY WORKS



– DENOTES HOLLOW BEARING TREE

— — LIMIT OF RESOURCE EXTRACTION

CAUTIONS :

1) THIS SURVEY HAS BEEN PREPARED FOR THE PURPOSE OF DETAIL & CONTOUR ONLY. THE LOCATION OF ANY FENCING OR STRUCTURE IN RELATION TO THE BOUNDARIES HAS NOT NECESSARILY BEEN EXACTLY DETERMINED.
2) UTILITY SERVICES SHOWN HAVE BEEN LOCATED BY SURVEY WHERE THEY ARE VISIBLE AND APPARENT. HOWEVER , THE APPROXIMATE POSITION OF UNDERGROUND SERVICES MAY HAVE ALSO BEEN PLOTTED FROM UTILITY AUTHORITY PLANS, AND THIS PLAN MUST BE READ IN CONJUNCTION WITH THE RELEVANT UTILITY AUTHORITY PLANS.
3) THE LOCATION OF SERVICES ARE TO BE VERIFIED BY OBTAINING CURRENT INFORMATION FROM "DIAL BEFORE YOU DIG" (PHONE 1100) PRIOR TO DESIGN/CONSTRUCTION WORKS. ALTERNATIVELY, THE EXACT LOCATION OF SERVICES SHOULD BE DETERMINED BY FIELD SURVEY IN CONSULTATION WITH THE SERVICE AUTHORITIES WHERE DEEMED NECESSARY.

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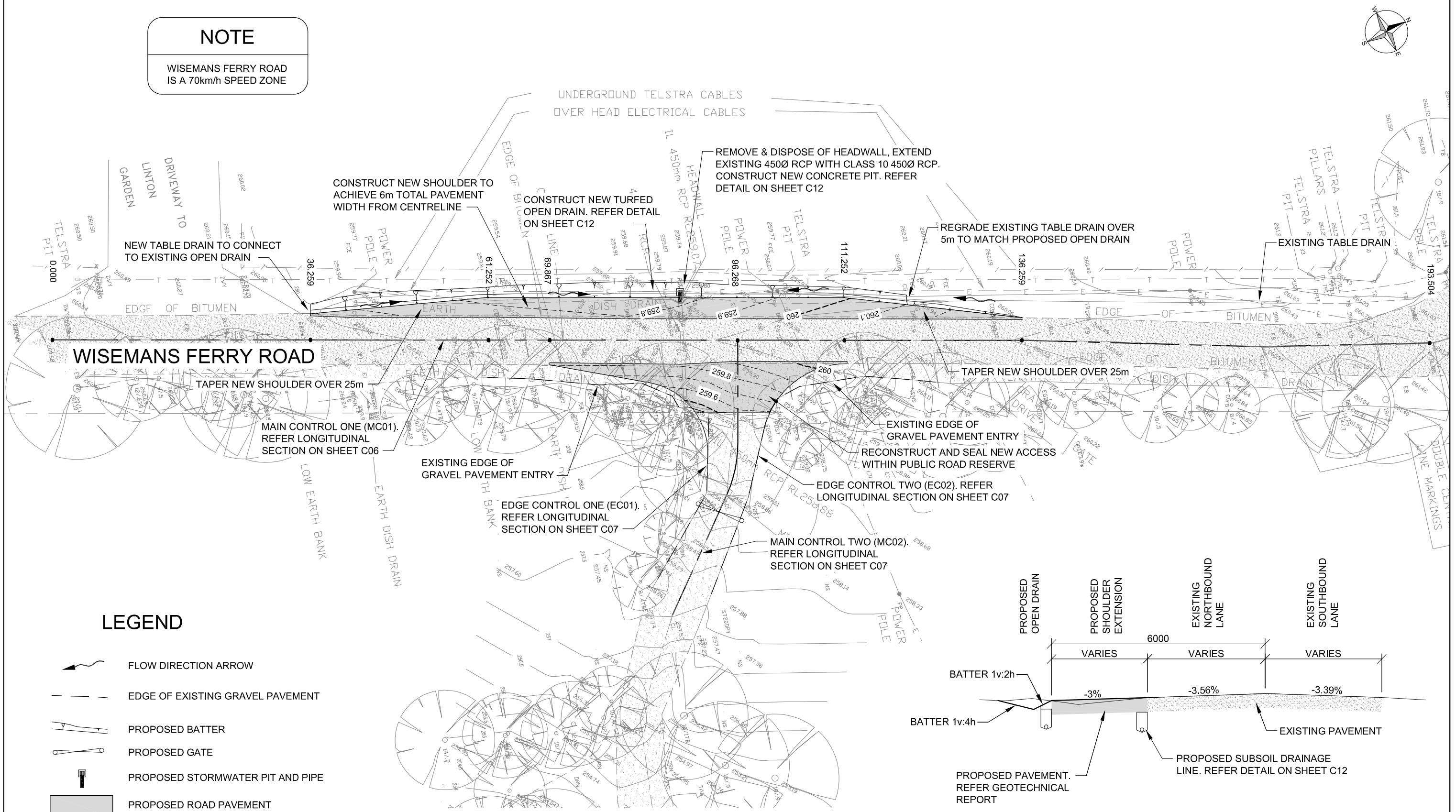
FIGURE 10

CAD FILE: 6175_FIGURE 10.dwg
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REFERENCE: 6175

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DATUM: Australian Height Datum / DATE 18/11/2010					SHEET OF SHEETS

NOTE

WISEMANS FERRY ROAD
IS A 70km/h SPEED ZONE



LEGEND

- FLOW DIRECTION ARROW
- EDGE OF EXISTING GRAVEL PAVEMENT
- PROPOSED BATTER
- PROPOSED GATE
- PROPOSED STORMWATER PIT AND PIPE
- PROPOSED ROAD PAVEMENT
- DESIGN CONTOUR (0.1m INTERVALS)
- DESIGN CONTOUR (0.5m INTERVALS)

TYPICAL CROSS SECTION

SCALE 1:100

FIGURE 11

No.	Amendment Description	Init.	Date
B	COUNCIL AMENDMENT	L.Mc	10/02/11
A	PRELIMINARY	L.Mc	26/10/10

A3 Original | This sheet may be prepared using colour and may be incomplete if copied

SCALES

Scale 1:500 (0 5 10 15 20 25)

Scale 1:100 (0 1 2 3 4 5)

Co-ordinate System: MGA Zone 56 | Height Datum:

RGH CONSULTING GROUP
Multi-discipline Engineering

Designed L.M.McBRIDE
Reviewed A.J.GRIFFITHS (MIE AUST, CPENG, NPER)

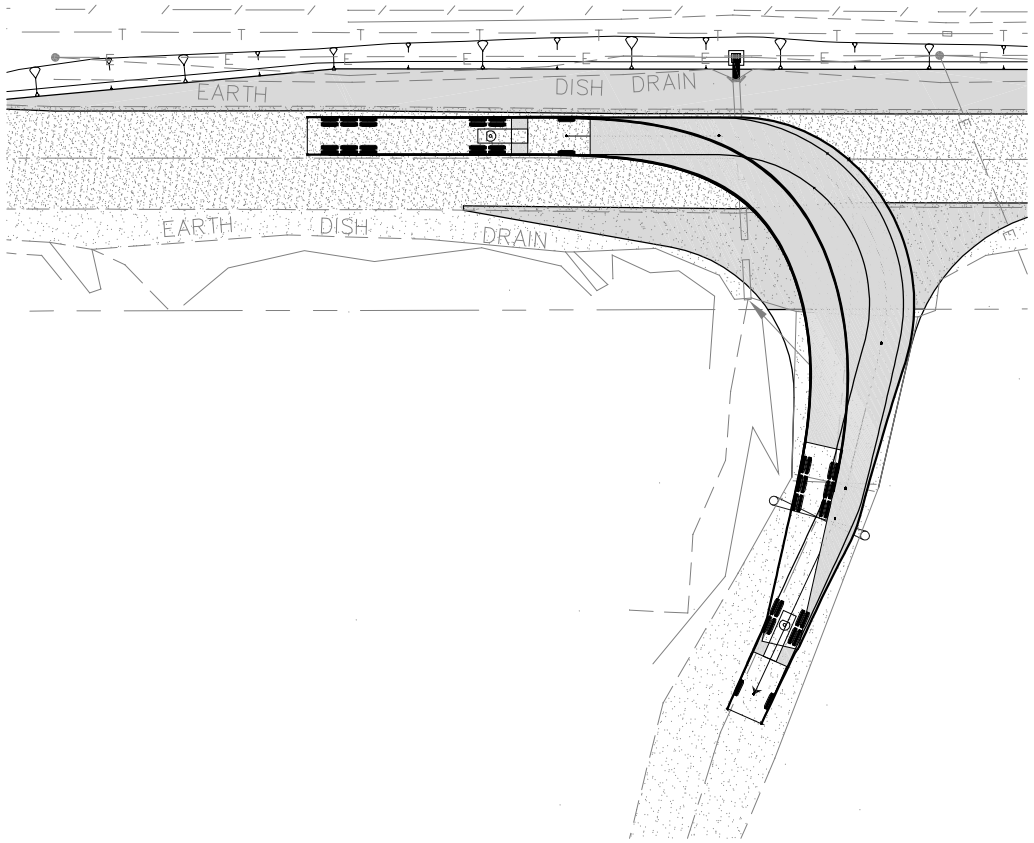
CLEVE SMITH EXCAVATIONS Pty Ltd

GOSFORD CITY COUNCIL
INTERSECTION UPGRADE - RINDEAN QUARRY
№ 620 WISEMANS FERRY ROAD, SOMERSBY

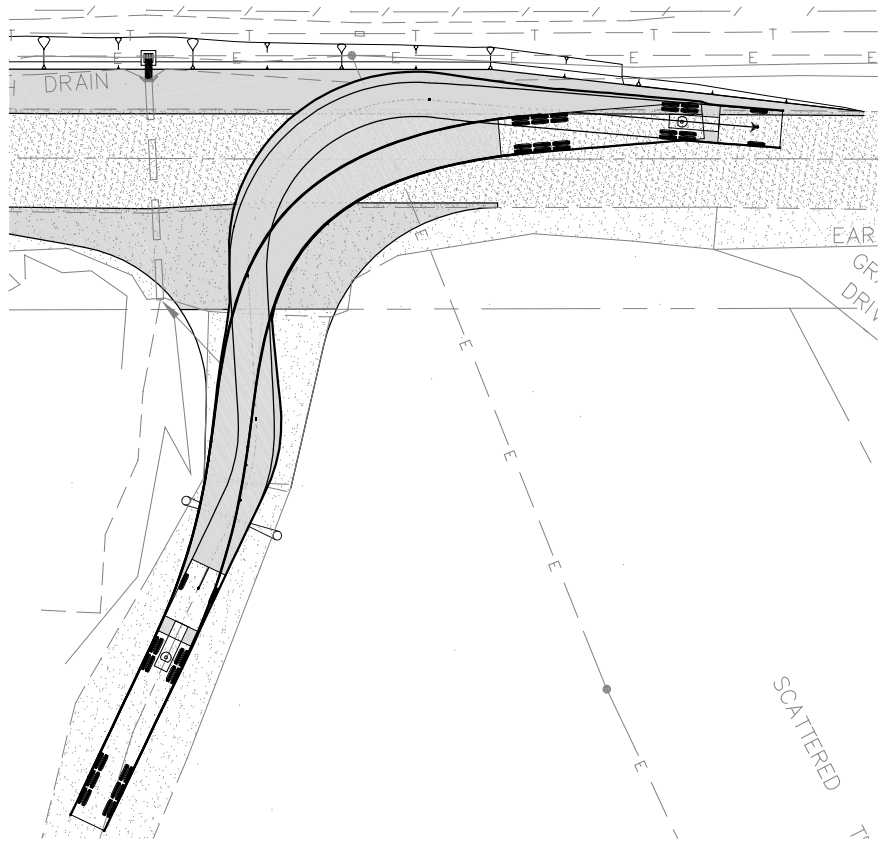
GENERAL SITE PLAN

RGH File №:	Drawing:	Date:	SHEET REF.
20100313		OCT 2010	C03

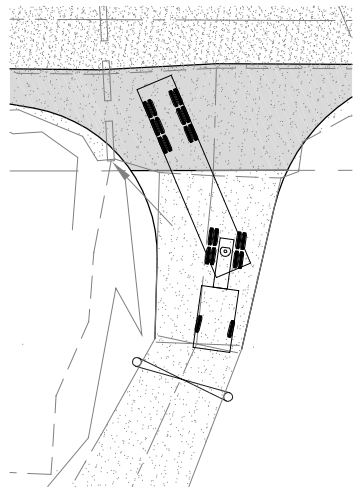
Project Manager:
PROFESSIONAL CONSTRUCTION SERVICES Pty Ltd



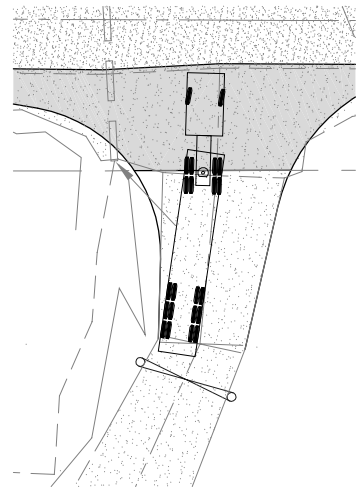
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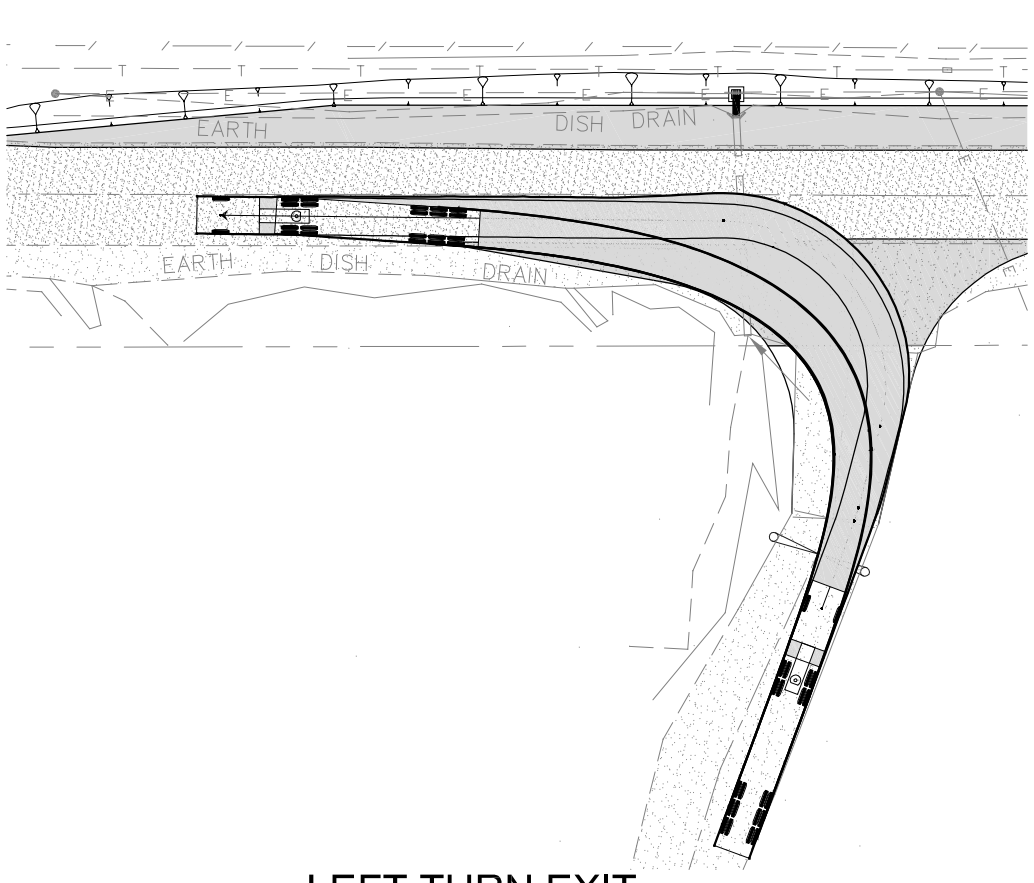
RIGHT TURN EXIT



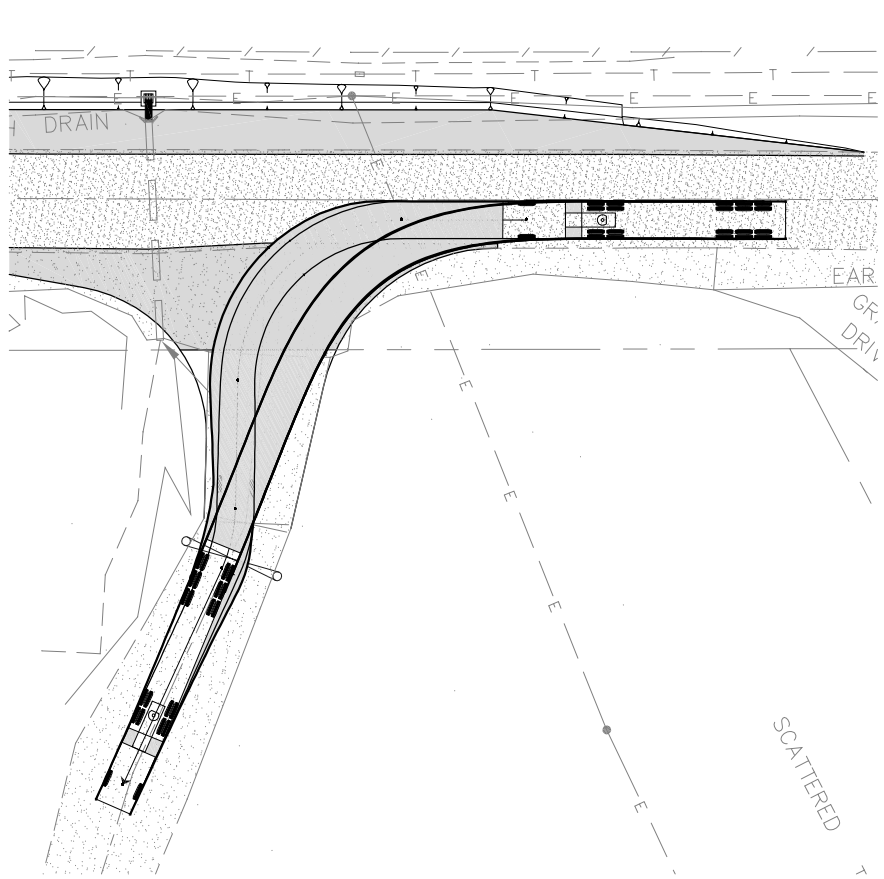
DRIVEWAY VEHICLE STORAGE
RIGHT TURN ENTRY



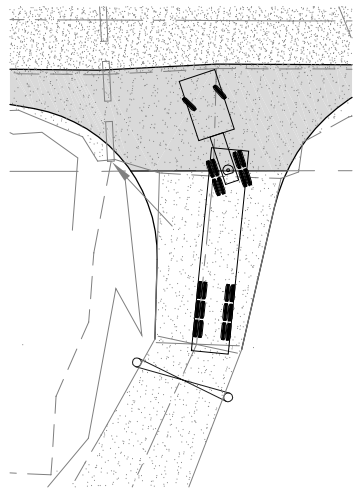
DRIVEWAY VEHICLE STORAGE
RIGHT TURN EXIT



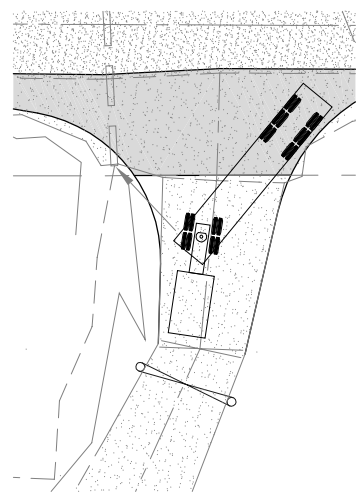
LEFT TURN EXIT



LEFT TURN ENTRY



DRIVEWAY VEHICLE STORAGE
LEFT TURN EXIT



DRIVEWAY VEHICLE STORAGE
LEFT TURN ENTRY

FIGURE 12

No.	Amendment Description	Init.	Date
B	COUNCIL AMENDMENT	L.Mc	10/02/11
A	PRELIMINARY	L.Mc	26/10/10

A3 Original | This sheet may be prepared using colour and may be incomplete if copied

SCALES
0 5 10 15 20 25
Scale 1:500

Co-ordinate System: MGA Zone 56 | Height Datum:

RGH CONSULTING GROUP
Multi-discipline Engineering

Designed L.M.McBRIDE
Reviewed A.J.GRIFFITHS (MIE AUST, CPENG, NPER)

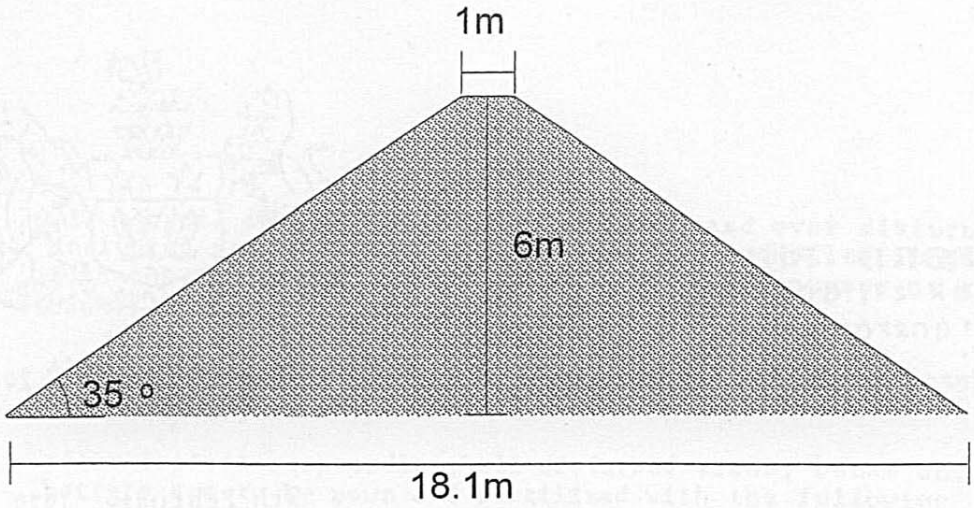
CLEVE SMITH EXCAVATIONS Pty Ltd

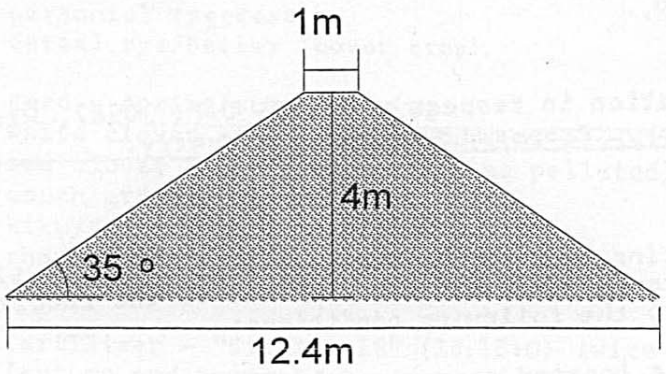
GOSFORD CITY COUNCIL
INTERSECTION UPGRADE - RINDEAN QUARRY
№ 620 WISEMANS FERRY ROAD, SOMERSBY

19m SEMI-TRAILER DESIGN VEHICLE MOVEMENTS

RGH File №:	Drawing:	Date:	SHEET REF.
20100313		OCT 2010	C15

Project Manager:
PROFESSIONAL CONSTRUCTION SERVICES Pty Ltd





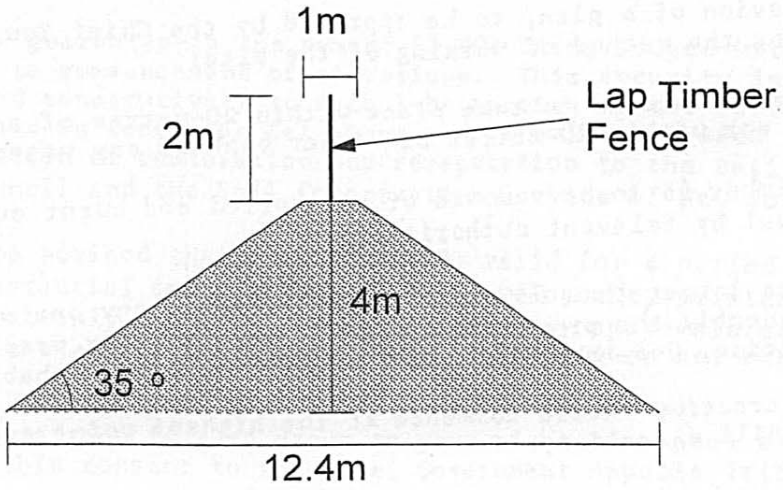


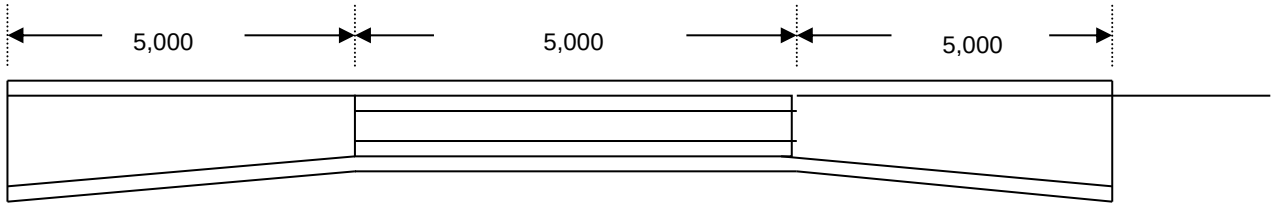
Figure 13

Rindean Quarry

Proposed Bund Design

Rindean Quarry Proposed Wheelwash

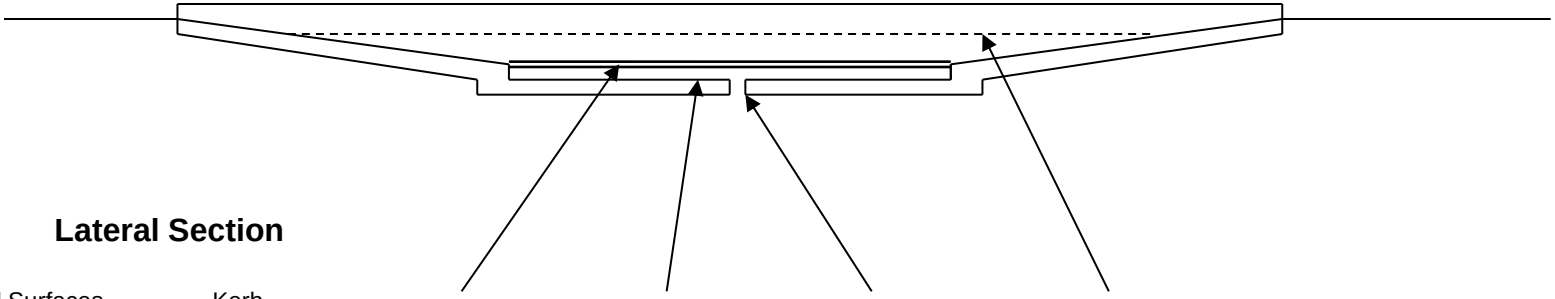
Plan



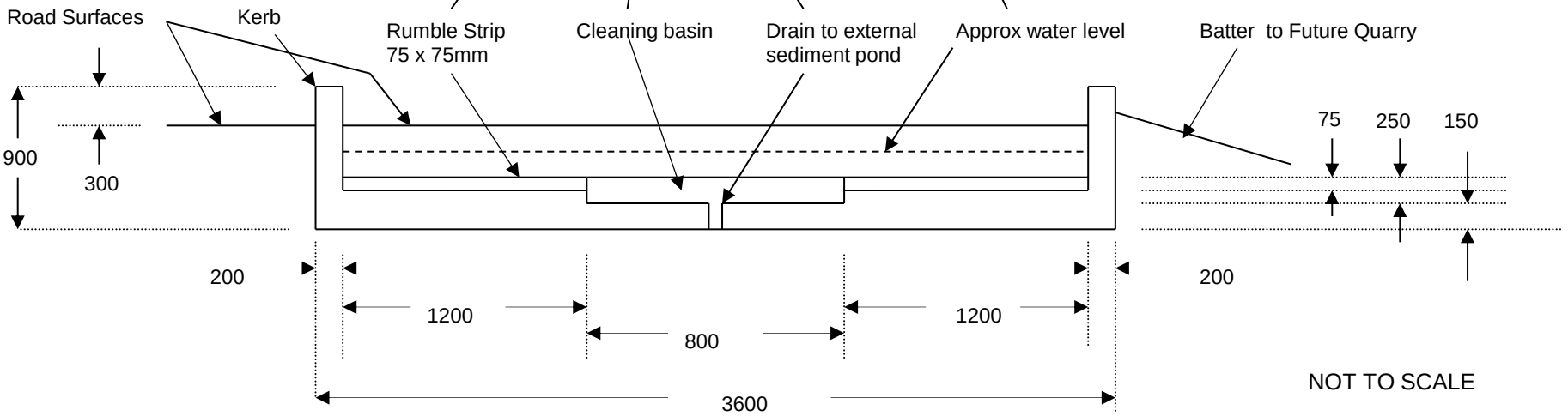
Construction

32MPA concrete
150mm slab
F82 mesh in floor and walls

Longitudinal Section



Lateral Section



NOT TO SCALE

All dimensions in mm

Figure 14

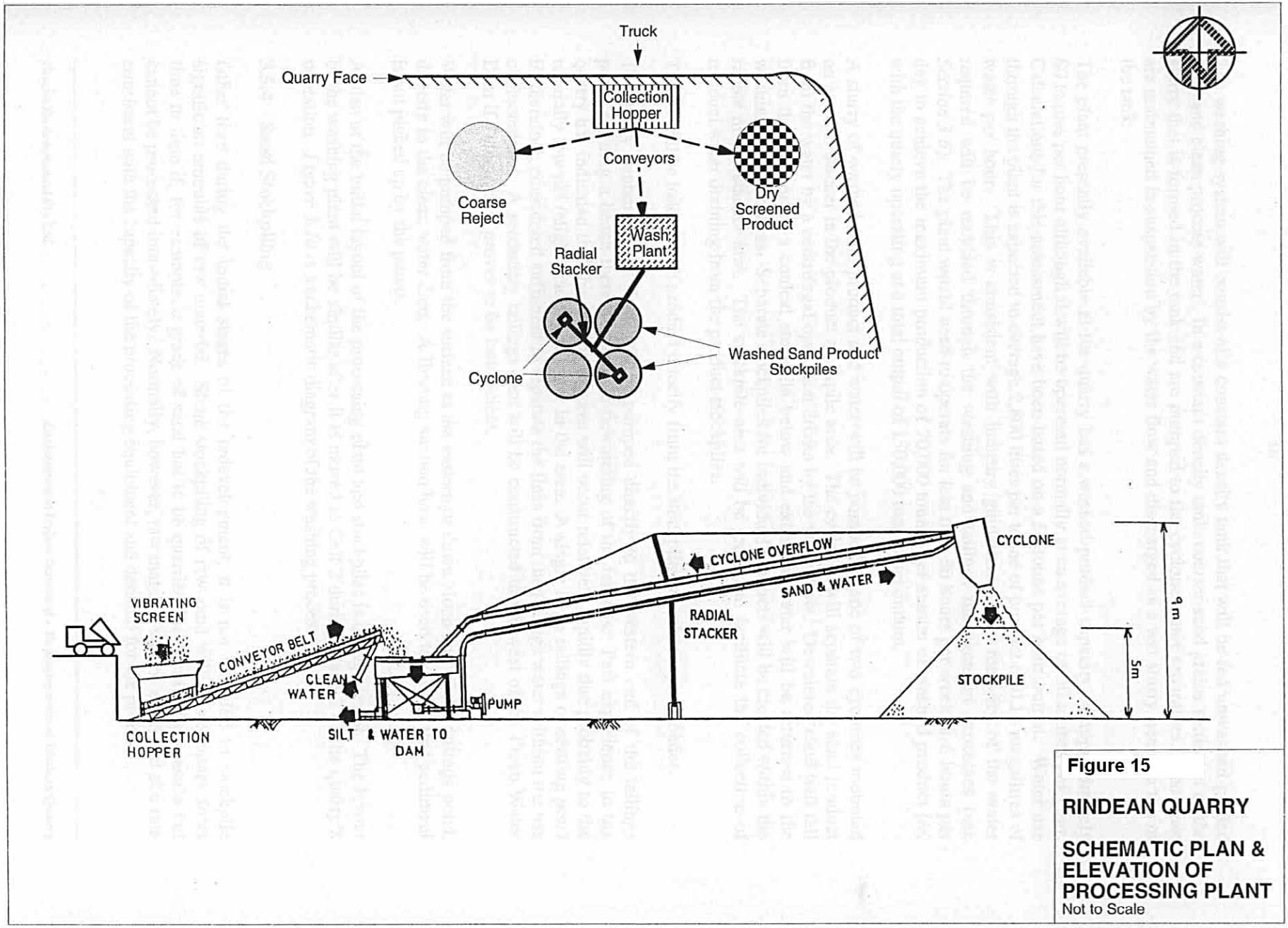
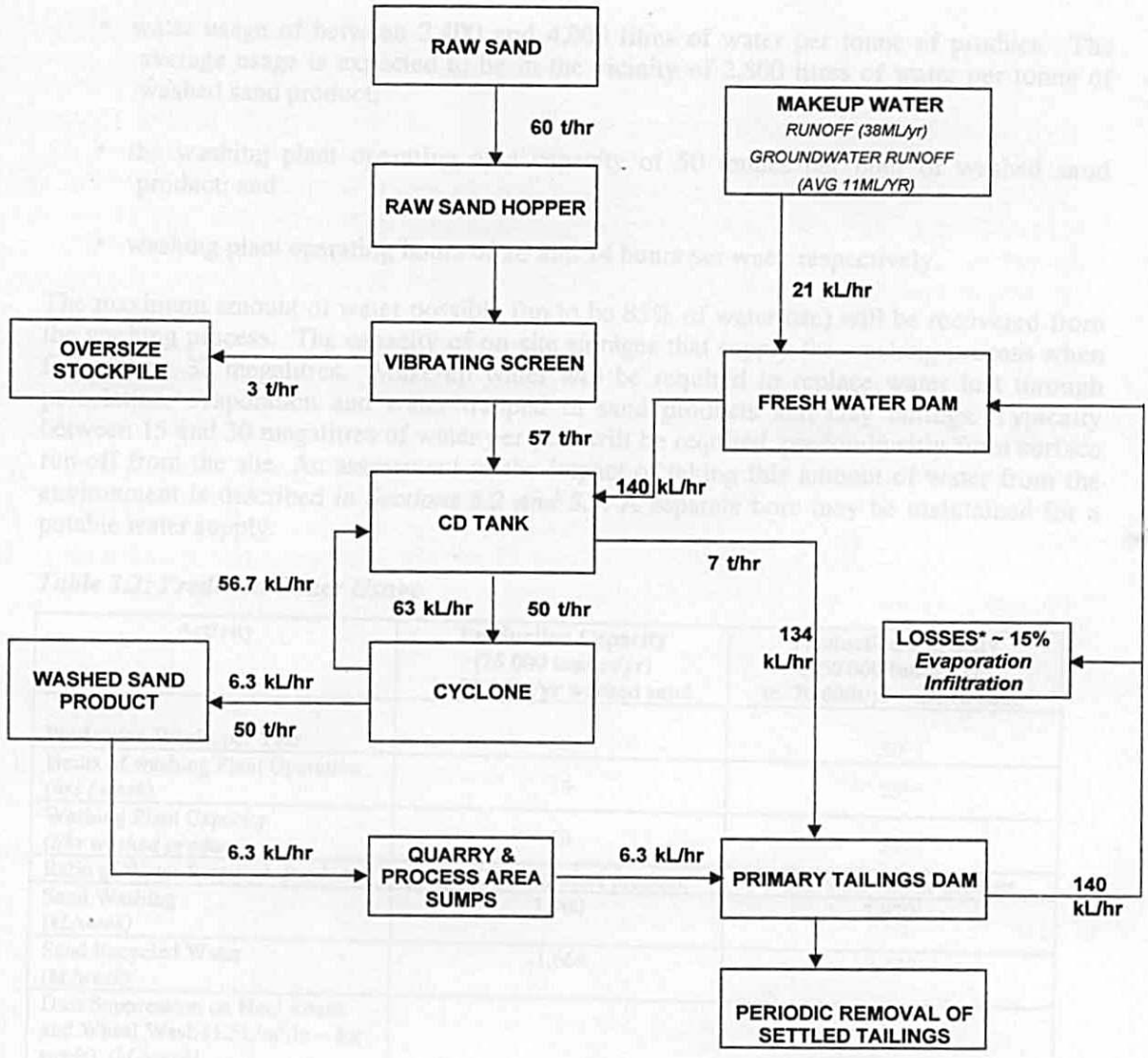


Figure 15

RINDEAN QUARRY

SCHEMATIC PLAN & ELEVATION OF PROCESSING PLANT

Not to Scale



Legend

9 kL/hr Water Flow Rate

6 t/hr Solids Flow Rate

Notes:

1kL of water = 1 tonne

* Losses from entire system

Figure 16

RINDEAN QUARRY

FLOW DIAGRAM - SAND WASHING PROCESS, FINES MANAGEMENT SYSTEM AND WATER BALANCE

STAGE 1

WATER MANAGEMENT INFRASTRUCTURE

LEGEND

- PUMP
- DRAIN OR WATERCOURSE
- PIPELINE OR CULVERT

N

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R1 R2 R3 R4

WISEMANS FERRY ROAD

EXISTING WATERCOURSE

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

BENCH & REHABILITATE

CONSTRUCT FRESH WATER POND No.2 R.L 211

EXCAVATE STORM RETENTION BASIN RL 213

REFORM EXISTING FRESH WATER POND No.1 R.L 215

20m BUFFER

EXISTING LINED DRAIN TO UNNAMED CREEK

100 METRE

METEOROLOGICAL STATION

6m WIDE FUTURE ACCESS ROAD

4m HIGH BUND WITH 100 METRE FENCE

4m HIGH BUND WITH METAL FENCE

TEMPORARY ACCESS ROAD

WHEEL WASHING FACILITY AND APPROACHES

QUARRY CELL 4

QUARRY CELL 3

PLANT & STOCKPILES

QUARRY CELL 2 R.L 216

2 D.P. 362339 15.723ha

EXCAVATE TO RL 215.5

REHABILITATION AREA CAP AND PLANT (FORMER SETTLING POND)

EXCAVATE SETTLING POND TO RL 211

EXISTING STORAGE POND COMMISSION AS TAILINGS POND

RAISE EDGE OF POND TO 1m ABOVE SURROUNDING RL

GRADE DOWN 1 : 100

QUARRY CELL 5

EXCAVATE TO R.L 216

QUARRY CELL 1

REHABILITATION AREA CAP AND PLANT (FORMER SETTLING POND)

20m BUFFER EXCAVATION LIMIT

20m BUFFER

4m HIGH BUND WITHIN BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

EXISTING WATERCOURSE

FIGURE 17

- DENOTES HOLLOW BEARING TREE
- DENOTES Grevillea shiressii
- DENOTES LIMIT OF BUFFER ZONE
- DENOTES EXISTING VEGETATION

NOTE :
LOCATIONS OF DRAINS AND PIPELINES ARE INDICATIVE. LOCATIONS WILL CHANGE AS THE QUARRY DEVELOPS

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY (NOT TO SCALE)

R6 R5

CAD FILE: 6175_STAGE 1_FIGURE 17.dwg
THIS PLOT: 10-04-2012 15:08
REFERENCE: 6175

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
WATER MANAGEMENT INFRASTRUCTURE
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

STEPHEN THORNE AND ASSOCIATES
CONSULTING SURVEYORS
SUITE 8, 42 MANN STREET, GOSFORD. 2250
Phone (02)4323–1255 Facsimile (02)4324–2226
P.O. BOX 1315 GOSFORD NSW 2250
A.C.N. 057 514 860 A.B.N. 51 057 514 860

SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: A 07/03/2011

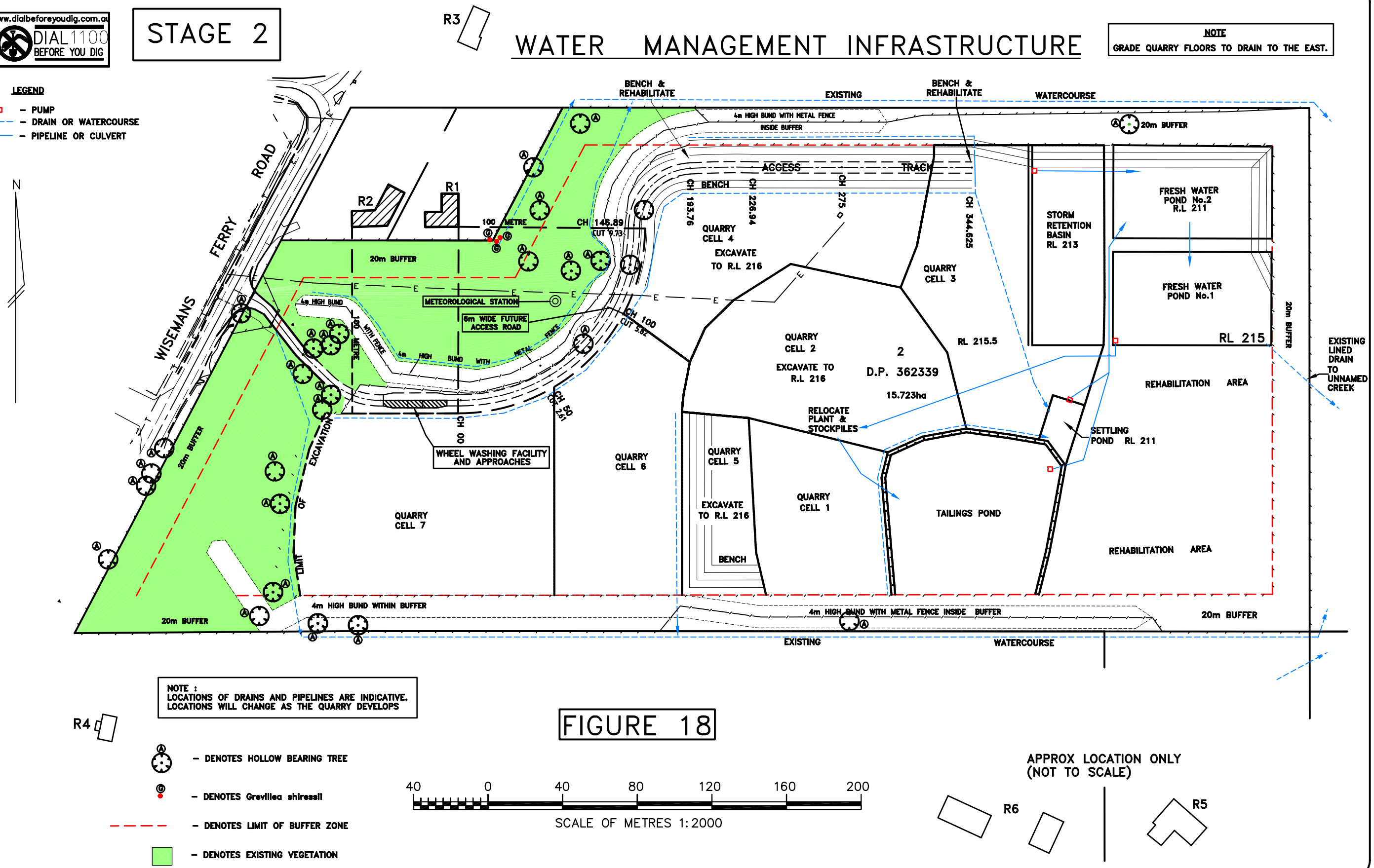
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STAGE 2

WATER MANAGEMENT INFRASTRUCTURE

NOTE
GRADE QUARRY FLOORS TO DRAIN TO THE EAST.

LEGEND
- PUMP
- DRAIN OR WATERCOURSE
- PIPELINE OR CULVERT



NOTE :
LOCATIONS OF DRAINS AND PIPELINES ARE INDICATIVE.
LOCATIONS WILL CHANGE AS THE QUARRY DEVELOPS

- DENOTES HOLLOW BEARING TREE
- DENOTES Grevillea shiressii
- DENOTES LIMIT OF BUFFER ZONE
- DENOTES EXISTING VEGETATION

FIGURE 18

40 0 40 80 120 160 200
SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

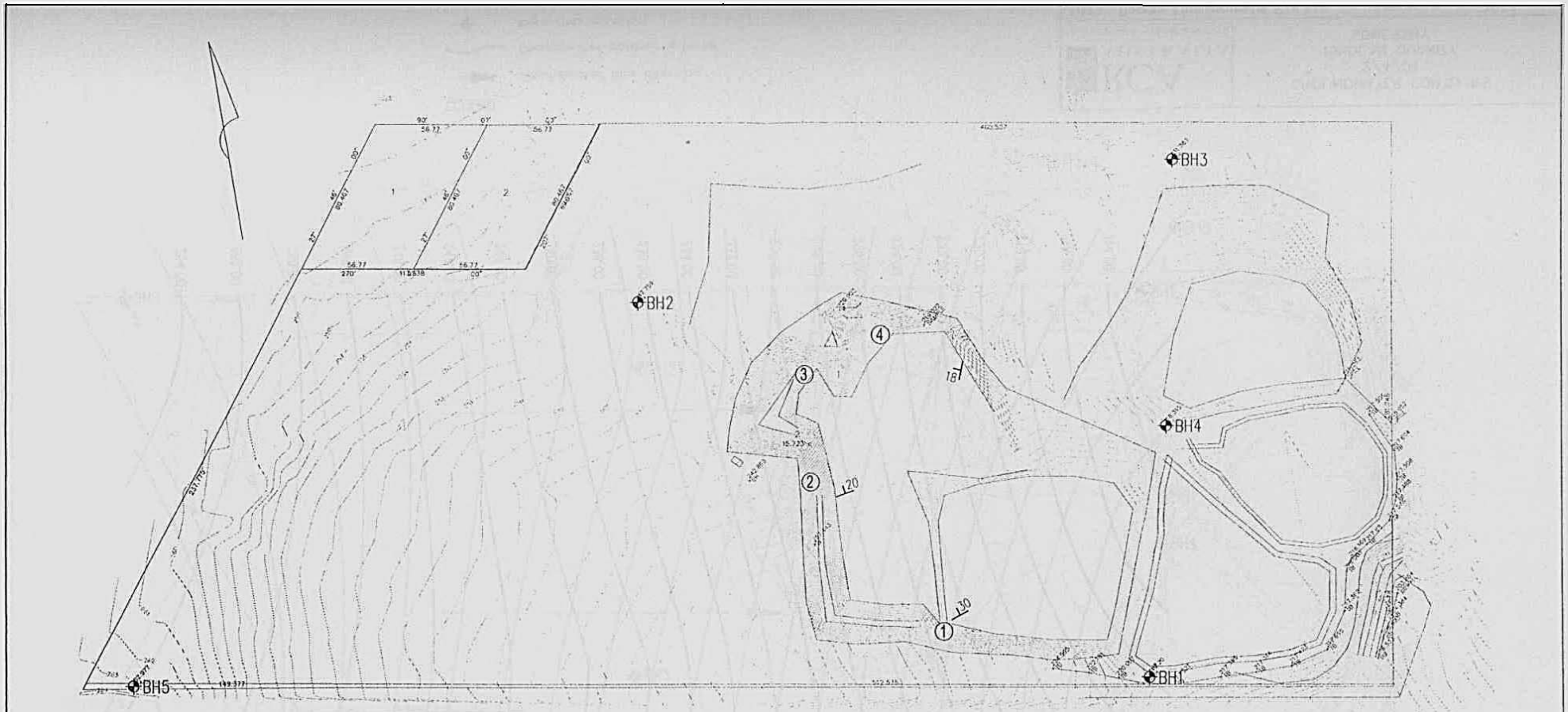
RINDEAN QUARRY PLAN – STAGE 2 – YEARS 3 TO 5
WATER MANAGEMENT INFRASTRUCTURE
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

STEPHEN THORNE AND ASSOCIATES
CONSULTING SURVEYORS
SUITE 8, 42 MANN STREET, GOSFORD. 2250
Phone (02)4323–1255 Facsimile (02)4324–2226
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A.C.N. 057 514 860 A.B.N. 51 057 514 860

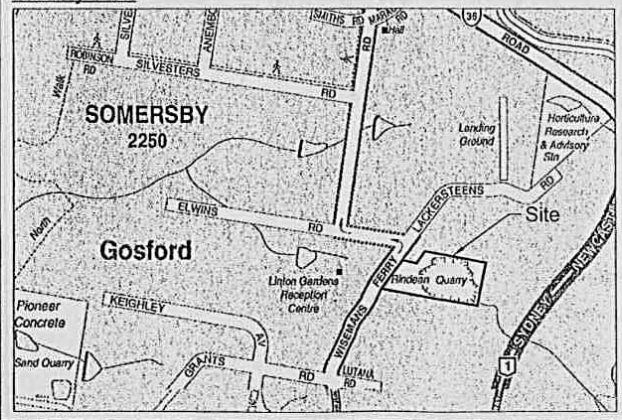
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REFERENCE: 6175.000

Australian Height Datum

REFERENCE: 6175 ISSUE: A 07/03/2011



Locality Plan



LEGEND

② Outcrop location

$\perp^{20}$ Bedding strike, dip and direction

Monitoring well locations

Figure 19

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

GROUNDWATER BORE LOCATIONS
RINDEAN QUARRY
SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	SMA	SCALE	1 : 2000	DRAWING No 1	REV 0
APPROVED BY	R	DATE	6.8.01	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

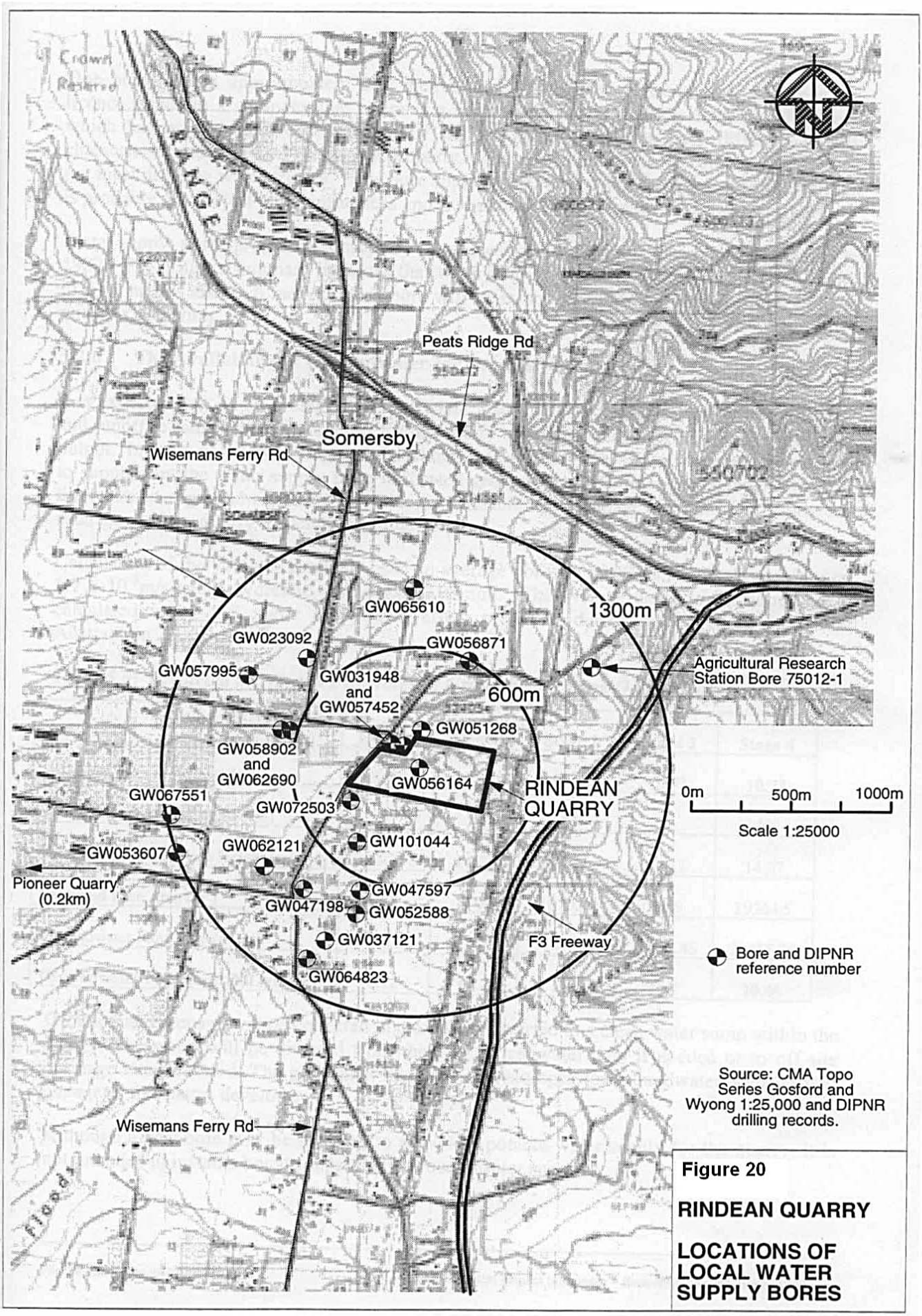


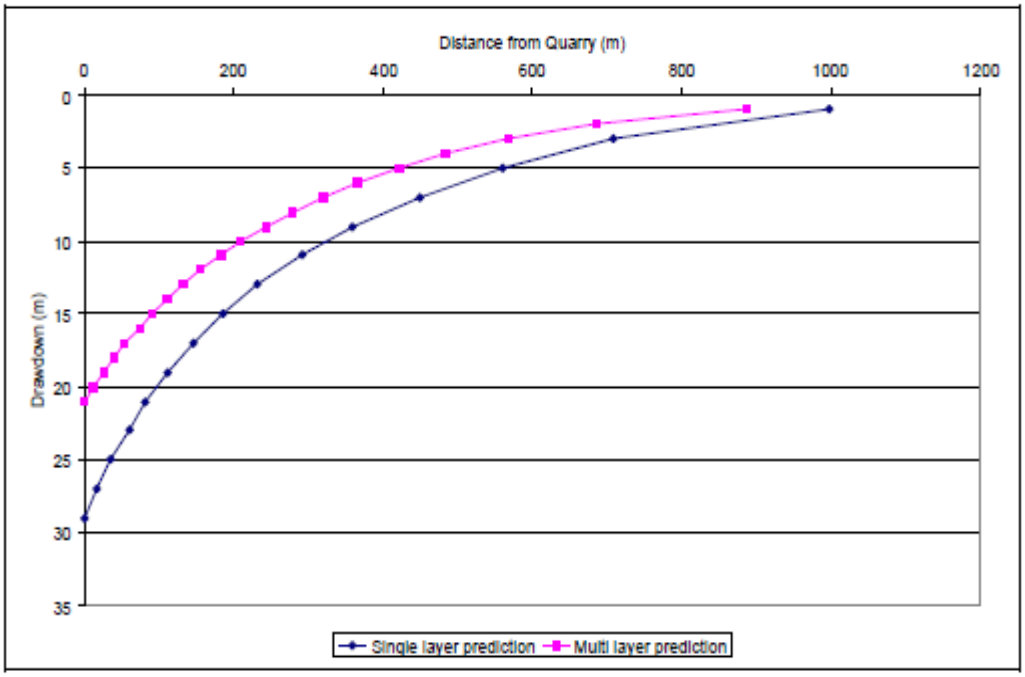
Figure 20

RINDEAN QUARRY

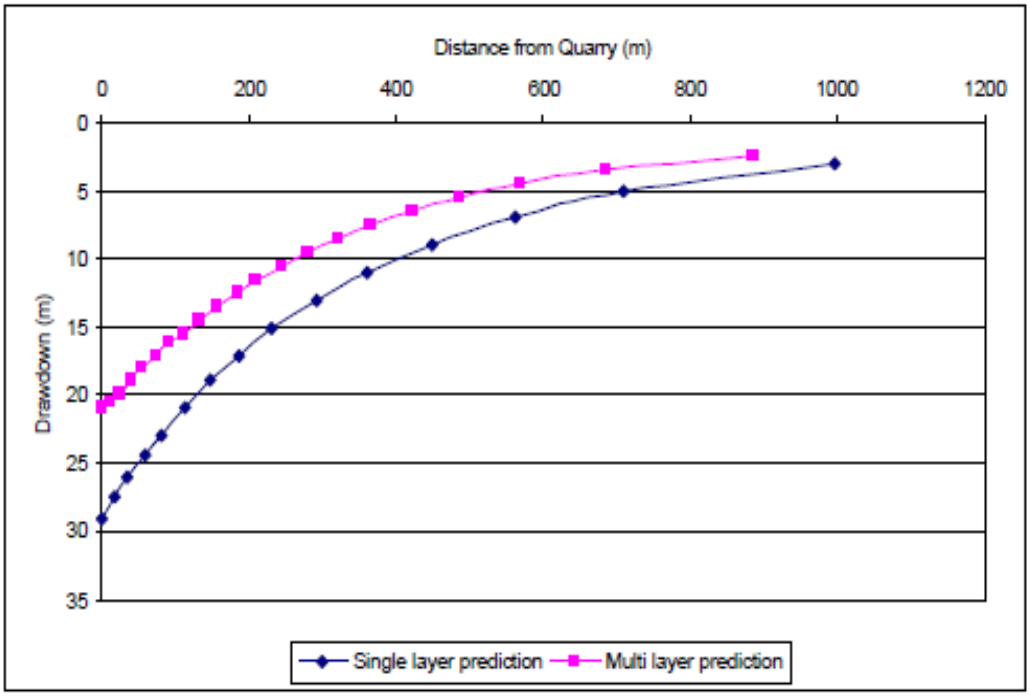
LOCATIONS OF LOCAL WATER SUPPLY BORES

Figure 21, Predicted Groundwater Drawdown

Maximum Predicted Drawdown at 100 years, 15% Recharge rate



Maximum Predicted Drawdown at 100 years, 11% Recharge rate



Source: Hydrogeological Investigation, Rindean Quarry Somersby, RCA Australia August 2004 and Addendum November 2005

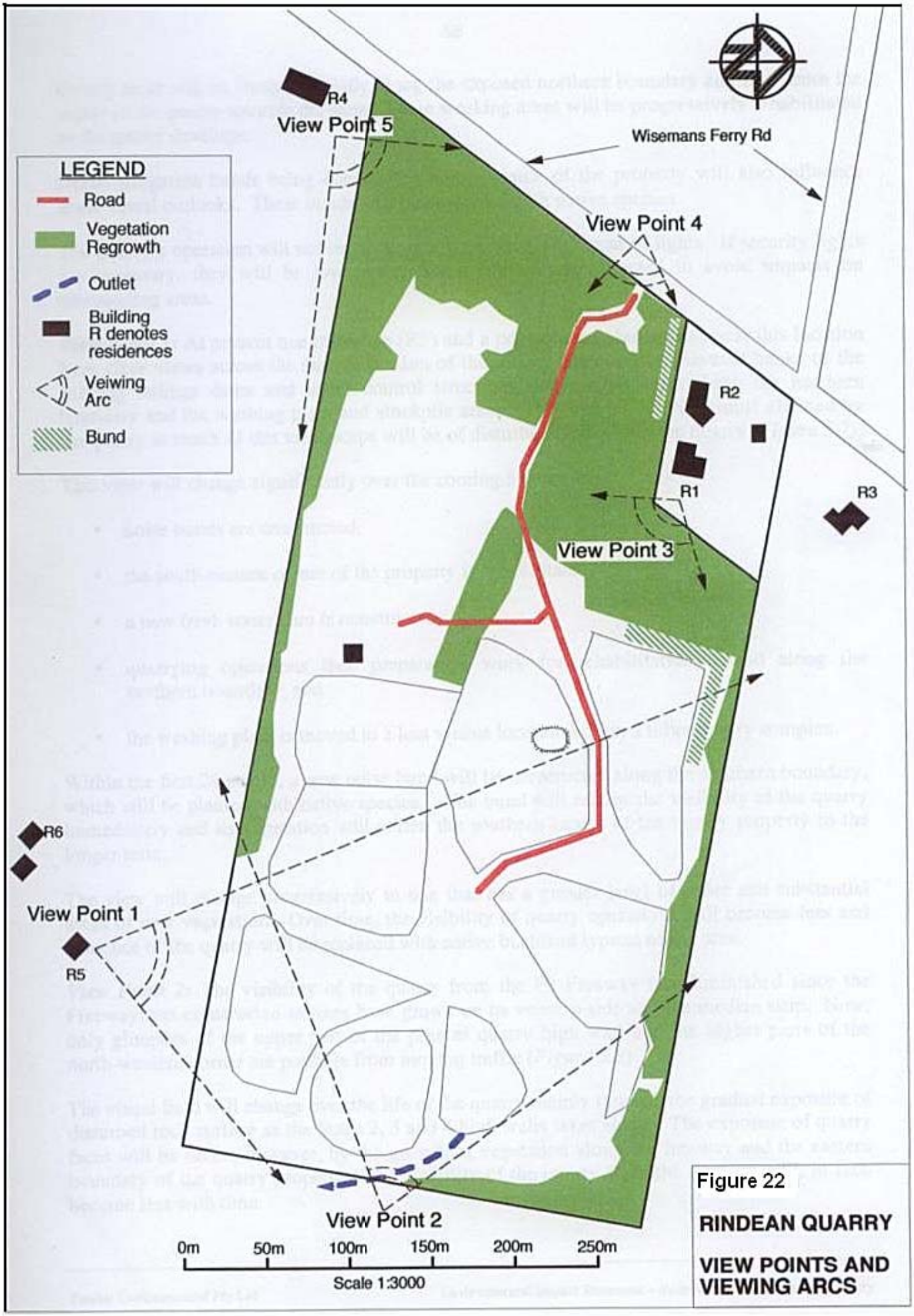
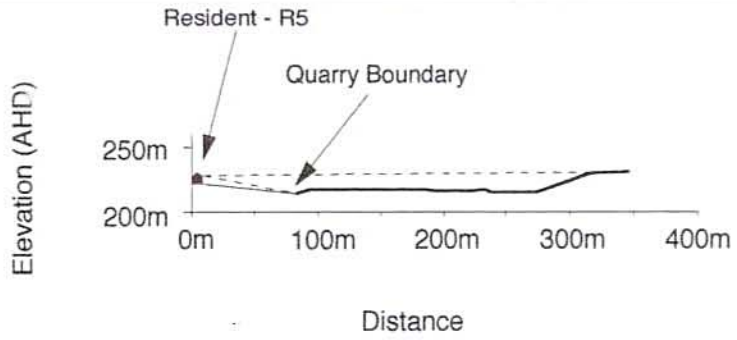


Figure 22

RINDEAN QUARRY

VIEW POINTS AND VIEWING ARCS



Note: At present, Residence R5 has a direct view of the eastern half of R indean Quarry, with only the rising ground levels to the west impeding north westerly views into the quarry. As rehabilitation establishes in the south eastern corner of the quarry, the view will become increasingly filtered. The quarry will be less visible as extraction proceeds to the west.

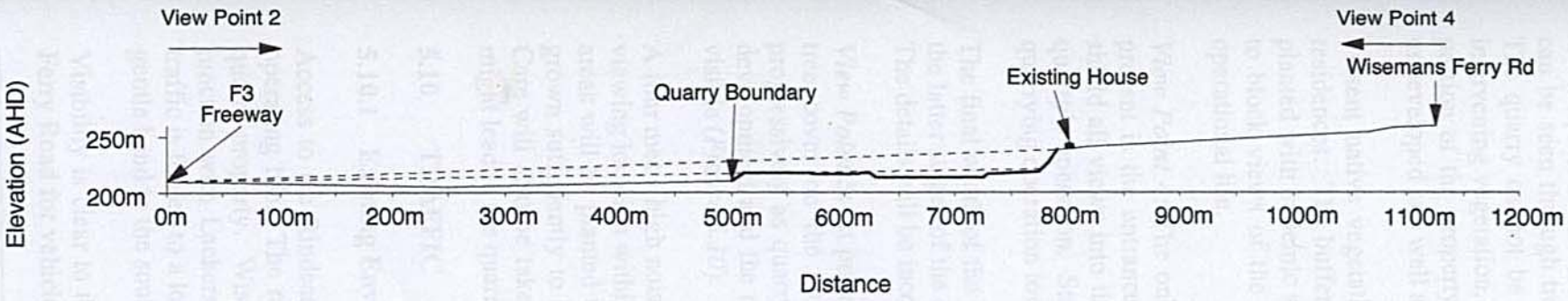


North westerly view from View Point 1 (Residence R5)

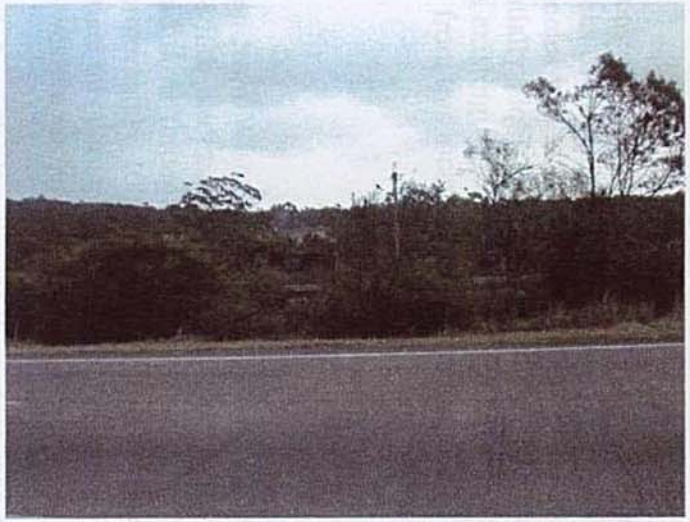
Figure 23

RINDEAN QUARRY

LINES OF SIGHT FROM VIEW POINT 1



Note: The view from Wisemans Ferry Road is limited by existing vegetation along the western end of the site. A vegetation buffer will be retained. The view of the quarry from the F3 Freeway is filtered by vegetation and will be obstructed further as vegetation grows on rehabilitation at the eastern end of the site.



Westerly view from View Point 2 (F3 Freeway)

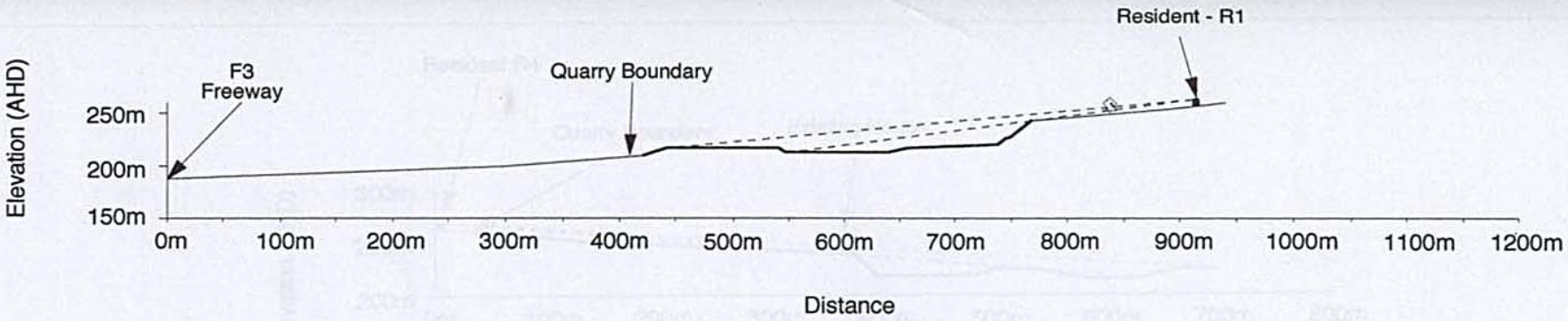


Easterly view from View Point 4 showing the quarry entrance on Wisemans Ferry Road.

Figure 24

RINDEAN QUARRY

LINES OF SIGHT FROM VIEW POINT 2 AND VIEW POINT 4



Note: View is filtered through existing vegetation between the residence and the and quarry. Visibility of the quarry will reduce as vegetation thickens. Rehabilitation at the eastern end of the quarry will reduce its visibility.

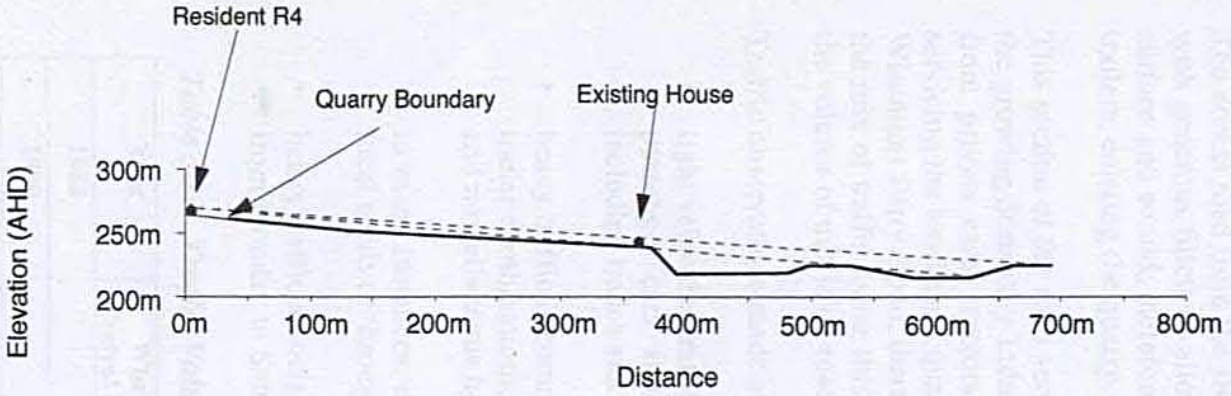


Easterly view from View Point 3 (Residence R1)

Figure 25

RINDEAN QUARRY

LINES OF SIGHT FROM VIEW POINT 3



Note: Existing vegetation obscures the quarry. A vegetation bund along the southern boundary of the quarry should obscure future workings.

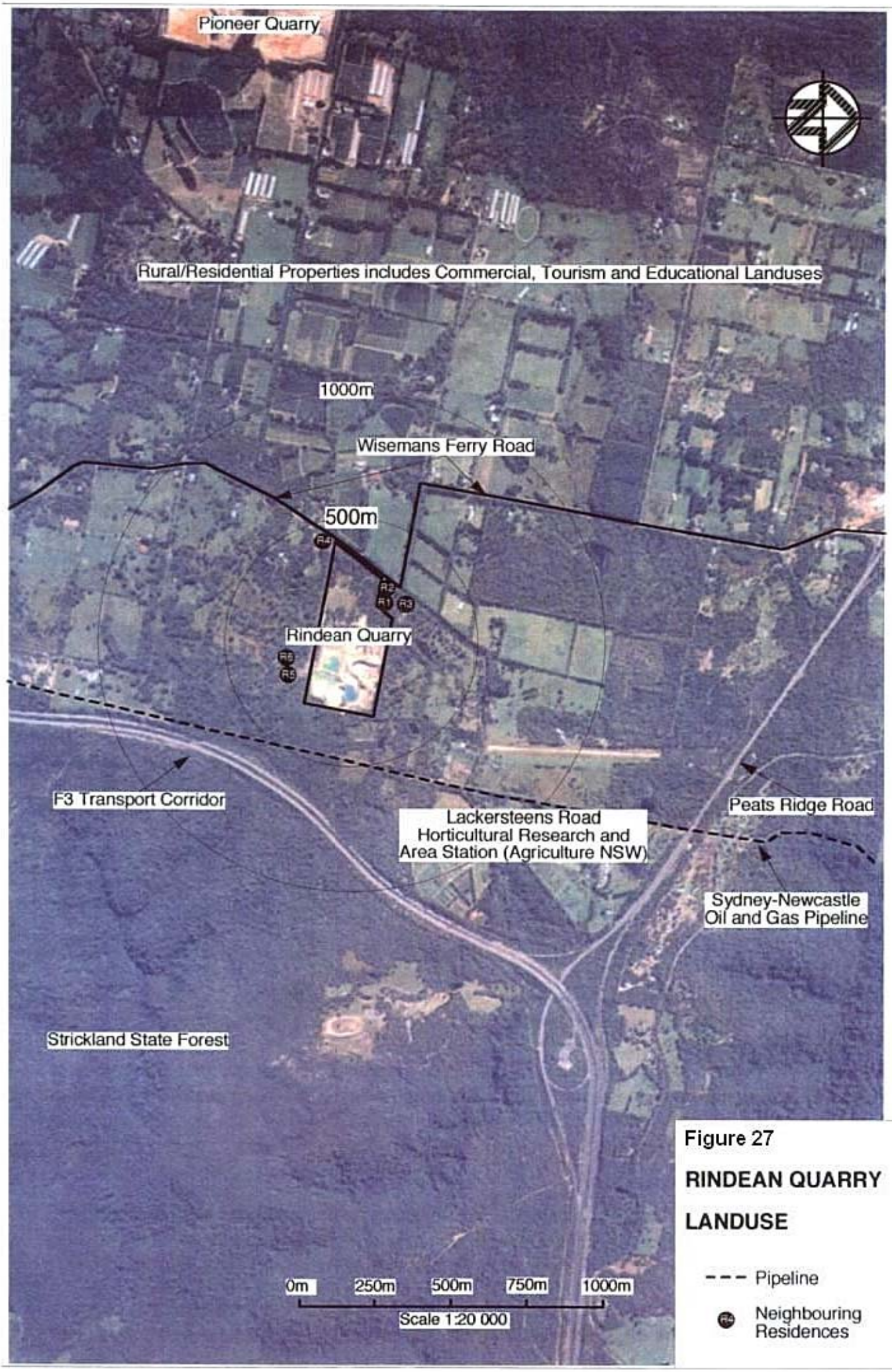


Easterly view from View Point 5 (Residence R4).

Figure 26

RINDEAN QUARRY

LINES OF SIGHT FROM VIEW POINT 5


Pioneer Quarry
Rural/Residential Properties includes Commercial, Tourism and Educational Landuses
1000m
Wisemans Ferry Road
500m
R4
R2
R1
R3
Rindean Quarry
R6
R5
F3 Transport Corridor
Lackersteens Road
Horticultural Research and
Area Station (Agriculture NSW)
Peats Ridge Road
Sydney-Newcastle
Oil and Gas Pipeline
Strickland State Forest
0m
250m
500m
750m
1000m
Scale 1:20 000
Figure 27
RINDEAN QUARRY
LANDUSE
Pipeline
Neighbouring
Residences

CLEVE SMITH EXCAVATIONS PTY LTD
MDJ QUARRIES PTY LTD

RINDEAN QUARRY
SOMERSBY, NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT
Volume 2

APPENDICES

April 2012

Coastplan Consulting Pty Ltd and
Frank Downing Environmental Assessment and Management

CLEVE SMITH EXCAVATIONS PTY LTD

MDJ QUARRIES PTY LTD

RINDEAN QUARRY
SOMERSBY, NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT
Volume 2

APPENDICES

APRIL 2012

Prepared for:	Cleve Smith Excavations Pty Ltd	620 Wisemans Ferry Rd Somersby NSW 2250 Telephone: (02) 4372 1597
and:	MDJ Quarries Pty Ltd	PO Box 3304, Erina NSW 2250 Telephone 4365 0632
Prepared by:	Coastplan Consulting	PO Box 6179 Kincumber NSW 2251 Telephone 4367 4060
and:	Frank Downing Environmental Assessment and Management	PO Box 1040 Toronto NSW 2283 Telephone 4975 5283

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Appendix 5	Flora and Fauna Impact Assessment, Rindean Quarry Lot 2 DP 362339 620, Wisemans Ferry Road Somersby, Keystone Ecological Pty Ltd, February 2012
Appendix 6	Air Quality Assessment, Proposed Sand Quarry, Somersby, Air Noise Environment Pty Ltd, February 2012
Appendix 7	Greenhouse Gas Assessment, Proposed Sand Quarry, Somersby, Air Noise Environment Pty Ltd, February 2012
Appendix 8	Hydrogeological Investigation, Rindean Quarry, Somersby, RCA Australia, August 2004
Appendix 9	Addendum to the Hydrogeological Assessment, RCA Australia, 4 November 2005
Appendix 10	Environmental Noise Assessment Sand Extraction, Rindean Quarry, Somersby, Atkins Acoustics and Associates Pty Ltd, July 2004
Appendix 11	Aboriginal Archaeological Assessment & Historical Heritage Impact Assessment, Rindean Quarry Somersby, NSW, Insite Heritage Pty Ltd. April 2012

APPENDIX 1

DIRECTOR GENERAL'S REQUIREMENTS

NSW GOVERNMENT | Planning & Infrastructure

Mining & Industry Projects
Contact: George Mobayed
Phone: 9228 6467
Fax: 9228 6466
Email: george.mobayed@planning.nsw.gov.au

Mr Tony Tuxworth
Coastplan Consulting
PO Box 6179
KINCUMBER NSW 2251

Dear Mr Tuxworth

Rindean Quarry, Gosford LGA (DGR 570)
Director-General's Requirements

I refer to your recent request to have the Director-Generals Requirements (DGRs) re-issued for the above development. I have attached a copy of the revised DGRs for the Environmental Impact Statement (EIS) required for local development under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). These requirements have been prepared in consultation with the relevant agencies and are based on the information your company has provided to date. I have also attached a copy of the previous and recent State agencies' and Council's input into the formation of the DGRs, which you are advised to consider during your preparation of the EIS.

In the recent request for DGRs, it was indicated that your proposal will require an approval from the Office of Environment and Heritage under the *Protection of the Environment Operations Act 1997*, the Department of Primary Industries under the *Water Management Act 2000,* the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) under the *Mining Act 1992*, and the NSW Roads and Traffic Authority under the *Roads Act 1993*. Accordingly, the proposal is classified as integrated development, under section 91 of the EP&A Act. If further integrated approvals are identified, you must undertake your own consultation with the relevant agencies, and address their requirements in the EIS. The NSW Office of Water and DTIRIS have not provided their comments and therefore you are advised to consult directly with these agencies for their requirements for your EIS.

When you lodge your DA for the proposal, you must provide:

- two hard copies and one electronic copy of the EIS to the Department;
- one hard and one electronic copy of the EIS to each identified integrated approval authority; and
- a cheque for $250 to each identified integrated approval authority, to offset costs involved in the review of the DA and EIS. Do not send a cheque to the Department of Planning and Infrastructure as it is not an integrated approval authority.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, then it will require an additional approval under the Commonwealth's *Environment Protection Biodiversity Conservation Act 1999 (EPBC Act).* This approval is in addition to any approvals required under NSW legislation. If you have any questions about the application of the EPBC Act to your proposal, you should contact the Department of Sustainability, Environment, Water, Population and Communities in Canberra (6274 1111 or www.environment.gov.au).

Should the consent authority approve the proposal, then under section 44 of the *Mines Inspection Act 1901,* the owner or general manager of a mine or quarry must give notice to a Mines Inspector of the commencement (or continuation) of mining or quarrying operations. The Applicant should contact the local Mine Safety Operations Branch of the Department of Trade and Investment, Regional Infrastructure and Services in regard to compliance with the *Mines Inspection Act 1901.*

If you have any enquiries about these requirements, please contact George Mobayed.

Yours sincerely

DKitto 2/8/11

David Kitto
Director
Mining & Industry Projects
as delegate for the Director-General

Director-General's Requirements

Clause 73 of the *Environmental Planning and Assessment Regulation 2000*

DGR Number	570
Proposal	Development of the Rindean Quarry, to extract up to 150,000 tonnes of sand per annum over a 20 year period.
Location	Somersby, approximately 9 km north-west of Gosford
Applicant	Coastplan Consulting
Date of Expiry	2 August 2013
General Requirements (refer Clauses 71 and 72 of the *Environmental Planning and Assessment Regulation 2000*)	The Environmental Impact Statement (EIS) must include: • an executive summary; • a full/detailed description of the proposal, including: - identification of the resource; - description of the site; - a history of previous quarrying operations on the site; - the proposed works (including rehabilitation works); - the duration and intensity of extraction operations; - any likely interactions between the proposed operations and existing/approved development and land use in the area; and - a detailed justification for the development; • a conclusion justifying the development on economic, social and environmental grounds, taking into consideration whether the proposal is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; and • a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.
Key Issues	The EIS must include a detailed assessment of the potential impacts of all phases of the proposal. The EIS must describe the measures that would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor the following potential impacts: • **Soil and Water** – including; - possible impacts upon surface and groundwater resources and proposed mitigation measures; - a detailed description of the proposed water management system, including water supplies and harvestable rights; - an annual site water balance for the proposed life of the development; and - possible impacts on adjacent licensed water users and the riparian environment. • **Traffic and Transport** – including: - the potential impacts of traffic from the proposal on the safety and efficiency of the public road network; and - the measures that would be implemented to upgrade and/or maintain the public road network over the life of the development; • **Noise and Blasting** – including a noise and blasting impact assessment to determine any impact upon nearby private receptors; • **Air Quality** – including greenhouse gas emissions; • **Flora and Fauna** – particularly critical habitats, threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems, affected by the impact of the proposal; • **Rehabilitation** – including: - a detailed description of the proposed measures that would be undertaken during and following quarry closure; - a staged rehabilitation strategy, including detailed justification for the

	proposed final land form and land use, and taking into consideration the objectives of any relevant strategic land use plans or policies; and - the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy; • **Heritage** – including Aboriginal and non-Aboriginal heritage; • **Visual Amenity**; • **Waste Management** – including: - identification of the quantity and type of waste that would be handled/stored/disposed of at the mine; and - the measures that would be implemented to manage any acid generating material and cyanide used onsite and in transport; • **Hazards and Risks** – including bushfires and any storage of dangerous goods; • **Utilities and Services**; and • **Social and Economic impacts.**
Environmental Planning Instruments	The EIS must assess the proposal against the relevant environmental planning instruments, including (but not limited to): • *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007;* • *State Environmental Planning Policy No. 55 – Remediation of Land;* • *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development;* • *State Environmental Planning Policy No. 44 –Koala Habitat Protection;* • *Sydney Regional Environmental Plan No. 8 (Central Coast Plateaus Area);* • *Sydney Regional Environmental Plan No. 9 - Extractive Industry (No 2 - 1995);* • *Gosford Interim Development Order 122;* • *Draft Gosford Local Environmental Plan 2009; and* • relevant development control plans and section 94 plans.
Guidelines	The EIS must take into account relevant State Government policies and guidelines, in particular the *New South Wales Groundwater Protection Policy,* the *Industrial Noise Policy* (EPA 2001), *Soils and Construction: Managing Urban Stormwater* (Landcom 2004), *Approved Methods for the Modelling and Assessment of Air Pollutants* (DEC), *Approved Methods for Sampling and Analysis of Air Pollutants* (DEC) and *Agricultural Issues for Extractive Industries on Rural Lands* (I&I 2010). During the preparation of the EIS you must consult the Department's EIS Guideline – Extractive Industries – Quarries. This guideline is available for purchase from the Department's Information Centre, 23-33 Bridge Street, Sydney or by calling 1300 305 695.
Consultation	During the preparation of the EIS, you must consult with Council and should consult with the relevant local, State and Commonwealth government authorities, service providers and community groups, and address any issues they may raise in the EIS. In particular, you should consult surrounding landowners and occupiers that are likely to be impacted by the proposal. Details of the consultations carried out and issues raised must be included in the EIS.

NSW GOVERNMENT | Office of Environment & Heritage

Your reference: DGR ID No. 570
Our reference: DOC11/31059, LIC 11/380
Contact: Alan Bawden, (02) 4908 6804

NSW Planning and Infrastructure
PO Box 39
SYDNEY NSW 2001

Attention: Mr George Mobayed

Dear Mr Mobayed

RINDEAN QUARRY, WISEMANS FERRY ROAD SOMERSBY
ENVIRONMENTAL IMPACT ASSESSMENT
PART 4 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT
RECOMMENDED DIRECTOR GENERAL REQUIREMENTS

I refer to your request for the Office of Environment and Heritage (OEH) Director General's Requirements (DGR'S) for an Environmental Impact Assessment (EIS) in respect to the Environment Planning and Assessment Act - Part 4 application for the Rindean Quarry, Wisemans Ferry road Somersby (the proposal), received by the OEH on 5 July 2011.

The OEH understands that the proposal is to extract up to 150,000 tonnes of sand from the premises annually, for a period of 20 years. The proposal is classified as a Schedule Activity under the Protection of the Environment Operations Act 1997 and accordingly an Environment Protection Licence (EPL) is required.

The OEH has considered the details of the proposal as provided by NSW Planning and Infrastructure (DP&I) and has identified the information it requires to assess the proposal (see **Attachment 1**). The proponent should ensure that the EIS is sufficiently comprehensive to enable the OEH to determine the extent of the impact(s) of the proposal.

In carrying out the assessment, the proponent should refer to the relevant guidelines as listed in **Attachment 2** and any relevant industry codes of practice and best practice management guidelines.

The OEH requests 2 hard and 4 electronic (CD) copies of the EIS for assessment. These documents should be addressed to the Office of Environment and Heritage; Regional Manager – Hunter, PO Box 488G Newcastle 2300.

The Department of Environment, Climate Change and Water is now known as the
Office of Environment and Heritage, Department of Premier and Cabinet

PO Box 488G, Newcastle NSW 2300
Ground Floor 117 Bull Street,
Newcastle West NSW 2302
Tel: (02) 4908 6800 Fax: (02) 4908 6810
ABN 30 841 387 271
www.environment.nsw.gov.au

If you require any further information regarding this matter please contact Alan Bawden on (02) 4908 6804.

Yours sincerely

20 JUL 2011

MARK HARTWELL
Head Regional Operations Unit – Hunter
Environment Protection and Regulation
Office of Environment and Heritage
Department of Premier and Cabinet

Attachment 1

Office of Environment and Heritage
Recommended Director General Requirements (DGRs)
For
Rindean Quarry - Somersby
Environmental Impact Assessment

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Environmental impacts of the project

1. Impacts related to the following environmental issues need to be assessed, quantified and reported on:
   - Aboriginal cultural heritage
   - Air Issues
     - air quality
     - greenhouse gas
   - Biodiversity
   - Noise and vibration
   - Waste including hazardous materials and radiation
     - General waste – any proposal
     - Hazardous materials and radiation
   - Water and Soils
     - Acid sulfate soils
     - Contaminated sites
     - Flooding and coastal erosion
     - Soils - general
     - Water quality and discharges

   Environmental Impact Assessments (EIS's) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment 2**.

Licensing requirements

1. On the basis of the information submitted to date, it appears the proposal is a scheduled activity - Extractive Industry under the *Protection of the Environment Operations Act 1997* (POEO Act) and will therefore require an Environment Protection Licence (EPL) if approval is granted. The EIS should address the requirements of Section 45 of the POEO Act determining the extent of each impact and providing sufficient information to enable the OEH to determine appropriate limits for the EPL.

2. Should project approval be granted, the proponent will need to make a separate application to the OEH for an EPL for the proposed facility prior to undertaking any on site works. Additional information is available through the *OEH Guide to Licensing* document (www.environment.nsw.gov.au/licensing/licenceguide.htm).

SPECIFIC ISSUES

Aboriginal cultural heritage

The EIS report should contain:

1. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.

2. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land.

3. A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the National Parks and Wildlife Regulation 2009 have been met.

4. The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.

5. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified.

6. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.

7. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

8. A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development.

In addressing these requirements, the proponent must refer to the following documents:

a) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the Environmental Assessment Report.

b) *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires an archaeological investigation to be undertaken.

Notes:

1. An Aboriginal Site Impact Recording Form (http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.

2. Under section 89A of the *National Parks and Wildlife Act* 1974, it is an offence for a person not to notify DECCW of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm), for each Aboriginal site found during investigations.

Air issues

Air quality

The EIS should include a detailed air quality impact assessment (AQIA). The AQIA should:

1. Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human heath and amenity.

2. Justify the level of assessment undertaken on the basis of risk factors, including but not limited to:
   a. proposal location;
   b. characteristics of the receiving environment; and
   c. type and quantity of pollutants emitted.

3. Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:
   a. meteorology and climate;
   b. topography;
   c. surrounding land-use; receptors; and
   d. ambient air quality.

4. Include a detailed description of the proposal. All processes that could result in air emissions must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.

5. Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.

6. Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.

7. Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005) http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf.

8. Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations (POEO) Act (1997)* and the *POEO (Clean Air) Regulation (2010).*

9. Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan 'Action for Air'.

10. Detail emission control techniques/practices that will be employed by the proposal.

Greenhouse gas

1. The EIS should include a comprehensive assessment of, and report on, the project's predicted greenhouse gas emissions (tCO2e). Emissions should be reported broken down by:
   a) direct emissions (scope 1 as defined by the Greenhouse Gas Protocol – see reference below),
   b) indirect emissions from electricity (scope 2), and
   c) upstream and downstream emissions (scope 3)

before and after implementation of the project, including annual emissions for each year of the project (construction, operation and decommissioning).

2. The EIS should include an estimate of the greenhouse emissions intensity (per unit of production). Emissions intensity should be compared with best practice if possible.

3. The emissions should be estimated using an appropriate methodology, in accordance with NSW, Australian and international guidelines (see below).

4. The proponent should also evaluate and report on the feasibility of measures to reduce greenhouse gas emissions associated with the project. This could include a consideration of energy efficiency opportunities or undertaking an energy use audit for the site.

Guidance Material

- The Greenhouse Gas Protocol: Corporate Standard, World Council for Sustainable Business Development & World Resources Institute http://www.ghgprotocol.org/standards/corporate-standard
- National Greenhouse Accounts (NGA) Factors, Australian Department of Climate Change (Latest release), http://www.climatechange.gov.au/publications/greenhouse-acctg/national-greenhouse-factors.aspx
- National Greenhouse and Energy Reporting System, Technical Guidelines (latest release) http://www.climatechange.gov.au/en/government/initiatives/national-greenhouse-energy-reporting/tools-resources.aspx
- National Carbon Accounting Toolbox http://www.climatechange.gov.au/government/initiatives/ncat.aspx
- Australian Greenhouse Emissions Information System (AGEIS) http://ageis.climatechange.gov.au/

Biodiversity

Biodiversity impacts can be assessed using **either** the BioBanking Assessment Methodology (scenario 1) or a detailed biodiversity assessment (scenario 2). The requirements for each of these approaches are detailed below.

The BioBanking Assessment Methodology can be used **either** to obtain a BioBanking statement, or to assess impacts of a proposal and to determine required offsets without obtaining a statement. In the latter instances, if the required credits are not available for offsetting, appropriate alternative options may be developed in consultation with OEH officers and in accordance with OEH policy.

Scenario 1 - Where a proposal is assessed using the BioBanking Assessment Methodology (BBAM):

1. Where a BioBanking Statement is being sought under Part 7A of the *Threatened Species Conservation* Act 1995 (TSC Act), the assessment must be undertaken by an accredited BioBanking assessor (as specified under Section 142B (1)(c) of the TSC Act 1995) and done in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008). To qualify for a BioBanking Statement a proposal must meet the improve or maintain standard.

1a. The EIS should include a specific Statement of Commitments that reflects all requirements of the BioBanking Statement including the number of credits required and any DG approved variations to impact on Red Flags.

2. Where the BioBanking Assessment Methodology is being used to assess impacts of a proposal and to determine required offsets, and a BioBanking Statement is not being obtained, the EA should contain a detailed biodiversity assessment and all components of the assessment must be undertaken in

accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008).

2a. The EIS should include a specific Statement of Commitments which:
- is informed by the outcomes of the proposed BioBanking assessment offset package;
- sets out the ecosystem and species credits required by the BioBanking Assessment Methodology and how these ecosystem and/or species credits will be secured and obtained;
- if the ecosystem or species credits cannot be obtained, provides appropriate alternative options to offset expected impacts, noting that an appropriate alternative option may be developed in consultation with OEH officers and in accordance with OEH policy;
- demonstrates how all options have been explored to avoid red flag areas;
- includes all relevant 'BioBanking files (e.g. *.xml output files), data sheets and documentation (including maps, aerial photographs, GIS shape files, other remote sensing imagery etc.) to ensure the OEH can conduct an appropriate review of the assessment.

3. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby NSW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Please refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECCW, 2010).

4. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify and assess any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

Scenario 2 - Where a proposal is assessed outside the BioBanking Assessment Methodology:

1. The EIS should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.

2. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:
   - the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians* (DECCW, 2009)
   - *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), and
   - Threatened species survey and assessment guideline information on www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.

   If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the EIS, to determine whether OEH considers that it is appropriate.

   Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:
   - been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or
   - utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for.

Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005). The OEH Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the *Atlas of NSW Wildlife* database must be the primary information sources for the list of threatened species present. The BioBanking Threatened Species Database, the Vegetation Types databases (available on OEH website at http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm and http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm, respectively) and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

3. The EIS should contain the following information as a minimum:
   a. The requirements set out in the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005).
   b. Description and geo-referenced mapping of study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.
   c. Description of survey methodologies used, including timing, location and weather conditions.
   d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EIS.
   e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.
   f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.
   g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.
   h. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 6 below).
   i. Provision of specific Statement of Commitments relating to biodiversity.

4. An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat. This assessment must take into account:
   a. the factors identified in s.5A of the EP&A Act, and
   b. the guidance provided by *The Threatened Species Assessment Guideline – The Assessment of Significance (DECCW, 2007)* which is available at: http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf

5. Where an offsets package is proposed by a proponent for impacts to biodiversity (and a BioBanking Statement has not been sought) this package should:

a) Meet theOEH's *Principles for the use of biodiversity offsets in NSW*, which are available at: www.environment.nsw.gov.au/biocertification/offsets.htm.
b) Identify the conservation mechanisms to be used to ensure the long term protection and management of the offset sites.
c) Include an appropriate Management Plan (such as vegetation or habitat) that has been developed as a key amelioration measure to ensure any proposed compensatory offsets, retained habitat enhancement features within the development footprint and/or impact mitigation measures (including proposed rehabilitation and/or monitoring programs) are appropriately managed and funded.

6. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby NSW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECC, 2010).

7. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

Noise and vibration

1. In relation to noise, the following matters should be addressed (where relevant) as part of the EIS.

General

2. Construction noise associated with the proposed development should be assessed using the *Interim Construction Noise Guideline (*DECC, 2009). http://www.environment.nsw.gov.au/noise/constructnoise.htm

3. Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the *Assessing Vibration: a technical guideline* (DEC, 2006). http://www.environment.nsw.gov.au/noise/vibrationguide.htm

4. If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in *Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990). http://www.environment.nsw.gov.au/noise/blasting.htm

Industry

5. Operational noise from all industrial activities (including private haul roads and private railway lines) to be undertaken on the premises should be assessed using the guidelines contained in the *NSW Industrial Noise Policy* (EPA, 2000) and *Industrial Noise Policy Application Notes.* http://www.environment.nsw.gov.au/noise/industrial.htm

Road

6. Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the *Environmental Criteria for Road Traffic Noise* (EPA, 1999). http://www.environment.nsw.gov.au/noise/traffic.htm

7. Noise from new or upgraded public roads should be assessed using the *Environmental Criteria for Road Traffic Noise* (EPA, 1999). http://www.environment.nsw.gov.au/noise/traffic.htm

Railway

8. Noise from increased rail traffic on the NSW Rail Network resulting from rail traffic generating development (e.g. an extractive industry) should be assessed using the environmental assessment requirements for rail traffic-generating developments available at http://www.environment.nsw.gov.au/noise/railnoise.htm

Waste, chemicals and hazardous materials and radiation

General waste – any proposal

The EIS should:

1. Include a detailed plan for in-situ classification of waste material, including the sampling locations and sampling regime that will be employed to classify the waste, particularly with regards to the identification of contamination hotspots.

2. Identify, characterise and classify all waste that will be generated onsite through excavation, demolition or construction activities, including proposed quantities of the waste.
   Note: All waste must be classified in accordance with *OEH's Waste Classification Guidelines.*

3. Identify, characterise and classify all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste. This includes waste that is intended for re-use or recycling.
   Note: All waste must be classified in accordance with *OEH's Classification Guidelines.*

4. Include a commitment to retaining all sampling and classification results for the life of the project to demonstrate compliance with *OEH's Waste Classification Guidelines.*

5. Provide details of how waste will be handled and managed onsite to minimise pollution, including:

   a) Stockpile location and management
      - Labelling of stockpiles for identification, ensuring that all waste is clearly identified and stockpiled separately from other types of material (especially the separation of any contaminated and non-contaminated waste).
      - Proposed height limits for all waste to reduce the potential for dust and odour.
      - Procedures for minimising the movement of waste around the site and double handling.
      - Measures to minimise leaching from stockpiles into the surrounding environment, such as sediment fencing, geofabric liners etc.

   b) Erosion, sediment and leachate control including measures to be implemented to minimise erosion, leachate and sediment mobilisation at the site during works. The EIS should show the location of each measure to be implemented. The Proponent should consider measures such as:
      - Sediment traps
      - Diversion banks

- Sediment fences
- Bunds (earth, hay, mulch)
- Geofabric liners.
- Other control measures as appropriate

The Proponent should also provide details of:

- how leachate from stockpiled waste material will be kept separate from stormwater runoff;
- treatment of leachate through a wastewater treatment plant (if applicable); and
- any proposed transport and disposal of leachate off-site.

6. Provide details of how the waste will be handled and managed during transport to a lawful facility. If the waste possesses hazardous characteristics, the Proponent must provide details of how the waste will be treated or immobilised to render it suitable for transport and disposal.

7. Include details of all procedures and protocols to be implemented to ensure that any waste leaving the site is transported and disposed of lawfully and does not pose a risk to human health or the environment.

8. Include a statement demonstrating that the Proponent is aware of OEH's requirements with respect to notification and tracking of waste.

9. Include a statement demonstrating that the Proponent is aware of the relevant legislative requirements for disposal of the waste, including any relevant Resource Recovery Exemptions, as gazetted by OEH from time to time.

10. Outline contingency plans for any event that affects operations at the site that may result in environmental harm, including: excessive stockpiling of waste, volume of leachate generated exceeds the storage capacity available on-site etc.

Water and soils

Acid sulfate soils

1. The potential impacts of the development on acid sulfate soils must be assessed in accordance with the relevant guidelines in the *Acid Sulfate Soils Manual* (Stone *et al.* 1998) and the *Acid Sulfate Soils Laboratory Methods Guidelines* (Ahern *et al.* 2004).

2. Describe mitigation and management options that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the project and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Contaminated sites assessment and remediation

1. The EIS should include an assessment of the contaminated site that is conducted in accordance with the guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997*, for example: *Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000), Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006), Sampling Design Guidelines (EPA, 1995), National Environment Protection (Assessment of Site Contamination) Measure 1999* (or update).

2. The EIS should provide the details on how the site contamination will be remediated and/or managed so that the site is, or can be, made suitable for the proposed use.

3. All reports should be prepared in accordance with the *Guidelines for Consultants Reporting on Contaminated Sites* (EPA, 2000).

1. The EIS should specify whether or not a site auditor, accredited under the *Contaminated Land Management Act 1997*, has been or will be engaged to issue a site audit statement to certify on the suitability of the current or proposed uses.

Flooding and coastal erosion

The EIS should include an assessment of the following referring to the relevant guidelines in Attachment 2:

1. Whether the proposal is consistent with any floodplain risk management plans.

2. Whether the proposal is compatible with the flood hazard of the land.

3. Whether the proposal will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties.

4. Whether the proposal will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

5. Whether the proposal incorporates appropriate measures to manage risk to life from flood.

6. Whether the proposal is likely to result in unsustainable social and economic costs to the community as a consequence of flooding.

Soil issues - general

The EIS should include:

1. An assessment of potential impacts on soil and land resources should be undertaken, being guided by *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC 2000). The nature and extent of any significant impacts should be identified. Particular attention should be given to:
   a. Soil erosion and sediment transport - in accordance with *Managing urban stormwater: soils and construction,* vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008).
   b. Mass movement (landslides) – in accordance with *Landslide risk management* guidelines presented in Australian Geomechanics Society (2007).
   c. Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets which includes *Site Investigations for Urban Salinity* (DLWC, 2002).

2. A description of the mitigation and management options that will be used to prevent, control, abate or minimise identified soil and land resource impacts associated with the project. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

3. Where required, add any specific assessment requirements relevant to the project.

Water

Describe Proposal

1. Describe the proposal including position of any intakes and discharges, volumes, water quality and frequency of all water discharges.

2. Demonstrate that all practical options to avoid discharge have been implemented and environmental impact minimised where discharge is necessary.

3. Where relevant include a water balance for the development including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Background Conditions

4. Describe existing surface and groundwater quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal.

   Proponents are generally only expected to source available data and information. However, proponents of relatively large and/or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could also include, for example:

   - water chemistry
   - a description of receiving water processes, circulation and mixing characteristics and hydrodynamic regimes
   - lake or estuary flushing characteristics
   - sensitive ecosystems or species conservation values
   - specific human uses (e.g. fishing, proximity to recreation areas)
   - a description of any impacts from existing industry or activities on water quality
   - a description of the condition of the local catchment e.g. erosion, soils, vegetation cover, etc.
   - an outline of baseline groundwater information, including, for example, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment
   - historic river flow data

5. State the Water Quality Objectives for the receiving waters relevant to the proposal. These refer to the community's agreed environmental values and human uses endorsed by the NSW Government as

goals for ambient waters (http://www.environment.nsw.gov.au/ieo/index.htm). Where groundwater may be impacted the assessment should identify appropriate groundwater environmental values.

6. State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC (2000) Guidelines for Fresh and Marine Water Quality (http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality).

7. State any locally specific objectives, criteria or targets which have been endorsed by the NSW Government.

Impact Assessment

8. Describe the nature and degree of impact that any proposed discharges will have on the receiving environment.

   Depending on the nature, scale and/or risk of the proposal, this could include specific requirements to consider impacts on, for example:
   - water circulation, current patterns, water chemistry and other appropriate characteristics such as clarity, temperature, nutrient and toxicants
   - changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, and groundwater)
   - disturbance of acid sulphate soils and potential acid sulfate soils
   - stream bank stability and impacts on macro invertebrates

   Depending on the nature, scale and/or risk of the proposal, modelling, monitoring, or both, may need to be undertaken to assess the potential impact of discharges on the receiving environment. If modelling is required to assess the potential impact of any discharge(s), this could include, for example:
   - a range of scenarios that encompass any variations in discharge quality and quantity as well as the relevant range of environmental conditions of the receiving waters. The scenarios could describe a set of worst-case conditions and typical conditions to ensure that both acute and chronic impacts are assessed
   - assumptions used in the modelling, including identification and discussion of the limitations and assumptions to ensure full consideration of all factors, including uncertainty in predictions.

   The internal OEH document *Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones* (http://deccnet/water/resources/AWQGuidance7.pdf) provides guidance on modelling considerations and principles for discharges to receiving waters.

9. Assess impacts against the relevant ambient water quality outcomes. Demonstrate how the proposal will be designed and operated to:
   - protect the Water Quality Objectives for receiving waters where they are currently being achieved; and
   - contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved.

10. Where a discharge is proposed that includes a mixing zone, the proposal should demonstrate how wastewater discharged to waterways will ensure the ANZECC (2000) water quality criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge, and that any impacts in the initial mixing zone are demonstrated to be reversible.

11. Assess impacts on groundwater and groundwater dependent ecosystems.

12. Describe how stormwater will be managed both during and after construction.

Monitoring

13. Describe how predicted impacts will be monitored and assessed over time.

    For relatively large and/or high risk developments, proponents should develop a water quality and aquatic ecosystem monitoring program to monitor the responses for each component or process that affects the Water Quality Objectives that includes, for example:

    - adequate data for evaluating compliance with water quality standards and/or Water Quality Objectives
    - measurement of pollutants identified or expected to be present in any discharge

    Water quality monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutant in NSW* (2004) (http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf).

Attachment 2 – Guidance Material

Title	Web address
Relevant Legislation	
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+140+1997+cd+0+N
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+14+1985+cd+0+N
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Threatened Species Conservation Act 1995	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Licensing	
OEH Guide to Licensing	www.environment.nsw.gov.au/licensing/licenceguide.htm
Aboriginal Cultural Heritage	
Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)	Available from DoP.
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Air Issues	
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2005)	http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf

Title	Web address
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+642+2002+cd+0+N
Greenhouse Gas	
The Greenhouse Gas Protocol: Corporate Standard, World Council for Sustainable Business Development & World Resources Institute	http://www.ghgprotocol.org/standards/corporate-standard
National Greenhouse Accounts (NGA) Factors, Australian Department of Climate Change (Latest release),	http://www.climatechange.gov.au/publications/greenhouse-acctg/national-greenhouse-factors.aspx
National Greenhouse and Energy Reporting System, Technical Guidelines (latest release)	http://www.climatechange.gov.au/en/government/initiatives/national-greenhouse-energy-reporting/tools-resources.aspx
National Carbon Accounting Toolbox	http://www.climatechange.gov.au/government/initiatives/ncat.aspx
Australian Greenhouse Emissions Information System (AGEIS)	http://ageis.climatechange.gov.au/
	Biodiversity
BioBanking Assessment Methodology (DECC, 2008)	http://www.environment.nsw.gov.au/resources/biobanking/08385bbassessmethod.pdf
BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW, 2008)	http://www.environment.nsw.gov.au/biobanking/operationalmanual.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Guidelines for Threatened Species Assessment (Department of Planning, July 2005)	Draft available from DoP
DECCW Threatened Species website	http://www.environment.nsw.gov.au/threatenedspecies/
Atlas of NSW Wildlife	http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp
BioBanking Threatened Species Database	http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm

Title	Web address
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biocertification/offsets.htm

Noise and Vibration

Interim Construction Noise Guideline (DECC, 2009)	http://www.environment.nsw.gov.au/noise/constructnoise.htm
Assessing Vibration: a technical guideline (DEC, 2006)	http://www.environment.nsw.gov.au/noise/vibrationguide.htm
Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990)	http://www.environment.nsw.gov.au/noise/blasting.htm
NSW Industrial Noise Policy (EPA 2000)	http://www.environment.nsw.gov.au/noise/industrial.htm
Industrial Noise Policy Application Notes	http://www.environment.nsw.gov.au/noise/applicnotesindustnoise.htm
Environmental Criteria for Road Traffic Noise (EPA, 1999)	http://www.environment.nsw.gov.au/noise/traffic.htm
Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (DECC, 2007)	http://www.environment.nsw.gov.au/noise/railinfranoise.htm
Environmental assessment requirements for rail traffic-generating developments	http://www.environment.nsw.gov.au/noise/railnoise.htm

Waste, Chemicals and Hazardous Materials and Radiation

Waste

Waste Classification Guidelines (DECC, 2008)	http://www.environment.nsw.gov.au/waste/envguidlns/index.htm
DECCW Resource recovery exemption	http://www.environment.nsw.gov.au/waste/RRecoveryExemptions.htm
POEO (Waste) Regulations 2005	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+497+2005+cd+0+N

Water and Soils

Acid sulphate soils

Acid Sulfate Soils Planning Maps	http://canri.nsw.gov.au/download/

Title	Web address
Acid Sulfate Soils Manual (Stone et al. 1998)	Manual available for purchase from: http://www.landcom.com.au/whats-new/the-blue-book.aspx Chapters 1 and 2 are on DoP's Guidelines Register at: Chapter 1 Acid Sulfate Soils Planning Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Planning%20Guidelines.pdf Chapter 2 Acid Sulfate Soils Assessment Guidelines: http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Assessment%20Guidelines.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.derm.qld.gov.au/land/ass/pdfs/lmg.pdf This replaces Chapter 4 of the Acid Sulfate Soils Manual above.
Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	http://www.planning.nsw.gov.au/DevelopmentAssessments/RegisterofDevelopmentAssessmentGuidelines/tabid/207/language/en-US/Default.aspx
Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.environment.nsw.gov.au/resources/clm/97104consultantsglines.pdf
Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006)	http://www.environment.nsw.gov.au/resources/clm/auditorglines06121.pdf
Sampling Design Guidelines (EPA, 1995)	Available by request from OEH's Environment Line
National Environment Protection (Assessment of Site Contamination) Measure 1999 (or update)	http://www.ephc.gov.au/taxonomy/term/44
Flooding and Coastal Erosion	
Floodplain development manual	http://www.dnr.nsw.gov.au/floodplains/manual.shtml
Soils – general	
Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)	http://www.dnr.nsw.gov.au/care/soil/soil_pubs/pdfs/tech_rep_34_new.pdf
Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008)	Vol 1 - Available for purchase at http://www.landcom.com.au/whats-new/publications-reports/the-blue-book.aspx Vol 2 - http://www.environment.nsw.gov.au/stormwater/publications.htm
Landslide risk management guidelines	http://www.australiangeomechanics.org/resources/downloads/
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3siteinvestigationsforurbansalinity.pdf
Local Government Salinity Initiative Booklets	http://www.environment.nsw.gov.au/salinity/solutions/urban.htm
Water	

Title	Web address
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

NSW GOVERNMENT | Office of Environment & Heritage

PCU024383

Contact: Katrina Stankowski
Phone: 02 9873 8569
Fax: 02 9873 8599
Email: Katrina.Stankowski@planning.nsw.gov.au

HOD number: 5061418
Job ID No: B433509
File number 11/
Your ref: DGR ID No. 570

Howard Reed
Manager Mining Projects
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Department of Planning
Received
2 1 JUL 2011
Scanning Room

Attention: George Mobayed

Dear Mr Reed.

Environmental Impact Statement referral – Commencement of Sand Quarrying – Rindean Quarry- 620 Wisemans Ferry Road, Somersby, Gosford LGA – Your Reference: DGR ID No. 570.

I refer to your letter dated 28 of April (received by this Branch on 1 July), seeking the Branch's key issues that need to be addressed in the relevant documentation Environmental Impact Statement (EIS) for the above mentioned development proposal.

In accordance with Clause 73 of the *Environmental Planning and Assessment Regulation 2000*, it is requested that the documentation should include a heritage impact assessment that addresses 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 and include reference to Belltrees, Woodlands and Kewita/Linton Park which are located on Wisemans Ferry Road in Somersby;

- The Heritage Council maintains the State Heritage Inventory which lists some items protected under the *Heritage Act, 1977* (e.g. listed on the NSW State Heritage Register) and other statutory instruments. This register can be accessed through the Heritage Office home page on the internet (http://www.heritage.nsw.gov.au);

  It should be noted that the legal standing of items listed on the State Heritage Register can also be provided by applying for a section 167 Certificate through the Heritage Branch home page;

  You should consult lists maintained by the Office of Environment & Heritage, the National Trust of Australia (NSW), the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999* and the local council in order to identify any identified items of heritage significance in the area affected by the

proposal. Please be aware, however, that these lists are constantly evolving and that items with potential heritage significance may not yet be 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), gardens, landscapes, views, 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/measures 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 should be undertaken by a qualified practitioner/consultant with historic sites experience. The Branch's website http://www.heritage.nsw.gov.au/13_subnav_07.cfm can provide lists of suitable consultants;

- 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 Environmental Protection & Regulation Group of the Office of Environment & Heritage;

- The relics provisions in the Heritage Act require an excavation permit to be obtained from the Heritage Council, or an exception to be endorsed by the Heritage Council, prior to commencement of works if disturbance to a site with known or potential archaeological relics is proposed. Where possible refer to archaeological zoning plans or archaeological management plans held by Local Councils. If any unexpected archaeological relics are uncovered during the course of work excavation should cease and an excavation permit, or an exception notification endorsement, 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 1979* (except where application relates to Integrated Development OR Major Infrastructure and Other Projects under Part 3A of the *EP&A Act, 1979*). 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 Heritage Branch would be happy to review any further documentation that may address any likely heritage impacts. If you have any further enquiries regarding this matter, please contact Katrina Stankowski on (02) 9873 8569.

Yours sincerely

14-07-2011

Dr Siobhan Lavelle OAM
A/Manager
Conservation Team
Heritage Branch
Office of Environment & Heritage

PCU024515

Telephone (02) 4325 8222 Please Quote: 10005984
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19 July 2011

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Dear Sir

Proposal - Rindean Quarry, Gosford LGA
DGR ID No 570

I refer to your letter of 28 June 2011 and advise that the following matters need to be included/addressed in the Environmental Impact Statement.

A Executive Summary

B The proposal

1. Objectives and characteristics of the proposal
2. Characteristics of the resource
3. Description of quarry operations
4. Site layout plans
5. Site preparation works to establish and continue the quarry
6. Infrastructure consideration
7. Rehabilitation
8. Previous operations on the site
9. Consideration of alternatives and justification for the preferred proposal

C The location

1. Planning information, site description and locality information
2. Overview of the affected environment

D Identification and prioritisation of issues

1. Overview of the methodology
2. Outcomes of the process

E The environmental issues

1. Traffic and road issues
2. Soils and geological issues
3. Water issues, including ground water and water bores in the locality, water quality

4. Air quality issues
5. Noise and blasting issues
6. Flora and fauna issues
7. Heritage issues
8. Visual issues
9. Hazards issues
10. Social and health issues
11. Economic issues
12. Cumulative issues

F **List of approved and licences required**

G **Compilation of mitigation measures**

H **Justification for the proposal**

I **What works, control measure etc are outstanding**

J **Details of public objections to the previous proposal approved under Development Consent 26467/2004 and proposed measures to mitigate impacts on adjoining and nearby residences.**

K **The following legislative/planning instruments:**

1. IDO No 122
2. Draft Gosford LEP 2009
3. SEPP Infrastructure
4. SEPP 55 - Remediation of land
5. Sydney REP 8 - Central Coast Plateau Areas
6. Sydney REP 9 - Extractive Industries
7. Sydney REP 20 – Hawkesbury/Nepean River Water Management Act 2000
8. Threatened species Act
9. EPA Act
10. Mining Act 1992
11. Protection of the Environment Operations Act 1997
12. Roads Act 1993
13. Rural Fires Act 1997

L **Engineering/Traffic**

1. Traffic study addressing
   i) Number of daily movements
   ii) Hours of operation
   iii) Vehicle manoeuvring into and out of the site and the intersection design of the entry/exit with Wisemans Ferry Road
   iv) Impact of tree removal as a result of the required intersection design for the entry/ext with Wisemans Ferry Road.
2. Stormwater management

M **All Environmental Factors previously considered under the last EIS need to be addressed, including:**

1. Air Quality
2. Noise
3. Groundwater
4. Stormwater Management

5. A Flora and Fauna Impact Assessment addressing Section 5A will need to be undertaken with new field surveys. This report (including field surveys) shall be prepared in accordance with Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft, DEC November 2004.
6. Additional target surveys for Prostanthera junonis (Somersby Mint Bush) undertaken during in accordance with the approved Recovery Plan need to underpin any assessment for this species.

Yours faithfully

R Eyre
Senior Assessment Planner

Department of
Infrastructure, Planning and Natural Resources

Memorandum

To	David Kitto, Manager Mining & Extractive Industries Major Development Assessment, GPO Box 3927, Sydney NSW 2001		
From	Mark Mignanelli, Resource Access Manager, Hunter Region Phone 02 4929 9850 Fax 02 4929 6364 e-mail Mark.Mignanelli@dipnr.nsw.gov.au		
Subject	Requirements for the Preparation of an EIS for Proposed Development of the Existing RIndean Sand Quarry Lot 2 DP 362339 Wiseman's Ferry Road Somersby		
Our Ref	ER5303	Your Ref	S04/00482
Date	26 March 2004		

INTRODUCTION

- The following information requirements have been prepared by the Resource Access Unit of the Department of Infrastructure, Planning and Natural Resources (DIPNR) Hunter Region as a guide for applicants/ consultants in the preparation of development proposals.
- Whilst this document has been prepared as a guide there may be circumstances that on formal referral of a proposal, DIPNR Hunter Region will require additional information to be provided.
- Details of the principal legislation administered by DIPNR (Natural Resources), relevant NSW State Government natural resource management policies and departmental EIS Guidelines, form an annexure to this document.

INFORMATION

Existing Approvals

1. Details of any existing consents/ approvals (eg. DA consent/permit/licence)

Land Status/Ownership

1. Land title description and if proposal includes Crown land (eg. bed of waterway or Crown roads)
2. Land tenure (eg. lease/ license) and if under mining lease or Crown leasehold
3. Details of the registered owner/s of the property and applicant/s
4. Evidence of the land owner's consent (eg. to lodge development application)

Site Information/ Survey

1. Site location with north point and scale
2. Layout plan
3. Survey plan of the existing site
4. Identification of survey pegs and property boundaries including Mean High Water Mark
5. Survey plan to provide cross sectional details
6. Topographic contours at regular intervals
7. Site features - watercourses, lakes, wetlands, vegetation, buildings, tracks, infrastructure etc.
8. Details on direction of flow, water levels, high bank, low bank, major aggradation / erosion for any watercourses, flood runners, terraces and other geomorphological features
9. Plan to identify 1: 100 year flood level

Project Description

1. Description of the ***proposed*** and ***existing*** development including all ancillary works (stormwater drainage, access, bridge, causeway, pipeline etc.)
2. Photographs panoramic (multiple frames) for development site. *Note:* If watercourses are impacted upon or in the vicinity of the development, include photographs also looking upstream and downstream
3. Site layout plan that indicates the location of photographic reference points

Operational Information

1. Operational plan detailing the ongoing operation including staging/ sequencing
2. Geotechnical engineers report on the stability of the proposal
3. Erosion and Sediment Control Plan prepared in accordance the guideline manual 'Managing Urban Stormwater Soils and Construction'
4. Rehabilitation plan that details the progressive and final restoration/ rehabilitation of landform, revegetation, surface water, groundwater and maintenance
5. Monitoring program for assessment on surface water
6. Monitoring program for assessment on groundwater
7. Contingency plans linked to the monitoring program

Vegetation

1. Details of any clearing of vegetation including mapping overlaid on an aerial photograph and/or a vegetation/ habitat map
2. Details of clearing methods
3. Identify species and/or elements of the vegetation structure to be cleared
4. Ameliorating measures, include details of on-going management, protection of vegetation and habitat retained for conservation purposes
5. Vegetation Management Plan that details the conservation/ rehabilitation of riparian buffer zones on site including the removal of exotic species, revegetation with native species and the stabilisation of erosion hazards

Geomorphology/ Watercourses

1. Assessment of the impact of the proposal on the existing flow regime (ie. flow quantity, velocity, frequency and duration) for all rainfall events up to a 100 year Average Recurrence Interval
2. Measures to be implemented to guard against actual and potential environmental disturbances during the construction and operation of the proposal
3. Stormwater Management Plan (*Note:* No on-line structures)

Groundwater

1. Define the purpose of the groundwater extraction
2. Location and construction details of all proposed *bores* (as defined under the *Water Act*)
3. Detail the expected annual groundwater extraction volumes from individual bores
4. Description of different aquifer systems including their extent and inter-relationships
5. Assess the beneficial use of the aquifer
6. Description of the physical and chemical characteristics of aquifers
7. Assessment of flow directions and rates of flow
8. Assessment of connections between any surface water bodies and/ or any dependent ecosystems
9. Details of any predicted impacts to the existing groundwater regime as a result of the proposal
10. Details of the predicted impacts of any final landform on the groundwater regime
11. Details of the existing groundwater users within the area of the proposal
12. Details of the impacts on existing groundwater users within the area of the proposal.

Department of Infrastructure, Planning and Natural Resources
Hunter Region: Suite 6/464 King Street Newcastle West NSW 2302 PO Box 2213 Dangar NSW 2309
Telephone: (02) 4929 4346 International: + 61 2 4929 4346 Facsimile: (02) 4929 6364

Surface Water

1. Identify sources of surface water
2. Provide projected annual volume requirements for surface water use
3. Define the purpose of surface water use
4. Location details/ plan for all existing pumps, dams, diversions, cuttings and levees
5. Location and design specifications for all clean water diversions including channels, detention basins and outlet fixtures
6. Location and design specifications for dirty water/ contaminated water circuit including channels, detention basins and outlet fixtures
7. Provide details regarding any dirty water/ contaminated discharge resulting from the proposed development
8. Provide information on detailed water balance including inflows and imports/ exports to and from the proposed development
9. Details of the integrated water management system, including an assessment of changes to the water balance under a range of conditions (including 10%, 50% and 90% wet years and severe storm events)

Water Storage Structures

1. Details of the location of water storage structures
2. Intended purpose of water storage structures
3. Calculation of the catchment area
4. Calculation of the water storage structure capacity (Ml)
5. Calculation of the water storage surface area
6. Calculate the Maximum Harvestable Right Dam Capacity (MHRDC)
7. Estimate the MHRDC as it changes over the life of the operations
8. Details of survey levels and design specifications (crest, bywash, discharge design etc.)
9. Details of stream order
10. Estimate of evaporation rates and annual evaporation losses
11. Low flow bypass provisions
12. Details of pumps and intended extraction volumes from the water storage structure/s
13. Details of any other persons/ party to be supplied (eg. volume, rate, purpose)
14. Identify impacts on other licence users or 'basic rights'

for Mark Mignanelli

Department of Infrastructure, Planning and Natural Resources
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ANNEXURE

Statutory Framework

1. Proposal to satisfy the statutory requirements of the following legislation administered by the Department of Infrastructure, Planning and Natural Resources (DIPNR), as applicable:

- *Rivers and Foreshores Improvement Act 1948*
- *Water Act 1912*
- *Water Management Act 2000*
- *Native Vegetation Conservation Act 1997*

Note: Acts and regulations can be accessed at www.austlii.edu.au

Policy Guidelines

1. The proposal to address the NSW State Government natural resource management policies, as applicable. Policies to include but not limited to:

- NSW State Rivers and Estuaries Policy
- NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers
- NSW Wetlands Management Policy
- NSW Groundwater Policy Framework Document - General
- NSW Groundwater Quantity Management Policy
- NSW Groundwater Quality Protection Policy
- NSW Groundwater Dependent Ecosystem Policy
- Farm Dams Policy

Note: Natural resource policies can be accessed at www.dipnr.nsw.gov.au

EIS Guidelines

1. The proposal to address departmental EIS Guidelines, as applicable.

- ***Section B: Extractive Industries, Mining and Mineral Processing***
  - Extractive industries – Quarries

Note: EIS Guideline information can be obtained by contacting DIPNR (Planning), Office of Sustainable Development Assessment and Approvals GPO Box 3927 SYDNEY 2001 or telephone (02) 9762 8044.

Department of Infrastructure, Planning and Natural Resources
Hunter Region: Suite 6/464 King Street Newcastle West NSW 2302 PO Box 2213 Dangar NSW 2309
Telephone: (02) 4929 4346 International: +61 2 4929 4346 Facsimile: (02) 4929 6364

Your Reference S04/00482
Our Reference : NEF13667 File No: 273073A1
Contact : Holly Ryan 4908 6828

19 MAR 2004

EPA

Coastal Regions

Director
Major Development Assessment
Department of Infrastructure, Planning and Natural Resources
GPO Box 3927
SYDNEY NSW 2001

18 MAR 2004

Dear Sir,

PROPOSED DEVELOPMENT OF THE EXISTING RINDEAN SAND QUARRY

I refer to your letter of 1 March 2004 requesting the Department of Environment and Conservation's (DEC) requirements for the preparation of an Environmental Impact Statement (EIS) relating to the above proposal.

The EIS should be prepared in accordance with the former Department of Urban Affairs and Planning EIS Guideline for Extractive Industries - Quarries which, in the main, identifies the environmental issues that the DEC requires be addressed.

In addition to this information, and specifically in relation to the application of the *Protection of the Environment Operations Act 1997*, the DEC has also determined specific information it requires to develop its General Terms of Approval. These requirements are contained in Attachment A. Specific issues of interest to the DEC are:

(a) The likelihood of increased noise impacts due to quarry operations;
(b) The potential for dust generation during earthworks and operations at the quarry; and
(d) Control of surface water on site to ensure that any contaminated surface water is adequately contained and treated on site during the construction and operation phases.

The proponent should be aware that any commitments made in the EIS may be formalised into the DEC's General Terms of Approval for the proposal and an Environment Protection Licence. Consequently, pollution control measures should not be proposed if they are impractical, unrealistic, or beyond the financial viability of the development.

The DEC requests that the applicant provide two copies of the EIS and any supporting or background reports when lodging its application with the DEC. These documents should be lodged at the DEC's Newcastle Office.

If you have any inquiries regarding this matter, please contact Holly Ryan on 4908 6828.

Yours sincerely

DAVID DARVALL
A/Head, Regional Operations Unit, Hunter
Department of Environment & Conservation

The EPA is part of the Department of Environment and Conservation
Environment Protection Authority
PO Box 488G Newcastle NSW 2300 Australia Telephone 61 2 4929 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

ATTACHMENT A – EIS REQUIREMENTS
Proposed development of the existing Rindean Sand Quarry at Somersby

DEC ISSUES OF CONCERN

1. EXECUTIVE SUMMARY

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

2. THE PROPOSAL

The objectives of the proposal should be clearly stated and refer to:

- the size and type of the operation;
- the anticipated level of performance in meeting required environmental standards and cleaner production principles;
- the staging and timing of the proposal;
- the proposal's relationship to any other industry or facility.

3. THE PREMISES

The EIS will need to fully identify all of the processes and activities intended for the site during the life of the project. This should include and not be limited to the following:

- Location of the quarry and proposed extension
- Identification and ownership details of any premises and land likely to be affected by the proposed expansion of the quarry;
- Maps supported by diagrams and/or aerial photographs showing the location of residences and properties that may be impacted by the expansion of the quarry, as well as any environmentally sensitive areas such as wetlands, creeks or streams and watercourses etc.
- All equipment proposed for use at the site;
- Site rehabilitation following the termination of the development;
- An outline of construction works including:
  - actions to address any existing soil contamination;
  - surface works including earthworks or site clearing;
  - re-use and disposal of cleared material (including use of spoil on-site);
  - construction timetable and staging; hours of construction; proposed construction methods;
  - environment protection measures including noise mitigation measures, dust controls, and erosion and sediment control measures.
  - methods to mitigate any expected environmental impacts of the development.

4. AIR

General

The EIS must include a detailed Air Quality Impact Assessment (AQIA). The AQIA must identify and describe in detail all possible sources of air pollution and activities/processes with the potential to cause air pollutants, including fugitive dust emissions beyond the boundary of the development site. This should cover both the construction and operational phases of the development. The AQIA should include cumulative impacts associated with existing developments and any developments for which development consent has been granted but that have not yet commenced.

The AQIA must describe the methodology used and any assumptions made to predict the impacts. Air pollutant emission rates, ambient air quality data and meteorological data used in the assessment must be clearly stated and justified.

The EIS should demonstrate that the facility will operate within the DEC's objectives, which are to minimise adverse effects on the amenity of local residents and sensitive land uses, and to limit the effects of emissions on local, regional and inter-regional air quality.

The AQIA should include and not be limited to the following:

- A description of existing air quality, using existing information and site representative ambient monitoring data. This description should include the following parameters:
  - dust deposition;
  - total suspended particulates;
  - PM_{10} particulate matter.

- The identification and location of all fixed and mobile sources of dust/air emissions from the development, including rehabilitation measures. The location of all emission sources should be clearly marked on a plan for key years of the quarry development. All pollutants of concern should be identified, with estimates emissions by quantity (and size for particles), source(s) and discharge point(s).

- Details of the project that are essential for predicting and assessing impacts on air quality including:
  - the quantity and physio-chemical characteristics of materials to be handled, stored or transported;
  - an outline of the procedures for material handling, storage and transport;
  - the management of activities and areas with potential for impacts on air quality.

  Note that emissions can be classed as either point (eg emissions from stack or vent) or fugitive (from wind erosion, leakages or spillages associated with loading or unloading, crushing/screening, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).

- A description of the topography and surrounding land uses.

- Details of the exact locations of dwellings, schools and hospitals etc. Where appropriate, provide a perspective view of the study area such as the terrain file used in dispersion models.

- Estimates of the resulting ground level concentrations of all pollutants. Use an appropriate dispersion model to predict ambient TSP and PM_{10} dust concentrations and dust deposition levels. Reference should be made to the EPA's *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales.*

- A detailed description of the methodology used to assess the air quality impacts of the development. The use of a particular dispersion model and model parameters used should be justified and discussed. The dispersion model input/output files should be included.

- Air quality impact predictions should include plans showing projected incremental levels of 24-hour average PM_{10} concentrations, annual average dust deposition rates and annual average total suspended particulate concentrations throughout the life of the quarry.

- An assessment on the impact of the quarry on local and regional air quality. Comparisons should be made with the *'National Environment Protection Measure for Ambient Air'* when assessing regional impacts. Local impacts should be assessed by considering background levels, the predicted project specific impacts and the cumulative impacts by comparison with the following dust deposition criteria:

Table 1: Health and Amenity Based Particulate Matter Standards/Goals/Criteria

Pollutant	Standard/Goal	Source Agency
Total Suspended Particulate (TSP) Matter	90 $\mu g/m^3$ (annual average)	NHMRC[1]
Dust Deposition	4 g/m^2/month (annual average)	SPCC[2]
Particulate Matter Less than 10 microns in Aerodynamic Equivalent Diameter (PM_{10})	50 $\mu g/m^3$ (24 hour average) 30 $\mu g/m^3$ (annual average)	NEPC[3] NSW EPA[4]

1 National Health and Medical Research Council.

2 NSW State Pollution Control Commission.

3 National Environment Protection Council. National Environment Protection Measure for Ambient Air Quality standard for reporting regional ambient air quality.

4 NSW EPA long term reporting goal for regional ambient air quality as published in Action for Air.

Table 2: NH&MRC Dust Deposition Criteria (Total Solids)

Existing Dust Level g/m^2/month (annual average)	Maximum Acceptable Increase Over Existing Dust Level g/m^2/month (annual average)	
	Residential Suburban	Other
2	2	2
3	1	2
4	0	1

- An assessment of cumulative air quality impacts and a description of the methodology used.
- An assessment of the potential impacts on air quality other than by dust, for example nitrogen oxide emissions from diesel equipment.
- A description of the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- A description of the contribution (if any) that the development will make to regional and global pollution, particularly in sensitive locations.
- An assessment of the impacts on air quality of dust and any other pollutants generated during construction works. In this context, particular attention should be given to:

- The nature, extent and duration of dust generating activities, e.g. earthmoving equipment, exposed surfaces, material stockpiles, unsealed trafficked areas, spillages etc.

- Consideration of the location of dust sources, particularly their proximity to sensitive receptors and prior to finalisation of any acquisition or similar processes.

Mitigation

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

- Include details of an air quality monitoring program to determine effectiveness of mitigation and to verify predictions, including provision for investigations in response to complaints.

- Detail control measures to be implemented to minimize dust generation during construction activities, crushing and screening, and from haulage roads and product stockpiles.

5. NOISE AND VIBRATION

General

The EIS must assess the likelihood and implications of intrusive noise and loss of amenity due to noise. The proposal will be assessed in accordance with the EPA's *Industrial Noise Policy* (INP) (2000). The EIS should also include:

- The identification of all noise and vibration sources from the development (including both construction and operation phases).

- Details of the times of operation for the construction and operational phases of the development and for all noise producing activities.

- Details of the haul roads in relation to residential dwellings. Diagrams should be to a scale sufficient to delineate individual residential blocks.

- The identification of noise monitoring locations. Particular attention should be given to any areas likely to be affected by the operations.

- The identification of any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals.

- The identification of the land use zoning of the site, the immediate vicinity and the potentially affected areas.

Impact Assessment

- Determine existing background noise levels at noise sensitive locations in the area in accordance with the INP.
- Determine the expected noise levels and noise characteristics (eg: tonality, impulsiveness vibration, etc) likely to be generated from noise sources during:

- site establishment;
- construction;
- operational phases;
- transport noise generated by the proposal; and
- other services.

- Determine the noise levels likely to be received at the most sensitive locations under both prevailing and adverse meteorological conditions of wind and temperature inversions. Noise contours for both daytime (7am-6pm), evening (6pm – 10pm) and night time (10pm-7am) periods should be provided. (These may also vary during construction and operational phases of the development).

  Note:- *Computer modelling of noise impacts should be undertaken using a recognised computer model.*
  - *Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible effects on sleep. This should include the maximum noise levels due to road traffic, the extent these maximum noise levels exceed ambient noise levels and the number of noise events from road traffic during the night on an hourly basis for a 'typical' night.*
  - *Noise predictions for individual receptors should be provided with one or more of the L_{Amax}, L_{A1}, L_{A10}, L_{Aeq}, L_{A90} descriptors reported for noise from stationary sources.*

- Consider the influence of existing meteorological conditions such as winds and temperature inversions in the prediction model so as to provide a true representation of actual noise levels.

- Assess the effect of noise mitigation measures incorporated into the predictive modelling.

- Compare the predicted noise levels with the appropriate noise criteria for the phase of development or activity being considered (determine the appropriate noise criteria for the surrounding area using the INP. (For construction noise criteria refer to the EPA's *Environmental Noise Control Manual*, 1994).

