ENVIRONMENTAL IMPACT STATEMENT

DUNMORE SAND & SOIL PTY LTD

ACN 003 497 229

DUNMORE LAKES SAND EXTRACTION PROPOSAL – STAGE 1

VOLUME 1

MAIN DOCUMENT

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

DUNMORE LAKES SAND EXTRACTION PROPOSAL – STAGE 1

ENVIRONMENTAL IMPACT STATEMENT

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ACN: 003 497 229

DUNMORE LAKES SAND EXTRACTION PROPOSAL – STAGE 1

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January 1999

Report No. 475/01

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FORM 2

Submission of environmental impact statement (EIS)
prepared under the Environmental Planning and Assessment Act, 1979
Section 77

EIS prepared by:

name:	Mr Robert William Corkery
qualifications:	B.Sc. (Hons), M.Appl. Sc.
address:	75 Kite Street ORANGE N.S.W. 2800
in respect of:	Extraction, processing and transportation of sand products and soil; delivery and placement of materials for landscape reconstruction; site rehabilitation and ancillary activities to all project components.

development application:

applicant name:	Dunmore Sand & Soil Pty Ltd
applicant address:	83 Riverview Road RIVERVIEW NSW 2066
land to be developed:	Swamp Road, Dunmore
lot no., DP/MPS, vol/fol etc proposed development	Lot 201 DP 865859; Lot 17 DP 607791 Parish of Terragong, County of Camden or map(s) attached

environmental impact statement

[✓] an environmental impact statement (EIS) is attached

certificate

I, Robert William Corkery, of 75 Kite Street, Orange, N.S.W., hereby certify that I have prepared the contents of this Statement and to the best of my knowledge

- it is in accordance with clauses 51 and 52 of the Environmental Planning and Assessment Regulation, 1994; and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

signature:

name: **Robert W Corkery**

date: 14 January 1999

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ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Impact Statement (EIS) has been prepared by R.W. Corkery & Co. Pty. Limited on behalf of Dunmore Sand & Soil Pty Ltd ("the Applicant") to accompany a Development Application for the development and operation of Stage 1 of the proposed Dunmore Lakes Sand Extraction Proposal (hereafter referred to as the "Dunmore Lakes Proposal") near Dunmore, approximately 4 km south-south-west of Shellharbour and 6 km north of Kiama in the Illawarra Region of New South Wales.

The Applicant has considerable experience with sand dredging, processing and landscape reconstruction as it has operated the Dunmore Sand Quarry for the past 10 years. The Applicant now proposes to extract the high quality sand from the nearby Dunmore Lakes Site, however, it proposes to continue to undertake its blending activities at the Dunmore Sand Quarry site.

For the purposes of this document, the land on which the proposed Dunmore Lakes Proposal would be developed is referred to as the "Project Site" and is owned by, or contracted for purchase by, the Applicant. The Project Site is located near the corner of Swamp Road and the Princes Highway and has been the subject of previous sand extraction operations in the late 1970's which formed the existing lakes on and immediately south of the Project Site. The local setting of the Project Site is shown on **Figure A**.

THE PROPOSAL

The Dunmore Lakes Proposal would involve the excavation and dredging of approximately 2.75 million tonnes of high quality fine-grained sand and a program of landscape reconstruction around the perimeter of the lakes created as a result of the extraction. The Applicant's main long-term rehabilitation objective for the Project Site is to create a scenic artificial lake system, foreshore and fringing wetlands and to create approximately five rural-residential lots. A project life of approximately 10 to 15 years is proposed.

The proposal has been designed in recognition of a number of variables which would influence the area of extraction and the final landform of the Project Site. The main variable is the proposed North Kiama Bypass, which has been approved for construction, however, the timing of its construction is subject to funding being made by the State Government. The other variable is the land zoning which is currently under review. Given the above variables, the Applicant has considered four extraction options which reflect different scenarios relating to the above variables.

Although each of the options is outlined in the EIS, the Applicant's proposal at this time relates to Option 2, as this option is both legally permissible and reflects the expectations of the Community and stated intentions of the State Government that the North Kiama Bypass is to proceed.

The main features of the Option 2 proposal (**Figure B**) would be:

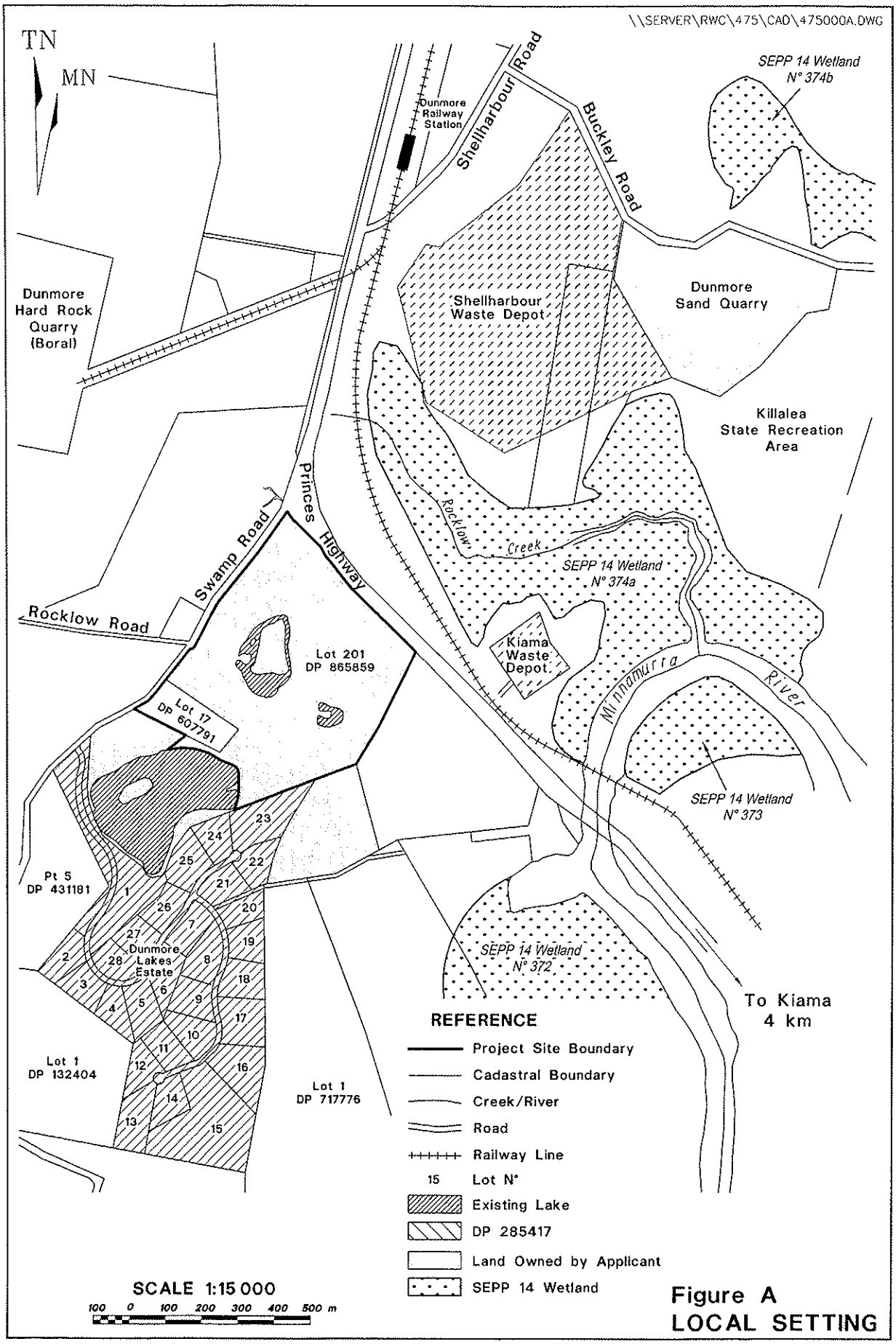

Figure A
LOCAL SETTING

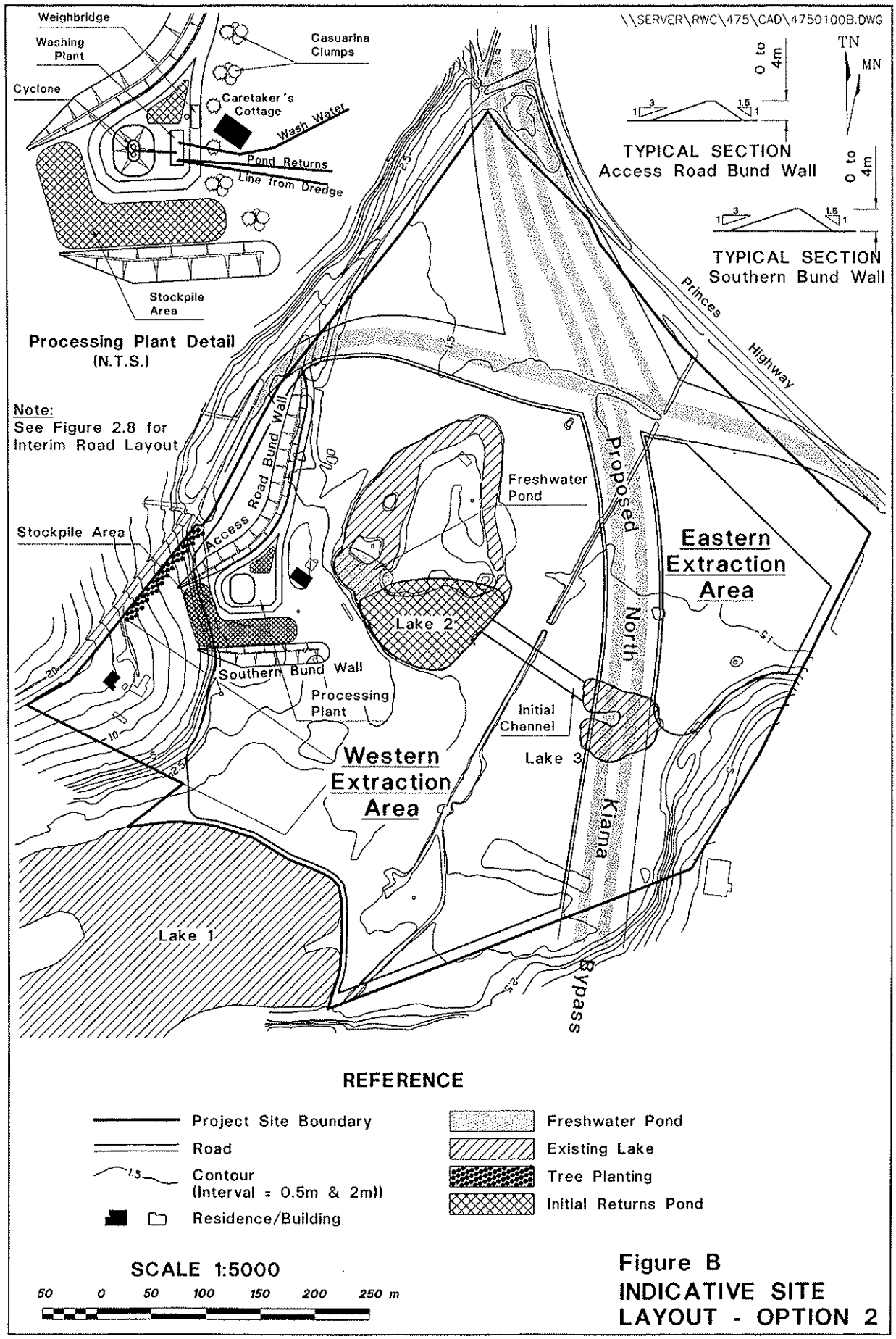

Figure B
INDICATIVE SITE LAYOUT - OPTION 2

(i) extraction of up to approximately 2.75 million tonnes of sand by excavating (edges and/or shallow areas) and dredging from a 19 ha area of land within the Project Site;

(ii) processing of all dredged sand within a relatively low-profile processing plant and maintenance of surrounding product stockpiles;

(iii) progressive backfilling of pre-determined areas to create up to 8.2 ha of useable, landscaped and mostly flood-free land;

(iv) progressive rehabilitation and landscaping of the lake foreshores and adjoining land to create a new scenic deep, 10 ha lake with approximately 3 ha of wetlands and a bird-nesting island; and

(v) the transportation of soil and sand products from the Project Site and backfill materials to the Project Site.

A Development Consent is being sought for 15 years to provide for all extraction and to complete all backfilling and rehabilitation activities.

The Applicant anticipates the sand would be extracted generally at a rate of between 500 tonnes and 2 000 tonnes per day, i.e. at a rate of approximately 150 tonnes per hour. The Applicant would normally expect to operate the dredge from 6.00 am to until 4.00 pm on weekdays and 12 noon on Saturdays and occasionally on Sundays. However, hours of operation beyond the normal hours are being sought to provide greater flexibility for the operation.

The proposal has been designed to be as simple and compact as possible and to complement the Applicant's existing activities at its Dunmore Sand Quarry. The Applicant would not undertake any blending or stockpiling of other earth materials on the Project Site to limit the extent of the activities for which approval is being sought and contain the overall impact of the proposal.

If the proposal is approved, the Applicant would prepare an Environmental Management Plan chiefly to document the operational and environmental management procedures that would be used to ensure compliance with the approval conditions. The Applicant would also prepare an Annual Environmental Management Report throughout the life of the proposal to report on the progress of its activities and outline plans for the ensuing year.

THE EXISTING ENVIRONMENT

The Project Site is situated on a low-lying floodplain area amongst local basaltic hills. To the south of the Project Site is a low basaltic ridgeline which effectively forms the catchment boundary between the Project Site floodplain and the Minnamurra estuarine wetland system to the south. The Project Site contains two small lakes and a third, much larger lake is situated directly to the south-west.

The Project Site is situated within the sub-catchment of Rocklow Creek, a tributary of the Minnamurra River. Rocklow Creek flows into the Minnamurra River downstream of the Princes Highway approximately 1 km to the east of the Project Site and approximately 1.5 km from the inlet to the ocean. Much of the lower catchment of Rocklow Creek including the Project Site is subject to regular inundation, hence, a feature of the local drainage network is extensive areas of swamps and wetlands. Two wetlands designated under SEPP 14 surround the confluence of Rocklow Creek and the Minnamurra River to the east of the Project Site and another wetland designated under SEPP 14 is located along the Minnamurra River to the south of the Project Site. The Project Site itself is poorly drained, with the bulk of rain infiltrating directly into the subsurface sands. Drainage through the Project Site is largely limited to the shallow man-made drain which bisects the Project Site and channels runoff towards the Princes Highway.

The valley sides surrounding the Project Site are underlain by the Bumbo Latite, a volcanic rock similar to basalt. The valley areas, including the Project Site, are infilled with substantial thicknesses of unconsolidated sediments of Quaternary Age (up to 6 500 years old). Exploratory drilling undertaken by the Applicant across the Project Site indicates that these sediments consist of fine-grained sand with a maximum thickness of approximately 18 m. The typical geological profile across the Project Site comprises a dark brown to black sandy loam topsoil averaging 0.3 m to 0.4 m thick underlain by yellow and grey fine-grained clean sand above a base of clay.

The sand deposit beneath the Project Site also forms an unconfined groundwater aquifer enclosed to the north, west and south by basalt ridges and is underlain by clay and sandstone. Most inflow to the sand aquifer is likely to occur as surface infiltration and the groundwater table responds rapidly to periods of heavy rainfall.

Most of the native vegetation across the Project Site has been cleared in the past for agricultural purposes and the land now largely supports a grassland dominated by introduced pasture species. The most prominent tree species is Swamp Oak *Casuarina glauca*. All of the native plant species recorded on the Project Site are common and widespread in the Shellharbour district. No rare or threatened plant species were recorded, nor any regionally significant plant species. The Project Site also supports a limited range of fauna comprising mainly birds and introduced terrestrial mammals. No threatened fauna were found on the Project Site.

Three Aboriginal archaeological sites are located within the Project Site. Two of the sites (Sites 4 and 5) are located adjacent to one another on an old dunal sand body near the western boundary of the Project Site. Although no items of European heritage are present on the Project Site, surrounding heritage items include Dunmore House to the east of the Project Site and the Peterborough School and Principal's Residence just to the west of the Project Site.

Much of the Project Site is currently used for grazing of horses and is zoned Rural 1(a) under the Shellharbour Local Environmental Plan No. 16, 1987, which permits extractive industries with Council's consent. On the northern boundary of the Project Site, along the Princes Highway, the land is zoned 7(d) Environmental Protection (Scenic). Surrounding land uses comprise grazing, rural-residential development,

dairying and other extractive industry. The Project Site is also bordered by the Princes Highway and bisected by the proposed North Kiama Bypass. A number of existing residences in the vicinity of the Project Site are located less than 0.5 km from the nearest point of the Project Site. The visual catchment of the Project Site includes Swamp Road, the Princes Highway and residences located in the northern half of the Dunmore Lakes Estate. Ultimately, much of the Project Site and its activities would be visible from the North Kiama Bypass.

Background noise levels in the vicinity of the Project Site are influenced largely by traffic on the Princes Highway and Swamp Road. The Project Site and surrounding area generally experiences good air quality.

SAFEGUARDS AND IMPACTS

The Dunmore Lakes Proposal has been designed with a range of safeguards and management procedures to ensure the level of impact(s) upon the environment on and around the Project Site meets specified criteria, achieves or exceeds accepted industry practice, or meets reasonable community expectations. A summary of the main safeguards and procedures and the assessed level of the proposal's impact(s) is set out below.

Air Quality:	The principal sources of air contaminants on the Project Site would comprise dust generated by vehicles travelling on the Project Site beyond the site access road, occasional dust from product stockpiles and exposed surfaces during the backfilling process. Dust would be contained to acceptable levels by sealing the site entrance road, maintaining vehicle speeds on site at low levels, installation of a sprinkler system to water the active areas in the vicinity of stockpiles and by limiting backfill placement to small areas at any one time. With the above controls in-place, it is assessed the impact of the operation on air quality would be acceptable.
Water Management and Quality:	Water quality within and downstream of the Project Site would be maintained mainly through the isolation of the dredging fines return pond, by enforcing a strict acceptance criteria and rigorous inspection system for backfill materials and by implementation of a flooding contingency plan and management plan for potential acid sulfate soil. Surface and groundwater flows and quality would not be adversely affected by the proposal.
Noise:	The principal noise controls to be employed on the Project Site include the use of well maintained earthmoving equipment, use of strategically placed soil stockpiles and bund walls for noise attenuation, maintenance of the internal road network and by

scheduling a number of activities to coincide with the construction of the Bypass and its subsequent use. Compliance to noise design goals is predicted to be achieved with the exception of one individual activity on the Project Site.

Soil: Few specific soil erosion controls would be required on the Project Site given the moist sandy nature of the soils and flat-lying occurrence. The principal controls would relate to the management of sediment from unsealed roads and the areas being progressively backfilled. The Applicant would maximise the recovery of soil on the Project Site for use in household landscape activities and for rehabilitation purposes on-site. Acid sulfate materials have been identified in sands below the water table. Their fine grain size will result in the pyritic materials being removed during processing and returned below the water, causing no adverse impact.

Visibility: The principal visual controls relate to minimising the number of earthmoving equipment on-site at any one time, construction of bund walls, positioning of the processing plant "behind" the hill structure on the south-western corner of the Project Site, planting a tree screen adjacent to Swamp Road and around the processing plant and through ongoing backfilling and progressive rehabilitation. The overall assessed visual impact of the proposal would be acceptable.

Flora and Fauna: It is assessed that the clearing of approximately 19 ha of land comprising largely grazed grassland dominated by introduced pasture species is not ecologically significant. The proposal is unlikely to have a significant impact on threatened flora and fauna species and may ultimately enhance the ecological values of the area through the creation of scenic lakes with fringing and foreshore wetlands.

Transportation: The Project Site is ideally located to gain access to the regional road network via a short section of Swamp Road. The impact of the proposal is assessed as acceptable given a range of traffic management strategies and through the proposed upgrading of Swamp Road and improvements to the Princes Highway / Swamp Road intersection.

Archaeology: The Applicant would apply to the Director of the NSW National Parks and Wildlife Service for a Consent to Destroy two adjoining archaeological sites (Sites 4 and 5). A representative of the Local Aboriginal Community would be employed to monitor all stripping and extraction activities in the vicinity of Sites 4 and 5. Any

Aboriginal artefacts found would be returned to the Local Aboriginal Community. No adverse impacts on Aboriginal culture would occur.

Services: The Applicant's proposal would not necessitate the installation of any additional services, although a section of the coaxial cable that traverses the northern part of the Project Site would need to be relocated by the relevant service authority.

Socio-economic Setting: Positive impacts arising from the proposal relate to continued employment of the Applicant's personnel and contractors, local spending, and the development of a significant fine sand resource. Negative impacts relate to traffic generation, potential short-term reductions in land values and loss of agricultural land.

Surrounding Landowners and Land Use: Given the safeguards outlined above, it has been assessed that the proposal would be accompanied by minor impacts on the surrounding landowners and land uses. Activities on the Project Site would be visible from a number of publicly accessible vantage points and residences and the surrounding landowners would also be aware of the increased traffic movements along Swamp Road.

CONCLUSION

The Applicant's proposal for the development and operation of the Dunmore Lakes sand extraction proposal in the manner identified in this document would enable a substantial high quality resource of local, regional and State significance to be developed relatively close to areas of significant population growth and the State Highway system.

All environmental constraints imposed upon the proposal would be overcome through the implementation of a range of safeguards and procedures to ensure the surrounding biophysical and socio-economic environment and surrounding residents are not adversely affected by the proposal. It is also noteworthy that the majority of the safeguards to be implemented with respect to this proposal are currently being responsibly exercised or implemented by the Applicant in its existing operations at the nearby Dunmore Sand Quarry.

Although some impacts would occur, it is assessed that the level of impact in all areas would meet specified criteria or reasonable community expectations, with any adverse impacts far outweighed by the positive impacts.

PREAMBLE

Section 1

INTRODUCTION

This section introduces the proposal for the development and operation of Stage 1 of the Dunmore Lakes Sand Extraction Proposal and reviews:

- *the format of the document;*
- *the Applicant;*
- *the background to the proposal;*
- *the existing Dunmore Sand Quarry;*
- *the relevant planning issues influencing the proposal;*
- *consultation undertaken with relevant Government Authorities and the local community;*
- *proposed ongoing documentation; and*
- *personnel involved in project design and preparation of this document and supporting documents.*

1.1 SCOPE

This Environmental Impact Statement (EIS) has been prepared by R.W. Corkery & Co. Pty. Limited on behalf of Dunmore Sand & Soil Pty Ltd ("the Applicant") to accompany a Development Application for the development and operation of Stage 1 of the proposed Dunmore Lakes Sand Extraction Proposal (hereafter referred to as the "Dunmore Lakes Proposal") near Dunmore, approximately 4 km south-south-west of Shellharbour and 6 km north of Kiama in the Illawarra region of New South Wales (see **Figure 1.1**).

For the purposes of this document, the land on which the proposed Dunmore Lakes Proposal would be developed is referred to as the Project Site and is owned by, or contracted for purchase by, the Applicant. The Project Site is located at the corner of Swamp Road and the Princes Highway and has been the subject of previous sand extraction operations in the late 1970's which formed the existing lakes on and immediately south of the Project Site. The local setting of the Project Site is shown on **Plate A** (lift out at the back of the document).

The Dunmore Lakes Proposal would involve the excavation and dredging of between 2.75 million and 4.5 million tonnes of sand and a program of landscape reconstruction around the perimeter of the created lakes.

The preparation of an EIS is a requirement under the provisions of the *Environmental Planning and Assessment Act 1979*, since the development and operation of an extractive industry of the type and size proposed is considered a "Designated Development" within the meaning of Schedule 3 Part 1 of the *Environmental Planning and Assessment Regulation 1994*. The Development Application (**Appendix 1**) notes the proposal is to be assessed as an "integrated development". Hence, this document also serves to support the Applicant's application for a Pollution Control Approval from the Environment Protection Authority (EPA) as well as other approvals.

Apart from presenting the Applicant's proposal for the development and operation of the Dunmore Lakes Proposal, this document also provides relevant background information and a description of the environmental setting of the Project Site and its surrounds. The features of the existing environment are described together with the environmental safeguards and procedures that would be adopted throughout the proposal and the predicted impacts once those safeguards and procedures are adopted.

The information presented in this document covers all aspects of the planning, development, operation, environmental monitoring and rehabilitation of the Dunmore Lakes Proposal at a level of detail consistent with industry standards. These aspects are presented in a manner that addresses the specific requirements of the Department of Urban Affairs and Planning, Shellharbour City Council and other Government Authorities, together with those raised during the public consultation process.

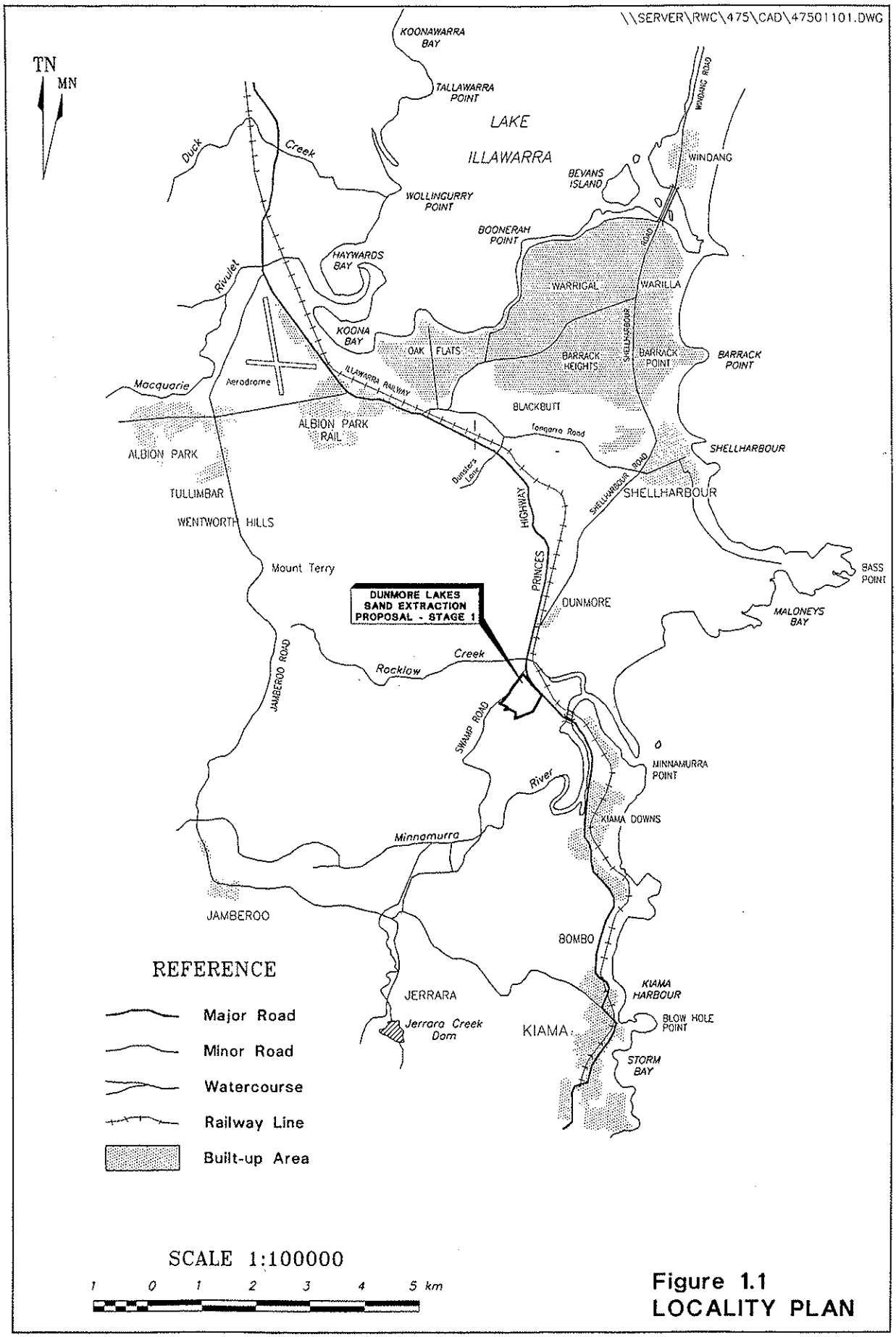

Figure 1.1
LOCALITY PLAN

1.2 DOCUMENT FORMAT

This EIS has been compiled in two volumes.

Volume 1: is the principal document comprising five sections with a set of Appendices (the document format for Volume 1 is discussed below); and

Volume 2: presents nine supporting specialist consultant reports (each of the specialist consultant reports have been summarized in Volume 1).

The requirements of Clause 54A and 55 of the *Environmental Planning and Assessment Regulation 1994*, and specific requirements of the Director-General of the Department of Urban Affairs and Planning (**Appendix 2**) and other Local and State Government Authorities have been incorporated in the appropriate section(s) of the document. **Appendix 2** also includes a summary table identifying where each of the Director-General's requirements is identified in the document, whilst **Appendix 3** includes a similar table identifying the specific requirements of the Local and State Government Authorities consulted. A complete copy of the correspondence received from the various Local and State Government Authorities is held by Council and the Applicant and is available for review on request during normal business hours throughout the period of exhibition of the Development Application and this document.

This document has also been prepared with due regard to the EIS Practice Guidelines for Extractive Industries – Quarries issued by the Department of Urban Affairs and Planning (September 1996) and the matters identified in Schedule 2 of the *Environmental Planning and Assessment Regulation 1994*.

The format of the document which is outlined below reflects the preference of the Department of Urban Affairs and Planning to integrate information on the existing environment, safeguards to mitigate adverse impacts and impact assessment in a single section. The format adopted is designed to assist the reader to understand the nature and implications of each issue yet maintain compliance with the specific requirements set out by the Department in Attachment 1 to the Director-General's requirements (**Appendix 2**).

Section 1: introduces the proposal and the Applicant and briefly reviews the background to the proposal and relevant planning issues. Information on the Applicant's existing operation off Buckley Road, Dunmore as well as ongoing documentation for the proposed quarry and the consultation undertaken with Government Authorities and local community are also included.

Section 2: describes the proposal in detail and outlines the Applicant's objectives and proposed plans for extraction, processing and transportation of sand products. The proposal for landscape reconstruction and progressive rehabilitation together with feasible alternatives to some activities are also outlined.

Section 3: describes the environmental setting of the Project Site as it relates to the planning of the proposal and the design of the safeguards and procedures to mitigate any potential adverse impacts of the proposal.

Section 4:

(i) describes features of the existing environment that would or may be affected by the proposal;

(ii) presents design and operational safeguards and where appropriate, management procedures that the Applicant has incorporated into the proposal to mitigate any potential adverse impacts to ensure the environment within and surrounding the Project Site is protected; and

(iii) analyses the potential impact the proposal would have on the environment within and surrounding the Project Site once the mitigating safeguards and procedures are adopted.

Section 5: evaluates the proposal and justifies the project in terms of biophysical, economic and social considerations and examines the consequences of not proceeding with the proposal.

References: source documents for data referred to are listed together with each of the specialist consultant reports which are included in Volume 2.

Glossary of Technical Terms and Symbols

Appendices: present correspondence from the Department of Urban Affairs and Planning and a summary of the requirements from each of the Authorities consulted:

The Appendices also include correspondence from Geotechnical Consultants, Pells, Sullivan & Meynink, an Energy Impact Statement and correspondence from the Illawarra Local Aboriginal Land Council.

The EIS is supported by nine reports prepared by specialist consultants commissioned by R.W. Corkery & Co. Pty. Limited on behalf of the Applicant, with the exception of the Archaeological Report which was prepared for a previous Development Application on the Project Site. Where there is any minor inconsistency between the EIS and any of the supporting studies, the EIS text and/or figures prevail. The subject matter of these reports and the authors are as follows.

- Fauna – Countrywide Ecological Service.
- Resource Significance – Don Reed & Associates Pty Ltd.
- Acid Sulfate Soils – Environmental & Earth Sciences.
- Water Quality – Illawarra Horticultural Services.

- Archaeology – Kerry Navin.
- Flora – Kevin Mills & Associates Pty Ltd.
- Acoustics – Richard Heggie Associates Pty Ltd.
- Water Management – SMEC Australia Pty Ltd.
- Traffic Management – Transport & Urban Planning Pty Ltd.

The contents of each of these separate reports has been summarised in this document and have been included in the references for this document. These reports have been compiled as Volume 2 of the EIS. Individual copies of each report or the entire Volume 2 can be provided free of charge to any person who purchases a copy of the EIS.

1.3 THE APPLICANT

Dunmore Sand & Soil Pty Ltd is a private Company engaged in land development, house building, general investment, and the quarrying / marketing of construction materials. Operation of the Dunmore Sand Quarry is currently its major sand project. The Company's three principal directors are Mr Kerry Steggles, Mr John Cornish and Mr Danny Holz, all with considerable experience in the industrial and construction materials industries. Mr Steggles is a Tertiary qualified geologist with over 35 years of experience in the non-metallic minerals and construction materials industries as well as being the principal of Resource Analysis & Development Pty Ltd, resource development and geological consultants. Mr Cornish formerly operated soil and sand extraction companies in the Camden area and the retail chain "Materials in the Raw" and now concentrates on large land development projects. Mr Holz has been involved with and managed sand extraction operations for more than 30 years and brings to the Company a great deal of practical experience.

1.4 BACKGROUND TO THE PROPOSAL

1.4.1 Introduction

An understanding of a number of factors relating to the Applicant's existing Dunmore Sand Quarry, history of the Project Site and the Illawarra sand market and alternative sand resources provide important background information to the current proposal for the Dunmore Lakes Sand Extraction Proposal. This section reviews the:

- operations of the Dunmore Sand Quarry;
- history of the sand extraction on the Project Site;
- search for additional sand resources;
- the Illawarra Sand Market;
- the Dunmore Sand Resource; and
- the North Kiama Bypass.

1.4.2 Dunmore Sand Quarry

The Applicant operates the Dunmore Sand Quarry on 16.8 ha of freehold land adjacent to the Shellharbour Waste Depot at the end of the constructed section of Buckley Road at Dunmore (**Figure 1.2**). The quarry has been in operation since late 1987 and during that time has produced approximately 900 000 tonnes of sand. Approximately 400 000 tonnes of sand remain on that site.

The Dunmore Sand Quarry is currently operated with a Development Consent issued by Shellharbour City Council on the 30th August 1996 which provides for the following principal activities:

- extraction of sand with a dredge and excavator – the current extraction rate is approximately 110 000 tpa;
- processing of extracted sand through a processing plant with the immediate return of the fines removed from the sand to the dredge pond;
- blending a range of imported sands and quarry products with on-site sand and soil to produce a number of proprietary blended products designed to meet individual customer's requirements;
- backfilling the dredged areas with virgin excavated natural materials (e.g. earth and rock) and uncontaminated concrete, brick and tile – the current receipt of backfill materials is approximately 120 000 tpa.
- Progressive rehabilitation of the site to an end land use suited to an eco-tourism land use. The principal features of the final landform would be 9 ha of flood-free land and a series of channels and lobes essentially forming a re-constructed wetland system across the site to connect two natural wetland systems upslope and downslope from the site.

Plates 1.1 to **1.8** display the existing activities at the Dunmore Sand Quarry. The on-site activities are approved between 6.00 am and 6.00 pm, Monday to Saturday and 8.00 am to 6.00 pm Sundays. Product transportation from the Dunmore Sand Quarry is approved between 5.00 am and 8.00 pm, Monday to Saturday and 8.00 am to 6.00 pm Sundays.

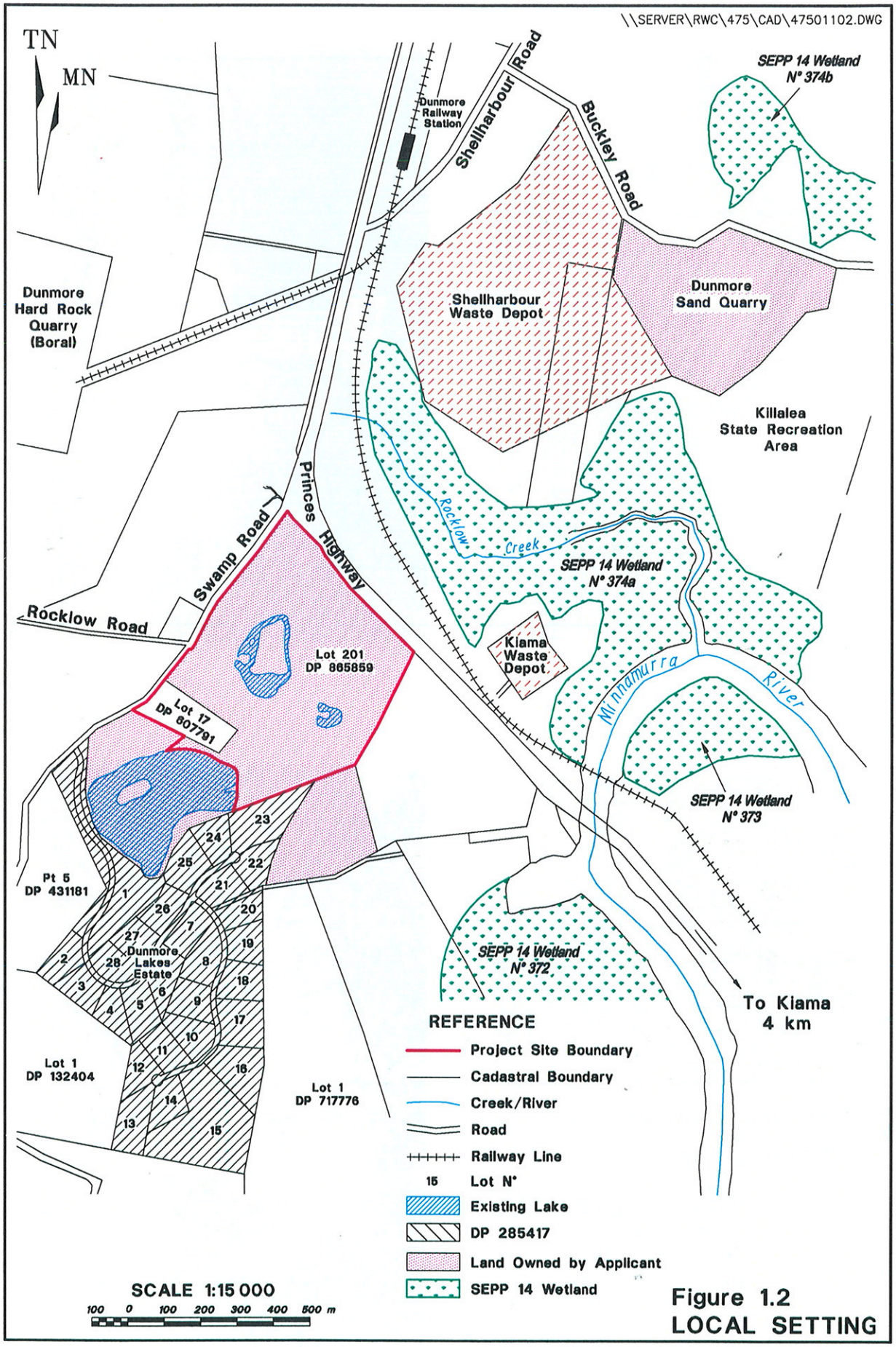

Figure 1.2
LOCAL SETTING

Plate 1.2 : Sand extraction using an excavator on the edge of the dredge pond at the Dunmore Sand Quarry. (Ref: 348 O/10)

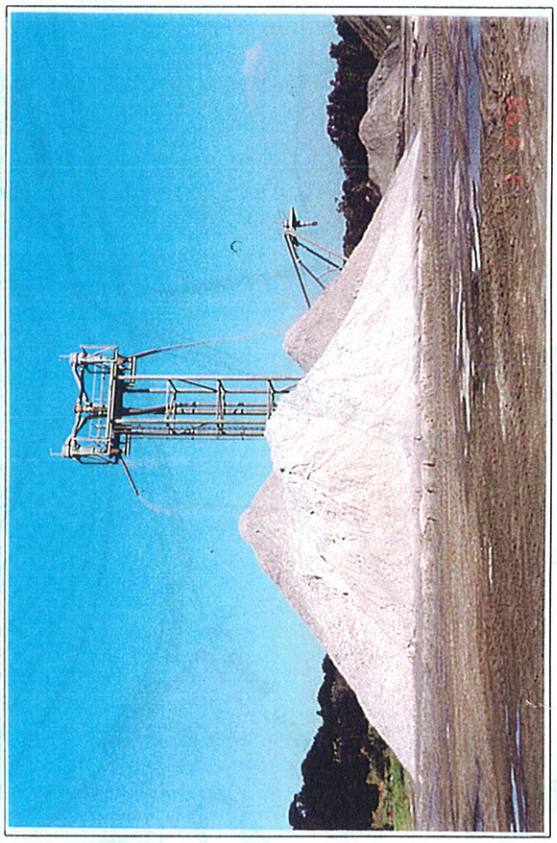

Plate 1.4 : Sand stockpiles beneath the twin cyclone tower at the Dunmore Sand Quarry. (Ref: 348 O/24)

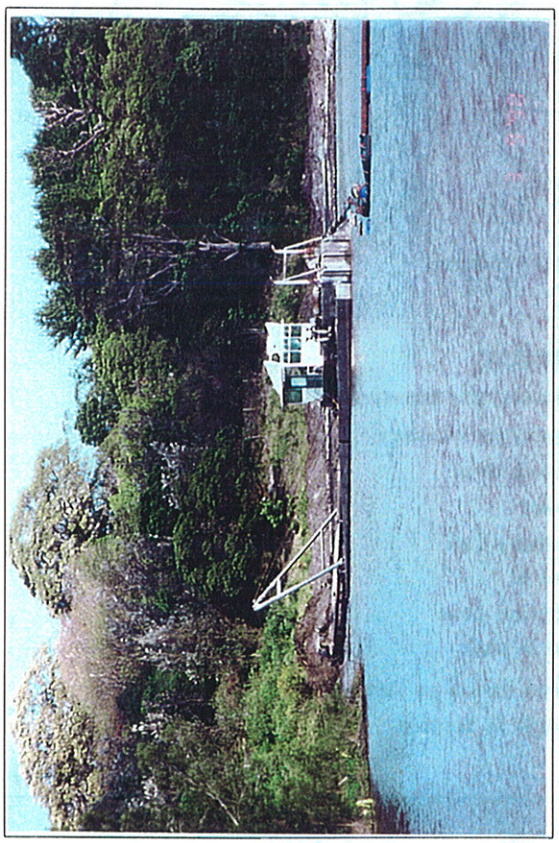

Plate 1.1 : The cutter-suction dredge operating at the Dunmore Sand Quarry. (Ref: 348 O/6)

Plate 1.3 : The processing plant at Dunmore Sand Quarry. (Ref: 348 N/5A)

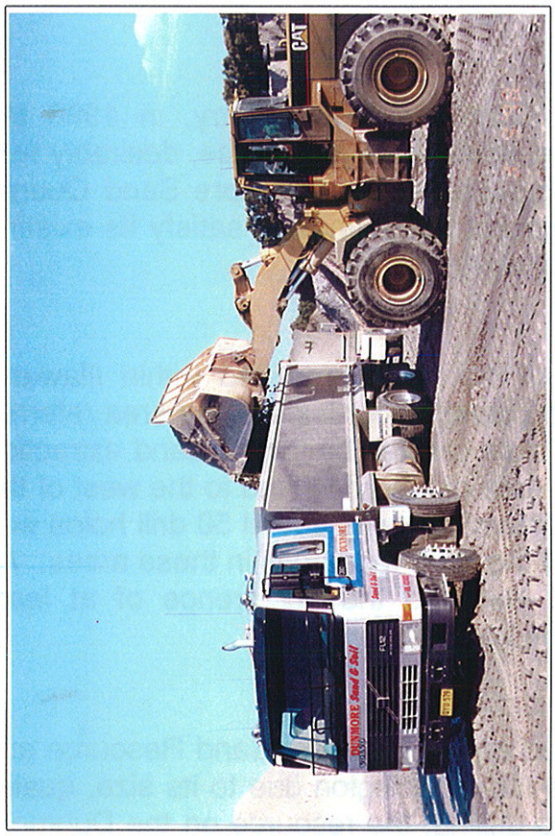

Plate 1.6 : Truck loaded by front-end loader at Dunmore Sand Quarry. (Ref: 348 N/15A)

Plate 1.8 : Temporary face of backfill material revegetated. (Ref: 348 O/20)

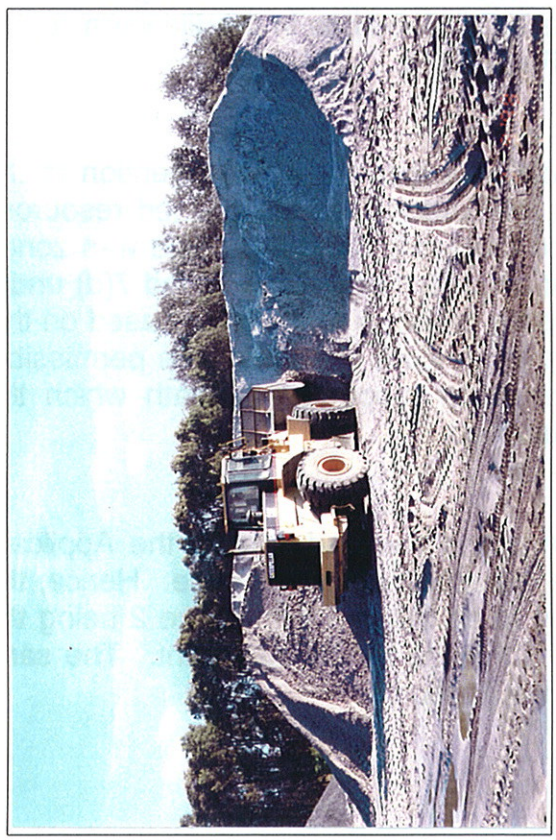

Plate 1.5 : Recovery of sand from a relocated stockpile at Dunmore Sand Quarry. (Ref: 348 N/11A)

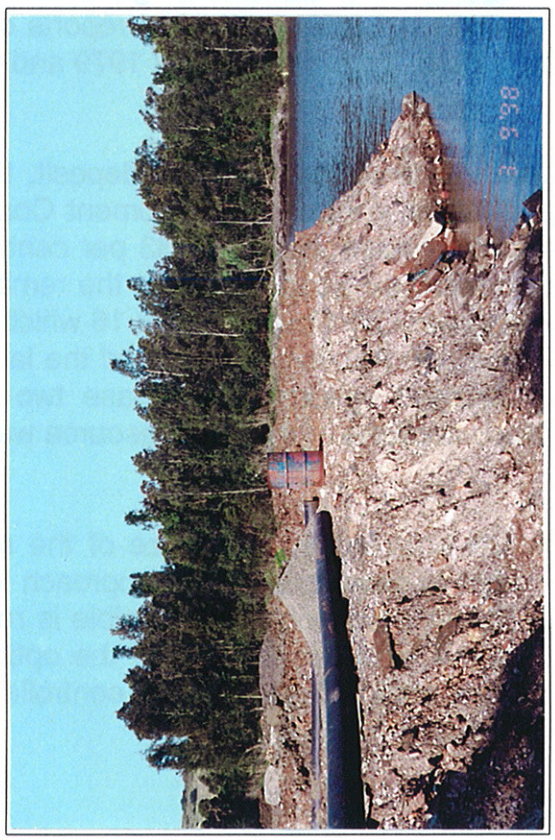

Plate 1.7 : Advancing face of backfill material into the dredge pond at Dunmore Sand Quarry. (Ref: 348 O/17)

1.4.3 Future Alternative Sand Sources

Given the dwindling sand resources at the Dunmore Sand Quarry, in 1996 the Applicant commenced its investigation into a replacement sand source, desirably with properties comparable to the sand already produced at the Dunmore Sand Quarry. A similar sand resource would enable the Applicant to continue to satisfy its existing customers and prepare the same range of proprietary blends.

The Applicant initially focussed its attention of the lands identified within Illawarra Regional Environmental Plan No 1 as containing sand resources, i.e. the area referred to as Dunmore Lakes named because of the lakes created by former sand extraction activities. Consideration was also given to the area of low-lying land to the west of the Princes highway. A comprehensive drilling program involving a total 50 drill holes was undertaken to define the limits and thickness of the sand resources in these areas. As a result of the investigations, the Applicant identified the occurrence of at least 13.5 million tonnes of sand in the area shown on **Figure 1.3**.

The area shown in **Figure 1.3** has been defined as the Dunmore Sand Resource and is deemed to be an important discovery in the Illawarra region due to its size, quality and proximity to the Princes Highway. Prior to drilling, the resource on the Dunmore Lakes Site was understood to contain sand up to 8 m thick, however, exploration drilling undertaken by the Applicant has identified that the sand is up to 18 m thick and of exceptionally high quality. The remainder of the resource area had previously not been identified in Illawarra Regional Environmental Plan No 1 and had gained little recognition in former geological reports on the sand resources in the Illawarra region (Smith 1978, Young and Reffel 1979 and MacRae, 1992).

Following the discovery of the deposit, the Applicant then turned its attention to the opportunities to obtain Development Consent for extraction of the defined resources and land acquisitions. Only 33 per cent of the Dunmore Sand Resource was zoned 1(a) to allow extraction whereas the remainder occurred within land zoned 7(d) under Shellharbour City Council's LEP 16 which currently prohibits extraction. Based on this outcome, the Applicant purchased the land on which sand extraction was permissible and obtained options to purchase two of the main properties beneath which the northern sections of the sand resource were identified.

With the knowledge of the size of the resource and the land zoning, the Applicant proposed to develop a staged approach to the extraction of the resource. Hence, the area where extraction is permissible is referred to as Stage 1 with Stage 2 being the bulk of the land currently under the option to purchase by the Applicant. The sand resources within Stage 3 are not controlled by the Applicant.

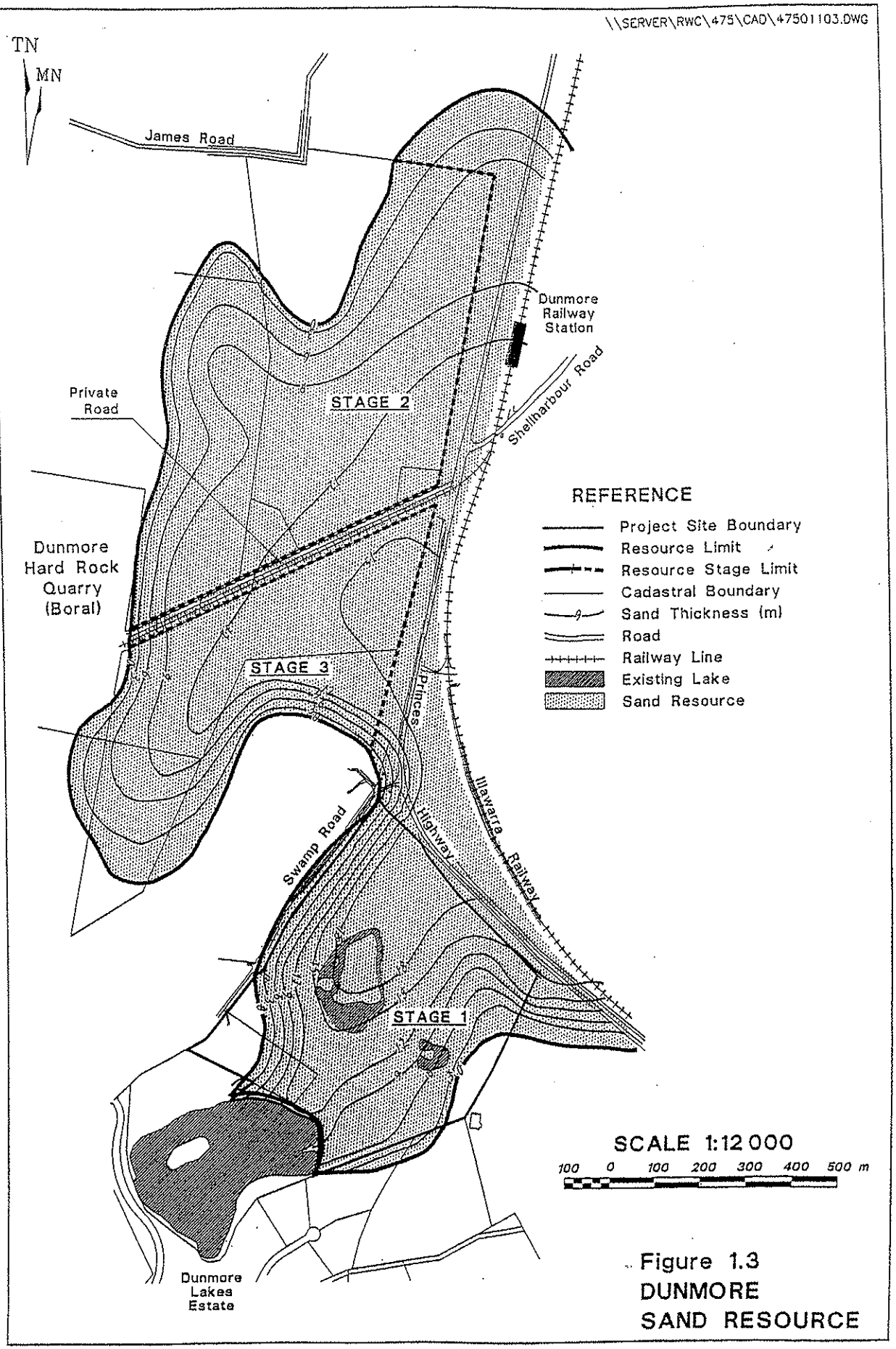

Figure 1.3
DUNMORE
SAND RESOURCE

1.4.4 Illawarra Sand Market

In order to obtain a full understanding of the Illawarra sand market and the regional significance of the Dunmore Sand Resource, the Applicant commissioned Don Reed & Associates Pty Ltd to review the supply and demand status of the Illawarra sand market. The principal findings of the report prepared by Don Reed & Associates Pty Ltd (1999) are set out below.

- The Northern Illawarra area consumes approximately 385 000 tonnes of fine sand annually. This requirement is reasonably static.
- Fine sand production in the Northern Illawarra has declined from 363 713 tonnes in 1990/91 to 194 976 tonnes in 1996/97. The Applicant currently produces about 50 per cent of fine sand recorded.
- The sand produced in the Northern Illawarra area represents about 50 per cent of its sand requirements with the remainder imported from Kurnell and the Southern Highlands.
- Unless substantial additional reserves are made available in the near future almost 80 per cent of the Northern Illawarra area's fine sand requirements will need to be imported.
- Existing sources of fine sand within the Northern Illawarra area are shown on **Figure 1.4** and are set out in **Table 1.1**. Distinction is made between resources with and without Development Consent.

In conclusion, Don Reed & Associates Pty Ltd (1999) determined that the Northern Illawarra area could be self-sufficient in fine sand for many decades if the sand within the Dunmore Sand Resource that is not subject to the RTA highway improvement program is extracted. Further discussion on alternative sources of fine sand is presented in Section 2.13.2. The need for the fine sand within the Dunmore Sand Resource for the Northern Illawarra area is an important factor in the justification of the proposal (see Section 5.1.2).

1.4.5 Initial Dunmore Lakes

The Project Site has been the subject of previous sand extraction operations in the 1970's through to the early 1980's which formed the existing lakes on and immediately south of the Project Site. It is believed that some of this sand extraction was undertaken primarily to develop a lake and wildlife sanctuary for the former Wild Australia Farm, an animal farm situated on the Project Site during the 1970's. Some of the structures relating to the animal farm still remain, including the lakes and the former kiosk and amenities building, now used as the Caretaker's Cottage.

TABLE 1.1
Fine Sand Sources – Northern Illawarra Area

Resource Location	Dunmore	Dunmore	Primbee / Lake Macquarie	Gerroa	Total
Quarry Operator	Dunmore Sand & Soil	Shellharbour City Council	South Coast Equipment	Cleary Bros	
Resources with Consent					
Current Quarry Production (tpa)	100 000	25 000	20 000	65 000	210 000
Reserves with Consent (tonnes)	400 000	250 000	40 000	1 135 000	1 835 000
Remaining life at Current tpa (yrs)	4	10	2	17**	8.5
Remaining life at 385 000 tpa (yrs)					4.8
Resource without Consent					
Additional reserves without Consent (tonnes)	13 500 000*		2 300 000	1 400 000	17 200 000
Additional Reserve life at 385 000 tpa (yrs)					45

* This includes 1.75 Mt of sand expected to be sterilised by the construction of the North Kiama Bypass through Dunmore Lakes - Stage 1

** Cleary Bros currently has a consent for their Gerroa site till 2002. This would need to be extended to enable the remaining sand resource to be fully extracted

Modified after Don Reed and Associates Pty Ltd (1999) - (See Table 5, Part 2 of Volume 2)

Sand extraction was a component of a former proposal for the land including the Project Site which involved a rural-residential subdivision and a water-based tourist recreation complex. Although the sand was not extracted as a result of that proposal, the existence of the sand resource remained as presented in the Illawarra Regional Environmental Plan No 1 and a Section 117(2) Direction by the Minister for Urban Affairs and Planning (see Section 1.5.4).

1.4.6 North Kiama Bypass

An important factor in the planning stages of the Dunmore Lakes Proposal has been consideration of the proposed North Kiama Bypass, which was originally proposed in 1991 to provide an alternative route for the Princes Highway to bypass the northern suburbs of Kiama. Those parts of the proposed Bypass assessable under Part 4 of the *Environmental Planning & Assessment Act 1979* were granted conditional development consent on 20 February 1997 by the Minister for Urban Affairs and

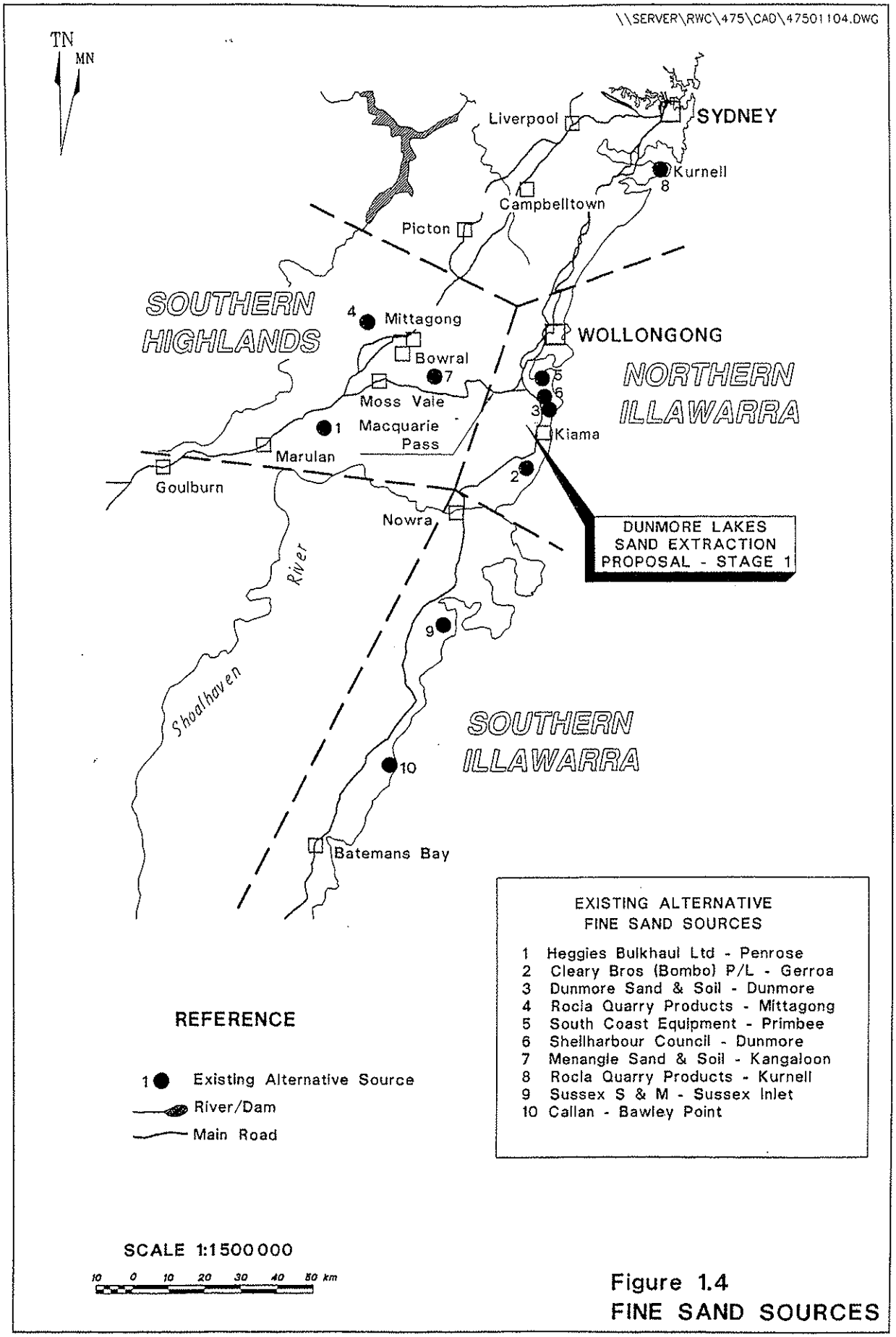

Figure 1.4
FINE SAND SOURCES

Planning whilst the remainder of the proposed Bypass assessable under Part 5 of the *Environmental Planning & Assessment Act 1979* was approved on 31 July 1997. The proposed Bypass was subsequently given the go-ahead by the Chief Executive of the RTA on 21 August 1997.