- The EIS must demonstrate that ground vibration and overpressure levels recommended by ANZECC will be achieved during blasting.

- The EIS must include a traffic noise assessment covering the expected movement of product off-site for the day, evening and night-time and proposed controls at the source and at affected received locations along the coal transportation routes. Reference should be made to the EPA's *Environmental Criteria for Road Traffic Noise* (1999).

Mitigation

- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.

- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures, the residual level of noise impact needs to be quantified by identifying:
  - locations where the noise level exceeds the criteria and extent of exceedance;
  - numbers of people (or areas) affected;
  - times when criteria will be exceeded;

- likely impact on activities (speech, sleep, relaxation, listening, etc);
- change on ambient conditions.

- Determine the most appropriate noise mitigation measures including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, community consultation, complaints handling/monitoring system etc.

6. WATER

General

- Provide details of the project that may have potential adverse impacts on water, such as drainage works and associated infrastructure, general earthworks, working capacity of structures, and water resource requirements of the proposal.

- Outline the site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts eg sedimentation ponds) and showing potential areas of modification of contours, drainage, etc.

- Describe the catchment including proximity of the development to any waterways, and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective.

- Describe existing surface water quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

- Provide historic stream flow data for the catchment where available.

- Provide site drainage details and surface runoff yield.

Impact Assessment

- Determine all cumulative changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, hydrologic regimes and groundwater).

- Detail all likely impacts on the existing habitat values, hydrology and water quality of all watercourses proposed to be impacted by the proposed activities and their downstream receiving waters.

- Develop short, medium and long term water management strategies aimed at minimising environmental impacts on existing water resources.

- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.

Note;- The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- The EIS should characterise the quality of surface and discharge water likely to be discharged from the site and detail appropriate water quality management practices for the site. The EPA has adopted the 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)' as a guide for the assessment of environmental impacts on aquatic ecosystems.

Mitigation

A water management plan and site water balance should be prepared which incorporates the following principles:

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.

- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site, and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls.

- Describe waste water treatment measures that are appropriate to the type and volume of waste water, and are based on the following hierarchy of avoiding generation of waste water - capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; treating any unavoidable discharge from the site to meet specified water quality requirements.

- Outline pollution control measures relating to storage of materials, possible accidental spills (eg preparation of contingency plans), appropriate disposal methods, and generation of leachate.

- Describe hydrological impact mitigation measures including:
  - site selection (avoiding sites that are prone to flooding and waterlogging, actively eroding or affected by deposition);
  - runoff minimisation;
  - the minimisation of flow regime reductions or modifications;
  - the avoidance of modifications to groundwater;
  - the retention of native vegetation and revegetation;
  - artificial recharge;
  - the provision of surface storages with impervious linings;
  - a monitoring program.

- Describe geomorphologic impact mitigation measures including:
  - site selection;
  - erosion and sediment controls;
  - minimising instream works;
  - treating existing accelerated erosion and deposition;
  - a monitoring program.

- Describe management procedures that will be adopted to prevent pollution of waters by effluent, stormwater runoff etc. The water management plan should also include a monitoring

program to assess the impacts of the operation on the quality and quantity of surface and groundwaters.

7. WASTE AND CHEMICALS

General

- Provide details of:
  - the quantity and type of all liquid wastes and non-liquid wastes likely to be generated at the premises;
  - the method for storing and disposing of any wastes or recovered materials at the facility.
  - details of sewage effluent treatment and disposal arrangements. Effluent should be treated and irrigated on site. The EIS should include a description of the effluent treatment and disposal system. On sit effluent disposal should conform to the EPA's draft "*Environmental Guideline for the Utilisation of Treated Effluent by Irrigation*" (1995).

Impact Assessment

- Identify potential impacts from the handling and storage of any wastes and/or chemicals.
- Identify all wastes which cannot be re-used. Disposal options must also be identified in accordance with EPA *Environmental Guidelines, Assessment, Classification and Management of Liquid and Non-Liquid Wastes.*

The above guideline can be obtained from the EPA's Pollution Line (Ph: 131555) or from the EPA's web site at: http://www.epa.nsw.gov.au/waste/guidelines.htm.

Mitigation

- Outline measures to avoid the generation of waste and promote the re-use, recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. SOIL CONTAMINATION

General

- Provide details of the site history. Proposed earthworks should be considered with regard to possible soil contamination.

Impact Assessment

- The EIS must determine whether contaminated soils are likely to be disturbed during the proposed works. If contaminated soils are likely to be disturbed, the EIS should detail the measures to be adopted to protect human health and the environment, and if necessary remediate or dispose of contaminated material.

Mitigation

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
  - erosion and sediment control measures;
  - proposals for the management of any acid sulfate soils.

The following EPA Guidelines may be helpful in assessing any actions required in respect of the proposed works:

- Contaminated Sites - Guidelines for Consultants Reporting on Contaminated Sites (EPA 1997);
- Contaminated Sites - Guidelines for the NSW Site Auditor Scheme (EPA 1998); and
- Contaminated Sites - Sampling Design Guidelines (EPA 1995).

8. MONITORING PROGRAMS

The EIS should include a detailed assessment of any noise, air quality, water quality or waste monitoring required during the construction phase and on-going operation of the facility to ensure that the development achieves a satisfactory level of environmental performance. The evaluation should include a detailed description of the monitoring locations, sample analysis methods and the level of reporting proposed.

9. EPA STATUTORY REQUIREMENTS

As the Environment Protection Licence for the premises has been surrendered, the proponent will need to apply for a new licence under the Protection of the Environment Operations Act 1997 if development consent is granted. General information on licence requirements can be obtained from the EPA's Pollution Line on 131 555 during office hours, or can be found at the EPA web site at: http://www.epa.nsw.gov.au/legal/.

EPA
March 2004

Attachment 3

FAXED 19-3-04

NSW NATIONAL PARKS AND WILDLIFE SERVICE
ABN 30 841 387 27

Mr David Kitto
Major Development Assessment
Department of Infrastructure, Planning and Natural Resources
GPO Box 3927
SYDNEY NSW 2001

22 MAR 2004

Our ref: 96/541 MB
Your ref: S04/00482

Dear Mr Kitto

Re: Proposed redevelopment of the existing Rindean Sand Quarry, Somersby

I refer to a recent notification of this development proposal to the former EPA arm of the Department of Environment and Conservation (DEC) in Newcastle inviting requirements for the Environmental Impact Statement (EIS) which is to be prepared.

As you are aware the National Parks and Wildlife Service (NPWS) has been amalgamated into the DEC, together with the EPA and a number of other agencies. The following comments are therefore provided by the DEC with regard to its responsibilities for biodiversity conservation and Aboriginal heritage.

The DEC understands the proposal involves redevelopment of the subject sand quarry following cessation of quarrying in 1997. The background information provided by Pacrim Environmental Pty Ltd is somewhat contradictory in its description of the proposed development as follows:

"Cleve Smith Excavations does not intend to operate the quarry but will carry out certain cleanup and earthwork operations to repair damage to the infrastructure from past operations and recent storms ... Cleve Smith Excavations intends to redevelop and reopen the quarry to produce washed and unwashed sands for the local, regional and Sydney markets".

The following comments are therefore provided on the basis that both sand extraction and rehabilitation activities are proposed. The DEC notes that detailed assessments of flora and fauna and an archaeological survey will be conducted during the preparation of the EIS and requests that these assessments include the following information:

Head Office
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

- **vegetation communities** including:
- description of the vegetation communities, as per the Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Mapping or other known classification;
- assessment of the conservation significance of the vegetation communities in terms of both the local and regional context;
- description of the habitat values of the vegetation, that is, available habitat attributes and which threatened species or species of non-threatened fauna they relate to;
- area of vegetation to be cleared or subjected to other disturbances;

The vegetation communities should also be quantified and shown on a map;

- **threatened species of flora and fauna, and endangered ecological communities** including:
- listings under the Threatened Species Conservation Act, (including preliminary listings and/or determinations);
- listings under the Commonwealth Environment Protection and Biodiversity Conservation Act;
- threatened flora listed as ROTAP (Rare or Threatened Australian Plants) species;
- those recorded on the site or in the vicinity of the site;
- those with the potential to occur;
- an assessment of their conservation significance;
- an assessment of how identified species utilise the habitat on or in the vicinity of the development site;

The NPWS Wildlife Atlas should be referenced for an indication of threatened flora and fauna species with the potential to occur. However, you should note that the number of records on the Atlas is directly proportional to the degree to which a given area has been surveyed. Therefore the absence of records on the Atlas should not be inferred to mean the area in question does not provide habitat for threatened species, and an appropriate level of on-site survey should be applied to determine the presence/absence of threatened species.

The DEC wishes to advise that a population of the threatened flora species *Prostanthera junonis* (Somersby Mintbush) occurs within 1.1km of this subject land and therefore targeted surveys should be carried out to determine whether or not it is present on the site. The *Prostanthera junonis* (Somersby Mintbush) Recovery Plan provides detailed information on this species and should be referred to in preparing the EIS.

Other threatened species known to occur in the area, and with the potential to occur include:
- *Hibbertia procumbens*
- *Tetratheca glandulosa*
- *Darwinia glaucophylla*

- Red-crowned Toadlet
- Giant Burrowing Frog
- Eastern Free-tail Bat
- Glossy Black Cockatoo
- Rosenberg Goanna
- Eastern Chestnut Mouse, and
- threatened woodland birds.

Assessment of potential impacts on these species will be needed as per Section 5A of the Environmental Planning and Assessment Act (the 8-part test).

- **known and potential Aboriginal heritage** including:
- an archaeological assessment; and
- an Aboriginal cultural heritage assessment;
- details of consultation with the local Aboriginal community.

If Aboriginal objects are present on the site, the Integrated Development Approval provisions of the Environmental Planning and Assessment Act will be triggered. Assessment of Aboriginal heritage values is to be undertaken in accordance with the NPWS Guidelines for Aboriginal Cultural Heritage and the Integrated Development Assessment Process (copy attached). This will involve consultation regarding the cultural values of the site with all groups representing the Aboriginal community.

- **rehabilitation**

The EIS should describe how the site is to be progressively rehabilitated, the nature and extent of rehabilitation undertaken to date, and how the two are to be integrated. Rehabilitation should employ endemic species, particularly those which provide foraging/roosting resources for threatened species known to occur.

I trust this information is of assistance. Should you require any additional information please contact, Meredith Billington, Conservation Planning Officer on (02) 9585 6953.

Yours sincerely

Helen Mulligan 19 March '04

Helen Mulligan
A/Manager, Conservation Planning Unit
Environment Protection and Regulation Division
Department of Environment and Conservation

APPENDIX 2

CORRESPONDENCE

STEPHEN THORNE & ASSOCIATES PTY LTD

POSTAL ADDRESS: PO BOX 1315, GOSFORD, NSW 2250 **TEL: (02) 4323 1255**

SUITE 8/42 MANN STREET, GOSFORD, NSW 2250 FAX: (02) 4324 2226

registered surveyors

A.C.N. 057 514 860
A.B.N. 51 057 514 860
Email: stsurvey@bigpond.net.au

The General Manager
Gosford City Council
PO Box 21
GOSFORD DX7211 NSW

Re: Development Application No 26467/2004, Proposed Extractive Industry Alterations to Existing Quarry on Lot 2 DP362339 No 620 Wisemans Ferry Road, Somersby, NSW

Dear Sir

I am writing to advise the Gosford City Council that, in regard to this application, I have conducted the survey work listed below and prepared survey plans in accordance with the requirements of the Council's development consent date 20 June 2006 as amended by its development consent of 17 September 2007.

I have:

1. received and taken into account the records of survey work performed in regard to this application by Wayne Ritchie, Consulting Land and Engineering Surveyors, formerly of PO Box 94, Avoca Beach NSW 2251. I refer, in particular, to his survey plan dated July 2006 which identifies the principal features of the property and the quarry including the locations of certain hollow bearing trees;

2. conducted fresh surveys of the western end of the property in regard to the proposed entrance road works, including those on the public road reserve, which have formed the basis of an application under the *Roads Act 1993* to conduct road works prepared by RGH Consulting Group for Cleve Smith Excavations Pty Ltd;

3. identified and recorded on survey plans the limits of the extraction area in the western end of the property and, in particular, the 100 metre minimum distances from residences referred to in the amended development consent;

4. identified and recorded the locations of the hollow bearing trees likely to be affected by the works identified in the April 2004 report by General Fauna and Fauna which forms Appendix 6 of the Environmental Impact Statement prepared in regard to this application;

5. identified and recorded on a survey plan the site for the meteorological station;

6. recorded on a survey plan the route of the access road to the west of the wheel wash, the site of the wheel wash and the route of the temporary access road to the present location of the sand processing plant to the east of the wheel wash.

Survey lines are presently being cleared to allow me to complete the survey of the property.

I understand that Mr Cleve Smith is in the process of installing protective fences around the hollow bearing trees recorded on the survey plan as likely to be affected by works within the quarry property. I will certify that this work has been completed in later correspondence.

I understand that you will require further certification from me in regard to the limits of the extraction area and the locations of internal security fences. I have been advised that these certifications will be provided as a part of Volume 2 of the Plan of Management for the Rindean Quarry which will be submitted to the Gosford City Council during 2011.

Yours sincerely

Stephen Thorne

Stephen Thorne

Surveyor Registered Under The Surveying and Spatial Information Act 2002

DATED : 24/11/2010

Telephone (02) 4325 8222

Please Quote: 9575965
R Eyre:lg
DA26467/2004
7 April 2011

Gosford City Council
49 Mann Street
Gosford NSW 2250
PO Box 21
Gosford NSW 2250
DX 7211 Gosford
Telephone: 02 4325 8222
Facsimile: 02 4323 2477
goscity@gosford.nsw.gov.au
www.gosford.nsw.gov.au
ABN 78 303 458 861

Tony Tuxworth
Coastplan Consulting
PO Box 6179
KINCUMBER NSW 2251

Development Application No DA 26467/2007
Plan of Management for Rindean Quarry
Lot 2 DP 362339 No. 620 Wisemans Ferry Road, Somersby

Dear Sir

I refer to the Plan of Management Volume 1 (date amended 5/04/2011) and Volume 2 (dated December 2010)

Council's Development Engineer advises;

"The Roads Act application has been approved and traffic management will be required to be in place for the construction of the intersection between the access and Wisemans Ferry Rd, as mentioned in the plan of management."

Council's Environmental Officer advises;

"Appendix 3 of POM V1 has now accurately plotted all hollow-bearing trees originally identified on Figure 9 of the F&F report as required under deferred commencement conditions A2, 5 & 6.

POM V1 (amendment 5.4.11) has been amended to accurately reflect hours of construction as detailed in deferred commencement condition A9.

In review of POM V2 Council is satisfied that the plan adequately address deferred commencement conditions A1(a) & 2. The plan provides details on Stages 1 & 2 and sets the framework for future stages 3-6. Through annual reporting and feedback, stages 3-6 can be further developed prior to the operation of these stages.

Written confirmation from the NSW Office of Water is required prior to full compliance with deferred commencement condition A7 and prior to commencement of any works associated with the construction element of the deferred commencement."

Yours faithfully



Robert Eyre
Senior Planner Development

NSW GOVERNMENT | Office of Water

Contact: Bruce Westbrook
Phone: (02) 4904 2578
Fax: (02) 4904 2503
Email: Bruce.Westbrook@water.nsw.gov.au

Gosford City Council
PO Box 21
GOSFORD NSW 2250

Our ref: 20BL172145
Your Ref: DA26467/2004

13 May 2011

Dear Sir/Madam

Subject: Groundwater Monitoring and Management Plan

The NSW Office of Water has reviewed the Groundwater Monitoring and Management Plan (Coastplan Consulting Reference 6209) for the Rindean Quarry, 620 Wisemans Ferry Road, Somersby for the deferred commencement of DA26467/2004.

The NSW Office of Water require that all the referenced bore holes (B1, B2, B3, B4 and B5) on site (Lot 2 Dp 362339) be subject to the monitoring and recording of the static water level at the commencement of operations on a quarterly basis for the first two (2) years and then on a six (6) monthly basis thereafter.

The NSW Office of Water also requires that the water quality sampling programme be undertaken on all of the monitoring boreholes (B1, B2, B3, B4 and B5) at the commencement of operations and at six (6) monthly intervals for the first two (2) years and then annually thereafter and reported on an annual basis.

If there is any failure in the recording process for any of the sites, the proponent is to undertake another water quality sample within 1 month of the original date of sampling.

The NSW Office of Water will require a copy of the annual audit report forwarded to PO Box 2213 Dangar NSW 2309.

If you have any further questions in relation to this matter, please do not hesitate to contact me on 4904 2578

Yours sincerely

Bruce Westbrook,
Licensing Officer,
Licensing North

APPENDIX 3

IMPLEMENTATION OF THE CONSOLIDATED CONDITIONS OF THE 2006 AND 2007 CONSENTS

Rindean Quarry, Somersby
Development Application No 26467
Quarry Management Plan
Implementation of the Consolidated Conditions of the Development Consents of 20 June 2006 and 17 September 2007

Consolidated Consent Condition	Response in EIS April 2012
A **1** The perimeter buffer areas and the limits of extraction shall be as they are described in the amended stage drawings dated August 2007 and in the approved Quarry Management Plan as it shall be from time to time. The limits for resource extraction will be: 1) a line 100 metres radius from any residence not associated with the quarry: 2) a line 20 metres from the northern and southern property boundaries; 3) a line approximately 50 to 80 metres from the western boundary, as shown in Figure 7 dated 22 August 2007 of amended Stage drawings. The buffer areas will be maintained as areas of native vegetation except that acoustic bunds, the wheel wash and the access road may be constructed within the buffer areas in accordance with the approved management plan.	The Quarry Management Plan has been prepared for Stage 1 and 2 of the quarry's operation (EIS Volume 3). It has been prepared in 6 Parts each dealing with a specific aspect of the quarry's operation. The limits or resource extraction are addressed in Part 2 of the Quarry Management Plan and survey plan at Figure 10 These limits will be surveyed and pegged prior to the commencement of work on the site. Plans for the construction phase are at Part 2 of the Quarry Management Plan
1(a) Prior to the commencement of any works on the site the applicant shall prepare a Quarry Management Plan. The Quarry Management Plan shall be submitted and approved by Council prior to the issuing of consent. **The Quarry Management Plan** shall include	See above
1(a).1 A plan of the approved amended quarry site design and layout	Parts 2 and 3 and Figures 5 to 10 of the Quarry Management Plan
1(a).2 A copy of the registered survey plan identifying the footprint of the approved quarry and location of all hollow bearing trees	Part 2.1 and Figure 10 of the Quarry Management Plan
1(a).3 The location of all safety and security fences	As above
1(a).4 The location of all acoustic barriers and plant facilities.	As above
1(a).5 Documentation defining and illustrating the various stages of operation from stage 1 through to stage 6.	Part 2 of the Quarry Management Plan provides detail for Stages 1 and 2 and an outline of the remaining three stages of the quarry's operation which will be the subject of later management plans.
1(a).6 The location of the meteorological recording station.	In clear space near NW corner of the property adjacent to the power line (Quarry Management Plan Part 2.1.13).
1(a).7 A copy of the Ground Water Monitoring Program approved by the Department of Natural Resources plus the inclusion of any recommendations to ameliorate any potential impacts to adjacent groundwater bores R1, 2, 3 and 4.	Part 6.1 of the Quarry Management Plan is the groundwater management plan approved by the NSW Office of Water (EIS Appendix 2).
1(a).8 An Erosion Sediment Control Plan.	Quarry Management Plan Part 6.2
1(a).8.1 An Erosion Sediment Control Plan shall;	
(a) Illustrate the philosophy of erosion sediment control over the six (6) stages	

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(b) Provide detailed direction on all erosion and sediment control for stage 1.	
(c) Be consistent with the requirements of the Department of Housing's 'Managing Urban Stormwater: Soils and Construction Manual'	
(d) Identify activities that could cause soil erosion and generate sediment	
(e) Describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters	
(f) Describe the location, function, and capacity of erosion and sediment control structures; and	
(g) Describe what measures would be implemented to maintain the structures over time.	
1(a).9 A Surface Water Monitoring Program.	Quarry Management Plan Part 6.2
1(a).9.1 The Surface Water Monitoring Program shall include:	
(a) The philosophy of water management for each of the six (6) stages.	
(b) Provide detailed baseline data on surface water flows and quality in water bodies that could potentially be impacted by the quarry.	
(c) Surface water impact assessment criteria.	
(d) A program to monitor surface water flows and quality.	
(e) A protocol for the investigation, notification and mitigation of any surface water quality issues.	
(f) A program to monitor the effectiveness of the erosion and Sediment Control Plan	
(g) A statement of the water usage of quarry operation and a comparison to the water usage in relations to the predicted water usage as *specified in pages 17 to 22 of the EIS*	
1(a).10 A Rehabilitation Strategy and Landscape Management Plan	Quarry Management Plan Part 6.3
1(a).10.1 The Rehabilitation Strategy and Landscape Management Plan must:	
(a) Discuss the strategy and philosophy of the progressive rehabilitation and landscaping of all stages	
(b) Identify the areas likely to be disturbed by the development	
(c) Describe in general the short, medium and long-term measures that would be implemented during the rehabilitation program	
(d) Describe in detail the measures that will be implemented to ensure the rehabilitation is successful	
(e) Describe how the performance of these measures will be monitored over time.	
(f) Include a vegetation clearing protocol, a pest and weed management plan and *a landscape plan.* Subject to the express approval of and at a time agreed to by Council, work may commence on essential drainage works only within the existing disturbed quarry and the rehabilitation of the former tailings dams prior to consent being given under A above.	
2. Prior to commencement of any works on the site a registered surveyor is to survey the footprint of the approved sand extraction area as presented in condition 1 and locate all the hollow bearing trees as identified on Figure 9 of the Flora and Fauna report contained in Volume 2 of the EIS. Once the approved quarry outline has been identified and the hollow bearing trees have been located they are to be marked onto a registered surveyor plan. A copy of this survey plan is to be submitted and approved by Council prior to the commencement of any earth works	EIS Appendix 2, Quarry Management Plan Part 2 and Figure 10

3. Prior to the commencement of any earth works on the site, other than such works as may be required for a security fence, a 2 metre high security fence and security gate is to be erected around the property boundary. The fenced is to be continuous except for the placement of an entry gate to allow access to the property. At 50 metre intervals along the security fence a sign shall be erected cautioning the presence of the open quarry with potential near vertical drops.	Quarry Management Plan Part 2.3. Work will begin as soon as the Construction Certificate for reinstatement works is issued.
4. Prior to the commencement of any earth works on site as a minimum a six (6) strand barb wire safety fence is to be erected around the perimeter of the approved sand extraction area. The safety fence is to be continuous except for the placement of entry gates to allow access for maintenance to the adjacent buffer areas. At 50 metre intervals along the safety fence a sign shall be erected advising that no quarry activity is to extend into the adjacent buffer areas except the erection and maintenance the acoustic barriers. At 20 metre intervals adjacent to excavations greater than 10 metres a warning sign shall be erected on the safety fence warning of the presence of near vertical drops.	Quarry Management Plan Part 2.3 Not practicable as construction of bunds would be constrained. The alternative in Part 2.3 proposes the use of coloured netting barriers until bunds are completed and wire fences can be constructed.
5. Prior to the commencement of any earth works on site a safety security web fence is to be placed around those hollow bearing trees that are to be retained. These hollow bearing trees are to be retained at all times.	Quarry Management Plan Part 2.3. These trees are identified on the survey plan (Figure 10).
6. Prior to the commencement of any earth works on site a registered surveyor is to advise Council by letter that the security and safety fence has been erected in accordance with conditions 3 and 4 and that all hollow bearing trees that are to be retained have a security web fence for protection in accordance with condition 5.	EIS Appendix 2. Protection of hollow bearing trees has been put into place. The need for earthworks to allow fencing, drainage and rehabilitation work to begin is acknowledged in conditions 1(a) 10 and 3 above.
7. Prior to the commencement of any works on site the applicant shall present to Council written confirmation	
(a) Full compliance with all conditions of consent from the Department of Water and Energy (formerly Department of Natural Resources) including presentation of an approved ground water monitoring program. Furthermore, the applicant is to obtain confirmation of adequate water entitlements for all seepage, extraction and monitoring works to undertake such extraction. In addition, the groundwater monitoring program and water use entitlements must comply and obtain approval with the Water Management Act 2000. If the Department of Water and Energy does not issue an approved ground water monitoring program water entitlement or compliance with the Water Management Act 2000, the consent shall lapse.	Quarry Management Plan Part 6.1
(b) Confirmation that copies of the approved ground water monitoring program have been distributed to the most likely affected residents being those properties identified as R 1, 2, 3 and 4.	Quarry Management Plan Part 6.1
8. Prior to the commencement of any sand extraction on the site for product the applicant will construct acoustic barriers at locations and with heights of 4 metres or 6 metres as identified in amended stage drawings dated August 2007. All acoustic barriers shall be completed within a four (4) week period from the date of commencement of construction. The Council is to be advised in writing of the commencement date of the original construction works required in this condition. Acoustic barrier may be of a trapezoidal earthen construction, a barrier fence or a combination of an earthen mound topped by a barrier fence. Any trapezoidal form shall have a minimum crest width of one metre. The mounds and barrier fences shall be constructed according to sound engineering and acoustic practice.	Quarry Management Plan Part 2.3. Figures 10 and 13
9. The construction activities to be undertaken under Conditions 8 and 10 shall only be carried out between 7.00 am to 5.00pm Monday to Friday and 7.00 am to 1.00 pm Saturday with no activities to be undertaken on Sundays and Public Holidays.	Quarry Management Plan Part 2.4
10. The access haulage road shall remain generally on its present alignment except that the road shall, where necessary be relocated to align with the northern edge of the excavation of Quarry Cell 7 as identified in the amended Stage drawings dated August 2007. The 6 metre bund or other acoustic barrier is to follow the alignment of the road and extend to within 20 metres of Wisemans Ferry Road. The earth base of any acoustic barrier shall not be placed within the drip line of	Quarry Management Plan Part 2.3 and Part 3. Figures 5-10, 11 and 12 Figures 10 and 14 in regard to the wheel wash See Condition 8

any Hollow Bearing tree. In locations where an earth acoustic barrier cannot be constructed due to the presence of the Hollow Bearing trees an alternative lap timber acoustic barrier is to be constructed. A wheel washing facility will be constructed approximately 100 metres from Wisemans Ferry Road in the location identified in the amended stage drawings dated August 2007. The access haulage road will be tar sealed from the wheel wash to Wisemans Ferry Road. Construction of the wheel wash and tar sealing of the access road shall be completed within the approved four (4) week construction period referred to in Condition 8 above	
11. Prior to the commencement of sand extraction the wheel wash facility, tar sealing of the haulage road from the entrance of Wisemans Ferry Road to the approved extraction area plus all acoustic earth mounds are to be fully constructed. During this initial construction phase all activities that involve the use of heavy machinery operation or the movement of earth and soil plus all acoustic mounds are to be fully constructed. During this initial construction of the acoustic earth mounds daily installation and maintenance of appropriate erosion and sediment control must be implemented. Acoustic mounds will be planted with locally endemic species at the earliest opportunity after their construction in consultation with neighbours and in accordance with the approved Rehabilitation plan and prior to commencement of extraction	Quarry Management Plan Part 2
12. Prior to the carrying out any development, the Applicant shall establish and subsequently maintain a meteorological station in the vicinity of the development, to the satisfaction of Council. The meteorological station shall as a minimum, unless otherwise authorised by Council, monitor daily rainfall and evaporation in accordance with the requirements in *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW*.	Quarry Management Plan Part 2.3.13
13. Deleted.	
14. The submission of a dilapidation report on the condition of Wisemans Ferry Road, Somersby.	Quarry Management Plan Part 6.7

B Upon compliance with the conditions of deferred commencement Council will issue an operative consent (Including stamped plans) that is subject to the following conditions:	
1. The development is to be carried out in accordance with the Environmental Impact Statement titled Cleve Smith Excavations Pty Ltd. Rindean Quarry Somersby, New South Wales Volumes 1 & 2 prepared by Pacrim Environmental Report 04/371-1 dated 2004 and supplementary information from Pacrim Environmental including letters and supporting documentation dated 17 June 2005, 9 December 2006 and email dated 25 January 2006 where amended in red, or where modified by any conditions of this consent.	Volumes 1 ,2 and 3 of the EIS dated April 2012.
2. The applicant shall not transport more than 150,000 tonnes of product per annum from the site.	EIS and Quarry Management Plan Part 1
3. The hours of operation are: Monday to Friday 7.00 am to 6 pm Saturdays 7.00 am to 1 pm for maintenance, loading and haulage. a No work is permitted on Sundays and Public Holidays b Resource extraction by ripping shall be limited to the hours of 8.00am to 5.00pm Monday to Friday.	Quarry Management Plan Part 4.4.

4. The following activities may be carried out at the premises outside the hours specified in Condition 3. a the delivery of materials as requested by Police or other government authorities for safety reasons; and b emergency work to avoid the loss of lives, property and/or to prevent environmental harm. In such circumstances the Applicant shall notify DEC and affected residents prior to undertaking the works, or within a reasonable period of time in the case of an emergency.	
5. Within the area of the amended quarry extraction the following excavation depths shall apply:	
(a) For the eastern section of the quarry across the areas identified as quarry cells 1, 2 and 3 as presented on Figure 2.2 in Volume 1 of the EIS no sand extraction is to occur below 215m AHD except for the construction of a water retention basin identified in the amended Stage drawings dated August 2007 and necessary for the retention of stormwater from a 1% AEP storm event and the extraction for the stormwater retention basin shall not exceed RL 213m AHD and except for the construction of freshwater Dam 3, which may be constructed to a depth of 4 metres. Therefore, no extraction is to occur below a depth of 211m AHD for the dam.	Quarry Management Plan Parts 3 and 4
(b) For the central section of the quarry across the area identified as quarry cell 6 as presented on Figure 3.14 in Volume 1 of the EIS no sand extraction is to occur below 216m AHD.	Quarry Management Plan Parts 3 and 4. Future Plan for Stage 3
(c) For the western section of the quarry across the area identified as quarry cell 7 as presented on Figure 3.14 in Volume 1 of the EIS no sand extraction is to occur below 217m AHD	Quarry Management Plan parts 3 and 4. Future Plan for Stage 4
6. Within the area of the amended quarry extraction the following excavation profile shall apply a For all new extraction below the natural ground level the first bench shall be no greater than 3 metres in height with the first bench width of no less than 4 metres b For all new extraction below the natural ground level the second and following bench heights and widths shall be a maximum of 5 metres in height with a minimum bench width of no less than 4 metres c On each of the newly created benches, the bench shall slope to the quarry face acting as a contour drain redirecting clean rainwater away from the active quarry. Furthermore, for the first 3 metres from the vertical quarry face the horizontal bench shall be loosely ripped and top dressed with soil to provide a medium to allow the horizontal bench to be revegetated with native endemic vegetation.	Quarry Management Plan Part 4
7. In respect to groundwater bores located R1 (identified as groundwater bore GW031948) and R2 (identified as groundwater boreGW0575420) during the first 6 months of commencement of operation of the quarry during Stage 1 the applicant shall redrill at their expense the depth of the groundwater bores to a depth to reproduce the water saturation zone thickness to the historical thickness prior to the commencement of the quarry operation. Please note the thickness of the water saturation zone may have to be increased or other steps to be taken to lessen the impact such as the installation of additional rainwater tanks for R1 and R2, at the expense of the applicant if as a result of the groundwater monitoring program the impacts upon the adjacent groundwater resources are greater than 10% variation of the predicted amounts.	Quarry Management Plan Part 6.1
8. I respect to groundwater bores located at R3 (identified as groundwater bore GW051268) during the first 6 months of commencement of operation of the quarry during Stage 2 the applicant shall redrill at their expense the depth of the groundwater bores to a depth to reproduce the water saturation zone thickness to the historical thickness prior to the commencement of the quarry operation. Please note the thickness of the water saturation zone may have to be increased or other steps to be taken to lessen the impact such as the installation of additional rainwater tanks for R3, at the expense of the applicant if as a result of the groundwater monitoring program the impacts upon the adjacent groundwater resources are greater than 10%variation of the predicted amounts.	Quarry Management Plan Part 6.1

9. I respect to groundwater bores located at R4 (identified as groundwater bore GW072503) during the first 6 months of commencement of operation of the quarry during Stage 4 the applicant shall redrill at their expense the depth of the groundwater bores to a depth to reproduce the water saturation zone thickness to the historical thickness prior to the commencement of the quarry operation. Please note the thickness of the water saturation zone may have to be increased or other steps to be taken to lessen the impact such as the installation of additional rainwater tanks for R4, at the expense of the applicant if as a result of the groundwater monitoring program the impacts upon the adjacent groundwater resources are greater than 10%variation of the predicted amounts.	Quarry Management Plan Part 6.1
10. Consent to extract and process sand is subject to progressive rehabilitation of past and future disturbed areas. To ensure the quarry implements an active rehabilitation program on historically disturbed areas and continues rehabilitation through out the life of the quarry consent is granted in the five-stages described in Section 6.4 of the Amended s96 Modification Report of December 2006 and the amended stage drawings dated July 2007 and as amended by the conditions required by this [amended] Notice of Determination. The Council acknowledges that changes might become necessary throughout the life of the quarry. Such changes must be documents in Quarry Management Plans and approved by the Gosford City Council.	Quarry Management Plan Part 6.3
(a) Stage 1 shall comprise the first two years of operation from the date of commencement of the construction phase of the quarry agreed with the Gosford City Council. On or before 3 years after the date of commencement of Stage 1, the 'rehabilitation area' as identified in Figure 4 of the Amended s96 Consent Modification Report August 2007 and acoustic earth mounds shall be successfully rehabilitated. Further, a report complied by a specialist in native vegetation as recognised by Council shall be forwarded to Council certifying compliance of successful rehabilitation. If certification is not forwarded to Council within this timeframe all sand extraction and processing shall cease until certification is provided. Successful rehabilitation means that, in the opinion of a specialist in native vegetation: • The grasses planted have established a 70% ground cover capable of preventing erosion within 12 months; and • Native groundcover, shrub and tree species are established sufficiently to prevent erosion and can be expected to provide a50% ground cover and a 25% canopy over the ground within 3 years. Note: If successful rehabilitation is unable to be achieved within the prescribed timeframe due to adverse climatic conditions then the Council shall be notified and provided detailed justification based on climatic data.	Quarry Management Plan Part 6.3
(b) Stage 2 shall comprise years 3 to 5 of operation from the date of commencement of the construction phase of the quarry agreed with the Gosford City. On or before 3 years after the date of commencement of Stage 2, the 'rehabilitation area' as identified in Figure 5 of the Amended s96 Consent Modification Report August 2007 shall be successfully rehabilitated. Further, a report complied by a specialist in native vegetation as recognised by Council shall be forwarded to Council certifying compliance of successful rehabilitation. If certification is not forwarded to Council within this timeframe all sand extraction and processing shall cease until certification is provided. Successful rehabilitation means that, in the opinion of a specialist in native vegetation: • The grasses planted have established a 70% ground cover capable of preventing erosion within 12 months; and • Native groundcover, shrub and tree species are established sufficiently to prevent erosion and can be expected to provide a 50% ground cover and a 25% canopy over the ground within 3 years. Note: If successful rehabilitation is unable to be achieved within the prescribed timeframe due to adverse climatic conditions then the Council shall be notified and provided detailed justification based on climatic data.	Quarry Management Plan Part 6.3

	In addition the applicant shall satisfy the Council that operational, environmental and rehabilitation objectives and targets for Stage 1 set down in the approved quarry management plan have been achieved or have been substantially achieved before extraction work identified for Stage 2 commences.	
(c)	Stage 3 shall comprise years 6 to 10 of operation from the date of commencement of the construction phase of the quarry agreed with the Gosford City Council. On or before 5 years after the date of commencement of Stage 3, the 'rehabilitation area' as identified in Figure 6 of the Amended s96 Consent Modification Report August 2007 shall be successfully rehabilitated. Further, a report complied by a specialist in native vegetation as recognised by Council shall be forwarded to Council certifying compliance of successful rehabilitation. If certification is not forwarded to Council within this timeframe all sand extraction and processing shall cease until certification is provided. Successful rehabilitation means that, in the opinion of a specialist in native vegetation: • The grasses planted have established a 70% ground cover capable of preventing erosion within 12 months; and • Native groundcover, shrub and tree species are established sufficiently to prevent erosion and can be expected to provide a 50% ground cover and a 25% canopy over the ground within 3 years. Note: If successful rehabilitation is unable to be achieved within the prescribed timeframe due to adverse climatic conditions then the Council shall be notified and provided detailed justification based on climatic data. In addition the applicant shall satisfy the Council that operational, environmental and rehabilitation objectives and targets for Stage 2 set down in the approved quarry management plan have been achieved or have been substantially achieved before extraction work identified for Stage 3 commences.	Quarry Management Plan Part 6.3
(d)	Stage 4 shall comprise years 10 to 19 of operation from the date of commencement of the construction phase of the quarry agreed with the Gosford City Council. On or before 9 years after the date of commencement of Stage 4, the 'rehabilitation area' as identified in Figure 7 of the Amended s96 Consent Modification Report August 2007 shall be successfully rehabilitated. Further, a report complied by a specialist in native vegetation as recognised by Council shall be forwarded to Council certifying compliance of successful rehabilitation. If certification is not forwarded to Council within this timeframe all sand extraction and processing shall cease until certification is provided. Successful rehabilitation means that, in the opinion of a specialist in native vegetation: • The grasses planted have established a 70% ground cover capable of preventing erosion within 12 months; and • Native groundcover, shrub and tree species are established sufficiently to prevent erosion and can be expected to provide a 50% ground cover and a 25% canopy over the ground within 3 years. Note: If successful rehabilitation is unable to be achieved within the prescribed timeframe due to adverse climatic conditions then the Council shall be notified and provided detailed justification based on climatic data. In addition the applicant shall satisfy the Council that operational, environmental and rehabilitation objectives and targets for Stage 3 set down in the approved quarry management plan have been achieved or have been substantially achieved before extraction work identified for Stage 4 commences.	Quarry Management Plan Part 6.3

(e) Stage 5 shall comprise year 20 of quarry operation from the date of commencement of the construction phase of the quarry agreed with the Gosford City Council. During this period, the applicant shall decommission and remove all plant and equipment and complete the rehabilitation of the site in accordance with the rehabilitation plan. In the event that quarrying is completed before year 20 of the quarry operation, the Council and the applicant may agree to bring forward the requirements of this condition.	Quarry Management Plan Part 3 and Part 6.3. Future Quarry Management Plan for Stage 4
(f) The applicant shall provide a bond in the form of a bank guarantee of $200,000 indexed by CPI increases from the date of commencement of the construction period to the closure of the quarry as an insurance against the failure of the applicant to comply with the conditions of consent. If, at the end of the quarry's operation, the site is restored in the manner set down in the quarry management plan, the bond will be released to the applicant by the Council. In the event of a failure by the applicant to comply with the requirements of the quarry management plan, the Council may require the bond to be forfeited and any costs incurred by the Council for the reasonable restitution of the site will deducted from the bond. Any residual money from the bond after reasonable costs have been deducted will be payable to the applicant. If the costs of restitution are greater than the value of the bond, the Council may recover the additional costs and the costs of recovery from the applicant.	Quarry Management Plan Part 1.6
(g) This Consent shall lapse 20 years from the date of commencement of construction for Stage 1 approved by the Council or such shorter periods as may be agreed by the Council and the applicant. Before the Consent lapses, the applicant shall have completed all of the site restoration and rehabilitation work required by the final quarry management plan to a standard acceptable to the Council. Where any restoration or rehabilitation work for any Stage has failed to maintain the standard set for successful rehabilitation, further works shall be undertaken to meet the standard set for successful rehabilitation. If the applicant fails to do so, the bond shall be forfeited and the monies from the bond applied to the restoration of the site in the manner of condition 10(f) above.	
11. All future water structures (including tailings dams) are to be designed to incorporate emergency overflows to cater for a 1% AEP storm event.	Quarry Management Plan Part 6.2
12. Prior to the commencement of each successive stage, the applicant shall report to the Council on the performance of the quarry in regard to the approved Quarry Management Plan in force for the preceding stage. Prior to the commencement of each Stage, the Quarry Management Plan shall be amended to take account of the objectives and targets for the Stage for the Stage and any changes that the applicant might propose for the Stage for approval by the Council. The applicant shall also provide a report on the quarry in relation to those matters listed in Condition A1 (a). The Council will not unreasonably withhold its approval to proceed with the operation with the quarry.	Quarry Management Plan Part 5
13. All loaded vehicles entering or leaving the site are to be covered at all times.	Quarry Management Plan Part 6.7
14. All loaded vehicles leaving the site are to use the wheel washing facility so that they are cleaned of material that may be deposited on a public road.	Quarry Management Plan Part 6.7
15. All unsealed trafficable areas are to be kept sufficiently damp to prevent windblown or traffic generated dust. A water truck is to be kept on site at all times for the purpose of dust suppression.	Quarry Management Plan Parts 6.5 and 6.7
16. The provision of sufficient parking on site for all quarry related traffic.	Quarry Management Plan Part 6.7
17. All practical measures shall be taken to prevent and/or minimise any off-site lighting impacts from the development.	Quarry Management Plan Part 6.6
18. All, external lighting associated with the development shall comply with Australian Standard AS4282(INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.. . .	Quarry Management Plan Part 6.6
19. Deleted	

20. Sediment must be removed from the erosion sediment control basins as soon as the capacity is reduced by 50%.	Quarry Management Plan Part 6.2
21. An impervious bund .wall and floor is to be erected around any fuel tank on site. The bunded area shall have a capacity to hold in excess of 110% of the total fuel storage to contain the fuel in the event of accidental spillage. These works are to be undertaken prior to the commencement on the extraction of material from the site.	Quarry Management Plan Parts 6l6 and 6.7. Refuelling of plant will be by contract. No fuel will be stored on site other than in small containers (less then 20 litres) for small equipment.
22. The approved development shall comply with all relevant requirements of applicable occupational health and safety legislation.	Quarry Management Plan Part 6.6
23. Compliance with the General Terms of Approval issued by the Department of Natural Resources as per Attachment A.	EIS and Director General's Requirements at EIS, Appendix 1
24. Compliance with the General Terms of Approval issued by the Department of Environment and Conservation as per Attachment B.	As above
25. The safety security web fences placed around trees to be retained in accordance with condition A5 are to be maintained for the life of the quarry. The developer or contractor shall take all necessary measures to **prevent damage to trees** and root systems during site works and construction activities, including work associated with the provision of water, sewerage and stormwater drainage services. In particular, works, erection of structures, excavation or changes to soil levels within three (3) metres of the trunks of trees identified in the approved plans to be retained are not permitted unless part of the development as approved. The storage of spoil, building materials, soils the driving or parking of any vehicle or machinery within three (3) metres, of the trunk of a tree to be retained, is not permitted.	Quarry Management Plan various parts
26. Erosion and Siltation control measures shall be undertaken in respect to any part of the land where the natural surface is disturbed or earthworks are carried out. The controls shall comply with Council's Code of Practise for Erosion and Sedimentation Control. **Advice:** The applicant shall be held responsible for any breaches of the *Protection of the Environment Operations Act 1997*. Failure to implement or maintain appropriate erosion/sediment control measures is a breach of Section 120 the *Protection of the Environment Operations Act 1997*. Such a breach is liable for a $750.00 on the spot fine for an individual or $1,500.00 for a Company. Applicant(s) are advised that spot checks of Erosion and Sedimentation Control measures may occur and fines for breaches imposed	Quarry Management Plan Part 6.2
27. Loading and unloading operations associated with the approved development shall be confined to within the property.	Quarry Management Plan Part 6.7
28. No signs other than **a Business Identification Sign** shall be displayed, or erected, until a formal application has been submitted to the Council, consent granted, and a Construction Certificate issued. A Business Identification Sign only indicated an affiliation with a trade, profession or other association relevant to the business conducted on the premises, upon which such a sign is displayed. Such a sign shall have an outline that would fit a rectangular figure 1.0m in length and 0.7m in height.	
29. Any relocation, or alteration, of any utilities or any existing services made necessary as a result of this development is to be carried out at no cost to Council, with satisfactory arrangements being made with the authority concerned. These services may include stormwater, telephones, electrical cables and power poles, gas, water mains (hydrants, stop valves stop cocks), sewer mains and manholes, parking signs, street signs and traffic signals.	Quarry Management Plan Parts 2.3 and 6.8
30. Energy Australia – For all commercial, industrial, multiple residential developments (excluding less than 6 dwellings), and proposed structures within 5m of the street frontage and higher than 3m, Energy Australia's written requirements in relation to: a) The need for the provision of a substation. b) The need to relocate existing overhead electrical infrastructure due to the close proximity to the proposed development,	Quarry Management Plan Parts 2.3 and 6.8

c) The method of connection of the property to the Energy Australia supply, ie Either underground connection or overhead connection, and d) The necessity for the provision of underground low voltage electricity conduits within the footpath area shall be obtained prior to the issue of a Construction Certificate and a copy provided to the Principal Certifying Officer.	
31. The provision of sediment control measures to prevent sediment transfer down slope and off site into the sandstone hanging swamp found off the south east corner at all times.	Quarry Management Plan Part 6.2
32. The operator is required to provide annual production data to the Mineral Resources Division of the Department of Primary Industries , as requested	Quarry Management Plan Part 5
33. Submission to Council of documentary evidence that demonstrates compliance with National Occupational Health and Safety Commission Standards (NOHSC) and the Department of Environment and Conservation requirements for dust emissions prior to the commencement of extraction of material from the site.	Quarry Management Plan Part 5
34. Plan of Management for Water Supply incorporating water savings initiatives/recycling shall be submitted to an approved by the Council's Water and Sewerage Asset Manager prior to the issue of a Section 307 Certificate. You are advised to contact Councils Water and Sewer Asset Management Group for further information regarding this matter.	Quarry Management Plan various The property will not be connected to the town water supply.
35. Prior to the issue of a Construction Certificate, a **security deposit** of $5,000.00 shall be paid into Council's trust fund to cover the cost of repairing damage to Council's assets caused as a result of the development. The security deposit shall be increased in accordance with the CPI increase prior to the commencement of each stage of the quarry. Such deposit will be refunded upon the completion of the project if no damage is caused.	Quarry Management Plan Part 1.6
36. Satisfactory arrangements shall be made for the provision of water and sewer services to the land. A copy of the Certificate of Compliance under Section 307 of the Water Management Act 2000, shall be obtained prior to the issue of the Construction Certificate. Contributions may be applicable to the Section 307 Certificate. Developers should make early application for a Section 307 Certificate from Council. For a copy of the application form 'Application for Certificate Under Section 305' contact Customer Service on (02) 4325 8200 or visit Councils web site www.gosford.nsw,gov,au to download a form from the Water and Sewerage forms index.	The property will not be connected to the town water supply
37. A pavement report prepared by a practising Geotechnical Engineer shall be submitted and approved by Council. The pavement depths shall be determined in accordance with Council's specifications and the following traffic loadings: Name of Street — Traffic Loading (ESAs) Wisemans Ferry Road — 1×10^7 Quarry Access Vehicle Crossing — 1×10^7 At the completion of construction, certifications shall be submitted prior to the issue of an Occupation Certificate. The Geotechnical Engineer is to certify that the pavements as built have been constructed in accordance with the Construction Certificate, accepted practice, and recommendations in the pavement report.	Quarry Management Plan Part 2 and Part 6.7
38. All work to be carried out within a public reserve shall be separately approved by Council, under the Roads Act 1993. Engineering plans for the work shall be prepared and designed by a suitably qualified person, in accordance with Council's 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and 'Code of Practice for Erosion and Sedimentation Control'. The plans shall be approved by Council prior to the issuing of a Construction Certificate required by this consent. A fee for the approval of engineering plans applies. The amount of this fee can be obtained from Council's Customer Services. All work is to be carried out in accordance with the Occupational Health and Safety Act.	Quarry Management Plan Part 2.3

39. A Construction Certificate for the Engineering works shall be issued concurrently with the Construction Certificate for building works prior to the commencement of any work. All civil engineering work shall be designed by a suitably qualified person, in accordance with Council's 'GCC Design Specification for Survey, Road and Drainage Works' and 'Code of Practice for Erosion and Sedimentation Control' and Civil Construction Specification'. All work that involves the disturbance of nearby properties must be consented by the nearby owner(s) in writing prior to the issue of a Construction Certificate. An engineering plan approval fee shall accompany an application to Council for a Construction certificate. The amount of this fee can be obtained from Council's Customer Services. All work is to be carried out in accordance with the Occupational Health and Safety Act.	
40. Construction of the following works in accordance with Councils 'Civil Construction Specification', 'GCC Design Specification for Survey, Road and Drainage Works' and 'Code of Practice for Erosion and Sedimentation Control' prior to the issue of an Occupation/Subdivision certificate. The works shall not have an adverse impact upon nearby properties and shall comply with Workcover Authority requirements. It is the contractors responsibility to ensure that all works shall be carried out in accordance with the Occupational Health and Safety Act. Note: A maintenance bond may be required on completion of the works in accordance with Section 1.07 of the Specification 'Civil Construction Specification'. a Upgrading of the quarry access to a Type BAR intersection with sealed shoulders on both sides of Wiseman's Ferry Road to accommodate truck swept paths. Left turn tapers at the access should be provided. (Refer to 'Guide to Traffic Engineering Practice, Intersections at Grade (Aust roads Inc., 2005)) b Provision of double barrier lines at the quarry access and extended to Lackersteens Road to prohibit overtaking of turning vehicles. c Provision of truck turning signs on Wiseman's Ferry Road. d The gate to the property shall be located at sufficient distance from Wisemans Ferry Road to hold an articulated vehicle	Quarry Management Plan Part 2.3
41. It is the contractor's responsibility to ensure that all works are carried out in accordance with the *Occupational Health and Safety Act*.	

APPENDIX 4

SUMMARY OF PUBLIC CONSULTATION IN REGARD TO DEVELOPMENT APPLICATION NO 26267/2004

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SUMMARY OF PUBLIC CONSULTATION IN REGARD TO DEVELOPMENT APPLICATION NO 26267/2004

SUMMARY REPORT OF MEDIATION OF 21 NOVEMBER 2005

[Source: Papers to Council for the meeting of 6 June 2006]

A facilitation meeting was held on 21 November 2005 between the applicant and objectors with an external mediator. The mediator advised that no agreement was reached and that the issues discussed included the following;

- Groundwater Impacts and impacts to drinking water
- Noise Impacts
- Air Quality Impacts
- Traffic movements
- Visual Impacts
- Quarry Setbacks from Boundaries
- Loss of Vegetation
- Hours of Operation
- Rehabilitation
- Safety Impacts

The mediator also advised that if the application were to be approved, the objectors would not only want the quarry to be on a much smaller area with stringent conditions but also they would like a sunset clause to be inserted limiting the approval to a year or two so the impacts of the quarry could be assessed.

In addition the objectors felt that not only should this application be refused but also that there should be no further development on the Somersby Plateau until Council carried out a detailed study of the impact of further development on the plateau and in particular the impact upon the health and amenities of local residents and upon the groundwater supplies.

SUMMARY OF PUBLIC SUBMISSIONS RECEIVED BY THE GOSFORD CITY COUNCIL IN 2005

[Source: Papers to Council for the meeting of 6 June 2006]

Twenty five (25) public submissions and 1 petition with 68 signatories were received by the Council in March 2006. A summary of the submissions is detailed hereunder. The comments are those of Council Officers.

1 *Non-compliance with previous development consent conditions, including no rehabilitation and the exceedence of the amount of extraction. The past behaviour of the applicant would indicate that the applicant would not adhere to new conditions.*

Comment
Council is required under the Environmental Planning and Assessment Act 1979 to determine development applications where they are the consent authority irrespective of the previous behaviour of the applicant.

2 *Traffic movements of 20 to 40 per week will adversely impact on the already congested and poorly maintained road increasing accidents in the region, reducing the amenity of the area, cost lives, cause damage to the road to be paid for by Gosford rate payers, increase noise and dust problems. The level of usage by quarry trucks on the road should mean a review of the existing speed limit to at least 70kmh.*

Comment
The proposal was referred to the Hunter Regional Development Committee who did not object to the development and required the imposition of conditions to up grade the access into and out of the site. The additional traffic movements will not result in adverse impacts to traffic movements on Wisemans Ferry Road.

A dilapidation report on the condition of Wisemans Ferry Road is required to be submitted by the applicant prior to the consent becoming operative. The existing speed limit is considered to be satisfactory however representations can be made to either the Gosford City Development Committee or RTA to have the speed limit reviewed.

3 *The proposed setbacks between the quarrying operations and the quarries boundaries and adjacent properties are totally inadequate i.e. 10 metres to the southern and northern boundaries and approximately 25 metres from the north-western corner.*

Gosford Council does not have a DCP in relation to extractive industries which defines setbacks. However Hornsby Shire Council's DCP requires a setback of 200 metres from a residence, 30 metres from a public road and 200 metres from habitats of threatened species, populations or ecological communities.

Comment
The setbacks in relation to the quarry are considered to be inadequate having regard to the assessment undertaken by Council's staff and the setbacks have been increased to 120 metres from the most affected residences. [The development consent of September 2007 approved a setback of 100 metres from residences.]

4 *The proposed hours of operation do not give consideration to the residents and should be 7.00am to 4.00pm Monday to Friday, no weekend operations including maintenance or on Public Holidays.*

Comment
The Department of Environment and Conservation have in their General Terms of Approval reduced the hours of operation to 7.00am to 5.00pm Monday to Friday and 7am to 1pm on Saturdays, with no activity to be undertaken at the premises on Sundays or Public Holidays unless a delivery of material outside these hours is required by police or other authorities under specified conditions. The hours of operation will be amended to reflect the requirements of the DEC.

5 *Due to the size and nature of the quarry site it is not possible to make it secure from entry by those who wish to enter and each entrant who in many cases will be children shall be exposed to risk of harm and injury. The quarry should be surrounded by a manproof fence with warning signs due to safety reasons and that it shares its northern boundary with a crown road which is technically accessible to the public.*

Comment
The quarry will be required to erect appropriate fencing around the quarry prior to the commencement of extraction of material from the site. Persons entering the site without permission are trespassing and that is a matter for the quarry operator.

6 *The proposed bunding means that every tree standing would be cleared. Native species will have their habitat disturbed or destroyed. The Flora and Fauna Assessment in the EIS has identified the existence of the threatened species Grevillea shiressi in the north western corner of the site.*

The consultant has recommended setbacks ranging from 30 to 60 metres. The proposed development is proposing to reduce the setbacks and locate bunding and the haul road in this area which is clearly inconsistent with the consultant's recommendation.

Is the flora and fauna study actually valid as the area was slashed of undergrowth prior to the commencement of the study. The removal of the vegetation in the western end of the site will erode the quality of the landscape.

Comment
The amended proposal recommended by Council's staff would ensure that the vegetation identified in the Flora and Fauna report would be retained.

7 *The proposal will affect bores of surrounding properties due to the water table being lowered from the quarry operations which will affect agricultural activities, supplementary drinking water and bores drying up.*

The surrounding residents should not have to prove that it was the quarry operations which caused the bores to run dry. Affected property owners should not have to undertake the cost of sinking their bores deeper due to the impact of the quarry on the groundwater table. There appears to be no medium to long term plan to conserve the underground resource so as to guide Council on yet another major assault on the Somersby Plateau.

In the current uncertainty of future water supplies and in keeping with the precautionary principle no DA should be approved that may adversely affect groundwater resources. The EIS presumes that the water extracted for the water bottling enterprise comes from a different aquifer than the one affected by the quarry operations. This is not acceptable and if wrong the depletion of the groundwater source upon the commercial water bottling enterprise would be catastrophic.

There should be no extension or new quarries approved until the study of the water resources in the area is completed. The EIS states that the predicted effect on the groundwater is based on limited data, it would be illogical to approve the quarry until its potential effects on the groundwater were better understood. The EIS does not display all the bores in the area, so it underestimates the number of bores affected.

What actions must the applicant take to control water, where the seepage into the quarry exceeds the applicant's harvestable rights. Compensation will be sought if the quality and quantity of our bore water is affected. The study does not appear to evaluate the impact of the quarry on two bores on 611 Wisemans Ferry Road as they are within 100 metres of the site they could be adversely affected. The study recommends that the water levels of bores be monitored by annual reports and if necessary review of the practises of the quarry operations, which is unrealistic and difficult for Council and residents to monitor.

The EIS maintains that there is surplus groundwater capacity available under the Water Sharing Plan for the Kulnura/Mangrove Mountain Water Resource. This is based on traditional rainfall and usage patterns that are no longer reliable and are questionable. The forecasts in the EIS must be doubtful.

Comment
The issues associated with groundwater have been outlined in the report by the Environmental Assessment and the Department of Natural Resources and recommendations made for an amended quarry operation.

8 There is a health danger posed by dust as well as dust impacts on our drinking water. The dust from this activity spreads not only to immediate neighbours but well beyond and could dramatically affect other more environmentally sound development opportunities for the area. Who will enforce the dust control plan?

Council should not agree to this development if it cannot obtain complete agreement from affected residents about the maximum level of tolerance over the life of the quarry for dust emanating from it. The Department of Health have suggested that the bunds are not an effective diversion of dust as it rises. Reports Page 121 6 June 2006

The quarries activities will result in undue amounts of dust and exhaust pollutants from machinery and trucks that operate on the quarry site. This will result in increased incidences of respiratory distress, asthma and there will be an increased need to remove dust from houses cars etc.

The EIS did not contain the air quality impact assessment requested by the EPA. What is Council going to do to guarantee that surrounding residents will not be affected by health issues in twenty or thirty years? There is no information in the EIS on how it will address the dust contamination of our drinking water. It would almost be impossible to control dust from the quarry which will decrease the air quality in the area.

Comment
These issues have been addressed in the report by the Environmental Assessment Department of Environment and Conservation and Public Health Unit of Northern Sydney and Central Coast Area Health Service.

9 *The noise impacts from the development spreads not only to the immediate neighbours but also beyond and could affect other more environmentally sound development opportunities in the area. The noise impacts on neighbours especially as the access road would be on the boundary to the north.*

The mining operations that include ripping of sandstone would have a detrimental effect on neighbours. Council should not agree to this development if it cannot obtain complete agreement from affected residents about the maximum level of tolerance over the life of the quarry for noise emanating from it.

The removal of bushland would also increase the potential for noise. The noise assessment has indicated that the appropriate indicative noise rating for the area is suburban, due to the location being impacted by the freeway and Wisemans Ferry Road and if so the quarry would not be allowed. The proposed development will increase the level of noise from that which currently exits. There will be an increase in noise as a result of trucks entering and exiting the quarry, bulldozers, earthmoving equipment and water pumps continually running.

The Department of Health advises that bunds offer little protection from noise as it travels up over them. The noise levels assumptions and the proposed noise management strategy are invalid as the background noise levels would have been lower if the original conditions of consent has been followed.

The gradient of the haul road will mean that trucks will be using maximum power and therefore maximum noise at the closest point to my home. The proposed quarry will have a detrimental effect my wedding and function business and the study does not evaluate the noise impact on my property.

Noise impacts from stage 1 which exceed noise exposure goals can be reduced by modifying the works within the stage, including retention of the existing haul road and location of the bunds closer to the source of the noise.

The noise modelling was undertaken assuming calm winds only. Windy days may lead to noise goals being exceed when monitoring is undertaken once the quarry is operational. There is no explanation that the sound power levels shown in Table 9 represent the Leq (15 min) noise level or are a straight sound power. The construction noise criterion for part of the works should be assessed as L10 and not Leq. Why was the meteorological data taken from Peats Ridge and other data from Mangrove Mountain in compiling the EIS.

Comment
The Department of Environment and Conservation has supported the noise assessment undertaken by the proponent and has granted it's General Terms of Approval. It has identified that it cannot set noise limits for Residence 4 in respect of the construction phase of the development. However it is proposed to amend the quarry to increase setbacks to the most affected neighbours to ensure the quarry operations are more aligned to the NSW Industrial Policy.

10 *When will rehabilitation begin and who will enforce it? Council needs to insist on the rehabilitation of all of the land to a stringent and demonstrable standard or it ought not approve this development.*

Concern is raised about the integrity of the operators of the quarry to carry out the rehabilitation required. Under the proposal rehabilitation will take place after ten or

more years of quarry operations before any reasonable level of rehabilitation is provided. The rehabilitation program appears half-hearted and cursory and will be only done if the extension goes ahead. Rather than risk any further environmental damage the quarry should regenerate naturally.

Comment
This issue has been addressed in the body of the report and conditions of consent.

11 *What happens in an extreme rainfall event if the retention ponds overflows and causes damage to the Narara Creek and Brisbane Water catchments?*

Comment
All future water structures such as water supply dams and tailing dams are to be designed to incorporate an emergency overflow that can handle the 1% AEP storm event. If for some reason the structures of the water supply dam or tailing dams were to fail under the provisions of the Protection of the Environment Operations Act 1995 (POEO Act) any damage to the environment must be rectified by the offender. Failure to address a breach of the POEA Act carries very severe penalties for a Tier 1 Offence (the maximum penalty is up to a 7 years imprisonment and or $1 million fine).

12 *Will Council install town water to all surrounding properties as rural properties are running out of water or have to go deeper to access spring water due to the depth that these extractive industries go down to.*

Comment
The area is outside Council's defined Water Service Area and Council has no plans to extend the service area at this time. Reports Page 123 6 June 2006

13 *The amenity of the area will also be affected.*

Comment
The amenity of the area will be affected particularly in the first four weeks of the project when the construction of the acoustic mounds are being undertaken. However once completed the amenity of the surrounding area is not likely to be adversely affected provided the conditions of consent are complied with.

14 *My property value will be extremely affected if this proposal is allowed to go ahead. How can a 45 metre deep hole be allowed 10 metres from property.*

Comment
No evidence has been submitted that verifies the claim. It should be noted that a quarry has operated on this site since 1979. The proposal is to be amended to increase setbacks from adjoining lands.

15 *This new development does not address the many environmental problems caused by sand mining.*

Comment
The submission does not outline the environmental problems however the EIS has identified and addressed potential impacts caused by the proposed quarry operations.

16 *There is scant regard to safety and danger of this development to people and animals without adequate fencing and vast steep walls and metres of water at the bottom.*

Comment
Any approved quarrying operations will require the provision of adequate fencing around the quarry site as identified in the Environmental Assessment of this report.

17 *Inadequate opportunity for community consultation.*

Comment
The development application was originally advertised for a period of 30 days as required by the Environmental Planning and Assessment Act 1979 and was subsequently extended to 40 days in which time submissions could be lodged.

18 *There is a lack of surety to ensure compliance with the proposed EMP over time.*

Comment
The conditions of consent are considered adequate to ensure compliance with the continued operation of the quarry.

19 *Poor justification of claimed regional and local benefits.*

Comment
Noted

20 *We have no faith or trust in the proposal as there are to many uncertainties and possibilities in the proposal to be a serious document.*

Comment
Noted

21 *The owner should give a bond of $ 5 to $10 million dollars to insure that the proposed quarry operator will reinstate the property as per the conditions of approval.*

Comment
The figure suggested cannot be substantiated as it is excessive. The conditions of consent are considered adequate to ensure that the site is progressively rehabilitated.

22 *Council late last year resolved to halt the approval of all new sand mining ventures until it had undertaken further research and consultation into the industry on the Central Coast with particular attention to its resource economic costs and environmental costs. This application should not be approve until such time as it has first consulted with the community and affected stakeholder groups on the place of sand mining in the medium to long term planning for the Somersby Plateau.*

Comment
Council is required to assess and determine the development application in accordance with the provisions of the Environmental Planning and Assessment Act 1979, the current planning controls and the information submitted by the applicant.

23 *Our Association believes that the principle long term value for the Somersby Plateau is as an agricultural and tourist hinterland for the Gosford area and so it's soils, visual amenity and attractive fields and bushland ought to be maintained not scared with unsightly and hazardous extractive industries like sand mining.*

Comment
Extractive industries are permitted within the 1(A) Rural Agricultural zone and a number of areas on the Somersby Plateau have been identified under Sydney Regional Environmental Plans 8 and 9 for the extraction of extractive materials.

24 *There is no material difference between this application and that refused by the land and Environment court that warrants this particular venture being approved.*

Comment
Each application must be treated on it's merits and not refused because a previous application was refused.

25 *This quarry is on 1A farm space an endangered species.*

Comment
The 1(A) Rural zone permits extractive industries with the consent of Council. Reports Page 125 6 June 2006

26 *The development application is inadequate with a number of key issues having not been addressed or give sufficient attention.*

Comment
The submission did not outline the inadequacies of the application.

27 *The proposal is not in the public interest.*

Comment
The approval of the proposal will be in the wider public interest in that sand used in the construction industry will be made available.

28 *The EIS is lacking in detail on aspects of the quarry operations in Stage 4 as it indicates that the plans are indicative only. How can the impacts be conclusively assessed if the proposal is a moving target?*

Comment
Council's Environmental Assessment has recommended the reduction in size of Stage 4 of the quarry so as to reduce environmental impacts on and off the site.

29 *We object on the grounds that if the applicant is given approval to recommence mining on this site there is a strong possibility that he will transfer or sell this approval to another company which have not made any commitments as to any possible conditions of approval.*

Comment
Any development consent granted runs with the land and not the owner or applicant. The conditions of consent bind all future operators and owners not just the current operator/owner.

30 *The Hon. Craig Knowles MP Minister for Infrastructure, Planning and Natural resources sent a letter to Marie Andrews in regard to the Somersby Plateau and the future of quarrying dated 14/12/2004. The Minister assured Marie Andrews…quote from letter "Please assure your constituent that the Government will not determine the Calga proposal, or any other new sand extraction proposal on the Plateau, until it has carefully considered all potential impacts and full taken into account the concern's of the community". Why isn't the Rindean Quarry being considered a new sand extraction proposal as it no longer has a DA or EPA licence?*

Comment
The Calga proposal was classified as a state significant development and as such the Minister for Planning was the determining authority. This proposal is not state significant development and Council is the determining authority. Council staff have considered the potential impacts and have recommended that an amended proposal be approved. Community consultation was undertaken in accordance with the requirements of the Environmental Planning and Assessment Act 1979. Reports Page 126 6 June 2006

31 *What has Council done in regard to preparing a DCP on quarries?*

Comment
Council previously advised that whilst a DCP for quarries may be desirable it would be some considerable time before the Integrated Planning Unit would be able to work through the existing ever growing program unless Council re-prioritised the work program to allow it to be undertaken.

32 *What is the depth of the quarry?*

Comment
The quarry will have varying depth from 211 metres AHD to 217 metres AHD.

33 *The EIS mentions that if the sandstone is too hard to extract the operators intend to leave this sandstone alone. This does not conform in our eyes to safe quarrying practices as mentioned in the EIS.*

Comment
The quarrying practices is a matter for the operator in accordance with established quarry practices and relevant regulations.

34 *The proposed quarry extension will transform it from what was a "backyard" operation to a facility completely inappropriate for the size of the site and its proximity to the surrounding residences.*

Comment
The quarry is proposed to be amended to ensure that its impact on adjacent residences falls within acceptable limits.

35 *Our submission has been impeded by the unavailability of the EIS as copies were not available and further requests of the applicant were unsuccessful.*

Comment
The applicant provided additional copies of the EIS as requested.

36 *The quarry is located in a residential area which will affect many more residences than the neighbouring properties.*

Comment
The area is classified as rural. The recommended amended proposal is unlikely to result in adverse impacts to the surrounding neighbourhood if the conditions of consent are complied with. Reports Page 127 6 June 2006

37 *The Somersby and Kulnura section of the Central Coast is the most picturesque with the highest amenity and should not be debilitated by sand mining.*

Comment
Extractive industries are permitted within the 1(A) Rural Agricultural zone and a number of areas on the Somersby Plateau and Kulnura have been identified under Sydney Regional Environmental Plans 8 and 9 for the extraction of extractive materials.

38 *There is potential for structural damage to our home due to the proximity of the proposed quarry operations from the potential ground movement and/ or damage from vibration transmitted through the ground. What guarantees exist that damage to my home will not occur.*

Comment
The damage done to adjoining or adjacent buildings/properties is a matter between the owners and the quarry operator.

39 *If the application were to proceed we ask that the depth of the extraction be limited to 20 metres in line with other quarries.*

Comment
There is no justification to require a restriction of the depth of the quarry to 20 metres in this instance.

40 *What guarantees would we have that excavators only would be used as proposed in the application when we know rippers have been used in the past.*

Comment
The proposed conditions of consent would limit the machinery to that documented in the EIS. The EIS is also binding in that it indicates that sandstone would not be ripped. The consent contains conditions to reflect this.

41 *What guarantees exist regarding the quality of the electricity supply to my home when problems in the vicinity of existing quarries are known to suffer electrical problems.*

Comment
This is a matter for Energy Australia as the power supply authority.

42 *I strongly object to this development as it will affect my business and property. I have four full time employees twenty casuals that might ultimately lose their jobs all my employees bar one were unemployed prior to receiving employment at Linton Gardens.*

Comment
The amended proposal as recommended will not result in adverse impacts to the surrounding area that would warrant refusal of the application.

43 *Should this DA be approved the property and business will suffer and will seek compensation.*

Comment
This is a matter between the parties involved not Council.

44 *The proposed development is clearly an over development of the site and fails to address the issues raised in the recent court decision and still an inappropriate development in the circumstances.*

Comment
The amended proposal as recommended by Council staff is considered appropriate given the competing land uses in the area.

45 *The Draft Heritage Study designated Linton Gardens as a heritage property of local significance. The LEP 22 requires Council to protect properties listed in the Heritage Study. The listing of the property indicates that the gardens are independently recognised as being of heritage value and require protection. A large noisy sand mining operation immediately over the road is a use that will not enhance the heritage value of Linton Gardens. The scale of the proposed quarry may well jeopardise the economic viability of the function centre.*

Comment
No information has been submitted that has demonstrated that the economic viability of the centre will be jeopardised. The amended layout proposed by Council's staff is not considered to adversely impact on the heritage value of the property.

46 *Evidence is mounting on the relationship between size of dust particles ingested at the quarry may cause serious lung disease.*

Comment
The Public Health Unit of the Northern Sydney and Central Coast Health Department has indicated that compliance by the quarry operator of the National Occupational Health and Safety Commission Standards and the DEC licence should protect on-site workers and surrounding residents from health risks associated with dust exposure.

47 *The application does not address the principles of ecological sustainable development.*

Comment
The amended proposal as recommended by Council staff takes into consideration the principles of ecological sustainable development.

48 *This proposal is entirely unsuitable as the land in question is surrounded by small rural residential blocks and fronts Wisemans Ferry Road.*

Comment
The amended proposal as recommended by Council staff is considered to satisfactory having regard to the surrounding residential development and Wisemans Ferry Road.

SUMMARY OF PUBLIC SUBMISSIONS RECEIVED BY THE GOSFORD CITY COUNCIL IN 2007

[Source: Papers to Council for the meeting of 11 September 2007]

Public Submissions

Six (6) public submissions were received in relation to the amended application. A summary of the submissions is detailed hereunder. The comments are those of Council Officers.

1 *The amenity of adjoining properties will be extremely destroyed if mining is permitted any closer to residences.*

Comment
The proposed reduction from 120m to 100m will alter the impact on adjoining residences. However, the impact is not regarded as significant as additional conditions and controls have been included.

2 *The impact on groundwater and dust to adjoining residences has not been adequately addressed.*

Comment
It is acknowledged the alteration of the quarry design will impact upon groundwater and potential dust generation. However, in respect to groundwater, the Department of Water and Energy has now required the amended quarry to comply with the Water Management Act 2000, prior to issuing an approval and the access haulage road is to be tar sealed for a distance of approximately 60 metres to the wheel wash facility that will reduce the generation of dust.

3 *The proposal will increase truck traffic movements and accident potential*.

Comment
There is no increase in truck movements proposed.

4 *Since the 70km/h speed limit was imposed not many trucks adhere to it.*

Comment
This is not a relevant issue for consideration in determination of either the original application or the proposed amendment.

5 *The proposal will affect significant wildlife in the area*.

Comment
The amendment will not have any significant additional impact. The site of Quarry Cell 7 has previously been cleared.

6 *The application is not a S96(1A) application and the modifications do not involve minimal environmental impact.*

Comment
The application has been advertised and previous objectors notified. The application is one which Council can assess and determine under Section 96.

7 *The reduction in setbacks will have greater impacts on surrounding residents by increased noise, loss of visual amenity, loss of bushland, and potential impact from dust.*

Comment
As discussed in points 1, 2 and 5 above, the amended quarry may alter the amenity of the adjacent residents however, the additional conditions and controls have been included to address these potential impacts.

8 *Council should adhere to its previous conditions and not "water them down" w hich will make enforcement of conditions difficult. Specific conditions should not be replaced by generalised conditions.*

Comment
The amended conditions are more concise and have not been watered down.

9 *The proposed reduction of buffers are objected to. These buffers are necessary to maintain the amenity of surrounding residents. The buffers reduce noise and act as natural dust filters. The quarry should not be permitted to operate up to 70m to 90 from residential homes.*

Comment
Through a series of "without prejudice" meetings the applicant has amended the Section 96 Application. The minimum distance to adjoining residents is now 100 metres.

10 *The reduced setbacks and buffer areas will impact groundwater operations from existing bores.*

Comment
It is acknowledged the change in the approved quarry extraction area may impact upon groundwater extraction. However, the Department of Water and Energy now requires the amended quarry to comply with the Water Management Act 2000, prior to issuing an approval.

11 *The application suggests the 120m setback is not a requirement of Hornsby and Baulkham Hills Councils' DCP's. This is incorrect.*

Comment
Copies of Hornsby Shire Council Extractive Industries DCP and Baulkham Hills Shire Council DCP No 16 - Extractive Industries have been provided. These documents require setbacks of:

- 10m from adjoining property boundaries (Hornsby and Baullkham Hills).
- 200 metres from a residence not associated with extraction (Hornsby).
- 100m from a residence not associated with the extraction (Baulkham Hills).

Accordingly the 100m now proposed is consistent with requirements for other Councils and for other quarries.

12 *The current approval locates the acoustic mounds in cleared areas. The application proposes to locate the mounds in areas that will require removal of bushland which is less than recommended in the applicant's Flora and Fauna Report. The acoustic mounds will be located closer to adjoining residences and Wisemans Ferry Road.*

Comment
The acoustic mounds and/or bunding have been located so as to minimise the removal of trees.

13 *There is no objection to the extension of the construction period to facilitate landscaping of the acoustic bunds subject to quarry operations not commencing until the landscaping of the bunds is complete.*

Comment
The conditions of consent requires this.

14 *The staging should not be modified. The original consent in 1979 only permitted one hectare to be quarried. There is some 8-10 hectares of the site which has been disturbed by quarrying operations with little or no rehabilitation. The conditions should clearly state what can be quarried and what is to be rehabilitated at any time.*

Comment
The proposed amendment and staging now reduces the areas to be extracted at any time and increases the areas to be rehabitated.

15 *The access road and bunds should not be relocated as it will be closer to the adjoining residences and bunds should not be reduced in width due to impacts of noise and air quality.*

Comment
The current Section 96 Application does propose to move the access road closer to the residents however, proposed conditions require the access road and acoustic barriers to be relocated parallel to the area of extraction.

16 *The current prohibition of ripping to extract material should be retained as ripping will create additional noise to surrounding residences.*

Comment
The Department of Mineral Resources has advised that the barring of ripping effectively sterilises the resources and prevents quarrying. Ripping is the normal method of quarrying for this material.

17 *Any extension of operating hours should not be approved due to the impact on adjoining residents that will occur for the life of the quarry.*

Comment
The extension of hours to 6.00pm weekdays will not have a significant increase in the impact on adjoining properties.

18 *The quarry should not be permitted lower than RL 215m.The deeper excavation will impact the groundwater aquifers and consume greater amounts of water for a longer period of time. Computer modelling is totally unreliable.*

Comment
The quarry floor is limited to RL215m AHD.

19 *Changes to the rehabilitation requirements appears to be the applicant trying to avoid his responsibilities before any work has started.*

Comment
The applicant has provided greater detail on rehabilitation methods and monitoring.

20 *The relocation of the bunds to 20m from the southern boundary is objected to and has not been agreed to as stated by the applicant. The removal of the bund wall on Wisemans Ferry Road side will result in inadequate buffering.*

Comment
A bund wall is not needed on the Wisemans Ferry Road side as the excavation will form a natural barrier.

21 *The quarry approved in 1979 was for extraction of about 360,000m3 of sand. Over 2.5 million m3 was removed illegally. The S96 proposal would result in removal of 6.3 million m3 ie 17 times the original consent in 1979.*

Comment
A new application has been submitted since 1979 which has been approved. Therefore the previous limits are not relevant.

22 *The conditions of deferred commencement consent and the time in which to comply with the conditions should not be extended. The applicant has had sufficient time to comply with the conditions and has used the time instead to lodge a S96 application.*

Comment
The extension of time to comply with the conditions of Consent is reasonable given the complexity of issues to be addressed. The Consent is still limited to five (5) years.

23 *All fencing required in Condition A4 should remain unchanged as a matter of security and safety.*

Comment
The condition should be adhered to so as to ensure prevention of access and safety.

24 *Condition B5 (RL 215m) shall not be altered to permit a lowering of the quarry as this will affect the water table. Further investigations by an independent study should be done.*

Comment
The quarry floor is limited to RL215m AHD, except for designated dams and on-site detention areas which have defined limits.

25 *The benches required under Condition B6 provide for drainage and bush regeneration. Removal will result in an open pit with straight cliff walls of about 42-45m and will be an eyesore from roads and adjoining properties.*

Comment
Benching should be retained for safety reasons and to provide a base for landscaping.

26 *Condition B10 should not be removed as rehabilitation is essential and this condition ensures progressive rehabilitation before the next stage is permitted. The approval in 1979 required no more than 2.5 acres being quarried at any one time. Currently 25 acres remain un-rehabilitated.*

Comment
The condition should be amended to reflect the changes. Rehabilitation is still required and proposed.

27 *Review of quarry operations should not be left to year 10 and should be carried out earlier to ensure clear directions of what is proposed.*

Comment
The amended conditions (B10) provide for assessment of rehabilitation required before proceeding to the next stage.

28 *The removal of Condition B25 should not be permitted. Fencing to protect trees to be retained is essential otherwise they will be knocked over by machinery.*

Comment
The condition should be retained to ensure trees to be retained are protected.

29 *The Water Management Plan showing the water from Quarry Cell 7 being directed down the neighbouring property and at the southern end are a concern and such large flows should not be deviated across neighbours' property.*

Comment
Water runoff is directed to settling ponds and retention basins at the eastern side of the site.

30 *The acoustic mounds should be fully landscaped before quarrying commences. The applicant should use more mature trees and not tube stock which takes time to grow.*

Comment
Landscaping the surrounds is required prior to commencement of quarry operations. Landscaping and rehabilitation is to be progressively undertaken throughout the life of the quarry.

31 The amendment appears to be solely based on economic grounds of the operator and not protection of the amenity of adjoining residents or the environment.

Comment
The economic operation of the quarry is a matter for the owner/operator however, the conditions must also be reasonable.

32 *A 200 metre setback from adjoining residences should be imposed particularly if ripping sandstone is to be carried out.*

Comment
The extraction is restricted to at least 100 metres from the nearest house. The level of excavation, time restrictions and acoustic mounds should mitigate the impact.

33 *The amended plans reduce by about 50% the bushland/vegetation buffer in the northwestern corner and relocate the acoustic bunds. This increases the impact on residences R1, R2 and R3.*

Comment
The additional area to be quarried (Cell 7) is at a lower level than surrounding properties. The additional impact is not considered to be significant.

34 *The access road to residences 5 and 6 is located along the southern boundary. Some level of vegetation should be maintained along the southern boundary to maintain visual amenity.*

Comment
The earth mound along the southern boundary will be landscaped.

35 *Council's previous requirement that a survey plan prepared by a registered surveyor should be adhered to so that an accurate plan of the quarry and works can be relied upon in future verification.*

Comment
This will be required with the plan of management and revision prior to the next stage.

36 *Condition A1 refers to extraction of "saleable material". Does this mean extraction can occur outside the area if not extraction for saleable product.*

Comment
No. Extraction is limited to that shown on the approved plans. Condition A1 has been amended to delete reference to "Saleable Product".

37 *Amended condition A8 now provides for acoustic mounds and/or barriers. The residents should be provided with plans showing the location of mounds and barriers to determine whether or not the bund can be landscaped.*

Comment
Earth mounds will be required where width permits. Where it does not, then an acoustic fence or barrier will be required. An acoustic mound could consist of part mound and part fence.

38 *Condition A11 no longer requires the acoustic mounds to be landscaped prior to sand extraction. It is not clear when landscaping is to occur. The mounds should be landscaped at the completion of their construction.*

Comment
Landscaping will commence immediately after construction and is required to be completed prior to commencement of extraction.

39 *Condition B10 refers to rehabilitation in Stage 2 (Figure 4) which is the same as for Stage 1. Does this mean no rehabilitation in Stage 2 (Figure 5).*

Comment
Rehabilitation will occur within both Stages 1 and 2. Rehabilitation for Stage 1 will be the successful completion of the buffer zones. For Stages 2 and 3 the disturbed area will be reduced from 6 to 4ha.

40 *Condition B10(e) refers to the rehabilitation during Stage 3 (Figure 6) however, Stage 4 (Figure 7) shows the area rehabilitated in Stage 3 proposed for extraction in Stage 4.*

Comment
This was an error in the figures. The applicant has amended the figures to show the correct rehabilitation/extraction areas.

41 *Condition B12 requires a revised Quarry Management Plan (QMP) prior to commencement of each Stage. The condition proposes that Council will not unreasonably withhold its approval to the revised plan at each Stage. This wording may place a fetter on Council's statutory discretion. Further changes should be subject to a S96 Application so that surrounding residents are given the opportunity to comment.*

Comment

The QMP does not modify the consent but ensures the matters required in Condition A1(a) are continually reviewed and adjusted as necessary to protect the adjoining properties and the environment. Including the words that Council shall not unreasonably withhold its approval does not give, or take away, Council's power. Such an onus currently exists.

42 *The variation to hours Condition B3 is opposed due to surrounding residential properties. The operation should cease at 5.00pm appropriate and should be maintained.*

Comment
The operations ceasing at 6.00pm is consistent with other quarry operations and should not significantly increase the impact on adjoining properties. The prohibition on operations on a Public Holiday should be retained.

43 *There has been inadequate time to reply to an increasingly complex proposal. The adjoining residents should have the same opportunity to consult Council Officers the same as the applicant.*

Comment
As the application is the subject of an appeal on deemed refusal, the Land & Environment Court is setting the time frame for consultation between the joint experts.

Council has insisted that the proposed amendments to the S96 are notified to the objectors.

44 *The noise bund should continue at least to the western buffer zone.*

Comment
The earth bund will need to change to an acoustic fence towards the western buffer zone due to the need to preserve trees in this location.

45 *The bund should be beside the Cell 7 operation so that extraction does not come within the 100 metre limit.*

Comment
The bund and road need to be relocated to the edge of the area to be extracted.

46 *The location of the access road is objected to as this results in substantially increased quarrying noise with no noise barrier.*

Comment
The limit of extraction is still 100 metres from the nearest residence. An acoustic barrier/earth mound will be provided beside the road.

50 *The definition of successful rehabilitation is objected to. All acoustic mounds are to be planted before operations commence.*

Comment
This is required as a condition. However, it will take time for landscaping to reach maturity. The definition also provides a method of measurement to assess compliance.

51 *The proposal will affect the health of adjoining residents.*

Comment
The proposed amendments will not significantly increase the impact on adjoining residents. The conditions of consent provide for environmental monitoring in the plan of management.

52 A new EIS should be prepared for impacts on groundwater, air pollution, noise etc. as the proposal is a substantially different quarry than that approved in June 2006.

Comment
The proposal is substantially the same development and a new or amended EIS is not required.

53 The plans show the private driveway on the southern boundary as a road. It is not a road.

Comment

The proposal does not rely on the adjoining driveway or road along the southern boundary.

Conclusion
The proposal amendments will alter the impact on adjoining residents, however the impact is not considered to be significant as additional controls and conditions have been included.

APPENDIX 5

FLORA AND FAUNA IMPACT ASSESSMENT

Flora and Fauna
Impact Assessment

Rindean Quarry
Lot 2 DP 362339
620 Wisemans Ferry Road
Somersby
Gosford LGA

For: Mr Cleve Smith

REF: GCC 11-498
February 2012



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Flora and Fauna
Impact Assessment

Lot 2 DP 362339
620 Wisemans Ferry Road
Somersby
Gosford LGA

REF: GCC 11-498
February 2012

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Cover: Power line easement along northern boundary; entry to Rindean Quarry from Wisemans Ferry Road; bushland that will remain as part of a visual, acoustic and ecological buffer; quarry equipment.

Photos: E. Ashby, December 2011

SUMMARY

This Flora and Fauna Impact Assessment has considered the likely impacts of the proposed development at Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby upon species, populations and communities of conservation significance.

The impact was assessed for nationally and state listed threatened species, populations or ecological communities, or their habitats.

The site is partially naturally vegetated, situated at the edge of the Somersby Plateau. The site has been an active quarry since 1979 and the proposed works area will be buffered from adjacent habitat by retained vegetation. Only 0.88 hectares of Somersby Plateau Forest will be removed for the project and 5 or 6 hollow-bearing trees may also be removed. Their loss will be ameliorated by the installation of nest boxes.

There is potential for two small patches of hanging swamps that are downslope and off site to become drier over a long period, but the modelling predicting this outcome relies on the aquifers being connected and there is no evidence that this is the case. Overland flow to these downslope off site areas will remain intact.

The site provides potential habitat for a number of threatened species of flora and fauna and several threatened fauna species were recorded on and near the site, principally bats:

- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat
- *Myotis macropus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle

Three individuals of the threatened shrub *Grevillea shiressii* were recorded near the site's boundary with an adjacent garden. These were almost certainly planted, as evidenced by their location and lack of suitable habitat.

The impact of this proposal on threatened species and endangered ecological communities of interest is likely to be minimal as it is concentrated mainly in the existing development footprint of the site.

The assessment of the criteria under the Commonwealth EPBC Act (1999) concluded that a referral to the Department of Sustainability, Environment, Water, Population and Communities is not required.

The assessment of likely impact under the New South Wales TSC Act (1995) concluded that a significant impact is not likely to occur upon any state listed threatened species, populations or endangered ecological communities. Therefore a Species Impact Statement is not recommended to be prepared for the proposal.

While it is judged that there will be no significant impact wrought by the proposed development on any species of conservation significance, the following recommendations are provided in order to ameliorate any impacts in relation to the proposal, particularly in regard to resident fauna and protection of downslope environments:

1. Consideration should be given to moving the bund near the entrance so that it impacts on already disturbed ground rather than cut into intact forest vegetation.
2. Lights to be used on site should be of a type that reduces spill and glare so that foraging by microbats is not further disrupted.
3. Clearing should be timed so that the felling of hollow-bearing trees can occur in a season that is least disruptive to resident breeding animals, probably late summer to autumn.
4. Hollow-bearing trees must only be removed with Council's permission and under supervision of a suitably-qualified and experienced ecologist or wildlife handler / rescue service (such as WIRES).
5. Prior to felling, a number of nest boxes of a variety of types should be erected in retained trees in order for animals to relocate or be relocated.
6. Ultimately, boxes should compensate for lost hollows at a ratio of at least 1:1. Supplementary boxes may need to be installed after the felled trees are inspected and the numbers and characteristics of the hollows properly determined.
7. It is important that the nest boxes are designed and built to provide thermal stability and so should the walls should be no thinner than 19 mm.
8. Plant species used for rehabilitation should be restricted to locally-native species and / or those introduced species that do not have the potential to become environmental weeds.
9. Unless it poses a safety hazard, fallen timber should not be removed from the site.
10. Sediment controls should be strictly observed throughout the life of the quarry.

The major conclusion arising from this Flora and Fauna Impact Assessment is that the proposed works are unlikely to result in a significant impact on any listed species or communities. Therefore, in accordance with the EPBC Act (1999), EPA Act (1979), TSC Act (1995) and FM Act (1994), a referral to the Department of Sustainability, Environment, Water, Population and Communities is not required, and nor is a Species Impact Statement required.

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1 INTRODUCTION

1.1 Background and Objectives

Keystone Ecological has been contracted by Cleve Smith Excavations to prepare an assessment of the likely impact of a proposed development upon nationally and state listed threatened flora and fauna and their habitats. It is proposed to extend the quarry Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby in the Gosford Local Government Area (LGA).

This Flora and Fauna Impact Assessment is guided by Director Generals Requirements (dated August 2011) issued for the overarching Environmental Impact Assessment (EIS), as well as by industry best practice survey and assessment protocols.

In particular, the relevant key issues for the EIS are:

1. to include a detailed assessment of the potential impacts of all phases of the proposal; and
2. to describe the measures that would be implemented to avoid, minimise, offset, manage and / or monitor the potential impacts on critical habitats, threatened species or populations and their habitats, endangered ecological communities and groundwater dependent ecosystems, affected by the impact of the proposal.

The following standard procedures also guided this assessment:

1. Review of the existing literature and information currently available for the subject site and general locality to determine issues for consideration;
2. Flora survey to identify species and vegetation communities present on the subject site;
3. Fauna survey to identify species present on the subject site;
4. Assessment of the conservation value of the species and communities recorded or identified with potential to occur on the subject site. This includes assessment of the condition of vegetation communities and the value of the subject site as fauna habitat;
5. Analysis of the likely significance of the impacts of the proposed action in accordance with Commonwealth and State legislative requirements and local guidelines; and
6. Identification of specific measures that may be incorporated into the design of the proposed action to provide for amelioration of likely impacts upon the native flora and fauna of the subject site.

1.2 The Site and the Proposal

The subject site is located at Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby in the Gosford Local Government Area (LGA). It lies in the Sydney Basin Bioregion in the Wyong Catchment sub-region and the centre of the site is approximately at grid reference 341406 E 6305761 N MGA on the northern boundary of the Gosford 1:25 000 topographic map sheet.

The location of the subject site is shown on a topographic map extract in Figure 1. The extent of local vegetation and development is illustrated in an aerial photograph at Figure 2.

The site is 15.723 hectares in extent and lies on the eastern side of Wisemans Ferry Road. It is situated at the eastern edge of the Somersby Plateau, falling away along the east-facing slope where the plateau joins the coastal ranges. Immediately to the east is a narrow patch of bushland between the subject site and the F3 Freeway that is also traversed by the Sydney-Newcastle oil and gas pipeline. Strickland State Forest lies one kilometre further to the east along with other substantial blocks of naturally-vegetated land.

To the north, south and west lie other properties on the Somersby Plateau that are variously used for residential, rural residential and agricultural purposes.

The subject site has been quarried for construction sand and gravel since 1979. The elevation of the western end of the lot is at 260 metres ASL - natural ground level. The quarrying activities have been confined to the eastern end of the property and the elevation at the eastern end is approximately 215 metres ASL.

The extent of the quarrying activities is illustrated in the aerial photograph reproduced at Figure 3. More than half of the site has been developed to some degree: open excavated ground, roads, dams and patches of rehabilitation or cleared paddock and slashed grassy power line easement. Natural vegetation makes up a small proportion of the site and is concentrated at the site's western end. The site supports four substantial and two small farm dams with a spillway emerging from its eastern boundary as a lined drain. This drain feeds into a gully that in turn feeds into the upper reaches of Narara Creek.

It is proposed to extend the quarry and extract up to 150,000 tonnes of sand annually for a period of 20 years.

Details of the final footprint are shown in Figure 3.

This proposal has been the subject of previous impact assessment and other relevant accompanying reports include a hydrological impact assessment (RCA Australia 2004) and a flora and fauna survey and impact assessment (General Flora and Fauna 2004).

1.3 Legislative Context and Scope

1.3.1 Director General's Requirements

This Flora and Fauna Impact Assessment is part of a larger Environmental Impact Statement (EIS), the scope of which is governed by the Director-General's Requirements (DGRs) issued by the NSW Department of Planning and Infrastructure in August 2011.

In order to address the impact of the proposal on biodiversity, a detailed biodiversity assessment has been undertaken, as per Scenario 2 detailed in the DGRs. Therefore, the scope and methodology employed for this survey and assessment are circumscribed by the DGRs and the following relevant guidelines:

- Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW 2009);
- Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft (DEC 2004); and
- Threatened species survey and assessment guideline information at www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.html.

The DGRs also require specific consideration of potential impact on the following threatened species:

- *Prostanthera junonis*
- *Tetratheca glandulosa*
- *Darwinia glaucophylla*
- *Pseudophryne australis* Red-crowned Toadlet
- *Heleioporus australasicus* Giant Burrowing Frog
- *Varanus rosenbergi* Rosenberg's Goanna
- *Calyptorhynchus lathami* Glossy Black-Cockatoo
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Pseudomys gracilicaudatus* Eastern Chestnut Mouse
- Threatened woodland birds

1.3.2 Commonwealth Legislation

The **Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act)** is a nationally applicable Act that is administered by the Department of Sustainability, Environment, Water, Population and Communities. This Act requires approval for actions that are likely to have a significant impact on matters of National Environmental Significance (NES).

There are seven matters of NES that are triggers for Commonwealth assessment and approval. These are:

1. World Heritage properties;
2. National Heritage places;
3. Ramsar wetlands of international importance;
4. Nationally threatened species and communities;
5. Migratory species;
6. Nuclear actions; and
7. Commonwealth marine environment.

Threatened species and ecological communities are listed under Part 13, Division 1, Subdivision A of the EPBC Act (1999). Migratory species are listed under Part 13, Division 2, Subdivision A of the Act.

The Department of Sustainability, Environment, Water, Population and Communities identifies the following:

> *"Under the EPBC Act a person must not take an action that has, will have or is likely to have a significant impact on any of these matters of NES without approval from the Commonwealth Environment Minister. There are penalties for taking such an action without approval.*
>
> *In general, an action that may need approval under the Act will involve some physical interaction with the environment, such as clearing native vegetation, building a new road, discharging pollutants into the environment, or offshore seismic survey.*
>
> *If, following a referral, it is determined that an action is likely to have a significant impact, and approval is therefore required, the action is called a 'controlled action'. The proposal will then undergo a formal assessment and approval process, and cannot proceed unless approval is granted.*
>
> *If it is determined that an action is not likely to have a significant impact, then the action is not a controlled action. Approval under the EPBC Act is not required and the action may proceed, subject to obtaining any other necessary permits or approvals."*

1.3.3 State Legislation

The **Environmental Planning and Assessment Act (1979) (EPA Act)** sets out seven factors in Section 5A that require consideration in terms of the likely significance of the impact of an action. This Section 5A Assessment is informally known as a 'seven part test'.

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, these seven factors must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats as listed under the Threatened Species Conservation (TSC) Act (1995) and Fisheries Management (FM) Act (1996).

If the application is for development on land that is, or is a part of, critical habitat, or is likely to significantly affect threatened species, populations or ecological communities, or their habitats, a Species Impact Statement must be prepared.

This Flora and Fauna Impact Assessment considers these factors in accordance with the aforementioned legislative requirements. It also provides conclusions in regard to the necessity for a Species Impact Statement.

1.3.4 Regional / Local

In addition to Gosford Council's requirements detailed in the DGRs, regionally significant ecological issues for the Gosford LGA are discussed in the Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002 (Murray et al. 2002).

According to Murray et al. (2002), flora and fauna surveys and assessments are to address each of the following:

1. likely impacts on species of regional significance identified;
2. likely impacts on vegetation communities within the Lower Hunter Central Coast Region that have been heavily cleared;
3. likely impacts on vegetation communities within the Lower Hunter Central Coast Region that are less than 1000 hectares in extent;
4. likely impacts on habitat corridors identified in Local Environmental Plans, Development Control Plans or other policies or plans that have been adopted by the relevant local council;
5. likely impact on rainforest vegetation, riparian vegetation, and coastal wetlands if present; and
6. the contents of any policies or plans that have been adopted by the relevant local council relating to specific species or areas.

The guidelines state that the significance of impacts should be assessed in a manner analogous to that required for a Section 5A Assessment.

Bell (2004a, 2004b) also identified the conservation significance of vegetation communities within the Gosford Local Government Area. Consideration has also been given within this report to this significant flora so identified.

1.4 Review of Relevant Past Studies

A literature review was carried out. Of particular importance were records of species or matters of conservation significance. This background information informed the field survey and impact assessment.

The following information was relied upon in regard to local ecological, conservation and planning issues for this study.

Flora and Fauna Assessment (General Flora and Fauna 2004)

This report was commissioned to address a previous proposal to extend the quarry on the subject site. A comprehensive survey was undertaken in April of 2004 and included targeted and general survey for flora and targeted survey for frogs, arboreal and terrestrial mammals, diurnal birds, owls and bats. The methodology is described in further detail in Sections 2 and 3 of this report but it was wide-ranging in its scope, although not conducted in the optimal season for the detection of some flora and frog species.

One threatened plant species and 3 threatened bat species were recorded:

1. *Grevillea shiressii* – 3 individuals were located near the north western corner of the site alongside the boundary of the neighbouring property. It was concluded that they had been planted;
2. *Pteropus poliocephalus* Grey-headed Flying-fox - this species was observed foraging nearby on flowering trees*;*
3. *Myotis adversus* Large-footed Myotis – this species was recorded foraging, presumably in the large tailings dams; and
4. *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat – this species was recorded foraging

No threatened flora species or endangered ecological communities were recorded but potential habitat for a number of threatened flora species was recognised in the natural bushland at the western end of the property.

Overall, it was concluded that the proposed extension of works would not impose a significant adverse impact on any species, populations or communities of conservation significance.

Soil Landscapes of the Gosford-Lake Macquarie 1: 100 000 sheet (Murphy 1993) and Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet Map (Murphy and Tille 1993)

This mapping indicates that the entire site occupies the Sydney Town soil landscape with Somersby directly above and Hawkesbury directly below.

Sydney Town soil landscape is an erosional landscape and comprises of undulating to rolling low hills with moderate inclined slopes on quartz sandstone. Its vegetation is predominately cleared low eucalypt open-woodland. Hazards include high erosion, localised permanent waterlogging, high permeability, acid soils and low fertility.

The Somersby soil landscape is a residual soil landscape comprised of undulating to rolling rises on a deeply weathered Hawkesbury Sandstone plateau. Local relief is up to 40 metres, rocky outcrops are absent and slopes are less than 15 percent. Its vegetation is predominantly cleared, low eucalypt open-woodland and scrubland. Limitations on this soil landscape include permanently high localised watertables, highly permeable soils, very low soil fertility and areas of stony soil.

The Hawkesbury soil landscape occurs on Hawkesbury Sandstone on rugged to rolling very steep hills. Uncleared eucalypt open-woodlands and tall open-forest occur commonly. Limitations include extreme soil erosion, mass movement, steep slopes, rocky outcrops, high permeability and low soil fertility.

The Natural Vegetation of the Gosford and Lake Macquarie 1:100,000 map sheet (Benson 1986)

This survey of the natural vegetation across the Gosford and Lake Macquarie 1:100,000 map sheet classified the subject site as being cleared in the western half and vegetated with 10ag (a complex of woodlands, forest, heaths on sandstone) in the eastern half. This mapping is considered unreliable in this instance as it is demonstrably incorrect.

This mapping has been superseded by mapping by LHCCREMS (2003) and Bell (2004a, 2004b).

Lower Hunter Central Coast Extant Vegetation Community Map and Technical Report (LHCCREMS 2003a) and Technical report for Extant Vegetation Community Map 2003 Update Report (LHCCREMS 2003b)

This mapping depicts the subject site as being mostly cleared, with Map Unit 26 Exposed Hawkesbury Woodland where natural vegetation is seen now. Directly to the south and south east, this study recognises and maps the presence of Map Unit 54 Sandstone Hanging Swamps and patches of Map Unit 29a Scrub to the north east and south east.

Exposed Hawkesbury Woodland is a widespread and variable vegetation type that occurs on crests, ridges and exposed slopes on sandy soils derived from Hawkesbury sandstone. The uppermost canopy is usually low (no more than 15 metres) and dominated by *Corymbia gummifera* Red Bloodwood*, Eucalyptus haemastoma* Scribbly Gum and *Angophora costata* Smooth-barked Apple*.* As elevation and rainfall increases, *Eucalyptus sieberi* Silver-top Ash tends to dominate. The understorey is usually shrubby and dense and very diverse.

This is an apt description of the natural vegetation of the subject site.

Map Unit 29a is a scrubby variant of Hawkesbury Plateau Banksia Scrub. The occurrence of Map Unit 54 Sandstone Hanging Swamps is likely to be an incorrect interpretation of the aerial photograph as they are shown to occur on and adjacent to the tailings dams.

The Natural Vegetation of the Gosford Local Government Area, Central Coast, New South Wales Part 1 Technical Report (Bell 2004a) and the Natural Vegetation of the Gosford Local Government Area, Central Coast, New South Wales Part 2 Vegetation Community Profiles (Bell 2004b)

This mapping depicts the subject site as mostly cleared, with most of the remaining natural vegetation as Map Unit E26d Somersby Plateau Forest. Map Unit E26d continues downslope and off site and two patches of E54 Sandstone Hanging Swamps are shown as occurring less than 100 metres from the eastern boundary.

This mapping was updated by Bell in 2009 and it is reproduced at Figure 6.

Map Unit E26d Somersby Plateau Forest occurs on exposed plateau tops and gentle slopes in heavily ironstone influenced soils and is often characterised by the presence of *Eucalyptus sieberi* Silver-top Ash in the canopy with *Doryanthes excelsa* Gymea Lily in the understorey. Other canopy trees also occur (e.g. *Corymbia*

gummifera Red Bloodwood, *Angophora costata* Smooth-barked Apple, *Eucalyptus piperita* Sydney Peppermint) over a diverse and dense shrubby understorey. The high rainfall on the Somersby Plateau has resulted in a uniquely friable sandstone and hence a floristically distinct vegetation community. Much of this has been cleared for agriculture and / or sand extraction.

Given its restricted distribution and reduced extent, this Map Unit is recognised as being of conservation significance on a regional level; see Gosford Council mapping reproduced at Figure 7.

This Map Unit is known to provide habitat for a number of threatened plant species (including *Prostanthera junonis, Acacia bynoeana, Eucalyptus camfieldii, Tetratheca glandulosa*) as well as some ROTAP species (*Grevillea oldei*, *Acacia kulnurensis* and *Lomandra brevis*).

2 FLORA SURVEY AND RESULTS

2.1 Survey Methods

Prior to the detailed survey of the subject site, and in addition to the literature review as described in Section 1 above, the following was carried out:

1. Colour aerial photography was interpreted prior to field survey to delineate preliminary vegetation community boundaries and areas of disturbance on site.

2. A search of the EPBC Act (1999) database using the Protected Matters Search Tool on the Department of the Environment, Water Heritage and the Arts website (www.environment.gov.au/erin/ert/epbc/index.html) was completed. The search area was confined to a 10 kilometre radius of the site. This identified species of conservation significance under the EPBC Act (1999) that may require habitat assessment or targeted survey.

3. The online component of the OEH Wildlife Atlas (wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp) was interrogated for an area confined to a 10 kilometre radius of the site. This search provided records of species of threatened flora within the locality. This online database has been recently upgraded and is now at http://www.bionet.nsw.gov.au/.

4. PlantNet, the online database of the National Herbarium of NSW at the Royal Botanic Gardens was also interrogated (http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm) for rare or threatened species that have been recorded in the locality.

Botanical survey was delayed until a known population of *Prostanthera junonis* was in flower nearby in the Somersby Industrial Estate. This population was reportedly in flower on 20th October 2011 (Mark Stables, Gosford City Council, personal communication) and so flora survey was conducted on the 2nd November 2011 and 17th December 2011 according to the recommended methodology in the *Prostanthera junonis* Recovery Plan.

Flora were sampled by way of random meander and two quadrats of 400 square metres each. These quadrats were located in the natural vegetation and their approximate locations shown in Figure 4. The location of the north western corner of each quadrat was captured by hand-held GPS. Grid references (MGA, Zone 56) of the north western corner of the two quadrats are 341196 E 6305840 N and 34116 E 6305773 N. The previous survey in 2004 was based on three transects and three quadrats in the natural vegetation as well as random meander across the whole site.

The data recorded are consistent with the standards used by the NSW National Parks and Wildlife Service and the Royal Botanic Gardens of the Office of Environment and Heritage. The data recorded included:

1. Geographical information (MGA, location, relevant aerial photography and topographic map);
2. Physical features (topographic position, elevation, slope, aspect and general soil type);
3. Disturbance history (including grazing, clearing/logging, weeds and fire);
4. Structural features of the vegetation according to Specht et al. (1995) (numbers and types of layers present, their heights, canopy cover, and three most dominant species in each layer); and
5. Species and their cover abundance using a modified Braun-Blanquet seven point scale.

Specimens were collected for later identification of plants not readily identifiable in the field. Such specimens were identified according to Harden (1990, 1991, 1992, 1993) and the interactive flora (Flora Online) provided online by NSW National Herbarium of the Royal Botanic Gardens (http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

2.2 Survey Limitations

The flora survey was conducted in accordance with the local guidelines adopted by Council (Murray et al. 2002) and the *Prostanthera junonis* Recovery Plan.

However, all surveys have inherent limitations as they can only ever represent a sample in time and place of the site's flora. Besides the unavoidable sampling bias to the area actually surveyed, in this instance, the results of survey may also be constrained by recent rainfall and season of survey.

Although the region is experiencing a wet La Nina period, over the last 10 years, rainfall statistics from the Gosford weather station show that the area has experienced below average rainfall as well as a change in the pattern of rain from summer-dominant rains towards a Mediterranean climate of winter rainfall. This pattern has been particularly pronounced in the last several years, with the autumn-winter rains falling in significant storm events, such as in June 2007.

The influence of this shifting weather pattern on native plant species is yet to be determined, but it is likely that those that rely on summer rains or a dry winter will have their life cycles affected.

The season of survey also influences the plant species that may be detected: many grasses, for example, can only be identified when they are flowering and fruiting; many orchids can only be detected when they are flowering.

However, for the flora species of interest for this site, the season and method of survey were appropriate.

2.3 Survey Results

2.3.1 Floristic Composition

In total, 205 locally-native species and 71 introduced species were observed within the subject site. A species list is provided in Table 1.1 in Appendix 1. Because of the high degree of similarity between the flora observed in this survey and the previous survey in 2004, the species list provided is a composite of the two.

These 278 species are representative of 88 families, with the dominant families being Poaceae (36 species), Proteaceae (25 species), Fabaceae / Mimosaceae (20 / 12 species), Asteraceae (17 species) and Myrtaceae (11 species). The sedges and rushes (Juncaceae, Cyperaceae and Restionaceae) were represented by 12 species and the ferns were also a dominant group, with 15 species across 9 families.

This high diversity is typical of this vegetation type and typical of sandstone communities in general.

The site contains a number of important weeds, with 8 listed noxious species and many environmental weeds. This pattern is typical of bushland and disturbed vegetation in such a setting.

No species of conservation significance were recorded in this survey, but three individual *Grevillea shiressii* had been reported near the northern boundary in the previous survey. As this area is within a retained buffer and the plants were almost definitely horticultural plantings, great effort was not expended trying to relocate them. Their locations are shown in Figure 5.

2.3.2 Map Units

Ten Map Units have been recognised and delineated across the site; these are shown in Figure 5 and some illustrated in the Photographs section. Brief descriptions are provided below. Map Unit 1 is more fully described than the other units as it is natural and fully-structured bushland.

Map Unit 1 – Natural and fully-structured bushland

Area: 3.4 hectares.
Location: Western end of the site with very narrow bands along the northern and southern boundaries.

Structural classification according to Specht: - Woodland
Vegetation layers:

Top: Trees –20 to 25 metres, 35% cover, dominated by *Eucalyptus piperita* Sydney Peppermint, *Angophora costata* Smooth-barked Apple, *Eucalyptus sieberi* Silver-top Ash and *Corymbia gummifera*

Red Bloodwood.

Middle: Small trees and shrubs – up to 3 metres, 15% cover, dominated by juvenile canopy trees and *Banksia serrata, Pittosporum undulatum* Sweet Pittosporum and *Persoonia levis*.

Lower: Shrubs, ferns and vines – 0 to 1.5 metres, 80-100% cover, dominated variously by *Gleichenia dicarpa* Pouched Coral Fern, *Doryanthes excelsa* Gymea Lily, *Lantana camara* Lantana and Smilax glyciphylla.

Condition: This vegetation community is in relatively good condition although it has experienced disturbances arising from tree fall, fire and weed infestation.

LHCCREMS Equivalence: This Map Unit is most similar to Map Unit 26 Exposed Hawkesbury Woodland.
Bell Equivalence: This Map Unit matches the description of Map Unit E26d Somersby Plateau Forest.

Map Unit 2 – Native trees, understorey disturbed or absent

Area: 0.21 hectares
Location: Alongside internal roads in western end of the site.
Dominant species: As per the canopy in Map Unit 1.

Map Unit 3 – Cleared and regrowing natural bushland

Area: 0.16 hectares
Location: Narrow band cut into the bushland along the Wisemans Ferry Road frontage.
Dominant species: As per canopy and understorey species in Map Unit 1.

Map Unit 4 – Cleared (grassy power line easement)

Area: 0.42 hectares
Location: Near the northern boundary in the site's north western corner.
Dominant species: Exotic grasses and *Coreopsis lanceolata*.

Map Unit 5 – Cleared (paddock, house, agriculture)

Area: 2.70 hectares
Location: East and south of the natural vegetation.
Dominant species: Exotic grasses.

Map Unit 6 – Cleared (excavated land and roads)

Area: 4.75 hectares
Location: Eastern part of the site. This is the dominant land use of the subject site.

Map Unit 7 - Swampy regrowth in excavated land

Area: 1.29 hectares
Location: East of the natural bushland at the edge of the excavation and in the south eastern corner where tailings dams have been rehabilitated.
Dominant species: Lot of bare ground and wetland tolerant ground species such as sedges, rushes and grasses.

Map Unit 8 – Woody regrowth and plantings in and around excavated land

Area: 1.07 hectares
Location: Scattered occurrences around excavated areas and dams.
Dominant species: Various shrubs and trees such as *Acacia longifolia, Kunzea ambigua* and *Leptospermum polygalifolium*.

Map Unit 9 – Dams, no fringing vegetation

Area: 1.00 hectares
Location: Large dam in the south eastern corner of the site and a small dam in the paddock near the western end.

Map Unit 10 – Dams with fringing vegetation

Area: 0.74 hectares
Location: Small dam near the bushland and two larger dams near the south eastern corner of the site.
Dominant species: Fringing vegetation is principally made up of rushes and sedges.

2.4 Flora Species of Listed Conservation Significance

Results from the Protected Matters Search Tool and the OEH Wildlife Atlas online database searches revealed a number of listed species that require consideration as part of this assessment. Their habitat requirements and likelihood to occur on site is explored in Table 1.2 in Appendix 1.

Of these species, three (probably planted) individuals of *Grevillea shiressii* were previously located near the boundary with a neighbouring property to the north west. This species is listed as Vulnerable under the EPBC Act (1999).

The potential impact of the proposal will be addressed therefore for the following species with realised or potential habitat on site:

- *Hibbertia procumbens*
- *Prostanthera junonis*
- *Tetratheca glandulosa*
- *Darwinia glaucophylla*
- *Grevillea shiressii*

A Section 5A Assessment has been completed for these species and the assessments are summarised in Section 5 of this document and detailed in Appendix 3.

2.5 Vegetation Communities of Listed Conservation Significance

Of the **Threatened Ecological Communities** listed under the State TSC Act (1995) and Commonwealth EPBC Act (1999), the Office of Environment and Heritage Threatened Species website lists 14 Endangered Ecological Communities as occurring or potentially occurring in the Wyong Catchment Management Authority (CMA) subregion, of which the subject site is a part. These are:

1. Coastal Saltmarsh in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions
2. Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions
3. Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions
4. Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion
5. Littoral Rainforest in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions
6. Low woodland with heathland on indurated sand at Norah Head
7. Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion
8. Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion
9. River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions
10. Swamp Oak Floodplain Forest of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions
11. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions

12. Sydney Freshwater Wetlands in the Sydney Basin Bioregion
13. Themeda grassland on seacliffs and coastal headlands in the NSW North Coast; Sydney Basin and South East Corner Bioregions
14. Umina Coastal Sandplain Woodland in the Sydney Basin Bioregion

None of these communities occurred on or near the site.

A number of **Vegetation Communities of Regional Significance** have been listed by Murray et al. (2002) and Bell (2004a, 2004b). These have been defined using similar criteria as adopted in the TSC Act (1995), the EPBC Act (1999) and other national objectives and targets for biodiversity conservation (Environment Australia 2001).

None of the vegetation communities listed by Murray et al. (2002) occur on or near the subject site. However, the natural vegetation on site (E26d – Somersby Plateau Forest) is recognised as Regionally Significant vegetation by Council, as a result of Bell's 2009 updated vegetation mapping.

This mapping is reproduced at Figure 7.

3 FAUNA SURVEY AND RESULTS

3.1 Survey Methods

Prior to the detailed survey of the subject site, and in addition to the literature review as described in Section 1 above, the following was carried out:

1. Colour aerial photography was interpreted prior to field survey to delineate preliminary vegetation community boundaries and areas of disturbance on site.

2. A search of the EPBC Act (1999) database using the Protected Matters Search Tool on the Department of the Environment, Water Heritage and the Arts website (www.environment.gov.au/erin/ert/epbc/index.html) was completed. The search area was confined to a 10 kilometre radius of the site. This identified species of conservation significance under the EPBC Act (1999) that may require habitat assessment or targeted survey.

3. The online component of the OEH Wildlife Atlas (wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp) was interrogated for an area confined to a 10 kilometre radius of the site. This search provided records of species of threatened flora within the locality. This online database has been recently upgraded and is now at http://www.bionet.nsw.gov.au/.

Details of the fauna survey effort are documented in Table 2.1 in Appendix 2 and depicted in Figure 4.

Fauna surveys were conducted for this impact assessment on the 2nd November, 16th, 17th and 18th December 2011 across the subject site. The fauna survey was intended to sample the various habitats present.

The weather was generally dry and hot with two days of heavy rainfall during the survey period. Details of the weather during survey are given in Table 2.2 in Appendix 2.

In summary, fauna were surveyed by spotlighting, call detection and playback, visual observation, specific habitat searching and searches for other signs of presence (tracks or traces). Seven hollow-bearing trees were watched at dusk for emerging fauna.

Reptiles were surveyed using both systematic searches and via opportunistic observations.

Searches of any likely habitat, such as leaf litter, rocks and fallen logs were carried out to locate sheltering reptiles. Nocturnal surveys of these areas were also employed to account for night time movements of reptiles.

Diurnal birds were surveyed during periods of high bird activity in the mornings and late afternoons. Birds were identified by sight and call.

Nocturnal bird survey primarily targeted threatened species of owls, although nocturnal birds such as other owls, nightjars and frogmouths were also recorded when encountered.

Survey for threatened owls was completed using the methodology of Kavanagh and Peake (1993). The survey was initiated at approximately 20 minutes after dusk and continued for approximately 40 minutes of darkness. At the survey point, a quiet listening period of approximately 20 minutes was employed to detect any nocturnal fauna already vocalising. Following this period, tape recorded calls of threatened bird species were played using a 10W speaker.

Calls of the Masked Owl, Sooty Owl, Barking Owl, Powerful Owl and Bush Stone-curlew were broadcast. Each call was broadcast for 5 minutes and was followed by 2 minutes of quiet listening. After the final broadcasted call, a further 5 minutes of quiet listening was employed, followed by a 10 minute spotlight of the area.

Other evidence of owl activity was also sought, such as white wash and regurgitated pellets for expert analysis of their contents.

Terrestrial mammals were not surveyed for this report as the site was considered unlikely to support any terrestrial species of import. Also, the previous survey of 2004 had trapped in the bushland and recorded only common small mammals such as *Antechinus stuartii* and *Rattus fuscipes.*

Arboreal mammals were surveyed by call playback, spotlighting and stagwatching. Similarly, no arboreal trapping was undertaken. The previous survey had carried out tree trapping and revealed only common species.

Searches were also carried out for scats at the base of trees for identification according to Triggs (1996). Other signs of presence such as diggings, prints and scratches were searched for and used in species identification.

Spotlighting for nocturnal arboreal fauna was conducted with a 50W spotlight. Particular emphasis was placed on examining trees that may be flowering, thus providing blossom and nectar for gliders and flying foxes.

Calls of the Yellow-bellied Glider and the Squirrel Glider were broadcast in order to elicit a response from any gliders present on the subject site and in the local area.

Megachiropteran bats were surveyed by spotlighting trees. Vocalisations of these bats were also listened for during nocturnal surveys.

Microchiropteran bats were surveyed via recording and analysis of their echolocation calls. Calls were recorded using an Anabat II bat detector during spotlighting across the site and also in two overnight stationary positions. Microchiropteran bat calls were analysed using the Anabat 5.1 software package and compared to a known call library (Pennay et al. 2004).

3.2 Survey Limitations

No trapping was undertaken as it was judged that the habitats available are likely only occupied by common species that are not of conservation significance and the stress imposed on the individuals by trapping could not be justified.

The major habitats available for species of concern are those associated with the canopy trees and hollows. Arboreal and volant species were surveyed according to best practice guidelines.

It is an acknowledged limitation that, no matter how much effort or expertise is employed, not all species that use a site will be recorded during ecological survey. For many fauna species, this is due to their mobility, cryptic nature and unpredictable movement throughout their habitat. In addition, migratory species may be present on the site at some times of the year, and absent at others. In addition to ecological reasons, environmental factors (such as weather, drought and bushfire) may impact on the type and number of species recorded within a site at any one time.

In order to overcome these survey limitations, this report includes a detailed assessment of the habitat present on the site. This habitat analysis is then compared to the results of database searches for threatened species occurring within a 10 kilometre radius of the site. This comparison allows for the prediction of potential use of the site by species of conservation significance. Any threatened species (flora or fauna) considered to have potential habitat within the site is then made subject to a Section 5A Assessment of Significance. This process ensures that all threatened species with potential to use the site are considered in the impact assessment, rather than only those that were recorded during survey.

3.3 Survey Results

Including the results from the previous survey, the subject site yielded a total of 81 native species and 4 introduced species of fauna during survey. Six of these species are listed as threatened.

Amphibians: Six common species of frogs were recorded in and around the dams.

Reptiles: Eight common reptiles were recorded during survey: Water Dragons and Red-bellied Black Snake near the large dams and skinks in the bushland.

Birds: Fifty one species of birds were recorded on the subject site during survey, one of which is a listed threatened species. The threatened species recorded was *Callocephalon fimbriatum* Gang-gang Cockatoo in the previous 2004 survey. The recorded assemblage contained a number of foraging guilds, waterbirds, seasonal migrants, birds of bushland and birds of open and disturbed areas. This diversity of birds is a reflection of the diversity of available habitats on the site and the extent of bushland in the local area.

Arboreal and Terrestrial Mammals: Three common arboreal mammals were recorded (*Pseudocheirus peregrinus* Common Ringtail Possum, *Trichosurus vulpecula* Common Brushtail Possum, *Petaurus breviceps* Sugar Glider), as well as two common small terrestrial mammals (*Antechinus stuartii* and *Rattus fuscipes*).

Microchiropteran bats: Eight or nine species of microchiropteran bats were recorded during survey, including 4 threatened species: *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat, *Myotis macropus* Large-footed Myotis and *Scoteanax rueppellii* Greater Broad-nosed Bat or *Falsistrellus tasmaniensis* Eastern False Pipistrelle. The species present represented a number of different foraging guilds and included cave dwellers and species that roost in hollow trees.

Megachiropteran bats: The megachiropteran bat *Pteropus poliocephalus* Grey-headed Flying-fox was recorded during previous survey, foraging on a nearby property.

3.4 Habitat Value and Connectivity

The main fauna habitat features of the subject site are the sheltering and foraging resources provided by the woody vegetation (particularly the hollow trees) and the connectivity provided by the subject site to other publicly reserved and privately owned bushland to the east and fragmented vegetation on the Plateau to the west. This connectivity is somewhat disrupted by the existing quarry and the F3 Freeway forms a significant barrier, so it is only likely to provide a corridor function for highly mobile species such as birds or bats.

The major canopy trees provide pollen and nectar in their blossom, and are dominated by spring and summer-flowering species when such resources are abundant. A few female *Allocasuarina* trees occur on site - the preferred food tree for Glossy Black-Cockatoos – but no evidence observed of feeding by this species (such as chewed cones).

The hollow-bearing trees contained a number of hollows with variously sized entrances, some of which were worn, thus indicating use.

The dense understorey vegetation provides shelter and foraging resources for many reptiles, mammals and small birds. The dams, associated swampy ground and fringing vegetation provides suitable amphibian habitat and the open water is well used by waterfowl.

3.5 Fauna Species of Listed Conservation Significance

Results from the Protected Matters Search Tool and the OEH Wildlife Atlas online database searches revealed a number of listed species that require consideration as part of this assessment. Their habitat requirements and likelihood to occur on site is explored in Table 2.4 in Appendix 2.

Of these species, the previous survey reported *Callocephalon fimbriatum* Gang-gang Cockatoo on site, *Pteropus poliocephalus* Grey-headed Flying-fox foraging nearby as well as *Myotis macropus* Large-footed Myotis and *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat foraging on the subject site. During the recent survey, calls were recorded that are attributable to either *Scoteanax rueppellii* Greater Broad-nosed Bat or *Falsistrellus tasmaniensis* Eastern False Pipistrelle.

The potential impact of the proposal will be addressed therefore for the following species with realised or potential habitat on site or within the zone of influence of the proposal:

- *Heleioporus australiacus* Giant Burrowing Frog
- *Pseudophryne australis* Red-crowned Toadlet
- *Varanus rosenbergi* Rosenberg's Goanna
- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Calyptorhynchus lathami* Glossy Black-Cockatoo
- *Glossopsitta pusilla* Little Lorikeet
- *Ninox connivens* Barking Owl
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Climacteris picumnus victoriae* Brown Treecreeper
- *Petroica boodang* Scarlet Robin
- *Petaurus australis* Yellow-bellied Glider
- *Pteropus poliocephalus* Grey-Headed Flying-fox
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat
- *Miniopterus australis* Little Bentwing-bat
- *Myotis macropus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Pseudomys gracilicaudatus* Eastern Chestnut Mouse

A Section 5A Assessment has been completed for these species and the assessments are summarised in Section 5 of this document and detailed in Appendix 3.

4 IMPACT AND AMELIORATION

A general principle of environmental management is to, in order of preference:

1. Avoid the impacts;
2. Minimise the impacts;
3. Mitigate the impacts; and
4. Compensate for residual impacts once all of the above options have been exhausted.

These principles have been applied in each of the identified direct and indirect impacts discussed below.

4.1 Direct Impacts

4.1.1 Vegetation Clearing

The approximate areas of each Map Unit that will be directly impacted by the footprint are as follows:

Map Unit	Area (ha)	Footprint (ha)	Remaining after development
1 - Natural and fully-structured bushland	3.3893	0.7373	78%
2 – Native trees, understorey disturbed or absent	0.2054	0.1471	28%
3 – Cleared and regrowing natural bushland	0.1592	0.0000	100%
4 – Cleared (grassy power line easement)	0.4238	0.0500	88%
5 – Cleared (paddock, house, agriculture)	2.6938	2.6012	3%
6 – Cleared (excavated land and roads)	4.7509	4.7509	0%
7 – Swampy regrowth in excavated land	1.2896	1.2896	0%
8 – Woody regrowth and plantings in and around excavated land	1.0679	1.0679	0%
9 – Dams, no fringing vegetation	1.0003	1.0003	0%
10 – Dams with fringing vegetation	0.7428	0.7428	0%
Total	**15.7230**	**12.3871**	

The loss of vegetation and excavation of the ground for the proposal is unavoidable. The proposed quarry extension requires the removal of up to 5 or 6 hollow trees and associated native vegetation over an area of approximately 0.88 hectares, along with the loss of habitats associated with the dams and some scattered regenerating / rehabilitated vegetation.

The footprint has been concentrated into the area that has already been cleared and excavated so that 76% of the bushland on the site (a total of 2.87 hectares of Map Units 1, 2 and 3) will be retained. Moreover, the local connectivity provided by this vegetation will not be significantly fragmented as the proposed footprint will simply push the boundary of development a little further (approximately 20 - 30 metres at the maximum) from its existing edge.

However, the location and scale of the acoustic bund near the entrance is problematic: it is proposed for construction in an area that currently supports intact native vegetation. In order to apply the first principle of good environmental management and avoid unnecessary impacts, it is desirable to instead locate this bund in the adjacent patch that is already cleared and disturbed. It is recognised that this preferred location based on ecological reasons may not satisfy the engineering criteria, but its relocation should nevertheless be considered.

4.1.2 Habitat Fragmentation

The proposed development area is a small extension of the already significant excavation that interrupts the largely fragmented habitats of the plateau from the larger intact remnant bushland of the lower coastal range

to the east.

The proposed works will not significantly alter this current pattern of connectivity.

4.1.3 Loss of Fauna Habitat

The loss of the small areas of natural vegetation will in general represent a loss of foraging, roosting and sheltering habitat for a range of fauna species including reptiles, birds and mammals. However this is relatively small in extent being a loss of only 0.88 hectares of intact, disturbed and regenerating bushland.

Of more potential importance however is the loss of 5 or 6 hollow-bearing trees. These trees are large and contain a variety of hollow sizes, thus providing potential roosting and breeding sites for threatened and common species of amphibians, reptiles, birds, bats and arboreal mammals.

These losses may be ameliorated by the installation of nest boxes of various sizes at a compensatory ratio of at least 1:1.

4.1.4 Light Pollution

A study of microchiropteran bat activity among different sites in parklands of Adelaide (Scanlon 2006, Scanlon and Petit 2008) found that dark parks were more important for bat diversity and activity (six species groups in the darkest park) than were artificially lit parkland areas (three species groups in the flood-lit park). *Chalinolobus gouldii* Gould's wattled bat and *Mormopterus* species 4 (94% of calls) were advantaged in urban parklands, being the only species recorded when lights were on at sports parks, whereas five species groups occurred when the lights were off.

Street lighting is also known to interrupt natural foraging behaviour of the threatened species *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat (Hoye and Hall 2008).

Lighting of the quarry should be minimised in time and space, limited to the areas where and when lighting is required for work or security and of a type that reduces spill and glare.

4.1.5 Displacement of Fauna

The felling of hollow-bearing trees will displace fauna resident at the time of felling and also has the potential to harm them during the felling process itself.

Therefore, a fauna handling protocol where animal welfare is paramount is to be followed during felling of hollow-bearing trees. The trees may need to be felled in sections or gently pushed to the ground to avoid injuring resident fauna. This must be done under supervision of an ecologist or wildlife carer so that resident fauna may be relocated into nest boxes erected in the retained bushland.

Nest boxes should be monitored and maintained in the long term.

The timing of the felling of the hollow trees is important in order to avoid the breeding seasons of species likely to be using the hollows for nesting. For most species of interest, this is usually late summer / autumn.

4.2 Indirect Impacts

The proposal has the potential to impose indirect impacts on vegetation and habitats that remain on site as well as to those that occur off site. While these are usually as a result of enhanced "edge effects" (e.g. increased weeds, increased exposure and instability of trees), in this case there is also a particular issue regarding groundwater. The Somersby Plateau contains significant aquifers that are exploited to varying degrees for agriculture and the production of bottled water and there are also a number of hanging swamps across the plateau, a groundwater dependant vegetation type.

Geotechnical investigations undertaken by RCA Australia indicate that there is likely to be an impact on

groundwater in a zone of a radius of 400 metres from the site. Natural drawdown of the water table during dry years is estimated to be approximately 5 metres and the model developed by this study indicates that this may increase to between 8 and 28 metres over a 100 year period.

Groundwater dependant ecosystems that are potentially affected are the two patches of hanging swamps that have been mapped as occurring less than 100 metres to the east of the site (see Figure 6). However, these are neither endangered ecological communities or recognised as regionally significant vegetation. If the models are accurate, the species composition of these patches of vegetation may change over time to a drier heath that is less reliant on perched water tables.

The accuracy of this model and its predictions are highly dependent on the connectivity of the aquifers in the region, which has not been established. It also should be noted that much of the water intercepted by the quarry will still be delivered to downslope environments via overland flow after passing through the tailings dams and other water controls on site. This is not the case with the nearby water extraction industry, where the aquifer is drained, bottled and shipped away on a large scale.

4.3 Runoff

Runoff from the large areas of exposed soil and rock poses a potential sedimentation hazard for downslope environments. However, such threats can be managed with the strategic use of dams and bunds and other erosion and sediment controls.

5 IMPACT ASSESSMENT

For the purposes of the impact assessment the following terms of reference are used:

- ***Subject site, site*** – lands within the subject allotment;
- ***Local area*** – lands within 2 kilometres of the subject site;
- ***Broader study area*** – lands within 10 kilometres of the subject site and includes the Office of Environment and Heritage (OEH) Wildlife Atlas and Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters database search areas; and
- ***Region*** – lands within 50 kilometres of the subject site.

For the threatened species of interest recorded within 10 kilometres of the subject site, (see Tables 1.2 and 2.4 in Appendices 1 and 2), the likelihood of occurrence of each species in or near the subject site was determined by analysis of their habitat requirements, the habitats on site and the nature and extent of adjacent habitats.

Each species has been assigned to one of four groups according to their likelihood of occurring on the subject site or within adjacent habitats likely to be impacted by the proposed works:

- ***High likelihood to occur*** - species whose preferred habitat features occur on the site and / or have been recorded close by in similar habitat, and / or are able to reach the subject site from other known and confirmed locations;
- ***Moderate likelihood to occur*** - species whose preferred habitat features in a strict sense occur on or near to the site but are considered generally unlikely to occur. This may be due to such things as the nature of habitats and disturbances between confirmed locations and the subject site, movement patterns of the subject species, the extensive and common nature of the available habitat in the local area, the rarity of the species, the length of time since it was last recorded and / or the size of its home range;
- ***Low likelihood to occur*** - species with specific terrestrial niches and habitat requirements that generally do not occur on or near the subject site or species that have not been found the area for a considerable period of time; and
- ***No likelihood to occur*** - these are generally aquatic or marine species.

The impacts of the proposal on those species listed in the first group (*high likelihood to occur*) have been assessed using a Section 5A assessment (or seven part test) as required by the EPA Act (1979). The remaining species assigned to the last three groups (those with no to moderate likelihood to occur) have not been considered in further detail as although possible, their presence is unlikely.

Under the Bilateral Agreement between the Commonwealth and New South Wales State Governments, these assessments are considered adequate in satisfying the EPBC Act (1999) for those species listed under both pieces of legislation for an Environmental Impact Assessment.

Section 5A of the EPA Act (1979) requires that the consent authority take into account seven factors when deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. If a significant impact is judged likely to occur, a Species Impact Statement (SIS) is required.

The potential impact of the proposal on the subset of threatened entities recorded on site or considered likely to occur are assessed in full individually in Appendix 3 and summarised below.

5.1 Flora

Hibbertia procumbens

This species was not recorded on the subject site during survey. There are a large number of records of this species in the local area, being endemic to the Somersby Plateau. It is listed by Bell (2004a) as being from a different although related vegetation community (Hawkesbury Banksia Scrub-Woodland) to that on the

subject site (Somersby Plateau Forest). It is also likely to occur in areas adjacent to Sandstone Hanging Swamps (Bell 2004b).

The intact Somersby Plateau Forest on site provides only marginal potential habitat for this species, but the vegetation downslope and off site is more likely to support individuals, with the nearest record to the subject site being in that direction near the F3 Freeway. Potential alterations to the groundwater within a zone of 400 metres from the site may impact on this species' potential habitat in the very long term.

The area of potential habitat to be removed is relatively small and only marginal for this species. The proposal will not fragment or isolate habitat or introduce a threatening process to its life cycle. The majority of potential habitat on site will be retained at a ratio of approximately 3.2:1 to that which will be removed.

The proposal is unlikely to have a significant impact on this threatened species.

Prostanthera junonis

This species was not recorded on the subject site during survey despite targeted survey at the right time of year. This species is endemic to the Somersby Plateau, occurring only on its eastern edge in 10 known populations within a north-south range of only 19 kilometres.

Potential habitat for this species is contained within the intact bushland in Map Unit 1, which is equivalent to Somersby Plateau Forest. Most of this vegetation will be retained – 78% of the Somersby Plateau Forest on site is outside of the proposed footprint.

The proposal is unlikely to have a significant impact on this threatened species.

Tetratheca glandulosa

This species was not recorded on the subject site during survey. This species is known to occur in Somersby Plateau Forest and so Map Units 1, 2 and 3 provide potential habitat for this species.

The majority of this potential habitat will be retained and the small loss for the proposal is unlikely to put a viable population at risk of extinction.

The proposal is unlikely to have a significant impact on this threatened species.

Darwinia glaucophylla

This species was not recorded on the subject site during survey. Potential habitat occurs in the Somersby Plateau Forest on the friable sandy soils and exposed rocky areas.

The majority of this potential habitat will be retained and the small loss for the proposal is unlikely to put a viable population at risk of extinction.

The proposal is unlikely to have a significant impact on this threatened species.

Grevillea shiressii

This species was recorded on the subject site during previous survey. Three individual shrubs were observed at the edge of the site's boundary with an adjacent garden.

This species is popular in horticulture and these specimens are almost undoubtedly planted. It is known to grow naturally along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils; the ridge habitat where it is growing on site is entirely unsuitable. It is known from only a few populations, mostly on the lower tributaries of the Hawkesbury River. The closest naturally-occurring records of this species are from Little Mooney Mooney Creek, 2.5 kilometres to the north west within an expanse of reserved bushland.

Notwithstanding the lack of suitable natural habitat, the area within which these individuals have been found will be retained and a wide buffer will remain between the shrubs and the development area.

The proposal is unlikely to have a significant impact on this threatened species.

5.2 Amphibians

***Heleioporus australiacus* Giant Burrowing Frog**

This species was not recorded on the subject site during survey.

This species occurs in hanging swamps on sandstone shelves and beside perennial creeks. Individuals are known to disperse over dry sandstone ridges through eucalypt forest. They usually breed and lay eggs within their burrows, which are later flushed into ephemeral pools where the tadpoles develop. As this species needs ephemeral pools for breeding, the development area only provides potential dispersal habitat, the vast majority of which will be retained across the site.

The patches of hanging swamps downslope and off site may experience a drying process over a long period of time (100 years) if the aquifers are connected and if overland flow does not compensate for losses through draw down of the water table. These likelihood of these impacts have not been quantified nor has this species been reported from those swampy patches.

However, even if these two small patches were to become too dry for this species, there are other similar patches of suitable habitat in the local area and the broader study area that are accessible to this species.

The proposal is unlikely to have a significant impact on this species.

***Pseudophryne australis* Red-crowned Toadlet**

This species was not recorded on the subject site during survey.

This species occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones and inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. It shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Such potential habitat occurs off site below the eastern boundary. The relevant overland hydrological processes are unlikely to be interrupted due to the water management and effluent control strategies to be employed.

The proposal is unlikely to have a significant impact on this species.

5.3 Reptiles

***Varanus rosenbergi* Rosenberg's Goanna**

This species was not recorded on the subject site during survey.

Potential habitat for this species on site is marginal at best as there are no rock outcrops or termite nests, both favoured and important elements of its habitat.

The proposal is unlikely to have a significant impact on this threatened species.

5.4 Birds

***Callocephalon fimbriatum* Gang-gang Cockatoo**

This species was recorded on the subject site during previous survey in 2004.

Potential habitat foraging habitat for this species occurs in the forested areas. The hollow-bearing trees on site (including some of those to be removed) provide potential breeding habitat but this species may not breed in this location, as it prefers tall forest in montane areas. The native trees to be removed may also contain potential foraging habitat for this species but such resources are common in the expanse of bushland in the local area.

The proposal is unlikely to have a significant impact on this threatened species.

***Calyptorhynchus lathami* Glossy Black-Cockatoo**

This species was not recorded on the subject site during survey.

Potential habitat for this species is contained within the potential nesting sites in the hollow-bearing trees and in the foraging resources available in the female *Allocasuarina* trees. Such resources are common across the site and in the local area and the losses of potential habitat relatively minor.

The proposal is unlikely to have a significant impact on this threatened species.

***Glossopsitta pusilla* Little Lorikeet**

This species was not recorded on the subject site during survey.

Potential foraging habitat for this species occurs on site in the heavy flowering eucalypts, particularly *Corymbia gummifera* Red Bloodwood and *Eucalyptus piperita* Sydney Peppermint. The hollow-bearing trees provide potential breeding sites for this species as well, including some of the hollow trees to be removed. However, the losses of foraging habitat are relatively small and the losses of hollows can be compensated for by the erection of nest boxes.

The proposal is unlikely to have a significant impact on this threatened species.

***Ninox connivens* Barking Owl**

This species was not recorded on the subject site during survey.

It was judged that the site contains potential foraging habitat for this species as provides fragmented bushland alongside open grassy paddocks, which this species favours. This is a highly mobile species able to exploit widely separated resources and suitable habitat for this species occurs in State Forests and other large reserves in the local area. The site contains potential nesting sites in large tree hollows which can be replaced by nest boxes and only a small area of potential foraging habitat will be removed.

The proposal is unlikely to have a significant impact on this threatened species.

***Ninox strenua* Powerful Owl**

This species was not recorded on the subject site during survey.

The subject site contains potential foraging habitat for this species as it supports habitat for its favoured prey – *Pteropus poliocephalus* Grey-headed Flying-fox and *Pseudocheirus peregrinus* Common Ringtail Possum. Although the site supports large tree hollows, this species prefers to roost and nest in deep gullies and so the landscape features of the site are inappropriate as roosting habitat.

Although the Powerful Owl prefers dense forest and feeds on other forest fauna, it has adapted to fragmented habitat in an urbanised landscape. There are a large number of records of this species across NSW and the forest types in which it has been recorded are common across the bioregion and in local reserves. This species has very large home ranges (up to 1,000 hectares) and the area to be affected by the proposal is relatively small in comparison.

The proposal is unlikely to have a significant impact on this threatened species.

***Tyto novaehollandiae* Masked Owl**

This species was not recorded on the subject site during survey.

Potential foraging habitat for this species occurs amongst both the vegetated and cleared areas. The subject site provides habitat for its preferred prey species. Preferred nesting and roosting sites include hollows or thick foliage and such elements are both contained within the small area of native vegetation to be removed.

However, the proposal is unlikely to have a significant impact on this threatened species due to the small size of the area to be removed and the ability of this species to exploit widely-separated resources.

***Climacteris picumnus victoriae* Brown Treecreeper**

This species was not recorded on the subject site during survey.

Potential foraging habitat for this species occurs in the rough-barked trees of the native bushland and potential nesting sites within the tree hollows. The area of potential habitat to be lost is very small when compared to what is to be retained on site and in the local area.

The proposal is unlikely to have a significant impact on this threatened species.

***Petroica boodang* Scarlet Robin**

This species was not recorded on the subject site during survey. The site is likely to provide only marginal potential habitat as the understorey of the intact bushland is probably too dense for this species to use.

Potential foraging habitat for this species occurs amongst both the vegetated and cleared areas. The use of remnant bushland by this species is dependent on the configuration of the habitat and its connectivity to other remnant bush. The proposal will not alter the connectivity of the local vegetation in any appreciable way for such a highly mobile species.

The proposal is unlikely to have a significant impact on this threatened species.

5.5 Mammals

***Petaurus australis* Yellow-bellied Glider**

This species was not recorded on the subject site during survey.

The subject site supports potential foraging habitat for this species, particularly in the *Eucalyptus piperita* Sydney Peppermint and *Corymbia gummifera* Red Bloodwood, and potential denning sites in the large hollows. This glider is an inhabitant of tall eucalypt forest and woodland and rests in hollows (generally in a living, smooth-barked eucalypt) during the day and forages within a home range of up to 35 hectares at night. The subject site is likely to be within the home range of families of this species that may occur in nearby Strickland State Forest and other reserved lands, although there is no evidence of this species using the hollows or foraging on site.

The area of habitat to be removed is relatively small. The hollows to be lost are few and will be replaced by nest boxes. The connectivity of habitat on the local area will not be compromised for this highly mobile species.

The proposal is unlikely to have a significant impact on this threatened species.

***Pteropus poliocephalus* Grey-headed Flying-fox**

This species was recorded near the subject site during the previous survey.

Critical habitat features for the life cycle of this species includes foraging resources (flowering and fruiting trees and vines) and habitat suitable for camps (rainforest gullies with dense forest).

Pteropus poliocephalus Grey-headed Flying-fox feeds on eucalypt blossom and soft fruits of rainforest trees. The subject site supports tree species known to provide blossom used by this species – *Corymbia gummifera* Red Bloodwood. The majority of the vegetation to be retained on site will continue to provide potential foraging habitat for this species.

There are no suitable camp sites on or near the site. Also, this is a highly-mobile species that can exploit even the most isolated of feed trees in highly urbanised situations.

The proposal is unlikely to have a significant impact on this threatened species.

***Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat**

This species was not recorded in the subject site during survey.

The subject site provides both potential foraging habitat for this species high above the canopy and roosting sites in the hollow-bearing trees. Although 5 or 6 hollow-bearing tree will be removed, this may be compensated for with replacement nest boxes. The potential habitat on site would only represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources. In addition, recommendations regarding light pollution will aid in mitigating potential impact on the foraging habitat of this species.

The proposal is unlikely to have a significant impact on this threatened species.

***Mormopterus norfolkensis* Eastern Freetail-bat**

This species was not recorded on the subject site during survey.

The subject site provides both potential foraging habitat for this species high above the canopy and breeding sites (hollow-bearing trees). The hollows to be removed will be compensated for with replacement nest boxes and the loss of vegetation is relatively small. The potential habitat on site would only represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources. In addition, recommendations regarding light pollution will aid in mitigating potential impact on the foraging habitat of this species.

The proposal is unlikely to have a significant impact on this threatened species.

***Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat**

This species was recorded foraging on the subject site during previous survey.

Potential foraging habitat for this species occurs above the tree canopy. This species forages principally on moths and other flying insects, usually snatched high above or just below the forest canopy, although it can also forage low to the ground over open grassy areas. However, this species requires caves or mine tunnels for roosting, none of which occur on the subject site. The habitat to be removed would also represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources. Urban lighting is known to disrupt the foraging behaviour of this species and so the implementation of the recommendations regarding lighting will further mitigate potential impact on its foraging habitat.

The proposal is unlikely to have a significant impact on this threatened species.

***Miniopterus australis* Little Bentwing-bat**

This species was not recorded on the subject site during survey.

Foraging habitat for this species occurs below the tree canopy in the forested areas. As this species roosts in caves or mine tunnels, the subject site only contains foraging habitat. The extent or configuration of the foraging habitat for this species will not significantly change as a result of the proposed works. This foraging habitat would also represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources.

The proposal is unlikely to have a significant impact on this threatened species.

***Myotis macropus* Large-footed Myotis**

This species was recorded on the subject site during previous survey.

This species may use the subject site for roosting and breeding in appropriate hollow-bearing trees. Some 5 or 6 hollow-bearing trees will be removed but the presence of water over which to forage will remain.

The proposal is unlikely to have a significant impact on this threatened species.

***Scoteanax rueppellii* Greater Broad-nosed bat**

This species was possibly recorded on the subject site during survey. Its call is almost indistinguishable from *Falsistrellus tasmaniensis* Eastern False Pipistrelle.

It was judged that this species has potential foraging habitat in the forested areas. This species is mainly found in wetter habitats, particularly along forest edges and watercourses and requires hollow-bearing trees for roosting and breeding. Although 5 or 6 hollow-bearing trees will be removed, this will be compensated for with replacement nest boxes. In addition, the potential habitat on site would only represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources.

The proposal is unlikely to have a significant impact on this threatened species.

***Falsistrellus tasmaniensis* Eastern False Pipistrelle**

This species was possibly recorded on the subject site during survey. Its call is almost indistinguishable from *Scoteanax rueppellii* Greater Broad-nosed Bat.

Potential foraging habitat for this species occurs among the tall eucalypts across the site. It forages on large beetles and other flying insects, probably caught just below the canopy. This species requires hollow trees for roosting, 5 or 6 of which will be removed by the proposal. The habitat on the subject site would also represent a very small proportion of what is available locally and regionally as this species is highly mobile, able to exploit widely separated resources.

The proposal is unlikely to have a significant impact on this threatened species.

Pseudomys gracilicaudatus Eastern Chestnut Mouse

This species was not recorded on the subject site during survey.

Potential foraging habitat for this species occurs among the dense understorey of Map Unit 1 Somersby Plateau Forest and downslope off site near the hanging swamp vegetation. It forages and shelters within tunnels in the dense undergrowth of swampy vegetation. The downslope groundwater-dependent vegetation types have the potential to be altered over a long time with the possible drawdown of the aquifer. This

potential habitat in the swampy areas would represent a very small proportion of suitable habitat that is available locally.

The proposal is unlikely to have a significant impact on this threatened species.

6 CONCLUSIONS AND RECOMMENDATIONS

This Flora and Fauna Impact Assessment has considered the likely impacts of the proposed development at Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby upon species, populations and communities of conservation significance.

The impact was assessed for nationally and state listed threatened species, populations or ecological communities, or their habitats.

The site is partially naturally vegetated, situated at the edge of the Somersby Plateau. The site has been an active quarry since 1979 and the proposed works area will be buffered from adjacent habitat by retained vegetation. Only 0.88 hectares of Somersby Plateau Forest will be removed for the project and 5 or 6 hollow-bearing trees may also be removed. Their loss will be ameliorated by the installation of nest boxes.

There is potential for two small patches of hanging swamps to become drier over a long period, but the modelling predicting this outcome relies on the aquifers being connected and there is no evidence that this is the case. Overland flow to these downslope off site areas will remain intact.

The site provides potential habitat for a number of threatened species of flora and fauna and several threatened fauna species were recorded on and near the site, principally bats:

- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Pteropus poliocephalus* Grey-headed Flying-fox'
- *Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat
- *Myotis macropus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle

Three individuals of *Grevillea shiressii* were recorded n site, but these are almost certainly planted.

The impact of this proposal on threatened species and endangered ecological communities of interest is likely to be minimal as it is concentrated mainly in the existing development footprint of the site.

The assessment of the criteria under the Commonwealth EPBC Act (1999) concluded that a referral to the Department of Sustainability, Environment, Water, Population and Communities is not required.

The assessment of likely impact under the New South Wales TSC Act (1995) concluded that a significant impact is not likely to occur upon any state listed threatened species, populations or endangered ecological communities. Therefore a Species Impact Statement is not recommended to be prepared for the proposal.

While it is judged that there will be no significant impact wrought by the proposed development on any species of conservation significance, the following recommendations are provided in order to ameliorate any impacts in relation to the proposal, particularly in regard to resident fauna and protection of downslope environments:

1. Consideration should be given to moving the bund near the entrance so that it impacts on already disturbed ground rather than cut into intact forest vegetation.

2. Lights to be used on site should be of a type that reduces spill and glare so that foraging by microbats is not further disrupted.

3. Clearing should be timed so that the felling of hollow-bearing trees can occur in a season that is least disruptive to resident breeding animals.

4. Hollow-bearing trees must only be removed with Council's permission and under supervision of a suitably-qualified and experienced ecologist or wildlife handler / rescue service (such as WIRES).

5. Prior to felling, a number of nest boxes of a variety of types should be erected in retained trees in order for animals to relocate or be relocated.

6. Ultimately, boxes should compensate for lost hollows at a ratio of at least 1:1. Supplementary boxes may need to be installed after the felled trees are inspected and the numbers and characteristics of the hollows properly determined.

7. It is important that the nest boxes are designed and built to provide thermal stability and so should the walls should be no thinner than 19 mm.

8. Plant species used for rehabilitation should be restricted to locally-native species and / or those introduced species that do not have the potential to become environmental weeds.

9. Unless it poses a safety hazard, fallen timber should not be removed from the site.

10. Sediment controls should be strictly observed throughout the life of the quarry.

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When conducting flora and fauna surveys, consultants are required to possess licences to ensure that works are completed in an appropriate manner.

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FIGURES

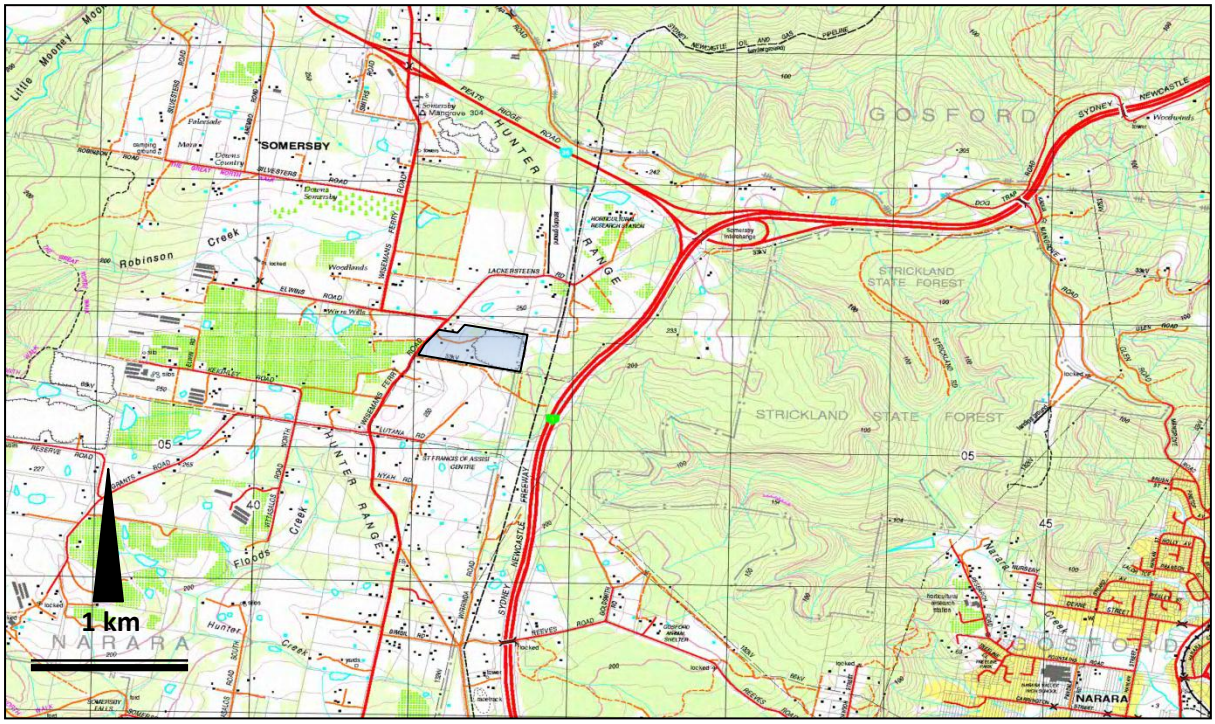


Figure 1: Subject site (blue) in relation to local features. Source map: Department of Lands Gosford 1:25,000 topographic map, TopoView Raster.



Figure 2: Subject site (red) is situated on the eastern fall of the Somersby Plateau and is separated from Strickland State Forest by the F3 Freeway. Source aerial photo: Nearmap (www.nearmap.com) dating from October 2011.

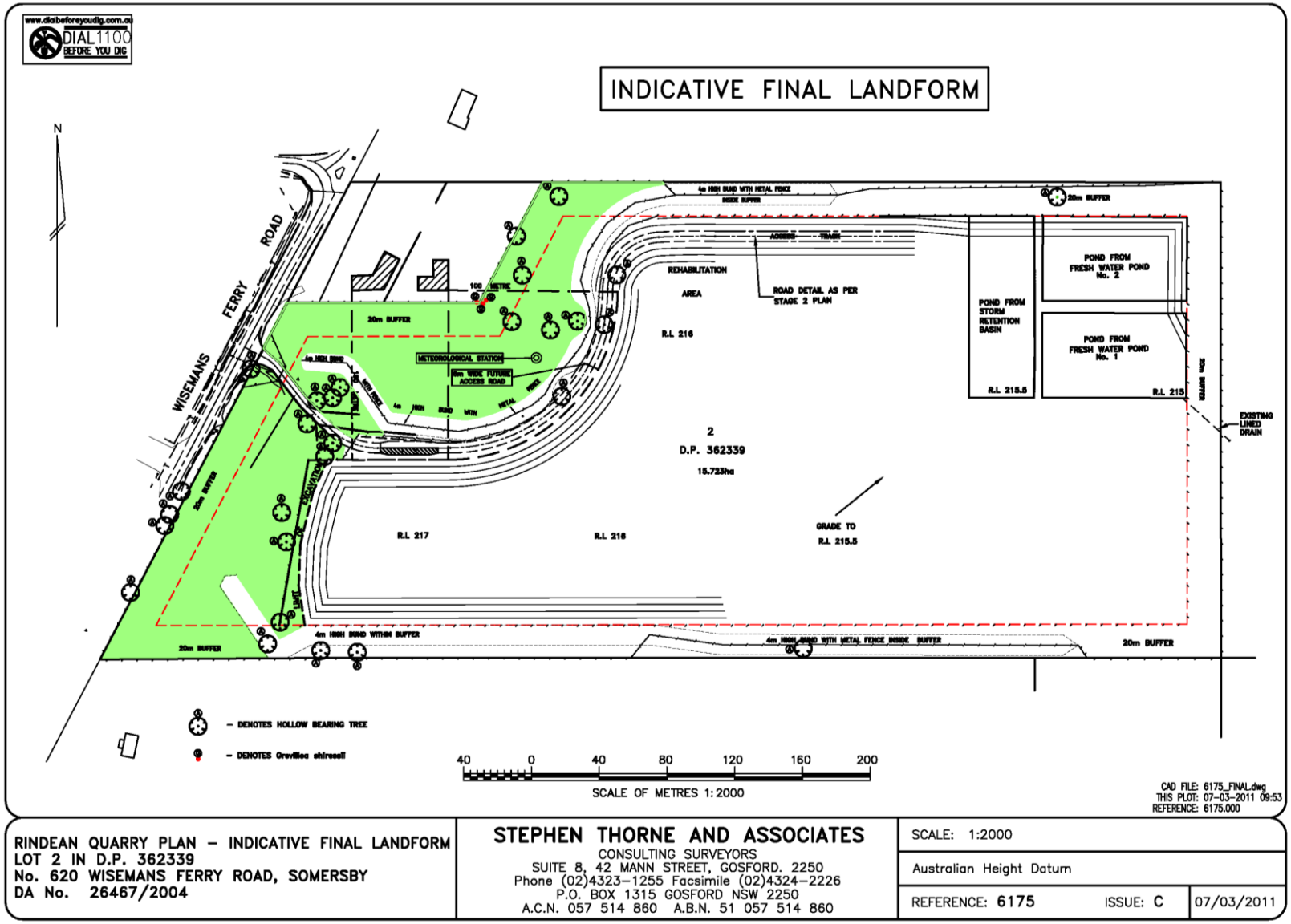


Figure 3: Plan showing details of the proposal.

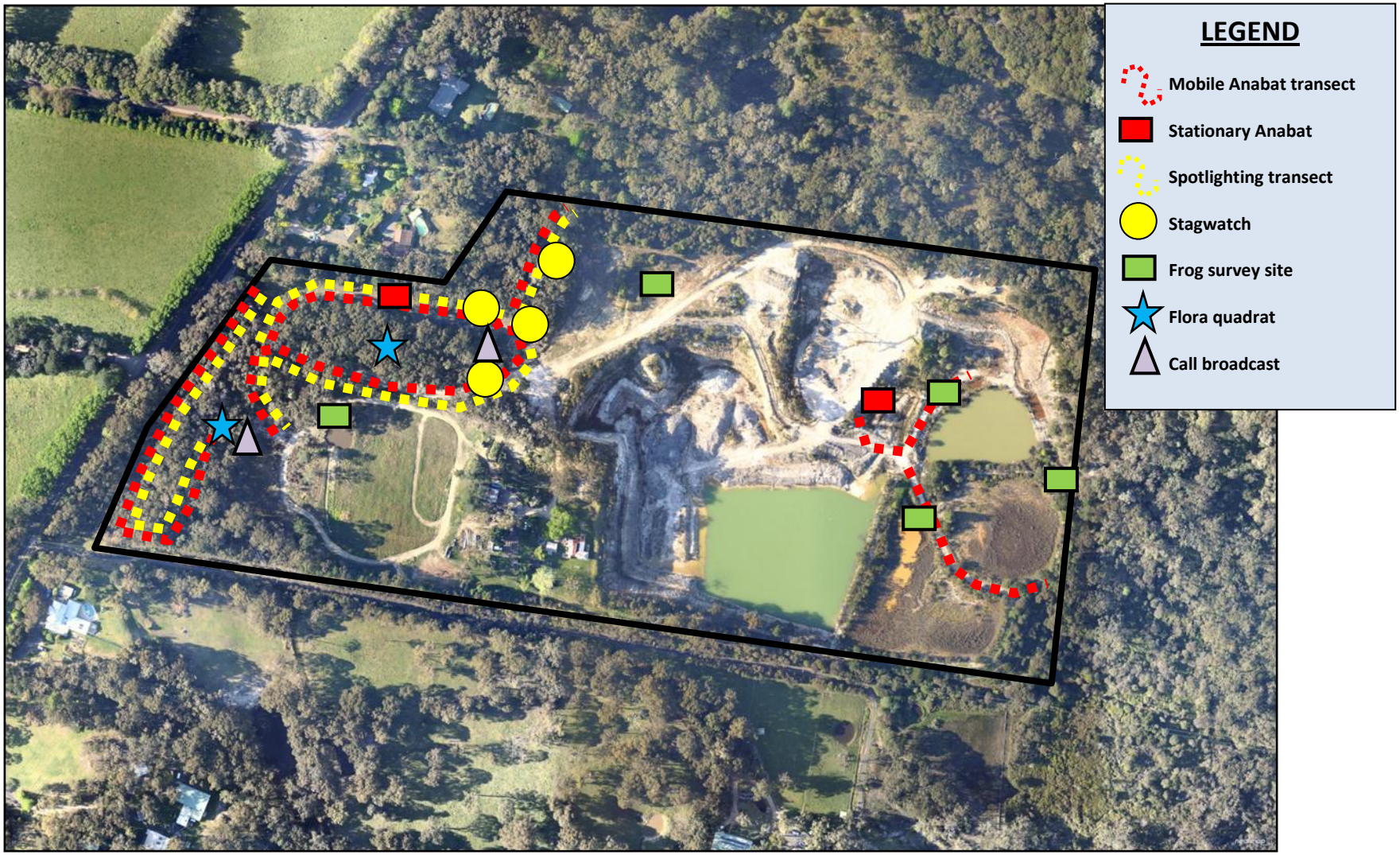


Figure 4: Aerial photograph showing the extent of quarrying and other activities on the subject site (black) and flora and fauna survey activities for this assessment. Random meander flora transects not shown for reasons of clarity. Source aerial: Nearmap.com; cadastre: NSW Land and Property Management Authority.



Figure 5: Aerial photograph showing existing vegetation and development divided into 10 map units (yellow) with the proposed clearing footprint superimposed (red). Hollow bearing trees are also shown and colour-coded according to their fate. Source aerial: Nearmap.com.

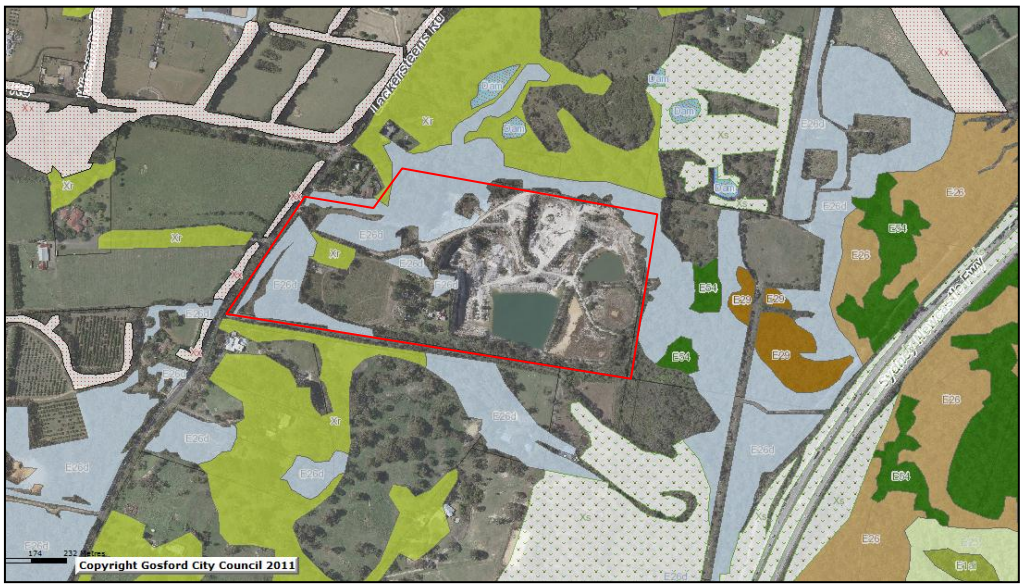


Figure 6: Vegetation types on and near the subject site (red outline). E26d – Somersby Plateau Forest, E29 – Hawkesbury Banksia Scrub – Woodland, E54 – Sandstone Hanging Swamps and Xr – disturbed canopy only. Source: Bell (2009) for Gosford Council (www.gosford.nsw.gov.au).

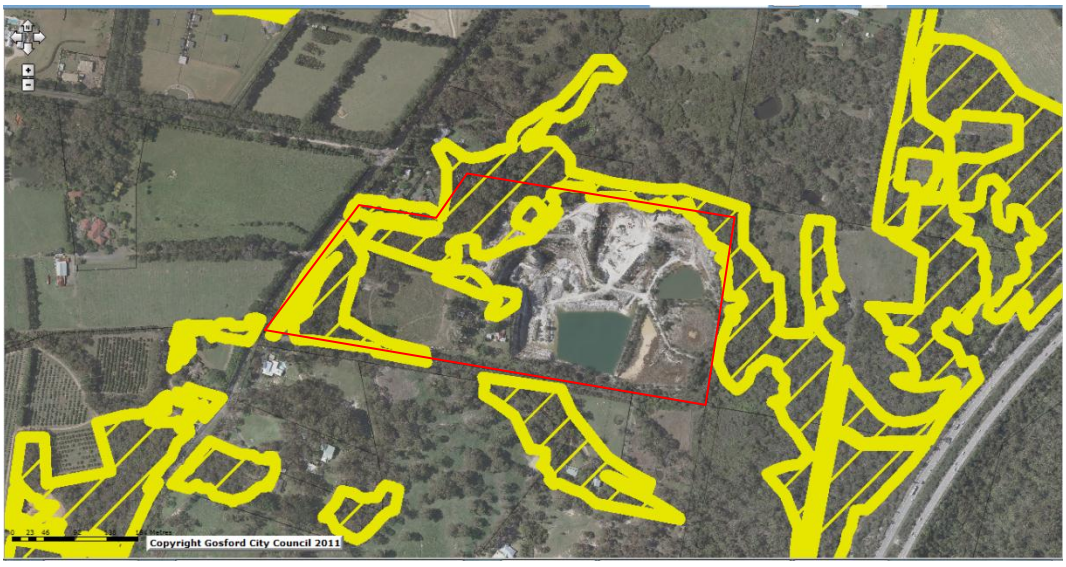
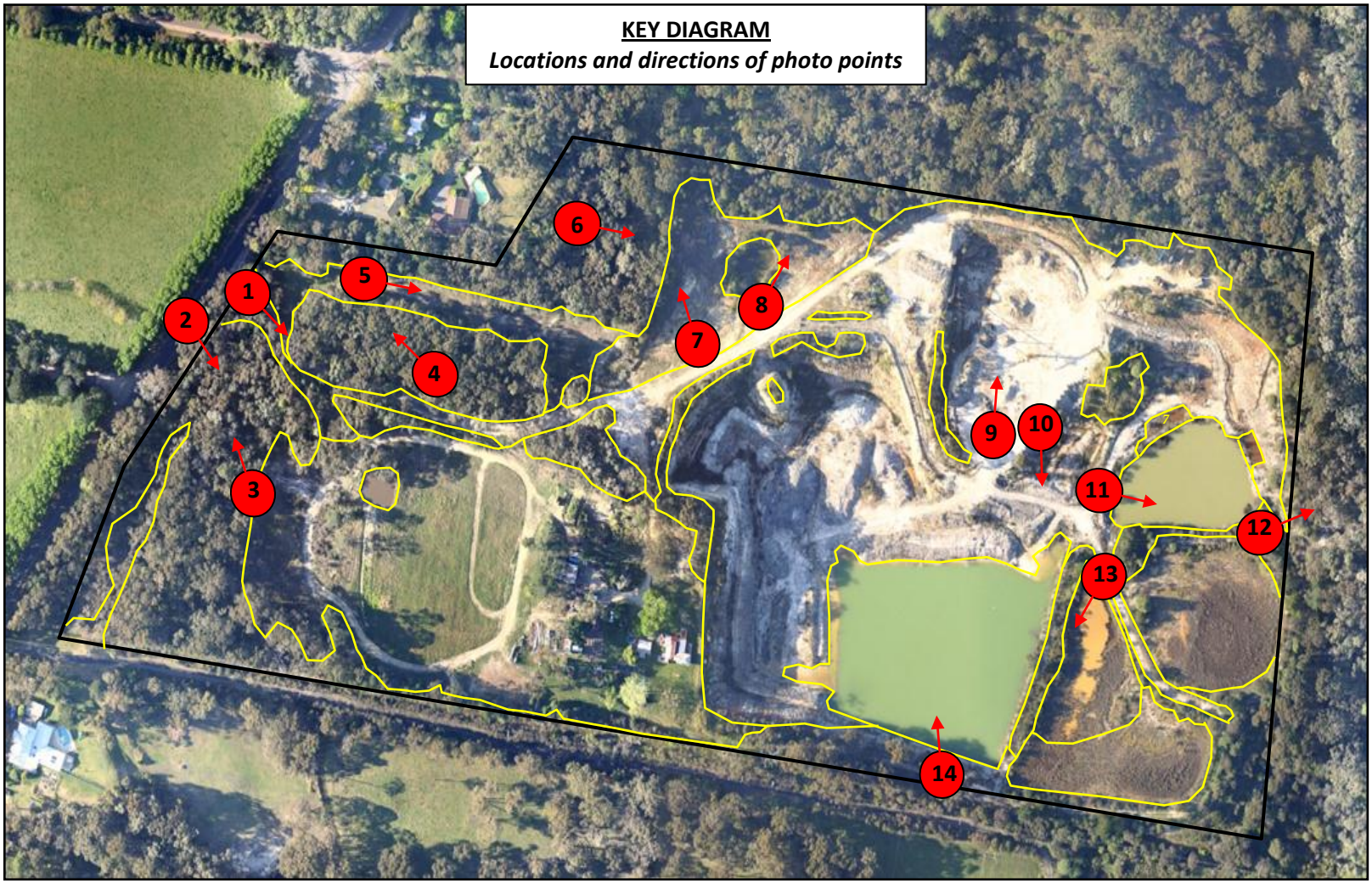


Figure 7: Distribution of Regionally Significant Vegetation (yellow diagonal) in and around the subject site (red). Source: Bell (2009) for Gosford Council (www.gosford.nsw.gov.au).

PHOTOGRAPHS


KEY DIAGRAM
Locations and directions of photo points
1
2
3
4
5
6
7
8
9
10
11
12
13
14



Photograph 1: Hollow-bearing tree (marked with flagging tape) near the entrance at the edge of Map Units 1, 4 and 6.



Photograph 2: Disturbed and weedy edge of Map Unit 1 along the Wisemans Ferry Road frontage.



Photograph 3: Map Unit 1 in the south western corner of the site is dominated by Gymea Lily in the understorey.



Photograph 4: Map Unit 1 in the north western part of the site also has a dense understorey but is dominated by other shrubs and ferns such as *Gleichenia*.



Photograph 5: Cleared grassy vegetation beneath the power lines along the easement on the north western part of the site.



Photograph 6: One of the hollow-bearing trees to be removed in Map Unit 1.



Photograph 7: Map Unit 7 is an open excavated area with little natural regeneration.



Photograph 8: Dense fringing vegetation around the edge of the small dam in Map Unit 10.



Photograph 9: Quarrying equipment lies idle in the centre of the site. The trees in the background are situated on the northern boundary of the site.



Photograph 10: Looking south towards the ponds in the south eastern corner of the site.



Photograph 11: Dam with fringing vegetation.



Photograph 12: Looking downslope into natural vegetation tot eh east off site and below the high dam wall



Photograph 13: Tailings pond with fringing vegetation.



Photograph 14: Looking north from the south eastern corner across the excavated part of the site to natural ground level in the background.

APPENDIX 1

FLORA DETAILS

Table 1.1: Flora species observed on the subject site and their conservation status. V=Vulnerable; number in the LGA column is the number of records of that species in Bell's dataset (those fewer than 5 considered locally significant), * = introduced species, [N] = Noxious Weed, class 4 or 5.

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair			
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair			
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern			
Anthericaceae	*Caesia parviflora* var. *parviflora*	Pale Grass-lily			
Anthericaceae	*Laxmannia compacta*	Slender Wire Lily			
Anthericaceae	*Thysanotus juncifolius*	-			2 records in database but is rather cryptic and easily overlooked outside of good years in the flowering season.
Anthericaceae	*Tricoryne simplex*	Yellow Rush-lily			1 record in database but is easily overlooked outside of good years in the flowering season.
Apiaceae	*Actinotus helianthi*	Flannel Flower			
Apiaceae	*Actinotus minor*	Lesser Flannel Flower			
Apiaceae	*Centella asiatica*	Swamp Pennywort			
Apiaceae	*Ciclospermum leptophyllum**	Slender Celery			
Apiaceae	*Foeniculum vulgare**	Fennel			
Apiaceae	*Hydrocotyle bonariensis**	Kurnell Curse			
Apiaceae	*Hydrocotyle peduncularis*	Pennywort			
Apiaceae	*Platysace linearifolia*	Narrow-leafed Platysace			
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia			
Apiaceae	*Xanthosia tridentata*	Rock Xanthosia			
Apocynaceae	*Parsonsia straminea*	Common Silkpod			
Araceae	*Gymnostachys anceps*	Settlers Flax			
Araceae	*Monstera deliciosa**	Fruit-salad Plant			
Araceae	*Zantedeschia aethiopica**	White Arum Lily			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax			
Arecaceae	*Livistona australis*	Cabbage Tree Palm			
Asparagaceae	*Asparagus asparagoides** [N4]	Bridal Creeper			
Asparagaceae	*Asparagus scandens**	Asparagus Fern			
Asteraceae	*Ageratina adenophorum** [N4]	Crofton Weed			
Asteraceae	*Ambrosia artemisifolia** [N5]	Annual Ragweed			
Asteraceae	*Aster subulatus**	Wild Aster			
Asteraceae	*Bidens pilosa**	Cobbler's Pegs			
Asteraceae	*Cassinia uncata*	Bent Cassinia			2 records in database. Not rare.
Asteraceae	*Chrysanthemoides monilifera* subsp. *rotundata** [N5]	Bitou Bush			
Asteraceae	*Cirsium vulgare**	Spear Thistle			
Asteraceae	*Conyza albida**	Fleabane			
Asteraceae	*Coreopsis lanceolata**	-			
Asteraceae	*Gnaphalium americanum**	Cudweed			
Asteraceae	*Hypochaeris radicata**	Flatweed			
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting			
Asteraceae	*Senecio madagascariensis**	Fireweed			
Asteraceae	*Sonchus oleraceus**	Common Sowthistle			
Asteraceae	*Tagetes minuta**	Stinking Roger			
Asteraceae	*Taraxacum officinale**	Dandelion			
Asteraceae	*Xanthium occidentale**	Noogoora Burr			
Baueraceae	*Bauera rubioides*	River Rose			
Bignoniaceae	*Pandorea pandorana*	Wonga Vine			
Blechnaceae	*Doodia aspera*	Rasp Fern			
Boraginaceae	*Echium plantagineum**	Patterson's Curse			
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle			
Cassytheceae	*Cassytha glabella*	Devils Twine			
Cassytheceae	*Cassytha pubescens*	Common Devil's Twine			
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak			
Commelinaceae	*Commelina cyanea*	Native Wandering Jew			
Convolvulaceae	*Dichondra repens*	Kidney Weed			
Convolvulaceae	*Ipomoea cairica**	Blue Morning Glory			
Cunoniaceae	*Callicoma serratifolia*	Black Wattle			
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush			
Cyatheaceae	*Cyathea cooperi**	Straw Treefern			4 records in database. Considered to be introduced to the Central Coast region.
Cyperaceae	*Caustis flexuosa*	Curly Sedge			
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch			
Cyperaceae	*Cyperus polystachyos*	-			1 record in database. Poorly collected group.
Cyperaceae	*Eleocharis sphacelata*	Tall Spike-rush			
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge			
Cyperaceae	*Gahnia sieberiana*	Red-fruited Saw-sedge			
Cyperaceae	*Isolepis prolifera**	-			
Cyperaceae	*Lepidosperma gunnii*	-			2 records in database. Not rare.
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge			
Cyperaceae	*Schoenoplectus mucronatus*	River Clubrush			
Cyperaceae	*Schoenus brevifolius*	Bog-rush			
Cyperaceae	*Schoenus imberbis*	-			
Cyperaceae	*Schoenus paludosus*	-			1 record in database.
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern			
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern			2 records in database.

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern			
Dennstaedtiaceae	*Pteridium esculentum*	Bracken			
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern			
Dilleniaceae	*Hibbertia acicularis*	Prickly Guinea Flower			
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower			
Dilleniaceae	*Hibbertia bracteata*	-			
Dilleniaceae	*Hibbertia cistiflora*	-			
Dilleniaceae	*Hibbertia monogyna*	-			
Doryanthaceae	*Doryanthes excelsa*	Gymea Lily		Listed as occurring at Gan Gan Hill and Toronto but very common on Somersby Plateau and elsewhere in Gosford LGA.	
Droseraceae	*Drosera spatulata*	Common Sundew			5 records in database. Often overlooked if conditions not moist.
Elaeocarpaceae	*Tetratheca ericifolia*	-			
Ericaceae	*Epacris pulchella*	NSW Coral Heath			
Ericaceae	*Leucopogon ericoides*	-			
Ericaceae	*Leucopogon lanceolatus*	Lance-leaf Beard-heath			
Ericaceae	*Monotoca scoparia*	Prickly Broom-heath			
Ericaceae	*Styphelia laeta* subsp. *latifolia*	Five Corners		Known to be conserved in Brisbane Water National Park.	
Ericaceae	*Trochocarpa laurina*	Tree Heath			
Euphorbiaceae	*Amperea xiphoclada*	Broom Spurge			
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush			
Euphorbiaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese Tree			
Euphorbiaceae	*Micrantheum ericoides*	-		Listed as occurring on the Tomago Peninsula but is very common if inconspicuous on sandy soils.	
Euphorbiaceae	*Ricinus communis**	Castor Oil Plant			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Fabaceae	*Aotus ericoides*	-			
Fabaceae	*Bossiaea heterophylla*	Variable Bossiaea			
Fabaceae	*Bossiaea obcordata*	Spiny Bossiaea			
Fabaceae	*Bossiaea scolopendria*	-			44 records in database but reaches its northern limit in the Gosford district.
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea			
Fabaceae	*Dillwynia floribunda* var. *floribunda*	Parrot Pea		Common in the south of the region but rarer in the north (e.g. Anna Bay).	
Fabaceae	*Dillwynia retorta* subsp. *retorta*	Eggs and Bacon			
Fabaceae	*Dillwynia rudis*	-			2 records in database. Not rare but this group often misidentified.
Fabaceae	*Glycine clandestina*	Twining Glycine			
Fabaceae	*Glycine microphylla*	-			
Fabaceae	*Gompholobium latifolium*	Broad-leaf Wedge-pea			
Fabaceae	*Hardenbergia violacea*	False Sarsparilla			
Fabaceae	*Jacksonia scoparia*	Dogwood			
Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea			
Fabaceae	*Phyllota phylicoides*	Heath Phyllota			
Fabaceae	*Pultenaea daphnoides*	Large-leaf Bush Pea			
Fabaceae	*Pultenaea rosmarinifolia*	-		Known from at least 3 reserves: Heaton State Forest, Brisbane Water National Park and Munmorah State Recreation Area.	62 records in database but reaches its northern limit at the Judge Dowling Range.
Fabaceae	*Pultenaea tuberculata*	-			
Fabaceae	*Senna pendula* var. *glabrata**	-			
Fabaceae	*Viminaria juncea*	Native Broom			
Geraniaceae	*Geranium homeanum*				
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Gleicheniaceae	*Sticherus urceolatus*	Fan Fern			
Goodeniaceae	*Dampiera stricta*	Blue Dampiera			
Goodeniaceae	*Goodenia ovata*	-			
Goodeniaceae	*Goodenia paniculata*	Swamp Goodenia			3 records in database. Widespread and not rare.
Goodeniaceae	*Scaevola ramosissima*	Purple Fan Flower			
Haloragaceae	*Gonocarpus micranthus* subsp. *micranthus*	-			
Hamamelidaceae	*Liquidambar styraciflua**	Sweet Gum			
Iridaceae	*Patersonia sericea*	Wild Iris			
Juncaceae	*Juncus cognatus**	-			
Juncaceae	*Juncus continuus*	-			5 records in database. Not rare. Notoriously overlooked and misidentified group.
Juncaceae	*Juncus mollis*				
Juncaceae	*Juncus planifolius*	Broad Rush			4 records in database. Not rare. Notoriously overlooked and misidentified group.
Juncaceae	*Juncus usitatus*	Common Rush			3 records in database. Not rare. Notoriously overlooked and misidentified group.
Lauraceae	*Cinnamomum camphora**	Camphor Laurel			
Liliaceae	*Lilium formosanum**	Formosan Lily			
Lindsaeaceae	*Lindsaea linearis*	Screw Fern			
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge-fern			
Lobeliaceae	*Lobelia alata*	-			
Lobeliaceae	*Pratia purpurascens*	Whiteroot			
Loganiaceae	*Mitrasacme polymorpha*	Mitrewort			
Lomandraceae	*Lomandra confertifolia* var. *rubiginosa*	-			
Lomandraceae	*Lomandra gracilis*	-			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush			
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush			
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush			
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry			
Lycopodiaceae	*Lycopodiella cernua*	Scrambling Clubmoss			
Malvaceae	*Pavonia hastata**	Pink Pavonia			
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne			
Mimosaceae	*Acacia decurrens*	Black Wattle			
Mimosaceae	*Acacia elata*	Cedar Wattle			
Mimosaceae	*Acacia irrorata* subsp. *irrorata*	Green Wattle			
Mimosaceae	*Acacia linifolia*	Flax Wattle			
Mimosaceae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle			
Mimosaceae	*Acacia myrtifolia*	Red Stem Wattle			
Mimosaceae	*Acacia oxycedrus*	Spike Wattle			
Mimosaceae	*Acacia podalyriifolia**	Queensland Silver Wattle			
Mimosaceae	*Acacia suaveolens*	Sweet Scented Wattle			
Mimosaceae	*Acacia terminalis*	Sunshine Wattle			
Mimosaceae	*Acacia ulicifolia*	Prickly Moses			
Mimosaceae	*Paraserianthes lophantha* subsp. *lophantha*	Crested Wattle			
Moraceae	*Ficus macrophylla*	Moreton Bay Fig			
Moraceae	*Morus alba**	White Mulberry			
Myrtaceae	*Angophora costata*	Smooth-barked Apple			
Myrtaceae	*Callistemon citrinus*				
Myrtaceae	*Corymbia gummifera*	Red Bloodwood			
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Myrtaceae	*Eucalyptus sieberi*	Silvertop Ash			
Myrtaceae	*Kunzea ambigua*	Tick Bush			
Myrtaceae	*Leptospermum polygalifolium*	Lemon Scented Tea Tree			
Myrtaceae	*Leptospermum squarrosum*	-			3 records in database. Not rare.
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea Tree			
Myrtaceae	*Lophostemon confertus**	Brush Box			
Myrtaceae	*Syncarpia glomulifera*	Turpentine			
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant			
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet			
Orchidaceae	*Acianthus* sp.	Orchid			
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid			
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid			
Orchidaceae	*Spiranthes sinensis*	Austral Ladies Tresses			
Oxalidaceae	*Oxalis* sp.				
Passifloraceae	*Passiflora edulis**	Common Passionfruit			
Philydraceae	*Philydrum lanuginosum*	Woolly Waterlily			1 record in database. Not rare. Widespread in suitable habitat.
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax Lily			
Phormiaceae	*Dianella prunina*	-		Known from Pokolbin State Forest. Not rare. Difficult group to identify.	
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge			
Phytolaccaceae	*Phytolacca octandra**	Inkweed			
Pinaceae	*Pinus radiata**	Radiata Pine			
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry			
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum			
Plantaginaceae	*Plantago lanceolata**	Ribwort			
Poaceae	*Andropogon virginicus**	Whisky Grass			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Poaceae	*Anisopogon avenaceus*	Oat Speargrass			
Poaceae	*Anthoxanthum odoratum**	Sweet Vernal Grass			
Poaceae	*Aristida ramosa*	Wire Grass			5 records in database. Group often overlooked and difficult to identify outside of fruiting season.
Poaceae	*Arundo donax**	Giant Reed			
Poaceae	*Austrodanthonia tenuior*	Wallaby Grass			2 records in database. Group often overlooked and difficult to identify outside of fruiting season.
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass			
Poaceae	*Briza maxima**	Quaking Grass			
Poaceae	*Bromus catharticus**	Prairie Grass			
Poaceae	*Chloris gayana**	Rhodes Grass			
Poaceae	*Cortaderia selloana** ***N4***	Pampas Grass			
Poaceae	*Cymbopogon refractus*	Barbwire Grass			
Poaceae	*Cynodon dactylon*	Common Couch			
Poaceae	*Dichelachne crinita*	Long-hair Plume Grass			3 records in database. Group often overlooked and difficult to identify outside of fruiting season.
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass			
Poaceae	*Digitaria sanguinalis**	Crab Grass			
Poaceae	*Echinochloa crus-galli**	Barnyard Grass			
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass			
Poaceae	*Ehrharta erecta**	Panic Veldtgrass			
Poaceae	*Entolasia marginata*	Bordered Panic			
Poaceae	*Entolasia stricta*	Wiry Panic			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Poaceae	*Eragrostis brownii*	Brown's Lovegrass			
Poaceae	*Imperata cylindrica* var. *major*	Blady Grass			
Poaceae	*Melinis repens**	Red Natal Grass			
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Rice Grass			
Poaceae	*Panicum simile*	Two Colour Panic			
Poaceae	*Paspalum dilatatum**	Paspalum			
Poaceae	*Paspalum urvillei**	Vasey Grass			
Poaceae	*Pennisetum clandestinum**	Kikuyu			
Poaceae	*Phragmites australis*	Common Reed			
Poaceae	*Poa labillardieri* var. *labillardieri*	Tussock Grass			1 record in database. Group often overlooked and difficult to identify outside of fruiting season.
Poaceae	*Setaria gracilis**	Slender Pigeon Grass			
Poaceae	*Sporobolus africanus**	Parramatta Grass			
Poaceae	*Sporobolus indicus* var. *capensis**	Parramatta Grass			
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass			
Poaceae	*Themeda australis*	Kangaroo Grass			
Polygalaceae	*Comesperma ericinum*	Matchheads			
Polygonaceae	*Persicaria decipiens*	Slender Knotweed			1 record in database. Not rare. Widespread and common in suitable habitat.
Proteaceae	*Banksia ericifolia* subsp. *ericifolia*	Heath-leaved Banksia			
Proteaceae	*Banksia oblongifolia*	-			
Proteaceae	*Banksia robur*	Wallum Banksia			
Proteaceae	*Banksia serrata*	Old Man Banksia			
Proteaceae	*Banksia spinulosa* var. *collina*	Hairpin Banksia			
Proteaceae	*Conospermum longifolium* subsp. *longifolium*	Smokebush			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Proteaceae	*Conospermum tenuifolium*	Grass-leaved Conospermum			3 records in database. Not rare. Common in suitable habitat but habit is quite cryptic.
Proteaceae	*Grevillea buxifolia*	-			
Proteaceae	*Grevillea mucronulata*	Green Spider Flower			3 records in database
Proteaceae	*Grevillea sericea*	Pink Spider Flower			
Proteaceae	***Grevillea shiressii***	-	V / V		Listed threatened species. No records in database but endemic to Mooney Mooney and Mullet Creeks.
Proteaceae	*Hakea dactyloides*	Broad-leaved Hakea			
Proteaceae	*Hakea salicifolia*	Willow Hakea			
Proteaceae	*Hakea sericea*	Needlebush			
Proteaceae	*Hakea teretifolia*	Dagger Hakea			
Proteaceae	*Isopogon anemonifolius*	Flat-leaved Drumsticks			
Proteaceae	*Lambertia formosa*	Mountain Devil			
Proteaceae	*Lomatia silaifolia*	Crinkle Bush			
Proteaceae	*Persoonia isophylla*	-			
Proteaceae	*Persoonia lanceolata*	Lance-leaved Geebung			
Proteaceae	*Persoonia levis*	Broad-leaved Geebung			
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung			
Proteaceae	*Petrophile sessilis*	Conesticks			
Proteaceae	*Symphionema paludosum*	-			3 records in database. Grows in swampy heath. Not rare but habitat is restricted.
Proteaceae	*Telopea speciosissima*	Waratah			
Ranunculaceae	*Clematis glycinoides* var. *glycinoides*	Clematis			
Restionaceae	*Empodisma minus*	-			
Restionaceae	*Hypolaena fastigata*	Tassel Rope-rush			

Family	Scientific Name	Common Name	Conservation Status		
			TSC / EPBC	Regional (LHCCREMS)	LGA (Bell 2004)
Restionaceae	*Lepyrodia scariosa*	Scale Rush			
Rhamnaceae	*Pomaderris andromedifolia*	-			
Rosaceae	*Rubus fruticosis* sp. agg.* [N5]	Blackberry			
Rosaceae	*Rubus parvifolius*	Native Raspberry			
Rubiaceae	*Morinda jasminoides*	-			
Rubiaceae	*Pomax umbellata*	Pomax			
Rutaceae	*Philotheca hispidula*	-			1 record in database. Not rare.
Rutaceae	*Zieria pilosa*	Hairy Zieria			
Santalaceae	*Leptomeria acida*	Native Currant			
Schizaeaceae	*Schizaea dichotoma*	Branched Comb Fern			2 records in database. Not rare.
Selaginallaceae	*Selaginella uliginosa*	Swamp Selaginella			
Smilacaceae	*Smilax glyciphylla*	Sarsparilla			
Solanaceae	*Physalis peruviana**	Cape Gooseberry			
Solanaceae	*Solanum mauritianum**	Wild Tobacco Bush			
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger-plant			4 records in database. Not rare.
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower			
Typhaceae	*Typha orientalis*	Cumbungi			2 records in database
Verbenaceae	*Lantana camara** [N4]	Lantana			
Verbenaceae	*Verbena bonariensis**	Purpletop			
Violaceae	*Viola hederacea*	Ivy-leaved Violet			
Vitaceae	*Cissus hypoglauca*	Water Vine			
Xanthorrhoaceae	*Xanthorrhoea media*	-			
Xyridaceae	*Xyris gracilis*	Slender Yellow-eye			
Zingiberaceae	*Hedychium gardnerianum**	Ginger Lily			

Table 1.2: Flora species of conservation significance recorded within 10 km of subject site. E=Endangered, EPop=Endangered Population, Ext=Extinct, V=Vulnerable. Source: NPWS Atlas database, 2011

Family	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat requirements	Suitability of Site
Dilleniaceae	*Hibbertia procumbens*	-	E	-	Occurs in scrub/heath on skeletal sandy soils and associated with 'hanging swamp' vegetation communities on sandy deposits in the higher western part of Central Coast.	Subject site perched above suitable habitat. Many records from the local area. Marginal potential habitat on site. High likelihood to occur. Further impact assessment required.
Elaeocarpaceae	*Tetratheca glandulosa*	-	V	V	Occurs in shale-sandstone transition habitat on shallow soils associated with Lucas Heights, Gymea, Lambert and Faulconbridge soil landscapes. Usually found on ridgetops to mid slopes in heath, scrub, woodland to open forest.	Marginal potential habitat on or near the site or within the zone of influence. Moderate likelihood to occur. Impact assessment required by OEH.
Elaeocarpaceae	*Tetratheca juncea*	-	V	V	Generally occurs on low nutrient soils associated with the Awaba Soil Landscape from Wyong LGA north to Great Lakes LGA and west to Cessnock LGA. Usually found in low open forest / woodland with a mixed shrub understorey and grassy ground layer.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Ericaceae	*Epacris purpurascens* var. *purpurascens*	-	V	-	Found in a range of habitat types, most of which have a strong shale soil influence, from Dural to Avon Dam. Found in scrub on periodically poorly-drained clay soil. Associated species include *Melaleuca thymifolia, Melaleuca decora.* No verified records from the Central Coast. Specimens attributed to this area are probably misidentified large specimens of the common *E. pulchella* (Dr E. Brown, National Herbarium of NSW).	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Fabaceae	*Senna acclinis*	Rainforest Cassia	E	-	Grows in or on the edges of subtropical and dry rainforest. Found in regrowth areas up to 15 years old.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Lamiaceae	*Prostanthera askania*	-	E	E	Occurs in moist sclerophyll forest and warm temperate rainforest communities on Narrabeen sandstone. Restricted to upper reaches of creeks	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur.

Family	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat requirements	Suitability of Site
					that flow into Tuggerah Lake or Brisbane Water.	No further assessment required.
Lamiaceae	*Prostanthera junonis*	Somersby Mint Bush	E	E	Probably restricted to the Somersby Plateau. Occurs on both Somersby and Sydney Town soil landscapes on gently undulating land over weathered Hawkesbury sandstone. It occurs in disturbed and undisturbed sites in open scrub, low woodland, or open forest.	Potential habitat on and near the site. High likelihood to occur. Further impact assessment required.
Lindsaeaceae	*Lindsaea fraseri*	Fraser's Screw Fern	E	-	In NSW known only from the north coast from poorly drained, infertile soils in swamp forest or open eucalypt forest. Record from the Central Coast dates form 1955 and its location is doubtful (Dr E. Brown, National Herbarium of NSW).	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Myrtaceae	*Callistemon linearifolius*	-	V	-	Occurs in dry sclerophyll open forest on sandy to clayey soils on sandstone. Woy Woy population all within 30 m of drainage line. Associated spp: Red Bloodwood, Grey Gum, Black She-oak and Smooth-barked Apple. Known from the Illawarra to Grafton area.	Marginal potential habitat near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Myrtaceae	*Darwinia biflora*	-	V	V	Occurs in scrub-heath on sandstone or in the understorey of woodland/open forest on shale capped ridges intergraded with Hawkesbury sandstone. Associated with overstorey species *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa.*	No potential habitat on the site or within the zone of influence. Moderate likelihood to occur. No further assessment required.
Myrtaceae	*Darwinia glaucophylla*	-	V	-	Occurs in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils entirely within the Gosford LGA.	Potential habitat on site or within the zone of influence. Moderate likelihood to occur. Impact assessment required by OEH.
Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V	V	Occurs in poor coastal country on shallow sandy soils overlying Hawkesbury sandstone; in coastal heath mostly on exposed sandy ridges; and near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum	V	V	Occurs only on the north coast of NSW in grassy woodland and dry eucalypt forest on deep,	No potential habitat on or near the site or within the zone of influence.

Family	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat requirements	Suitability of Site
					moderately fertile and well-watered soils. Record from the Gosford area dates from 1955.	Moderate likelihood to occur. No further assessment required.
Myrtaceae	*Melaleuca biconvexa*	-	V	V	Occurs in paperbark swamp forest and lowland rainforest.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Myrtaceae	*Micromyrtus blakelyi*	-	V	V	Occurs in heathlands in shallow sandy soils in cracks and depressions of sandstone rock platforms. Restricted to areas near the Hawkesbury River north of Sydney.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V	Occurs in littoral or riverside gallery rainforests.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V	Ill-defined habitat preferences but is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla* Scribbly Gum, *Eucalyptus sieberi* Silvertop Ash, *Corymbia gummifera* Red Bloodwood and *Allocasuarina littoralis* Black Sheoak. Appears to prefer open areas in the understorey of this community and is often found in association with *Cryptostylis subulata* Large Tongue Orchid and *Cryptostylis erecta* Tartan Tongue Orchid.	Marginal potential habitat on site as some associated species are present. Moderate likelihood to occur. No further assessment required.
Orchidaceae	*Dendrobium melaleucaphilum*	Spider Orchid	E	-	Epiphyte in paperbark swamp forest.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Orchidaceae	*Diuris bracteata*	-	E	Extinct	Small populations are known to occur on roadsides on ridges in the Kulnura area, Pittwater and Brisbane Water National Park. Habitat includes mown grass and the open edges of dry sclerophyll woodland.	Marginal potential habitat on site and in the zone of influence. Low likelihood to occur. No further assessment required.
Proteaceae	*Grevillea shiressii*	-	V	V	Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy	Observed on site but specimens very likely planted as it is a common species in

Family	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat requirements	Suitability of Site
					or loamy soils. Known from only a few populations, mostly near Gosford on the lower tributaries of the Hawkesbury River (Mooney Mooney and Mullet Creeks).	cultivation and it is not known to naturally occur in ridge top habitat. Closest naturally-occurring records from Little Mooney Mooney Creek, 2.5 km to the north west. Further impact assessment required.
Proteaceae	*Persoonia hirsuta* subsp. *hirsuta*	-	E	E	Occurs in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. In the study area, is known from the rugged bushland in the ranges to the west of the subject site, such as in Yengo National Park. No records occur on the Somersby Plateau or in nearby coastal forests.	No potential habitat on site or within the zone of influence. Low likelihood to occur. No further assessment required.

Table 1.3: Survey requirements of flora species of interest.

Family	Species	Survey considerations (OEH 2011)	Adequacy of survey
Dilleniaceae	*Hibbertia procumbens*	When flowering, generally between December and March but reported also from September to November; depends on prevailing climatic conditions.	Adequate - survey conducted in correct season after good rain.
Lamiaceae	*Prostanthera junonis* Somersby Mint Bush	Targeted survey for should be conducted over 2-3 days spread evenly over the plant's main flowering period (October to mid December).	Adequate – survey conducted at the correct frequency at a time when a known reference population nearby was in flower.
Myrtaceae	*Callistemon linearifolius*	Best detected when in flower from September to March.	Adequate - survey conducted in correct season.
Myrtaceae	*Darwinia glaucophylla*	Best detected when in flower from May to December.	Adequate - survey conducted in correct season.
Orchidaceae	*Cryptostylis hunteriana* Leafless Tongue Orchid	Only when in flower between November and February. May not flower every year depending on climatic conditions	Adequate - survey conducted in correct season when reference populations were in flower.
Orchidaceae	*Diuris bracteata*	Only identifiable when in flowering from late August to early September (personal observation).	Inadequate – survey conducted outside of flowering season but as it is unlikely to occur on site this is not considered a major impediment to assessment.
Proteaceae	*Grevillea shiressii*	Detectable and identifiable all year.	Adequate - survey conducted in correct season.
Proteaceae	*Persoonia hirsuta* subsp. *hirsuta*	Easiest during flowering in summer and autumn.	Adequate - survey conducted in correct season.

APPENDIX 2

FAUNA DETAILS

Table 2.1: Fauna survey effort on the subject site for the 2004 study by General Flora and Fauna and also for this study.

Fauna Group	Survey Technique	Survey Effort	No of people	Date
Amphibians	Call broadcast – *Litoria aurea* *Heleioporus australasicus* *Pseudophryne australis* *Litoria littlejohni*	2 nights	?	April 2004
	Active searching	?	?	03/04/2004
		?	?	04/04/2004
		?	?	11/04/2004
		?	?	17/04/2004
	Call recording	1 hour	2	16/12/2011
		1 hour	2	17/12/2011
Diurnal Reptiles	Habitat searches	?	?	03/04/2004
		?	?	10/04/2004
		?	?	11/04/2004
		3 hours	2	17/12/2011
		2.5 hours	1	18/12/2011
Nocturnal Reptiles	Spotlighting	?	?	09/04/2004
		?	?	11/04/2004
		?	?	17/04/2004
		2 hours	2	16/12/2011
		2 hours	2	17/12/2011
Diurnal Birds	Direct observation	20 minutes	?	April 2004
		20 minutes	?	April 2004
		2 hours	2	02/11/2011
		1 hour	2	16/12/2011
		4 hours	2	17/12/2011
		2.5 hours	1	18/12/2011
Nocturnal Birds	Call playback- Powerful Owl Barking Owl Masked Owl Sooty Owl Bush Stone-curlew	?	?	09/04/2004
		?	?	17/04/2004
		45 minutes	2	16/12/2011
		45 minutes	2	17/12/2011
	Spotlighting	?	?	09/04/2004
		?	?	11/04/2004
		?	?	17/04/2004
		2 hours	2	16/17/2011
		2 hours	2	17/17/2011
Terrestrial Mammals	Trapping, Elliott size A	100 trap nights	NA	April 2004
	Trapping, cage	12 trap nights	NA	April 2004
	Habitat searches	?	?	03-17/04/2004
		1 hour	2	16/12/2011
		4 hours	2	17/12/2011
		2.5 hours	1	18/12/2011
Arboreal Mammals	Trapping, Elliott size B	36 trap nights	NA	April 2004
	Call playback- Squirrel-Glider Yellow-bellied Glider	40 minutes	2	16/12/2011
		40 minutes	2	17/12/2011
	Stagwatching	1 hour	2	16/12/2011
		1 hour	2	17/12/2011

Fauna Group	Survey Technique	Survey Effort	No of people	Date
	Spotlighting	?	?	09/04/2004
		?	?	11/04/2004
		?	?	17/04/2004
		2 hours	2	16/17/2011
		2 hours	2	17/17/2011
Microchiropteran Bats	Trapping, harp trap	4 trap nights	NA	April 2004
	Anabat II continuous recording	45 minutes x 2 occasions	NA	09/04/2004
		45 minutes x 2 occasions	NA	17/04/2004
		12 hours	NA	16-17/12/2011
		12 hours	NA	17-18/12/2011
Megachiropteran Bats	Spotlighting	?	?	09/04/2004
		?	?	11/04/2004
		?	?	17/04/2004
		2 hours	2	16/17/2011
		2 hours	2	17/17/2011

Table 2.2: Weather details from Peats Ridge weather station on and around the period of recent survey. Source: Bureau of Meteorology, 2011.

Date	Temperature (^{0}C)				Rain (mm)	Relative Humidity (%)		Wind Direction		Wind Speed (kph)	
	Min	Max	9am	3pm		9am	3pm	9am	3pm	9am	3pm
1/11/2011	11.6	18.8	15	-	0.2	80	-	S	-	4	-
2/11/2011	10.9	25.2	18	19.9	0	72	72	NW	SE	4	9
12/12/2011	15.6	16.3	16.3	16.2	35.4	98	86	S	S	4	9
13/12/2011	14	19	16	18	4.8	82	65	S	E	9	9
14/12/2011	12.7	19.2	15.9	17.6	0	79	65	S	ESE	9	4
15/12/2011	12.2	20.6	16.2	18.5	0.2	74	65	SE	E	4	4
16/11/2011	10.1	19.5	17.6	18.9	0	75	62	SE	E	4	4
17/11/2011	11	20.2	17	19.5	0	72	71	SE	E	4	4
18/11/2011	11.5	23.1	17.5	21.3	0	72	63	E	E	4	19

Table 2.3: Fauna recorded on the subject site by Keystone Ecological in this study (^{KE}) and by General Flora and Fauna in a previous survey (^{GFF}). * = introduced. Species listed under TSC Act (1995) or EPBC Act (1999) are indicated in bold.

Fauna Group	Scientific Name	Common Name	Type of Record
Amphibian	*Litoria latopalmata*	Broad-palmed Frog	Call recorded ^{GFF}
Amphibian	*Litoria verreauxii*	Verreaux's Tree Frog	Call recorded ^{GFF}
Amphibian	*Litoria fallax*	Eastern Dwarf Tree Frog	Call recorded $^{KE, GFF}$
Amphibian	*Limnodynastes peronii*	Striped Marsh Frog	Call recorded ^{GFF}
Amphibian	*Crinia signifera*	Common Eastern Froglet	Call recorded $^{KE, GFF}$
Amphibian	*Uperoleia fusca*	Dusky Toadlet	Call recorded ^{GFF}
Reptile	*Amphibolurus muricata*	Jacky Lizard	Observed ^{GFF}
Reptile	*Physignathus lesueurii*	Eastern Water Dragon	Observed $^{KE, GFF}$
Reptile	*Ctenotus robustus*	Striped Skink	Observed ^{GFF}
Reptile	*Ctenotus taeniolatus*	Copper Tailed Skink	Observed ^{GFF}
Reptile	*Egernia major*	Land Mullet	Observed ^{GFF}
Reptile	*Eulamprus quoyii*	Eastern Water Skink	Observed ^{GFF}
Reptile	*Lampropholis delicata*	Garden Skink	Observed $^{KE, GFF}$
Reptile	*Pseudechis porphyriacus*	Red-Bellied Black Snake	Shed skin ^{KE} Anecdotal $^{KE, GFF}$
Bird	*Phalacrocorax melanoleucos*	Little Pied Cormorant	Observed ^{GFF}
Bird	*Ardea pacifica*	White-necked Heron	Observed ^{KE}
Bird	*Egretta novaehollandiae*	White-faced Heron	Observed ^{GFF}
Bird	*Anas castanea*	Chestnut Teal	Observed ^{KE}
Bird	*Anas supercilliosa*	Pacific Black Duck	Observed $^{KE, GFF}$
Bird	*Chenonetta jubata*	Australian Wood Duck	Observed $^{KE, GFF}$
Bird	*Aquila audax*	Wedge-tailed Eagle	Observed ^{GFF}
Bird	*Vanellus miles*	Masked Lapwing	Observed ^{GFF}
Bird	*Leucosarcia melanoleuca*	Wonga Pigeon	Heard ^{KE} Observed $^{KE, GFF}$
Bird	*Ocyphaps lophotes*	Crested Pigeon	Observed ^{GFF}
Bird	***Callocephalon fimbriatum***	**Gang-gang Cockatoo**	**Observed** ^{GFF}
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	Observed $^{KE, GFF}$
Bird	*Platycercus eximius*	Eastern Rosella	Observed ^{GFF}
Bird	*Platycercus elegans*	Crimson Rosella	Observed ^{GFF}

Fauna Group	Scientific Name	Common Name	Type of Record
Bird	*Eudynamys scolopacea*	Common Koel	Heard[KE]
Bird	*Tyto alba*	Barn Owl	Observed [GFF]
Bird	*Aegotheles cristatus*	Australian Owlet-nightjar	Heard [GFF]
Bird	*Dacelo novaeguineae*	Laughing Kookaburra	Observed[KE, GFF]
Bird	*Hirundo neoxena*	Welcome Swallow	Observed [GFF]
Bird	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	Observed[KE, GFF]
Bird	*Coracina tenuirostris*	Cicadabird	Heard[KE]
Bird	*Rhipidura fuliginosa*	Grey Fantail	Observed[KE, GFF]
Bird	*Rhipidura leucophrys*	Willie Wagtail	Observed [GFF]
Bird	*Colluricincla harmonica*	Grey Shrike-thrush	Heard[KE] Observed[KE, GFF]
Bird	*Pachycephala pectoralis*	Golden Whistler	Heard[KE] Observed[KE, GFF]
Bird	*Pachycephala rufiventris*	Rufous Whistler	Observed [GFF]
Bird	*Eopsaltria australis*	Eastern Yellow Robin	Heard[KE] Observed[KE, GFF]
Bird	*Psophodes olivaceus*	Eastern Whipbird	Observed [GFF]
Bird	*Malurus cyaneus*	Superb Fairy-wren	Observed[KE, GFF]
Bird	*Acanthiza lineata*	Striated Thornbill	Observed [GFF]
Bird	*Acanthiza pusilla*	Brown Thornbill	Observed [GFF]
Bird	*Gerygone mouki*	Brown Gerygone	Heard[KE]
Bird	*Sericornis frontalis*	White-browed Scrubwren	Observed [GFF]
Bird	*Cormobates leucophaeus*	White-throated Treecreeper	Observed [GFF]
Bird	*Acanthorhynchus tenuirostris*	Eastern Spinebill	Observed [GFF]
Bird	*Anthochaera chrysoptera*	Little Wattlebird	Heard[KE] Observed[KE, GFF]
Bird	*Lichenostomus chrysops*	Yellow-faced Honeyeater	Heard[KE] Observed[KE, GFF]
Bird	*Myzomela sanguinolenta*	Scarlet Honeyeater	Observed [GFF]
Bird	*Manorina melanocephala*	Noisy Miner	Observed [GFF]
Bird	*Meliphaga lewinii*	Lewin's Honeyeater	Observed [GFF]
Bird	*Phylidonyris novaehollandiae*	New Holland Honeyeater	Observed [GFF]
Bird	*Dicaeum hirundinaceum*	Mistletoe Bird	Observed [GFF]
Bird	*Pardalotus punctatus*	Spotted Pardalote	Heard[KE]
Bird	*Zosterops lateralis*	Silvereye	Observed [GFF]
Bird	*Neochmia temporalis*	Red-browed Finch	Observed [KE]
Bird	*Ptilonorhynchus violaceus*	Satin Bowerbird	Observed [GFF]
Bird	*Grallina cyanoleuca*	Australian Magpie-Lark	Observed [GFF]
Bird	*Cracticus torquatus*	Grey Butcherbird	Observed [GFF]
Bird	*Gymnorhina tibicen*	Australian Magpie	Observed [GFF]
Bird	*Strepera graculina*	Pied Currawong	Observed [GFF]
Bird	*Corvus coronoides*	Australian Raven	Observed [GFF]
Mammal	*Antechinus stuartii*	Brown Antechinus	Trapped [GFF]
Mammal	*Pseudocheirus peregrinus*	Common Ringtail Possum	Observed [GFF] Dreys [GFF] Scats [GFF]
Mammal	*Petaurus breviceps*	Sugar Glider	Observed [GFF]
Mammal	*Trichosurus vulpecula*	Common Brushtail Possum	Anecdotal [GFF]

Fauna Group	Scientific Name	Common Name	Type of Record
Mammal	*Wallabia bicolor*	Swamp Wallaby	Observed [GFF]
Mammal	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	**Observed flying overhead and foraging in nearby vegetation** [GFF]
Mammal	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	Call recorded [GFF]
Mammal	***Miniopterus schreibersii oceanensis***	**Eastern Bent-wing Bat**	**Call recorded** [GFF]
Mammal	*Chalinolobus gouldii*	Gould's Wattled Bat	Call recorded [GFF]
Mammal	***Myotis macropus***	**Large-footed Myotis**	**Call recorded** [GFF]
Mammal	*Vespadelus pumilus*	Eastern Forest Bat	Call recorded [GFF]
Mammal	*Nyctophilus* sp.	Long-eared Bat unknown species	Call recorded [GFF]
Mammal	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	**Call recorded attributable to one of these three species** [KE]
Mammal	*Scotorepens orion*	Eastern Broad-nosed Bat	
Mammal	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**	
Mammal	*Rattus fuscipes*	Bush Rat	Trapped [GFF]
Mammal	*Oryctolagus cuniculus**	Rabbit	Scratchings [GFF] Scats [GFF]
Mammal	*Canis familiaris**	Dog	Observed [KE] Scats [GFF]
Mammal	*Vulpes vulpes**	European Red Fox	Observed [GFF] Scats [KE,GFF]
Mammal	*Felis catus**	Cat	Observed [GFF]

Table 2.4: Fauna species of conservation significance recorded within 10 km of subject site. E = Endangered, EPop = Endangered Population, Ext = Extinct, V = Vulnerable, Source: OEH Wildlife Atlas database, 2011

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
Amphibian	*Litoria brevipalmata*	Green-thighed Frog	V	-	Occurs in range of forested habitats where surface water gathers after rain.	Potential habitat on site. Closest record from Strickland State Forest dating from 1991. Moderate likelihood to occur. No further assessment required.
Amphibian	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	Occurs along permanent rocky streams with thick fringing vegetation of eucalypt woodlands and heaths on sandstone outcrops. Males call from low vegetation close to slow flowing pools. Eggs and tadpoles found in pools that receive extended sun; also use temporary isolated pools.	No potential habitat on or near the site or within the zone of influence. Low likelihood of occurrence. No further assessment required.
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	E	V	Inhabits marshes, dams and stream-sides.	Marginal potential habitat on the subject site and within the zone of influence. However, no records occur within the local area and the few from the broader study area date from 1967 and 1975. Low likelihood to occur.
Amphibian	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Found in heath, woodland and open forest with sandy soils. Critical habitat includes fish-free pools, with sandy soils nearby. Emerges to feed/breed after rain; travels hundreds of metres to creeks to breed.	Potential habitat occurs on site and in the zone of influence. High likelihood to occur. Further impact assessment required.
Amphibian	*Mixophyes balbus*	Stuttering Frog	E	V	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	No potential habitat on site or in the zone of influence. Low likelihood to occur. No further assessment required.
Amphibian	*Mixophyes iteratus*	Giant Barred Frog	E	E	Forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m; breed around shallow, flowing rocky streams	No potential habitat on or near the site or within the zone of influence. Low likelihood of occurrence. No further assessment required.

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
					from late spring to summer.	
Amphibian	*Pseudophryne australis*	Red-crowned Toadlet	V		Restricted to heads of periodically wet drainage lines below sandstone ridges that often have shale caps. Needs rocks and dense vegetation or litter for shelter.	Potential habitat below the site within the zone of influence. Moderate likelihood to occur. Impact assessment required by OEH.
Reptile	*Varanus rosenbergi*	Rosenberg's Goanna			Found in heath, open forest and woodland in rocky habitats; termite mounds are a critical habitat component for nesting. Shelters in hollow logs, rock crevices and in burrows.	Marginal potential habitat on or near the site or within the zone of influence. Moderate likelihood to occur. Impact assessment required by OEH.
Reptile	*Hoplocephalus bitorquatus*	Pale-headed Snake	V	-	Patchily distributed in eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest from Qld to Tuggerah and in NW NSW. Favours streamside areas, and shelters under loose bark or in tree hollows. Largely arboreal and prey includes frogs, geckoes, skinks and bats.	Potential habitat occurs on site and in the zone of influence. Moderate likelihood to occur. No further assessment required.
Reptile	*Hoplocephalus stephensii*	Stephens' Banded Snake	V	-	Found in large areas of rainforest and eucalypt forest with abundant hollows.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Bird	*Pterodroma leucoptera leucoptera*	Gould's Petrel	E	M	Terrestrial habitat confined to offshore islands.	No potential habitat on or near the site or within the zone of influence. No likelihood to occur. No further assessment required.
Bird	*Ardenna carneipes*	Flesh-footed Shearwater	V	-	Terrestrial habitat confined to Lord Howe Island.	No potential habitat on or near the site or within the zone of influence. No likelihood to occur. No further assessment required.
Bird	*Pterodroma nigripennis*	Black-winged Petrel	V	-	Terrestrial habitat confined to offshore islands, including Lord Howe Island.	No potential habitat on or near the site or within the zone of influence. No further assessment required.

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
Bird	*Botaurus poiciloptilus*	Australasian Bittern	E	E	Favours permanent freshwater wetlands, particularly with fringing vegetation.	Potential habitat on site. Closest record is from Glenworth Valley dating from 1992. Moderate likelihood to occur. No further assessment required.
Bird	*Ixobrychus flavicollis*	Black Bittern	V	-	Occurs in freshwater and estuarine wetlands.	Potential habitat on site. Closest record is from Glenworth Valley dating from 1992. Moderate likelihood to occur. No further assessment required.
Bird	*Ephippiorhynchus asiaticus*	Black-necked Stork	E	-	Inhabits permanent freshwater wetlands	Potential habitat on site. No records within the local area with the closest record being from Terrigal Lagoon. From 1997. Moderate likelihood to occur. No further assessment required.
Bird	*Pandion cristatus*	Eastern Osprey	V	-	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes	No potential habitat on or near the site or within the zone of influence. No likelihood to occur. No further assessment required.
Bird	*Hamirostra melanosternon*	Black-breasted Buzzard	V	-	Lives in a range of inland habitats, especially along timbered watercourses Central Coast record is probably a misidentification or vagrant.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Bird	*Lophoictinia isura*	Square-tailed Kite	V	-	Found in timbered habitats with a particular preference for timbered watercourses	Potential foraging habitat on site and in surrounding bushland. Moderate likelihood to occur. No further assessment required.
Bird	*Hieraaetus morphnoides*	Little Eagle	V	-	Seen over woodland and forested lands and open country, extending into the arid zone; tends to avoid rainforest and heavy forest. Nest in mature living trees in open woodland or tree-lined watercourses; rarely in isolated trees.	Potential foraging habitat on site and in surrounding bushland. Moderate likelihood to occur. No further assessment required.
Bird	*Burhinus grallarius*	Bush Stone-curlew	E	-	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. A small breeding	Potential habitat on site and in zone of influence. Closest record is from Wyoming near the old

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
					population on the Central Coast along the eastern side of Brisbane Water.	reptile park site, dating from 1993. Low likelihood to occur. No further assessment required.
Bird	*Haemotopus longirostris*	Australian Pied Oystercatcher	E	-	Favours intertidal flats of inlets and bays, open beaches and sandbanks	No potential habitat on or near the site or within the zone of influence. No likelihood to occur. No further assessment required.
Bird	*Ptilinopus superbus*	Superb Fruit-dove	V	-	Occurs in rainforest	No potential habitat on or near the site or within the zone of influence. No likelihood to occur. No further assessment required.
Bird	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	In summer, generally found in montane forests and woodlands; in winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Breeds in large and old hollow-bearing trees in forest.	Reported from site during previous survey. Further impact assessment required.
Bird	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	Breeds in large hollow-bearing trees in forest and forages on Allocasuarina species.	Potential foraging and nesting habitat on site and in the zone of influence. High likelihood of occurrence. Further impact assessment required.
Bird	*Glossopsitta pusilla*	Little Lorikeet	V	-	Mostly in dry open eucalypt forests and woodlands. Feeds on tree nectar and pollen, particularly profusely-flowering eucalypts, but also melaleucas and mistletoes and mistletoe fruit. Nomadic, movements probably related to food availability.	Potential foraging and nesting habitat on site and in the zone of influence. High likelihood of occurrence. Further impact assessment required.
Bird	*Neophema pulchella*	Turquoise Parrot	V	E	Inhabits woodlands adjoining clearings, timbered ridges and creeks in farmland. Forages on ground feeding on grass seed or low vegetation.	Potential habitat on and near the site. Only record within the broader study area is based on a call, dating from 2007. Otherwise, this species is known from the rugged bushland within the region to the west. Moderate likelihood of occurrence. No further assessment required.

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
Bird	*Lathamus discolor*	Swift Parrot	E	E	Occurs on mainland between March and October where eucalypts are flowering profusely or where there are abundant lerp infestations.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Bird	*Ninox connivens*	Barking Owl	V	-	Occurs in eucalypt woodland, open forest, swamp woodlands and timbered watercourses. Occasionally uses dense vegetation for roosting. Breeds in hollows in large old trees.	Potential foraging and roosting habitat on site and in the zone of influence. Only record within the broader study area is from Strickland State Forest to the east dating from 1985. High likelihood of occurrence. Further impact assessment required.
Bird	*Ninox strenua*	Powerful Owl	V	-	Usually roosts in dense vegetation and hunts for arboreal mammals across large home range	Potential foraging habitat on site and in zone of influence. Regularly recorded from the local area and the broader study area. High likelihood of occurrence. Further impact assessment required.
Bird	*Tyto novaehollandiae*	Masked Owl	V	-	Occurs in forests, but often hunts along forest edges such as roadsides.	Potential foraging and roosting habitat on site and in the zone of influence. Closest and most recent record within the broader study area is from Strickland State Forest to the east dating from 2009. High likelihood of occurrence. Further impact assessment required.
Bird	*Tyto tenebricosa*	Sooty Owl	V	-	Occurs in rainforest and moist eucalypt forests. Forages on arboreal mammals.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Bird	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	Mainly inhabits woodlands dominated by rough-barked eucalypts (e.g. stringybarks), usually with an open grassy understorey	Potential habitat on site and in the zone of influence. Closest records are from Jilliby SCA to the north and near Mangrove Mountain to the north west. Moderate likelihood to occur. Impact assessment required by OEH.
Bird	*Grantiella picta*	Painted Honeyeater	V	-	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A	No potential habitat on or near the site or within the zone of influence.

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
					specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	Low likelihood to occur. No further assessment required.
Bird	*Anthochaera phrygia*	Regent Honeyeater	CritE	E	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Occasionally non-breeding flocks forage in Swamp Mahogany and Spotted Gum forests on central and north coast and rarely on the south coast	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Bird	*Daphoenositta chrysoptera*	Varied Sittella	V	-	Found in eucalypt woodlands and forests, preferring rough-barked trees or mature trees with hollows or dead branches.	Potential foraging and nesting habitat on site but prefers large tracts of forest. There are a number of records from the broader study area but irregularly seen over time with the most recent being 2007. Moderate likelihood to occur. No further assessment required.
Bird	*Petroica boodang*	Scarlet Robin	V	-	Occurs in open forests and woodlands. During winter, will visit more open habitats such as grasslands, farmland and urban parks and gardens but abundant logs and coarse woody debris are important structural components of its habitat.	Potential habitat on site but rarely recorded. Only records from the broader study area date from 1986 and 1997, some distance from the subject site. Moderate likelihood to occur. Impact assessment required by OEH.
Mammal	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	Occurs in a number of forest habitats but requires large areas of relatively intact forest	Marginal potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Mammal	*Dasyurus viverrinus*	Eastern Quoll	E	-	No recent sightings of this species in NSW – may be extinct.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Mammal	*Phascolarctos cinereus*	Koala	V	-	Occurs where suitable food trees present, generally on rich open valleys.	No recognised food trees occur on site. Low likelihood to occur. No further assessment required.
Mammal	*Petaurus australis*	Yellow-bellied Glider	V	-	Favours tall mature eucalypt forest in	Potential foraging and denning habitat on

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
					areas with high rainfall and nutrient rich soils.	site. Records within the local area are recent, dating from 2002. High likelihood to occur. Further impact assessment required.
Mammal	*Petaurus norfolcensis*	Squirrel Glider	V	-	Found in forest and woodland with diverse understorey that provides forage throughout the year.	Marginal potential foraging habitat along with denning habitat on site. Closest records within the broader study area date from 1980s and 1990s. Moderate likelihood to occur. No further assessment required.
Mammal	*Cercartetus nanus*	Eastern Pygmy-possum	V	-	Mostly found in woodland and heath with dense cover of flowering plants such as Banksia, Eucalyptus and Callistemon.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Mammal	*Potorous tridactylus*	Long-nosed Potoroo	V	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is essential and sandy loam soil is common habitat feature.	Potential foraging and sheltering habitat on site. Recent records from within the broader study area in similar habitats. Moderate likelihood to occur. No further assessment required.
Mammal	*Macropus parma*	Parma Wallaby	V	-	Preferred habitat is moist eucalypt forest with dense shrubby understorey with grassy open areas nearby.	Potential habitat on site. Very rarely sighted in broader study area and then restricted to the forests to the north. Low likelihood of occurrence. No further assessment required.
Mammal	*Pteropus poliocephalus*	Grey-Headed Flying-fox	V	V	Foraging habitat in flowering eucalypts, particularly winter-flowering species; camps in dense wet forest or rainforest gullies.	Observed overhead and near site during previous survey. Further impact assessment required.
Mammal	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	-	Roosts in tree hollows, buildings or terrestrial burrows in treeless areas. Forages high over forest canopy for insects.	Potential foraging and roosting habitat on site. High likelihood to occur. Further impact assessment required.
Mammal	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	-	Occur in dry sclerophyll forest and woodland, roost in hollows and man-made structures.	Potential foraging and roosting habitat on site. High likelihood to occur.

Fauna Group	Scientific Name	Common Name	Status TSC Act (1995)	Status EPBC Act (1999)	Habitat Requirements	Suitability of Site
						Further impact assessment required.
Mammal	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	V	-	Roosts in caves and forages above canopy.	Recorded on site during previous survey. Further impact assessment required.
Mammal	*Miniopterus australis*	Little Bentwing-bat	V	-	Roosts in caves and forages beneath tree canopies.	Potential foraging habitat on site. High likelihood to occur. Further impact assessment required.
Mammal	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Roosts in caves and found mainly in areas with extensive cliffs and caves. Generally rare with a very patchy distribution in NSW. Found in well-timbered areas containing gullies.	Potential marginal foraging habitat on site and roosting habitat in nearby Strickland State Forest. Moderate likelihood to occur. No further assessment required.
Mammal	*Myotis macropus*	Large-footed Myotis	V	-	Forages over large bodies of water and roosts in hollows or under old wooden bridges.	Reported from site during previous survey. High likelihood to occur. Further impact assessment required.
Mammal	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-	Found in a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though most commonly found in tall wet forest. Roosts in tree hollows and forages over creeks and other corridors in forest.	Call of this species possibly recorded during survey. High likelihood to occur. Further impact assessment required.
Mammal	*Phoniscus papuensis*	Golden-tipped Bat	V	-	Found in rainforest and adjacent sclerophyll forest. Roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams.	No potential habitat on or near the site or within the zone of influence. Low likelihood to occur. No further assessment required.
Mammal	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	Forages and roosts in tall moist forest	Call of this species possibly recorded during survey. High likelihood to occur. Further impact assessment required.
Mammal	*Pseudomys gracilicaudatus*	Eastern Chestnut Mouse	V	-	Occurs in heathland, most common in dense, wet heath and swamps	Potential habitat below the site within the zone of influence. Moderate likelihood to occur. Impact assessment required by OEH.

Table 2.5: Fauna species of interest and their survey requirements.

Fauna Group	Species	Survey considerations (OEH 2011)	Adequacy of survey
Amphibian	*Litoria brevipalmata* Green-thighed Frog	Known to call between October to March within 3 days of heavy rains (5 mm plus in 24 hours).	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Litoria littlejohni* Littlejohn's Tree Frog	Breeding is triggered by heavy rain and can potentially occur all year, but is usually from late summer to early spring when conditions are favourable.	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Litoria aurea* Green and Golden Bell Frog	August to March; during or immediately following substantial rain in this period;	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Heleioporus australiacus* Giant Burrowing Frog	Adults difficult to detect at times other than when calling during warm weather, late spring summer and after rains; distinctive tadpoles are readily observable for lengthy periods.	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Mixophyes balbus* Stuttering Frog	Detectable in the warmer months particularly after heavy rainfall.	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Mixophyes iteratus* Giant Barred Frog	Detectable from October to May	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Amphibian	*Pseudophryne australis* Red-crowned Toadlet	After rain	Adequate – survey conducted in summer within 3 days of 40 mm of rain falling over a 2 day period.
Reptile	*Varanus rosenbergi* Rosenberg's Goanna	Detectable all year.	Adequate.
Reptile	*Hoplocephalus bitorquatus* Pale-headed Snake	Detected mid spring to mid autumn	Adequate – survey conducted in summer.
Reptile	*Hoplocephalus stephensii* Stephens' Banded Snake	Best detected mid spring to mid autumn.	Adequate – survey conducted in summer.
Bird	*Botaurus poiciloptilus* Australasian Bittern	Detectable all year but semi-nomadic.	Adequate.
Bird	*Ixobrychus flavicollis* Black Bittern	Detectable all year but semi-nomadic.	Adequate.
Bird	*Ephippiorhynchus asiaticus* Black-necked Stork	Detectable all year.	Adequate.
Bird	*Hamirostra melanosternon* Black-breasted Buzzard	Detectable all year.	Adequate.
Bird	*Lophoictinia isura* Square-tailed Kite	Detectable all year.	Adequate.
Bird	*Hieraaetus morphnoides* Little Eagle	Detectable all year.	Adequate.
Bird	*Burhinus grallarius* Bush Stone-curlew	Detectable all year but particularly in breeding season in late winter - early spring.	Adequate.
Bird	*Callocephalon fimbriatum*	No information available but easily	Adequate – recorded in

Fauna Group	Species	Survey considerations (OEH 2011)	Adequacy of survey
	Gang-gang Cockatoo	detectable when present (pers ob).	previous survey.
Bird	*Calyptorhynchus lathami* Glossy Black-Cockatoo	Detectable all year.	Adequate.
Bird	*Glossopsitta pusilla* Little Lorikeet	No information available but easily detectable when present (pers ob).	Adequate.
Bird	*Neophema pulchella* Turquoise Parrot	Detectable all year.	Adequate.
Bird	*Lathamus discolor* Swift Parrot	Mid autumn to mid winter when favoured trees are flowering.	Adequate – survey not undertaken during peak season but favoured trees do not occur on site and so unlikely to occur.
Bird	*Ninox connivens* Barking Owl	Detectable all year.	Adequate.
Bird	*Ninox strenua* Powerful Owl	Detectable all year.	Adequate.
Bird	*Tyto novaehollandiae* Masked Owl	Detectable all year.	Adequate.
Bird	*Tyto tenebricosa* Sooty Owl	Detectable all year but secretive.	Adequate.
Bird	Brown Treecreeper (eastern subspecies)	Detectable all year.	Adequate.
Bird	*Grantiella picta* Painted Honeyeater	Potentially present at any time of year.	Adequate.
Bird	*Anthochaera phrygia* Regent Honeyeater	Potentially, any time of year. Nomadic and/or possibly migratory; coastal visitor mostly March -August	Adequate.
Bird	*Daphoenositta chrysoptera* Varied Sittella	Detectable all year.	Adequate.
Bird	*Petroica boodang* Scarlet Robin	Detectable all year.	Adequate.
Mammal	*Dasyurus maculatus* Spotted-tailed Quoll	Detectable all year.	Adequate.
Mammal	*Dasyurus viverrinus* Eastern Quoll	Detectable all year.	Adequate.
Mammal	*Phascolarctos cinereus* Koala	Detectable all year.	Adequate.
Mammal	*Petaurus australis* Yellow-bellied Glider	Detectable at any time of year by call response and spotlighting.	Adequate – correct survey techniques employed.
Mammal	*Petaurus norfolcensis* Squirrel Glider	Detectable all year.	Adequate.
Mammal	*Cercartetus nanus* Eastern Pygmy-possum	Mid spring to mid autumn	Adequate.
Mammal	*Potorous tridactylus* Long-nosed Potoroo	Detectable all year.	Adequate.
Mammal	*Macropus parma* Parma Wallaby	All year.	Adequate.
Mammal	*Pteropus poliocephalus* Grey-Headed Flying-fox	Detectable when foraging habitat fruiting and/or flowering.	Adequate – detected near site in previous survey.
Mammal	*Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat	Detectable all year.	Adequate.
Mammal	*Mormopterus norfolkensis* Eastern Freetail-bat	Detectable all year.	Adequate.
Mammal	*Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat	Most detectable mid spring to mid autumn. Thought to hibernate from June to August.	Adequate – recorded in previous survey.

Fauna Group	Species	Survey considerations (OEH 2011)	Adequacy of survey
Mammal	*Miniopterus australis* Little Bentwing-bat	Most detectable mid spring to mid autumn. Thought to hibernate from June to August.	Adequate.
Mammal	*Chalinolobus dwyeri* Large-eared Pied Bat	Mid spring-mid autumn	Adequate.
Mammal	*Myotis macropus* Large-footed Myotis	Detectable all year.	Adequate – recorded in previous survey.
Mammal	*Scoteanax rueppellii* Greater Broad-nosed Bat	Most detectable mid spring to mid autumn.	Adequate – possibly recorded during this survey.
Mammal	*Phoniscus papuensis* Golden-tipped Bat	Most detectable mid spring to mid autumn.	Adequate.
Mammal	*Falsistrellus tasmaniensis* Eastern False Pipistrelle	Most detectable mid spring to mid autumn.	Adequate – possibly recorded during this survey.
Mammal	*Pseudomys gracilicaudatus* Eastern Chestnut Mouse	Detectable all year.	Adequate.

APPENDIX 3

SECTION 5A ASSESSMENTS
"7 PART TESTS"

Hibbertia procumbens

Hibbertia procumbens is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Hibbertia procumbens is a prostrate and spreading shrub that produces large sessile yellow flowers in summer (Harden and Everett 2000). Defining characters for this taxon include the length of the sepals (10-15 mm) and the number of carpels (usually 4) (Conn 2004).

It has been recorded mostly from within *Banksia ericifolia–Angophora hispida–Allocasuarina distyla* scrub/heath on skeletal sandy soils, but it may also be found associated with 'hanging swamp' vegetation communities on sandy deposits (DECC 2009). In the Gosford LGA, potential habitat for this species includes all areas mapped as Hawkesbury Banksia Scrub-Woodland (Unit E29) and all areas adjacent to Sandstone Hanging Swamps (Unit E54) (Bell 2004a).

This species was, until recently, thought only to occur near Mangrove Mountain in the central coast region (e.g. Harden and Everett 2000, Bell 2002). However, recent studies have revealed that it is far more widespread, being recorded in a band from near Mogo Creek to the west of Mangrove Creek Dam in the north west to near Wondabyne in the south east (NSW NPWS 2006). It has been recorded in four conservation reserves: Yengo, Popran and Brisbane Water National Parks and Strickland State Forest (DECC 2009).

It has been recorded from Map Unit 29 Sydney Hinterland and Exposed Scribbly Gum Woodland and Map Unit 32 Sydney Hinterland Dwarf Apple Scrub (DECC 2008). This species is more common in Victoria, where populations are concentrated in the coastal districts, and it is also known from Tasmania (Bell 2002). However, the populations outside of NSW are likely to be described as a separate species (Bell 2004a).

It is known to resprout after fire and is thought to have a persistent seed bank (DECC 2009). Threats to this species are thought to include inappropriate fire regime (particularly too frequent fire), clearing of native vegetation, weed invasion and recreational use of Crown land (DECC 2009).

This species was not recorded on the subject site. Habitat for this species on the subject site is marginal and within Map Unit 1, which equivalent to Somersby Plateau Forest *sensu* Bell (2004a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This species is a small shrub that is adapted to fire and probably some level of disturbance is required to trigger germination. The removal of a small band of potential habitat is unlikely to put a viable local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

***Response*:**

Potential habitat shall be removed in a total area of approximately 0.88 hectares. Two small patches of groundwater dependent ecosystems (hanging swamps) that occur downslope and off site may also be impacted by the drawdown of the water table for several metres over a period of 100 years.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

***Response*:**

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

***Response*:**

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

***Response*:**

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DECC 2009). Of relevance to this proposal are the following:

1. The ecological requirements of this species and its life cycle, as well as the direct risk to individual specimens/populations, should be considered in bushfire management planning and incorporated into mitigation activities. Identified potential habitat for this species should be similarly treated;
2. Research to establish the taxonomic status of the species; and
3. Modelling to predict potential habitat and survey within that to ascertain the conservation status of the species.

The proposal retains a large vegetated buffer between known populations and development and removes or disturbs a very small area of potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

REFERENCES

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Prostanthera junonis

Prostanthera junonis is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is listed as Endangered under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Prostanthera junonis is a low spreading shrub (0.1 to 0.3 metres high) with small pale mauve flowers and dull green leaves on long branches (NSW NPWS 2000a). It is an inconspicuous plant when not flowering and is very difficult to detect and identify vegetatively (NSW NPWS 2000b). Survey is not adequate for this species unless it is conducted during its peak flowering period (October to mid-December), although it is known to flower sporadically in other seasons (NSW NPWS 2000c).

Known populations of this species are extremely limited, occurring in approximately 42 hectares across approximately 50 square kilometres on the Somersby Plateau of the central coast of New South Wales (NSW Scientific Committee no date), an area characterised by the Somersby and Sydney Town soil landscapes (NSW NPWS 2000a). In such soil landscapes it occurs on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub (DECC 2009). It occurs in both disturbed and undisturbed sites (DECC 2009).

Habitat types are broadly classified as open forest, low woodland and open scrub (NSW NPWS 2000a). This species has been recorded from sites which have not been burnt for a number of years, albeit in low numbers (NSW NPWS 2000). While mature plants appear to be incapable of resprouting after fire, it may trigger seed germination (DECC 2009).

This species was not recorded on the subject site. Potential habitat for this species occurs on the subject site in the Somersby Plateau Forest: Map Units 1, 2 and 3.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

It should be assumed that any population is viable regardless of its size until further assessment indicates otherwise (NSW NPWS 2000c). The loss of the viability of a local population will have a significant impact on the species (NSW NPWS 2000c).

The life cycle of this species is likely to be disrupted should significant habitat loss or degradation occur. Buffer zones of 20-50 metres are considered likely to be adequate to ameliorate direct and indirect impacts of clearing adjacent to known populations.

Fire is also a very important life cycle trigger as it is reportedly killed by fire although its exact fire response is still unknown.

Soil erosion and siltation as a consequence of adjacent development are two specific processes that are likely to disrupt the life cycle of this species through disturbance to the soil seed bank by increased run off and other forms of disturbance which remove and/or frequently disturb the soil (e.g. track construction, vegetation clearance) may also negatively impact on the seed bank.

The reproductive ecology of this species is largely unknown, but if a pollen vector was unable to travel within and between populations due to increased fragmentation, then this would threaten the viability of a local population.

Important life cycle triggers are likely to be associated with fire and fire will be excluded from the post-development landscape. Thus the potential habitat remaining on site will become less suitable

over time. It is unlikely that the adverse management of potential habitat will place a local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

***Response*:**

Potential habitat shall be removed in a total area of approximately 0.88 hectares. Two small patches of groundwater dependent ecosystems (hanging swamps) that occur downslope and off site may also be impacted by the drawdown of the water table for several metres over a period of 100 years.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

***Response*:**

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

***Response*:**

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

***Response*:**

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DECC 2009). Of relevance to this proposal are the following:

1. Reinstate an appropriate fire regime (either prevent frequent fire or undertake ecological burns as appropriate);
2. Undertake targeted searches for the species in known or potential habitat during its flowering period prior to any development or clearing activities;
3. Install stormwater control mechanisms to prevent runoff from development upslope of populations;
4. Limit access to populations through fencing/signage;
5. Undertake weed control as required using removal methods that will not impact on the species (hand pull or cut and paint weeds);
6. Protect and actively manage populations on private land through covenants, fencing and the preparation of site-specific vegetation management plans;
7. Improve vegetative connectivity within and between areas of known and potential habitat through revegetation/regeneration programs; and
8. Monitor population health and numbers for any changes.

The proposal will not alter the current fire regime in the local area and this survey and assessment process also serves these recovery strategies. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

REFERENCES

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

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Hawkins, C.A., Haddad, N.I., Scott, L.A., Morrison, J.A., Catt, C.B.J. and Daines, D.G. (1984) A study of regional lands on the Hunter Plateau in relation to regional planning. Department of Agriculture, Sydney. Unpublished Report

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NSW National Parks and Wildlife Service (2000a) Threatened Species Information – *Prostanthera junonis*

NSW National Parks and Wildlife Service (2000b) Somersby Mintbush *Prostanthera junonis* Recovery Plan

NSW National Parks and Wildlife Service (2000c) Environmental Impact Assessment Guidelines - *Prostanthera junonis*

NSW National Parks and Wildlife Service (2002) Threatened Species of the Upper North Coast of New South Wales - Flora. NSW National Parks and Wildlife Service Northern Directorate, Coffs Harbour

NSW Scientific Committee (No Date) *Prostanthera junonis* – Endangered Species Listing. Final Determination

Tierney, D.A. (1994) The reproductive ecology and rarity of *Prostanthera* sp. Somersby. Unpublished report, Diploma of Natural Resources, University of New England

Tetratheca glandulosa

Tetratheca glandulosa is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999). The listing under this latter act is currently under review.

Tetratheca glandulosa is a spreading shrub usually to 20 centimetres high, with alternate leaves or leaves in whorls of three to four (Gardner and Murray 1992). The flower stalk and sepals are covered with red glandular hairs, which distinguishes this from other *Tetratheca* species (DECCW 2010).

This species has a distribution from Sampsons Pass (Yengo National Park) in the north, East Kurrajong in the west, east to Ingleside and south to West Pymble (Lane Cove National Park) (Gardner and Murray 1992, NSW NPWS 2000, DECCW 2010).

Tetratheca glandulosa is strongly associated with areas of shale-sandstone transition habitat (NSW NPWS 2000), particularly in sandy or rocky heath or scrub (Gardner and Murray 1992, Fairley 2004). Associated soil landscapes are Lucas Heights, Gymea, Lambert and Faulconbridge (DECCW 2010).

Topographically, this species occurs on ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches (NSW NPWS 2000, DECCW 2010). Soils are generally shallow, yellow, clayey / sandy loam and stony lateritic fragments are also common in the soil profile (DECCW 2010).

In the Gosford LGA potential habitat exists across a wide area in the Exposed Hawkesbury Woodland complex (Unit E26) (Bell 2004a).

The reported flowering period covers most of the year: July to November (Gardner and Murray 1992), July to January (Fairley 2004), March–December with a peak August–November (Benson and McDougall 2001), July-November with residual flowers persisting until late December (DECCW 2010). Therefore, it is likely that this species may be found flowering at most times of the year, depending on local conditions, with a spring-summer flush.

Population dynamics of this species are poorly known, but juveniles appear to be uncommon within any given population, with the majority of plants usually consisting of resprouting adults (DECCW 2010). It has been observed to resprout after fire (Benson and McDougall 2001) and subsequent field observations indicate that it is likely to be clonal (DECCW 2010). The post-fire environment may trigger germination as exposure of the seeds of a closely-related species *T. hirsuta* to cold smoke or smoked water promoted germination (DECCW 2010).

A recent comprehensive vegetation survey has been conducted by the then Department of Environment and Climate Change and covered more than 240,000 hectares of rugged bushland. This study area included Yengo National Park, Parr State Conservation Area and the adjoining private lands east of the Putty Road. The resultant report (DECC 2008) provides classification and mapping of the vegetation types in the study area as well as commentary on the conservation status of important species and communities, including this species.

Tetratheca glandulosa has been recorded from Map Unit 17 Sydney Hinterland Peppermint – Apple Forest, Map Unit 18 Sydney Hinterland Sheltered Turpentine – Apple Forest, Map Unit 21 Sydney Hinterland Bloodwood-Mahogany Transition Forest, Map Unit 22 Sydney Hinterland Exposed Red Bloodwood-Stringybark Forest, Map Unit 29 Sydney Hinterland Exposed Scribbly Gum Woodland and Map Unit 30 Sydney Hinterland Rocky Yellow Bloodwood Woodland (DECC 2008) and E26d Somersby Plateau Forest (Bell 2004a and 2004b).

This species was not recorded on the subject site during survey. Potential habitat occurs in the natural vegetation in the E26d Somersby Plateau Forest.

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

Response:

An important trigger of life cycle stages for this species appears to be fire and its related characteristics. The suppression of wildfire near the developed areas has always been an aim of management of the site. The level of disruption to the life cycle of this species by this fire management regime shall not change with the advent of the new development.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that it's local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DECCW 2010). Of relevance to this proposal are the following:

1. Provide sufficient vegetative buffers to prevent habitat degradation and maintain habitat connectivity;
2. Minimise habitat loss, particularly within large populations and those at the edge of the species range;
3. Maintain and improve habitat connectivity within and among populations;
4. Restore degraded habitat using bush regeneration techniques; and
5. Minimise and/or prevent factors which promote habitat degradation (e.g. large edge-area ratios, urban / agricultural runoff and storm water, unrestricted access etc).

The proposal retains a large vegetated buffer between known populations and development and removes or disturbs a very small area of potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

References

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glandulosa

NSW National Parks and Wildlife Service (2002) Threatened Species of the Upper North Coast of New South Wales - Flora. NSW National Parks and Wildlife Service Northern Directorate, Coffs Harbour

Darwinia glaucophylla

Darwinia glaucophylla is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Darwinia glaucophylla is a spreading, prostrate shrub with ascending branchlets to 15 centimetres high (Wilson 1991). This species flowers from winter to spring (Wilson 1991).

It is confined to the Gosford district, where it grows in heath or woodlands often associated with sandstone on friable shallow soils (Wilson 1991), particularly rock platforms (NSW Scientific Committee 2002). It is also known from areas near hanging swamps (DECC 2009). This species has been recorded known from only 15 sites, several of which are within or near Brisbane Water National Park; one is known from within Popran National Park (DECC 2009).

Associated species in scrub habitats include *Banksia ericifolia*, *Acacia terminalis*, *Acacia oxycedrus*, *Angophora hispida*, *Hakea teretifolia*, *Bauera rubioides*; in woodland habitat it is associated with *Corymbia gummifera* Red Bloodwood, *Corymbia eximia* Yellow Bloodwood, *Eucalyptus haemastoma* Scribbly Gum and *Eucalyptus punctata* Grey Gum.

The species is killed by fire and population numbers may fluctuate in relation to time since the last fire (NSW Scientific Committee No Date). Germination is unlikely in the absence of fire but it is highly sensitive to too frequent or infrequent fire (DECC 2009). The recommended fire interval is 5 to 10 years (DECC 2009). Like most *Darwinia* species, seed is dispersed by ants (DECC 2009).

Hybrids occur with *Darwinia fascicularis* but these are readily identifiable by their erect habit (NSW Scientific Committee 2002).

This species was not recorded on the subject site. Potential habitat for this species occurs on the subject site in the Somersby Plateau Forest.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

An important trigger of life cycle stages for this species appears to be fire and its related characteristics. The suppression of wildfire near the developed areas has always been an aim of management of the site. The level of disruption to the life cycle of this species by this fire management regime shall not change with the advent of the new development.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DEC 2007). Of relevance to this proposal are the following:

1. Appropriate fire management - recommended fire interval of 5-10 years;
2. Implement sediment control programs;
3. Prepare and implement guidelines for maintenance of trails and tracks to minimise disturbance to habitat;
4. Restrict and control access, especially vehicles;
5. Protect areas of habitat from clearing and further fragmentation; and
6. Restore degraded habitat using bush regeneration techniques.

The proposal retains a large vegetated buffer between known populations and development and removes or disturbs a very small area of potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

REFERENCES

NSW National Parks and Wildlife Service (2000) Threatened Species of the Lower North Coast of New South Wales. NSW National Parks and Wildlife Service Northern Directorate, Coffs Harbour

NSW National Parks and Wildlife Service (2002) Threatened Species of the Upper North Coast of New South Wales - Flora. NSW National Parks and Wildlife Service Northern Directorate, Coffs Harbour

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Wilson, P. G. (1991) *Darwinia* In: Harden, G. J. (Ed) (1991) Flora of New South Wales. Volume 2. University of New South Wales Press, Sydney

Grevillea shiressii

Grevillea shiressii is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Grevillea shiressii is a tall spreading shrub up to 5 metres tall with unusual blue-grey flowers that turn a translucent cream over time, with pink-mauve styles (Fairley 2004). This species is known only from two populations in on the northern side of the Hawkesbury River – along the banks of Mooney Mooney Creek and Mullet Creek near Wondabyne (OEH 2012). Both of these populations are within Brisbane Water National Park.

The vegetation of these areas consists of tall moist eucalypt forest on alluvium, dominated by *Eucalyptus deanei* (Fairley 2004). It is a fire sensitive obligate seeder (OEH 2012) and this, along with its highly restricted distribution, makes it susceptible to local extinction with an inappropriate fire regime.

This species was recorded as three individuals near the site's northern boundary along the edge of an adjacent garden. This species is popular in horticulture and these individuals are almost certainly planted. Suitable natural habitat does not occur on site for this species, being adapted to moist riparian zones, not exposed high plateaux.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

The life cycle of this species is likely to be driven by fire. Implementation of the proposal is unlikely to alter the fire regime experienced by the area supporting these three shrubs. There is no evidence to suggest that these three shrubs outside of their preferred habitat represents a viable local population.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Although the area within which this species has been recorded on site is unsuitable natural habitat, it is within an area to be retained and will be buffered from the development activities.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Response:

The development will remove a narrow band of vegetation along the interface between the existing quarry the remnant vegetation. This is not within the realised habitat or known preferred natural habitat of this species. The extent of bushland in the local area will remain essentially unchanged.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Response:

The vegetation to be removed does not represent the natural preferred habitat of this species.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

There has been no critical habitat declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a recovery strategy has been identified: "Continued habitat protection" (OEH 2012).

The proposal retains the area within which this species was recorded. It also retains a large vegetated buffer between them and development and removes or disturbs a very small area of vegetation that does not represent suitable potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with this recovery strategy.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

REFERENCES

Fairley, A. (2004) *Seldom Seen - Rare Plants of Greater Sydney.* Reed New Holland:Sydney

***Heleioporus australiacus* Giant Burrowing Frog**

The Giant Burrowing Frog is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Giant Burrowing Frog is a large warty brown frog with pale spots on the sides and a pale belly (Cogger 2000). Breeding males often have black spines on the backs of the fingers and they breed during summer and autumn (Robinson 1993).

This species appears to have a disjunct distribution, with the northern population restricted to sandstone geology from the southern end of Olney State Forest to Jervis Bay, and a southern population occurring in pockets from Narooma to eastern Victoria (NSW NPWS 2001, DEH 2006). Penman et al. (2004) consider the northern population to be well represented in the Sydney Basin Bioregion's reserve system.

The northern population generally occurs in sandstone ridgetop habitat and broad upland valleys, where they are associated with small headwater creeklines and intermittent drainages (NSW NPWS 2001). On the Central Coast, they are known particularly to occur in hanging swamps on sandstone shelves and beside perennial creeks (DEH 2006). They have also been recorded from disturbed habitats such as fire dams and naturalised detention basins. A new population was recently found in Bargo State Conservation Area, a significant westerly extension from the Woronora Plateau (DECC 2007).

Giant Burrowing Frogs are found in sandy creek banks (Robinson 1993), where they are often associated with crayfish burrows (Barker et al. 1995). These frogs also excavate their own burrows and use them for shelter, aestivation and calling for mates (NSW NPWS 2001). Breeding occurs within burrows and the eggs are flushed from them into associated ephemeral pools (e.g. small soaks formed in eroded sandstone drainage lines) (NSW NPWS 2001) and is rarely associated with permanent ponds or streams (Mahony 1993).

Recent study in the areas to the south of Sydney have determined that this species is associated with upland swamps, with critical habitat features being the presence of small pools that are free of fish (particularly *Gambusia*) and nearby sandy areas for burrowing (DECC 2007).

This species was identified in a large number of locations across Yengo National Park in both breeding and non-breeding sites, but particularly in Parr State Conservation Area (DECC 2008). Breeding habitat occurs particularly near the shallow headwaters of minor drainage channels where sandy soils have accumulated, or on larger creek lines with alluvial sand and rocky pools (DECC 2008).

Individuals may disperse over dry sandstone ridges through eucalypt forest (Webb 1983, 1987, 1991) and adults were also sighted dispersing across ridgetop habitat after heavy rain in the Yengo study (DECC 2008). This habitat is common across the reserves and so a large proportion of the reserves provide this potential habitat.

The populations in the large reserves of Yengo National Park and Parr State Recreation Area are considered to be very important for the regional conservation of this species but there are no specific management actions required, as it is widespread and thought to be relatively secure (DECC 2008).

No specimens have been recorded from cleared lands and the species appears to be dependent on areas with native vegetation (DEH 2006). Many adults and tadpoles were detected after severe wildfires in 2001 on the Woronora Plateau, indicating that they can survive such events (DECC 2007).

This species was not recorded on the subject site during survey for calling adults or tadpoles. Potential dispersal habitat occurs within the forest and woodland and off site swamp vegetation may provide potential breeding sites.

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

Response:

The development area and adjacent bushland provides potential dispersal habitat for this species. Its nature will remain essentially unchanged for this function and so the proposal will not disrupt this life cycle stage of the species. The closest off site swamp habitat may become drier over a long period of time if the modelled water table drawdown occurs and so these two small patches will become less suitable for this species. However, there are many other alternative patches of habitat and the likelihood of this drawdown is unknown.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares. Two small patches of groundwater dependent ecosystems (hanging swamps) that occur downslope and off site may also be impacted by the drawdown of the water table for several metres over a period of 100 years.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified for this species (OEH 2011). Relevant among these are:

1. Where bush fire hazard reduction is necessary, apply mosaic, low frequency, low intensity burns;
2. Apply post-harvest burns only when habitat assessment have been carried out;
3. Retain native vegetation and minimise ground disturbance where the species occurs; and
4. Protect breeding sites from disturbance, sedimentation and pollution.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Pseudophryne australis* Red-crowned Toadlet**

The Red-crowned Toadlet is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Red-crowned Toadlet is a small, darkly coloured frog with scattered red flecks on the body and white patches on the base of each limb (Robinson 1993). 'Red-crowned' refers to the red or orange T-shaped patch on the top of the head, linking the eyes and the nose (Barker et al. 1995).

This species has a distribution defined by the Hawkesbury Sandstone geology of the Sydney Basin Bioregion where records are distributed in a belt around, but not on the Cumberland Plain (NSW Scientific Committee 2002). It is found from Pokolbin State Forest in the north to the Nowra area in the south, and Mt Victoria in the west (NSW NPWS 2001a). Most sites are on fairly low coastal ranges under 200 metres in elevation (NSW NPWS 2001a).

Individuals of this species are found below sandstone ridges, generally where shale lenses are weathering at the base of cliff lines (NSW Scientific Committee 2002) and is usually within about 100 metres of the ridge top (NSW NPWS 2001b). Favoured microhabitats for sheltering sites include under flat sandstone rocks (either resting on bare rock or damp loamy soils), under logs on soil, beneath thick ground litter and in horizontal rock crevices near the ground.

Red-crowned Toadlets are not usually found along permanent flowing water courses, instead preferring permanently moist soaks or areas of dense ground vegetation or litter along or near headwater stream beds. These drainage systems are adjacent to ridges and channel water from the ridges, benches, cliffs and talus slopes to the perennial streams in the gullies below (NSW NPWS 2001b). Such watercourses are dry or reduced to scattered shallow pools or ponds for much of the year, and have sustained flow for only a few weeks following thunderstorms. Under natural conditions these feeder creeks have high water quality and low nutrient loads (NSW NPWS 2001).

The Red-crowned Toadlet is relatively long-lived (8-10 years) and able to withstand prolonged periods of drought through its nocturnal, semi-fossorial lifestyle and use of moist microhabitat refugia (NSW NPWS 2001a). They deposit their eggs in terrestrial nests beneath rocks and logs or in leaf litter, relying on rainfall to wash partially developed tadpoles into ephemeral creeks for completion of the reproductive cycle (NSW Scientific Committee 2002). The timing of follow up rain events and the duration of temporary pools is critical to reproductive success. Many clutches are lost when the shallow pools dry up too quickly and therefore recruitment is usually in low numbers (NSW NPWS 2001a).

This specialised terrestrial reproductive strategy and reliance on ephemeral water flow means that it may be particularly vulnerable to activities that impact on hydrology or water quality (NSW NPWS 2001b). Red-crowned Toadlets have not been recorded breeding in permanently flowing streams or waters that are even mildly polluted (NSW NPWS 2001a).

When not breeding, Red-crowned Toadlets are thought to disperse across its sandstone habitat, and many individuals have been observed sheltering under cover that would be unsuitable for egg-laying. However, it is likely that such 'dispersion' is only in the order of a few tens of metres from suitable breeding areas and so are quite localized, largely restricted to the immediate vicinity of suitable breeding habitat (NSW NPWS 2001a).

Frogs have been recorded calling in all months of the year, including winter. Although its call can be heard all year round (DECCW 2009), the best time to search for them is between late August to early May (NSW NPWS 2001b). Eggs have been found in all months (NSW NPWS 2001a).

They will call in response to unusual noises such as clapping, although this technique is not always successful and may sometimes actually cause call suppression. Broadcasting their call may elicit a response call but at times it too may also have the reverse effect of silencing individuals (NSW NPWS

2001b). Survey for this species should also include active searching of suitable microhabitat.

Recognised threats to the survival of this species include high frequency fire, removal of bush rock, loss of habitat through development of ridges, disease, water pollution and changed hydrological regimes (DECCW 2009). Thumm (1997) has suggested that Red-crowned Toadlet habitat should not be subjected to planned fire frequencies of greater than once in a 10 year cycle because of its potential impact on the availability and moisture of leaf litter (NSW NPWS 2001b).

This species was not recorded on or near the subject site despite survey despite being undertaken during warm late afternoons / early evenings after good rain in summer. Potential habitat occurs downslope from the site in the head of the gully that eventually feeds into Narara Creek.

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

Response:

This species is particularly vulnerable to changes in hydrology or water quality (NSW NPWS 2001a). They do not breed in pools that are outside of the pH range of 5.5 to 6.5, in creeks that are even mildly polluted and or in permanently flowing streams. Cover provided by rocks, leaf litter or rocky crevices are essential and so activities that interfere with this cover (including bushfire) can severely impact on this species (NSW NPWS 2001a). As this species occurs in small and discrete colonies, a localized impact in favoured breeding or refuge habitat can have a significant impact on a local population (NSW NPWS 2001a).

The condition of the small drainage line gully that occurs off site and downslope will not be altered by the proposal as the activities will remain the same. Sedimentation, erosion, effluent and stormwater controls will continue to contribute to protection of this potential habitat. Therefore it is concluded that the proposal will not disrupt the life cycle of this species such that it threatens a viable local population.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that it's local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

There will be no alteration to the potential habitat near the site.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

The potential habitat for this species will not be fragmented or isolated by the works.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat near the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery actions have been identified (DECCW 2009). Relevant amongst them are:

1. Apply mosaic pattern hazard reduction techniques;
2. Do not remove sandstone rock from bushland in escarpment areas;
3. Retain and protect habitat and buffers around habitat, particularly vegetation on upper slopes and ridges; and
4. Protect water quality and maintain natural water flows in drainage lines below developed ridges.

The proposal retains a large vegetated buffer between known populations and development and removes or disturbs a very small area of potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes “Clearing of Native Vegetation” and “Removal of Hollow-bearing Trees”.

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***Varanus rosenbergi* Rosenberg's Goanna**

The Rosenberg's Goanna is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Rosenberg's Goanna grows to about one metre in total length (Cogger 2000). It is a dark greyish colour with black crossbands, and is finely spotted in yellow or white (Swan et al. 2004). This species has a distribution from the far south of Western and Southern Australia, with isolated populations in Victoria and coastal New South Wales (Cogger 2000).

It inhabits coastal heaths, humid woodlands and wet and dry sclerophyll forests (Cogger 2000) and appears to prefer areas with sandy soils, presumably as they are suitable for burrowing (Wilson and Knowles 1988). It is generally a terrestrial species, finding shelter in logs and rock crevices (Cogger 2000). Eggs are laid from November to February (Wilson and Knowles 1988), in a burrow excavated into the base of a termite mound (Swan 1990). Termite mounds are a critical habitat component (DECCW 2010).

It has been recorded from a number of conservation reserves across NSW including Yengo, Wollemi, Ku-ring-gai Chase, Blue Mountains, Dharug, Popran, Royal, Heathcote, Kanangra Boyd, Abercrombie River and Kosciuszko National Parks, Garawarra State recreation Area and Berowra Valley Regional Park (NPWS 2005).

The vertebrate fauna of the large sandstone-based reserves around the Sydney fringe are relatively poorly known and so DECCCW has recently undertaken targeted and systematic survey of priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

This species was identified in nine widely spaced locations across that study area as well as in a number of locations in neighbouring Wollemi and Dharug National Parks (DECC 2008). Its preferred habitat of rocky ridges and slopes is common and this species is moderately well represented in conservation reserves around the Sydney Basin; no immediate management actions are required for this species in the Yengo National Park area (DECC 2008).

This species was not recorded on the subject site. Marginal potential habitat for this species occurs in the forested vegetation, but there is no suitable outcropping of rock and no termite mounds. Large hollows may provide potential shelter sites.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This species was not observed on the subject site and the closest records are almost 10 kilometres away in the Holgate area (1998) and in Brisbane Water National Park near Kariong (2004). Habitat features critical to the life cycle of this species (such as breeding sites) do not occur on site The proposed works are unlikely to place a local viable population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Marginal potential forging habitat and sheltering sites will be removed across 0.88 hectares of vegetation.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery

strategies have been identified (DECCW 2010). Of relevance are the following:

1. Keep cats indoors and restrain dogs in and adjacent to areas where this species occurs; desex domestic cats and dogs;
2. Assess the appropriateness of cat and dog ownership in new subdivisions;
3. Do not fragment known habitat with clearing, roads or other development;
4. Search for the species in suitable habitat in areas that are proposed for development or management actions;
5. Retain all termite mounds and fallen timber in areas that support this species;
6. Retain and protect heath, woodland and forest remnants within the known distribution of the species;
7. Ensure remnant populations remain connected or linked to each other; in cases where remnants have lost connective links, re-establish links by revegetating sites to act as stepping stones for dispersal;
8. To reduce roadkills, new roads or road upgrades in areas supporting habitat should have elevated sections constructed (to facilitate goannas passing underneath); and
9. Mark sites onto maps or plans.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Callocephalon fimbriatum* Gang-gang Cockatoo**

The Gang-gang Cockatoo is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). The population of this species in the Hornsby and Ku-ring-gai Local Government Areas has been listed as an Endangered Population (NSW Scientific Committee 2001). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Gang-gang Cockatoo is a medium-sized slaty grey cockatoo. Both sexes have a crest and the head of the male is scarlet (Simpson and Day 1996). It is distributed from southern Victoria through eastern parts of New South Wales northward to the Hunter region, although isolated records are known from as far north as Coffs Harbour (NSW Scientific Committee 2005).

This species exhibits seasonal movements. In summer, it occupies the tall montane forests and woodland, particularly in heavily timbered and mature wet sclerophyll forests. In winter, it may occur at lower altitudes in drier more open eucalypt forests and woodlands and is often found in urban areas (DECCW 2010) although such areas probably may be those with significant bushland nearby as it is also reportedly scarcely seen in the urban areas of Sydney and Wollongong (DECC 2008). They are also known to undertake nomadic as well as seasonal movements.

Gang-gang Cockatoos feed mainly on seeds of native and introduced trees and shrubs, with a preference for eucalypts, wattles and introduced hawthorns. They will also eat berries, fruits, nuts and insects and their larvae. Outside of the breeding season they will feed in flocks of up to 60 birds. By contrast they feed in pairs or small family groups during the breeding season (Australian Museum 2005).

Birds usually do not breed until aged four years. Breeding occurs between October and January, and they nest in hollows in the trunks or large limbs of large trees (Gibbons 1999, Gibbons and Lindenmayer 2000), usually in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water (Beruldsen 1980).

This species has declined in distribution and abundance between 1977 and 2001 (NSW Scientific Committee 2005). The causes of this apparent decline are unclear, but may include loss of breeding sites through the clearing of habitat, combined with their late onset of sexual maturity. Disease may also be implicated as they are susceptible to Psittacine cirovirus disease (NSW Scientific Committee 2005).

The population that persists in the Hornsby and Ku-ring-gai Local Government Areas, bounded by Beecroft – Cheltenham in the west, Epping – North Epping in the south, Turramurra – South Turramurra in the east, and Thornleigh – Wahroonga to the north, has been listed as an Endangered Population (NSW Scientific Committee 2001). It is estimated to be between 18 and 40 pairs and birds have been breeding since at least 1994. They show strong nest site fidelity to the large old trees in which they have been observed breeding (NSW Scientific Committee 2001).

The vertebrate fauna of the large sandstone-based reserves around the Sydney fringe are relatively poorly known and so DECCCW has recently undertaken targeted and systematic survey of priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

It was regularly recorded during that survey throughout the year, indicating that the Yengo and Parr areas provide habitat for this species all year round (DECC 2008). As the species is widespread across the sandstone reserves of the Sydney Basin, it is currently considered to be relatively secure in the region (DECC 2008). No specific management actions are required for this species in this area (DECC 2008).

Based on a similar survey protocol in the Greater Southern Sydney Region, this species is also

considered to be a common resident with a stable population in that region (DECC 2007).

This species was recorded on the subject site during previous survey. The subject site contains potential foraging habitat for this species in the native flowering trees and potential nesting sites in the tree hollows present.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Habitat features critical to the life cycle of this species include breeding sites in large tree hollows. A small number of hollow-bearing trees may need to be removed, but this species is not known to nest in that area. Potential foraging resources will be removed. However, given the expanse of available habitat in the local area, this is not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

The population that persists in the Hornsby and Ku-ring-gai Local Government Areas has been listed as an Endangered Population (NSW Scientific Committee 2001). However, this population does not coincide with the Gosford LGA.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares along with 5 or 6 hollow-bearing trees.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery actions have been identified for this species (DECCW 2010). Relevant among them are:

1. Develop fire management options within forested habitat areas that give priority to minimising loss of habitat trees;
2. Provide supplementary hollows/nest boxes within the primary habitat areas;
3. Develop a strategy that includes street tree or other planting, browse plant species within reserves and private residences;
4. Monitor utilisation of the relevant forested areas as to nesting, foraging and other habitat uses; and
5. Investigate movement patterns within and between areas occupied by individuals from the population

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Calyptorhynchus lathami* Glossy Black-Cockatoo**

The Glossy Black-Cockatoo is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). A population of this species in the Riverina has been listed as an Endangered Population (NSW Scientific Committee 1999) due to considerable pressure form a number of identified threats. This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Glossy Black-Cockatoo is the smallest of the black cockatoo species in Australia. This species is usually seen in pairs or sometimes with a single young. It breeds in autumn and winter and requires large hollows for nesting.

It is reported to prefer dry forest types in intact, less rugged landscapes (NSW NPWS 1999) and is distributed mainly along the eastern half of NSW and the south eastern corner of Queensland (Slater et al. 1995). In NSW, this species is recorded in highest densities to the east of the Great Dividing range, however scattered records exist as far west as the Riverina and Pilliga Scrub (Garnett and Crowley 2000).

The vertebrate fauna of the large sandstone-based reserves around the Sydney fringe are relatively poorly known and so DECCCW has recently undertaken targeted and systematic survey of priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

The southern Yengo and Parr reserves provide an extensive area of high quality habitat for this species and appears to support greater numbers than in the northern part of Yengo National Park (DECC 2008, DEC 2005).

It is a highly specialised feeder, requiring cones from specific *Allocasuarina* and *Casuarina* species (Garnett and Crowley 2000) and so impacts on these food resources (such as from inappropriate fire regimes) may threaten this species. However this species is well protected across the sandstone environments of the Sydney Basin and no management actions are recommended within the Yengo and Parr areas (DECC 2008).

This species was not recorded on the subject site. Marginal potential foraging habitat for this species occurs in the few *Allocasuarina* trees observed and the hollow-bearing trees provide potential nesting sites.

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

Response:

Critical habitat features for this species include foraging resources and breeding hollows. A relatively small area of foraging habitat will be disrupted, and 5 or 6 hollow trees will be removed but these are not known to provide nesting sites for this species. It is judged that the proposal is unlikely to significantly disrupt the life cycle of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

An Endangered population of this species has been listed for the Riverina Local Government Area. This does not coincide with the Gosford Local Government Area.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that it's local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares and 5 or 6 hollow-bearing trees will be removed. However, only the biggest of the hollows is a potential nesting site for this species.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified for this species (DECCW 2010). Relevant among them are:

1. Reduce the impact of burning to retain diverse understorey species and in particular to permit the regeneration of She-oaks;
2. Protect existing and future hollow-bearing trees for nest sites;
3. Retain and protect areas of native forest and woodland containing She-oaks;
4. Establish forested corridors linking remnant areas of habitat; and
5. Include local She-oak species in bush revegetation works.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Glossopsitta pusilla* Little Lorikeet**

The Little Lorikeet is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Little Lorikeet is the smallest of the Lorikeets, with a black bill, bright green body and red forehead and throat (Pizzey and Knight 1997). It may be confused with other small lorikeets such as the Purple-crowned Lorikeet, but makes a distinctively lower-pitched and buzzing call in flight (Higgins 1999).

It is known from coast and south eastern Australia from near Cairns in far north Queensland to Adelaide (Pizzey and Knight 1997). In New South Wales it occurs in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett *et al.* 2003). They occur mostly in dry open eucalypt forests and woodlands in old growth and logged forest as well as in remnant patches and roadside vegetation (NSW Scientific Committee 2009).

This species is generally considered to be nomadic, moving in response to flowering eucalypts (NSW Scientific Committee 2009). A long term study of a population on the north western slopes revealed that they are resident from April to December and may return to the nest area if some trees are flowering in the vicinity (Courtney and Debus 2006).

They usually forage in the tree canopies in small flocks and sometimes in the company of other lorikeet species (Readers Digest 2002). Profusely-flowering eucalypts are favoured, such as box species on the slopes and tablelands (Courtney and Debus 2006) and in *Eucalyptus robusta* Swamp Mahogany and *Eucalyptus pilularis* Blackbutt on the Central Coast (pers obs). Blossom of other trees are also used (e.g. *Melaleuca* species) and the fruits of mistletoes are also sometimes eaten (NSW Scientific Committee 2009).

This species is an obligate hollow nester (Gibbons and Lindenmayer 2002) that are usually located high in the trees (Pizzey 1980) but sometimes as low as 2 metres (Courtney and Debus 2006) in living smooth-barked eucalypts. The entrances to these nests are small (approximately 3 centimetres in diameter) and are kept open by the lorikeets chewing at the growing bark (NSW Scientific Committee 2009). Hollows are known to be used continuously, with one used for at least 29 years (Courtney and Debus 2006). The breeding season extends from May to September (Higgins 1999) or July to January with a peak in October (Barrett et al. 2003).