Small amounts of funds have been provided to date by the State Government for design works and limited strategic land acquisition. Indications are currently provided by the RTA that construction could commence as early as year 2000 and be completed by late 2004. The Applicant has not yet been approached by the RTA for acquisition of land required for the Bypass although the route has been surveyed and some preliminary geotechnical investigations carried out. The Applicant is aware of the minor re-alignment of the Bypass that was presented in a Statement of Environmental Effects dated 24 August 1998 (Connell Wagner (1998). **Figure 1.5** incorporates the amended alignment south of Lake 3.

The Applicant was aware of the RTA's plans for the Bypass when it considered purchasing the land containing the Project Site. At that time it was recognised the land not required for the Bypass contained a substantial quantity of fine sand. In any event, the assessment of the Bypass proposal had recognised that the Bypass would be constructed on a regionally significant sand resource.

In the vicinity of the Project Site, the proposed Bypass will consist of a new four lane divided road and a new interchange near the intersection of Swamp Road and the existing Princes Highway at Dunmore (see **Figure 1.5**). The interchange would provide for south-bound traffic to exit onto the old Princes Highway and Swamp Road and for north-bound traffic to enter onto the Bypass from either Swamp Road or the Princes Highway. The RTA does not have any plans at this stage for on and off ramps to the south (shown dotted on **Figure 1.5**), although they have advised the Applicant that backfilling after sand extraction would be supported in those areas, provided it is backfilled to the RTA's requirements.

Whilst the North Kiama Bypass would limit the extent of sand extraction on the Project Site, the Applicant recognises there would be opportunities, particularly during the construction period to work closely with the RTA and its contractor(s). The Applicant proposes to continue its constructive dialogue with the RTA to ensure both activities proceed in an environmentally responsible manner and that the cumulative environmental impact of both activities remains acceptable.

1.5 PLANNING ISSUES

1.5.1 Introduction

The zoning and development controls covering the Project Site are contained in Local Environmental Plan No. 16 (Shellharbour City Council), Illawarra Regional Environmental Plan No. 1, various State Environmental Planning Policies and a Section 117(2) Direction with respect to mineral resources.

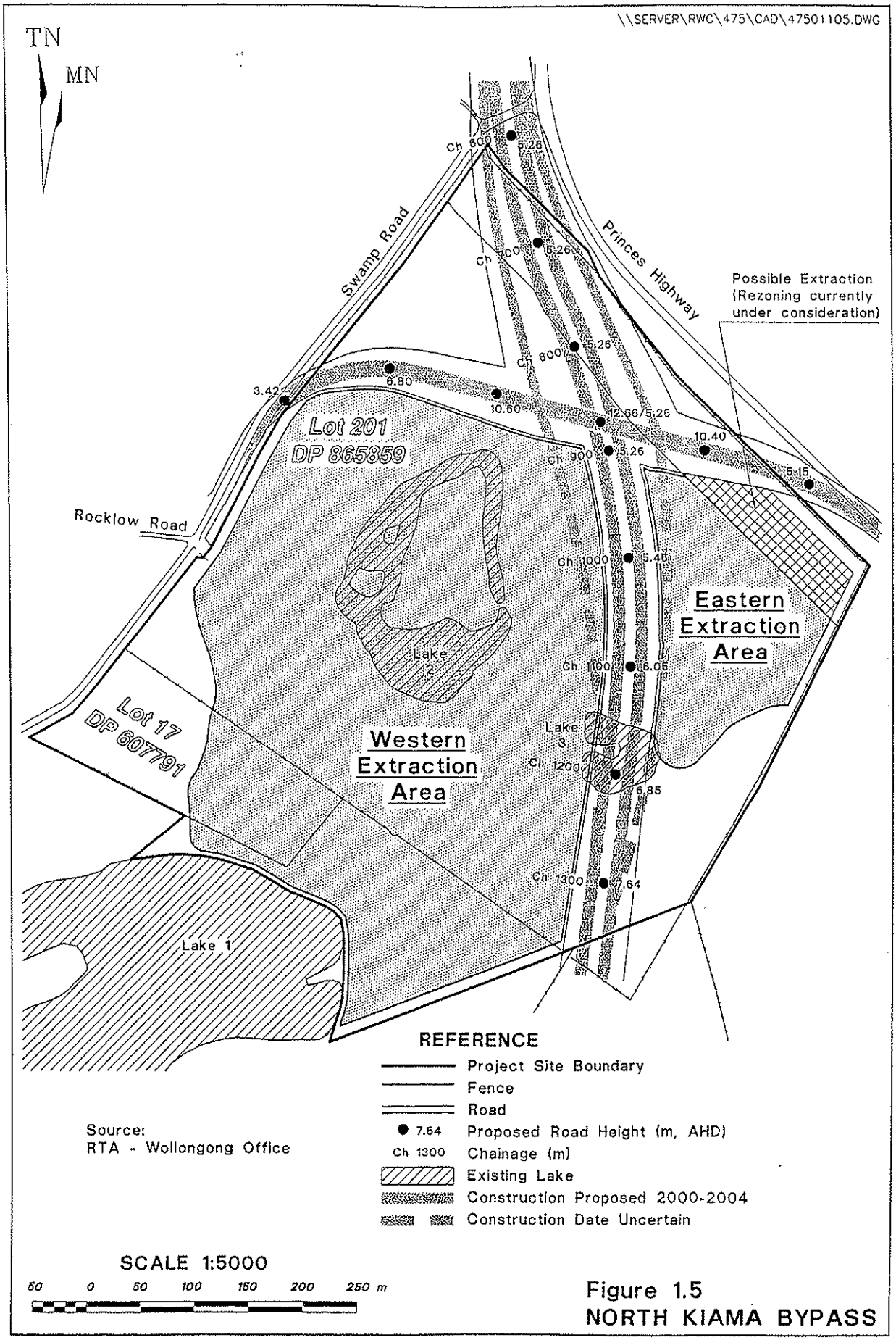

Figure 1.5
NORTH KIAMA BYPASS

1.5.2 Local Planning Issues

The current land use zoning in the vicinity of the Project Site is shown on **Figure 1.6**. Much of the Project Site is zoned Rural 1(a), under the Shellharbour Local Environmental Plan No. 16, 1987. Directly to the south of the Project Site is land zoned Rural 1(c), while directly east of the Project Site is an area zoned Rural 1(b). On the northern boundary of the Project Site, along the Princes Highway, the land is zoned 7(d) Environmental Protection (Scenic).

The objectives of the aforementioned zones, as stated in the planning instrument, are provided in **Table 1.2**.

TABLE 1.2
Objectives of Land Use Zones
Shellharbour Local Environmental Plan No. 16

Zone	Objectives
Rural 1(a)	* To protect the agricultural potential of rural land and to prevent the fragmentation of viable rural holdings * To prevent premature and sporadic subdivisions and to ensure consolidation of urban areas thus enhancing the prospect of the economic provision of public services * To prevent, on the fringe of urban areas, the subdivision of land into small lots which would prejudice the proper layout of additional urban areas as a result of natural growth
Rural 1(b)	* To prevent the establishment of traffic generating development along main rural traffic arteries
Rural 1(c)	* To allow low density rural residential neighbourhoods to be developed, taking advantage of changing demand for housing and the availability of rural land not suited to agricultural, industrial or urban uses * To maintain the environmental quality and visual amenity of the Municipality of Shellharbour's rural areas * To reduce the demand for subdivision for residential purposes of productive agricultural land
Extractive Industrial 4(c)	* To identify those areas specifically allocated for extractive purposes
Environmental Protection (Scenic) 7(d)	* To protect various areas which are environmentally sensitive and which enhance visual amenity

Extractive industries are a permissible land use in areas zoned Rural 1(a) with Council's consent.

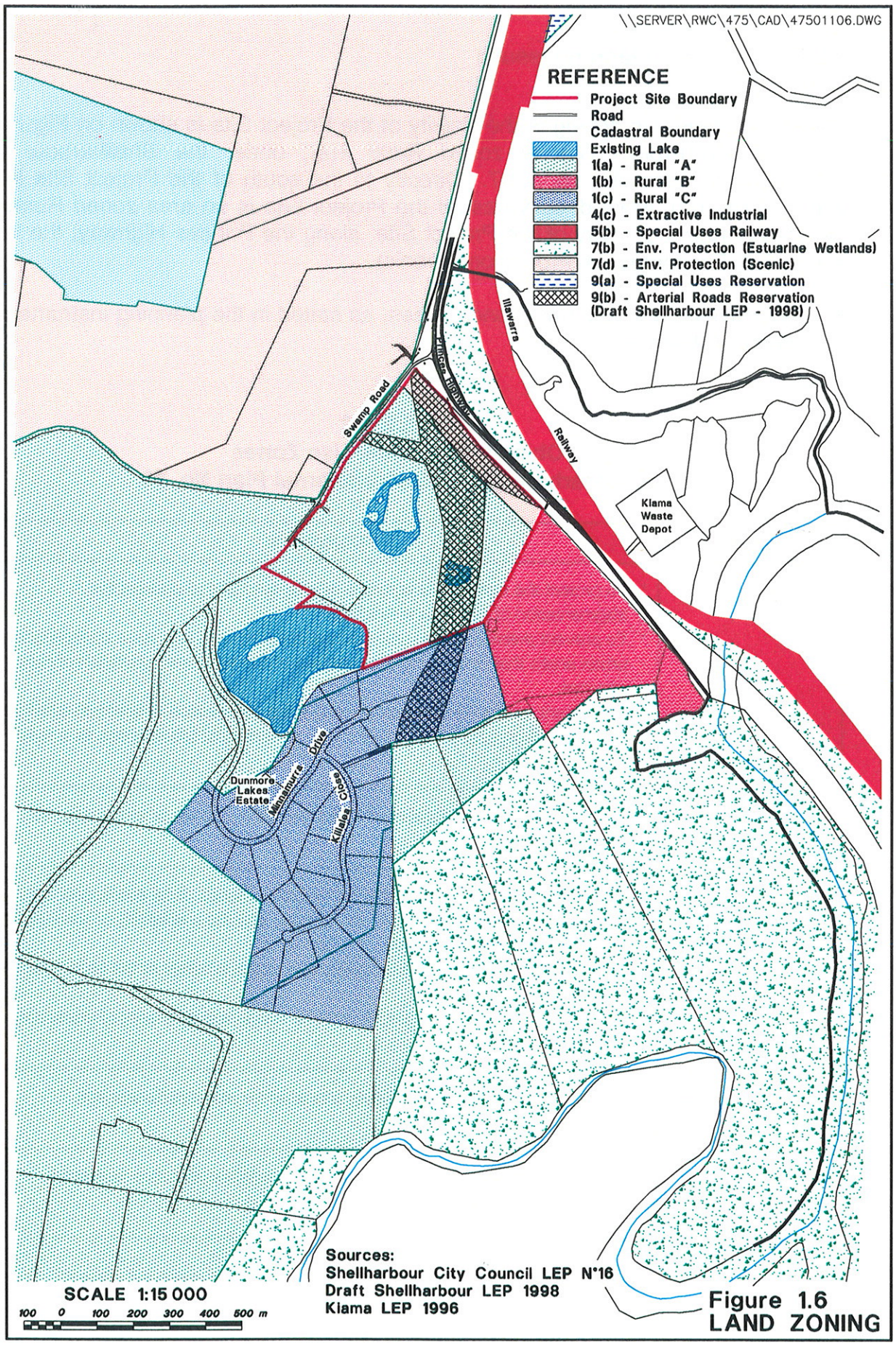

Figure 1.6
LAND ZONING

Council has also recently placed on exhibition the Draft Shellharbour Local Environmental Plan No. 1998. This Draft Plan provides for the re-zoning of land covered by the proposed North Kiama Bypass from 1(a) Rural "A" and 7(d) Environmental Protection (Scenic) to 9(b) Arterial Roads Reservation Zone. The main objective of the proposed re-zoning is to allow for the acquisition of land reserved for main or arterial roads. Extractive industry would be a permissible land use with Council's consent in areas zoned Arterial Roads Reservation 9(b). It is noted that much of the land currently zoned 7(d) adjacent to the existing Princes Highway has been re-zoned to allow for sand extraction. Only a small area of the Project Site remains zoned 7(d).

1.5.3 Regional Planning Issues

Illawarra Regional Environmental Plan No. 1

In addition to LEP No. 16, the Project Site is also covered by the Illawarra Regional Environmental Plan No. 1 (IREP). IREP was gazetted in April 1986 to provide a broad framework for coordinated action between various State government authorities in respect to development of the Illawarra region comprising the Wollongong, Shellharbour, Kiama, Shoalhaven and Wingecarribee Local Government Areas. The objectives of the plan include the following.

- To place certain requirements on developments.
- To provide information and guidance to local Councils with respect to local environmental plans.
- Defining the extent of interest of the Department of Urban Affairs and Planning (DUAP).
- Identifying DUAP's attitude and position on a wide range of environmental, social and economic issues.

Under the IREP, the Project Site comprises land of both prime crop and pasture potential as well as containing extractive materials. The following excerpt from the IREP outlines the objectives relating to rural lands.

"11. The objectives relating to rural lands are -

(a) to retain the productive capacity of prime crop and pasture lands;

(b) to protect valuable natural environments, as identified on sheets 1 - 10, 14, 15 and 17 of the map;

(c) to provide for wildlife movement between major protected wildlife habitats;

(d) to effectively manage the development of rural lands having regard to flood potential, bushfire risks, salinisation, soil degradation, erosion and weed infestation;

(e) to allow for the development of small rural holdings in appropriate locations;

(f) to prevent uneconomic demand for State Government services;

(g) to allow for future urban expansion;

(h) to retain the scenic attributes of rural areas; and

(i) to provide for developments which by virtue of their character require siting away from urban areas."

The objectives and other provisions noted in the IREP relating to land containing extractive material area as follows.

"32. The objectives relating to extractive materials are -

(a) to manage the extractive resources of the region in a co-ordinated manner so as to meet community needs while ensuring that adverse impact on the environment and the community is minimal;

(b) to ensure that development proposals for land containing extractive resources are assessed in relation to the potential problem of rendering those resources unavailable; and

(c) to ensure that the transportation of extractive materials has a minimal adverse impact on the community and that the transportation of large volumes of extractive materials shall by-pass urban areas where possible.

33. (1) The consent authority shall not consent to a development application for consent to carry out development on land identified on the map as land containing extractive materials otherwise than for the purposes of -

(a) extractive industries and related purposes;

(b) agriculture and associated purposes;

(c) local road; or

(d) home industries,

without the concurrence of the Director.

(2) In deciding whether to grant concurrence under subclause (1), the Director shall take into account -

(a) the impact the proposed development, if carried out, would have on the availability of extractive materials; and

(b) whether the benefit to the community of the proposed development, if carried out, is greater than the costs to the community of refusing consent to the development application, redesigning or relocating the development or rendering the extractive materials unavailable.

34. A draft local environmental plan for urban development on land identified on the map as containing extractive materials or for adjacent land shall be prepared only after the consent authority has consulted the Secretary of the Department of Mineral Resources and considered -

(a) the impact the proposed development is likely to have on the availability of the particular resources, or on any current resource extraction operations;

(b) whether the development would render that resource unavailable, and considered this cost to the community when compared with costs to the community of not permitting the development; and

(c) whether provision can be made for compatible land uses adjacent to areas of present or likely future resource extraction.

35. When practicable, the consent authority should consider attaching to appropriate development consents a condition requiring the transport of extractive materials or other bulk freight by other than road haulage."

Draft Shellharbour Rural Strategy

In addition to the above development controls, the Draft Shellharbour Rural Strategy ("the Rural Strategy") has recently been adopted by Shellharbour City Council. The main functions of the Rural Strategy are to:

- establish a common vision, goals and objectives for the management of rural lands;
- suggest ways of achieving such goals through stated performance targets and actions; and
- provide a mechanism for involving the community in the implementation of the Rural Strategy including input from the community.

The Rural Strategy has a number of broad goals and objectives relating to natural and cultural assets including biodiversity, water resources, heritage and landscape,

agriculture and mineral resources. The main objectives noted in the Rural Strategy in relation to mineral resources are as follows.

" • Identify and map the extent of quarry resource, estimated extraction rates, plans of extraction and likely buffer requirements.

• Establish a land use planning and management approach that protects identified resources of regional significance, and facilitates resolution of conflicts with values and uses of surrounding lands.

• Encourage community awareness about issues in relation to quarry operations and adjacent land uses and involvement in resolving issues; including end use of altered landscapes. "

The Rural Strategy will be used by Council to formulate policies and draft guidelines which in-turn would then be used to review the provisions of the Shellharbour LEP No. 16 and to prepare a new draft Rural LEP and associated draft Development Control Plans for the rural hinterland.

Draft Illawarra Coast Planning Strategy

The Draft Illawarra Coast Planning Strategy is currently being prepared by the Illawarra - South Coast DUAP office for public exhibition in 1999. The strategies being prepared against a background of policies and strategies as well as land use and development controls, which provide the broad and detailed framework for management of the environment, population growth and economic activity on the Illawarra coast. The strategy also provides a broad framework for existing and proposed extractive industries. It is noted that the Draft Illawarra Coast Planning Strategy is consistent with the strategic policy framework prescribed in the NSW Coastal Policy 1997.

1.5.4 State Planning Issues

SEPP 11 - Traffic Generating Developments

As this proposal is considered to be a traffic generating development, the Applicant is required to refer the proposal to the Roads and Traffic Authority for comment. The Applicant has maintained a close dialogue throughout the preparation of the EIS particularly with respect to the RTA's plans for the North Kiama Bypass.

SEPP 14 - Coastal Wetlands

SEPP 14 was gazetted with the aim of preserving and protecting coastal wetlands and applies to any development that has the potential to damage or destroy wetlands.

Figure 3.2 shows the location of SEPP 14 wetlands in relation to the Project Site. There are no SEPP 14 wetlands on the Project Site itself.

SEPP 44 - Koala Habitat Protection

Shellharbour Local Government Area is identified in Schedule 1 of this policy as an area providing habitat for koalas. The policy requires an investigation to be carried out to determine if any koala food trees are present on the Project Site. As a component of the fauna survey, none of the species of food trees listed in Schedule 2 of the policy was identified.

Section 117(2) Direction

A direction under Section 117(2) has been issued for the Albion Park/Dunmore Area. The relevant plan accompanying the direction was issued in March 1998 and effectively covers the area of the Dunmore Sand Resource identified on **Figure 1.3**. The Department of Mineral Resources has identified this area as containing a significant sand resource. This recognition is supported by the recent declaration by the Minister for Urban Affairs and Planning that the Dunmore Sand Resource – Stage 1 is of State significance.

1.6 CONSULTATION

1.6.1 Government Consultation

As part of the initial investigations to establish whether to proceed to an EIS, R.W. Corkery & Co. Pty Ltd and the Applicant met with representatives of the RTA to discuss the proposal in view of the proposed North Kiama Bypass. Once it was established that the proposed Dunmore Lakes Proposal could proceed without unduly affecting the proposed Bypass, and vice-versa, the following Government Authorities were consulted and invited to attend an on-site Planning Focus Meeting held on 24 November 1997.

- Department of Urban Affairs and Planning (Sydney and Wollongong)
- Environment Protection Authority (Wollongong)
- Department of Land & Water Conservation (Wollongong)
- National Parks & Wildlife Service (Hurstville)
- Department of Mineral Resources (St Leonards)

- Roads & Traffic Authority (Wollongong)
- Shellharbour City Council (Blackbutt)

The issues identified at the Planning Focus Meeting as a result of the site inspection are outlined in **Table 1.3**.

TABLE 1.3
Issues Raised by Government Authorities at the Planning Focus Meeting

Authority	Issues Raised
Department of Urban Affairs and Planning	* No specific issues * Reliant upon input from other authorities
Environment Protection Authority	* Acid sulphate soils * Water quality (on-site / Rocklow Creek) * Predictive modelling re: noise * Conceptual final land use (and predicted water quality)
Department of Land & Water Conservation	* Acid sulphate soils * Matters raised in previous correspondence
National Parks & Wildlife Service	* Adequacy / appropriateness of previous flora / fauna / archaeological surveys * Further studies (at the right time of year) if considered appropriate * Consultation with Local Aboriginal Land Council * Details of the geological occurrence of shell deposits (c.f. cultural deposits)
Department of Mineral Resources	* Definition of resources on-site * Regional supply / demand for sand * End land use
Roads & Traffic Authority	* Access arrangements (pre / post North Kiama Bypass) * Extraction program (relating to North Kiama Bypass) * Treatment / landscaping of the perimeter adjacent to Bypass * Use of B-doubles (after bypass is constructed)
Shellharbour City Council	* Impacts upon wetlands north of the Princes Highway and casuarinas adjacent to the highway * Results of consultations with Kiama Council, Minnamurra River Management Committee, and the Illawarra Catchment Management Trust * European / Aboriginal heritage * Visual issues * End landform and land use * Information on the resources present

Subsequent to the Planning Focus Meeting, the following authorities were also consulted.

- Telstra (Wollongong)
- Department of State and Regional Development (Sydney)
- Kiama Municipal Council (Kiama)

Correspondence from the Department of Urban Affairs and Planning is included as **Appendix 2**, together with a summary table identifying where each specific issue is addressed in the document. A summary of issues raised by other Government Authorities, and where each specific issue is addressed in this document, is presented in **Appendix 3** of this document.

Copies of the draft EIS were circulated amongst relevant Government Authorities. Constructive comments were received from DUAP, EPA, DMR, Kiama Council and the Illawarra Catchment Management Committee. Staffing shortages in Shellharbour City Council, NPWS and DL&WC prevented responses being supplied by those authorities. The RTA's comments were conveyed to the Applicant at a meeting held in December 1998. All constructive comments provided are gratefully acknowledged.

1.6.2 Community Consultation

Having operated the Dunmore Sand Quarry since 1988, the Applicant considers itself a member of the Dunmore community and therefore recognises the importance of consulting with its neighbours and a willingness to openly discuss actual or perceived problems and to implement constructive changes. The Applicant is committed to undertaking its various activities in a responsible manner which ensures its co-existence with other landholders and land users in the area is environmentally and socially responsible and minimises any perceived or real impacts on other members of the community.

During the early planning stages of the proposal, representatives of R.W. Corkery & Co. Pty. Limited and / or the Applicant consulted with a number of surrounding landowners to explain the nature of the proposal and to ascertain and / or discuss issues of concern regarding the proposal. During the preparation of the EIS, a community information evening was held on the 3rd September 1998 principally involving surrounding landowners and nearby residents within the Dunmore Lakes Estate. At that meeting the following range of issues were raised by the community in response to a preliminary outline of the proposal.

- ownership of land and overall intention of Applicant when land was purchased;
- how Dunmore Lakes proposal fits in with proposed North Kiama Bypass;
- method of stockpiling and height of sand stockpiles;
- vehicle frequency and volume of trucks per day;

- means of screening for visibility and noise, particularly from the Old School House and Dunmore Lakes Estate;
- surface water flows across Swamp Road and potential drainage blockages by new / upgraded roads and aesthetic bund walls;
- hours of operation particularly for use of front-end loader;
- safety concerns regarding additional truck movements on Swamp Road;
- safety and efficiency concerns regarding the Swamp Road and Princes Highway intersection;
- long-term intersection plans;
- use of flood-lighting on site;
- Council's Development Control Plan for Dunmore Lakes Estate and its reference to the proposal;
- flooding of Project Site including holding capacity of Project Site etc. -should site be protected from flooding?;
- noise impacts associated with operations - how are potential noise impacts determined - assurances / controls to limit noise impacts;
- assurances / conditions emplaced on the Applicant's operations;
- community involvement once proposal is operational;
- why use Swamp Road? - Use of alternative road beside Swamp Road on Company's land.

The Applicant gratefully acknowledges the input from its neighbours and surrounding residents to date.

The Applicant has advised local residents that it would support the involvement of a resident representative in a committee to review the progress of the sand extraction operation. Such committees are becoming more common and provide an opportunity for local residents (through their representative) to be closely involved with the review of the performance of the operation and to provide a means of improving the two way communications with the local community.

1.7 ONGOING DOCUMENTATION

Successful environmental management invariably involves regular, organised documentation to ensure that, irrespective of personnel changes, all aspects of planning, environmental control, monitoring and responses to problems are properly recorded. A range of ongoing documentation is proposed to ensure that the highest level of environmental performance can be achieved. The documentation proposed and an outline of their content is set out below.

Environmental Management Plan

This plan would be finalised after receipt of Development Consent and all other approvals discussed in Section 2.1.3. The principal objective of the plan would be to set out in detail how the quarry would be developed to ensure all approval conditions would be met. The plan would outline the Applicant's plans for the entire project in a similar manner to the EIS but particular emphasis would be placed upon the first 12 months of operation. The document would also incorporate the strategies for long term environmental management.

The Environmental Management Plan would include the following.

- **Preamble** - including background information, timetables, reporting procedures and management.
- **Site Access** - site access before, during and after the construction of the Bypass and intersection with Swamp Road.
- **Extraction Plans** - overall plans for the quarry development and plans for quarry establishment in light of proposed North Kiama Bypass.
- **Landscape Reconstruction Plan** - details of the plan to backfill part of the extracted areas.
- **Processing Plant** - final layout and design and details of stockpiling.
- **Water Management** - overall site water management.
- **Erosion and Sediment Controls** - details of relevant soil erosion controls and procedures for auditing effectiveness of controls.

- **Landscaping and Rehabilitation** - an overview of all rehabilitation, performance targets and the first year's activities in particular.

- **Environmental Monitoring** - Details of the monitoring programs for noise, water quality, air quality and revegetation.

It is proposed that the Environmental Management Plan would be reviewed every five years to ensure the changes in technology, market trends, community/government expectations and environmental management can be reviewed particularly for the long term planning of the operations.

Annual Environmental Management Report

The Applicant proposes to prepare an Annual Environmental Management Report that details the following for both the past year and the plans for the ensuing year.

- areas of disturbance associated with soil removal and sand extraction;
- production levels;
- sand extraction areas;
- backfilling and rehabilitation;
- water management;
- erosion and sediment controls;
- traffic levels; and
- environmental monitoring.

It is proposed that this report would also duplicate as the Environmental Management Report required by the NSW EPA. Where appropriate, performance targets would be set for the ensuing year and/or reported upon for the following year. This report would be presented to a committee comprising representatives of the relevant Government Authorities and a local community representative.

The Applicant is familiar with the requirements for annual reporting given they have already prepared two annual reports for its Dunmore Sand Quarry and is committed to the ongoing preparation of such reports.

1.8 MANAGEMENT OF THE INVESTIGATIONS

The preparation of the EIS has been managed by Mr Rob Corkery, B.Sc.(Hons), M.Appl.Sc., Principal of R.W. Corkery & Co. Pty. Limited. Also involved in the document's preparation have been the Managing Director of Dunmore Sand and Soil Pty Ltd, Mr Kerry Steggles, B.E.(Hons) and Mr David Coleman, B.Sc(Hons), Environmental Scientist with R.W. Corkery & Co. Pty. Ltd.

A number of the components of the proposal and the existing environment have been the subject of specific studies by the following specialist consultants.

- Countrywide Ecological Service (Fauna*).
- Don Reed & Associates Pty Ltd (Significance of the Sand Resource*).
- Environmental & Earth Sciences (Acid Sulfate Soils*).
- Illawarra Horticultural Services (Water Quality* and Wetland Design).
- Kerry Navin (Archaeology*).
- Kevin Mills & Associates Pty Ltd (Flora*).
- Richard Heggie Associates Pty Limited (Noise*).
- Pells Sullivan Meynink Pty Ltd (Geotechnical issues).
- Peter Dundon & Associates Pty Ltd (Hydrogeology).
- SMEC Australia Pty Ltd (Hydrology and Hydrogeology*).
- Transport & Urban Planning Pty Ltd (Traffic*).

The studies identified with an asterisk (*) have been compiled as Volume 2 of the EIS and summarised in the EIS itself whereas those without an asterisk have been incorporated directly into the EIS. The perspective sketches contained in this document have been prepared by EDAW (Aust) Pty Ltd.

PREAMBLE

Section 2
DESCRIPTION OF THE PROPOSAL

This section presents the Applicant's objectives and proposal to develop and operate Stage 1 of the Dunmore Lakes Sand Extraction Proposal. The extent of the sand resources is defined and the proposals for extraction, processing and product transportation are outlined together with the Applicant's plans for progressive rehabilitation.

Emphasis is placed throughout this section upon presenting the Applicant's plans in a conceptual manner, particularly given the uncertainties relating to the construction of the North Kiama Bypass. It is envisaged that more detailed plans would be formulated throughout the life of the project to ensure the activities and final landform and landscaping are undertaken in a manner that accurately reflects the relevant constraints and local community expectations.

This section incorporates a review of the feasible alternatives that have been considered throughout the design of the proposal. These alternatives relate to the area of sand extraction, product transportation and landscaping.

Details of the Applicant's proposal to manage surface water and groundwater, and matters relating to noise, traffic, visibility, soil and air quality are presented in Section 4 of this document.

2.1 OUTLINE OF THE PROPOSAL

2.1.1 Objectives

The Applicant's principal objectives for the development and operation of Stage 1 of the Dunmore Lakes Sand Extraction Proposal are to continue as the major supplier of fine sand to the Illawarra area, to secure long-term employment for the existing direct and indirect workforce, and to create a scenic artificial lake system to enhance the surrounding properties. These objectives would be achieved by:

(i) producing a range of high quality sand products, some of which are comparable to those already produced at the Applicant's existing Dunmore operation;

(ii) progressively increasing production levels to meet market requirements for fine sand throughout the Illawarra area and beyond;

(iii) progressively placing and shaping fill materials to pre-determined profiles around the lakes followed by progressive landscaping; and

(iv) undertaking all activities in a manner that complies with all relevant statutory requirements and accommodates the reasonable expectations of surrounding landowners and residents.

2.1.2 The Project Site

For the purposes of this document, the Project Site refers to the area shown on **Figure 2.1** which covers part of Lot 201, DP 865859 and Lot 17, DP 607791 in Parish Terragong and County Camden.

Figure 2.1 displays the boundary of the Project Site which covers a total of 32 ha and represents approximately 64 per cent of the land either owned by or contracted to be owned by the Applicant should the proposal be approved. Lot 201 which is owned by the Applicant covers a total area of approximately 47.6 ha. Lot 17 which covers an area of approximately 2.4 ha is currently owned by J. & R. Hambly. The Applicant holds an option to purchase Lot 17 should the proposal be approved.

2.1.3 Overview of the Proposal

The Applicant proposes to develop a sand extraction operation adjacent to Swamp Road and the Princes Highway near Dunmore to produce high quality sand products for use in the construction industry for a period of approximately 10 to 15 years.

The proposal has been designed in recognition of a number of variables which would influence the area of extraction and the final landform. These variables are briefly introduced in this section to provide the background for alternative proposals

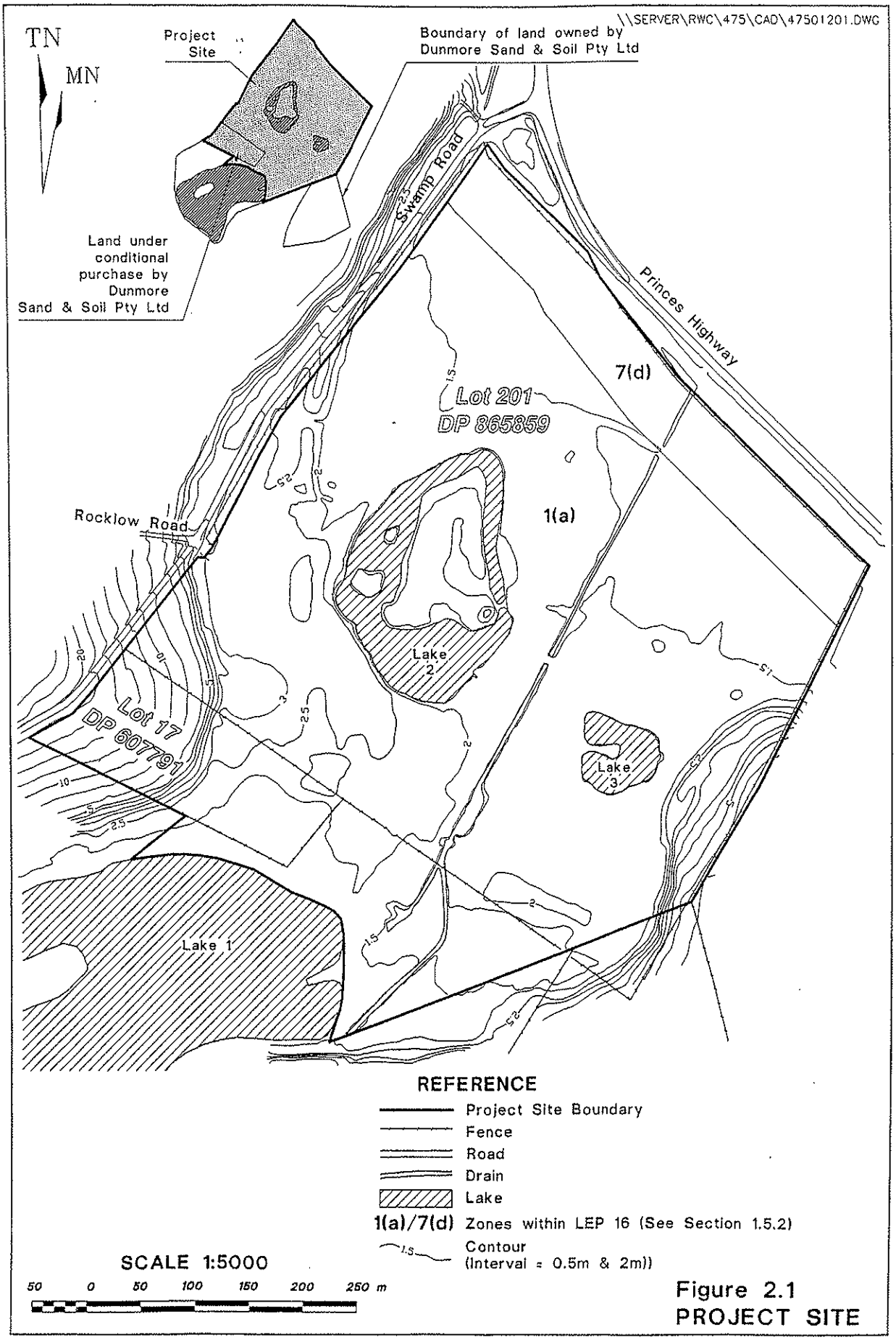

Figure 2.1
PROJECT SITE

included in this section. In brief, the main single factor likely to influence the amount of sand extracted from the Project Site is the proposed construction of the North Kiama Bypass. The Bypass has been approved for construction, however, the timing of its construction is subject to funding allocation being made by the State Government. Some funds have been released for initial design and some property acquisition, however, the Applicant has not been approached to date, nor is aware of when it may be approached. The other variable influencing the potential area extracted is the land zoning which is currently under review. With such uncertainties, and the Applicant's recognition of the importance of the sand resources beneath the Project Site, the Applicant has considered the following four options, each of which is presented in **Figure 2.2.**

OPTION 1: Extraction of all sand within the land zoned 1(a) within the Project Site and placement of fill materials throughout the extracted area to provide the long-term base for the Bypass.

OPTION 2: Extraction of all sand within the land zoned 1(a) within the Project Site but outside the "footprint" of land understood to be required by the RTA for the proposed Bypass and land rendered unsuitable for sand extraction. This option would also involve placement of fill materials to create an appropriate landform around the lakes.

OPTION 3: Extraction of all sand within the land zoned 1(a) and 7(d) within the Project Site and placement of fill materials within the area required for the long-term base of the Bypass and to create an appropriate landform around the lakes.

OPTION 4: Extraction of all sand within the land zoned 1(a) and 7(d) within the Project Site outside the "footprint" of the proposed Bypass and land rendered unsuitable for sand extraction. This option would also involve placement of fill materials within the area required for the long-term base of the Bypass and to create an appropriate landform around the lakes.

Option 1 is the Applicant's preferred option principally as it maximises the recovery of the sand resources from within the Project Site on land which currently permits sand extraction. This option would remain an option whilst ever the land required for the Bypass is owned by the Applicant. The Applicant recognises that Option 1 would only be realised if for some unknown reason the North Kiama Bypass was constructed in another location or at a time considerably later than that currently envisaged.

Option 2 is the Applicant's second preference assuming the resumption / purchase of the land required by the RTA proceeds for the North Kiama Bypass.

It is to be noted that Options 3 and 4 include an area of proposed sand extraction that is zoned 7(d) in which sand extraction is currently prohibited. The current re-consideration of zoning (under LEP 16) adjacent to the North Kiama Bypass, may enable the restriction upon sand extraction to be removed (see Section 1.5.2).

Presentation of these options and assessing their environmental impact in this document is considered valid given the imminent reconsideration of the zone boundaries. The relocation of the highway throughout the term of the proposed project would be a further reason for altering the zoning in that location. The Applicant recognises extraction in the 7(d) zone may require a separate and new Development Application if the zoning is not changed prior to determination of the Development Application, however, prefers to signal its intentions to surrounding landowners and authorities at this stage.

For the purposes of describing the Applicant's proposal in this section, the description is confined to Option 2 as this option is both legally permissible and reflects the expectations of the Community and stated intentions of the State Government that the North Kiama Bypass is to proceed. Notwithstanding that position, Section 2.13 of this document also reviews Options 1, 3 and 4 in the event a rezoning occurs and/or the construction of the North Kiama Bypass does not proceed in its currently approved position.

The main features of the Option 2 proposal would be:

(i) extraction of up to approximately 2.75 million tonnes of sand by excavating and dredging from a 19 ha area of land within the Project Site;

(ii) processing of all dredged sand within a relatively low-profile processing plant and maintenance of surrounding product stockpiles;

(iii) progressive backfilling of pre-determined areas to create up to 8.2 ha of useable, landscaped and mostly flood-free land;

(iv) progressive rehabilitation and landscaping of the lake foreshores and adjoining land to create a new scenic deep, 10 ha lake with some wetland shallows and a bird-nesting island; and

(v) the transportation of soil and sand products from the Project Site and backfill materials to the Project Site.

A Development Consent is being sought for 15 years to provide for all extraction and to complete all backfilling and rehabilitation activities.

The proposal has been designed to be as simple and compact as possible and to complement the Applicant's existing activities at its Buckley Road site at Dunmore. The Applicant would not undertake any blending or stockpiling of other earth materials on the Project Site to limit the extent of the activities for which approval is being sought and the overall impact of the proposal.

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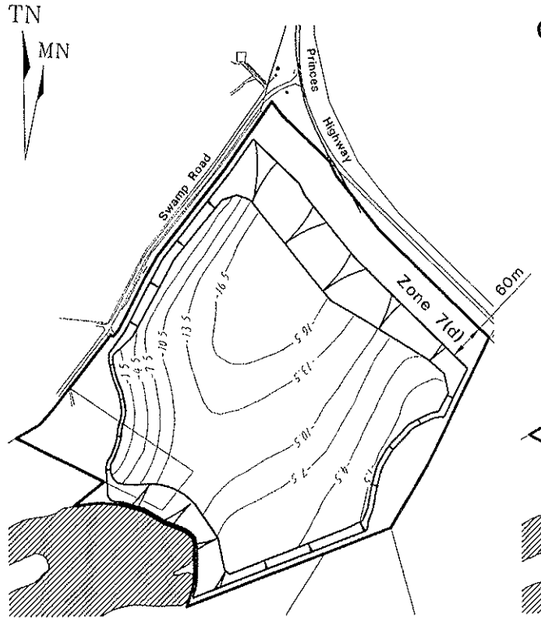
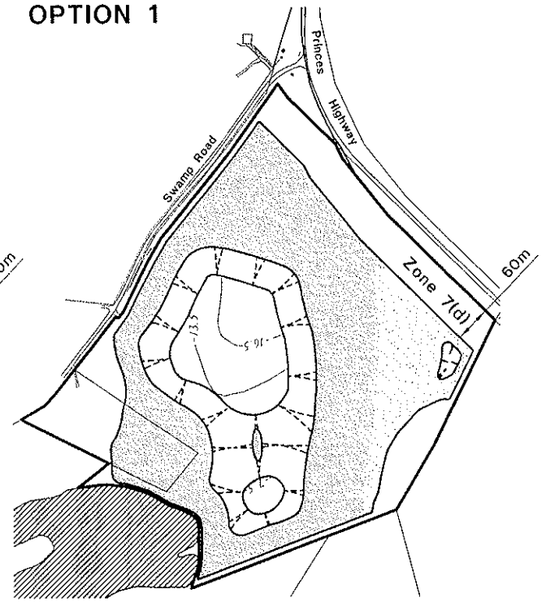
OPTION 1

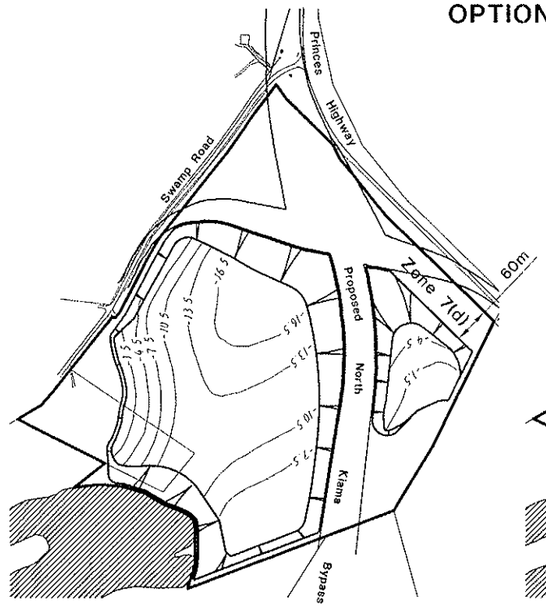


Extraction
(Area = 25.0 ha)

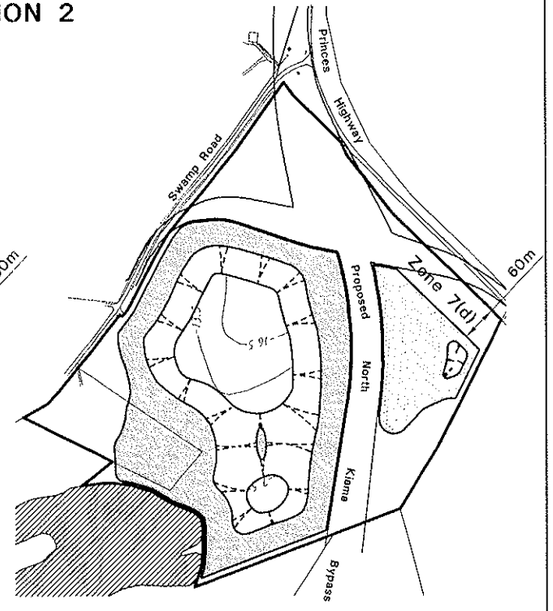


Landscape Reconstruction
(Surface Area = 16.1 ha)

OPTION 2



Extraction
(Area = 19.0 ha)

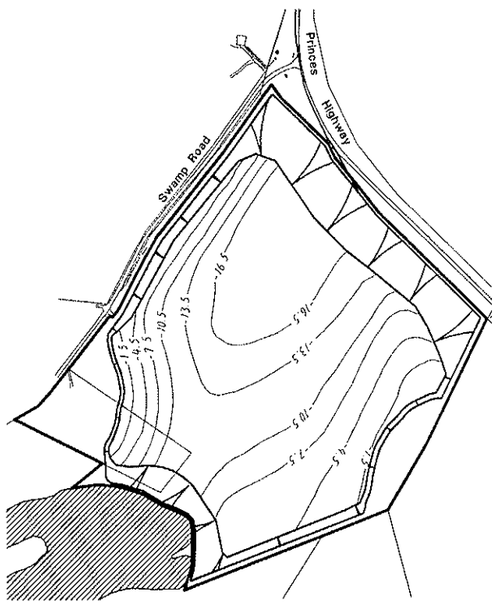


Landscape Reconstruction
(Surface Area = 8.2 ha)

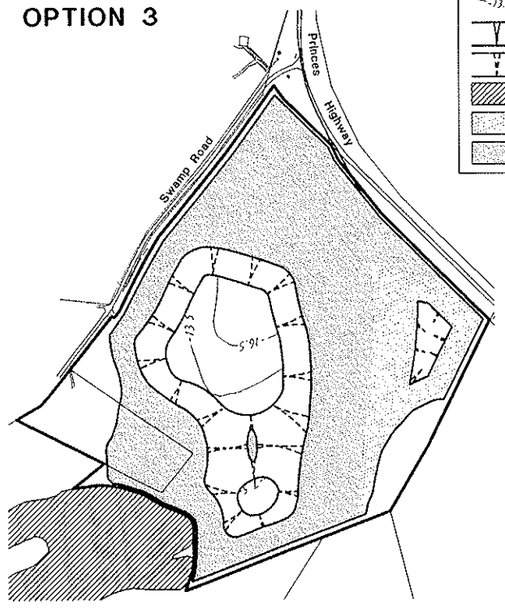
REFERENCE

- Project Site Boundary
- Cadastral Boundary
- Road
- -13.5- Approx Elevation (m, AHD)
- Extraction Batter
- Landscape Reconstruction Batter
- Existing Lake
- Backfilled to existing levels
- Backfilled up to 4.0m, AHD

OPTION 3



Extraction
(Area = 27.7 ha)



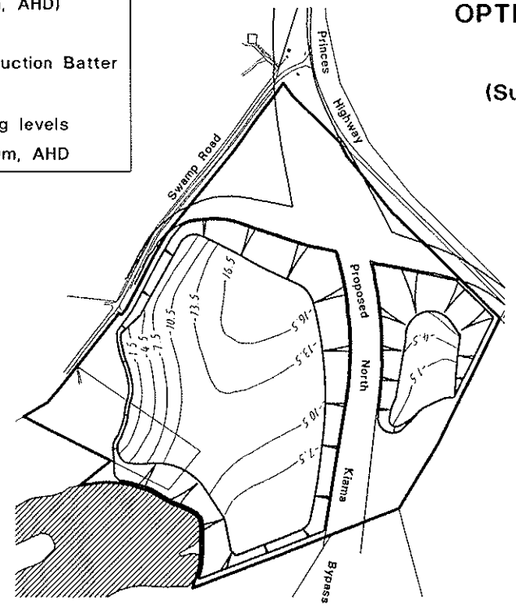
Landscape Reconstruction
(Surface Area = 18.5 ha)

SCALE 1:10 000

100 0 100 200 300 400 500 m

OPTION 4

Landscape Reconstruction
(Surface Area = 8.9 ha)



Extraction
(Area = 19.7 ha)

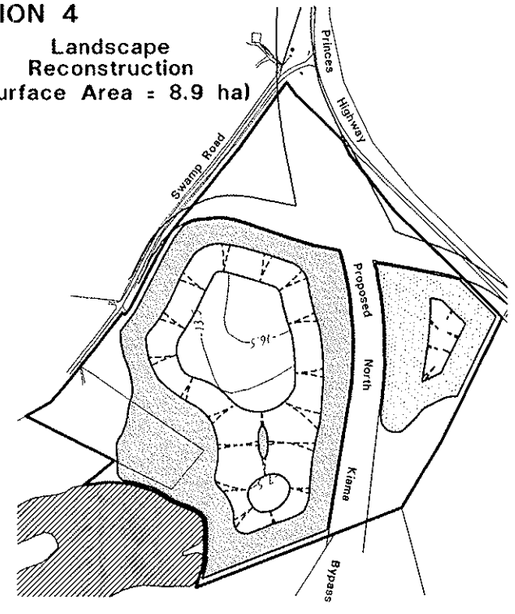


Figure 2.2
OPTIONS FOR EXTRACTION AND LANDSCAPE RECONSTRUCTION

2.1.4 Approvals Required

Schedule 2(7) of the *Environmental Planning and Assessment Regulation 1994*, as amended, requires this document to identify the list of approvals required to enable this proposed development to proceed. The approvals required are as follows.

(i) Development Consent under *Section 76* of *the Environmental Planning and Assessment Act, 1979*, as amended.

(ii) A Pollution Control Approval under *Section 17I* of the *Pollution Control Act, 1970.*

(iii) A Section 138 consent under the Roads Act 1993 is required for minor works to the Princes Highway / Swamp Road intersection.

(iv) A licence to permit placement of specified materials on the Project Site under the *Waste Minimisation and Management Act, 1995.* (Although a licence is required, rebates are provided as the materials obtained are effectively inert materials used as a means to construct an engineered rehabilitated landform).

(v) A Permit to destroy identified archaeological material within the Project Site under *Section 90* of the *National Parks and Wildlife Act 1974.*

Given more than one approval is required, the proposal is recognised as integrated development under the provisions of Section 91 of the *Environmental Planning and Assessment Act, 1979*, as amended. It is noted that the Applicant intends to apply for (iv) and (v) should (i), (ii) and (iii) be granted. Further documentation is required to accompany applications for (iv) and (v) and this documentation needs to closely reflect the Development Consent and its conditions for the project.

2.2 RESOURCES AND PRODUCTS

2.2.1 Resources

The principal resource contained within the Project Site is a fine-grained sub-rounded quartz sand (**Plate 2.1**). The drilling and resource evaluation programme undertaken by the Applicant has identified that there is almost 1.7 million cubic metres of sand beneath the Option 2 area capable of producing 2.75 million tonnes of sand products. **Table 2.1** lists the recoverable sand resources in both the eastern and western extraction area. Distinction is made between the resources that are removed by excavator and not processed and those that are dredged and processed. Further details of the occurrence of the resource and its characteristics are presented in Section 3.2.

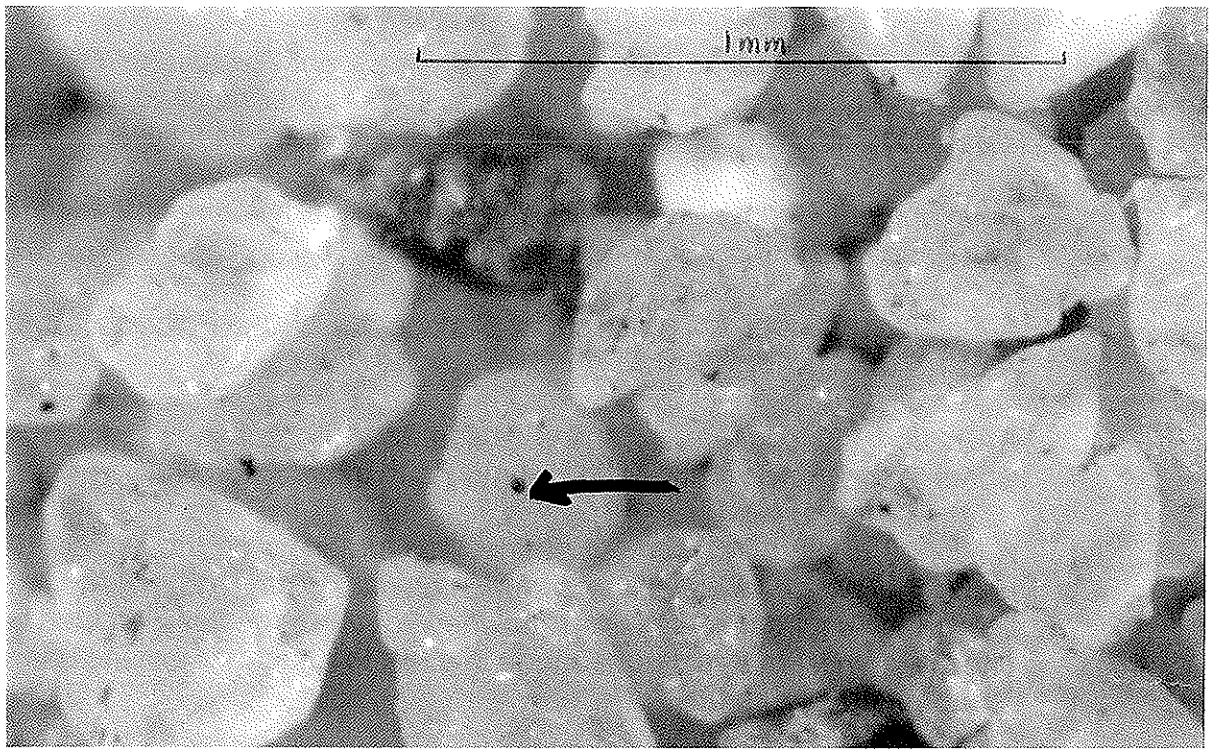


Plate 2.1: A photomicrograph of the fine-grained sub-rounded quartz grains within the Dunmore Sand Resource (Source: Applied Petrographic Services)

TABLE 2.1
Recoverable Sand Resources – Option 2

Sand Type	Resource Quantity (a)					
	Western Extraction Area		Eastern Extraction Area		Total Area	
	m^3	t	m^3	t	m^3	t
Sand Recoverable by Excavator (not processed) (b)	15 000	24 000	35 000	56 000	50 000	80 000
Sand Recoverable by Dredge (processed) (c)	1 680 000	2 520 000	100 000	150 000	1 780 000	2 670 000
Total	1 695 000	2 544 000	135 000	206 000	1 820 000	2 750 000

Notes

(a) Quantities are sales tonnes ex site which have a moisture content of 5 to 7 per cent

(b) The conversion factor from m^3 to t = 1.6 t/m^3

(c) The conversion factor from m^3 to t = 1.5 t/m^3 (as approximately 9 per cent of the material dredged would be returned to the fines return pond after processing)

2.2.2 Sand Products

The sand products produced on the Project Site would principally reflect the method of extraction. The excess topsoil and sand recovered by excavator would effectively yield unscreened products that would be removed directly from site with little or no stockpiling. The sand that is extracted by dredge would all be processed to yield washed products. After processing, the sand resource would yield a single sand product with a size grading within the following range.

Sieve Aperture	Per Cent Passing
2.36 mm	100
1.18 mm	100
600 μm	97 to 100
425 μm	85 to 95
300 μm	40 to 60
150 μm	3 to 5
75 μm	0 to 2

The sand is ideally suited as a component raw material for concrete and similar products either as a fine concrete sand or as a component of coarse sand blends. It is expected that up to 90 per cent of the sand would be used for these purposes. Small quantities from around the edges of stockpiles would be sold as washed filling sand. The Applicant would also use the sand to create proprietary blends of a range of construction materials for use in various construction projects. All blending would take place at the Applicant's Dunmore Sand Quarry.

2.3 SAND EXTRACTION

2.3.1 Extraction Methods

The method of sand extraction would be dictated by the geometry / depth of the sand deposit, the presence of the groundwater table within 2 m of the ground surface, and the constraints related to the North Kiama Bypass. For those areas where the resource is less than 3 m to 4 m thick or the proposed limit of extraction is adjacent to the North Kiama Bypass, sand would be removed by excavator. This sand would not be processed on site, but rather removed directly from site.

For those areas away from the margins of the deposit where it is only 3 m to 4 m thick and adjacent to the North Kiama Bypass beyond the zone extracted by excavator, the sand would be extracted by dredge.

2.3.2 Design of Extraction Area

The presence of the North Kiama Bypass would result in two extraction areas being developed, one on the eastern side (2.6 ha) and one on the western side (16.4 ha). **Figure 2.3** presents the proposed site layout for Option 2.

The boundaries of the eastern extraction area would be positioned 3 m from the boundary of the North Kiama Bypass and 5 m from the eastern boundary of the Project Site. The north-eastern boundary would coincide with the boundary between the 1(a) and 7(d) zones on the Project Site (see **Figure 2.1**). The boundaries of the western extraction area would likewise be positioned 3 m from the boundary of the North Kiama Bypass and no closer than 5 m from all property boundaries. Where extraction is proposed to occur within 3 m from the boundary of the North Kiama Bypass, the Applicant proposes to remove the soil from the 3 m section to assist with achieving stability when creating the landform that laps onto the Bypass foundation.

All extraction adjacent to the proposed North Kiama Bypass would be undertaken such that the average slope of the sand left in-situ would be approximately 1:3 (V:H) or 18°, i.e. prior to backfilling. This slope from all boundaries has been adopted following advice from Pells, Sullivan & Meynink (**Appendix 4**) that a slope of this grade would be an appropriate slope that would be stable beneath the pond surface and not destabilise any existing or proposed structure associated with the Bypass. It is recognised that the slope would not be straight but irregular in profile to reflect the scalloping effect created by the dredging arm and the excavator.

2.3.3 Extraction Procedures

The proposed extraction procedures would involve the following.

Definition of the Nominated Extraction Stage

Each area to be stripped of its topsoil would be clearly marked out prior to any site activities to ensure the subsequent activities are confined to the nominated extraction stage.

Topsoil Removal

Topsoil within each defined extraction stage would be removed either by:

- bulldozer pushing the topsoil into windrows for loading into trucks (by excavator or front-end loader), or
- excavation by excavator with either direct loading into trucks or into draining stockpiles prior to loading.

The topsoil would either be removed directly from site or placed on areas for use in site rehabilitation and use in bund wall construction.