Population trends are uncertain with evidence of decline in part of its range (e.g. in South Australia, south west slopes and south coast of NSW) (NSW Scientific Committee 2009) but there appeared to be a small increase across NSW according to latest Bird Atlas (Barrett et al. 2003). The NSW Scientific Committee (2009) considers that the data indicate a moderate state-wide reduction in population size over the past 15 years or three generation lengths, a time frame equivalent to the life cycle of the species. Also, there are many examples of bird species that are threatened nationally whose initial decline was first apparent in South Australia (Horton and Black 2006).

Threats to this species include loss of breeding sites and foraging resources due to land clearing which is particularly relevant in the western districts where road-widening has removed important patches of remnant woodland (NSW Scientific Committee 2009). Observations of 50 nest hollows over 43 years noted a 40% loss (the majority caused by humans) without a commensurate rate of hollow replacement (Courtney and Debus 2006).

This species was not recorded in the subject site. Potential foraging habitat for this species occurs in the Myrtaceae on site recognised for their high pollen and nectar output, including *Corymbia gummifera* Red Bloodwood (autumn) and *Eucalyptus piperita* Sydney Peppermint (summer). Potential nesting sites occur in the hollow-bearing trees across the site.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Only a very small area of potential foraging habitat will be removed and the 5 or 6 hollow-bearing trees will be replaced by nest boxes. The proposal is unlikely to result in the extinction of a viable local population.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares and the loss of 5 or 6 hollow-bearing trees.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (OEH 2011):

1. Retain large old trees, especially those that are hollow-bearing;
2. Ensure recruitment of trees into the mature age class so that there is not a lag period of decades between the death of old trees and hollow formation in younger trees;
3. Protect large flowering Eucalyptus trees throughout the habitats frequented by this species. Manage remnant woodlands and forest for recovery of old-growth characteristics;
4. Where natural tree recruitment is inadequate, replant local species to maintain foraging habitat and breeding sites;
5. Reduce the abundance of feral Honeybees and limit the exploitation of nectar by domestic bees where resources are spatially or temporally sparse (e.g. in years of drought); and
6. Document nest sites and ensure their protection.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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Ninox connivens Barking Owl

The Barking Owl is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Barking Owl is a medium-sized owl most commonly found to the west of the Great Dividing Range often along wooded watercourses (Slater et al. 1995). This species generally occurs in drier open woodland habitats, including Box – Ironbark and *Eucalyptus camaldulensis* habitats (Robinson 1994). It has been recorded along the edges of woodlands, often where vegetation is bordered by farmland.

Unlike other owls, this species is known to be active during the daylight hours (Hollands 2008). Their diet varies, with invertebrates predominant for most of the year (NSW DEC 2005). During the breeding season, birds and small mammals become more important dietary items. Introduced mammals and birds are major prey items in some areas. Typical mammalian prey includes the European Rabbit, Sugar Glider and Black Rat, while typical bird prey includes the Galah, Common Starling and Eastern Rosella (Kavanagh et al. 1995, Debus 1997).

This species nests in large tree hollows with entrance sizes varying from approximately 30 to 16 centimetres wide (Taylor et al. 2002) usually in live rather than dead trees (Smith and Smith 2000). Home range sizes are difficult to determine, however, radio-tracking of one breeding female in north eastern Victoria indicated that its home range was approximately 226 hectares (Taylor et al. 2002). It is likely that this figure would vary considerably, and may be much larger in some areas.

In the Greater Southern Sydney Region this species is thought to occur either patchily, or at extremely low densities throughout much of the Region but particularly in areas where there are grassy open woodlands. Fragmentation and land clearance has probably rendered much of the area unsuitable. Nonetheless, areas with a higher proportion of remnant vegetation, such as around Wilton, Bargo and in the west around The Oaks, appear to still provide suitable habitat (DECC 2007b). The Burragorang and Wollondilly Valleys contain a significant amount of intact Grassy Box Woodland and are likely to be the most important areas within the Region.

The vertebrate fauna of the large sandstone-based reserves around the Sydney fringe are relatively poorly known and so DECCCW has recently undertaken targeted and systematic survey of priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

Recent accurate records are concentrated around the dry open edges of the reserves in the northern part of the study area, particularly around Big Yango Station and near the eastern and western boundaries of the park (DECC 2008). In the local area, it has probably been impacted by the loss of hollow-bearing trees over the years and clearing of foraging habitat.

This species was not recorded on the site during survey. Marginal breeding and roosting habitat occurs on site along with potential foraging habitat in the birds and arboreal mammals that it supports.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Habitat features critical to the life cycle of this species include foraging resources and breeding sites (large tree hollows). While foraging habitat is common, there are few suitable hollow trees on site.. Given the expanse of available habitat for this species in the local area, and the fact that hollow tree losses will be compensated for by replacement nest boxes, the proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares and potential roost trees within the 5 or 6 hollow trees to be cleared.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

A number of objectives and strategies for this species have been detailed in the Draft Recovery Plan for the Barking Owl *Ninox connivens* (NSW NPWS 2003). Of relevance to this proposal are the following objectives:

1. Protect known Barking Owl nest sites and surrounding habitat;
2. Assist with the protection of Barking Owl habitat from disturbance due to developments and activities; and
3. Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment

Another objective of this plan is to integrate it with other relevant plans such as the Recovery Plan for the Large Forest Owls (DEC 2005). Specific applicable objectives from that plan include:

1. Manage and protect habitat off reserves and State forests - To minimise further loss and fragmentation of habitat outside conservation reserves and State forests by protection and management of significant owl habitat (including protection of individual nest sites);
2. Model and map owl habitat and validate with surveys - To assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected; and
3. Monitor owl population parameters - To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Ninox strenua* Powerful Owl**

The Powerful Owl is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Powerful Owl is the largest of the Australia Owls, with bold chevrons across the chest.

This species is recorded from most types of sclerophyll forest along the south east coast of Australia (Slater et al. 1995), generally on the eastern slopes of the Great Dividing Range. Habitat ranges from tall open forests to woodland, however it is often found roosting or nesting in large trees along gullies (Simpson and Day 1999).

The Powerful Owl requires large hollows (generally with a diameter greater than 30 centimetres) for breeding. Home ranges for territorial pairs appear to range from 800 to 1,000 hectares (although much larger territories have been recorded) (Kavanagh 2002).

This species can be observed roosting in dense vegetation during the day, often clutching the remains of prey species in its talons. The Powerful Owl is a specialist predator of arboreal marsupials, particularly the Common Ringtail Possum in coastal lowland areas and the Greater Glider in the tablelands, but the Sugar Glider, Common Brushtail Possum and Grey-headed Flying-fox are also common prey species (DECCW 2010). Its diet is also supplemented by diurnal birds, particularly the Pied Currawong and many parrot species (DECCW 2010). Scansorial and terrestrial mammals (particularly rats) are also recorded in Powerful Owl pellets, although rarely (DECCW 2010).

Recent work has found this species in higher densities more widespread in the sandstone reserves around Sydney than previously thought and in the Greater Southern Sydney Region, this species is considered to be a common and stable resident (DECC 2007b).

DECCCW has also recently undertaken targeted and systematic survey of other priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

In the Yengo and Parr areas, this species was found to be widespread, albeit at lower densities than occur in the nearby wetter coastal habitats such as in Jilliby State Conservation Area (DECC 2008).

This species was not recorded on the subject site. Marginal foraging habitat for this species occurs on the subject site as it supports favoured prey species. The hollow trees are considered unsuitable for nesting and the site is considered unsuitable for roosting as this species prefers dense wet gullies for both activities.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Habitat features critical to the life cycle of this species include foraging resources and breeding sites (large tree hollows). The site provides potential foraging habitat only. The loss of a very small area of such habitat is unlikely to place a viable local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

A number of objectives and strategies for this species have been detailed in the Recovery Plan for the Large Forest Owls (NSWDEC 2005). Of relevance to this proposal are the following objectives:

1. Manage and protect habitat off reserves and State forests - To minimise further loss and fragmentation of habitat outside conservation reserves and State forests by protection and management of significant owl habitat (including protection of individual nest sites);
2. Model and map owl habitat and validate with surveys - To assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected; and
3. Monitor owl population parameters - To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species.

The first objective is served by this assessment process with survey conducted for this species and recommendations made for minimisation of potential impact and conservation of important habitat features.

The second and third objectives are served by the conducting of survey for this assessment and the provision of data to the relevant authorities.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Tyto novaehollandiae* Masked Owl**

The Masked Owl is listed as Vulnerable under the Schedules of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Masked Owl resembles a large Barn Owl, however is darker on the upper parts of the body. This species generally occurs in sub-coastal habitats of eastern Australia, but there are also records from inland watercourses (Garnett and Crowley 2000).

It is shy and secretive, roosting by day in hollows or thick foliage and hunts by night in woodlands and clearings (Pizzey 1980). This species appears to be a dietary specialist, with the majority of prey species being small, terrestrial mammals (Kavanagh 2002b), although some birds or small arboreal mammals are also taken. The Masked Owl is believed to be a stationary hunter, using a regular series of low perches within its territory to wait for prey, which it locates by sound. Prey appears to be taken in a slow deliberate attack rather than by pursuit (Smith and Smith 2000).

Large hollow bearing trees are required for nesting and daytime roosting. Nest sites are often within riparian forest habitats (Garnett and Crowley 2000). Home ranges sizes have been estimated at between 800 – 1200 hectares for this species (Kavanagh 2002a), however this has potential to vary greatly.

It does not persist in forest fragments of smaller than 200 hectares (Kavanagh 2002a) and the core areas of its distribution are on the Central Coast and lower Hunter Valley (DECC 2008).

The vertebrate fauna of the large sandstone-based reserves around the Sydney fringe are relatively poorly known and so DECCCW has recently undertaken targeted and systematic survey of priority areas, including northern Yengo National Park (DEC 2005) and southern Yengo National Park and Parr State Conservation Area (DECC 2008).

The habitat within the Yengo and Parr reserves is of secondary quality to this species as it prefers open forest and woodland habitats within which it hunts for its (mostly) terrestrial prey. However, given the development pressures in its habitat outside the reserves, it is likely that Yengo National Park and Parr State Conservation Area are important for the conservation of this species.

This species was not recorded on the subject site. Foraging resources for this species occur in the vegetated parts. The site does not provide suitable roosting or nesting habitat.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Habitat features critical to the life cycle of this species include foraging resources and breeding sites (large tree hollows) in riparian areas. While foraging habitat is common, there is no roosting / nesting habitat. Given the expanse of available habitat for this species in the local area, the proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential foraging habitat shall be removed in a total area of approximately 0.88 hectare.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

A number of objectives and strategies for this species have been detailed in the Recovery Plan for the Large Forest Owls (DEC 2005). Of relevance to this proposal are the following objectives:

1. Manage and protect habitat off reserves and State forests - To minimise further loss and fragmentation of habitat outside conservation reserves and State forests by protection and management of significant owl habitat (including protection of individual nest sites);
2. Model and map owl habitat and validate with surveys - To assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected; and
3. Monitor owl population parameters - To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species.

The proposal retains a large vegetated buffer between known populations and development and removes or disturbs a very small area of potential habitat. Therefore, together with the recommendations for minimising potential impact of runoff and sedimentation, the proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Climacteris picumnus* Brown Treecreeper**

The Brown Treecreeper is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Brown Treecreeper is a medium-sized brown bird occurring in dry woodlands, forest clearings, ecotones and eucalypts along watercourses, particularly along the eastern half of Australia. This species is often seen on the ground in areas of sparse cover or foraging among fallen timber or tree trunks (Simpson and Day 1999). It is a sedentary species, nesting in tree hollows within a pair's territory (NSW Scientific Committee 2001).

This species appears unable to maintain viable populations in remnants less than 200 hectares and its abundance decreases as remnant size decreases (Barrett et al. 1994). Additional threats occur from females being unable to disperse to isolated remnants (Garnett and Crowley 2000). This species is often found in the same habitat as the similar White-throated Treecreeper, however the two can be distinguished by the obvious white eyebrow of the Brown Treecreeper (Slater et. al 1995).

This species was not recorded on the subject site. Potential foraging habitat occurs on the rough-barked trees and potential nest sites occur in the hollow trees.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Potential foraging habitat is common across the site and only a small area will be removed. The 5 or 6 hollow trees to be removed may provide potential nesting sites and so the potential impact of their losses will be ameliorated by the erection of nest boxes.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:
This question is not relevant to a threatened species

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares and in the removal of 5 or 6 hollow trees.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DEC 2007). Of relevance are the following:

1. Modify grazing management practices that will maintain or improve habitat values and still allow some grazing to occur at strategic times of the year;
2. Do not allow further loss of dead standing or fallen timber from firewood collection or on-farm practices such as 'tidying up'; do not allow removal of hollow-bearing dead or living trees and stumps on private and public lands;
3. Fencing of known habitat to protect natural features and to allow natural regeneration; and
4. Increase remnant size and connectivity through incentives and DEC threatened species extension services.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes “Clearing of Native Vegetation” and “Removal of Hollow-bearing Trees”.

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***Petroica boodang* Scarlet Robin**

The Scarlet Robin is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Scarlet Robin is a small songbird. Males have black upperparts and chin, red breast, white lower belly, a large white forehead spot, and white flashes in the wings and tail. The female is brown with a large white forehead spot, dull brick-red breast, and white flashes in the wings and tail (NSW Scientific Committee 2010).

It is found in south eastern Australia and the south west of Western Australia (NSW Scientific Committee 2010). In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes and may appear as far west as the eastern edges of the inland plains in autumn and winter (OEH 2011).

Its habitat is dry eucalypt forests and woodlands with an open grassy understorey with few scattered shrubs (OEH 2011.) It lives in both mature and regrowth vegetation and occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps (OEH 2011). However, it is thought that habitat may become unsuitable if dense regeneration occurs after bushfires or other disturbances (OEH 2011).

Important components of its habitat are abundant logs and fallen timber on which they perch and from which they forage (NSW Scientific Committee 2010).

The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, from July to January (OEH 2011). It builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree which is often a dead branch in a live tree, or in a dead tree or shrub (Higgins and Peter 2002, Debus 2006a, 2006b).

They usually occur singly or in pairs or occasionally in small family parties (OEH 2011). In autumn and winter this species migrates to more open habitats such as grassy open woodland or paddocks with scattered trees (NSW Scientific Committee 2010). At this time it joins mixed flocks of other small insectivorous birds which forage through dry forests and woodlands (OEH 2011).

In recent decades the Scarlet Robin is believed to have undergone a moderate reduction in population size in NSW based on comparative evidence from broadscale surveys (NSW Scientific Committee 2010). It is thought to be sensitive to habitat degradation (Watson et al. 2001, 2003; Radford et al. 2005; Radford and Bennett 2007), and overgrazing (Olsen et al. 2005).

For instance, its occurrence (presence/absence) is positively associated with patch size and components of habitat complexity including increasing tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (Watson et al. 2003). Research has demonstrated that it is (a) less common in isolated patches of 30 hectares or less where there was no tree cover within 200 m and less than 20% cover within 1 km; (b) less common in sites surrounded by cattle grazing; (c) absent from sites surrounded by cereal cropping; (d) more common as time increased since removal of grazing; and (e) more common in sites with native versus exotic grasses if ungrazed for more than 10 years (Barrett et al. 2003).

'Clearing of native vegetation' and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes that are particularly relevant to this species (NSW Scientific Committee 2010). Over-abundant populations of *Strepera graculina* Pied Currawong, supported by exotic berry-producing shrubs, may be a potentially severe threat to its breeding productivity (Debus 2006c), exacerbated by other native and exotic predators (NSW Scientific Committee 2010).

This species was not recorded on the subject site. Potential foraging and breeding habitat for this species occurs across the subject site in the vegetated parts.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Critical habitat components for this species is the presence of fallen timber and logs and large expanses of habitat. Such habitat features occur in the Somersby Plateaus Forest the amount of habitat available in the broader study area surpasses the threshold of 30 hectares. The modification of such a relatively small area as the development area is considered unlikely to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (OEH 2011). Of relevance are the following:

1. Retain existing forest, woodland and remnant grassland vegetation, including paddock trees;
2. Retain dead timber on the ground in open forest and woodland areas;
3. Enhance potential habitat through regeneration by reducing the intensity and duration of grazing;
4. Fence remnants to protect from long-term, intense grazing;
5. Increase the size of existing remnants, by planting trees and establishing buffer zones of unmodified, uncultivated pasture around woodland remnants;
6. Keep domestic cats indoors at night; desex domestic cats. Assess the appropriateness of cat ownership in new subdivisions adjacent to Scarlet Robin habitat; and
7. Avoid the use of exotic berry-producing shrubs in landscape and garden plantings in areas adjacent to Scarlet Robin habitats.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Petaurus australis* Yellow-bellied Glider**

The Yellow-bellied Glider is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Adult Yellow-bellied Gliders are medium-sized gliders and have a distinctive yellow belly (which may be cream in younger animals), long almost hairless ears and a tail about 1.5 times the head-body length (Goldingay 2008). The Yellow-bellied Glider is the largest and most vocal of the Australian petaurids (Russell 1995). They are highly social, with strong group cohesion maintained with regular calling (Menkhorst and Knight 2001). Calls also have a definite territorial function as they are given more frequently near the periphery of a territory then at the centre (Goldingay 2008). They fiercely protect territories, readily attacking and even killing trespassing gliders (Goldingay 2008).

This species has a patchy distribution from Mackay in Queensland to near Melbourne in Victoria, and there are isolated populations in south western Victoria (Menkhorst and Knight 2001). It rests in hollows (generally in a living, smooth-barked eucalypt) during the day and forages at night within an average home range of between 30 and 60 hectares (Goldingay 2008). Gliders may travel over 2 kilometres in a single night while foraging.

This species lives in family groups of 2 to 6 individuals which commonly share a hollow that is changed periodically throughout the year (Goldingay 2008). A single young is usually produced, with a peak between August and September (Goldingay 2008).

The Yellow-bellied Glider is an inhabitant of tall eucalypt forest and woodland (Russell 1995). Group sizes vary according to the quality and availability of habitat.

It principally feeds on plant and insect exudates including nectar, sap, honeydew and manna (NSW NPWS 2003). It obtains its protein from insects and, to a certain extent, pollen ingested whilst feeding on nectar. It is a relatively large mammal for such a low energy diet and so it spends the majority (up to 90%) of its time feeding (Goldingay and Kavanagh 1991). Thus, the availability of high quality food is important in determining its local distribution. The Yellow-bellied Glider spends more time foraging than any other mammal and the presence of enough resources all year round in their home range is critical to their survival.

This species has been the subject of much active research, particularly in production forests where critical resources may be lost across large areas. It has been determined that food resource availability at a given location is linked strongly to climatic factors and the flowering and fruiting patterns of the tree species present (NSW NPWS 2003). The gliders respond to events such as flowering or bark shedding and feed preferentially on those resources (e.g. nectar/pollen or sap respectively) as they are available.

Kavanagh (1987) observed gliders searching under loose bark for arthropods and honeydew, and licking the phloem sap from incisions made in the bark of eucalypts, in all seasons of the year. By contrast, other foraging behaviours such as licking flowers to obtain nectar, licking foliage and small branches to obtain honeydew, chewing manna from small branchlets, and shredding fibrous bark to obtain beetle larvae, were confined to particular seasons.

The variability in available food resources means that preferred Yellow-bellied Glider habitat usually supports a mixture of different species so that they may rely on a continuous food supply throughout the year (NSW NPWS 2003).

Sap appears to provide a very important source of food for the Yellow-bellied Glider. Many individual gliders may feed on sap trees together where they cling to the trunks, chew down to the cambium and lick up the oozing sap. They chew characteristic triangular incisions into trunks to obtain sap from favoured feed trees (Menkhorst and Knight 2001) but trees used over many years may have long vertical furrows (Goldingay 2008).

The selection of feed trees is apparently a complex behaviour where the number and species of trees used varies between location and season. It has been suggested that gliders continually sample sap flow from a number of trees and then feed on individual trees displaying whatever properties the gliders are seeking (NSW NPWS 2003). It is unknown what these properties are, nor what pattern they follow. However, they must be rare as active sap trees comprise less than one percent of all trees in a given stand of forest (Lindenmayer 2002).

Although little is known about what guides their choice, sap trees tend to be large and vigorous specimens (NSW NPWS 2003) which can be utilised by Yellow-bellied Gliders for more than 10 years (Goldingay 1991). Kavanagh (1987b) found that Yellow-bellied Gliders primarily selected trees of certain species and secondarily trees of larger size for foraging, with 92% of trees used over 60 centimetres diameter at breast height (DBH) and 58% over 80 centimetres DBH. He noted that the gliders selected the trees with the greatest number of flowers in which to forage for nectar. This coincides with the older trees, because mature trees (c.200 years old) produce 2.2-15.5 times as many flowers as "pole stage" trees (c.25 years old).

Yellow-bellied Gliders are known to feed on a range of different species throughout their range, but species used at one location are not necessarily used at another (NSW NPWS 2003). In NSW, sap tree species are mostly eucalypts.

Given its feeding ecology, the Yellow-bellied Glider is therefore sensitive to changes in habitat that result in resource gaps in time and space. It also uses hollow trees for denning in family groups. Such large hollows are scarce and a family group tend to use a number of these (up to 13) within their home range (NSW NPWS 2003). Thus they are also sensitive to loss of hollow-bearing trees.

As well as direct loss of resources, fragmentation of habitat for this species may create dispersal barriers across which they cannot glide, thus effectively isolating family groups and preventing gene flow. Although they are known to glide to a maximum distance of 140 metres (NSW NPWS 2003), smaller gaps can constitute a dispersal barrier as the gliding distance is related to factors such as the height of the tree from which it launches. Typical gliding distances are usually in the order of 40 metres (Goldingay 2008).

This species was not recorded on the subject site but has been reported from the local area in recent times. The site provides both potential forging and denning habitat.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Critical habitat factors for the life cycle of this species include foraging and breeding habitat. Both such habitat features will be removed (0.88 hectares and 5 or 6 hollow trees0 but this is a relatively small area and the hollows will be replaced by nest boxes. It is unlikely that the impact on the small area of potential habitat for the proposed dwelling will have an adverse effect on the life cycle of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares of vegetation and 5 or 6 hollow trees.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

There is no critical habitat declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

A number of objectives and strategies for this species have been detailed in the Recovery Plan for the

Yellow-bellied Glider (NPWS 2003). Of relevance to this proposal are the following objectives:

1. To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat;
2. To encourage State government agencies and local governments to consider the inclusion of regional-based Yellow-bellied Glider habitat types, sap trees and sap tree species in planning instruments;
3. To consolidate survey results and records, including existing records that do not appear in the NPWS Atlas of NSW Wildlife, to identify the status of the Yellow-bellied Glider on privately-owned and public forested land;
4. To identify and monitor significant populations of the species;
5. To identify significant Yellow-bellied Glider populations and the specific management issues associated with them. The NPWS will support monitoring of these populations and, where possible, implement appropriate management;
6. To facilitate strategic research into the ecology of the Yellow-bellied Glider that is relevant to its conservation; and
7. Liaison between NPWS and research institutes, tertiary institutions, State government agencies and other public authorities to facilitate strategic ecological research that is relevant to the conservation of the Yellow-bellied Glider.

Specifically, DECCW (2011) recommend that the following strategies be implemented:

1. Retain den trees and recruitment trees (future hollow-bearing trees);
2. Retain food resources, particularly sap-feeding trees;
3. Retain and protect areas of habitat, particularly mature or old growth forest containing hollow-bearing trees and sap-feeding trees;
4. Maintain connectivity between habitat patches; and
5. In urban and rural areas retain and rehabilitate habitat to maintain or increase the total area of habitat available, reduce edge effects, minimise foraging distances and increase the types of resources available.

All of these objectives and strategies are served by the conducting of survey for this assessment and the provision of data to the relevant authorities.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Pteropus poliocephalus* Grey-headed Flying-fox**

The Grey-headed Flying-fox is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Grey-headed Flying-fox is a large flying-fox with a white or greyish head, reddish mantle around the neck and thick, shaggy fur extending to the ankles (Strahan 1995). This species has a distribution along eastern coastal Australia from Rockhampton in Queensland to western Victoria (Churchill 2008). The Grey-headed Flying-fox is a common species in rainforest and wet sclerophyll forest (Strahan 1995), also frequenting mangroves, paperbark swamps and cultivated areas (Churchill 1998). It is usually seen in large, noisy colonies, or in day 'camps' usually placed close to water in gullies with dense forest canopies (Tidemann 1995). This is a highly mobile species, and camps are regularly moved in response to local food availability (Churchill 1998). Most births occur around October (Strahan 1995).

They forage widely at night mainly for rainforest fruits and native blossoms (Strahan 1995), and this species is likely to be an important pollinator for many native species (Tidemann 1995). Seventy-five percent of foraging forays are within 20 kilometres of the camp but some individuals may commute 50 kilometres to a productive food sources (Tidemann et al. 2008).

They have been recorded as feeding on 201 plant species of 50 families, with almost half of these in the Myrtaceae (Churchill 2008) but the pollen and nectar of *Eucalyptus*, *Melaleuca* and *Banksia* (Eby 2000) are their principal foods. Native figs are also important and they also appear to eat the salt glands from mangrove trees (Churchill 2008).

The availability of native fruits, nectar and pollen varies over time and throughout the range of the species. This species is highly nomadic in response to the uneven distribution of their food plants, sometimes travelling hundreds of kilometres to find suitable resources and / or feeding in domestic gardens, parks and orchards. Such characteristics make it very difficult to define key habitat areas (Eby and Lunney 2002). Also, the areas that offer foraging resources at any time are small and vary in location between years (Eby and Lunney 2002).

Although variable, a general pattern of movement can be discerned. Almost half of the eucalypt species used by the Grey-headed Flying-fox flower in summer and such summer-flowering species are distributed throughout their range. Thus, in summer, this species is generally widely dispersed.

However, the winter-flowering species they use are largely restricted to the woodlands of the western slopes or the lowland coastal communities (Eby and Lunney 2002). Thus, they are usually highly aggregated in winter, depending on where the nectar is flowing.

This winter convergence makes the species vulnerable to changes in these coastal communities, particularly as it coincides with the areas of greatest development. High rates of mortality can result from result from losses of small areas of key winter habitat (Eby and Lunney 2002). These losses are compounded by removal and fragmentation of other resource patches used at other times.

Even in areas of remaining forest, nectar flow itself is impacted upon by dieback, drought, fire, and local fluctuations in temperature and rainfall (Eby and Lunney 2002).

The spring also presents potential bottlenecks for this species as several key spring-flowering trees are primarily confined to relatively flat and fertile land such as has already been extensively cleared and is still favoured by development (Eby and Lunney 2002). This also coincides with the time of birth of young when there is an added nutritional requirement and the females do not venture far from the maternity camp to feed.

These camps may contain tens of thousands animals, depending upon the abundance of locally available food sources. They are generally located in close proximity (20 km or less) to a regular food

source, often in stands of riparian rainforest, Paperbark or Casuarina forest (Eby 1995). Site fidelity is high and some camps in NSW have been used for over a century (Eby 2000). Just such a long term camp is located at Matcham, approximately 10 kilometres to the east of the subject site.

Being so highly mobile, connectivity of forest patches is not critical for this species to be able to exploit different areas of vegetation. However, they are impacted by direct loss of habitat as well as via long term changes on critical features such as nectar flow wrought by dieback and other consequences of forest fragmentation.

The number of species of fruits and flowers exploited by this species is large, as befitting its extraordinarily broad distribution along the east coast of Australia.

This species was recorded foraging in neighbouring vegetation during previous survey in 2004 and presumably feed on blossom of the subject site when it is available.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

No critical life cycle features for this species were observed on or near the subject – no camps have been recorded from this area nor is there habitat on the site suitable for one. The proposal may remove some potential food trees, but similar foraging opportunities exist for this species across the subject site and in the nearby reserved bushland. Therefore it is unlikely the proposal will place a viable local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

A draft recovery plan for this species has been released (DECCW 2009) within which 10 major recovery actions have been identified:

1. Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range;
2. Enhance winter and spring foraging habitat for Grey-headed Flying-foxes;
3. Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes;
4. Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture;
5. Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps;
6. Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions;
7. Monitor population trends for the Grey-headed Flying-fox;
8. Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts;
9. Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox; and
10. Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan

The proposal retains most of the habitat on site and removes only a very small area. The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat**

The Yellow-bellied Sheathtail-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Yellow-bellied Sheathtail-bat is distinguished by glossy black fur on the upper body and white or cream fur on the lower body (Strahan 1995). Males have a prominent throat pouch (Churchill 1998). This species is found roosting in tree hollows in a very wide variety of habitats ranging from wet forests to deserts (Menkhorst and Knight 2001, Churchill 2008). They have also been recorded roosting in abandoned nests of Sugar Gliders, in buildings or in animal burrows (Churchill 1998). They roost singly or in groups of up to 6 (DECCW 2009) or 10 (Richards 2008) but large maternity colonies may exceed 100 individuals (Richards 2008).

It is a common species in northern Australia (Menkhorst and Knight 2001). Females produce one young between the months of December and March (Churchill 2008). Although seasonal movements are unknown, there is speculation about a migration to southern Australia (Victoria, south-western NSW and South Australia) in late summer and autumn (DECCW 2009).

They forage mainly for beetles, high above the tree canopy or lower over open ground and at the forest edge (Churchill 2008).

This species was not recorded in the study area during survey. Potential foraging habitat for this species occurs across the site in vegetated and open areas. Potential roosting habitat occurs within the hollow-bearing trees scattered across the site.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Key habitat features for this species include hollows in live or dead trees as well as other shelter sites like exfoliating bark or other animals' nests. The proposal will remove 5 or 6 hollow trees but these resources will be replaced by nest boxes. It is unlikely that the removal of a small area of potential foraging habitat and some hollows will place a viable local population at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be modified across a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

***Response*:**

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DECCW 2009). Of relevance to this proposal are the following:

1. Raise landowners' awareness about the presence of the species and provide information on how their management actions will affect the species' survival;
2. DECCW should be consulted when planning development/s to minimise impact/s on populations;
3. Conduct searches for the species in suitable habitat in proposed development areas;
4. Retain stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats;
5. Retain a buffer of vegetation around roost sites in vegetated areas;
6. Protect hollow-bearing trees for breeding sites, including those on farmland; younger mature trees should also be retained to provide replacements for the older trees as they die and fall over;

7. Reduce the use of pesticides in the environment;
8. Encourage regeneration and replanting of local flora species to maintain bat foraging habitat;
9. Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape; and
10. Mark known sites and potential habitat onto maps used for planned poison-spraying activities.

The proposal retains most potential habitat on site, disturbs a very small area of potential habitat and replaces lost hollows with nest boxes. The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes “Clearing of Native Vegetation” and “Removal of Hollow-bearing Trees”.

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***Mormopterus norfolkensis* Eastern Freetail-bat**

The Eastern Freetail-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane (DECCW 2009).

The Eastern Freetail-bat is an insectivore but nothing specific is known about its diet (Churchill 1998, 2008). It is thought that they forage within a few kilometres of their roost (Churchill 2008, Hoye et al. 2008).

It is found along the east coast from south eastern Queensland to southern NSW (DECCW 2009). Most records are from dry eucalypt forest and woodland, although a number have been caught flying low over a rocky river through rainforest and wet sclerophyll forest (Hoye et al. 2008). Research in coastal forests near Coffs Harbour have shown that it is more active on upper slopes where the flyways are open and uncluttered, rather than along creeks (Hoye et al. 2008).

Although it has been recorded roosting in the roof of a hut, under bark and the caps of telegraph poles, it is more usually found in hollows in large mature trees (Churchill 2008). All natural roost sites have been found in large mature eucalypts and they will use paddock trees and remnant vegetation in farmland (Hoye et al. 2008). They will also roost in artificial roosts, with a colony in NSW known to use the same boxes for over 5 years (Churchill 2008).

Young are born in late November or early December and are free-flying by late January (Hoye et al. 2008).

This species was not recorded on the subject site. Potential foraging habitat probably occurs across the subject site in and around the vegetated areas and the hollow trees provide potential roost sites

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Habitat features critical to the life cycle of this species include foraging resources (vegetation) and breeding sites (tree hollows). Although a few hollows may be removed, most of the vegetation will remain essentially unchanged. The proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified for this species (DECCW 2009). Relevant among them are:

1. Retain hollow-bearing trees and provide for hollow tree recruitment;
2. Retain foraging habitat; and
3. Minimise the use of pesticides in foraging areas.

The proposal retains most habitat on site and will replace lost hollows with nest boxes. The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Miniopterus schreibersii oceanensis* Eastern Bent-wing Bat**

The Eastern Bent-wing Bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern Bent-wing Bat has been identified as a result of revision to the taxonomy of the Common Bent-wing Bat (*Miniopterus schreibersii*). The Eastern Bent-wing Bat closely resembles the Little Bentwing-bat, however is larger (Strahan 1995). This species is distributed across the well-watered parts of eastern and northern Australia, however it hibernates in the southern parts of the range (Strahan 1995). Its range extends along the entire east coast of Australia, with a gap forming along the Gulf of Carpentaria, where records begin again in the Kimberley (Churchill 1998).

Primary roost sites include caves with colonies reaching thousands in number (Strahan 1995), however they also use other man-made structures such as abandoned mines and road culverts (Churchill 2008). The 12 maternity roosts that are known to throughout the range of this species are located in limestone and sandstone caves, abandoned gold mines, concrete bunkers and lava tubes (Hoye and Hall 2008).

In the southern, non-tropical parts of its range mating occurs in early winter but implantation is delayed until August. After mating and with the onset of spring, adult females move from numerous widely scattered roosts to specific nursery caves where the young are born and reared to independence. Here they form discrete populations of pregnant females, non-breeding females and juvenile males at a maternity cave in the spring and summer (Hoye and Hall 2008).

Scattered colonies located within a single large watershed often use a particular nursery cave year after year. Nursery colonies disband between February and March, adults and juveniles going separate ways, and will disperse several hundreds of kilometres from the maternity cave (DECCW 2009). These bats are strong fliers and often travel long distances, with one individual recorded moving 1300 km (Dwyer 1969).

Overwintering roosts depend on the sex and age of individuals with bats often selecting cool areas located within caves, mines, tunnels, drains and bridges during the colder months of the year when insects are few (Hoye and Hall 2008). In such sites they may enter periodic torpor as an energy-saving strategy, reducing their metabolic temperatures and prolong fat reserves over winter (Churchill 1998). In the tropical areas, however, diurnal shelter sites may be found in roofs of buildings (Hoye and Hall 2008).

It has a fast and direct flight (Hoye and Hall 2008) and can reportedly travel up to 65 kilometres in a night (Dwyer 1966). It forages principally on moths, usually snatched high above the forest canopy, although it can also forage low to the ground over open grassy areas (Churchill 1998, 2008) and along waterways and tracks (Hoye and Hall 2008). It also regularly forages around street lights and may be active throughout winter in coastal locations (Hoye and Hall 2008).

This species is vulnerable to losses of maternity sites and increased mortality is observed at overwintering roosts that are frequently disturbed (Hoye and Hall 2008). Foxes and cats are major predators (Hoye and Hall 2008), and bats overwintering in urban areas show high levels of injury from collisions with cars and trains, flooding and other urban hazards (Hoye and Spence 2004).

This species was recorded on the subject site during previous survey in 2004. Foraging habitat for this species occurs across the site in and around the vegetated areas.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Critical habitat features for this species are the caves used for roosting and breeding. There are no such features on the site. The proposal will not modify the potential foraging habitat on the site. Therefore the proposal will not adversely affect the long-term viability of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified for this species (DECCW 2010). Relevant among them are:

1. Control foxes and feral cats around roosting sites, particularly maternity caves;
2. Retain native vegetation around roost sites, particularly within 300 metres of maternity caves;
3. Minimise the use of pesticides in foraging areas; and
4. Protect roosting sites from damage or disturbance.

The proposal retains most habitat suitable for this species and removes only a very small area of habitat. The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Miniopterus australis* Little Bentwing-bat**

The Little Bentwing-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Little Bentwing-bat is distinguished from other bentwing-bats by its small size and very long terminal joint in the third digit of the forelimb (Strahan 1995). This species has a distinctively short muzzle and a domed head (Churchill 1998).

These bats have a distribution running along the east coast of Australia from Cape York to northern New South Wales (Churchill 1998). In tropical areas, it ranges from the coast to higher elevations but further south it is largely restricted to the coast (Hoye and Hall 2008). Because it is rarely recorded away from the coastal plain, recent records near Wheelbarrow Ridge in Parr State Conservation Area are of interest (DECC 2008).

In the southern part of their range, Little Bentwing-bats may hibernate during winter months (Churchill 1998) but are known to remain active through much of winter, emerging to feed on many nights (Hoye and Hall 2008). It forages via aerial pursuit of small insects (moths, wasps and ants) beneath the canopy of well-timbered habitats including rainforest, paperbark swamps and wet and dry sclerophyll forest (Hoye and Hall 2008).

This species roosts communally in caves or similar suitable spaces, often with *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat (Hoye and Hall 2008). Females gather in large maternity colonies in summer (Menkhorst and Knight 2001), and a single young is born in December (Strahan 1995). Non-breeding roost sites have included one observation of use of a tree hollow, but it is not known whether this occurs regularly (Hoye and Hall 2008).

This species was not recorded on the subject site. Potential foraging habitat occurs on the subject site in the vegetated parts.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Critical habitat features for this species are the caves used for roosting and breeding. There are no such features on the subject site. A small amount of potential foraging habitat will be removed, but the overall nature of the site will be unchanged. Therefore the proposal will not adversely affect the long-term viability of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site. Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified for this species (DECCW 2010). Relevant among them are:

1. Retain stands of native vegetation;
2. Reduce use of pesticides; and
3. Protect known roosting and nursery sites and surrounding forest.

The proposal will remove only a very small area of potential foraging habitat and will not impact on important nursery habitat.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Myotis macropus* Large-footed Myotis**

The Large-footed Myotis is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Large-footed Myotis is a small bat, distinguished by its large feet (Strahan 1995). This is a predominantly coastal species, and rarely extends further than 100 kilometres inland (Churchill 1998). It has a distribution from the Kimberley to Victoria and South Australia and occurs inland along some major river systems such as the Murray River (Churchill 1998).

This species has been recorded from most habitat types, with proximity to water thought to be the main habitat determinant (Churchill 1998); a maternity roost, for example, was located under a wooden bridge in a rural landscape (Law et al. 2001). However, despite most roosts being located within 500 metres of waterways (Campbell 2011), a radio-tracking study of this species in south east Queensland revealed that it may travel up to 10 kilometres several times a night from its communal roost site to its foraging habitat over a large reservoir (Barclay et al. 2000).

It roosts communally in caves (Strahan 1995), but also in tree hollows, amongst vegetation, in mines and stormwater drains (Churchill 1998), tunnels (Barclay et al. 2000), buildings (DEC 2005) and under bridges (Law et al. 2001). Each male sets up and defends a small harem of females and young within the larger maternity colony (Barclay et al. 2000, Law et al. 2001).

They are generally torpid over winter (Richards 1995). In the southern parts of its range, a single young is born from November to December (Menkhorst and Knight 2001). When not breeding, males either roost alone or form bachelor groups of up to 20 individuals (Richards et al. 2008).

It may hunt individually or in groups, using its large feet to rake the surface of the water and catch small fish or aquatic insects from rivers and lakes (Richards et al. 2008). It is also known to forage for aerial insects in a downward spiralling flight (Richards et al. 2008). It is thought to echolocate on the surface ripples caused by small fish. Robson (1984) identified a large number of fish scales amongst droppings from this bat, which were subsequently identified as *Gambusia* species (Ray Williams pers comm).

This species was recorded on the subject site during the previous survey in 2004 foraging in the large dam. The site also provides potential roost sites in the large hollow-bearing trees.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Habitat features critical to the life cycle of this species include foraging resources and breeding sites. The foraging resources will be temporarily disrupted but such water bodies will remain a feature of the site. Most hollow trees will be retained and lost hollows will be replaced by nest boxes. Given the large expanse of available habitat for this species in the local area, the proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Five or six potential roost sites will be removed. Potential foraging habitat will be disrupted as the tailings dams are rehabilitated and reorganised over the life of the quarry.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

There has been no critical habitat declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery

strategies have been identified (DECC 2008). Of relevance to this proposal are the following:

1. Retain native vegetation along streams and rivers and around other waterbodies;
2. Minimise the use of pesticides adjacent to foraging areas; and
3. Protect roosts from damage or disturbance.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Scoteanax rueppellii* Greater Broad-nosed Bat**

The Greater Broad-nosed Bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Greater Broad-nosed Bat is the largest of the broad-nosed bats, with a dark reddish-brown back and slightly paler below (Hoye and Richards 1995). It has a broad, almost bare muzzle, large eyes and well spaced ears (Strahan 1995). The Greater Broad-nosed Bat has a distribution ranging from the Atherton Tablelands in northern Queensland, down along the coastal regions into southern New South Wales (Churchill 1998). In the southern parts of its range, this species is only found at low altitudes (below 500 metres ASL) (Churchill 1998).

The open nature of eucalypt woodland and forest suits its direct flight pattern and probably overcomes the cluttered nature of the wetter forests by using forest tracks and natural openings (Hoye and Richards 2008). It roosts in trunk or branch hollows, cracks and fissures in trunks, under bark and the roofs of old buildings (Churchill 2008).

This species is usually recorded along forest edges or watercourses (Strahan 1995), flying relatively slowly with little manoeuvrability (Menkhorst and Knight 2001). They feed on slow-flying prey such as large moths hawked quite low to the ground along the edges of vegetation (Churchill 1998). They are also known to eat other bats and probably do so in the wild (Churchill 1998).

Maternity sites are formed in suitable trees and young are born in January (Strahan 1995). This species generally emerges soon after sunset, flying 3 to 6 metres above the ground (Hoye and Richards 1995).

In a study of Yengo National Park and surrounds, this species was recorded from a number of forest types, most frequently on alluvial flats or forests of the lower slopes (DECC 2008).

This species was possibly recorded on the subject site foraging along the power line easement. However, the call recorded was poor and not easily distinguishable from another bat's call – *Falsistrellus tasmaniensis* Eastern False Pipistrelle. Potential foraging habitat for this species occurs across the subject site in and around the vegetated areas and potential roosts occur in the hollow-bearing trees.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

Habitat features critical to the life cycle of this species that occur on the subject site include breeding sites (tree hollows). Five or six hollow trees will be removed as part of the proposal but these will be replaced by nest boxes. Only a small area of potential foraging habitat will be removed and modified. The proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

***Response*:**

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

***Response*:**

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

***Response*:**

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (DECCW 2010). Of relevance are the following:

1. Raise landowners' awareness of the presence of this species, and provide information on how their management actions will affect the species' survival;
2. Actively encourage the conservation of the riparian vegetation and water quality of streams and rivers;
3. DEC should be consulted when planning development/s to minimise impact/s on populations;
4. Conduct searches for the species in suitable habitat in proposed development areas;
5. Retain stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats;
6. Retain a buffer of vegetation around roost sites in vegetated areas;
7. Protect hollow-bearing trees for breeding sites, including those on farmland; younger mature trees should also be retained to provide replacements for the older trees as they die and fall over;
8. Reduce the use of pesticides in the environment and enter known sites of this species and its potential habitat onto maps used for planned poison spraying activities;
9. Encourage regeneration and replanting of local flora species to maintain bat foraging habitat; and
10. Assess the site's importance to the species' survival, including linkages provided between ecological resources across the broader landscape.

The proposal retains a large vegetated buffer between habitat and development and removes or disturbs a very small area of potential habitat. The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes “Clearing of Native Vegetation” and “Removal of Hollow-bearing Trees”.

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Strahan, R. (1995) A Photographic Guide to Mammals of Australia. New Holland, Sydney Australia

***Falsistrellus tasmaniensis* Eastern False Pipistrelle**

The Eastern False Pipistrelle is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern False Pipistrelle is a large, robust bat with dark to reddish brown fur on the back, and paler grey fur on the belly (Churchill 1998). There is a characteristic notch on the outer margin of the ear, near the tip (Churchill 1998). This species is found from south east Queensland, through New South Wales and into Victoria and Tasmania (Churchill 1998). Eastern False Pipistrelles inhabit sclerophyll forests east of the Great Dividing Range. They appear to prefer wet high-altitude forests (Law et al. 2008), especially where trees are over 20 metres high (Churchill 1998).

Eastern False Pipistrelles generally roost in small colonies in the trunks of hollow eucalypts; however they have been found roosting in caves and old wooden buildings (Churchill 1998). They apparently hibernate over winter in the southern parts of its range (Phillips 1995).

Flight is swift and direct, often just below or within the tree canopy (Churchill 1998). Radio-tracking studies in Victoria revealed a maximum nightly movement of 13 kilometres between daytime roosts in hollow trees (NSW NPWS no date). The diet of this species appears to be dominated by beetles and one study suggested that the species can preferentially select larger beetles as prey (NSW NPWS no date).

The Eastern False Pipistrelle is a highly mobile species with movements of up to 12 kilometres between roosting and foraging sites (Menkhorst and Lumsden 1995).

Single young are born in December (Menkhorst and Knight 2001).

This species was possibly recorded on the subject site foraging along the power line easement. However, the call recorded was poor and not easily distinguishable from another bat's call – *Scoteanax rueppellii* Greater Broad-nosed Bat. Potential foraging habitat for this species occurs across the subject site in and around the vegetated areas and potential roosts occur in the hollow-bearing trees.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Habitat features critical to the life cycle of this species include foraging resources and breeding sites. A small area of foraging habitat will be removed and 5 or 6 hollow trees will be removed. However, these hollows will be replaced by nest boxes. Given the expanse of available habitat for this species in the local area, and the ameliorative measures to be employed, the proposed works are not considered to impose a significant impact on the life cycle stages of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

***Response*:**

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Potential habitat shall be removed in a total area of approximately 0.88 hectares including 5 or 6 hollow trees.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

Such a small area of clearing will not significantly alter the configuration of habitat in the local area or broader study area for this species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

Large areas of potential and realised habitat occur in the broader study area, much of which is reserved. The area of potential habitat to be impacted by the proposed works is of little importance in this context.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

No critical habitat has been declared for this species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (OEH 2011). Of relevance are the following:

1. Retain native vegetation that is floristically and structurally diverse;

2. Minimise the use of pesticides within or adjacent to areas where insectivorous bats occur; and
3. Protect roost sites from disturbance.

The proposal retains most of the natural bushland on site that is structurally and floristically diverse. Potential roost sites to be lost will be replaced by nest boxes. The proposal is considered to be largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

***Response*:**

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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***Pseudomys gracilicaudatus* Eastern Chestnut Mouse**

The Eastern Chestnut Mouse is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern Chestnut Mouse is a large, bulky mouse with a short face and bristly chestnut hair (Strahan 1995).

This species has a patchy distribution in coastal Australia, from Cooktown in Queensland, to Brisbane Water National Park in New South Wales (Fox 2008).

In the southern part of its range, this species is found in low numbers in dense heathland, wet heath and swamps (OEH 2012). In northern areas, it is more an animal of grassy woodlands and often on ridgetops (Fox 2008). Optimum habitat appears to be young regenerating heath (18 months to 4 years post-fire), and fire history is thought to be a determinant of presence (Fox 2008). Studies have shown this species to be competitively excluded by *Rattus lutreolus* Swamp Rat as the heath vegetation ages (Fox 1995).

The Eastern Chestnut Mouse is a nocturnal species, feeding at night via runways through the grassy and sedge understorey (OEH 2012) and spending the day in a nest or shallow burrow (Strahan 1995). Recent radio-telemetry studies have shown that the refuge sites chosen are those that provide the maximum protection with the tallest and most dense vegetation (Pereoglou et al. 2011). Most individuals show strong site attachment with home ranges of less than 0.5 hectares (Fox 2008).

It has a broad diet of grass stems, invertebrates, fungi and seeds, with the relative significance of each component varying seasonally (OEH 2012).

Breeding usually occurs between September and March (Fox 1995), producing up to three litters from spring to autumn. This rapid breeding strategy allows rapid build-up of numbers in years following fire (OEH 2012). In the field, some females have been observed to breed in two successive years and several males lived through a second summer (Fox 2008).

This species was not recorded on the subject site. Potential habitat for this species occurs downslope and off site in hanging swamp vegetation. The closest record of this species is from the Holgate area dating from 2008.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

Habitat features critical to the life cycle of this species include the density and height of vegetation so that it provides cover for its diurnal nests and burrows. Also, the vegetation needs to be at the correct seral stage to favour this species.

No suitable potential habitat occurs on site, but it may occur in the hanging swamps below the site. These areas may, over a long period of time, shift from a wet heath to a more dry heath. However, there is no evidence that this off site vegetation is suitable for this species other than the mapped vegetation type. As this species is seemingly profoundly impacted by the seral stage of the community, its habitat is ephemeral under natural circumstances. If a population did occur in this area and the modelled drawdown occurs, then those small areas of swamp may become less suitable as potential habitat.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Response:

This question is not relevant to a threatened species.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Response:

This question is not relevant to a threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Response:

Two small patches of groundwater dependent ecosystems (hanging swamps) that occur downslope and off site may be impacted by the drawdown of the water table for several metres over a period of 100 years if such predictions come to pass.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and,

Response:

The swamp vegetation off site will potentially shift to a drier heath but the connectivity of habitat for this species will remain unchanged in the local area and broader study area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Response:

This species has not been recorded from the subject site or near the subject site. The closest record of this species is almost 10 kilometres to the east. As potential habitat only that is unlikely to be occupied by this species, it cannot be regarded as habitat important for its long term survival. Larger areas of potential and realised habitat occur in the broader study area, much of which is reserved.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Response:

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Response:

There is no recovery plan or threat abatement plan for this species. However, a number of recovery strategies have been identified (OEH 2012). Of relevance to this proposal are the following:

1. Keep domestic cats indoors at night and prevent dogs from roaming in areas of habitat. Desex domestic cats;
2. Undertake fox and feral cat and dog control program targeting areas of known or high quality potential habitat;
3. Apply mosaic pattern hazard burns to ensure that a range of age stands of heath is available to each population of Eastern Chestnut Mouse;
4. Assess the appropriateness of cat ownership in new subdivisions; and
5. All vegetation within 200 metres of heaths and swamps supporting the species should be retained and not disturbed.

The proposal is largely consistent with these recovery strategies.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Response:

The proposed works contribute to the Key Threatening Processes "Clearing of Native Vegetation" and "Removal of Hollow-bearing Trees".

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APPENDIX 6

AIR QUALITY ASSESSMENT

Coastplan Consultanting Pty Ltd

AIR QUALITY ASSESSMENT - PROPOSED SAND QUARRY, SOMERSBY

FINAL REPORT

April 2012

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02	Final for Client	11/4/12	SW		CB	
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Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s).

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APPENDIX A: AIR QUALITY GLOSSARY

1 INTRODUCTION

1.1 SCOPE OF ASSESSMENT

Coastplan Consulting Pty Ltd commissioned Air Noise Environment Pty Ltd to undertake an air quality assessment for a proposed sand quarry development at Somersby. The study has been undertaken to assess the potential air quality impacts in accordance with the requirements of the Director General of Planning as follows:

*'**Air Quality***

The EIS should include a detailed air quality impact assessment (AQIA). The AQIA should:

1. *Assess the risk associated with potential discharges of fugitive and point source emission for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human health and amenity.*

2. *Justify the level of assessment undertaken on the basis of risk factors, including but not limited to:*
   a. *proposal locations;*
   b. *characteristics of the receiving environment; and*
   c. *type and quantity of pollutants emitted.*

3. *Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:*
   a. *meteorology and climate;*
   b. *topography;*
   c. *surrounding land-use, receptors; and*
   d. *ambient air quality.*

4. *Include a detailed description of the proposal. All processes that could result in air emissions must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.*

5. *Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.*

6. *Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.*

7. *Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005) http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf*

8. *Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the Protection of the Environment Operations (POEO) Act (1997) and POEO (Clean Air) Regulation (2010).*



9. *Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan 'Action for Air.'*

10. *Detail emission control techniques/practices that will be employed by the proposal.*

The NSW OEH Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005) document specifies two levels of assessment for air dispersion modelling. For the purpose of the assessment, a Level 2 assessment has been undertaken which utilises one year of site-specific meteorology. In addition, the Calpuff dispersion model has been utilised, which is an approved dispersion model under the NSW OEH Approved Methods document.

1.2 PROPOSED DEVELOPMENT

The proposed development is the reinstatement of the Rindean Quarry on Lot 2 in DP 362339 at 620 Wisemans Ferry Road, Somersby, NSW. The F3 Freeway passes 350 metres to the east of the site. The site is situated in a Primary Production Zone according to the Gosford Local Environment Plan 2009. The site is bounded by Primary Production Zones to the north-west and south. To the east is an area designated as Rural Landscape, which is currently vacant. The nearest sensitive receptors to the development site include residential properties adjacent to the north-western boundary and southern boundary.

The site was previously used as a quarry starting in 1979 however, operations ceased in 2003. The proposal is to re-open the quarry with an annual throughput of up to 150,000 tonnes per annum of dry screened or washed construction sand. Raw material extraction and crushing will take place at the quarry floor using a dozer. The extracted material will be transported using haul trucks to a screening and washing plant prior to off-site transport.

The quarry operation on the site will be conducted over 5 stages. Stage 1 will involve the excavation of Quarry Cells 1 to 2 and establishment of a stormwater retention basin and freshwater pond. Fixed plant and stockpiles will be located in Quarry Cell 3. During Stage 2, Quarry Cells 3to 5 will be excavated and plant and stockpiles will be relocated to Quarry Cell 2. Stages 3 and 4 will involve progressively the excavation of Quarry Cells 6 and 7. Rehabilitation will continue throughout the operation. Rehabilitation will be completed and the site vacated during Stage 5.

Figures 1 and 2 present the development site location and surrounding landuses. Figures 3a to 3c present the proposed site layout for Stages 1 to 4.

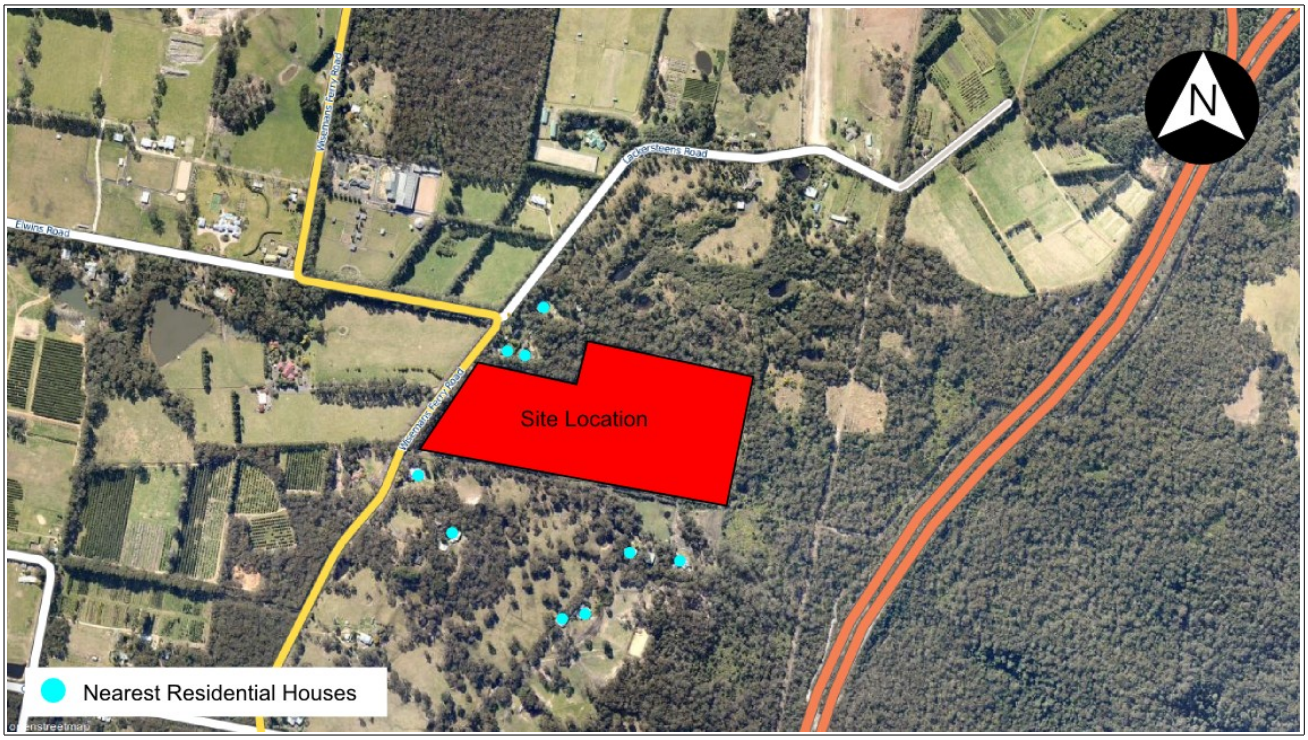


Figure 1: Proposed Site Location

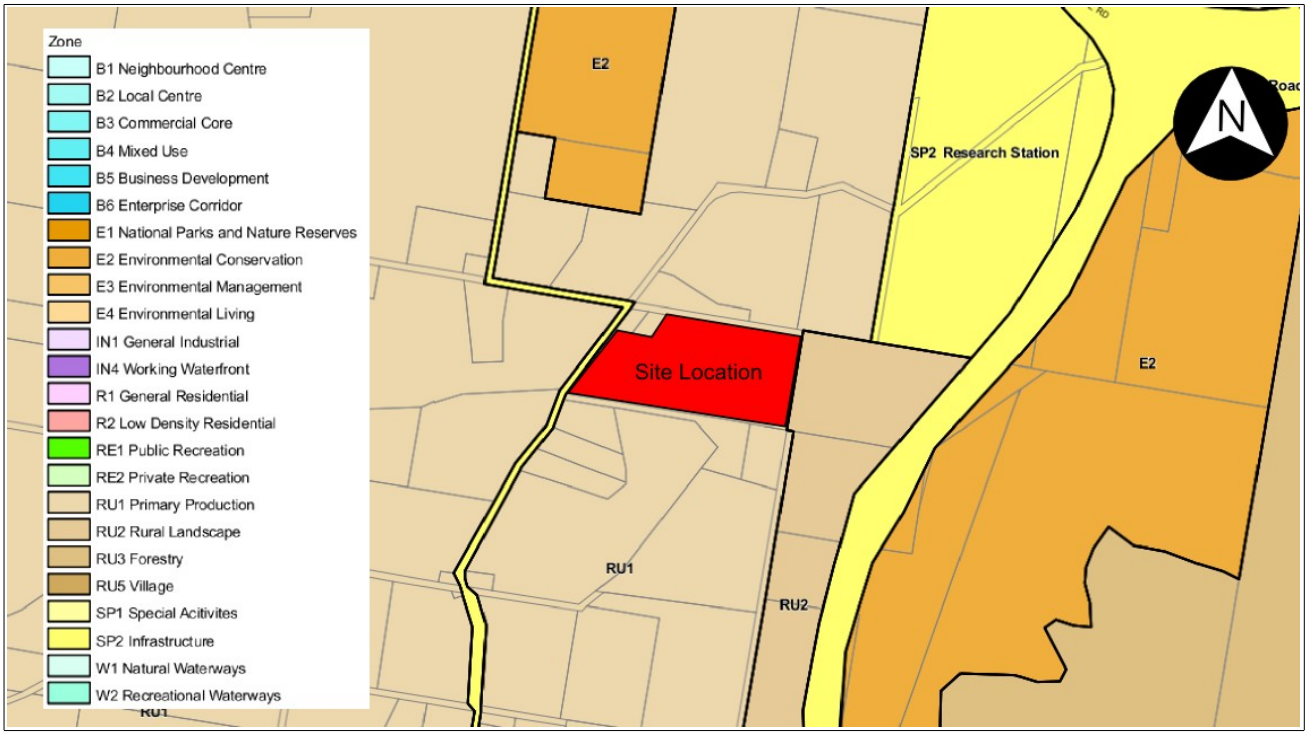


Figure 2: Surrounding Land Uses

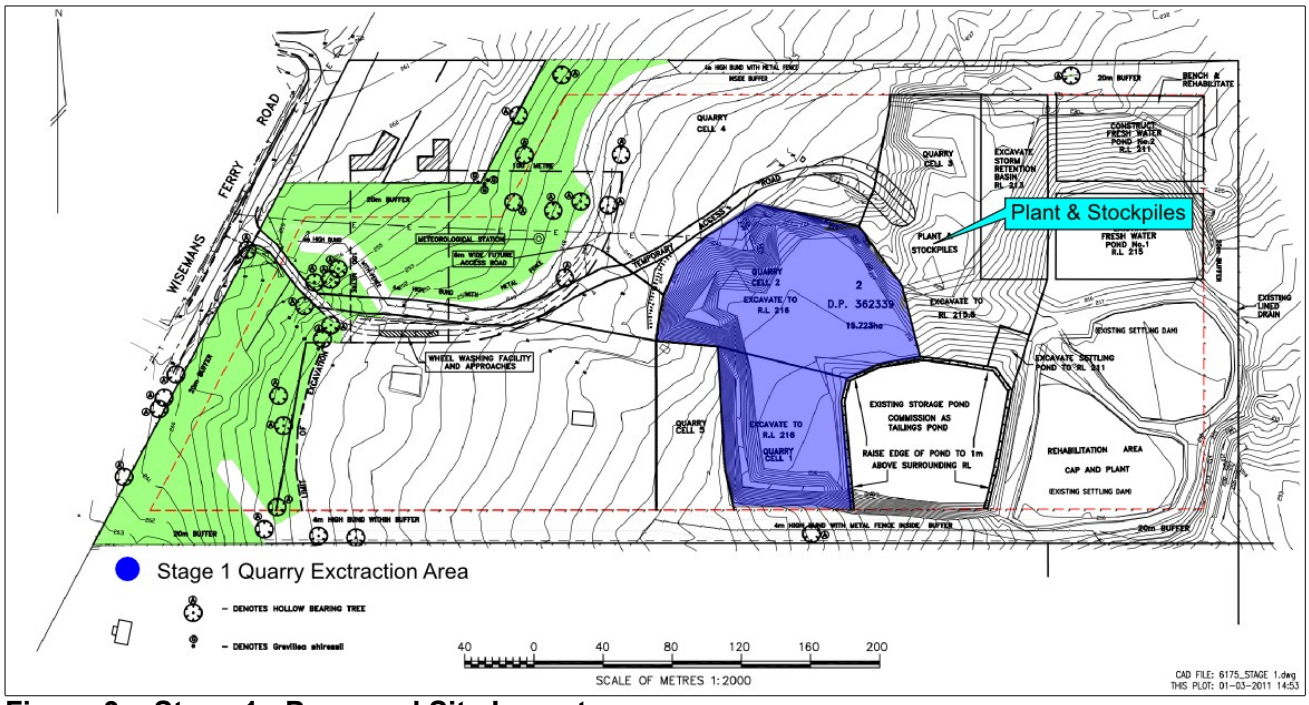


Figure 3a: Stage 1 - Proposed Site Layout

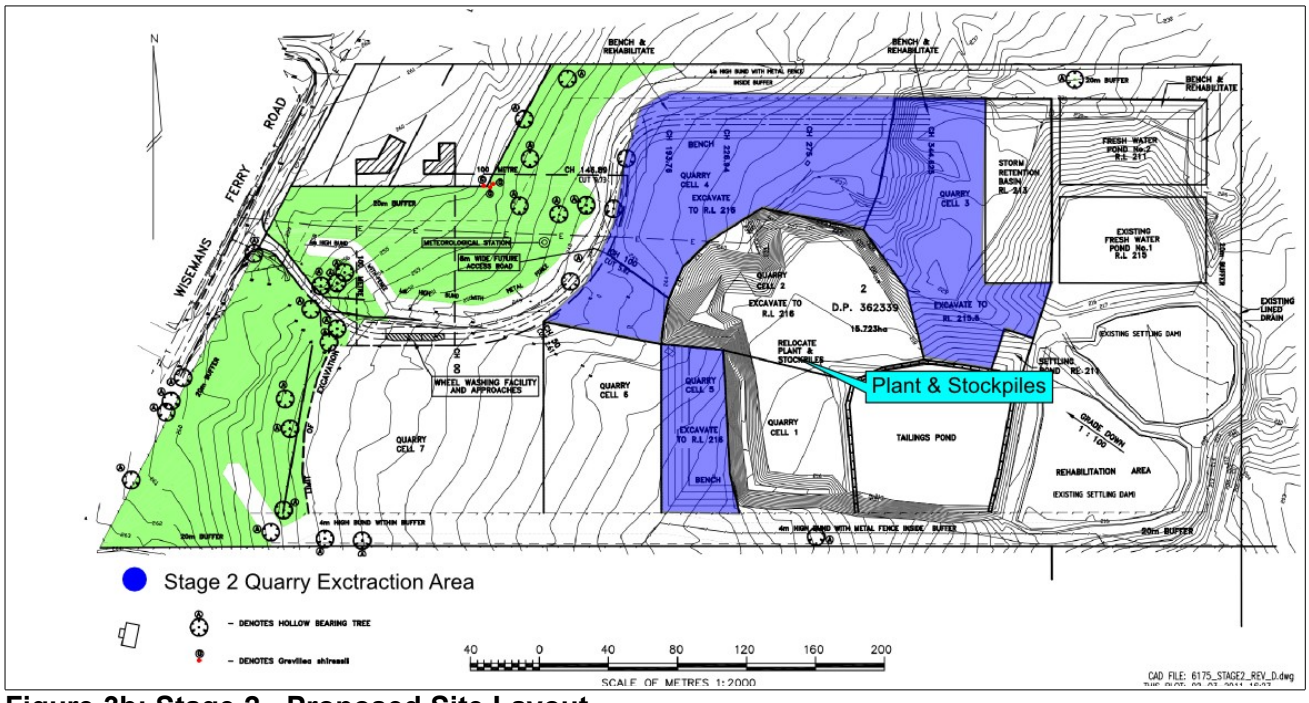


Figure 3b: Stage 2 - Proposed Site Layout

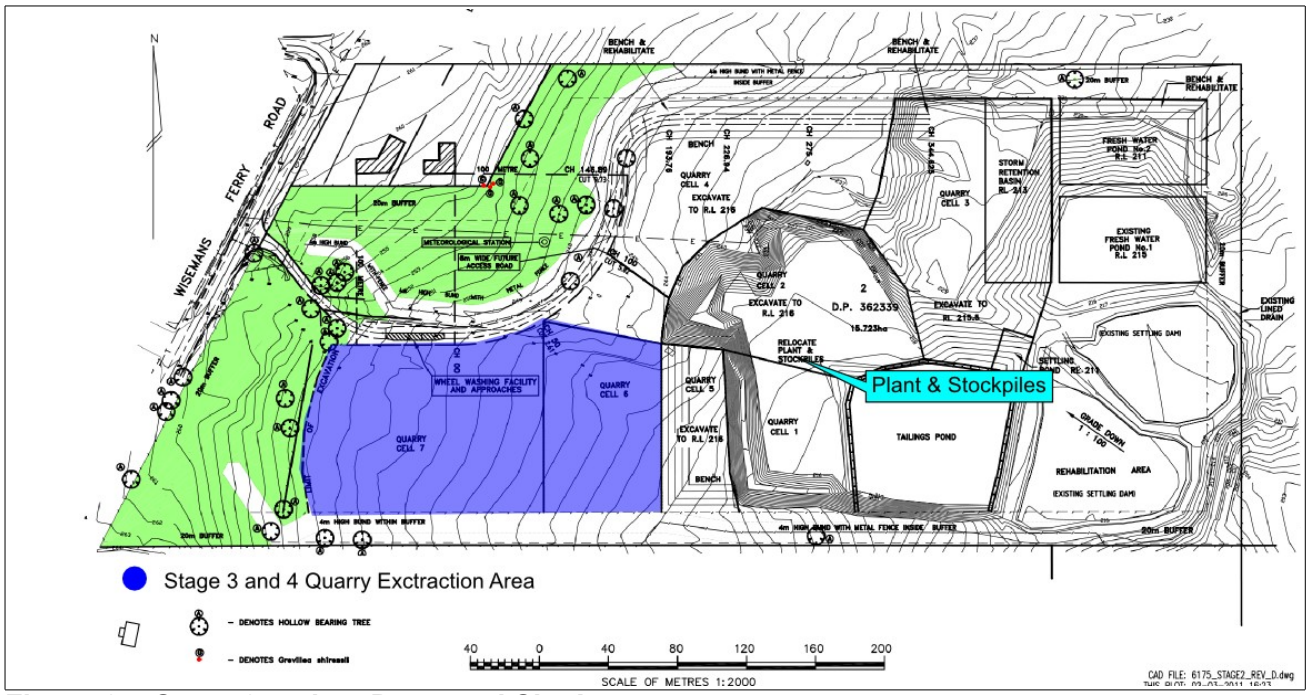


Figure 3c: Stage 3 and 4 - Proposed Site Layout

1.3 THIS REPORT

This report summarises the methodology, results and conclusions of the air quality assessment. A glossary of terms is presented in Appendix A to assist the reader.

2 POTENTIAL AIR EMISSION SOURCES

For sand quarry activities, the main air emission compounds with a potential to impact sensitive receptors include deposited dust, $PM_{2.5}$, PM_{10} and Total Suspended Particulates (TSP). The particulate air emissions are primarily associated with extraction activities, haul routes and stockpiles. Elevated concentrations of deposited dust and TSP can present a risk to the environmental amenity of an area, while elevated concentrations of $PM_{2.5}$ and PM_{10} can present a risk to human health.

Quarry excavation will occur across 7 different quarry cells and the types of emissions and activity are expected to be identical for each cell. The following is a summary of potential particulate emission sources for the Rindean quarry:

- overburden removal;
- screening;
- dried screened product stockpiles (approximately 2000 m^2);
- unsealed haul routes;
- wind erosion over exposed extraction areas; and
- diesel equipment.

The extraction process using a dozer is predominantly a damp process because of the natural level of moisture in the parent material. Hence, minimal particulate emissions are expected from the extraction face and transportation to the screening plant. The screened product will also contain a level of moisture which will be dependent on the moisture content of the material being screened. Water sprays will also be utilised on site to reduce emissions from haul routes and stockpiles. The proposed haul route will be gravelled (extraction site to wheel wash) and sealed (wheel wash to Wisemans Ferry Road). Following excavation, rehabilitation of each stage would be undertaken using a loader and tractor for up to 2 weeks. All vehicle loads will be covered and no blasting will be used for the process.

Gaseous exhaust emissions from diesel equipment are another source of potential air emissions. Exhaust emissions are likely to come from dry screen equipment, haul trucks, D9 dozer, one excavator and one loader. The main type of gaseous compounds released from diesel engines include carbon monoxide and nitrogen oxides.

A typical daily throughput of 500 tonnes is expected with up to 20 road trucks leaving the site each day. The quarry is proposed to operate from Monday to Friday 7.00 am to 6.00 pm and Saturday 7.00 am to 1.00 pm. The quarry will not operate on Sunday. In addition, resource extraction will not occur before 8.00 am.

During the construction phase, air emissions would also be primarily associated with particulates from clearing and exhaust emissions from diesel equipment. The main works are associated with construction of internal roads prior to operation for the quarry and these works are expected to occur for short durations only (up to 5 days).

The proponent proposes a number of measures to minimise the potential for air quality impacts as follows:

- buffer (including vegetation) along the western boundary of the site, up to 65 metres;
- water sprays to stockpiles and haulage roads;
- covering of truck loads with tarpaulins;

- wheel wash for trucks prior to leaving the site; and
- use of current generation technology for plant items (e.g. diesel vehicles).

Table 2.1 presents a summary of the main air emission sources modelled in this assessment. Modelling has not been considered for construction and rehabilitation works, given the short duration of these activities. Modelling of the operational scenario (excavation and processing) is likely to represent worst-case emissions.

TABLE 2.1: MODELLED EMISSION SCENARIOS AND SOURCES

No.	Scenario	Particulate Emissions	Exhaust Emissions
1	Operational – Quarry Cell 1	▪ overburden removal; ▪ screening; ▪ dried screened product stockpiles ▪ unsealed haul route; ▪ wind erosion over exposed extraction areas. ▪ diesel equipment.	▪ D9 Dozer; ▪ excavator; ▪ dump truck ▪ haul truck (20 movements per day) ▪ screen; ▪ loader.
2	Operational – Quarry Cell 4		
3	Operational – Quarry cell 7		

The Director General requirements indicates a consideration of worst case emission scenarios. It is noted that a throughput of 500 tonnes per day has been modelled, which is representative of a typical daily throughput to achieve the proposed full production of 150,000 tonnes per annum. It is noted that the daily production rate could vary from this however, these variations are difficult to estimate as this would require anticipation of peak demands, which would be based on unforeseen contracts.

3 EXISTING ENVIRONMENT

3.1 SURROUNDING LAND AND EMISSION SOURCES

As discussed in Section 1.2, the land parcels surrounding the proposed quarry site are designated as Primary Production Zones or Rural Landscape Zones. The nearest sensitive receptors to the development site include residential dwellings adjacent to the north-western boundary and southern boundary. Figures 1 and 2 in Section 1.2 identify the surrounding landuses and nearest sensitive receptor locations.

Existing air emission sources surrounding the proposed site include:

- road traffic along the local road network, particularly the F3 Sydney-Newcastle Freeway (located 350 metres east of the site);
- Hanson Central Coast Sand Quarry located 2 km to the west; and
- a number of poultry sheds located between 1.5 km and 1.8 km west.

A review of the NSW Planning and Infrastructure project database indicates a potential for two additional quarries in the Somersby area. One proposed quarry is an extension to the Hanson Central Coast Quarry and is located 1.5 km west of the proposed development site at the end of Keighley Avenue. The second proposed quarry is to be located 2.8 km south-west of the development site at the end of Grants Road. These quarry proposals are currently in the planning stage and awaiting a final decision by the Director General.

Given the large separation distances (1.5 km to 2.8 km), potential air emissions from existing and potential industry sources are unlikely to have a significant contribution to the air environment at sensitive receptors adjacent to the proposed quarry site.

The quarry site is located at a basin below surrounding ridges to the north, south and west, which rise up to 40 metres above the site RL of approximately 220 metres.

3.2 LOCAL METEOROLOGY

Historical windroses for the Bureau of Meteorology Peats Ridge weather station (9 km north-west of the site) indicates that the region is dominated north-easterly to south-easterly winds during the morning and south-westerly and westerly winds during the afternoon periods.Figure 4 presents 9.00 am and 3.00 pm windroses for Peats Ridge.

Average rainfall levels for the area are relatively high at approximately 1271 mm per year according to the BOM.

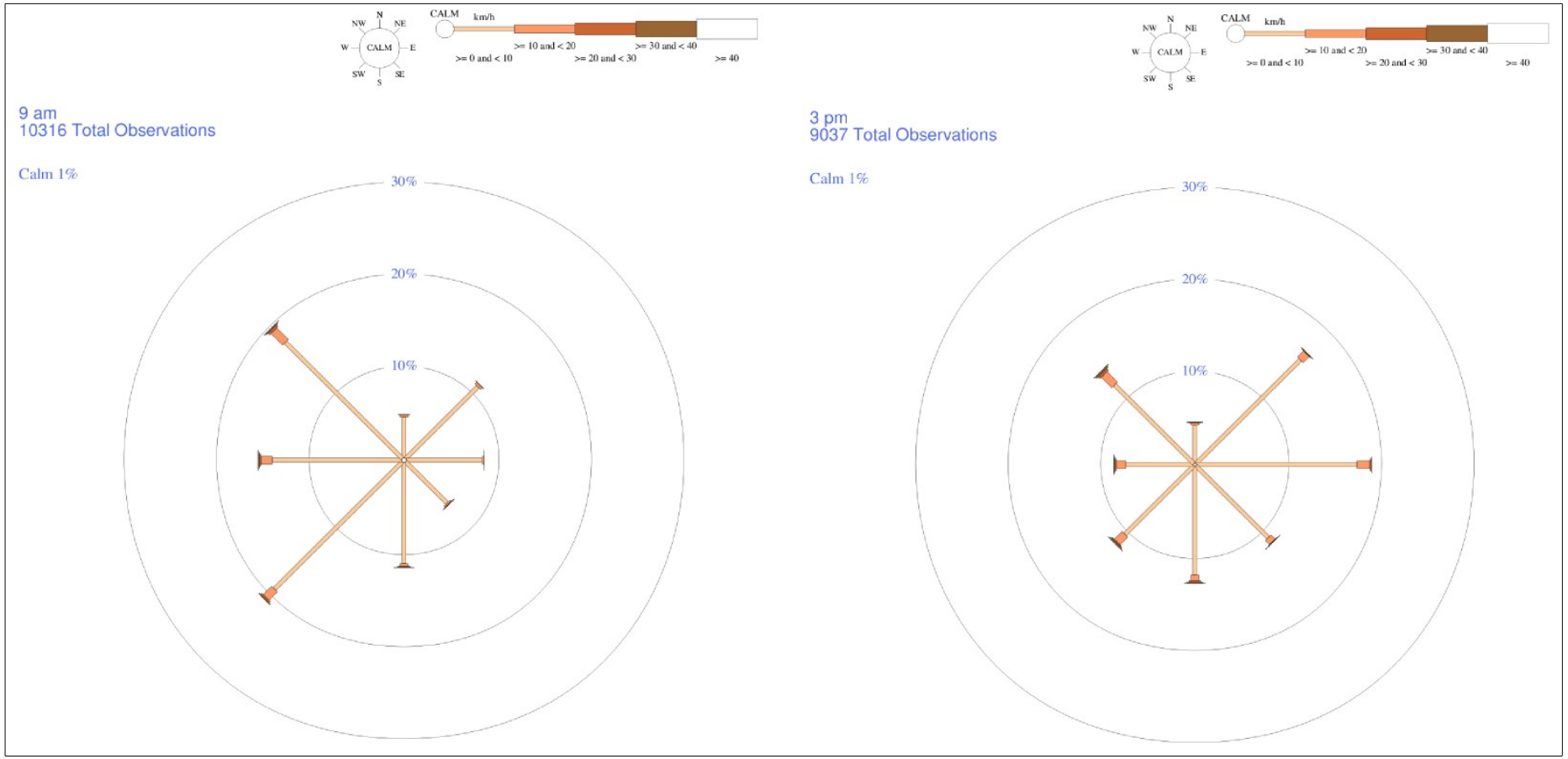


Figure 4: Peats Ridge - Bureau of Meteorology 9 am and 3 pm Windroses

3.3 BACKGROUND AIR QUALITY

The NSW Office of Environment and Heritage provides ambient air quality data from monitoring stations operated throughout NSW. The nearest monitoring stations are situated in the Sydney area (south of Somersby). Table 3.1 below presents ambient pollutant concentrations for the Sydney monitoring stations for the year 2011.

TABLE 3.1: SUMMARY OF AMBIENT POLLUTANT CONCENTRATIONS FOR THE SYDNEY AREA (μg/m^3)

Monitoring Station	Measured PM_{10}		Measured CO		Measured NO_2	
	75th Percentile 24-hour Average	Annual Average	75th Percentile 24-hour Average	Annual Average	75th Percentile 24-hour Average	Annual Average
Randwick	19.5	16.0	-	-	21.1	14.0
Rozelle	20.5	16.6	457.5	382.6	28.2	20.9
Lindfield	15.5	13.3	-	-	24.4	18.4
Chullora	23.1	19.8	457.5	406.7	31.9	24.5
Earlwood	21.7	18.0	-	-	22.5	17.4
Richmond	16.0	13.2	-	-	11.3	9.6
St Marys	18.4	14.7	-	-	13.2	10.8
Vineyard	16.9	14.0	-	-	13.2	11.0
Prospect	19.4	15.9	457.5	383.6	24.4	19.5
Adopted	***16.9***	***14.0***	***457.5***	***383.6***	***13.2***	***11.0***

Of the above locations in the Sydney area, Richmond and Vineyard are considered to be most representative of the proposed site location for PM_{10} and NO_2 levels. These sites are located on the outskirts of the Sydney area and less likely to be influenced from significant industry and traffic networks. In the absence of site specific data, PM_{10} and NO_2 monitoring data from Vineyard has been considered. For carbon monoxide, background levels from Prospect have been adopted.

4 ASSESSMENT CRITERIA

Air quality criteria relevant to the assessment are specified in the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales' (2005). Table 3.1 presents air quality criteria for particulates and gaseous compounds applicable to the development.

TABLE 3.1: AIR QUALITY CRITERIA

Pollutant	Concentration ($\mu g/m^3$)	Averaging Period
PM_{10}	50 30	24-hours Annual
Total suspended particulates (TSP)	90	Annual
Deposited Dust	Maximum increase of 2 g/m^2/month Maximum of 4 g/m^2/month	Annual
Carbon Monoxide	100,000 30,000 10,000	15-minute 1-hour 8-hour
Nitrogen Dioxide	246 62	1-hour Annual

The above air quality goals for PM_{10}, Carbon Monoxide (8-hour average) and Nitrogen Dioxide are also referenced in the Air National Environment Protection Measure (Air NEPM), which are specifically identified as air quality targets under the NSW State Plan and associated 'Action for Air' air management strategy plan.

5 AIR QUALITY ASSESSMENT

5.1 MODELLING METHODOLOGY

5.1.1 Overview

Atmospheric dispersion modelling involves the mathematical simulation of the dispersion of air contaminants in the environment. The modelling utilises a range of information to estimate the dispersion of pollutants released from a source including:

- meteorological data for surface and upper air winds, temperature and pressure profiles, as well as humidity, rainfall, cloud cover and ceiling height information;
- emissions parameters including source location and height, source dimensions and physical parameters (eg exit velocity and temperature) along with pollutant mass emission rates;
- terrain elevations and land use both at the source and throughout the surrounding region; and
- the location, height and width of any obstructions (such as buildings or other structures) that could significantly impact on the dispersion of the plume.

For the purpose of the assessment, meteorological modelling has been undertaken using TAPM (The Air Pollution Model) and CALMET to predict localised meteorological conditions. The meteorological data derived from these models have been used as an input for the CALPUFF dispersion modelling.

5.1.2 TAPM Predictions

A site specific meteorological dataset has been determined using the prognostic model TAPM (The Air Pollution Model). Prognostic models, such as TAPM, permit the development of localised meteorological datasets, based on synoptic weather conditions. The model predicts the regional flows important to dispersion, such as sea breezes and terrain induced flows, against a background of larger-scale meteorology provided by synoptic analyses. The output of this model, when used with a diagnostic meteorological model, such as Calmet, provides a meteorological dataset suitable for introduction into the diagnostic wind field results. This methodology is the recommended approach for the modelling of contaminant concentrations using Calmet[1].

Predictions of meteorological parameters for the year 2009 for the region in the surroundings of the West Gosford area were undertaken using TAPM (Version 4). The model was configured with a series of nested grids chosen to provide an appropriate communication and transfer of information from the broad synoptic to the local scale.

The model was configured to use a domain consisting of 25 x 25 x 25 grid points with nesting spacings of 30 km, 10 km, 3 km and 1 km. The model utilised data taken from the the NASA SRTM (Shuttle Radar Topography Mission) dataset (90 metre intervals).

[1] *TRC Environmental Corporation (March 2011) 'Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia' prepared on behalf of the NSW Office of Environment and Heritage.*

5.1.3 CALMET Predictions

5.1.3.1 Overview

Upper air and surface data (for the year 2009) derived from the TAPM model was input to CALMET to predict meteorological conditions near the development site. The following sections provide an overview of the data utilised in the CALMET modelling, along with details of some of the key parameters selected to establish calculation limits within CALMET.

5.1.3.2 Vertical Stations

For the purposes of the modelling, CALMET was initialised with a total of 12 vertical layers with layer boundaries at 20 m, 50 m, 80 m, 160 m, 250 m, 500 m, 750 m, 1,000 m, 1,500 m, 2,000 m, 3,000 m and 4,000 m respectively. The vertical levels used in the modelling were selected to provide the model with the ability to predict a generic range of atmospheric conditions near to the site.

5.1.3.3 Terrain and Land Use Data

Terrain height data was based on data from the Shuttle Radar Imaging Mission (SRTM), and obtained from the United States Geological Survey (USGS) web site. This produced terrain height data on a 3 arc-second longitude/latitude grid (approximately 0.09 km) for a grid domain of 10 km x 10 km encompassing the site region.

Land use and coastline data was also obtained from the USGS and incorporated into the CALMET model.

5.1.4 CALPUFF Dispersion Modelling

The CALPUFF modelling system treats emissions as a series of puffs. These puffs are then dispersed throughout the modelling area and allowed to grow and bend with spatial variations in meteorology. In doing so, the model is able to retain a memory of the plume's movement throughout a single hour and from one hour to the next while continuing to better approximate the effects of complex air flows.

CALPUFF utilises the meteorological processing and prediction model CALMET to provide three dimensional wind field predictions for the area of interest. The final wind field developed by the model (for consideration by CALPUFF) includes an approximation of the effects of local topography, the effects of varying surface temperatures (as is observed in land and sea bodies) and surface roughness (resulting from varied land uses and vegetation cover in an area). The CALPUFF model is able to resolve complex terrain influences on local wind fields including consideration of katabatic flows and terrain blocking.

5.1.5 CALPOST

Post processing of modelled emissions is undertaken using the CALPOST package. This allows the rigorous analysis of pollutant predictions generated by the CALPUFF system. In particular CALPOST is able to provide an analysis of predicted pollutant concentrations for a range of averaging periods from 1 hour to 1 year.

5.2 METEOROLOGY

5.2.1 Wind Predictions

Figure 5 presents a comparison of predicted 9 am and 3 pm wind roses with measured wind roses for the BOM Peats Ridge meteorological station. As shown in the results, the predicted wind roses at 9 am and 3 pm are comparable with the historical windrose data. There some variations during the afternoon, with the predicted wind conditions have less westerly wind conditions. It is noted that 2009 surface and upper air data has been utilised for predictions. Any variations in data may be a result of atypical wind conditions during the year 2009.

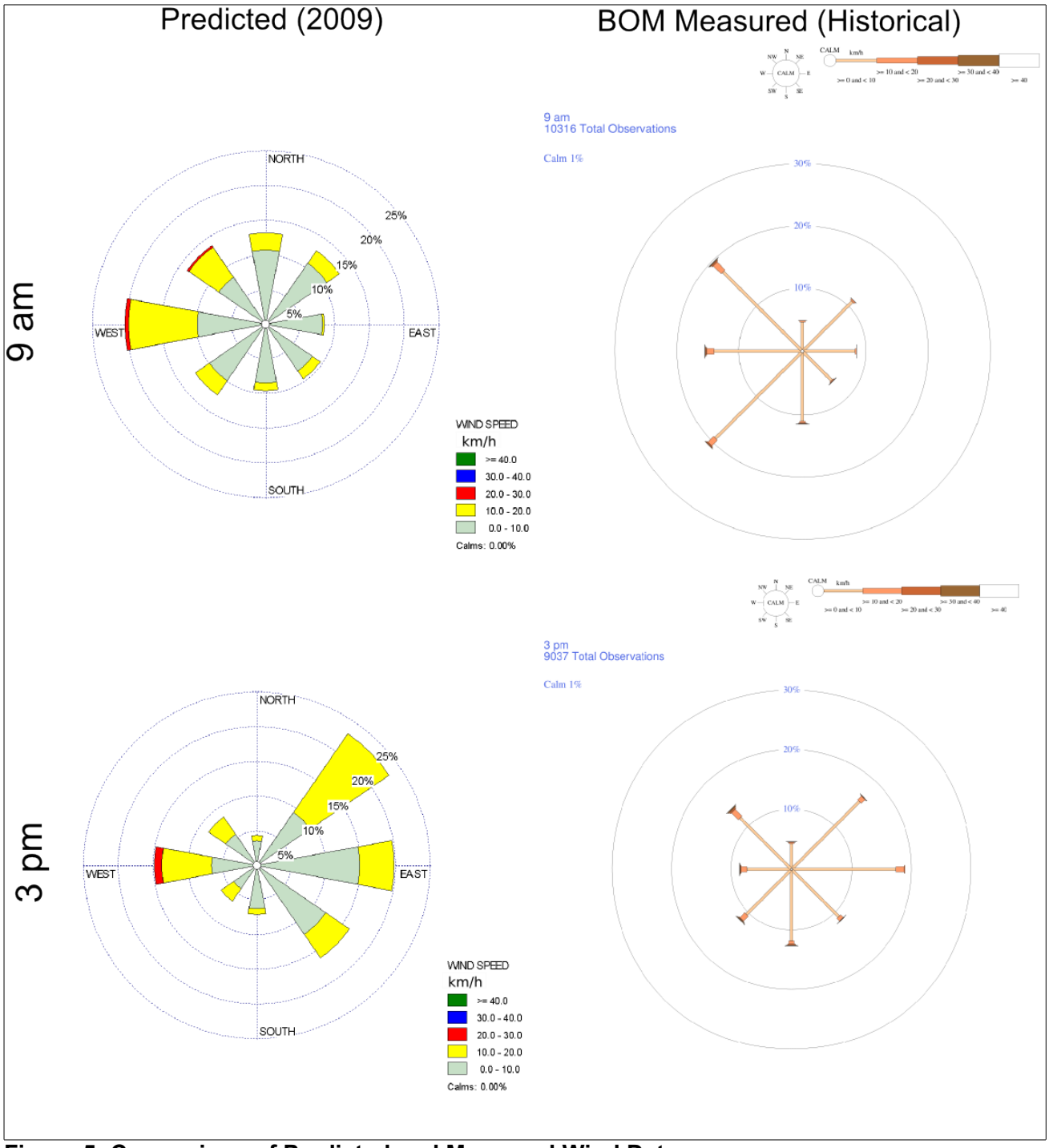


Figure 5: Comparison of Predicted and Measured Wind Data

5.2.2 Predicted Atmospheric Stability

The amount of turbulence in the ambient air has a major effect upon the rise and dispersion of emissions. The amount of turbulence in the atmosphere is often described using series of six Pasquill stability classes A, B, C, D, E and F (Turner, 1970). Of these, Class A denotes the most unstable or most turbulent conditions and Class F denotes the most stable or least turbulent conditions. Table 5.1 provides a summary of the predicted atmospheric stability conditions (derived

by CALMET) for the project site. These data indicate a high percentage frequency of occurrence for stable conditions (stability class F) during night periods. More neutral or unstable conditions are predicted during day periods. This is due primarily to the impact of solar heating on atmospheric turbulence and is considered typical for the region.

TABLE 5.1: SUMMARY OF PREDICTED STABILITY CLASSES BY HOUR

Hour	Predicted Pasquill Stability Class					
	A	B	C	D	E	F
0	0	0	0	109	99	156
1	0	0	0	116	100	148
2	0	0	0	113	98	153
3	0	0	0	119	89	156
4	0	0	0	117	94	153
5	0	0	25	175	72	92
6	0	15	75	190	44	40
7	0	24	115	225	0	0
8	1	79	132	152	0	0
9	2	116	105	141	0	0
10	58	84	89	133	0	0
11	62	97	75	130	0	0
12	50	103	70	141	0	0
13	29	95	78	162	0	0
14	3	95	92	174	0	0
15	1	81	111	171	0	0
16	0	18	141	205	0	0
17	0	0	82	179	22	78
18	0	0	14	156	37	157
19	0	0	0	96	70	198
20	0	0	0	98	81	185
21	0	0	0	104	83	177
22	0	0	0	109	91	163
23	0	0	0	115	94	154

5.3 AIR EMISSION DATA

In order to predict emission rates for the above sources, a review of available published literature relating to sand quarry operations has been completed. The following documents have been utilised to estimate emissions:



1. AP 42 (5th Edition), Compilation of Air Pollutant Emission Factors, Vol. 1 Stationary Point and Area Sources, Chapter 11.19.2, Crushed Stone Processing and Pulverised Mineral Processing.

2. Emission Estimation Technique Manual for Combustion Engines, National Pollution Inventory, Version 3, 2008.

3. Emission Estimation Technique Manual Mining and Processing of Non-Metallic Minerals, National Pollution Inventory, Version 2, 2000.

Table 5.2 presents emission factors sourced from the above literature.

TABLE 5.2: EMISSION FACTORS

Activity/Source	Units	TSP	PM_{10}	$PM_{2.5}$	CO	NO_x
Overburden removal	kg/Mg	0.0250	0.0120	0.0018	-	-
Screening	kg/Mg	0.0125	0.0043	0.00065	-	-
Transfer to stockpiles	kg/Mg	0.004	0.0017	0.00026	-	-
Loading trucks with dried screened product	kg/Mg	0.025	0.012	0.0018	-	-
D9 Dozer – diesel engine	kg/kWh	0.0018	0.00176	0.00163	0.0150	0.0352
Excavator – diesel engine	kg/kWh	0.0029	0.0029	0.0027	0.0099	0.0396
Wheeled loader – diesel engine	kg/kWh	0.0036	0.0036	0.0033	0.0119	0.0396
Haul truck – diesel engine	kg/kWh	0.0018	0.0018	0.0017	0.0068	0.0230
Screen – diesel engine	kg/kWh	0.0051	0.0051	0.0050	0.0160	0.0720
Wind erosion over dried screened product stockpiles	$kg/m^2/hr$	0.00004	0.00002	0.000003	-	-
Haul Route	g/VKT	4230	1250	187.5	-	-
Wind Erosion at Excavation Areas	$kg/m^2/hr$	0.00004	0.00002	0.000003	-	-

In order to derive emission rates using the above emission factors, the following assumptions have been made:

- throughput rate of 500 tonnes per day of product and 67 tonnes per day of overburden;
- 0.2 ha area of product stockpiles;
- excavation areas of 0.25 ha, 7.3 ha and 8.6 ha for Cells 1, 4 and 7, respectively;
- total distance travelled by haul truck on site is 0.6 km (20 movements per day are expected for haul trucks);
- fuel usage for diesel equipment:
  - 400 L/day for D9 Dozer;
  - 15 L/day for wheeled loader (4 m^3 bucket);
  - 150 L/day for 20 tonne excavator;



  - 150 L/day for on-site haul truck;
  - 80 L/day for screening equipment.

- 50% reduction to emissions for water sprays used at the aggregate and product storage areas;
- 75% reduction to emissions for water sprays along haul route (Level 2 watering, greater than 2 L/m^2/h); and
- 90% reduction to emissions for screening (wet process).

A summary of estimated emission rates based on the above information is presented in Table 5.3.

TABLE 5.3: ESTIMATED EMISSION RATES (g/s)

Activity	TSP	PM_{10}	$PM_{2.5}$	CO	NO_x
Overburden removal	0.0231	0.0111	0.0017	-	-
Screening	0.0174	0.0060	0.0009	-	-
Transfer to stockpiles	0.0056	0.0024	0.0004	-	-
Loading trucks with dried screened product	0.1736	0.0833	0.0125	-	-
D9 Dozer – diesel engine	0.0244	0.0244	0.0227	0.2089	0.4889
Excavator – diesel engine	0.0151	0.0151	0.0139	0.0516	0.2063
Wheeled loader – diesel engine	0.0019	0.0019	0.0017	0.0062	0.0206
Haul truck – diesel engine	0.0094	0.0094	0.0089	0.0354	0.1198
Screen – diesel engine	0.0142	0.0142	0.0139	0.0444	0.2000
Haul Route	0.3525	0.1042	0.0156	-	-
Wind erosion over dried screened product stockpiles	0.0111	0.0056	0.0008	-	-
Wind Erosion at Excavation Areas (Cell 1)	0.0139	0.0069	0.0010	-	-
Wind Erosion at Excavation Areas (Cell 4)	0.0406	0.0203	0.0030	-	-
Wind Erosion at Excavation Areas (Cell 7)	0.0478	0.0239	0.0036	-	-

5.4 DUST DEPOSITION DATA

Dust deposition modelling has been undertaken using the Calpuff dispersion model. For the purpose of estimating dust particulate sizes, particle distribution data has been sourced from the US Environmental Protection Agency AP 42 document Chapter 13.2.4 “Aggregate handling and storage piles”. Based on the mass distribution, a geometric mass mean diameter and standard deviation of 9.0 μm and 2.37 has been calculated, respectively. Table 5.4 presents the parameters considered for the assessment.

TABLE 5.4: DUST CHARACTERISTICS

Particle Size (micron)	Mass Fraction
< 2.5	0.07
2.5 – 5	0.20
5 - 10	0.20
10 - 15	0.18
15 - 30	0.35

5.5 MODELLED RECEPTORS

Gridded receptors over a 3000 m x 3000 m grid (50 m spacing) surrounding the proposed development have been considered in the dispersion modelling. In addition, 7 discrete receptors representing the nearest sensitive receptors have also been considered.

5.6 SOURCE LOCATIONS

Figure 6 presents the modelled source locations for the three modelling scenarios (Cell 1, Cell 4 and Cell 7).

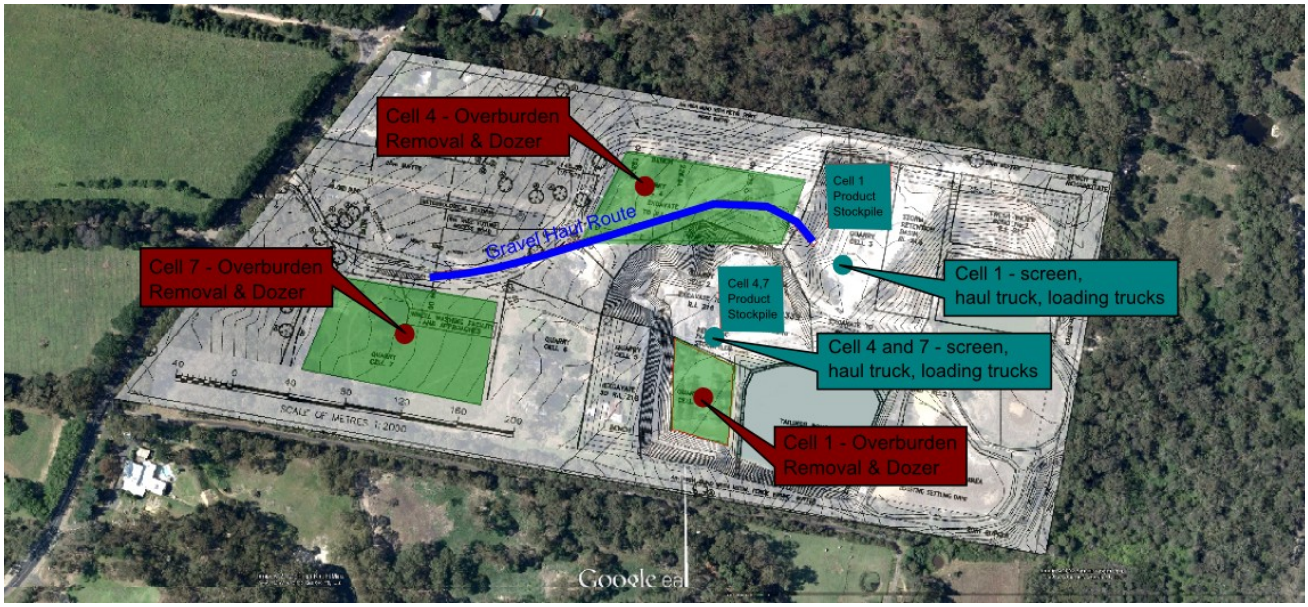


Figure 6: Modelled Source Locations

5.7 MODELLING RESULTS

Table 5.5 presents predicted cumulative ground level concentrations at the nearest sensitive receptors. The cumulative predictions take into consideration ambient air quality data presented in Table 3.3. Figures 7a to 7c and 8a to 8c present predicted cumulative ground level concentrations



for PM_{10} (24-hour average) and NO_2 (1-hour average), respectively.

It is noted that the model predicts NO_x concentrations based on NO_x emission rates. In order to estimate potential NO_2 concentrations, a 10 % conversion factor has been considered. This is considered appropriate given the relatively small separation distances between emission sources and sensitive receptors.

TABLE 5.5: MAXIMUM PREDICTED CUMULATIVE GROUND LEVEL CONCENTRATIONS AT NEAREST SENSITIVE RECEPTORS

Pollutant	Maximum Predicted Sensitive Receptor Ground Level Concentration (µg/m³)			Criteria (µg/m³)	Averaging Period
	Cell 1	Cell 4	Cell 7		
PM_{10}	**77.1**	**118.0**	**75.0**	50	24-hours
PM_{10}	20.9	23.3	21.2	30	Annual
TSP	15.0	17.5	15.4	90	Annual
Dust	0.5	0.6	0.6	Max increase of 2 g/m²/month	Annual
CO	2352.2	2094.3	3077.4	100,000	15-minute
CO	1893.4	1698.0	2443.0	30,000	1-hour
CO	567.1	1073.1	778.5	10,000	8-hour
NO_2	**413.1**	**356.6**	**544.0**	246	1-hour
NO_2	11.6	12.3	11.7	62	Annual

As indicated in Table 5.4, compliance is predicted at the nearest sensitive receptors for the modelled compounds, except for PM_{10} (24-hour average) and NO_2 (1-hour average).

An analysis of the emission rates indicates that the unpaved (gravel only) haul route is predicted to be the main contributor to particulate emissions and the PM_{10} exceedance. It is noted that the NPI emission factor for mining haul routes (neither sealed or gravelled) has been adopted in the absence of more site specific data. This is likely to result in conservative predictions given that the proposed haul route is to be gravelled. Actual particulate concentrations are likely to be lower provided that the haul route is maintained on a regular basis (in addition to water sprays).

The highest PM_{10} concentrations are predicted for the 3 properties near the north-western corner of the site. It is noted that a 4.0 m earthmound and a vegetative buffer (up to 65 metres) is proposed between the nearest excavation cells (Cell 4 and 7) and the sensitive receptors. Though difficult to quantify, the vegetative buffer is likely to provide some benefit in reducing particulate concentrations at these receptors. Particulate removal is dependent on a number of different factors and some studies have indicated between a 35% and 56% removal of particulates[2,3]

For NO_2, further analysis of the results indicates the following number of exceedances in a one year

[2] *Laird, D.J. 1997. Wind tunnel testing of shelterbelt effects on dust emissions from swine production facilities. Thesis (M.S.), Iowa University.*
[3] *Thernelius, S.M. 1997. Wind tunnel testing of odor transportation from swine production facilities. Thesis (M.S.), Iowa University.*

period based on the predicted meteorological windfield:

- Cell 1 scenario – 1 exceedance of the 1-hour average criteria at up to 1 receptor;
- Cell 4 scenario – 9 exceedances of the 1-hour average criteria at up to 3 receptors; and
- Cell 7 scenario – 5 exceedances of the 1-hour average criteria at up to 3 receptors.

The above exceedances occur under worst-case wind conditions during the year. The modelling assumes an excavator, haul truck, dozer and loader are operating simultaneously in a 1-hour period. In practice, machine usage will be intermittent and continuous operation is unlikely to be required.

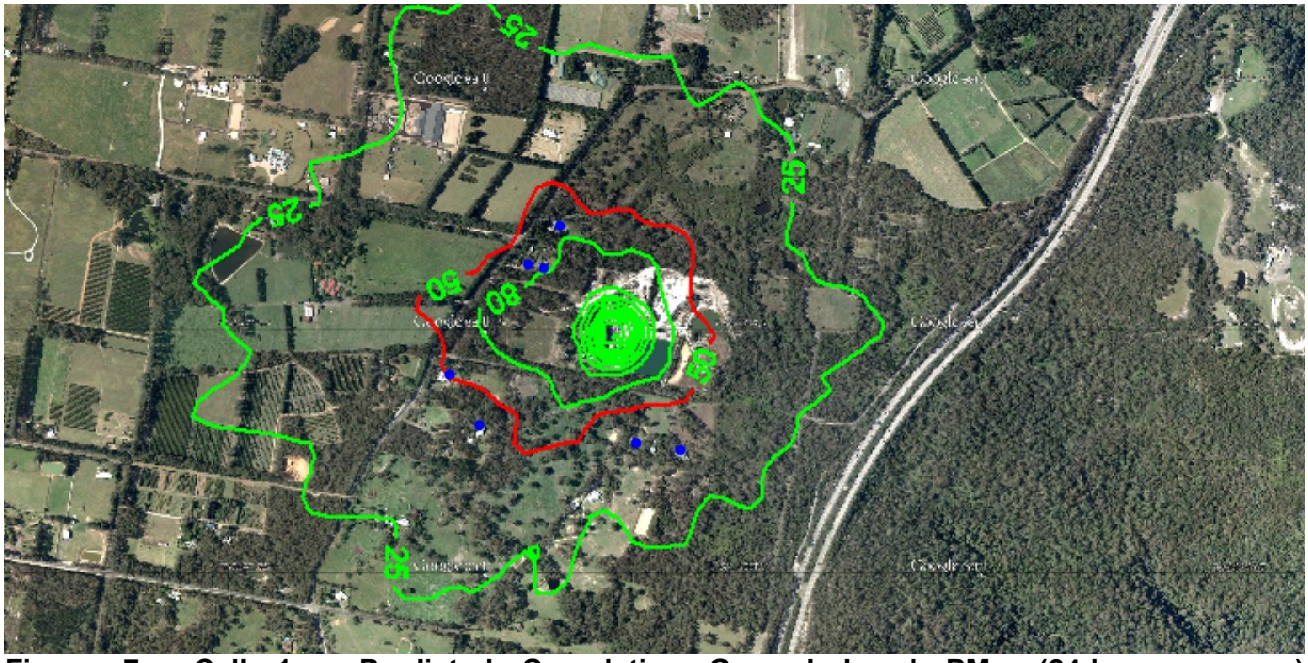


Figure 7a: Cell 1 - Predicted Cumulative Ground Level PM_{10} (24-hour average) Concentrations ($\mu g/m^3$)

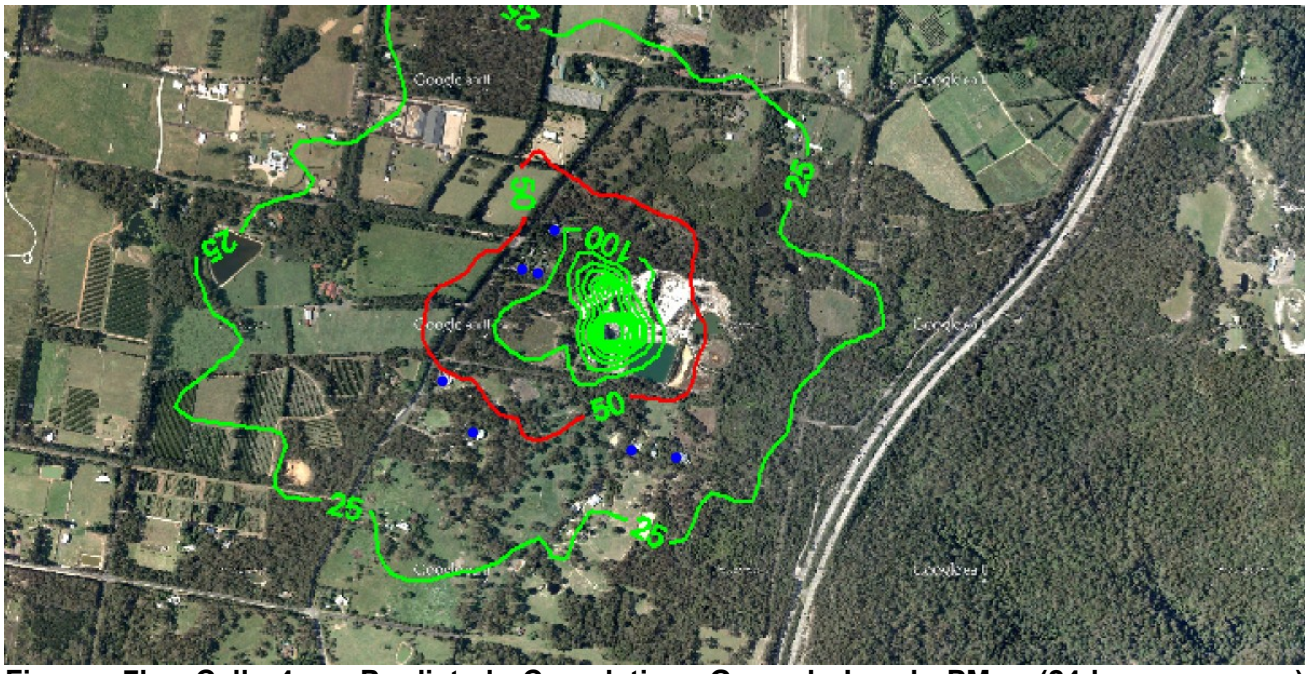


Figure 7b: Cell 4 - Predicted Cumulative Ground Level PM_{10} (24-hour average) Concentrations ($\mu g/m^3$)

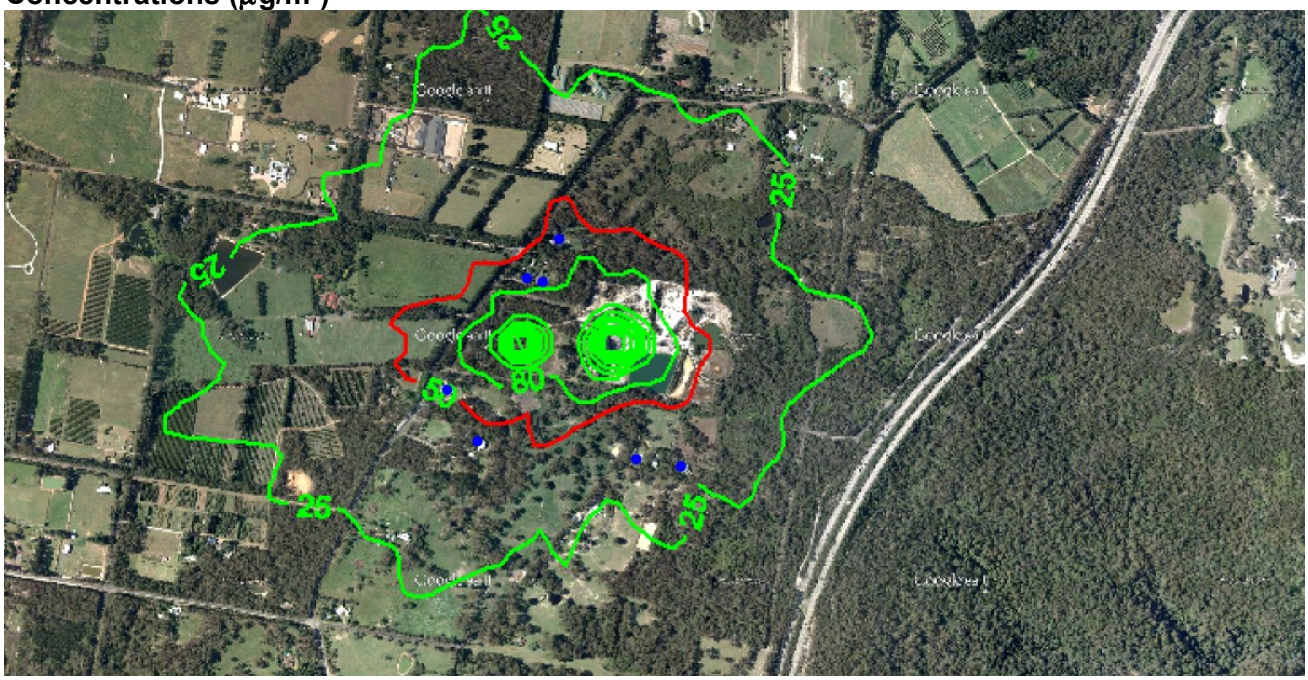


Figure 7c: Cell 7 - Predicted Cumulative Ground Level PM_{10} (24-hour average) Concentrations ($\mu g/m^3$)

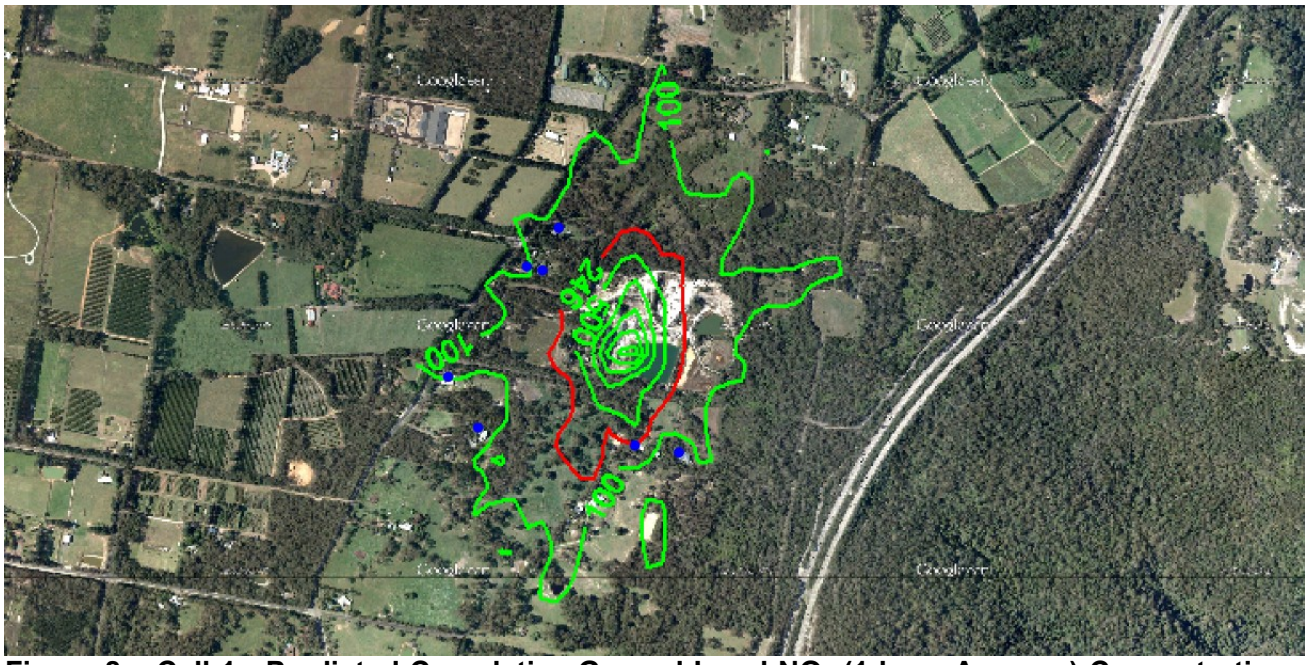


Figure 8a: Cell 1 - Predicted Cumulative Ground Level NO_2 (1-hour Average) Concentrations ($\mu g/m^3$)

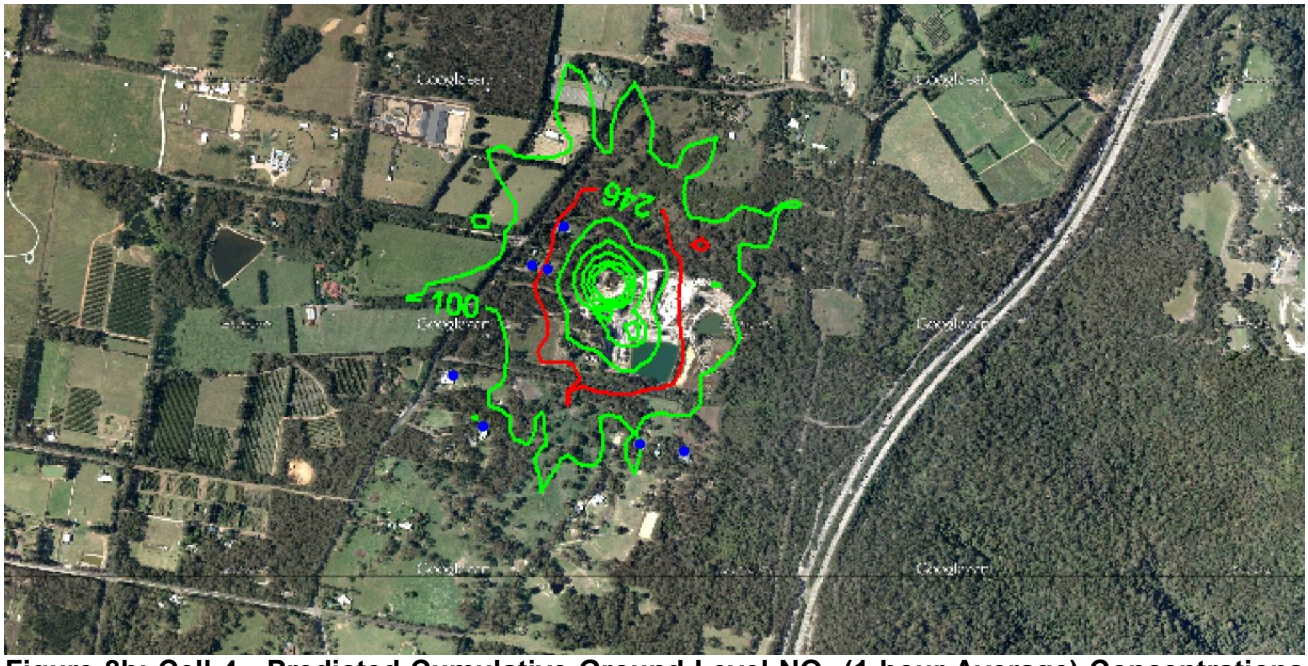


Figure 8b: Cell 4 - Predicted Cumulative Ground Level NO_2 (1-hour Average) Concentrations ($\mu g/m^3$)

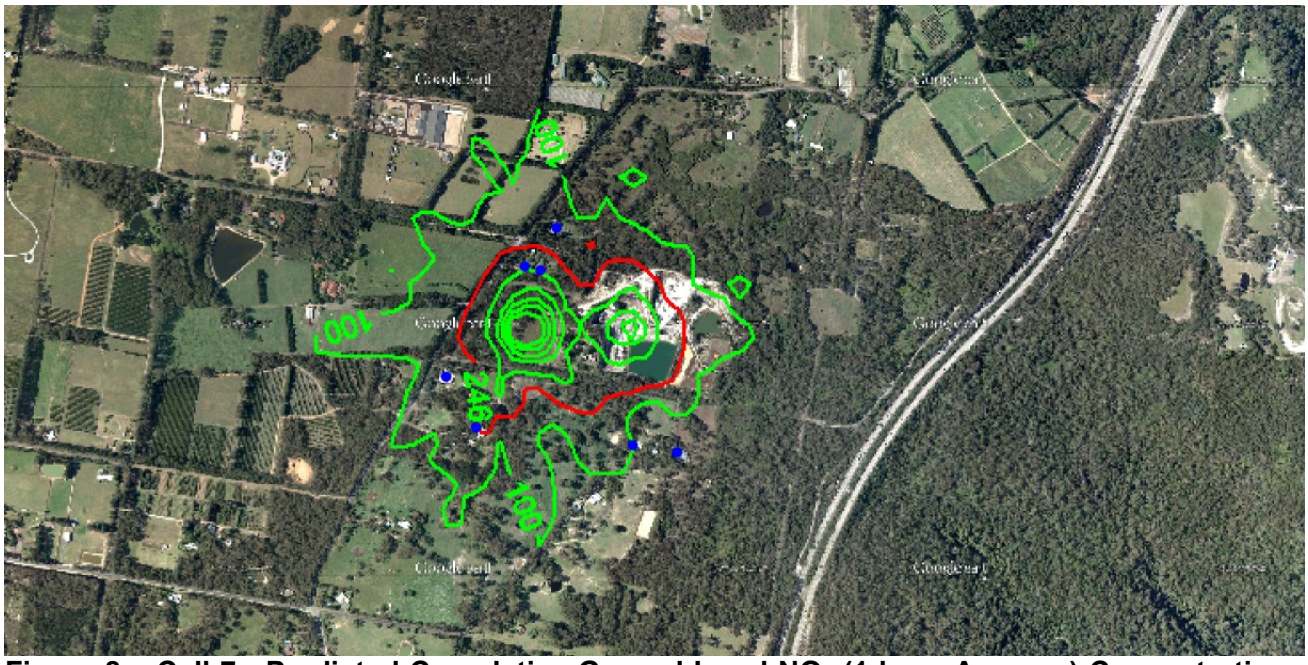


Figure 8c: Cell 7 - Predicted Cumulative Ground Level NO_2 (1-hour Average) Concentrations ($\mu g/m^3$)

5.8 RECOMMENDED MEASURES

The predicted ground level concentrations indicate non-compliances for PM_{10} (24-hour average) and NO_2 (1-hour average) at receptors adjacent to the proposed quarry. It is noted that there is a degree of conservatism in the modelling inputs and actual concentrations are likely to be lower. Nevertheless, there are a number of measures that can be implemented to assist in the management of air emissions. These include the following:

- regular use of water trucks (greater than 2 $L/m^2/h$) on exposed areas of ground, particularly unpaved haul routes;
- ensure sufficient water truck capacity is available on site at all times;
- regular maintenance of the gravelled haul route;
- conducting PM_{10} monitoring for a 1 week period during the initial stages of each cell excavation to confirm PM_{10} concentrations. Monitoring positions should be representative of the nearest receptors;
- use of Best Available Technology for stationary and mobile diesel equipment.
- regular maintenance of diesel equipment.

6 NSW LEGISLATION AND STRATEGIES

Items 8 and 9 of the Director General's requirements identify a need to assess the proposed quarry in the context of the following New South Wales Government legislation and documents:

- Protection of the Environment Operations (POEO) Act 1997;
- Protection of the Environment Operations (POEO) Clean Air Regulation 2010; and
- NSW State Plan 2010 and associated 'Action for Air' air quality management plan.

The POEO Act 1997 outlines procedures and requirements in relation to environmental policies, licences, notices (in the event of offences) and audits. The POEO (Clean Air) Regulation 2010 provides regulatory measures associated specifically with air quality. Measures are provided for key emission sources including domestic-related sources, motor vehicles and industrial emissions. Overall, the POEO legislative documents provide protection measures for preventing environmental harm.

According to the POEO Act 1997 (Schedule 1 – Scheduled Activities, Item 16 and 19), the proposed quarry comes under the following definitions of scheduled activities:

- Item 16 - any processing of materials by separation (e.g. screening sand) with a throughput of more than 150 tonnes per day or 30,000 tonnes per year.

- Item 19 – any extraction, processing or storage of extractive materials (e.g. sand) with a throughput of more than 30,000 tonnes per year.

Based on the above definitions, the proposed quarry is considered a scheduled premise and is subject to the emission standards outlined in Schedule 4 of the Clean Air Act 2010. In addition, as the quarry is proposed to commence after 1 September 2005, the development falls within the Group 6 division. The Clean Air Act provides emission standards for various groups of activities (Groups 1 to 6), which are defined by their commencement data.

Table 6.1 presents emission standards relevant to the proposed Rindean quarry.

TABLE 6.1: SCHEDULE 4 EMISSION STANDARDS RELEVANT TO THE PROPOSED QUARRY

Air Impurity	Activity or Plant	Standard of Concentration for Group 6 Activity
Solid Particles (Total)	Any activity or plant (except as listed below)	50 mg/m^3
	Any crushing, grinding, separating or materials handling activity	100 mg/m^3
Nitrogen Dioxide, Nitric Oxide or both.	Any activity or plant (except boilers, gas turbines and stationary reciprocating internal combustion engines listed below)	350 mg/m^3

According to the NSW OEH, the above standards apply to individual plant items or activities where



emissions are discharged through a vent or stack. Hence, air emissions from diesel engines maybe considered the only plant items for which the standards apply at the Rindean quarry premise. It is recommended that Best Available Technology be utilised for stationary and mobile diesel equipment to minimise the potential for exceedances.

'Action for Air' is a 25-year air quality management plan issued by the NSW Government for the Greater Metropolitan Region covering Sydney, the Lower Hunter and the Illawarra. The twofold objective of 'Action for Air' is to reduce emissions to comply with the NSW State Plan cleaner air targets (specifically the air quality goals of the Air National Environment Protection Measure (NEPM)) and to reduce the population's exposure to air pollution. As indicated by the objectives, reduction of emissions is a central goal of the air quality management plan. The preceding report sections present proposed mitigation measures for reducing potential air pollution (Section 2), predicted modelling results in comparison with NEPM goals (Section 5.7) and additional air quality management measures (Section 5.8) for minimising potential exceedances.

7 CONCLUSIONS AND RECOMMENDATIONS

Dispersion modelling using the Calpuff model has been undertaken to assess potential air quality impacts associated with the Rindean Quarry. The dispersion modelling incorporates a prognostic meteorological dataset for the area (based on TAPM and CALMET), background air quality concentrations and NPI emission factors. Three modelling scenarios have been considered (excavations cells 1, 4 and 7). The modelling considers a throughput of 500 tonnes per day and 75% reduction for water sprays along haul routes (Level 2 water, greater than 2 L/m^2/h).

The results of the modelling can be summarised as follows:

- compliance for deposited dust, PM_{10} (annual average), TSP, NO_2 (annual average) and CO at all nearest sensitive receptors; and
- non-compliance for PM_{10} (24-hour average); and
- non-compliance for NO_2 (1-hour average).

Non-compliances are predicted at the receptors directly adjacent to the proposed quarry (up to 4 receptors) during worst-case wind directions. Actual concentrations are likely to be lower in view of the following factors:

- conservative emission factors for the haul route (main contributor to particulate emissions) have been used in the absence of site specific data. The proposed haul road is to be gravelled (while emission rates are based on roads neither sealed nor gravelled);
- conservative emission factors for diesel equipment. While, emission rates are based on NPI documents, which is a standard procedure, it is noted that the factors are derived from US EPA data published between 1985 and 1996. The proponent intends to utilise Best Available Technology during the life of the quarry, resulting in lower emission rates;
- it is noted that a vegetative buffer (up to 65 metres) is proposed between the nearest excavation cells (Cell 4 and 7) and the north-western sensitive receptors. Though difficult to quantify, the vegetative buffer is likely to provide some benefit in reducing particulate concentrations at these receptors. Some studies have indicated between a 35% and 56% removal of particulates; and
- the modelling assumes an excavator, haul truck, dozer and loader are operating simultaneously in a 1-hour period. In practice, machine usage will be intermittent and continuous operation will not be required.

There are a number of measures (in addition to those mentioned in Section 2) that can be implemented to assist in the management of air emissions. These include the following:

- regular use of water truck (greater than 2 L/m^2/h) on exposed areas of ground, particularly unpaved haul routes;
- ensure sufficient water truck capacity is available on site at all times;
- regular maintenance of the gravelled haul route;



- maintenance of vegetative buffer;
- regular maintenance of diesel equipment.

Overall, based on the predicted results and giving consideration to conservative assumptions, the risk of emissions to air from the proposed sand quarry to both human health and environment is likely to be low provided the recommended controls are implemented at the site. It is therefore recommended that these controls are incorporated into the environmental management plan for the site prior to the commencement of operations.

APPENDIX A

AIR QUALITY GLOSSARY

APPENDIX A: GLOSSARY OF AIR QUALITY TERMINOLOGY

Term	Definition
Conversion of ppm to mg/m^3	Where R is the ideal gas constant; T, the temperature in kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows: $\mu g\ m^{-3}$ = (P/RT) x Molecular weight x (concentration in ppm) $= \frac{P \times \text{Molecular weight} \times (\text{concentration in ppm})}{62.4 \times (273.2 + T°C)}$ For the purposes of the air quality assessment all conversions were made at 25°C.
g/s	grams per second
mg/m^3	milligrams (10^{-3}) per cubic metre. Conversions from mg/m^3 to parts per volume concentrations (ie, ppm) are calculated at 25 degrees Celsius as required by the SEPP(AQM).
$\mu g/m^3$	micrograms (10^{-6}) per cubic metre. Conversions from $\mu g/m^3$ to parts per volume concentrations (ie, ppb) are calculated at 25 degrees Celsius.
ppb	parts per billion.
ppm	parts per million.
VOC	Volatile Organic Compounds. These compounds can be both toxic and odorous.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
50th percentile	The value exceeded for 50 % of the time.

Term	**Definition**
NO_x	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (eg, NO to NO_2).
NO_2	Nitrogen dioxide – one of the group of NO_x compounds that can form through chemical interactions in the atmosphere following emission from the source.

APPENDIX 7

GREENHOUSE GAS ASSESSMENT

Coastplan Consulting Pty Ltd

GREENHOUSE GAS ASSESSMENT - PROPOSED SAND QUARRY, SOMERSBY

FINAL REPORT

April 2012

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Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s).

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1 INTRODUCTION

1.1 SCOPE OF ASSESSMENT

Coastplan Consulting Pty Ltd commissioned Air Noise Environment Pty Ltd to undertake a greenhouse gas assessment for a proposed sand quarry development at Somersby. Specifically, the requirements of the Director General of Planning have been addressed:

'Greenhouse Gas

1. *The EIS should include a comprehensive assessment of, and report on, the project's predicted greenhouse gas emissions (CO2-e). Emissions should be reported broken down by:*

   a) direct emissions (scope 1 as defined by the Greenhouse Gas Protocol,
   b) indirect emissions from electricity (scope 2); and
   c) upstream and downstream emissions (scope 3)

   before and after implementation of the project, including annual emissions for each year of the project (construction, operation and recommissioning).

2. *The EIS should include an estimate of the greenhouse emissions intensity (per unit of production). Emissions intensity should be compared with best practice if possible.*

3. *The emissions should be estimated using an appropriate methodology, in accordance with NSW, Australian and International guidelines.*

4. *The proponent should also evaluate and report on the feasibility of measures to reduce greenhouse gas emissions associated with the project. This could include a consideration of energy efficient opportunities or undertaking an energy audit for the site.'*

This assessment has been undertaken in accordance with accepted methodologies and provides responses to each of the four items raised by the Director General's in the terms of reference of the Environmental Impact Statement for the project.

1.2 PROPOSED DEVELOPMENT

The proposed development is the reinstatement of the Rindean Quarry on Lot 2 in DP 362339 at 620 Wisemans Ferry Road, Somersby, NSW. The F3 Freeway passes 350 metres to the east of the site. The site is situated in a Primary Production Zone according to the Gosford Local Environment Plan 2009. The site is bounded by Primary Production Zones to the north-west and south. To the east is an area designated as Rural Landscape, which is currently vacant. The nearest sensitive receptors to the development site include residential properties adjacent to the north-western boundary and southern boundary.

The site was previously used as a quarry starting in 1979 however, operations ceased in 2003. The proposal is to re-open the quarry with an annual throughput of up to 150,000 tonnes per annum of dry screened or washed construction sand. Raw material extraction and crushing will take place at the quarry floor using a dozer. The extracted material will be transported using haul trucks to a screening and washing plant prior to off-site transport.

The quarry operation on the site will be conducted over 5 stages. Stage 1 will involve the excavation of Quarry Cells 1 to 2 and establishment of a stormwater retention basin and freshwater pond. Fixed plant and stockpiles will be located in Quarry Cell 3. During Stage 2, Quarry Cells 3to 5 will be excavated and plant and stockpiles will be relocated to Quarry Cell 2. Stages 3 and 4 will involve progressively the excavation of Quarry Cells 6 and 7. Rehabilitation will continue throughout the operation. Rehabilitation will be completed and the site vacated during Stage 5.

Figures 1 and 2 present the development site location and surrounding landuses. Figures 3a to 3c present the proposed site layout for Stages 1 to 4.

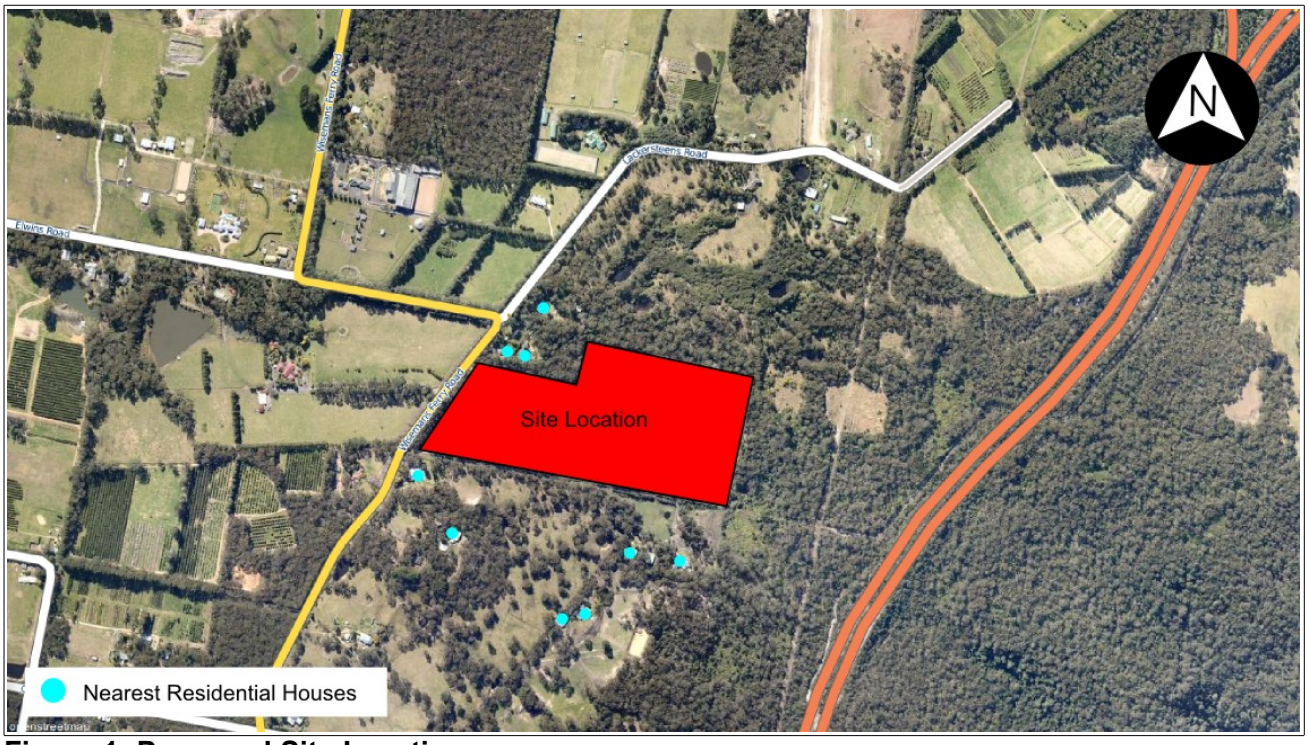


Figure 1: Proposed Site Location

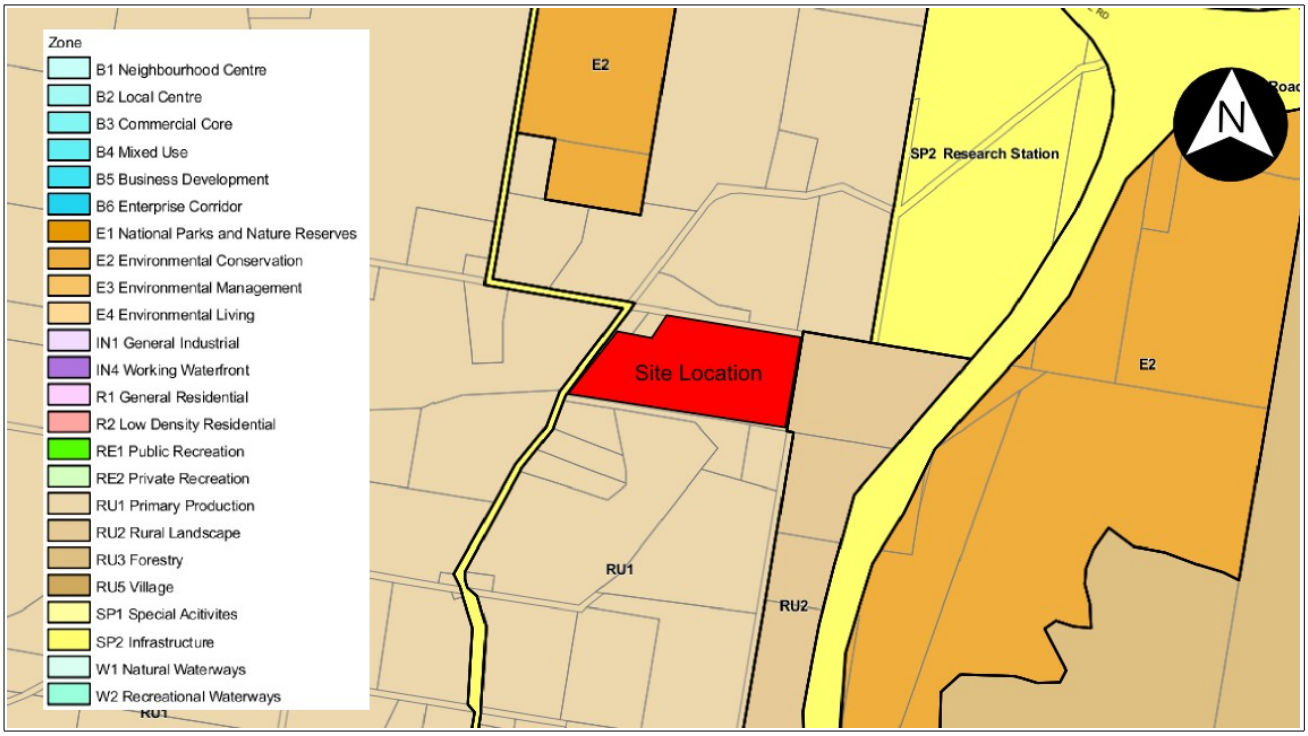


Figure 2: Surrounding Land Uses

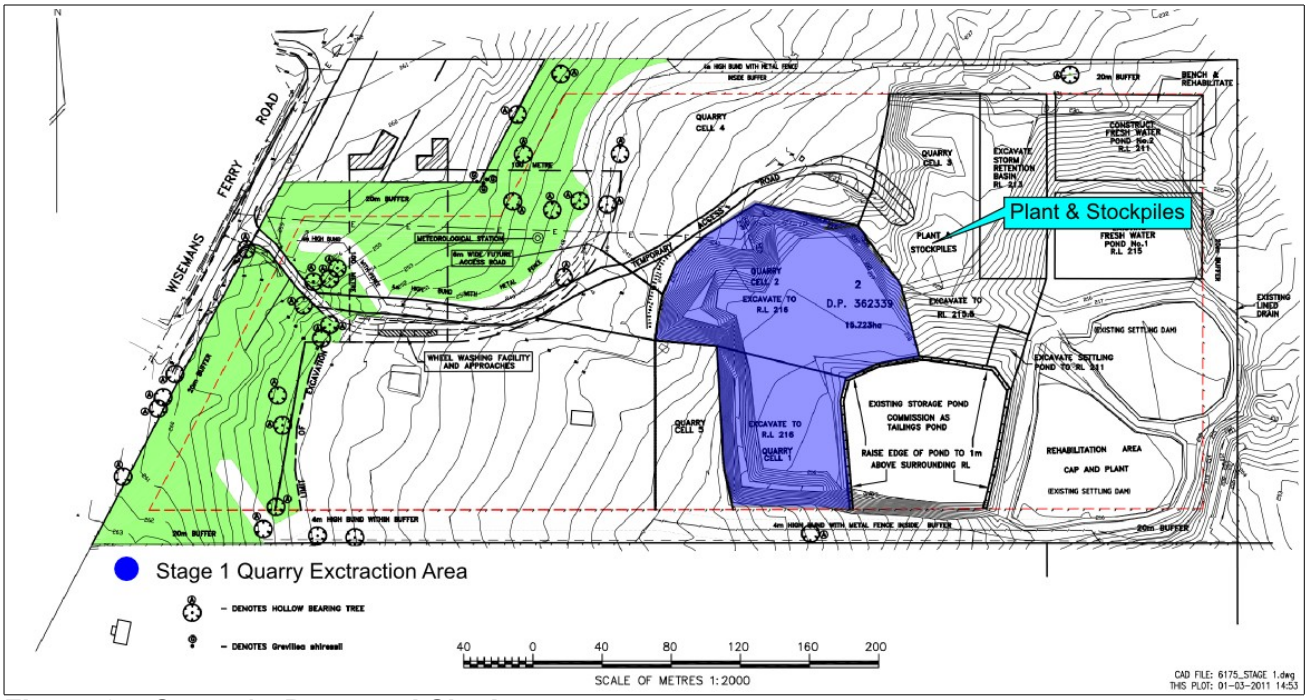


Figure 3a: Stage 1 - Proposed Site Layout

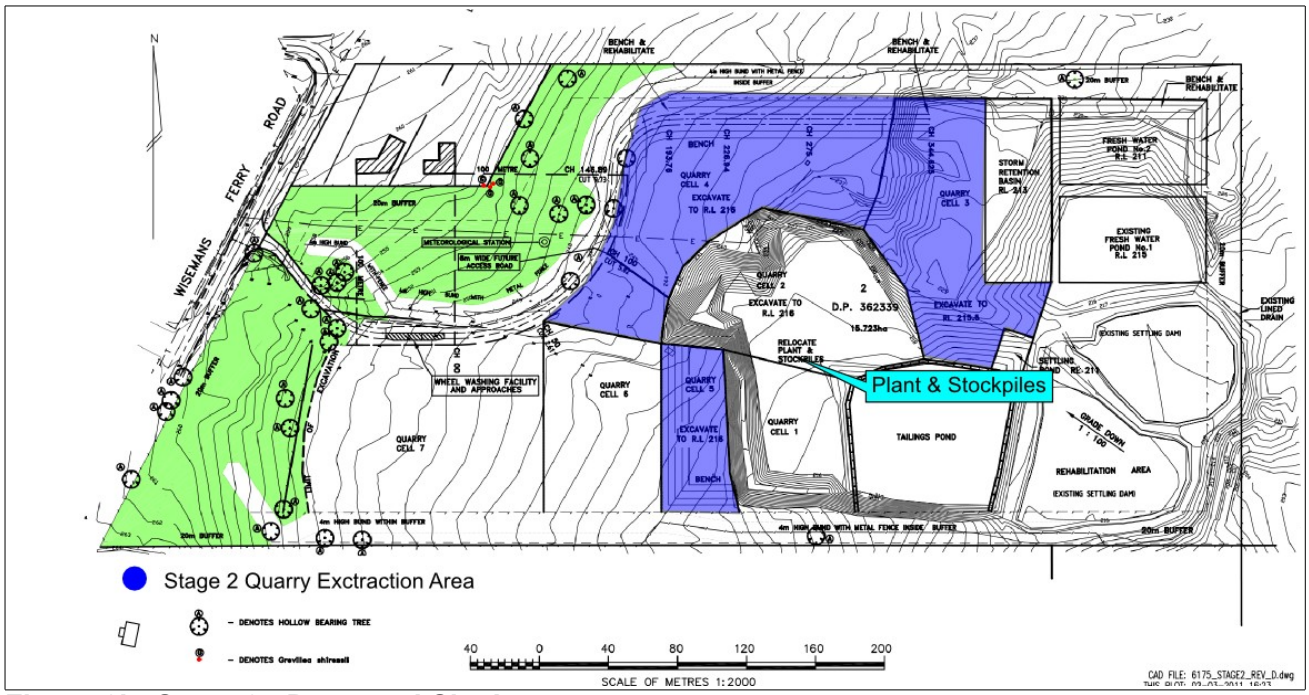


Figure 3b: Stage 2 - Proposed Site Layout

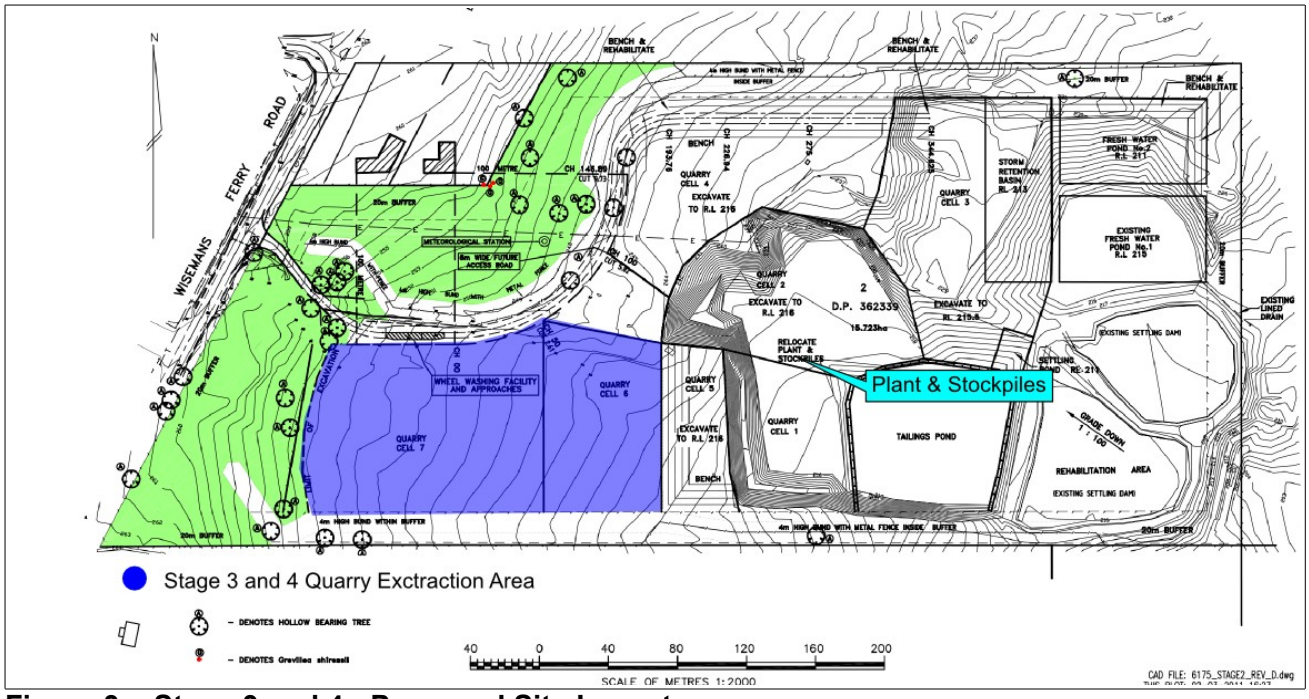


Figure 3c: Stage 3 and 4 - Proposed Site Layout

2 REGULATORY FRAMEWORK

2.1 KYOTO PROTOCOL

The Kyoto Protocol provides a framework by which developed countries (Party to the agreement) have an undertaking to reduce collective greenhouse gas emissions by at least 5 % below 1990 levels during the period 2008 to 2010. Australia ratified the agreement in 2007 which thereby came into effect in March 2008.

The protocol provides the following “flexible mechanisms” as a means for the Parties to the agreement to cost effectively reduce carbon pollution:

- emissions trading
- clean development mechanism
- joint implementation.

These mechanisms allow for Party countries to sponsor GHG reduction programs in developing (non-Party) countries and claim the associated reductions as part of the binding reductions required under the Protocol.

In 2009 Australia issued the Australian National Greenhouse Accounts which provided in an inventory of national greenhouse gas emission estimates for the period 1990 – 2009 which was submitted under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The report identified that Australia's total GHG emissions, excluding the land use, land use change and forestry sector, were estimated to be 545.8 million tonnes (Mt), CO2-equivalent (CO2-e) in 2009.

2.2 AUSTRALIAN CLIMATE CHANGE POLICY

The Australian Climate Change Policy provides a framework by which GHG emissions can continue to be managed. The policy is based on the under-lying concept of three pillars:

- mitigation – reduce Australia's GHG emissions
- adaptation – adapt to the climate change we can not avoid
- global solution – help shape a collective international response

Incorporated into the policy are a number of initiatives and legislative tools including the Clean Energy Future, Australian Carbon Trust, the Clean Energy Act 2011 (and related legislation) and the National Greenhouse Energy Reporting Act 2007 (NGER).

2.3 CLEAN ENERGY ACT 2011

In November 2011, The Clean Energy and associated legislation was passed by the Australian Senate. The legislation provides a framework for establishing a carbon price mechanism as follows:

- a three year fixed price phase from 1 July 2012 at $23 per tonne (indexed at 2.5 % per annum); and
- a market based price phase and emissions trading scheme commencing 1 July 2015.

The legislation also establishes:

- assistance for emissions-intensive trade exposed industries;
- the Climate Change Authority - to advise government on the setting of carbon pollution caps and the periodic review of the carbon pricing mechanism and other associated legislation; and
- the Clean Energy Regulator – to administer and enforce the carbon price mechanism among others

2.4 NATIONAL GREENHOUSE AND ENERGY REPORTING ACT 2007 (NGER)

The National Greenhouse and Energy Reporting Act 2007 (NGER) introduced a single national reporting framework for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production of corporations. The objectives of the Act were to:

- underpin the introduction of an emission trading scheme;
- inform government policy formulation and the Australian public;
- meet Australia's international reporting obligations;
- assist Commonwealth, State and Territory government programs and activities;
- avoid duplication of similar reporting systems in the states and territories.

Under the National Greenhouse and Energy Reporting Act 2007, there are requirements for controlling corporations to register and report if they emit greenhouse gases, produce energy, or consume energy at or above specified quantities in a given financial year. The reporting thresholds are being phased in as follows:

- From 1st July 2008 corporations were required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 500 terajoules or more of energy.
  - their corporate group emits 125 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 500 terajoules or more of energy.
- For the reporting year 2009 – 2010 corporations are required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 500 terajoules or more of energy.
  - their corporate group emits 87.5 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 350 terajoules or more of energy.
- For the reporting years after 2009 – 2010 corporations are required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 500 terajoules or more of energy.
  - their corporate group emits 50 kilotonnes or more of greenhouse gas (CO_2 equivalent), or produces/consumes 200 terajoules or more of energy.

Specific guidance with respect to the scope of the reporting requirements has been developed[1], as well as detailed methodologies for calculating greenhouse gas emissions and/or energy use[2].

Table 2.1 defines the Greenhouse Gases that must be reported under the Act.

TABLE 2.1: GREENHOUSE GASES THAT MUST BE REPORTED UNDER THE ACT

Item	Greenhouse Gas	Chemical Formula	Global Warming Potential (GWP)
1	Carbon dioxide	CO_2	1
2	Methane	CH_4	21
3	Nitrous oxide	N_2O	310
4	Sulphur hexafluoride	SF_6	23 900
5	HFC-23	CHF_3	11 700
6	HFC-32	CH_2F_2	650
7	HFC-41	CH_3F	150
8	HFC-43-10mee	$C_5H_2F_{10}$	1 300
9	HFC-125	C_2HF_5	2 800
10	HFC-134	$C_2H_2F_4$ (CHF_2CHF_2)	1 000
11	HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1 300
12	HFC-143	$C_2H_3F_3$ (CHF_2CH_2F)	300
13	HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	3 800
14	HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	140
15	HFC-227ea	C_3HF_7	2 900
16	HFC-236fa	$C_3H_2F_6$	6 300
17	HFC-245ca	$C_3H_3F_5$	560
18	Perfluoromethane (tetrafluoromethane)	CF_4	6 500
19	Perfluoroethane (hexafluoroethane)	C_2F_6	9 200
20	Perfluoropropane	C_3F_8	7 000
21	Perfluorobutane	C_4F_{10}	7 000
22	Perfluorocyclobutane	c-C_4F_8	8 700
23	Perfluoropentane	C_5F_{12}	7 500
24	Perfluorohexane	C_6F_{14}	7 400

[1] *Australian Government, Department of Climate Change – National Greenhouse and Energy Reporting Guidelines, 2008.*

[2] *Australian Government, Department of Climate Change - National Greenhouse and Energy Reporting System Measurement, Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia, June 2009.*

The range of activities that are carried out by a Corporation are divided into groups for the purposes of determining reporting requirements under the Act. These groups are termed Scope 1, Scope 2 and Scope 3, for the purposes of reporting. Examples of the activities that fall within each are identified in Table 2.2. Only Scope 1 and 2 emission types are included in the NGER reporting requirements. Scope 3, which are outside the scope of the Corporation or facility to control or manage, are excluded from the NGER requirements.

TABLE 2.2: SCOPE 1, 2 AND 3 ACTIVITY EXAMPLES

Scope 1	Scope 2	Scope 3
The release of greenhouse gas into the atmosphere as a direct result of an activity or series of activities (including ancillary activities) that constitute the facility.	The release of greenhouse gas as a result of one or more activities that generate electricity, cooling or steam that is consumed by the facility but that *do not* form part of the facility.	Emissions that occur outside the boundary of a facility as a result of activities at a facility and are not Scope 2 activities.
E.g., power generation, emissions from haul vehicles operated by the facility, direct emission of greenhouse gases from extraction and processing of raw materials, emissions from on-site waste disposal.	E.g., greenhouse gas emissions caused by electricity use by the facility, where that electricity is not produced at the facility.	E.g., greenhouse gas emissions from off-site waste disposal, transport emissions where the transport is not provided by or managed by the facility.
Mandatory to report under NGER		Not Mandatory to report under NGER

3 GHG INVENTORY METHODOLOGY

3.1 ACCOUNTING AND REPORTING PRINCIPLES

The GHG emissions inventory for the proposed Rindean Sand Quarry has been prepared in accordance with the accounting and reporting principles detailed within the Greenhouse Gas Protocol[3]. The protocol was developed to provide a framework for internationally accepted accounting and reporting standards for GHG emissions from companies.

The key principles provided in the Greenhouse Gas Protocol include:

- Relevance: The inventory must contain the information that both internal and external users need for their decision making;
- Completeness: All relevant emissions sources within the inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled;
- Consistency: The consistent application of accounting approaches, inventory boundary and calculation methodologies is essential to producing comparable GHG emissions over time;
- Transparency: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used; and
- Accuracy: Data should be sufficiently precise to enable intended users to make decisions with reasonable assurance that the reported information is credible.

The greenhouse gas emission inventory for the Project is based on the methodology detailed in the Greenhouse Gas Protocol, and the relevant emission factors in the National Greenhouse Accounts (NGA) Factors, the Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2005 – Energy (Fugitive Emissions) and the relevant Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance.

3.2 MATERIALITY

Materiality is a concept used to minimise the time spent verifying data that does not impact on the inventory in a material way. The exact materiality threshold that is used in GHG emissions accounting and auditing is subjective and dependant on the context of the site and the features of the inventory. Depending on the context, the materiality threshold can be expressed as a percentage of a total inventory, a specific amount of GHG emissions, or a combination of both.

For the purposes of this assessment, emissions are assumed to be immaterial if they are likely to account for less than 5% of the overall emissions profile.

[3] *World Business Council for Sustainable Development and World Resource Institute (2004), 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard'*

3.3 INVENTORY ORGANISATIONAL BOUNDARY

The organisational boundary of the project is defined as the proposed Rindean sand mine project and is delineated by the physical study area (described as Lot 2 in DP 362339) and includes all GHG emissions controlled or produced by the project.

Auxiliary infrastructure located outside the project area, such as water management systems, and wastewater treatment facilities are not included within the inventory organisational boundary. While discussed in this report (as Scope 3 emissions) third-party shipping and end use of the mined sand products are also outside the inventory organisational boundary.

3.4 ACTIVITY DATA SOURCES

Activity data used to assess Scope 1, Scope 2 and Scope 3 emissions for the proposed Rindean Sand Mine were taken from usage estimated prepared by the client. It is understood that these estimates were based on estimates operational requirements for the construction and operation of the facility (including fuel and power usage).

3.5 EMISSION FACTORS

Direct measurement of GHG at the emission source can give the most accurate and precise assessment of GHG emissions. Direct measurement of emissions however is not feasible were a project is still in the design phase (as is the case for the proposed Rindean Sand Mine). For the purposes of the assessment, emission factors have been used in accordance with the GHG Protocol methodology. Emission factors are a factor expressed as the amount of GHG emissions per unit of activity, which can be used to determine inventories for a site and remove the need for site specific testing of emissions.

Emission factors can be obtained from various sources, for example, the Department of Climate Change, from site-specific information or from operational details obtained from similar emission sources. Emission factors used to calculate GHG emissions (as CO2-e) from the combustion of diesel and electricity consumption have been sourced from the Department of Climate Change and Energy Efficiency National Greenhouse Accounts Factors – July 2011. Table 3.1 presents a summary of the emission factors used in the study.

TABLE 3.1: SUMMARY OF EMISSION FACTORS

Emission Source	Emission Factor	Units	Source
Combustion emission factor (diesel)	2.67	t CO2-e / kL	Table 4: Fuel combustion emission factors – fuels used for transport energy purposes (NGA Factors – July 2011)
Emissions from consumption of purchased electricity	0.89	kg CO2-e / kWh	Table 5: Indirect (scope 2) emission factors for consumption of purchased electricity from the grid (NGA Factors – July 2011)

4 EMISSIONS INVENTORY

4.1 SCOPE 1 EMISSIONS

Scope 1 emissions included in the inventory include estimates of emissions as a result of:

- Construction and rehabilitation of the sand mine (including clearing and fencing, site clean up, construction of access roads, wheel wash and preparation of access road).
- Extraction of raw material and site maintenance (including stripping overburden, ripping and crushing raw material and internal road maintenance).
- Processing of product (including dry screening, stacking product and loading product onto trucks)
- Water, fines and dust management (including dust suppression, draining of settling ponds and water retention ponds and desilting of tailings and settling ponds).

Table 4.1 below presents a summary of the estimated fuel (diesel) usage for each of the identified activities over the 20 year expected life of the sand mine.

TABLE 4.1: ESTIMATED FUEL USAGE (L)

Year	Construction and Rehab				Extraction of raw material and site maintenance	Processing of product		Water, fines and dust management	
	Clean up etc.	Access road	Wheel wash	Rehab	Ripping and Crushing	Screening	Loading	Dust Suppression and Irrigation of Rehab	Drainage management and desilting
1	3200	550	150	2500	20000	8000	2000	9600	4800
2	-	-	-	2500	45000	10000	2000	7200	4800
3	-	-	-	1250	90000	19200	3600	7200	4800
4	-	-	-	1250	90000	19200	3600	7200	4800
5	-	600	-	1250	90000	19200	3600	7200	4800
6	-	-	-	1250	90000	19200	3600	7200	4800
7	-	-	-	1250	90000	19200	3600	7200	4800
8	-	-	-	1250	90000	19200	3600	7200	4800
9	-	-	-	1250	90000	19200	3600	7200	4800
10	-	-	-	1250	90000	19200	3600	7200	4800
11	-	-	-	1250	90000	19200	3600	7200	4800
12	-	-	-	1250	90000	19200	3600	7200	4800
13	-	-	-	1250	90000	19200	3600	7200	4800
14	-	-	-	1250	90000	19200	3600	7200	4800
15	-	-	-	1250	90000	19200	3600	7200	4800
16	-	-	-	1250	90000	19200	3600	7200	4800

Year	Construction and Rehab				Extraction of raw material and site maintenance	Processing of product		Water, fines and dust management	
	Clean up etc.	Access road	Wheel wash	Rehab	Ripping and Crushing	Screening	Loading	Dust Suppression and Irrigation of Rehab	Drainage management and desilting
17	-	-	-	1250	90000	19200	3600	7200	4800
18	-	-	-	1250	90000	19200	3600	7200	4800
19	-	-	-	1250	90000	19200	3600	7200	4800
20	-	-	-	1250	-	-	-	7200	4800

Given the estimated fuel usage provided in Table 4.1 above, Table 4.2 presents estimated Scope 1 GHG emissions for each year of the project.

TABLE 4.2: SCOPE 1 EMISSIONS ESTIMATES (KG CO2-E)

Year	Construction and Rehab				Extraction of raw material and site maintenance	Processing of product		Water, fines and dust management	
	Clean up etc.	Access road	Wheel wash	Rehab	Ripping and Crushing	Screening	Loading	Dust Suppression and Irrigation of Rehab	Drainage management and desilting
1	8,634	1,484	405	6,745	53,963	21,585	5,396	25,902	12,951
2	0	0	0	6,745	121,416	26,981	5,396	19,427	12,951
3	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
4	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
5	0	1,619	0	3,373	242,833	51,804	9,713	19,427	12,951
6	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
7	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
8	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
9	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
10	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
11	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
12	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
13	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
14	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
15	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
16	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
17	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
18	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
19	0	0	0	3,373	242,833	51,804	9,713	19,427	12,951
20	0	0	0	3,373	0	0	0	19,427	12,951

Year	Construction and Rehab				Extraction of raw material and site maintenance	Processing of product		Water, fines and dust management	
	Clean up etc.	Access road	Wheel wash	Rehab	Ripping and Crushing	Screening	Loading	Dust Suppression and Irrigation of Rehab	Drainage management and desilting
Totals	8,634	3,103	405	74,204	4,303,540	929,234	175,913	395,015	259,020

4.2 SCOPE 2 EMISSIONS

Scope 2 emissions for the project are primarily related to energy consumed by the wash plant proposed for the site. Other energy uses on the site are expected to be immaterial against total site emissions. Table 4.3 presents a summary of estimated Scope 2 emissions for the life of the proposed sand mine.

TABLE 4.3: SUMMARY OF SCOPE 2 EMISSIONS

Year	Estimated Energy Usage (kWh)	Estimated Energy Usage (terajoules)	Estimated GHG Emissions (kg $C_{O2\text{-}e}$)
1	-	-	-
2	10000	0.036	8900
3	42900	0.154	38181
4	42900	0.154	38181
5	42900	0.154	38181
6	42900	0.154	38181
7	42900	0.154	38181
8	42900	0.154	38181
9	42900	0.154	38181
10	42900	0.154	38181
11	42900	0.154	38181
12	42900	0.154	38181
13	42900	0.154	38181
14	42900	0.154	38181
15	42900	0.154	38181
16	42900	0.154	38181
17	42900	0.154	38181
18	42900	0.154	38181
19	42900	0.154	38181

Year	Estimated Energy Usage (kWh)	Estimated Energy Usage (terajoules)	Estimated GHG Emissions (kg C_{O2-e})
20	-	-	-

4.3 SCOPE 3 EMISSIONS

Scope 3 emissions represent GHG emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction and production of purchased materials, transportation of purchased fuels, and employee business travel and commuting.

Scope 3 emissions are not routinely reported by companies because:

- Emissions are difficult to estimate accurately;
- The company does not have effective control of the emissions sources; and
- A company's Scope 3 emissions will be reported elsewhere by a second company as their Scope 1 emissions. As an example, emissions from combustion of diesel fuel by trucks (owned and operated by the Company receiving the product) delivering raw materials to site will be reported by the receiving company as one of its Scope 1 emissions.

It is noted that these emissions are an optional reporting class under the Greenhouse Gas Protocol.

For this project, Scope 3 emissions associated with the following sources have been investigated:

- transport of mined product to client sites (independent truck operators); and
- construction of the road junction at the main entrance to the site.

The transport of finished product to client sites is to be undertaken by independent contractors and is dependent on demand. To provide an indication of the potential emissions from these activities, the following assumptions have been applied:

- all deliveries undertaken using heavy road truck and trailer combinations;
- average of 2,000 local trips (approximately 30 km each way) and 2,500 Sydney trips (approximately 80 km each way) per year which is equivalent to 520,000 km per annum;
- average truck fuel consumption of 28.9 L / 100 km[4];

Based on the above assumptions, fuel usage for delivery of finished product to client sites is estimated to be 150,200 L of diesel per annum. This is equivalent to 401,034 kg of CO2-e per annum or 8,020,680 kg CO2-e over the 20 year life of the project.

Emissions from the construction of the new road junction are unable to be estimated at this time. This work is to be undertaken by independent contractors and as such details such as equipment requirements, the source for raw materials (gravel, bitumen etc.) and the construction methodology

[4] *CSIRO (October 2008) 'Modelling the Road Transport Sector, Appendix to Australia's Low Pollution Future, The Economics of Climate Change Mitigation' prepared on behalf of Treasury*



to be adopted is unknown. Therefore, for the purposes of this assessment, this component of the construction phase of the project has not been included in the GHG inventory.

4.4 SUMMARY OF EMISSIONS

Table 4.4 below presents a summary of the estimated total scope 1, 2 and 3 emissions over the 20 year life of the proposed sand quarry project.

TABLE 4.4: ESTIMATED TOTAL GHG EMISSIONS OVER LIFE OF PROJECT

Type of Emissions	Estimated GHG Emissions Over Project Life
Scope 1	6,149 tonne CO2-e
Scope 2	658 tonne CO2-e
Scope 3	8,021 tonne CO2-e
Total	14,828 tonne CO2-e

This is equivalent to an estimated 4.9 kg CO2-e per tonne of sand produced. It is noted that a literature review did not identify any best practice guidance for GHG emissions per unit of production for sand quarrying operations.

Table 4.5 presents a summary of the annual Scope 1 and Scope 2 emissions over the life of the project.

TABLE 4.5: ESTIMATED ANNUAL GHG EMISSIONS OVER LIFE OF PROJECT

Year	Estimated Scope 1 Emissions (tonne CO2-e)	Estimated Scope 2 Emissions (tonne CO2-e)	Total of Estimated Scope 1 and Scope 2 GHG Emissions Over Project Life (tonne CO2-e)
1	137.07	-	137.07
2	192.92	8.90	201.82
3	340.10	38.18	378.28
4	340.10	38.18	378.28
5	341.72	38.18	379.90
6	340.10	38.18	378.28
7	340.10	38.18	378.28
8	340.10	38.18	378.28
9	340.10	38.18	378.28
10	340.10	38.18	378.28
11	340.10	38.18	378.28
12	340.10	38.18	378.28

Year	Estimated Scope 1 Emissions (tonne CO2-e)	Estimated Scope 2 Emissions (tonne CO2-e)	Total of Estimated Scope 1 and Scope 2 GHG Emissions Over Project Life (tonne CO2-e)
13	340.10	38.18	378.28
14	340.10	38.18	378.28
15	340.10	38.18	378.28
16	340.10	38.18	378.28
17	340.10	38.18	378.28
18	340.10	38.18	378.28
19	340.10	38.18	378.28
20	35.75	-	35.75

Based on the estimated emissions presented in Table 4.5, the proposed sand quarry is not expected to trigger the NGER reporting threshold of 25 kilotonnes CO_2-e (25,000 tonnes CO_2-e) of Scope 1 and 2 greenhouse gases for a single facility.

Similarly, data presented in Table 4.3 indicates that the proposed facility it not expected to exceed the 200 terajoules energy trigger level for NGER reporting based on energy usage alone.

5 GHG MITIGATION OPTIONS

Whilst this assessment has demonstrated that the overall emissions of GHG for the proposal are relatively low, and well within the reporting thresholds as defined in the NGER requirements, the Director General requires that mitigation options such as offsets are considered for the project.

Given the proposed scale and intensity of the proposed sand quarry, there are limited options available for the mitigation of greenhouse gas emissions, Power consumption is expected to be minimised as far as practicable with only two significant users of grid supplied power identified (the wash plant and associated water pump) hence further reduction of these emissions is expected to be impractical.

The remainder of GHG emissions identified are the result of the combustion of diesel by plant and equipment operating on site. Measures with the potential to reduce GHG emissions for these plant and equipment items include:

- investigation of the use of biofuels in plant and equipment (it is noted that this may not be possible given the geographical location of the site and specific fuel requirements of the plant and equipment);
- turning off idle machines where ever possible;
- where possible stockpile all overbuden on site (rather than shipping to off-site locations)
- where possible select plant and equipment that are fuel efficient (ie generally newer modern plant and equipment); and
- where possible source supplies locally (thereby minimising transportation emissions to get product to site).

APPENDIX 8

HYDROGEOLOGICAL INVESTIGATION

HYDROGEOLOGICAL INVESTIGATION

RINDEAN QUARRY, SOMERSBY

Prepared for

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AUGUST 2004

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RCA ref: 3977-001/2

9th August 2004

PACRIM Environmental Pty Ltd
2/120 Darby Street
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Attention: Frank Downing

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

Geotechnical Engineering
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HYDROGEOLOGICAL ASSESSMENT
RINDEAN QUARRY, SOMERSBY

1 INTRODUCTION

This report presents the findings of a hydrogeological investigation undertaken at Rindean Quarry, Somersby, NSW. The report was prepared on behalf of Mr Frank Downing of Pacrim Environmental Pty Ltd.

It is understood that a groundwater assessment is required that would fulfil the requirements of an EIS to accompany a Development Application for ongoing operation of the quarry.

This assessment includes the following:

- A groundwater study detailing the current status of groundwater at the site. An assessment of the impact on adjacent properties as a result of sand extraction is also required.
- A geotechnical study to determine the stability of the quarry with regards to the proposed extraction near Wiseman's Ferry Road.

2 SITE CONDITION AND SURROUNDING ENVIRONMENT

The site is located on the eastern side of Wisemans Ferry Road adjacent to the Sydney to Newcastle Freeway, refer to Drawing 1. It is situated in a rural / residential area to the south of Somersby township. Rindean Quarry is bounded by the F3 Freeway, a State agricultural research station and private residences, and is situated on the fringe of a topographic high, with moderate slopes generally to the southeast. The site has gravel access roads. The site is fenced and is locked after hours. A neighbouring property had evidence of discharge from a septic tank. This property was situated up gradient of the site.

The nearest waterway is an arm of Narara Creek which courses near the rear of the property and is considered to be a receiving water body for the site. Downgradient of the site the Narara Creek receives runoff from the F3 Freeway.

It is understood that the site operated as a quarry from 1979 through to 2003 under a previous lease. During this time it operated outside of the original DA consent.

It is understood that the site operated under a number of various leases in the past, the last of which was Hodgsons who submitted a Section 96 application to Gosford City Council to expand the site, however this was rejected. A new DA is currently being prepared.

A pumping well exists on the site which was constructed in 1982 and has recently been re-drilled. The driller's summary indicates that water bearing zones were encountered at a depth of 11.8m and 26.6m. The log also identifies discharge for each aquifer to be 0.2L/s and 0.7L/s respectively.

There are twenty-one (21) registered groundwater bores within an approximately 1.2km radius of the site. The location of these bores and groundwater search data is detailed in Appendix B. The majority of bore use was for domestic, stock and irrigation purposes, however a commercial bottled water plant, Somersby Springs, exists <500m distance from the southern site boundary.

3 FIELDWORK

Hydrogeological investigations consisted of the drilling and logging of five (5) bores across the site and a visual inspection of exposed outcrops by a geologist. Initial drilling on the 19th of March was by rotary auger, however difficult drilling conditions resulted in a change to rotary drilling using a rock roller bit. This method was also laboured and therefore drilling was ceased to resume at a later date using percussion drilling methods. On the 31st of March a second drilling rig was employed and the remainder of bores were drilled over a three (3) day period. Three of these bores were constructed using percussions drilling and the last was constructed using coring to obtain a rock sample from the area proposed for additional quarrying. Borelogs are presented in Appendix C.

Seepage was noted in the quarry walls at several distinct levels during fieldwork on the 19th March 2004. Seepage was noted in Area 1 (see Drawing 1) at a band approximately 7-8m from the surface (~223RL). An ironstone band below the seepage is acting as a layer of lower permeability, directing water flow along a horizontal flow path. Two other seepage bands were identified in the same area, one at approximately 4-5m (~225RL) from the surface which was not laterally continuous and another damp band at approximately 14m (~216RL) from the surface, however no flow was emerging from this layer. Area 2 had seepage discharging from a band at approximately 10m below the surface. This appeared to discharge at a higher rate than general seepage, indicating some confinement within the aquifer. In both Areas 3 and 4, seepage discharged from a clay/shale layer that was surveyed to daylight in the quarry wall at an RL of 229.9m. An approximation of the relative level of seepage from the existing quarry walls is given in Table 1.

Table 1 *Approximation of Water Levels in the Existing Quarry Walls*

Area	Approximate Depth from Surface (m)	RL of Surface (m)	RL of Seepage (m)
1	7-8	230	223
1	4-5	230	225
1	14	230	216
2	10	240	230
3 and 4	NR	NR	229.902

* NR – not required as RL of seep was surveyed.

Note that during a site visit on the 11th May 2004 seepage from the quarry walls had ceased in most locations with the exception of Area 4, where a minor discharge was still observed.

Groundwater samples were collected from two of the bores. A sample was collected from BH2 for an up gradient representation of water quality. It was also noted that a neighbouring property in the area may have a leaking septic tank. The second sample was collected from BH4 to provide an indication of down gradient water quality. The two samples were analysed for major cations and anions, pH, electrical conductivity (EC), Total Dissolved Solids (TDS), nitrate, ammonia, E Coli, and biological oxygen demand (BOD). Following the collection of these samples an effluent (methane) odour was noted at BH1. A sample was subsequently collected from BH1 for analysis of cations and anions, pH, EC, nitrate, nitrite, BOD and E Coli.

4 HYDROGEOLOGICAL

4.1 DEPTH OF GROUNDWATER TABLE AT SITE

Groundwater levels were gauged in the five piezometers installed during this investigation. The locations of the groundwater monitoring bores are shown in Drawing 1 in Appendix A. The depths to groundwater are shown below on Table 2. Field water monitoring logs are shown in Appendix D. Standing water levels were taken as a difference in the depth to the water in each bore, and the supplied relative levels (RL's) for all the bores.

Table 2 *Monitoring Well Survey Details and Water Level Gauging*

Monitoring Well	Bore Height (RL at ground surface) (m, AHD)	Depth to Aquifer (m below top of casing) 1-2/04/04	Depth to Aquifer (m below top of casing) 11/05/04	Stick up (m)	RL of Water Table (m, AHD) 1-2/04/04	RL of Water Table (m, AHD) 11/05/04
BH1	218.2	5.09	5.4	0.72	212.39	212.08
BH2	247.795	6.18	6.88	0.81	240.81	240.12
BH3	231.383	10.38	10.7	0.7	220.30	219.98
BH4	218.315	3.36	3.35	0.7	214.26	214.27
BH5	262.97	6.2	7.19	0.77	256	255.01

4.2 HYDRAULIC GRADIENT AND PERMEABILITY

Groundwater contours and groundwater flow directions were determined from water level gauging undertaken at the site. Contours and flow directions are shown on Drawings 2 and 3 in Appendix A.

The groundwater flow direction was determined to be in an easterly direction. The average hydraulic gradient across the site was found to be 0.08 m/m.

Permeability assessments comprised rising head tests and were undertaken on all five bores. The results are presented below in Table 3 and calculations are shown in Appendix E.

Table 3 *In Situ Permeability Results*

Bore	Screened Strata	Permeability (m/s)
BH1	Sandstone	7.2×10^{-9}
BH2	Sandstone	3.7×10^{-8}
BH3	Sandstone	3.2×10^{-9}
BH4	Sandstone	1.9×10^{-8}
BH5	Sandstone	3.7×10^{-9}
	Geometric Mean	1.7×10^{-8}

Using the mean permeability, average hydraulic gradient and an estimated porosity between 3% and 5%, the groundwater velocity at the site was estimated to range between 0.9m/yr and 1.5m/yr.

4.3 Summary of Local Groundwater Users

A search of the DLWC groundwater bore records was undertaken to assess the groundwater usage in the area and a summary is given below in Table 4.

Table 4 *Local Groundwater Users (Based on DLWC Records)*

Bore	Date	Depth to Groundwater (m)	Final Depth (m)	Type of Aquifer/Strata	Intended Purpose
GW023092	01/07/1965	6.7	19.8	sandstone	Domestic
GW031948	01/02/1970	6.7	30.5	sandstone	Domestic
GW037121	01/01/1973	7.6	33.5	Shale/clay	Stock
GW047198	24/10/1978	6.1	46	Sandstone	Domestic
GW047597	11/09/1980	8	26	Sandstone	Domestic
GW051268	12/12/1979	5.1	30	Sandstone	Domestic
GW052588	22/08/1980	7	30	Sandstone	Domestic
GW053607	03/12/1980	15	62	Sandstone	Domestic
GW056164	21/04/1982	6	30	Sandstone	Domestic

Bore	Date	Depth to Groundwater (m)	Final Depth (m)	Type of Aquifer/Strata	Intended Purpose
GW056871	13/03/1983	14	34	Sandstone	Domestic
GW057452	15/03/1983	9	32	Sandstone	Domestic
GW057995	14/03/1983	5	46	Sandstone	Domestic
GW058902	20/09/1983	20	30	Sandstone	Domestic
GW062121	26/08/1983	16	43	Sandstone	Industrial
GW062690	17/05/1986	4	25	Sandstone	Domestic
GW064823	23/03/1985	10.3	40	No Details Found	Domestic
GW065610	16/07/1988	6	40	No Details Found	Domestic
GW067551	02/08/1989	6	34	Sandstone	Domestic
GW072503	07/12/1993	18	48	Sandstone	Domestic
GW101044	31/12/1967	No Details Found	67	No Details Found	Commercial
GW101920	23/07/1998	20	66	Sandstone	Domestic

Note: Bore details underlined are for a commercial bottled water spring.

Of the twenty one bores found with a 1.2km radius of the site, the majority of groundwater use is for domestic, stock and irrigation purposes. These bores are predominately in sandstone aquifers. Groundwater occurs at depths varying from 4m to 20m from the surface.

4.4 Discussion On Subsurface Conditions

The site is underlain by sandstone of differing weathering profiles. The sandstone is largely cross bedded with bedding generally dipping to the west 18°-30° in the lower sections of the quarry face, however higher in the strata bedding was identified to dip to the east. Variations in bedding dip have resulted from cross bedding structures. The sandstone is fine-medium grained with poorly developed joints which are widely spaced.

Groundwater occurs at a relatively shallow depth (generally 3 – 10m below the surface). The groundwater gradient was determined to be 0.08 with groundwater RL's ranging from 212m Australian Height Datum (AHD) in the east to 256m AHD in the west. Based on the groundwater gradient observed and permeability results, flow rates would be expected to be between 0.9m/year and 1.5m/year.

In summary, both topography and structural geology have an influence on the groundwater flow direction. Flow in the area of the quarry mirrors the topography, as well as bedding planes. Perched water results from bands of lower permeability restricting vertical migration of infiltration. Seepage and in some cases springs occur where these lower permeability bedding planes daylight, directing subsurface water and in some cases groundwater to the surface. Through this means subsurface water and groundwater can recharge creeks in the area and maintain seemingly permanent seepage areas.

The strata are of low permeability with an average permeability of 1.7×10^{-8} m/s. This value refects the clay content of the sandstone, widely spaced joints and tight apertures along bedding planes and joints.

5 GROUNDWATER MODELLING

Groundwater modelling of the proposed quarry extension was undertaken to:

- Assess the impacts on regional groundwater regime that will result from the proposed change to landform;
- Assess the impact on groundwater uses within the area of the proposed landform change.

5.1 MODEL DESIGN

The groundwater modelling package used was Visual Modflow. VModflow is a commercially available finite difference computer package.

Two models were used to examine the effects of quarrying on groundwater in the region. Both models were designed using a grid around the proposed quarry extension area with grid boundaries up to 3km from the site boundaries. Grid sizes were 20m around the proposed quarry extension and increased to 100m at the model boundaries. Boundaries were established at sufficient distances from the interest area to ensure that the boundaries have negligible effect on the model domain.

VModflow packages used in both models were drainage and recharge. Drainage was used to simulate the effect of the proposed extraction area on the groundwater table and also to determine water make within the void. Recharge allows modelling of infiltration at the site.

5.2 Model Assumptions

5.2.1 Single Layer Model

The single layer model has assumed a single layer homogeneous unconfined aquifer. The thickness of the aquifer was assumed to extend from 0m AHD to 295m AHD. The surface level was estimated using digital topographical models. It was assumed in the model that there was no interaction between surface water and groundwater with the exception of direct infiltration, for example springs and seepage pathways were not modelled. Instead the calibration process utilised the infiltration variable to mimic the discharge of groundwater through these pathways.

5.2.2 Multi-Layer Model

The aquifer system was assumed to extend from 0m AHD to 295m AHD. The surface level was estimated using digital topographical models.

Cored bore data (Appendix C) indicates the presence of significant bands of ironstone between sandstone layers. The multi-layer model has approximated this substrata through the addition of a thin, low permeability layer at approximately 50 metres below the surface level, which acts as an aquitard separating the aquifer. A layer at 50m below the surface is situated below the base of the proposed quarry, and is still located within the upper regions of the groundwater table. This was considered to be most representative of the effects of lower permeability zones on the regional groundwater regime. The multi layered scenario was also modelled with the low permeability layer at approximately 90 metres below the surface level. The deeper layer was chosen to assess the sensitivity of the groundwater regime to the lower permeability zones.

The boundary for both models was fixed as a constant head following the 180m AHD contour to the west and the 170m AHD contour to the east of the site. Water levels at these locations were set as 10m below the surface level, where 10m was calculated to be the average depth to water table.

Groundwater within the Somersby area is not considered to interact with creeks and river systems, and therefore these features were not included in the models. Seepage is observed at the site, and generally within the Somersby area, however seepage is primarily associated with springs or perched water and has minimal interaction with the aquifer. The 'recharge' package in the model calibration was used to represent the infiltration to the aquifer including the losses resulting from perched water or springs.

All model outcomes presented in the following are based on the conceptual quarry extension proposal, Stages 1 to 4.

The single layer model design is attached in Drawing 4, and a cross section of the multi-layer model is attached in Drawing 5.

5.3 AQUIFER PARAMETERS

5.3.1 SINGLE LAYER MODEL

Hydraulic conductivity was assumed to be 2E-07m/s for the single layer model. This value is a commonly referenced value for Hawkesbury Sandstone. Permeability testing undertaken at the site found lower permeability values in the order of 1E-08m/s, which are considered to be outside the range of permeability values for intact sandstone. Calibration of the model also indicated that permeability values of 1E-07m/s are representative of regional conditions.

Storage coefficient was set as 0.005 based on available published data for similar material (Ref. 1).

Porosity was set as 5%, again based on previous experience and available published data for similar materials (Ref. 1).

Rainfall data used in the simulations was taken from the Bureau of Meteorology Peats Ridge weather station and was 1248mm/year, on average (Ref. 2). Due to recent drought conditions these rainfall levels are likely to be below long term averages. The use of this data is considered valid as only the infiltration portion is included and therefore the sensitivity of the data is reduced. The proportion due to infiltration is determined in the model calibration process.

Evaporation was determined to be 1200mm/year, based on mean daily records (Ref. 2).

5.3.2 MULTI-LAYER MODEL

The hydraulic conductivity was assumed to be 2E-07m/s for the upper and lower sandstone aquifers, as for the single layer model. The middle ironstone layer was assumed to have a conductivity of 1E-08m/s. Storage, porosity, rainfall and evaporation parameters for the multi-layer model were as for the single layer model.

5.4 CALIBRATION OF THE MODEL

The calibration objective for the groundwater model was to approximate groundwater levels identified in groundwater bores in the Somersby region. This data was obtained from the groundwater bore register maintained by the Department of Infrastructure, Natural Resources and Planning (DIPNR). Note that the data obtained spans approximately 30 years and that recent water level gauging at these boreholes has not been undertaken.

The models were calibrated using both recharge and conductivity. The net inflow of rainfall and the conductivity of the aquifer were varied until the piezometric levels resembled those of the regional bore field data. After calibration, recharge used in the single layer model varied from 20 to 100mm/year and recharge used in the multi-layer model varied from 5 to 100mm/year. A conductivity of 2E-07m/s was applied over the entire single layer model and a conductivity of 1E-08m/s was used for the top layer of the multi-layer model. Graphs of observed and calculated heads for the calibration of the single and multi- layer models are shown in Drawings 6 and 7 respectively.

The calibration of the models was considered to be satisfactory, given the inaccuracy of the data set being modelled. In general, the modelled piezometric heads were higher than those observed, which maximises the impact of the proposed extension on the regional water table and is a conservative approach to calibration.

5.5 Proposed Quarry Extension

The proposed quarry extension was entered as a drain to simulate a void in both models. The void was established based on the proposed mine stages (four off) provided by the client. The extension of the quarry is modelled to take 20 years. The progression of the quarry is shown on Drawing 8.

The basement of the quarry was an RL of 215m based on cross section data provided by the client.

5.6 Regional Effects of the Proposed Extraction Operation

Groundwater levels in the Somersby area have been noted to vary by up to 4m due to seasonal fluctuations (based on previous experience). Observations at the Department of Infrastructure, Planning and Natural Resources research site identified a variation in water levels of 1m over a five year monitoring period (Ref. 4).

The results indicate that water level variations in the Somersby area differ between sites and that the regional variations lie between 1m and 4m variations. On this basis significant groundwater effects were determined to be effects in excess of 4m. However, the potential for cumulative effects in drawdown, i.e. maximum drawdown occurring during periods of low rainfall and depressed water table, should be considered.

5.6.1 Single Layer Model

Drawing 9 depicts the current regional groundwater contours identified by the single layer model and the impacted area after changes to the landform from the proposed quarry extension. Predicted drawdown with time in the surrounding borefield is represented on Drawing 10.

The single layer model has predicted up to 5m drawdown 0.6km from the site after a period of 100 years, with up to 13 bores impacted (bores with greater than 10% sat thickness decline). Figure 1 shows the maximum predicted drawdown with distance from the quarry.

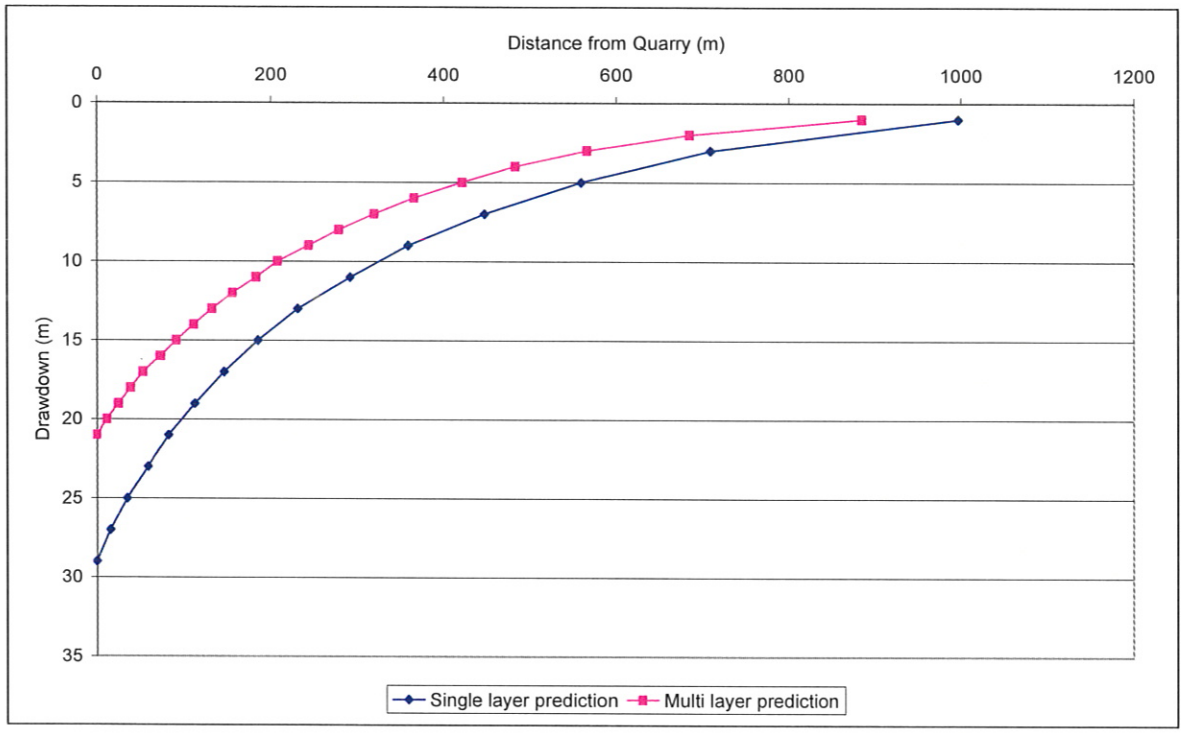


Figure 1 *Maximum Predicted Drawdown*

Table 2 shows the impact of drawdown on local groundwater users. The impact on Somersby Springs bottled water is not considered to be problematic due to the water quality recorded in bores constructed at Rindean Quarry. At the investigation site the water quality is not of a standard adequate for use as drinking water, therefore Somersby Springs bottled water is likely to be from a separate aquifer. Also, the commercial spring water is sourced from an aquifer at greater depths than that observed at Rindean Quarry. The modelling has been conservative as it was based on a one layer model and hence will predict an impact on deeper aquifers which are not expected to be hydraulically linked.

Please note that no details were found regarding water bearing zones or drillers logs for the commercial bottled water spring and subsequently the saturated thickness was estimated from the nearest registered bore. This bore recorded two (2) water bearing zones with different hydraulic heads and therefore separate aquifers. The deepest of these hydraulic heads was utilised for the estimate of the commercial bore. This supports the case that a separate aquifer is likely to be used for the commercial bottled water than that observed at Rindean Quarry. More intensive investigations are required to confirm that there will be no impact on groundwater used at the commercial user's property.

5.6.2 MULTI-LAYER MODEL

Drawing 11 depicts the current regional groundwater contours identified by the multi-layer model, and the impacted area after changes to the landform from the proposed quarry extension. Predicted drawdown with time in the surrounding borefield for the multi-layer model is represented on Drawing 12.

The multi-layer model has predicted up to 5m drawdown 0.4km from the site after a period of 100 years, with up to 15 bores impacted. Figure 1 shows the predicted drawdown with distance from the quarry.

Table 2 shows the impact of drawdown on local groundwater users as predicted by the multi-layer model. It indicates a smaller drawdown in most bores when compared with the single layer model drawdown predictions. This is a result of the low permeability ironstone layer which decreases the connectivity of the upper and lower sandstone aquifers.

As indicated in Table 2, changing the depth of the low permeability layer from 50m below the ground surface level (Multi-Layer Model Shallow) to 90m below the ground surface level (Multi-Layer Model Deep) had little impact on draw down, with an average difference in draw down between the two models of only 0.7m.

Table 2 *Effect of Decrease in Saturated Thickness on Local Bores.*

Bore	Saturated thickness (m)	Draw Down Single Layer Model (m)	Draw Down Multi-layer Model Shallow (m)a	Draw Down Multi-layer Model Deep (m)b
BH1	6.5	2.10	13.82	12.54
BH2	7.9	26.57	24.71	23.99
BH3	8.0	0.29	15.57	14.97
BH4	5.4	0.00	13.44	12.76
BH5	23.1	31.03	25.41	23.00
GW023092	13.1	3.69	2.19	2.92
GW031948	23.8	27.24	23.96	23.49
GW037121	25.9	3.05	0.91	1.13
GW047198	39.9	4.18	2.23	2.59
GW047597	18.0	5.77	5.11	5.55
GW051268	24.9	21.50	22.45	21.82
GW052588	23.0	1.89	1.71	2.07
GW053607	47.0	2.18	0.93	1.14
GW056164	24.0	17.13	21.75	20.01
GW056871	20.0	1.43	2.40	3.22
GW057452	23.0	15.47	13.79	14.91
GW057995	41.0	3.61	2.02	2.64
GW058902	10.0	5.62	3.31	4.05
GW062121	27.0	4.71	2.23	2.63
GW062690	21.0	8.35	5.07	5.64
GW064823	29.7	1.66	0.61	0.74
GW065610	34.0	0.06	0.90	1.51
GW067551	28.0	-0.04	-1.65	-1.40
GW072503	30.0	21.51	16.13	15.62
GW101044	*41.0	21.5	10.50	10.11

Note: underlined = commercial bottled water spring;

*= Saturated Thickness estimated from surrounding bores

[a] = Ironstone layer located 50m below ground surface level

[b] = Ironstone layer located 90m below ground surface level

5.7 RECOMMENDATIONS

Modelling indicates that the effect of the proposed quarry extension on groundwater is highly dependent on the hydraulic connectivity of the aquifers in the region. To improve the accuracy of the model it is recommended that additional characterisation of the subsurface be undertaken. Characterisation should include as a minimum:

- Water level gauging of current groundwater levels at all bores listed in Table 2;
- Pump test should be carried out to quantify hydraulic conductivity and storativity for use in groundwater modelling. This could be undertaken at the bore on site and using the surrounding bores to measure groundwater impact; and
- Water quality testing to assess water quality parameters to assess if water extracted from the Rindean Quarry bores is from a separate aquifer to the Somersby Springs bottled water.

6 RESULTS

6.1 GROUNDWATER CHEMISTRY

An Environmental Scientist from RCA Australia undertook groundwater sampling on the 1st and 2nd of April 2004. Bore development was not required as no water was utilised during the drilling process in two of the bores. Sampling was undertaken on the day following installation. A sample was also collected from BH1 following bore development. The samples were appropriately preserved (<4°C) before transport to the laboratory (Amdel and Hunter Water Australia Laboratories) under chain of custody documentation within 24 hours of sampling. Sampling was carried out using a Teflon bailer. Decontamination was undertaken between sampling rounds by washing equipment with XTRAN and rinsing three times in potable water. Water sampling records are contained in Appendix D.

6.1.1 ACCEPTANCE CRITERIA

6.1.1.1 ANZECC 2000

These water quality guidelines have been endorsed by the NSWEPA (Ref. 3). These are complex guidelines that consider not only the level of protection (eg 99% or 95%) but also the state of the receiving water (eg moderately disturbed). Additional allowances are also made for the bioaccumulation of some chemicals. These guidelines replace the NEPM guidelines for water.

ANZECC 2000 guidelines are categorised into the percentage of species to be protected and values are provided for 99% protection to 80% protection. The level of protection adopted is dependent on the state of the receiving water bodies and is to be decided by local government, stakeholders and the catchment management authority.

The receiving water in this instance is considered to be Narara Creek. This is not considered to be a tidal waterway and so fresh water guidelines are used. This creek collects runoff from the Newcastle –Sydney Freeway and is a modified water way, therefore a 95% protection level has been used from the boundary of the site.

6.1.2 RESULTS

The results of the sampling are summarised below in Table 3 and laboratory reports are contained in Appendix F.

Table 3 *Result Summary*

Sample ID	**Unit**	**PQL**	**Guideline 95% Fresh**	**S-1a**	**S-2a**	**S-3a**
Date				**1/04/2004**	**1/04/2004**	**2/04/2004**
Sample Location				**BH4**	**BH2**	**BH1**
				Down Gradient	**Up Gradient**	**Down Gradient**
Sample collected by				**MC**	**MC**	**MC**
Water Quality						
pH		0.1		6.3	5.6	5.8
Conductivity at 25C	uS/cm	1		190	220	140
TDS (calc.)	mg/l	1		120	140	--
Sulphate	mg/l	1		19	8	8
Chloride	mg/l	1		22	39	29
Nitrate as N	mg/l	0.01		0.72	5.9	nd
Total Alkalinity	mg/l	1		30	8	17
Bicarbonate	mg/l	1		30	8	17
Carbonate	mg/l	1		nd	nd	Nd
Hydroxide	mg/l	1		nd	nd	Nd
Sodium	mg/l	0.2		20	30	17
Potassium	mg/l	0.1		1.2	0.7	1
Calcium	mg/l	0.1		11	4	4.4
Magnesium	mg/l	0.1		3.4	4.8	2.8
Total hardness	mg/l	0.5		43	30	--
Cation Total	me/L	0.1		1.8	1.9	--

Sample ID	Unit	PQL	Guideline 95% Fresh	S-1a	S-2a	S-3a
Date				1/04/2004	1/04/2004	2/04/2004
Sample Location				BH4	BH2	BH1
				Down Gradient	Up Gradient	Down Gradient
Sample collected by				MC	MC	MC
Anion Total	me/L	0.1		1.6	1.5	--
Ion Balance	%	0.1		4	11.2	--
Ammonia as N	µg/l	0.01	2570	0.04	nd	0.01
Biological Water Quality						
E Coli	col/100mL			--	--	<91
BOD5-Total	mg/L			--	--	18

- pH readings in all three bores sampled recorded slightly acid conditions.
- EC readings indicate fresh water with similar concentrations of dissolved solids downgradient and upgradient.
- Ammonia concentrations are low and are below the ANZECC guidelines (2570 µg/L) (Ref. 3).
- BOD in BH1 is relatively low indicating that there is minimal biological activity.
- E Coli in BH1 is in low concentrations. This again indicates minimal biological activity.
- Major Cation and Major Anions are listed in Table 4.

Table 4 *Anions and Cations*

	BH4		BH2		BH1	
	meq/L	% contribution	meq/L	% contribution	meq/L	% contribution
Cations						
Na+	0.83	49.02	0.35	36.23	0.35	42.25
K +	0.03	1.82	0.02	1.86	0.03	3.11
Mg++	0.28	16.59	0.39	41.12	0.23	27.98
Ca++	0.55	32.56	0.20	20.78	0.22	26.66
Total	1.69	100.00	0.96	100.00	0.82	100.00

	BH4		BH2		BH1	
	meq/L	% contribution	meq/L	% contribution	meq/L	% contribution
Anions						
Cl-	0.62	40.37	1.10	72.35	0.82	63.85
SO4--	0.40	25.74	0.17	10.96	0.17	13.00
NO3-	0.01	0.76	0.10	6.26	0.00	0.08
NO2-	0.00	0.06	0.01	0.01	0.00	0.02
HCO3-	0.49	31.99	0.13	8.62	0.28	21.75
CO3-	0.02	1.08	0.02	1.10	0.02	1.30
Total	1.54	100.00	1.52	100.00	1.28	100.00

The major cation in down gradient bores is Sodium with Magnesium contributing the most in the up gradient bore. Potassium contributed the least in all bores sampled.

Chloride is the major anion in all bores sampled followed by Bicarbonate in the down gradient bores only. There was only a minimal contribution by other anions.

To assess the overall chemistry of the groundwater, the results of the three bores sampled on 01-02/04/04 have been plotted on a piper trilinear plot (Appendix G). The plot shows that the groundwater chemistry in all bores is consistent. This implies that there is no significant change in groundwater chemistry as groundwater flows beneath the site.

7 GEOTECHNICAL ASSESSMENT

It is understood that extension to the quarry is proposed for the area located just to the east of Wisemans Ferry Road. Extension will involve excavation of a cell to a depth of >30m from the surface. RCA Australia Pty Ltd recommends a 10m buffer zone between the excavation and Wisemans Ferry Road to be adopted. This will ensure long term stability of the road, provide access to the upper batters and allow room for the construction of drainage and noise mound structures.

The existing quarry faces were visually assessed to be battered in the order of 45° to 55° with poorly developed benches. This has been confirmed by contour plans for the quarry which indicate existing batter gradients of between 50° and 55° for the western and southern walls of quarry cell 1.

Examination of core samples collected during drilling from the proposed area have shown that the rock profile consists of soil and extremely weathered friable sandstone to a depth of approximately 15m, see Appendix B for core log. This overlies highly weathered to moderately weathered sandstone of estimated low to medium strength which occurs to a depth of approximately 25m, and beyond this is slightly weathered sandstone of estimated medium strength.

The existing wall profile exposed in quarry cell 1 and 2 comprises highly weathered to moderately weathered sandstone of estimated low to medium strength. The cored bore drilled at the south-western corner of the site near Wisemans Ferry Road encountered up to 15m of weak clayey sandstone rock that exhibited soil strength properties. This weaker sandstone material was not observed in the existing quarry faces of cells 1 and 2. The excavation of the cell will occur in sandstone ranging from estimated extremely low to medium strength. In the lower strength clayey sandstone materials, the stability of the excavation will be predominantly controlled by the rock strength properties. In the more competent sandstone rock materials the stability of the excavation will be predominantly controlled by the orientation of rock mass defects such as bedding planes, joints, clay seams/zones and faults. The control over stability exerted by the rock mass defects will increase with depth as the rock material increases in strength.

Instability in the weaker clayey sandstone materials usually involves circular slip failure / slumping. The risk of localised slumping in weaker sandstone and soil strength materials can be reduced by adopting batter gradients appropriate for the material strength.

Instability in the more competent sandstone materials usually involves localised block and wedge failure along bedding/joint planes, clay seams or clay coated defects that have an adverse orientation relative to the cut. These occurrences can be treated on a specific basis during construction by rock bolting and barring down. The approach commonly employed in deep excavations is to adopt rock batter slopes appropriate to the overall material and defect properties of the cut and to treat specific localised areas as warranted. Where large-scale structures with adverse orientation relative to cut batters or lower strength material properties exist (i.e. rotated/disrupted bedding in fault zones, continuous clay seams), batter slope reduction or specific slope treatment measures will be required as discussed in the following sections.

Table 5 indicates the maximum recommended batter slopes appropriate for the various soil and rock types to be encountered in proposed cell excavation. The approximate depths shown in Table 5 are based on the profile encountered in the cored bore drilled at the south-western corner of the site near Wisemens Ferry Road. At that location a significantly deeper (up to 15m) soil and very weak clayey sandstone profile was encountered in comparison to the profile observed in the existing quarry faces lower down the site.

Additional investigation will be required to assess the extent of soil and very weak clayey sandstone encountered at the south-western corner of the site.

The existing quarry faces occur in highly weathered to moderately weathered rock of estimated low to medium strength. The current batter gradients of 50° to 55° (approximately 1H:1.5V) are considered to be appropriate for these materials from a geotechnical stability viewpoint.

Table 5 *Excavation Batter Slopes*

Approximate Depth (m) from surface*	Maximum Batter Slope	Slope	Material Type
0-15	1.5H:1V	33^0	Soil horizons and extremely weathered / extremely low strength rock (friable).
15-25	1H:1.5V	56°	Highly weathered to moderately weathered rock with low to medium strength. This corresponds to the materials currently exposed in the existing quarry walls.
>25	1H:3V	71°	Slightly weathered rock with medium strength or higher.

* Based on borehole data, to be confirmed during excavation

The batter slopes shown on Table 5 assume the provision of adequate erosion protection measures such as surface drainage and the specific treatment of any weak or loose zones/seams.

Batter slope design should incorporate benches at regular intervals. The maximum vertical difference in elevation between benches commonly adopted by the RTA is 7m, however considering the proposed development involves quarrying, a maximum bench height of 11m is suggested. Minimum bench width should be 3 to 4m with the bench surface graded back into the cut at a minimum gradient of 1 in 20 to a catch drain.

Rockfall protection measures need to be considered, especially if personnel are to be working at the base of batter slopes. To limit overall rockfall risk, all batter slope faces should be progressively cleaned of loose material during excavation and access routes for equipment to benches maintained should access be required to undertake batter remediation works. A windrow/berm approximately 3m from the toe of the batter slope can be progressively pushed up during excavation works to provide rock fall protection and to restrict access to the base of the excavation. To assist in erosion control, soil and weathered rock materials battered at 1.5V:1H or less should be vegetated. A cut-off drain should be installed along the crest of the excavation cell.

It is recommended that the design of the proposed quarry extension is based on the excavation batter gradients shown in Table 5.

The batter gradients will need to be amended during construction where the material properties of the sandstone encountered varies from that assumed in the design batter. Where weaker materials are encountered than assumed in design, the batter will need to be laid back to the appropriate gradient for the materials. Conversely, where more competent rock is encountered than assumed in design, the batter can be steepened to the appropriate gradient for the materials. It is recommended that geotechnical assessment of the cell be undertaken progressively during excavation to assess batter gradient requirements and treatment of rock wedges and weak seams (clay, fault, etc.).

8 CONCLUSIONS

The geology of the site comprises sandstone of varying degrees of weathering and is highly cross bedded.

Groundwater flow at the site follows the topography and flows to the east. Modelling of a single layer aquifer predicts that there is significant drawdown (>5m) within a 0.6km radius the site and up to 13 bores will potentially be effected. Further modelling was undertaken using a stratified model to simulate zones of lower permeability within the aquifer. Modelling indicated reduced drawdown predictions, with a radius of impact of 0.4km from the site. It is recommended that additional fieldwork be undertaken to aid in calibration and confirm model predictions. Fieldwork should include the measurement of groundwater levels in the regional borefield, groundwater pumping test on site and regional water quality analysis.

The groundwater chemistry suggests that activities at the site are not affecting groundwater quality at this time.

Batter slopes carrying from 1H:1.5V in soil strength materials to 1H:3V in medium strength or better sandstone have been recommended for the proposed quarry. The batter gradient adopted should be based on the material properties of the sandstone rock encountered during construction.

9 LIMITATIONS

This report has been prepared for Pacrim Environmental Pty Ltd in accordance with the agreement between RCA Australia (RCA). The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Pacrim Environmental Pty Ltd. The report may not contain sufficient information for purposes of other uses or for parties other than Pacrim Environmental Pty Ltd. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully,

RCA AUSTRALIA

Susan Alagic
Environmental Geologist

Fiona Robinson
Manager Environmental Services

REFERENCES

[1] Freeze and Cherry, *Groundwater*, Prentice Hall, 1979.

[2] Bureau of Meteorology, 2003

[3] ANZECC, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October 2000

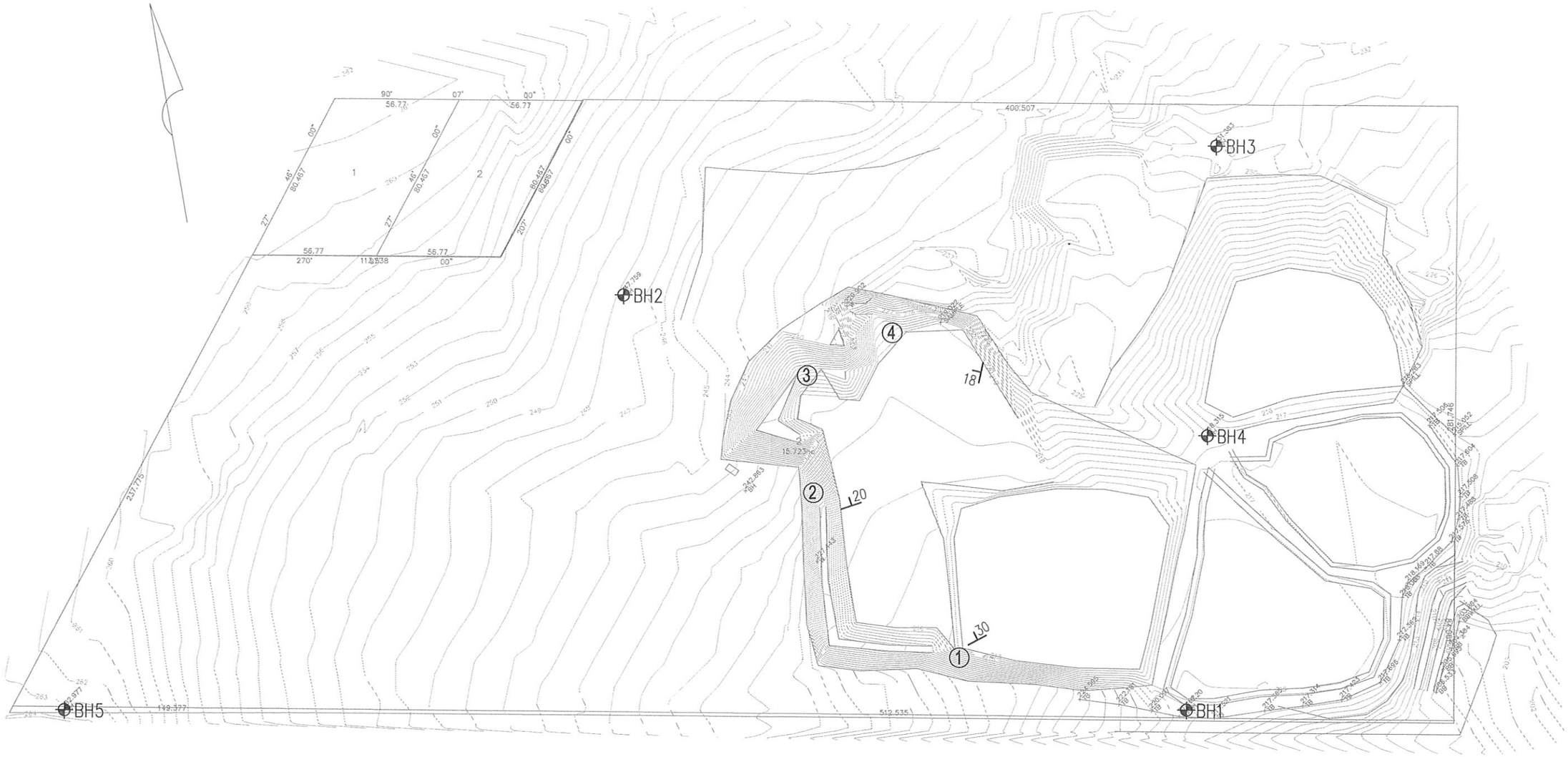
[4] Pacrim Environmental, Correspondence, 22nd July 2004.

GLOSSARY

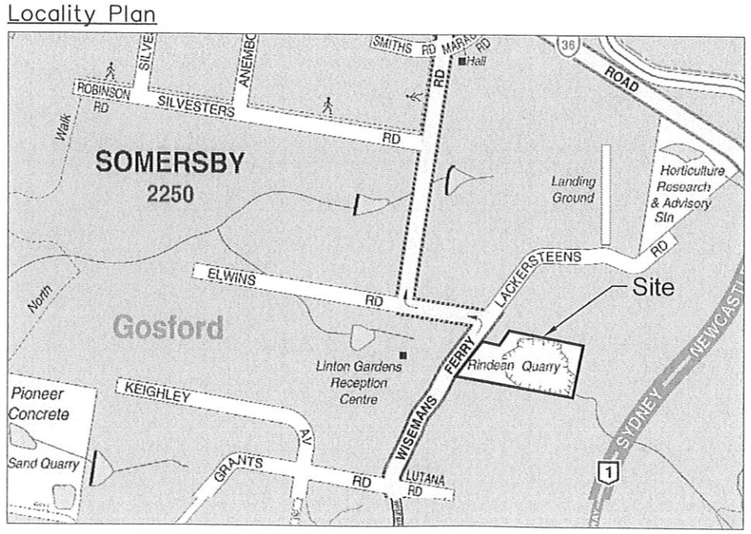
AHD	Australian Height Datum (m), based on a mean sea level
ANZECC	Australian and New Zealand Environmental Conservation Council
POLLUTE	Groundwater computer model
PQL	Practical Quantitation Limit
QA	Quality Assurance
RPD	Relative Percentage Difference
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

Appendix A

Drawings



Locality Plan



LEGEND

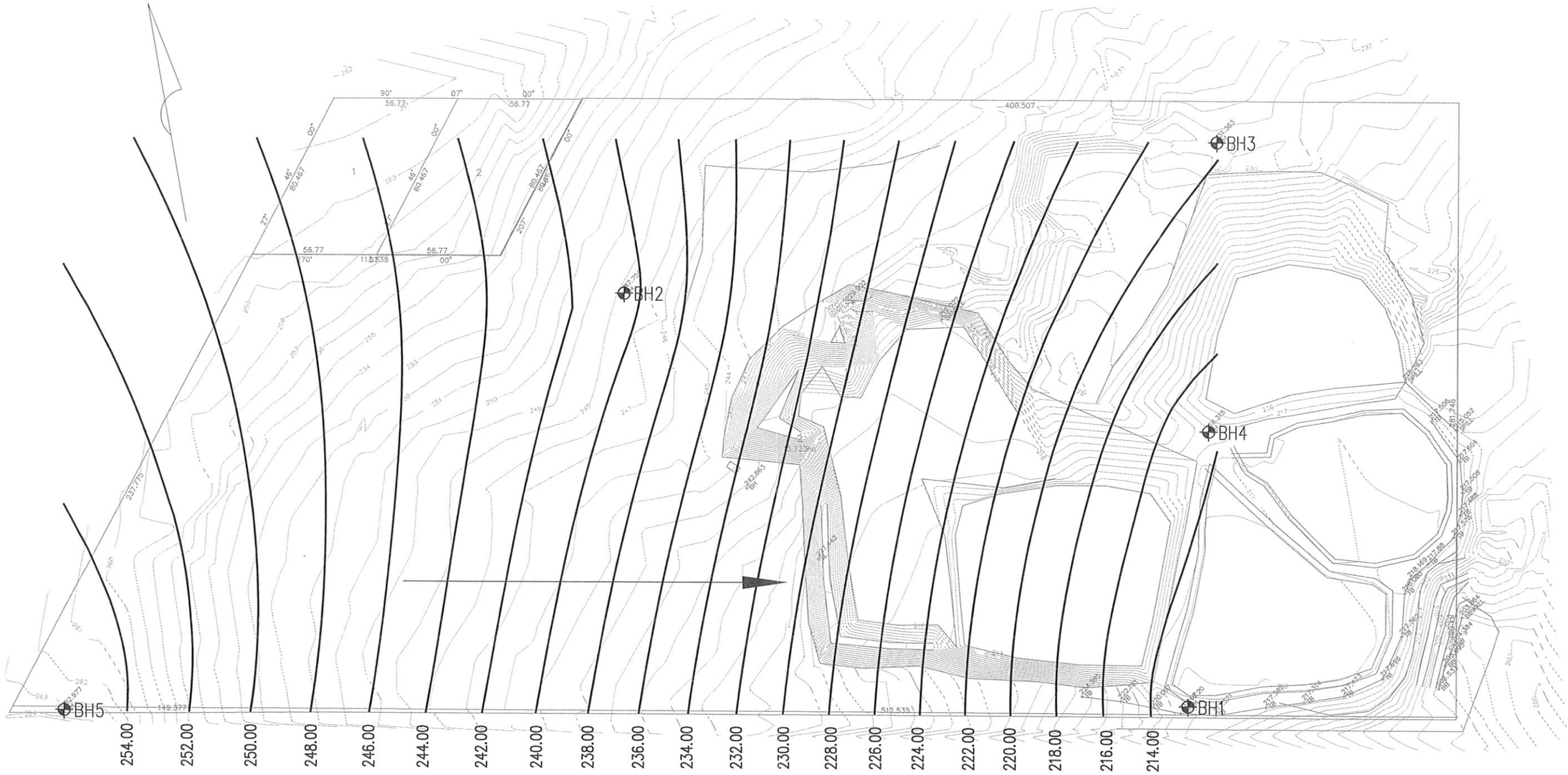
②	Outcrop location
120	Bedding strike, dip and direction
⊕	Monitoring well locations

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GROUNDWATER BORE LOCATIONS
RINDEAN QUARRY
SOMERSBY

CLIENT Pacrim Environmental Pty Ltd		PROJECT No 3977	
DRAWN BY SMA	SCALE 1 : 2000	DRAWING No 1	REV 0

2DT-DWG-A3H-001/1



LEGEND

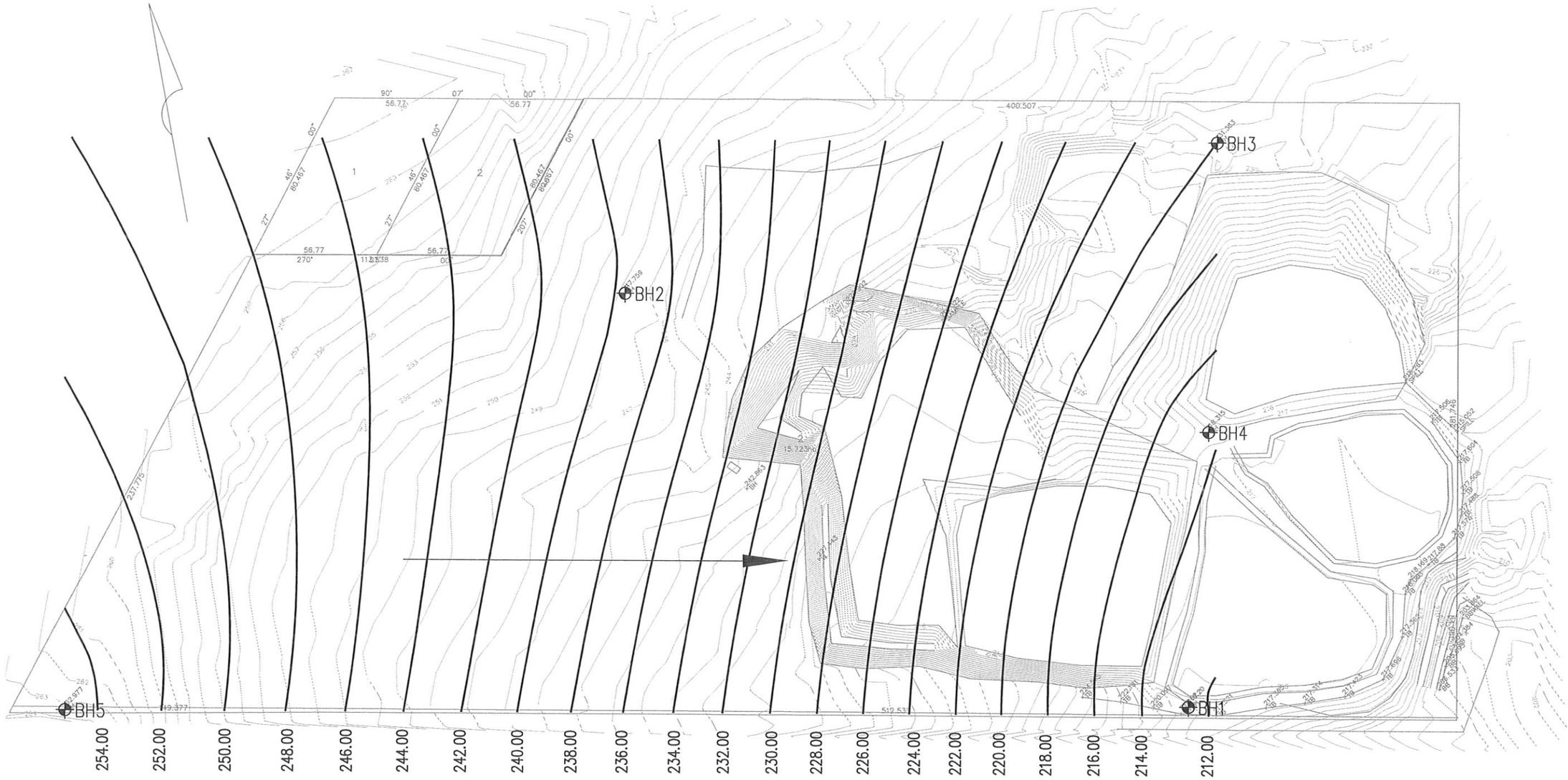
- Groundwater flow direction
- Groundwater contour interval
- Bore hole location

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GROUNDWATER CONTOURS
2/4/04
RINDEAN QUARRY
SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	SMA	SCALE	1 : 2000	DRAWING No	2 REV 0

:DT-DWG-A3H-001/1



LEGEND

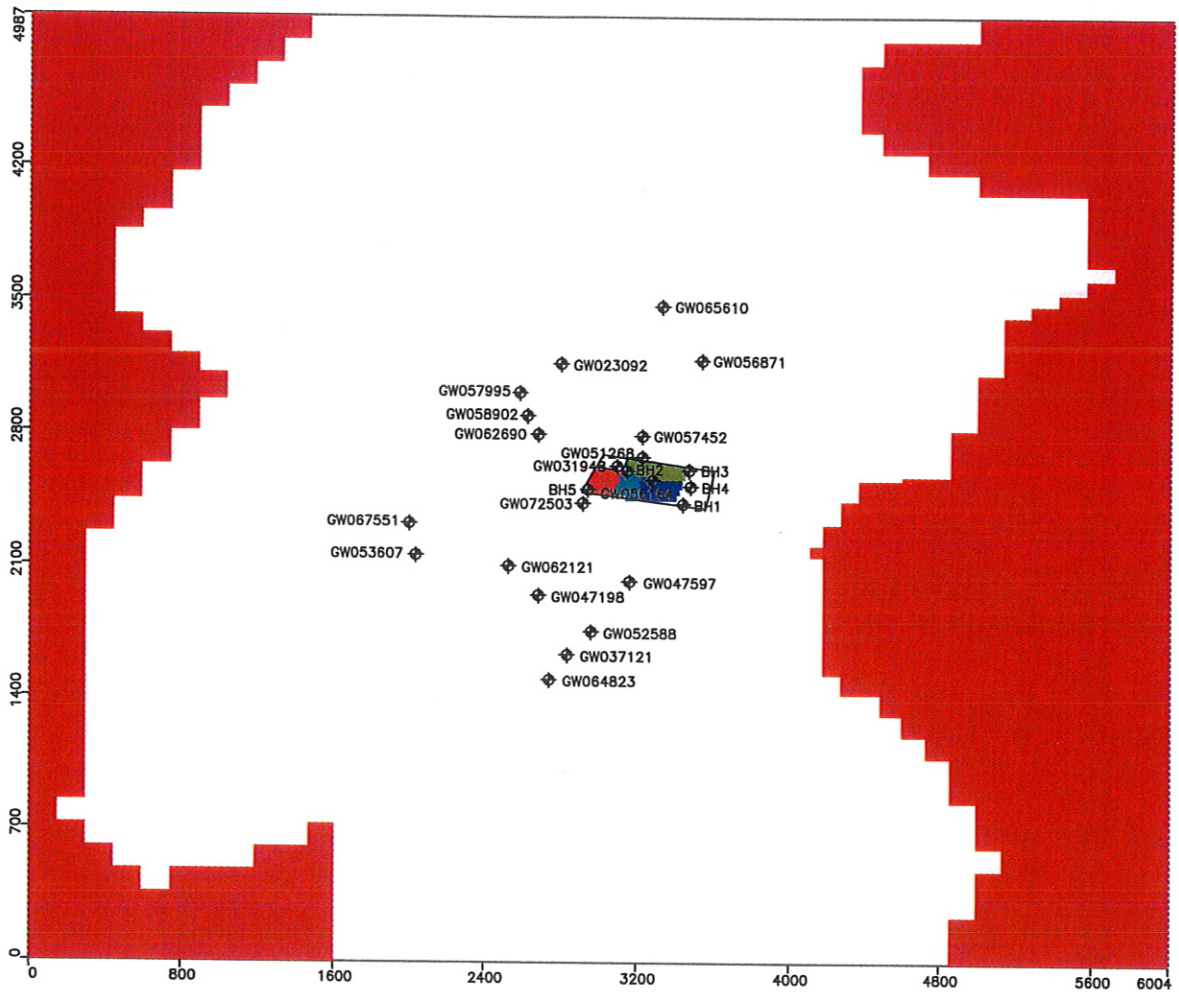
- Groundwater flow direction
- Groundwater contour interval
- Bore hole location

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GROUNDWATER CONTOURS
11/5/04
RINDEAN QUARRY
SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	SMA	SCALE	1 : 2000	DRAWING No 3	REV 0

DT-DWG-A3H-001/1



LEGEND

- Constant head
- Groundwater monitoring bore

SINGLE LAYER MODEL DESIGN SHOWING DISCRETISATION
RINDEAN QUARRY SOMERSBY

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CLIENT	Pacrim Environmental Pty Ltd						
DRAWN BY	FR	SCALE	N.T.S.	PROJECT No	3977	OFFICE	Newcastle
APPROVED BY	R	DATE	6.8.04	DRAWING No	4	Rev 0	

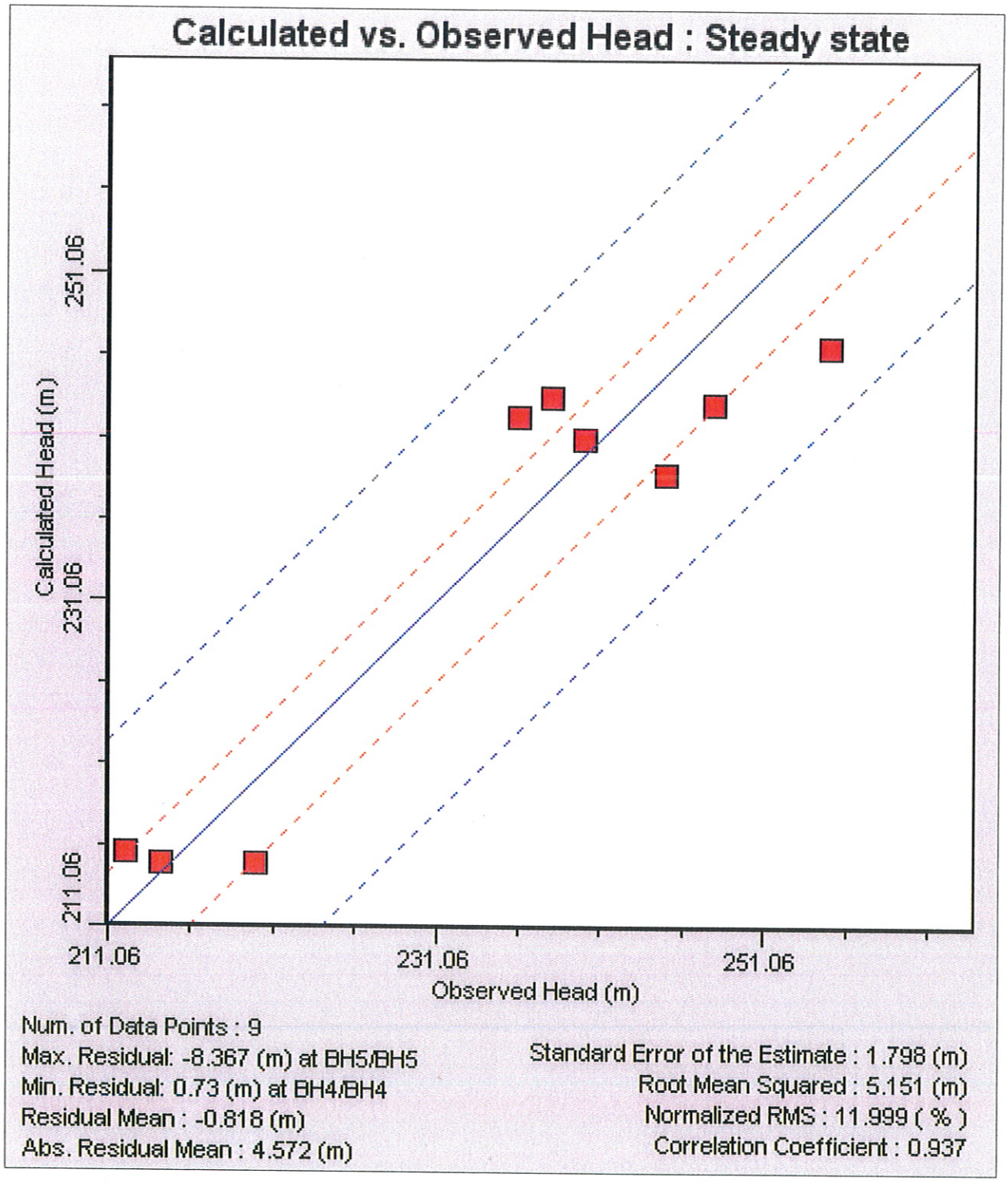
CDT-DWG-A4V-001/1



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MULTI LAYER MODEL DESIGN SHOWING LAYERS CROSS SECTION RINDEAN QUARRY SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	FR	SCALE	N.T.S.	DRAWING No 5	REV 0

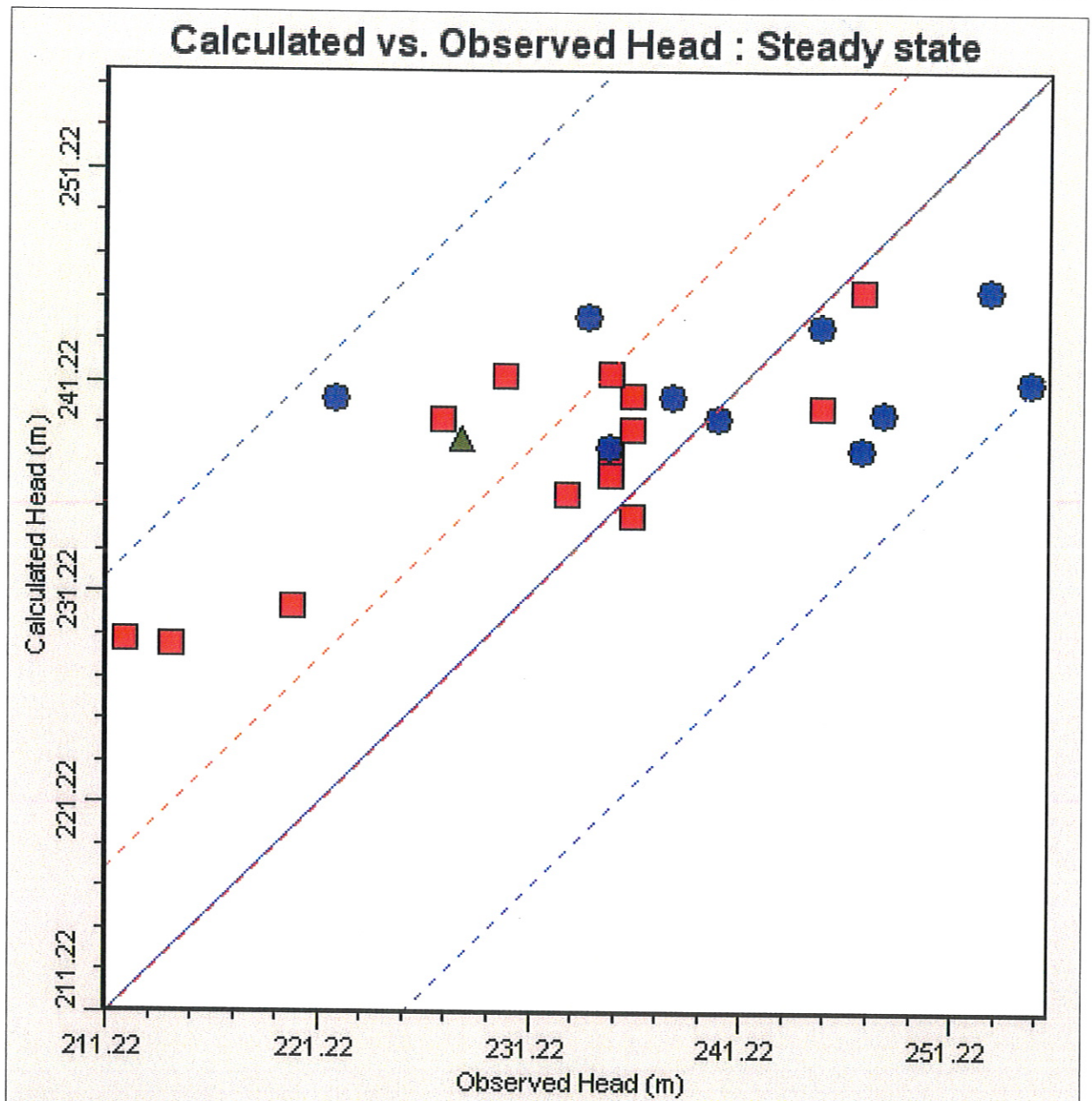


CDT-DWG-A4V-001/1

RCA AUSTRALIA
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SINGLE LAYER MODEL CALIBRATION
RINDEAN QUARRY SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd						
DRAWN BY	FR	SCALE	N.T.S.	PROJECT No	3977	OFFICE	Newcastle
APPROVED BY	R	DATE	6.8.04	DRAWING No	6	Rev 0	



Num. of Data Points : 25
Max. Residual: 18.328 (m) at GW072503/GW072503
Min. Residual: -0.626 (m) at BH2/BH2
Residual Mean : 3.377 (m)
Abs. Residual Mean : 7.221 (m)
Standard Error of the Estimate : 1.684
Root Mean Squared : 8.912
Normalized RMS : 20.76 (
Correlation Coefficient : 0.

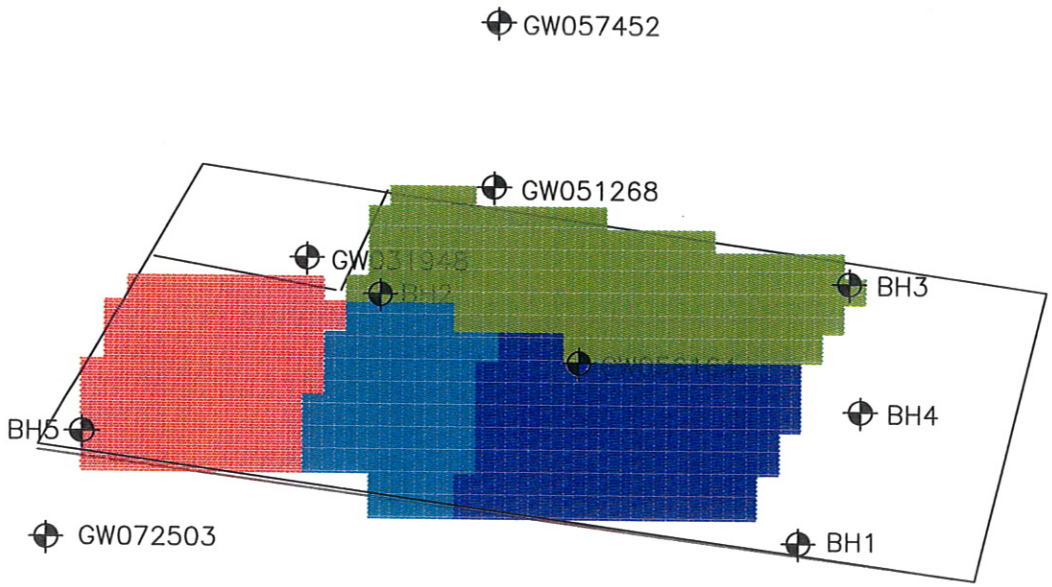
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- Layer #2
- Layer #3
- 95% confidence interval
- 95% interval

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

MULTI LAYER MODEL CALIBRATION
RINDEAN QUARRY SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd						
DRAWN BY	FR	SCALE	N.T.S.	PROJECT No	3977	OFFICE	Newcastle
APPROVED BY	R	DATE	6.5.04	DRAWING No	7	Rev 0	

CDT-DWG-A4V-001/1



LEGEND

- Stage 1
- Stage 2
- Stage 3
- Stage 4
- Bore Location

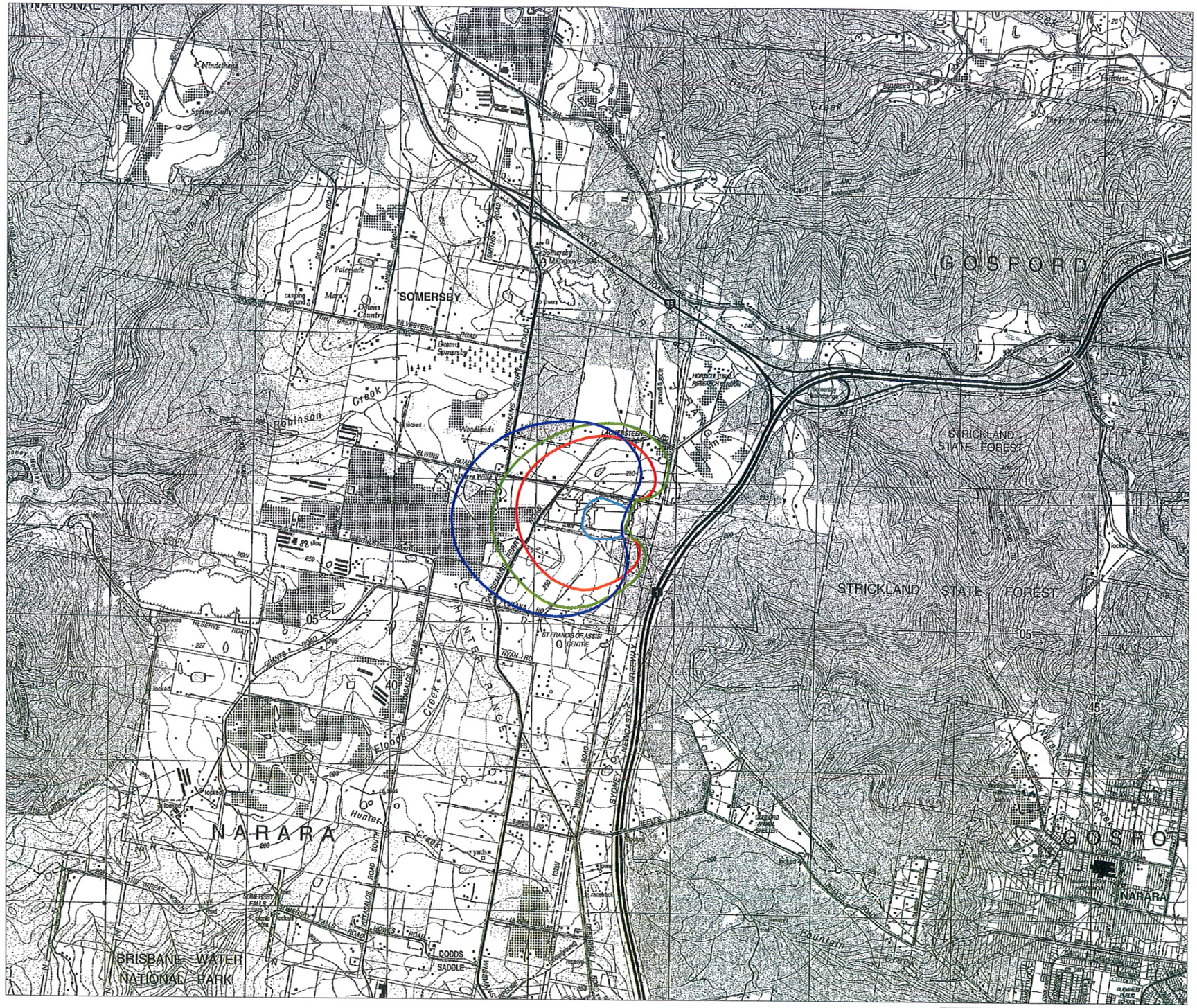
RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

QUARRY PROFILES
RINDEAN QUARRY SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd						
DRAWN BY	FR	SCALE	N.T.S.	PROJECT No	3977	OFFICE	Newcastle
APPROVED BY	R	DATE	6.8.04	DRAWING No	8	Rev 0	

CDT-DWG-A4V-001/1


SOMERSBY
GOSFORD
STRICKLAND STATE FOREST
STRICKLAND STATE FOREST
NARARA
BRISBANE WATER NATIONAL PARK
Creek
Hunter
Creek
Creek
Creek
Fountain
Creek
Somersby Industrial Park
Somersby Park
Somersby Shopping Centre
Somersby Public School
Somersby Golf Course
Somersby Waterfall
Somersby Falls
Somersby Falls Reserve
Somersby Falls Road
Somersby Park Road
Old Vegetable Gardens
Old Vegetable Gardens Road
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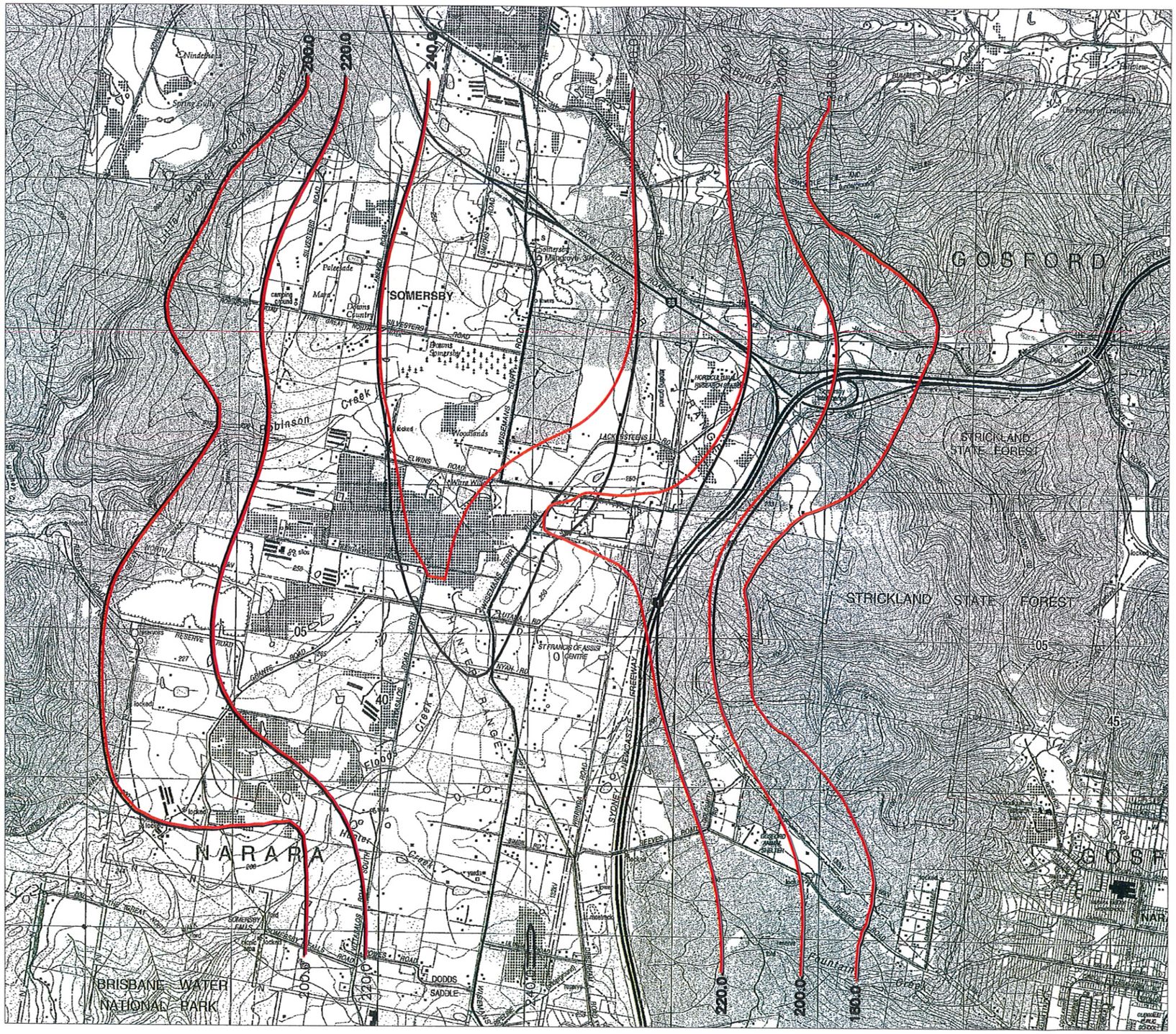
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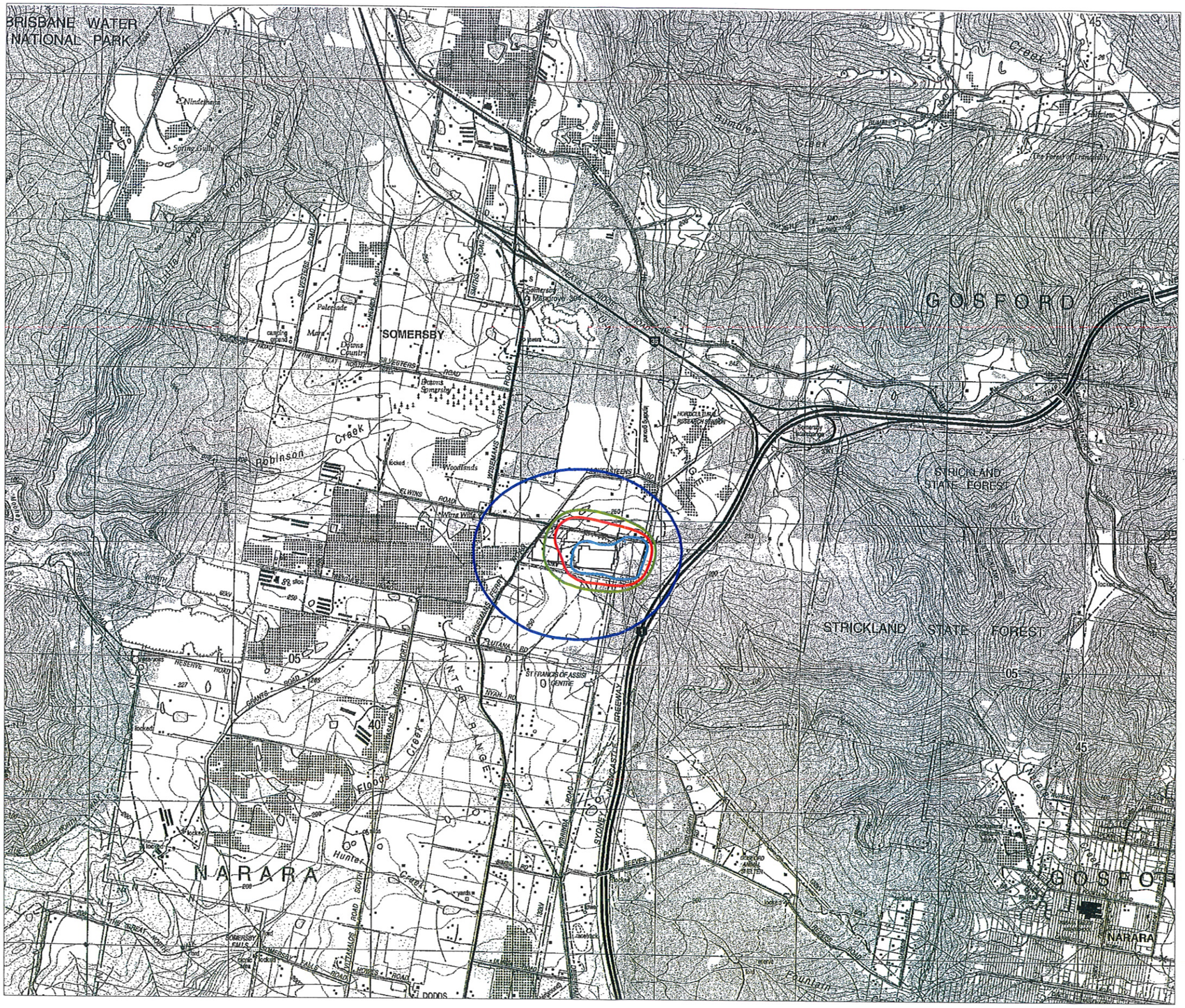
RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

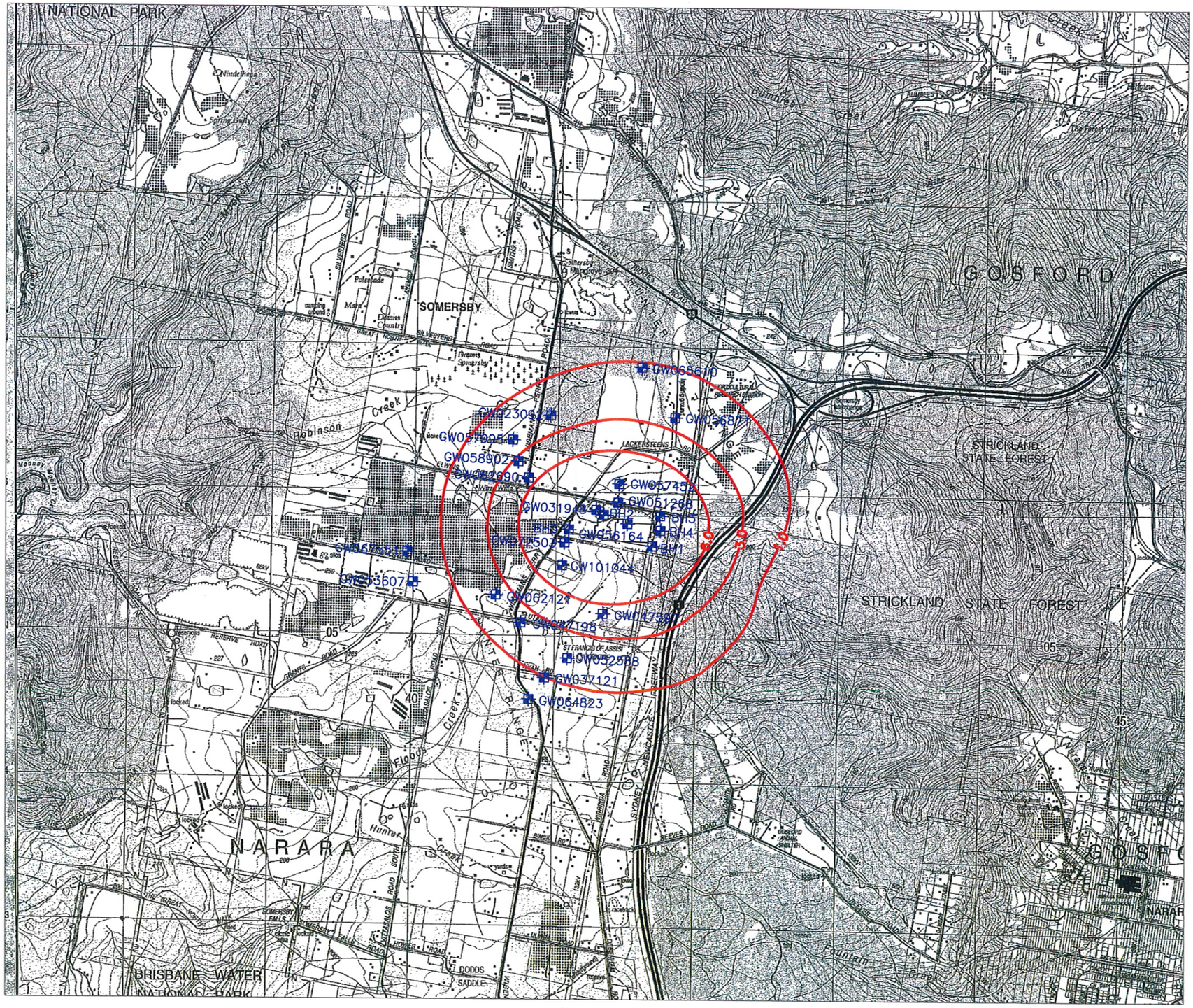
SINGLE LAYER MODEL
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RINDEAN QUARRY SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	FR	SCALE	1 : 30000	DRAWING No	10 REV 0
APPROVED BY		DATE			NEWCASTLE

CDT-DWG-A3H-001/1


SOMERSBY
GOSFORD
STRICKLAND STATE FOREST
STRICKLAND STATE FOREST
NARARA
BRISBANE WATER NATIONAL PARK
Robinson Creek
Flood Creek
Hawkins Creek
Fountain Drain
Little Wyong River
Dodds Saddle
Pacific Highway
Old Pacific Highway
Wisemans Ferry Road
Mount Penang Parklands
Somersby Industrial Park
Somersby Waterworks
Somersby Falls
Somersby Falls Picnic Area
Somersby Falls Track
Somersby Falls Road
Dodds Saddle Road
Somersby Park Road
Somersby Park
Somersby Park Golf Club
Somersby Park Golf Course
Somersby Park Golf Club Driving Range
Somersby Park Golf Club Clubhouse
Somersby Park Golf Club Car Park
Somersby Park Golf Club Practice Fairway
Somersby Park Golf Club Practice Green
Somersby Park Golf Club Practice Bunker
Somersby Park Golf Club Practice Tee
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Somersby Park Golf Club Practice Range
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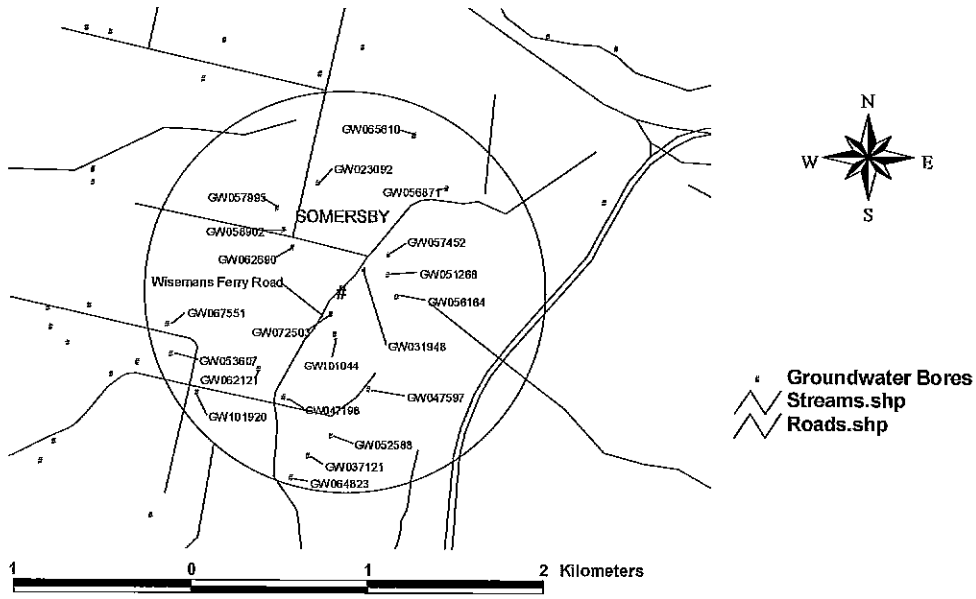

BRISBANE WATER
NATIONAL PARK
SOMERSBY
GOSFORD
STRICKLAND STATE FOREST
NARARA
Creek
Hunter
Robinson
Dundee
Flood
Woodlands
Palerang
Mangrove
Fountain
Pacific Highway
Wyong Road
Old Pacific Highway
Sydney-Newcastle Freeway
Somersby Falls Road
Mount Penang Parklands
St Francis of Assisi Catholic Centre
Somersby Industrial Estate
Somersby Shopping Centre
Gosford Anglican Grammar School
Gosford Golf Club
Gosford Public School
Gosford West Public School
Narara Public School
Narara Valley High School
Narara Valley Public School
Gosford Anglican Retirement Village
Gosford Regional Cemetery
Gosford Showground
Gosford Sports Park
Gosford Water Treatment Plant
Somersby Water Treatment Plant
Somersby Sewage Treatment Plant
Somersby Golf Course
Somersby Caravan Park
Somersby Falls
Somersby Falls Reserve
Somersby Falls Track
Somersby Park
Somersby Park Road
Somersby Park Track
Somersby Quarry
Somersby Shopping Centre


NATIONAL PARK
GOSFORD
SOMERSBY
STRICKLAND STATE FOREST
STRICKLAND STATE FOREST
NARARA
BRISBANE WATER
NATIONAL PARK
Robinson Creek
Burnleys Creek
Hunter Creek
Flood Creek
Fountain Brook
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GW058902
GW051268
GW056164
GW101044
GW062124
GW047538
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Appendix B

Groundwater Bore Search

Groundwater Bores approximately 1.2kms near Wisemans Ferry Road Somersby dated 23/03/2004



Date/Time :23-Mar-2004 10:56 AM
User :STANNER
Report :RMGW001D.QRP
Executable :S:\G5\PROD32\Ground.exe
Exe Date :27-Oct-2003
System :Groundwater
Database :Dlwcp

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW023092 *Converted From HYDSYS*

License :10BL015984

Work Type : Bore open thru rock
Work Status : Supply Obtained
Construct. Method : Rotary Mud
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	GENERAL USE

Commenced Date : **Final Depth :** 19.80 m
Completion Date :01-Jul-1965 **Drilled Depth :** 19.80 m

Contractor Name :
Driller :

Property : - SOMERSBY
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	21
Licensed :	NORTHUMBERLAND	NARARA	LT A DP

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2N WYONG
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6306175 **Latitude (S) :**33° 22' 18"
Easting :340800 **Longitude (E) :**151° 17' 19"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Asbestos Cement	-0.10	3.50	127			Seated

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.70	10.90	1.20	Consolidated	6.70		0.01			Good
17.90	18.20	0.30	Consolidated	6.70		0.25			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.24	0.24	Soil	Soil	
0.24	1.21	0.97	Stones	Stones	
1.21	3.35	2.14	Clay	Clay	
3.35	9.75	6.40	Sandstone Interlayere	Sandstone	
9.75	19.81	10.06	Sandstone Water Supply	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Jul-1965						Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW023092 *Converted From HYDSY:*

Remarks

SITED RMB 32 SOMERSBY VIA 2250

*** End of GW023092 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW031948 *Converted From HYDSY.*

License :10BL024129

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Rotary
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	GENERAL USE

Commenced Date : **Final Depth :** 30.40 m
Completion Date :01-Feb-1970 **Drilled Depth :** 30.50 m

Contractor Name :
Driller :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	28
	Licensed :NORTHUMBERLAND	NARARA	LT F DP

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305700 **Latitude (S) :**33° 22' 34"
Easting :341080 **Longitude (E) :**151° 17' 30"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	-0.10	18.10	127			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.20	18.30	0.10	Consolidated	6.70		0.15			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	16.76	16.76	Clay		
0.00	16.76	16.76	Sandstone Very Soft	Sandstone	
16.76	30.48	13.72	Sandstone Water Supply	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Feb-1970	5.00	6.70	18.20	0.15	18.00	(Unknown)			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW031948 *****

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW037121 *Converted From HYDSY:*

License :10BL029075

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Rotary Air
Owner Type : Private

	Authorised Purpose(s)	Intended Purpose(s)
	STOCK	STOCK

Commenced Date : **Final Depth :** 33.50 m
Completion Date :01-Jan-1973 **Drilled Depth :** 33.50 m

Contractor Name :
Driller :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	160
	Licensed :NORTHUMBERLAND	NARARA	LT DP

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6304630 **Latitude (S) :**33° 23' 17"
Easting :340830 **Longitude (E) :**151° 17' 19"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	-0.30	8.80	127			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.80	25.80	3.00	(Unknown)	7.60		0.38			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	33.52	33.52	Rock Nominal Water Supply		
0.00	33.52	33.52	Shale Nominal	Shale	
0.00	33.52	33.52	Clay Nominal	Clay	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	01-Jan-1973	24.00	7.60	24.30	0.38	24.00	(Unknown)			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Trentment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW037121 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW047198 *Converted From HYDSYS*

License :10BL131022

Work Type :Bore open thru rock
Work Status :(Unknown)
Construct. Method :Cable Tool
Owner Type :Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	IRRIGATION

Commenced Date :
Completion Date :01-Oct-1978
Final Depth : 46.00 m
Drilled Depth : 46.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK
Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	LE DP10982 (57)
Licensed :	NORTHUMBERLAND	NARARA	LTE DP10982

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :
CMA Map :9131-2S GOSFORD
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)
Northing :6304950
Easting :340675
Latitude (S) :33° 22' 58"
Longitude (E) :151° 17' 14"

GS Map :0055B2 AMG Zone :56 Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	5.80	162			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	5.80	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.20	15.60	0.40	Consolidated	6.10		0.27			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	Topsoil Sandy	Topsoil	
0.30	0.80	0.50	Clay Gravel	Clay	
0.80	5.30	4.50	Shale Clay	Shale	
5.30	15.20	9.90	Sandstone Yellow Silty	Sandstone	
15.20	15.60	0.40	Sandstone Yellow Coarse Water Supply	Sandstone	
15.60	33.20	17.60	Sandstone Yellow Silty	Sandstone	
33.20	39.30	6.10	Shale Dark	Shale	
39.30	42.00	2.70	Sandstone Grey	Sandstone	
42.00	46.00	4.00	Sandstone Yellow	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	24-Oct-1978	5.00	6.10	46.00	0.27		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW047198 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW047597 *Converted From HYDSYS*

License :10BL132874

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	IRRIGATION
STOCK	

Commenced Date : **Final Depth :** 26.00 m
Completion Date :01-Sep-1980 **Drilled Depth :** 26.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	30
	Licensed :NORTHUMBERLAND	NARARA	PT30

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9131-2S GOSFORD
River Basin :212 - HAWKESBURY RIVER **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation :
Elevation Source :(Unknown)

Northing :6305025 **Latitude (S) :**33° 22' 56"
Easting :341150 **Longitude (E) :**151° 17' 32"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.20	3.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
8.80	9.00	0.20	Consolidated	8.00					Fresh
21.60	22.60	1.00	Consolidated	2.60					Fresh
24.00	24.60	0.60	Consolidated	2.60					Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	Loam Sandy	Sandstone	
1.50	7.80	6.30	Sandstone Yellow Silty	Sandstone	
7.80	8.80	1.00	Sandstone Silty	Sandstone	
8.80	9.00	0.20	Sandstone Open Water Bearing	Clay	
9.00	13.60	4.60	Clay Grey Shale	Sandstone	
13.60	21.60	8.00	Sandstone Silty	Sandstone	
21.60	22.60	1.00	Sandstone Coarse Water Bearing	Sandstone	
22.60	24.00	1.40	Sandstone Yellow	Sandstone	
24.00	24.60	0.60	Sandstone Coarse Water Bearing	Ironstone	
24.60	26.00	1.40	Ironstone		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	11-Sep-1980	1.00	2.60	25.00	0.30		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW047597 *Converted From HYDSYS*

*** End of GW047597 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW051268 *Converted From HYDSYS*

License :10BL110923

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	DOMESTIC

Commenced Date : **Final Depth :** 30.00 m
Completion Date :01-Dec-1979 **Drilled Depth :** 30.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : 0-500 ppm
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	L1 DP921418 (28)
	Licensed :NORTHUMBERLAND	NARARA	L1 DP921418

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305680 **Latitude (S) :**33° 22' 35"
Easting :341220 **Longitude (E) :**151° 17' 35"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	5.50	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
16.90	17.20	0.30	Consolidated	5.10		0.20			Fresh
27.80	28.70	0.90	Consolidated	5.10		1.25			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Topsoil Sandy		
0.40	1.90	1.50	Gravel Cemented Clay	Gravel	
1.90	2.80	0.90	Sandstone Yellow Silty	Sandstone	
2.80	16.90	14.10	Sandstone Yellow Silty	Sandstone	
2.80	16.90	14.10	Clay Bands Fine	Clay Bands	
16.90	17.20	0.30	Sandstone Coarse Open Water Supply	Sandstone	
17.20	27.80	10.60	Sandstone Yellow Silty	Sandstone	
27.80	28.70	0.90	Sandstone Coarse Open	Sandstone	
28.70	30.00	1.30	Sandstone White Silty	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	12-Dec-1979	1.00	5.10	26.00	1.25		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW051268 *****

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW052588 *Converted From HYDSYS*

License :10BL114447

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock	DOMESTIC	DOMESTIC
Work Status :(Unknown)	STOCK	STOCK
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 30.00 m
Completion Date :01-Aug-1980 **Drilled Depth :** 30.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A **Standing Water Level :**
GWMA :606 - MANGROVE MOUNTAIN **Salinity :** Fresh
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	L1 DP518409 (30)
	Licensed :NORTHUMBERLAND	NARARA	LT 1 DP 518409

Region :10 - SYDNEY SOUTH COAST **CMA Map :**9131-2S GOSFORD
River Basin :211 - MACQUARIE - TUGGERAH LAKES **Grid Zone :**56/1 **Scale :**1:25,000
Area / District :

Elevation : **Northing :**6304750 **Latitude (S) :**33° 23' 5"
Elevation Source :(Unknown) **Easting :**340950 **Longitude (E) :**151° 17' 24"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	6.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
7.40	7.60	0.20	Consolidated	7.00		0.20			Fresh
26.80	27.90	1.10	Consolidated	7.00		0.60			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	Topsoil Sandy	Clay	
0.80	2.60	1.80	Clay Red Sandy Gravel	Sandstone	
2.60	4.80	2.20	Sandstone Silty	Clay	
4.80	5.30	0.50	Clay Grey	Sandstone	
5.30	7.40	2.10	Sandstone Yellow Silty	Sandstone	
7.40	7.60	0.20	Sandstone Yellow Coarse Water Supply	Sandstone	
7.60	16.50	8.90	Sandstone Grey Silty Fine Clay Bands	Sandstone	
16.50	22.70	6.20	Sandstone Silty	Clay	
22.70	23.00	0.30	Clay Red	Sandstone	
23.00	26.80	3.80	Sandstone Silty	Sandstone	
26.80	27.90	1.10	Sandstone Coarse Water Supply	Sandstone	
27.90	30.00	2.10	Sandstone Yellow		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	22-Aug-1980	1.00	7.00	30.00	0.60		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW052588 *Converted From HYDSYS*

*** End of GW052588 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW053607 *Converted From HYDSY*

License :10BL135011

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	IRRIGATION
STOCK	

Commenced Date : **Final Depth :** 62.00 m
Completion Date :01-Dec-1980 **Drilled Depth :** 62.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	DP204322 (19)
Licensed :	NORTHUMBERLAND	NARARA	PT19

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305160 **Latitude (S) :**33° 22' 51"
Easting :340025 **Longitude (E) :**151° 16' 49"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.20	3.40	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	3.40	168			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.10	18.20	0.10	Consolidated	18.00		0.06			Fresh
41.60	42.00	0.40	Consolidated	15.00		0.25			Fresh
56.80	56.90	0.10	Consolidated	15.00		0.30			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Topsoil Sandy		
0.40	4.80	4.40	Shale Clay	Shale	
0.40	4.80	4.40	Sandstone Bands	Sandstone	
4.80	9.60	4.80	Sandstone Yellow Silty Clay Bands	Sandstone	
9.60	13.20	3.60	Sandstone Grey Silty Clay Bands	Sandstone	
13.20	41.60	28.40	Sandstone Yellow Silty Clay Bands Water Supply	Sandstone	
41.60	56.80	15.20	Sandstone Grey Coarse Water Supply	Sandstone	
56.80	62.00	5.20	Sandstone Yellow Water Supply	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	03-Dec-1980	1.00	15.00	62.00	0.30		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW053607 *****

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW056164 *Converted From HYDSYS*

License :10BL121924

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	DOMESTIC
FARMING	STOCK
STOCK	

Commenced Date : **Final Depth :** 30.00 m
Completion Date :01-Apr-1982 **Drilled Depth :** 30.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone :001 - MANGROVE MT.-KULNURA

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	LF DP10982 (28)
Licensed :	NORTHUMBERLAND	NARARA	LF DP10982

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305560 **Latitude (S) :**33° 22' 39"
Easting :341275 **Longitude (E) :**151° 17' 37"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	4.30	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	4.30	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
11.80	12.10	0.30	Consolidated	11.00		0.20			(Unknown)
26.60	27.80	1.20	Consolidated	6.00		0.70			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Soil Sandy	Clay	
0.40	1.60	1.20	Clay Cemented Gravel	Clay	
1.60	2.70	1.10	Ironstone	Ironstone	
2.70	3.70	1.00	Clay	Clay	
3.70	11.80	8.10	Sandstone Yellow Silty	Sandstone	
11.80	12.10	0.30	Sandstone Yellow Silty Open Water Supply	Sandstone	
12.10	26.60	14.50	Sandstone Yellow Silty	Sandstone	
26.60	27.80	1.20	Sandstone Coarse Open Water Supply	Sandstone	
27.80	30.00	2.20	Sandstone Yellow Silty	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	21-Apr-1982	1.00	6.00	30.00	0.70		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW056164 *****