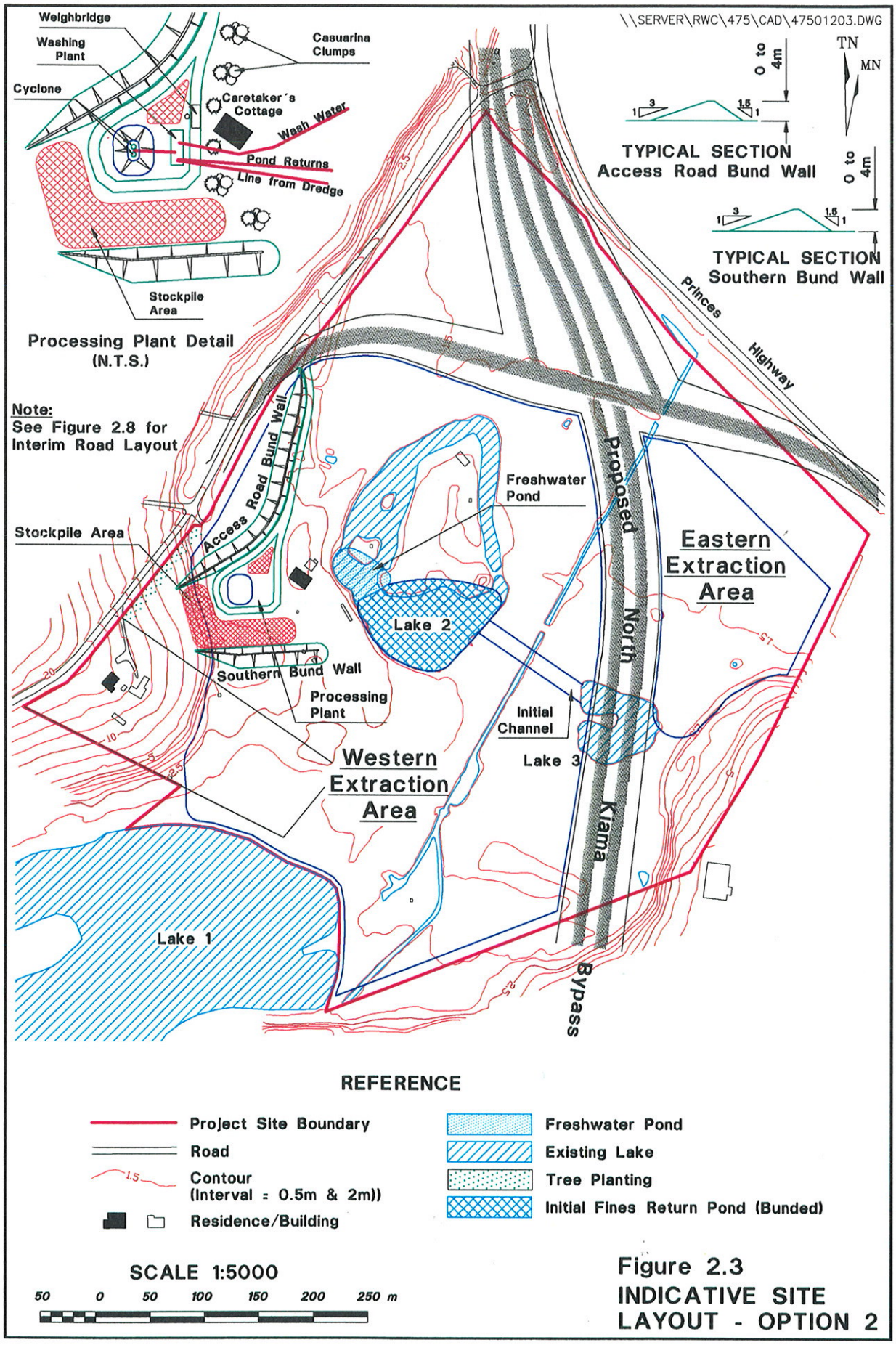


Figure 2.3
INDICATIVE SITE LAYOUT - OPTION 2

Extraction by Excavator

Where the sand thickness to be extracted is less than approximately 3 m to 4 m, the sand would generally be extracted using an excavator. Based upon advice from Pells, Sullivan & Meynink Pty Limited (**Appendix 4**), the external slope would be created with a roughened profile to assist in achieving stability in the fill materials placed on the external slope. The excavated sand would either be loaded directly into a truck or stockpiled briefly to dewater sufficiently until it is loaded out. The extraction and stabilising activities are shown as Steps 1 and 2 on **Figure 2.4**.

Extraction by Dredging

The bulk of the sand would be recovered by a modern cutter-suction dredge (see **Plate 1.1**). The dredge would float on the pond at a level generally equivalent to the groundwater table and would move backwards and forwards across the active dredge pond cutting away against the underwater face of sand. This would involve the raising and lowering of the dredge arm. The dredge would be equipped to extract the sand resource from a depth of 4 m to 18 m. Step 3 on **Figure 2.4** schematically shows the operation of the dredge.

2.3.4 Extraction Sequence

The Applicant would undertake the extraction in a sequence that reflects the timing of the construction of the North Kiama Bypass. **Figure 2.5** displays a conceptual extraction sequence with extraction considered in eight stages.

Stage 1: Extraction in Stage 1 would commence with the use of an excavator extracting sand from the perimeter of the eastern extraction area. Whilst this is underway, the dredge would be assembled in a purpose excavated dredging hole with a narrow channel excavated to Lake 3. Once within the eastern extraction area, the dredge would extract the sand with thicknesses greater than 3 m to 4 m. The sand slurry pipeline would be positioned on the ground across the alignment of the Bypass and initial channel back to the processing plant.

Once the perimeter is extracted within the eastern extraction area, this activity would recommence on the western side of the proposed North Kiama Bypass.

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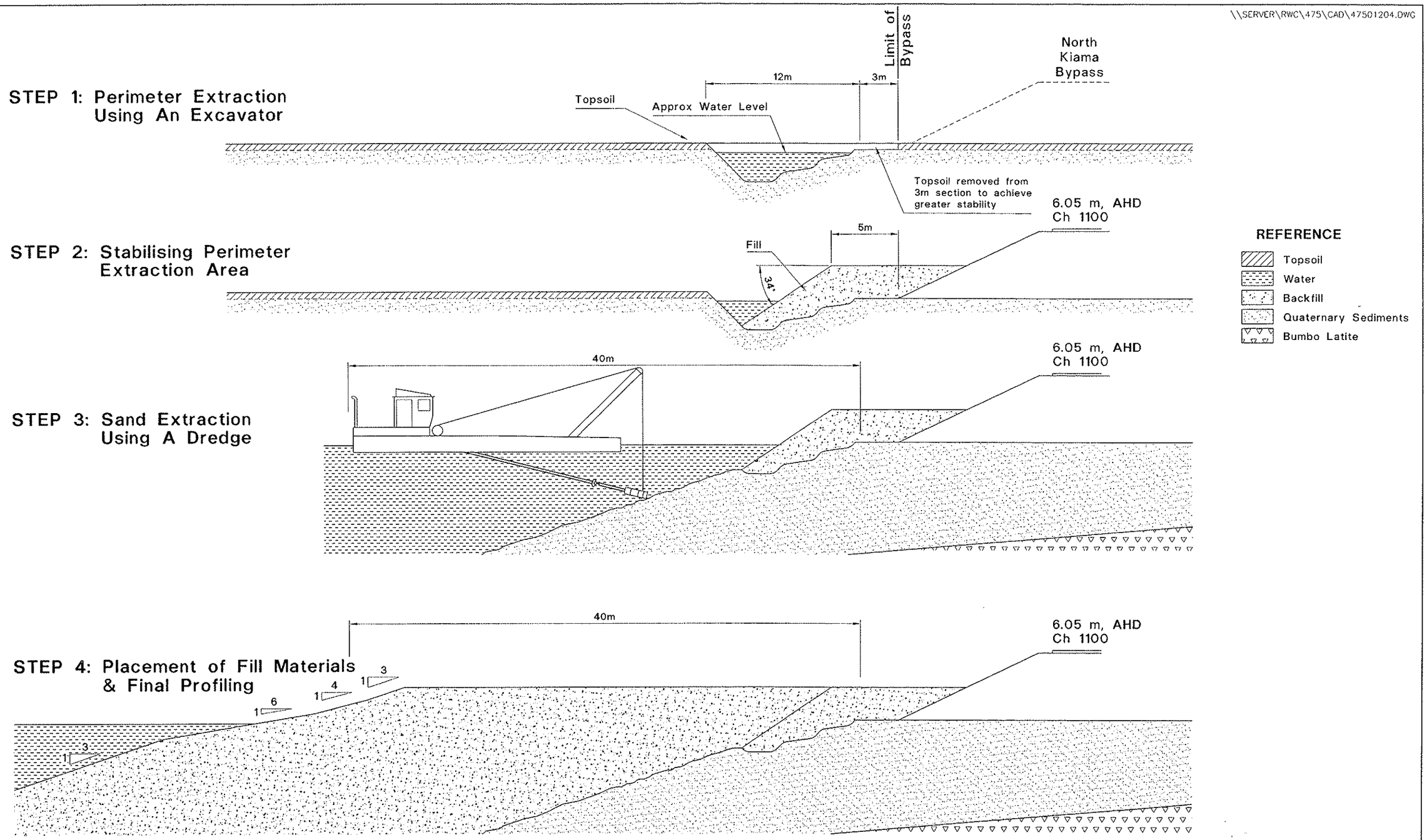

See Figure 1.5 for Chainage 1100 Location

Figure 2.4
SAND EXTRACTION, SLOPE STABILISATION AND BACKFILLING PROCEDURES

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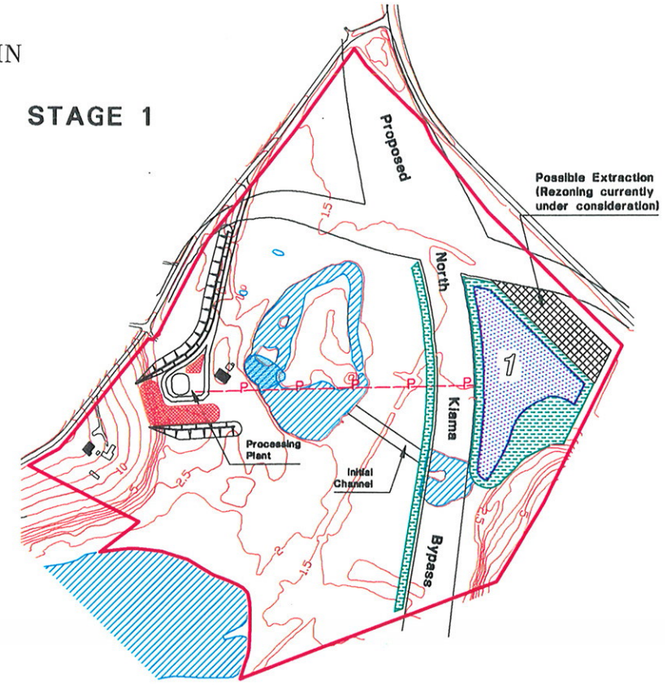
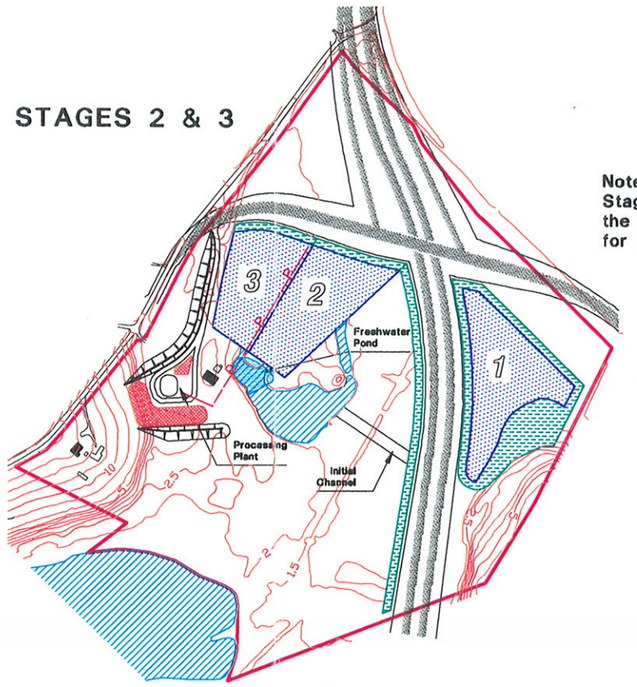
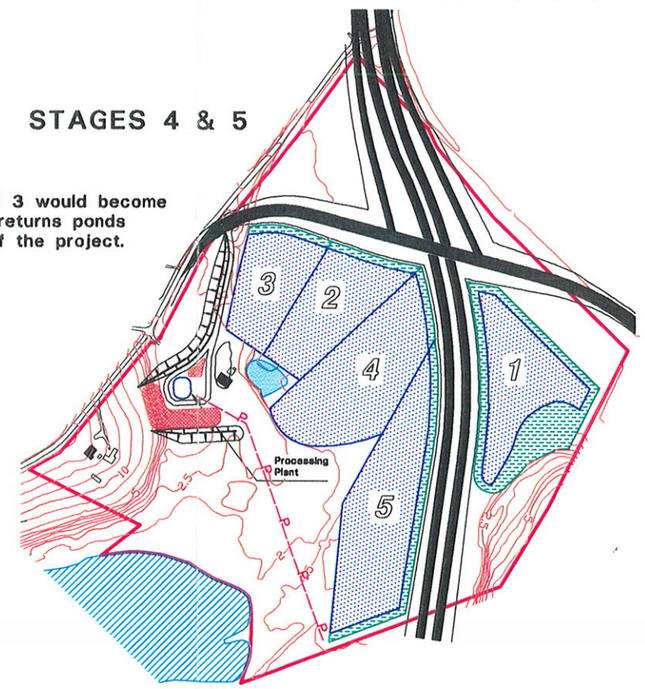
STAGE 1



STAGES 2 & 3

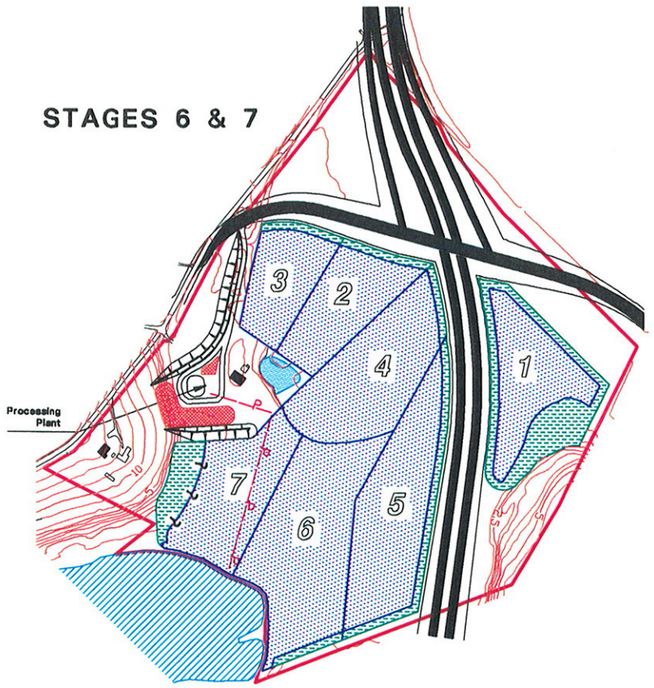


STAGES 4 & 5

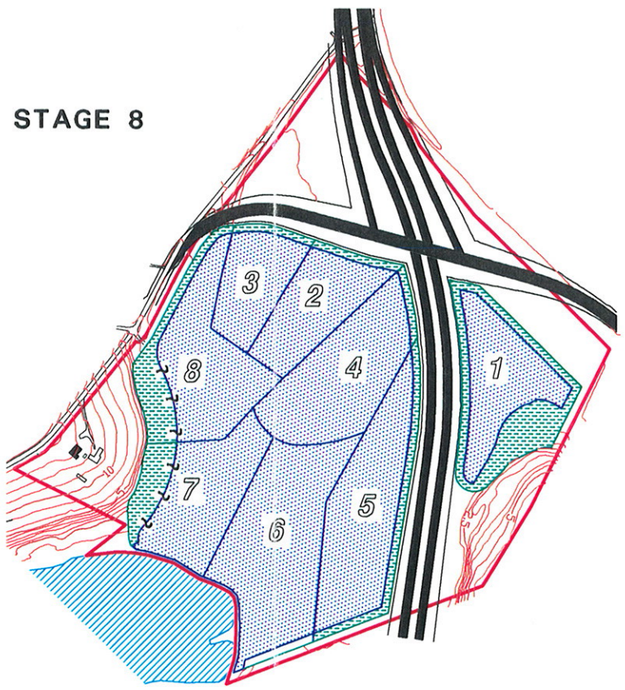


Note:
Stages 2 and 3 would become the principal returns ponds for the life of the project.

STAGES 6 & 7



STAGE 8



REFERENCE

- Project Site Boundary
- Contour (Interval = 0.5m)
- 1 Extraction Stage
- Area Extracted by Excavator
- Area Extracted by Dredge
- Existing Lake
- Freshwater Pond
- Product Stockpile
- Residence
- Building
- Sand Slurry Pipeline
- Road
- Bypass (Possible/In place)
- Bund Wall

SCALE 1:8000

100 0 100 200 300 400 m

Figure 2.5
INDICATIVE PROPOSED EXCAVATION AND DREDGING SEQUENCE - OPTION 2

Stages 2 & 3: Extraction in Stage 2 would be confined to the western extraction area. The perimeter area would again be excavated (and backfilled). Whilst this is underway, the dredge would return to the western side of the North Kiama Bypass, through the initial channel and Lake 2 and commence extraction in Stage 2. Dredging would progress generally in a northerly direction in Stage 2 and back in a southerly directly in Stage 3. The sand slurry pipeline would be positioned between Stages 2 and 3 and that area removed at the end of Stage 3.

Stages 4 & 5: The bulk of the extraction in these stages would be by dredging within only a comparatively short campaign of perimeter extraction using an excavator near the southern boundary of the Project Site. Dredging would involve progressively moving southwards through Stages 4 and 5.

Stages 6 & 7: Extraction in these stages would involve both perimeter extraction with an excavator and dredging. During these stages, dredging would generally be progressively northwards in Stage 6 and southwards in Stage 7. The sand slurry pipeline would be probably positioned between Stages 6 and 7 and again that area would be removed at the end of Stage 7.

Stage 8: Extraction in the final stage would involve extraction by both excavator and dredge. It would be the Applicant's intention to dredge as much sand as possible and process it on site. However, there would come a time during Stage 8 to remove the processing plant and dredge and recover the remaining sand by excavator principally by retreating towards the Project Site entrance.

The proposed staging is by necessity conceptual as the timetable of the Roads & Traffic Authority is not known. Given this need, the Applicant recognises that it would be necessary to develop updated plans on an annual basis that identify where extraction (and backfilling) would take place and how the activities co-exist with the construction plans of the RTA and its contractors.

The Applicant estimates the duration of extraction in each extraction stage would vary from 1 to 2 years.

2.3.5 Production Levels

The Applicant anticipates the sand would be extracted generally at a rate of between 500 tonnes and 2 000 tonnes per day, i.e. at a rate of approximately 150 tonnes per hour. Based on these production levels, the Applicant expects the dredge to operate for between 200 and 270 days per year. Annual production rates of 200 000 tonnes to 350 000 tonnes are envisaged by the Applicant. It is noted that each 100 000 tonnes of dredged sand would yield about 90 000 to 95 000 tonnes of product after processing.

2.3.6 Equipment

Where practicable, the Applicant intends to maximise the use of its equipment already in operation at the Dunmore Sand Quarry. However, there would be a need for some dedicated equipment on the Project Site. **Table 2.2** sets out the equipment to be used on site and the likely duration of its use. Any future equipment would involve similar size equipment to that replaced.

TABLE 2.2
Mobile Equipment List

Equipment	Use	Duration on Site *
Bulldozer (D65EK)	Topsoil stripping, and backfill placement and shaping	Full-time
Hydraulic Excavator (Cat E300)	Topsoil stripping, perimeter sand extraction and truck loading	1 to 2 weeks per campaign (0-2 campaigns per year)
Front-end Loader (FL 140)	Loading topsoil and excavated sands into trucks, creating and maintaining stockpiles	2 to 3 weeks per campaign (3 to 4 campaigns per year)
Front-end Loader (Cat 970 F)	Loading product trucks, creating and maintaining stockpiles and removing oversize screenings from the plant to the pond. Some topsoil loading and shaping bund walls	Full-time (up to 2 000 t/ day)
Cutter Suction Dredge (12" delivery line)	Extraction of sand 4m - 18m thick	Full-time
Boat (10 HP outboard motor)	Moving dredge tie lines, monitoring, maintenance	Full-time

2.4 BACKFILLING OPERATIONS

2.4.1 Introduction

The Applicant proposes to backfill around the perimeter of the extracted areas as the basis for a landscape reconstruction program intended to create an area of land with sufficient width around the created lakes to sustain the proposed final land uses. This activity is an integral component of the existing operation of the Dunmore Sand Quarry. Hence, the description of the operations in this section are drawn from site experience together with geotechnical advice from Pells, Sullivan & Meynink (**Appendix 4**) and advice from Illawarra Horticultural Services on suitable profiles for the development of wetland communities.

This sub-section concentrates upon the operational aspects of the backfilling operations. Specific details of the landscape reconstruction as it relates to the development of wetland communities and fauna habitats is presented in Section 2.12.

2.4.2 Backfilled Landscape Design

Figure 2.6 displays the proposed areas of backfilling within the Project Site and proposed final levels. The principal features of the design are as follows.

(i) Within the eastern extraction area, backfilling is proposed to a level comparable to existing topographic levels. Some localised increase in elevation may occur if a long-term access road is created to provide access to land south of Dunmore House. The exact area of the lake created would reflect the availability of backfill materials at the time of backfilling and the exact timing of the construction of the North Kiama Bypass in that area.

(ii) Within the western extraction area, the landscape reconstruction would involve the creation of a flood-free landform wherever possible, i.e. at a level of approximately 4.0 m, AHD. The areas where a 4.0 m, AHD level would be achievable would be adjacent to the North Kiama Bypass and the Swamp Road off-ramp and adjacent to the elevated area in the south-western corner of the Project Site.

(iii) Provision has been made to backfill the areas that may potentially become the north-bound off-ramp and south-bound on-ramp from the Bypass. The RTA supports the extraction of sand and backfilling of these areas given the need for such a facility is not contemplated within the term of the proposed sand extraction operation.

(iv) The selection of the final slopes created by the backfilling reflects the need for stable slopes (see **Appendix 4**) and slopes able to sustain wetland communities, particularly on the edge of the final lake adjacent to the Bypass. Details of the slopes and their suitability for wetland vegetation are discussed in Section 2.12.

(v) The backfilling program would also involve the creation of at least two more permeable zones adjacent to the North Kiama Bypass to ensure natural groundwater pressures beneath the Bypass are not raised artificially through the placement of fill materials ultimately with a lower permeability on both sides of the Bypass. Details of these materials are presented in Section 2.4.3.

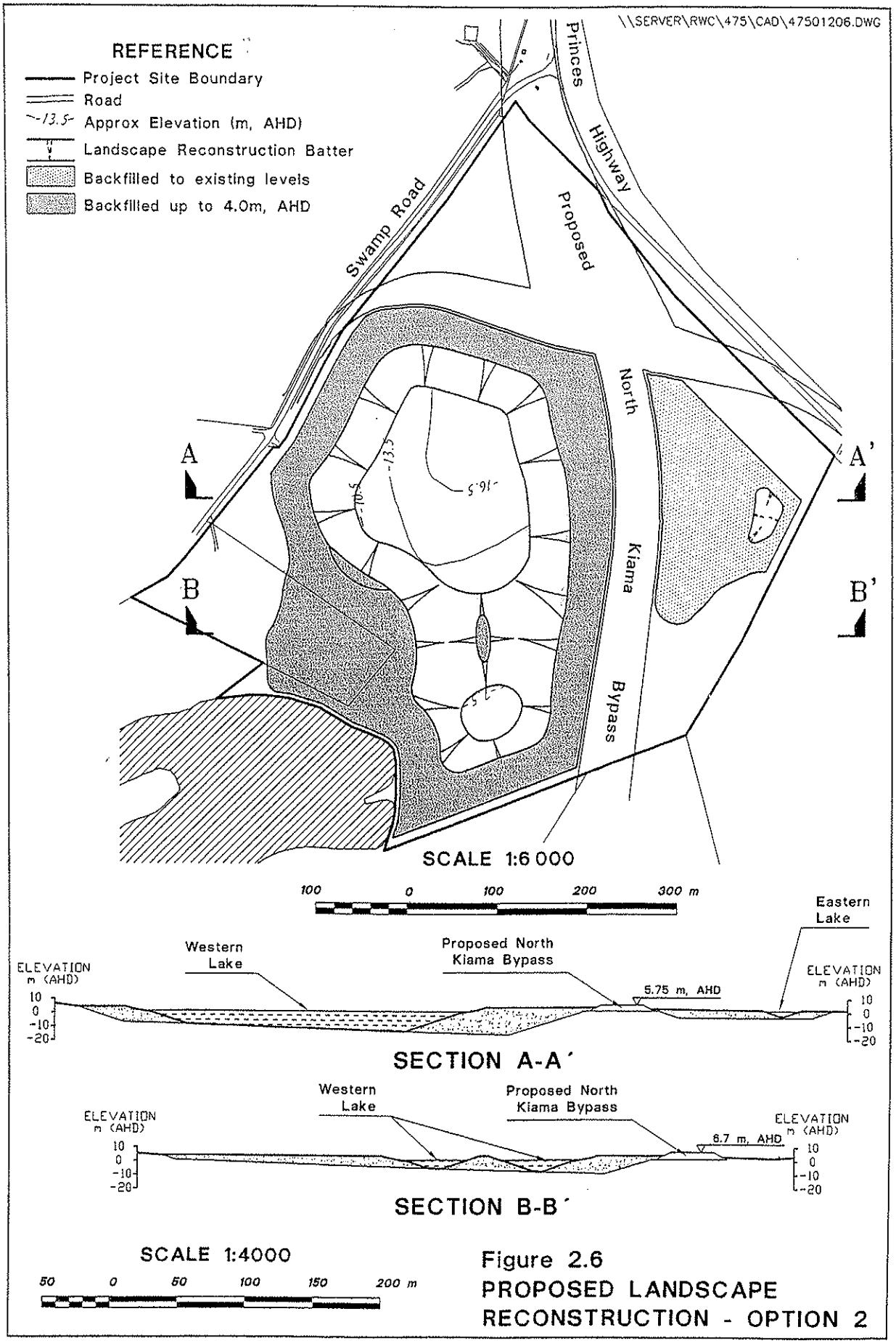


Figure 2.6
PROPOSED LANDSCAPE RECONSTRUCTION - OPTION 2

The need for the type of facility proposed for the placement of naturally excavated natural material and reprocessed coarse inert aggregate rubble is evident from the increased quantity of these materials currently received at the Dunmore Sand Quarry. Facilities such as the Dunmore Sand Quarry benefit from the receipt of such materials to reconstruct usable landforms after extraction of regionally important sand resources and at the same time assist in extending the operational lives of controlled landfill facilities.

2.4.3 Backfilling Materials

The Applicant proposes to undertake the backfilling with two classes of materials, namely:

(i) virgin excavated natural materials; and

(ii) a non-waste product comprising reprocessed inert solid materials such as uncontaminated brick, concrete and tiles.

The non-waste product used is referred to by the Applicant at its Dunmore Sand Quarry as "Coarse Inert Aggregate Rubble". A typical specification for this type of product is set out in **Table 2.3**.

The source of the uncontaminated natural material should principally be from civil engineering construction projects and subdivisions. It would include clay, sand, rock and earth. Material meeting the "Coarse Inert Aggregate Rubble" specification would be drawn principally from EPA licensed inert waste recycling and processing operations where the major component is currently brick.

Because of its lack of very hard rock strength, this material is unsuitable for crushing to form a range of recycled aggregates and road bases. It is however, ideal for landscape reconstruction involving backfilling of ponds. The material contains very minor amounts of wood, steel, and plastic, as noted in the specification. These materials have been specifically researched by Illawarra Horticultural Services to confirm their non-deleterious inert behaviour. The following comments regarding the nature of these materials and the potential effect on water quality have been provided for this EIS by Illawarra Horticultural Services and are supported by observations made at the Dunmore Sand Quarry over a number of years.

Potential Effects of Rock, Brick and Tile Material

These materials are chemically and biologically inert and would have no impact on water quality nor would they interfere with ecological processes vital to the health of the system. Materials such as these are used routinely in the construction of breakwaters, erosion control structures and many other engineering applications within water bodies.

TABLE 2.3
Specifications for Coarse Inert Aggregate Rubble

1 Product Name
Coarse Inert Aggregate Rubble

2 Product Description
A < 400mm and > 75mm Inert Aggregate Rubble composed essentially of brick, concrete and tile from reprocessed concrete, brick, and tile based builders waste or similar material.

3 Method of Reprocessing
Builders waste and similar material is collected and directed to the EPA Licensed Waste Depot and classified into various qualities. The concrete, brick and tile based builders waste is then sorted to remove essentially all extraneous matter such as wood, metals, plastic. Should any builders waste contain hazardous waste it is completely excluded.

The sorted product is then broken to approximately < 400mm and directed through a screening process which removes the majority of < 75mm material.

4 Sizing Specification

> 400mm	10% maximum
< 400mm plus 75mm	80% maximum
< 75mm	20% maximum
< 1mm	5% maximum

5 Minor Components

Wood	2% maximum
Plastic	1% maximum
Steel / metal	1% maximum

6 Loose Porosity (open)
Not less than 30%

7 Uses and Applications
Rubble drain filling.
Stabilising rubble aggregate for soft ground.
Inert hard porous fill for stabilising mine workings such as dredge ponds, particularly if they contain soft tailing return finds and mud.

Potential Effects of Concrete

Concrete is comprised largely of a complex of calcium aluminates, silicates and other insoluble compounds. Concrete and cement are not soluble in water at any pH level. In acidic water (i.e. pH 6 or below) calcium may react slowly with the free hydrogen ions present, dissolve and ionise in water. However, given the existing pH levels of the lakes and from observations made at the Dunmore Sand

Quarry, acidic conditions are unlikely to occur. This material is therefore not likely to react in the water and would not introduce additional calcium to the environment.

If any long term leaching was to occur, the extent of calcium release would be significantly less than the level of calcium release to the water from natural sources. It is probable that the naturally derived calcium would prevent any leaching from the added concrete, as any calcium within the system would be in ionic equilibrium.

Potential Effects of Metal

Only small amounts of metal would be introduced to the dredge ponds. Any iron or steel present would have an oxidised outer skin due to the formation of the various iron oxides that form naturally when metals are exposed to the atmosphere. These compounds may be soluble in acidic conditions but not in alkaline conditions as is found in the dredge ponds. Due to this inability to react and dissolve under the conditions of the dredge pond water, iron and steel can be considered as inert.

If any iron was to ionise, which would only occur under extreme conditions, the amount of iron released would be minor compared with the natural background levels found within local rock types such as basalts which have a high ferromagnesian level.

No additional iron would enter the system, as the iron ion equilibrium constant would have been reached with the abundance of natural iron.

Potential Effects of Timber

Generally timber will float due to the low specific gravity of the wood due to entrapped air particles. When this occurs the Applicant would remove the floating material and bury within the backfill material. Some material will be trapped under water and would subsequently be subject to minor decomposition. However, it is unlikely that this material will decompose substantially and add nutrients to the environment. Timber has a Carbon to Nitrogen ratio (C:N) of about 500. In order for decomposition to occur there must be a source of nitrogen present and the C:N reduced to at least 30 for the decomposing micro-organisms to have any chance at commencing the breakdown process. Analysis of water in the lakes indicates that there is little nitrogen present. In addition, the pH of the water and the absence of sufficient free oxygen dissolved in the water at depth, is such that fungal decomposition of the timber would not occur.

Potential Effects of Plastics

A small amount of plastic material would inevitably be included in the backfill material. The most common plastics would be polyethylene, both low density (sheeting, bags) and high density (fittings, bottles, etc).

In the open environment these materials are degraded by ultraviolet radiation, the breakdown products being ethylene, ethylene oxides, etc. eventually breaking down to carbon dioxide and water. If they are included in the waste, a considerable percentage should float and be removed along with the floating timber, the balance would be buried with the rest of the backfill. If buried plastics would not be subject to ultraviolet degradation, and so would take many years to degrade. The breakdown rate would be reduced further by the lower temperature of the water relative to the open environment (the rate of breakdown is regulated by temperature, and for each 10°C drop in temperature the rate of degradation is halved). Consequently, any of the degradation products released over this time would not have an impact on the quality of groundwater.

Based on its experience at the Dunmore Sand Quarry, the Applicant recognises the importance of rigorous inspection procedures for the incoming backfill material to ensure that any material not meeting specification and that could potentially lead to adverse changes to the quality of water in the dredge pond are detected and excluded. Details of the inspection procedures are set out in Section 2.4.4.

2.4.4 Backfilling Procedures

2.4.4.1 Receipt Procedures

The procedures to be used at the Project Site would be at least as stringent as those already in use at the Dunmore Sand Quarry and would involve the following.

(i) The source of the materials is determined and recorded.

(ii) Completion of data sheets by drivers identifying the source and type of material delivered. The source must have already been accepted as per Item (i).

(iii) After each data sheet is signed off, the truck is directed to the active signposted unloading area where the load is inspected. Any unsuitable loads would be reloaded and the truck driver advised to take the load to the Shellharbour Waste Depot adjacent to the Dunmore Sand Quarry or a similar facility.

(iv) Loads accepted at the signposted receiving area would be culled over with earthmoving equipment to remove any unuseable minor accessory components before placing it as backfill. Any materials culled would be delivered to the Shellharbour Waste Depot.

The Applicant would need to place suitable coarse material for the two zones adjacent to the North Kiama Bypass that are required to maintain porous continuity beneath the Bypass. Materials of this type, as recommended by Pells, Sullivan & Meynink in **Appendix 4,** would be periodically delivered to the site. The materials would be placed in the pre-determined locations.

2.4.4.2 Backfill Placement

Once the load(s) of backfill materials are cleared for placement, the Applicant would either push the materials into the pond or across the landform above the water line. Above the water line, the backfill would be a mixture of the two classes of materials received, with the surface layer dominantly the natural excavated material with a bias towards the soily material.

An important objective of the landscape reconstruction activities on site would be to minimise the area of active backfilling at any one time. Emphasis would be placed upon progressive completion of the final landform to assist in progressive site rehabilitation. It is likely that the backfilling would be undertaken in at least two areas concurrently on site.

2.4.5 Backfilling Sequence

Figure 2.7 identifies eight stages of landscape reconstruction through the placement of backfill materials within the Project Site. This sequence is conceptual given the uncertainties regarding the timing of the construction of the North Kiama Bypass. The Applicant would develop annual plans for backfill placement in the same manner as the annual extraction plans. The principal features of the backfilling sequence are as follows.

(i) Emphasis would be placed upon initially backfilling the perimeter excavated area adjacent to the North Kiama Bypass and the Swamp Road Overpass.

(ii) The backfilling of the eastern extraction area would also be a priority to ensure that all backfilling was completed by the time construction of the Bypass is well advanced.

(iii) The remainder of the backfilling sequence would follow the extraction sequence again with the emphasis upon completing all areas to final levels in the shortest possible time frame to enable rehabilitation to proceed.

The Applicant estimates the backfill materials would be delivered at a rate of between 50 000 tonnes and 150 000 tonnes per year. This equates to 28 000 m^3 and 84 000 m^3 backfilled per year. The upper limit of materials received throughout the life of the operation would be in the order of 840 000 m^3.

The area of backfilling will be confined as much as practicable to limit the active area of visible earth and earth-moving activities. Each stage would be effectively backfilled to the nominated final level within a 1 to 2 year period.

2.5 SAND PROCESSING AND STOCKPILING

2.5.1 Introduction

In order to meet customer requirements, the Applicant would screen and wash the dredged sand in the on-site processing plant.

The process of dredging involves creating a sand slurry which is a convenient means to convey the sand to the processing plant.

The proposed sand processing and stockpiling activities would be similar but simpler to those currently employed at the Dunmore Sand Quarry (see Section 1.3.2) involving less machinery and material movement. However, minor modifications would be made to both the plant and stockpiling area to reflect the local environmental setting within the Project Site. It is intended that the processing operations do not involve any dry screening or blending as is the case at the Dunmore Sand Quarry.

The main reasons for locating the processing plant in the area nominated on **Figure 2.3** were:

(i) the site is comparatively close to Swamp Road, the intended exit road from the Project Site;

(ii) the plant could be positioned to a certain extent "behind the hill" when viewed from elevated areas within the Dunmore Lakes Estate and nearby; and

(iii) the site is close to the margin of the deposit in an area that could be extracted by excavator once the plant is removed.

The main features of the layout are as follows.

(i) The "circular" road through the stockpile area provides for trucks to remain on a sealed road whilst they are loaded from stockpiles on either side.

(ii) The stockpiles and bund walls in the position shown would provide an effective sand barrier between the front-end loader and nearest residences around the Project Site.

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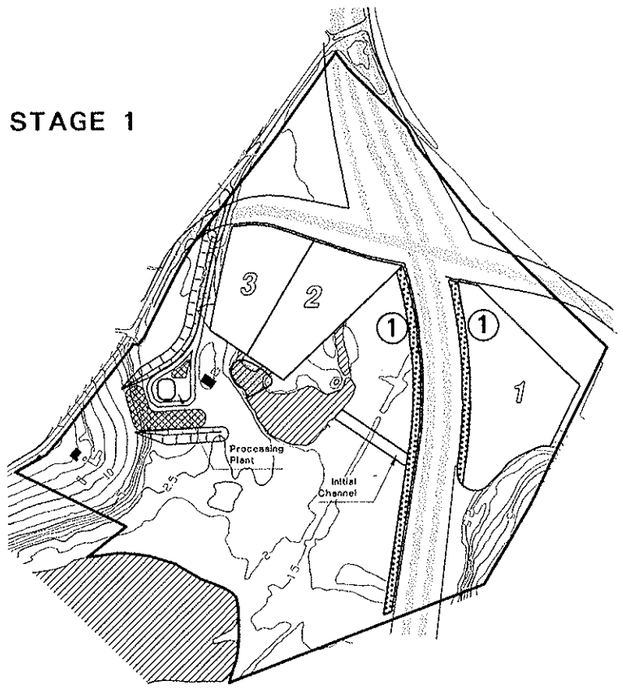
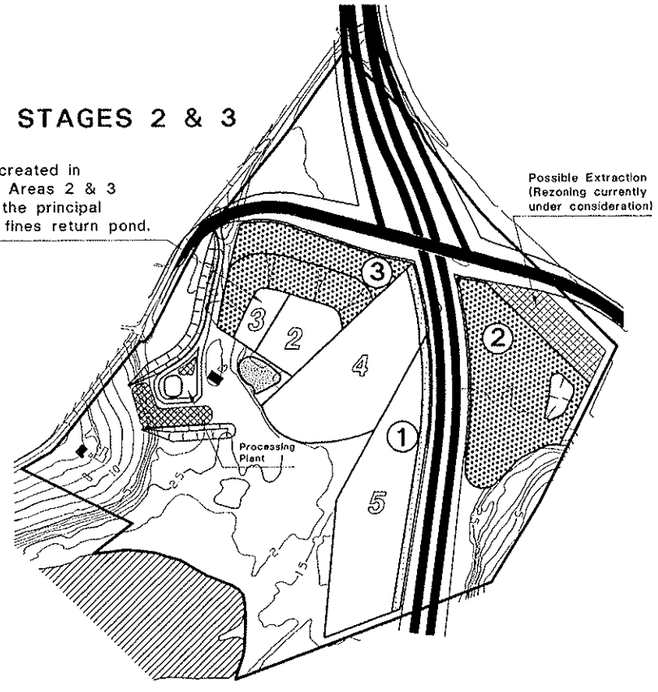
STAGE 1



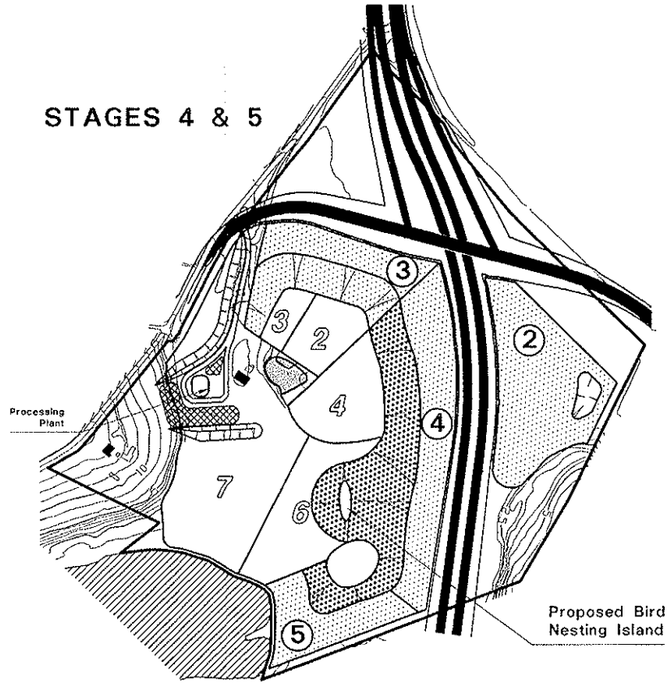
STAGES 2 & 3

The void created in Extraction Areas 2 & 3 would be the principal long term fines return pond.

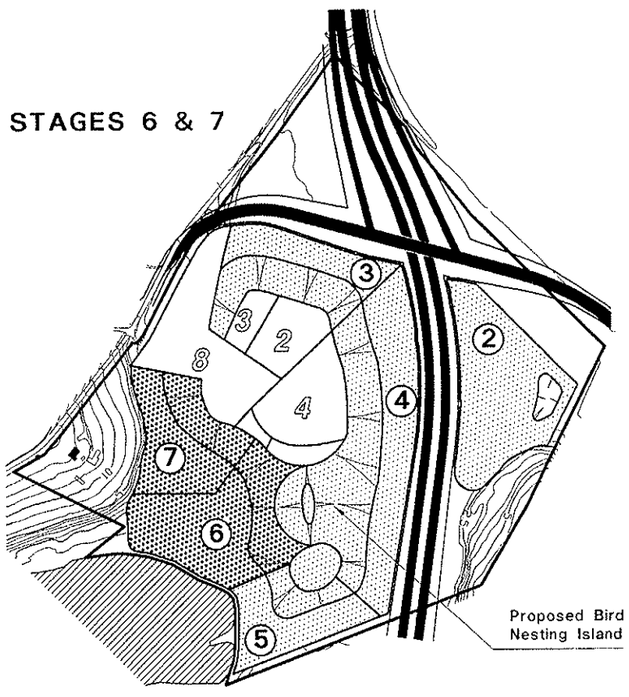
Possible Extraction (Rezoning currently under consideration)



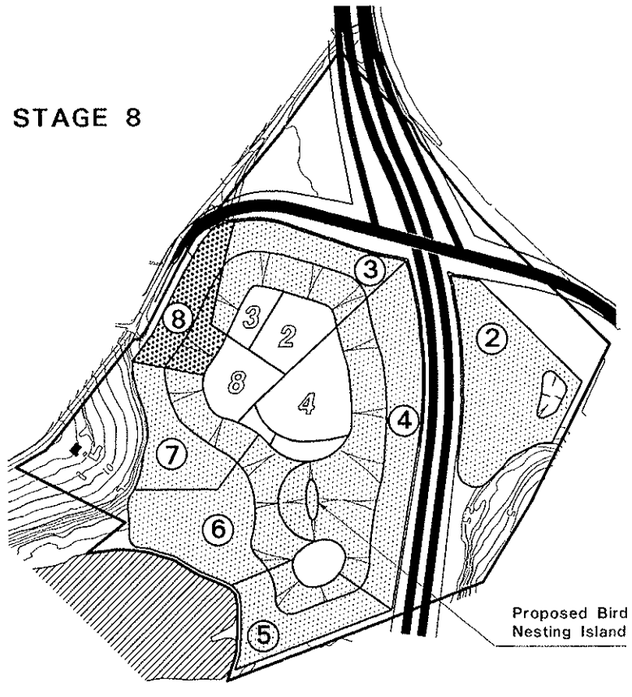
STAGES 4 & 5



STAGES 6 & 7



STAGE 8



REFERENCE

- Project Site Boundary
- Contour (Interval = 0.5m)
- ② Reconstruction Stage
- 1 Extraction Stage
- Existing Lake
- Area of Reconstructed Landscape
- Area of Active Landscape Reconstruction
- Residence
- Building
- Road
- Bypass (Possible/In place)
- Bund Wall
- Freshwater Pond
- Product Stockpile

SCALE 1:8000

100 0 100 200 300 400 m

Figure 2.7
INDICATIVE LANDSCAPE RECONSTRUCTION SEQUENCE - OPTION 2

(iii) The southern bund wall would restrict the visibility of the processing plant and product stockpiles from the Dunmore Lakes Estate.

(iv) The weighbridge would be located adjacent to the former Ticket Office which would provide a suitable building for maintenance of weighbridge equipment and documentation.

2.5.2 Processing Operations

The processing operations are comparatively simple in that the sand is washed and sized with a single product produced and the oversize and undersize materials separated.

The sand slurry from the dredge would be pumped directly to the processing plant where it enters through a surge box onto the top deck of a double deck vibrating screen. The top deck comprises a coarse screen (12 mm) and the second deck is a finer 1.5 mm screen. These separate the coarse oversize rubble such as clay balls, sticks, peat, large shells, etc and finer oversize material from the feed. This oversize material would be directed via a chute to a stockpile bay at one end of the plant and would be periodically removed to the fines return pond.

All material passing through the fine screen cloth into the washery bin system would be further processed in the first compartments of the plant by a series of spray bars that introduce clean water pumped from a pontoon on the dredge pond. The resultant sand slurry would be pumped from the base of the bin system to the main cyclone separation tower approximately 12 m high where two cyclones separate off and discharge clean sand slurry returning predominantly silty clay slurry to the washing plant. The sand product would fall onto conical heaps up to 9 m high. The heaps would gradually dewater by gravity to a moisture content of 5 to 7 per cent.

Water draining from the conical heaps of washed product sand would drain back towards the fines return pond. Water and fines return from the cyclones to the bin system would provide energy for grain scrubbing in that system. The silt and clay slurry water would exit the processing plant by way of a gutter around the inside of the top of the bin structure. It flows into pipes that feed a major pipeline that would discharge back into the nominated fines return pond. It is noted that not all fine sand is recovered through processing and the Applicant may periodically dredge the area near the discharge outlet to recover the bulk of the fine sand lost through initial processing.

2.5.3 Product Stockpiling

The Applicant would stockpile sand within the conical heaps below the cyclone separation tower and on both sides of the access road. These stockpiles would be up to 6 m high so as to provide additional noise buffering and would be created by the transfer of sand from the conical heaps by front-end loaders. It is envisaged that up to 10 000 to 15 000 tonnes would be stockpiled around the processing plant.

2.6 TRANSPORTATION

2.6.1 Introduction

The issues relating to product transportation are considered in this document in the context of the RTA's plans for the North Kiama Bypass, i.e. before, during and after Bypass construction and the various types of vehicle movements that are proposed throughout the life of the project. It is recognised at the outset that the sand resource is well located with respect to the main road network and only requires the use of a small section of a local road (Swamp Road) to gain access to the Princes Highway. The Applicant has been assisted with its assessment of access arrangements by Transport and Urban Planning Pty Ltd whose report is included in Volume 2.

For the purposes of the Applicant's planning, the RTA has advised the Applicant of the following schedule for the construction of the North Kiama Bypass.

(i) The existing road network would remain in use for a period until approximately Year 2004. During the period 2002 to 2004 the bulk of the Bypass construction would be undertaken with the northern and southern connections left till last.

(ii) A modified road local network around the Swamp Road/Princes Highway intersection would be used for a period of approximately 6 months during the final stages of Bypass construction.

(iii) The North Kiama Bypass would be fully operational by about late 2004.

Throughout the life of the project, use of the local road network and intersections would be made by a range of vehicles. In brief, incoming vehicles would either be laden with backfill materials or unladen arriving to be loaded with processed sand, unprocessed sand or soil. Outgoing vehicles would desirably be laden with any one of the three main products, particularly those delivering backfill materials to the Project Site. The Applicant would encourage / support backloading wherever possible. Details of the types and relative proportions of vehicles is presented in Section 2.6.4.

2.6.2 Site Access

Prior to the Bypass construction, access for trucks and other vehicles travelling to and from the Project Site would be via the existing section of Swamp Road between the site entrance and the Princes Highway. **Figure 2.8(A)** displays the location of the proposed site entrance during this period and the main internal road network.

The site entrance has been selected to maximise the distance to the Cornue / Stocker and Creagan residences yet maintain an acceptable sight distance for vehicles entering and travelling along Swamp Road. At the proposed site entrance, visibility for drivers of cars (at a typical height of 1.15 m) would be approximately 350 m to the south and 220 m to the north. The Applicant proposes to widen the sealed pavement along Swamp Road to a constant width of 6.5m for the 220 m from the site entrance to the Princes Highway.

Figure 2.8(B) displays the works the Applicant proposes to undertake to improve the efficiency and safety of the intersection of Swamp Road and the Princes Highway. These works include:

- creating a 40 m sheltered right-turn bay within the existing pavement (through re-painting the road markings at the intersection);
- widening a short section of Swamp Road to improve left-turn movements from the Princes Highway; and
- trimming of vegetation to improve sight distances to the east.

After the North Kiama Bypass is operational, all vehicles travelling to and from the Project Site would use the entrance identified on **Figure 2.8(C)**.

During the construction of the entrance to the Bypass and overpass, the Applicant would work closely with the RTA and Shellharbour City Council to achieve safe arrangements for vehicles entering and leaving the Project Site.

2.6.3 Transport Routes

Figures 2.8(D) and **(E)** respectively identify the various routes that would be travelled by trucks leaving the Project Site prior to and after the construction of the Bypass. The Applicant currently estimates the bulk of all trips (> 95 per cent) will arrive from and depart to the north. Approximately one half of these truck movements would have an origin or destination involving Shellharbour Road with the remainder travelling north using the Princes Highway. The bulk of the trucks travelling along Shellharbour Road would travel to the Dunmore Sand Quarry where the sands would be blended with other products at that site.

2.6.4 Traffic Types and Levels

Based on the Applicant's current experience, it is expected that the bulk of the sand products transported from the Project Site would be undertaken in 30 t to 33 t capacity truck and dog trailer rigs (**Plate 1.6**). Some sales would be despatched by 25 t capacity semi-trailers and smaller 13 t to 17 t capacity rigid trucks. For the purposes of establishing traffic levels, the average truck capacity would be approximately 27.5 t. The average capacity of trucks delivering backfill materials to the site would be 20 t.

Table 2.4 sets out the estimated average number of loads despatched and average number of loads of backfill materials delivered on both an annual and hourly basis.

TABLE 2.4
Proposed Average Traffic Levels

Year Ending 30 June	Loads Despatched		Loads Delivered		Total	
	Annual	Hourly	Annual	Hourly	Annual	Hourly
2000	7333	3	2500	1	9833	4
2001	9167	3	3750	2	12 917	5
2002	11 000	4	5 000	2	16 000	6
2003	11 833	4	5 000	2	16 833	6
2004	12 667	4	5 000	2	17 667	6
2005	13 667	5	6 250	2	19 917	7
2006 +	14 667	5	7 500	3	22 137	8
Source: Transport & Urban Planning (1998) (See Part 9 of Volume 2)						

For the purpose of assessing the impact of the proposed traffic levels on the existing traffic, a maximum of 10 loads or 20 truck movements per hour is considered realistic. In reality, this occurrence would only be occasional, but nevertheless, it is appropriate that impact assessment is based on this rate.

2.7 DEVELOPMENT TIMETABLE, HOURS OF OPERATION AND PROJECT LIFE

2.7.1 Development Timetable

The Applicant proposes to work closely with the RTA to ensure its activities and the construction planned by the RTA can operate with a full level of cooperation. Notwithstanding this commitment, the fact that the RTA's plans are only indicative, would require details of the programmed development to be prepared with the RTA after Development Consent is obtained.

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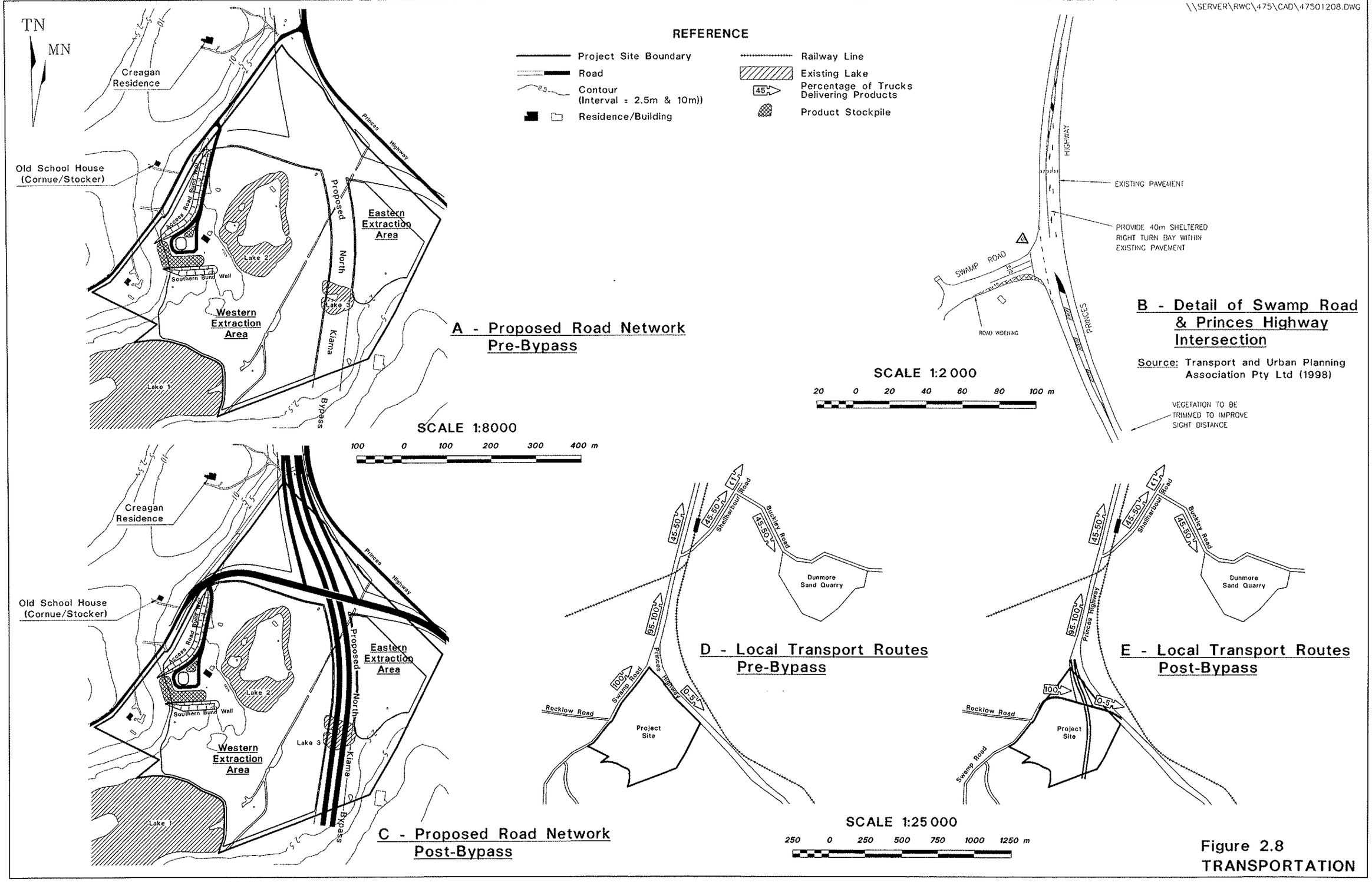

Figure 2.8
TRANSPORTATION

The Applicant envisages that the necessary components required for site development would require approximately 3 months to establish, i.e. based on the following estimates.

Activity	Timeframe
Transfer dredge to Project Site and re-assemble and excavate initial pond system	1 month
Construct access road bund wall	1 month
Swamp Road Roadworks	2 months
Construct and seal site access road	2 months
Construct and commission the processing plant and associated bund walls (including power supply)	2 months

A number of these activities would occur concurrently.

2.7.2 Hours of Operation

The Applicant proposes to undertake its normal activities within the range of operational hours set out in **Table 2.5** Should there be a need to operate outside these hours for any emergency, permission would be sought from Council.

TABLE 2.5
Proposed Hours of Operation

Activity	Proposed Hours of Operation		
	Monday - Friday	Saturday	Sunday
Soil Removal *	6.30 am - 6.00 pm	6.30 am - 6.00 pm	-
Extraction using Excavator *	6.30 am - 6.00 pm	6.30 am - 6.00 pm	-
Extraction by Dredge	6.00 am - 8.00 pm	6.00 am - 6.00 pm	8.00 am - 4.00 pm
Product Despatch	6.00 am - 6.00 pm	6.00 am - 6.00 pm	8.00 am - 4.00 pm
Incoming Fill Materials	6.30 am - 6.00 pm	6.30 am - 6.00 pm	8.00 am - 4.00 pm
Maintenance #	6.00 am - 8.00 pm	6.00 am - 6.00 pm	8.00 am - 4.00 pm

* Activities within 150 m of any residence would not commence until 7.00 am

\# Maintenance may be carried out at other times provided it is inaudible at surrounding residences.

The Applicant would normally expect to operate until 4.00 pm – weekdays, 12 noon – Saturdays and occasionally on Sundays. The hours of operation sought beyond these normal hours would provide the flexibility necessary to efficiently operate the site to satisfy the requirements for large infrastructure projects, unusual markets, or emergencies.

2.7.3 Project Life

The Applicant envisages the 2.75 million tonnes of sand would be extracted over a period of 8 to 10 years with the landscape reconstruction program likely to continue for a further 3 to 5 years. Therefore, the Applicant proposes to seek a Development consent for 15 years to enable the extraction of sand identified in Option 2 and for the associated proposed landscape reconstruction.

2.8 WASTE MANAGEMENT

2.8.1 Nature of Wastes

The wastes generated on site would be either production or non-production wastes. The production wastes would include the oversize and undersize materials produced from the processing plant whilst the non-production wastes would include fencing and building materials removed from extraction areas; general domestic-type wastes from the on-site buildings and routine maintenance consumables including oils and greases.

2.8.2 Management of Production Wastes

Oversize Materials

The Applicant expects the oversize material generated as a result of processing to amount to less than 1 per cent of the total quantity processed. This material would be predominantly shell, clay balls and sticks and would accumulate in the oversize stockpile bay from where it would be transferred by front-end loader to the active backfilling area.

Undersize Material (Fines)

The silts and clays washed from the sand would amount to approximately 8 per cent of sand processed. The materials would also incorporate any fine shell, organics and any fine pyrite present. The fine materials would be pumped directly to the active fines disposal pond. Throughout the life of the proposed project the Applicant would sequentially use at least two ponds to collect the fines. The initial fines return pond would be a partitioned-off section of Lake 2 (see **Figure 2.3**). It is likely towards the end of Stage 3 that the section of Lake 2 would be dredged and the fines redistributed to the next fines pond, most likely to be in the area of Stage 3. These two fines return ponds would satisfy the Applicant's requirements for the bulk of the life of the project. Details of the active areas for fines management would be detailed in each annual report.