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW056871 *Converted From HYDSYS*

License :10BL123988

Work Type : Bore
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC

Commenced Date :
Completion Date :01-Mar-1983
Final Depth : 34.00 m
Drilled Depth : 34.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone :001 - MANGROVE MT.-KULNURA

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	L1 DP548869 (21)
Licensed :	NORTHUMBERLAND	NARARA	LT 1 DP 548869

Region :10 - SYDNEY SOUTH COAST
River Basin :211 - MACQUARIE - TUGGERAH LAKES
Area / District :

CMA Map :9131-2N WYONG
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6306187
Easting :341525

Latitude (S) :33° 22' 18"
Longitude (E) :151° 17' 47"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Galvinised Steel	-0.30	5.20	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	5.20	168			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
28.10	28.30	0.20	Consolidated	14.00		0.09			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	Soil Sandy	Shale	
0.60	1.20	0.60	Shale Clay	Sandstone	
1.20	8.30	7.10	Sandstone Silty	Sandstone	
8.30	10.10	1.80	Sandstone Yellow Silty	Clay	
10.10	10.30	0.20	Clay Grey	Sandstone	
10.30	17.60	7.30	Sandstone Silty	Sandstone	
17.60	26.80	9.20	Sandstone Yellow	Sandstone	
26.80	28.10	1.30	Sandstone Grey	Sandstone	
28.10	28.30	0.20	Sandstone Grey Open Water Supply	Clay	
28.30	28.60	0.30	Clay Grey	Sandstone	
28.60	34.00	5.40	Sandstone Yellow		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	13-Mar-1983	1.00	14.00	34.00	0.09		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

*** End of GW056871 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW057452 *Converted From HYDSY*

License :10BL125558

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	DOMESTIC

Commenced Date : **Final Depth :** 32.00 m
Completion Date :01-Mar-1983 **Drilled Depth :** 32.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	L2 DP524053 (21)
Licensed :	NORTHUMBERLAND	NARARA	LT 2 DP 524053

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305790 **Latitude (S) :**33° 22' 31"
Easting :341215 **Longitude (E) :**151° 17' 35"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quanti

If	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	2.80	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
13.70	13.90	0.20	Consolidated	10.00		0.20			Fresh
27.70	28.00	0.30	Consolidated	9.00		0.50			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	Gravel Sandy	Sandstone	
0.30	0.90	0.60	Sandstone	Shale	
0.90	2.40	1.50	Shale Clay	Sandstone	
2.40	13.70	11.30	Sandstone Yellow Silty	Sandstone	
13.70	13.90	0.20	Sandstone Yellow Open Water Supply	Sandstone	
13.90	27.70	13.80	Sandstone Yellow Silty	Sandstone	
27.70	28.00	0.30	Sandstone Coarse Open Water Supply	Sandstone	
28.00	28.30	0.30	Clay White	Clay	
28.30	32.00	3.70	Sandstone White	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	15-Mar-1983	1.00	9.00	32.00	0.50		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW057452 *****

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this dat The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW057995 *Converted From HYDSY.*

License :10BL126698

Work Type :Bore open thru rock
Work Status :(Unknown)
Construct. Method :Cable Tool
Owner Type :Private

Authorised Purpose(s)	Intended Purpose(s)
DOMESTIC	IRRIGATION
IRRIGATION	
STOCK	

Commenced Date :
Completion Date :01-Sep-1983
Final Depth : 46.00 m
Drilled Depth : 46.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - SCHNEIDER
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK
Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	39
	Licensed :NORTHUMBERLAND	NARARA	LT 1 DP 620696

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :
CMA Map :9131-2N WYONG
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)
Northing :6306020
Easting :340580
Latitude (S) :33° 22' 23"
Longitude (E) :151° 17' 11"

GS Map :0055B2 AMG Zone :56
Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantil

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Galvinised Steel	-0.20	2.90	168			Cemented

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
21.60	22.40	0.80	Consolidated	5.00		0.40			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	Soil Sandy	Soil	
0.80	1.90	1.10	Soil Sandy Small Gravel	Soil	
1.90	2.60	0.70	Shale Clay	Shale	
2.60	9.80	7.20	Sandstone Yellow Ironstone Bands	Sandstone	
9.80	21.60	11.80	Sandstone Grey	Sandstone	
21.60	22.40	0.80	Sandstone Grey Open Water Supply	Sandstone	
22.40	28.10	5.70	Sandstone Grey	Sandstone	
28.10	46.00	17.90	Sandstone Yellow	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	14-Sep-1983	2.00	5.00	46.00	0.40		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW057995 *****

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this dati The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW058902 *Converted From HYDSYS*

License :10BL130926

	Authorised Purpose(s)	Intended Purpose(s)
Work Type :Bore open thru rock	DOMESTIC	DOMESTIC
Work Status :(Unknown)		
Construct. Method :Cable Tool		
Owner Type :Private		

Commenced Date :
Completion Date :01-Sep-1983
Final Depth : 30.00 m
Drilled Depth : 30.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - N/A
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK
Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	NARARA	L2 DP620696 (39)
Licensed :	NORTHUMBERLAND	NARARA	LT 2 DP 620696

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :
CMA Map :9131-2N WYONG
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)
Northing :6305900
Easting :340620
Latitude (S) :33° 22' 27"
Longitude (E) :151° 17' 12"

GS Map :0055B2 AMG Zone :56 Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Corrugated Galvenised Iron	-0.20	5.90	168			Seated

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
20.50	20.70	0.20	Consolidated	20.00		0.10			Fresh
26.60	26.90	0.30	Consolidated			0.20			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.10	1.10	Soil Sandy	Soil	
1.10	2.00	0.90	Soil Wet Sandy	Soil	
1.10	2.00	0.90	Clay	Clay	
2.00	4.20	2.20	Ironstone	Ironstone	
4.20	5.10	0.90	Sand Soft Wet	Sand	
5.10	20.70	15.60	Sandstone Yellow Water Supply	Sandstone	
20.70	26.90	6.20	Sandstone Grey Water Supply	Sandstone	
26.90	30.00	3.10	Sandstone Yellow	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	20-Sep-1983	1.00		30.00	0.20		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW058902 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW062121 *Converted From HYDSYS*

License :10BL136364

Work Type : Bore open thru rock
Work Status :(Unknown)
Construct. Method : Cable Tool
Owner Type : Private

Authorised Purpose(s)	Intended Purpose(s)
INDUSTRIAL	IRRIGATION
IRRIGATION	

Commenced Date : **Final Depth :** 43.00 m
Completion Date :01-Aug-1987 **Drilled Depth :** 43.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - SMITH
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	57
	Licensed :NORTHUMBERLAND	NARARA	LT PTD DP 10982

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305100 **Latitude (S) :**33° 22' 53"
Easting :340525 **Longitude (E) :**151° 17' 8"

GS Map :0055B2 **AMG Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.30	6.20	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
14.80	15.10	0.30	Consolidated	14.00		0.10			(Unknown)
36.70	38.80	2.10	Consolidated	16.00		1.20			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	Loam Sandy		
0.50	1.40	0.90	Gravel Consolidated	Gravel	
1.40	4.20	2.80	Sandstone Yellow	Sandstone	
4.20	5.30	1.10	Sand Wet	Sand	
5.30	36.70	31.40	Sandstone Yellow Water Supply	Sandstone	
36.70	38.80	2.10	Sandstone Grey Soft Water Supply	Sandstone	
38.80	43.00	4.20	Sandstone	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	26-Aug-1987	1.00	16.00	35.00	1.20		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW062121 *****

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW062690 *Converted From HYDSYS*

License :10BL141411

Work Type :Bore open thru rock
Work Status :(Unknown)
Construct. Method :Cable Tool
Owner Type :Private

Authorised Purpose(s)	Intended Purpose(s)
INDUSTRIAL	DOMESTIC

Commenced Date :
Completion Date :01-May-1986
Final Depth : 25.00 m
Drilled Depth : 25.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property : - COLLINS
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	L1 DP517230 (28)
	Licensed :NORTHUMBERLAND	NARARA	LT 3 DP 1027884

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/1 Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6305800 Latitude (S) :33° 22' 31"
Easting :340675 Longitude (E) :151° 17' 14"

GS Map :0055B2 AMG Zone :56 Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.20	9.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
17.10	17.40	0.30	Consolidated	10.00		0.20			Fresh
21.30	21.80	0.50	Consolidated	4.00		0.60			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	4.80	4.80	Clay Grey Sandy	Clay	
4.80	7.90	3.10	Clay Grey Sandy	Clay	
4.80	7.90	3.10	Sandstone Fine Layers	Sandstone	
7.90	12.40	4.50	Sandstone Yellow Silty	Sandstone	
12.40	25.00	12.60	Sandstone Yellow Water Supply	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	17-May-1986	1.00	4.00	25.00	0.60		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

*** End of GW062690 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW064823 *Converted From HYDSY!*

License :

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock		DOMESTIC
Work Status : (Unknown)		STOCK
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 40.00 m
Completion Date : 23-Mar-1985 **Drilled Depth :** 0.00

Contractor Name :
Driller : 1435 ISELT, John Hans

Property : **Standing Water Level :**
GWMA : **Salinity :** Fresh
GW Zone : **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	NARARA	41
	Licensed :		

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9131-2S GOSFORD
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6304500 **Latitude (S) :** 33° 23' 13"
Elevation Source : **Easting :** 340740 **Longitude (E) :** 151° 17' 16"

GS Map : 0055B2 **AMG Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	-0.30	9.70	152			Driven into Hole
1	1	Casing	Pressure Cemented Casing	0.00	9.70	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
29.50	29.90	0.40	Consolidated	10.30		0.20			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	23-Mar-1985	1.50	10.30	40.00	0.20		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW064823 *****

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW065610 *Converted From HYDSY:*

License :

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock		DOMESTIC
Work Status : (Unknown)		STOCK
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 40.00 m
Completion Date : 16-Jul-1988 **Drilled Depth :** 0.00

Contractor Name :
Driller : 1435 ISELT, John Hans

Property : **Standing Water Level :**
GWMA : **Salinity :** Fresh
GW Zone : **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	NARARA	21
	Licensed :		

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9131-2N WYONG
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6306475 **Latitude (S) :** 33° 22' 9"
Elevation Source : **Easting :** 341325 **Longitude (E) :** 151° 17' 40"

GS Map : 0055B2 **AMG Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	-0.30	11.70	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.40	15.70	0.30	Consolidated	8.00		0.20			Fresh
33.70	34.00	0.30	Consolidated	6.00		0.60			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	16-Jul-1988	1.00	6.00	40.00	0.60		Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

***** End of GW065610 *****

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW067551 *Converted From HYDSYS*

License :

	Authorised Purpose(s)	Intended Purpose(s)
Work Type :Bore		DOMESTIC
Work Status :(Unknown)		
Construct. Method :Cable Tool		
Owner Type :Private		

Commenced Date : Final Depth : 34.00 m
Completion Date :02-Aug-1989 Drilled Depth : 34.00 m

Contractor Name :
Driller :1435 ISELT, John Hans

Property :
GWMA :
GW Zone :

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

County	Parish	Portion/Lot DP
Form A :NORTHUMBERLAND	NARARA	L3 DP714478
Licensed :		

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9131-2S GOSFORD
Grid Zone :56/I Scale :1:25,000

Elevation : 0.00
Elevation Source :

Northing :6305325.5 Latitude (S) :33° 22' 46"
Easting :339991.5 Longitude (E) :151° 16' 47"

GS Map : AMG Zone :56 Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Galvinised Steel	-0.20	6.30	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
17.80	18.10	0.30	Consolidated	14.00		0.12			Fresh
29.90	31.60	1.70	Consolidated	6.00		0.37			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.10	1.10	Sandy Soil	Sandstone	
1.10	2.90	1.80	Yellow Sandstone	Gravel	
2.90	4.10	1.20	Cemented Gravel	Clay	
4.10	4.40	0.30		Sandstone	
4.40	17.80	13.40	Yellow Sandstone	Sandstone	
17.80	18.10	0.30	Yellow Sandstone (wb)	Clay	
18.10	18.30	0.20		Sandstone	
18.30	21.50	3.20	Grey Sandstone	Sandstone	
21.50	29.90	8.40	Yellow Sandstone	Sandstone	
29.90	31.60	1.70	Yellow Sandstone (wb)	Sandstone	
31.60	34.00	2.40	Yellow Sandstone		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	02-Aug-1989	1.00	6.00	34.00	0.37	0.00	Bailer			
Single-Rate Pumping Test	02-Aug-1989	0.00	6.00	34.00	0.37					

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

ACC 7

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW067551 *Converted From HYDSYS*

*** End of GW067551 ***

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DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW072503 *Converted From HYDSYS*

License :

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore open thru rock		DOMESTIC
Work Status : (Unknown)		STOCK
Construct. Method : Cable Tool		
Owner Type : Private		

Commenced Date : **Final Depth :** 48.00 m
Completion Date : 07-Dec-1993 **Drilled Depth :** 48.00 m

Contractor Name :
Driller : 1435 ISELT, John Hans

Property : **Standing Water Level :**
GWMA : **Salinity :** Fresh
GW Zone : **Yield :**

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	NARARA	L1 DP515352
	Licensed :		

Region : 10 - SYDNEY SOUTH COAST **CMA Map :** 9131-2S GOSFORD
River Basin : 212 - HAWKESBURY RIVER **Grid Zone :** 56/1 **Scale :** 1:25,000
Area / District :

Elevation : 0.00 **Northing :** 6305433.8 **Latitude (S) :** 33° 22' 43"
Elevation Source : **Easting :** 340908.3 **Longitude (E) :** 151° 17' 23"

GS Map : **AMG Zone :** 56 **Coordinate Source :** GD.,ACC.GIS

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	-0.30	11.70	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.50	18.70	0.20	Consolidated	18.00		0.07			Fresh
44.10	44.30	0.20	Consolidated	26.00		0.18			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Sandy Soil	Gravel	
0.40	1.60	1.20	Cemented Gravel	Ironstone	
1.60	2.90	1.30		Sandstone	
2.90	14.10	11.20	Soft Yellow Sandstone	Clay	
14.10	14.30	0.20	White Clay	Sandstone	
14.30	18.50	4.20	Yellow Sandstone	Sandstone	
18.50	18.70	0.20	Yellow Sandstone (w.b)	Sandstone	
18.70	21.60	2.90	Grey Sandstone	Sandstone	
21.60	44.10	22.50	Yellow Sandstone	Sandstone	
44.10	44.30	0.20	Yellow Sandstone (w.b)	Clay	
44.30	44.60	0.30	White Clay	Sandstone	
44.60	48.00	3.40	Yellow Sandstone		

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	07-Dec-1993	1.00	26.00	48.00	0.18	48.00	Bailer			

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

ACC = 7

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*** End of GW072503 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW101044

License :10BL156635

	Authorised Purpose(s)	Intended Purpose(s)
Work Type :Bore	DOMESTIC	COMMERCIAL
Work Status :(Unknown)	INDUSTRIAL	
Construct. Method :	IRRIGATION	
Owner Type :	STOCK	

Commenced Date :
Completion Date :31-Dec-1967
Final Depth : 67.00 m
Drilled Depth :

Contractor Name :
Driller :

Property : - SOMERSBY SPRINGS
GWMA :606 - MANGROVE MOUNTAIN
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK
Standing Water Level :
Salinity :
Yield : 0.37 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A :NORTHUMBERLAND	NARARA	LOT2 DP515808
	Licensed :NORTHUMBERLAND	NARARA	LT 2 DP 515808

Region :10 - SYDNEY SOUTH COAST
River Basin :
Area / District :
CMA Map :
Grid Zone :
Scale :

Elevation :
Elevation Source :
Northing :
Easting :
Latitude (S) :
Longitude (E) :

GS Map :
AMG Zone :
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

It	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	67.00	200			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

(No Drillers Log Details Found)

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Summary Details Found)

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method

(No Development Details Found)

Remarks

Form A Remarks:
OWNER USING BORE FOR COMMERCIAL PERPOSES AT TIME OF ENTRY

*** End of GW101044 ***

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The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW101920

License :10BL158554

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status :(Unknown)	STOCK	STOCK
Construct. Method : Rotary		
Owner Type :		

Commenced Date : **Final Depth :** 66.00 m
Completion Date :23-Jul-1998 **Drilled Depth :** 66.00 m

Contractor Name :J.H. ISELT
Driller :1435 ISELT, John Hans

Property : - N/A **Standing Water Level :** 20.00 m
GWMA :606 - MANGROVE MOUNTAIN **Salinity :** Fresh
GW Zone :008 - MOONEY MOONEY AND MULLET CREEK **Yield :** 0.36 L/s

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Clicnt	**Form A :**NORTHUMBERLAND	NARARA	LOT29 DP755246
	Licensed :NORTHUMBERLAND	NARARA	LT 29 DP 755246

Region :10 - SYDNEY SOUTH COAST **CMA Map :**
River Basin : **Grid Zone :** **Scale :**
Area / District :

Elevation : **Northing :** **Latitude (S) :**
Elevation Source : **Easting :** **Longitude (E) :**

GS Map : **AMG Zone :** **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantit

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	11.50	210			Rotary Air
1		Hole	Hole	11.50	66.00	150			Rotary Air
1	1	Casing	PVC Class 9	-0.50	11.50	160	145		C: -.2-11.5m; Screwed and Glued; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
24.20	26.00	1.80		20.00	35.00	0.03	35.00	0.50	Fresh
61.60	63.90	2.30		20.00	66.00	0.35	66.00	2.00	Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	Topsoil	Soil	
0.30	1.20	0.90	Sandy Clay	Sandy Clay	
1.20	3.50	2.30	Cemented Gravel	Gravel	
3.50	7.90	4.40	Yellow Clay	Clay	
7.90	24.20	16.30	Yellow Sandstone	Sandstone	
24.20	26.00	1.80	Yellow Sandstone W. B.	Sandstone	
26.00	28.50	2.50	Yellow Sandstone	Sandstone	
28.50	32.70	4.20	Shale	Shale	
32.70	53.10	20.40	Yellow Sandstone	Sandstone	
53.10	58.50	5.40	Shale	Shale	
58.50	61.60	3.10	Yellow Sandstone	Sandstone	
61.60	63.90	2.30	Yellow Sandstone W. B.	Sandstone	
63.90	66.00	2.10	Yellow Sandstone	Sandstone	

Pumping Tests - Summaries

Pumping Test Type	Date	Duration (hr)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By
Single-Rate Pumping Test	23-Jul-1998	2.00	20.00	66.00	0.36		Airlift	Probe	Container of known vol.	Paul Iselt

Pumping Tests - Readings

Pumping Test Type	Date	Time (mins)	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Intake Depth (m)	Test Method	To Measure Water Level	To Measure Discharge	Tested By

(No Pumping Test Reading Details Found)

Chemical Treatment

Treatment	Method	Duration	Success

(No Chemical Treatment Details Found)

Development

Method	Time Taken	Other Development Method
Air	2.00	

Remarks

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

DEPARTMENT OF INFRASTRUCTURE, PLANNING AND NATURAL RESOURCES
Work Summary

GW101920

*** End of GW101920 ***

*** End of Report ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Appendix C

Bore Logs

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH1

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Rindean Quarry, Somersby

PROJECT No: 3977
DATE: 19/3/04
SURFACE LEVEL: Existing
SHEET 1 of 2
METHOD OF ADVANCE: Solid Flight Auger and Rock Roll drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				SANDSTONE, low strength, fine grained, slightly moist, red/brown	Backfill
		1.0		becoming brown	Bentonite Seal
				SANDSTONE, with some clay and gravel, low strength, fine grained	
				becoming red	
				brown	
		2.3			
		2.5		Sandy CLAY, quite moist, grey and brown mottling	
				Clayey SAND/weathered SANDSTONE, moist, white/ brown mottling, becoming sandier	
				dryer grey/white mottling	
				Commenced Rock roll Drilling at 3.8m	Gravel
5.1 ▽					Screened 4.8–7.9m
				3 bands of iron stone between 3.8m–6.5m	
				Ironstone band	
				white clay seam	Collapse

LOGGED: MC | CHECKED: MD | DATE: 11/6/04

CRS–TBL–A4V–003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH1

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 19/3/04
SURFACE LEVEL: Existing
SHEET 2 of 2
METHOD OF ADVANCE: Solid Flight Auger and Rock Roll Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				Clayey SAND/weathered SANDSTONE, as above	Gravel
				Changed to drag bit at ~10.7m	
11				Ironstone band	Collapse
				End Bore Hole BH1 at 11.2m	
12					
13					
14					
15					
16					
17					
18					
19					

LOGGED: MC | CHECKED: MD | DATE: 11/6/04

CRS-TBL-A4V-003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH2

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 31/3/04
SURFACE LEVEL: Existing
SHEET 1 of 2
METHOD OF ADVANCE: Solid Flight Auger and Percussion Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		0.6		Silty SAND, slightly moist, grey, TOPSOIL/SLOPEWASH	Backfill
		1.5		Silty Clayey SAND, slightly moist, grey, RESIDUAL	
		2.5		SANDSTONE, with some clay, estimated low strength, slightly moist, white to orange becoming lighter	
		6.5		SANDSTONE, with some clay, estimated low strength, slightly moist, orange becoming moist, orange/light orange/orange/yellow Commenced percussion drilling at ~3.0m NOTE: Water level during drilling 6.5m, Static water level in piezometer at 6.18m	Bentonite Seal Gravel Screened 7.4–10.2m
6.5 ▽				Sandy CLAY/extremely weathered SANDSTONE, saturated, light orange	

1 2 3 4 5 6 7 8 9

LOGGED: MC | CHECKED: MD | DATE: 11/6/04

CRS–TBL–A4V–003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH2

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 31/3/04
SURFACE LEVEL: Existing
SHEET 2 of 2
METHOD OF ADVANCE: Solid Flight Auger and Percussion Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				Sandy CLAY/extremely weathered SANDSTONE, as above	Gravel
				becoming Clayey SAND	
				End Bore Hole BH2 at 14.0m	

11 12 13 14 15 16 17 18 19

LOGGED: MC | CHECKED: MD | DATE: 11/6/04

CRS-TBL-A4V-003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH3

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 31/3/04
SURFACE LEVEL: Existing
SHEET 1 of 2
METHOD OF ADVANCE: Solid Flight Auger and Percussion Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		0.6		FILL, GRAVEL, slightly moist, brown	Backfill
		1.7		Clayey SAND, slightly moist, grey becoming wetter and darker	
		2.2		Gravelly SAND, with some clay, very moist, brown	
				SANDSTONE, estimated medium strength, very low moisture, reddish pink becoming lighter	
				Ironstone band	
		5.5		SANDSTONE, reddish pink	
				Ironstone band	
		9.0		SILTSTONE, estimated medium strength, dry	
		9.5		Clayey SANDSTONE, estimated low strength, moist, orange/brown	

LOGGED: MC CHECKED: HD DATE: 6/6/04

CRS-TBL-A4V-003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH3

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 31/3/04
SURFACE LEVEL: Existing
SHEET 2 of 2
METHOD OF ADVANCE: Solid Flight Auger and Percussion Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
10.4 ▽				Clayey SANDSTONE, estimated low strength, very moist, brown/red NOTE: Static water level 10.38m	Backfill; Bentonite Seal; Gravel; Screened 13.0–16.0m
				End Bore Hole BH3 at 18.0m	

11 12 13 14 15 16 17 18 19

LOGGED: MC | CHECKED: MD | DATE: 11/6/04

CRS–TBL–A4V–003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH4

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Somersby

PROJECT No: 3977
DATE: 1/4/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Solid Flight Auger and Percussion Drilling

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		0.05		FILL, Crushed SANDSTONE	
		0.5		FILL, SAND, with some clay, low strength, slightly moist, light brown/orange	
		1.0		FILL, SAND, with organics, grey	
		1.1		CONCRETE, possibly an old pipe	
				SAND, with some clay, low moisture, brown becoming lighter and more orange	
		2.2		SAND, with increasing clay, fine grained, low moisture, yellow with white mottling	
		2.6		SANDSTONE, estimated low strength, low moisture, fine grained, yellow/light grey	
3.4 ▽				becoming more light grey becoming more orange becoming whiter, slight moisture increase	
				becoming more yellow/light grey Increase in grain size and strength, saturated, orange colour	
				becoming light orange	
				NOTE: Static Water level at 3.4m	
				End Bore Hole BH4 at 8.05m	

Backfill
Bentonite Seal
Gravel
Screened 4.2–7.2m

LOGGED: MC
CHECKED: MD
DATE: 11/6/04

CRS–TBL–A4V–003/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CORED BORE REPORT LOG

HOLE No: BH5

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Rindean Quarry, Somersby

DATE: 2/4/04
PROJECT No: 3977
SURFACE LEVEL: Existing

SHEET: 1 of 3
LOGGED BY: SMA
CHECKED: MD

WATER	REDUCED LEVEL	DEPTH (M)	STRATA	DESCRIPTION ROCK TYPE, grain size, colour Structure, minor components, alteration	ESTIMATED STRENGTH EL VL L M H VH EH	WEATHERING	DEFECT SPACING (mm) 30 100 300 1000 3000	SPECIFIC DEFECT DESCRIPTION Parting	Joint	Clay Seam	Shear	Dip (Degrees)	Thickness (mm)
				TOPSOIL, Silty SAND, dark brown									
				Clayey SAND, fine grained, orange, RESIDUAL									
		1		Clayey SANDSTONE, fine grained, orange, friable									
		2		Commenced NMLC Coring at 2.7m									
			Fe	IRONSTONE		EW							
		3		Clayey SANDSTONE, fine grained, orange, ironstone staining becoming white, friable from 2.8m								75	
			Fe	IRONSTONE									
				Clayey SANDSTONE, as above									
				CORE LOSS, 3.43m to 3.528m									
				Clayey SANDSTONE, fine grained, white with pink mottling, sugary									
				CORE LOSS, 3.85m to 4.0m									
		4		Clayey SANDSTONE, fine grained, white with pink mottling, friable, no major defects				Unless otherwise noted, defects are beddings between 0-15.	Surfaces are rough and planar				
		5											
				IRONSTONE, red, 20mm									
		6		Clayey SANDSTONE, fine to medium grained, pale orange, friable									
				becoming medium grained, no defects									
		7		CORE LOSS, 6.86m to 8.85m				No significant defects					
		8											
				SANDSTONE, with some clay, medium grained, pink, friable									
		9		becoming course grained with speckles of weathered ironstone									
				IRONSTONE, 15mm									
				Clayey SANDSTONE, fine grained, white									
				CORE LOSS, 9.74m to 9.91m									
				Clayey SANDSTONE, fine grained, pink, no major defects									

WEATHERING
Fr Fresh
SW Slightly
MW Moderately
HW Highly
EW Extremely

STRENGTH
EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low
EL Extremely Low

DRILLING RECORD (Drill, method of advance, casing, testing)

X = Point load strength test result
Core Lifts at

CRS-CBL-A4V-001/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CORED BORE REPORT LOG

HOLE No: BH5

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Rindean Quarry, Somersby

DATE: 2/4/04
PROJECT No: 3977
SURFACE LEVEL: Existing

SHEET: 2 of 3
LOGGED BY: SMA
CHECKED: MD

WATER	REDUCED LEVEL	DEPTH (M)	STRATA	DESCRIPTION ROCK TYPE, grain size, colour Structure, minor components, alteration	ESTIMATED STRENGTH EL VL L M H VH EH	WEATHERING	DEFECT SPACING (mm) 30 100 300 1000 3000	SPECIFIC DEFECT DESCRIPTION Parting Joint Clay Seam Shear Dip (Degrees) Thickness (mm)
				Clayey SANDSTONE, fine grained, pink, no major defects		EW		
				IRONSTONE, 20mm				
				Clayey SANDSTONE, medium grained, pink brown and purple mottling				
		11						
			Fe	Minor IRONSTONE band				
				Clayey SANDSTONE, fine to medium grained, white, no major defects, friable				
		12		some pink mottling				
		13						
		14				HW		
		15		SANDSTONE, with ironstone staining, fracture lanes at 15° and 0°		MW		
		16		Clayey SANDSTONE, fine grained, white, massive		HW		
				CLAY seam, fine grained, white, no defects				
			Fe	IRONSTONE, with staining		MW		
			Fe					
		17	Fe					
			Fe	Cross bedding at 15°				
		18		Clayey SANDSTONE, fine grained, white and orange mottling, massive		HW		
		19		Gravelly SANDSTONE medium grained, orange bedding				
				IRONSTONE				
				Gravely SANDSTONE, medium grained, white and orange mottling, grading upwards, rounded gravel				
				SANDSTONE, medium grained, fining upwards becoming clayey, contains cross bedding at 15°				

Unless otherwise noted defects are bedding partins between 0°–15°.
Surfaces are rough and planar
No significant defects

WEATHERING
Fr Fresh
SW Slightly
MW Moderately
HW Highly
EW Extremely

STRENGTH
EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low
EL Extremely Low

DRILLING RECORD (Drill, method of advance, casing, testing)
X = Point load strength test result
Core Lifts at

CRS—CBL—AAV—001/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

CORED BORE REPORT LOG

HOLE No: BH5

CLIENT: Pacrim Environmental Pty Ltd
PROJECT: Groundwater Assessment
LOCATION: Rindean Quarry, Somersby

DATE: 2/4/04
PROJECT No: 3977
SURFACE LEVEL: Existing

SHEET: 3 of 3
LOGGED BY: SMA
CHECKED: MD

WATER	REDUCED LEVEL	DEPTH (M)	STRATA	DESCRIPTION ROCK TYPE, grain size, colour Structure, minor components, alteration	ESTIMATED STRENGTH EL VL L M H VH EH	WEATHERING	DEFECT SPACING (mm) 30 100 300 1000 3000	SPECIFIC DEFECT DESCRIPTION Parting / Joint / Clay Seam / Shear / Dip (Degrees) / Thickness (mm)
		21		SANDSTONE, as above becoming mica rich with organic layers in bedding		HW/MW		
				Sandy CLAYSTONE, fining upward, becoming clay, white with orange staining, fractures at 0°		MW		
				Clayey SANDSTONE, fine grained, orange, cross bedding at 0°–20°, contains organics				
		22						Clay Seam: 2
		23						
		24		Cross bedding at 40°				
			Fe	IRONSTONE				
		25		SANDSTONE, with some clay, fine grained, orange, cross-bedding up to 20°				
		26		SANDSTONE, fine grained, white, cross bedding up to 15°, some organic layers, some yellow mottling, becoming pink upward		SW		
		27						
		28		mottling/staining becoming yellow again				
		29		NOTE: 50mm diameter PVC piezometer installed * Screened 11.3–14.3m * Gravel backfill 3.0–29.5m * Bentonite seal 2.5m–3.0m * Backfill 0.0–2.5m				
				End Bore Hole BH5 at 29.5m				

Unless otherwise noted, defects are beddings between 0°–15°. Surfaces are rough and planar

WEATHERING
Fr Fresh
SW Slightly
MW Moderately
HW Highly
EW Extremely

STRENGTH
EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low
EL Extremely Low

DRILLING RECORD (Drill, method of advance, casing, testing)
X = Point load strength test result
Core Lifts at

CRS-CBL-AAV-001/1

Appendix D

Field Logs

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENVIRONMENTAL SAMPLE COLLECTION RECORD

CLIENT: Pacrim Environmental.
PROJECT:
LOCATION: Somersby.
PROJECT MANAGER: PM

DATE: 1-4-04
PROJECT No: 3977
CLIENT REF:

Sample ID	Location	Depth (m)	PID (ppm)	Sample Type	Sample Description	Comments	Lab (y / n)
S-1a	BH4			Water	Bore water sample	No Odour	
SQ1	"			Water	"	Duplicate of S-1a	
S-2a	BH2			Water	"	No Odour	
S-3a	BH1			"	"	Sewage odour	
S-3b	"			"	"	"	
S-3c	"			"	"	"	

1-04

RCA Australia	Sampled by: MC	Date: 1-4-04
Office: Newcastle	Checked by:	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

PERMEAMETER PERMEABILITY TEST

CLIENT: Pacrim Environmental P/L DATE: 1-4-04

PROJECT: Groundwater Assessment PROJECT No: 3977

LOCATION: Somersby. CLIENT REF:

Bore No: BH1 Static Water Level Depth (cm): 5.09 m

Depth of Bore (cm): 7.86 m Internal Permeameter Radius (cm): 2.5 2.5 cm

Bore Radius (cm): 5 cm Depth to Any Impermeable Layer (cm):

Vegetation at Site:

Time Elapsed Between First Filling and Start of Measurement (min):

Was Soil Wet, Moist or Dry at Time Of Excavation?:

DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	
1-4-04 @ 0	805		13	787	37	6.4
30 sec	8.00		15	729	39	6.4
60 sec	797		17	7.20	41	6.3
120 sec	7.90		19	7.11	43	6.3
3 min	785		21	7.04	45	6.2
4 min	780		23	6.95	47	6.1
5	776		25	6.87	49	6.1
6	770		27	6.80	51	6.1
7	765		29	6.73	53	6.0
8	760		31	6.66	55	6.0
9	755		33	6.60		
11	747		35	6.54		

TEST METHOD: AS/NZS 1547:2000

COMMENTS: Water has an odour - eg. Sewage.
~12L purged

Depth of well - 7.9
(from ground level)
plus stick up of 0.72

RCA Australia	Tested by: S. Alagic	Date: 1-4-04
Office:	Checked by:	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

PERMEAMETER PERMEABILITY TEST

CLIENT: Paerim Environmental P/L DATE: 2-4-04

PROJECT: Groundwater Assessment PROJECT No: 3977

LOCATION: Somersby CLIENT REF:

Bore No: BH2 Static Water Level Depth (cm): 6.18 m

Depth of Bore (cm): 10.16m Internal Permeameter Radius (cm): 50mm

Bore Radius (cm): 5 Depth to Any Impermeable Layer (cm):

Vegetation at Site: Bush 3m to North of Bore.

Time Elapsed Between First Filling and Start of Measurement (min): 30L Bailed out.

Was Soil Wet, Moist or Dry at Time Of Excavation?:

Mn

DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)
0	7.47				
1	7.09				
2	6.76				
3	6.62				
4	6.55				
5	6.40				
6	6.35				
7	6.33				
8	6.31				
9	6.30				
10	6.29				
	Finish.				

TEST METHOD: AS/NZS 1547:2000

COMMENTS: 81cm - height of pipe above ground.
10.18 - depth of pipe.

4 7.1

RCA Australia	Tested by: MC	Date: 2-4-04
Office: Newcastle	Checked by:	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

PERMEAMETER PERMEABILITY TEST

CLIENT: Paecim Environmental P/L DATE: 2-4-04

PROJECT: Groundwater Assessment PROJECT No: 3977

LOCATION: Somersby CLIENT REF:

Bore No: BH3

Depth of Bore (cm): 16.82

Bore Radius (cm): 5

Static Water Level Depth (cm): 10.38

Internal Permeameter Radius (cm): 50mm

Depth to Any Impermeable Layer (cm):

Vegetation at Site:

Time Elapsed Between First Filling and Start of Measurement (min):

Was Soil Wet, Moist or Dry at Time Of Excavation?:

Mm

DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)
0	14.71		18	13.15	
1	14.62		20	12.95	
2	14.53		23	12.66	
3	14.44		26	12.41	
4	14.37		29	12.17	
5	14.30		32	11.99	
6	14.24		35	11.80	
8	14.10		38	11.64	
10	13.95		41	11.50	
12	13.85		44	11.37	
14	13.62		47	11.24	
16	13.39		50	11.15	

TEST METHOD: AS/NZS 1547:2000

COMMENTS: 16.80m - Depth of well
70cm - Heigh of pipe from ground.
22L purged

RCA Australia	Tested by: MC	Date: 2-4-04
Office:	Checked by:	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

PERMEAMETER PERMEABILITY TEST

CLIENT: Pacific Environmental DATE: 2-4-04

PROJECT: Groundwater Assessment PROJECT No: 3977

LOCATION: Somersby CLIENT REF:

Bore No: BH4

Depth of Bore (cm): 7.91

Bore Radius (cm): 5

Static Water Level Depth (cm): 3.36

Internal Permeameter Radius (cm): 50mm.

Depth to Any Impermeable Layer (cm):

Vegetation at Site:

Time Elapsed Between First Filling and Start of Measurement (min):

Was Soil Wet, Moist or Dry at Time Of Excavation?:

Min

DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)
0	5.51		14	3.61	
1	5.14		16	3.56	
2	4.90		18	3.54	
3	4.62		Finish.		
4	4.39				
5	4.22				
6	4.07				
7	3.98				
8	3.88				
9	3.80				
10	3.74				
12	3.67				

TEST METHOD: AS/NZS 1547:2000

COMMENTS:

m-Height of pipe out of ground.
7.91m Depth of well

25L purged.

RCA Australia	Tested by: MC	Date: 2-4-04
Office:	Checked by:	Date:

Hunter Water Lab
49350500

RCA AUSTRALIA
GEOTECHNICAL & ENVIRONMENTAL

ENGINEERING FIELD SHEET

~~PERMEAMETER~~ Piezo PERMEABILITY TEST

CLIENT: Paerim Environmental P/L DATE: 2-4-04

PROJECT: Groundwater Assessment PROJECT No: 3977

LOCATION: Somersby CLIENT REF:

Bore No: BH5

Static Water Level Depth (cm): 6·20

Depth of Bore (cm): 1387

Internal Permeameter Radius (cm): 50mm

Bore Radius (cm): 5

Depth to Any Impermeable Layer (cm):

Vegetation at Site:

Time Elapsed Between First Filling and Start of Measurement (min):

Was Soil Wet, Moist or Dry at Time Of Excavation?:

DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)	DATE & TIME	WATER LEVEL IN TUBE (cm)	DROP IN WATER LEVEL (cm)
0	8.56		16	7.43	
1	8.33		21	7.36	
2	8.17		31	"	
3	8.04				
4	7.94				
5	7.86				
6	7.77				
7	7.70				
8	7.65				
~~8~~ 10	7.57				
~~10~~ 12	7.51				
14	7.46				

TEST METHOD: AS/NZS 1547:2000

COMMENTS:

Height of pipe above ground - 77cm
Depth of pipes - 14-28m

* 26L purged

RCA Australia	Tested by: MC	Date: 2-4-04
Office: Newcastle	Checked by:	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

WATER SAMPLING RECORD

CLIENT: PACRIM
PROJECT: RINDERA QUARRY
LOCATION: WISEMANS FERRY RD SOMERSBY

DATE: 11/5/04
PROJECT No: 3977
CLIENT REF:

WATER METER USED:
DATE & TYPE OF LAST CALIBRATION (1PT OR FULL):
METHOD OF SAMPLING:
PRESERVATION & STORAGE (TICK): Field Temp ☐ Chilled (<4°C) ☐ Frozen ☐
Un-preserved ☐ Preserved: ☐ Acid (H_2SO_4) ☐ Acid (HNO_3) ☐ Alkaline (NaOH) ☐ Filtered ☐
TESTS REQUIRED:
OTHER DETAILS:

BORE OR LOCATION ID: BH1
TIME: TO
BORE DEPTH: 9.59 HEIGHT ABOVE GROUND LEVEL: 0.63
DEPTH TO AQUIFER: 5.4 VOLUME PURGED:
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance:
Duplicate/Equipment Wash Identification and Other Remarks:

BORE OR LOCATION ID: BH4
TIME: TO
BORE DEPTH: 7.91 HEIGHT ABOVE GROUND LEVEL: 0.66
DEPTH TO AQUIFER: 3.35 VOLUME PURGED:
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance:
Duplicate/Equipment Wash Identification and Other Remarks:

RCA Australia	Sampled by: SMA	Date:
Office:		

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

BORE OR LOCATION ID: BH3
TIME: _____ TO _____
BORE DEPTH: 16.82 HEIGHT ABOVE GROUND LEVEL: 0.68
DEPTH TO AQUIFER: 10.70 VOLUME PURGED: _____
RESULTS OF WATER QUALITY CHECK: _____

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance: _____
Duplicate/Equipment Wash Identification and Other Remarks: _____

BORE OR LOCATION ID: BH2
TIME: _____ TO _____
BORE DEPTH: 10.16 HEIGHT ABOVE GROUND LEVEL: 0.81
DEPTH TO AQUIFER: 6.88 VOLUME PURGED: _____
RESULTS OF WATER QUALITY CHECK: _____

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance: _____
Duplicate/Equipment Wash Identification and Other Remarks: _____

BORE OR LOCATION ID: BH5
TIME: _____ TO _____
BORE DEPTH: 13.87 HEIGHT ABOVE GROUND LEVEL: 0.73
DEPTH TO AQUIFER: 7.19 VOLUME PURGED: _____
RESULTS OF WATER QUALITY CHECK: _____

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance: _____
Duplicate/Equipment Wash Identification and Other Remarks: _____

Appendix E

Calculations

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT: Pacrim Envrionmental
PROJECT: Rindean Quarry
LOCATION: Somersby

DATE: 14/05/2004
RCA ref: 3977
CLIENT REF:

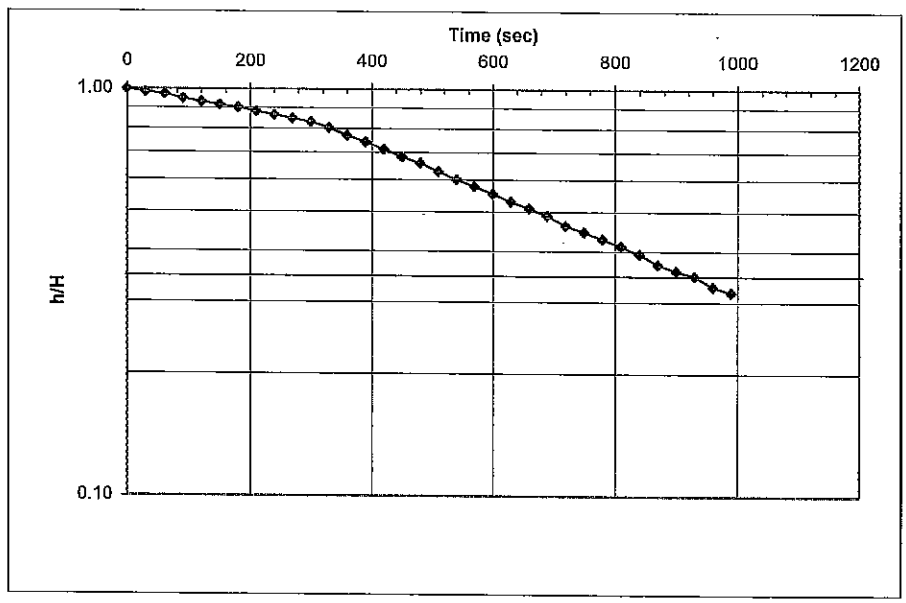
BORE DETAILS

Bore No.	BH1
Piezometer length (L)	3 m
Piezometer radius (r)	0.0025 m
Bore radius (R)	0.005 m
Depth of piezometer	7.86 m
Static water level	5.09 m
Lag time T_o	930 sec
(37% recovery)	

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	5.090		
0	8.050	2.96	1.00
30	8.000	2.91	0.98
60	7.970	2.88	0.97
90	7.900	2.81	0.95
120	7.850	2.76	0.93
150	7.800	2.71	0.92
180	7.760	2.67	0.90
210	7.700	2.61	0.88
240	7.650	2.56	0.86
270	7.600	2.51	0.85
300	7.550	2.46	0.83
330	7.470	2.38	0.80
360	7.370	2.28	0.77
390	7.290	2.2	0.74
420	7.200	2.11	0.71
450	7.110	2.02	0.68
480	7.040	1.95	0.66
510	6.950	1.86	0.63
540	6.870	1.78	0.60
570	6.800	1.71	0.58
600	6.730	1.64	0.55
630	6.660	1.57	0.53
660	6.600	1.51	0.51
690	6.540	1.45	0.49
720	6.460	1.37	0.46
750	6.410	1.32	0.45
780	6.360	1.27	0.43
810	6.310	1.22	0.41
840	6.255	1.165	0.39
870	6.190	1.1	0.37
900	6.150	1.06	0.36
930	6.120	1.03	0.35
960	6.060	0.97	0.33
990	6.030	0.94	0.32

TEST METHOD: Rising head



Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability **7.2E-09 m / sec**

RCA Australia	Tested by: SMA	Date: 1/04/04
Office:	Checked by: PH	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT: Pacrim Environmental
PROJECT: Rindean Quarry
LOCATION: Somersby

DATE: 14/05/2004
RCA ref: 3977
CLIENT REF:

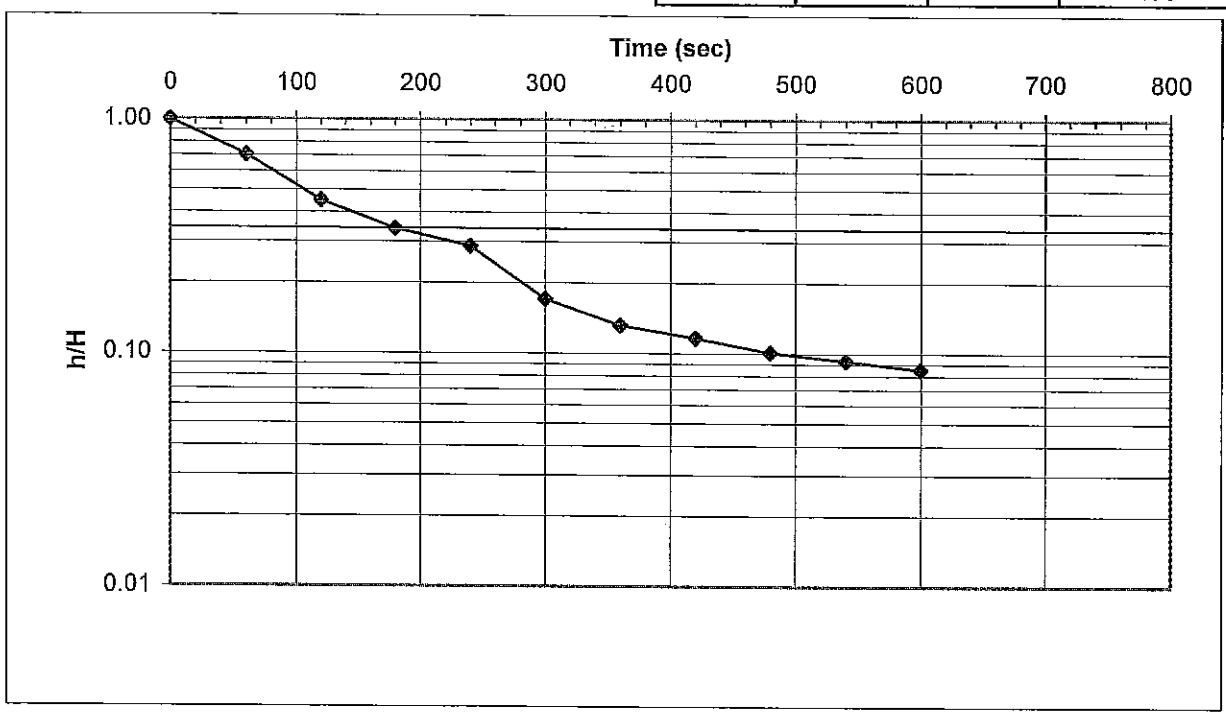
BORE DETAILS

Bore No.	BH2
Piezometer length (L)	3 m
Piezometer radius (r)	0.0025 m
Bore radius (R)	0.005 m
Depth of piezometer	10.16 m
Static water level	6.18 m
Lag time T_o (37% recovery)	180 sec

TEST METHOD: Rising head

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	6.180		
0	7.470	1.29	1.00
60	7.090	0.91	0.71
120	6.760	0.58	0.45
180	6.620	0.44	0.34
240	6.550	0.37	0.29
300	6.400	0.22	0.17
360	6.350	0.17	0.13
420	6.330	0.15	0.12
480	6.310	0.13	0.10
540	6.300	0.12	0.09
600	6.290	0.11	0.09



Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability **3.7E-08 m / sec**

RCA Australia	**Tested by:**	**MC**	**Date:**	**2/04/2004**
Office:	**Checked by:**	**PH**	**Date:**	

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT:	Pacrim Environmental	DATE:	14/05/2004
PROJECT:	Rindean Quarry	RCA ref:	3977
LOCATION:	Somersby	CLIENT REF:	

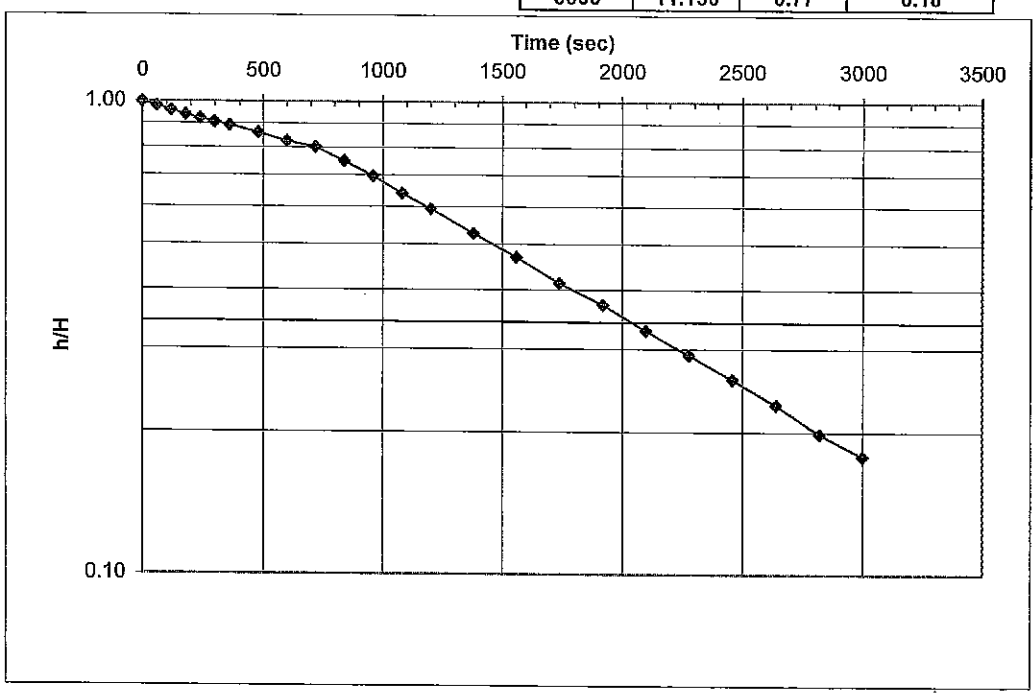
BORE DETAILS

Bore No.	BH3	
Piezometer length (L	3	m
Piezometer radius (r	0.0025	m
Bore radius (R)	0.005	m
Depth of piezometer	16.82	m
Static water level	10.38	m
Lag time T_o (37% recovery)	2100	sec

TEST METHOD: Rising head

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	10.380		
0	14.710	4.33	1.00
60	14.620	4.24	0.98
120	14.530	4.15	0.96
180	14.440	4.06	0.94
240	14.370	3.99	0.92
300	14.300	3.92	0.91
360	14.240	3.86	0.89
480	14.100	3.72	0.86
600	13.950	3.57	0.82
720	13.850	3.47	0.80
840	13.620	3.24	0.75
960	13.390	3.01	0.70
1080	13.150	2.77	0.64
1200	12.950	2.57	0.59
1380	12.660	2.28	0.53
1560	12.410	2.03	0.47
1740	12.170	1.79	0.41
1920	11.990	1.61	0.37
2100	11.800	1.42	0.33
2280	11.640	1.26	0.29
2460	11.500	1.12	0.26
2640	11.370	0.99	0.23
2820	11.240	0.86	0.20
3000	11.150	0.77	0.18



Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability 3.2E-09 m / sec

RCA Australia	Tested by:	MC	Date:	2/04/2004
Office:	Checked by:	PH	Date:	

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT: Pacrim Environmental
PROJECT: Rindean Quarry
LOCATION: Somersby

DATE: 14/05/2004
RCA ref: 3977
CLIENT REF:

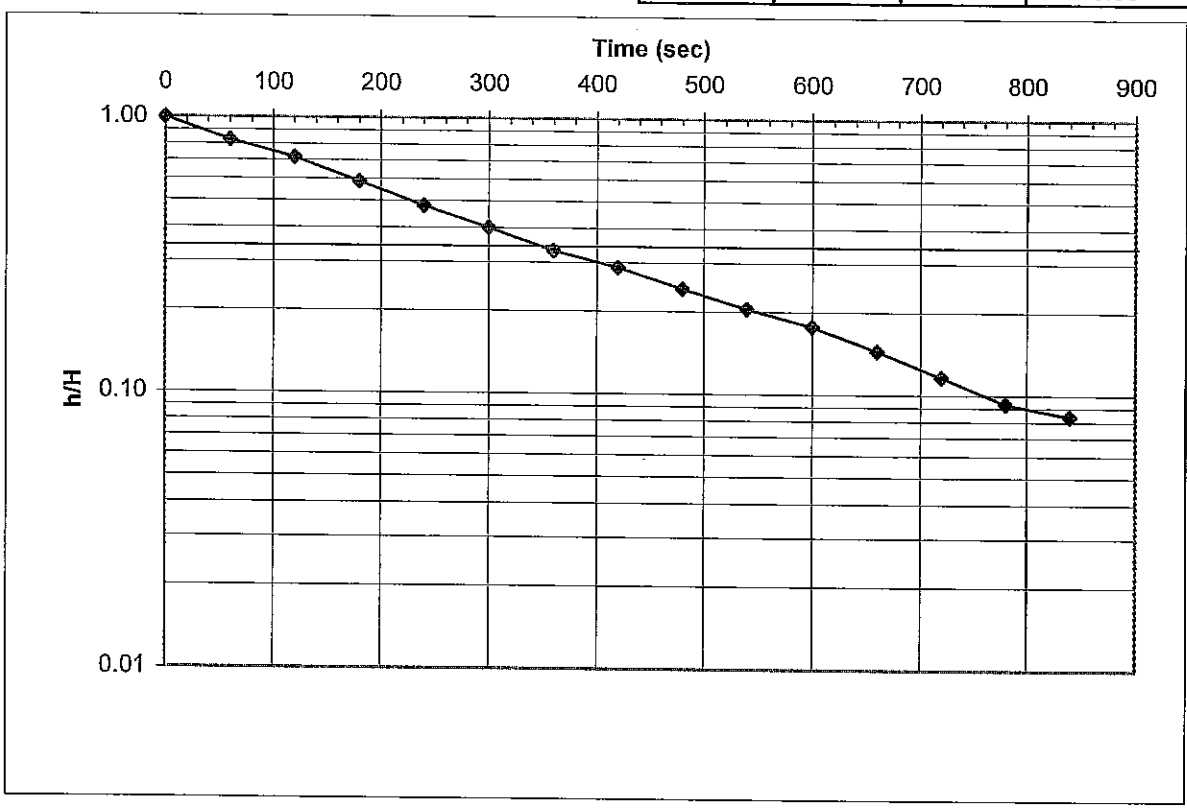
BORE DETAILS

Bore No.	BH4
Piezometer length (L)	3 m
Piezometer radius (r)	0.0025 m
Bore radius (R)	0.005 m
Depth of piezometer	7.91 m
Static water level	3.36 m
Lag time T_o (37% recovery)	350 sec

TEST METHOD: Rising head

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	3.360		
0	5.510	2.15	1.00
60	5.140	1.78	0.83
120	4.900	1.54	0.72
180	4.620	1.26	0.59
240	4.390	1.03	0.48
300	4.220	0.86	0.40
360	4.070	0.71	0.33
420	3.980	0.62	0.29
480	3.880	0.52	0.24
540	3.800	0.44	0.20
600	3.740	0.38	0.18
660	3.670	0.31	0.14
720	3.610	0.25	0.12
780	3.560	0.2	0.09
840	3.540	0.18	0.08



Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability **1.9E-08 m / sec**

RCA Australia	**Tested by: MC**	**Date: 2/04/04**
Office:	**Checked by: PH**	**Date:**

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT: Pacrim Environmental
PROJECT: Rindean Quarry
LOCATION: Somersby

DATE: 14/05/2004
RCA ref: 3977
CLIENT REF:

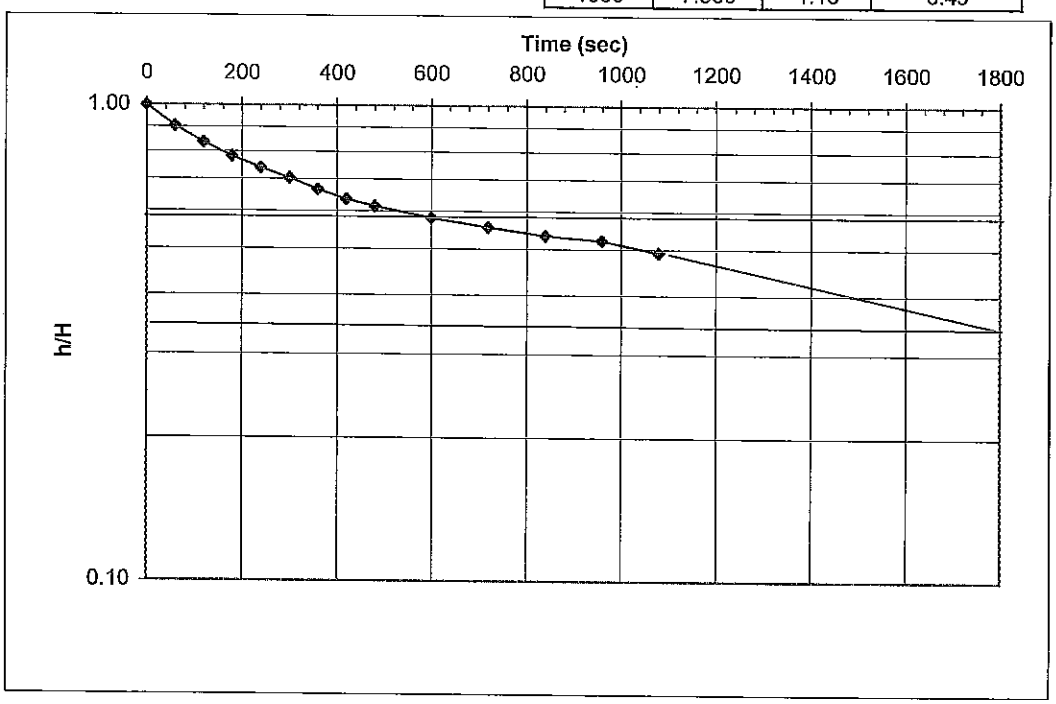
BORE DETAILS

Bore No.	BH5
Piezometer length (L)	3 m
Piezometer radius (r)	0.0025 m
Bore radius (R)	0.005 m
Depth of piezometer	13.87 m
Static water level	6.2 m
Lag time T_o (37% recovery)	1800 sec

TEST METHOD: Rising head

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	6.200		
0	8.560	2.36	1.00
60	8.330	2.13	0.90
120	8.170	1.97	0.83
180	8.040	1.84	0.78
240	7.940	1.74	0.74
300	7.860	1.66	0.70
360	7.770	1.57	0.67
420	7.700	1.5	0.64
480	7.650	1.45	0.61
600	7.570	1.37	0.58
720	7.510	1.31	0.56
840	7.460	1.26	0.53
960	7.430	1.23	0.52
1080	7.360	1.16	0.49



Note: extrapolation of data was required (shown in red).

Based on Hvorslev method $K = \frac{r^2 \ln(L/R)}{2LT_o}$

Calculated Permeability **3.7E-09 m / sec**

RCA Australia	Tested by: MC	Date: 02/04/04
Office:	Checked by: PH	Date:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

HYDRAULIC GRADIENT

CLIENT:	Pacrim Environmental	**DATE:**	14/05/2004
PROJECT:	Rindean Quarry	**RCA ref:**	3977
LOCATION:	Somersby	**CLIENT REF:**	

Flow Ra te = **1.4783009032** m/year

$$v = i \times k / n$$

Where;

Hydraulic Gradient = i (m/m)

Flow rate = v (m/s)

Permeabilty = k (m/s)

Porosity = n

Average Hydraulic Gradient =	0.084722068
Average Permeability =	1.6599E-08
Estimated Porosity =	0.03

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

HYDRAULIC GRADIENT

CLIENT:	Pacrim Environmental	**DATE:**	14/05/2004
PROJECT:	Rindean Quarry	**RCA ref:**	3977
LOCATION:	Somersby	**CLIENT REF:**	

Flow Ra te = **0.8869805419** **m/year**

$$v = i \times k / n$$

Where;

Hydraulic Gradient = i (m/m)

Flow rate = v (m/s)

Permeabilty = k (m/s)

Porosity = n

Average Hydraulic Gradient =	0.084722068	
Average Permeability =	1.6599E-08	
Estimated Porosity =	0.05	

gradient 1	2.8126E-08	0.085388
gradient 2		0.084056
		0.084722

Appendix F

Laboratory Reports

amdel

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The tests, calibration or measurements covered by this document have been performed in accordance with NATA requirements which include the requirements of ISO/IEC 17025 and are traceable of Australian national standards of measurement. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 1464

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CERTIFICATE OF ANALYSIS

Contents :
1. Cover Pages (2)
2. Analysis Report Pages
3. QA/QC Appendix
4. Additional Reports - External (if applicable)
5. Chain of Custody (if applicable)

Report No.	:	4N0720
Attention	:	Matt Clark
Client	:	Robert Carr & Associates PO Box 175 CARRINGTONNSW 2294
Samples	:	1
Reference/Order	:	3977
Project	:	3977
Received Samples	:	06/04/04
Instructions	:	06/04/04
Date Reported	:	13/04/04

PLEASE SEE FOLLOWING PAGES FOR METHOD LISTING AND RESULTS

RESULTS

All samples were analysed as received. This report relates specifically to the samples as received. Results relate to the source material only to the extent that the samples as supplied are truly representative of the sample source. This report replaces any preliminary results issued. Note that for methods indicated with "*", NATA accreditation does not cover the performance of this service. Three significant figures (or 2 for <10PQL) are reported for statistical purposes only. Where "Total" concentrations are reported for organic suites of compounds this is the summation of the individual compounds and the PQL is noted for reporting purposes only. This report has been authorized by NATA signatories for PDF format. Refer to the method descriptions for further information.

James McMahon B.Sc.,Ph.D. (Chem.)
Manager - Environmental

amdel

Job Number : 4N0720
Client : Robert Carr & Associates
Reference : 3977
Project : 3977

	Lab No	E75283				
		S-3a				
Analyte	Sample Id	2/4				
	PQL					
E2430 Conductivity (uS/cm at 25.0 C)						
Electrical Conductivity	1	140				
E2720 Sulphate in Water						
Sulphate	1	8				
E2380 Chloride in Water						
Chloride	1	29				
E2550 Nitrate as N in Water						
Nitrate as N	0.01	nd				
E2310 Total Alkalinity in Water						
Bicarbonate as CaCO3	1	17				
Carbonate as CaCO3	1	nd				
Hydroxide as CaCO3	1	nd				
Alkalinity as CaCO3	1	17				
E4810 Dissolved Metals in Waters						
Calcium	0.1	4.4				
Potassium	0.1	1.0				
Magnesium	0.1	2.8				
Sodium	0.2	17				

PQL = Practical Quantitation Limit
LNR = Samples Listed not Received
nd = <PQL
-- = Not Applicable
Refer to Amdel standard laboratory qualifier codes for comments.

Soils : mg/kg (ppm) dry weight unless otherwise specified
Waters : mg/L (ppm) unless otherwise specified in Method Header
Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

amdel

AMDEL INTERNAL QUALITY ASSURANCE REVIEW.

Job No. 4N0720

General

1. Laboratory QA/QC including Method Blanks, Duplicates, Matrix Spikes, Laboratory Control Samples or CRM's are included in this QA/QC appendix. (Where applicable)
2. Inter-Laboratory proficiency trial results are available upon request.
3. PQLs are matrix dependent and are increased accordingly where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spike or surrogate recoveries.
5. Where 3 and 2 significant figures are reported for >10x PQL and <10x PQL respectively, the last figure is uncertain and is provided for statistical purposes only.
6. Samples duplicated or spiked are from this job only and are identified in the following QA/QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered samples, unless noted otherwise.

Maximum Holding Times for Soils, Sediments and Waters

Parameter	Holding Times
Soils	
Volatile and Semi-Volatile Organic Analysis.	Extracted in 14 days, analysed within 40 days.
Metals	Extracted and analysed within 28 days-6 months.
Inorganics*	Extracted and analysed within 7-28 days.
TCLPs*	Extracted and analysed within 14 days, (Zero Headspace-TCLP 7 days).
Waters	
Volatile Organic Analysis	Analysed within 7 days (USEPA requires 14 days).
Semi-Volatile Organic Analysis	Extracted in 7 days, analysed within 40 days.
Inorganics*	Analysed within 24 hrs-28 days.
Metals (dissolved metals should be supplied field filtered)	Prepared and analysed within 28 days.

* Please refer to 'Preservation Information Chart for Soils, Sediments & Waters' for further information. (ISFORM.098). Holding times may be extended with the use of preservation bottles and/or freezing samples. Holding times can be calculated from dates reported in the body of the report. Tests clearly exceeding holding times will be noted when sufficient information is provided.
Reference: USEPA SW846 and AMDEL SPM-01 (incorporating NEPM Guidelines).

Chain of Custody and Sample Integrity

	Yes/No/NA
Chain of Custody / instructions received with samples	Yes
Custody seals were received intact, if used	NA
Samples were received chilled and in good condition	Yes
Samples received appropriately preserved for all tests	No
VOC/SVOC samples were received in teflon lined containers	NA
Samples received with Zero Headspace	NA
Chain of Custody completed and attached (if applicable)	Yes

Chromatography Calibration/Acceptence Criteria (if applicable)

Retention time window meets acceptance criteria (+/-2%)	NA
Reference standard meets acceptance criteria (+/-10%)	NA
Recalibration standard meets acceptance criteria (+/-15%)	NA
Internal standard recovery acceptable.	NA

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AMDEL STANDARD LABORATORY QUALIFIER CODES.

Job NO. 4N0720

Qualifier Codes	Description
*	PQLs are raised due to matrix interference.
@	PQLs are raised due to insufficient sample provided for analysis.
$	The mass imbalance indicates the presence of other ions not measured as part of this procedure.
nd	<PQL
--	Not applicable
LNR	The sample was listed on the COC, but not received.
IS	Insufficient sample was supplied to conduct this analysis.
AN	The analysis indicates the presences of an analyte that has been 'tentatively' identified, and the associated numerical value represents it's approximate concentration.
A	Sample results are reported on an 'as received' basis (not moisture corrected).
B	The sample was not received in a suitable timeframe to allow completion within the recommended holding time.
C	This sample was received with headspace.
D	This sample was received with the incorrect preservation for this analysis.
E	The raw data indicates the absence of 0.055g of Copper Sulphate in the sample.
F	This sample contained significant amounts of solids and was therefore analysed by settling and decanting the aqueous phase to avoid including the solid in the analysis portion.
G	This test was performed outside the recommended holding time.
H	This sample contained significant material >5mm which was removed prior to analysis.
ISD	Insufficient sample was supplied to conduct duplicate analyses.
ISM	Insufficient sample was supplied to conduct matrix spike analyses.
W	The spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.
J	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause.
K	The matrix spike concentration is less than five times the background concentration in the sample, and therfore the spike recovery can not be determined.
L	The surrogate recovery is outside of the recommended acceptance criteria, due to matrix interference.
M	The surrogate recovery is outside of the recommended acceptance criteria. Insufficent sample remains to perform re-analysis.
N	Results are expressed in mg/L (ppm) due to the high concentration of the analyte.
O	The results reported are 'recoverable organics' for this fraction, as the chromatogram and peak shape indicates the presence of a significant concentration of polar compounds.
P	The concentration reported is mainly due to a single peak.
Q	This samples contains volatile halogenated oxygenated or other compounds that are included and quantitated as part of TPH C6-9.
R	Theoretically the total result should be greater or equal to the dissolved concentration. However the difference reported is within the uncertainty of the individual tests.
S	The mass imbalance was equal to or less than 0.2 milli-equivalents.
T	During Kjeldahl digestion, nitrate (>10mg/L) can oxidise ammonia resulting in a negative TKN interference, which may have occurred for this sample.
U	Theoretically the TKN result should be greater or equal to ammonia concentration. However the difference reported is within the uncertainty of the individual tests.
V	This sample contained significant amounts of sediment which was included in the analysis portion as requested.
SUR	Surrogate recoveries could not be determined due to the dilution required to quantify the analyte.

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Job Number : 4N0720

QAQC : Laboratory Duplicate(s)

Analyte	Dupl A	Dupl B	Average	RPD (%)	Dupl A	Dupl B	Average	RPD (%)
E2430 Conductivity (uS/cm at 25.0 C) (E75283)								
Electrical Conductivity	140	140	140	0%				
E2310 Total Alkalinity in Water (E75283)								
Bicarbonate as CaCO3	18	17	18	5%				
Alkalinity as CaCO3	18	17	18	5%				

PQL = Practical Quantitation Limit
nd = <PQL
-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
(W) Waters : mg/L (ppm) unless otherwise specified

The number in brackets after the method header identifies the sample tested.

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NATA Accredited Laboratory Number: 1464

ANALYTICAL SERVICES DIVISION
ABN 30 008 127 802
Correspondence to:
PO Box 331
HUNTER REGIONAL MAIL
CENTRE NSW 2310

99 Mitchell Rd
CARDIFF NSW 2285
Telephone: (02) 4902 4800
Facsimile: (02) 4902 4899

CERTIFICATE OF ANALYSIS

Contents :
1. Cover Pages (2)
2. Analysis Report Pages
3. QA/QC Appendix
4. Additional Reports - External (if applicable)
5. Chain of Custody (if applicable)

Report No.	:	4N0706
Attention	:	Susan Alagic
Client	:	Robert Carr & Associates
	:	PO Box 175
	:	CARRINGTONNSW 2294
Samples	:	2
Reference/Order	:	3977
Project	:	3977
Received Samples	:	01/04/04
Instructions	:	01/04/04
Date Reported	:	08/04/04

PLEASE SEE FOLLOWING PAGES FOR METHOD LISTING AND RESULTS

RESULTS

All samples were analysed as received. This report relates specifically to the samples as received. Results relate to the source material only to the extent that the samples as supplied are truly representative of the sample source. This report replaces any preliminary results issued. Note that for methods indicated with "*", NATA accreditation does not cover the performance of this service. Three significant figures (or 2 for <10PQL) are reported for statistical purposes only. Where "Total" concentrations are reported for organic suites of compounds this is the summation of the individual compounds and the PQL is noted for reporting purposes only. This report has been authorized by NATA signatories for PDF format. Refer to the method descriptions for further information.

James McMahon B.Sc.,Ph.D. (Chem.)
Manager - Environmental

amdel

Job Number : 4N0706
Client : Robert Carr & Associates
Reference : 3977
Project : 3977

Analyte	Lab No	E74433	E74434			
		S-1a	S-2a			
	Sample Id	1/4/04	1/4/04			
	PQL					
E2600 pH in Water						
pH	0.1	6.3	5.6			
E2430 Conductivity (uS/cm at 25.0 C)						
Electrical Conductivity	1	190	220			
E2690 Total Dissolved Solids in Water						
TDS (calc.)	1	120	140			
E2720 Sulphate in Water						
Sulphate	1	19	8			
E2380 Chloride in Water						
Chloride	1	22	39			
E2550 Nitrate as N in Water						
Nitrate as N	0.01	0.72	5.90			
E2310 Total Alkalinity in Water						
Alkalinity as CaCO3	1	30	8			
Bicarbonate as CaCO3	1	30	8			
Carbonate as CaCO3	1	nd	nd			
Hydroxide as CaCO3	1	nd	nd			

PQL = Practical Quantitation Limit
LNR = Samples Listed not Received
nd = <PQL
-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
Waters : mg/L (ppm) unless otherwise specified in Method Header
Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Refer to Amdel standard laboratory qualifier codes for comments.

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AMDEL INTERNAL QUALITY ASSURANCE REVIEW.

Job No. 4N0706

General

1. Laboratory QA/QC including Method Blanks, Duplicates, Matrix Spikes, Laboratory Control Samples or CRM's are included in this QA/QC appendix. (Where applicable)
2. Inter-Laboratory proficiency trial results are available upon request.
3. PQLs are matrix dependent and are increased accordingly where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spike or surrogate recoveries.
5. Where 3 and 2 significant figures are reported for >10x PQL and <10x PQL respectively, the last figure is uncertain and is provided for statistical purposes only.
6. Samples duplicated or spiked are from this job only and are identified in the following QA/QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered samples, unless noted otherwise.

Maximum Holding Times for Soils, Sediments and Waters

Parameter	Holding Times
Soils	
Volatile and Semi-Volatile Organic Analysis.	Extracted in 14 days, analysed within 40 days.
Metals	Extracted and analysed within 28 days-6 months.
Inorganics*	Extracted and analysed within 7-28 days.
TCLPs*	Extracted and analysed within 14 days, (Zero Headspace-TCLP 7 days).
Waters	
Volatile Organic Analysis	Analysed within 7 days (USEPA requires 14 days).
Semi-Volatile Organic Analysis	Extracted in 7 days, analysed within 40 days.
Inorganics*	Analysed within 24 hrs-28 days.
Metals (dissolved metals should be supplied field filtered)	Prepared and analysed within 28 days.

* Please refer to 'Preservation Information Chart for Soils, Sediments & Waters' for further information. (ISFORM.098). Holding times may be extended with the use of preservation bottles and/or freezing samples. Holding times can be calculated from dates reported in the body of the report. Tests clearly exceeding holding times will be noted when sufficient information is provided.
Reference: USEPA SW846 and AMDEL SPM-01 (incorporating NEPM Guidelines).

Chain of Custody and Sample Integrity

	Yes/No/NA
Chain of Custody / instructions received with samples	Yes
Custody seals were received intact, if used	NA
Samples were received chilled and in good condition	Yes
Samples received appropriately preserved for all tests	Yes
VOC/SVOC samples were received in teflon lined containers	NA
Samples received with Zero Headspace	NA
Chain of Custody completed and attached (if applicable)	Yes

Chromatography Calibration/Acceptence Criteria (if applicable)

Retention time window meets acceptance criteria (+/-2%)	NA
Reference standard meets acceptance criteria (+/-10%)	NA
Recalibration standard meets acceptance criteria (+/-15%)	NA
Internal standard recovery acceptable.	NA

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AMDEL STANDARD LABORATORY QUALIFIER CODES.

Job NO. 4N0706

Qualifier Codes	Description
*	PQLs are raised due to matrix interference.
@	PQLs are raised due to insufficient sample provided for analysis.
$	The mass imbalance indicates the presence of other ions not measured as part of this procedure.
nd	<PQL
--	Not applicable
LNR	The sample was listed on the COC, but not received.
IS	Insufficient sample was supplied to conduct this analysis.
AN	The analysis indicates the presences of an analyte that has been 'tentatively' identified, and the associated numerical value represents it's approximate concentration.
A	Sample results are reported on an 'as received' basis (not moisture corrected).
B	The sample was not received in a suitable timeframe to allow completion within the recommended holding time.
C	This sample was received with headspace.
D	This sample was received with the incorrect preservation for this analysis.
E	The raw data indicates the absence of 0.055g of Copper Sulphate in the sample.
F	This sample contained significant amounts of solids and was therefore analysed by settling and decanting the aqueous phase to avoid including the solid in the analysis portion.
G	This test was performed outside the recommended holding time.
H	This sample contained significant material >5mm which was removed prior to analysis.
ISD	Insufficient sample was supplied to conduct duplicate analyses.
ISM	Insufficient sample was supplied to conduct matrix spike analyses.
W	The spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.
J	The duplicate %RPD is outside the recommended acceptance criteria. Further analysis indicates sample heterogeneity as the cause.
K	The matrix spike concentration is less than five times the background concentration in the sample, and therfore the spike recovery can not be determined.
L	The surrogate recovery is outside of the recommended acceptance criteria, due to matrix interference.
M	The surrogate recovery is outside of the recommended acceptance criteria. Insufficent sample remains to perform re-analysis.
N	Results are expressed in mg/L (ppm) due to the high concentration of the analyte.
O	The results reported are 'recoverable organics' for this fraction, as the chromatogram and peak shape indicates the presence of a significant concentration of polar compounds.
P	The concentration reported is mainly due to a single peak.
Q	This samples contains volatile halogenated oxygenated or other compounds that are included and quantitated as part of TPH C6-9.
R	Theoretically the total result should be greater or equal to the dissolved concentration. However the difference reported is within the uncertainty of the individual tests.
S	The mass imbalance was equal to or less than 0.2 milli-equivalents.
T	During Kjeldahl digestion, nitrate (>10mg/L) can oxidise ammonia resulting in a negative TKN interference, which may have occurred for this sample.
U	Theoretically the TKN result should be greater or equal to ammonia concentration. However the difference reported is within the uncertainty of the individual tests.
V	This sample contained significant amounts of sediment which was included in the analysis portion as requested.
SUR	Surrogate recoveries could not be determined due to the dilution required to quantify the analyte.

amdel

Job Number : 4N0706

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E2430 Conductivity (uS/cm at 25.0 C)						
Electrical Conductivity	1	1				
E2720 Sulphate in Water						
Sulphate	1	nd				
E2380 Chloride in Water						
Chloride	1	nd				
E2550 Nitrate as N in Water						
Nitrate as N	0.01	nd				
E2310 Total Alkalinity in Water						
Alkalinity as CaCO3	1	nd				
Bicarbonate as CaCO3	1	nd				

PQL = Practical Quantitation Limit
nd = <PQL
-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
(W) Waters : mg/L (ppm) unless otherwise specified

amdel

Job Number : 4N0706

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E2530 Total Hardness						
Total Hardness as CaCO3	0.5	nd				
E2330 Ammonia as N in Water						
Ammonia as N	0.01	nd				
E4810 Dissolved Metals in Waters						
Sodium	0.2	nd				
Potassium	0.1	nd				
Calcium	0.1	nd				
Magnesium	0.1	nd				

PQL = Practical Quantitation Limit
nd = <PQL
-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
(W) Waters : mg/L (ppm) unless otherwise specified

HUNTER WATER LABORATORIES

A CONSULTING DIVISION OF HUNTER WATER AUSTRALIA PTY LTD
ABN 19 080 869 905

23 Rosegum Close
WARABROOK NSW 2304
Tel: (02) 4935 0500
Fax: (02) 4935 0505

PO Box 317
Hunter Region Mail Centre
NSW 2310

Hunter Water Australia Pty. Limited

REPORT OF ANALYSIS

Client: RCA Australia
PO Box 175, 92 Hill St, CARRINGTON, NSW 2294

Contact: Susan Alagic

Sample Date: 2 April 2004

Date Received: 2 April 2004 at 17:00 - Sample Ambient
1 Water sample sampled and submitted by client

Testing Commenced: 4 April 2004 at 12:40

Order Number: 3977

Report Number: HWA-0736/04

Note: Interim Report Number HWL-0400351 sent by facsimilie transmission on the 7 April 2004.

Sample ID	*Date*	*Time*	*Description*
H0407042	2/04/2004	Not recorded	RCA S-3B

Analysis	*Method / Category*	*Result*	*Unit*
E coli	HWC017 (E coli)	<91	col/100mL

Robin Woodward
Principal Microbiologist
7 April 2004

Bacterial Testing Conditions
OPTIMUM - within 6 hours of collection, sample cool/cold
OTHER - within 24 hours of collection, sample cool/cold and kept in the dark

The results on this report relate only to the items tested.
Results from this report are not to be reproduced without acknowledgement.
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< less than *~ approximately* *est = estimated* *ND = not detected*

HUNTER WATER LABORATORIES

A CONSULTING DIVISION OF HUNTER WATER AUSTRALIA PTY LTD
ABN 19 080 869 905

23 Rosegum Close
WARABROOK NSW 2304
Tel: (02) 4935 0500
Fax: (02) 4935 0505

PO Box 317
Hunter Region Mail Centre
NSW 2310

Hunter Water Australia Pty Limited

REPORT OF ANALYSIS

NATA Accreditation: 3626

Client: RCA Australia
PO Box 175, 92 Hill St, CARRINGTON, NSW 2294

Contact: Susan Alagic

Sample Date: 2 April 2004

Date Received: 2 April 2004
1 sample sampled and submitted by client and tested as received

Order Number: 3977

Report Number: HWA-0806/04

Note: This report replaces Preliminary Report Number PR-0400368

Sample ID	*Date*	*Description*
H0407042	2/04/2004	RCA S-3B

Analysis	*Method / Category*	*Result*	*Unit*
BOD5 - Total	APHA (1998) 5210 B (BOD5)	18	mg/L
Nitrate	Inhouse 8.2 (Nitrate)	0.057	mg/L N
Nitrite	Inhouse 7.2 (Nitrite)	0.010	mg/L N
pH	APHA (1998) 4500-H+ B (pH)	5.8	-

Andrea Swan
(Approved NATA Signatory)
Laboratory Manager
20 April 2004

National Association of Testing Authorities, Australia
NATA Accredited Laboratory
Accreditation Number: 3626

The results on this report relate only to the items tested.
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HUNTER WATER LABORATORIES

CHEMICAL - SERVICE REQUEST



Do any sample also require Microbiological analysis YES ☑ NO ☐

CLIENT DETAILS

Client / Company: RCA AUSTRALIA

Location/Address: 92 HUNTER ST CARRINGTON

Charge No:

Order No: 3977

Post Code: 2294

Telephone: 02 49029225 (Home) (Work)

Fax: 02 4902 9299

Contact Name: Susan Alagic

Results by:

DESCRIPTION OF SAMPLES

No	Sample Identification	Collection Date / Time	(office use only) METRIX No
1	S3B & C	2/4/04	
2	[redacted]	[redacted]	
3			
4			
5			
6			
7			
8			
9			
10			

TEST REQUIRED (make X in appropriate spaces under sample No)

Determination	1	2	3	4	5	6	7	8	9	10	Remarks
Acidity											
Alkalinity (pH 4.5)											
Ash Percentage											
BOD (filtered) (settled) (total)	X										
Carbon Dioxide											
Chloride											
Chlorophyll 'a'											
COD (filtered) (settled) (total)											
Colour (apparent) (true)											
Conductivity											
Cyanide (Free) (Total)											

TEST REQUIRED (make X in appropriate spaces)											
Determination	1	2	3	4	5	6	7	8	9	10	Remarks
Dissolved Oxygen											
Fluoride (low) (total dissolved)											
Oxygen Absorbed											
pH	X										
Redox Potential											
Salinity											
Sodium Absorption Rate											
Specific Oxygen Uptake Rate											
Sulphate											
Sulphide (total dissolved)											
Suspended Solids (NFR)											
Total Kjeldahl Nitrogen (TKN)											
TKN (dry wt)											
Total Dissolved Solids											
% Total Fixed Solids											
Total Hardness (full) (calc)											
Total Oil & Grease											
Total Organic Carbon (TOC)											
% Total Solids (105°C)											
% Total Volatile Solids											
Turbidity											
UV Transmittance											
Volatile Acids											

NUTRIENTS

TEST REQUIRED (make X in appropriate spaces)											
Determination	1	2	3	4	5	6	7	8	9	10	Remarks
Free Ammonia											
Nitrates											
Nitrites											
Silica											
Total Oxidised Nitrogen(TON)											
Phosphorus Ortho											
Total Phosphorus											
Total Phosphorus (dry wt)											
Total Phosphorus (low)											
Soluble Reactive Phosphorus											

METALS

Determination	TEST REQUIRED (make X in appropriate spaces) 1	2	3	4	5	6	7	8	9	10	Remarks
Aluminium (dry wt) (low) (filt)											
Antimony											
Arsenic											
Barium											
Beryllium											
Boron											
Cadmium											
Calcium											
Chromium											
Cobalt											
Copper											
Iron											
Lead											
Magnesium											
Manganese											
Mercury											
Molybdenum											
Nickel											
Potassium											
Selenium											
Silver											
Sodium											
Tin											
Zinc											

OTHER

Determination	TEST REQUIRED (make X in appropriate spaces) 1	2	3	4	5	6	7	8	9	10	Remarks
E Coli	X										

Fee: $ .....
(Minimum fee $55.00)
Includes GST

Subject to the terms and conditions overleaf the ***Hunter Water Australia Pty Limited*** ***A.C.N. 080 869 905*** trading as (and hereinafter called) **Hunter Water Laboratories** offers to provide the client with the analysis of the sample for the fee.

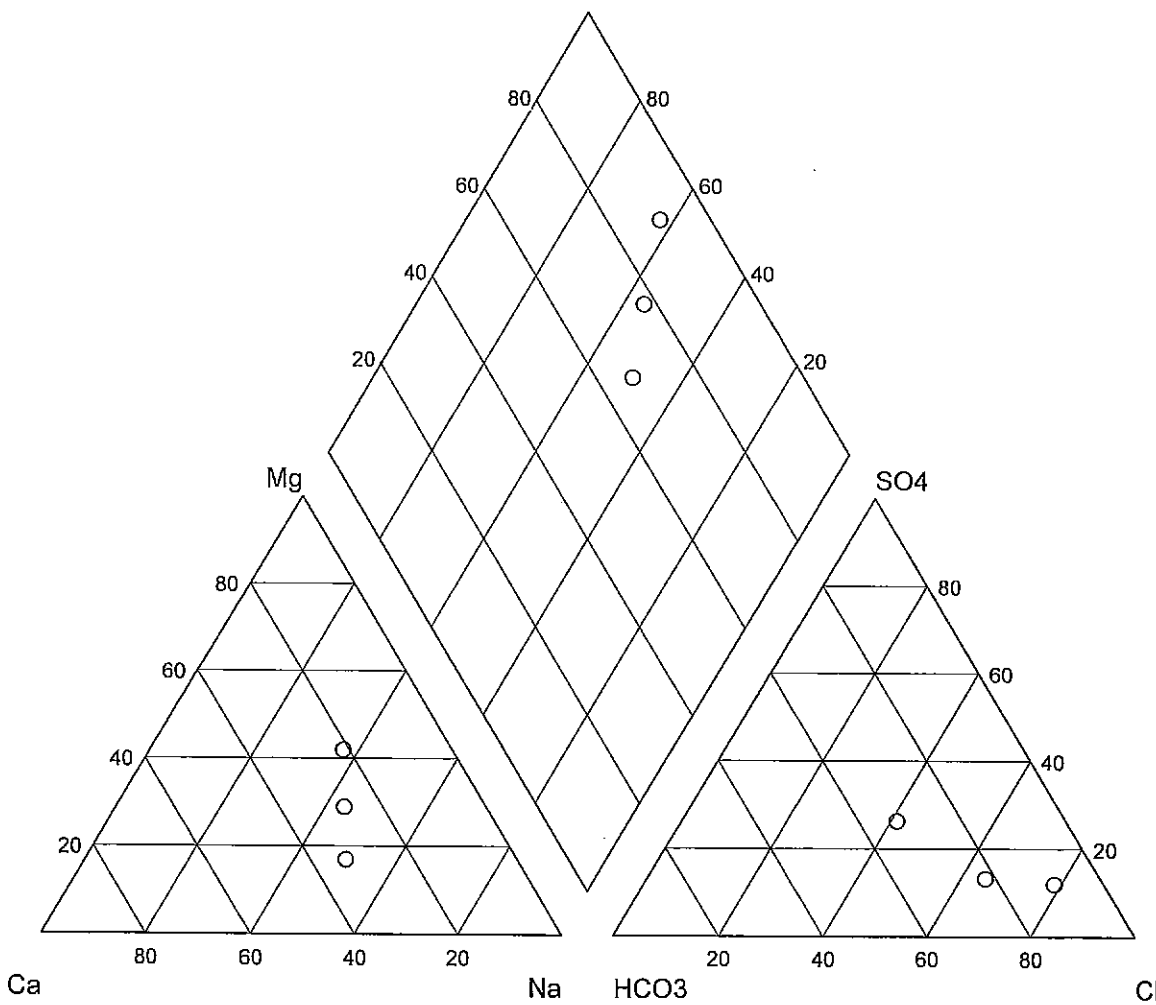
Signed for an on behalf of the
Hunter Water Laboratories

I (the client) agree to be bound by the term's and conditions overleaf

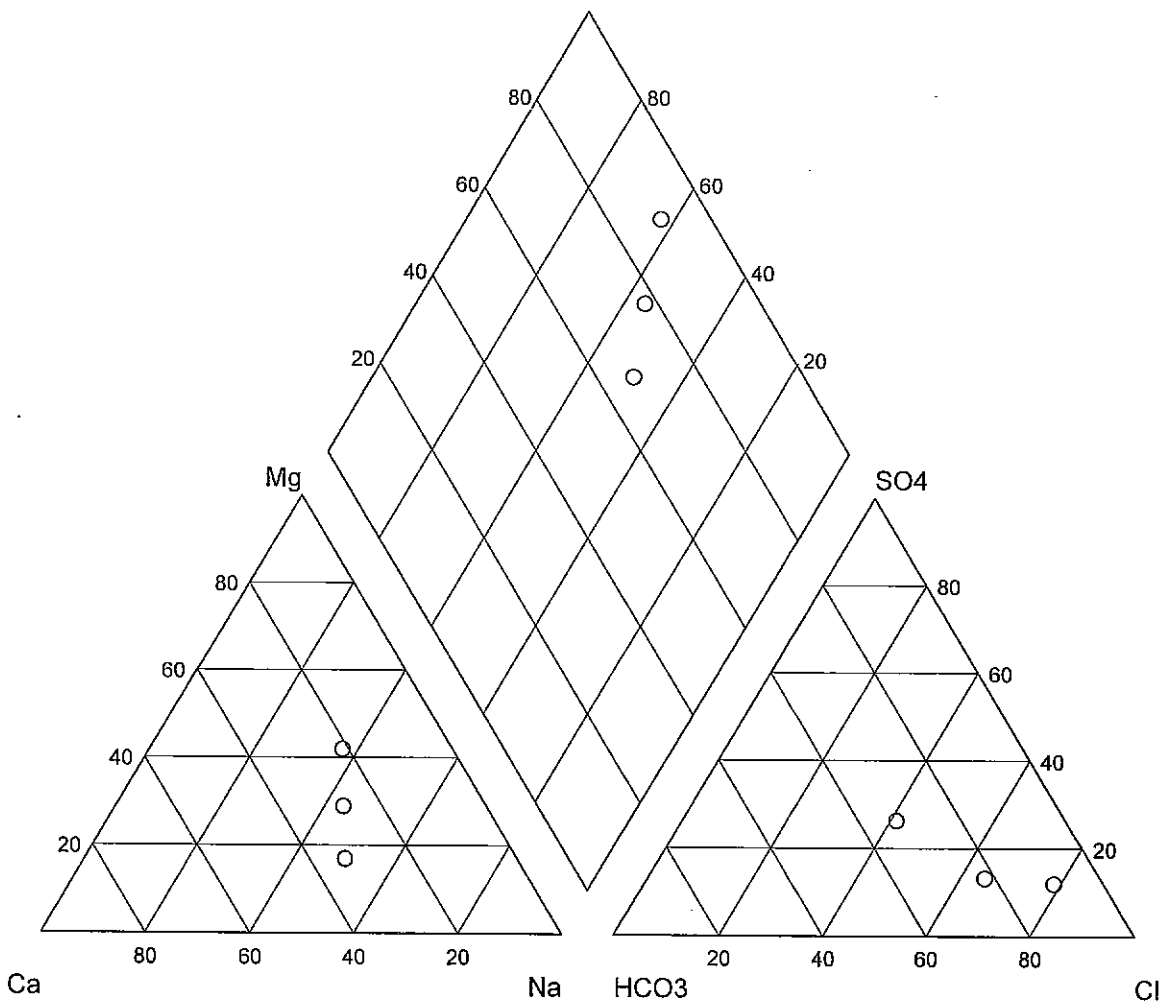
Appendix G

Piper Plots

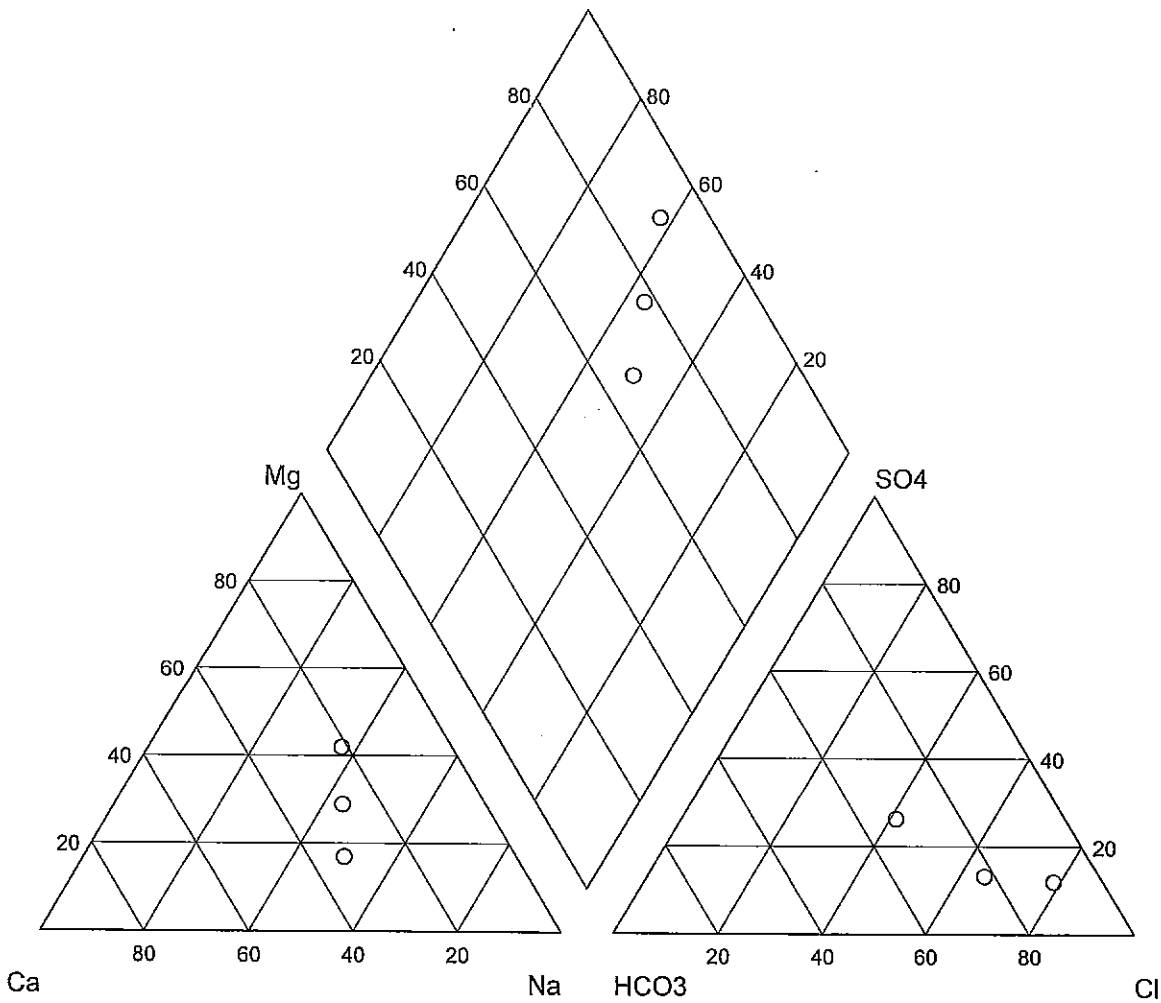
S1a Piper Plot



S2A Piper Plot



S3a Piper Plot



APPENDIX 9

ADDENDUM TO THE HYDROGEOLOGICAL INVESTIGATION

RCA ref: 3977 a -001/0

4th November 2005

PACRIM Environmental Pty Ltd
2/120 Darby Street
NEWCASTLE NSW 2300

Attention: Frank Downing

ADDENDUM TO THE HYDROGEOLOGICAL ASSESSMENT RINDEAN QUARRY, SOMERSBY

1 INTRODUCTION

This letter is an addendum to the previous report by RCA titled “Hydrogeological Assessment at Rindean Quarry, Somersby, NSW”. This addendum was prepared on behalf of Mr Frank Downing of Pacrim Environmental Pty Ltd.

The addendum presents variations in water table model predictions that result from a reduction in recharge during site operations. The purpose of the analysis was to lower the recharge rate to simulate low rainfall during site operations. Model calibration undertaken during previous modelling and found that a recharge rate of 15% of average annual rainfall provided the most optimum calibration in combination with the strata permeabilities adopted. This model was re-analysed with a recharge rate of 11% of average annual rainfall to represent low rainfall conditions.

2 RESULTS

The results of the simulation with recharge value of 11% of average annual rainfall are presented the following figure.

Figure 1: Current results with lower recharge value (11%).

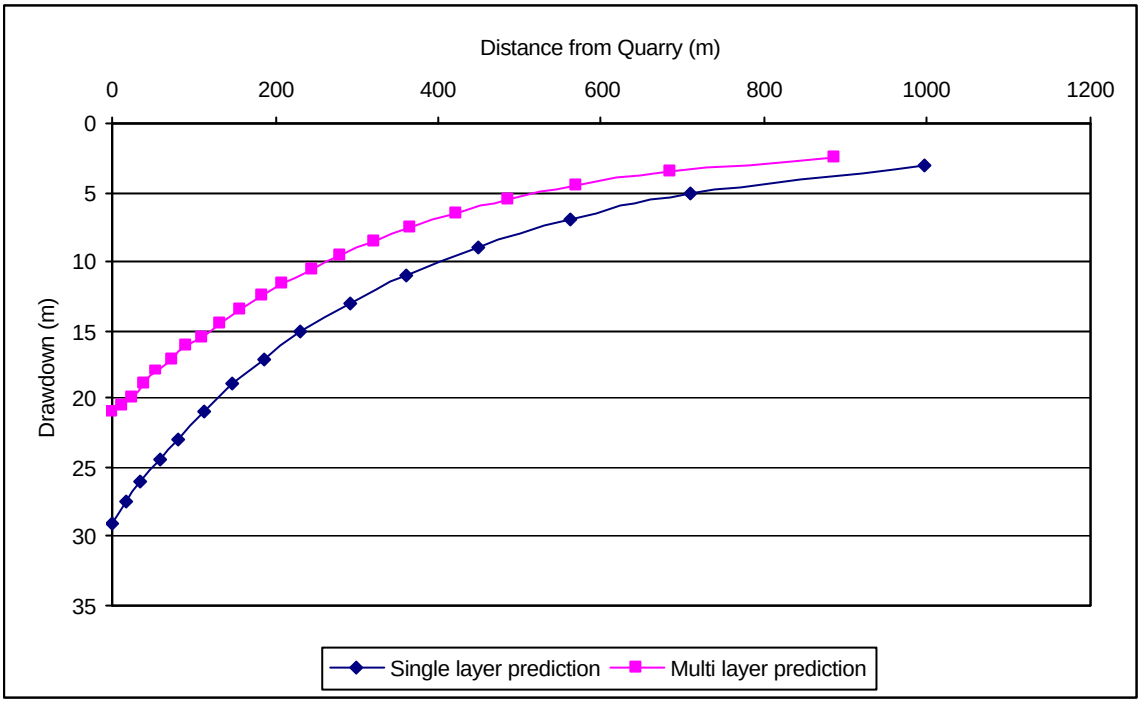
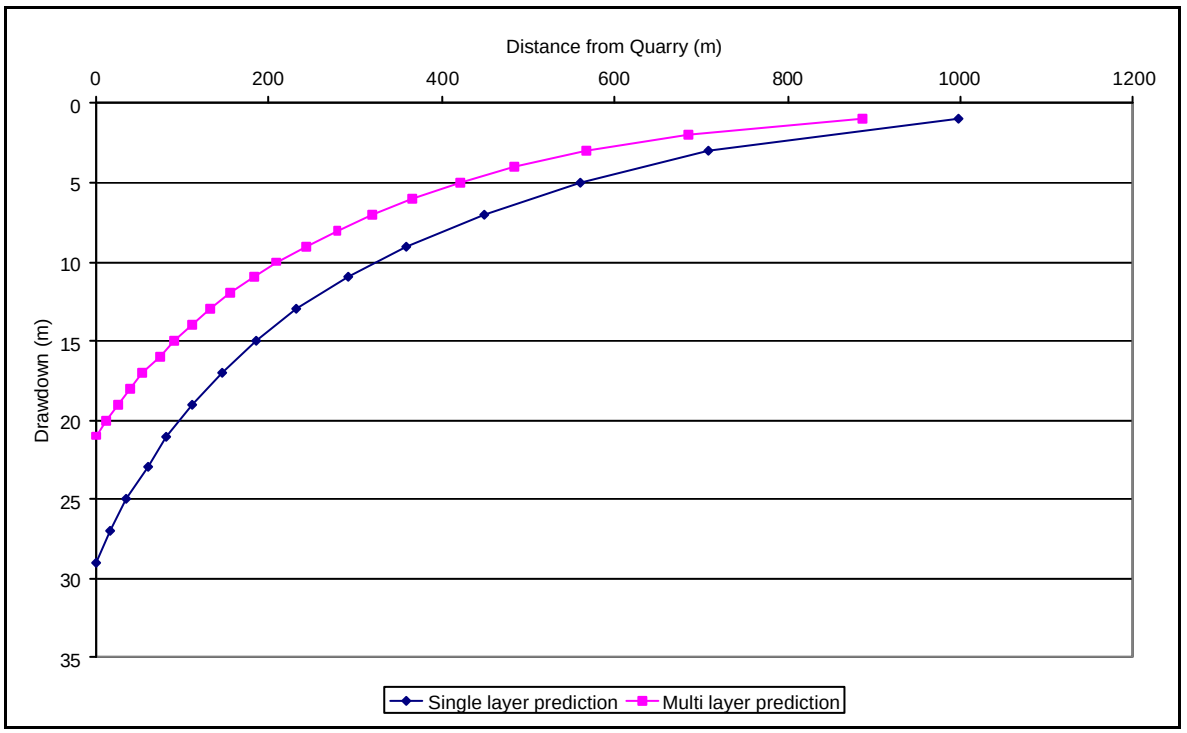


Figure 2: Previous results with higher recharge.



From the two graphs presented above, it can be determined that there is no additional drawdown due to reduced rainfall within close proximity of the site (<100m), however, additional drawdown is noticed at a distance away from the quarry. The maximum additional drawdown of 2.5m is noticed at a distance of 200m the quarry. The decrease in recharge results in a regional decrease in water level by 2m in single layer model and by 1.5m in multi layer model.

3 POTENTIAL DECREASE IN YIELD DUE TO THE LOW RECHAGE

It is difficult to predict the decrease in bore yield, that results from a decrease in the water table as bore yield is dependent on a number of factors including aquifer stratification, fracturing, bore condition and bore installation techniques. However, an estimate of decrease in bore yield can be drawn from percentage decline in saturated thickness (e.g. 5% decrease in saturated thickness indicates 5% decrease in yield). –

Table 1 *Effect of Decrease in Saturated Thickness on Local Bores.*

Bore	Saturated thickness (m)	Previous Draw Down Single Layer Model (m)	Previous Draw Down Multi-layer Model 1 (m)[a]	Current Draw Down Single Layer Model (m)	Current Draw Down Multi-layer Model 1 (m)[a]	% Further Decrease in Saturated Thickness Single Layer Model	% Further Decrease in Saturated Thickness Multi Layer Model
GW023092	13.1	3.69	2.19	5.69	3.69	15.27	11.45
GW031948	23.8	27.24	23.96	28.24	24.90	4.20	3.95
GW037121	25.9	3.05	0.91	5.05	2.41	7.72	5.79
GW047198	39.9	4.18	2.23	6.18	3.73	5.01	3.76
GW047597	18.0	5.77	5.11	7.77	6.61	11.11	8.33
GW051268	24.9	21.50	22.45	22.50	23.45	4.02	4.02
GW052588	23.0	1.89	1.71	3.89	3.21	8.70	6.52
GW053607	47.0	2.18	0.93	4.18	2.43	4.26	3.19
GW056164	24.0	17.13	21.75	19.13	23.25	8.33	6.25
GW056871	20.0	1.43	2.40	3.43	3.90	10.00	7.50
GW057452	23.0	15.47	13.79	17.47	15.29	8.70	6.52
GW057995	41.0	3.61	2.02	5.61	3.52	4.88	3.66
GW058902	10.0	5.62	3.31	7.62	4.81	20.00	15.00
GW062121	27.0	4.71	2.23	6.71	3.73	7.41	5.56
GW062690	21.0	8.35	5.07	10.35	6.57	9.52	7.14
GW064823	29.7	1.66	0.61	3.66	2.11	6.73	5.05
GW065610	34.0	0.06	0.90	2.06	2.40	5.88	4.41
GW067551	28.0	-0.04	-1.65	1.96	-0.15	7.14	5.36
GW072503	30.0	21.51	16.13	23.51	17.63	6.67	5.00
GW101044	41.0	21.5	10.50	23.50	12.00	4.88	3.66

Note: underlined = commercial bottled water spring;

*= Saturated Thickness estimated from surrounding bores

[a] = Ironstone layer located 50m below ground surface level

4 LIMITATIONS

This report has been prepared for Pacrim Environmental Pty Ltd in accordance with the agreement between RCA Australia (RCA). The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Pacrim Environmental Pty Ltd. The report may not contain sufficient information for purposes of other uses or for parties other than Pacrim Environmental Pty Ltd. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully,

RCA AUSTRALIA

Bishnu Gautam
Environmental Engineer

Fiona Robinson
Manager Environmental Services

APPENDIX 10

ENVIRONMENTAL NOISE ASSESSMENT

APPENDIX 11

ABORIGINAL ARCHAEOLOGICAL ASSESSMENT & HISTORICAL HERITAGE IMPACT ASSESSMENT

INSITE HERITAGE PTY LTD
PO BOX 98
WANGI WANGI NSW 2267
PH/FAX 02 49755 818
insite@idl.net.au

Aboriginal Archaeological Assessment & Historical Heritage Impact Assessment Rindean Quarry Somersby, NSW

Report to
Mr Frank Downing for
Coastplan Consulting

April 2012



Plate 1 Rindean Quarry view north east.

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Executive Summary

Insite Heritage Pty Ltd were commissioned to provide additional information for submission to Gosford City Council in a resubmitted Environmental Impact Statement. A Consent granted by the Council in June 2006 was unworkable and amended by a Section 96 application in 2007. The Consent was never acted upon. A physically smaller quarry is now proposed for the site and this report addresses issues raised by Council based upon the previous EIS.

The Department of Planning issued revised DGR's August 2011, for assessment of the project under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report addresses the requirements of the DGR's for both Aboriginal cultural heritage and non indigenous heritage.

One previously unrecorded broken stone flake was located on a track within the proposed Cell 7. In consultation with the registered Aboriginal stakeholders it is proposed to manage the item under an Aboriginal Heritage Impact Permit (AHIP) to relocate the artefact from the area of impact to the vegetation buffer zone located about 100 meters to the north. The object is of low cultural heritage significance in comparison to other sites in the area.

The authors of this report are Angela Besant and Elizabeth Wyatt, Insite Heritage Pty Ltd.

1.0 Introduction

1.1 Location & Objectives

Insite Heritage Pty Ltd were commissioned on behalf of Coastplan Consulting to provide an updated Aboriginal archaeological assessment and historic heritage impact assessment for the proposed Rindean Quarry project. The site has operated as a quarry from 1979 to 2003. The quarry has been subject to additional Consents in 2006 and 2007 however these plans were not acted upon at the time.

The site comprises 16ha on is two kilometres from Somersby on the eastern side of Wisemans Ferry Road. The project area includes existing voids over approximately 50% or the site.

The objective of this assessment is to update the previous 2004 assessment and consult with the Aboriginal community as per clause 80C of the National Parks and Wildlife Regulation 2009.

1.2 Investigators & Contributors

The field work for the assessment was undertaken by Ms Tracy Howie of Gringai Tribal Link Corporation and Sharon Hodges of Darkinjung Local Aboriginal Land Council, and Elizabeth Wyatt and Angela Besant archaeologists of Insite Heritage Pty Ltd.
Information regarding the proposed project included in this report was supplied by Mr Frank Downing for Coastplan Consulting.

Please refer to Appendix A for the cultural heritage assessment from Registered Aboriginal Stakeholders (RAP's). The authors of this report are Angela Besant and Elizabeth Wyatt of Insite Heritage Pty Ltd.

1.2 Development Context

As previously stated Rindean Quarry propose to recommence mining activity on the site, extracting of in-situ sandstone to supply sand to the building industry amongst others.

1.3 Proposed Development

The proposed development involves the staged progression of mining additional seven cells, followed by progressive rehabilitation. The existing voids will also be rehabilitated. The location of the site is shown in Figure 1. An aerial photograph of the existing site is shown in Figure 2. Figure 3 shows the proposed development plan and Figure 4 the final rehabilitation plan.

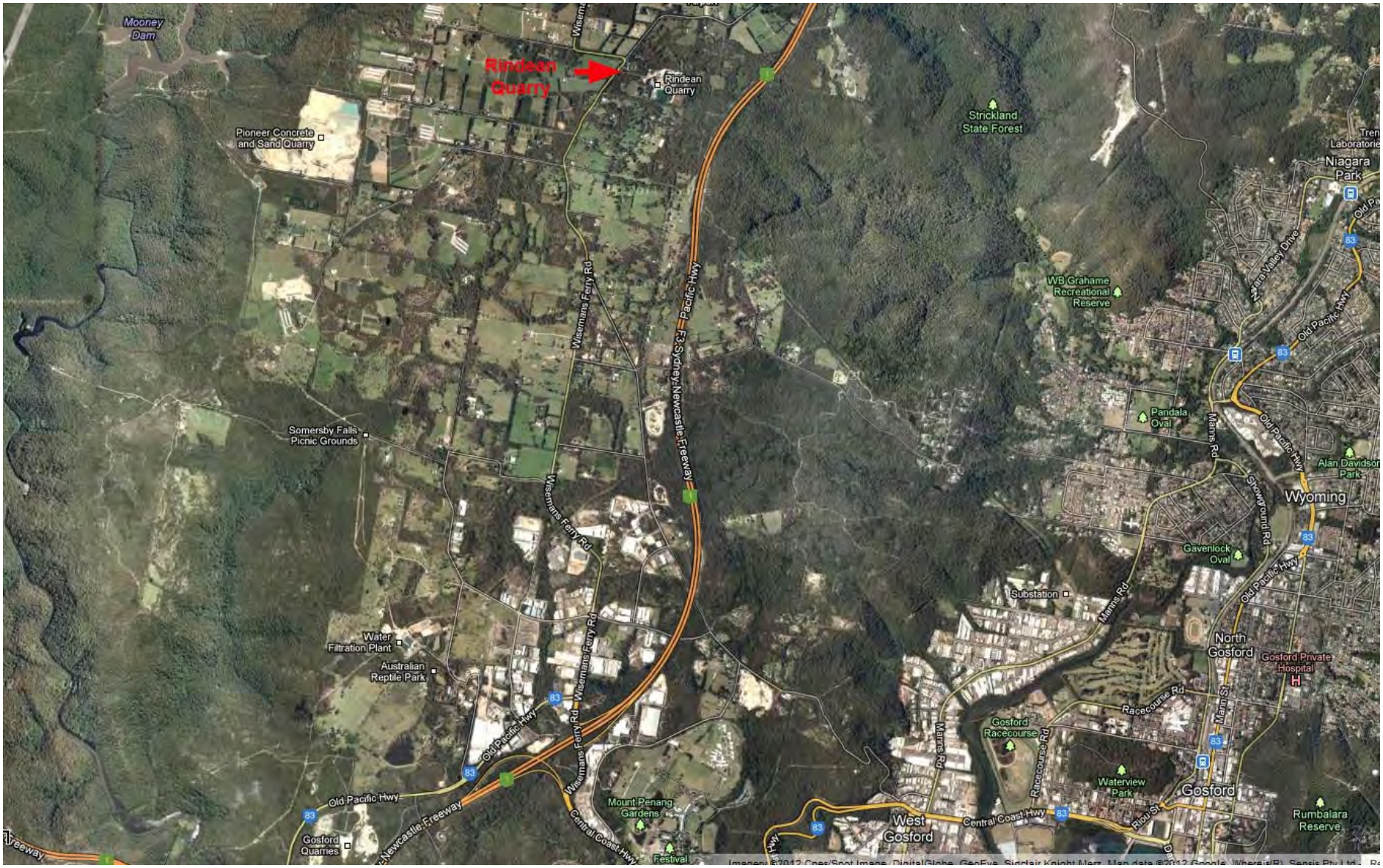


Figure 1 Rindean Quarry Somersby NSW location (courtesy of Coastplan Consulting)



Figure 2 The existing site - Rindean quarry (courtesy of Coastplan Consulting.)

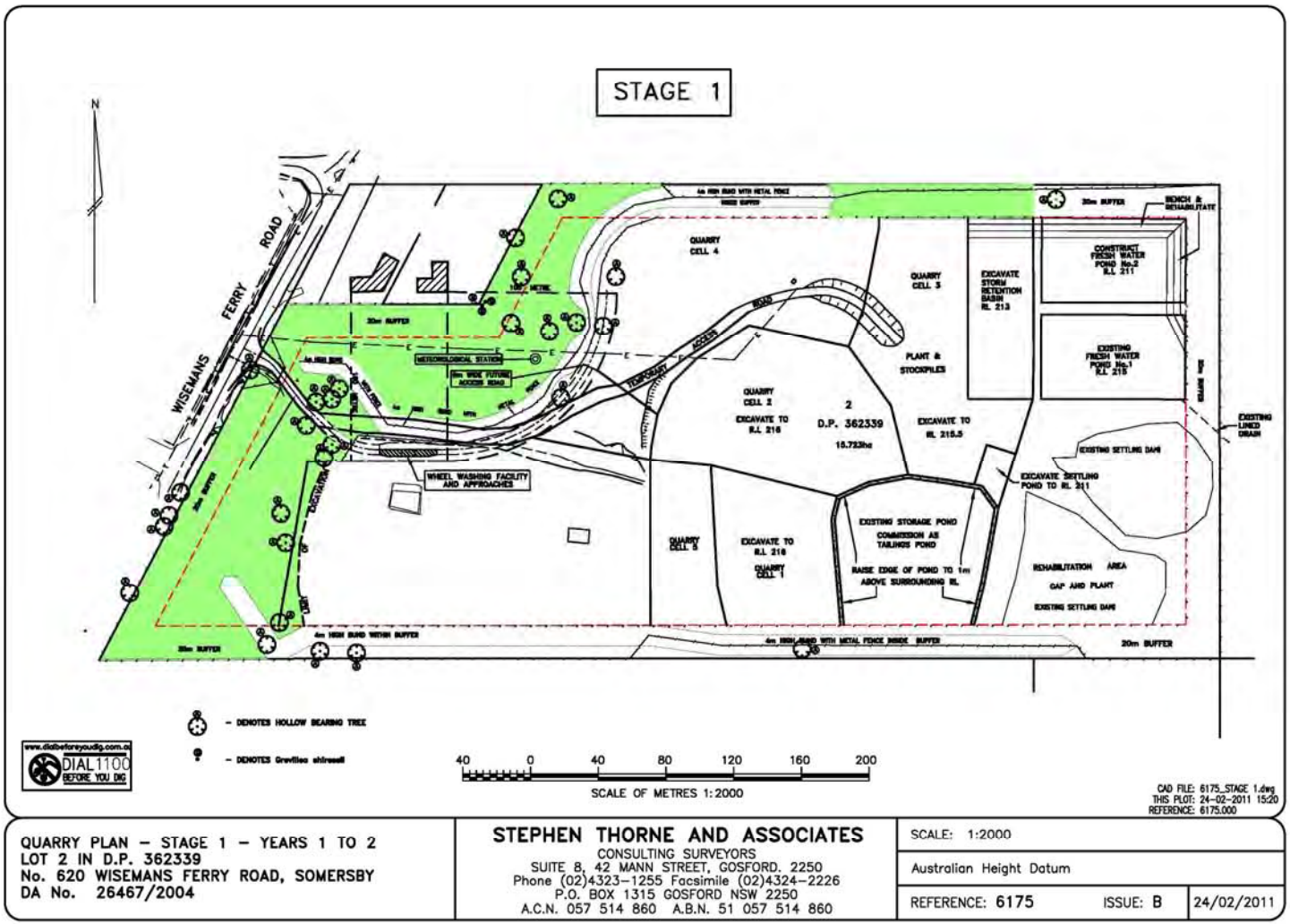


Figure 3 Stage 1 Cell plan

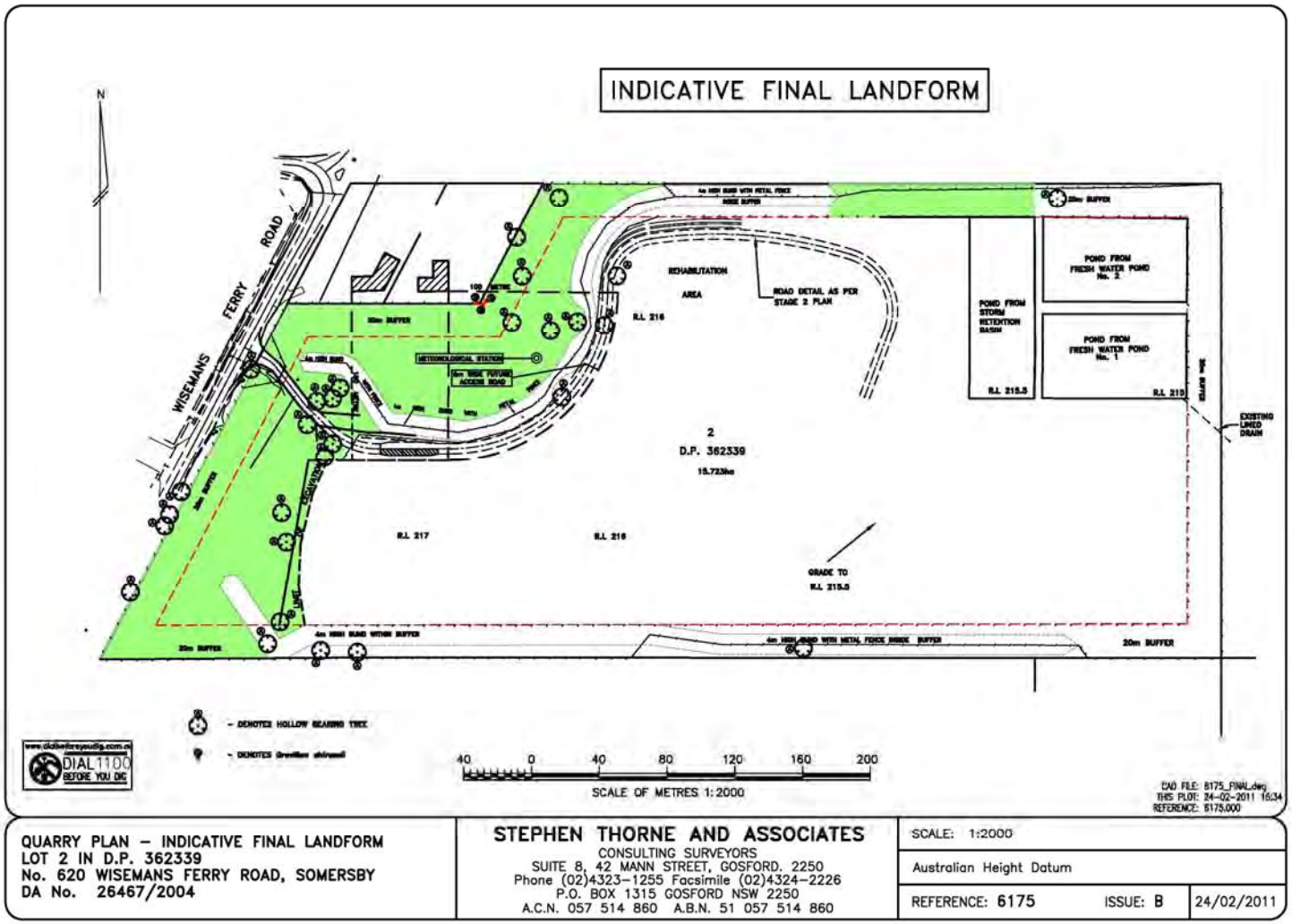


Figure 4 Final rehabilitation plan

1.4 Environmental Context

Geology & Soils

The study area is located on the Somersby Soil Landscape, comprising Hawkesbury Sandstone, weathered in places to 10 metres deep (Murphy 1993). The topography of the study area is undulating low rises on a plateau.

Vegetation & Landuse

The majority of the site has been cleared of vegetation leaving a buffer of native vegetation on the western boundary and western end of the northern boundary. The buffer zone is approximately 20m in width and comprises, scribbly gum (*Eucalyptus haemastoma),* brown stringy bark (*Eucalyptus capitellata)* red bloodwood (*Eucalyptus garrifera)* smooth-barked apple (*Angophera costata), b*lackbutt (*Eucalyptus pilsdaris)* and old man banksia (*Banksia serrata).*

The topographic map shows a dam on the property at the rear of the house that is now infilled. The site has channels excavated to depths of 2 metres to divert water from the house and the area of the voids.

The western portion of the site that is cleared of vegetation shows evidence of levelling and a history of cultivation. The property owner recalled a small gravel quarry on the western portion of the site. The area of cleared ground at the western end of the site shows extensive landscape modification with levelling and channels and fill.

1.5 Consultation and Aboriginal involvement

In accordance with Office of Environment and Heritage guidelines, Aboriginal persons or groups who may have information that would assist the assessment process will be identified by the process outlined in clause 80C of the NPW Regulation.

A copy of the report will be provided for comment to any registered party that hasn't been involved in the assessment to date.

The site has been reinspected by Darkinjung LALC and Gringai Tribal Link. The reports received from the these inspections can be seen in

3.0 Aboriginal Archaeological Context

3.1 Regional Context

Somersby is located on Hawkesbury sandstone, a landform unit renowned for its rock engravings and art. The Grants Road Aboriginal Reserve contains numerous engravings and is located about 4 kilometres south west of the study area.

3.2 Local Indigenous Archaeological Context

An additional engraving of a human figure was located in 2007 at Grants sand quarry on Grants road in the course of a quarry expansion assessment. The figure was to be avoided and retained in-situ. The figure was located about 500m from the Grants Road Reserve site, both of which are located on the central plateau of the sandstone ridge. The study area is located on the eastern slope of the plateau.

3.4 AHIMS Search

An AHIMS search was conducted over an area of 18 sq km around the study area. A total of 43 sites were located. The site types are broken down is shown in Table 1.

Table 1 AHIMS recorded site type breakdown*

Rock Engraving	9	Potential Arch Deposit (PAD)	2
Grinding Groove	28	Art – pigment or engraved	3
Stone arrangement	1	Total	43

*note that some individual sites may have multiple characteristics – these are listed under the first characteristic recorded.

The AHIMS search demonstrates that the site types recorded on the Somersby plateau are the site types dependant upon a suitable sandstone soil landscape. This area is in contrast to most areas of NSW where open camp sites are the most common site type in general. There are no open campsites recorded in this area which indicates a probable ceremonial use of the escarpment rather than a generalised occupation area. The preservation of common site types in this area is likely to be dependant upon intact horizontal sandstone surfaces. The two areas of PAD recorded in the area are closed sites – that is the deposits within rock shelters. The sandy shallow topsoil of the area is not conducive to the preservation of occupation sites in an open context.

3.5 Predictive Model of Archaeological Potential

The following is a brief description of the site types that may or may not occur within the study area:

ARTEFACT SCATTERS / OPEN CAMP SITES: these sites comprise stone artefacts deposited in the course of tool manufacture, occupation of a camp site or transient use of the landscape. These objects are unlikely to occur on the subject site due to disturbance and landscape context which demonstrates a paucity in this site type.

BURIALS: Human remains tended to be placed in hollow trees, caves or sand deposits. Therefore this site type is unlikely to occur in the study area due to the

level of vegetation clearing, surface disturbance and lack of sand deposits of more than a few mm depth.

GRINDING GROOVES: Grinding grooves are formed in stone where stone hatchet or axe 'blanks' have had their edges ground sharp. Sandstone is generally preferred, as the sand particles have excellent abrasive qualities particularly when water is introduced onto the grindstone.

Whilst grinding grooves are common in the general area their survival in the study area is unlikely due to the existing disturbance to the site.

ART – PIGMENT OR ENGRAVED
Art that is known in the general area includes representations of animals, anthropomorphic figures and symbolic art. This site type may occur in undisturbed parts of the study area.

The survival of this site type is unlikely to occur due to the degree of disturbance. An extensive engraved art site is located within the Reserve on Grants Road several km to the north east.

SCARRED/MODIFIED TREES: Scarred trees contain scars caused by the removal of bark for use in manufacturing canoes, containers, shields or shelters. Mature trees and remnants of stands of the original vegetation have the potential to contain scars. These are unlikely to occur on this site as the majority of the area has been cleared.

4.0 Survey Details

4.1 Survey Objective

The purpose of the survey was to identify an Aboriginal objects or sites that may be impacted by the proposed development, consult with those stakeholder representatives selected for fieldwork and to develop appropriate management strategies if required.

4.2 Survey Details

The study area was reinspected in 2012 and found greatly unchanged from the 2004 site inspection. The site was inspected twice, once with Gringai Tribal Link and on a second day with Darkinjung LALC.

A foot inspection was conducted over the site, particularly utilising any areas of exposure. The survey avoided the void area for safety reasons however any undisturbed land surfaces around the voids were inspected. The site was found to be unchanged from the 2004 survey, probably due to the poor skeletal soils where these are in-situ which prevents thick vegetation growth. In addition the large part of the site that has been subject to previous quarrying remains as it was in 2004.

4.3 Survey Results

In general the survey area was found to be highly disturbed from the rural and industrial history of the site.

The survey coverage details remain unchanged from the 2004 survey. The variation was found with one isolated find within survey unit 3d – the orchard area, described as a highly modified, levelled and depressed topography in comparison to the surrounding area. The isolated find located on the track in this unit is highly likely to have been introduced to the site.

An isolated broken artefact was located in cell 7 in a highly disturbed context. The artefact was located on a vehicle track that traversed an area that has been levelled and modified; therefore it is not in-situ and may have been introduced in road base.

The isolated artefact was located on a track in an area of heavy disturbance. The location appeared on the margins of a cut and fill area. The artefact was located on track 2m wide.

Table 2 Artefact details

GDA	L x W x T *	Material	Type	Comments
341355 E 6305739N	26x31x15	FGS*	Broken flake proximal	10% cortex Crushed platform Right margin snap.

*length by width by thickness in mm
*fine grained siliceous

No areas of PAD (Potential Archaeological Deposit), was identified within the impact zone of the proposal.



Plate 2 The central vehicle access view east.



Plate 3 The modified landscape showing built up margin of water diversion channels.



Plate 4 The broken FGS flake - its location on the surface of the ground and its context may indicate that it is has been redeposited perhaps in road base.



Plate 5 The western portion of the site with buffer zone to Wisemans Ferry Road - view west. Note the level character of this the north west corner of the old orchard area.

5.0 Significance of Indigenous Archaeological Sites

5.1 Significance Criteria

The basic processes of assessing significance for items of heritage are outlined by *The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance: the Burra Charter* (amended 1999) and its associated *Guidelines*. Sites may be significant according to several criteria, including scientific or archaeological significance, significance to Aboriginal people, aesthetic value, the degree to which a site is representative of archaeological and/or cultural type, and value as an educational resource. In New South Wales the nature of significance relates to historic, aesthetic, social, scientific, cultural or educational criteria and sites are also assessed on the degree to which they exhibit rare or representative characteristics of their type, or whether they exhibit historic or cultural connections.

Scientific Significance

In order to determine scientific significance it is necessary to first place sites within a local and regional context. This process enables the assessment of any individual site in terms of merit against other sites of similar nature within similar contexts.

Public Significance

The sites are assessed in terms of their educational value, to enhance community knowledge and appreciation of cultural heritage.

Cultural Significance

Generally, all sites are of significance to the Aboriginal people. It has been recognised however that with the widespread nature of site distribution, sites will eventually be impacted upon by development. It is however necessary to conserve where possible sites which are of high significance to the community.

Representative Significance

Site significance is rated low, medium and high. The significance of individual sites is determined by factors such as representativeness, rarity, and the sites potential to add scientific data to what is known about past human occupation of the Australian continent. Conservation outcomes are determined by comparison of a site's qualities with known sites in the region that have been protected.

5.2 Significance Assessment

The isolated find is considered to be of low scientific significance given that lack of context in its location and the artefact type / material's commonality in open sites in the region.

The cultural significance of the object is documented in the cultural assessments in Appendix A. The representatives in the field indicated that the collection of the object was an acceptable management option.

6.0 Assessment of Historical archaeological potential

A search of the Somersby area on the NSW Heritage Office database which includes Gosford City Council's Local Environment Plan did not identify any historic items on or near the study area.

The buildings within the study area appear to date to the 1960's in style and materials. The buildings include a cottage and sheds in addition to animal pens.

As no heritage items were identified by the survey, a significant assessment is not required.

7.0 Legislation

THE NATIONAL PARKS AND WILDLIFE ACT 1974
The NPW Act (section 90) provides statutory protection for all material evidence of Aboriginal occupation of NSW. Aboriginal places which are areas of cultural significance to the Aboriginal community, are also protected by the 1974 Act (section 84) that states:

The Minister may declare lands to be 'protected archaeological areas' to preserve Aboriginal places and relics; and

It is an offence to disturb or destroy an Aboriginal place or relic without first obtaining written consent from the Director of National Parks and Wildlife Service NSW.

The National Parks and Wildlife Act 1974 requires the obtaining of a Section 87 Permit if a person wishes to excavate land to disturb or discover an Aboriginal object (relic) or disturb or move an Aboriginal object.

A Section 90 Heritage Impact Permit is required if an activity will or is likely to destroy, damage, desecrate or deface and Aboriginal object or Aboriginal place.

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 (NPW A s.5(1)).

THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT (1979)
In NSW the EP&A Act "*Is the principal law overseeing the assessment and determination of development proposals*"[1]. The EP&A Act requires environmental impacts to be considered in land use planning and environmental impact assessment.

Part 4 of the Act predominantly covers development proposals which require consent from Local Councils and in some cases by the Minister for Planning[2]. Sections of Part 4 of the Act and relevant clauses of the EP&A Regulations 2000 ensure that Aboriginal heritage is considered in the assessment (including consultation) of development applications under that Part.

THE HERITAGE ACT OF NSW (1977)
The Heritage Act provides protection to all relics, making it illegal to disturb or excavate land to discover, expose or move a relic, without a permit issued by the NSW Heritage Council. Section 4(1) of the *Heritage Act* (as amended 2009) defines 'relic' as follows: ***relic*** *means any deposit, artefact, object or material evidence that:*

[1] http://www.planning.nsw.gov.au/PlanningSystem/DevelopmentAssessmentSystems/Howtofindoutwhichdevelopmentassessmentproce/tabid/92/Default.aspx

[2] ibid

(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and (b) is of State or local heritage significance.

Where potential archaeological sites have been identified the proponent must provide an archaeological assessment, notify the Heritage Council of New South Wales and consider comments received and ensure that all necessary excavation permits under the Heritage Act 1977 have been granted.

8.0 Management Recommendations

The following management recommendations are applicable to the study area as surveyed at the time.

8.1 Post European Heritage

No constraints regarding post European heritage were identified by the assessment.

8.2 Indigenous Heritage

One Aboriginal object was identified in the study area. The management of that object as discussed in the field with the community representatives could include:

1. Apply for an Aboriginal Heritage Impact Permit and relocate the artefact from its location in cell 7 to the buffer zone and lodge an updated site card with AHIMS.
2. Apply for an Aboriginal Heritage Impact Permit and collect the artefact. The artefact would then be subject to a Care and Control application by any party who wishes to store the artefact.

Should any potential items of Aboriginal heritage or suspected deposit be unearthed, work should cease in that area and an archaeologist, registered stakeholder or DECCW should be contacted immediately.

Please also refer to Appendix C for the report and management recommendations from the Aboriginal community.