2.8.3 Management of Non-Production Wastes

Fencing and Old Building Materials

A range of fencing and old building materials remain on site from former land uses on the Project Site. The Applicant would progressively dismantle the fences and old buildings and stables and remove all materials from site, i.e. other than those than are consistent with the coarse inert aggregate rubble. Those materials that can be recycled would be despatched to appropriate recycling centres and the remainder taken to the Shellharbour Waste Depot.

Domestic-type Wastes

All papers and general wastes and maintenance consumables originating from the site's activities would be collected in specially marked receptacles. These receptacles would be regularly removed from sites for disposal at the Shellharbour Waste Depot.

Oils and Greases

All used oils and greases would be collected and stored in four x 200 litre drums in a bunded storage area. These drums would be pumped out by a licenced waste oil recycling contractor, normally every month.

2.9 INFRASTRUCTURE AND SERVICES

2.9.1 Infrastructure

The Applicant proposes to utilise as much of the existing infrastructure on site as possible throughout the life of the project. The existing dwelling on site would continue to be used as a caretaker's cottage until it needs to be demolished late in the project life. The toilet facilities associated with the caretaker's cottage should be sufficient for the project's life. In the unlikely event the toilet facilities need to be supplemented, portable toilets would be brought to the site. Portable toilets would be used after the caretaker's cottage is demolished.

2.9.2 Services

Power: The Applicant proposes to commission Integral Energy to upgrade the reticulated power to the Project Site to provide 3 phase 415 volt power required to operate the processing plant. It is understood existing power poles would be used for most of the upgraded service.

Water: All process water requirements would be drawn directly from a fresh water pond created within Lake 2 (**Figure 2.3**).

All potable water requirements would be drawn from the caretaker's cottage.

Telephone: The Applicant would probably rely solely on mobile services and two-way radio on the Project Site. The principal point of contact with the Applicant would remain the Dunmore Sand Quarry, Buckley Road, Dunmore

Fuel: The Applicant would install a 10 000 litre diesel tank in a bunded area in close proximity to the processing plant. Details of the Applicant's use of fuel for the project is presented in an Energy Statement in **Appendix 5**.

2.10 EMPLOYMENT

The development and operation of the Dunmore Lakes Sand Extraction Proposal – Stage 1 would maintain employment for existing staff and provide additional employment opportunities. There would be four full-time employees on site increasing to five full-time employees over time. These employees would be operators of the dredge, front-end loader, bulldozer and weighbridge. The periodic campaigns with the small front-end loader and excavator and maintenance program would also generate part-time employment on site.

The progressive increase in product output from the existing level of 110 000 tpa at the Dunmore Sand Quarry to levels approaching 350 000 tpa would generate local employment for up to an additional 10 persons. It is likely these persons may be drawn from other operations that may close down in the northern Illawarra area or reduce output during the lifetime of this operation.

The Applicant would still maintain its employment base at the Dunmore Sand Quarry to manage all sales and its blending operations. In total, the Applicant's operations provide employment for 13 persons, i.e. on site and for office management.

2.11 SAFETY AND SECURITY

The Applicant would adopt all the required safety measures for the use of earthmoving equipment, dredging and processing operations required by the Department of Mineral Resources and the WorkCover Authority of NSW.

The Applicant would undertake regular inspections of its boundary fences to ensure they are in a good condition. Signs exhibiting the warning "Danger – Deep Water" would be positioned at regular intervals around the Project Site.

A security protocol would be in place to deter theft and vandalism. An important part of this protocol would be the presence of a full-time caretaker on site. Security lighting would also be installed at critical locations around the processing plant. The exact configuration/direction of lighting would be finalised in a manner to limit and/or avoid any light being directed to adjoining residences.

2.12 REHABILITATION AND LANDSCAPING

2.12.1 Introduction

The Applicant's proposal to extract the important sand resources beneath the Project Site has been developed with full recognition given to the need for a high standard of progressive rehabilitation and landscaping. The following sub-sections describe the Applicant's rehabilitation objectives and the proposed final landform and its intentions for both short-term and long-term rehabilitation. The rehabilitation procedures have been prepared in consultation with Mr Russ Elliss of Illawarra Horticultural Services.

2.12.2 Rehabilitation Objectives

The Applicant's rehabilitation objectives for the Project Site can be classified as either short-term or long-term. The short term objectives relate to:

(i) stabilising all audio-visual bund walls as soon as practicable after their construction;

(ii) stabilising all completed landscape reconstruction activities as soon as practical after they are completed; and

(iii) achieving a high standard of landscaping throughout the operational life of the project, particularly around the area of the processing plant.

The long-term rehabilitation objectives relate to:

(i) establishing a landform that is both functional and blends into the rural and rural / residential character of the land surrounding the Project Site. The existing large lake on the Applicant's property immediately south of the Project Site is seen as an asset to the local community, particularly for its visual appeal;

(ii) creating a scenic lake system adjacent to the North Kiama Bypass that increases the visual experience for surrounding residents and of motorists travelling along the North Kiama Bypass;

(iii) developing a series of habitats that would complement the surrounding native plant communities including the nearby SEPP wetlands;

(iv) providing opportunities for increased recreational uses for subsequent owners of the land; and

(v) creating a balance between land and water features with sufficient land created around the lake system to support sustainable land uses.

2.12.3 Final Landform and Land Use

Figure 2.9 displays the final landform for Option 2 featuring the following.

(i) The western lake covering approximately 7.1 ha and including an island of 0.2 ha. The floor of the lake would reflect the final depth of dredging, stable batter slopes on the backfilled materials (see **Appendix 4**), and the residual surface above the fines return pond system at the northern end of the lake. The Applicant envisages this area would lie approximately 1-2 m below the average water level and provide wider shallower slopes for wetland development on the northern side of the final lake. Insufficient materials would be available within the project life to backfill the western lake to create a wetland across the full 7 ha.

(ii) The eastern lake covering approximately 0.15 ha. The exact dimensions of the eastern lake would reflect the availability of backfilling materials prior to the completion of the North Kiama Bypass.

(iii) A number of areas with an elevation of approximately 4.0 m, AHD, i.e. 0.4 m above the 1 in 100 year flood level.

(iv) Where the surrounding topography is lower than 4.0 m, AHD, the final landform created on the Project Site would be contoured to blend with surrounding natural topography.

Plates 2.2 and **2.3** show schematic oblique aerial photographs of the final landform and lake system.

The Applicant recognises that the rehabilitation of the Project Site after sand extraction would provide an opportunity to enhance the environment for surrounding landowners and travellers along the North Kiama Bypass together with the opportunity to increase the area of land committed to long-term nature conservation.

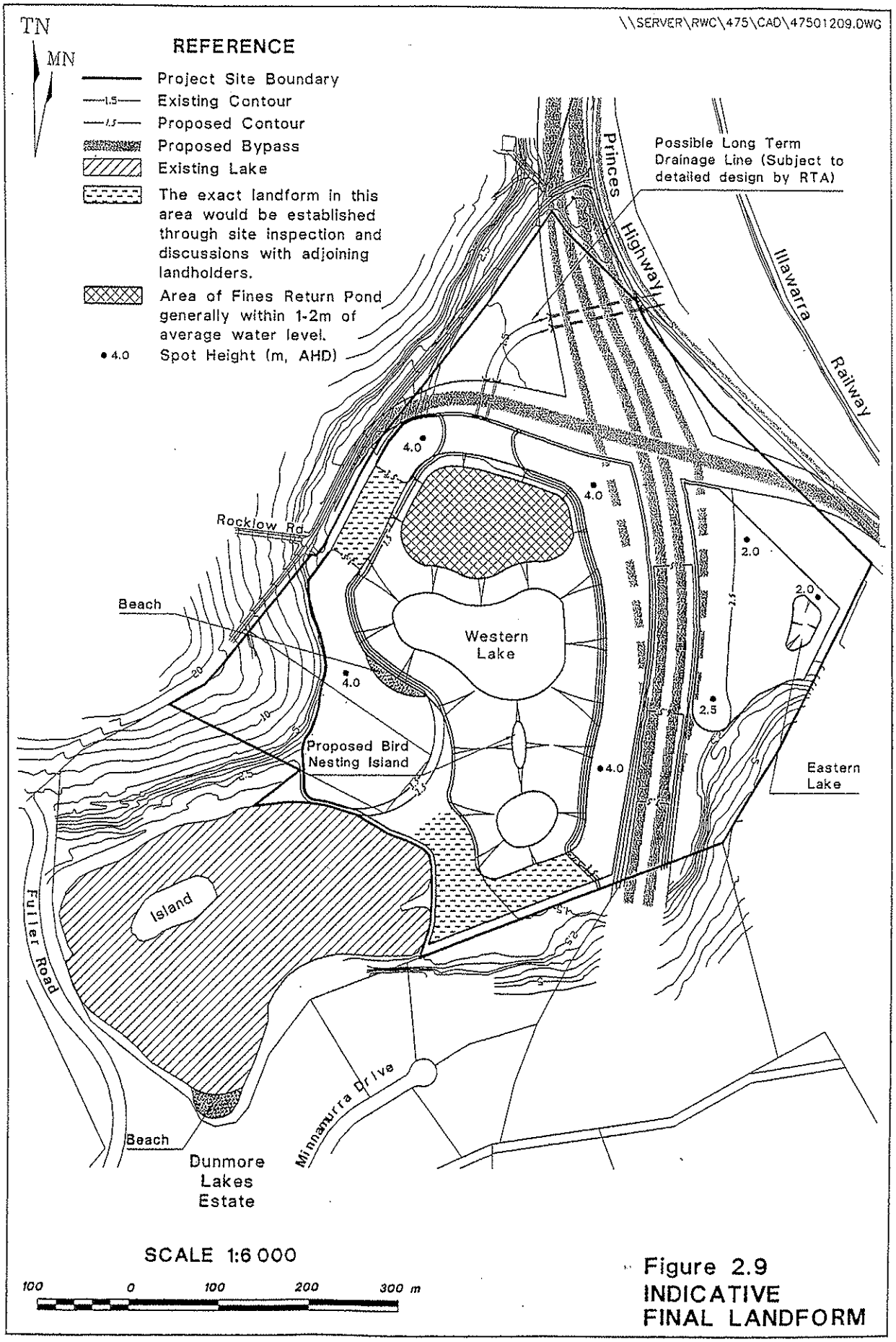

Figure 2.9
INDICATIVE FINAL LANDFORM

The Applicant proposes the final landform is developed with the following land uses (see **Figure 2.10**).

(i) Approximately five x 1 ha rural/residential lots on the elevated area west of Lake 1 and the new lake. This development would be serviced by an access road from Swamp Road generally at a location opposite Rocklow Road (at or near the existing site entrance). The proposed rural/residential development would complement the nearby Dunmore Lakes rural/residential area and simply provide an extension to that development. A detailed subdivision plan would be lodged with Council to enable these lots to be created. Up to four 1 ha lots may also be created on the eastern side of the property adjacent to the North Kiama Bypass in the area already zoned 1(c) (See **Figure 1.6**).

(ii) The western lake would be maintained as a visual feature and potentially a recreational asset for those rural/residential properties that front onto the lake. The Applicant would consider alternatives for the ownership/responsibility for the lake (and the adjoining Lake 1) at the time when the rural/residential lots are created, i.e. public/private/ community ownership. The creation of a lake comparable in size to the existing lake is considered to be a long-term asset for the area, in a similar manner to the existing lake. Residents/land owners within the Dunmore Lakes Estate already place considerable aesthetic value on the existing lake, and to the extent that they have requested that tree planting is limited around the lake so as not to shield the lake from their views.

(iii) The shallow foreshores around the western lake, and the area of the former fines return ponds in particular, would be developed as sustainable wetlands designed to complement the nearby natural wetlands on the eastern side of the Princes Highway.

(iv) All land adjacent to the North Kiama Bypass and the northern and eastern side of the final lake would be developed as a native arboretum featuring a range of trees and shrubs indigenous to the area. It is proposed that this area would extend from the edge of the Bypass to the shallow slopes of the lake where the foreshore wetland would be developed. It is intended that this area is sufficiently wide to ensure that a reasonable width of vegetation remaining once the RTA ultimately constructs the southern ramps from the Swamp Road Overpass.

The entire area adjacent to the North Kiama Bypass would be set aside for a long-term nature conservation land use. Long-term ownership of that area (public and/or private) would be determined once the required stage of rehabilitation had been achieved. The development of an area of nature conservation land use on the edge of the North Kiama Bypass would complement similar natural areas adjacent to the existing Princes Highway.

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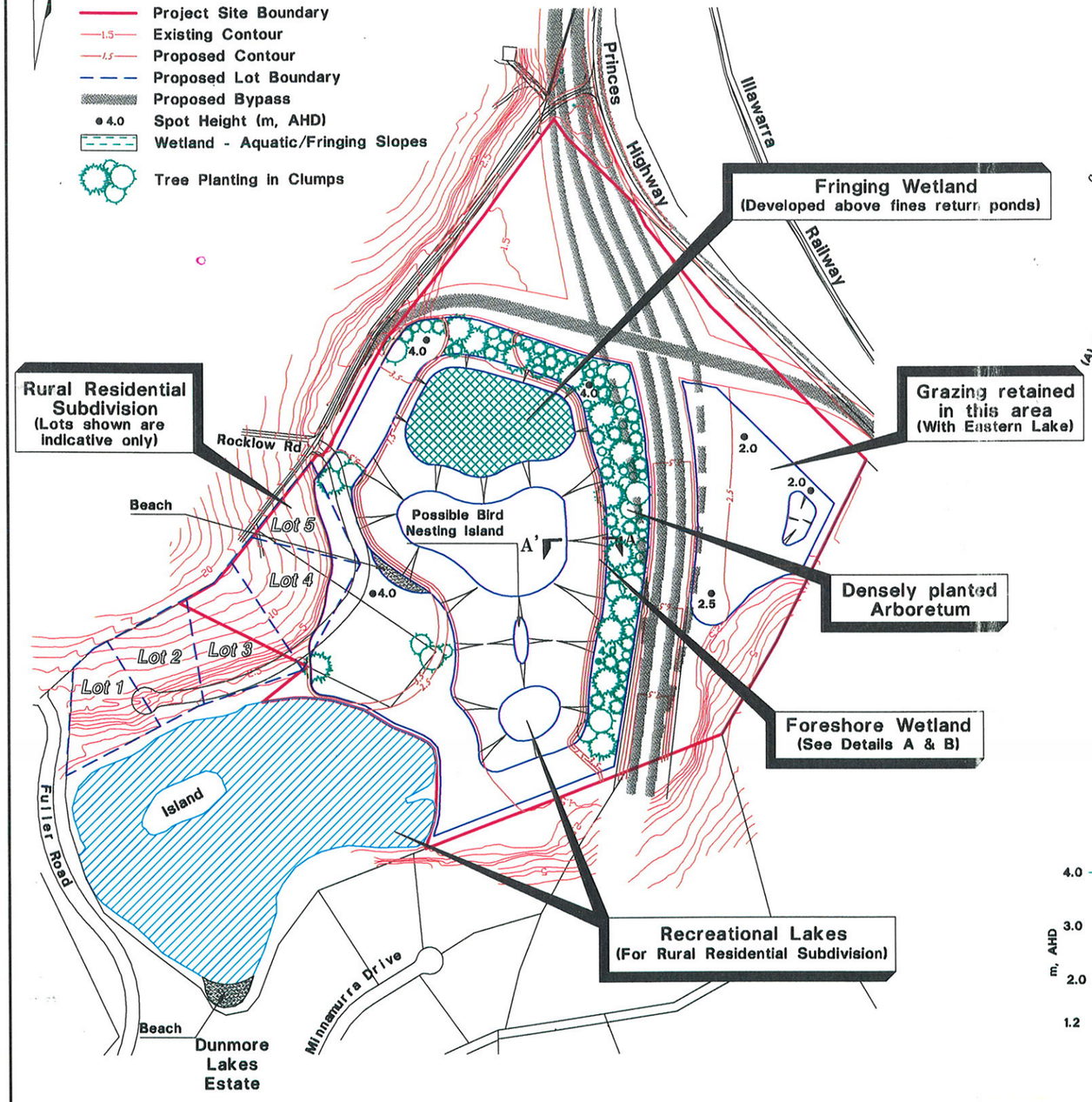
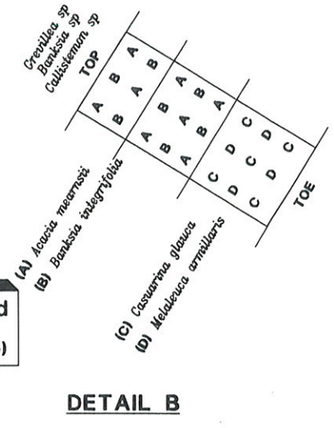
REFERENCE

- Project Site Boundary
- 1.5 Existing Contour
- 1.5 Proposed Contour
- Proposed Lot Boundary
- Proposed Bypass
- 4.0 Spot Height (m, AHD)
- Wetland - Aquatic/Fringing Slopes
- Tree Planting in Clumps

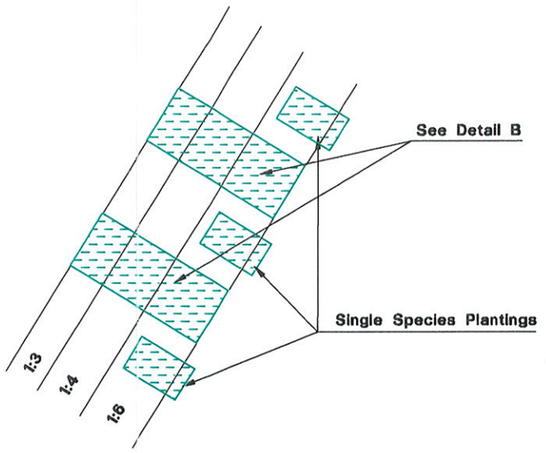


SCALE 1:6 000

100 0 100 200 300 m

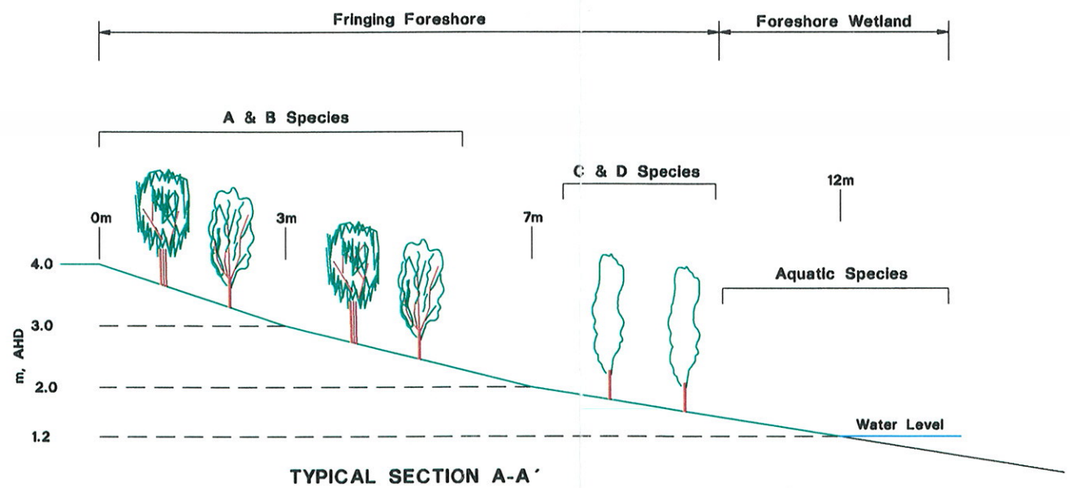


DETAIL B



DETAIL A

Total Initial Coverage <30%



TYPICAL SECTION A-A'

Figure 2.10
INDICATIVE FINAL LAND USE

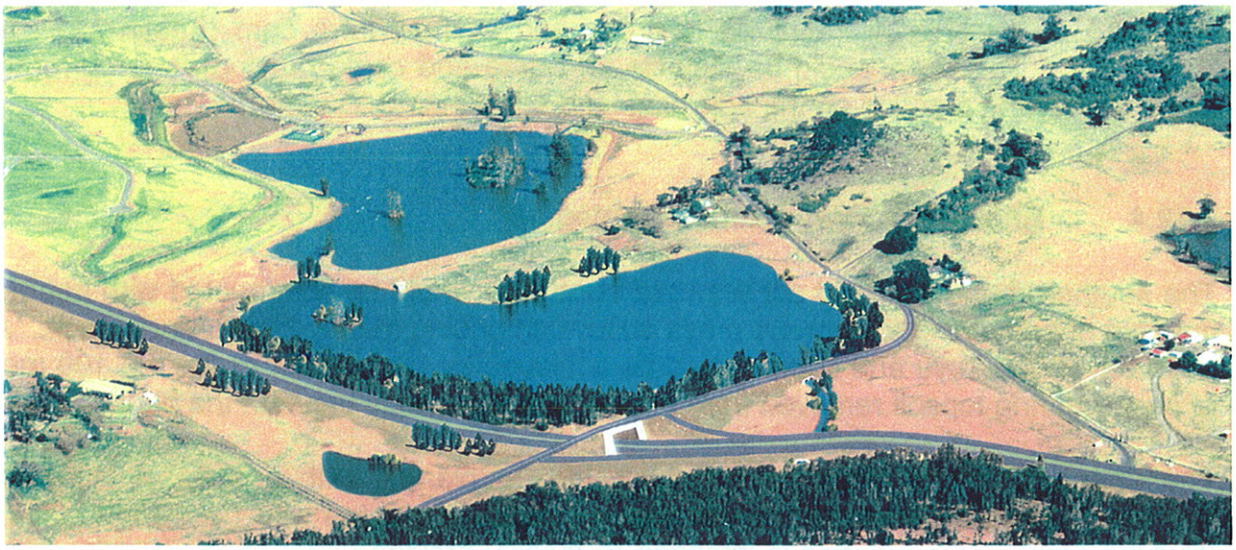


Plate 2.2: An oblique aerial view to the south-west across the Project Site conceptually showing the final form of the lake system on the Project Site.

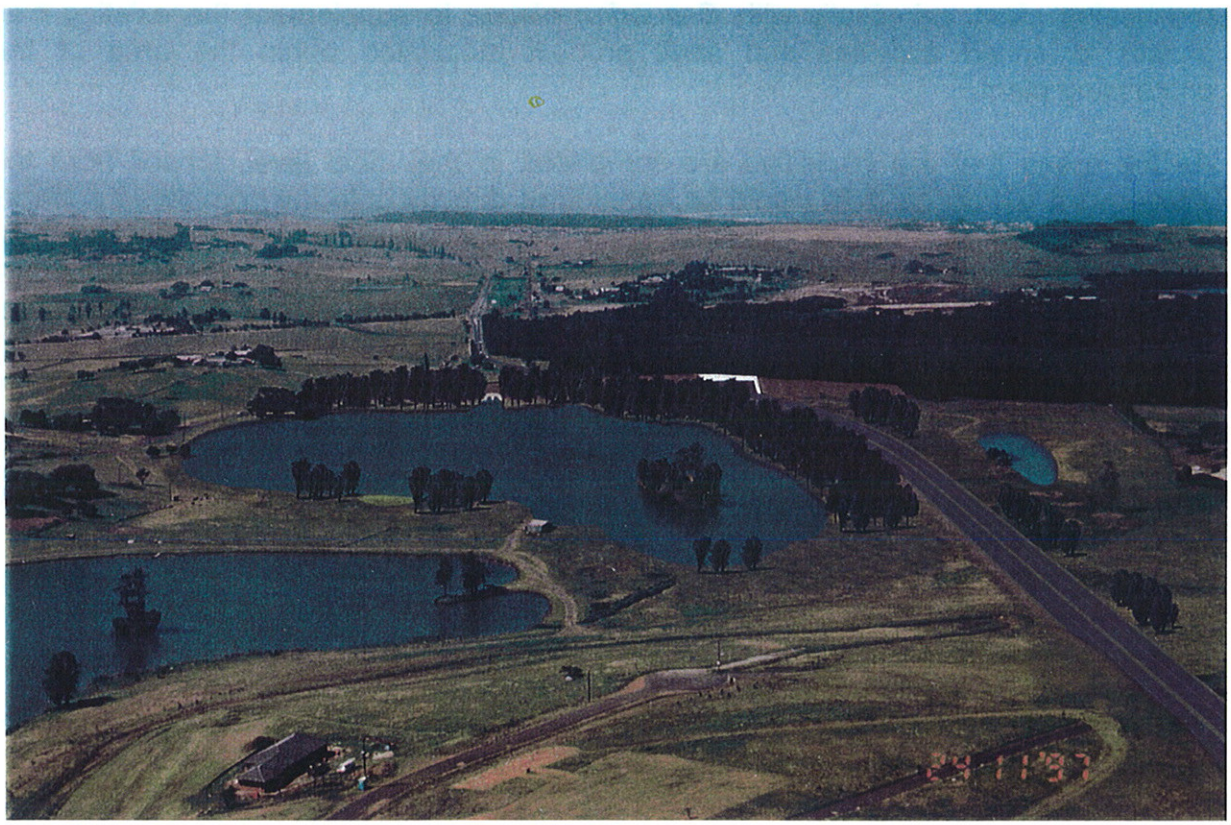


Plate 2.3: An oblique aerial view to the north across the Project Site conceptually showing the final form of the lake system on the Project Site.

(v) An area of improved pastures and a small farm dam (Eastern Lake). This area would be suitable for horse and cattle grazing as is currently the practice on the adjoining land surrounding "Dunmore House".

2.12.4 Short-term Revegetation Strategies

The southern bund wall and access road bund wall would be constructed with batters capable of sustaining a vigorous grass cover comprising mainly kikuyu and couch. A good cover of Kikuyu and couch would be achieved by the transfer of the top 100 mm of seed-bearing topsoil removed from the areas immediately beneath the bund walls.

The upper section of each bund wall would be planted with a suite of *Acacias*, *Grevilleas* and *Callistemons* and the inside footslopes planted with *Casuarina glauca* (Swamp Oak). This planting is intended to quickly provide variability to an otherwise planar feature. The lower sections of the outer face access road bund wall would be periodically mowed.

The Applicant also proposes to undertake a revegetation program around the processing plant, principally with *Casuarina glauca* to supplement the existing tree growth to shield activities and sand product stockpiles within the area of the processing plant.

As the areas that are backfilled are completed to their final level, topsoil from the subsequent extraction area would be transferred directly onto the completed surface. This direct transfer should assist in achieving maximum short-term growth. An important element of the short-term rehabilitation strategy would also be to manage weeds although it has been the Applicant's experience at the Dunmore Sand Quarry that whilst weeds flourish in the first 2 to 3 years, they diminish in abundance with time, particularly in those areas planted with tubestock. If necessary, the Applicant would utilise biodegradable herbicides on the Project Site.

The Applicant would ensure that traffic through rehabilitated areas is minimised and confined to defined tracks.

2.12.5 Long-term Revegetation Strategies

The long-term revegetation strategies relate to either the elevated land created through this program of landscape reconstruction or the lake foreshores.

Elevated Land

The Applicant proposes to densely plant the final elevated landform around the western side of the North Kiama Bypass to form an arboretum on the eastern side of the eastern lake. This planting would provide a degree of visual shielding of the Bypass from the proposed and existing rural/residential areas and provide a vegetated foreground for motorists travelling along the Bypass. This concept is displayed in

Figure 2.10. The principal species and their respective heights at maturity are set out in **Table 2.6**.

TABLE 2.6
Tree and Shrub Species for Landscaping Elevated Land

Common Name	Botanical Name	Height at Maturity	Years to Reach Maturity
Sydney Golden Wattle	*Acacia longifolia*	5 m	10
Coast Banksia	*Banksia integrifolia*	10 m	20
Old Man Banksia	*Banksia serrata*	6 m	15
White Bottlebrush	*Callistemon salignus*	5 m	10
Swamp Oak	*Casuarina glauca*	20 m	30
Bangalay	*Eucalyptus botryoides*	20 m	20
Sydney Blue Gum	*Eucalyptus saligna*	30 m	25
Coast Tea-Tree	*Leptospermum laevigatum*	3 m	10
Source: Illawarra Horticultural Services			

The Applicant would ensure the bulk of the taller trees are planted on the northern and eastern sides of the western lake so as not to unduly restrict views of the lakes from residences in the Dunmore Lake Estate. Those trees placed around the lakes would be planted in small clumps at strategic locations. This strategy reflects the outcome of discussions with a number of residents of the Dunmore Lakes Estate.

Lake Foreshores

The revegetation of the lake foreshores would be undertaken with full recognition of the principles of wetland reconstruction techniques. **Figure 2.10** shows it is proposed to create both foreshore wetlands around the perimeter of the western lake (except for the beach area shown and the required access points for recreational purposes) and a fringing wetland developed above the fines return ponds within the area extracted in the northern part of the lake. In total, an area of approximately 3.5 ha of wetlands would be created. **Figure 2.10** shows the progressive changes in slope of the lake foreshore from 1:3 (V:H) to 1:6 (V:H) to accommodate the wetland species and fringing vegetation communities. An important feature of the final slope would be an average slope of 1:6 (V:H) for a distance of up to 12 m from the average location of the water's edge. This slope would vary locally in slope and provide the required substrate for the range of species identified by Illawarra Horticultural Services.

The Applicant proposes to spread topsoil and/or processing fines across areas of the foreshore wetlands to provide an appropriate substrate for the growth of wetland species. Illawarra Horticultural Services advised that the aquatic plants to be planted and likely to colonise the wetland areas prefer a fine-textured medium with a high organic level and high cation exchange capacity. A fine-grained substrate would be

superior than a sandy substrate in achieving the diversity of wetland vegetation as evidenced by vegetation in nearby natural wetlands.

The Applicant expects the area of fringing wetland above the fines return ponds will colonise naturally, particularly as a result of its use by birds using nearby wetlands. The substrate of fines in this area would be most suitable for the development of this wetland.

The selection of wetland plant species is based upon those principals identified to be successful by Jacobs et al (1995). The main aquatic plants to be planted are set out in **Table 2.7**. Most of these species have been identified to be suited to the conditions surrounding the lakes developed within the Dunmore Sand Quarry.

It is expected that the Common Reed, *Phragmites australis*, would establish large areas of the lake edges and be one of the dominant plant species. *Baumea articulata* would be introduced to offer protection to water fowl. There is the possibility that this species would be less dominant than *P. australis* in time . In order to provide support during high water episodes, *Cyperus exaltatus* would be grown. As well as being able to prevent erosion, it would also provide a protective habitat for smaller bird species such as wrens and some finches.

TABLE 2.7
Wetland Plant Species for Lake Foreshore Revegetation

Wetland Species	Flexibility in Habitat Needs	Speed of Establishment	Persistence in Wetland
Phragmites australis	very good	very slow	excellent
Bolboschoenus fluviatills	good	very good	very good
Cyperus exaltatus	poor	excellent	very good
Baumea articulata	good	slow	poor
Schoenoplectus mucronautus	poor	slow	poor
Myriphyllum crispatum	poor	good	very good
Ludwigia peploides	very good	slow	excellent
Source: Illawarra Horticultural Services			

The Applicant proposes to adopt the planting procedures recommended by Jacobs et al (1995) in which they support spot plantings rather than chequerboard plantings. The Applicant would endeavour to source as much propagating material from local populations. The options are seed or plant pieces (stem, rhizome or ramets). The type of propagating material is listed in **Table 2.8**. The planting density would also depend upon the species.

TABLE 2.8
Wetland Plant Species and Planting Density

Wetland Species	Propagating Material	Planting Density (plants/m^2)
Phragmites australis	seed	4
Bolboschoenus fluviatills	pieces	1
Cyperus exaltatus	seed	6
Baumea articulata	seed	4
S. mucronautus	seed	6
Schoenoplectus validus	seed	4
Myriophyllum crispatum	pieces	2
Ludwigia peploides	pieces	1
Source: Illawarra Horticultural Services		

Planting would be done in plots 5 m in length and 3 m in width at 10 to 15 m intervals. Each plot would be made up of plants from the same species, with plots alternating with each of the listed species. This would cover up to 30 per cent of the lake's foreshore . Some of the unplanted area may be used to create beaches, although a good section of this may be colonised by the wetland plants in the planted plots.

Fringing Foreshore

A plant succession is proposed as an adjunct to the foreshore wetland ecosystem around the foreshores of the final lakes that is from the edge of the wetland areas to the top of the 4.0 m, AHD land contour. This area is referred to as the fringing foreshore on **Figure 2.10**. To achieve this, some trees would be planted along the fringing foreshores, but the plants around the wetland edges would generally be smaller shrubs such as *Grevillea* spp., *Banksia* spp. and *Callistemon* spp. Trees forming part of the succession would include *Casuarina glauca, Acacia mearnsii, Melaleuca armillaris, Banksia integrifolia* and other species native to the area.

The plant species growing up the contour would vary, depending upon the location along the fringe. Nearest to the shoreline would be species such as *Casuarina glauca.* Further up the slope would be alternating plantings of *acacia mearnsii* and *Banksia integrifolia.* Between these trees would be shrubs of various *Grevillea* spp. *Banksia* spp., and *Callistemon* spp., as well as other flowering species that may be advantaged by the conditions. The planting density would depend upon the individual genus selected.

The planting densities of the larger plants would be in the order shown in **Table 2.9**.

TABLE 2.9
Planting Densities of Larger Plants on the Fringing Slopes

Plant Species	Planting Density (plants / 10m^2)
Casuarina glauca	4
Acacia mearnsii	5
Melaleuca armillaris	3
Banksia integrifolia	3
Source: Illawarra Horticultural Services	

2.12.6 Rehabilitation Maintenance

The Applicant's commitment to effective rehabilitation would involve an ongoing maintenance program. This would include:

- monitoring grass cover and tree / shrub growth;
- replacement of any dead seedlings; and
- weed control.

2.13 DEVELOPMENT ALTERNATIVES

2.13.1 Introduction

Schedule 2.3 of the *Environmental Planning & Assessment Regulation 1994*, as amended, requires that "any feasible alternative to carrying out the development or activity be addressed". The consideration of feasible alternatives relate to the following activities.

(i) Alternative sources of fine sand.

(ii) Areas of sand extraction within the Project Site.

(iii) Alternative methods of product transportation.

(iv) Extent of backfilling within excavated voids.

(v) Alternative sites for backfill placement in the Illawarra area.

2.13.2 Alternative Sources of Fine Sand

Figure 1.4 identifies alternative approved fine sand sources at Kurnell (near Sydney) and within the Southern Highlands, Northern Illawarra area and Southern Illawarra area. Don Reed and Associates Pty Ltd (1999) reviewed each of these sites as alternatives to the Dunmore Sand Resource. Brief reference has already been made in Section 1.4.4 to the limited resources and/or other restrictions upon production from the sources within the Northern Illawarra area.

Don Reed and Associates Pty Ltd considers it unlikely that substantial quantities of fine sand would be transported to the Northern Illawarra area from the Southern Illawarra area as those operations are only small scale dune sand quarries satisfying local market requirements.

It is likely that small quantities of fine sand could continue to be transported from Kurnell to the Northern Illawarra area, however, Don Reed and Associates Pty Ltd (1999) suggests that sites in the Southern Highlands would be the major alternative sources of fine sand for markets in the Northern Illawarra area. Although such alternatives do exist, the increased use of sand from that area would result in unnecessary increases in truck movements via Macquarie Pass and considerably longer transport hauls for the construction materials required in the Northern Illawarra area.

Don Reed and Associates Pty Ltd (1999) recognises that the proposal to develop the Dunmore Lakes Sand Extraction Proposal – Stage 1 would enable the Northern Illawarra area to be near self-sufficient for fine sand for up to 15 years.

2.13.3 Areas of Sand Extraction Within the Project Site

Discussion in Section 2.1.3 identified four options for the extraction of sand within the Project Site. Option 2 was presented throughout Section 2 of this document as the most likely option to proceed should a Development Consent be forthcoming. The Applicant needs to canvas the other options in this section given:

(a) Information has not been received to date indicating substantial funds have been allocated by the State Government for the construction of the North Kiama Bypass; and

(b) the restrictions placed upon extraction by existing provisions within LEP 16 are being reviewed at present. In brief, it is the Applicant's position that if for some unforeseen reason(s) that the North Kiama Bypass is not constructed in its nominated position, then Development Consent is granted for Option 1. In the event that rezoning does occur prior to the determination of its Development Application, the Applicant would seek an approval to recover the additional sand from the area currently zoned to prohibit sand extraction. This would involve either Option 3 or Option 4, depending on whether the North Kiama Bypass is constructed

or not. In the event the area is re-zoned after the determination of the Development Application, the Applicant would seek an amendment of its Development Consent to recover the sand from that area.

Option 1

The likely variations that would occur if Option 1 was approved rather than Option 2 are set out below.

Area of Extraction:	The area of extraction under Option 1 would increase (above Option 2) by 5.9 ha.
Resource Quantity:	The resource recovered would increase by an estimated 1.1 million tonnes.
Final Landform:	The final landform would be comparable to Option 2 although it would require a total of 1.2 million m^3 of backfill to achieve the same landform, i.e. back to 4.0 m, AHD.
Extraction Method:	A similar extraction method would be used as proposed in Option 1.
Sand Processing:	The same processing would be undertaken.
Project Life:	The additional sand extraction would extend the duration of extraction by approximately 3 to 4 years. The additional backfilling would extend the duration of landscape reconstruction by approximately 5 years. In total, a 20 year Development Consent would be appropriate.
Transportation:	No changes to the rate of transportation would be envisaged. Rather, the duration of both product despatch and backfill receipts would increase for the periods referred to above.

Option 3

If Option 3 is undertaken, the likely variations would be similar to those referred to above for Option 1 although there would be an addition 120 000 tonnes of sand recovered and 100 000 tonnes of backfill to be placed.

Option 4

If Option 4 is undertaken, there would be minor variations to be proposal for Option 2. These variations relate to the opportunity to recover an additional 650 000 tonnes of sand from the 60 m wide strip adjacent to the Princes Highway and to place an additional 500 000 m^3 tonnes of backfill materials. The overall change to the proposal would be minor with an extension of the project life by approximately 2 to 3 years.

2.13.4 Alternate Methods of Product Transportation

2.13.4.1 Rail

The proximity of the South Coast Railway Line to the Project Site could provide an opportunity for the delivery of the sand products by rail. This is not a feasible option principally because of the diverse market distribution for the Company's products and the need to transport it by truck to a railhead in any event.

2.13.4.2 Pumping

The Applicant considered the option to pump sand from the Project Site to a new processing plant site adjacent to Boral's Dunmore Hard Rock Quarry on land under option to purchase by the Applicant. This option was not pursued because a substantial proportion of the land on which the pipeline was to be laid is zoned 7(d) which prohibits both the placement and use of such pipelines in those areas.

2.13.5 Extent of Backfilling within Excavated Voids

The Company considered the option of limiting the extent of backfilling to that required to cover and stabilise the exposed sand. This option was not favoured as the area of "visible" land on the foreshores of the lakes formed would be sufficiently narrow to considerably restrict the options for landscaping and future land uses following rehabilitation.

2.13.6 Alternate Sites for Backfill Placement

The Applicant's program for landscape reconstruction is dependent to a large extent upon the availability of uncontaminated excavated natural materials and coarse inert aggregate rubble. The availability of this material is to some extent a function of the alternative sites that accept these materials.

Uncontaminated excavated natural materials can be placed on rural properties with the consent of the local Council whereas placement of coarse inert aggregate rubble requires approval from both Council and EPA where more than 20 000 tonnes of the material is placed annually in a site. The sites licenced to receive builders waste aggregate rubble in the Illawarra area include Wollongong Builder's Refuse Depot (at Port Kembla), Shellharbour and Kiama Council's Waste Depots (at Dunmore) and Helensburgh Builder's Refuse Depot. Huntley Colliery has recently received approval to place up to 5.5 million tonnes of uncontaminated excavated natural materials in the area of the former coal fines tailings dam.

The Illawarra Waste Planning and Management Board is currently finalising a Waste Facilities and Services Plan for the Illawarra area. Such a plan will need to recognise the benefit to sites such as the Dunmore Sand Quarry and the current proposal for reconstructing usable landforms using reprocessed waste materials which would otherwise be placed in controlled landfill facilities.

The Applicant remains confident that despite the fact alternative sites exist for placement of both of these types of material that its customer base will be retained because of its easy access from the highway network and the quick on-site turnaround for trucks delivering materials to the site.

PREAMBLE

Section 3

ENVIRONMENTAL SETTING

This section describes the environmental setting within and surrounding the Project Site.

Emphasis is placed on providing information about the environmental features that influence the assessment of a wide range of other environmental parameters. Information is provided in this section on the regional, local and Project Site topography and geology, meteorology and land ownership.

Other features of the local environment that would or may be affected by the proposal are described in detail in Section 4.

3.1 TOPOGRAPHY

3.1.1 Regional Topography

The regional topography in the Illawarra area is characterised by low-lying land near the coastline and mountainous terrain associated with the Illawarra Range, approximately 8 km west of the Project Site. The Illawarra Range, reaches a peak elevation of 711 m, AHD on Knights Hill, approximately 12 km west of the Project Site. Escarpments and steep slopes cut by numerous creeks and gullies are common in the range. A large, flat, drowned river valley associated with the Minnamurra River lies just south of the Project Site.

3.1.2 Local Topography

The Project Site is situated on a low-lying floodplain area amongst local basaltic hills. To the south of the Project Site is a low basaltic ridgeline trending roughly east-west with a moderately steep hill at the eastern end of the ridgeline. The hill attains a maximum elevation of approximately 36 m, AHD and side slopes of approximately 20 per cent grade. This ridgeline effectively forms the catchment boundary between the low-lying floodplain of the Project Site and the Minnamurra estuarine wetland system to the south.

On the northern side of the Princes Highway are low-lying wetlands associated with the confluence of the Rocklow Creek / Minnamurra River. Directly to the north of Swamp Road is a small hill (20.5 m, AHD) whilst immediately to the west of the Project Site, the landform is characterised by undulating low hills, ridgelines and shallow gullies. Local topography is presented on **Figure 3.1**.

3.1.3 Project Site Topography

The bulk of the Project Site is situated on the low-lying floodplain area which generally has elevations of 5 m, AHD or less. **Figure 3.2** identifies that within the proposed extraction areas, elevations range from 1.5 m, AHD to 3.2 m, AHD within the floodplain. The Project Site contains two small lakes (Lakes 2 and 3). A third, much larger lake (Lake 1) is situated directly to the south-west of the Project Site. These lakes have a maximum depth of approximately 8 m and are a result of past sand extraction activities.

A slightly elevated feature, potentially representing a former edge of the estuarine lake, is present on the western side of the Project Site. This feature lies approximately 1.5 m above the nearby floodplain area. The Project Site is also bisected by a shallow man-made drain which channels runoff from the large lake across the Project Site towards the Princes Highway.

Beyond the low-lying floodplain, surrounding slopes are moderate to gentle and rise to elevations of approximately 15 m, AHD near Swamp Road.

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Base Map Source:
KIAMA 9028-1-S (1984)
ALBION PARK 9028-1-N (1985)
1:25000 Topographic

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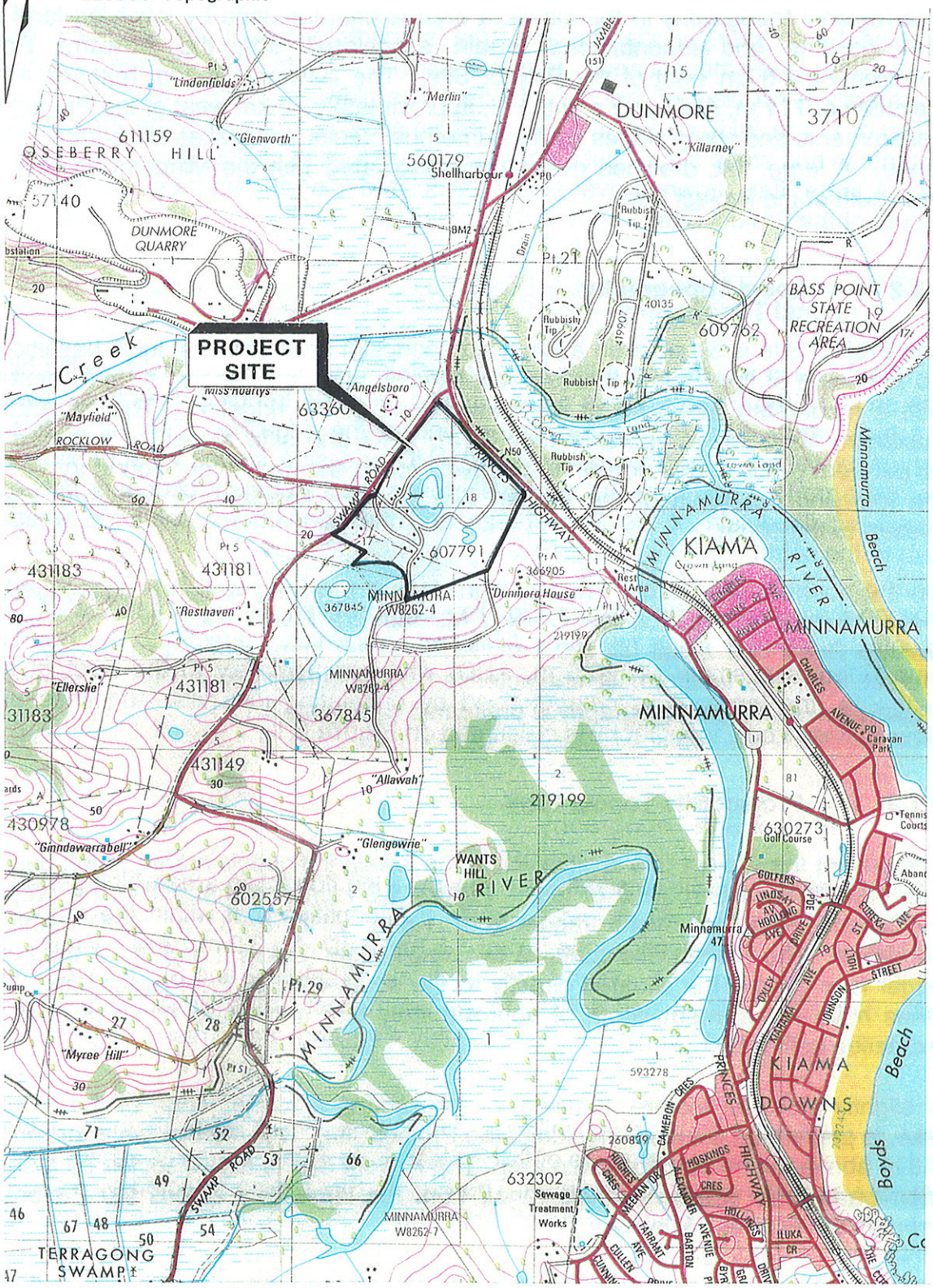

SCALE 1:25 000

250 0 250 500 750 1000 1250 m

Figure 3.1
LOCAL SETTING

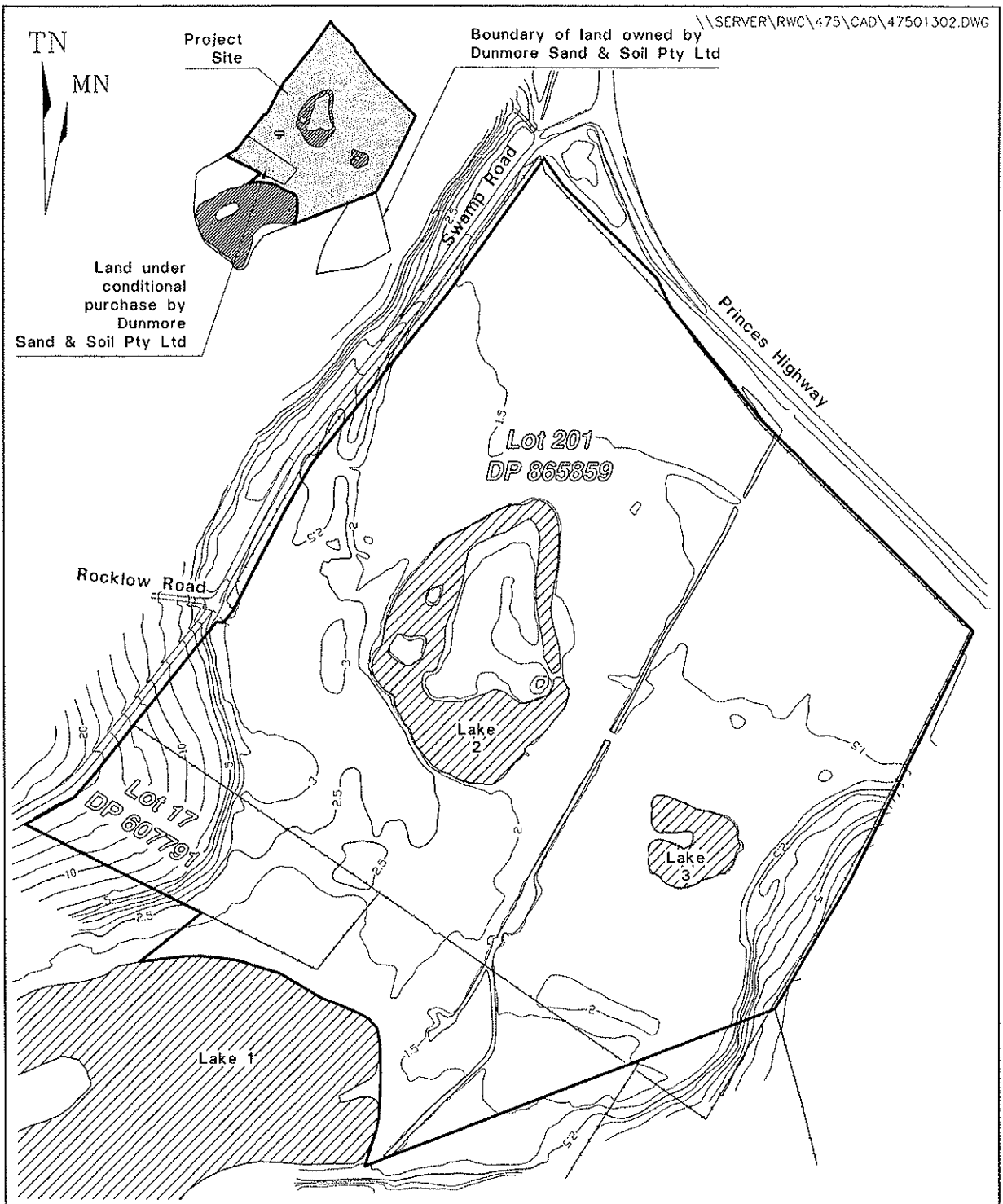

Figure 3.2
PROJECT SITE TOPOGRAPHY

3.2 GEOLOGY

3.2.1 Regional Geology

According to the Kiama 1:50 000 Geological Map, the Kiama-Dunmore area is underlain by rocks belonging to the Shoalhaven Group of Permian age, consisting of an interbedded series of red-brown and grey volcanic sandstones of the Budgong Sandstone, mid-grey and dark grey siltstone to fine sandstone of the Berry Siltstone, and latites (basalts) of the Bumbo Latite.

The Kiama Sandstone, which is overlain by the Bumbo Latite, is a sub-unit of the Budgong Sandstone and is comprised of thinly laminated sandstones and siltstones up to 76 m in thickness. The Bumbo Latite reaches a maximum thickness of 150 m, although it is generally 60 m or less. The latite most likely originated as a lava flow and consists of mid-grey to black porphyritic basalt.

The lower valley slopes and floodplain areas, including much of the Project Site, are infilled with Quaternary estuarine and riverine sediments consisting of sand, gravels and swamp deposits.

3.2.2 Local Geology

The valley sides surrounding the Project Site are underlain by the Bumbo Latite, a volcanic rock similar to basalt which is exposed in the nearby Dunmore Hark Rock Quarry north-west of the Project Site (see **Figure 3.1**). It appears that the basal contact of the basalt is close to sea level and that the rock below the valley floor is sandstone. Records held by the Department of Land and Water Conservation of several water bores in the area indicate that the basalt overlies shale and sandstone with the contact near 0 m, AHD.

The valleys of the Minnamurra River and Rocklow Creek cut through the Bumbo Latite and are now essentially "drowned" river valleys infilled with substantial thicknesses of unconsolidated sediments. The sediments, of Quaternary Age (up to 6 500 years old), are considered to be of marine rather than alluvial origin and consist of fine to medium-grained quartz sand with a minor lithic component occasional shell bands and clay lenses, presumably formed by the landward movement of coastal sand during fluctuations in sea level. No naturally occurring shell bands are exposed on the surface.

3.2.3 Project Site Geology

Exploratory drilling undertaken by the Applicant across the Project Site indicates the sand deposit has a maximum thickness of approximately 18 m. Contours of sand thickness on **Figure 3.3** show the variation in sand thicknesses on the Project Site. The location of drill holes and a typical geological section are also shown on **Figure 3.3** whilst the graphic geological records are presented in full in SMEC (1999).

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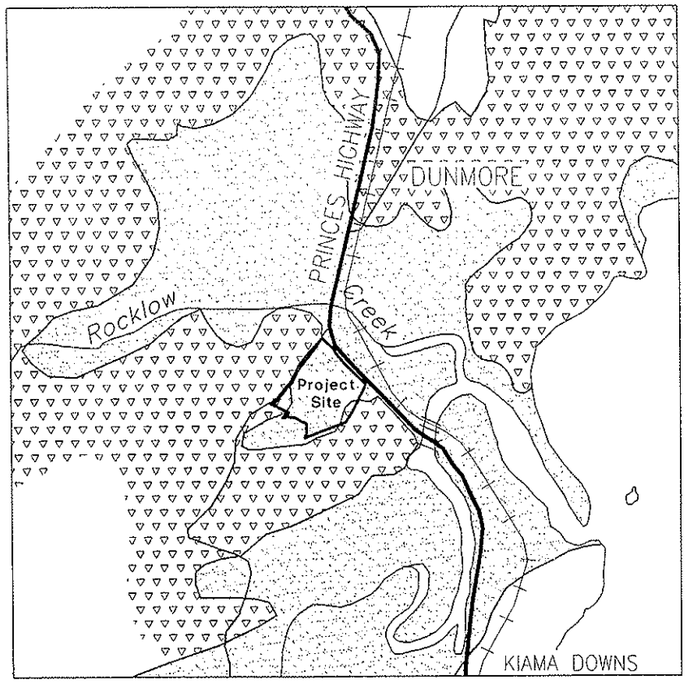
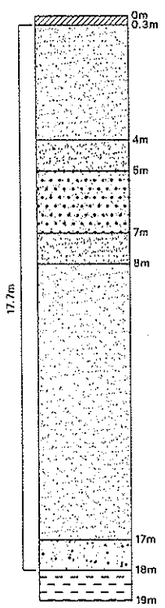
MN



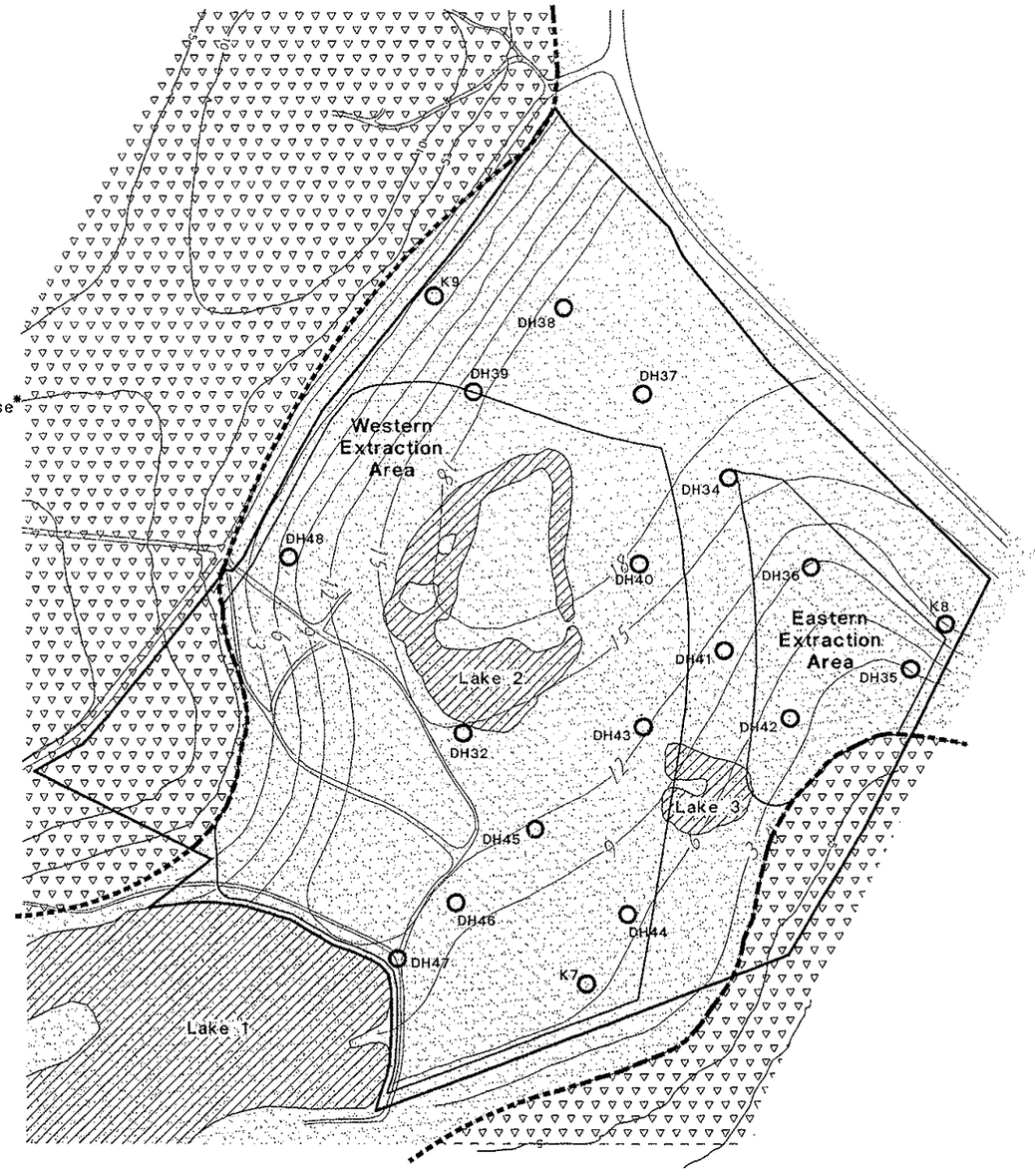
REGIONAL GEOLOGY



Soil
Silt/Fine Sand
Sand Fine/Coarse*
Sand Medium/Fine*
Sand Medium
Sand Medium/Coarse*
Clay
Basalt

*Refers to sub-classification of fine or medium-grained sand

TYPICAL DRILL CORE



PROJECT SITE GEOLOGY

REFERENCE

- Project Site Boundary
- Contour (Interval = 0.5m)
- Railway
- Road - Major/Minor
- Creek/River
- Quaternary Sediments
- Bumbo Latite
- Resource Boundary
- Thickness of Sand Resource (m)
- DH40 Reverse Circulation Air Core Borehole
- K10 Geological Survey Borehole
- Existing Lake
- Proposed Limit of Extraction

Sources:
9028 KIAMA
1:100000 Topographic

Amended after:
SI 56-9 WOLLONGONG
1:250000 Geological
9028-1 KIAMA
1:50000 Topographic

SCALE 1:50000
0.5 0 0.5 1.0 1.5 2.0 2.5 km

SCALE 1:5000
50 0 50 100 150 200 250 m

Figure 3.3
GEOLOGY

The typical geological profile across the Project Site comprises a sandy loam topsoil averaging 0.3 m to 0.4 m thick (maximum of 1 m thick) underlain by yellow then grey fine-grained clean sand above a base of clay. Within the sand there are several sections where the sand contains some interstitial clay, described in the drill logs as 'puggy' or 'slightly puggy'. These sections are irregular across the Project Site and are generally less than 3 m thick. Size analyses of the clean sand indicate less than 5 per cent of the grains are greater than 0.6 mm and a silt and clay fraction of between 5 and 10 per cent, with 15 to 20 per cent silt and clay fines in the 'puggy' clayey sand.

The bulk of the sand grains are sub-rounded to well-rounded quartz grains (see covers for Volume 1 and Volume 2) and, when washed, are comparable to the high quality sands produced a number of years ago at Kurnell.

3.2.4 Resource Assessment

Site geological investigations undertaken by the Applicant for the purposes of resource assessment comprised:

- a review of Geological Survey of NSW borehole information (3 boreholes);
- the drilling of 18 reverse circulation holes across the Project Site. These holes were a part of an extensive exploration drilling program undertaken by the Applicant in the vicinity of the Project Site in February 1998. This program also included two undisturbed vibrocore holes adjacent to DH 34 and DH 38, taken for ongoing research; and
- geological logging of the drill holes and particle size-grading analysis of numerous samples.

Based on the site investigations outlined above, the Applicant has defined a resource of approximately 4.5 million tonnes of fine-grained sand beneath the Project Site. This quantity allows for set-backs from the site boundaries and required extraction profiles presented on **Figure 2.4**. Details of the occurrence of the resource within the 1(a) and 1(d) zones within Project Site is set out in **Table 3.1**.

It is noted that combined resource quantity east and west of the Bypass is approximately 2.75 million tonnes and there are 1.75 million tonnes beneath the "footprint" of the Bypass.

TABLE 3.1
Sand Resources Within the Project Site

Resource Area	Resource Quantity - Tonnes		
	Area Zoned 7(d)	Area Zoned 1(a)	Total
Area East of Bypass	100 000	150 000	250 000
Bypass	650 000	1 100 000	1 750 000
Area West of Bypass	-	2 500 000	2 500 000
TOTAL	750 000	3 750 000	4 500 000

3.3 METEOROLOGY

3.3.1 Source of Data

The meteorological data presented in this section has been drawn from a range of sources including the Bureau of Meteorology Stations at:

- the Kiama Bowling Club (Site Number 068038) approximately 6 km to the south of the Project;
- Port Kembla (Station 068053 – no longer used) approximately 16 km north of the Project Site; and
- Dunmore which is just north of the Project Site.

Some data is also drawn from the RAN Air Station near Nowra (Site Number 068076) situated approximately 35 km to the south of the Project Site. The data collected comprises temperature, rainfall, frequency of frosts and fog, pan evaporation and wind.

3.3.2 Temperature

Average daily maximum and minimum temperatures recorded at Kiama are presented in **Table 3.2**. The Kiama-Dunmore area generally experiences warm summers and mild winters. Mean daily temperatures range from 8.4°C (minimum) to 18.1°C (maximum) in winter, and from 16.2°C (minimum) to 25.0°C (maximum) in summer. February is the warmest month with a mean daily maximum temperature of 25.0°C and July is the coldest month with a mean daily minimum temperature of 8.4°C.

3.3.3 Rainfall

The annual rainfall distributions for Kiama and Dunmore are shown in **Table 3.2** and are based on approximately 14 years and 12 years records, respectively.

The average annual rainfall for Kiama and Dunmore is 1258 mm and 1051 mm respectively.

Highest rainfalls at Kiama occur in the period between March and June. March has the highest mean rainfalls of 143 mm. August and September are the driest months at Kiama with mean rainfalls of 77 mm and 75 mm respectively. On average, Kiama experiences 10 rain days per month and 127 rain days per year.

Rainfall records collected at Dunmore between 1962 and 1974 show a similar rainfall distribution to Kiama. March and June are the wettest months with median rainfalls of 111 mm and 131 mm respectively. July is the driest month with a median rainfall of 20 mm.

3.3.4 Temperature Inversions

Temperature inversions are significant noise enhancing phenomena and are often expressed as fogs and occur in conjunction with frosts. They invariably occur of an evening with clear skies and when wind speeds are low or calm conditions prevail. The inversions normally disappear early the following morning. **Table 3.2** presents a record of fog and frost frequencies for Kiama, the closest recording site to the Project Site. Fogs generally occur in January and February whilst frosts occur from May to July, although the frequency of both phenomena is very low.

3.3.5 Wind

The wind speed and direction at Port Kembla are graphically presented on a seasonal basis on **Figure 3.4**. The Project Site is located in a coastal area similar to Port Kembla and is subject to reasonably strong onshore winds predominantly from a north-easterly direction, particularly in spring and summer. In autumn and winter there is a stronger influence from the south-westerly quadrant. The Applicant's experience at its existing sand extraction site since 1987 indicates that the strongest winds occur from the west.

TABLE 3.2
Climatic Summary – Kiama, Nowra and Dunmore

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
TEMPERATURE (Kiama)													
Mean Daily Maximum (°C)	25.0	25.0	24.1	22.1	20.1	17.6	16.8	18.1	19.7	21.6	22.6	23.9	21.4
Mean Daily Minimum (°C)	17.5	17.7	16.3	14.0	12.1	9.3	8.4	8.7	10.4	12.5	14.4	16.2	13.1
RAINFALL (Kiama)													
Mean Monthly Rainfall (mm)	110.5	117.9	143.8	131.1	121.7	126.0	87.7	77.4	75.2	86.7	86.8	93.7	1258.3
Highest Monthly Rainfall (mm)	364.8	507.7	620.1	686.4	623.1	671.0	455.5	378.1	239.4	443.5	591.9	408.2	-
Lowest Monthly Rainfall (mm)	13.9	3.2	9.2	7.7	1.5	0.0	0.0	0.0	1.8	4.4	1.5	4.6	-
Mean Number of Rain Days	12.2	11.6	12.6	11.2	10.8	9.9	8.6	8.5	9.2	10.7	11.0	11.2	127.6
RAINFALL (Dunmore)													
Mean Monthly Rainfall (mm)	115	103	132	119	65	122	24	68	49	83	83	88	1051
Median	98	69	111	81	47	131	20	60	44	67	49	66	977
Rain Days per Month	10	8	11	8	7	9	4	7	5	8	9	9	95
MEAN MONTHLY EVAPORATION (mm) (Nowra)													
	195	159	145	120	96	87	96	123	150	176	183	213	-
FROST FREQUENCY (Kiama)													
Mean number of days with frost	Nil	Nil	Nil	Nil	0.1	0.1	0.3	Nil	Nil	Nil	Nil	Nil	0.5
FOG FREQUENCY (Kiama)													
Mean number of days with fog	0.1	0.1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.1	Nil	0.3

Source: Bureau of Meteorology

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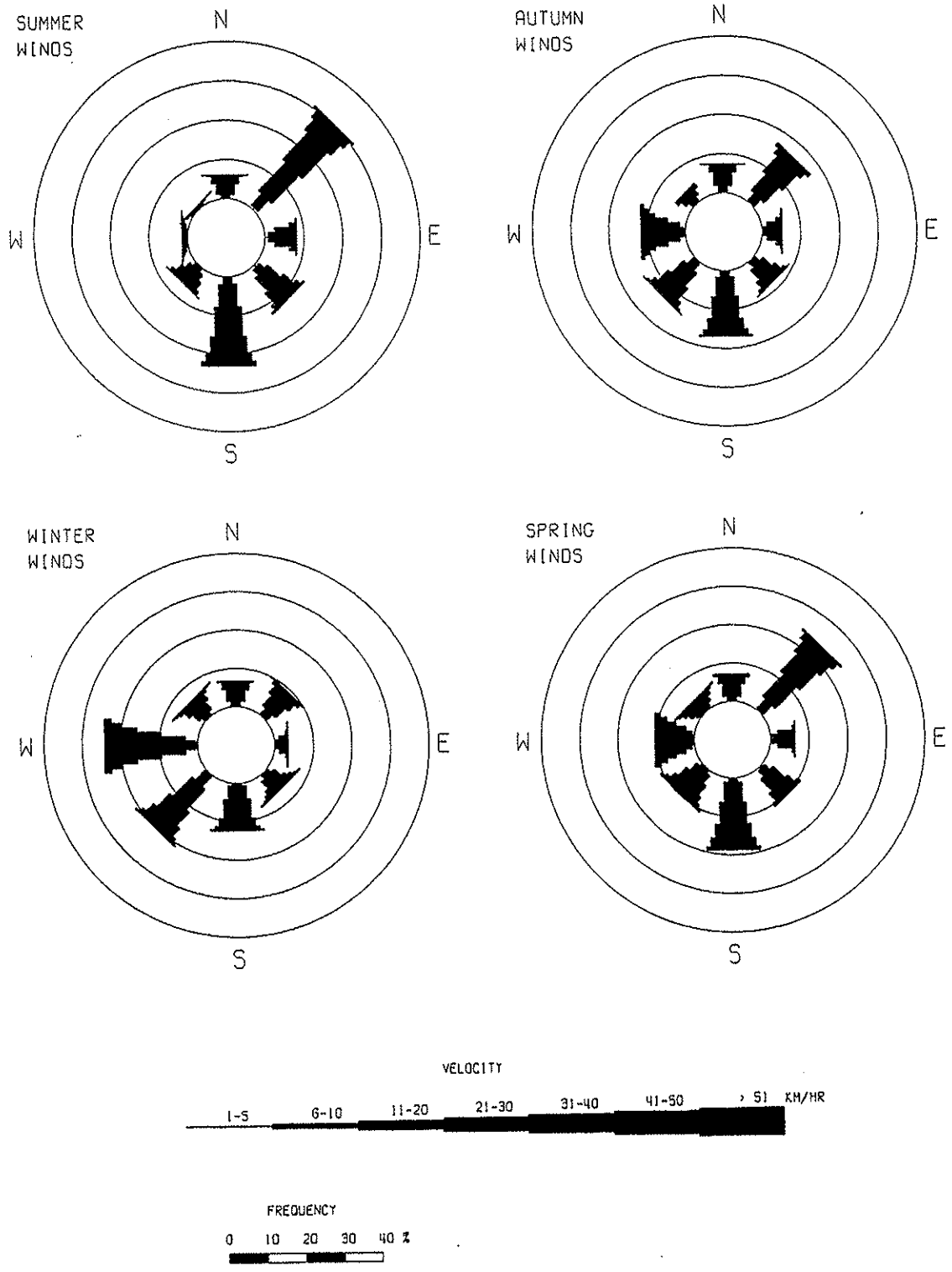

Source:
Port Kembla Signal Station
9am and 3pm Readings
(1957 to 1976)

Figure 3.4
WIND SPEED AND DIRECTION

Table 3.3 presents a breakdown of the proportion of winds blowing towards surrounding residences from the Project Site.

TABLE 3.3
Frequency of Winds Blowing Towards Surrounding Residences

Residence	Wind Direction	Time of Day	Jan		Feb		Mar		Apr		May		Jun	
			< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10
Old School House	SE	9 am	3	8	3	6	1	4	1	3	-	1	-	3
		3 pm	3	13	2	13	3	15	3	9	3	8	4	6
Dunmore House	W	9 am	-	1	-	1	1	4	2	10	5	23	6	23
		3 pm	-	1	-	-	-	1	-	8	1	16	1	13
Dunmore Lakes Estate	N	9 am	1	5	2	4	4	7	4	6	3	5	1	5
		3 pm	1	5	1	6	1	5	1	4	1	6	1	7

Residence	Wind Direction	Time of Day	Jul		Aug		Sept		Oct		Nov		Dec	
			< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10	< 10	> 10
Old School House	SE	9 am	-	1	-	2	1	2	2	5	5	6	2	7
		3 pm	2	7	2	10	2	10	1	12	2	14	2	14
Dunmore House	W	9 am	6	29	4	23	2	15	1	8	1	7	-	3
		3 pm	1	20	-	18	-	13	-	9	-	8	-	4
Dunmore Lakes Estate	N	9 am	2	5	2	7	2	9	2	8	2	6	2	5
		3 pm	1	5	1	4	-	4	1	5	1	7	1	7

Source: Bureau of Meteorology Site No. 068053 at Port Kembla Wind Speed km/h

3.3.6 Evaporation

Table 3.2 presents mean daily pan evaporation for Nowra, the closest recording site for evaporation. Evaporation exceeds rainfall throughout the year with the exception of May and June.

3.4 LAND OWNERSHIP AND SURROUNDING RESIDENCES

3.4.1 Land Ownership

Lot 201, DP 865859 within the Project Site is wholly owned by Dunmore Sand & Soil Pty Ltd. The ownership of the surrounding land is shown on **Figure 3.5** and Lot 17, DP 607791 is owned by J.R. Hambly. The Applicant has an option to purchase Lot 17 should the proposal be approved.

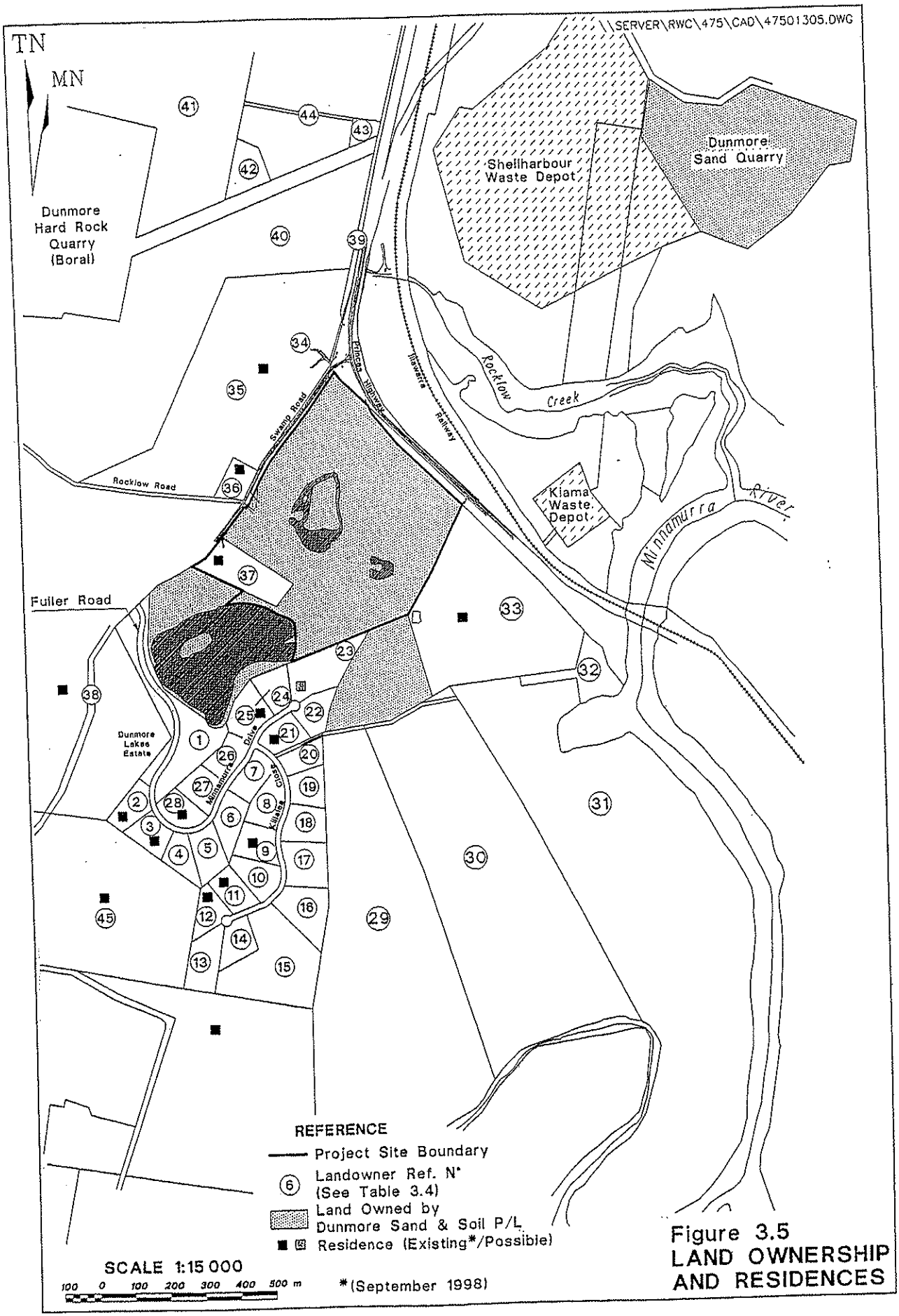

Figure 3.5
LAND OWNERSHIP AND RESIDENCES

3.4.2 Surrounding Residences

The closest residences to the Project Site or those residences from which part of the Project Site are visible are shown on **Figure 3.4** and are listed in **Table 3.4**. The information presented on **Table 3.4** was drawn from a variety of sources including the agent responsible for marketing the lots within the Dunmore Lakes Estate. The information was current at September 1998. For the purposes of assessing the impact of the proposal, noise measurements and visual cross-sections have incorporated some of these residences and are referred to in later sections of the document. The distances from these residences to both the nearest point on the Project Site and the nearest point of sand dredging operations are also noted in **Table 3.4**.

TABLE 3.4
Land Ownership and Residences in the Vicinity of the Project Site

Page 1 of 2

Landowner No.	Owner	Residence	Approximate Elevation of Residence (m, AHD)	Aproximate Distance (km) of Residence to nearest point of Project Site	Approximate Distance (km) of Residence to nearest point of dredging operation
1	Willandra Villas Pty Ltd	No	-	-	-
2	P & C Camada	Yes	15	0.65	0.65
3	B Harris	Yes	15	0.65	0.65
4	G & S Donaldson	No	-	-	-
5	-	-	-	-	-
6	C Neaves	No	-	-	-
7	J Edmond & J Croll	No	-	-	-
8	P A & G Camilleri	No	-	-	-
9	?	Yes	29	0.55	0.55
10	D & P Pickles	No	-	-	-
11	T & S O'Dwyer	Yes	32	0.65	0.65
12	?	Yes	32	0.7	0.7
13	P & D Clark	No	-	-	-
14	J & W Sala	No	-	-	-
15	P & C Finn	No	-	-	-
16	K Tugrul	No	-	-	-
17	P & M Delaney	No	-	-	-
18	R & B Bleimuth	No	-	-	-
19	J Smithers	No	-	-	-
20	R & I Forskitt	No	-	-	-
21	D & M Peachey	Yes	25	0.25	0.25
22	Willandra Villas Pty Ltd	No	-	-	-
23	Willandra Villas Pty Ltd	No	-	-	-
24	Willandra Villas Pty Ltd	No	-	-	-
25	G A Heathcoate & N M Pantle	Yes	15	0.2	0.2
26	J & B Forrest	No	-	-	-
27	A & L Sheppard	No	-	-	-
28	B & K Wallace	Yes	8	0.55	0.55
29	J G Mandi	No	-	-	-

Cont'd Page 3-17

TABLE 3.4
Land Ownership and Residences in the Vicinity of the Project Site

Landowner No.	Owner	Residence	Approximate Elevation of Residence (m, AHD)	Aproximate Distance (km) of Residence to nearest point of Project Site	Approximate Distance (km) of Residence to nearest point of dredging operation
30	Redister Pty Ltd	No	-	-	-
31	Redister Pty Ltd	No	-	-	-
32	A E K Parbury	?			
33	Redister Pty Ltd	Yes	21	0.15	0.2
34	Telecom Australia	No	-	-	-
35	J R T Creagan	Yes	13	0.2	0.25
36	W Cornue / M Stocker	Yes	7	0.05	0.1
37	J J & R A Hambly	Yes	15	-	0.1
38	Union Trustee Co.	Yes	13	0.55	0.6
39	Hi-Quality Concrete Industries Ltd	No	-	-	-
40	Hi-Quality Concrete Industries Ltd	No	-	-	-
41	O J Horky	?			
42	Boral Resources (NSW) Pty Ltd	No	-	-	-
43	Boral Resources (NSW) Pty Ltd	No	-	-	-
44	P M Robinson	?			
45	T R Gotterson	Yes	42	0.9	0.9

PREAMBLE

Section 4

FEATURES OF THE EXISTING ENVIRONMENT AND SAFEGUARDS AND IMPACTS OF THE PROPOSAL

This section describes the features of the environment within and surrounding the Project Site that would or may be affected by the proposal. The extent of description and associated data collection varies throughout this section and is invariably related to the potential for impacts to occur throughout the operation of the proposed extraction area.

This section also describes the design and operational safeguards and, where appropriate, management procedures the Applicant would adopt throughout the life of the Dunmore Lakes Proposal to mitigate any potential adverse impacts. It is recognised that all projects have impacts but it is necessary for impacts to comply with specified criteria, design goals, statutory guidelines or reasonable community expectations.

This section also incorporates the predicted impacts upon the various components of the existing environment, that is, once the various safeguards and procedures are adopted. Where considered appropriate, proposals for monitoring are also presented.

The format of this section reflects a request from the Department of Urban Affairs and Planning to integrate information on the existing environment, safeguards to minimise impacts, prediction and assessment of impacts.

PART A: THE PHYSICAL ENVIRONMENT

4.1 WATER RESOURCES

4.1.1 Introduction

An understanding of the regional, local and Project Site drainage and flooding is drawn from SMEC Australia Pty Ltd (SMEC) (1999). This report draws heavily upon the findings of previous studies in the area and includes a description of the hydrologic characteristics of the Project Site and local area and an assessment of flooding. SMEC (1999) also addresses the issue of groundwater resources.

The following sub-sections outline surface water drainage and flooding on the Project Site and throughout the local area together with a description of the local Project Site groundwater regime. A full copy of the hydrological/hydrogeological study is presented in SMEC (1999). Peter Dundon & Associates assisted SMEC Australia Pty Ltd finalise the hydrogeological assessment of the proposal.

4.1.2 Surface Water Occurrences

4.1.2.1 Drainage Network

Regional Drainage

The Project Site lies within the lower catchment of the Minnamurra River which in turn lies within the Wollongong Coast Drainage Basin (Water Resources Commission, 1980). The inlet of the Minnamurra River to the ocean lies approximately 2.5 km to the south-east of the Project Site. The Minnamurra River drains some of the eastern slopes of the Illawarra Range and has a catchment area of approximately 124 km^2 (see **Figure 4.1**).

Local Drainage

The Project Site is situated within the low-lying sub-catchment of Rocklow Creek, a tributary of the Minnamurra River and is approximately 0.7 km west of the nearest point of the Minnamurra River. **Figure 4.1** shows Rocklow Creek flows into the Minnamurra River downstream of the Princes Highway approximately 1 km to the east of the Project Site and approximately 1.5 km from the inlet to the ocean. Rocklow Creek has a total catchment area of approximately 21 km^2 upstream of the crossing at the Princes Highway near Dunmore.

A number of ephemeral tributaries of Rocklow Creek drain the foothills of the Illawarra Range and other rolling hills to the west and around the Project Site. The Project Site lies within one of these small catchments, one which has an area of 3.3 km^2 above the Project Site (**Figure 4.1**). Much of the lower catchment of Rocklow Creek is subject to regular inundation, hence, a feature of the local drainage network is the area of swamps and wetlands. An extensive predominantly tidal wetland area surrounds the confluence of Rocklow Creek and the Minnamurra River. The wetland on the northern side of the Minnamurra River is designated under SEPP 14 as Wetland No. 347a whilst the wetland on the southern side is designated as Wetland No. 373. A large wetland area is also located along the Minnamurra River to the south of the Project Site. This wetland area is designated Wetland No. 372 (see **Figure 4.1**, Local Drainage).

Project Site Drainage

The Project Site itself is poorly drained, reflecting the low-lying nature of the landform. The bulk of rain falling on the Project Site infiltrates directly into the sands beneath the surface, that is, until such time as the groundwater level rises to the surface. Surface water runoff from upslope areas to the north and south also flows onto the Project Site as overland sheet flow or via shallow drainage depressions.

Drainage through the Project Site is largely limited to a shallow man-made drain which bisects the Project Site (see **Figure 4.1**) This drain conveys runoff from near the southern boundary of the Project Site, as well as local runoff from the Project Site itself, in a northerly direction through culverts under the Princes Highway and Illawarra Railway and into the wetlands near the confluence of Rocklow Creek / Minnamurra River.

4.1.2.2 Flooding Behaviour

Flooding is a common occurrence across the Project Site and the entire Minnamurra River floodplain with major flood events having been reported by local property owners for the years 1932, 1942, 1952, 1959, 1975 and 1978 (Connell Wagner, 1996) and recently in August 1998.

The Minnamurra River floodplain covers an area of approximately 6 km^2 and during major flood events acts as a large retarding basin which significantly attenuates the peak of the floodwave as it moves down the floodplain. Peak flood levels in the Rocklow Creek sub-catchment and subsequently on the Project Site are caused predominantly by water backing up from the Minnamurra River rather than by flood flows in the Rocklow Creek sub-catchment (Connell Wagner, 1996). Local runoff contributes in the early part of storms and produces high velocities across the Project Site (Lawson and Treloar Pty Ltd, 1989). Flooding in both the Rocklow Creek sub-catchment and the downstream section of the Minnamurra River is often affected by elevated sea levels generated by storm surge and also by the available flow area at the ocean entrance. After long calm periods with low river flow, the ocean entrance closes partially due to the build-up of coastal sand which in-turn increases the flood

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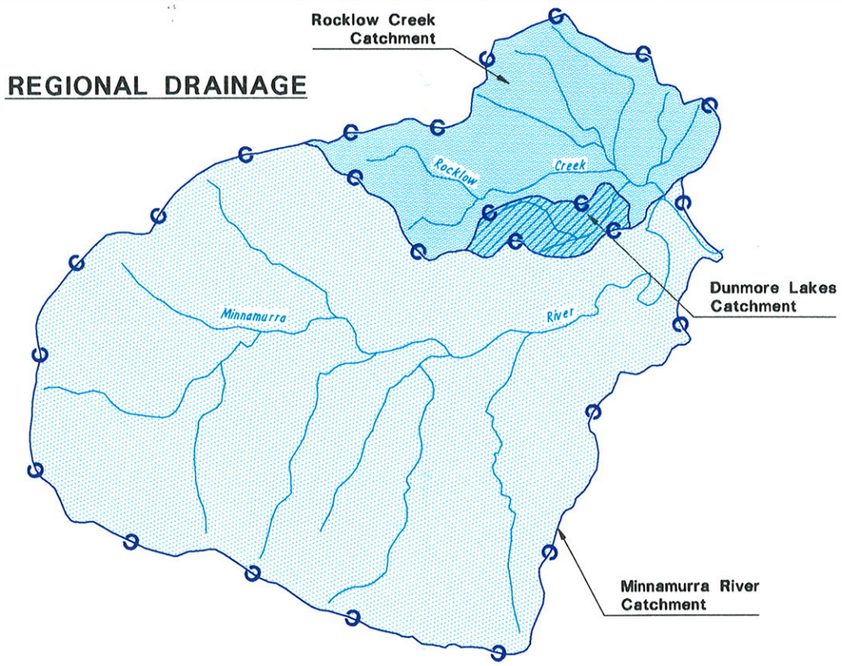
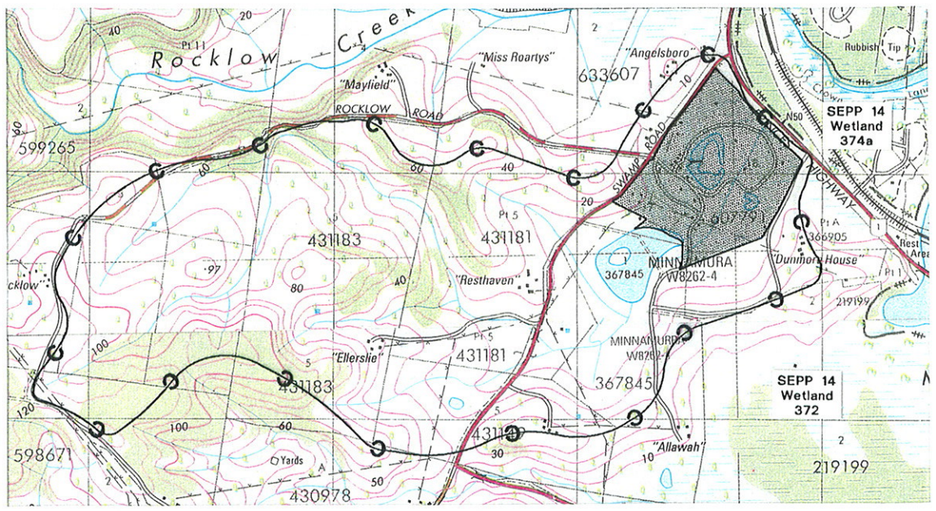
REGIONAL DRAINAGE



REFERENCE

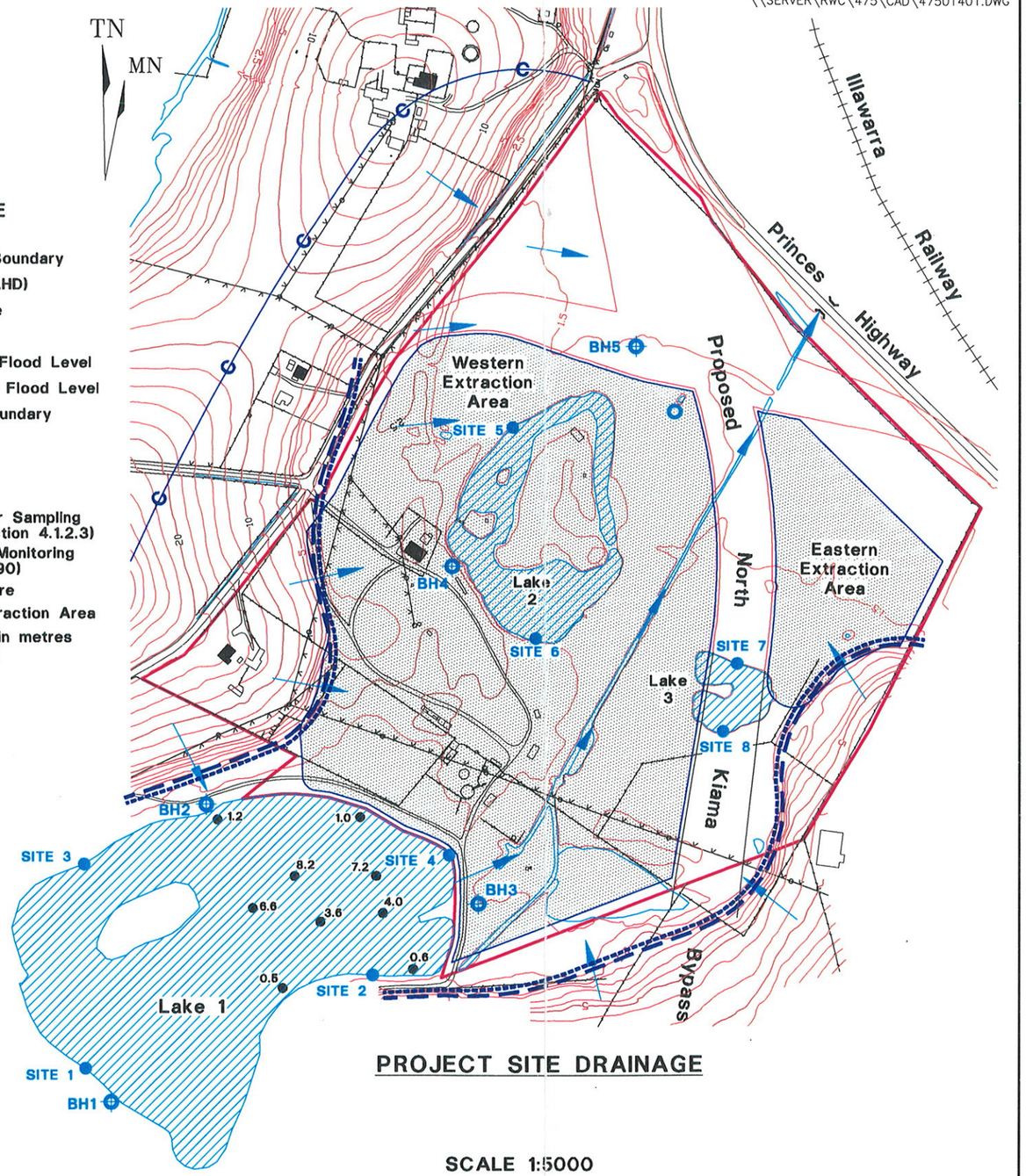
- Project Site Boundary
- Contour (m, AHD)
- Powerline/Pole
- Fence
- 1 in 20 Year Flood Level
- 1 in 100 Year Flood Level
- Catchment Boundary
- Creek
- Residence
- Building
- SITE 1 — Surface Water Sampling Site (See Section 4.1.2.3)
- BH3 — Groundwater Monitoring Bore (IEC, 1990)
- Production Bore
- Proposed Extraction Area
- 1.2 — Water Depth in metres (Source: RTA)



LOCAL DRAINAGE

SCALE 1:25 000

250 0 250 500 750 1000 1250 m



PROJECT SITE DRAINAGE

SCALE 1:5000

50 0 50 100 150 200 250 m

Figure 4.1
DRAINAGE

levels during the early part of a flood event, after which the entrance is scoured fully open, with a consequent drop in flood levels (Connell Wagner 1996).

Several flood studies have been completed for the Minnamurra River floodplain and are relevant to the proposed sand extraction. As a component of the hydrological study undertaken for this EIS, SMEC reviewed the four studies listed below.

- Gutteridge Haskins & Davey Pty Ltd (1988)
- Lawson and Treloar Pty Ltd (1989)
- Lawson and Treloar Pty Ltd (1993)
- Sinclair Knight (1993)

The estimated peak flows and flood levels from each of these studies are summarised in SMEC (1999). Flood levels from Lawson and Treloar (1993) have been adopted by SMEC for the Project Site given they were assessed to be based on the most comprehensive assessment. The estimated flood levels and their respective Annual Exceedance Probability (AEP) on the Project Site for existing catchment conditions are:

- 3.6 m, AHD for the 1% AEP (1 in 100 year) event;
- 3.3 m, AHD for the 5% AEP event; and
- 3.2 m, AHD for the 10% AEP event.

Figure 4.1 shows the extent of inundation for the 1% (1 in 100 year event) and 5% (1 in 20 year event) AEP events. Due to the topography of the Project Site there is little difference in the 1% and 5% AEP inundation areas, as the Project Site is flat and surrounded by hills which restrict the spread of water. Important features with respect to flooding on the Project Site are:

- the critical storm duration that produces the highest flood level at the Project Site is nine hours, i.e. within the Minnamurra River catchment. However, it is noted that both Rocklow Creek and Dunmore Lakes Catchments have much shorter critical storm durations;

- flooding in the lower sections of the Project Site is due to backwater from the Minnamurra River;

- peak velocities occur early in the flood event when local runoff is dominant; and

- runoff from rural-residential areas, such as the Dunmore Lakes Estate to the south of the Project Site have had negligible impact on the total flood volumes.

The existing hydrological conditions will be modified slightly as a result of the construction of the North Kiama Bypass. The RTA is required to install sufficient drainage beneath the Bypass to ensure that the Bypass does not cause any adverse impacts upon local flooding. At the time of preparation of this Statement, the RTA had no firm plans for the drainage beneath the Bypass. The RTA has advised that the

most likely location for the long-term drainage line is that shown on **Figure 2.9**, i.e. to the north and turning easterly under the northern ramps of the Bypass. It is understood that these plans will be prepared in detail prior to the commencement of construction.

4.1.2.3 Water Quality

An assessment of the existing water quality of the three artificial lakes has been undertaken by Illawarra Horticultural Services (IHS) (1999). Results of analyses of eight water samples collected from the lakes are presented in **Table 4.1**. Sample locations are shown on **Figure 4.1**.

Observations relating to the surface water quality data presented in **Table 4.1** are as follows.

pH - The pH levels of the three lakes were quite different with Lake 1 being the most alkaline and Lake 3 being slightly above neutral. It is likely that the pH level of Lakes 2 and 3 was influenced by biological activity.

Electrical Conductivity and Total Dissolved Solids - The level of dissolved solids in each lake was low. The higher EC in Lake 3 is probably due to evaporation.

Dissolved Oxygen - The level of dissolved oxygen in the surface waters was close to saturation due to the aerating effect of wind. The levels of dissolved oxygen in Lake 3 were lower due to a higher nutrient load.

Alkalinity - Alkalinity was higher in Lake 1 than the other two lakes which may reflect differences in the organic loads or reflect differences in the sediments underlying the lakes.

Turbidity - As expected, turbidity was lower in Lake 1, being deeper than the other lakes. Lake 3 had the highest turbidity levels due to the influence of biological activity and increased suspended sediment.

Phosphorus - Phosphorus levels were generally low and varied between the lakes.

Nitrate-Nitrogen - Nitrate-nitrogen levels were all relatively low.

Results of analyses of water samples collected between May 1997 and September 1998 in Lake 1 are presented in IHS (1999). These results show the fluctuations in water quality experienced in Lake 1 and presumably in other lakes in the area, due to

seasonal and environmental factors such as the heavy rainfall experienced throughout the area in July and August 1998.

The water quality of the Dunmore Lakes was previously investigated by Interaction Environmental Consultant (1990) as a component of a previous proposal for the site. The findings of this investigation were similar to the results noted above.

TABLE 4.1
Surface Water Quality – Dunmore Lakes

Test/Location *	*Lake 1*				*Lake 2*		*Lake 3*	
Sample No.	*Site 1*	*Site 2*	*Site 3*	*Site 4*	*Site 5*	*Site 6*	*Site 7*	*Site 8*
pH	8.5	8.5	8.5	8.4	8.1	8.4	7.3	7.6
Electrical Conductivity (uS/cm)	345	350	345	345	270	275	400	395
Total Dissolved Solids (mg/L)	230	235	230	230	180	185	265	265
Dissolved Oxygen (mg/L)	8.6	8.3	8.3	8.5	8.4	8.4	6.4	7.4
Alkalinity (mg $CaCO_3$/L)	1.6	1.6	1.6	1.6	0.9	0.9	0.9	0.9
Redox Potential (mV)	210	211	203	200	220	190	206	194
Turbidity (NTU)	3.5	3.7	2.9	3.5	6.1	4.7	7.5	8.1
Phosphorus (mg/L)	0.41	0.37	0.47	0.42	0.96	0.89	1.19	1.21
Nitrate-Nitrogen (mg/L)	0.17	0.13	0.11	0.14	0.16	0.17	0.16	0.18

Source: Illawarra Horticultural Services (see Part 4 of Volume 2) * See Figure 4.1

The key findings of both investigations may be summarised as follows.

- The water table at the Project Site is located close to ground level ranging from 0 to 2 m below the surface with an average depth of around 0.8 m.
- There is no contamination of either surface or groundwater with leachate from the neighbouring solid waste depots.
- Bacteriological levels (E.coli) of the lakes are above recreational use standards, which correlates with the agricultural land use (cattle grazing).
- Algal blooms were observed in Lake 3 (IHS 1999).

- Water in the lakes is well mixed, probably due to wind activity driven by onshore and offshore breezes.

- Biochemistry differed in each of the three lakes due to variations in depth, water temperature and nutrient levels (from water birds).

In support of the good water quality within the lakes, there are well developed plant communities on the banks of the lake, well established aquatic plants in the shallow areas and well established bird, amphibian, fish and aquatic invertebrate life.

Water quality monitoring has also been carried out at the Dunmore Sand Quarry by Illawarra Horticultural Services since July 1990. Water quality data for both the Dunmore Sand Quarry and Dunmore Lakes Project Site is presented in full in IHS 1999.

The Minnamurra River, which is regularly flushed by tidal action, has generally good water quality (Kiama City Council, 1995). However, extensive water quality monitoring in the river has indicated that elevated nutrient levels and some faecal contamination is present due to agricultural activities (Connell Wagner, 1996).

Water quality within Rocklow Creek is influenced largely by both the Shellharbour and Kiama Council Waste Disposal Depots, the Dunmore Hard Rock Quarry and agricultural activities in the catchment. Results of water quality monitoring in late 1994 indicate a high chemical oxygen demand and high phosphorus levels, although conductivity and total dissolved solids are within acceptable limits (Connell Wagner, 1996).

4.1.3 Groundwater Occurrences

4.1.3.1 Introduction

A hydrogeological study of the Project Site was undertaken by SMEC Australia Pty Ltd (1999) in conjunction with the hydrological study described in Section 4.1.2.

The hydrogeological work involved:

(i) a review of the available geological information for the area, namely a series of boreholes drilled in February 1998 by Dunmore Sand & Soil Pty Ltd and bore data provided by the Department of Land and Water Conservation;

(ii) a review of previous hydrogeological studies undertaken in the area, in particular that undertaken by Interaction Environmental Consultant (1990); and

(iii) the establishment of a screened pumping bore near the centre of the Project Site and five observation bores in May 1998 (see **Figure 4.1**). A

pump test was performed to determine the hydraulic conductivity of the sand aquifer and the quality of groundwater.

4.1.3.2 Groundwater Levels

The sand deposit beneath the Project Site forms the principal unconfined groundwater aquifer which is of finite dimensions, enclosed to the north, west and south by basalt ridges on the boundary or just beyond the Project Site. The floor of the aquifer is sandstone, basalt and clay. To the east, downstream, the sand deposit appears to continue to the coast along Rocklow Creek and the Minnamurra River.

During a reasonably dry period in 1989-90 the groundwater table was recorded at about 0.8 m, AHD and rose briefly to the surface following rainfall of 280 mm in two days (Interaction Environmental Consultant 1990). It is therefore evident that the groundwater table responds rapidly to periods of rainfall. In 1998, after a period of rain, the water table was measured at 1.5 m, AHD. It is understood that during extended dry periods the water level in the lakes in the vicinity of the Project Site fall to an estimated 0.2 m, AHD.

Information from groundwater bores (Interaction Environmental Consultant 1990) indicates that the rock below and on either side of the sand deposit is a poor aquifer with water flows restricted to local areas of open fractures. Groundwater inflows from these areas are considered unlikely to contribute significantly to the recharge of the sand aquifer.

Most inflow to the sand aquifer is likely to occur as surface infiltration. Infiltration is either directly through the topsoil above the sand or by overland flow across the slopes on the valley sides. Limited recharge may also occur through seepage from the man-made channel that traverses the Project Site.

Analysis of data from a pumping test supervised by SMEC in May 1998 indicated a moderate to high hydraulic conductivity (permeability) for the sand aquifer is 15 to 30 m/d, which is a typical range for fairly clean fine-coarse sands. The groundwater levels recovered rapidly following pumping.

There is no evidence of current groundwater extraction from the aquifer within the Project Site for agricultural or industrial purposes. Use is currently limited to drinking supplies for farm animals obtained from the lakes within the Project Site.

Groundwater levels indicate a very gentle hydraulic gradient towards the coast in a northeasterly direction through the site, with steeper lateral gradients from the flanking high ground into the central axis of the valley-fill deposit. Based on this gradient (0.00005 – 0.0001), a permeability of 20 – 30 m/d, and an average aquifer thickness of 9 – 10 m across the average 400 m width of the deposit, the total groundwater throughflow is estimated to be in the range of 4 – 12 m^3/d, or less than 0.1 per cent of the total catchment rainfall.

Recharge to the sand aquifer would occur primarily by direct infiltration of rainfall on the sands and the lakes and runoff from higher in the catchment, possibly with minor

additional inflows from the less permeable flanking rocks. The primary discharge mechanism would be evapotranspiration losses from the lakes and also directly from the shallow water table. The small residual amount would discharge from the deposit to the northeast as groundwater throughflow, to the Minnamurra River estuary and thence to the ocean beyond.

4.1.3.3 Water Quality

Data on groundwater quality within the Project Site is drawn from groundwater monitoring undertaken across the Project Site by Interaction Environmental Consultants (IEC) between December 1989 and February 1990. IEC established five shallow (3 m) monitoring bores around the periphery of Lake 1, just south of the Project Site, and Lake 2 on the Project Site (see **Figure 4.1**).

In addition, as a component of the pump testing undertaken in May 1998 (see Section 3.5.2.2), Illawarra Horticultural Services (IHS) undertook groundwater sampling during the testing procedure. The results of the sampling are presented in **Table 4.2**.

4.1.3.4 Recharge and Discharge

Groundwater recharge would occur primarily by direct infiltration of rainfall on the sand deposit and the lakes, and of runoff from the remainder of the catchment, which might flow onto the deposit. The sand deposit itself occupies about 0.5 km^2 of the total 3.3 km^2 catchment. Annual rainfall is 1 258 mm at nearby Kiama.

Additional smaller inflows may also occur from the flanking lithologies, but these are believed to be substantially less permeable than the sand deposit, so the volumes from this source would be minor.

The primary discharge mechanism would be evaporation and transpiration losses (as discussed above). The balance would discharge by throughflow along the deposit to the northeast, eventually into the Minnamurra River estuary and the ocean beyond.

The throughflow rate is small, but would be sufficient to maintain the good water quality in the sand deposit and the lakes.

The results indicate that the shallow groundwater in the vicinity of the Project Site has a low content of dissolved salts and metal ions and is mildly acidic to around neutral. The water was quite clean and would be suitable for horticultural and agricultural uses. Comparison with the Australian Drinking Water Guidelines (see **Table 4.2**) also indicates that the overall groundwater quality is good.

TABLE 4.2
Groundwater Quality – Pumping Bore

Test	Guideline Limits *	1129 #	1130 #	1131 #	1132 #
pH	6.5 to 8.5	7.1	7.1	7.5	7.5
Electrical Conductivity (EC) (uS/cm)		475	477	503	456
Total Dissolved Solids (TDS) (mg/L)	< 500	318	320	337	306
Turbidity (NTU)	5	5.0	4.1	3.8	3.0
Total Alkalinity (meq $CaCO_3$/L)		3.23	3.06	2.74	2.65
Total Hardness (mg $CaCO_3$/L)	60 to 200	162	158	150	143
Sodium (mg/L)	< 180	34			36
Magnesium (mg/L)		8.9	9.5	9.2	8.2
Potassium (mg/L)		3.7			3.8
Calcium (mg/L)		51	48	45	44
Silicon (mg/L)		5.0			4.5
Copper (mg/L)	< 1	<0.002			<0.002
Zinc (mg/L)	< 0.01	0.007			0.011
Iron (mg/L)	< 1	1.54			1.10
Manganese (mg/L)	< 0.1	0.083			0.021
Chloride (mg/L)	< 250	46.6			54.6
Nitrate (mg/L)	< 50	<0.5			<0.5
Sulphate (mg/L)	< 250	14.0			21.3

Source: Illawarra Horticultural Services (See Table 3.2, Part 4 of Volume 2)
* *Australian Drinking Water Guidelines - Summary*, 1996, National Health and Medical Research Council

1129 # Start of pumping trial
1130 # After 40 minutes pumping
1131 # After 1.5 hours pumping
1132 # After 2.5 hours pumping

4.1.4 Water Management

4.1.4.1 Introduction

The management of water on and around the Project Site would be important both throughout the operational life of the project and after extraction and rehabilitation is completed given the Project Site's low topographic relief and the bulk of it lies within

the 1 in 100 year flood level. This section considers the management of both surface water and groundwater together given their inter-relationship on site.

The principal objectives of the water management component of the overall site management are to ensure:

(i) water quality beyond the Project Site is not adversely affected;

(ii) site activities or structures do not adversely affect normal runoff and flooding activities;

(iii) groundwater levels are not lowered in the nearby SEPP 374a wetlands; and

(iv) a permanent acceptable drainage system is left in place after the site is rehabilitated.

The approach to water management has been compiled in conjunction with SMEC (Australia) Pty Ltd together with contributions from the Applicant given their extensive experience at the nearby Dunmore Sand Quarry.

The construction of the North Kiama Bypass would cause local modifications to the drainage during its construction and ongoing operation. The Applicant recognises the RTA has not yet addressed the issue of through-flow beneath the embankment of the Bypass. However, the Applicant is mindful of the need to ensure its plans for the site also accommodate the modifications that arise as a result of the construction of the Bypass.

4.1.4.2 Safeguards and Management Procedures

Safeguards and management procedures are required for two main scenarios, namely:

(i) management of waters originating from the catchment upstream of the Project Site; and

(ii) management of flood waters backing up from Rocklow Creek.

Management of Upslope Runoff

Runoff from upstream of the Project Site currently flows into Lake 1 and then towards the Princes Highway through an excavated Channel (**Figure 4.1**). It is understood this channel has been efficient in conveying most upstream flows with some minor breakouts occurring.

The Applicant would need to relocate this channel prior to the commencement of extraction within Stage 5. However, the exact alignment of the drain would need to tie

in with the drainage controls incorporated beneath the North Kiama Bypass. A long-term channel would be incorporated in the reconstructed landform. Detailed plans of the drainage structures would be prepared in conjunction with the RTA and presented in the appropriate Annual Environmental Management Report.

Management of Backed-up Floodwaters

The Applicant would operate the sand extraction activities in a manner that would remain vulnerable to flood waters backing up to the Project Site from Rocklow Creek and Minnamurra River. It has been the Applicant's experience at the Dunmore Sand Quarry that floodwater from the Minnamurra system has been observed to be far more turbid than and debris-laden than the dredge pond or fines return pond water. It would be inappropriate nor practical to isolate the entire Project Site from flood waters backing up from Rocklow Creek. Rather the Applicant would undertake the following safeguards and management procedures to minimise impact of flooding on site and the site's activities on surface water quality.

Isolation of the Fines Return Pond

The fine silts and clays placed in a fines return pond after sand processing could potentially enter and contribute to the deterioration of water quality in the Rocklow Creek Catchment during a flood event although it is more likely that the floodwaters would deteriorate the quality of the fines return pond water. The Applicant proposes to construct a perimeter bund around the active fines return pond to a height of approximately 3.6 m, AHD, i.e. the 1 in 100 year flood level (Lawson & Treloar, 1993). The orientation of the perimeter bund would reflect the geometry of the Bypass earthworks, the stage of production, and temporary/permanent drainage beneath the Bypass. This structure would effectively isolate the fines return pond from the backed-up flood waters. No other surface water bodies, including the active dredge pond, would need to be isolated from backed-up flood waters as they would have comparatively low concentrations of suspended solids.

Acceptance and Inspection Criteria for Backfill Materials

The Applicant recognises that well defined and enforced acceptance and inspection criteria for backfill materials would ensure that there are negligible changes in the water quality. This recognition is based on many years of experience at the Dunmore Sand Quarry where the Applicant has a rigorous inspection system in place that is well understood by the contractors delivering materials to the site. Details of the inspection procedures have previously been described in Section 2.4.4.

Fuel and Oil Management

All fuel and oil would be stored such that the top of the bund wall around the tanks would be above 3.6 m, AHD. The inside of the bund wall would be coated with concrete to prevent seepage from within the bund.

Flooding Contingency Plan

Based on their experience at the Dunmore Sand Quarry, the Applicant's staff are aware that a sufficient warning of an impending flood would be available to enable all excavation, dredging, backfilling and processing activities to cease. Activities would only be resumed once it is safe and appropriate to do so. The Applicant would ensure that all earthmoving equipment, motors and any other on-site equipment are moved to higher ground near the south-western corner of the Project Site.

Other Safeguards and Procedures

Bund Walls

The site access road bund wall would have appropriate piped sections to convey water beneath the structure to the on-site drainage channels. The exact location of the pipes would be determined prior to the construction of the bund wall.

Permeable Zones Adjacent to Bypass

The Applicant would ensure that at least two sections of the backfill placed adjacent to the embankment of the North Kiama Bypass would be formed with coarse inert aggregate rubble or equivalent materials to ensure those sections are sufficiently permeable to avoid any unacceptable build up of pore pressure beneath the North Kiama Bypass from the presence of the less permeable backfill materials – Pells Sullivan & Meynink – **Appendix 4.**

4.1.5 Assessment of Impacts

4.1.5.1 Criteria for Impact Assessment

It has previously been recorded in Section 4.1 that the calculated level of the 1 in 100 year flood event in the vicinity of the Project Site is 3.6 m, AHD. This level would remain the minimum level considered appropriate to raise land surfaces to achieve a flood-free status.

Other criteria to assess the level of impact relate to water quality. It is unlikely that the Applicant would ever need to discharge water from the Project Site as all discharges would be into the ponds created on site which would be in equilibrium with the

groundwater and / or protected by a perimeter bund wall. From a water quality perspective, an appropriate goal would be to ensure long term water quality is not adversely affected by the site's activities.

For the purpose of assessing impact on groundwater levels, it is considered appropriate that the draw downs in groundwater levels are negligible and within the natural variations in local groundwater levels; i.e. not to be lower than 0.2 m, AHD.

4.1.5.2 Surface Water

Occurrence

The maintenance of the existing channel across the Project Site and its realignment to direct upslope runoff around the active dredge pond would ensure downstream water quality is not adversely affected. Surface flows would not be adversely affected by the site access road bund wall and southern bund wall.

The Project Site would continue to be inundated by flood waters backing up Rocklow Creek and Minnamurra River. The impact of such events should be minor as there would be a slightly higher capacity than at present to contain water in the ponds themselves i.e. ground level. SMEC (1999) recorded the flood storage of the Project Site would increase by approximately 18 500 m^3 as a result of the excavation of the new lake.

Surface flows would be marginally affected by the above ground structures such as the site access road bund wall, southern bund wall and the bund protecting the active fines return pond. The degree of impact would be minor given the comparatively minor area that these structures cover on the floodplain, compared with, for example, the embankment for the North Kiama Bypass.

Water Quality

From a review of the existing water quality at the Dunmore Lakes Project Site and extensive water quality data from the existing Dunmore Sand Quarry, Illawarra Horticultural Services (1999) predict that there would be only local changes in the water quality in the dredge pond, particularly with turbidity. IHS expect minor variations in nutrient levels such as phosphorus and nitrate-nitrogen in response to both seasonal and environmental variations such as elevated levels during the warmer months of the year and reduced levels following heavy rainfall. Based on the extensive monitoring of variations of temperature and Total Dissolved Solids with depth at the Dunmore Sand Quarry, thermal stratification is not evident as a result of the existing dredging operations and this phenomena is subsequently not expected to occur as a result of the proposal. Ultimately the water would return at least generally to pre-extraction quality and most likely to a better overall quality.

4.1.5.3 Groundwater

Daily variations in groundwater levels are unlikely to occur unless there is substantial rainfall. This prediction is based on the Applicant's experience at the Dunmore Sand Quarry where levels in the dredge pond are monitored daily. Peter Dundon & Associates Pty Ltd in SMEC (1999) assessed that whilst groundwater levels are maintained at 0.5 m, AHD or higher, saline intrusion would not be expected to occur. Furthermore, changes in groundwater salinity are not expected as a result of increased evapotranspiration from the new lake as Peter Dundon & Associates considered existing rates of evapotranspiration would already be high.

Peter Dundon & Associates review the proposed practices of fines placement and landscape reconstruction using virgin excavated natural materials and coarse inert aggregate rubble and concluded:

(i) permeability would be re-established beneath the site as a result of the placement of sufficiently permeable backfill and the localised placement of the processing fines, i.e. leaving a substantial proportion of the pond walls and floor with little contact with the processing fines;

(ii) the fines will effectively isolate ongoing groundwater flow in the north-western section of the areas extracted adjacent and near to the basaltic basement which already creates a similar phenomenon.

4.1.6 Monitoring

The Applicant proposes to monitor water quality in the dredge pond initially at a range of depths on a quarterly basis increasing to six monthly. The principal parameters to be monitored are set out below.

pH	Phosphorus
Electrical Conductivity	Nitrogen
Total Dissolved Solids	Dissolved Oxygen
Sulfate	Turbidity

The Applicant would also undertake monthly measurements of the water level in the active dredge pond and the fines return pond. The extent of monitoring would be discussed and reviewed in conjunction with the Environment Protection Authority.

All monitoring results would be incorporated in each Annual Environmental Management Report together with details of any modifications of the monitoring program agreed with the Environment Protection Authority.

4.2 SOILS

4.2.1 Soil Occurrences

4.2.1.1 Soil Distribution and Characteristics

Information relating to the nature of soils across the Project Site has been drawn mainly from the extensive drilling program undertaken by the Applicant as a component of the resource assessment, a specific soil survey by Environmental & Earth Sciences (see Volume 2) and also by reference to the document "Soil Landscapes of the Kiama 1:100 000 Sheet" and accompanying map (Hazelton, 1992). According to this document, the Project Site and its surrounds incorporates elements of the Killalea, Bombo, Shellharbour and Mangrove Creek Soil Landscapes.

Much of the Project Site is situated within the Killalea Soil Landscape consisting of Alluvial Soils (Uc1.21). In general, these soils consist of dark brown to black fine sandy loam to clayey loam, rich in organic / peat material, and with an average thickness of 0.3 m and a maximum thickness of 1 m. Soil pH values tend to be acidic reflecting the presence of humic acids originating from the organic matter. Environmental & Earth Sciences (1999) recorded field soil pH measurements generally between 5.5 and 6.0. These soils exhibit a distinct boundary with the underlying light grey sands, are moderately to highly fertile and only slightly to moderately erodible.

The slightly elevated south-western corner of the Project Site is situated on the margin of the Bombo Soil Landscape. Soils in this landscape consist of Brown Podzolic Soils (Db1.11, Db1.21) and Red Podzolic Soils (Dr2.21). In general, the soil profile consists of a brownish black sandy loam topsoil overlying a reddish brown sandy clay subsoil. These soils are characteristically acidic, porous, of low to moderate fertility and slightly to moderately erodible.

The small hill directly north of Swamp Road comprises part of the Shellharbour Soil Landscape. Dominant soils in this landscape are Red Podzolic Soils (Dr4.41), Prairie Soils (Dy4.11) and Brown Krasnozems (Gn3.14). The soil profile consists of friable brownish black sandy loam topsoil overlying reddish brown to brown, strongly pedal sandy clay loam to heavy clay subsoil. These soils are generally acidic, of moderate fertility and highly erodible.

The final landscape element is the Mangrove Creek Soil Landscape, which is situated along the north-eastern boundary of the Project Site adjoining the Princes Highway. This landscape comprises much of the tidal flats and estuarine areas to the east and south of the Project Site and consists of organic-rich, dark brown to black silty to sandy loams. These soils are generally of low fertility and slightly to moderately erodible.

4.2.1.2 Acid Sulfate Soils

Introduction

An issue commonly required to be addressed in developments in or near estuarine areas along the NSW Coast is the presence of actual or potential acid sulfate soils. Acid sulfate soils exist where pyrite (iron sulfide) has formed in the soil as a result of bacterial processes whereby iron found in waterlogged saline sediments combines with sulphur produced by the decomposition of organic matter. Disturbance of acid sulfate soils may lead to the oxidation of the pyrite to form sulphuric acid which may adversely affect surrounding soil and surface water runoff.

The "Albion Park Acid Sulfate Soil Risk Map" (Soil Conservation Service of NSW, 1995), predicts the presence of acid sulfate soil materials within the soil profile on the Project Site. A survey undertaken as a component of the North Kiama Bypass Updated EIS (Connell Wagner, 1996) identified one soil sample at a depth of 0 – 0.5 m on the eastern section of the Project Site with a high acid sulfate soil potential. Given the extensive drilling undertaken by the Applicant which verified the virtual absence of the classic pyritic clays and the Applicant's experience at the Dunmore Sand Quarry, the Applicant commissioned Environmental & Earth Sciences to undertake a survey of sub-surface materials to ascertain the presence and/or extent of pyritic material within the sandy sediments.