8.0 References

Insite Heritage, 2004 Aboriginal Heritage Assessment for Rindean Quarry Somersby . Report to Pacrim Environmental

Murphy, C.L. 1993 Soil Landscapes of the Gosford – Lake Macquarie 1:100,000 Sheet. Department of Conservation and Land Management

Appendix A– AHIMS Search

Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Rindean 1

Client Service ID : 67451

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-3-0644	Narara Creek;	AGD	56	341748	6305315	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	480
	Contact	**Recorders**	Alexandra Kelly					**Permits**		
45-3-0657	Somersby;Howe Aboriginal Area;	AGD	56	339131	6303527	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	Fred McCarthy					**Permits**		
45-3-0553	Narara;	AGD	56	343717	6302792	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	Len Dyall					**Permits**		
45-3-1369	Narara Creek;	AGD	56	341910	6304240	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1370	Narara Creek;	AGD	56	341930	6304250	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1371	Narara Creek;	AGD	56	342318	6304228	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1387	Narara Creek K-O-40;	AGD	56	341730	6304640	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1389	Glen Allen;Narara Creek K-O-43;	AGD	56	341800	6305130	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	287
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1390	Glen Allen; K-O-44;	AGD	56	341690	6304950	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1391	Glen Allen;Narara Creek K-O-45;	AGD	56	341740	6305040	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	287
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1392	Glen Allen; K-O-46;	AGD	56	341750	6305050	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1396	Narara Creek; K-O-52;	AGD	56	341700	6304130	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-1397	Narara Creek; K-O-53;	AGD	56	342309	6304685	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	

Report generated by AHIMS Web Service on 10/04/2012 for Angela Besant for the following area at Datum :GDA, Zone : 56, Eastings : 338000 - 344000, Northings : 6303000 - 6306000 with a Buffer of 50 meters.Additional Info : to provide an archaeological context for the updating of an arch assessment for a proposed quarry. Number of Aboriginal sites and Aboriginal objects found is 43

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Rindean 1

Client Service ID : 67451

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	ASRSYS					Permits		
45-3-1398	Narara Creek;K-O-54;	AGD	56	341830	6305180	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	ASRSYS					Permits		
45-3-1402	Narara Creek;	AGD	56	341870	6304230	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	ASRSYS					Permits		
45-3-1405	Narara Creek;	AGD	56	341960	6304280	Open site	Valid	Grinding Groove :	Axe Grinding Groove	
	Contact	Recorders	ASRSYS					Permits		
45-3-1411	Narara Creek;	AGD	56	341990	6304300	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	ASRSYS					Permits		
45-3-0521	Narara Creek;	AGD	56	343893	6303161	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	Recorders	Alexandra Kelly					Permits		
45-3-0524	Narara Creek;	AGD	56	343715	6302883	Open site	Valid	Grinding Groove : -, Art (Pigment or Engraved) : -	Axe Grinding Groove,Rock Engraving	
	Contact	Recorders	Alexandra Kelly					Permits		
45-3-0901	Narara Creek;Reeves Road;	AGD	56	342820	6303340	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	17
	Contact	Recorders	Val Attenbrow					Permits		
45-3-2193	B.W.N.P.;	AGD	56	337870	6303480	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	1333
	Contact	Recorders	Warren Bluff					Permits		
45-3-0042	Old Gosford Road; Piles Creek;	AGD	56	342400	6303150	Open site	Valid	Art (Pigment or Engraved) : -, Grinding Groove : -	Axe Grinding Groove,Rock Engraving	
	Contact	Recorders	Margrit Koettig					Permits		
45-3-0048	Narara Creek;	AGD	56	343715	6302883	Open site	Valid	Grinding Groove : -, Art (Pigment or Engraved) : -	Axe Grinding Groove,Rock Engraving	
	Contact	Recorders	I.M Sim					Permits		
45-3-0049	Narara Creek;	AGD	56	342801	6302866	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders	ASRSYS					Permits		

Report generated by AHIMS Web Service on 10/04/2012 for Angela Besant for the following area at Datum :GDA, Zone : 56, Eastings : 338000 - 344000, Northings : 6303000 - 6306000 with a Buffer of 50 meters.Additional Info : to provide an archaeological context for the updating of an arch assessment for a proposed quarry. Number of Aboriginal sites and Aboriginal objects found is 43

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Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Rindean 1

Client Service ID : 67451

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-3-0050	Narara Creek;	AGD	56	343158	6303330	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-0051	Narara Creek;	AGD	56	341880	6304700	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	J.C Lough					**Permits**		
45-3-0052	Narara Creek;	AGD	56	341900	6305180	Open site	Valid	Grinding Groove : -, Art (Pigment or Engraved) : -	Axe Grinding Groove,Rock Engraving	287
	Contact	**Recorders**	ASRSYS					**Permits**		
45-3-0315	Sommersby	AGD	56	338674	6303518	Open site	Valid	Grinding Groove : -, Art (Pigment or Engraved) : -	Axe Grinding Groove,Rock Engraving	
	Contact	**Recorders**	IM Sim					**Permits**		
45-3-0316	Sommersby	AGD	56	337942	6303504	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	IM Sim					**Permits**		
45-3-1066	Narara Creek;	AGD	56	341748	6305315	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	480
	Contact	**Recorders**	Alexandra Kelly					**Permits**		
45-3-3173	FLOODS CREEK	AGD	56	340050	6303920	Open site	Valid	Grinding Groove : -		
	Contact	**Recorders**	Warren Bluff					**Permits**		
45-3-3320	Spear Sharpening Grooves	GDA	56	343894	6303244	Open site	Valid	Grinding Groove : 4		
	Contact Searle	**Recorders**	Mr.Daniel O'Brien					**Permits**		
45-3-3326	Spear Sharpening Grooves 2	GDA	56	343878	6303848	Open site	Valid	Grinding Groove : 1		
	Contact Searle	**Recorders**	Mr.Daniel O'Brien					**Permits**		
45-3-3327	Stone Arrangement Horticultural Research Station	GDA	56	343661	6303696	Open site	Valid	Stone Arrangement : -		
	Contact Searle	**Recorders**	Mr.Daniel O'Brien					**Permits**		
45-3-3329	Shelter with Art and Deposit Horticultural Research Station	GDA	56	343878	6303848	Open site	Valid	Art (Pigment or Engraved) : 2		
	Contact Searle	**Recorders**	Mr.Daniel O'Brien					**Permits**		
45-3-3330	Axe Grinding Grooves HRS	GDA	56	343916	6303760	Open site	Valid	Grinding Groove : 30		
	Contact Searle	**Recorders**	Mr.Daniel O'Brien					**Permits**		
45-3-3331	PAD HRS	GDA	56	343702	6303595	Closed site	Valid	Potential Archaeological Deposit (PAD) : -		

Report generated by AHIMS Web Service on 10/04/2012 for Angela Besant for the following area at Datum :GDA, Zone : 56, Eastings : 338000 - 344000, Northings : 6303000 - 6306000 with a Buffer of 50 meters.Additional Info : to provide an archaeological context for the updating of an arch assessment for a proposed quarry. Number of Aboriginal sites and Aboriginal objects found is 43

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : Rindean 1

Client Service ID : 67451

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact: Searle	Recorders: Mr.Daniel O'Brien						Permits:		
45-3-3321	PAD with Shell	GDA	56	343719	6303584	Closed site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact: Searle	Recorders: Mr.Daniel O'Brien						Permits:		
45-3-3323	AGG Dawson Street	GDA	56	343946	6303391	Open site	Valid	Grinding Groove : 2		
	Contact: Searle	Recorders: Mr.Daniel O'Brien						Permits:		
45-3-3334	SDS1	GDA	56	342987	6303420	Open site	Valid	Grinding Groove : 1, Art (Pigment or Engraved) : 1		100470
	Contact: Searle	Recorders: Heritage Concepts						Permits:		
45-3-3343	grants rd re 1	GDA	56	338241	6304060	Open site	Valid	Art (Pigment or Engraved) : -		
	Contact:	Recorders: Mrs.Angela Besant						Permits:		
45-3-3344	grants rd re 2	GDA	56	338141	6304060	Open site	Valid	Art (Pigment or Engraved) : -		
	Contact:	Recorders: Mrs.Angela Besant						Permits:		
45-3-3375	SDS1A	GDA	56	342987	6303420	Open site	Valid	Grinding Groove : -		
	Contact:	Recorders: Heritage Concepts						Permits:		

Report generated by AHIMS Web Service on 10/04/2012 for Angela Besant for the following area at Datum :GDA, Zone : 56, Eastings : 338000 - 344000, Northings : 6303000 - 6306000 with a Buffer of 50 meters.Additional Info : to provide an archaeological context for the updating of an arch assessment for a proposed quarry. Number of Aboriginal sites and Aboriginal objects found is 43

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Appendix B – Heritage Searches

Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into two sections.

- **Section 1**. contains items listed by the **Heritage Council** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Branch.
- **Section 2**. contains items listed by **Local Councils & Shires and State Government Agencies**. This section may also contain additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

Click on an item name to view the full details.
The search results can be re-sorted by clicking on the **(sort)** option at the top of each column.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Listed Under Heritage Act
Mount Penang Parklands	Pacific Highway	Somersby	Gosford	Yes

There was 1 record in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Information Source (sort)

There was a total of 1 record 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 Branch 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.

Appendix C – Aboriginal Community Reports

Aboriginal Cultural Heritage Assessment Report

Rindean Quarry
620 Wisemans Ferry Road Somersby
Lot 2 D.P. 362339

Report to Insite Heritage
17 February 2012

Darkinjung Local Aboriginal Land Council
PO Box 401
Wyong NSW 2259
Tel 02 - 43512930
Email: darkinjung@dlalc.org.au

Author: Sharon Hodgetts

Aboriginal Heritage Site Assessment Report

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Aboriginal Heritage Site Assessment Report

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Figure 1: Map showing the approximate location of the assessment site, Somersby NSW indicated by red circle.

Source: Google Maps.



Figure 2: Map shows the approximate location of the assessment site indicted by the red circle.

Source: Google Maps.

1. Introduction.

This Report has been prepared as part of an Aboriginal Heritage Assessment for Darkinjung Local Aboriginal Land Council (DLALC) and on behalf of Insite Heritage The assessment was undertaken over one day, 17th February 2012.

The aim of the assessment is to inspect the location of the proposed development and to identify any Aboriginal cultural heritage, places, or objects, of significance to the Aboriginal community, and for the site's developer to meet the statutory obligations and requirements under the National Parks and Wildlife Act (1974) and the Environmental Protection Act (1979).

2. Description of the Assessment area and Development Proposed

The assessment area is situated within the boundaries of the Darkinjung Local Aboriginal Land Council. DLALC is located on the Central Coast of New South Wales, its boundaries stretch from Catherine Hill Bay to the Watagan Mountains in the North, Hawkesbury River to the South, Pacific Ocean to the East while the western boundary stretching along Judge Dowling Range from Bucketty to Spencer (Darkinjung Local Aboriginal Land Council).

The assessment site and proposed development is located at, 620 Wisemans Ferry Road Somersby and is known as Rindean Quarry.

Somersby is located on the Somersby Plateau, on the NSW Central Coast and is situated approximately 8 km north-west of Gosford. The Somersby area is predominantly an agricultural area with a number of small farms, orchards, plant nurseries and horse studs. The F3 Freeway and Strickland State Forest is located approximately 450m to the east of the assessment site. A number of existing quarry are located in the area, Pioneer Concrete and Sand Quarry is situated approximately 2.5km to the south-west of the assessment site on Reservoir Road.

The assessment site is dominated by land that has been previously disturbed. Disturbance includes the existing quarry, cleared land and areas of native bushland that has been invaded by introduced species of plants and various weeds. There is also disturbance related to the existing cottage and associated farm sheds.

The development proposed is to extend the existing quarry to the west of the assessment site towards Wisemans Ferry Road. The extension will predominantly stay within the disturbed sections of the site including the cottage and open paddock area.



Figure 3: The diagram shows the location and boundary of the assessment site.

Source: http://lite.maps.nsw.gov.au/

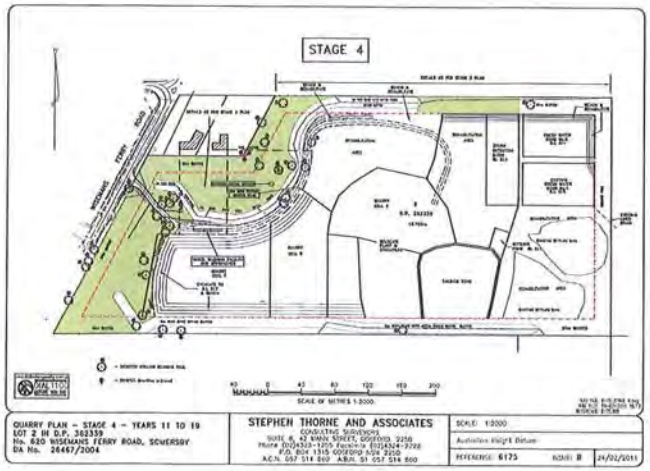


Figure 4: The diagram shows the proposed extension to the existing quarry.

Source: Insite Heritage.

3. Description of Impact.

The Rindean quarry assessment area is located within Somersby between Wisemans Ferry Road and the F3 Freeway.

The extension of the existing quarry will require that all vegetation and top soil is removed to access the sand and sandstone suitable to be quarried from below the surface to a considerable depth.

As a consequence of the quarrying process the landscape will become devoid of any original vegetation and soil.

There will be a 20 metre buffer zone around the parameter of the site. The north-west corner of the assessment site will have a 100 metre buffer zone which is the required distance from an existing residence not associated with the quarry.

The assessment site has various areas of disturbance that range from total destruction within the quarry to areas with low level of disturbance such as within the paddocks and areas with intact vegetation along the boundaries. Areas with low level of disturbance have the potential to contain Aboriginal cultural heritage sites and material which can become exposed with vegetation clearing and soil excavation.

Potential impacts to Aboriginal sites in general include excavation and erosion which can expose and/or destroy artefacts on top of, or below the soil surface. Impact can also include the destruction of vegetation and the surrounding landscape which can contain Aboriginal cultural heritage, material remains or cultural places. Other impacts associated with this type of project may include alteration to the water and drainage patterns in the area.

The Aboriginal cultural heritage most at risk from this type of works are, rock engravings, scar trees, open sites, middens and isolated artefact. Other forms of Aboriginal sites at risk include cultural and spiritual places. Adverse impact could include exposure of artefacts and other Aboriginal archaeology or cultural heritage and destruction of Aboriginal places, through water runoff and soil erosion, impact from machinery or tools associated treadage. These impacts could occur during the various phases of the project, while after completion impacts can be a result of altered runoff and natural water movement which are also a threat. The greatest impact on Aboriginal heritage places in NSW occurs in the form of soil erosion (Byrne 1997:1). Runoff and erosion can potentially cause siltation and/or exposure and destruction of Aboriginal cultural heritage sites. Indirect impacts may occur in the form of alterations to drainage and erosion patterns (Byrne 1997:2).

Trampling and treadage has had a significant impact on Aboriginal sites in NSW. The impact of treadage on open sites can result in displacement and damage to individual artefacts. Treadage can also initiate soil erosion (Byrne 1997:3) including for example by people damaging the vegetation and exposing the soil surface, workers unknowingly walking over sites, or being in the vicinity of sites that may be sensitive, sacred or mythical.

Tools and treadage associated with the project during and post construction phases have the potential to destroy or adversely alter sites if the area is not adequately protected.

The main types of Aboriginal sites impacted by soil excavation works and removal in general are middens, occupation sites, burials and isolated artefacts. Also at risk are rock shelters and platforms with occupation sites, and/or art sites including axe grinding groove and rock carvings, scar and carved trees. Aboriginal walking trails and trading routes, mythological, spiritual and ceremonial sites can also be disturbed or destroyed as soil removal can initiate soil erosion or undermine the surface near or under the site. Excavation may also compromise the landscape which is part of the local Aboriginal people's culture and heritage.

Indirect impact, consist of altered drainage and erosion patterns, which can expose and/or destroy artefacts on top of, or below, the soil surface. Impact can also include the destruction of vegetation and the surrounding landscape which can incorporate Aboriginal people's remains or cultural places. The landscape surrounding an Aboriginal place or site is also a very significant part of Aboriginal culture; the landscape is an extension of the site, and can also be described as a Cultural Landscape.

The greatest impact on Aboriginal heritage places in NSW occurs in the form of soil erosion (Byrne1997:1). Runoff and erosion can potentially cause siltation and destruction of Aboriginal archaeological sites (Byrne 1997:2).

This type of development could impact on any potential Aboriginal archaeological sites located within and outside the boundary of the assessment site.

4. Qualifications, Relevant Experience and Community Endorsement

I have completed Certificate III Horticulture, Parks and Garden through the TAFE Open Training and Education Network (OTEN), Certificate III Conservation and Land Management, Specialising in Indigenous Land Management through the Ryde College of TAFE Ryde and have completed the Diploma in Indigenous Archaeology at the University of New England, Armidale NSW.

I have gained experience through liaison and collaborating with both Aboriginal and non-Aboriginal representative from such organisation as, State Forest NSW, NSW National Parks and Wildlife Service, NSW Office of Environment and Heritage, Central Coast Hunter Range Regional Aboriginal Co-management Committee, Greater Blue Mountains World Heritage Area Aboriginal Reference Group, Tuggerah Lakes Estuary Coastal and Floodplain Management Committee, Gosford City and Wyong Shire Councils and professionals such as Archaeologist, Anthropologist, Biologist and Environmentalist. I have worked under the guidance and management of Darkinjung Local Aboriginal Land Council and have the endorsement of the council and the local Aboriginal community.

5. Statutory Requirements and Legislation.

Aboriginal heritage and places are protected by law under Legislation. Two basic pieces of legislation concerned with Aboriginal Heritage Management are the National Parks and Wildlife Act 1974 (NPW Act) and The Environmental Planning and Assessment Act 1979 (EP&A Act)

Section 84 of the National Parks and Wildlife Act (1974) provides protection for 'Aboriginal Places'. The act defines Aboriginal places as 'areas of cultural significance to the Aboriginal Community'. Section 90 of this Act gives protection for all 'Aboriginal Relics'. The act defines Aboriginal relics as 'any material evidence of the Aboriginal occupation of New South Wales'. The Minister will gazette areas as Aboriginal places if satisfied that adequate evidence exist to show that the area was or is of special importance to the Aboriginal community.

The National Parks and Wildlife Act 1974 (NPW Act) Legislation does not structure any formal mechanisms to make sure that areas with potential to contain Aboriginal sites or places of special significance are evaluated before impact on those areas. It is the Environmental Planning and Assessment Act (EP&A Act) which carries out this function.

The Environmental Planning and Assessment Acts principal function is to consider 'environmental impacts' in land use and decision making. Environmental impacts include impacts on Aboriginal Heritage. There are three main sections in the EP&A Act which are applicable to Aboriginal Heritage. Part III, administrate the preparation of planning instruments; Part IV relates to development evaluation process for local government (consent) authorities; and Part V which communicate to activity approvals by Government (determining) authorities.

Part III of the Act governs the preparation of the following three planning instruments: 1. State Environmental Planning Policies (SEPPs); 2. Regional Environmental Plans (REPs); 3. Local Environmental Plans (LEPs). These planning instruments dictate allowable uses and potential constraints on land use. When preparing planning instruments the Department of Urban Affairs and Planning have guidelines which should be followed. These guidelines list Aboriginal sites and places of significant to the Aboriginal community as values which should be assessed.

Part IV of the legislation governs the decision making process by local government authorities during a development application. Section 90 of the Act lists impacts which must be considered before development approval is granted. Under section 90 (1) 9b consideration must be given for 'the impact of that development on the environment (whether or not the subject of an environmental impact statement)'. Section 90 (1) 9b includes Aboriginal sites and heritage.

Part V of the legislation governs the decision making process by State Government authorities for activities conducted by that agency or under authority from the agency are controlled by Part V of the EP&A Act. It is mandatory for these agencies to consider environmental impacts of proposed activities then, determine whether the level of impact is adequate to necessitate the planning of an Environmental Impact Statement (EIS). Environmental impacts include Aboriginal sites and places. The Department of Planning New South Wales has created a set of guidelines for explaining Section 112 which requires that Aboriginal Heritage is assessed as part of the process (Byrne 1997: 2-3).

There are number of amendments to the NPW Act 1974. The amendments include a number of guidelines. These guidelines can be viewed on the NSW Office of Environment and Heritage (OEH) website.

The process of due diligence under the OEH guidelines require that a proponent of a development assess impacts of the proposed activity.

Below is a brief explanation of the process from the OEH web site,

The purpose of due diligence is to identify whether Aboriginal objects are present in an area, and to determine whether a proposed activity will have impacts on Aboriginal objects. Therefore it is essential to identify and understand all the expected impacts of the proposed activity.

There are two categories of activity used for assessing impacts:

(1) Activities involving no additional surface disturbance.
(2) Activities causing additional surface disturbance.

For activities causing additional surface disturbance, it is necessary to determine whether an activity is proposed for:

a) a developed area or a previously disturbed area, or
b) an undisturbed area.

For activities in previously developed or disturbed areas, it is then necessary to determine whether the new activity will create significant additional surface disturbance. If it will, then the process for undisturbed areas will apply'.

Due diligence involves taking reasonable and practicable measures to determine whether your actions will harm an Aboriginal object and if so avoiding that harm (Office of Environment and Heritage formally NSW Department of Conservation Climate Change and Water).

Note: Any works that may disturb, damage, or destroy Aboriginal cultural heritage requires an Aboriginal Heritage Impact Permit (AHIP) from OEH, this includes impacts to both registered and unknown Aboriginal sites that may require excavation or disturbance to the soil of any kind. Prosecution may result if works are carried without a relevant permit.

6. Aboriginal Cultural Heritage, Values and Significance.

Aboriginal people have inhabited Australia between 50,000 and 60,000 years, evidence for this can be found from material dated from Malakunanja and Nauwalabila rock shelter in the Northern Territory (Mulvaney & Kamminga 1999:141). Further evidence for human occupation is displayed through the skeletal remains of Mungo 3 discovered at Lake Mungo New South Wales. These remains have been dated to be between 28 000 and 32 000 years old (Morwood 2002:12). Aboriginal people's occupation of the Central Coast shown through archaeology, Aboriginal cultural heritage, material and spiritual places provides the local Aboriginal community with a sense of connection to the land, the people and culture. These materials and places present tangible evidence of the past and should be conserved.

The first inhabitancies of the Central Coast region were members of the Darkinjung (Darginung, Darginyung), language group. Several researches and publications show tribal or language group boundaries within similar areas, but exact boundaries are unlikely. Boundaries are a European concept and there was likely a zone between language groups which was shared and utilised by neighbouring groups.

Stone artefacts in the Upper Mangrove Creek area of the Central Coast have been dated between 10,000 to 15,000 years old (Attenbrow 2002: 153). These provide some reliable evidence of Aboriginal people's occupation of the region.

European exploration of the Central Coast area began soon after the arrival of the First Fleet in 1788. Settlement of the Hawkesbury River began about 1794 and in 1820 the area between the Hawkesbury and the Hunter Rivers become available for settlement (Brisbane Water National Park Plan of Management 1992:19).

Evidence for Aboriginal habitation, includes middens, which consist of shell, bone, charcoal, tools and sometimes burials. A midden is likely to contain only a selection of shell fish species available in the local environment. It may contain a high proportion of individuals of a edible size, stone artefact, charcoal from camp fires, pumice, coral, faunal bone and human burials (Byrne 1997:5). Shell middens are also important scientifically they can be dated, they provide precious information about Aboriginal use of the environment and changes in behaviour over time. Other evidence includes, fish traps and stone arrangements, deposits in sandstone shelters, including artefact, charcoal, shell and bone remains, rock engravings and pigment art. Additional forms of Aboriginal cultural evidence can consist of abraded channels, grooves and grinding stones, axe grinding grooves, scared and carved trees, water holes, quarry sites, open sites or camp sites, stone artefact scatters, graves, earth mound, walking trails along trading routes, mythological and ceremonial sites. In some cases landscape modification can provide evidence of Aboriginal people's occupation.

The landscape surrounding an Aboriginal place or site can be seen in a spiritual sense and is very important to Aboriginal people. The landscape can be an extension of a site, or the landforms and features within the landscape can be the site. Aboriginal sites can also be connected through sight lines to other sites or places of significants. These features are all part of the cultural landscape.

Some sites are associated with site lines and tracks, their purpose and associated stories connect these site with others site across Darkinjung country and should not be viewed in isolation of each other. Considering this, changing the context of an Aboriginal site by landscape degradation compromises the spiritual and cultural

connection that Aboriginal people have to the land and or the site. In many cases landscape destruction can be considered, destruction of an Aboriginal site and the Darkinjung cultural landscape.

Recent research of certain areas of the Central Coast has revealed an intricate network of Aboriginal cultural heritage sites, connected by Aboriginal walking trails and routes which have been utilised over hundreds and in some cases thousands of years, these tracks where utilised to access seasonal resources, carry out trade, teaching and ceremonies. These sites are connected and form part of a complex Aboriginal cultural landscape. The significance of many of these sites and the significance of the connection they have to each other and the landscape has been highlighted as very important for Aboriginal people both culturally and spiritually.

The Darkinjung people were fishers, hunters and gatherer of plants and animals of the land, rivers, estuaries and sea. These places including the hills, valleys, creeks, wetlands, lakes and coastline provided food, medicines, and raw material for tools, weapons, shelter and decoration. These environments and landforms also provided the basis for spiritual and cultural life and are of value and significance to the local Aboriginal community. Certain environments can be considered to have a higher Aboriginal cultural heritage potential because of their ecology and landform and the associated flora, fauna and other resources needed for everyday life. The proposed development site lies in an area with a high Aboriginal cultural heritage value. This is because of the surrounding, mountains, lakes, creeks, coastline and associated woodland and wetland habitats. These environments and ecological zones provided the local Aboriginal population with many food and other natural resources.

Therefore considering the long Aboriginal occupation of Australia and the Central Coast it could be predicted that most areas, particularly those with minimal disturbance have the potential to produced Aboriginal cultural heritage material or places.

Aboriginal sites are connected to each other within the landscape, a number of places and sites hold spiritual and cultural importance to the local Aboriginal community through their physical link to ancestors and the past. This connection attaches the community to land, traditions and strengthens bonds within the Aboriginal community. Safe guards need to be put in place to protect the spiritual and environmental integrity of a site and the cultural landscape. These Aboriginal materials, places and landscapes have value and significance to the local Aboriginal community and need to be protected.

7. The Assessment Site

The assessment site is part of the district of Somersby. The site is situated approximately 80 kilometres from Sydney on the Central Coast of NSW and covers an area of approximately 650 metres long by 250 metres wide.

The assessment site is surrounded by hills, ranges, valleys, creeks, wetland, bays and coast line. As shown previously these types of environments and the resources they provided to local Aboriginal people, was very important.

Several Aboriginal sites have been located and recorded in the area surrounding the assessment site; the closest is approximately 700 metres to the west.

Details of recorded Aboriginal sites can be found on the OEH Aboriginal Heritage Information Management System (AHIMS) database. Also see Table 1 on page 16.

The topography of the assessment site is relatively flat although gently slopes towards the east of the plateau.

Vegetation in the assessment area consists of native and introduced species of plants including weed varieties. The native species are located primary around the boundary of the property.

The vegetation includes, such species as Sydney Red Gum/ Smooth Baked Apple *(Angophora costata)*, Sydney Peppermint *(Eucalyptus piperita)*, and other various *Eucalyptus* species, Gymea Lily *(Doryanthes excelsa)*, Banksia *(Banksia* spp*)*, Wattle *(Acacia* spp*)*, Bracken *(Pteridium esculentum)* and also various introduced and weeds species such as Radiata pine *(Pinus radiate)*, Privet *(Ligustrum* spp*)* and other shrubs and grasses.

The Somersby area and the assessment site is surrounded by several areas of bush land, such as Brisbane Waters National Park to the west and Strickland State Forest, to the east. Narara creek also lies to the east while Brisbane Water lies approximately 7 kilometres to the south-east and of the site.

Many of the native plant and faunal species found in the area and assessment site are considered a valuable food and material resource for the local Aboriginal inhabitants. Examples of those resource plants found in the area consist of; Gymea Lily (*Doryanthes excelsa*), the flower spike of this plant was eaten, while the roots were also harvested and made into roasted cakes. Mat Rush (*Lomandra longifolia*) can be used as string or for food (Stewart & Percival 1997:33-35). Bracken (*Pteridium esculentum*), the rhizomes are used for food, but are toxic if not treated by roasting or baking. The young fronds are also roasted and eaten, while the sap of the crushed leaf is used to relieve ant or nettle stings (Stewart & Percival 1997:44). Many of the Paper barks (*Melaleuca* spp), Tea-trees (*Leptospermun* spp), Bottlebrush (*Callistemon* spp) and Wattle (*Acacia* spp) provide food, medicinal and other resources through the nectar from flowers, leaves and bark (Robinson 1991:55). Lilypilly (*Acmena* and *Syzygium* spp) provided eatable fruit (Robinson 1991:369-371) while the bark of Geebung's (*Persoonia* species) has medicinal qualities and the fruit can be eaten. The plant can be used for sore eyes and to strengthen fishing lines (Stewart & Percival 1997:42). Native Rock Lily (*Dendrobium speciosum*) has starchy stems that are roasted before eating. The stems could also be chewed and applied to injuries such as burns or wounds (Stewart & Percival 1997:16). The roots of Native Yams (*Dioscorea transversa*) can be eaten raw (Stewart & Percival 1997:19). The Saw-sedge (*Gahnia* aspera) has seeds that are

ground to make flour (Stewart & Percival 1997:33). The Cabbage Tree Palm (*Livistona australis*) has growing tips that are edible raw or roasted. The leaves are also used as thatch for shelters and weaving baskets, while the bark fibres are used for making fishing lines (Stewart & Percival 1997:34). Many of the Gum Trees (*Eucalyptus, Angophora, Corymbia* spp) provide resources from various parts of the plant. These include string, tools, weapons, shelter, canoes, food, medicinal and spiritual uses.

The assessment site is located within 7 kilometres of an area abundant in various marine and estuary resources including fish, shell fish, marine birds and animals. Middens provide evidence of these resources utilised by Aboriginal people. Middens where once abundant along the NSW coastline, but since colonization many have been destroyed by erosion, urban development and ustilised as a resource earlier this century, for such things as lime burning or for building mortar.

Middens contain the remains of meals consumed by Aboriginal people, their tools and also burials. Some of the marine species consumed on the Central Coast include, Turban shell (*Turbo torquata* and *Turbo undulata*), Sydney Rock Oysters (*Saccostrea glomerata*, formerly known as *Saccostrea commercialis*), Sydney Cockle (*Anadara trapezia*), Pipi (*Plebiodonax d' toides*), Sydney Whelk (*Pyrazus ebeninus.*), Nerita sp and Limets (*Cellana* sp).

The examples above shows that the assessment site and the surrounding area have the potential to provide Aboriginal people with abundant, reliable food and material resources that are within close proximity. Therefore the assessment site is considered to have potential for Aboriginal cultural heritage sites or artefacts which may be concealed by deposits of soil, vegetation and leaf litter.

The areas of the site with a higher potential for Aboriginal cultural heritage include places where there has been minimal disturbance, and areas with intact soil, mainly below the current soil surface. In the past activities on, or near, the site could have negatively impacted on, destroyed or relocated potential Aboriginal cultural heritage material.

Site Name	AHIMS Number
Narara Creek	45-3-0052
Narara Creek	45-3-1066
Glen Allen/Narara Creek K-0-43	45-3-1389
Glen Allen/Narara Creek K-0-44	45-3-1390
Glen Allen/Narara Creek K-0-45	45-3-1391
Glen Allen K-0-46	45-3-1392
Somersby K-0 -48	45-3-1394
Narara Creek K-0-54	45-3-1398

Table 1: Shows details of eight (8) of the nearest registered Aboriginal site located approximately 650 metre from assessment site.

Source: DLALC Assets Governor and OHE AHIMS Database.

8. Assessment Methodology.

Prior to any Aboriginal site survey, assessment or monitoring carried out in the field, a desk top analysis of the area is carried out. This involves consulting the relevant topographical, council and survey maps, and the DLALC Asset Governor incorporating, NSW Office of Environment and Heritage (OEH), Aboriginal Heritage Information Management System (AHIMS) Data base.

It should be noted in regards to the OEH AHIMS data base that many Aboriginal sites listed on the data base often are not situated within the location as shown on maps referring to the AHIMS information. Therefore it can be difficult to relocate the precise position of many registered Aboriginal sites due to some of the following reasons:

- Registered sites were recorded before the introduction of GPS units.
- In the past many registered Aboriginal sites were recorded on a topographical map with a scale of 1:25000. The co-ordinates were acquired by cross references to easting and northing figures located along the side of the map. The site was then mark as a point on the map and as a result of this, the co-ordinates could be up to 1 millimetre off, on the map, which then results in the sites location recorded as an error of up to 250 metres on the ground.
- Sites were frequently recorded in different datum for example: Some site where recorded in AGD which has now change to GDA 94 therefore the site could be out by as much as 200 metres on the ground.
- Human error, locations of Aboriginal sites may have been incorrectly recorded.
- Inability to visually relocated sites due to thick bush, vegetation, leaf litter, silt and other debris, and hazardous or inaccessible topography.

Having considered the above points, it should also be noted that sites recorded more recently are often situated in the correct location given.

Along with the above the main strategy used to assess the area is to consult the relevant topographical, survey maps, and site plans including the DLALC Asset Governor incorporating AHIMS database along with previous Aboriginal Cultural Heritage Site Surveys conducted by DLALC on neighbouring properties and consider the documented evidence of Aboriginal burials located or removed from these properties, then to consider areas of this site with the potential for Aboriginal cultural heritage material along with access to ground surface visibility.

9. Assessment Fieldwork.

The assessment and inspection of the proposed extension to the Rindean Quarry site for Aboriginal cultural heritage sites and places was conducted on the 17 February 2012. Involved in the assessment of the site was Sharon Hodgetts Project Officer Culture and Heritage representing Darkinjung Local Aboriginal Land Council and Liz Wyatt Archaeologist Insite Heritage.

The aim was to physically walk over the assessment sites in the areas of the proposed development and also to inspect the surrounding area for any Aboriginal cultural heritage.

The inspection of the proposed development site was required so that any Aboriginal cultural heritage material or sites located within the area could be assessed, protected and properly managed.

The site is located within an area which may have the potential to contain Aboriginal cultural heritage sites. The area was thoroughly inspected and one (1) Aboriginal cultural heritage site was relocated. The isolated artefact was previously discovered a few days prior to the assessment by Angela Bessant from Insite Heritage as part of this assessment.

Overall a large area of the site is disturbed, the exception to this maybe the boundaries of the assessment site. The main areas of the assessment which were inspected was within the proposed extension of the quarry footprint, as other parts of the site were not considered to be impacted by the development.

Day One.
Weather conditions: Fine.

Transect
One transect was walked. The site was accessed from (GPS location 56H 0341162 6305807) on Wisemans Ferry Road. The transect proceeded in an easterly direction from Wisemans Ferry Road and along a dirt access track toward the existing quarry.

At the quarry, the transect then turns south and heads towards a farm cottage and associated machinery sheds. The transect then turns back to the west past the shed and into an open paddock. The paddock has limited soil exposures due to the thick grass covering. The only exposures of soil within the paddock is on a dirt track which travels around the parameter of the paddock. A secondary track lies in a north-south direction and is located a few metres west of the primary track. The secondary track is the location of the isolated artefact. The artefact was relocated and inspected.

The transect then proceed to follow the primary track to the north, then follows this to the west, south and back towards the east. From here the transect moves back towards the north-west of the sites to the properties access track were the transect ends.

The artefact was recorded at GPS 56 H 0341255 6305731.



Figure 5: Map shows the approximate boundary of the site, indicated by the red line, and the transect walked, indicated by the yellow line. The location of artefact is indicated as a red circle.

Source: Map source and Google earth.

10. Photographs.



(Photograph S. Hodgetts)

Figure 6: Photograph shows part of the assessment site from the properties access track, facing west.



(Photograph S. Hodgetts)

Figure 7: Photograph shows part of the assessment site facing north and into the existing quarry.



(Photograph S. Hodgetts)

Figure 8: Photograph shows part of the assessment site looking into the existing quarry.



(Photograph S. Hodgetts)

Figure 9: Photograph shows part of the assessment site towards the farm house, facing south.



(Photograph S. Hodgetts)

Figure 10: Photograph shows part of the assessment site from the farm house and into towards the paddock, facing west.



(Photograph S. Hodgetts)

Figure 11: Photograph shows part of the assessment site from the paddock, facing south.



(Photograph S. Hodgetts)

Figure 12: Photograph shows part of the assessment site on the northern side of the paddock, facing west.



(Photograph S. Hodgetts)

Figure 13: Photograph shows the location of the artefact indicated in the photograph by the red arrow.



(Photograph S. Hodgetts)

Figure 14: Photograph shows the artefacts.



(Photograph S. Hodgetts)

Figure 15: Photograph shows a dam within the paddock to the north-west of the assessment site.



(Photograph S. Hodgetts)

Figure 16: Photograph shows the continuation of the primary track in the western side of the paddock.

11. Fieldwork Results.

One (1) Aboriginal cultural heritage site was relocated within the proposed development site. The artefact was recorded at GPS 56 H 0341255 6305731.

The site consists of one isolated stone artefact situated within a soil exposure along a secondary dirt track. The artefact is located in the midsection of the site within a paddock. In the past the paddock has been utilised for agricultural activities such as an orchard. The artefact was recently discovered by Angela Bessant of Insite Heritage as part of this assessment.

The artefact is a broken flake of a fine grained siliceous material with dimensions of approximately 26 x 31 x15 mm. The artefact is not thought to be in situ and not considered to be part of a Potential Archaeological Pad (PAD) because of the lack of certain elements in the landscape that are usually associated with a PAD. The artefact was likely subjected to post-depositional processes, such as transported through the soil through mechanical of environmental factors or deposited as a manuport.

12. Discussion and Recommendations.

There is a possibility for objects or sites of Aboriginal cultural heritage within the assessment site. All have Aboriginal cultural heritage value. Areas of higher Aboriginal cultural heritage potential are those areas with minimal ground surface and subsurface disturbance such as within areas of intact soil and native vegetation.

A large area of the assessment site has been highly disturbed in the past. Land disturbance includes, clearing of vegetation, excavations of the soil for the existing quarry and the property access road have all decreased the possibility for the survival of objects or sites of Aboriginal cultural heritage in some areas of the assessment site.

Several Aboriginal cultural heritage sites within the area have been documented and recorded on the AHIMS data base. These are within approximately 650 m of the assessment site.

This is tangible evidence of Aboriginal occupation of the area and is considered of high cultural value. Therefore there is a possibility for further Aboriginal objects or sites to be located within the least disturbed areas of the assessment site and surrounding area. All have Aboriginal cultural heritage value.

One (1) Aboriginal cultural heritage sites (an isolated artefact) was visibly evident within the assessment site. This should be properly recorded and registered on the AHIMS data base with OEH as soon as possible. DLALC should be informed when this is carried out and sent a copy of the completed Aboriginal Site Recording Form and allocated registered site number.

DLALC do not support the expansion of any existing or new quarry developments within the Somersby Plateau and Peats Ridge region. This is because the region along the valleys and ridge lines of Somersby and Peat Ridge is the location of many Aboriginal sites. Aboriginal sites both individually and collectively, located within this region and the associated cultural landscape have not been adequately researched and appropriately recognised. It is noted in the report, *Aboriginal Heritage Assessment for Rindean Quarry Somersby* Insite Heritage (2004), 'that at the very least the locality was a travel corridor to the lower country and water bodies to the east', which also recognises the Aboriginal cultural use of the area.

Recent research of the district has revealed an intricate network of Aboriginal cultural heritage sites, connected by Aboriginal walking trails and routes which have been utilised over time to access seasonal resources carry out trade, teaching and ceremonies. These sites are connected and form part of a complex Aboriginal cultural landscape. The significance of many of these sites and the significance of the connection they have to each other and the landscape has been highlighted as very important for Aboriginal people both culturally and for future Aboriginal cultural heritage research.

Considering the points above the proposed development will impact on exiting and potential Aboriginal cultural heritage sites or material located within the assessment site.

Therefore DLALC do not recommend that the quarry be given development approval based on the points previously discussed.

DLALC recommend that monitoring takes place when any soil excavation is carried out within proximity to the isolated artefact and also within the paddock and all other areas within the development site footprint that have low levels of disturbance.

This is to determine the stratigraphy of the soil and assess whether there is any potential for Aboriginal artefact to be located within the soil profile. This should be carried out until such time as the possibility for any Aboriginal cultural heritage sites or material can be determined or excluded.

Recommendations for all other types of excavations works proceed with caution until the subsoil profile and any inclusions, such as stone, shell or bone associated with Aboriginal cultural heritage can be determined. This is because the soil may contain further Aboriginal cultural heritage material.

If the development gains approval to proceed with the extension to the existing quarry then an application must be made to the Director General of the Department of Premier and Cabinet under the National Parks and Wild Life Act 1974 (NPW Act) for an Aboriginal Heritage Impact Permit (AHIP) for investigation purposes only.

Employee's, contractors, and personnel employed and or contracted by the sites developer as part of the quarry construction works should receive basic training in the recognition of Aboriginal cultural heritage material. They should be made aware of the importance of such material and places to, in particular the Aboriginal community, but also the non Aboriginal community. They should also be made aware of the legal implications of removal, disturbance and damage to any Aboriginal cultural heritage material and sites.

When vegetation clearing or earth work activities are conducted, workers should be observant and keep a look out for surface shell, bone, rocks, or any other artefact material.

The sites developers must give notice to Darkinjung LALC 30 days prior to any commencement of construction work and to engage a Darkinjung LALC Sites Officer to monitor any earthworks or excavations when recommended. This is due to the possibility of uncovering Aboriginal objects/items of significance whilst earthmoving/excavation takes place.

If during the course of excavation, earthmoving and/or construction if suspected Aboriginal cultural heritage material is encountered, work should cease immediately in that area, the area should be flagged, then avoided and the Office of Environment and Heritage (OEH) and Darkinjung LALC be immediately notified. Work should only recommence when an appropriate and approved management strategy has been agreed to be OEH and Darkinjung LALC.

Also recommended is that if any Aboriginal cultural heritage sites or material be discovered that an Aboriginal Cultural Heritage Management Plan be developed in consultation with DLALC to protect and preserve registered and potential Aboriginal cultural heritage sites within the assessment site.

Overview of recommendation

1. DLALC do not recommend that the quarry be given development approval. DLALC do not support the expansion of any existing or new quarry developments within the Somersby Plateau and Peats Ridge region.

2. Recommend that monitoring takes place of any soil excavation carried out within close proximity to the isolated artefact, within the paddock and all other areas within the proposed development footprint with low levels of disturbance.

3. Recommendations for all other types of excavations works are to proceed with caution until the subsoil profile and any inclusions, such as stone, shell or bone associated with Aboriginal cultural heritage can be determined. This is because the soil may contain further Aboriginal cultural heritage material.

4. If the development gains approval to proceed to extend the existing quarry then an application must be made to the Director General of the Department of Premier and Cabinet under the National Parks and Wild Life Act 1974 (NPW Act) for an Aboriginal Heritage Impact Permit (AHIP) for investigation purposes only.

5. Employees, contractors, and personnel employed and contracted by the sites developers should receive basic training in the recognition of Aboriginal cultural heritage material.

6. They should be made aware of the importance of such material and places to both the Aboriginal, and non Aboriginal, community and made aware of the legal implications of removal, disturbance and damage to any Aboriginal cultural heritage material and sites.

7. When vegetation clearing or earth work activities are conducted, workers should be observant and keep a look out for surface shell, bone, rocks, or any other artefact material.

8. The sites developers must give notice to Darkinjung LALC 30 days prior to any commencement of construction work and to engage a Darkinjung LALC Sites Officer to monitor any earthworks or excavations when recommended. This is due to the possibility of uncovering Aboriginal objects/items of significance whilst earthmoving/excavation takes place.

9. If during the course of excavation, earthmoving and/or construction if suspected Aboriginal cultural heritage material is encountered, work should cease immediately in that area, the area should be flagged, then avoided and the Office of Environment and Heritage (OEH) and Darkinjung LALC be immediately notified. Work should only recommence when an appropriate and approved management strategy has been agreed to be OEH and Darkinjung LALC.

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RINDEAN QUARRY
SOMERSBY, NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 3

DRAFT MANAGEMENT PLAN

Stages 1 and 2, Years 1 to 5

April 2012

Coastplan Consulting Pty Ltd and
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SOMERSBY, NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 3

DRAFT MANAGEMENT PLAN

Stages 1 and 2, Years 1 to 5

April 2012

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FIGURES

Note: The figures for the plan of management are the relevant figures from the EIS of April 2012. The content of figures and their numbering are identical to those in the EIS. As there are multiple reference to some of the figures throughout the document and to avoid repetition, all figures have been placed at the rear of the document.

Figure 1 *Rindean Quarry - Location*
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Figure 9 *Rindean Quarry Plan - Indicative Final Landform*
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Figure 11 *Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby - Site Plan*

Figure 12 *Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby - 19m Semi Trailer Design Vehicle Movements*

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TABLES

Note: Tables presented in Parts 4 and 5 are listed below. The tables presented in Part 6 are listed in the list of contents for each individual plan.

Table 4.1 *Estimated Annual Production of Product Types*

Table 5.1 *Report Schedule to the Gosford City Council, Stages 1 and 2*

Table 5.2 *Rindean Quarry, Inspection, Audit and Reporting Requirements*

REFERENCES

Cleve Smith Excavations Pty Ltd, Environmental Impact Statement, Rindean Quarry Somersby, New South Wales, Pacrim Environmental, September 2004 (EIS) Volumes 1 and 2.

Cleve Smith Excavations Pty Ltd, Amended s96 Consent Modification Report, Pacrim Environmental, August 2007 (S96 report)

Correspondence from the Gosford City Council to Cleve Smith Excavations Pty Ltd dated 20 June 2006 containing a Deferred Development Consent in regard to Development Application No 26467/2004, Lot 2, DP362339, No 620 Wisemans Ferry Road, Somersby, New South Wales.

Correspondence from the Gosford City Council to Cleve Smith Excavations Pty Ltd dated 17 September 2007 approving modifications to the Deferred Development Consent of 20 June 2006 in regard to Development Application No 26467/2004, Lot 2, DP362339, No 620 Wisemans Ferry Road, Somersby, New South Wales.

PART 1

INTRODUCTION

1.1 Authority for the Quarry Operation

This Draft Quarry Management Plan is a part of the environmental impact statement (EIS) supporting a development application submitted to the Gosford City Council by Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd. The development application is to operate an extractive industry at Lot 2 DP:362339, No. 620 Wisemans Ferry Road, Somersby, New South Wales also known as Rindean Quarry. The proposal is for the quarry to reopen and to operate in the manner and within the footprint approved by the Council in deferred development consents issued to Cleve Smith Excavations Pty Ltd (Development Application No 26467/2004) in 2006 and 2007 to produce up to 150,000 tonnes per annum of washed and unwashed construction sand for Sydney and local markets.

Those consents lapsed. Consent to the development application submitted now is required for the quarry to reopen and operate. The quarry had previously operated from 1979 to 2003 under a development consent, which is still current, granted by the Council in February 1979.

Once the consent is granted in regard this development application, the plan will be amended to take account of the conditions of the consent, and submitted to the Council as the final quarry management plan for Stages 1 and 2 of the quarry's operation.

1.2 Purpose of the Management Plan

This plan will be the document which guides the reinstatement of the quarry and Stages 1 and 2 of the quarry's operation and provides certainty to the Council that all conditions of consent will be met. Future quarry management plans, which will build on the experience of operating the quarry in the first two stages, will submitted to the Gosford City Council before each future stage begins.

Although the quarry will operate under a consent and conditions issued by the Gosford City Council, all quarrying operations must be performed in accordance with New South Wales mine safety and occupational health and safety legislation.

1.3 Content of the Management Plan

The quarry management plan is a comprehensive document which prescribes the requirements for operating the quarry, environmental management and protection, rehabilitation and the monitoring of environmental performance. The plan is the appropriate vehicle for regulating both the day-to-day and the staged operations of the quarry. In providing the Council with a benchmark against which to judge, amongst other things, the quality of operations, achievements in rehabilitation and the effectiveness of environmental protection, it will provide a significant level of control over the conduct of the quarry. It will also provide the flexibility necessary to respond to unpredicted changes in the operation of the quarry and environmental performance.

Although it is part of the EIS dated April 2012, it has been written as a document that can stand alone.

Part 2 of the plan deals with the preliminary work necessary to reinstate the quarry's operation. This work will be performed during a 26 week construction period when the New South Wales Industrial Noise Policy allows noise exposure targets for the quarry's operation to be exceeded.

Part 3 of the plan sets down the objectives for the quarry's operation and a broad work program for Stages 1 and 2. It also describes indicative operations for Stages 3, 4 and 5 and closure of the quarry.

Part 4 of the plan describes how the quarry will be operated and managed.

Part 5 of the plan describes the auditing and reporting commitments and requirements.

Part 6 of the plan describes the management of the key potential environmental impacts arising from the quarry's operation.

The environmental impact statement (EIS) and this plan are based on and take into account:

1) the consolidated conditions of development consents issued by the Council dated 20 June 2006 and 17 September 2007 in regard to Development Application No 26467/2004 for the redevelopment of the Rindean Quarry;

2) the EIS for Rindean Quarry dated December 2004 which supported that application;

3) the S.96 Consent Modification Report for Rindean Quarry dated August 2007;

4) the quarry management plan in regard to these consents approved by the Council in correspondence of 7 April 2011; and

5) the groundwater monitoring and management plan approved by the NSW Office of Water in correspondence of 13 May 2011.

1.4 Location and Property Details

The property containing the Rindean Quarry is located within the Gosford local council area approximately six kilometres north-west of Gosford, two kilometres south-west of the Somersby locality and 350 metres to the west of the Sydney to Newcastle (F3) Freeway.

The quarry is located on a 15 hectare parcel of land known as Lot 2 DP 362339, 620 Wisemans Ferry Road, Somersby (the Rindean Quarry property). The land is zoned as *1(a) (Rural Agriculture)* under Gosford City Council's *Interim Development Order N^{o} 122* and *RU1 Primary Production* under the Council's Draft Local Environment Plan 2009. Extractive industry is a permitted use on land zoned as *1(a) (Rural Agriculture)* and *RU1 Primary Production* subject to development consent. The property is owned jointly by Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd.

1.5 Operating Company Profile

Cleve Smith Excavations Pty Ltd has conducted earth moving and haulage businesses in the Central Coast region for a number of decades. Cleve Smith is the Principal and a Director of Cleve Smith Excavations. Pty Ltd. Cleve Smith Excavations has owned the property on which the Rindean Quarry is located since 1994 and operated the quarry during part of that time. The quarry was leased to and operated by a contractor from 1997 to 2003. MDJ Quarries Pty Ltd was formed in 2010 as a partner company in the quarry's reinstatement and operation.

1.6 Community Consultation

Neighbouring residents have been advised by letter of the requirement to submit a fresh development application and to invite them to discuss the proposal with the principals. Neighbours have been invited to contact Cleve Smith or Michael Jones to discuss the proposal. Formal consultation will be available when the development application and the EIS are placed on public exhibition.

Once the reinstatement of the quarry begins, a telephone system will be installed with a 24 hour answering machine to record incoming calls and email access will be provided. All complaints and responses to the complaints will be logged. Complainants who leave recorded or email messages will be contacted as soon as practicable after the complaint is lodged.

1.7 Security Deposits

The Cleve Smith Excavations Pty Ltd and MDJ Quarries Pty Ltd will post security deposits or bonds as required by the development consent issued for the proposal by the Gosford City Council in the form of cash or bank guarantees. These deposits or guarantees will apply from the time of issue of the Construction Certificate to the closure of the quarry.

PART 2

PRELIMINARY WORKS

2.1 Site Survey

A detailed survey of the site has been conducted by a registered surveyor. The purpose of the survey was to:

1) confirm the boundaries of the site and the location of existing vegetation, infrastructure, ponds and quarry voids;
2) peg the limits of quarry operations as allowed by the amending development consent of 17 September 2007;
3) peg the boundaries of buffer areas required by the development consents;
4) peg the noise attenuation infrastructure;
5) peg the route and identify the levels of the access roads within the quarry;
6) identify and mark those hollow-bearing trees and other significant vegetation that are required to be protected.

The results of this survey have been recorded on survey plans which form part this Plan of Management (Figures 4 to 10 inclusive).

2.2 Planning of Preliminary Works

The preliminary works are those necessary to reinstate the quarry to the point where production can begin. These works are the construction of:

1) the perimeter fence and certain internal fencing;
2) noise attenuation bunds;
3) the access from Wisemans Ferry Road;
4) the internal access road;
5) the wheel wash; and
6) essential water management and sediment control infrastructure within the site.

These works will begin once a Construction Certificate is issued by the Gosford City Council.

These works will be carried out during a 26 week construction period beginning on a nominated date after the Construction Certificate has been issued. Work that will require the operation of heavy equipment in proximity to adjacent residences will be performed during a 4 week period within the 26 week construction period in accordance with New South Wales Industrial Noise Policy (see *Section 2.3.8* below). This work, which will be the construction of noise control bunds and earthworks associated with the construction of the access road and wheel wash, will begin on a date to be agreed with the Council. The timing of the various works will depend on the availability of equipment, weather and the completion of infrastructure design.

All residents of adjoining properties will be provided with written advice explaining the construction works before the beginning of the construction period. Opportunities for consultation throughout the construction period will be available.

2.3 Description and Conduct of the Preliminary Works

2.3.1 Safety, Security and Site Protection

Construction of a perimeter fence comprising a 1.8 metre high chain wire fence topped with two strands of barbed wire will commence shortly after the Construction Certificate is issued by Gosford City Council. The total height of the fence will be two metres. Clearing a path for the fence to a width

of two metres will be performed using appropriate plant ahead of the construction of the fence. The fence will skirt significant trees and other plants or areas identified as having significance.

Fencing will begin along Wisemans Ferry Road. Construction will continue along the northern and southern boundaries of the property and finally along the eastern boundary.

A new entrance gate that will deter unauthorised entry will be installed as part of the construction of the new entrance. A site office will be located adjacent to the access road. All vehicles and people entering the quarry will be required to report to the office on entry.

Signage will be attached to the perimeter fence or erected at intervals of 50 metres along all boundaries of the property cautioning of the presence of the open quarry with the potential for near vertical drops and warning that public access is not permitted. A sign identifying the quarry and cautionary signage will be located at the entrance gate. The sign will carry the quarry's contact telephone number and email address.

Trees and areas identified as requiring protection have been identified and protected by a dropper and coloured safety mesh fence. These fences, which are intended to keep plant and equipment at least 3 metres from any tree so marked, will be maintained for the life of the quarry.

Coloured webbing safety fencing will be erected to identify and protect areas of significant risk, in particular, along existing quarry walls, before work commences on the site. Wire fencing, including barbed wire fencing where necessary, to identify and protect buffer areas and other areas of significant vegetation will be erected progressively once the construction and the planting of vegetation on the bunds has been completed.

2.3.2 Construction of Bunds

Noise attenuation bunds will be constructed in locations identified at *Figure10.* The bunds will be 4 or 6 metres high. They will take the form of a 4 metre high or 6 metre high earth mound, a partial height earth mound topped with a fence to the full height required (*Figure 13)*. The location and form of the bunds will be chosen to minimise the impacts on existing vegetation as well as provide the most effective noise attenuation for neighbouring properties.

Construction of the bunds will begin in areas adjacent to the closest adjoining residential properties to minimise the period of noise exposure within these properties.

Construction of bunds will require the extraction of overburden from stockpiles on the site or from areas identified for the future extraction of product sand. These operations will be performed by heavy equipment including a bull dozer, wheeled loader, an excavator and a dump truck. Equipment will comply with current standards for noise emissions.

There will be insufficient overburden in stockpiles and in-situ on the site for the construction of the bunds and the capping of the old tailings ponds at the eastern end of the site. It will be necessary, therefore, to import some clean material for the construction of bunds. Any import of material will be in accordance with Council requirements.

The vegetation of the bunds will take place through natural regeneration supplemented by the planting of tube stock or seed selected from the list of suitable species identified in the rehabilitation plan. New vegetation will be fertilised by hand and irrigated using a tanker and pump as required. Vegetation of the bunds will begin as soon as they are constructed and will be maintained in accordance with the rehabilitation plan.

2.3.3 Construction of the Access Road

The access from Wisemans Ferry Road will remain in its present location. The modified junction has been designed by an engineering consultant in accordance with New South Wales Department of Road and Maritime and the Gosford City Council requirements (*Figure 1* and *Figure 12*).

Construction, which will involve the widening of Wisemans Ferry Road shoulders, the extension and sealing of the runoff area adjacent to the quarry gate, drainage, road markings, signage and extending the runoff area by moving the quarry gate to the east will begin at an agreed time within the 26 week construction period. Work likely to cause the noise exposure at adjacent residences to exceed noise exposure targets by more than 10dBA will be conducted during the agreed 4 week construction period.

Traffic control during construction will be managed by the constructing contractor in accordance with normal Council and Department of Roads and Maritime requirements. A Traffic Management Plan will be required.

A 6 metre wide internal road from the relocated gate to the wheel wash (see Section 3.4 below) will be formed and compacted providing a constant gradient using, as far as practicable, materials obtained within the quarry. The road will avoid nominated hollow bearing trees. Material will be imported for tar sealing of this section of the access road. This work and the construction of the wheel wash will be coordinated, as far as practicable, with the construction of the access from Wisemans Ferry Road to limit the impacts on neighbours.

A temporary gravel access road from the wheel wash to the present site of the sand processing plant (at RL230) will be constructed early in the construction period (*Figure 10*). This road will be excavated to levels below the current ground surface to achieve a better than a 10% gradient. There will be adequate parking and turning space for trucks in the vicinity of the plant. This road will also be important for the transport of material within the quarry for the construction of the bunds. Large concrete blocks and earth mounds will be installed beside any excavated drops to ensure a safe operation.

Construction of the final access road to the east of the wheel wash, which will follow the northern boundary through cells 3 and 4 to an RL of 215 metres, will not take place until these areas are scheduled for excavation late in Stage 1 or in Stage 2 of the quarry's operation. Constructing the road through this area during the quarry's reinstatement would disrupt the orderly sequence of quarrying and produce substantial material that would have to be stockpiled for later processing. Stockpiling would be inefficient in terms of both noise generation, fuel use and carbon emissions.

The noise associated with the construction of this section of the road will be no different to that from quarrying operations to extract raw material. Dust control will be maintained through the use of a water cart.

The indicative routes of the temporary and permanent access roads to the east of the wheel wash are identified in *Figure 10* and *Figure 6* respectively.

2.3.4 Construction of the Wheel Wash

A concrete wheel wash will be constructed beside the internal access road in the location identified in *Figure 10*. The design plans of this structure and its association with the access road are at *Figure 14*. The principal earthworks and construction will be performed during the nominated 4 week heavy construction period.

The water supply for the wheel wash will be provided from a small existing dam on land to the south of the wheel wash (*Cell 7*) for the initial stages of the quarry's operation. Provision will be made to drain the wheel wash for maintenance through a silt trap or small settling pond for recycling though the dam. An alternative water supply will be needed for Stage 4 of the quarry's operation. Details of that facility will be provided in the management plan for Stage 3 or 4.

2.3.5 Surface Water Management

During the initial construction phase, surface water will be managed using the drains and containments that have been constructed and maintained in the past, except that:

1) drainage works will be incorporated into the construction of the Wisemans Ferry Road junction, temporary internal access road and the wheel wash. Drainage will be constructed to link with existing drainage infrastructure;

2) the aim will be to disperse rather than concentrate in drains the water flowing over newly rehabilitated areas and constructed bunds;

3) bailed hay, sand bags or gravel beds will be used to contain erosion and slow the flow of water in drains.

Any new infrastructure will be designed to tie in with the wider water management framework that will be developed during Stage 1 of the quarry's operation and described in *Part 6.1, Part 6.2* and *Figure 17* of this Management Plan.

All runoff from the site and quarry operations will be directed towards the centre of the property and to two storage ponds in the north eastern corner of the property to facilitate water reuse in the processing plant. Excess water will leave the site through an existing drainage channel and drain to the creek. Storm water directed on to the site from Wisemans Ferry Road will be diverted around the quarry to an existing drainage line along an easement on the southern boundary of the site. This drainage will not affect the hanging swamp in an adjacent property to the south. The swamp is above the level of this drainage line. Drainage from the north western corner of the site will be diverted around the quarry to an existing drainage line along the northern boundary.

2.3.6 Quarry Cleanup

Preliminary earthworks will be necessary within the existing disturbed area of the quarry to tidy up and shape the quarry floor and operating areas and to construct a safe operating environment. This work, which will be located well within the area approved for excavation, will be conducted during the 26 week construction period when it will provide essential material for the construction of noise attenuation bunds. The principal equipment used will be a bull dozer, a rubber tyred loader, excavator and a road or off-road truck.

There will be no excavation for product sand during this period. There will, however, be considerable transport of material within the quarry as material is moved and placed for the construction of the noise bunds.

Any waste material generated that is not suitable for the construction of the bunds, rehabilitation or road works within the quarry will be disposed of off site. Such waste is likely to be small in volume and limited to scrap steel, drums and equipment abandoned at the end of the past quarry operation. It is highly unlikely that contaminated waste will be encountered. Waste will be disposed of as described in *Section 2.3.10* below.

The drainage lines and temporary sedimentation ponds will be formed or restored during this period to prevent the contamination of runoff water. These works will be consistent with and directed towards the permanent water management infrastructure.

2.3.7 Reinstatement of the Sand Processing Plant and Loading Areas

The sand processing plant, product stockpiles and the loading area will remain in their present locations for Stage 1 and into Stage 2 of the quarry's operation. The area will be connected to the main access road via a temporary road, which is identified on the plans at *Figure 10*. This road will be surveyed and constructed during the construction period to a standard sufficient for the operation of heavy vehicles.

The area around the present processing plant will be cleaned up and made safe for its intended use. Clean material not suitable for product (mainly oversized material) will be used immediately for the construction of noise barriers or rehabilitation of the decommissioned tailings ponds. Other waste will be disposed of in accordance with the requirements of *Section 2.3.10* below. A clearly visible perimeter barrier in the form of an earth mound or large concrete blocks will be installed around the loading area to ensure the safe operation of vehicles.

The existing sand processing plant will be recommissioned towards the end the 26 week construction period. Testing will be conducted using product raw sand already stockpiled on the site.

2.3.8 Noise Management

The noise assessment prepared as part of the 2004 EIS predicted that some major construction work might result in noise exposure at two adjacent residences that exceeds the project assessment goals determined in accordance with the NSW Industrial Noise Policy. The Policy allows for work which results in an increase in the noise exposure of between 10 and 20 dBA above the goals to be conducted during a designated 4 week construction period. The timing of this work will be decided in consultation with the Gosford City Council. Less intrusive construction work which is likely to exceed noise exposure goals by less than 10dBA will continue throughout the overall 26 week construction period as allowed for by the Policy.

Work that might approach the project assessment goals for noise exposure will be performed during the nominated 4 week construction period at times most convenient to the residents. Periods and

locations of expected peak construction noise will be identified during planning. These times and locations will be notified to residents in advance.

Noise emissions throughout the construction period and operation of the quarry will be managed in accordance with the Noise Management Plan which forms part of this Plan of Management (*Part 6.4*). The noise management plan is based on the recommendations of an external noise consultant (*Appendix 10* of the EIS of March 2012) and safeguards proposed in the *Section 5.5.5* of the EIS of March 2012. The Noise Management Plan is consistent with the requirements of the New South Wales Industrial Noise Policy.

Particular attention will be given to minimising the noise of reversing alarms (consistent with safe operations), plant and vehicle exhausts and plant and vehicle cooling fans.

2.3.9 Air Quality Management

The quarry will make only an incremental contribution to vehicle pollution load in the locality. Principal sources will remain traffic on the F3 Freeway and Wisemans Ferry Road at the eastern and western boundaries of the site respectively. Diesel exhaust fumes from plant and vehicles may be noticeable within the quarry, although they are expected to dissipate rapidly. The operation of the quarry is unlikely to result in a deterioration of existing air quality levels beyond the property boundaries.

Most fixed plant in the quarry will be powered by mains electricity. Mobile plant and trucks engaged in haulage will generally be diesel powered.

A number of management actions will be undertaken to minimise the pollution load and to prevent significant impacts on nearby properties. These are set out in the Air Quality Management Plan at *Part 6.5*. The management actions are consistent with the recommendations of the air quality and greenhouse gas assessments conducted by *Air Noise Environment Pty Ltd* in 2011/12.

2.3.10 Services and Waste

The quarry is an existing facility that has long-established electricity and telephone services. These services have been maintained in working order. The primary overhead electricity service into the quarry will remain unchanged for the construction period, Stage 1 and the initial part of Stage 2 of the quarry's operation. Changes will be required when the plant is relocated to its final site during Stage 2. Quarry management will deal directly with the electricity supplier when the need arises. No approvals will be required prior to the Construction Certificate being issued.

Internal changes will be required to establish a site office and when the existing house is removed. Arrangements will be made with contractors and electricity and telephone authorities when these changes are needed.

The quarry does not have a town water supply or sewage service and there are no plans to connect these services. Water needed for sand processing and dust control will be drawn from resources within the quarry which are explained in detail in the EIS and this Management Plan Potable water will be collected from rainwater sources or brought on to the site.

In the short term, portable toilets serviced by a contractor will be used on the site. In the longer term a waterless environmentally friendly toilet system may be installed. Domestic waste water will be collected in a lined pit, treated and drained or emptied periodically on to a reclamation area away from the water management infrastructure. The volume of this water will be small. Oily waste will be collected in drums and disposed of by a waste contractor.

Some solid waste will be generated during the construction period. The majority of this will be clean waste generated by earthworks for road construction. This material will be used in the construction of the bunds or rehabilitation.

Any contaminated waste will be handled and disposed of in accordance with regulatory requirements. The most significant future waste will be asbestos cement sheet from the demolition of the existing residence and sundry sheds on the property. Removal and disposal will be performed by a licensed contractor. This will not occur until Stage 2 of the quarry's operation.

Any metallic waste generated will be recycled. General waste will be collected in an industrial hopper and removed by a contractor.

2.3.11 Other Hazards

Occupational health and safety plans and emergency plans will be displayed prominently on notice boards in the quarry office and the staff amenities area. All new staff will be required to provide evidence of appropriate training and qualifications for the work they are to perform. Additional training will be provided where appropriate.

Contractors will be briefed on OH&S and emergency procedures when they arrive at the site and required to sign an acknowledgment that this briefing has been received. Contractors will be required to show evidence of insurance where appropriate.

Areas of significant risk within the quarry will be identified with coloured webbing safety fencing until permanent protection can be put into place or work is completed. These areas will include quarry walls and other embankments and areas where heavy maintenance or reconstruction is being conducted.

There will be no requirement to store fuel on site other than the few litres required for small equipment such as a chainsaw. Fuel for small equipment will be stored in approved containers of less than 20 litres in a locked shed or shipping container adjacent to the quarry office. The storage will be identified with an appropriated sign.

The refueling of diesel powered plant will be performed by a contractor in the manner used at many construction sites across the region. The contractor's procedures will be followed and precautions maintained to eliminate spillage. Initially, refueling will be conducted on a prepared area to the east of the wheel wash. As the quarry is developed, refueling will be conducted elsewhere at identified sites. Refueling sites will be formed and surfaced with clay to ensure that any spillage will be contained. Any material contaminated during refueling will be quarantined for disposal off site in an approved facility.

The processing plant and pumps will be powered by mains electricity or by small diesel engines.

Lighting within the quarry will be limited to a few low wattage night-time security lights. All practical measures shall be taken to prevent or minimise off-site impacts of these lights and disturbance to wildlife. All external lighting will comply with Australian Standard AS4282(INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.

2.3.12 Traffic and Transport

A Transport and Traffic Management plan can be found in Part 6.7 of this Management Plan.

Road hazards to the public will be managed in accordance with Council and RTA requirements.

Loaded vehicles will be entering the quarry during the construction period carrying materials of various types and leaving the quarry with non-toxic waste. No product will be dispatched until approval is received from the Council for production to begin. All vehicles entering and leaving the quarry will be expected to have their loads and load areas covered in accordance with the rules applying to public roads.

All loaded vehicles leaving the site will be required to use the wheel washing facility once it has been completed to avoid depositing dirt on public roads. During the construction period, a sign will be erected before the gate advising the drivers of vehicles leaving the quarry to check their vehicles and remove manually any material that they might inadvertently deposit on public roads. This material should be no more than small amounts of residual sand picked up on tyres within the quarry. A water truck with a pump and hose will be available near the gate to wash vehicles if required.

Loading and unloading operations associated with the reinstatement and operation of the quarry will be confined to within the property. There will be times during the construction of the access from Wisemans Ferry Road, however, when contractors will have no alternative but to perform loading and unloading operations within the road reserve.

Contractors will be required to operate and maintain traffic control during the construction period in accordance with Council and RTA requirements.

There will be ample provision for quarry traffic to park within the quarry property.

2.3.13 Meteorological Station

An automatic meteorological station has been installed towards the north-western corner of the property adjacent to the power line, where it will be away from tree cover and remain undisturbed for the life of the quarry. A grassed area will be established around the equipment. Data on temperature, rainfall and evaporation will be recorded and reported in annual reports of the quarry's operations.

2.4. Hours of Operation During Construction

The operating hours approved by the Gosford City Council will be adopted. During the agreed construction period only the hours of operation will be:

Monday to Friday	7am to 5 pm
Saturday	7am to 1pm
Sundays and Public Holidays	Closed

PART 3

STAGING OF THE QUARRY OPERATION

STAGES 1 AND 2

3.1 Purpose and Scope of the Plan

The proposal is to reinstate and operate the Rindean Quarry in five stages. This part of the quarry management plant describes the staging of the quarry's operation in general terms and a work plan for Stages 1 and 2 which cover the first 5 years of the quarry's operation. An indicative program is provided for Stages 3, 4 and 5. Details of the operation in Stages 3, 4 and 5 will be provided in subsequent quarry management plans which will be completed and provided to the Gosford City Council before each stage begins.

3.2 Objectives and Targets

The quarry will be operated with the following objectives in mind:

1) to produce construction sand and related products for the Central Coast and Sydney markets. This objective is consistent with New South Wales State Government policy;

2) to conduct a safe and efficient operation;

3) to operate the quarry in a manner that will cause the minimum disruption to neighbours and the surrounding environment; and

4) to conduct a rehabilitation program progressively throughout the life of the quarry that will leave the property, when quarrying is completed, as a stable, erosion-free landform consistent with the local environment.

3.3 The Stages

The quarry will be developed and operated in the five stages described below.

*Stage 1 (*Years 1 and 2*)* of the quarry's operation will begin at the end of the construction period described above. However there is likely to be some overlap in regard, for example, to preliminary work related to the reinstatement of water management infrastructure and rehabilitation which may begin during the construction period. Stage 1 will involve a reinstatement of the quarrying and sand processing operation and a substantial start to the rehabilitation program (*Figure 5*).

Stage 2 (Years 3 to 5) will involve the beginning of a significant restructuring of the quarrying operation, the quarrying and preparation for rehabilitation of disturbed areas along the northern boundary of the property and the expansion of the rehabilitation program (*Figure 6*).

Stage 3 (Years 6 to 10*)* will involve an expansion of the rehabilitation program into Cells 3 and 4 and an expansion of the quarrying operation westwards towards Wisemans Ferry Road into Cell 6 (*Figure 7*). Topsoil from *Cell 6* will be used for rehabilitation.

Stage 4 (Years 11 to 19) of the redevelopment is planned to involve a progressive extension of the quarrying operation towards Wisemans Ferry Road and the possible establishment of new tailings and fresh water ponds. Areas no longer in use would be decommissioned and rehabilitated progressively. Present plans for Stage 4 can be regarded as indicative only (*Figure 8*).

Stage 5 (Year 20) will involve the decommissioning and removal of all plant and equipment, the final rehabilitation of the site to the rehabilitation plan and the final inspection of the site by the Council and other relevant authorities. The final form of the quarry after decommissioning is shown in *Figure 9, Indicative Final Landform*.

3.4. Work Program for Stage 1

1. Complete any outstanding work set down for the construction period (see above).
2. Begin rehabilitation at the south-eastern end of the property. Cap the two decommissioned former tailings ponds with reject material stored on site or won during the cleanup. Top dress and plant out this area as described in the rehabilitation plan including on the embankments in the south-eastern corner of the site to stabilise the area and create a visual barrier to quarrying operations.
3. Restore buffer areas and complete internal security fencing progressively as access is available.
4. Establish or restore progressively the basic infrastructure for sediment control and water management, including a central settling pond.
5. Tidy up and consolidate plant and product stockpiles in the area of Cell 3. Construct the temporary access road to this area.
6. Clean up *Cell 1* and *Cell 2* and establish a quarry floor at a nominal RL (relative level) of 215 metres AHD.
7. Establish a new tailings pond in the existing water storage pond to the east of *Cell 1*. The walls of this pond will be raised approximately 1 metre above the adjacent quarry floor and rehabilitation areas to exclude runoff from other parts of the quarry.
8. Restore and reform the present freshwater storage pond to be known as *Fresh Water Pond No 1* (FW1).
9. Construct a new fresh water storage pond in the north-eastern corner of the property adjacent to the present fresh water pond to be known as *Fresh Water Pond No 2* (FW2). Bench the north-eastern corner of the property adjacent to the pond and prepare for rehabilitation. Retain viable vegetation in the corner buffer of the property.
10. Construct a storm water retention basin on the quarry floor to RL 213 immediately to the west of the freshwater storage ponds. This basin will be equipped with a sump and pump capable of emptying it. Bench the northern wall of this basin and extend the benching into *Cell 3* as required.
11. Demolish the house above Cell 5 to allow future quarrying operations to extend to the west. Strip the topsoil when required for rehabilitation. Stabilise the surface.

3.5 Work Program, Stage 2

1. Construct the permanent access road to and along the northern boundary of the property in accordance with the plan for Stage 2 (*Figure 6*). The road will be constructed as an all-weather gravel road with safety barriers and a constant gradient of approximately 10%.
2. Bench between the road and the property boundary. Prepare benches for rehabilitation to link with the north-eastern corner, top dress and plant out.
3. Relocate the plant and product stockpiles into *Cell 2* in the centre of the property. Gear up to produce a full range of products on demand.
4. Quarry to final levels and bench *Cell 3* and *Cell 4* from the permanent access road to the centre of the quarry. Prepare benches for rehabilitation.
5. Extend the water management infrastructure as required.
6. Begin the quarrying and benching of *Cell 5*.

PART 4

THE DESIGN AND OPERATION OF THE QUARRY

4.1 Quarry Design and Layout

The design and layout of the quarry will be as described in this plan of management and in the accompanying survey plans. The quarry design and layout will evolve as the quarry expands from Stage 1 into Stages 2, 3 and 4 within the overall footprint. Changes that become necessary during this evolution will be dealt with and made public in subsequent management plans.

4.2 Reinstating the Operating Base

An initial working quarry floor will be established in *Cell 1* and *Cell 2* (*Figure 5*) at or near RL215. *Cell 3* and *Cell 4* will be cleaned up. The sand processing plant will be reinstated and consolidated in *Cell 3* together with product stockpiles. These operations will produce a quantity of raw material which will be stockpiled temporarily in *Cell 4* and processed progressively into saleable product as washed or dry screened sand. Any material recovered that is not suitable for production will be used immediately in the capping the decommissioned tailings ponds.

Water management and erosion control infrastructure and operations will be restored in accordance with the Erosion Sediment Control Plan and Surface Water Monitoring Program (*Part 6.2* below and *Figure 17*). A new fresh water storage pond will be constructed in the north-eastern corner of the quarry property with a floor at RL 211 metres to supplement present process water storage and water conditioning infrastructure. It will be managed in association with the present adjacent fresh water storage pond.

A new tailings pond will be established in a present water storage pond. This pond, which for some years, has contained clean surface water that has drained through the site from up-slope or is groundwater seepage from existing quarry faces, will be pumped into the fresh water storage ponds. The wall of the tailings pond will be raised above the level of the general quarry floor to exclude water from surface runoff and seepage. Water in the pond will be maintained at a level at least 1.5 metres below the top of the wall to allow for rainfall from a 1% AEP storm event. Little other work should be needed to establish the tailings pond which has been a stable water storage for some time.

The base level for water management will be RL215 which is the level of the existing spillway of the fresh water pond. This level will also provide the base level for the quarry floor. Part of the quarry floor will be excavated to a level two metres below this level (RL213) to form a storm water retention pond. Water will be pumped, as required, from a sump in the pond to the first of the fresh water storage ponds to ensure that it remains empty.

4.3 Quarry Operations

4.3.1 Topsoil Stripping And Management

The natural topsoil throughout the site is a sandy loam up to 30cm thick overlaying an overburden horizon approximately 1.5 to 2 metres thick. However, because of the extent of disturbance of the site through past sand quarrying, gravel extraction and agriculture, there are few if any areas that can be regarded as exhibiting the original soil profile. The amount of topsoil suitable for rehabilitation that is available on the site will be limited and, in the long term, may be insufficient for rehabilitation needs. The need for topsoil will, in most instances, be established ahead of its availability.

The stripping of topsoil and overburden will be performed using an excavator and a small haul truck or a road truck. The noise of the stripping operation is likely, therefore, fall within the noise goals set for all stages of the quarry's operation which assumed that a noisier bull dozer would be used.

Areas to be stripped will be sprayed with a glyphosate herbicide 3 to 4 weeks before topsoil stripping to kill weed growth. Alternatively, areas to be stripped will initially be scalped to remove weed growth if this action is considered necessary by the rehabilitation specialist. Any scalpings will be buried at a depth sufficient to prevent seed germination within an area being rehabilitated.

Existing vegetation will be retained on all areas not required for quarrying or ancillary operations.

As the quarry operation extends into new areas, topsoil will be stripped by an excavator immediately prior to quarrying. Overburden that is not suitable for processing as product will be set aside for use in rehabilitation. All material will be taken directly to rehabilitation areas by truck and, in most instances, spread shortly afterwards. The storage of topsoil other than for short periods will not be required.

The first of the areas to be stripped will be the area identified in *Figure 5* as *Cell 5*. This will occur towards the end of Stage 1 or in Stage 2.

4.3.2 Resource Extraction

The main resource is horizontally bedded friable sandstone of varying grades of hardness, grain size, clay content and colour interspersed with horizontal bands of ironstone gravel that are typically less than 20cm thick. In a few areas, the continuity of the sandstone is broken with inclined beds of soft shale. A geologist will be consulted as required to advise on the stability of the parent material and the quarry faces and benches.

Both the ironstone gravel and the shale can be regarded as secondary resources although, in the short to medium term, they will be treated as coarse reject material that will be used to establish caps on the decommissioned tailings ponds.

The friable sandstone will be extracted from the working face or bench by ripping with a D9 or equivalent bulldozer which is the common practice throughout the industry. An excavator will be used in areas where a bulldozer cannot operate with safety. Benches will be established along all quarry faces as required by the amended consent. The inclination of quarry faces will vary between 33 and 70^0 depending on the long-term stability of the sandstone.

There will be no blasting.

Primary crushing of the sandstone will be performed by the bulldozer on the quarry floor. Past experience in the quarry has indicated that no other crushing will be necessary prior to the raw material being screened.

Laterite and shale will be extracted separately using similar methods and transported directly to the areas being rehabilitated.

Resource extraction will begin in *Cell 1* and *Cell 2* and continue there until the final RL for the quarry floor is reached. Material extracted from the site of the new water storage pond as part of its construction will be used as product or material for rehabilitation according to its characteristics. Construction of the permanent access road will also produce material suitable as product. *Cell 3* and *Cell 4* along the northern boundary of the property will be quarried to their final levels and profiles during Stage 2. The working face will be benched along the northern and western boundaries of these cells to the profiles required for final rehabilitation. Extraction will then move into *Cell 5* prior to which the quarry house will be removed. This extraction program is expected to be completed within the first five years of operation.

Subsequent resource extraction will be a benched operation continuing in a westerly direction from *Cell 5* towards Wisemans Ferry Road. The final profiles of the side walls of these operations and of the final face adjacent to Wisemans Ferry Road will take account of requirements for final rehabilitation.

The final quarry floor will generally slope from RL217 metres in the western end of the excavation to RL215 metres in the eastern end.

4.3.3 Raw Material Handling

The sandstone varies in colour, texture and hardness in different parts of the quarry. These differences in raw materials lead to different products required by industry. As a general rule, the crushed sandstone will be loaded by a wheeled loader into a small haul truck and transported directly to the receiving hopper on the screening plant. This approach to raw material handling avoids double handling, thereby reducing plant operating time, fuel use and noise emissions

Raw material will generally be extracted at a rate consistent with the capacity of the processing equipment and demand for product. Other than during the initial stages of the reinstatement, it is not

intended to stockpile significant amounts of raw material. Some stockpiling of raw sand will be necessary from time to time if, for example, a grade of sand has to be quarried for operational reasons but cannot be processed immediately.

4.3.4 Sand Products

The quarry will produce a range of dry screened and washed sand products to satisfy market demand. The principal products that will be sold and the estimated volumes of each are listed in *Table 4.1.* There are growing markets both locally and in Sydney for each of these products.

At a 50% production rate of 75,000 tonnes per annum, the quarry would produce approximately 1,500 tonnes of saleable product per week and an average of 200 tonnes per week of overburden and fine reject material that would be used on site for rehabilitation. At the maximum production rate of 150,000 tonnes per annum, the quarry would produce approximately 3,000 tonnes per week of saleable product and an average of 400 tonnes per week of overburden and fine reject material.

Different grades of sand will be produced to satisfy the specifications for concrete batch mixing, mortar sand or other products. These specifications will be met by selecting suitable raw material for processing, adjusting the washing process or remixing measured amounts of clay fines into washed sand product. The proportions of individual products produced will depend upon demand.

Table 4.1 - Estimated Annual Production of Product Types

Product	**Tonnes Per Annum at 50% Production (75,000tpa)**	**Tonnes Per Annum at 100% Production (150,000tpa)**
Unwashed sand for construction fill and horticulture	15,000	30,000
Yellow and white graded sand as mortar sand	20,000	40,000
Washed and graded sand for concrete production	35,000	70,000
Coarse reject material and overburden (1)	5,000	10,000
Total Saleable Product	**75,000**	**150,000**
Fine reject material (tailings)	5,000	10,000

(1) A substantial proportion of this material will be used for rehabilitation work.

The fine material, consisting of the silt and clay fraction of the raw material with a particle size of generally less than 75 microns, is estimated to be 12 to 15% of the raw material. The washing process separates the fine material from the coarse product and the resultant slurry is disposed of in the tailings pond. The tailings are essentially inert and pose no threat to humans or the environment. They contain residual nutrients from the raw material and, therefore, will be added to material being used for rehabilitation. Product that is not washed will retain the fines.

4.3.5 Sand Processing

Raw material will be fed from the receiving hopper to a vibrating screen by conveyor. Screened material will pass to a hopper below. A proportion of the screened material will be diverted from the processing stream to separate stockpiles to be sold as dry-screened or unwashed product. The remainder will be transported by conveyor to the washing plant. Coarse reject material will be stockpiled nearby for sale as fill or for transport to rehabilitation areas.

Unwashed or dry screened sand will be the principal product throughout Stage 1. Accordingly water demand for sand processing is likely to be small.

The main components of the plant for dry screening are:

- a raw material receiving hopper;
- a conveyor feed to a vibrating screen system; and

- a conveyor to transport screened sand to stockpiles.

A portion of the screened sand will pass through a single wash process to remove the majority of the silt and clay fraction from product sand. Washed sand will be dried and stacked on product stockpiles. Additional components of the plant for this process are:

- a conveyor to transport screened sand to the washing plant;
- a washing hopper or constant density tank discharging washed sand product and fine waste at separate outlets;
- a sand pump and feed to a cyclone mounted on a radial stacker;
- a graded product stockpile area;
- a tailings pond;
- a system of catch drains to collect runoff from the processing area and transfer it to a sediment pond and the fresh water pond; and
- a series of pumps to handle clean water and water contaminated by tailings.

The fixed equipment will be powered by a stationary diesel motor or by mains electricity.

The washing system will consist of a constant density tank that will be fed unwashed graded sand and clean process water. In a constant density tank, coarser sand grains settle out of the slurry that is formed in the tank and are pumped to the cyclone water separators. The fines are maintained in suspension by the water flow and discharged as a wet slurry near the top of the tank.

The plant presently available at the quarry has a washed product capacity of approximately 80 tonnes per hour although it will be operated normally at an average of 50 tonnes per hour. Calculations for this assessment have been based on a 50 tonne per hour output. Water use through the plant is expected to average 2,800 litres per tonne of product or 0.14 megalitres of water per hour. This is consistent with industry guidelines. The majority of the water required will be recycled through the washing and tailings management processes. The plant will need to operate for less than 30 hours per week or 6 hours per day to achieve the maximum production of 70,000 tonnes per annum of washed product (*ie,* with the quarry operating at a total output of 150,000 tonnes per annum).

A slurry of washed sand product and water will be pumped to one of two cyclones mounted on a radial stacker in the product stockpile area. The cyclones will separate the sand product from the water by a centrifugal operation driven by the water flow. Dewatered sand will fall from the cyclone to a conical stockpile below and extracted water will be recovered and conditioned through the water management system for reuse. Separate stockpiles for individual products will be created within the radius of the stacker arm. The stockpile area will be graded to facilitate the recovery of residual water draining from the product stockpiles. Trucks will be loaded with product directly from the stockpiles by a rubber tyred loader.

The slurry containing the fines will be pumped directly to the western end of the tailings pond, forming a beach there to facilitate dewatering of the tailings. Past experience in the quarry has indicated that the settling process will occur relatively rapidly due probably to the naturally low pH (slight acidity) of water in the area. A single large tailings or settling pond is, therefore, considered sufficient to separate the fines from the tailings water without the use of flocculants.

Water will be pumped or syphoned from the surface at the eastern or down-slope end of the tailings pond, directly to the northern fresh water water storage pond. A floating pickup and suction hose will ensure that sediment is not picked up by the pump or syphon.

Initially in Stage 1 of the redevelopment, the processing plant and the product stockpiles will remain where they are now below an existing quarry face in *Cell 3*. The receiving hopper will be fed from Cell 4 which is at a higher level. The plant and stockpiles will be moved to *Cell 2* in the centre of the property during Stage 2 of the operation (*Figure 6*). Plant noise will be contained by locating the processing equipment and product stockpiles initially below a quarry face and subsequently behind a residual bund left on the quarry floor. The plant will remain towards the centre of the property throughout the later stages of the development although it may be moved to the west with the progression of the quarrying operation.

A plan of the initial layout of the processing plant and stockpiles is at *Figure 15*. The layout of the washing plant will be similar after it is moved to *Cell 2* during Stage 2 of the quarry's operation. *Figure 16* is a schematic diagram of the washing process and water demand.

4.3.6 Sand Stockpiling

Product stockpiles will be located within a quarry cell adjacent to the processing plant where the existing quarry faces or a residual bund will be used to screen the noise of the plant and loading operations. The access road will lead directly to the stockpile area.

Stockpiles will have a conical or elongated conical shapes and a natural fall slope of approximately 35^0. Separate stockpiles will be maintained for each sand product.

Stockpiles will be maintained at a level that will provide a buffer against expected demand, the need to stand machinery down for maintenance and inclement weather. It is expected that total stockpile of product will be maintained at approximately 6,000 tonnes or less.

4.4 Hours of Operation

The approved hours of operation will be:

Monday to Friday	7am to 6pm
Saturday	7am to 1pm
Sundays and public holidays	Closed
Maintenance	Saturday 7am to 6pm and Sunday only if critical repairs are necessary

The first hour of the morning will be restricted to loading and haulage operations. Resource extraction and processing will not begin until 8am.

4.5 Community Relations

Cleve Smith Excavations Pty Ltd has made a number of commitments to reduce or offset the impacts of the quarry that might be felt by neighbouring residents.

A telephone answering system and a computer will be installed to take and record incoming phone calls, including those related to concerns or complaints by neighbours and other members of the public.

1) The telephone number and email address will be in public directories and on a sign at the gate.
2) Reasonable efforts will be made to respond to complaints on the day that they are made.
3) The response might be action within the quarry to reduce or eliminate the source of concern, if such action is feasible, without referral to the complainant.
4) Otherwise a response will be made on the following business day.
5) All calls will be logged and a record of the nature of the call and the action taken will be maintained for audit purposes.

Neighbours will be consulted in regard to the timing of works during the construction period and prior to occasions when works likely to generate higher than normal noise levels are to be conducted.

1) Consultation will take the form of a telephone call, visit, letter or pamphlet.
2) The aim will be to ensure that non-routine work generating significant noise is conducted at times when it will cause the least disturbance to neighbours.

The hydrogeological assessment conducted for the 2004 Environmental Impact Statement concluded that extending the quarry might affect the yields in adjacent bores. A commitment was given, therefore to deepen the bores at residences R1, R3 and R4 if it could be demonstrated that the quarry had affected the ground water supply.

The public is warned that Rindean Quarry is an industrial site in which heavy machinery will be operating. Public access cannot be permitted without a prior appointment with the quarry manager.

PART 5

AUDITING AND REPORTING

5.1 Annual Audit Inspections

An audit inspection will be conducted annually by an independent auditor. The auditor's report will address those matters identified in the audit schedule as well as those matter that the auditor identifies in the course of his or her audit.

5.2 Reporting

Audit reports in Years 2 and 5 will be submitted to the Council 3 months before the anniversary of the Construction Certificate being issued. Audit reports for the intervening years will be submitted to the Gosford City Council on the anniversary date. The reports will be public documents.

A diary or day book will be maintained in which both routine inspections and significant events or actions will be recorded.

Table 5.1 Report Schedule to the Gosford City Council, Stages 1 and 2

Timing	Nature of the report	Matters to be addressed
6 months from date of commencement	Initial report on the reinstatement of the quarry	Matters as set out in the amended development consent.
End of Year 1	Annual audit report	Report of the operation of the quarry with particular attention to matters identified in *Table 5.2.*
3 months before the end of Year 2	Report on performance in Stage 1	Report of the operation of the quarry.
End of Year 3	Annual audit report	Report of the operation of the quarry with particular attention to matters identified in *Table 5.2.*
End of Year 4	Annual audit report	Report of the operation of the quarry with particular attention to matters identified in *Table 5.2.*
3 months before the end of Year 5	Report on performance in Stage 2	Report of the operation of the quarry.

Table 5.2 Rindean Quarry, Inspection, Audit and Reporting Requirements

Action	Frequency	Response
Operations		
Total tonnage of products exiting the quarry gate	Annual	Report in annual audit report.
Tonnage of individual products exiting the quarry gate	Annual	Report in annual audit report
Opening and closing times outside the approved limits	All occasions	Record instances with reasons. Report in annual audit reports.
Complaints from the public	All occasions	Record instances, the nature of the complaint and action taken. Report in annual audit report.

Groundwater management

Test static water levels, and water characteristics in bores on properties R1, R3 and R4	At the start, 6 monthly monthly for 2 years then annually	Report to Council at six months then annually Implement commitment to redrill adjacent bores if required.
Test yield in bores at residences R1, R3 and R4	At the start then biennially	Report to Council in relevant reports.
Test water characteristics in test bores on properties on BH1, BH4 and BH5 within the Rindean property	At the start, 6 monthly for 2 years then annually	Report in annual audit report.
Photograph sites of significant seepage from quarry walls Sample water and test characteristics	At the start, 6 monthly for 2 years then annually	Report in annual audit report
Test static water levels, and water characteristics in 3 selected bores at 600 metres from the quarry	At the start, 6 monthly for 2 years then annually	Report to Council in relevant reports
Test yield in 3 selected bores 600 metres from the quarry	At the start then biennially	Report to Council in relevant reports

Surface water management

Visually test water in fresh water ponds for sediment load	Weekly and after heavy rain	Record results and respond as required
Sample and laboratory test water in freshwater ponds against criteria	At the start, 6 monthly for 2 years then annually. After unusual storm event	Report in annual audit report
Record water usage in processing plant	Weekly	Report in annual audit report
Sample and laboratory test water at the nominated site in the creek upstream from the quarry outlet	At the start, 6 monthly for 2 years then annually. After unusual storm event	Report in annual audit report

Meteorology

Check gauge and record rainfall	Daily	Report in annual audit report
Download and record other met data	Weekly	Report in annual audit report

Erosion and sediment control

Inspect drains and silt traps	Weekly and after heavy rain	Clean and repair as necessary
Inspect sediment ponds, the tailings pond and the wheel wash	Weekly	Clean as necessary or when sediment reaches 50% of capacity
Inspect water levels in sediment ponds, the tailings pond, the wheel wash and the storm water retention basin	Daily or as necessary.	Drain or adjust levels as necessary
Inspect quarry surfaces and rehabilitated areas for erosion	Monthly and after heavy rain	Restore as necessary

Vegetation and Rehabilitation

Inspect freshly completed rehabilitation	Weekly for first month then monthly by staff	Irrigate as required Report concerns to contractor
Inspect established rehabilitation	6 monthly by quarry staff	Report concerns to contractor Restore as necessary or directed

Identify and remove weed growth	Monthly	Consult contractor when significant action required
Record the amounts and nature of material brought on to the site for use in rehabilitation.	All occasions	Report in annual audit report
Inspect the protective guards installed around significant vegetation.	Monthly to 3 monthly as required.	Replace or repair as required.
Inspection by a rehabilitation specialist to assess the success of the program	During Year 2 and Year 5	Report to Council
Inspect all rehabilitation	Annually	Report in annual audit report.

Hazards

Inspect work areas, roads, plant and stockpiles for safety issues	Daily	Rectify or isolate as necessary
Inspect work areas, roads, plant and stockpiles during dry weather to identify dust hazards	Frequently as required.	Apply water or stop work causing a dust hazard as required.
Inspect plant and equipment to ensure that it is operating correctly and within specification, particularly in regard to noise, fuel and oil leaks and safety.	Daily	Rectify problems Avoid the unnecessary use of audible alarms.
Inspect emergency equipment to ensure that it is complete and in working order.	Weekly	Rectify any deficiencies
Inspect the perimeter fence and internal safety fences.	Monthly to 3 monthly as required.	Repair as required

PART 6

ENVIRONMENTAL MANAGEMENT PLANS

STAGES 1 AND 2, YEARS 1 TO 5

Part 6 contains environmental management plans for the potential sources of environmental impact resulting from the quarry's operation. Each forms a part of the overall Quarry Management Plan.

The individual plans are:

6.1 Groundwater Monitoring and Management Plan

6.2 Erosion and Sediment Control and Surface Water Monitoring Plan

6.3 Rehabilitation Strategy and Landscape Management Plan

6.4 Noise Management Plan

6.5 Air Quality Management Plan

6.6 Safety, Hazard and Waste Management Plan

6.7 Transport and Traffic Management Plan

RINDEAN QUARRY, SOMERSBY, NSW

6.1. GROUNDWATER MONITORING AND MANAGEMENT PLAN

April 2012

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Table 1 *Height of the Water Table in Monitoring Bores Located on the Rindean Quarry Property, RCA Australia, April/May 2004*

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Table 3 *Existing Bore Data, Rindean Quarry Environs, from RCA Australia, March 2004*

Table 4 *Effect of Decrease in Saturated Thickness on Local Bores, RCA Australia, November 2005.*

Table 5 *Predicted Maximum Flowrates of Groundwater from Quarry Faces, August 2004*

Table 6 *Prediction of Maximum Seepage of Groundwater from Quarry Faces based on the EIS of September 2004, Recalculated for the Department of Water and Energy, October 2008*

Table 7 *Prediction of Maximum Seepage of Groundwater from Quarry Faces based on the Consent of 17 September 2007, Calculated for the Department of Water and Energy, October 2008*

Figures

Relevant figures are:

Figure 19 *Groundwater [Test] Bore Locations, Rindean Quarry, Somersby (from EIS Appendix 4, Hydrological Investigation, RCA Australia)*

Figure 20 *Rindean Quarry, Locations of Local Water Supply Bores*

1. Purpose and Scope of the Plan

This plan describes plans for the monitoring and management of groundwater in the Rindean Quarry. It is part of the Management Plan for the Quarry.

It is consistent with the consolidated conditions of the consents issued by the Gosford City Council on 20 June 2006 and 17 September 2007 in regard to Development Application No 26467/2004 for the redevelopment of the Rindean.

The Groundwater Monitoring and Management Plan below is identical in most respects to that dated February 2011 and approved by the NSW Office and Water in correspondence of 13 May 2011. Minor changes have been made to bring the text up to date. As the proposal contained in the EIS of March 2012 is identical in all significant respects to the proposal to which the consolidated consent applies, this management plan is regarded as valid in regard to the March 2012 proposal.

RCA Australia Pty Ltd was engaged to undertake a hydrological study of the site and to report on the potential impacts on groundwater in the local area of an expanded operation in the quarry. The principal report prepared by RCA Australia and dated August 2004 is at *Appendix 7* of the EIS. A supplementary report prepared by RCA Australia at the request of the Gosford City Council was submitted to the Council on 9 December 2005 (*Appendix 8* of the EIS). Both reports have been taken into account in preparing the plan submitted to and approved by the NSW Office of Water.

2. Summary of the Plan

2.1 Water Management System

The water management system for the quarry is based on the maximum reuse and recycling of water within the site. The water management system consists of;

1) a network of gravity drains to collect runoff from all sources including groundwater seepage from the quarry faces. The pattern of this network will change as the quarry is developed;
2) in-line settling ponds to reduce sediment in water being recycled;
3) two storage ponds in series to maintain a reserve of water for quarry needs and to condition this water. Water which is excess to needs will leave the site through these ponds and an existing lined drain to an adjacent creek;
4) a storm water retention basin;
5) a tailings pond in which clay fines will settle out of process water. Water from this pond will be returned to the water management network; and
6) various pumps and pipelines.

The recovery of groundwater in Rindean Quarry is incidental in that it accumulates through quarrying operation intersecting several superficial aquifers in the area which respond quite rapidly to variations

in rainfall. During the prolonged dry period up to 2009, seepage from the quarry faces all but stopped. Throughout 2010, 2011 and the first quarter of 2012 the seepage was active.

2.2 Groundwater Monitoring Program

The accumulation of groundwater within the quarry occurs solely through seepage from open quarry faces and is incidental to the quarrying operation. It is not feasible to isolate this water from runoff caused by rainfall or to measure the volume of seepage from the quarry faces of an active quarry, where extraction is changing the quarry profile. Therefore, there can be no specific actions to manage this water.

The water monitoring program has the following elements:

1) measurement of the water levels and the analysis of water quality at the five monitoring bores drilled by RCA Australia for groundwater analysis in 2004 before work commenced on the site and at intervals specified below thereafter;

2) measurement of the levels and the analysis of water quality in bores located at residences identified as R1, R3 and R4 before work commences on the site and at intervals specified below thereafter subject to the agreement of the residents;

3) yield testing at the bores located at residences identified as R1, R3 and R4 before work commences on the site and at intervals specified below thereafter; and

4) descriptive and photographic monitoring of surface flows from the face of the quarry throughout the life of the quarry. Analysis of water quality before work commences and at intervals specified below thereafter.

2.3. Groundwater Contingency Plan

Commitments have been made and the consolidated conditions of consent required the quarry operator to monitor the effects of the quarry on groundwater levels and quality and to compensate three adjacent property owners by augmenting their bore water supplies if they are found to be affected.

3. Groundwater Use and Hydrology

The regional climate, geology, surface hydrology and groundwater hydrology are described in *Section 5* of the April 2012 EIS.

The August 2004 and November 2005 reports prepared by RCA Australia provided the basis for the analysis of potential groundwater impacts. Initial modelling was based on a 15% recharge rate. RCA Australia subsequently undertook further modelling of the groundwater based on a lower (11%) recharge rate at the request of the Gosford Council to reflect the lower than average rainfall being experienced in the area at the time. RCA Australia reported the results of the revised modelling in an addendum to its original report. Both the initial and supplementary analyses performed by RCA Australia and have been taken into account in the preparation of this groundwater monitoring plan.

3.1 Existing Groundwater Use

A borehole search undertaken by RCA Australia in 2004 using the then Department of Infrastructure, Planning and Natural Resources (DIPNR) records identified 21 registered bores within a 1.2 km radius of the quarry (*Figure 20*). The registered bores, used for irrigation, domestic or stock purposes, are drilled to depths of 20 to 60 metres within the sandstone formations. Static water levels recorded at the time of drilling varied between four and 20 metres.

A registered bore (GW056164) is present on the Rindean Quarry site in the vicinity of the residence. This has been used only as a domestic supply. It is not required for any purpose associated with quarrying and will be decommissioned when the house is demolished. It will be removed as excavation moves into its location. No bores will be maintained on the site for water supply.

Groundwater seeps from the existing quarry faces at rates that vary with rainfall patterns and the area of quarry face exposed. This water accumulates in the present water management system. Water

that is excess to needs will flow from the site along an approved drain to an adjacent unnamed tributary of Narara Creek that flows through Gosford West to Brisbane Water.

Some neighbouring properties collect and use water from naturally occurring springs for various purposes.

3.2 Groundwater Hydrology

The site is located on the eastern fringe of the area classified as the Brisbane Water Groundwater Source (Zone 3) in the *Water Sharing Plan for the Kulnura Mangrove Mountain Groundwater Sources, Water Management Act 2000*.

The Hawkesbury Sandstone formations support well-developed aquifers. Aquifers higher in the sandstone sequence appear to be associated with near horizontal bands of ironstone that act as aquitards (barriers to the movement of water within the geological profile). Aquifer recharge is local from rain falling within the area. Aquifer discharge through surface springs and, in the instance of Rindean Quarry, through quarry faces demonstrates some interaction between surface and ground water.

The lowering of the water table and a reduction in natural surface discharge in the area in drought conditions to 2009 indicate that the height of the water table is influenced in the relatively short term by significant changes in rainfall. Observations by RCA Australia are that the water table can vary in height by up to four metres with seasonal conditions. Monitoring records for a bore on the nearby agricultural research station indicate that locally the variation is in the order of one metre and that the lag between rainfall peaks and peaks in bore water level is four to six months. Changes in water levels in bores due to rainfall variation in the Somersby area differ between sites and regional variations range between one and four metres.

Groundwater levels were measured at the five monitoring bores drilled on the site in March 2004 (*Table 1*). Groundwater occurred at the time of measurement at relatively shallow depths of between three and ten metres below the surface. The variation of groundwater levels observed was consistent with both the topography and structural geology of the area.

The groundwater flow was determined to be in an easterly direction across the site. The average hydraulic gradient was calculated to be 0.08m/m. Groundwater flow rates were estimated to be between 0.89m and 1.48m per year.

Groundwater from three of the monitoring bores on the site was analysed for water quality. Bore BH2 was selected as being representative of up-gradient water quality and BH4 for down-gradient conditions. Water from BH1 was analysed after an odour of effluent was detected during drilling (*Table 2*).

Drilling records for bores within 1.2 kilometres of the quarry site indicate the presence of aquifers at depths of approximately 10 to 15 metres and 20 to 30 metres below the surface (*Table 3*). This is consistent with observed seepage associated with ironstone bands at the quarry face. Available water quality records indicate that water in these aquifers is acidic (pH~4.5) and is, therefore, outside the drinking water aesthetic guideline adopted by the Department of Health of pH 6.5 to 8.5 based on *Australian Drinking Water Guidelines, NHMRC/ARMCANZ 1996*, and *Guidelines for Drinking Water Quality, WHO, 1996*. No guideline value is given for pH on health grounds.

The results of modelling the groundwater drawdown by RCA Australia in 2004 and the comparative results using a 15% and an 11% recharge rate in November 2005 are at *Table 3 and Table 4* respectively.

3.3 Proposed Use of Groundwater

It will not be practicable to divert past the water management system water that seeps from the quarry faces. It will, therefore be collected in the system and continue to be one of several sources of process water for sand washing.

Estimates were made of the volume of water expected to seep from the quarry faces for the EIS *(Table 5).* The calculation of the volumes available used an average porosity of 4%, a mean permeability of 1.7×10^{8}m/s and a hydraulic gradient of 0.08m/m. The average depth to the aquifer was calculated using a 5 metre draw-down effect predicted during investigations by RCA Australia in 2004.

Subsequently the estimate of volume was amended for comparative purposes *(Table 6)* and to take account of the smaller area of quarry face that would be exposed by the extent of excavation allowed by the development consent of 17 September 2007 *(Table 7).* The estimated volumes in *Table 7* are those used for the preparation of this plan of management.

Measures of groundwater seepage obtained in December 2010 and January 2011 indicated that the seepage of water at that time was in the vicinity of 5ML per annum which is less than the estimate of existing seepage calculated for the September 2004 EIS. As it will be impractical to measure groundwater once quarry operations resume, estimates of future seepage as the quarry expands will be based on the 2004 and subsequent predictions described above. These estimates can be regarded as likely maximum flows when the ground is saturated from peak seasonal rainfall.

A water access licence (aquifer) was granted in 2009 with a zero allocation (20BL172145 dated 20 April 2009) by the Department of Water and Energy for the use of groundwater by the quarry. Since the licence was granted, a 5 megalitre groundwater allocation has been purchased and a 10 megalitre groundwater allocation has been leased. Both have been registered with the NSW Office of Water as dealings.

4. Groundwater Monitoring Program

4.1 Elements of the Program

The water monitoring program has the following elements:

1) measurement of the water levels and the analysis of water quality at the five monitoring bores drilled by RCA Australia for groundwater analysis in 2004 before work commences on the site and at intervals specified below thereafter;

2) measurement of the levels and the analysis of water quality in bores located at residences identified as R1, R3 and R4 before work commences on the site and at intervals specified below thereafter subject to the agreement of the residents;

3) yield testing at the bores located at residences identified as R1, R3 and R4 before work commences on the site and at intervals specified below thereafter; and

4) descriptive and photographic monitoring of surface flows from the face of the quarry throughout the life of the quarry. Analysis of water quality before work commences and at intervals specified below thereafter.

4.2 Establishing a Baseline

A baseline for assessing the effect of the quarry on groundwater is established by the data presented in *Tables 1* to *7* below. This data will be supplemented by data collected against each of the elements of the water monitoring program before work commences on the site.

4.3 Monitoring of Boreholes

Five boreholes are located at Rindean Quarry; two bores are located up gradient of the existing quarry and three are located down gradient (*Figure 1*). Static water levels and water characteristics in these bores were tested immediately after drilling (*Tables 1* and *2*). Bores BH1, BH4 and BH5 will be tested before operations begin and, thereafter, at six monthly intervals for the first two years and then annually during the audits of the quarry's operation. [

Bores located at residences R1, R2, R3 and R4 will be tested for:

1) static water level and water characteristics before operations begin and, thereafter, at six monthly intervals for the first two years and then annually: and

2) yield at two yearly intervals during the audits of the quarry's operation subject to the consent of the owners.

Three selected bores at a distance of 600 metres from the quarry will also be tested using this regime provided that adequate drilling and initial water data is available from Department of Primary Industries records. Additional bores within a radius of 600 metres of the quarry may be tested if there is a compelling reason do so. Cleve Smith Excavations will have no responsibility for testing unregistered bores or bores drilled after 1 January 2005.

This testing regime is considered sufficient for the monitoring program and no further boreholes are planned.

4.4 Monitoring Analytes

The number and types of analytes to be sampled and tested will be those found in *Table 2*. Other bores will be tested for static water level and drawdown only.

4.5 Monitoring Protocols

Static groundwater levels will be tested using a measured dip meter with a water level sensor and electronic whistle.

Groundwater sampling will use the following process depending on access:

1) the bore will be purged to evacuate the stagnant water from the casing and promote inflow of in-situ groundwater from the adjacent aquifer. Calculations on the volume of water to be purged are dependent on the height of water in the borehole and the diameter of the borehole casing. All purging will utilise a stainless steel bailer;

2) after the bore has refilled following purging, a sample will be taken with the stainless steel bailer and placed into standard sample bottles; and

3) the bailer will be decontaminated between sampling rounds by washing with several litres of water containing a biodegradable phosphorus-free detergent and rinsing with a couple of litres of potable water. Waste water will be disposed of away from the borehole and watercourses.

If access is restricted by pumping equipment and the above regime is, therefore, not practicable, an alternative testing regime using pumping equipment on the bore will be adopted. The revised regime will be documented in the audit report.

All water samples will be transported to an accredited laboratory for testing within 24 hours of sampling under a chain of custody documentation. Samples will be maintained at a temperature of less than 4^{o}C.

4.6 Reporting

The results of the water monitoring and testing program be included in the annual audit reports of the quarry's operation submitted to the Gosford City Council. The reports will be public documents.

5. Groundwater Contingency Plan

Cleve Smith Excavations will redrill at its expense existing bores at residences R1, R2, R3 and R4 if testing identifies a significant lowering of the static water level within or a significant loss of water supply from the bores. Redrilling of bores at R1 and R2 will be performed after the initial round of testing has been completed. Bores at R3 and R4 will be redrilled during Stage 2 and Stage 4 of the quarry's operation if required. Criteria for redrilling the bores will be based on the advice from a qualified hydrogeologist and consultation with the respective owners.

The results of baseline monitoring and the agreed groundwater monitoring program will be assessed by RCA Australia or another suitable hydrogeologist at two years and five years after the quarry commences operation. If the results vary significantly from predictions contained in the hydrological study conducted by RCA Australia, this will be reported to the Gosford City Council with recommendations for action.

6 References

Environmental Impact Statement Rindean Quarry Somersby, New South Wales, Pacrim Environmental, September 2004

Hydrological Investigation Rindean Quarry, Somersy, RCA Australia, August 2004

Addendum to the Hydrogeological Assessment, Rindean Quarry, Somersby, RCA Australia, November 2005

AS5667.11-1998 Water Quality – Sampling Part 11: Guidance on sampling of groundwaters

Murray-Darling Basin Groundwater Quality Sampling Guidelines – Technical Report No.3, Groundwater Working Group of MDBC, undated

Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region, DIPNR, September 2003

TABLES

Table 1 Height of the Water Table in Monitoring Bores Located on the Rindean Quarry Property, RCA Australia, April/May 2004

Monitoring Well	Bore Height (RL @ ground surface)	Depth to aquifer (m below top of casing) 1-2/04/04	Depth to Aquifer (m below top of casing) 11/5/04	Stick Up (m)**	RLof Water Table (mAHD) 1-2/4/04	RL of Water Table (mAHD) 11/5/04
BH1	218.2	5.09	5.4	0.72	212.39	212.08
BH2	247.795	6.18	6.88	0.81	240.81	240.12
BH3	231.383	10.38	10.7	0.7	220.30	219.98
BH4	218.315	3.36	3.35	0.7	214.26	214.27
BH5	262.97	6.2	7.19	0.77	256	255.01

** Height of the top of the casing above the ground level (RL) for the bore
Source: Rindean Quarry EIS Table 5.2

Table 2 Rindean Quarry Groundwater Quality Test Results, RCA Australia, April 2004

Water Quality Parameter	Unit	Sample ID and Date Tested		
		BH4 Down gradient 1/4/2004	BH2 Upgradient 1/4/2004	BH1 Downgradient 2/4/2004
pH		6.3	5.6	5.8
Conductivity @ 25°C	µS/cm	190	220	140
TDS (calc)	mg/L	120	140	-
Sulphate	mg/L	19	8	8
Chloride	mg/L	22	39	29
Nitrate as N	mg/L	0.72	5.9	0.057
Total Alkalinity	mg/L	30	8	
Bicarbonate	mg/L	30	8	17
Carbonate	mg/L	nd	nd	nd
Hydroxide	mg/L	nd	nd	nd
Sodium	mg/L	20	30	17
Potassium	mg/L	1.2	0.7	1
Calcium	mg/L	11	4	4.4
Magnesium	mg/L	3.4	4.8	2.8
Total Hardness	mg/L	43	30	-
Cation Total	me/L	1.8	1.9	-
Anion Total	me/L	1.6	1.5	-
Ion Balance	%	4	11.2	-
Ammonia as N	mg/L	0.04	nd	0.01
Total Alkalinity	mg/L			17
Biological Water Quality				
E. Coli	col/100mL			<91
BOD_5 - Total	mg/L			18

Source: Rindean Quarry EIS Table 5.3.

Table 3 ***Existing Bore Data, Rindean Quarry Environs, from RCA Australia, March 2004***

Bore Reference	Date of Completion	RL at Surface	Distance from Quarry Centre (km)	Final Depth	SWL on completion (DLWC) (a)	SWL July 04 (a)	Estimated Drawdown RCA 1 (b)	Estimate Drawdown RCA 2 (c)	Comment
GW031948	01/02/70	254	0.1	30.4	6.7	8.01	27.24	23.96	At residence R1. Supply affected, bore may become dry. Redrill.
GW057452	15/03/83	261	0.2	32	9	11.46	15.47	13.79	At residence R2. Supply likely to be affected. Likely redrill..
GW051268	12/12/79	250	0.2	30	5.1	8.53	21.5	22.45	At residence R3. Supply may be affected. Monitor.
GW072503	07/12/ 93	265	0.2	48	18	22.88	21.51	16.13	At residence R4. Supply likely to be affected. Likely redrill.
GW056164	21/04/82	242	Within site	30	6	19.56	17.13	21.75	Bore to be removed
GW023092	01/07/ 65	250	0.8	19.8	6.7	-	3.69	2.19	Supply may be affected. Monitor
GW047597	11/09/80	230	0.6	26	8.0	-	5.77	5.11	Supply may be affected. Monitor
GW058902	20/09/83	250	0.75	30	20	-	5.62	3.31	Supply may be affected. Monitor
GW062690	17/05/86	250	0.75	25	4	-	8.35	5.07	Supply may be affected. Monitor
GW047198	24/10/78	260	0.75	46	6.1	-	4.18	2.23	Significant effect unlikely
GW057995	14/03/83	245	1	46	5	-	3.61	2.02	Significant effect unlikely
GW062121	26/08/83	250	0.9	43	16	-	4.71	2.23	Significant effect unlikely
GW052588	22/08/80	245	0.8	30	7	-	1.89	1.71	Significant effect unlikely
GW056871	13/03/83	270	0.6	34	14	-	1.43	2.40	Significant effect unlikely
GW065610	16/07/88	270	1.0	40	6	-	0.06	0.90	Significant effect unlikely
GW037121	01/01/73	250	1.0	33.5	7.6	-	3.05	0.91	Significant effect unlikely
GW053607	03/12/80	260	1.25	62	15	-	2.18	0.93	Significant effect unlikely
GW064823	23/03/85	250	1.1	40	10.3	-	1.66	0.61	Significant effect unlikely
GW067551	02/08/89	255	1.25	34	6	-	-0.04	-1.65	Significant effect unlikely
GW101044 (d)	31/12/ 67	250	0.5	67	No details found	-	21.5	10.5	Commercial bore in deep aquifer. Significant effect unlikely.
GW101920	23/07/98			66	20	-			Data incomplete

All dimensions in metres
(a) Static water level in bore
(b) RCA 1 refers to the single layer groundwater model
(c) RCA 2 refers to the multi-layer groundwater model shallow (low permeability at 50 metres)
(d) Somersby Springs commercial bore. probably draws from deeper aquifer
Source: Rindean Quarry EIS Table 5.5

Table 4 Effect of Decrease in Saturated Thickness on Local Bores, RCA Australia, November 2005.

Bore	Saturated Thickness (metres)	Previous Draw Down Single Layer Model[(a)] (metres)	Previous Draw Down Multilayer Model [(a) (c)] (metres)	Current Draw Down Single Layer Model [(b)] (metres)	Current Draw Down Multilayer Model [(b) (c)] (metres)	% Further Decrease In Saturated Thickness Single Layer Model	% Further Decrease In Saturated Thickness Multi Layer Model
GW031948	23.8	27.24	23.96	28.24	24.90	4.20	3.95
GW057452	23.0	15.47	13.79	17.47	15.29	8.70	6.52
GW051268	24.9	21.50	22.45	22.50	23.45	4.02	4.02
GW072503	30.0	21.51	16.13	23.51	17.63	6.67	5.00
GW056164	24.0	17.13	21.75	19.13	23.25	8.33	6.25
GW023092	13.1	3.69	2.19	5.69	3.69	15.27	11.45
GW047597	18.0	5.77	5.11	7.77	6.61	11.11	8.33
GW058902	10.0	5.62	3.31	7.62	4.81	20.00	15.00
GW062690	21.0	8.35	5.07	10.35	6.57	9.52	7.14
GW047198	39.9	4.18	2.23	6.18	3.73	5.01	3.76
GW057995	41.0	3.61	2.02	5.61	3.52	4.88	3.66
GW037121	25.9	3.05	0.91	5.05	2.41	7.72	5.79
GW052588	23.0	1.89	1.71	3.89	3.21	8.70	6.52
GW056871	20.0	1.43	2.40	3.43	3.90	10.00	7.50
GW065610	34.0	0.06	0.90	2.06	2.40	5.88	4.41
GW062121	27.0	4.71	2.23	6.71	3.73	7.41	5.56
GW053607	47.0	2.18	0.93	4.18	2.43	4.26	3.19
GW064823	29.7	1.66	0.61	3.66	2.11	6.73	5.05
GW067551	28.0	-0.04	-1.65	1.96	-0.15	7.14	5.36
GW101044[d]	41.0	21.5	10.50	23.50	12.00	4.88	3.66

Note: (a) Based on 15% recharge rate
(b) Based on 11% recharge rate
(c) Ironstone layer located 50m below ground surface level
(d) Commercial bottled water spring

Source: *Addendum to the Hydrogeological Assessment, Rindean Quarry, Somersby*, RCA Australia, November 2005

Table 5: Predicted Maximum Flowrates of Groundwater from Quarry Faces, August 2004

Parameter	Existing	Stage 1	Stage 2	Stage 3	Stage 4
Average Depth to Aquifer (m)	5.73	5.73	10.73	10.73	10.73
Average Quarry Face Height (m)	20	20	25	25	30
Effective Saturated Face Height (m)	14.27	14.27	14.27	14.27	14.27
Saturated Face Area (m^2)	5708	5708	10702.5	9989	19264.5
Groundwater Flow Rate (m^3/yr)	6120.25	6120.25	11475.48	10710.45	20655.86
Groundwater Flow Rate (ML/yr)	**6.12**	**6.12**	**11.5**	**10.7**	**20.66**

Source: EIS September 2004, *Table 5.6*

Table 6 Prediction of Maximum Seepage of Groundwater from Quarry Faces based on the EIS of September 2004, Recalculated for the Department of Water and Energy, October 2008

Stage	Length of seepage face (m)	Area of seepage face (m2)	Seepage Volume (ML/yr)
Exisiting	425	6 065	6.06
1	425	6 065	6.06
2	725	10 345	12.1
3	700	9 989	11.78
4	1075	15 802.5	18.65

Formula: Length x 14.27(average height) x 1.18 (average flow rate m3/yr)

Table 7: Prediction of Maximum Seepage of Groundwater from Quarry Faces based on the Consent of 17 September 2007, Calculated for the Department of Water and Energy, October 2008

Stage	Length of seepage face (m)	Area of seepage face (m2)	Seepage Volume (ML/yr)
Exisiting	425	6 065	6.06
1	425	6 065	6.06
2	650	9 276	10.95
3	700	9 989	11.79
4	900	12 843	15.15

Formula: Length x 14.27(average height) x 1.18 (average flow rate m3/yr)

RINDEAN QUARRY, SOMERSBY, NSW

6.2. EROSION AND SEDIMENT CONTROL AND SURFACE WATER MONITORING PLAN

April 2012

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Table 2 Rindean Quarry, Surface Water Quality Analysis Pre Construction

Figures

Relevant figures are:

Figure 15	*Rindean Quarry, Schematic Plan and Elevation of Processing Plant*
Figure 16	*Rindean Quarry, Flow Diagram – Sand Washing Process, Fines Management System and Water Balance*
Figure 17	*Rindean Quarry Plan Stage 1 – Water Management Infrastructure*
Figure 18	*Rindean Quarry Plan Stage 2 – Water Management Infrastructure*
Figure 20	*Rindean Quarry, Locations of Local Water Supply Bores*

1. Purpose and Scope of the Plan

This plan describes plans for erosion control, sediment control and surface water management and the surface water monitoring program for the operation of the Rindean Quarry. It forms part of the Management Plan for the operation of the quarry.

This plan is consistent with the consolidated conditions of the development consents issued by the Gosford City Council on 20 June 2006 and 17 September 2007 in regard to Development Application No 26467/2004 for the redevelopment of the Rindean Quarry. Other than in minor changes to bring the text up to date, it is identical to the plan approved by the Gosford City Council in correspondence of 7 April 2011.

2. The Philosophy of the Plan

The processing of washed sand will require the use of substantial quantities of water. The central philosophy of surface water management will be to make the quarry self sufficient in water throughout all stages of its working life. The focus of water management is, therefore, reuse and recycling.

The **erosion sediment control plan** (incorporating a surface water management plan) aims to:

1) collect and control runoff from rainfall, quarry face seepage, the sand processing plant and stockpiles using a network of managed drains, sediment barriers, sediment traps and ponds;
2) divert water entering the quarry site from higher ground to the west, principally the Wisemans Ferry Road Reserve and the buffer area at the western end of the property, around the operating quarry to adjacent streams and Narara Creek;
3) facilitate the infiltration and the dispersal of runoff through vegetation growth and surface treatments in areas under rehabilitation;
4) condition the surface water collected through a primary settling basin and two storage ponds to a quality that can be reused for sand processing or released from the site;
5) meet the process water demand from the surface water management system;
6) release excess clean surface water through an existing lined drain to a nearby creek; and
7) control storm water flows.

The **surface water monitoring program** will monitor runoff, sediment traps, water levels and water quality in storage ponds and the release of water to the stream to the east of the property.

The water management and sediment control plan will be consistent with the requirements of the guideline *Managing Urban Stormwater: Soils and Construction* (NSW Department of Housing, 1998).

New South Wales Government guideline, *Managing Urban Stormwater: Soils and Construction Manual.*

3. Hydrology and Water Usage

The regional climate, geology, surface hydrology and groundwater hydrology were described in the EIS. The summary below of the present local water usage, surface hydrology, groundwater hydrology and available records provides background for this plan.

3.1 Groundwater

A borehole search undertaken through Department of Infrastructure, Planning and Natural Resources (DIPNR) in 2004 identified 21 registered bores within a 1.2 km radius of the quarry (*Figure 20*). The registered bores, used for irrigation, domestic or stock purposes, are drilled to depths of 20 to 60 metres within the sandstone formations. Static water levels recorded at the time of drilling varied between four and 20 metres.

Groundwater seeps from the existing quarry faces at rates which vary with rainfall patterns. This water was used to supplement process water supplies accumulated from runoff when the quarry was operating previously or allowed to flow from the site. Some neighbouring properties collect and use water from naturally occurring springs for various purposes.

3.2 Surface Water

The quarry is within the catchment of the Narara Creek which flows through the Strickland State Forest and the industrial suburbs of West Gosford to Brisbane Water approximately seven kilometres to the south-east and to Broken Bay at the mouth of the Hawkesbury River. The property drains into an unnamed creek on Agriculture NSW land a few metres to the east of the property boundary. This creek which is a tributary of Narara Creek, has its source on agricultural, grazing and rural residential lands to the north of the property and drains water from the F3 Freeway corridor. Neither this creek nor the Narara Creek can be regarded as pristine waterways.

There are no streams entering the site. Water enters the site from the disbursed sources of the Wisemans Ferry Road Reserve and neighbouring properties. Surface water flows on the site are irregular and, apart from seepage from the quarry faces, depend solely on rain events. The annual average rainfall (1981 to 2010) at nearby Peats Ridge is 1264.3mm. Rainfall is relatively consistent throughout the year but is punctuated by storm events.

4. Water Balance

4.1 Process Water Demand

Water will be required for dust suppression on unsealed roads and operating areas during dry conditions. This water, which will form a small part of the overall water demand, will be applied as required using a truck or trailer mounted tank and spray bar.

When the quarry is producing dry screened sand, no water will be required for production other than for dust suppression during dry conditions. This water will be provided from a fixed or mobile tank, pump and sprays. Water demand will be a small portion of the overall demand.

Water will be pumped from a storage within the quarry to the wheel wash on the access road to maintain the required level. The water requirement will be a small portion of the overall demand.

When the quarry is producing washed sand product, substantial quantities of water will be required for the washing process. The EIS of April 2012 contains a explanation of the washing process and estimates of the water demand. This information was summarised in a flow diagram which is reproduced below (*Figure 15* and *Figure 16*).

4.2 Anticipated Water Availability

Seepage from the quarry faces is expected to yield between zero and 15 megalitres of water per annum depending on rainfall patterns and the length of the quarry face exposed. The table below, reproduced from the *Groundwater Monitoring and Management Plan* provides estimates for expected maximum flows during the 4 stages of the quarry's production.

The EIS (Section 3.6) estimated that an average of 12.6 megalitres per annum would be available from a 5 hectare quarry working area. It estimated that up to 38 megalites per annum of water might be available from the whole of the quarry property. In an average year, therefore, water available

from runoff should exceed the volume of "make up" water identified in the water balance after taking account of infiltration, seepage and water that cannot be captured during storm events.

Table 1: Prediction of Maximum Seepage of Groundwater from Quarry Faces based on the Consent of 17 September 2007, Calculated for the Department of Water and Energy, October 2008

Stage	Length of seepage face (m)	Area of seepage face (m2)	Seepage Volume (ML/yr)
Exisiting	425	6 065	6.06
1	425	6 065	6.06
2	650	9 276	10.95
3	700	9 989	11.79
4	900	12 843	15.15

4.3 Measuring Water Use

Water will be supplied to the processing plant from the southern storage pond (FW1) by a mains electricity driven pump and pipeline. A flow metre will be installed in the pipeline adjacent to the pump. A record of water use will be maintained.

5. Surface Water Management

Water from the site will be collected through a network of drains, a settling pond and storage ponds. *Figure 17 and Figure 18* show the network proposed for Stages 1 and 2 of the quarry's operation. Although the drainage network will be extended and modified for later stages of the quarry's operation the general principles and management infrastructure will remain essentially the same. Details of the drainage network for subsequent stages will be included in drawings for those stages.

Water entering the site from Wisemans Ferry Road to the west of the property will, as far as practicable, be diverted around the property in peripheral drains.

Water from properties to the south is intercepted by the drainage line which has formed in the easement along the southern boundary.

Water from properties in the northwestern corner of the property will, as far as practicable, be diverted by an existing drain along the northern boundary of the property.

It will not be practicable to separate water seeping from quarry faces from other site runoff. Water from this source will, therefore, be collected in the network of drains within the quarry and combined with other runoff.

Surface runoff from all sources within the quarry will be collected in the primary settling basin adjacent to the new tailings pond. Water will be pumped from the surface of the settling basin to the northern most fresh water pond (FW 2). Water will gravity feed from the surface of this pond to the southern (existing) storage pond (FW 1). Process water will be drawn from this pond. Excess water will be allowed to flow from it through the existing lined drain (RL215 metres) to a nearby creek that is an unnamed tributary of Narara Creek.

The target maximum sediment load for water leaving the site though this drain is 50mg/litre. Experience suggests that it will be possible to achieve this target without the use of flocculants in all but extreme circumstances. Water seeping from the quarry faces has, historically, had a low pH (moderately high acidity) which is thought to contribute to the relatively high settling rates of sediment observed in quarry water storages in the past.

Water accumulating in the tailings pond will recycled by pump or syphon from a surface pickup to the northern storage pond (FW 2).

An area will be excavated between the holding ponds and the quarry workings to an RL of 213 metres to create a storm water detention basin. With a capacity of 4.5 ML, this basin will be sufficient to manage runoff from the quarry property from a 1% AEP (1:100 year) storm event (80mm/hour over 1 hour, Bureau of Meteorology). Any water collecting in the storm water holding basin will be pumped into the northern storage pond (FW 2). The basin will be maintained in an empty state.

The Landscape Management and Rehabilitation Plan describes the program to establish and maintain a vegetation cover on disturbed areas of the quarry property. This program is central to controlling erosion and facilitating the infiltration and dispersal of runoff.

Drains will be constructed to collect runoff from these areas and from working areas of the quarry. Where practical, drains will be constructed with a less than 2% gradient. Sandbags, silt nets, hay bales, rock lining and rock beds will be used to contain water flow rates and collect sediment. The drains will be inspected weekly and following significant rainfall to ensure that they are maintained in working condition. The drains will terminate in a primary sediment pond. Sediment control structures will be maintained to ensure that they retain at least 50% of their capacity for water management.

The walls of the tailings pond will be elevated above the quarry floor to exclude general runoff. The level of water in the pond will be maintained at a level at least 1.5 metres below the top of the surrounding wall to allow for the storage of rainfall from a 1% AEP (1:100 year) storm event

6. Sediment Control

Sediment control within the operational quarry and the quarry property will be linked closely to the Rehabilitation Strategy and Landscape Management Plan. All disturbed areas of the property that are not within the operational areas will have a vegetation cover of grasses, shrubs and trees established as soon as possible after operations have been completed. Areas being rehabilitated will be formed to disburse runoff. In many instances, areas to be planted out will be ripped to assist plant growth. Ripping will enhance infiltration and reduce runoff. Revegetation of the site and the routine inspections of revegetated areas will provide a primary control over erosion.

Rehabilitation will involve breaking up of hard areas and the spreading of topsoil which will be exposed until plant growth provides soil stability and a ground cover. Commonly used methods of erosion control such as mulching and bitumen spraying will be employed. Barriers, contours and permanent and temporary drains will be constructed to manage runoff from these areas and to trap silt carried by runoff.

Sediment control over operational areas will be achieved in several ways:

1) runoff from quarry faces and extraction areas will be collected in constructed drains where flow rates will be controlled and primary sediment collected as described above;
2) necessarily exposed surfaces will be stabilised;
3) raw material stockpiles will be kept to a minimum. Areas where raw materials can be stockpiled will be identified as such and perimeter drains constructed around them;
4) product stockpile areas will be formed to avoid loose material and to disburse water draining from them into perimeter drains;
5) vehicles will be required to use formed roads;
6) plant will be required to operate as far as practicable on firm ground to avoid surface disturbance; and
7) constructed drains will be inspected regularly and sediment traps cleaned. Sediment will be mixed with raw materials or soil for rehabilitation.

All fines collected from sand processing will be piped to and contained within the tailings pond.

All runoff collected will be channelled to a central settling pond before it is pumped to a fresh water pond. If necessary, a second settling pond will be employed. The tailings pond and other settling ponds will be cleaned regularly and the sediment collected will be mixed with soil to improve the seed bed for rehabilitation. There will be no need to dispose of waste sediment on-site or off-site.

All vehicles that have been operating in the quarry, except for passenger and small goods vehicles, will be required to pass though the wheel wash located beside the access road on departure. The wheel wash has a ribbed bottom and a water depth of between 200 and 300mm to remove quarry materials from tyres and wheels. The nature of the material in the quarry makes the use of spays unnecessary. However, a water tanker with a high pressure hose will be available for any vehicle. The road either side of the wheel wash is sealed.

The condition of the road either side of the wheel wash will be monitored. The road will be cleaned as necessary. The sediment pit in the wheel wash will be cleaned weekly or more frequently if

necessary. Runoff from the wheel wash and road cleaning will be returned to the water management system through a sediment trap and drains.

7. Surface Water Monitoring Program

7.1 Establishing a Baseline

Baseline data for the surface water monitoring program will be the data collected in 2004 and recorded in the EIS and data from samples collected at the commencement of the construction period at quarry faces, the existing storage pond and the creek to the east of the property. The data set will be extended to include both storage ponds when the second is completed during Stage 1. Available data is in *Table 2.*

Table 2 Rindean Quarry, Surface Water Quality Analysis Pre Construction

Local Watercourses and Seepage	Monitoring Results		
	pH - Avg	TDS (mg/L) Avg	TSS (mg/L) Avg
Quarry face seepage	4.4	152	-
Water storage pond northern (not yet constructed)	-	-	-
Water storage pond southern	-	-	-
Unnamed creek (upstream of quarry outlet)	4.83	108	6

Because of the dispersed nature of surface water flows on and around the site and the irregularity of flows which are closely related to rainfall, there are no available measured data on surface water flows. Calculations of the available water supply are based, therefore, on rainfall data and theoretical analyses.

7.2 Water Sampling

Surface water quality will be sampled at four locations described below. Samples will be collected at 6 monthly intervals for the first two years, annually from the completion of Stage 1 and within 24 hours of any unusual storm event. The results of sampling will be compared with baseline data and reported in routine audit reports to the Council.

The sampling sites will be:

1) the pond identified as FW2 in *Figure 17* adjacent to its outlet. This measures the quality of stored water part way though its conditioning cycle;

2) the pond identified as FW1 in *Figure 17* adjacent to its outlet. This will be indicative of the characteristics of surface water leaving the quarry site. Water at this location will be monitored during the annual program of water quality testing and within 24 hours of an unusual storm event when the flow from the site is high;

3) at the most productive seepage site from the quarry face which will be indicative of the characteristics of water entering the site from aquifers. The site will vary from time to time as the quarry face advances. Water flow is likely to vary with rainfall patterns. Water samples will be matched with photography and a general description of water seepage from the quarry face. Water at this location will be monitored during the annual program of water quality testing;

4) a monitoring point on the unnamed creek to the east of the property upstream of Rindean Quarry outlet. This will be indicative of the water quality of runoff from properties upstream from the quarry. Water at this location will be monitored during the annual program of water quality testing and within 24 hours of an unusual storm event when the flow at the site is high.

Water entering the site from up-slope will be in the form of runoff from adjacent residential properties and Wisemans Ferry Road. Such water is likely to flow on to the site only during persistent rainfall and significant storm events and is likely to be contaminated with road dust, fertiliser and other normal pollutants of a rural-urban environment. There are no watercourses entering the quarry site and, therefore, no suitable sites to monitor the characteristics of water entering the quarry site from up-slope.