Investigations

An investigation was undertaken by Environmental & Earth Sciences in accordance with the NSW EPA *Environmental Guidelines: Assessing and Managing Acid Sulfate Soils* (1995) and the Acid Sulfate Soil Management Advisory Committee (ASSMAC) *Acid Sulfate Soil Manual* (1998).

The investigation involved a field sampling program involving 15 cored holes of 1.8 m to 3.8 m depth (see **Figure 4.2**) and a laboratory program using various analytical methods referred to in the above reference documents. The principal parameters measured were.

- Net acid generating potential (NAGP).
- Total oxidisable sulfide (TOS).
- Peroxide oxidisable combined acidity and sulfate (POCAS).

Initial laboratory analyses were conducted on complete samples without any differentiation for particle size. Further analyses were undertaken to confirm the fine size fraction (< 75 μm) contains at times pyrite at a significant level, as has been observed at the Dunmore Sand Quarry. The further analyses were supplemented by a petrographic analysis undertaken by Applied Petrographic Services.

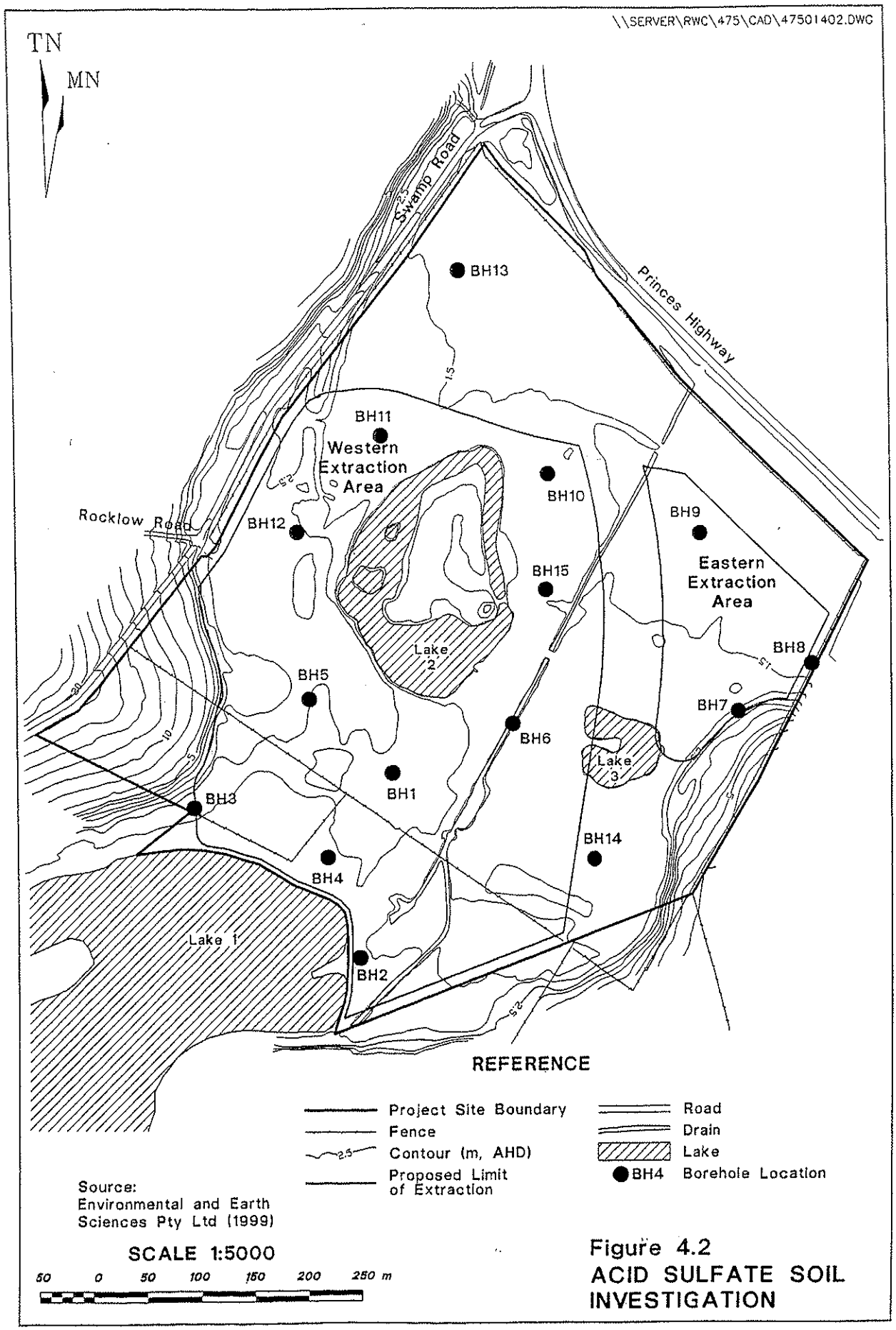


Figure 4.2
ACID SULFATE SOIL INVESTIGATION

Results

The analyitical results revealed the following.

- Concentrations of sulfides in samples from above the water table were negligible (<0.03%) indicating all soils on site do not have a significant potential to generate acid as a result of pyrite oxidation.

- Concentrations of sulfides in samples from below the water table at times were significant (up to 0.62%).

- Negligible concentrations of sulfides are present in the sand product size fraction (namely > 75 μm) and the bulk of sulfides were confirmed to be present in the fine fraction (<75 μm).

The most definitive assessment of the presence of pyritic material within the sand involved photomicrographs and a petrographic analysis undertaken by Applied Petrographic Services (Appendix D in Environmental & Earth Sciences (1999)). This analysis of two samples identified by Environmental & Earth Sciences as having the highest pyrite content revealed that most sand grains in these samples were coated with and partly bonded by fines which comprise clays, organic matter, pyrite, gypsum, feldspar and rock fragments. The pyrite occurs as "very fine grained isolate spherulites (less than 0.01 mm), or in small aggregates (estimated up to 1% present)". Some quartz grains contain very fine-grained pyrite inclusions, which in effect, are not free to react.

The petrographic and size fraction analyses confirmed the Applicant's understanding of the occurrence of pyritic particles in the Dunmore sand, namely, the fines (containing spherulitic pyrite) are loosely bound to the grains and easily removed by vigorous washing. The bulk of the pyrite is then collected as fines in the residue water from the processing plant.

4.2.1.3 Value for Rehabilitation

Both the topsoils and the subsoils across the Project Site are a valuable resource and would be recovered for rehabilitation purposes and for use in the preparation of blended soil products.

4.2.2 Soil Management

4.2.2.1 Soil Stockpiling

The Company proposes to minimise topsoil stockpiling on site. In the event soil needs to be stockpiled for more than 3 months it would be shaped with its maximum height no more than 3 m during the period of storage, unless used as a bund wall. The topsoil would be allowed to naturally regenerate in a similar manner to the existing proven practices at the Dunmore Sand Quarry.

4.2.2.2 Soil Erosion and Sediment Controls

The natural occurrence of the soils on the flat-lying sections of the Project Site and their moist sandy nature dictates that few soil erosion controls are required. The principal controls would relate to the management of sediment from unsealed roads and the areas being progressively backfilled. In this regard, the Applicant would ensure that the interim and final surfaces created by backfilling slope towards the site ponds.

4.2.2.3 Acid Sulfate Soils

The emphasis upon management of the identified pyritic sands that occur below the water table needs to be upon avoidance or prevention of acid generation through:

- thorough, vigorous washing in the processing plant;
- immediate placement of the fines to the fines return pond to ensure all pyritic spherulites are unable to oxidise; and
- maintenance of water levels generally within naturally occurring levels.

This practice has proved most effective at the existing Dunmore Sand Quarry over the past 10 years where no problems have been experienced with acid generation. In the unlikely event that acidification is identified, Environmental & Earth Sciences (1999) recommend the Applicant could:

(i) reprocess the sand;

(ii) use the sand for blending with other products; or

(iii) neutralising with agricultural lime.

4.2.3 Assessment of Impact

4.2.3.1 Soil Resources

The Applicant's approach to soil management is assessed to be acceptable given they are maximising the recovery of the soil for use in household landscape activities and the retention of sufficient soil for on-site uses, particularly site rehabilitation.

4.2.3.2 Acid Sulfate Soils

The comprehensive assessment of the occurrence of acid sulfate soils beneath the Project Site and the Applicant's proven management procedures would ensure that the occurrence of the acid sulfate soils beneath the water table would have no adverse environmental impact.

4.3 NOISE

4.3.1 Introduction

The sand extraction and landscape reconstruction proposal has been designed with best environmental management practices to ensure that all noise-generating activities are undertaken in a manner that achieves a noise level approaching compliance with the relevant EPA criteria. The design of noise attenuation measures and assessment of impact of the proposal has been undertaken in conjunction with Richard Heggie Associates Pty Ltd, Acoustical Consultants of Sydney.

This sub-section initially reviews the features of the local noise climate and how it will change during the construction and operation of the North Kiama Bypass. It also reviews the noise criteria that the EPA recommends when assessing the impact of noise-generating activities. The proposed design and operational safeguards are then outlined together with operational and management procedures that would be adopted throughout the life of the project. The predicted level of impact upon the surrounding noise climate is subsequently presented together with monitoring procedures proposed to demonstrate compliance with the recommended noise guidelines.

4.3.2 Background Noise Levels

The noise climate around the Project Site is influenced largely by:

- traffic on the Princes Highway and Swamp Road;
- extraction activities at the nearby Dunmore Hard Rock Quarry; and
- rural equipment and activities including stock and birds.

Noise levels around individual residences are also influenced by wind in the trees surrounding the residences, particularly when wind speeds exceed 1.5 m/s.

A background noise survey was conducted at three residential properties located around the Project Site. The noise levels at the three residential receivers is considered to be representative of the existing noise levels at the residential properties in the area. These unattended monitoring locations (DN-1, DN-2 and DN-3) are illustrated on **Figure 4.3** and described as follows:

DN-1 On the north-western boundary, setback a similar distance from Princes Highway as the residence.

DN-2 Near the large oak tree approximately 20 m from house.

DN-3 On the north-eastern boundary, adjacent to house.

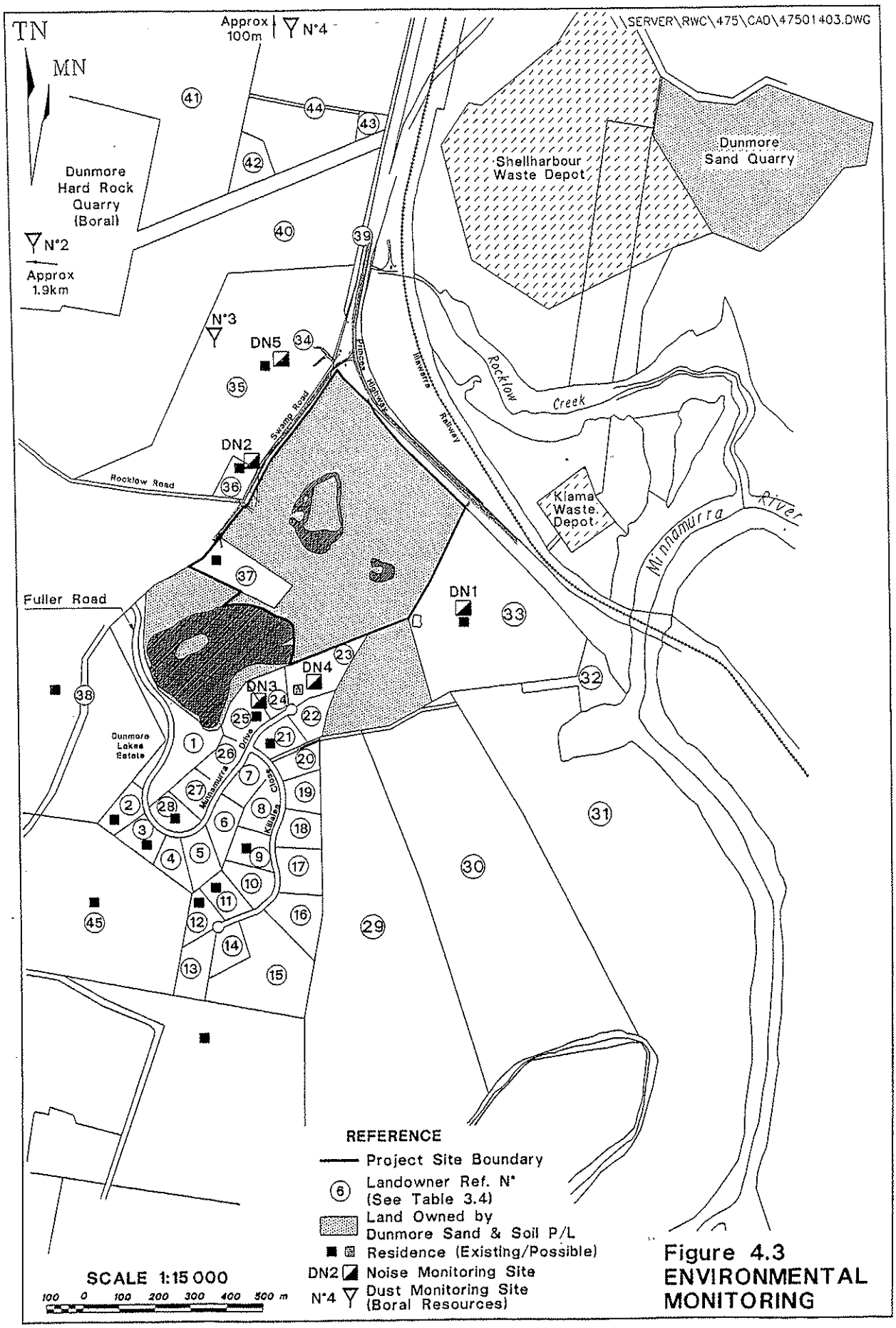


Figure 4.3
ENVIRONMENTAL MONITORING

Unattended measurements were conducted between 1600 hours on Thursday 10 September and 1500 hours on Wednesday 16 September 1998. Noise logging was conducted using three ARL noise loggers. The noise loggers were set to continuously record background statistical noise levels in consecutive 15 minute intervals. The results of the noise monitoring are summarised in **Table 4.3**.

Figure 4.3 also shows the locations of Sites DN-4 and DN-5 which are noise impact assessment locations referred to later in this sub-section.

TABLE 4.3
Measured $_{LA90\ (15\ minute)}$ Background Noise Levels

Location	Measured Lowest Repeated LA90 (15 minute) Noise Levels			
	0600 - 0700 hours	0700 - 1800 hours	1800 - 2000 hours	0600 - 2000 hours
DN-1	48 dB(A)	45 dB(A)	47 dB(A)	46 dB(A)
DN-2	41 dB(A)	39 dB(A)	42 dB(A)	40 dB(A)
DN-3	39 dB(A)	38 dB(A)	41 dB(A)	39 dB(A)
Note: The measured ambient noise levels between 0600 hours and 2000 hours are considered representative of the noise environment and are therefore used as a basis for determining noise assessment criteria				
Source: RHA (see Table 4.2.1, Part 7 of Volume 2)				

4.3.3 Noise Controls

4.3.3.1 Introduction

The Company proposes to incorporate a range of design and operational safeguards, and operational procedures into the proposal to ensure that the effectiveness of the noise controls are optimised throughout all stages of the project. The proposed safeguards have been selected based on their known effectiveness at other extractive industry sites. Wherever possible, the controls reflect best environmental management practice.

4.3.3.2 Construction Activities

The principal construction activities that would be undertaken to commence sand production on site would involve the following activities.

- Construction of the site access road and its associated bund wall.
- Extraction of sand and soil from north-western perimeter of western extraction area (in the vicinity of DN-2) and the southern portion of the eastern extraction area (in the vicinity of DN-1). These materials would be

used to form the access road bund wall. The excavated areas would be stabilised and backfilled.

- Levelling of the Processing Plant Site, (including building up with hard-standing quality fill) and erection and commissioning of the processing plant. This would also involve construction of the southern bund wall.

- Assembly and commissioning of the dredge and dredge line together with excavation of the dredge pond.

The principal noise controls adopted during bund wall construction would involve the use of earthmoving equipment that is well maintained and that incorporates standard muffler systems. An important component of the bund wall construction program would be the comparatively short duration, with each bund wall effectively constructed within a few weeks.

The erection of the processing plant and dredge would be comparatively quiet with activities involving the use of a crane and light fabrication equipment e.g. welders etc.

It is intended that soil removal and sand extraction will commence within the eastern extraction area during the initial construction phase.

4.3.3.3 On-site Operations

The principal controls to be adopted throughout on-site operations are as follows.

(i) All earthmoving equipment would be well maintained to achieve the sound power levels nominated in **Table 4.4**.

(ii) For short-term activities, strategically placed soil stockpiles would be used for noise attenuation.

(iii) Activities involving earthmoving equipment near the perimeter of the Project Site would not commence until after the commencement of other on-site operations.

(iv) The internal road network would be maintained to a high standard to minimise body rattle from trucks travelling across the site, particularly those delivering backfill materials. The site access road would also be sealed, including the section of road around the processing plant.

(v) The Applicant proposes to minimise the presence of unladen trucks on site through maximising the use of back-loading.

Apart from adopting these controls, the Applicant recognises that the noisier activities, particularly near the boundary would invariably occur for comparatively short periods. Particular care and common sense would be exercised at all times.

4.3.3.4 Transportation

The close proximity of the Project Site to the Princes Highway would enable all trucks to enter and leave the Project Site with a minimum of noise impact on the two closest residences adjacent to Swamp Road identified on **Figure 4.3**. The site entrance would be located midway between residences DN-2 and DN-5. The Applicant would ensure its own trucks would be well maintained to comply with standard EPA noise requirements for trucks and would discourage the use of any trucks with unacceptable noise characteristics. As is the current practice, the Applicant would discourage the use of air brakes when approaching the site entrance from the external or internal road network.

TABLE 4.4
Equipment Sound Power Levels

Proposed Equipment	Sound Power Level (dB(A))*
Bulldozer (Komatsu D65EK)	110
Front End Loader (Furakawa FL140)	107
Truck	112
Excavator (CAT EL300A)	113
Dredge	104
Surge Bin and Screen	102
Cyclone Tower	100
Water Pump	74
* Based upon measurement of identical equipment at the Dunmore Sand Quarry Source: RHA (See Appendix C, Part 7 of Volume 2)	

4.3.4 Assessment of Impacts

4.3.4.1 Introduction

The assessment of impact of the Applicant's proposal upon the local noise climate has been undertaken by Richard Heggie Associates Pty Ltd. The assessment relies upon the use of computer predictions of likely noise levels at non-project-related residences. For the purpose of noise impact assessment, the proposed activities have been assessed at these surrounding residential locations, namely DN-1, DN-2 and DN-4. The existing noise levels were monitored at or near these three representative locations.

The noise impact assessment has been undertaken for all likely operating activities throughout the life of the project. However, emphasis has been placed upon assessing those activities occurring at locations on the site that could be considered as the

potentially "worst-case" location occurring for a reasonable duration. In reality, many of these worst case activities would occur infrequently or for short periods of time.

The noise impact assessment is initially presented in relation to a number of individual activities on the site as it is likely that a single activity near the perimeter of either the eastern or western extraction area would generate the highest noise levels at the receivers. Each individual activity has been assessed using the components of equipment used in that activity. This is representative of the planned operations on site, as activities using multiple pieces of equipment would not have all items operating simultaneously. The individual activity has therefore been assessed using the worst component part of that activity.

The assessment concludes with an evaluation of two combined noise level scenarios where the noise levels from individual activities are combined together to give the cumulative noise level for these activities on the Project Site. These scenarios are more representative of longer term activities on the Project Site rather than the individual activities.

4.3.4.2 Guidelines for Assessing Noise Impact

The guidelines for assessing the impact of the proposal on the local noise climate are nominated by the EPA, whose principal aim is to minimise the occurrence of offensive noise in the community.

To be both effective and equitable, the EPA accepts that the determination and application of environmental noise control measures must take into account many factors including the:

- Variation in response between individuals to any noise;
- Inherently noisy characteristics of many activities;
- Circumstances under which the noise occurs;
- Technical and economic feasibility for noise control; and
- Social worth of the activity.

The EPA has developed a framework of environmental noise objectives to provide a basis for consistency, equity and effectiveness in the application of control measures whilst retaining the capacity for discretion in specific circumstances. The EPA's broad environmental noise objectives are two-fold (EPA Noise Control Manual (1994), page 19-1):

(i) that noise from any single source does not intrude greatly above the prevailing background noise level; and

(ii) that the background noise level does not exceed the level appropriate for the particular locality and land-use.

Social surveys have indicated that noise from any particular source would be audible to many people in the community when the L_{A10} level of the noise exceeds the background level (L_{A90}) by more than 5 dB(A) for a period of 15 minutes. The noise may have characteristics which are pleasant or unpleasant to the listener. It is similarly noted that most people become used to both regular and irregular noise.

The noise level goals for the site construction activities and the site operations are set out below. Details of how they have been determined are provided in Richard Heggie & Associates (1999).

Table 4.5 lists the proposed criteria for the construction phase of the subject proposal.

TABLE 4.5
Noise Design Goals for Construction Activities

Location (see Figure 3.7)	Minimum Repeatable L_{A90} level	L_{A10} Noise Assessment Criteria dB(A)	
		Construction	
		4 weeks	4 - 26 weeks
DN - 1	46	66	56
DN - 2	40	60	50
DN -4	39	59	49
Source: RHA (See Tables 4.2.1 and 5.1.4.1, Part 7 of Volume 2)			

Table 4.6 presents the L_{A10} noise assessment criteria for the proposed site operations throughout the life of the project after the allowed 26 week construction period.

TABLE 4.6
Noise Design Goals for Site Operations dB(A)

Location	Minimum Repeatable L_{A90} Level Existing	Predicted Repeatable L_{A90} Level with Bypass	L_{A10} Noise Assessment Criteria* dB(A)		
			Before	During **	After
DN - 1	46	51	51	56 - 66	56
DN - 2	40	45	45	50 - 60	50
DN - 4	39	44	44	49 - 59	49
* Before, during and after construction of the North Kiama Bypass ** Limit depends on duration of road construction activity and combined noise level. Source: RHA (See Tables 4.2.1 and 5.1.4.1, Part 7 of Volume 2)					

4.3.4.3 Construction Activities

The assessment of noise impact of construction activities concentrates upon the construction of the site access road bund wall and southern bund wall. Both bund walls would be constructed using the Komatsu D65EK bulldozer with some assistance from the Furakawa FL140 loader and the CAT EL300A excavator. Additionally the process of soil removal and sand extraction on the north-western perimeter of the western extraction area and the southern portion of the eastern extraction area are to occur during the initial construction phase. The use of the excavator during this activity has been assessed at the most affected sites, ie Residences DN-1 and DN-2.

Table 4.7 lists the likely distances between the site activity and the closest residences together with the predicted L_{A10} noise levels.

TABLE 4.7
Predicted Noise Levels During Construction Activities

Site	Distance (m)	Predicted L_{A10} Noise Levels dB(A)				L_{A10} Noise Assessment Criteria dB(A)	Compliance
		Bulldozer	F.E.L.	Excavator	MAX		
DN-1	600	34	35	48	48	66	Yes
DN-2	100	58	49	59	59	60	Yes
DN-4	500	35	34	-	35	59	Yes
Source: RHA (See Table 7.1.1, Part 7 of Volume 2)							

Based upon predicted levels, noise would be clearly audible during the construction activities. However, these levels are below the short-term noise design goal for construction activities.

For the information of readers, the predicted L_{A10} levels are for periods of 15 minutes. For an item of equipment that operates continuously in one location over the period of 15 minutes, the noise levels are likely to be relatively constant. For activities such as loading trucks and delivering of backfill materials however, the noise levels would vary, often considerably during the 15 minute period.

4.3.4.4 Perimeter Extraction Activities

The noise generated by the excavator removing the sand and soil from the perimeter of the eastern and western extraction areas and its subsequent removal by truck has been assessed at the closest point to each of the three nominated residences - see **Table 4.8**. The three components of the activity were assessed individually as the equipment will not operate simultaneously. These are:

(i) Extraction and stockpiling adjacent to the extraction area using an excavator.

(ii) Truck entering / exiting the extraction area.

(iii) Loading truck using the front-end loader.

Extraction of sand from the perimeter adjacent to Residence DN-4 and the perimeter of dredging sequence Stages 2 and 3 are scheduled to occur later in the project at a time coinciding with the construction and subsequent operation of the North Kiama Bypass.

TABLE 4.8
Predicted Noise Levels During Perimeter Extraction

Site	Distance (m)	Predicted L_{A10} Noise Levels dB(A)				L_{A10} Noise Assessment Criteria * dB(A)			Compliance		
		Excavator	Truck	F.E.L.	MAX	Before	During**	After	Before	During	After
DN-1	300	48	50	39	50	51	56 - 66	56	Yes	Yes	Yes
DN-2	80	59	46	49	59	45	50 - 60	50	No N/A +	Yes	No N/A +
DN-4	150	50	51	40	51	44	49 - 59	49	No N/A ***	Yes	Yes

* Before, during and after construction of the North Kiama Bypass
** Limit depends on duration of road construction activity and combined noise level
+ N/A - Not Applicable: Current scheduling indicates process will not occur in this period

Source: RHA (See Table 7.2.1 Part 7 of Volume 2)

4.3.4.5 Soil Removal (After Construction Period)

The Applicant proposes (after the construction period activity) to progressively remove the topsoil overlying the sand during two 2 week campaigns or equivalent each year. The soil would be pushed up into stockpiles with the Komatsu D65EK bulldozer and loaded into trucks (using the Furakawa FL140 front-end loader) for despatch from the site and/or placement on areas on site to be revegetated.

Soil removal from the area potentially most affecting Residences DN-2 and DN-4 are scheduled to occur later in the project at a time coinciding with the construction and operation of the North Kiama Bypass. Soil removal from the eastern extraction area is currently scheduled to dominantly occur during the initial site construction phase as also is the soil on the north-western perimeter between the access road bund wall and Swamp Road closest to DN-2.

Table 4.9 lists the predicted noise levels during the soil removal activities at the three nearby residences from the component items of equipment associated with the activity.

TABLE 4.9
Predicted Noise Levels During Soil Removal

Site	Distance (m)	Predicted Noise Levels dB(A)				L_{A10} Noise Assessment Criteria * dB(A)			Compliance		
		Bulldozer	Truck	F.E.L.	MAX	Before	During **	After	Before	During	After
DN-1	250	46	50	39	50	51	56 - 66	56	Yes	Yes	Yes
DN-2	170	50	46	49	50	45	50 - 60	50	No N/A+	Yes	Yes
DN-4	200	49	51	40	51	44	49 - 59	49	No N/A+	Yes	Yes

* Before, during and after construction of the North Kiama Bypass
** Limit depends on duration of road construction activity and combined noise level
+ N/A - Not applicable: Current scheduling indicates process will Not occur in this period
Source: RHA (See Table 7.2.1 Part 7 of Volume 2)

4.3.4.6 Dredging

The Applicant proposes to relocate its existing dredge (**Plate 1.1**) to extract the sand from the areas nominated on **Figure 2.3**. Dredging would be an almost continuous operation through most operational days. **Table 4.10** lists the predicted noise levels attributable to the dredge at the three nominated residences.

TABLE 4.10
Predicted Noise Levels – Dredging Operations

Site	Distance (m)	Predicted Noise Levels (dB(A))	L_{A10} Noise Assessment Criteria* dB(A)			Compliance		
			Before	During **	After	Before	During	After
DN-1	320	40	51	56 - 66	56	Yes	Yes	Yes
DN-2	190	43	45	50 - 60	50	Yes	Yes	Yes
DN-4	280	41	44	49 - 59	49	Yes	Yes	Yes

* Before, during and after construction of the North Kiama Bypass
** Limit depends on duration of road construction activity and combined noise level
Source: RHA (See Table 7.2.1, Part 7 of Volume 2)

4.3.4.7 Processing

The processing plant would operate whenever the dredge is operational. **Table 4.11** lists the predicted noise levels at the surrounding residences that would be attributable to the operation of the processing plant. For the purpose of noise impact assessment, it has been assumed that one front-end loader is operational and two trucks are moving along the road around the stockpiles. All noise sources would be shielded from surrounding residences during product loading operations.

TABLE 4.11
Predicted Noise Levels – Processing Operations

Site	Distance (m)	Predicted Noise Levels (dB(A))			L_{A10} Noise Assessment Criteria * dB(A)			Compliance		
		Fixed Plant	Mobile	Total	Before	During **	After	Before	During	After
DN-1	600	32	34	36	51	56 - 66	56	Yes	Yes	Yes
DN-2	175	43	42	46	45	50 - 60	50	No	Yes	Yes
DN-4	450	31	35	36	44	49 - 59	49	Yes	Yes	Yes

* Before, during and after construction of the North Kiama Bypass

** Limit depends on duration of road construction activity and combined noise level

Source: RHA (See Table 7.2.1, Part 7 of Volume 2)

4.3.4.8 Landscape Reconstruction

The Applicant's program to reconstruct the landform around both extraction areas would involve the delivery of backfill materials by truck and pushing/shaping the material with the Komatsu D65EK bulldozer. **Table 4.12** lists the predicted noise levels attributable to these activities being conducted near the closest point to the three nominated residences. The assessment is based upon two separate components, a bulldozer pushing material at a level of 4.0 m AHD and a truck unloading.

Landscape reconstruction in the areas most affecting DN-2 and DN-4 are scheduled to occur later in the project at a time coinciding with the construction and subsequent operation of the North Kiama Bypass. Some reconstruction is also envisaged near DN-2 during the construction phase.

TABLE 4.12
Predicted Noise Levels – Landscape Reconstruction

Site	Distance (m)	Predicted Noise Levels (dB(A))			L_{A10} Noise Assessment Criteria * dB(A)			Compliance		
		Bulldozer	Truck	MAX	Before	During **	After	Before	During	After
DN-1	225	46	50	50	51	56 - 66	56	Yes	Yes	Yes
DN-2	140	50	46	50	45	50 - 60	50	No N/A+	Yes	Yes
DN-4	200	49	51	51	44	49 - 59	49	No N/A+	Yes	Yes

* Before, during and after construction of the North Kiama Bypass

** Limit depends on duration of road construction activity and combined noise level

+ N/A - Not Applicable: Current scheduling indicates process will not occur in this period

Source: RHA (See Table 7.2.1 Part 7 of Volume 2)

4.3.4.9 Combined Noise Levels

Throughout the life of the project, there would be some activities that would be conducted simultaneously. This sub-section reviews the likely noise levels attributable to two scenarios that are typical of activities that could be experienced at surrounding residences.

Scenario 1:

		DN-1	DN-2	DN-4
A	Dredge Operational (Stage 4)	430 m	310 m	500 m
B	Processing Plant Operational	600 m	190 m	480 m
C	Landscape Reconstruction (Stage 2)	570 m	250 m	630 m
D	Product Truck on Site Access Road	630 m	120 m	600 m

Scenario 2:

		DN-1	DN-2	DN-4
A	Dredge Operational (Stage 6)	410 m	410 m	280 m
B	Processing Plant Operational	600 m	190 m	480 m
C	Landscape Reconstruction (Stage 4)	300 m	470 m	340 m
D	Product Truck on Site Access Road	630 m	120 m	600 m

Table 4.13 presents the predicted noise levels for operation Scenarios 1 and 2.

TABLE 4.13
Predicted Combined Noise Levels

Site	L_{A10} Noise Design Goal * dB(A)			Scenario 1	Compliance			Scenario 2	Compliance		
	Before	During **	After		Before	During	After		Before	During	After
DN-1	51	56 - 66	56	40	Yes	Yes	Yes	45	Yes	Yes	Yes
DN-2	45	50 - 60	50	48	No N/A+	Yes	Yes	46	No N/A+	Yes	Yes
DN-4	44	49 - 59	49	40	Yes	Yes	Yes	45	Yes	Yes	No

* Before, during and after construction of the North Kiama Bypass
** Limit depends on duration of road construction activity and combined noise level
+ N/A - Not Applicable: Current scheduling indicates process will not occur in this period

Source: RHA (See Table 7.3.1, Part 7 of Volume 2)

It is anticipated that neither of Scenario 1 nor Scenario 2 will occur prior to the construction and subsequent operation of the North Kiama Bypass.

4.3.4.10 Cumulative Impacts

The increased level of activity associated with the construction of the North Kiama Bypass would be relied upon to effectively mask noise levels from various activities, albeit for comparatively short periods of time. The Applicant would work closely with the RTA to ensure the cumulative noise impacts of all operations remain within specified criteria. Comprehensive monitoring throughout this period would aid in the scheduling of activities to ensure criteria are satisfied.

4.3.4.11 Conclusion

The assessment of individual activities near the boundary of the Project Site has provided an appreciation of the potentially greatest level of noise impact throughout the life of the operation. These activities could at times generate noise levels greater than the recommended assessment criteria, that is in the absence of the construction or on-going operation of the North Kiama Bypass. It is therefore envisaged that as the Applicant has scheduled a number of its activities to coincide with the construction of the Bypass and its subsequent use, the proposal's potential impact on the local noise climate would be minimal.

Compliance to noise design goals is predicted to be achieved on all cases analysed except for one case of a 1 dB(A) excess. The Applicant intends to maintain their dialogue with local residents to ensure every feasible response is made to any noise problems or concerns.

The assessment of both the individual operational activities and the combined activity scenarios has provided the basis upon which it can be assessed that under normal operations, EPA guidelines would generally be satisfied.

4.3.4.12 Monitoring

The Applicant would monitor the noise levels generated by its activities at critical stages of site development and operations. The Applicant intends to cooperate closely with the RTA to coordinate its activities to minimise noise impacts. Such an approach would involve joint monitoring for the period of construction and immediately following the opening of the North Kiama Bypass, particularly to ensure the cumulative impacts of both activities is acceptable.

Details of noise monitoring would be presented in each Annual Environmental Management Report and would reflect the outcomes of discussions with the EPA and RTA. The results of all noise monitoring would be presented in each Annual Environmental Management Report. The extent of monitoring required would be reviewed annually in conjunction with the EPA.

4.4 AIR QUALITY

4.4.1 Introduction

The assessment of air quality matters relating to the proposed operations is based largely upon the Applicant's experience at the Dunmore Sand Quarry.

4.4.2 Existing Air Quality

The Project Site is located on a rural coastal area which generally experiences good air quality. In the vicinity of the Project Site, air quality is influenced primarily by dust generated at the nearby Dunmore Hard Rock Quarry, the nearby waste disposal depots operated by Shellharbour and Kiama Councils, and also currently by earthmoving activities on the adjoining Dunmore Lakes Estate rural-residential development. Vehicle movements along unsealed roads, vehicle exhausts from the surrounding road network, salt spray, and exhausts from mobile equipment on the nearby quarry and waste disposal depots also influence air quality to a limited degree.

Monitoring of dust deposition is undertaken on a monthly basis at the nearby Dunmore Hard Rock Quarry. Deposited dust monitoring results for the period January 1997 to February 1998 from three deposited dust gauges located north-west of the Project Site are presented in **Table 4.14**.

The data presented in **Table 4.14** indicates that, on the whole, the levels of dust deposition in the vicinity of the Dunmore Hard Rock Quarry are moderate and generally well within the EPA's amenity criteria. For comparative purposes, the EPA identifies that amenity from dust fallout generally begins to diminish above levels of 4 to 5 g/m^2/month. Although there is no quantitative background data on airborne dust levels in the proximity of the Project Site, airborne dust levels are likely to be in the range of 25 to 50 $\mu g/m^3$.

4.4.3 Potential Sources of Contaminants

The principal potential sources of air contaminants on the Project Site would be:

(i) dust generated by vehicles travelling on the Project Site beyond the site access road;

(ii) occasional dust from product stockpiles;

(iii) fumes generated by the dredge, mobile equipment and vehicles on site; and

(iv) exposed surfaces during the backfilling process.

TABLE 4.14
Deposited Dust Levels

Site Number*	No. 2		No. 3		No. 4	
Parameters Measured	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash
SAMPLING PERIOD						
9.1.97 to 10.2.97	2.00	1.12	3.14	2.00	3.30	1.87
10.2.97 to 10.3.97	3.86	2.34	3.81	2.42	4.96	2.73
10.3.97 to 7.4.97	2.05	1.43	4.59	2.89	2.45	1.70
7.4.97 to 9.5.97	1.96	0.86	2.12	1.32	1.82	1.12
9.5.97 to 10.6.97	5.68	4.61	3.50	2.63	2.59	1.74
10.6.97 to 10.7.97	3.87	2.89	3.51	2.41	4.65	3.40
10.7.97 to 8.8.97	0.74	0.36	1.17	0.87	1.22	0.94
8.8.97 to 9.9.97	0.97	0.58	2.17	1.52	1.45	0.97
9.9.97 to 9.10.97	3.73	2.67	3.72	2.18	3.64	2.19
9.10.97 to 7.11.97	2.31	1.47	2.23	1.63	1.94	1.38
7.11.97 to 9.12.97	1.87	1.06	5.88	5.25	3.25	2.07
9.12.97 to 8.1.98	3.03	1.61	-	-	3.20	1.57
8.1.98 to 6.2.98	2.49	1.47	6.45	4.04	12.44	3.94

Units = g/m^2/month * See Figure 4.3 for location

Source: Boral Resources

Sand washing activities would not be a source of air contaminants given the materials remain wet or moist at all times.

4.4.4 Safeguards and Management Procedures

The Company proposes to adopt the following safeguards and management procedures to control air quality on the site.

(i) The site access road would be sealed from the site entrance to the processing plant and stockpile area.

(ii) All vehicle speeds on site are maintained at low levels.

(iii) A sprinkler system if found necessary would be used to water the active areas in the vicinity of washed sand stockpiles during periods of dry windy weather.

(iv) All exhausts on equipment and vehicles used on site are properly maintained and are directed away from the ground so as not to stir up dust.

(v) The area of backfill placement would be kept as small as practical to limit the areas of dust generation.

(vi) The bulk of the stockpiled products contain a moderate amount of moisture (5 per cent to 7 per cent) and as such do not pose problems with respect to air quality.

It is noted that the site of the processing plant is shielded immediately to the south-west by a low hill structure and bund walls to 4 m in height on both sides running off that hill.

4.4.5 Assessment of Impacts

4.4.5.1 Guidelines for Impact Assessment

Guidelines for impact assessment relate to both dust and exhaust emissions. With respect to dust, the principal criteria would relate to dust deposition rather than airborne dust. The bulk of the dust generated on the Project Site would be of a size capable of "falling out" of the atmosphere and depositing on surfaces, e.g. window sills, parked cars, washing etc.

The EPA adopts an amenity-based guideline for dust deposition that involves restricting the increase in the mean annual dust deposition rate to no more than 2 g/m^2/month above existing levels, provided the existing levels are not already high. The levels recorded by Boral Resources indicate air quality is good and it is therefore appropriate to adopt the 2 g/m^2/month criterion.

4.4.5.2 Impact Assessment

It is assessed that with the implementation of the above safeguards and procedures, the impact of the Company's operation on air quality would be acceptable.

4.4.6 Monitoring

Given the proposed safeguards and procedures to be implemented, it is considered unnecessary to undertake any monitoring of deposited dust levels. However, in the unlikely event dust becomes an operational issue, monitoring would be undertaken for a period agreed with the EPA.

PART B: THE BIOLOGICAL ENVIRONMENT

4.5 ECOLOGY

4.5.1 Flora

4.5.1.1 Introduction

A flora survey of the Project Site was conducted by Kevin Mills & Associates Pty Limited (KMA) on 8 April 1998. The objectives of the survey were to:

(i) prepare a plant species list and describe the plant communities across the Project Site;

(ii) identify any threatened plant species (*Threatened Species Conservation Act 1995*) occurring on the Project Site;

(iii) describe the impact of the proposed development on flora;

(iv) apply the "eight part test" in section 5A of the *Environmental Planning and Assessment Act 1979*, as amended, to determine whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats; and

(v) make recommendations to mitigate the impact of the proposed development on flora.

The Project Site is considered typical of cleared dairy country in the lower Minnamurra River Catchment. The site has been used for grazing purposes in the past and hence has been extensively cleared of native vegetation. Scattered stands of Swamp Oak (*Casuarina glauca*) exist around the lakes and small islands which are a result of previous sand extraction and rehabilitation programs. An extensive Swamp Oak Forest within the Princes Highway road reserve and beyond borders the north-eastern boundary of the Project Site i.e. within SEPP Wetland 374a (see **Figure 1.2**).

Although the flora survey undertaken by KMA is the first comprehensive floristic study of the Project Site, numerous other flora and fauna studies have been conducted in the vicinity of the Project Site and include:

- a flora and fauna study conducted by J.A. Broadbent in 1990 for the North Kiama Bypass EIS;

- a supplementary flora and fauna assessment was undertaken in 1991 by Quality Environmental Management Pty Limited (QEM) for the North Kiama Bypass EIS. This study assessed the impacts of

the proposed Bypass upon the estuarine and floodplain wetlands of Terragong Swamp and the environment of Tabbagong Forest;

- a subsequent fauna assessment and 'seven point test' for significance of impact was undertaken by QEM in 1993;
- a flora and fauna survey was conducted by Mount King Ecological Surveys in 1993 for the Realignment of the Princes Highway, Oak Flats to Dunmore EIS. This survey concentrated on four vegetation communities along the proposed route and included the Swamp Oak Forest which borders the north-eastern boundary of the Project Site; and
- an ecological assessment of the Dunmore Swamp Oak Forest was also conducted by Chris J. Chafer & Associates in 1995.

4.5.1.2 Survey Methodology

The flora survey methodology essentially involved describing the vegetation across the Project Site including producing a comprehensive list of native flora.

The survey was undertaken on 8 April 1998 during which the entire Project Site was thoroughly investigated on foot together with the northern edge of Lake 1. All native plant species observed were recorded, as well as the most prominent and most common introduced plant species. The survey also included a search for threatened species listed on the *Threatened Species Conservation Act 1995*. The vegetation communities were classified according to the classification system developed by Walker and Hopkins (1984).

4.5.1.3 Results

As indicated above, most of the native vegetation across the Project Site has been cleared in the past for agricultural purposes and the land now largely supports a grassland dominated by introduced pasture species. Only 15 local native plant species were recorded on the Project Site. In contrast, 26 introduced plant species were recorded and are far more abundant. A full list of the species recorded is presented in KMA (1999).

The grassland, which is grazed, is mainly composed of introduced pasture species such as Kikuyu Grass *Pennisetum clandestinum,* Narrow-leaf Carpet Grass *Axanopus affinis* and Paspalum *Paspalum dilatatum.* Couch Grass *Cynodon dactylon*, a native grass, is also common. Weeds such as Spear Thistle *Cirsium vulgare,* Ribbed Plantain *Plantago lanceolata,* Curled Dock *Rumex crispus*, Tall Fleabane *Conyza albida*, Fireweed *Senecio madagascariensis,* Paddy's Lucerne *Sida rhombifolia* and Blackberry *Rubus fruticosus* are also common in the grassland.

The site also contains clumps of Lantana *Lantana camara*, sparsely scattered trees and occasional patches of trees. The most prominent tree species is Swamp Oak *Casuarina glauca*, some of which occur naturally and some of which were planted during revegetation programs, singly and in clumps. The only other naturally occurring tree and shrub species on the site include a small number of Bangalay *Eucalyptus botryoides*, Coast Wattle *Acacia sophorae* and Maiden's Wattle *Acacia maidenii*.

The other trees on the Project Site appear to have been planted. Most are exotic trees and native trees that do not naturally occur in the district. The species include Camphor Laurel *Cinnamomum camphora*, Coral Tree *Erythrina x sykesii*, Silky Oak Grevillea *Grevillea robusta*, Weeping Willow *Salix babylonica*, Lemon-scented Gum *Eucalyptus citriodora*, Spotted Gum *Eucalyptus maculata*, Bracelet Honey-myrtle *Melaleuca armillaris* and Brush Box *Lophostemon confertus*.

The vegetation in and around the ponds is also a mixture of native and introduced plant species. Swamp Oak *Casuarina glauca* is the most prominent native tree, of which some are naturally occurring whilst others have been planted during rehabilitation programs. Native plants such as Cumbungi *Typha orientalis*, Tall Sedge *Carex appressa* and Common Rush *Juncus usitatus* also occur in and around the ponds and in other moist areas, such as along drains and on low lying ground. Introduced wetland plants such as Pennywort *Hydrocotyle bonariensis*, Bush Starwort *Aster subulatus* and Umbrella Sedge *Cyperus eragrostis* also occur in these locations.

Conservation Significance

All of the native plant species recorded on the Project Site are common and widespread in the Shellharbour district. No rare or threatened plant species were recorded, nor any regionally significant plant species.

The vegetation on the Project Site, a grassland dominated by introduced species with scattered trees, is not a significant plant community. It is common and widespread in the district and across New South Wales. Because of its highly disturbed character and unnatural floristic composition, this vegetation community has little conservation significance. However, the wetland vegetation in and around Lake 1 has much greater conservation significance. Lake 1 is also one of only a small number of permanent freshwater wetlands in the Shellharbour district and provides good habitat for flora and fauna. As discussed in Section 3.13, this lake was created by sand extraction in the late 1970's.

4.5.1.4 Safeguards

Throughout the development and operation of Stage 1 of the Dunmore Lakes sand extraction proposal, the Applicant would implement the following safeguards and strategies to minimise any adverse impacts upon the native flora of the Project Site and surrounding area.

(i) Stripping of the grass and topsoil would be undertaken progressively to minimise the area of exposed soil. The area stripped at any one time would be limited to manageable extraction stages.

(ii) Clearing of Swamp Oak trees would be minimised and confined mainly along the drain on the site. Clearing would be undertaken progressively during the relevant stages. This species would be also used in the rehabilitation and landscaping of the Project Site.

(iii) Short-term rehabilitation goals would be to stabilise all completed landscape reconstruction activities.

(iv) Progressive rehabilitation and landscaping of the dredging lake foreshores and adjoining land would be undertaken to create a new 7 ha lake with some wetland shallows and a bird-nesting island.

(v) The Applicant would develop a series of habitats that would compliment the surrounding native plant communities including the nearby SEPP 14 wetlands.

(vi) Establishment of wetland species and fringing vegetation communities, many of which have been identified to be suited to the conditions surrounding the lakes developed within the Dunmore Sand Quarry. The Applicant would use native trees and shrubs as an adjunct to the wetland species around the foreshores of the final lake.

(vii) Wherever possible, the Applicant would source as much propagating material from local populations.

(viii) Management of weeds and ongoing maintenance would be undertaken across the Project Site on an as-needs basis.

(ix) The Applicant would ensure that traffic through rehabilitated areas is minimised and confined to defined tracks as far as is practicable.

(x) The Applicant may exclude grazing stock permanently from some rehabilitated areas and allow grazing once other areas are sufficiently stabilised (e.g. adjacent to rural-residential lots). This would be controlled through fencing.

(xi) Groundwater monitoring would be undertaken to ensure that the sand extraction operations do not adversely impact the Swamp Oak forest to the north-east of the Project Site within SEPP Wetland 374a.

Rehabilitation procedures are more fully described in Section 2.12.

4.5.1.5 Assessment of Impacts

The development and operation of the Dunmore Lakes sand extraction proposal would involve the progressive clearing of approximately 19 ha of land comprising largely grazed grassland dominated by introduced pasture species with scattered and occasional patches of trees. Kevin Mills & Associates Pty Ltd (1999) have determined that the removal of this vegetation community is not ecologically significant. The community is very unnatural / highly disturbed and composed of introduced flora and native plants that are common and widespread in the district and region. The vegetation community across the Project Site does not have a high conservation value. No SEPP 14 Wetlands occur on the Project Site.

No threatened flora species have been recorded on the Project Site. However, the potential impact of the proposal on threatened flora species has been assessed in detail by KMA (1999) in the context of the "Eight-Part Test" requirements of Section 5A of the Environmental Planning and Assessment Act 1979. **Table 4.15** provides a brief summary of the outcome of the Eight-Part Test as applied to both threatened flora and fauna.

The retention of groundwater levels similar to natural levels (see Section 4.1.5.2) would ensure that the health of the vegetation within the SEPP Wetland 374a north-east of the Project Site is not compromised by the proposed sand extraction on the Project Site.

4.5.2 Fauna

4.5.2.1 Introduction

A fauna survey of the Project Site and in the vicinity of Stages 2 and 3 (**Figure 1.3**) was undertaken in March and April 1998 by Dr Leong Lim and Dr Arthur White of Countrywide Ecological Service (CES).

The fauna survey was undertaken to detect and identify the fauna species inhabiting or using the Project Site and to assess the likely impact of the proposal on those fauna species, especially threatened species as listed on Schedule 1 (Endangered) and Schedule 2 (Vulnerable) of the *Threatened Species Conservation Act 1995.* Particular attention was focussed on the occurrence of the Green and Golden Bell Frog *Litoria aurea* and / or suitable habitat for this species on the Project Site. CES have also assessed the need, or otherwise, for a Species Impact Statement (SIS) and also a Koala Habitat Management Plan under State Environmental Planning Policy No. 44.

The following sub-sections provide a summary of the survey findings. A full copy of the fauna survey report is presented in CES (1999). As indicated in Section 4.5.1.1, numerous other flora and fauna studies have been conducted in the vicinity of the Project Site. Those studies which are particularly relevant for the Project Site and are therefore also referenced in the following sub-sections are Mount King Ecological Surveys (1993) and Chris J. Chafer & Associates (1995).

TABLE 4.15
Eight-Part Test of Significance - Flora and Fauna

Test Component	Response Relating to the Proposal
(a) Whether the life cycle of a threatened species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.	No threatened species of flora or fauna have been recorded across the Project Site with the exception of the Large Bent-wing Bat. Given the small scale of the proposal and the known habitat of this species, the proposal is unlikely to disrupt any local viable population.
(b) Whether the life cycle of an endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.	No endangered populations have been declared in the City of Shellharbour under the TSC Act.
(c) Whether a significant area of known habitat of a threatened species, population or ecological community in the region is to be modified or removed.	No significant area of known habitat will be modified or removed in the region.
(d) Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.	No. There are no areas of known threatened species habitat across the Project Site.
(e) Whether critical habitat will be affected.	No critical habitat has been declared in the City of Shellharbour.
(f) Whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or similar protected areas in the region).	No.
(g) Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.	No. Sand extraction is not a threatening process under the TSC Act.
(h) Whether any threatened species, population or ecological community is at the limit of its known distribution.	The Large Bent-wing Bat would not be at the limit of its geographic range at Dunmore.
Source: Kevin Mills & Associates Pty Ltd (1998) (See Part 6 of Volume 2)	

4.5.2.2 Survey Methodology

Several methods were used to detect and identify fauna present across the Project Site. Initially, CES prepared a checklist of fauna known from the general area using the NPWS Atlas of NSW Wildlife. A preliminary assessment suggested that while several endangered and threatened species were known from the broader area, most would be unlikely to occur on the Project Site due to the lack of suitable habitat. Only the Green and Golden Bell Frog could not be discounted, although some other species may also use the Project Site.

The main survey was conducted on 12 March 1998 and a follow-up listening watch and spotlight search was carried out on the evening of 3 April 1998.

During the daylight hours, a hand search of fallen timber, logs, sheets of iron and other solid ground cover was carried out. This was done in order to locate sheltering reptiles or frogs. All animals found were captured, identified and immediately released. Also during daylight hours, a survey of the local bird fauna was carried out using binoculars. No trapping was carried out for birds, reptiles or frogs.

Twenty hair sampling tubes were laid across the Project Site to assess the small mammal population of the area. These were collected on 3 April 1998 after an exposure of over three weeks and the hairs recovered from them analysed.

Predator scats were also collected across the Project Site for later analysis of hair and bone samples.

After dusk and through the evening, the Project Site and the neighbouring part of the Dunmore Lakes Estate were searched using spotlights to locate nocturnal animals. Concurrently, ultra-sonic bat recorders (ANABAT V) were used to detect insectivorous bats. No suitable site was available for the deployment of harp traps or mist nets.

4.5.2.3 Results

Regional Fauna

A checklist of fauna known from the region suggests the following.

(i) There are probably up to 18 species of frogs, including the endangered Green and Golden Bell Frog, the vulnerable Giant Burrowing Frog and Red-crowned Toadlet in the region.

(ii) Up to 214 bird species have been recorded in the region reflecting the diversity of habitat in the region. They include 6 endangered and 28 vulnerable species.

(iii) Some 60 species of mammals have been recorded in the region, including a rich and diverse bat fauna. Endangered species include the

Smoky Mouse and the Eastern Quoll. There are also at least 11 species of exotic mammals recorded in the region.

(iv) Of the 24 reptiles on the checklist, none are threatened or are of regional significance. There might still have been some confusion with *Varanus rosenbergi* which could be found in the region and may have been recorded as *Varanus varius* in earlier times.

(v) The Large Dragonfly, *Petalura gigantea*, has also been recorded in the region.

Project Site Fauna

In general, the fauna across the Project Site was not very diverse or abundant due largely to the lack of suitable habitat.

Reptiles and Amphibians

No frogs were heard or found on the Project Site, nor were any secure breeding sites noted. However, potential foraging habitat for the Green and Golden Bell Frog existed alongside the open drain that traverses the Project Site. Only two lizard species were found, namely Grass Skink *Lampropholis guichenoit* and Delicate Skink *Lampropholis delicata*. Both of these species are very common and adapt well to altered environments. Many more reptile and amphibian species were recorded by Mount King Ecological Surveys (1993) and Chris J. Chafer & Associates (1995) in the vicinity of the Swamp Oak Forest to the north-east of the Project site.

Terrestrial and Arboreal Mammals

No arboreal mammals were observed on or within the vicinity of the Project Site. The only two species observed were exotic predators, namely Feral Cat and European Red Fox. The Echidna was also identified from scat and hair tube analysis.

Bats

Flying foxes were observed flying over the Project Site during the survey and insectivorous bats were also recorded at the lake on the Project Site. Species noted were the Grey-headed Flying Fox *Pteropos poliocephalus* and the Large (Common) Bent-wing Bat *Miniopterus schreibersii*. Only a few bat calls, less than 20 over a 90 minute period were recorded over the Project Site including the vulnerable Large Bent-wing Bat and Eastern Broad-nosed Bat.

Birds

Thirty four species of birds were observed in the vicinity of the Project Site including five exotic species.

Invertebrates

No Large Dragonfly *Petalura gigantea* was observed on the Project Site or immediate environs.

Threatened Fauna

No threatened fauna was found on the Project Site. The highly modified nature of the Project Site also makes it unsuitable for Green and Golden Bell Frogs. While this species is known to exploit certain types of disturbed habitats, there are two major factors that will limit or prevent Bell Frogs from using the Project Site, namely the lack of solid ground cover and the absence of over-wintering shelter sites and also the presence of the introduced Plague Minnow *Gambusia holbrooki* which have been shown to eat Bell Frog eggs and tadpoles.

Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (New South Wales 1995) applies to the Shellharbour Local Government Area, which is among the local government areas listed on Schedule 1 of the Policy. The 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:

(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core Koala habitat;

(b) by encouraging the identification of areas of core Koala habitat; and

(c) by encouraging the inclusion of areas of core Koala habitat in environment protection zones."

The Policy aims to identify "potential Koala habitat", which is defined as native vegetation where trees of the species listed on Schedule 2 of the Policy constitute at least 15 per cent of the total number of trees present.

None of the eucalypt species present on the Project Site are listed on Schedule 2 of the policy as Koala food trees and there is neither primary nor potential Koala habitat on the Project Site or immediate environs.

4.5.2.4 Safeguards

Given that the Project Site only supports a sparse fauna and that no threatened or endangered species were noted, no specific safeguards are required for the protection of native fauna. However, Countrywide Ecological Service (1999) notes that the safeguards proposed to minimise the proposal's impacts on native flora would apply equally for the improvement of habitats for native fauna.

4.5.2.5 Assessment of Impacts

The Project Site only supports a sparse fauna and offers little habitat to native species. No threatened fauna was found on or adjoining the Project Site except the Large Bent-wing Bat. This species is a cave dweller and is unlikely to be affected significantly by the proposal. One endangered species known to occur in the local area, the Green and Golden Bell Frog, was not found on the Project Site, nor is it believed that it is likely to ever inhabit the Project Site (CES, 1999). In a similar manner to flora (see Section 4.6.1.2), CES (1999) have assessed the potential impact of the proposal on threatened fauna species in the context of the Eight-Part Test (see **Table 4.15**).

As no Koalas were recorded during the survey and as no Koala food trees, as listed within Schedule 2 of SEPP 44, are present on the Project Site, CES (1999) have determined that the Project Site does not constitute either primary nor potential Koala habitat.

Following application of the "Eight-Part Test", both KMA (1999) and CES (1999) have concluded that the proposal is unlikely to have an impact on threatened species, populations or ecological communities and that the preparation of a Species Impact Statement is not required.

PART C: THE BUILT AND SOCIAL ENVIRONMENT

4.6 TRANSPORTATION

4.6.1 Introduction

The following sections on traffic management and assessment of impacts have been drawn from the traffic assessment report prepared for this statement by Transport & Urban Planning Pty Ltd (1999).

4.6.2 Existing Conditions

4.6.2.1 Road Network

Access to the Project Site would be off Swamp Road via a proposed quarry access road. Swamp Road intersects with the Princes Highway approximately 0.3 km to the north-east of the proposed quarry access road (**Figure 4.4**). The Princes Highway (SH 1) is the major north-south arterial route along the coast and provides the main road link between Sydney and Wollongong and the South Coast.

The Princes Highway at Dunmore is predominantly a two-lane road. North of Swamp Road at the intersections of Shellharbour Road and Tabbita Road the highway has been widened to 4 lanes. The speed limit on the section of the Princes Highway from north of Shellharbour Road to south of Swamp Road (a distance of approximately 3 km) is 100 km/h. Either side of this 100 km/h section, the speed limit reduces to 80 km/h.

Swamp Road is a local road and provides access to Jamberoo Road and an alternative route to Kiama. It is a 2 lane rural road with no centreline or edgeline markings and has an 80 km/h speed limit along that section adjacent to the Project Site.

The section of Swamp Road adjacent to the Project Site between the Princes Highway and Rocklow Road has recently been resurfaced and the road carriageway is 5.7 to 5.8 m wide. The resurfacing has reduced the road carriageway width to less than the current AUSTROAD standards. The current AUSTROAD standards requires a minimum road carriageway width of 6.0 m (2 x 3.0 m lanes) and desirably 6.5 m (2 x 3.25 m lanes) for the level of traffic using Swamp Road. The speed limit in Swamp Road is 80 km/h.

Swamp Road forms a T junction with the Princes Highway some 800 m south of the Shellharbour Road. An auxiliary lane treatment (AUR) for the right turn into Swamp Road is provided in the northern approach of the Princes Highway. Swamp Road is subject to give way control and minor flaring is provided at the intersection. Sight distance along the Princes Highway is:

- more than 400 m from Swamp Road to the north;
- approximately 300 m from Swamp Road to the south; and
- approximately 230 m from the south bound right turn lane in the Princes Highway to the south.

The sight distance for the right turn movement from the Highway is restricted by a combination of a curve in the road and by vegetation on the adjacent SRA land, south of the intersection. Safe intersection sight distance requirements for various operating speeds on rural roads as defined by AUSTROADS is shown in **Table 4.16**.

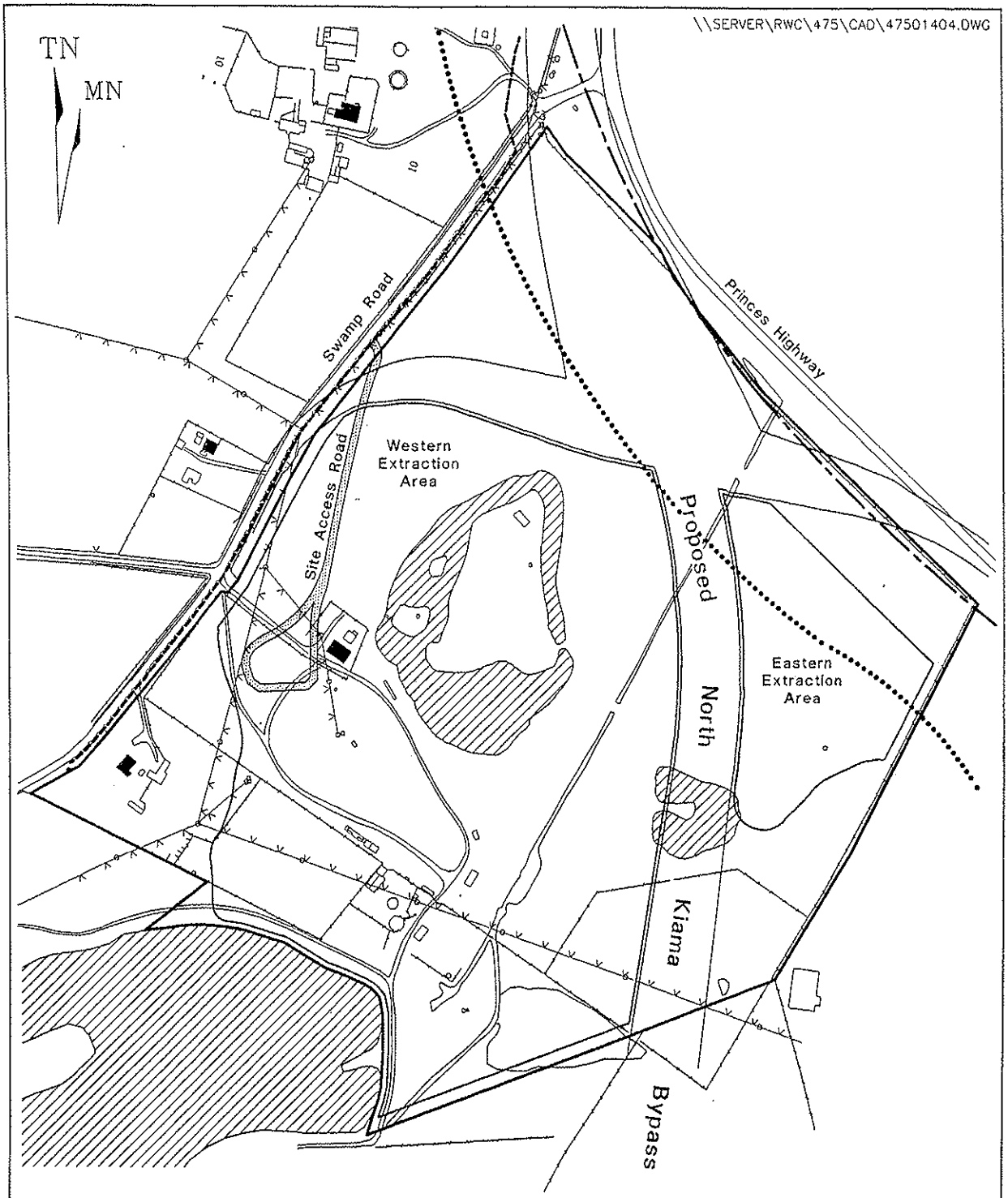


Figure 4.4
ROAD NETWORK AND SERVICES

TABLE 4.16
Safe Intersection Sight Distance Requirements

Speed (km/h)	Safe Intersection Sight Distance (metres)
70	140
80	175
90	210
100	250
Source: Transport & Urban Planning (See Table 2.1, Part 9 of Volume 2)	

Reference to **Table 4.16** shows that in general, sight distance requirements are met at the intersection, although there is a need to improve the sight distance for the right turn vehicles into Swamp Road by the removal of some of the vegetation on the SRA land.

From the Princes Highway intersection the initial 400 m of Swamp Road is very flat but thereafter rises moderately sharply over a hill to the south of the Project Site. The proposed site access road would intersect with Swamp Road to the north of an existing property access track approximately midway between the Princes Highway and Rocklow Road. The proposed access road would be sealed from the site office to the intersection with Swamp Road. Sight distance in Swamp Road along the frontage of the Project Site is generally satisfactory. Sight lines are available along Swamp Road from the northern boundary of the site to the Princes Highway in the east and to a hill some 210 m west of Rocklow Lane in the west. The speed limit along Swamp Road is 80 kph.

4.6.2.2 Traffic Levels

Annual average traffic (AADT) levels have been recorded for the Princes Highway at counting stations at Dunmore (north and south of Shellharbour Road) and Kiama (at the quarry railway crossing). The traffic volumes summarised in **Table 4.17** indicate a regular increase in traffic flow on the Princes Highway with an average annual increase of between 5 per cent and 6 per cent. **Table 4.17** also provides directional splits and the percentage of heavy vehicles recorded at the same stations.

A traffic assessment for the Princes Highway and Swamp Road has also been undertaken by Mr Terry Lawrence of Transport & Urban Planning Pty Ltd. As a component of this assessment traffic counts were carried out on Friday, 11 September 1998 between 6.00 am and 5.00 pm at the intersection of the Princes Highway and Swamp Road.

TABLE 4.17
Traffic Volumes – Princes Highway (SH 1)

Station No.	Location	1986 AADT	1988 AADT	1990 AADT	1992 AADT	1994 AADT	1997 AADT	% North-bound	% South-bound	% HV
07.041	Dunmore 0.8 km N of MR522, Sheilharbour Road	10371	14167	15739	17449	18992	19995	49.7	50.3	9.9
07.042	Dunmore 0.8 km S of MR522, Sheilbharour Road	17968	16511	22188	25153	25118	27174	50.0	50.0	9.1
07.317	Kiama at Quarry Railway Crossing	18159	--	22308	--	25641	26623	50.5*	49.5*	6.5*

Source: RTA
HV = Heavy Vehicles
* Inferred from Station 07.804 (Approximately 0.6 km S of 07.317)

During the monitoring period, traffic volumes using the Princes Highway ranged between 1 017 vehicles per hour and 2 285 vehicles per hour. Heavy vehicles (i.e. trucks Class 3 and above) accounted for 9 per cent of the total traffic using the highway. Traffic volumes using Swamp Road were low, ranging between 17 and 71 vehicles per hour with a total traffic volume of 392 vehicles in the 11 hour period. The major movement into and out of Swamp Road is the right turn in from the Highway and the left turn out of Swamp Road. Heavy vehicles accounted for 12.8 per cent of the traffic using Swamp Road.

During the morning (8.00 to 9.00 am) and afternoon (3.00 to 4.00 pm) peak traffic periods:

- the peak direction in the Princes Highway carries between 1 271 and 1 320 vehicles per hour;
- the right turn from the Princes Highway into Swamp Road numbers between 19 – 36 vehicles; and
- the left turn out of Swamp Road numbers between 37 – 63 vehicles with the right turn movement from Swamp Road totalling 3 – 7 vehicles.

Observations on site during the afternoon peak period confirm that Swamp Road traffic faces minor delays during this period, although regular gaps appear in the Princes Highway traffic.

The speed of traffic using the Highway during the afternoon peak period appeared to be much lower than the 100 km/h speed limit. This was confirmed by a radar speed survey undertaken on Thursday, 5 November 1998 between 11.00 am and 2.00 pm.

This survey found that the 85th percentile speed for south-bound traffic on the Princes Highway north of Swamp Road was 80-81 km/h.

A review of the 5 year accident history from 1/1/93 to 31/12/97 for the intersection indicates that there have been a total of 6 crashes, 4 of which were injury accidents. Four of the total accidents were rear end (three in the Highway and one in Swamp Road) with the remaining two accidents involving vehicles travelling on the Highway. One accident was a right turning accident and the remainder a head on accident (not overtaking). There were no right angled accidents involving vehicles turning out of Swamp Road. There were no crashes in the section of Swamp Road adjacent to the Project Site during the same 5 year period.

4.6.3 Future Road Network

A major change to the road network in the area would be the proposed North Kiama Bypass. That part of the proposed bypass that traverses the Project Site would consist of a four lane dual carriageway, where each carriageway would be comprised of two 3.5 m wide lanes separated by a 4 to 5 m wide median. The exact carriageway dimensions would be determined during the detail design phase and would be in accordance with the appropriate design standards at that time. As a component of the proposed Bypass, a new interchange would be constructed at the present Swamp Road / Princes Highway intersection. The Swamp Road interchange would consist of a two lane bridge over the proposed Bypass with onload and offload ramps. The proposed Bypass and interchange is shown conceptually on **Figure 4.5**.

4.6.4 Proposed Traffic Management

4.6.4.1 Short Term

In the short term, the proposed treatment for the Prince Highway / Swamp Road intersection would include:

- linemarking the intersection to provide a right turn bay in the northern approach of the Princes Highway in lieu of the existing AUR treatment;
- additional widening in Swamp Road to provide for two approach lanes and widening on the south western corner to accommodate a single unit truck left turn movement; and
- removal of vegetation on SRA land south of the intersection to improve sight distance.

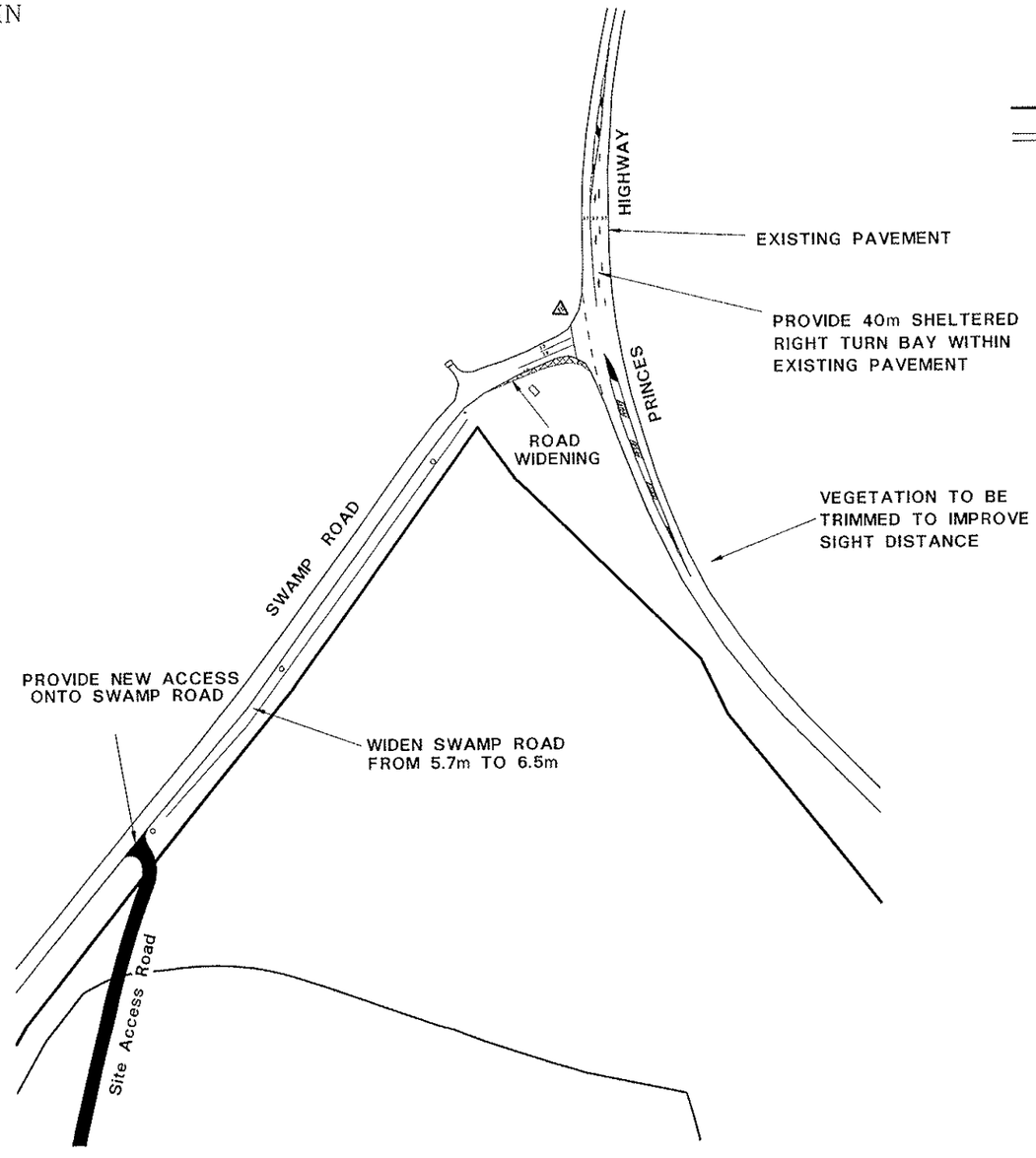
The protected right turn bay has been designed for an operating speed of 80 km/h which is the standard the existing AUR treatment has been designed to. It is considered that the protected right turn bay will reduce the friction and potential rear end conflict associated with increased right turning movements from the Highway at the intersection.

\\SERVER\RWC\475\CAD\47501405.DWG

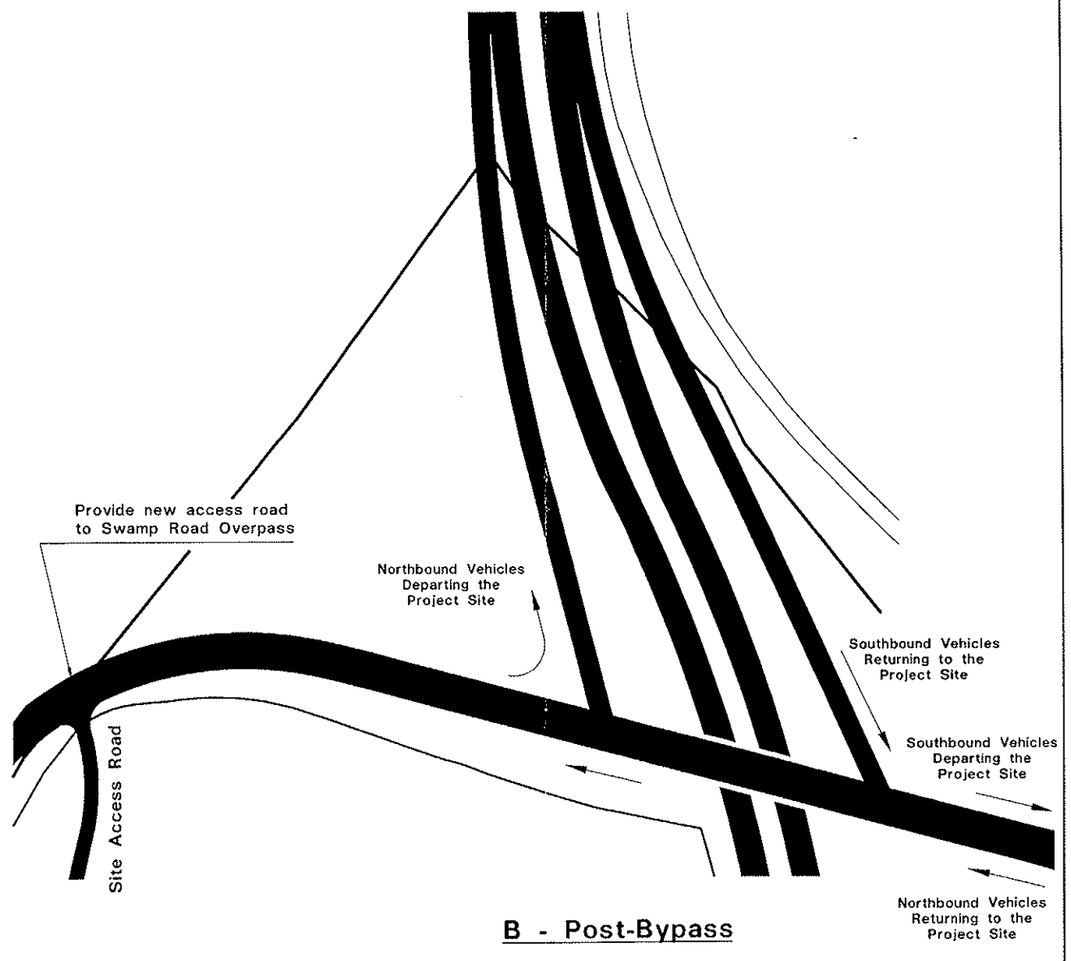
TN
MN

REFERENCE

Project Site Boundary
Road (Existing/Proposed)



A - Pre-Bypass



B - Post-Bypass

Source: Transport and Urban Planning Associates Pty Ltd (1998)

SCALE 1:2500

25 0 25 50 75 100 125 m

Figure 4.5
ROAD ACCESS ARRANGEMENTS

No additional treatment is proposed for the let turn movement out of Swamp Road for the following reasons:

- the increase in the left turn movement due to the proposal is 6 to 9 movements per hour, which is a very small increase;
- the analysis shows only a small increase in delay to the left turn vehicles due to the additional volumes. These delays are considered acceptable; and
- the limited time that the intersection would be used (3 to 4 years) until construction of the North Kiama Bypass.

Consideration was given to a left turn acceleration lane out of Swamp Road however this has been rejected due to:

- the small left turn volume;
- minimal increase in traffic for the proposal; and
- anecdotal evidence that such lanes can be more problematical due to drivers 'charging out' and not exercising care when merging.

The location of the site access road and the recommended treatment in Swamp Road are shown on **Figure 4.5**. Reference to this figure shows:

- the proposed site entrance road which is positioned approximately midway between the Princes Highway and Rocklow Road, to maximise sight distances and reduce impacts on the adjacent properties. The sight distance at the intersection meets the AUSTROAD standards for the operating speed limit.
- Widening of the Swamp Road road pavement to 6.5 m between the Princes Highway and the Access Road (see **Figure 4.5**). The existing pavement width of 5.7 m is not sufficient.

4.6.4.2 Medium Term

Figure 4.5 shows the recommended location for the access road after the construction of the North Kiama Bypass. The position of the access road would be maintained in the location selected for the short term period.

The access road would intersect the reconstructed Swamp Road on the apex of the curve. This location affords maximum sight distance for vehicles entering Swamp Road and retains suitable separation from the adjacent properties in Swamp Road. At this point, Swamp Road will be higher than its current level and it would be necessary to raise the level of the proposed access road at the new intersection, to match the level of Swamp Road.

In addition to the above traffic management strategies, to further ensure that the transportation of products from the Project Site does not adversely impact upon other road users or local road conditions, the Applicant would implement the following safeguards which are consistent with those applied at the Dunmore Sand Quarry.

(i) All trucks travelling to and from the Project Site would be covered unless the load nature made covering unnecessary. A sign would be placed on the access road to remind drivers to cover their load before exiting the site.

(ii) The Applicant would instruct all drivers of project-related vehicles to drive in a courteous and safe manner and to adhere to sign-posted speed limits. Truck drivers would also be encouraged to minimise the use of exhaust brakes on the local road network and access road. The Applicant would operate a strict transport policy which would require all truck drivers to agree to drive in accordance with the specified conditions.

(iii) Adherence to approved hours of operation.

(iv) Placement of appropriate warning and advisory signs on Swamp Road and at the access road / Swamp Road intersection.

(v) The Applicant would contribute to the upgrading and maintenance of the section of Swamp Road that it uses between the Princes Highway and the new site access road.

4.6.5 Assessment of Impacts

4.6.5.1 Introduction

The 10 return truck movements per hour would increase traffic using the Princes Highway / Swamp Road intersection by around 1 per cent in the morning and afternoon peak periods and slightly more in the business peak hour.

To assess the impact the additional traffic would have on the intersection of the Princes Highway / Swamp Road, INTANAL analysis has been undertaken by Transport & Urban Planning Pty Ltd (1999).

INTANAL, is a computer program that assesses the performance of intersections under traffic signal, roundabout or sign control. Generally the best criteria for assessing an intersection performance under sign control are Level of Service (LS), Degree of Saturation (DS), Average Vehicle Delay (AVD) and Highest Movement Delay (HMD) for each minor movement.

The modelling has been undertaken for both the existing situation and also for the Year 2004 with the extraction operation in place using the traffic volumes referred to in Section 2.6 and the additional truck movements generated by the proposal in the Year 2004. No other traffic growth has been assumed for the Year 2004, as this would

distort the analysis with respect to the impact of the proposal. The intersections current geometry has been adopted in the modelling for the existing situation, although modified for the Year 2004 to that shown on **Figure 4.5**.

The results of modelling are shown in **Table 4.18** and reveal the following:

- the intersection is currently operating at a Level of Service D during the morning and afternoon peak periods, due to highest movement delay for the right turn movement out of Swamp Road;

- the impact of additional truck movements associated with the proposal is quite small with increases in the order of 0.5 to 2.0 seconds to the delays of vehicles making either the right turn from the Princes Highway and / or the left turn from Swamp Road, which are the major movements associated with the extraction proposal; and

- the increase in delay to the right turn movement out of Swamp Road is between 0.8 and 3.2 seconds, with the proposal in place.

TABLE 4.18
INTANAL Results for Intersection of Princes Highway and Swamp Road

Criteria	AM Peak		PM Peak		Business Hours	
	Existing	2002 with Proposal	Existing	2002 with Proposal	Existing	2002 with Proposal
LS	D	E	D	D	C	C
DS	0.15	0.25	0.15	0.20	0.09	0.13
AVD	0.8	1.5	1.1	1.5	1.0	1.4
HMD for Hwy RT	20.8	21.6	15.0	15.3	14.1	14.3
HMD for LT from Swamp Road	29.0	31.2	17.3	17.9	15.3	15.7
HMD for RT from Swamp Road	55.0	58.2	49.7	51.6	39.4	40.7

Where

LS	-	*Level of Service*
DS	-	*Degree of Saturation*
AVD	-	*Average Vehicle Delay (in seconds)*
HMD for Hwy RT	-	*Highest movement delay for the right turn from the Highway (in seconds)*
HMD for Swamp Rd LT	-	*Highest movement delay for the left turn from Swamp Road (in seconds)*
HMD for Swamp Rd RT	-	*Highest movement delay for the right turn from Swamp Road (in seconds)*

Source: Transport & Urban Planning (See Table 3.2, Part 9 of Volume 2)

The intersection would operate at a Level of Service D/E due to the delay to the right turn movement out of Swamp Road. This is currently a minor movement at the intersection numbering 3 and 7 vehicles per hour during the morning and afternoon peak period and would increase by 1 truck movement with this proposal.

The truck movements exiting the site in Swamp Road would have no impact on the level of service or safety in Swamp Road, due to low volumes using Swamp Road (63 to 118 vehicles in the peak hours) and the low traffic generation of the proposed operation of 6 to 10 two way truck movements per hour.

4.6.5.2 Long Term

Following construction of the North Kiama Bypass the proposal would generate a maximum of 12 two way truck movements per hour. These would use the new on and off load ramp to Swamp Road from the North Kiama Bypass to travel to and from the site. The 12 two way truck movements per hour would have no measurable impact on the Bypass traffic and on Swamp Road.

4.7 SERVICES

4.7.1 Existing Services

The Project Site is both traversed and bordered by power and telephone services managed by Integral Energy and Telstra respectively (see **Figure 4.4**).

Power

Low voltage and 11 kV overhead mains extend along Swamp Road and traverse the south-western corner of the Project Site. Both lines also extend across the southern end of the Project Site, with the low voltage main connecting to sheds near the southern boundary of the Project Site and the 11 kV main connecting to Dunmore House to the east of the Project Site.

Telephone

Telstra maintains a number of telephone services in the vicinity of the Project Site. Two overhead telephone lines border the Project Site, one along the Princes Highway and the other extends along Swamp Road. A short line extends from the Swamp Road line to the former kiosk building on the Project Site.

Subsurface cables in the vicinity of the Project Site include:

- a coaxial cable situated approximately 2 m below the surface traverse the northern part of the Project Site. Telstra is currently investigating the possibility of decommissioning this cable;
- a local riser cable along the Princes Highway; and
- a fibre optical cable along the eastern side of Swamp Road. The location of this line would need to be taken into consideration by the Applicant.

4.7.2 Assessment of Impact

The Applicant's proposal would not necessitate the installation of any additional services to the Project Site, although Integral Energy would be commissioned to upgrade the existing reticulated power to the Project Site.

Sand extraction within the Eastern Extraction Area would also necessitate the relocation of a section of the coaxial cable that traverses the northern part of the Project Site. The Applicant would contract the relevant service authorities to undertake the required work. This work would also most likely be required for the North Kiama Bypass.

The fibre optical cable located along the eastern side of Swamp Road would not be disturbed by the proposal.

PART D: THE SOCIAL ENVIRONMENT

4.8 VISIBILITY

4.8.1 Introduction

The visibility of the activities within the Project Site has been assessed to be an important constraint in the design of the site's activities and proposed methods of operation. This sub-section reviews the components of the existing visual climate together with the overall planning that has been taken into account and the visual controls that would be implemented throughout the life of the project. The likely impact of the proposed activities on the local visual amenity is presented.

4.8.2 Existing Visual Climate

The Dunmore area forms part of a wider landscape which stretches from Marshall Mount to Berry and from the Illawarra Escarpment to the coastline. The Jamberoo Valley, situated to the south-west of the Project Site, is an integral part of the

landscape and this area has been listed as a conservation area by the National Trust and is also gazetted in the Illawarra Regional Environmental Plan No. 1 as an area of high visual quality.

The landscape in the vicinity of the Project Site has an open character due to extensive clearing of the land and the low topographic relief. The surrounding terrain generally comprises rounded hills and gentle slopes with some steeper gully areas which merge into low lying rural flats, floodplains and estuarine wetlands. The principal land uses within the Dunmore area are grazing and extractive industries, both of which also form an important component of the visual landscape. According to the Rural Land Study (Shellharbour City Council 1996) the Project Site and surrounding area has a high visual status.

The key visual elements of the Project Site and immediate surrounds include:

(i) the existing lakes set in the low lying floodplain;

(ii) a prominent ridgeline that extends from Dunmore House along the southern boundary of the Project Site;

(iii) rolling hills and shallow gullies to the west of the Project Site; and

(iv) scattered mature Swamp Oak trees around the edge of the lakes and clustered on small islands within the lakes as well as bordering the north-eastern margin of the Project Site along the Princes Highway.

Figure 4.6 shows the local visual catchment of the Project Site which is either currently or potentially visible from a number of residences to the west and south of the Project Site. Views from the Princes Highway across the Project Site are partially screened due to the intervening trees, however much of the Project Site is visible from the adjacent section of Swamp Road.

4.8.3 Visual Controls

The Applicant has planned the proposed activity in such a manner that:

(i) minimises the quantity of earthmoving equipment used on site, and therefore limiting the visual impact of moving objects;

(ii) minimises the area of activity to a level that is practical but confines the visual impact; and

(iii) utilises a hill structure on the Project Site to limit visibility from the Dunmore Lakes Estate.

The principal controls to lessen the visual impact of the proposal are set out below.

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TN
MN

Rocklow Road
Swamp Road
Princes Highway
Eastern Extraction Area
Western Extraction Area
"Dunmore House"
"Seaview Stud"
Dunmore Lakes Estate
Killalea Close
Minnamurra Drive

REFERENCE

- Project Site Boundary
- Local Visual Catchment Boundary (Approximate)
- Road
- Contour (m, AHD)
- 18 Lot N° DP 285417
- Residence/Building (September 1998)
- Existing Lake

SCALE 1:10 000

100 0 100 200 300 400 500 m

Figure 4.6
VISIBILITY

(i) A bund wall would be constructed adjacent to the site access road to limit the visibility of vehicles travelling on the road. This would extend along the northern side of the processing plant up onto the hill structure so as to provide shielding.

(ii) A bund wall would be constructed on the southern side of the processing plant area.

(iii) Strategically placed clumps of *Casuarina glauca* trees would assist in restricting visibility of the processing plant area, particularly from the new Bypass (see Processing Plant Detail - **Figure 2.3**).

(iv) All bund walls constructed on site would be surfaced with topsoil directly transferred from an active operational area or from under the bund wall to maximise the regrowth on the surface of the bund wall. This approach is proposed based on the Applicant's experience at the Dunmore Sand Quarry.

(v) As each area of backfilling is completed and the required landscape reconstruction completed, the completed surface would be vegetated with the exception of a defined road.

(vi) The processing plant would be painted a grey / green colour to limit its visual obtrusiveness (see **Plate 1.3**).

(vii) The processing plant would be placed as low as possible and the twin cyclone tower would be positioned at a maximum height of about 12 m, i.e. 3 m lower than the tower at the Dunmore Sand Quarry (see **Plate 1.4**).

(viii) The processing plant would be positioned "behind" the hill structure on the western corner of the Project Site to limit its visibility from Dunmore Lakes Estate.

(ix) The Applicant would plant a three row tree screen with intervening shrubs for a 150 m (approximately) section immediately inside their land adjacent to Swamp Road (see **Figure 2.3**).

4.8.4 Assessment of Impacts

The assessment of visibility of the proposal is presented based upon a range of locations external to the Project Site.

Dunmore Lakes Estate

Residents within 15 lots within the Estate would be able to observe a sequence of activities across the Project Site. Earthmoving equipment would be visible for short periods for soil removal and perimeter sand extraction. The most common activities observed would be dredging and the delivery of backfill materials. Processing activities would be shielded, however some residents would observe the cyclone tower and top of the light grey sand stockpile beneath the tower.

The degree of impact of these activities would vary within the Estate, however, it is recognised that the view angle is shallow and that no contrasts are likely with any skyline. It is assessed that the visual impact from the Estate would be moderate but is recognised that the development will ultimately improve the visual impact with the creation of the additional large scenic lake surrounded with vegetation. **Plate 4.1** presents an artist's representation of the landform of the site after extraction is completed, i.e. when viewed from "Seaview Stud" immediately south of Dunmore Lakes Estate.

Dunmore House

The residents of Dunmore House would be able to observe the earthmoving equipment and trucks for a period of a few years whilst the sand is extracted within the eastern extraction area and backfill materials are placed and shaped. The activities would be readily visible from the access road to Dunmore House, and, partial views of some areas of the Project Site would be possible from the Dunmore House residence. The Applicant's activities on the part of the Project Site near Dunmore House are planned to precede the construction activities associated with the North Kiama Bypass. Ultimately, the view of the section of the Project Site between Dunmore House and the Bypass would be enhanced by the presence of the sculptured lake. The Bypass would limit long term views of the remainder of the extraction activities planned west of the Bypass.

Old School House

Residents of the old school house would have their views of the site's activities restricted through the construction of a sculptured landscaped bund wall just inside the Project Site. The principal component of the site visible from the residence would be the twin cyclone tower and top of the grey sand stockpile, although this view would be restricted because of vegetation within the foreground.

Motorists on the Princes Highway

The substantial stand of Swamp Oaks adjacent to the highway (**Plate 4.2**) provide substantial vegetative shielding from the bulk of the highway. Motorists currently travelling southwards along the Princes Highway have a short period (a matter of seconds) to view part of the Project Site (**Plate 4.3**). These views will no longer exist once construction of the Bypass commences in that area (about 2002).

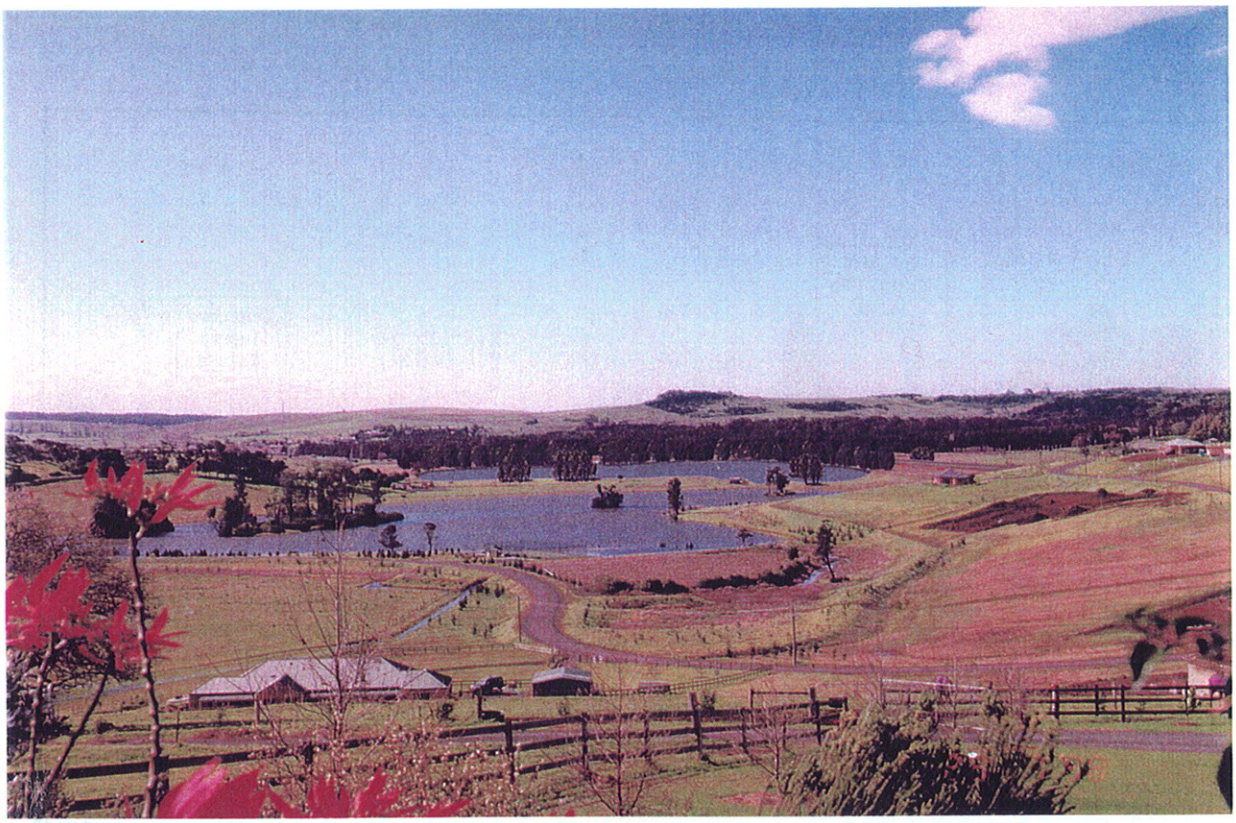

Plate 4.1: A view from Seaview Stud towards the north across the Project Site conceptually showing the final form of the lake system on the Project Site

The overall visual impact for motorists travelling along the Princes Highway is assessed to be minor particularly given:

- the dredging activities during the first two years would be occurring in the eastern extraction area, i.e. an area substantially shielded by roadside Swamp Oaks (**Plate 4.2**);
- the processing plant area would be partially shielded by existing vegetation (see **Plate 4.3**);
- the views would be sufficiently long distance (at least 400 m so that the field of view of the processing plant would be comparatively small; and
- construction equipment, compounds etc. associated with the Bypass construction are expected to be in place by about 2002, thereby limiting visibility of the Project Site.

Plate 4.2: View when travelling southwards along Princes Highway towards the Project Site. Note – Roadside Swamp Oaks shield the Eastern Extraction Area.

Plate 4.3: View southwards from the edge of the Princes Highway towards the site of the Processing Plant Area (marked).

Motorists on Swamp Road

Motorists travelling along Swamp Road would have restricted views of some site activities. When near the Project Site, views would be restricted by the bund wall adjacent to the site access road and perimeter tree screen. Activities would be visible from sections of Swamp Road until it is removed in about 2004.

Motorists on the North Kiama Bypass

The dredging and backfilling activities would be clearly visible from the North Kiama Bypass after the Bypass becomes operational. The bund walls and Swamp Oak visual screening around the processing plant area would limit the motorist's views of that area. Furthermore, it will be more distant from the Bypass than the dredging and backfilling activities.

Whilst it is acknowledged that motorists would view operational activities on the Project Site during the life of the proposal, these observations need to be assessed in the context of all views and the following factors.

- The active area of disturbance would be kept to a minimum with emphasis placed upon progressive rehabilitation. At any one time, the bulk of the land would either be grassed (as at present), subject to rehabilitation, or a lake.

- The area of operational activities would be relatively small compared to the many square kilometres visible from the Bypass.

- Viewers would also be aware of other major construction activities being undertaken (e.g. further road work) and other industrial features e.g. the nearby Dunmore Hard Rock Quarry. Most motorists accept that such activities are a fact of life in the Illawarra area as resources are fundamental to the ongoing private and public construction projects.

- The duration of observations from the Bypass of operational activities would be between 6 and 11 years. The final views of landscaped lakes with adjoining rural-residential properties would be in place for far longer, and likely to be part of the long-term landscape. Such a feature is seen as a positive long-term benefit that outweighs the short-term observations of activities on site.

- Views of the site activities would gradually diminish over time as the vegetation adjacent to the Bypass and around the processing plant area increases in height.

4.9 HERITAGE

4.9.1 Aboriginal Heritage

4.9.1.1 Introduction

The Aboriginal history of the Project Site and immediate surrounds has been studied by consultant archaeologists Ms Kerry Navin and Mr Kelvin Officer of Navin Officer Archaeological Resource Management. The archaeological investigation was commissioned by Martin, Morris & Jones Pty Limited and formed a component of a development application for an earlier proposal for the Project Site. The following sub-sections present a summary of investigations undertaken, the survey results and assessment of the significance of the findings. A full copy of the archaeological survey report is presented in Navin (1989). On-site meetings have also been held in September 1998 with representatives of the Illawarra Council Aboriginal Land Council.

4.9.1.2 Method of Investigation

The archaeological studies comprised:

- a review of relevant studies undertaken in the area;
- site and archival searches of the NSW National Parks & Wildlife Service site data base;
- liaison with the Illawarra Local Aboriginal Land Council; and
- a detailed field survey to investigate the occurrence and significance of any Aboriginal cultural material was conducted in October 1989. The survey area included the entire Project Site but also extended beyond the Project Site boundary.

4.9.1.3 Field Survey Strategy

Prior to commencement of the field survey, the consultants conducted a desk top study of the survey area landform as well as previous archaeological work conducted on the South Coast. As a result of this pre-fieldwork assessment, the consultants were able to predict the type of archaeological sites likely to occur and site location sensitivity across the survey area.

The nature of the topography across the survey area precludes the existence of rock shelters. As the land is cleared, the existence of Aboriginal scarred trees is also a remote possibility. Open artefact scatters could be expected to occur on the ridgelines in the southern portion of the survey area. Middens and artefact scatters and possibly burials may occur on elevated ground in the proximity of the wetlands. The landform with the greatest archaeological potential in the survey area is the elevated, and well drained level ground, adjacent to low lying flood plain.

4.9.1.4 Results

A total of five archaeological sites and three isolated finds were located within the survey area. However, only three of these sites (Sites 3, 4 and 5) are located within the Project Site (see **Figure 4.7**).

Site 3 has been exposed in the spoil of a cattle burial pit and is located on the edge of a low terrace situated at the base of a ridgeline to the north of Dunmore House and is outside the proposed area of extraction. The site consists of flaked artefacts.

Sites 4 and 5 are located adjacent to one another on an old dunal sand body near the western boundary of the Project Site (see **Figure 4.7**). The sites comprise a low to medium density scatter of stone artefacts and fractured pieces of shell.

4.9.1.5 Significance Assessment

Significance assessment, according to a range of criteria including scientific or archaeological significance, significance to Aboriginal people, aesthetic value and value to the public as an educational or recreational resource has occurred for all sites recorded during the survey as follows.

Site 3
As there is a possibility of sub-surface in-situ material existing at this site it is not possible to assess archaeological significance without further investigation to determine the extent and integrity of the site.

Sites 4 and 5

These two sites are located on a relict sand dune near the western boundary of the Study Area. Both sites are evident in disturbed areas, however, there is a high probability that these sites are more extensive than is apparent at present. The potential for sub-surface material existing at these sites is very high.

Navin (1989) suggested there is also a possibility of burials occurring in this dune feature although this is not fully supported by Roy Kennedy of ILALC representative (pers comm). Burials are generally found in soft sediment such as sand or alluvial silts, and are usually only visible where there has been some disturbance of sub-surface sediments or where some erosional process has exposed them. This area is considered the most archaeologically sensitive zone within the Project Site.

4.9.1.6 Safeguards

Should Development Consent be granted for the proposal, the Applicant would apply to the Director-General of the NSW National Parks and Wildlife Service for a Consent to Destroy Sites 4 and 5. It is the Applicant's intention to engage Archaeological

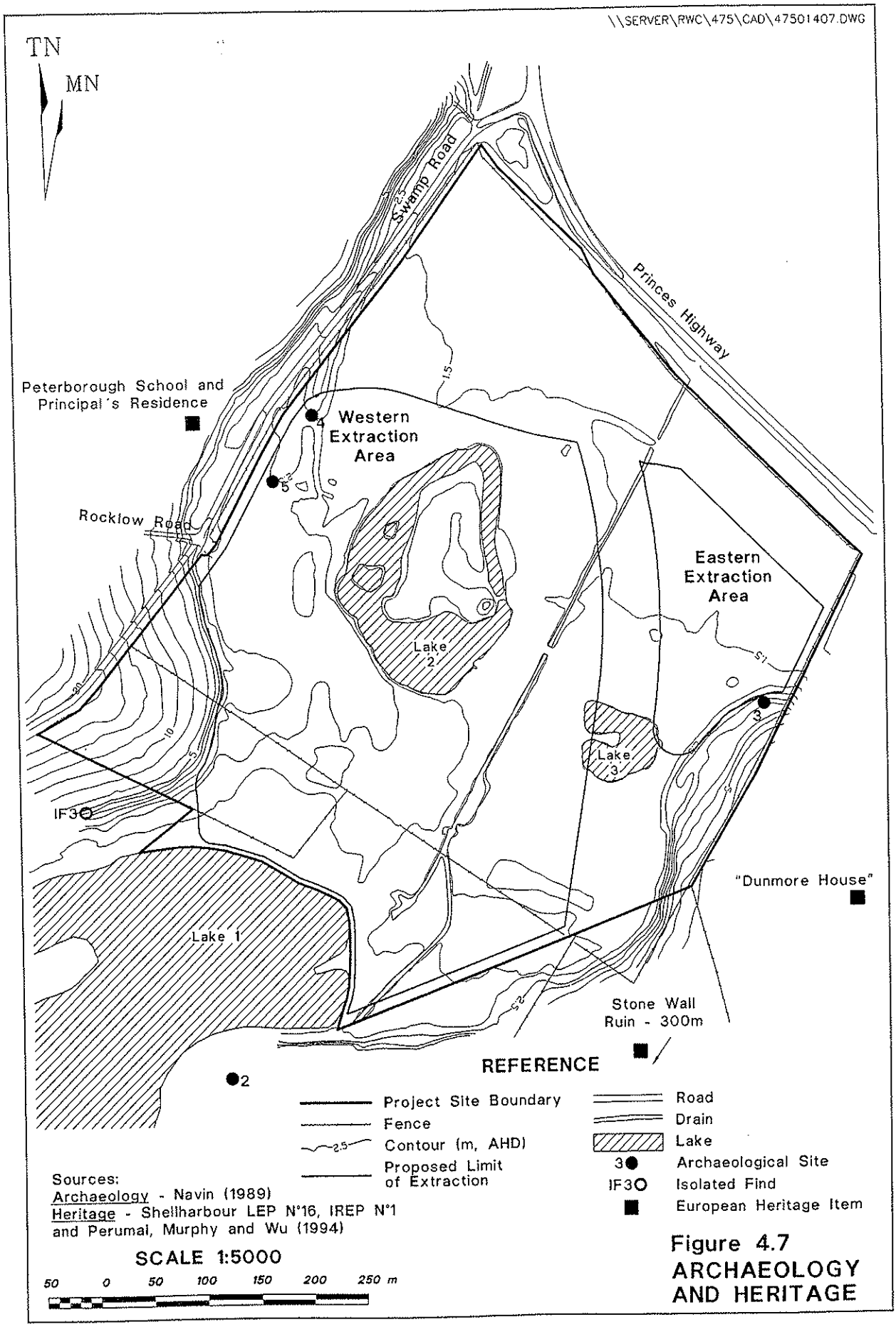

Figure 4.7
ARCHAEOLOGY AND HERITAGE

Consultants Navin Officer to prepare the relevant application for the Consent to Destroy. Any safeguards arising from the issued approval would be implemented.

The Applicant is committed to involve the ILALC as required to inspect those areas requiring inspection during excavation of the soil, particularly in the vicinity of Sites 4 and 5. Any Aboriginal artefacts found would be returned to the Local Aboriginal Community. In the event that any archaeological material is found elsewhere on the Project Site, it is proposed to cease work in that area and inform both the ILALC and the NPWS.

4.9.1.7 Assessment of Impacts

Site 3 is located outside the Eastern Extraction Area and subsequently would not be impacted by the proposal. However, Sites 4 and 5 are located near the western boundary of the Western Extraction Area and consequently would be disturbed by the proposal. Provided the required safeguards are appropriately implemented, it is assessed that the proposal would have an acceptable impact on the Aboriginal history of the area.

4.9.2 European Heritage

4.9.2.1 Identification

Although no items of European heritage are present on the Project Site, a number of heritage items are present in the vicinity of the Project Site and are briefly described below.

Dunmore House

Dunmore House is an impressive early mansion set on a prominent hilltop to the east of the Project Site. The house was constructed around 1868 – 1872 and is listed by the National Trust, Shellharbour Local Environmental Plan No. 16 and Illawarra Regional Environmental Plan No. 1 and is considered to be of regional significance (Perumal Murphy Wu, 1994).

Stone Wall near Dunmore House

Navin (1989) identified a small section of dry stone wall to the south-west of Dunmore House, south of the Project Site. The wall is aligned approximately north-south along the northern side of a vehicular track and is in a bad state of repair with most of the upper wall rocks fallen to form an overall low rock mound. These basalt stone wall fences are characteristic of the Kiama district and date from the mid 19th Century. The stone wall is not a good example of the type which is generally identified in the Illawarra Regional Environmental Plan No. 1 and does not have a high level of significance.

Peterborough School and Principal's Residence and Grounds

This item is an outstanding example of a Victorian period rural school building and residence located off Swamp Road just to the west of the Project Site. The buildings were built between 1868 and 1872 and are listed by the National Trust, Shellharbour Local Environmental Plan No. 16 and Illawarra Regional Environmental Plan No. 1.

4.9.2.2 Safeguards

The safeguards and management procedures already noted for noise (Section 4.3.3), air quality (Section 4.4.4), traffic management (Section 4.6.3) and visibility (Section 4.8.3) would apply equally to the protection of the heritage values of Dunmore House and the Peterborough School Principal's Residence. The Applicant would, as part of its ongoing community consultation, remain in regular contact with the owners of both properties.

4.9.2.3 Assessment of Impacts

Given that the overall impacts associated with noise, air quality, traffic management and visibility would not be significant, it is assessed that the heritage values of the Dunmore House and the Peterborough School Principal's Residence would not be compromised.

4.10 LAND USE AND PLANNING

4.10 1 Existing Land Use

Much of the Project Site is currently used for grazing, principally of horses. Some remnant buildings and structures occur from former land uses, particularly the theme park. The big lake (Lake 1), which was subject to previous sand extraction adjoins the southern boundary of the Project Site. The lake is currently not used for any recreational activity other than by the Wollongong Model Yacht Club on weekends and occasional weekdays. The Applicant intends to support the ongoing use of Lake 1 for this activity.

Surrounding land uses comprise:

- rural land used for grazing – it is noted that the use of this land for grazing is limited as it is not prime grazing land;
- rural residential development at the Dunmore Lakes Estate directly south of the Project Site;
- horse riding and training ("Dunmore House") and a horse stud ("Seaview Stud");

- a wedding reception venue within the Old School House and grounds;
- rural land used for dairying to the south of Dunmore Lakes Estate and on the northern side of Swamp Road;
- transport in the major transportation corridors on the eastern side of the Project Site including the Princes Highway (State Highway No. 1) and the Illawarra Railway. The proposed North Kiama Bypass also transects the Project Site (see **Figure 4.5**);
- waste disposal in the Dunmore Recycling and Waste Disposal Depot operated by Shellharbour Municipal Council and also the waste disposal depot operated by Kiama Municipal Council. Both depots are situated on the eastern side of the Princes Highway to the north-east of the Project Site;
- hard rock extraction at the Dunmore Hard Rock Quarry operated by Boral Resources (NSW) Pty Ltd to the north-west of the Project Site;
- residential development in the nearby village of Dunmore; and
- estuarine wetlands bordering the Minnamurra River to the south of the Project Site and surrounding the Rocklow Creek / Minnamurra River confluence to the east of the Project Site.

4.10.2 Assessment of Impacts

4.10.2.1 Land Uses

The surrounding land uses are unlikely to be adversely affected by the proposal in that air quality would be controlled, traffic impacts would be minor, noise levels would generally be within nominated criteria, groundwater levels would not change substantially from natural levels, and surface water would be managed. This assessment is made with the expectation that residents and visitors (e.g. to "Dunmore House" riding school) will be aware of certain activities from time to time. Adverse impacts are not envisaged with the nearby wedding reception venue because of typically lower levels of activity of a Saturday. Nevertheless, the Applicant would maintain communication to ensure any adverse impacts are avoided.

In the longer term, the rehabilitated landform would be fully compatible with surrounding land uses as they would invariably be similar to existing land uses, namely, rural/residential, lakes and, nature conservation (wetlands in particular).

4.10.2.2 Surrounding Land Owners

The preceding sub-sections have evaluated the environmental impacts of a range of issues that collectively influence the overall impact that the proposal would have on surrounding landowners and land uses. These issues relate to water quality, air quality, noise, product transportation and visibility.

An important component of the proposal would be the implementation of a range of design and operational procedures that would be adopted to ensure that no surrounding resident is subjected to unacceptable levels of noise, dust, discharges of water, or suffers any significant long-term loss of visual amenity.

It is assessed that the development and operation of the proposal would be accompanied by generally minor impacts on the surrounding landowners and land uses. The basis of this assessment is as follows.

(i) Sand extraction operations would be confined to defined areas on the Project Site. Most surrounding residences would be sufficiently distant from the Project Site to be not directly impacted by the proposed operations. As a component of the proposal, strict operational procedures and safeguards would be implemented to minimise the impacts upon residences particularly those adjacent to Swamp Road and within Dunmore Lakes Estate.

(ii) It has been assessed that the proposal would cause occasional minor noise exceedances.

(iii) Although the Project Site is visible from a number of publicly accessible vantage points and residences, it has been assessed that with the proposed safeguards, the overall visual impact should be acceptable. Ultimately, in the long-term, the visual impact of the proposal would be lessened by progressive rehabilitation and by the presence of the two scenic lakes. The development of these lakes would also help to soften the visual impact of the proposed North Kiama Bypass.

(iv) Although surrounding landowners and local road users would be aware of the increased traffic movements along the short section of Swamp Road, it has been assessed that the levels would not have a significant impact on this short section of road nor affect the safety of other road users. The planned improvements to the intersection of Swamp Road and the Princes Highway would benefit all local road users until the Bypass is operational.

(v) It has been assessed that the proposal would have no adverse impacts upon the areas native flora and fauna. In fact, the creation of over 3 ha of shallow wetlands will improve native habitats.

(vi) Given that the sand extraction operations have been previously conducted across the Project Site, the proposal would not significantly impact surrounding agricultural land uses.

The Applicant recognises that the level of impact could vary from one person to another and with individual circumstances. Accordingly, the Applicant anticipates regular consultation, particularly with adjoining landowners to ensure individual impacts are minimised. From a community perspective, the Applicant is also keen to maintain a good level of communication with the wider community to ensure the level of impacts of the overall operation remain acceptable. As a component of this, the local community would be involved in the on-going management of the project through the Annual Environmental Management Report process (see Section 1.6).

4.10.2.3 Planning Objectives

Table 4.19 reviews how the Dunmore Lakes proposal satisfies the stated objectives of the local and regional planning instruments. Although the objectives are provided in paraphrased form in the following table, they are provided in full in Section 1.5.

TABLE 4.19
Review of Proposal Against Objectives of Local and Regional Planning Instruments

Objectives	How Proposal Satisfies
Shellharbour LEP No. 16, 1987	
Rural 1(a) * protect the agricultural potential of rural land * prevent premature and sporadic subdivisions * to prevent the subdivision of land into small lots	Although the Project Site is used for periodic grazing, it is not prime agricultural land, nor is it used for commercial agriculture purposes. The bulk of the Project Site lies below the 1 in 100 year flood level and is not suitable for subdivision. Opportunities do exist for the creation of about 5 small lots.
Environmental Protection (Scenic) 7(d) * protect various areas which are environmentally sensitive and which enhance visual amenity	The Applicant's proposal will ultimately enhance the ecological value of the Project Site and the creation of scenic lakes will enhance the area's visual amenity.
Draft Shellharbour Rural Strategy	The design of the proposal with safeguards to minimise impact on the environment and surrounding community is consistent with the main objectives in relation to mineral resources noted in the Strategy

TABLE 4.19 Cont'd
Review of Proposal Against Objectives of Local and Regional Planning Instruments

Objectives	How Proposal Satisfies
IREP No. 1	
11(a) to retain productive capacity of prime crop and pasture lands	Although the Project Site is currently used for periodic grazing, it is not suitable for regular cultivation and does not serve as commercial agricultural land owing to its proximity to urban areas and a rural-residential subdivision
(b) to protect valuable natural environments	The proposal would result in the creation of scenic lakes and wetland areas which would enhance the ecological value of the Project Site and create additional fauna habitat
(c) to provide for wildlife movement between major protected wildlife habitats	The creation of additional habitat on the Project Site would provide greater opportunity for wildlife movement to adjoining SEPP 14 wetlands
(d) to effectively manage flood, bushfire, salinisation, soil degradation, erosion and weed infestation	Safeguards and management procedures would be implemented to ensure effective management of these and other environmental factors
(e) to allow small rural holdings in appropriate locations	At the end of the project life, there would be opportunities for the development of a limited number of small rural holdings
(f) to prevent uneconomic demand for State Government services	The proposal would not impact State Government services. Savings may occur with the construction of the North Kiama Bypass
(g) to allow for future urban expansion	Given that the project has a limited life, the proposal would not prevent future urban expansion
(h) to retain the scenic attributes of rural areas	The creation of scenic lakes and wetland areas would enhance the scenic attributes of this area
(i) to provide for developments which require siting away from urban areas	The sand resource would be sterilised by urban encroachment
32(a) to manage the extractive resources in a co-ordinated manner	The proposal has been designed cognizant of the community needs and with a range of safeguards and management procedures to ensure minimal impact on the environment and community
(b) to ensure that development proposal is assessed in relation to the potential problem of rendering resources unavailable	The proposal seeks to maximise the extraction of the fine sand resource taking into consideration the proposed North Kiama Bypass and nearby rural-residential residences
(c) to ensure that the transportation of extractive materials has a minimal adverse impact on the community	Upgrading of Swamp Road and other safeguards would be implemented to ensure minimal impacts on the community

4.11 SOCIO-ECONOMIC CLIMATE

4.11.1 Introduction

An understanding of the socio-economic climate provides a basis to assess the potential impacts of the proposal on the individuals that live and work locally and the local business community. The Applicant recognises that its economic influence is perhaps wider than its social influence as it purchases goods and services from many providers throughout the Illawarra area. This section provides the basis for assessing the potential impact of the Dunmore Lakes – Stage 1 proposal on the local and regional communities. Emphasis is placed in this section on the more tangible and measurable components of the local community. These components, together with the more intangible costs and benefits are discussed in Section 4.12 which considers the social impacts of the proposal.

The Project Site lies within but near the southern limit of the Shellharbour Local Government Area (LGA) and is situated approximately 4.5 km south of Shellharbour and approximately 6 km north of Kiama. From the perspective of Kiama Municipal Council, the Project Site is situated adjacent to the "gateway" from the north to their Local Government Area.

Information to assist in describing the local community is drawn from the 1996 Census data provided by the Australia Bureau of Statistics for both Shellharbour LGA and Kiama LGA. Shellharbour LGA covers an area of approximately 147 km^2 and Kiama LGA covers an area of approximately 257 km^2.

Table 4.20 presents selected population characteristics from the 1996 Census for Shellharbour and Kiama LGA's. Over the last 25 years Kiama has experienced significant population growth whilst Shellharbour has experienced moderate population growth. Population growth in Kiama is expected to continue, but at a reduced rate largely due to a limited supply of land for urban development, whilst Shellharbour's population is expected to grow steadily to 2006 (Department of Planning, 1994). Age characteristics for the populations are provided in **Table 4.21**.

Table 4.22 presents relevant employment statistics for NSW, Shellharbour and Kiama LGA's. Manufacturing is the major employment industry in Shellharbour accounting for approximately 19 per cent of the labour force whilst Education is the major employer in the Kiama LGA accounting for approximately 13 per cent of the labour force. Retail Trade, Health and Community Services and Construction are the next most prominent employment sectors in the area. It is noted that Agriculture, Forestry and Fishing is not a significant employment sector in the area accounting for 0.8 per cent and 3.2 per cent of the labour force of Shellharbour and Kiama LGA's respectively. Mining (and quarrying) account for about twice the State average in this industry. Tourist related enterprises (accommodation, cafes and restaurants) employ higher than the State average in the Kiama LGA reflecting its prominence as a popular tourist destination.

TABLE 4.20
Selected Population Characteristics – Shellharbour and Kiama LGA's

Characteristics	Shellharbour			Kiama		
	Male	Female	Persons	Male	Female	Persons
Total persons(a)	25,934	26,146	52,080	8,690	9,016	17,706
Aged 15 years and over(a)	19,177	19,694	38,871	6,505	6,979	13,484
Aboriginal	421	438	859	78	71	149
Torres Strait Islander	25	29	54	3	0	3
Both Aboriginal/Torres Strait Islander(b)	8	15	23	0	0	0
Australian born	19,389	19,458	38,847	7,349	7,638	14,987
Born overseas:						
Canada, Ireland, NZ, South Africa, UK(c) and USA	2,612	2,801	5,413	737	768	1,505
Other country(d)	3,143	3,051	6,194	370	341	711
Total	5,755	5,852	11,607	1,107	1,109	2,216
Speaks English only and aged 5 years and over	19,995	20,247	40,242	7,596	7,980	15,576
Speaks language other than English(e) and aged 5 years and over	3,204	3,250	6,454	288	276	564
Australian citizen	23,241	23,252	46,493	8,150	8,447	16,597
Australian citizen aged 18 years and over	15,623	16,031	31,654	5,650	6,112	11,762
Unemployed(f)	1,849	1,200	3,049	358	238	596
Employed(f)	11,873	8,170	20,043	3,984	3,095	7,079
In the labour force(f)	13,722	9,370	23,092	4,342	3,333	7,675
Not in the labour force(f)	5,116	9,936	15,052	2,066	3,541	5,607
Unemployment rate(f)	13.5%	12.8%	13.2%	8.2%	7.1%	7.8%
Enumerated in private dwelling(a)	25,780	25,942	51,722	8,536	8,735	17,271
Enumerated in non-private dwelling(a)	154	204	358	154	281	435
Persons enumerated same address 5 years ago(g)	0	0	0	4,659	4,836	9,495
Persons enumerated different address 5 years ago(g)	0	0	0	2,668	2,842	5,510
Overseas visitor	26	50	76	24	29	53

(a) Overseas visitors are included in these categories. All other categories exclude overseas visitors.
(b) Applicable to persons who are of both Aboriginal and Torres Strait Islander origin.
(c) Comprises England, Scotland, Wales, Northern Ireland, Channel Islands, Isle of Man and UK and Ireland n.f.d.
(d) Includes 'inadequately described', 'at sea', and 'not elsewhere classified'.
(e) Includes 'non-verbal so described' and 'inadequately described'.
(f) Applicable to persons aged 15 years and over.
(g) Applicable to persons aged 5 years and over.