7.3 Assessment Criteria

The number and types of analytes sampled and tested during the preparation of the EIS will be adopted for the monitoring program (*Table 2*).

The targets will be the criteria set by the relevant New South Wales Government authority, namely:

- pH − +/- 1 unit from background;
- Electrical Conductivity − <1 500µs/cm;
- Total Grease − <10mg/L; and
- Suspended Solids, <50mg/L.

7.4 Monitoring Protocols

Surface water samples will be collected in standard sample bottles in accordance with standard test procedures.

All water samples will be transported to an accredited laboratory for testing within 24 hours of sampling under chain of custody documentation. Samples will be maintained at a temperature of less than $4^{o}C$.

7.5 Responses

Any significant departures from baseline or prior testing will be reported to the Gosford City Council in annual audit reports.

The causes of any such departures will be investigated and, where practicable, corrective action will be taken. Details of causes and actions taken will recorded and reported in audit reports

8. Reporting

Results of the water management and monitoring and erosion control programs will be reported in the annual audit reports for the quarry. The annual audit reports to the Gosford City Council will be public documents. The surface water management and erosion control records to be reported are:

1) the volume of water used in sand processing and other site operations; and
2) the results of water sampling at the four sampling sites.

There will be two measures of the effectiveness of the erosion control plan:

1) achievement of the New South Wales Government criteria as the maximum sediment load for water leaving the site though eastern drain other than in exceptional circumstances;
2) a low incidence of erosion reported in the annual inspections of rehabilitated areas.

9. References

Environmental Impact Statement Rindean Quarry Somersby, New South Wales, Pacrim Environmental, September 2004

Hydrological Investigation Rindean Quarry, Somersy, RCA Australia, August 2004

Addendum to the Hydrogeological Assessment, Rindean Quarry, Somersby, RCA Australia, November 2005

AS5667.11-1998 Water Quality – Sampling Part 11: Guidance on sampling of groundwaters

Murray-Darling Basin Groundwater Quality Sampling Guidelines – Technical Report No.3, Groundwater Working Group of MDBC, undated

Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region, DIPNR, September 2003

Managing Urban Stormwater: Soils and Construction (NSW Department of Housing, 1998).

RINDEAN QUARRY, SOMERSBY, NSW

6.3. REHABILITATION STRATEGY AND LANDSCAPE MANAGEMENT PLAN

April 2012

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Table 1 *Rindean Quarry, Plant Species for Use in Revegetation and Landscaping*

Table.2 *Rindean Quarry, Plant Species for Use in the Rehabilitation of Wet Areas*

Figures

Relevant figures are:

Figure 5 *Rindean Quarry Plan Stage 1 – Years 1 to 2*

Figure 6 *Rindean Quarry Plan Stage 2 – Years 3 to 5*

Figure 7 *Rindean Quarry Plan Stage 3 – Years 5 to 10*

Figure 8 *Rindean Quarry Plan Stage 4 – Years 11 to 19*

Figure 9 *Rindean Quarry Plan - Indicative Final Landform*

1. Purpose and Scope of the Plan

This plan describes the strategy and philosophy for the rehabilitation and landscape management for the life of the quarry. It forms part of the management plan for the quarry.

This plan is consistent with the consolidated conditions of the consents issued by the Gosford City Council on 20 June 2006 and 17 September 2007 in regard to Development Application No 26467/2004 for the redevelopment of the Rindean Quarry. Other than in minor changes to bring the text up to date, it is identical to the rehabilitation and landscape management that was approved by the Gosford City Council in correspondence of 7 April 2011.

This Plan takes into account the flora and fauna assessment prepared by Keystone Ecological (February 2012).

Rehabilitation of the site will be on-going throughout the operating life of the quarry. Soil management will be undertaken in accordance with the principles contained in *Managing Urban Stormwater: Soils and Construction* (NSW Department of Housing, 1998).

2. Objectives and Targets

The objectives of this rehabilitation plan are to:

1) to conduct a rehabilitation program progressively throughout the life of the quarry that will leave it when completed as a stable, erosion-free landform consistent with the local environment;

2) rehabilitate areas disturbed by past quarrying operations that are not required for the new operation as a priority;

3) reduce the area of disturbed land in the quarry (ie land not under rehabilitation or not yet used for quarry operations) from almost on two thirds of the property (9 hectares) to approximately 6 hectares within Stage 1 of the operation (ie the first two years);

4) reduce the disturbed area of the quarry to approximately 5 hectares by the end of Stage 2 of the operation (ie by year 5);

5) maintain the area of disturbed land within the property at less than 5 hectares for the remaining life of the quarry;

6) use material available on the site, including stockpiles, overburden, topsoil stripped from the site prior to construction works and quarrying and fines from the sand washing process, for rehabilitation work; and

7) rehabilitate the site with a viable mixture of grasses and indigenous plants which will result in a diverse and sustainable ecosystem.

The planting and management of bunds constructed for noise mitigation will follow the principals and practices used for the rehabilitation program. This work will be performed as the bunds are completed.

3. Present Landform

The property is located on the eastern fringe of the Somersby Plateau. The land slopes down generally to the east from a ridge that can be identified by the path of Wisemans Ferry Road and forms part of the catchment of Brisbane Water. The slope was interrupted to the east of the property by construction of the F3 freeway.

The western half of the property is at or close to the natural level of the land. The eastern half of the property has been incised by up to 30 metres by past quarrying or built up by the containment of former tailings ponds.

The Rindean Quarry was operated as a sand quarry from 1979 to 2003 and more than a half of the 15 hectare property is in a disturbed state from past quarrying. The balance of the property shows evidence of disturbance for gravel extraction and agricultural use over its history. Therefore, most, if not all of the vegetation on the property is regrowth of varying ages. A number of mature trees identified during flora and fauna surveys will be protected for their habitat values.

Some parts of the property, in particular the former tailings ponds, are in urgent need of rehabilitation. The rehabilitation program will begin, therefore, towards the end of the construction period before the quarry begins production with the capping of the former tailings ponds.

4. Final Landform

The in its final form the property will take the form of an amphitheatre of native forest similar to that found in the adjacent Strickland State Forest. The quarry void will be surrounded to the north, west and south by benched walls that will have been softened and vegetated progressively throughout the life of the quarry as described in *Section 7.2* below. To the east, the present embankment to the original ground level will remain as it is at present but with a cover of endemic vegetation. Three water storage ponds will be softened in plan and retained as water features noting that the present ponds have provided an environment for birds, frogs and turtles. The quarry floor will slope from an RL of 217 metres in the west to 215 metres in the east. The quarry floor will be ripped and planted out with a mix of endemic species. A contoured plan of the final landform is at *Figure 9*

5. Revegetation History

The regrowth of vegetation in the past has been through natural processes. There are no recorded attempts at formal revegetation. Regrowth in the recent past has generally been vigorous as would be expected in the local environment. The incidence of exotic plants on the property is relatively low. There are a few examples of native shrubs along the boundaries of the property that are not endemic to the area, including the listed threatened species *Grevillea shiressii* near the north–western boundary. It is likely that these have been planted by persons unknown.

6. Management of the Existing Native Vegetation

The majority of the existing native vegetation on the site is along the western and north-western boundaries of the property. These are buffer areas, which are identified in the survey plan of the site and the plans for the various stages of the operation of the quarry. They will be left undisturbed apart from the construction of noise mitigation bunds and the perimeter fence. Measures will be taken in the design and construction of noise mitigation infrastructure to minimise the disturbance to existing vegetation. Where disturbance is unavoidable such disturbance will be offset by the planting out of bunds with endemic native species.

Significant trees identified in the EIS will be marked and fenced as required by the development consent. Those trees within or close to operating areas of the quarry will be identified and protected with coloured mesh fences.

Native regrowth in other parts of the site will be incorporated into the rehabilitation program whenever possible. Exotic species, principally pines, will be removed.

Both existing vegetation and rehabilitation will be inspected annually for weed growth and corrective action taken if necessary. The property has a bushfire management plan which will apply to all vegetation on the site.

7. Rehabilitation Planning

7.1 Independent advice

An independent specialist in native flora revegetation (Global Soils) was engaged to advise on the rehabilitation program outlined in the EIS and in the 2007 s96 report to Council. Another specialist will be engaged to guide the planning and implementation of the rehabilitation program, monitor the effectiveness of rehabilitation and to advise on the need for changes to the program when and where necessary

The initial report from Global Soils observed, among other things that:

> Experience at another sand quarry in the local area, along with experience at many other sites, shows that the proposed surface growing medium will be suitable for native plant growth.
>
> Many of the areas to be revegetated at Rindean Quarry are too far from natural seed sources and will need to be direct seeded/planted to achieve satisfactory vegetation cover. These techniques are well proven at many other mine and quarry sites and can be readily adapted to Rindean Quarry.
>
> Preventing potential weed invasion will be one of the major challenges to achieving successful revegetation. In this regard the weed content of any potential surface material will need to be closely monitored.

and:

> Experience at other sites has shown that rapid revegetation of proposed sites can be readily and quickly achieved . . . Although beyond the scope of current needs, the proposed Rehabilitation Management Plan will include details on the joint sowing of a rapidly establishing sterile, cereal cover crop (to achieve rapid surface stabilization), in conjunction with a diverse mix of local native tree and shrub species. Recent changes in weather patterns suggest improved rainfall patterns in future years which should assist revegetation. Despite this, and assuming a return to dry conditions, it is confidently believed that successful and rapid revegetation can be achieved on the site with key species showing at least 1m per year height growth over the first five years, without the need for artificial watering.
>
> In addition to the above comments it is strongly recommended that, upon approval, the existing central tailings dam be quickly capped and revegetated in order to clearly demonstrate revegetation techniques and the companies *bona fides,* to interested parties.

Plans of the progressive rehabilitation and the indicative final landform are at *Figure 5* to *Figure 9*. They have the benefit of advice from the independent specialist.

7.2 Potential Constraints to Vegetation Establishment

There are no significant potential constraints to the establishment of vegetation. The Rindean Quarry is situated in an area that generally has a high and reliable rainfall. Irrigation from on-site water supplies will be used when necessary. Past regrowth on the property has been vigorous and there is no evidence to suggest that this will not be the case in the future. There is no local evidence that plant diseases will be a problem. Weed management and bushfire control are elements of the management plan.

7.3 Topsoil Characteristics and Management

The natural topsoil in the area is a grey sandy loam that provides conditions for good plant growth and has good drainage characteristics. The amount available is limited and is likely to be insufficient for all rehabilitation needs. A topsoil mix of A and B horizon soils, other suitable sandy overburden and fines from the tailings dam will be used throughout the rehabilitation process. In some instances it might be necessary to import soil for rehabilitation.

As there will be an immediate and continuing demand for topsoil for rehabilitation, it is unlikely that topsoil will be stored for other than short periods of time. Normally it will be moved after excavation directly to areas where it is to be used.

7.4 Surface Drainage and Erosion Control

Surface drainage within the quarry will be directed towards harvesting runoff for use in sand processing. For this a network of surface drains and ponds will be maintained to collect and direct

the runoff, minimise erosion and remove sediment from the water. Excess water will leave the site through the storage ponds and a single drain at the eastern end of the property. Erosion control is set down in the Surface Water Management and Sediment Control Plan.

The objective will be to disperse rather than concentrate runoff over the bunds and other rehabilitated area to minimise erosion and assist infiltration. Runoff will be concentrated in drains or in other constructed waterways only at the margins of these areas.

7.5 Maximizing Soil Water Availability and Water Harvesting

Water harvesting and water reuse and recycling on the site are central to the quarry's operations. These are described elsewhere in the management plan.

All areas being rehabilitated will be ripped to facilitate the infiltration of rainwater. Surface treatments described elsewhere will be used to aid infiltration and minimise evaporation. The mixing of clays from tailings ponds with topsoil is will assist with water retention for plant growth.

7.6 Compaction and Site Preparation

Areas to be rehabilitated will be ripped and covered with a layer of the topsoil mix prior to planting. Post planting compaction is unlikely to be a problem because of the nature of the soils and the underlying ripped sandstone

7.7 Overburden Management

An estimated 500 cubic metres of overburden consisting of coarse sands and broken sandstone is stockpiled on the site at present. This will be used in the initial stages for the construction of bunds and capping of the former tailings ponds at the eastern end of the site. Weed growth will be destroyed by spraying with a glyphosate herbicide during dry weather before the overburden is shifted. Larger weeds will be removed by hand only if necessary.

There will be no requirement for the storage of significant overburden. Overburden on the site will be limited and, apart from the initial construction of noise bunds, all of the overburden, which is universally a sandy loam containing some gravel and small sandstone, is expected to be consumed by the rehabilitation program.

7.8 Organics

Organic matter in the topsoil will be augumented to a limited extent through the chipping of vegetation that is cleared. The amount of vegetation to be cleared is minimal however. Organic matter in the form of baled hay and native vegetation mulch from elsewhere will be brought on to the site when required for erosion control and rehabilitation.

7.9 Species Selection and Other Plant Issues

The opportunities for collecting seed on the site for use in the rehabilitation program are limited. Therefore, plant stock or seed will be purchased from registered nurseries. Species selected for planting will be taken from *Table 1* which lists suitable species endemic to the eastern slopes of the Somersby Plateau. If the species listed are not available commercially, other similar species identified on the site in flora surveys may be substituted.

Plant species that may be used in the development of wet areas are listed in *Table 2*.

Tubestock will be planted randomly to replicate, as far as practicable, the generation of native bushland typical of the area. Trees shrubs and grasses will be planted in a manner that will ensure succession in the development of, eventually, a mature bushland as well as the objectives of the rehabilitation program.

7.10 Timing

Fencing to protect critical vegetation will be put into place before production begins as required by the development consent. The rehabilitation program will begin with the planting out of bunds during the construction period. It will continue with the capping and planting out of the former settling ponds at the eastern end of the property. Some material suitable for this work is already stockpiled on the site. The rehabilitation program will then proceed progressively along the

northern side of the property as excavation for product is completed. The timing of the successive stages or the quarry's development and rehabilitation is set out in the main body of the management plan Figures 5 to 9

Table 1 Rindean Quarry, Plant Species for Use in Revegetation and Landscaping

Scientific Name	Common Name	Comment
Trees		
Angophora costata	Smooth-barked Apple	Identified on site
Angophora hispida	Dwarf Apple	Not identified but within range
Corymbia gummifera	Red Bloodwood	Identified on site
Eucalyptus capitellata	Brown Stringybark	Not identified but within range
Eucalyptus haemastoma	Scribbly Gum	Not identified but within range
Eucalyptus punctata	Grey Gum	Not identified but within range
Eucalyptus sieberi	Silver-top Ash	Identified on site
Leptospermum trinervium	Paperbark Ti-tree	Identified on site
Shrubs		
Acacia fimbriata	Fringed Wattle	Not identified but within range
Acacia oxycedrus	Spike Wattle	Identified on site
Banksia ericifolia	Heath-leafed Banksia	Identified on site
Banksia serrata	Old Man Banksia	Identified on site
Grevillea buxifolia	Grey Spider Flower	Identified on site
Grevillea sericea	Pink Spider Flower	Identified on site
Hakea sericea	Bushy Needlebush	Identified on site
Hakea teretifolia	Dagger Hakea	Identified on site
Lambertia formosa	Mountain Devil	Identified on site
Persoonia lanceolata	A Geebung	Identified on site
Persoonia levis	Broad-leaf Geebung	Identified on site
Petrophile pulchella	Cone Sticks	Not identified but within range
Boronia ledifolia	Sydney Boronia	Not identified but within range
Philotheca hispidulus	Rough Wax Plant	Identified on site
Doryanthes excelsa	Gymea Lily	Identified on site
Xanthorrhoea sp.	A Grasstree	Identified on site
Ground Covers		
Actinotus helianthi	Flannel Flower	Identified on site
Hibbertia linearis	Showy Guinea Flower	Not identified but within range
Hibbertia obtusifolia	Grey Guinea Flower	Not identified but within range
Leucopogon ericoides	Bearded Heath	Identified on site
Woollsia pungens	Snow Wreath	Not identified but within range
Pimelea linifolia	Rice Flower	Identified on site
Lomandra glauca ssp. Glauca	Pale Mat-rush	Not identified but within range
Lomandra obliqua	Fish Bones	Identified on site
Cynodon dactylon	Common Couch	Identified on site
Pennisetum clandestinum	Kikuyu Grass	Introduced grass identified on site

Table 2 Rindean Quarry, Plant Species for Use in the Rehabilitation of Wet Areas

Scientific Name	Common Name	
Wetland plants		
Acacia elongata	Slender swamp wattle	Not identified but within range
Asplenium flabellifolium	Necklace fern	Not identified but within range
Baumea juncea	Bare twig rush	Not identified but within range
Juncus spp*	-	Identified on site
Selaginella uliginosa	Swamp club-moss	Identified on site
Sowerbaea juncea	Rush (Vanilla lily)	Not identified but within range

*Select from *Juncus cognatus, Juncus continuus, Juncus mollis, Juncus planifolius,* and *Juncus usitatus* found on site

7.11 Key Indicators of the Effectiveness of the Rehabilitation Program

The key indicators below will be used for assessing the success or otherwise of the rehabilitation program.

The key indicators are:

1). Vegetation has become sufficiently established on acoustic bunds by the end of Stage 1 to retard erosion, contribute to the stability of the structures and improve the visual outlook from adjacent areas.

2). The rehabilitation of buffer zones on the boundaries of the property has been completed successfully by the end of Stage 1. This will be a requirement for the quarry operation to progress to Stage 2.

3). Successful rehabilitation has reduced the disturbed area within the property to approximately 6 hectares by the end of Stage 1.

4). Successful rehabilitation has reduced the disturbed area within the property to approximately 4 hectares by the end of Stage 2.

5). Successful rehabilitation means that, in the opinion of a specialist in native vegetation:

   a) the grasses planted have established a 70% ground cover capable of preventing erosion within 12 months of being planted; and

   b) native groundcover, shrub and tree species are established sufficiently to prevent erosion and can be expected to provide a 50% ground cover or a 25% canopy over the ground within 3 years of being planted; or

   c) rehabilitation that has failed to meet the targets for successful rehabilitation has been replanted according to the specialist's recommendations at the earliest opportunity taking account of seasonal factors.

6). Any areas that have been eroded by high volume runoff show evidence of having been restored.

8. Implementation

8.1 Capping of the Former Tailings Ponds

Capping of the two former tailings ponds at the eastern end of the property will begin shortly after the Construction Certificate is issued. Capping up to one metre thick will begin from the eastern periphery of each pond using overburden currently held on site and is likely to continue over several months as suitable material becomes available. As with the construction of noise attenuation bunds elsewhere on the property, it might be necessary to import some clean virgin material for the capping operation if sufficient suitable overburden cannot be supplied from the site.

The shallow voids will be moved progressively towards the centre of the quarry and reduced in size. Residual water contaminated with fines will be pumped into the newly constructed tailings management system as necessary. The revised surface levels will direct runoff towards the centre of the quarry where it will be collected and added to the water management system.

Both ponds dried out on the surface during the low rainfall period to mid 2009 to the point where the surface crust became sufficiently stable to support a small machine. The surface is, therefore, expected to be sufficiently stable to support the cap. As some standing water has collected since from rainfall, care will be required when operating machinery during the capping process.

Both ponds have experienced natural regrowth in vegetation, trees, shrubs and grasses over substantial parts of their areas. This regrowth has assisted in removing subsoil water and, wherever possible, it will be preserved during capping. Newly capped areas will be planted out with shrub and tree tubestock in the same manner as for other revegetation. Water tolerant species endemic to the area will be favoured.

Capping and revegetation will be completed by the end of the first year of the quarry's operation.

8.2 Treatment of Quarry Walls

Benched quarry walls left after the extraction of raw material will be ripped and broken down as required to eliminate, as far as possible, sheer drops within the final land form and create a stable rock and rubble face for rehabilitation. The residual benches and rubble faces will be planted or seeded with shrub and tree species endemic to the area as soon as they have been prepared. Supplementary soil will be added to the benches only where necessary.

8.3 Soil Preparation

A and B horizon soil removed from areas to be quarried will be mixed with fines from the tailings dam at a ratio of no greater than 1:5 to create a topsoil for rehabilitation which will have water retention properties, good structure and a concentration of nutrients natural to the area. Mixing will be performed by machine before the topsoil is applied to the area being rehabilitated.

This technique was strongly supported by the rehabilitation specialist engaged to provide advice.

> This technique is strongly supported as it will enhance the physical structure of the growing medium resulting in enhanced soil water holding capacity and consequent plant growth, while reducing the later problem of rehabilitating fine particle tailings dams.

The amount of topsoil remaining on the property is limited. The mixing of A and B horizon material with tailings will extend the amount of viable topsoil available. Neverthess, there will have to be economy in its use and it is unlikely that any of the recovered material or the topsoil mix will require storage for other than short periods. If storage becomes an issue, it will only be in Stage4. It might become necessary to import topsoil to complete the rehabilitation program. Questions of importing clean virgin topsoil and storage will be addressed in later management plans when the need can be confirmed and quantities estimated with some accuracy.

8.4 Soil Stabilisation

Soil on freshly rehabilitated areas will be stabilised by creating a coarse surface, using mulch or straw or by spraying with bitumen. The technique used will be that recommended by the planting contractor and will vary with the slope, nature of the planting surface and whether tubestock or seed is planted. Slopes will be contoured where necessary to slow runoff.

8.5 Planting Specifications

Planting will be performed to the following specifications.

Tube stock	Shrubs: One slow release fertiliser pellet. Plant at 2-3m spacing.
	Trees: Two slow release fertiliser pellets. Plant at 3-4m spacing.
Direct seeding	Rate to be 5kg/ha made up of:
	Eucalyptus and Angophora tree species: 0.5kg/ha
	Acacia, Leptospermum, Banksia and Hakea species: 4.5kg/ha
	Shrub species seed will be pretreated by soaking in boiling water as necessary.
Grasses	The topsoil mix will be fertilised with the equivalent of 200kg/ha of organic fertiliser (*eg* blood and bone or Dynamic Lifter or equivalent) as it is placed.
	Seeding rate as recommended by supplier.

9. Maintenance and Monitoring

The rehabilitation work will be assessed annually for the first 5 years by an independent specialist to assess maintenance requirements and progress towards targets set. Inspection requirements thereafter will be set down in the management plans for subsequent stages. The findings will be included in the quarry's audit and compliance reports to the Council.

The maintenance program will be guided by the findings of the independent specialist. However, the following inspections and actions will be carried out as a matter of course:

1) freshly completed rehabilitation will be inspected weekly for the first month by quarry staff. Any concerns will be reported to the planting contractor;

2) new work will be inspected monthly by quarry staff to check the viability of seedlings and grasses, to identify and correct erosion or potential erosion, for the need for irrigation and to identify and remove weed growth;

3) established work will be inspected every 6 months by quarry staff for the same purposes. A written report will be prepared and retained;

4) rehabiltation areas will be irrigated as necessary; and

5) grassed areas will be reseeded and seedlings replaced as necessary.

The removal of weeds will normally be performed by hand. However a herbicide spraying program using an approved herbicide will be conducted under the guidance of the rehabilitation specialist if manual removal is not feasible.

Fertiliser will not be applied other than during initial plantings unless advised by the rehabilitation specialist following an annnual inspection. The rehabilitation specialist will determine the appropriate fertiliser and application rate.

RINDEAN QUARRY, SOMERSBY, NSW

6.4 NOISE MANAGEMENT PLAN

April 2012

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4. Noise Sources Within the Quarry 2
5. The Environmental Noise Assessment 3
6. Mitigation of Plant and Operational Noise 3
7. Mitigation of Transportation Noise 3
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Figures

Relevant figures are:

Figure 10 *Survey plan showing preliminary work to be performed and the ultimate limits of the quarry's footprint*

1. Purpose and Scope of the Plan

This noise management plan has been prepared as a basis for noise minimization within the quarry. The plan is consistent with New South Wales Industrial Noise Policy.

It is consistent with the consolidated conditions of the consents issued by the Gosford City Council on 20 June 2006 and 17 September 2007 in regard to Development Application No 26467/2004 for the redevelopment of the Rindean Quarry. Other than in minor changes to bring the text up to date, this plan is identical with that approved by the Gosford City Council in correspondence of 7 April 2011.

The operation of the quarry described in the April 2012 EIS will generate levels of noise exposure no greater to those described in the 2004 proposal. Since then, ambient noise has changed only in regard to increases in traffic on the adjacent F3 Freeway and Wisemans Ferry Road, there have been no changes to legislation or government policy that affect the proposal and the mobile plant to be used will be of a later generation and, therefore, more efficient and quieter, than that on which the assessment was based. Therefore, the environmental noise assessment conducted by Atkins Acoustics and Associates Pty Ltd during the preparation of the 2004 Environmental Impact Statement (EIS) and the noise exposure goals that it contained remain valid.. The report by Atkins Acoustics and Associates Pty Ltd is the basis of this noise management plan.

2. Objectives and Targets

The objective of the noise management plan is, within the ambient environment, to minimise disturbance to the local community by noise resulting from the quarry's operations.

The targets or noise management are those identified in the report by Atkins Acoustics and Associates Pty Ltd in accordance with the New South Wales Industrial Noise Policy. The *Interim Construction Noise Guideline* (DECC 2009) does not apply.

3. Ambient Noise Environment

The location of Rindean Quarry does not have a typical rural noise environment. The quarry is located between Wisemans Ferry Road which forms the western boundary of the quarry property and the F3 Freeway which passes within 350 metres of the eastern boundary.

Wisemans Ferry Road, classed as a regional road, carries substantial traffic including heavy vehicles servicing the local sand extraction and rural industries and the Somersby industrial area. Wisemans Ferry Road turns though a slow corner greater than 90^0 within 75 metres of the quarry gate. Noise from the road is frequent although not constant.

The quarry and several surrounding houses are higher than and overlook the F3 Freeway although views of the Freeway are, in most instances, obscured by trees. Noise from the Freeway, which continues day and night, is a significant component of the background noise in the area. Noise levels are higher during the 6am to 8am morning and 5.30pm to 7.30pm afternoon traffic peaks.

4. Noise Sources Within the Quarry

The main sources of operational noise within the quarry will be:

1) the removal of topsoil and overburden before the extraction of resource;
2) the extraction and crushing of friable sandstone from the working face of the quarry and on the quarry floor by a large bulldozer and excavator;
3) the loading of raw material by a loader or excavator on to a medium sized dump truck and its transport within the quarry;
4) the screening and washing plant processing raw material into saleable sand product;
5) the loading of product on to trucks by a rubber tired loader; and
6) the loading, transport and spreading of reject material, overburden and soil in rehabilitation operations.

No blasting will be conducted.

The main source of transport noise will be associated with the transport of sand product from the quarry by trucks operated by independent hauliers. Trucks leaving the quarry will be required to stop before entering Wisemans Ferry Road as a safety measure.

The majority of trucks operating in the sand trade, particularly on the longer haul Sydney route, are now modern, technologically advanced vehicles that create relatively low noise footprints especially at low speeds. High power reduces the need for gear changes, gear boxes are automatic or semi-automatic, engine management systems control power output, exhaust mufflers effectively control exhaust noise and cooling fans are designed to minimise noise. These technologies will limit the noise emitted by trucks hauling out of the quarry and starting into Wisemans Ferry Road. Older style trucks that create a noise nuisance are becoming a minority.

5. The Environmental Noise Assessment

The the principal conclusions of the environmental noise assessment conducted by Atkins Acoustics and Associated Pty Ltd were:

1) six residential properties adjacent to the quarry site are potentially affected by noise from the quarry;

2) the existing ambient noise environment for the area can be described as typically suburban as it is controlled by traffic noise on the F3 Freeway. The noise environment is also influenced by local road traffic on Wisemans Ferry Road;

3) noise modelling has shown that noise levels are predicted to exceed project assessment goals, mainly during the construction of boundary noise bunding;

4) other than for surface works in Cell 7, the modelling results show that predicted noise levels satisfy the recommended project assessment goals;

5) noise modelling was performed with all plant and equipment operating simultaneously to cover the worst case scenario;

6) without noise mitigation measures in the form of engineering, site establishment and management controls, the findings of modelling have shown that predicted noise levels from the proposed development could exceed the recommended assessment goals.

6. Mitigation of Plant and Operational Noise

Acoustic bunding constructed along the site boundaries during the initial site establishment period is designed to mitigate operational noise (*Figure 10* and *Figure 13*).

Noise control measures recommended by Atkins Acoustics and Associates Pty Ltd have been adopted as the rules for operating plant and equipment.

The rules are:

1) All site plant will be equipped and operated to the manufacturers specifications and will be fitted with residential grade engine exhaust mufflers and engine side covers.

2) Plant and equipment (except the dozer) will be selected and modified to satisfy a level of performance typical of or better than current industry standards.

3) The dozer will be fitted with engineered secondary noise controls including mufflers, engine covers, cooling fan and lubricated track systems such that the dynamic sound power emission level [at source] is less than 107dB(A).

4) All site operated trucks (being used as haul trucks) will be required to comply with the noise requirements of Australian Design Rule 28/01.

5) Where practicable,l all reversing alarms will be removed from mobile plant or replaced with low level alarms and flashing lights.

6) The dozer will not be operated before 8am or after 5pm or on Saturdays except in an emergency.

7) The dozer will not be used, as far as possible, at or near the natural ground level. Topsoil and overburden stripping will be performed by quieter excavators or rubber tyred loaders.

8) Where practicable, static plant and working stockpiles will be positioned to maximise acoustic shielding.

9) Where practicable, the extraction face will be orientated to minimise reflected noise to residential receivers.

7. Mitigation of Transportation Noise

Improvements to the infrastructure within the quarry will reduce vehicle noise.

1) The access road will be constructed at a constant grade of approximately 10% to minimise gear changing and will be maintained in a smooth condition;

2) The access road will be sealed from the wheel wash to the entrance gate, approximately 80 metres, and for a short distance to the east of the wheel wash to eliminate the chassis noise of empty trucks passing over a rough surface.

3) Noise barriers required by the conditions of the amended consent will reduce the incidence of noise from all sources.

The following rules have been imposed to minimise vehicle noise.

1) The speed limit within the quarry will be 20kph for all vehicles.

2) All vehicles operating to and from the quarry will be required to comply with regulatory noise limits.

3) The use of horns and alarms, except for mandatory reversing alarms, will be avoided within the quarry.

4) The use of engine or exhaust brakes will be banned within the quarry and discouraged on adjacent public roads.

8. Conduct of the plan

1) All staff and contractors will be made aware of the plan and its rules.

2) All staff and contractors will be made familiar with the operation of plant, equipment and vehicles.

3) Daily checks will be made of all operating plant and equipment to ensure that it is operating correctly and within specification.

4) Noise monitoring will be conducted at critical locations during the 4 week construction period and when activities are likely to cause significant noise exposure.

5) The noise outputs of plant, vehicles and equipment will be tested and reported during audits.

RINDEAN QUARRY, SOMERSBY, NSW

6.5 AIR QUALITY MANAGEMENT PLAN

April 2012

Contents

1. Purpose and Scope of the Plan 1
2. Objectives 1
3. Sources of Atmospheric Pollution 1
4. Dust Monitoring 2
5. Operational Safeguards 2

1. Purpose and Scope of the Plan

This air quality management plan describes the procedures for dust control and air quality monitoring that will apply to the Rindean Quarry.

Air quality and greenhouse gas assessments were conducted by *Air Noise Environment Pty Ltd* in 2011/12. The this plan and the management actions described below are consistent with the recommendations of the assessments.

2. Objectives

The objectives of the air quality management plan are to:

1) prevent the generation of dust at potential sources within the quarry;
2) ensure that dust from the quarry does not affect neighbouring properties; and
3) minimise the quarry's contribution to greenhouse gas pollution of the atmosphere.

3. Sources of Atmospheric Pollution

Atmospheric pollution resulting from quarry operations will come from several sources;

1) dust from quarrying and haulage operations;
2) exhaust gases from diesel-powered vehicles and equipment;
3) fuel used in transporting product from the quarry and supplies to the quarry; and
4) external sources of pollution that arise from the generation of mains electricity used in the quarry.

All sources of pollution were taken into account in the assessments conducted by *Air Noise Environment Pty Ltd.*

Dust present in the atmosphere from local sources other than the quarry includes dust caused by traffic on unsealed roads, unsealed road shoulders, farming and poultry operations. The principal exhaust emissions in the area are caused by traffic using Wisemans Ferry Road and the F3 Freeway.

The quarry is located in a depression. It is protected from strong westerly and northerly winds by the ridgelines located along the northern and western boundaries. It is exposed to southerly and, in particular, easterly winds although these are generally humid and less likely to generate dust.. Some eddying can be expected within the quarry because of its size and the presence of benched high walls around the southern, western and northern margins.

The quarry will make only an incremental contribution to vehicle pollution load in the locality. The principal sources will remain traffic on the F3 Freeway and Wisemans Ferry Road at the eastern and western boundaries of the site respectively. Diesel exhaust fumes from plant and vehicles may be noticeable within the quarry, although they are expected to dissipate rapidly. The operation of the quarry is unlikely to result in a deterioration of existing air quality levels beyond the property boundaries.

Most fixed plant in the quarry will be powered by mains electricity. Mobile plant and trucks engaged in haulage will, generally, be diesel powered.

4. Dust Monitoring

The generation of dust within the quarry will be monitored visually at all times and action taken to rectify, stop or move activities generating dust. This requirement will apply, in particular, to activities being conducted on the boundary of the property such as the construction of noise bunds during the construction period.

5. Operational Safeguards

Management actions will be undertaken to minimise the pollution load and the impacts of the quarry affecting nearby properties include, as a minimum:

1) existing vegetation will be retained and new vegetation planted along the boundaries of the quarry, providing shelter from strong winds;

2) the quarry will be excavated below ground level which will reduce wind disturbance within the quarry and hence the creation of dust;

3) once quarrying is below the weathered zone, the porous sandstone will retain a high level of moisture and the sand will remain in a damp state;

4) the operational safeguards will include the watering of haulage roads and machinery manoeuvring areas, water sprays to the stockpiles, the wheel wash near the entrance to the site and sealing the access road from the wheel wash to Wisemans Ferry Road. A water cart of sufficient capacity will be available on site at all times. Internal haul roads will be maintained in good condition.

5) trucks carrying product from the site are required legally to have their loads covered at all times;

6) overburden will normally be transported directly to rehabilitation areas where it is to be used to avoid double handling. In the rare event that stockpiling is necessary, this will be done on site.

7) the use of fuel efficient equipment and the regular maintenance of diesel equipment is vital to contain the large overhead of fuel costs. Modern current generation machinery will be used throughout the site. Machinery will be turned off when it is not in use;

8) the use of biofuels in plant and equipment will be considered if it is available and compatible with the high standard of machinery being used;

9) a large proportion of the stockpiled sand product will have been screened and washed to remove all or some of the fine (less than 75 micron) fraction;

10) clay fines which make up the tailings from the washing process will be stored under water in tailings dams. When tailings are being worked into material for rehabilitation, precautions will be taken to prevent the generation of dust; and

11) where possible supplies will be sourced locally to minimise transportation emissions.

All vehicles on the site will be required to observe speed limits and other operational constrains applied to ensure safe operation. If a vehicle that comes on to the site is observed to be causing visible pollution (eg a smoky exhaust) the driver of the vehicle will be notified and asked to have the problem repaired before returning to the site.

RINDEAN QUARRY, SOMERSBY, NSW

6.6 SAFETY, HAZARD AND WASTE MANAGEMENT PLAN

April 2012

Contents

1. Purpose and Scope of the Plan 1
2. Objectives 1
3. Regulatory Control 2
4. The Present State of the Site 2
5. Occupational Health and Safety 2
6. Public Safety 2
7. Bush Fire Management 3
8. Waste Management 3
   - 8.1 Dealing with Present Waste 3
   - 8.2 Dealing with Future Waste 3
9. Cleaner Production 3

1. Purpose and Scope of the Plan

This purpose of this plan is to identify requirements for the safe operation of the quarry. It does not provide detail in most instances because in key areas separate specialist plans are required by the relevant State statutes some of which are in transition. These plans have been prepared by specialists and are required to be submitted to the relevant authorities before the quarry begins operation. Copies will be provided to the Gosford City Council for information and to be a part of the available public record.

2. Objectives

Principal objectives in operating the quarry will be to:

1) ensure the safety of those working within or associated with the quarry;
2) prevent the site becoming a source of risk for adjacent areas;
3) manage all waste and hazardous materials in accordance with statutory requirements; and
4) protect the quarry site from external risks.

3. Regulatory Control

Quarrying is an activity that is administered under:

Work Health and Safety Act 2011

Work Health and Safety Regulation 2011

Mine Health and Safety Act 2004

Mine Health and Safety Regulations 2007

The Work Health and Safety Act 2011 and *Work Health and Safety Regulation 2011* have replaced the *Occupational Health and Safety Act 2000 and the Occupational Health and Safety Regulation 2007* from 1 January 2012 as a part of the national harmonisation of work place health and safety legislation.

The *Minerals Industry Safety Handbook* is a resource produced by the Resources and Energy Division of the Department of Trade and Investment, Regional Infrastructure and Services to help all mines assess risks, develop risk controls and put in place or review workplace practices and procedures. It promotes standards in best practice in occupational health and safety. The Handbook is a companion to the *Safety Management Plan - Workbook*, which contains information on implementing health and safety management plans.

The quarry will be operated in accordance with the requirements of the Gosford City Council where these requirements are consistent with New South Wales Government regulation of the quarrying industry although State Government legislation and regulation has precedence.

4. The Present State of the Site

The present state of the site is a result of its prior occupation by a contract operator. As far as is known, however, the site contains no hazardous waste or other materials that present a risk to health and safety, other than asbestos that is contained in the cladding of existing buildings.

The intention is to clean up the site during the initial stages of the redevelopment and to conduct future operations in accordance with sound quarry management practices.

All materials produced as a result of quarrying operations will be sold as product or used in rehabilitation. Waste from the quarry site will be limited, therefore, to materials associated with the maintenance of plant and equipment, general rubbish from a site cleanup, a small amount of putrescible and human waste associated with the occupation of the site and waste materials from the demolition of a house and outbuildings on the property.

5. Occupational Health and Safety

A separate Mine Safety Management Plan incorporating an Emergency Plan and an Occupational Health and Safety Plan will be prepared accordance with New South Wales Government legislation. It will be an adjunct to but not part of the Quarry Management Plan.

6. Public Safety

Quarrying is an extractive industry that engages heavy equipment and, therefore, has inherent risks. In the type of operation proposed for Rindean Quarry the risks, apart from those associated with the transport of product and supplies on public roads, are contained entirely within the quarry site. There will be no blasting, for example, and, therefore, no risk of fly rock.

Although the quarry operators will have a duty of care to minimise the risks associated with quarrying in regard to the public safety, the public also has a responsibility not to trespass on the property.

The perimeter of the property will be delineated by a 2 metre high chain wire and barbed wire fence. Signs will be erected at the quarry gate and at intervals of 50 metres along the perimeter fence warning of the presence of an open quarry with potential near vertical drops.

Safety fences and warning signs will be maintained in areas of significant risk within the property in accordance with the requirements of the development consent.

The general public will not be permitted in the quarry. Anyone entering the quarry on business will be required to register first at the quarry office. Small volume sales will be made to assist local businesses and property owners. Purchasers will be required to adhere strictly to the rules of the quarry, to remain on the designated access road and to load in a designated area.

The rehabilitation program will continue throughout the life of the quarry to return the site to a condition consistent with the wider area. These operations will reduce the risks associated with the residual quarry void. The final stage of the quarrying operation will be to clean up the site, remove remaining structures and equipment, complete the rehabilitation program and make the site safe. However, public caution will be necessary beyond this point. The use of the quarry site beyond closure can only be a matter for future consideration.

7. Bush Fire Management

The potential for Rindean Quarry to be a source of fire is low. Quarry operations generally have a low number of potential ignition sources that are usually confined within the quarry pit and floor areas away from vegetated areas. Principle sources of fire will be equipment fires, vehicle fires and litter or rubbish fires.

The potential for the quarry to contribute to the general risk of bush fire propagation will increase as the proportion of the quarry under rehabilitation increases.

The fire management plan involves:

1) the appointment of the Quarry Manager as the principal fire warden;
2) reduction of excessive fire fuel loads within regrowth vegetation, buffers and rehabilitation;
3) avoiding a build up of litter or rubbish;
4) constructing and maintaining fire breaks along boundaries where the need is identified;
5) banning the lighting of unauthorized fires on site;
6) maintaining a basic fire fighting capacity i.e. extinguishers for equipment fires, a pump and hose on the water cart and knapsack sprays on quarry vehicles; and
7) a requirement to report immediately to the quarry manager any fire that occurs within the quarry or nearby and, if necessary, advise local fire authorities.

8. Waste Management

8.1 Dealing with Present Waste

The site at present has a scattering of waste materials associated with past quarrying activities. These materials include plant and equipment parts, tyres and concrete. Metallic materials will be taken to a scrap yard for recycling. Concrete will be crushed and used as a stabilising material on the site. Old tyres will be used as road markers or stockpiled prior to disposal in the required manner.

An old house and outbuildings on the property will be demolished during Stage 1 of the quarry operation to make way for future quarrying. These buildings are principally of timber frame and fibro sheet construction. Because of the age of the buildings, the fibro sheet is likely to contain asbestos. Those materials that have a future use will be considered for recycling. Other materials will be dumped at the local Council waste disposal facility.

The fibro sheet will be removed from the structure before it is demolished. It will be handled only in a sealed or wet condition to eliminate airborne dust by qualified personnel wearing suitable protective clothing and face masks, loaded into a truck and securely covered before being disposed of at a facility nominated by the Gosford Council.

8.2 Dealing with Future Waste

Waste and recyclable materials will be managed in accordance with good management practice. As far as practicable, the disposal of waste from the servicing of plant and equipment, in particular tyres, will be the responsibility of the service contractors. Waste that remains the responsibility of the quarry will be collected in bins for recycling or disposal at a local facility.

Hydrocarbon contamination of soil will be avoided through the proper handling of fuels and oils and maintenance of plant and equipment. Refuelling will be performed by registered contractors in designated areas constructed in a manner that will contain any spills and prevent the inflitration of hydrocarbons into groundwater. Hydrocarbon contaminated soil will be treated on site on a case by case basis.

Contaminated or hazardous waste will **not** be buried within the quarry property.

The use of portable serviced toilets or composting toilets will eliminate problems associated with a septic system. Putrescible waste will be collected in separate covered bins and disposed of regularly in a Gosford Council facility.

9. Cleaner Production

The quarry will generate wastes typical of all quarry operations, including used oil and grease, used packaging, cleared vegetation, construction debris, sewage, overburden and fines. The quarry will operate in accordance with the principles of the *Protection of the Environment Operations (Waste) Regulation, 199*6.

Waste minimisation practices will be adopted throughout the quarry's operating life. These practices will include the conservation of energy, avoiding spills, reusing surplus materials and using recycling facilities. Particular measures that will be adopted by the quarry will include:

1) purchasing and contract practices that include environmental and waste considerations;
2) separating recyclable materials from the mixed waste stream where practicable;
3) collecting used oils and grease for recycling off-site;
4) collecting residual wastes separately and disposal at the nearest Council landfill;
5) using cleared vegetation where appropriate for timber or to enhance habitat in rehabilitation areas; and
6) using surplus overburden and fines in the rehabilitation of the site.

Equipment will be selected to ensure maximum energy efficiency in order to minimise greenhouse gas emissions and reduce operating costs. All fixed plant will be powered by electricity.

RINDEAN QUARRY, SOMERSBY, NSW

6.7 TRANSPORT AND TRAFFIC MANAGEMENT PLAN

April 2012

Contents

1. Purpose and Scope of the Plan 1
2. Objectives 1
3. Responsibility and Infrastructure 1
4 The Transport and Traffic Management Rules 2
5. Loading 2

Figures

Relevant figures are:

Figure 6 *Rindean Quarry Plan Stage 2 – Years 3 to 5*

Figure 10 *Survey plan showing preliminary work to be performed and the ultimate limits of the quarry's footprint*

Figure11 *Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby – Site Plan*

Figure12 *Intersection Upgrade, Rindean Quarry, No 620 Wisemans Ferry Road, Somersby – 19m Semi Trailer Design vehicle Movements*

1. Purpose and Scope of the Plan

The preparation of a transport and traffic management plan is a commitment given in the Environmental Impact Statement (EIS) for Rindean Quarry.

2. Objectives

The objectives of this plan are that:

1) the operation of vehicles within the quarry, including the loading of sand products is conducted in an orderly manner with minimum disturbance to neighbouring properties; and
2) traffic entering and leaving the quarry does so with minimum risk to other road users.

3. Responsibility and Infrastructure

Transportation of the product from the quarry will be performed almost entirely by independent contractors, many of them owner drivers. Their operations are controlled by

New South Wales Government legislation and regulations. Rindean Quarry does have control over their operations within the quarry and will maintain a posted set of rules by which the operators will be required to abide. However, drivers will have the ultimate responsibility for the safe and considerate operation of their vehicles.

The junction of the quarry access road has been redesigned and constructed to take into account the requirements of NSW Roads and Maritime and the Gosford City Council. The redesign included moving the gate to the east to allow sufficient distance for a truck and trailer combination to stop between the road verge and the gate. (*Figure 11* and *Figure 12*).

Vehicle access within the quarry will change over the quarry's life. *Figure 10* shows the initial access road to the location of the processing plant. *Figure 6* shows the permanent route into the quarry to the later location of processing plant near the centre of the quarry floor.

A wheel wash will be installed approximately 80 metres from the gate and the entrance road sealed to prevent vehicles carry dirt on to Wisemans Ferry Road. The remainder of the access road into the quarry will be an all-weather gravelled road 6 to 8 metres wide with a constant gradient of approximately 10%. Safety barriers of in-situ sandstone, earth mounds, concrete blocks or steel or post and wire railings will be installed where necessary.

4 The Transport and Traffic Management Rules

1) All vehicles must report to the site office located immediately to the east of the wheel wash.
2) The speed limit within the quarry is 20kph for all vehicles.
3) All vehicles must stop before entering Wisemans Ferry Road.
4) The loads of all vehicles must be covered before the vehicles leave the loading area.
5) All vehicles must be checked for loose material, for example on drawbars. This material must be removed before the vehicles leave the loading area.
6) All heavy vehicles must pass through the wheel wash before leaving the quarry.
7) All vehicles operating to and from the quarry are be required to comply with regulatory noise limits.
8) The use of horns and alarms, except for mandatory reversing alarms, and heavy braking is to be avoided within the quarry.
9) The use of engine or exhaust brakes is banned within the quarry and discouraged on adjacent public roads.
10) Road vehicles must remain on the access road or designated standing areas within the quarry.
11) Drivers are required at all times to operate their vehicles in a manner that will not create excessive noise or cause concern to neighbours or members of the public.

5. Loading

Loading will be performed by a rubber tired loader directly from product stockpiles. Drivers should note that:

1) trucks and trailers will be parked as directed to minimise transit distances for the loader and the noise of loading;
2) the driver of the truck is responsible for the quantity and balance of the load on the truck and will advise the loader operator accordingly.

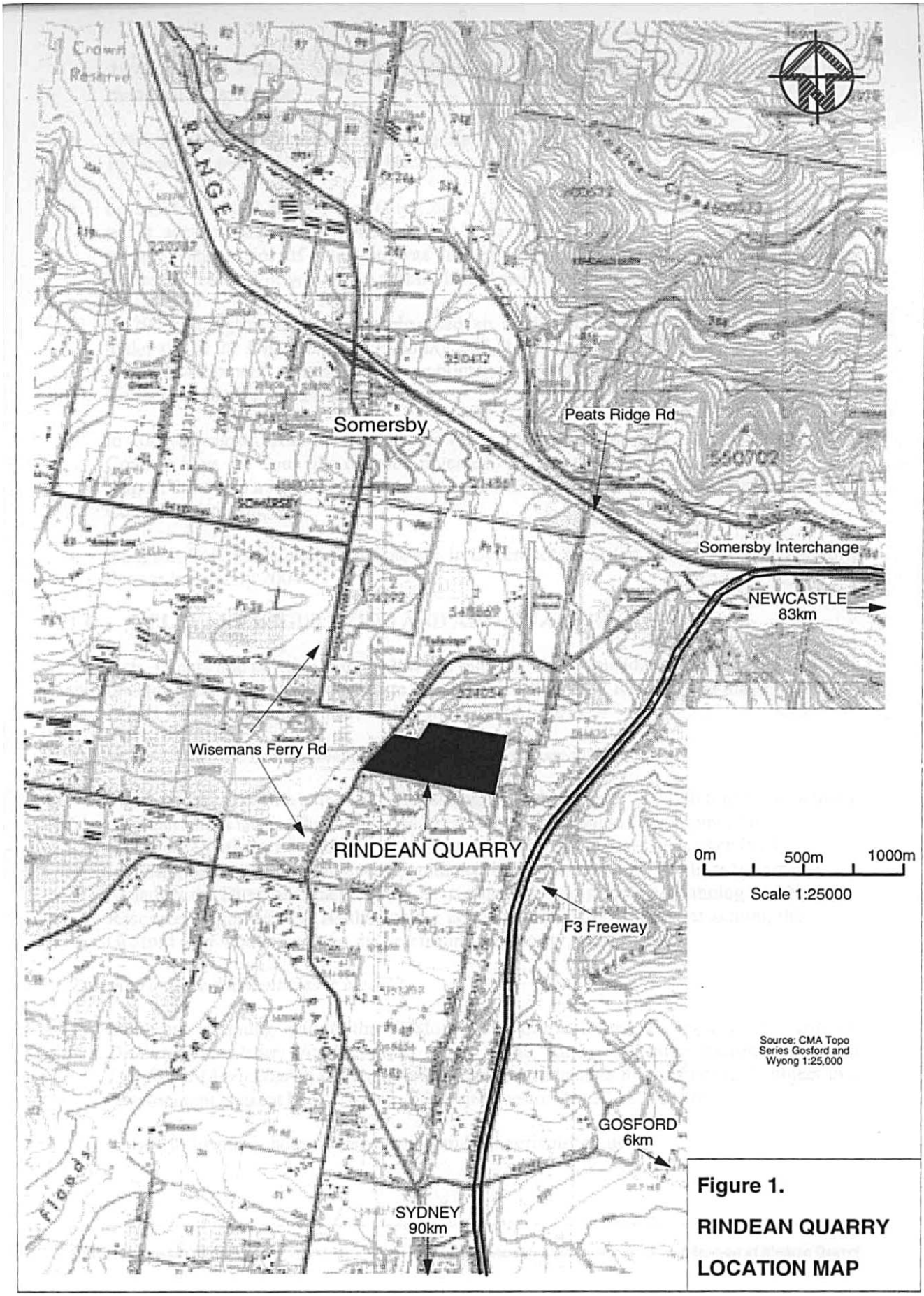
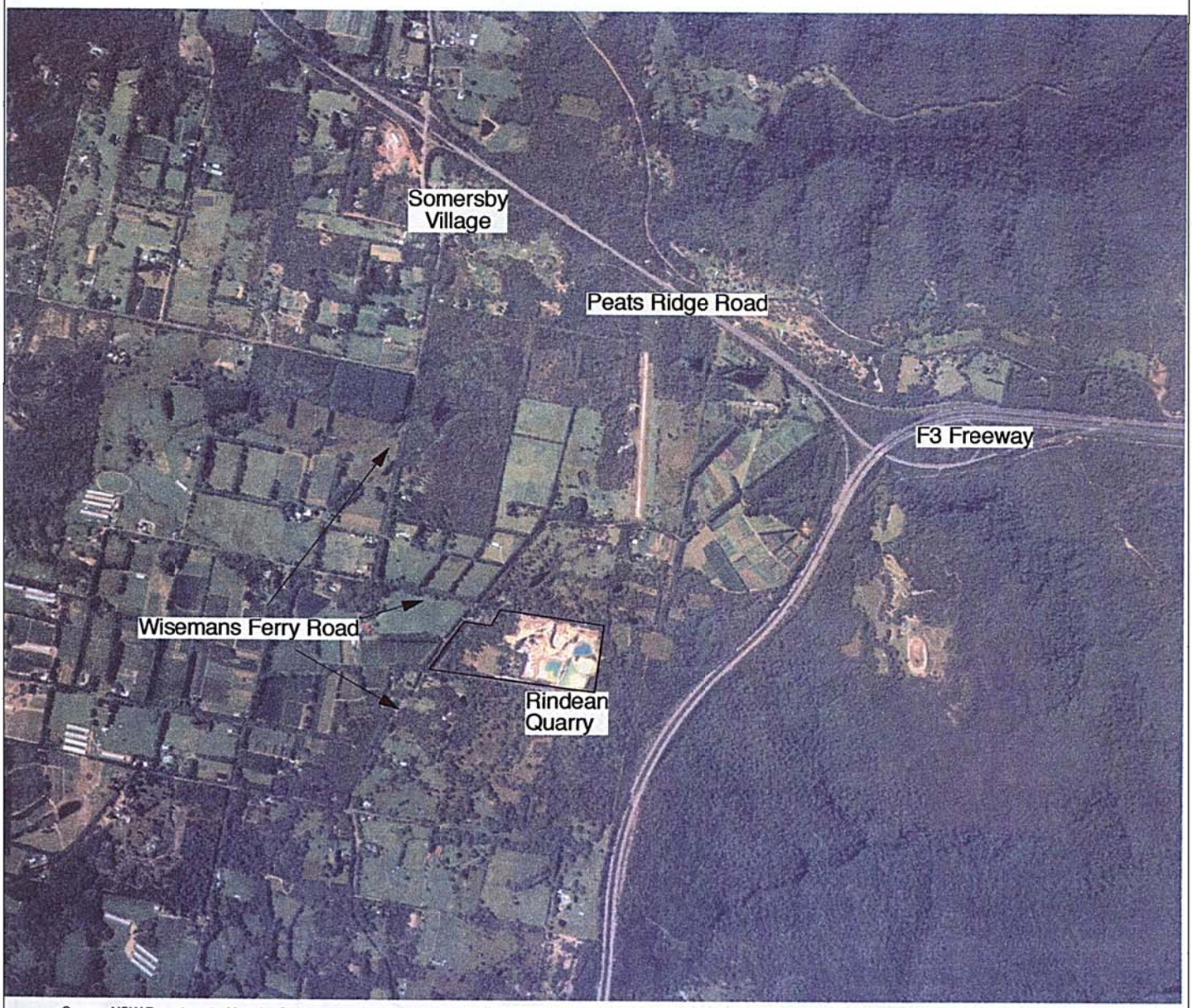


Figure 1.

RINDEAN QUARRY

LOCATION MAP



Source: NSW Department of Lands, Order No: 14610, Date: 16/03/2004

0m 500m 1000m 1500m 2000m

Scale 1:25000

Figure 2.

LOCAL SETTING


N
Image © 2010 Sinclair Knight Merz
© 2010 Whereis® Sensis Pty Ltd
©2010 Google
Imagery Date: Dec 18, 2006
33°22'32.09" S 151°17'39.62" E elev 810 ft
Eye alt 2907 ft

Figure 3

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EXISTING ENVIRONMENT

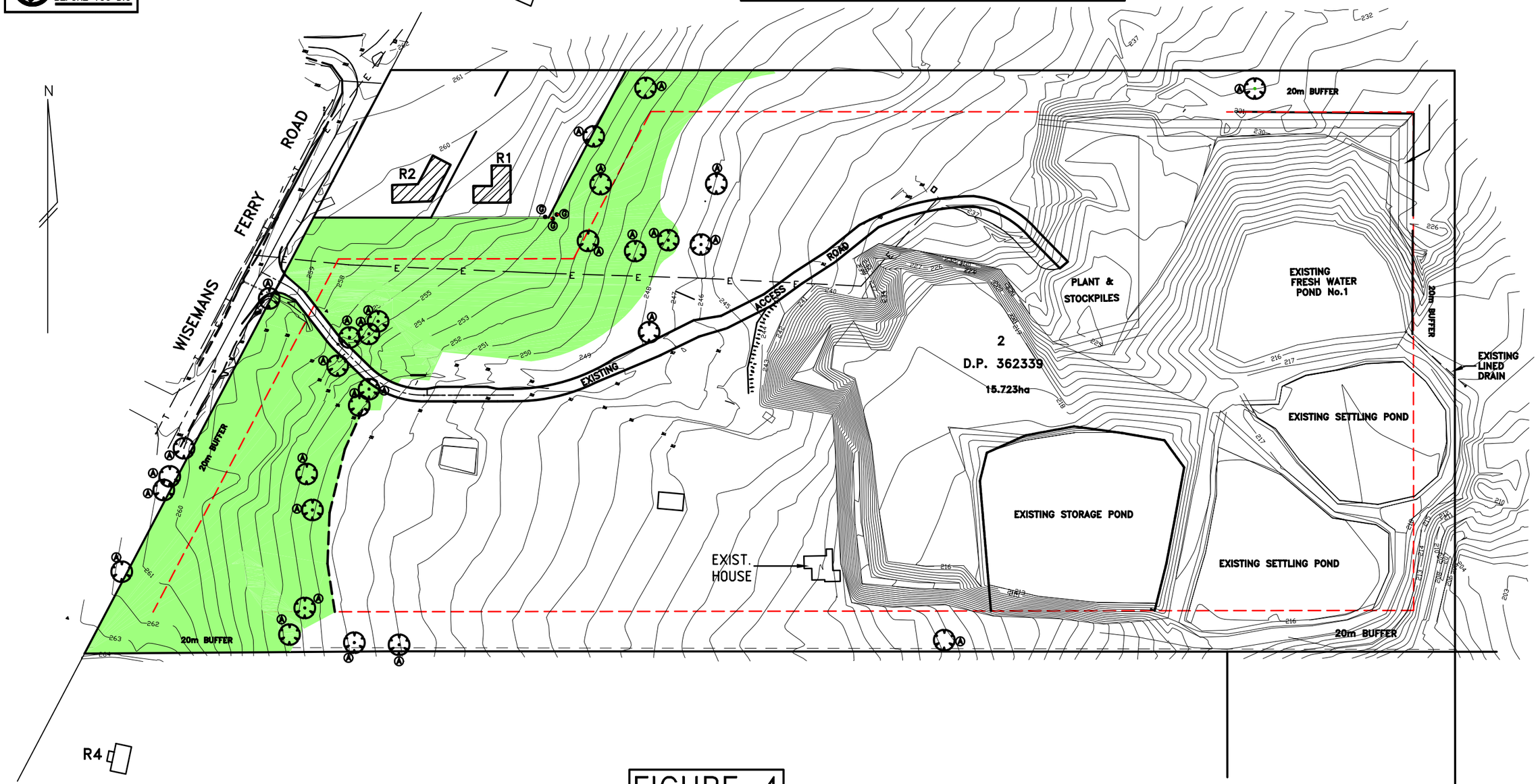


FIGURE 4

CAD FILE: 6175_STAGE 1.dwg
THIS PLOT: 01-03-2011 14:53
REFERENCE: 6175.000

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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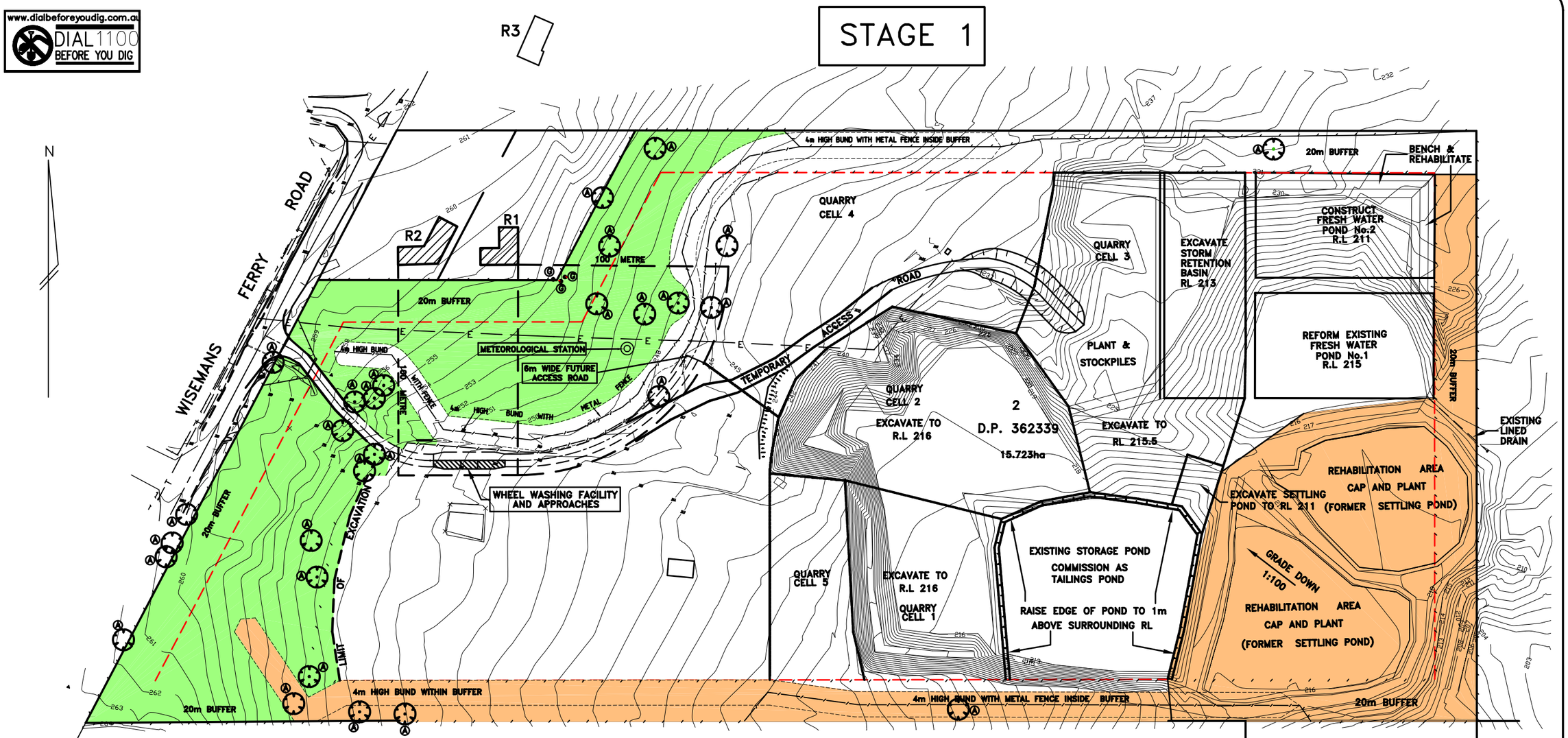
SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 05/04/2012

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STAGE 1



– DENOTES HOLLOW BEARING TREE

– DENOTES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

FIGURE 5

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY (NOT TO SCALE)

CAD FILE: 6175_STAGE 1.dwg
THIS PLOT: 01-03-2011 14:53
REFERENCE: 6175.000

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
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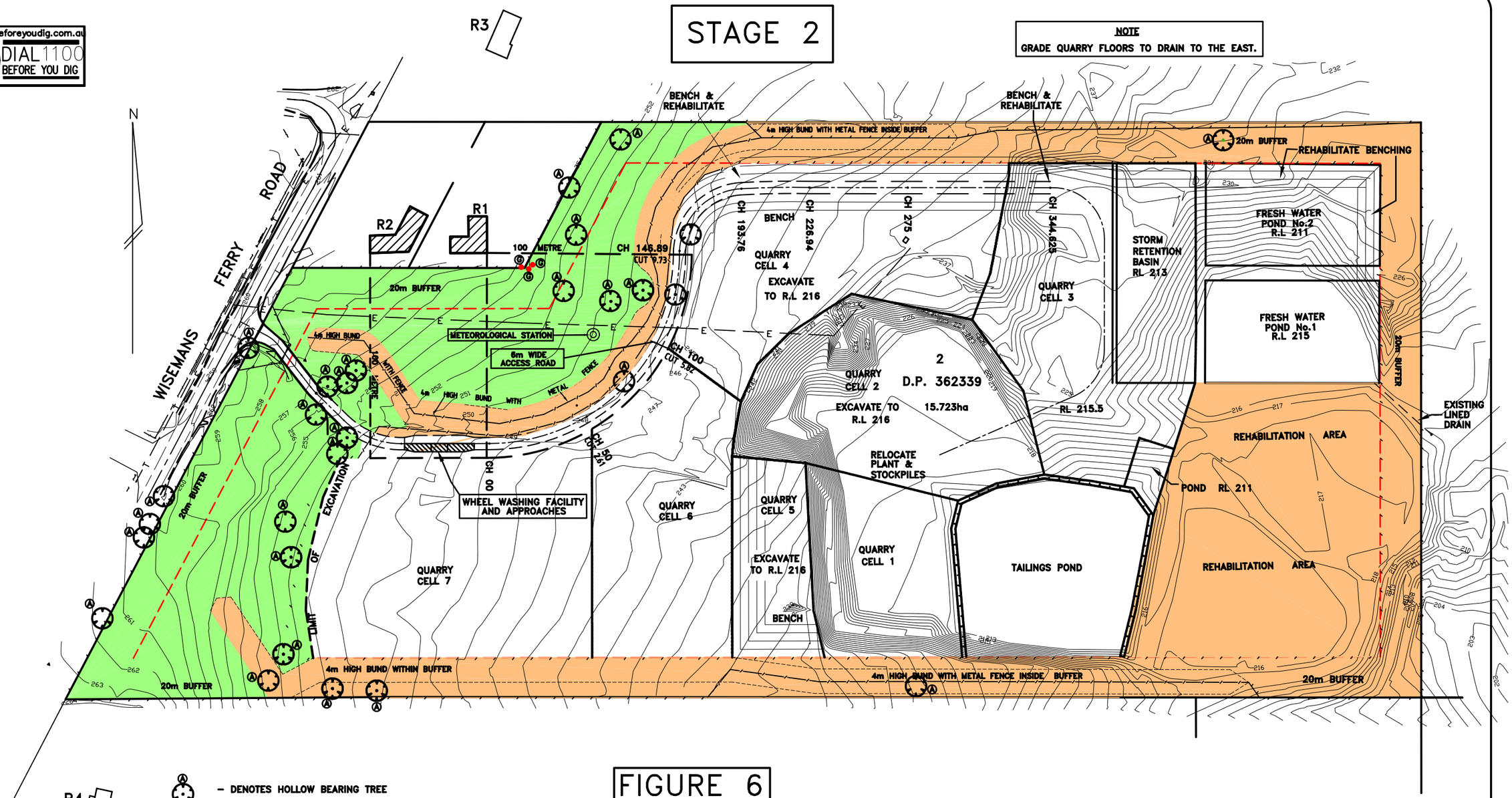
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STAGE 2

NOTE
GRADE QUARRY FLOORS TO DRAIN TO THE EAST.



– DENOTES HOLLOW BEARING TREE

– DENOTES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

FIGURE 6

40 0 40 80 120 160 200
SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

CAD FILE: 6175_STAGE2_REV_E.dwg
THIS PLOT: 10-04-2012 14:03
REFERENCE: 6175

QUARRY PLAN – STAGE 2 – YEARS 3 TO 5
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
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STAGE 3

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N

R3

REHABILITATE

REHABILITATE

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

DETAILS AS PER STAGE 1 PLAN

ACCESS TRACK

BENCH

R2

R1

100 METRE

FERRY ROAD

WISEMANS

20m BUFFER

4m HIGH BUND

100 METRE WITH FENCE

4m HIGH BUND WITH METAL FENCE

METEOROLOGICAL STATION

6m WIDE ACCESS ROAD

BENCH

QUARRY CELL 4
R.L 216

QUARRY CELL 3
RL 215.5

STORM RETENTION BASIN
RL 213

FRESH WATER POND No.2
R.L 211

FRESH WATER POND No.1
R.L 215

20m BUFFER

EXISTING LINED DRAIN

QUARRY CELL 2
R.L 216

2
D.P. 362339
15.723ha

CH 00

WHEEL WASHING FACILITY AND APPROACHES

EXCAVATION

OF

LIMIT

QUARRY CELL 6

EXCAVATE TO R.L 216 & BENCH

QUARRY CELL 5

PLANT & STOCKPILES

QUARRY CELL 1

SETTLING POND RL 211

REHABILITATION AREA

TAILINGS POND

QUARRY CELL 7

BENCH

20m BUFFER

4m HIGH BUND WITHIN BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

R4 – DENOTES HOLLOW BEARING TREE

– DENOTES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

R6

R5

CAD FILE: 6175_STAGE 3_REV D.dwg
THIS PLOT: 10-04-2012 14:01
REFERENCE: 6175.000

FIGURE 7

RINDEAN QUARRY PLAN – STAGE 3 – YEARS 6 TO 10
LOT 2 IN D.P. 362339
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DA No. 26467/2004

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Australian Height Datum

REFERENCE: 6175 ISSUE: D 07/03/2011

STAGE 4

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N

R3

DETAILS AS PER STAGE 1 PLAN

R2

R1

100 METRE

20m BUFFER

METEOROLOGICAL STATION

6m WIDE FUTURE ACCESS ROAD

4m HIGH BUND WITH 100 METRE FENCE

4m HIGH BUND WITH METAL FENCE

WISEMANS FERRY ROAD

20m BUFFER

EXCAVATION LIMIT

WHEEL WASHING FACILITY AND APPROACHES

QUARRY CELL 7

EXCAVATE TO R.L 217 & BENCH

QUARRY CELL 6

RL 216 – 217

4m HIGH BUND WITHIN BUFFER

20m BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

ACCESS TRACK

REHABILITATION AREA

REHABILITATION AREA

2 D.P. 362339.

QUARRY CELL 2

15.723ha

PLANT & STOCKPILES

TAILINGS POND

STORM RETENTION BASIN RL 213

FRESH WATER POND No.2 R.L 211

FRESH WATER POND No.1 R.L 215

20m BUFFER

EXISTING LINED DRAIN

REHABILITATION AREA

SETTLING POND RL 211

REHABILITATION AREA

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

R4

– DENOTES HOLLOW BEARING TREE

– DENITES Grevillea shiressii

– DENOTES LIMIT OF BUFFER ZONE

– DENOTES REHABILITATION AREA

– DENOTES EXISTING VEGETATION

FIGURE 8

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY (NOT TO SCALE)

R6

R5

CAD FILE: 6175_STAGE 4_REV D.dwg
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REFERENCE: 6175

RINDEAN QUARRY PLAN – STAGE 4 – YEARS 11 TO 19
LOT 2 IN D.P. 362339
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INDICATIVE FINAL LANDFORM

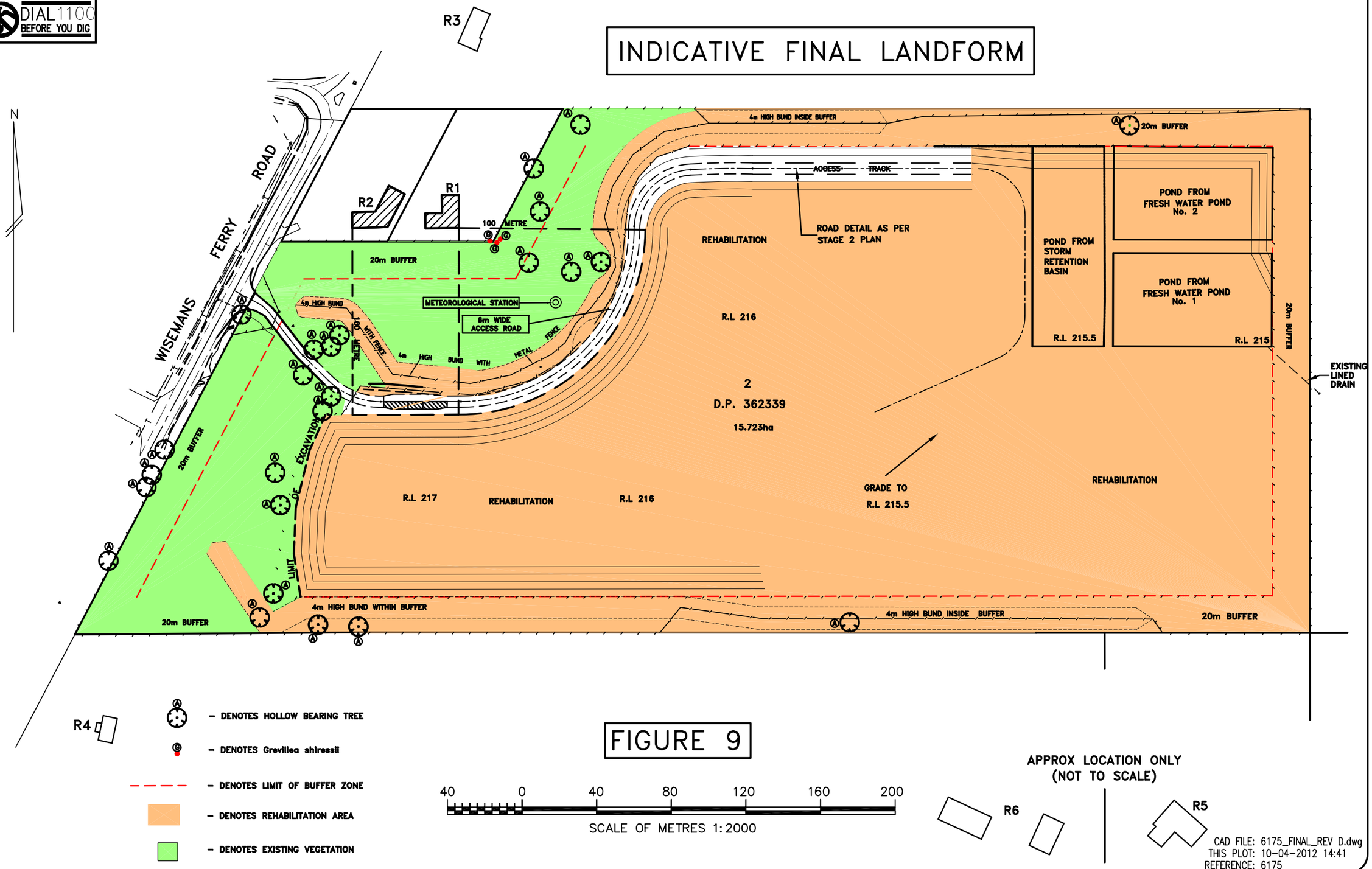


FIGURE 9

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

R6 R5

CAD FILE: 6175_FINAL_REV D.dwg
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REFERENCE: 6175

RINDEAN QUARRY PLAN – INDICATIVE FINAL LANDFORM
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

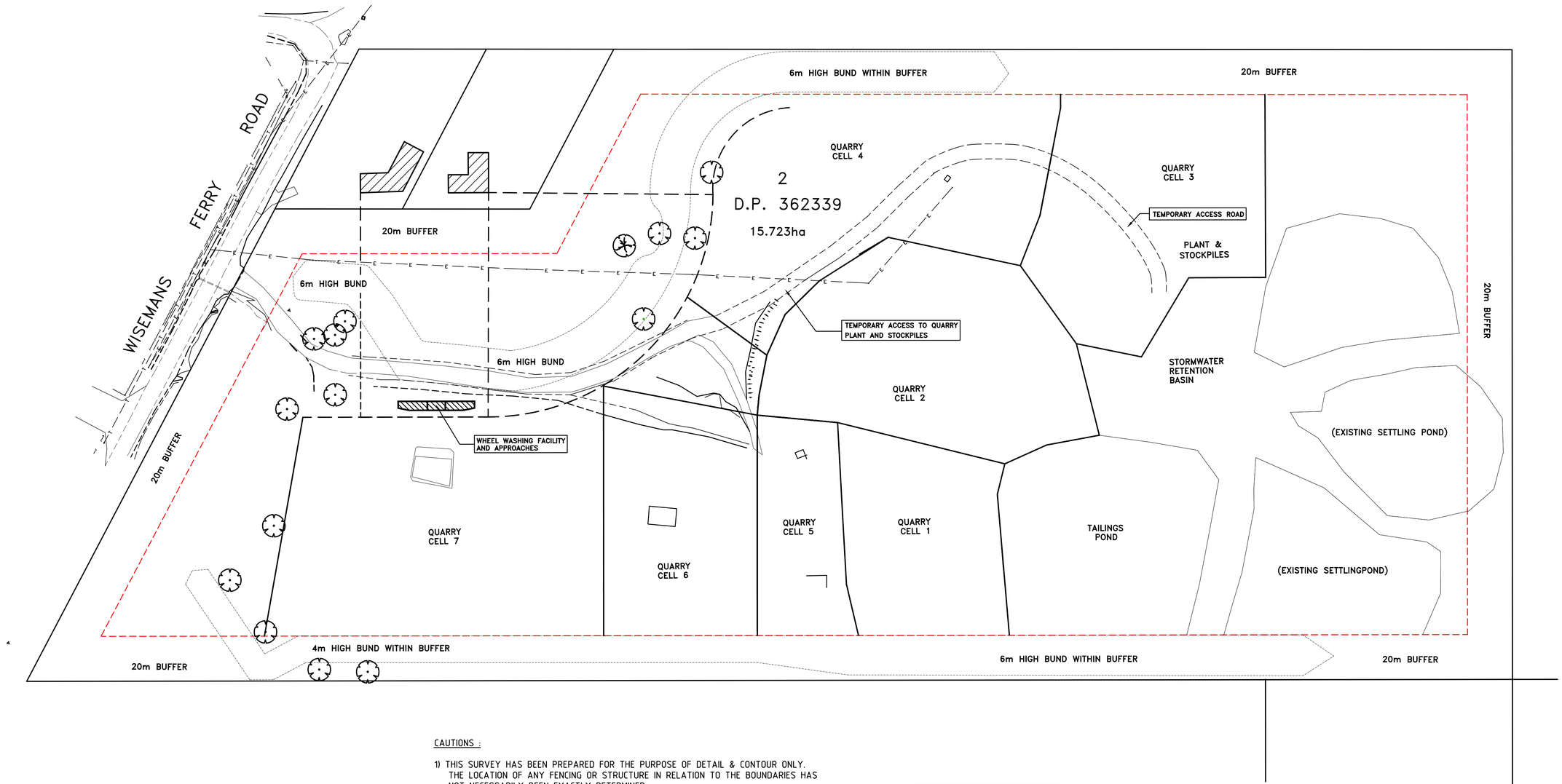
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SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: D 10/04/2012

PRELIMINARY WORKS



– DENOTES HOLLOW BEARING TREE

CAUTIONS :

1) THIS SURVEY HAS BEEN PREPARED FOR THE PURPOSE OF DETAIL & CONTOUR ONLY. THE LOCATION OF ANY FENCING OR STRUCTURE IN RELATION TO THE BOUNDARIES HAS NOT NECESSARILY BEEN EXACTLY DETERMINED.
2) UTILITY SERVICES SHOWN HAVE BEEN LOCATED BY SURVEY WHERE THEY ARE VISIBLE AND APPARENT. HOWEVER , THE APPROXIMATE POSITION OF UNDERGROUND SERVICES MAY HAVE ALSO BEEN PLOTTED FROM UTILITY AUTHORITY PLANS, AND THIS PLAN MUST BE READ IN CONJUNCTION WITH THE RELEVANT UTILITY AUTHORITY PLANS.
3) THE LOCATION OF SERVICES ARE TO BE VERIFIED BY OBTAINING CURRENT INFORMATION FROM "DIAL BEFORE YOU DIG" (PHONE 1100) PRIOR TO DESIGN/CONSTRUCTION WORKS. ALTERNATIVELY, THE EXACT LOCATION OF SERVICES SHOULD BE DETERMINED BY FIELD SURVEY IN CONSULTATION WITH THE SERVICE AUTHORITIES WHERE DEEMED NECESSARY.

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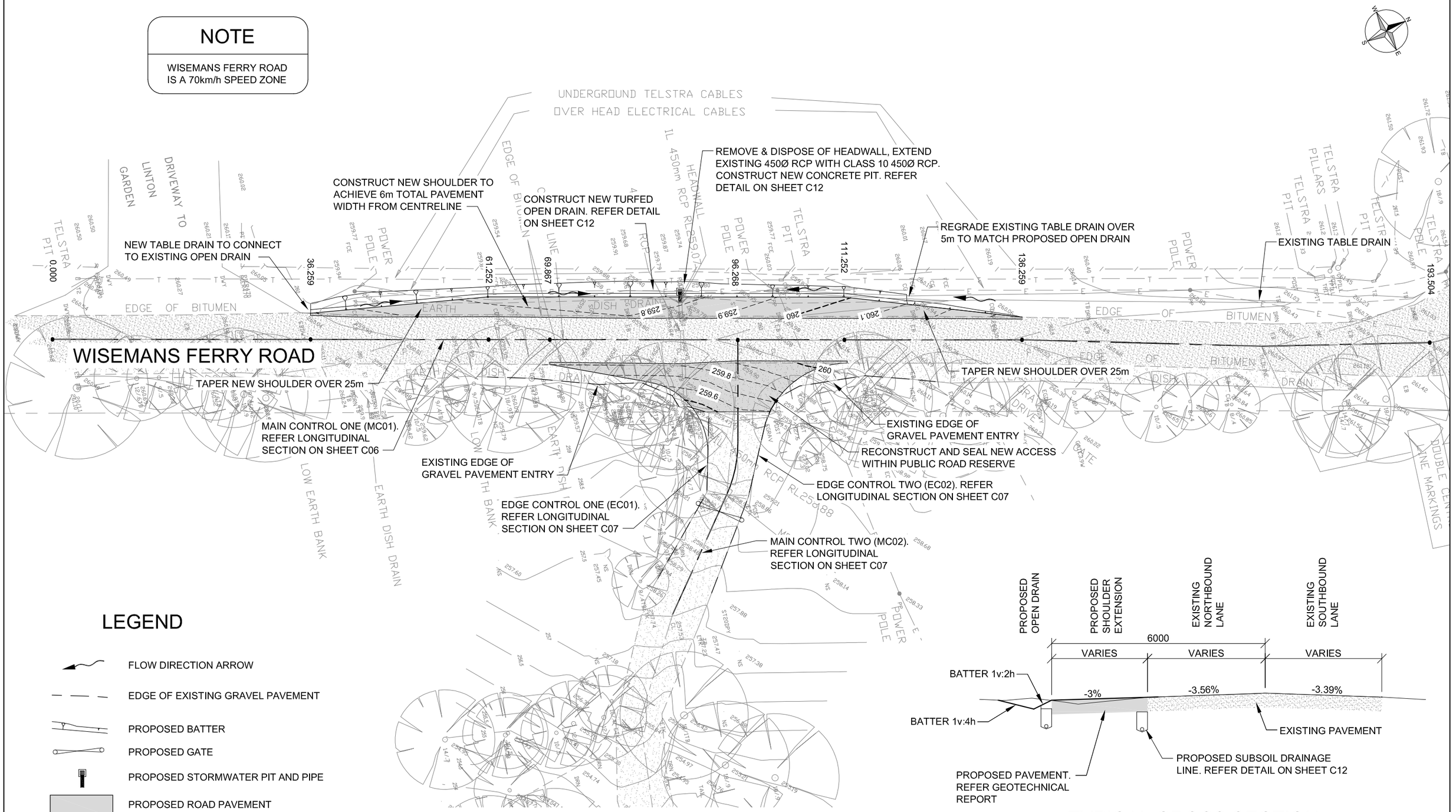
FIGURE 10

CAD FILE: 6175_FIGURE 10.dwg
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REFERENCE: 6175

SCALE: 1:1000 @ A1 SHEET 1:2000 @ A3 SHEET	STEPHEN THORNE AND ASSOCIATES PTY LTD CONSULTING SURVEYORS SUITE 8, 42 MANN STREET, GOSFORD. 2250 Phone (02)4323-1255 Facsimile (02)4324-2226 P.O. BOX 1315 GOSFORD NSW 2250 A.C.N. 057 514 860 A.B.N. 51 057 514 860	QUARRY ACCESS PLAN LOT 2 IN D.P. 362339 RINDEAN QUARRY No. 620 WISEMANS FERRY ROAD, SOMERSBY	20 0 20 40 60 80 100 SCALE OF METRES 1:1000 20 0 20 40 60 80 100 SCALE OF METRES 1:2000 (A3 SHEET)	amendments	PLAN NUMBER 6175 / ISSUE A
DATUM: Australian Height Datum / DATE 18/11/2010					SHEET 1 OF 1 SHEETS

NOTE

WISEMANS FERRY ROAD
IS A 70km/h SPEED ZONE



LEGEND

- FLOW DIRECTION ARROW
- EDGE OF EXISTING GRAVEL PAVEMENT
- PROPOSED BATTER
- PROPOSED GATE
- PROPOSED STORMWATER PIT AND PIPE
- PROPOSED ROAD PAVEMENT
- DESIGN CONTOUR (0.1m INTERVALS)
- DESIGN CONTOUR (0.5m INTERVALS)

TYPICAL CROSS SECTION

SCALE 1:100

FIGURE 11

No.	Amendment Description	Init.	Date
B	COUNCIL AMENDMENT	L.Mc	10/02/11
A	PRELIMINARY	L.Mc	26/10/10

A3 Original | This sheet may be prepared using colour and may be incomplete if copied

SCALES

Scale 1:500 (0 5 10 15 20 25)

Scale 1:100 (0 1 2 3 4 5)

Co-ordinate System: MGA Zone 56 | Height Datum:

RGH CONSULTING GROUP
Multi-discipline Engineering

Designed L.M.McBRIDE
Reviewed A.J.GRIFFITHS (MIE AUST, CPENG, NPER)

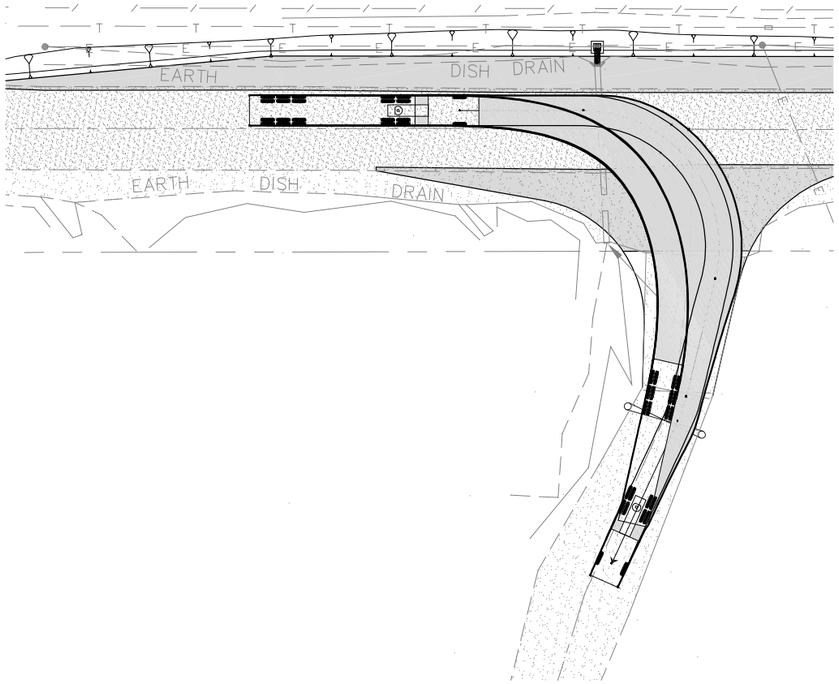
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GOSFORD CITY COUNCIL
INTERSECTION UPGRADE - RINDEAN QUARRY
№ 620 WISEMANS FERRY ROAD, SOMERSBY

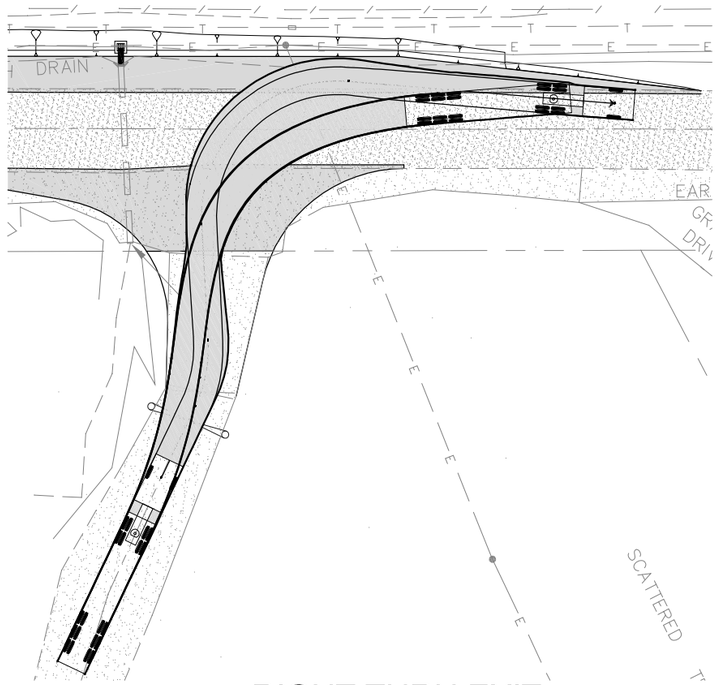
GENERAL SITE PLAN

RGH File №:	Drawing:	Date:	SHEET REF.
20100313		OCT 2010	C03

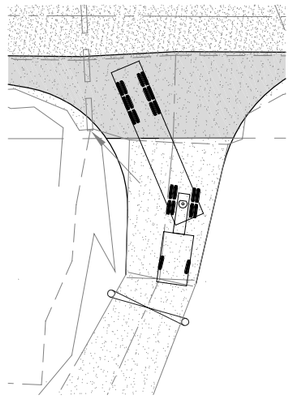
Project Manager:
PROFESSIONAL CONSTRUCTION SERVICES Pty Ltd



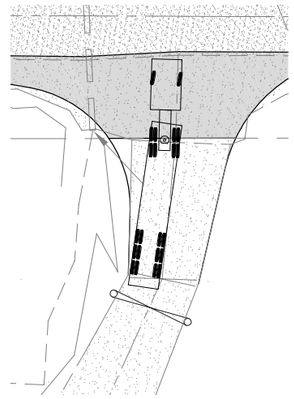
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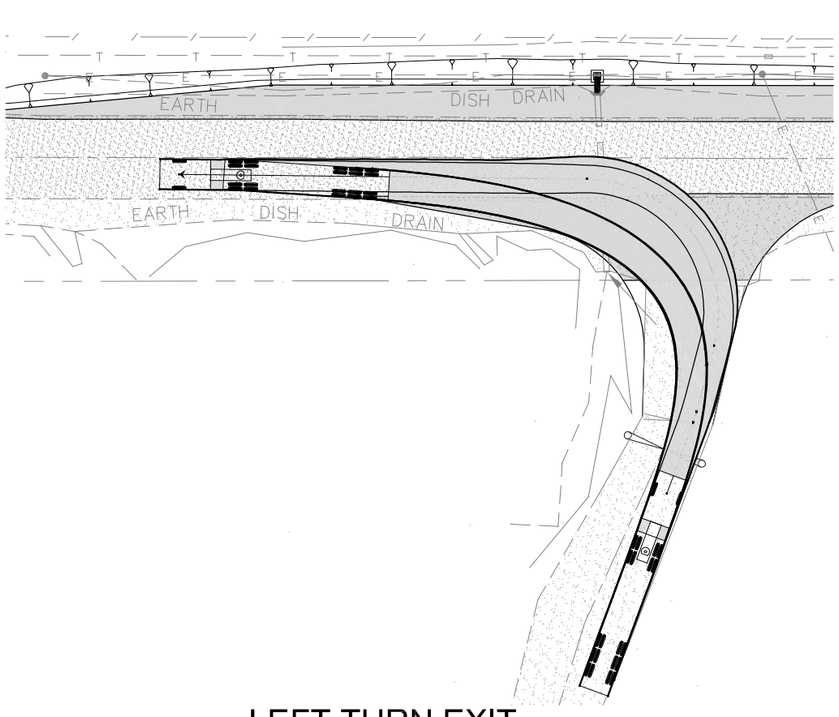
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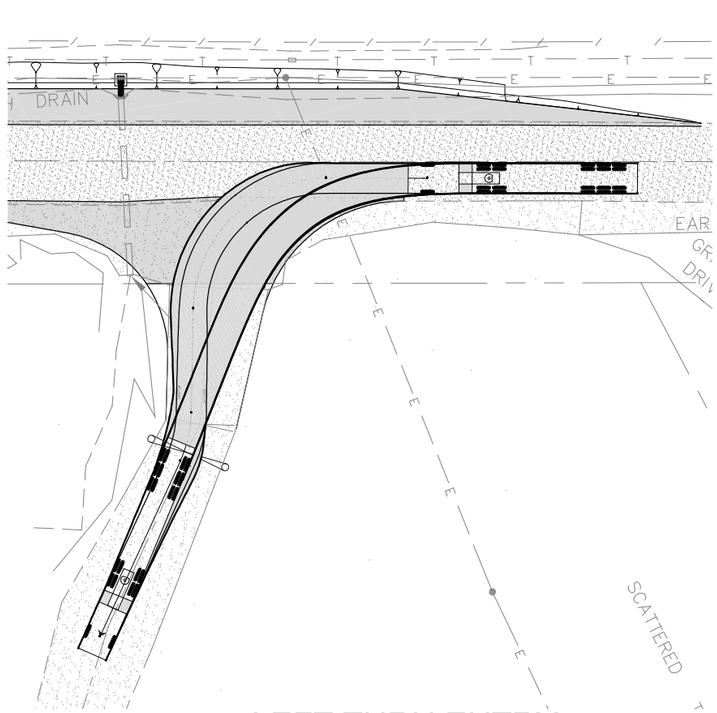
DRIVEWAY VEHICLE STORAGE
RIGHT TURN ENTRY



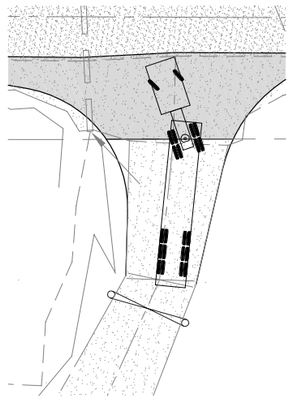
DRIVEWAY VEHICLE STORAGE
RIGHT TURN EXIT



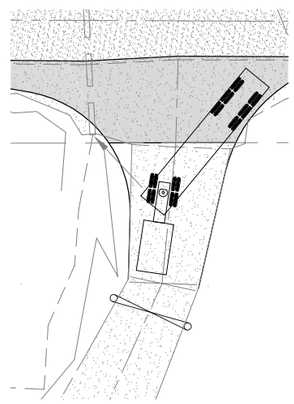
LEFT TURN EXIT



LEFT TURN ENTRY



DRIVEWAY VEHICLE STORAGE
LEFT TURN EXIT



DRIVEWAY VEHICLE STORAGE
LEFT TURN ENTRY

FIGURE 12

No.	Amendment Description	Init.	Date
B	COUNCIL AMENDMENT	L.Mc	10/02/11
A	PRELIMINARY	L.Mc	26/10/10

A3 Original | This sheet may be prepared using colour and may be incomplete if copied

SCALES
0 5 10 15 20 25
Scale 1:500

Co-ordinate System: MGA Zone 56 | Height Datum:

RGH CONSULTING GROUP
Multi-discipline Engineering

Designed L.M.McBRIDE
Reviewed A.J.GRIFFITHS (MIE AUST, CPENG, NPER)

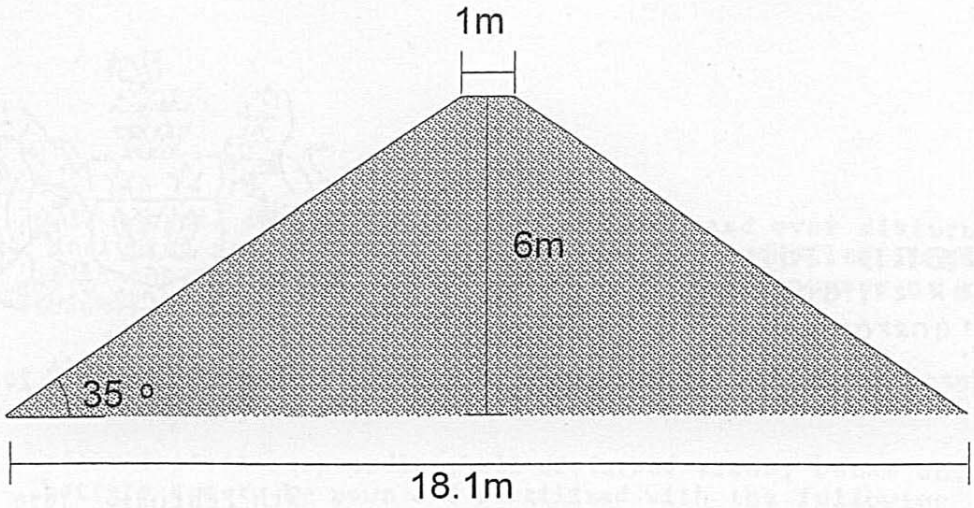
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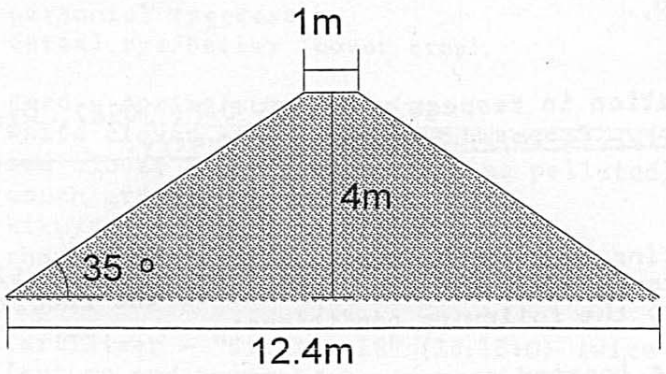
GOSFORD CITY COUNCIL
INTERSECTION UPGRADE - RINDEAN QUARRY
№ 620 WISEMANS FERRY ROAD, SOMERSBY

19m SEMI-TRAILER DESIGN VEHICLE MOVEMENTS

RGH File №:	Drawing:	Date:	SHEET REF.
20100313		OCT 2010	C15

Project Manager:
PROFESSIONAL CONSTRUCTION SERVICES Pty Ltd





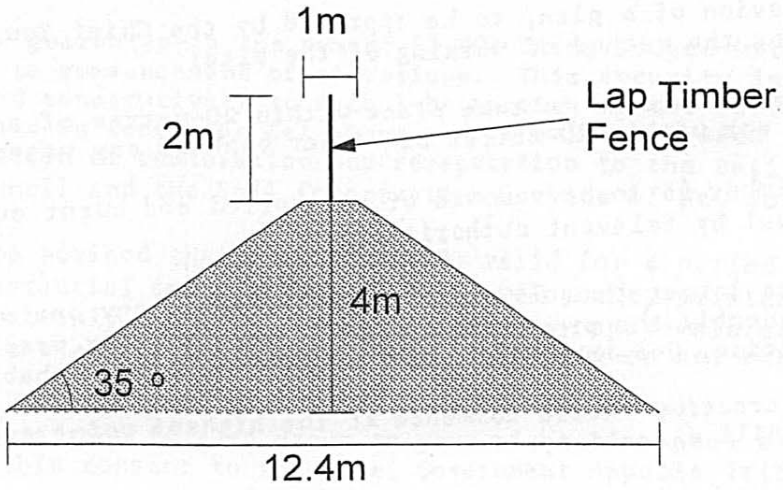


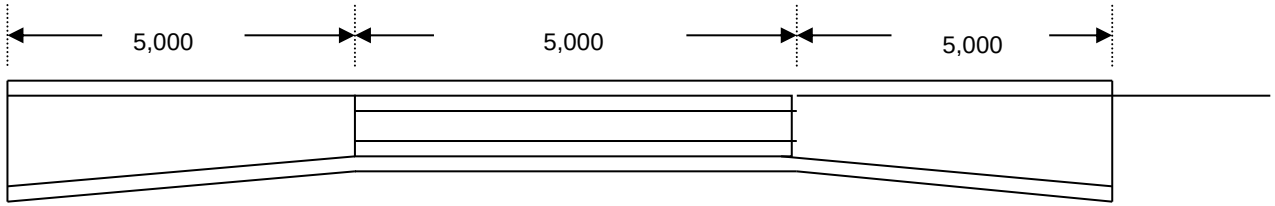
Figure 13

Rindean Quarry

Proposed Bund Design

Rindean Quarry Proposed Wheelwash

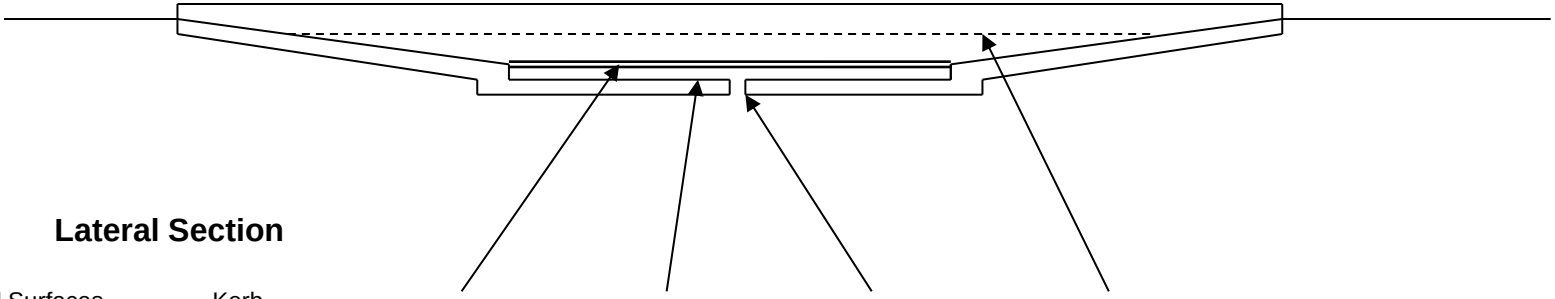
Plan



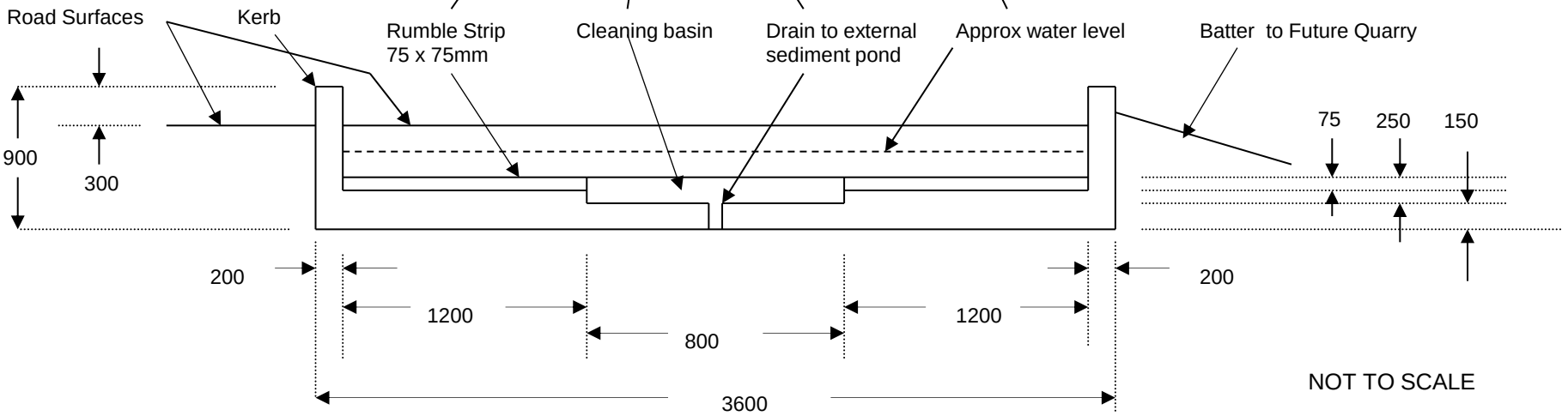
Construction

32MPA concrete
150mm slab
F82 mesh in floor and walls

Longitudinal Section



Lateral Section



NOT TO SCALE

All dimensions in mm

Figure 14

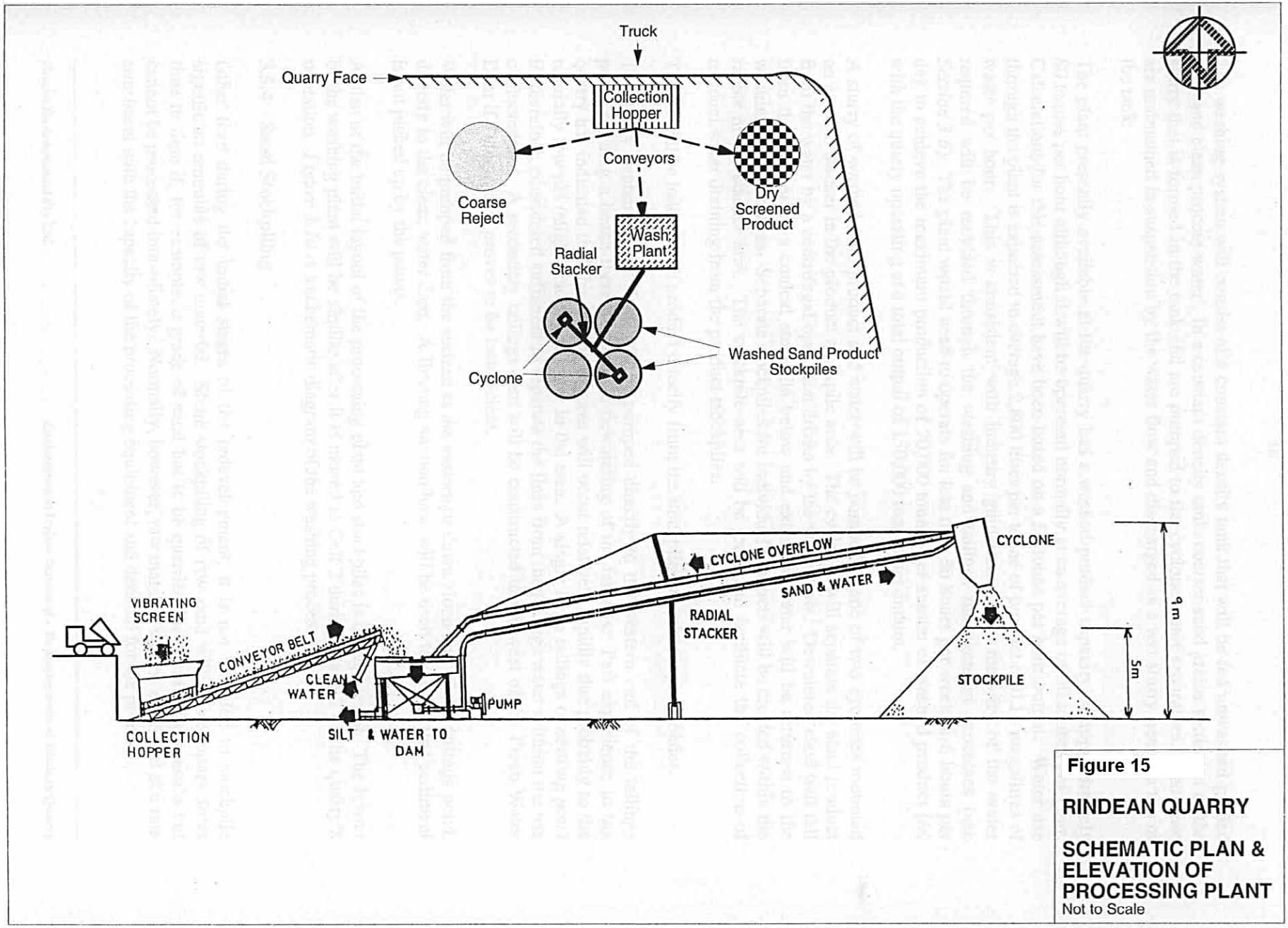
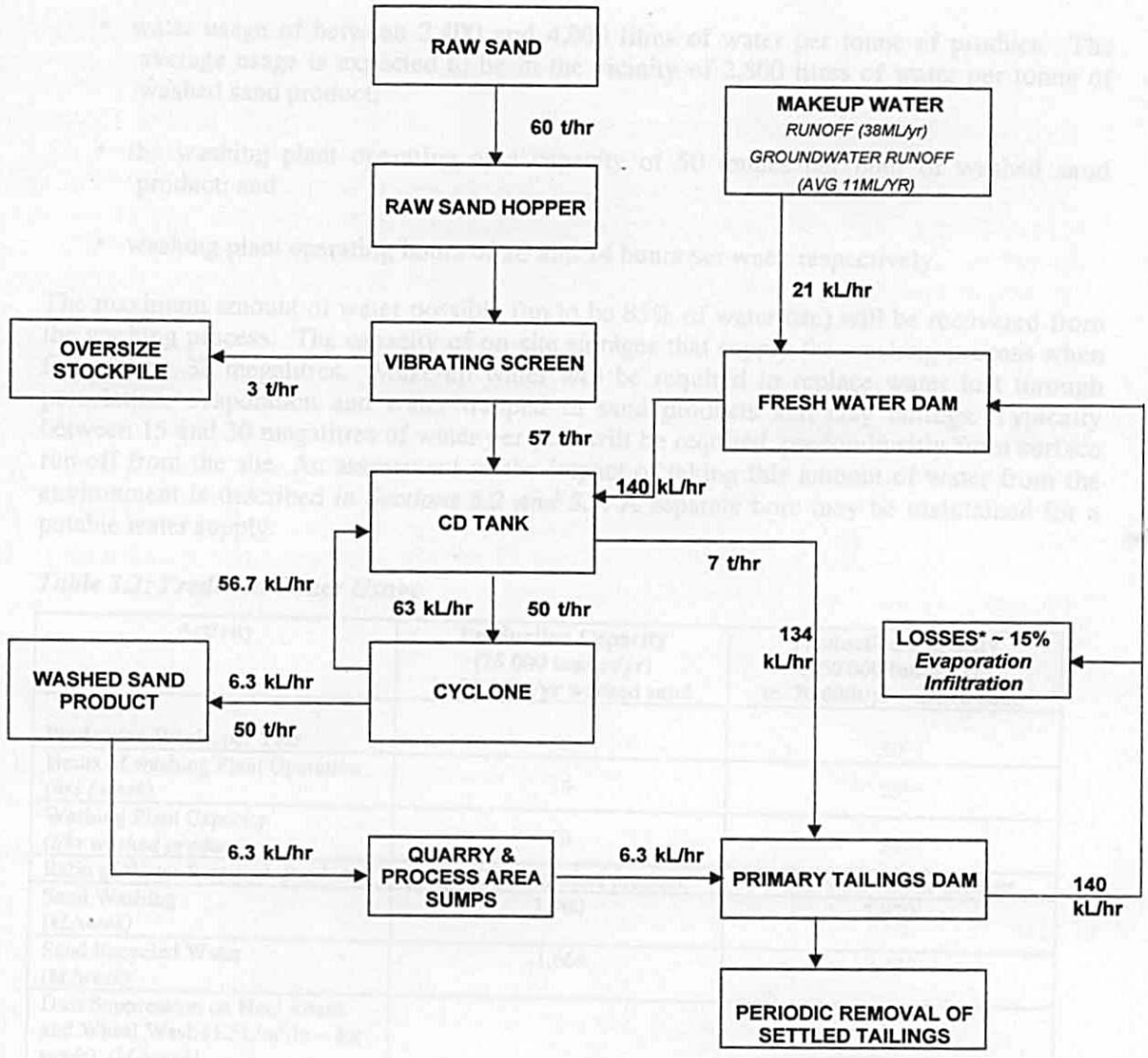


Figure 15

RINDEAN QUARRY

SCHEMATIC PLAN & ELEVATION OF PROCESSING PLANT

Not to Scale



Legend

9 kL/hr Water Flow Rate

6 t/hr Solids Flow Rate

Notes:

1kL of water = 1 tonne

* Losses from entire system

Figure 16

RINDEAN QUARRY

FLOW DIAGRAM - SAND WASHING PROCESS, FINES MANAGEMENT SYSTEM AND WATER BALANCE

STAGE 1

WATER MANAGEMENT INFRASTRUCTURE

LEGEND

- PUMP
- DRAIN OR WATERCOURSE
- PIPELINE OR CULVERT

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WISEMANS FERRY ROAD

R1 R2 R3 R4

EXISTING WATERCOURSE

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

BENCH & REHABILITATE

QUARRY CELL 4

QUARRY CELL 3

EXCAVATE STORM RETENTION BASIN RL 213

CONSTRUCT FRESH WATER POND No.2 R.L 211

REFORM EXISTING FRESH WATER POND No.1 R.L 215

100 METRE

20m BUFFER

METEOROLOGICAL STATION

6m WIDE FUTURE ACCESS ROAD

4m HIGH BUND WITH 100 METRE WITH FENCE

4m HIGH BUND WITH METAL FENCE

TEMPORARY ACCESS ROAD

PLANT & STOCKPILES

QUARRY CELL 2 R.L 216

2 D.P. 362339 15.723ha

EXCAVATE TO RL 215.5

REHABILITATION AREA CAP AND PLANT (FORMER SETTLING POND)

EXISTING LINED DRAIN TO UNNAMED CREEK

WHEEL WASHING FACILITY AND APPROACHES

EXCAVATE SETTLING POND TO RL 211

EXISTING STORAGE POND COMMISSION AS TAILINGS POND

GRADE DOWN 1 : 100

QUARRY CELL 5

EXCAVATE TO R.L 216

QUARRY CELL 1

RAISE EDGE OF POND TO 1m ABOVE SURROUNDING RL

REHABILITATION AREA CAP AND PLANT (FORMER SETTLING POND)

20m BUFFER

EXCAVATION LIMIT

4m HIGH BUND WITHIN BUFFER

4m HIGH BUND WITH METAL FENCE INSIDE BUFFER

20m BUFFER

EXISTING WATERCOURSE

FIGURE 17

- DENOTES HOLLOW BEARING TREE
- DENOTES Grevillea shiressii
- DENOTES LIMIT OF BUFFER ZONE
- DENOTES EXISTING VEGETATION

NOTE :
LOCATIONS OF DRAINS AND PIPELINES ARE INDICATIVE. LOCATIONS WILL CHANGE AS THE QUARRY DEVELOPS

40 0 40 80 120 160 200

SCALE OF METRES 1:2000

APPROX LOCATION ONLY (NOT TO SCALE)

R6 R5

CAD FILE: 6175_STAGE 1_FIGURE 17.dwg
THIS PLOT: 10-04-2012 15:08
REFERENCE: 6175

RINDEAN QUARRY PLAN – STAGE 1 – YEARS 1 TO 2
WATER MANAGEMENT INFRASTRUCTURE
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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A.C.N. 057 514 860 A.B.N. 51 057 514 860

SCALE: 1:2000

Australian Height Datum

REFERENCE: 6175 ISSUE: A 07/03/2011

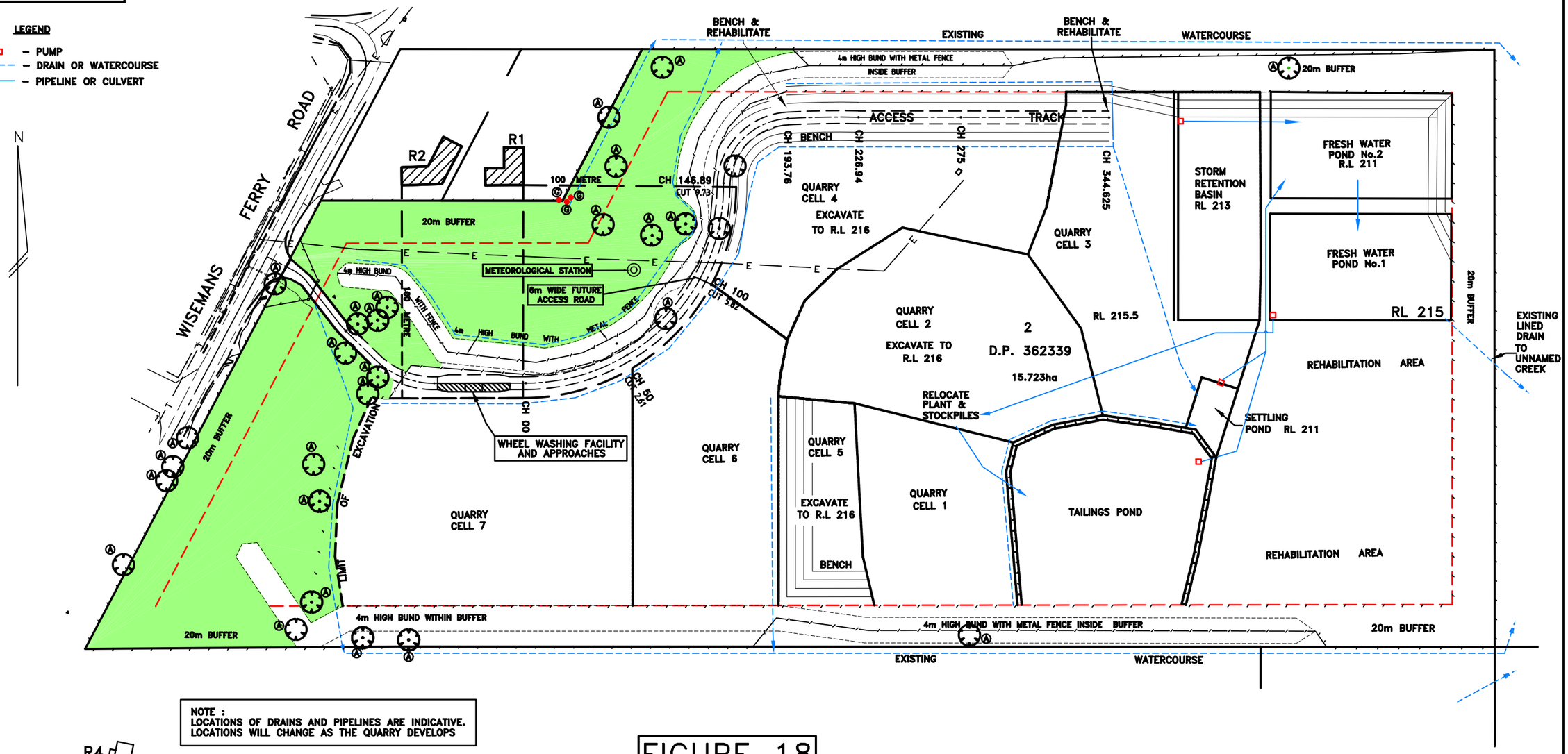
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STAGE 2

WATER MANAGEMENT INFRASTRUCTURE

NOTE
GRADE QUARRY FLOORS TO DRAIN TO THE EAST.

LEGEND
- PUMP
- DRAIN OR WATERCOURSE
- PIPELINE OR CULVERT



NOTE :
LOCATIONS OF DRAINS AND PIPELINES ARE INDICATIVE.
LOCATIONS WILL CHANGE AS THE QUARRY DEVELOPS

- DENOTES HOLLOW BEARING TREE
- DENOTES Grevillea shiressii
- DENOTES LIMIT OF BUFFER ZONE
- DENOTES EXISTING VEGETATION

40 0 40 80 120 160 200
SCALE OF METRES 1:2000

APPROX LOCATION ONLY
(NOT TO SCALE)

FIGURE 18

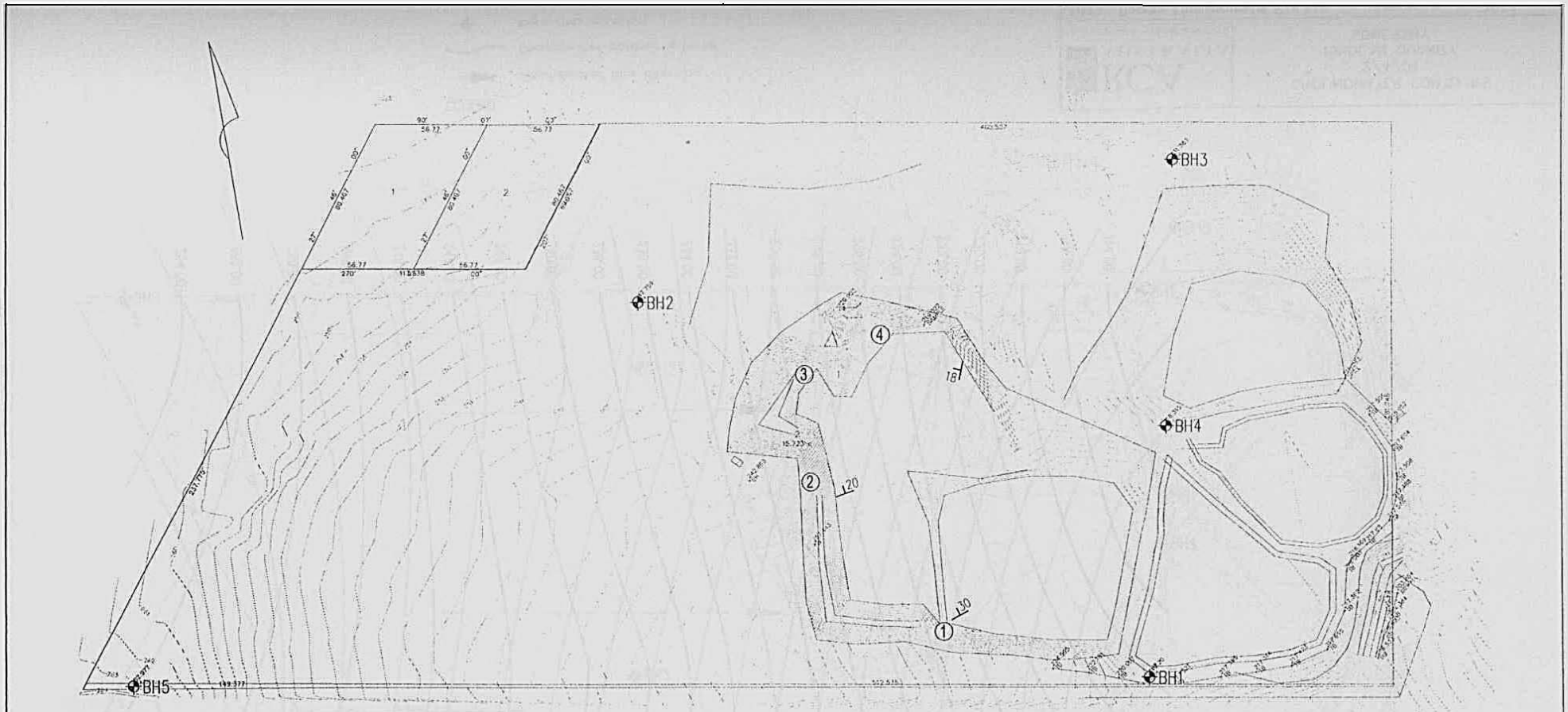
RINDEAN QUARRY PLAN – STAGE 2 – YEARS 3 TO 5
WATER MANAGEMENT INFRASTRUCTURE
LOT 2 IN D.P. 362339
No. 620 WISEMANS FERRY ROAD, SOMERSBY
DA No. 26467/2004

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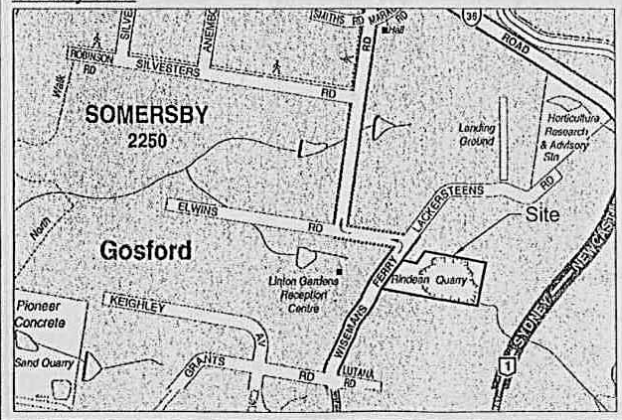
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REFERENCE: 6175.000

Australian Height Datum

REFERENCE: 6175 ISSUE: A 07/03/2011



Locality Plan



LEGEND

② Outcrop location

$\perp^{20}$ Bedding strike, dip and direction

Monitoring well locations

Figure 19

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

GROUNDWATER BORE LOCATIONS
RINDEAN QUARRY
SOMERSBY

CLIENT	Pacrim Environmental Pty Ltd			PROJECT No	3977
DRAWN BY	SMA	SCALE	1 : 2000	DRAWING No 1	REV 0
APPROVED BY	R	DATE	6.8.01	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

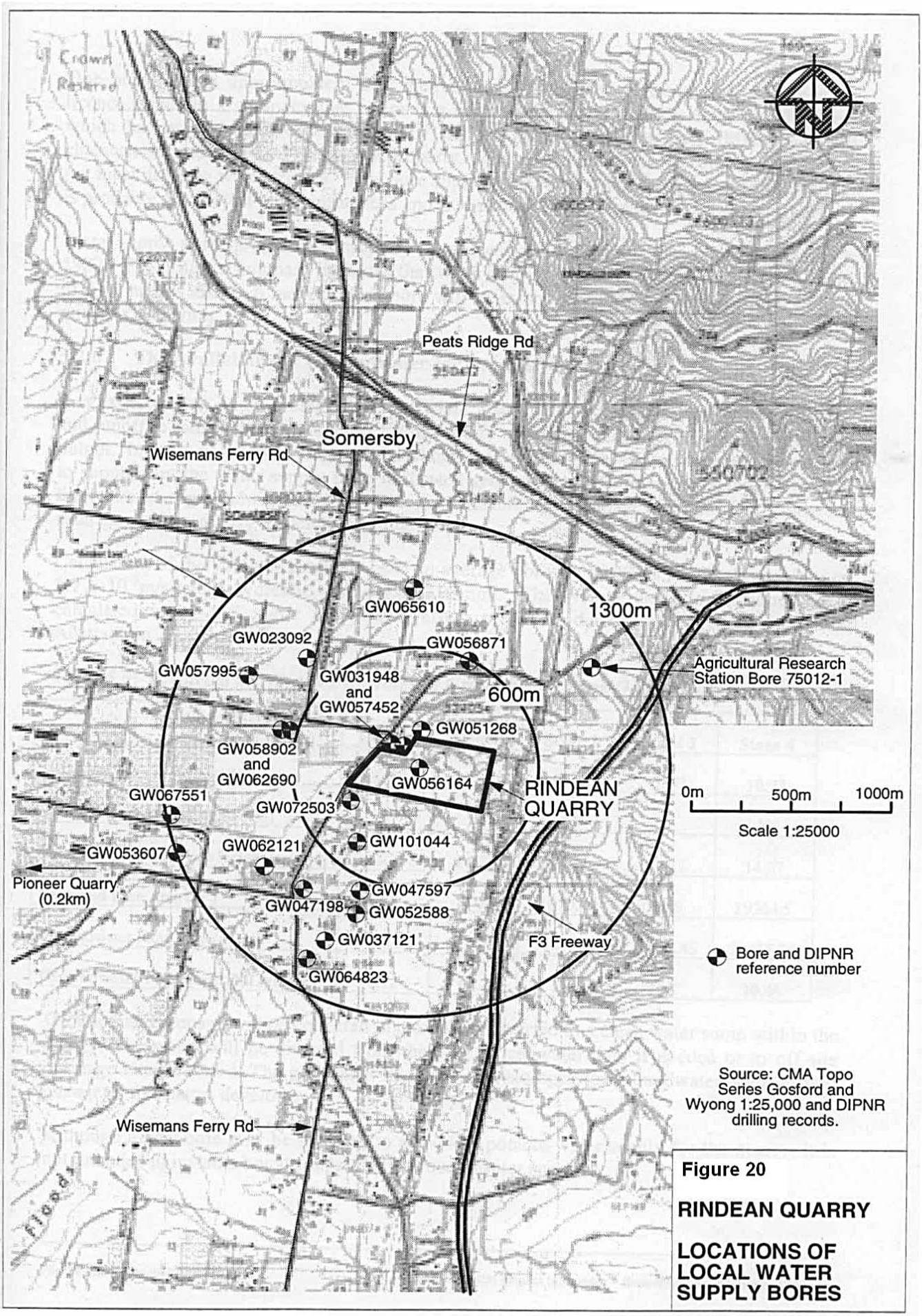


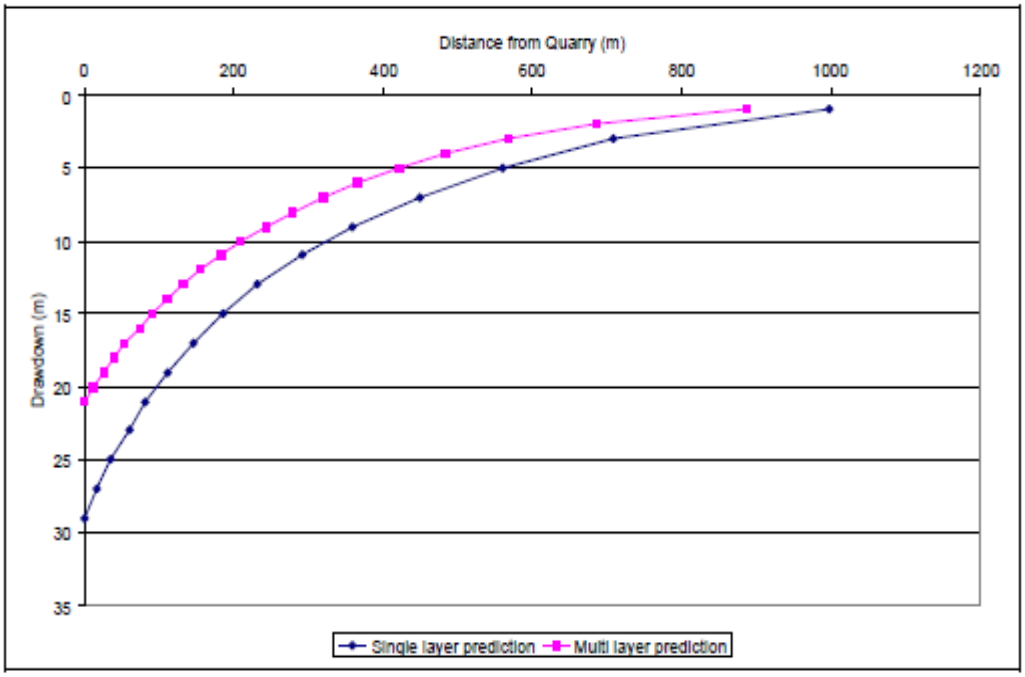
Figure 20

RINDEAN QUARRY

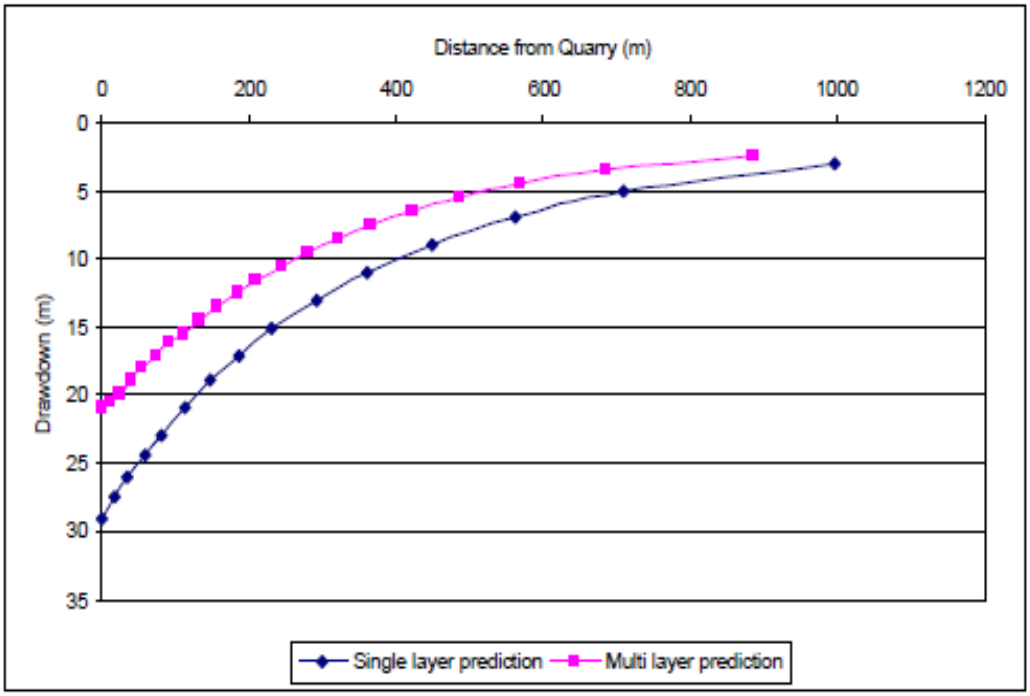
LOCATIONS OF LOCAL WATER SUPPLY BORES

Figure 21, Predicted Groundwater Drawdown

Maximum Predicted Drawdown at 100 years, 15% Recharge rate



Maximum Predicted Drawdown at 100 years, 11% Recharge rate



Source: Hydrogeological Investigation, Rindean Quarry Somersby, RCA Australia August 2004 and Addendum November 2005