Source: Australian Bureau of Statistics

TABLE 4.21
Age Characteristics by Sex for Shellharbour and Kiama

Age	Shellharbour			Kiama		
	Male	Female	Persons	Male	Female	Persons
0 - 4	2285	2150	4435	661	583	1,244
5 - 9	2,184	2,130	4,314	766	719	1,485
10 - 14	2,286	2,171	4,457	755	732	1,487
15 - 19	2,038	1,816	3,854	623	539	1,162
20 - 24	1,801	1,822	3,623	442	384	826
25 - 29	1,869	1,953	3,822	409	395	804
30 - 34	2,179	2,220	4,399	525	610	1,135
35 - 39	2,134	2,223	4,357	704	793	1,497
40 - 44	1,860	1,923	3,783	743	712	1,455
45 - 49	1,799	1,650	3,449	579	567	1,146
50 - 54	1,297	1,357	2,654	451	455	906
55 - 59	1,162	1,188	2,350	386	397	783
60 - 64	944	957	1,901	338	407	745
65 - 69	860	899	1,759	422	473	895
70 - 74	599	732	1,331	371	432	803
75 - 79	342	427	769	269	352	621
80 +	268	478	746	221	436	657
Total	**25,933**	**26,146**	**52,079**	**8,689**	**9,015**	**17,704**

Source: Australian Bureau of Statistics

At the time of the 1996 Census the unemployment rates for Shellharbour and Kiama LGA's were 13.2 per cent and 7.8 per cent respectively. At that time, the unemployment rate in Kiama was lower than the State average (8.8 per cent), whilst the unemployment rate in Shellharbour was well above the State average.

The recent development of the Dunmore Lakes Estate has commenced the transformation of this local area from a fringing rural area to a rural-residential area. From a social perspective, the local community within the Dunmore Lakes Estate is in its early stages of development and no fully representative characteristics of the community are evident. Initial indications are that the estate is attracting a range of professional persons and tradesmen and their families who prefer the style of living offered by a rural-residential development. Issues of concern to such persons were provided to the Applicant during the public consultation process (see Section 1.6.2).

TABLE 4.22

Employment Levels - Shellharbour and Kiama

Industry	New South Wales				Shellharbour				Kiama			
	Male	Female	Total	%	Male	Female	Total	%	Male	Female	Total	%
Agriculture, Forestry and Fishing	65,466	26,694	92,160	3.6%	95	57	152	0.8%	160	64	224	3.2%
Mining	19,999	1,447	21,446	0.8%	372	6	378	1.9%	99	4	103	1.5%
Manufacturing	220,872	91,072	311,944	12.2%	3,285	541	3,826	19.1%	523	142	665	9.4%
Electricity, Gas and Water Supply	18,462	3,485	21,947	0.9%	156	32	188	0.9%	58	10	68	1.0%
Construction	142,198	21,400	163,598	6.4%	1,604	206	1,810	9.0%	590	88	678	9.6%
Wholesale Trade	108,000	51,953	159,953	6.3%	669	188	857	4.3%	183	71	254	3.6%
Retail Trade	165,962	175,315	341,277	13.3%	1,295	1,823	3,118	15.6%	450	463	913	12.9%
Accommodation, Cafes and Restaurants	58,727	68,001	126,728	5.0%	342	564	906	4.5%	194	258	452	6.4%
Transport and Storage	90,060	31,016	121,076	4.7%	796	103	899	4.5%	186	44	230	3.3%
Communication Services	37,039	16,803	53,842	2.1%	214	105	319	1.6%	65	31	96	1.4%
Finance and Insurance	53,706	68,179	121,885	4.8%	151	395	546	2.7%	77	123	200	2.8%
Property and Business Services	146,800	124,929	271,729	10.6%	975	705	1,680	8.4%	329	246	575	8.1%
Government Administration and Defence	67,815	42,232	110,047	4.3%	371	3,351	722	3.6%	214	145	359	5.1%
Education	59,143	114,387	173,530	6.8%	363	681	1,044	5.2%	377	548	925	13.1%
Health and Community Services	54,037	184,419	238,456	9.3%	330	1,600	1,930	9.6%	158	586	744	10.5%
Cultural and Recreational Services	31,863	27,775	59,638	2.3%	126	176	302	1.5%	58	74	132	1.9%
Personal and Other Services	47,208	44,079	91,287	3.6%	330	369	699	3.5%	171	110	281	4.0%
Non-classifiable economic units	20,164	13,585	33,749	1.3%	213	92	305	1.5%	39	29	68	1.0%
Not stated	24,032	20,551	44,583	1.7%	186	171	357	1.8%	51	58	109	1.5%
Total	**1,431,553**	**1,127,322**	**2,558,875**		**11,873**	**8,165**	**20,038**		**3,982**	**3,094**	**7,076**	

Source: Australian Bureau of Statistics

4.11.2 Assessment of Impacts

The impacts of the development and operation of the Dunmore Lakes sand extraction proposal in terms of the local socio-economic setting are both positive and negative. The positive impacts are as follows.

(i) The Applicant would continue to employ 13 personnel involved directly with its operations and administration. Increased direct and indirect employment would occur as the Applicant gradually increases production.

(ii) The Applicant estimates that it would spend approximately 2 million (in 1998 dollars) per year in the local economy, through wages, contractors charges, fuel, maintenance and other purchases. The benefits to local business would continue.

(iii) The Applicant and its locally-based employees and contractors would continue to contribute towards the local spending for housing, local produce, services and food.

(iv) The social benefits of sustaining and improving direct and indirect employment.

(v) The continued supply of high quality sand products to the Illawarra region and the opportunity to expand the supply of proprietary blended products to the construction and building industry.

(vi) Local developers and builders would benefit through the continued presence of a local source of sand products.

The continued supply of sand products from within the Northern Illawarra area would reduce the quantity of sand products imported to the area, particularly from the Southern Highlands via Macquarie Pass. Less fuel would therefore be used for product distribution and there would be fewer opportunities for motor vehicle accidents on that route involving trucks.

The following negative socio-economic outcomes could occur should the Applicant's proposal be approved.

(i) Up to 19 ha of predominantly Class IV land would be lost from agricultural production. The land to date has not been highly productive and the proposed changed land uses will complement those already in the area. It should also be noted that a portion of this land would be removed permanently from agricultural production should the proposed North Kiama Bypass be constructed.

(ii) Short-term perceptions that surrounding property values may decrease. Whilst documentation is essentially non-existent regarding property values and their fluctuations in response to extractive industry approvals and activities, it is a common observation that for new projects, once extraction is underway and the type of operation is understood, property values appear unaffected by the extraction operations.

(iii) Product trucks and trucks delivering backfill materials would use and be seen along a short section (200 m) of Swamp Road. The negative impact of this activity would be minor, if at all, given the planned road improvements that will benefit all motorists.

4.12 SOCIAL IMPACT ASSESSMENT

4.12.1 Introduction

Section 4.11 presented a range of data and observations about the Shellharbour and Kiama Local Government Areas together with areas immediately surrounding the Project Site. The positive and negative impacts presented in that section concentrated on the tangible or measurable components of the surrounding communities and the impacts of the proposal. This section addresses a number of the matters presented in Section 4.11, however, greater emphasis is placed upon evaluating the well-being of those communities that would come into contact with the Applicant and the proposal should it be approved.

The approach to assessing the social impact of the proposal has been compiled with reference to the "Guidelines for Assessing Social Impacts" (NSW Cabinet Office, 1997) and "Techniques for Effective Social Impact Assessment – A practical guide" (Cox, 1995).

4.12.2 The Local Community

The local community surrounding the Dunmore Lakes – Stage 1 Project Site is comparatively small and centres upon Swamp Road, a local road that also serves as a secondary tourist road to Jamberoo. As discussed in Section 4.11, the character of the local community is presently changing as the Dunmore Lakes Estate is being settled. The larger properties around the estate have both long-standing owners and comparatively new owners.

The area south of the Princes Highway has for many years been unchanged with short periods of activity (including sand extraction) on the Project Site. There has been very little change in land use during that time on land surrounding the Project Site. Within the last few years, there have been some changes in land ownership with consequent changes in land use proposed, e.g. "Seaview" has now been developed as a horse stud and the Old School House is being developed as a Wedding

Reception Venue. Dunmore House has remained an important local venue for horse riding and training.

The greatest change to be planned within the local community is the construction and use of the North Kiama Bypass. This project which is due for completion in 2004 will transform the local area with the construction of an elevated road above the flood-prone land and a deep excavation through the ridge to the south-west of "Dunmore House". The Applicant is keen to ensure that its activities are coordinated with those of the RTA during the Bypass construction and after it is operational. Given the Applicant owns the land adjoining the Bypass and Swamp Road overpass, it has the opportunity to provide for long-term landscaping that would improve/shield the visual appearance of the Bypass from virtually all residences in the local community.

The Applicant recognises that issues relating to visual appearance, noise and increased use of the short section of Swamp Road are important to the well-being of the local community. In response to this recognition, the Applicant would endeavour to minimise the impact of its proposal on the local community, not only through the implementation of the various safeguards presented in earlier sections but through regular and genuine consultation with the community. This contact could be on a one to one basis or through the Community Consultative Committee referred to in Section 1.6.2.

In conclusion, it is assessed that the impact of the proposal on the local community will initially be moderate because of the changes that are likely to occur from the existing situation particularly from a visual, noise and traffic perspective. The Applicant would need to ensure that all safeguards and procedures are followed to ensure that, although the activities are noticeable and periodically audited (within EPA criteria), the activity is unobtrusive as possible to the local community.

4.12.3 Dunmore – Kiama Area

The Applicant considers itself a longstanding member of the Dunmore Community having operated the Dunmore Sand Quarry for over 10 years. As such, the Applicant is keen to maintain a good working relationship with local businesses and residents.

From a slightly wider perspective, the Kiama area has a greater tourist focus than does Dunmore or Shellharbour. It is therefore important that the issues relating to the proposal that are relevant to tourism in the Kiama area are satisfactorily addressed. These matters principally relate to visibility and to a lesser extent on transportation.

Section 4.8 reviews the visual controls that would be incorporated within the proposal and the extent of site activities visible prior to and after the construction of the North Kiama Bypass. Whilst there would be periods when certain activities would be observed, it is assessed that the activities are unlikely to influence tourist activity or visitor experience for those persons visiting the Kiama district. The proposed sand extraction would be a temporary land use that would ultimately create a sculptured lake / foreshore landform that would enhance rather than detract from visitor experience.

The issue of trucks on local roads is invariably an issue of concern to residents, tourist groups and Councils. In the case of the current proposal, it is very well placed being only 0.2 km from the Princes Highway (pre-North Kiama Bypass) and able to connect directly with the Swamp Road overpass (post-North Kiama Bypass). With such traffic arrangements, the proposal would have negligible impact on the social fabric of the Dunmore / Kiama community.

4.12.4 Illawarra Area

The issues of visibility and truck transportation could also influence the social impact of the Illawarra area. Other influencing issues include the social benefits of obtaining construction materials from within the area rather than importing such materials.

Many persons in the Illawarra area currently travel along the Princes Highway near Dunmore (approximately 18 000 vehicles per day). Again the issue of visibility would be important from the existing and future road network. Many residents of the Illawarra would similarly travel via Macquarie Pass towards the Southern Highlands and it is a common preference for fewer trucks on that section of Road. Such a position could occur if the Northern Illawarra area became self-sufficient in fine sand.

The economic benefits to business in the Illawarra area would be noticeable if the construction industry was able to obtain its raw materials from local and not distant sources. Cost savings would result from considerably shorter travel distances.

PREAMBLE

Section 5
JUSTIFICATION/EVALUATION OF THE PROPOSAL

This section concludes the document with an evaluation of the Dunmore Lakes sand extraction proposal – Stage 1. This evaluation firstly justifies the proposal in terms of the need for the fine sand and to backfill the perimeter of the void. The proposal is further justified in terms of biophysical, economic and social considerations. It then assesses the proposal in the context of the principles of Ecologically Sustainable Development. The section concludes with an outline of the consequences of not proceeding with the development.

5.1 JUSTIFICATION OF THE PROPOSAL

5.1.1 Introduction

Schedule 2 (5) of the *Environmental Planning and Assessment Regulation 1994* requires this document to justify the development of the Dunmore Lake sand extraction proposal in the manner proposed having regard to biophysical, economic and social considerations and the principles of Ecologically Sustainable Development. This section initially justifies the proposal in terms of the need for the fine sand within the resource and the need to backfill with the nominated materials to create the final landform. The justification of the proposal in terms of the biophysical, economic and social considerations draws principally upon the assessments of impact set out in Section 4 of this document.

5.1.2 The Need for Fine Sand

An important component in the justification of the proposal is to demonstrate the need for additional sources of fine sand to be developed specifically within the Northern Illawarra area and then to demonstrate that Dunmore Lakes – Stage 1 could satisfy that need. This assessment of need is drawn from a review of the supply and demand for fine sand undertaken by Don Reed and Associates Pty Ltd (1999). This sub-section essentially draws together the profile of the Illawarra Sand Market (Section 1.4.4) and the alternative sources of fine sand (Section 2.13.2).

The need for any commodity or resource used by our society is determined by examining the demands for the commodity or resource and the sources capable of satisfying those deans in both the short-term and long-term. Alternative materials may also be present that could be substituted for the commodity or resource.

The need to consider and plan for long-term sources is fundamental to successful planning because:

(i) potential land use conflicts and environmental problems are minimised; and

(ii) commodities are provided at realistic prices to consumers.

Don Reed and Associates Pty Ltd (1999) established that the demand for fine sand in the Northern Illawarra area is relatively static at approximately 385 000 t per year. At present, approximately 50 per cent of this demand is supplied from four sources within the Northern Illawarra area. The remainder of the demand is currently supplied from Kurnell and the Southern Highlands. In total, the four sources have 1 835 000 t remaining which at the current rate of extraction would theoretically last for approximately 8.5 years. Such a theoretical approach is inappropriate given:

(i) the rate of extraction within the site operated by Shellharbour City Council is related to the area required for landfill, i.e. the rate of sand

production is "landfill-driven". Hence, it is unlikely that annual production would vary far from 25 000 t;

(ii) the limited resources at Primbee are being retained for use in company-owned concrete plants, and for one or two long-term clients; and

(iii) the resources at Gerroa are being extracted at a modest rate (60 000 tpa to 70 000 tpa) principally to only supply Cleary Bros' internal requirements. Furthermore, the Development Consent for extraction of the Gerroa resources is due to expire in 2002. No certainty exists that the estimated 850 000 t of sand remaining at Gerroa in 2002 could be extracted beyond that time.

In reality, the proportion of fine sand required within the Northern Illawarra area will be supplied more from outside the area than within the area unless other resources are developed. By the year 2002, the principal sources of fine sand would be Shellharbour City Council (at approximately 25 000 tpa) and perhaps Cleary Bros (at approximately 60 000 to 70 000 tpa). Unless other sources are developed within the Northern Illawarra area by that time, the annual shortfall of approximately 300 000 t would need to be imported, principally from the Southern Highlands, via Macquarie Pass.

Don Reed and Associates Pty Ltd (1999) discounted the use of blast furnace slag or manufactured sand as alternative replacement sources of fine sand, principally because those materials are too coarsely graded. Given the lack of alternative materials to fine sand and the uncertainties that Don Reed and Associates Pty Ltd describe with respect to sand extraction within Lake Illawarra and Gerroa, the need to extract the Dunmore Sand Resource – Stage 1 is compelling, i.e. provided it can be extracted in an environmentally responsible manner – as described in this statement.

The ongoing supply of fine sand from within the Northern Illawarra area, i.e. from Dunmore Lakes – Stage 1, will not only reduce the long distances travelled by trucks from the Southern Highlands but would provide for a long-term aesthetically pleasing and environmentally sustainable feature at Dunmore.

5.1.3 Justification of Backfilling

The justification of the backfilling operation at the Project Site centres upon the issues of maximising the recovery of high quality sand resources and the provision of a destination for virgin excavated natural materials and inert reprocessed wastes. The placement of the inert reprocessed wastes on the Project Site does not mean the site is a landfill.

The proposed backfilling activity has the principal objective of re-creating a margin of useable land (and wetlands) around the perimeter of the areas from which sand is extracted. The Applicant's proposal therefore provides for not only the creation of a flood-free landform adjacent to the Bypass but will ultimately provide foundations for the southern ramps from the North Kiama Bypass. The reconstructed landform will

also provide a minimal area of additional land to support the rural-residential lots, the owners of which would have a vested interest in the lakes and wetland areas. If the same landform was not extracted and the sand was left in situ, in the order of 1 million tonnes of high quality sand would be sterilised.

One of the objectives of the Waste Minimisation and Management Act 1996 is "to promote and ensure environmentally responsible transporting, reprocessing and handling of waste". The existing operation at the Dunmore Sand Quarry and similarly proposed at the Dunmore Lakes site, clearly meets this objective.

Transporting

The fact that the principal activity is sand extraction and processing and the supply of a product required for the construction industry, provides the Applicant with the opportunity to backload materials from excavation sites where its sand products are delivered. This backloading of materials demonstrates "environmentally responsible transporting". The backloading is carried much further with the Applicant able to arrange for reprocessed waste materials, i.e. "coarse inert aggregate rubble" from EPA licenced Waste Receival and Recycling centres to be transported to Dunmore in trucks that have delivered coarse quarry products from the Illawarra area to the Sydney metropolitan area.

Reprocessing

The promotion of reprocessing of, in this case, builders waste to create a "non-waste" product such as coarse inert aggregate rubble, could not be sustained if reprocessed materials could not be used or disposed of in an environmentally acceptable manner. There is clearly a need for sites to use reprocessed materials to reduce the pressure placed on landfills particularly within the Sydney metropolitan area. The Applicant's sites at Dunmore provide an excellent opportunity for the use of the reprocessed materials to create an engineered landform around the lake perimeter in what would otherwise solely be a deep lake.

Handling

As discussed in Section 2.4.4, the Applicant has a rigorous system in place to ensure the materials received are screened and handled in an efficient manner. The approach to handling, the level of efficiency on the site, coupled with the close proximity to the Princes Highway, has already and would enable trucks to achieve quick turnarounds on site.

In summary, the restoration backfilling of the existing Dunmore Sand Quarry and the proposed Dunmore Lakes site offers the waste industry a suitable site for the use of their reprocessed waste and alleviate some of the pressures on controlled landfill facilities.

5.1.4. Biophysical Considerations

The Dunmore Lakes sand extraction proposal has been designed in such a manner that the Applicant can continue to produce a range of high quality construction sand products without adversely affecting the environment around Dunmore and the surrounding district. Although some physical impacts would occur as a result of the proposal, it has been determined that the level of these impacts falls within specified criteria or reasonable community expectations.

The assessed physical impacts on the local environment from the development of the proposal and the justification of those impacts are set out below.

(i) The proposal would result in the further modification of the Project Site which has already been significantly modified by past sand extraction and agricultural activities. The principal modification in the long term would be the creation of two scenic lakes.

(ii) A range of water management controls and safeguards would be implemented to ensure that water quality beyond the Project Site is not adversely affected. Surface water flows and flooding would not be significantly impacted and groundwater monitoring would be undertaken to ensure that levels are not changing on site and therefore potentially affecting the adjoining wetlands.

(iii) The progressive clearing of up to 19 ha of grassland for the development of the sand extraction proposal would be inevitable. However, implementation of the nominated safeguards and progressive rehabilitation would ensure minimal adverse impacts on local native flora and fauna. Rather, the proposed creation of the two lakes, an arboretum and more than 3 ha of wetlands would increase potential habitat for local flora and fauna.

(iv) Dust generation on the Project Site would be managed principally through the use of a sprinkler system in the vicinity of the stockpiles and by sealing the site access road.

(v) Operational activities associated with the proposal, though audible at nearby residences from time to time, would generally satisfy the EPA noise criteria at existing residences. Reliance would placed upon undertaking certain activities during and following the construction of the North Kiama Bypass.

(vi) Contributed traffic noise levels on Swamp Road would not increase significantly as a result of the proposal.

(vii) No rare or threatened plant species nor animal species would be significantly impacted by the proposal.

(viii) Although part of the processing plant and certain earthmoving and sand extraction operations would be visible from surrounding residences, local road network and ultimately from the North Kiama Bypass, the overall visual impact would be only moderate. Progressive rehabilitation would ensure that the visual impact of the proposal remains acceptable throughout the life of the operation. Ultimately, the landform created (and vegetated) would be most aesthetic.

5.1.5 Economic Considerations

The economic considerations of the proposal are assessed in the context of the benefits to the economy if the Development Application for Stage 1 of the Dunmore Lakes sand extraction proposal is approved. Should the Applicant's Development Application be approved, there would be a number of direct and / or economic benefits for the Applicant, its employees and contractors, as well as for the local community, and State and Federal Governments. These benefits are set out below.

Dunmore area, Shellharbour and Kiama LGA's and the Illawarra Region

- Continued direct employment of the Applicant's existing staff, together with additional employees. In total, the Applicant's operations provide employment for 13 persons. Continued employment is recognised by the Applicant to be important to the local economy.

- The Applicant currently contributes approximately $0.5 million annually to the local economy in wages for its employees.

- The Applicant's continued expenditure on services and the purchase and maintenance of items of plant and equipment would continue to benefit local businesses. Current annual expenditure on these exceeds $1.5 million.

- Financial contributions by the Applicant, employees and contractors to the local economy would continue, particularly for housing, food and clothing, entertainment and services.

- A cost competitive supply of high quality sand products to the construction industries in the Illawarra Region would continue.

- Should the proposal be approved, local residents would also benefit through the Applicant's contributions to the upgrading and on-going maintenance of Swamp Road.

New South Wales

- The New South Wales Government would benefit directly from the long-term employment of the Applicant's workforce and associated charges and flow-ons.

- A cost competitive supply of high quality sand products to the New South Wales construction industry would be maintained from Stage 1 for a period of up to 15 years for the construction of roads, housing, schools, hospitals and major infrastructure projects. The potential further Stages 2 and 3 of the Dunmore Lakes Scheme would extend this period out to possibly 30 years.

- The NSW Government (through the RTA) would benefit from the proposed backfilling and raising of ground level for the long term construction of the southern ramps for the North Kiama Bypass.

Australia

- Australia would also benefit from the Dunmore Lakes sand extraction proposal in the form of corporate income tax and personal income tax.

The impacts upon the Local, State and Federal economies if the Applicant's Development Application is not approved are assessed as follows.

- The Applicant and the community would lose an important source of specialised raw materials and one which would effectively underpin its future business in the Illawarra Region. The unavailability of the additional resource would inevitably result in the retrenchment of all locally employed operational staff within a period of approximately 5 years.

- A failure to secure Development Approval would essentially sterilise the resource and as such would be contrary to its recognition as an important resource within Illawarra REP No. 1.

- The economic benefits to the Local, State and Federal economies would not eventuate to the same extent.

- The extraction area would continue to provide an income as grazing land – a value per hectare far less than its use as a source of raw materials for the construction industry.

- There would be a requirement to transport the required construction materials from alternative and perhaps more distant sources with an attendant impact on the cost of the raw materials (and hence final product cost), and also the social costs associated with increased road haulage e.g. road safety, road maintenance costs, increased road congestion and

greenhouse emissions. Increased costs could also have an adverse impact on the timing and economics of major infrastructure projects.

- Any perceived reduction in property values due to the presence of the project in the local area would not eventuate.

5.1.6 Social Considerations

The principal social considerations that would arise from the approval of the Applicant's Development Application would be as follows.

(i) Long term direct employment of the Applicant's existing employees would be maintained and additional jobs would also be created.

(ii) Continued support of local services through expenditure by the Applicant, its contractors and employees.

(iii) Continued indirect employment such as employment for transport sub-contractors employed by the Applicant and its customers.

(iv) Continued provision of a cost competitive local source of sand to the local community.

(v) The Applicant's contributions to local community groups or infrastructure projects would continue to benefit the local community.

(vi) The Applicant's commitment to the upgrading and on-going maintenance of Swamp Road would benefit the local residents.

The proposal has been designed to ensure all potential adverse impacts are controlled which, in turn, would result in adverse social impacts being limited.

In the event that the Development Application is not approved, the social consequences would be the reverse of the benefits listed above, namely:

(i) a minimum of 13 persons directly employed by the Applicant would be progressively retrenched;

(ii) the employment for local truck drivers contracted by the Applicant or its customers would be foregone to other drivers servicing other extractive industries;

(iii) the support for local services by the Applicant and its employees would be lost;

(iv) increased social costs associated with the need to transport required raw materials from more distant sources to the end user may transpire; and

(v) a loss of revenue to Shellharbour City Council and the NSW and Federal Governments.

The proposal to extract fine sand from the last major province in the northern Illawarra area has been assessed to have substantial social worth for the region, its industries and its population. The social worth of the proposal and its positive impacts are assessed to outweigh the negative impacts.

5.2 ECOLOGICAL SUSTAINABILITY

5.2.1 Introduction

Ecologically Sustainable Development (ESD) is a concept which can be defined as development which uses, conserves, and enhances the community's resources in such a way that ecological processes are maintained and our existing and future quality of life can be improved. An alternative definition is "a development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations". This sub-section of the EIS has been prepared with reference to a range of documents including the draft Practice Guidelines for ESD in Environmental Impact Assessment prepared by the Department of Urban Affairs and Planning.

Extractive industry products contribute substantially to the material well-being of all Australians and underpin the physical fabric of our society given they are used, for example, in the construction of homes, road, airports, water supply schemes, community facilities shops, offices, sporting and entertainment facilities, and infrastructure projects. The production of these products is also important for regional development and employment. However, quarries and raw material processing activities do involve some degree of environmental disturbance. In the context of ESD, the issue of whether environmental impacts are irreversible or affect long-term ecological sustainability is important. For this reason, it is the overall objective of the ESD process to ensure compatibility between extraction and the environment. Because extraction involves the removal of non-renewable resources, the first step towards achieving ESD involves ensuring efficient use of the identified resources and therefore achieving maximum resource utilisation.

It is intended in this sub-section to address how the Dunmore Lakes Sand Extraction Proposal has been planned and would operate in a manner that is consistent with the principles of ESD. It is also necessary for the proposal to be prepared **and** evaluated with an approach that is consistent with the two main features of the National Strategy for Ecologically Sustainable Development (NSESD) namely:

(i) the need to consider in an integrated way the wider economic, social and environmental implications of our decisions and actions for Australia, the international community and the biosphere; and

(ii) the need to take a **long-term** rather than a short-term view when taking those decisions and actions.

5.2.2 Principles of ESD

As defined under *Schedule 2(8)* of the *Environmental Planning and Assessment Regulation, 1994*, ESD involves the following four interrelated principles:

- the precautionary principle;
- the principle of intra- and inter-generational equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

The Precautionary Principle

This principle states that "where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

(ii) an assessment of the risk-weighted consequences of various options (IGAE, 1992).

To satisfy this principle of ESD, emphasis must be placed on anticipation and prevention of environmental damage, rather than reacting to it. For this purpose, the Applicant has engaged a number of specialist consultants during the design of the proposal to examine the existing environment, predict possible impacts and recommend safeguards in order to ensure that the level of impact satisfies statutory requirements or reasonable community expectations. Considerable emphasis has been placed upon planning for the prevention or minimisation of environmental harm.

Environment safeguards, as discussed throughout this section, are measures that have been planned with a comprehensive knowledge of the existing environment and an appreciation of the potential impacts, in order to prevent or limit environmental degradation. Throughout the development of the proposal, the Applicant and their consultants have adopted an anticipatory approach to risk, particularly the risk of irreversible ecological damage by undertaking an appropriate level of investigation and environmental evaluation. Reliance has also been placed upon experience gained at

the Dunmore Sand Quarry to date, particularly with respect to noise and air quality issues and surface water management.

After a full evaluation of the potential environmental impacts of the proposal, there are no activities or features for which there is a level of uncertainty in achieving an acceptable level of environmental performance. The procedures necessary to achieve good and responsible extraction practices are well known and, equally important is a proactive response to on-site environmental management and a co-operative and open approach to all issues with appropriate Government Authorities. These elements have been demonstrated by the Applicant in its existing extraction and processing operations since its acquisition of the Dunmore Sand Quarry in 1987. It is considered that there are no irreversible features of the proposal with the exception of the depletion of a resource required for continued prosperity of the local and regional community. Features of the local environment such as water quality, soil resources, air quality and flora and fauna would be managed throughout the life of the project such that they would be comparable before and after the proposed extraction operations.

Intra- and Inter-Generational Equity

The objective of this ESD principle is that "the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations" (IGAE, 1992).

This principle is based on social equity for the current generation (intra-generational) and future generations (inter-generational).

Intra-generational equity requires that the economic and social benefits of the proposed development be distributed appropriately among all members of the community. The Dunmore Lakes sand extraction proposal, and particularly the safeguards proposed with respect to flora, fauna, water, air, noise, visibility, transportation and soil management, have been designed to ensure that no part of the community would be unacceptably disadvantaged.

The non-material well-being or "quality of life" of existing and future residents of the Dunmore area would continue to be maintained throughout and beyond the life of the project through implementation of safeguard measures to mitigate any environmental impacts, and a progressive rehabilitation program.

The Applicant's proposal has been planned to ensure efficient recovery of the sand resource and the production of a range of high quality sand products for a wide range of uses in the civil, construction and building industries.

The sand products used in the construction of buildings and infrastructure benefit the local and wider population. Housing, major buildings, infrastructure such as roads, bridges and tunnels which typically have a life of 50 to 100 years or longer when constructed using better quality materials, benefit both present and future generations. The conversion of construction material into finished infrastructure is both a process of value adding and a long-term investment in the materials.

Conservation of Biological Diversity and Ecological Integrity

Biological diversity or biodiversity describes life forms and is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity. Ecological integrity describes the condition of an ecosystem that is relatively unaltered from its natural state. For the purposes of this assessment, biodiversity is considered both on the Project Site, and where appropriate, beyond the Project Site.

Although minor impacts would occur on a local scale, the Applicant's specialist consultants consider that in both the short and long-term, the biodiversity of the Project Site and surrounding area would be conserved, maintained and, more than likely improved as a greater diversity of habitat and vegetation returns to the Project Site. Given the Company's proposed adoption of recommendations to minimise impact, the relatively small number of native trees to be cleared, the implementation of progressive rehabilitation, and the use of flora species native to the area, the biodiversity and ecological integrity of the area long-term would be maintained.

Improved Valuation and Pricing of Environmental Resources

This principle involves consideration of the materials proposed to be extracted and the surrounding environmental resources (e.g. air, water, land and living things) which may be affected. The valuation and pricing of the extracted and processed materials comprises the cost of extracting, processing and rehabilitation costs, profit, delivery costs and the final cost to the customer.

Whilst it is difficult to assign a dollar value to environmental resources, the subjective value placed by the Applicant on the environmental resources, other than the extracted resource, is evident in the extent of research, planning and design of environmental safeguards and measures to prevent irreversible damage of these resources. The Applicant's emphasis on the production of high quality, high value products from the raw materials as a means of maximising the value of the limited resource available is also noted.

5.2.3 Conclusion

The development and operation of the Dunmore Lakes Sand Extraction Proposal has been designed to assist in the extraction of one of the Region's recognised extractive resources in both an efficient and environmentally responsible manner. The approach taken in planning the proposal has been multi-disciplinary, with community involvement and consultation with professionals and various Government Authorities, and with emphasis on the application of safeguards shown to be effective in the Applicant's existing operations.

It has been assessed that the proposal would enable the continued production of sand products for use in the building and construction industries within the limits of accepted criteria and with minimal adverse impact on the surrounding physical environment. The proposal is consistent with the features which distinguish an

ecologically sustainable approach to development in that the development and operation of the Dunmore Lakes sand extraction proposal would provide a high quality resource for local, Illawarra and Sydney construction projects for a period of up to 15 years.

The economic and social benefits of such development are also considered to outweigh the possible short-term economic, social or environmental "costs" to the local community.

5.3 CONSEQUENCES OF NOT PROCEEDING WITH THE DEVELOPMENT

Schedule 2(3)(a) of the *Environmental Planning and Assessment Regulation 1994*, requires this document to address the consequences of not proceeding with the Dunmore Lakes sand extraction proposal. The consequences of not proceeding are manifold and include:

(i) essentially sterilising an extractive resource recognised within the Illawarra REP No. 1 which would otherwise be of economic value to the local community and Illawarra region for a period of up to 15 years;

(ii) the Company would need to downsize its existing workforce as the existing resources at the Dunmore Sand Quarry are depleted. The existing resources approved for extraction at the Dunmore Sand Quarry would be depleted within less than 5 years;

(iii) a number of indirect jobs would be foregone such as truck drivers involved in product transportation;

(iv) the extraction of approximately 2.75 Mt of sand and production of a range of specialised construction products ideally suited for a range of uses would not eventuate;

(v) the economic and social benefits identified in Sections 5.1.3 and 5.1.4 would not eventuate;

(vi) significant additional costs would be borne by small consumers, the construction industry, State Government Authorities and Councils due to the possible increased costs attributable to the increase distance materials from alternative resources would need to be transported particularly from the Southern Highlands via Macquarie Pass; and

(vii) the minor potential impacts on the local environment would not eventuate.

5.4 CONCLUSION

The Applicant's proposal for the development and operation of the Dunmore Lakes sand extraction proposal in the manner identified in this document would enable a substantial high quality resource of local, regional and State significance to be developed relatively close to areas of significant population growth and the State Highway system.

All environmental constraints imposed upon the proposal would be overcome through the implementation of a range of safeguards and procedures to ensure the surrounding biophysical and socio-economic environment and surrounding residents are not adversely affected by the proposal. It is also noteworthy that the majority of the safeguards to be implemented with respect to this proposal are currently being responsibly exercised or implemented by the Applicant in its existing operations at the nearby Dunmore Sand Quarry.

Although some impacts would occur, it is assessed that the level of impact in all areas would meet specified criteria or reasonable community expectations, with any adverse impacts far outweighed by the positive impacts.

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GLOSSARY

Glossary of Technical Terms and Symbols

GLOSSARY OF TECHNICAL TERMS AND SYMBOLS

Technical Terms

ABS	Australian Bureau of Statistics
acid sulfate soil	Common name given to sediment and soil containing iron sulfides (iron pyrite) which oxidise creating sulfuric acid
air pollutant	a substance in ambient atmosphere resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air contaminant")
air pollution	presence of air pollutants
alluvium	deposit of sand, mud etc formed by flowing water.
ambient air quality	the quality of the ambient air near ground level, expressed as concentrations or deposition rates of air pollutants - also expressed as existing air quality
aquatic	pertaining to water
aquifer	rock or sediment strata which is characteristically porous and permeable, therefore will transmit the flow or passage of water. Generally the horizontal flow is in the slightly down dip direction
association	an aggregation of botanically-related types which also have similar structure
attenuation	reduction in sound pressure levels between two locations
backfill	material used to fill created void
background noise level	the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source; or sound generated for test purposes)
basalt	fine-grained, dark volcanic igneous rock
batter	receding slope from ground upwards
bulk density	for aggregate is the mass in the air of surface-dry particles divided by the saturated by surface-dry volume
bund wall	a man-made earth mound used to visually and acoustically screen nearby receivers
catchment	drainage area of a reservoir, river, creek, etc.
catchment area	the area determined by topographic features within which rainfall will contribute to runoff at a particular point
chloride	the univalent negative ion of the element chlorine (Cl^-)

clay	a size term denoting particles, regardless of mineral composition, with diameter less than 0.004mm
community	a combination of plants that are dependant on their environment and influence one another and modify their own environment. They form together, with their common habitat and other associated organisms, an ecosystem, which is also related to neighbouring ecosystems and to the macroclimate of the region
conductivity	the dissolved salt content of water expressed in terms of μs/cm
conglomerate	coarse grained sedimentary rock (>2mm) consisting of subrounded fragments
contour bank	an earth bank constructed across a slope parallel to contours
cutter-suction dredge	A floating machine that extracts sand through mechanically cutting and then pumping the sand to a processing plant
cyclone	a conical shaped vessel designed to separate particles from a moving stream of either air or water
decibel	unit expressing difference in power between acoustic signals
Development Application	an application for approval of an activity deemed to require an approval prior to commencement
dip	the angle that rock strata make with a horizontal surface measured at right angles to the strike
diversion bank	an earth bank constructed to divert water away from disturbed areas
dust	particles of mostly mineral origin generated by erosion of surfaces and the mining and handling of materials
EC	electrical conductivity (see conductivity)
ecosystem	the totality of biological processes and interactions within a specified physical environment
ephemeral	lasting only a short time
ephemeral creek	creek in which flow is intermittent usually short term following rainfall
excavate	to dig into natural material or fill using an excavator or other machinery
excavator	item of tracked earth moving equipment fitted with a bucket or an articulated boom and used for digging material from a face in front of, or below the machine. An excavator would be used around the perimeter of the lakes
existing air quality	the quality of the ambient air near ground level, expressed as concentrations or deposition rates or air pollutants - also expressed as ambient air quality
exotic	introduced or foreign, not native

extraction	a term synonymous with quarrying
fallout	the sedimentation of dust or fine particles in the atmosphere
fill	material imported and emplaced to raise the general surface level of a site
final void	cavity created by material extraction
fines	material such as clay or silt sized particles
fluvial	pertaining to or produced by a river
formation (or unit)	a (named) succession of sedimentary beds having some common characteristics
fresh rock	rock unaffected by natural weathering processes
friable	easily crumbled as in poorly cemented rocks
geochemical	chemical aspects of the composition of the earth's crust
geomechanical	the materials engineering of rock properties and behaviour when forces or loads are applied to the rock mass
geotechnical	Technical or engineering aspects relating to soil, rock and other materials
groundwater	water contained in voids such as fractures and cavities in rocks and inter-particle spaces in sediments
highly weathered rock	rock affected by considerable weathering to the extent that it is friable
hydraulic gradient	the direction of flow of groundwaters
hydrocyclone	a cyclone specifically designed for wet applications
infrastructure	the necessary buildings, roads and equipment associated with a quarrying operation
intermittent	flows periodically, irregularly
inversion	weather term for surface defining boundary between two layers of air or different temperatures
lithic sandstone	sedimentary rock of sand grade in which rock fragments are proportionally more important than feldspar grains
lithology	refers to the general characteristics of sediments
loam	loose soil composed of clay and sand, especially a kind containing organic matter and of great fertility
Local Environmental Plan	a plan developed by a council to control development in part or all of the Shire or Municipality
macrophyte	vascular plant
matrix	fine grained constituent of some sedimentary rocks containing coarser grains and fragments
micro-organisms	organism such as bacteria not visible to the naked eye
mobile equipment	wheeled or tracked self-propelled equipment such as trucks and front-end loaders
monitoring	the regular measurement of components of the environment to establish environmental standards are being met

mottling	multi-coloured effect in soils - grey and yellow-brown is common
mulch	straw, leaves, loose earth, etc. spread on the ground or produced by tillage to protect the roots of newly planted trees, crops, etc.
non-perennial	refers to streams which do not flow the whole year through - also known as intermittent streams
operational constraints	limitations upon a project by equipment or machinery
palaeo channel	a former river or stream course now infilled by deposits of sand and gravel
particulate matter	small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particles
perennial	refers to stream which has flow throughout the year
permeability	a material property relating to the ability of the material to transmit water
Permian	Geological period of time from 280 to 225 million years before present
photomicrograph	photograph taken through a microscope
podzolic	soil descriptive term for soils that are strongly acid and highly differentiated
population	a group of organisms all of the same species occupying a particular area
porphyritic	a textural term describing rock containing relatively large crystals set in a finer-grained "groundmass"
porous	containing voids, pores, interstices or other openings which may or may not by interconnected
potable	water suitable for human consumption
potentiometric surface	equilibrium standing groundwater level
processing plant	a group of equipment used to clean and grade sand
processing screen	a screen used to separate various sizes of material for further crushing or product screening
product screen	used in the final size of the product
product truck	a registered truck used for the delivery of products from the quarry to the customer
pyrite	the most wide-spread sulphide material FeS_2. Found in many geological settings
quadrat	a square survey area
quartz	the most common form of silica (SiO_2) usually clear or white
Quaternary	geological period of time from 2 million years before present to present
raw feed	material from the active extraction area - of a size suitable for processing
Recent	geological time period representing the last 5 000 years

Regional Environmental Plan	a plan prepared by the State Government Department responsible for planning where controls on development are considered on a regional and statewide basis
rehabilitation	the preparation of a landform after quarrying and its stabilisation with grasses, trees and shrubs
reserves	refers to an estimated quantity of useable material
resource	recoverable material of economic interest
fines return pond	excavation for placement of fine materials washed from the dredged and processed sand
revegetation	replacement of vegetation principally grasses and legumes on areas disturbed by quarrying or other activities
road base	road pavement usually made up of densley graded crushed rock in varying sizes
saline	water with high salt concentration
salinity	the dissolved content of water expressed in terms of milligrams per litre
sand	sediment comprising particles in 0.063 to 2mm size range
sand slurry	sand mixed with water
sandstone	general term for sedimentary rock with grain size from 0.063mm to 2mm - grains may be minerals or rock fragments
scarify	to stir the soil without altering its form, or disturbing its sequence of layers
screening	a process which separates material into various fractions - this usually involves a mechanical vibration of the rock over a series of decks fitted with steel mesh, steel plate or polyurethane or rubber mats with fixed sized apertures
sedimentary rocks	rocks formed from material derived from pre-existing rocks or by chemical precipitation
shale	fine grained sedimentary rock types such as siltstone or mudstone which part readily along well-defined bedding planes
silica	silicon dioxide (SiO_2)
siliceous	having a high silica (quartz) content
silt	a classic sediment, most of the particles of which are between 0.063mm and 0.004mm in diameter.
silt-traps	structure designed to trap silt and sediment
siltstone	general term for sedimentary rock with grain size from 0.004mm to 0.063mm - individual grains not discernible with unaided eye
silt-stop fencing	fine mesh fencing normally installed downslope of a sediment source, designed to trap silt and sediment and allow the water to pass through
solodic	soil descriptive term for soils that are mildly leached
spatial	related to areal extent

specific gravity	the weight of any body or substance considered with regard to the weight of an equal bulk of pure water
sulfate	a bivalent negative ion of sulphur and oxygen ($SO_4^{=}$)
surge box	part of processing plant that regulates flow from dredge
suspended solids	analytical term applicable to water samples and referring to material recoverable from the sample by filtration
temperature inversion	an increase in air temperature with height
temporal	related to time
terrestrial	of the land as distinct from water
Tertiary	geological time period, 2- 60 million years ago, comprising Palaeocene and Pliocene epochs
topography	landform
topsoil	the surface layer of a poorly-developed or well-developed soil profile containing the main percentage of organic material
turbidity	Discolouration of or suspension of particles in water resulting in a reduction in clarity
vehicle movement	a one-way trip
volcanics	a general term applied to rock types of volcanic origin (e.g. basalt).
weathered rock	rock affected to any degree by the processes of chemical or physical weathering
weathering	the group of processes (e.g. action of air, rain, water etc,) change in character, decay and eventually crumble to soil
wetland	swamp or damp area of land
wet processing plant	a plant designed to wash unwanted sized materials from product

Symbols

'000t	multiples of one thousand tonnes
AHD	Australian Height Datam; in metres above mean sea level.
ARI	Average Recurrence Interval
AADT	Average Annual Daily Traffic
A-Scale	a sound level measurement scale. It disseminates against low frequencies. It approximates the human ear.
CEC	Cation Exchange Capacity
cm	centimetre (unit of measure)
dB(A)	the unit of measurement of sound pressure level heard by the human ear
g	gram (= 0.001 kilogram)
g/m^2/month	grams per square metre per month -unit for deposited dust
ha	hectare (100m x 100m)
Hz	hertz - a unit of frequency
IDO	Interim Development Order
km/h	kilometres per hour
kL	thousand litre
kg	kilogram (weight measure)
kg/ha	kilograms/hectare
km	kilometre (= 1000 meters)
km^2	square kilometres
kV	thousand volts (Electrical Potential Unit)
kVA	kilovolt amps
KW	thousand Watts (Energy unit)
L	litre
LEP	Local Environment Plan
L/s	litres per second
L_{A10}	sound level exceeded 10 per cent of the sampling time
L_{A90}	sound level exceeded 90 per cent of the sampling time
L_{Aeq}	the L_{Aeq} is the "equal energy" average noise level, and is used in some instances for the assessment of traffic noise affects or the risk of hearing impairment due to noise exposures
m	metre
mm	millimetre
ML	million litres
Mm^3	million cubic metres
m^2	square metres
m^3 pa	cubic metres per annum
m^3	cubic metres
Mg	milligram (weight unit)
mg/L	milligrams per litre (parts per million)
MJ	million Joules (Energy unit)
ML	megalitre
mm	millimetre (= 0.001 metres)
mm/day	millimetres per day
mm/month	millimetres per month
mm/s	millimetres per second
Mt	million tonne (metric tonne = 1 000kg)

Mtpa	million tonnes per annum
pH	measurement indicating whether water or soil is acid or alkaline
SG	specific gravity
swl	standing water level
t	tonnes
TDS	total dissolved solids expressed in mg/L
tpa	tonnes per annum
tph	tonnes per hour
$\mu g/m^3$	micrograms per cubic metre
µm	micron (1 micron = 0.001 millimetre)
µS/cm	micro Seimens per centimetre

APPENDICES

APPENDICES

APPENDIX 1

(No. of Pages Excluding Cover Page = 3)

Development Application

Department of Urban Affairs and Planning

Form 1 — **Application for state significant development**
made under Section 78A of the Environmental Planning and Assessment Act, 1979

For office use only:
DA number: File number:
DA fee: Branch:
Date received:

Applicant
name: DUNMORE SAND & SOIL PTY. LTD.
address: 83 RIVERVIEW STREET, RIVERVIEW, NSW, 2066
telephone: (02) 9418 9156
facsimile: (02) 9418 7895

Land to be developed *(attach map(s))*
local government area: SHELLHARBOUR CITY
address: CORNER OF SWAMP ROAD AND THE PRINCES HIGHWAY, DUNMORE
lot no., DP/MPS, etc.: LOT 201, DP865859 & LOT 17, DP607791 IN PARISH OF TERRAGONG AND COUNTY CAMDEN.

Proposed development
type:
- ☐ use of land/building
- ☐ erection of a building
- ☐ subdivision of land/building
- ☐ carrying out of work
- ☐ demolition
- ☑ other *(specify)* EXTRACTIVE INDUSTRY

description (eg residential flat building or open cut coal mine): SAND EXTRACTION PROPOSAL

proposed use: EXTRACTION OF SAND & SOIL USING DREDGE & EXCAVATOR(S), PROCESSING & TRANSPORTATION, BACKFILLING FOR LANDSCAPE RECONSTRUCTION.

estimated cost: $880,000

Planning instrument
Under which planning instrument is consent being sought? (eg SEPP 34): 76A(7) ENVIRONMENTAL PLANNING & ASSESSMENT ACT, (1979)

Is this application for integrated development? ☑ yes ☐ no

list other approvals to be obtained *(see note 1)*:
Fisheries Management Act 1994 ☐ s 144 ☐ s 201 ☐ s 205
Heritage Act ☐ s 58
Mine Subsidence Compensation Act 1961 ☐ s 15
National Parks and Wildlife Act 1974 ☐ s 90
Pollution Control Act 1970 ☐ s 17A ☐ s 17C ☐ s 17D ☑ s 17I
Rivers and Foreshores Improvement Act 1948 ☐ Part 3A
Roads Act 1993 ☑ s 138
Waste Minimisation and Management Act 1995 ☐ s 44
Water Act 1912 ☐ s 10 ☐ s 13A ☐ s 18F ☐ s 20B ☐ s20CA ☐ s 20L ☐ s 116 ☐ Part 8

Is a **Construction Certificate** application to be lodged at the same time as the application for development consent? ☐ yes ☑ no
If yes, Form 11 must be completed and lodged with the application

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Department of Urban Affairs and Planning

Type of consent (if applicable)	☐ deferred commencement ☐ staged development
Required attachments	☐ 4 copies of plan of land *(see note 2)* ☐ 4 copies of plans/drawings of proposed development *(see note 3)* ☐ 1 copy of plan for purposes of clause 48B of the EP&A Regulation 1994 *(see note 4)* ☐ other information *(see note 5)* ☑ application fee *(comprising the DA fee, plus $250 for each integrated approval body where integrated development. See note 1)* ☐ additional copies of plans and DA for each integrated approval body where not designated development
Environmental impact - designated development - other development or	☑ 4 copies of an environmental impact statement (EIS) are attached ☐ 4 copies of a statement of environmental effects are attached *(see note 6)* ☐ the proposed development is considered to have a negligible effect
Other attachments *(see note 7)*	☐ additional material submitted by applicant *(see note 8)* ☐ details of any prior stage consent granted ☐ evidence that long service levy has been paid is attached *(see note 9)*
Consent of all owner(s) *(required if the applicant is not the owner of the land)* – Part land only being Lot 17, DP 607791 Swamp Rd., Dunmore.	As the owner of the above property, I/we consent to this application being made *(see note 10)*
signature(s)	x [signature] x [signature]
name(s)	JAMES JOSEPH HAMBLY ROBYN ANN HAMBLY
date	19.1.99 19.1.99
Signature of applicant or person signing on behalf of the applicant	
signature(s)	[signature]
name, if not applicant	KERRY RONALD STEGGLES
capacity, if not applicant	MANAGING DIRECTOR
date	19.1.1999

Notes for completing Development Application:

Note 1 An application for integrated development must include:
a) sufficient information for the approval body to make an assessment of the application *(information is available from each approval body as to their requirements)*
b) an additional fee for each approval body as determined by cl. 100 of the Regulation *(this fee may be lodged directly with the approval body for designated development together with a copy of the development application and environmental impact statement)*
c) additional copies of plans as determined by the consent authority

Note 2 A plan of the land must indicate:
a) location, boundary dimensions and site area of the land, north point and scale
b) existing vegetation and trees on the land
c) location and uses of existing buildings on the land
d) existing levels of the land in relation to buildings and roads

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Department of Urban Affairs and Planning

e) location and uses of buildings on sites adjoining the land

Note 3 Plans or drawings describing the proposed development must indicate (where relevant):

a) the location of proposed new buildings or works (including extensions or additions to existing buildings or works) in relation to the land's boundaries and adjoining development
b) floor plans of proposed buildings showing layout, partitioning, room sizes and intended uses of each part of the building
c) elevations and sections showing proposed external finishes and heights
d) proposed finished levels of the land in relation to buildings and roads
e) building perspectives, where necessary to illustrate the proposed building
f) proposed parking arrangements, entry and exit points for vehicles, and provision for movement of vehicles within the site (including dimensions where appropriate)
g) proposed landscaping and treatment of the land (including plant types and their height and maturity)
h) proposed methods of draining the land.

Note 4 Where relevant an A4 plan of the building that indicates its height and external configuration, as erected, in relation to the site on which it is to be erected.

Note 5 Other information must indicate (where relevant):

in the case of shops, offices, commercial or industrial development:
details of hours of operation
plant and machinery to be installed
type, size and quantity of goods to be made, stored or transported
loading and unloading facilities

in the case of a change of building use (except where the proposed change is to a class 1a or a class 10 building) where no alterations or additions to the existing building are proposed:
a list of any fire safety measures in the building or on the land on which the building is situated in connection with the proposed change of building use, and
a separate list of such of those measures as are currently implemented in the building or on the land on which the building is situated.

The list must describe the extent, capability and basis of design of each of the measures concerned.

in the case of subdivision:
details of the existing and proposed subdivision pattern (including the number of lots and location of roads)
details of consultation with public authorities responsible for provision or amplification of utility services required by the proposed subdivision
preliminary engineering drawings indicating proposed infrastructure including roads, water, sewerage, and earthworks
existing and finished ground levels

in the case of demolition:
details of age and condition of buildings or works to be demolished

in the case of advertisements:
details of the size, type, colour, materials and position of the sign board or structure on which the proposed advertisement is to be displayed

in the case of development relating to an existing use:
details of the existing use

in the case of development that requires consent under the *Wilderness Act 1987*:
a copy of the consent under the *Wilderness Act 1987*

in the case of development involving the erection of a building, work or demolition:
details of the methods of securing the site during the course of construction.

Note 6 Where a proposed development is not designated development, the application must be accompanied by a statement of environmental effects unless the proposed development is considered to have a negligible effect (eg minor interior alterations) which must:

a) demonstrate that the environmental impact of the development has been considered
b) set out steps to be taken to protect the environment or to mitigate the harm.

Note 7 The consent authority may, within 21 days of receiving the development application, ask for additional information on the development application if that information is necessary for the determination of the

application or if that information is required by a concurrence authority.

The consent authority may, within 25 days after the lodgement of a development application for integrated development, ask for additional information concerning the development if the information is necessary for the determination of the application or if the information is required by an approval body.

Note 8 The application may be supported with additional material (eg photographs, slides, models, etc.) illustrating the proposed development and its context.

Note 9 Under s 80(10A) of the *Environmental Planning and Assessment Act, 1979* development consent cannot be granted until any long service levy payable under section 34 of the *Building and Construction Industrial Long Service Payments Act 1986* (or where such a levy is payable by instalments, the first instalment of the levy) has been paid. The local council may be authorised to accept payment.

Note 10 In the case of Crown land within the meaning of the *Crown Lands Act 1989*, the owner's consent must be signed by an officer of the Department of Land and Water Conservation, authorised for these purposes by the Governor-in-Council, from time to time.

APPENDICES

APPENDIX 2

(No. of Pages Excluding Cover Page = 5)

Correspondence from the Department of Urban Affairs and Planning and coverage within the Environmental Impact Statement

New South Wales Government
Department of Urban Affairs and Planning

Mr Robert Corkery
R W Corkery and Co Pty Ltd
PO Box 80
ORANGE NSW 2900

Contact: Alison Clausen
Our Reference: W92/00100/002
Your Reference:

3 DEC 1997

Dear Mr Corkery

Proposed Extractive Industry, Lot 102 DP 855086
Dunmore Lakes, Shellharbour

Thank you for your letter of 6 November 1997 indicating that you are consulting with the Director-General on behalf of Dunmore Sand and Soil Pty Ltd regarding the preparation of an environmental impact statement (EIS) for the above proposal.

Statutory requirements for the form and content of the EIS under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), together with the requirements for public exhibition and seeking approval are outlined in Attachment No. 1.

Attachment No. 2 *Extractive Industries Quarries* contains advice on the type of information most likely to be relevant to the development you propose. Not all of the matters raised may be appropriate for consideration in the EIS for this proposal, equally, the attachment is not exhaustive.

In addition, pursuant to Clause 52 of the *Environmental Planning and Assessment Regulation, 1994*, the Director-General requires that the following matters be specifically addressed in the EIS:

- consideration of the proposal in relation to the objectives and relevant provision of Illawarra Regional Environmental Plan No. 1, particularly in relation to extractive industries and identified heritage items including Dunmore House
- assessment of the impact of the proposal on the Minnamurra River and SEPP 14 Wetland No. 374a and description of proposed water quality management measures
- assessment of the presence of acid sulphate soils and preparation of an outline acid sulphate soil management plan if relevant. Reference should be made to Attachment 3 *Acid Sulphate Soils - Assessment and Management Guidelines (Draft)* and Attachment 4 *Acid Sulphate Soils - Analytical Methods* prepared by the NSW Acid Sulphate Soil Management Advisory Committee (November 1997).

Governor Macquarie Tower
1 Farrer Place, Sydney 2000
Box 3927 GPO, Sydney 2001

Telephone: (02) 9391 2000
Facsimile: (02) 9391 2111

- description of the traffic impacts of the proposal including the numbers of movements and the types of vehicles and the effects on the local and regional road network including Swamp Road and the Princes Highway
- details of the timing of the proposal in relation to the construction of the North Kiama Bypass and the cumulative effects of the proposal with respect to this development
- discussion of impacts on the adjacent land uses in particular the Dunmore Lakes Estate in terms of noise and dust generation and visual impacts and details of proposed mitigation measures

The EIS should also contain the results of consultation with the following bodies:

- Department of State and Regional Development
- Roads and Traffic Authority
- Department of Mineral Resources
- Shellharbour Council
- Department of Land and Water Conservation
- National Parks and Wildlife Service
- Environment Protection Authority

It should be noted that the onus is on the proponent to identify all parties with an interest in the proposal.

Should you have any enquiries regarding this matter please contact Alison Clausen on (02) 9391 2259.

Yours sincerely

for David Mutton
Acting Manager
Major Assessments and Hazards Branch
As Delegate for the Director-General

DEPARTMENT OF URBAN AFFAIRS AND PLANNING

Attachment No. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS
Pursuant to Schedule 2 and clause 51 of the *Environmental Planning and Assessment Regulation 1994* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including:
   (a) the consequences of not carrying out the development or activity; and
   (b) the reasons justifying the carrying out of the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity; and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
   (c) the likely impact on the environment of the development or activity, having regard to:
      (i) the nature and extent of the development or activity; and
      (ii) the nature and extent of any building or work associated with the development or activity; and
      (iii) the way in which any such building or work is to be designed, constructed and operated; and
      (iv) any rehabilitation measures to be undertaken in connection with the development or activity; and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment.
5. The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development.
6. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
7. A list of any approvals that must be obtained under any other Act or law before the development or activity may lawfully be carried out.
8. For the purposes of Schedule 2, the principles of ecologically sustainable development are as follows:
   (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
   (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
   (c) Conservation of biological diversity and ecological integrity.
   (d) Improved valuation and pricing of environmental resources.

Note

The matters to be included in item (4)(c) might include such of the following as are relevant to the development or activity:

(a) the likelihood of soil contamination arising from the development or activity;
(b) the impact of the development or activity on flora and fauna;

(c) the likelihood of air, noise or water pollution arising from the development or activity;
(d) the impact of the development or activity on the health of people in the neighbourhood of the development or activity;
(e) any hazards arising from the development or activity;
(f) the impact of the development or activity on traffic in the neighbourhood of the development or activity;
(g) the effect of the development or activity on local climate;
(h) the social and economic impact of the development or activity;
(i) the visual impact of the development or activity on the scenic quality of land in the neighbourhood of the development or activity;
(j) the effect of the development or activity on soil erosion and the silting up of rivers or lakes;
(k) the effect of the development or activity on the cultural and heritage significance of the land.

An environmental impact statement referred to in Section 77(3)(d) of the Act shall be prepared in written form and shall be accompanied by a copy of Form 2 of the Regulation signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 55 to 57 of the Regulation.

Attention is also drawn to clause 115 of the Regulation regarding false or misleading statements in EISs.

Note

Should the development application to which the EIS relates not be exhibited within 2 years from the date of issue of the Director-General's requirements, under clause 52(5) of the Regulation the proponent is required to reconsult with the Director-General.

– ✧ –

APPENDIX 2

Dunmore Lakes Proposal – Stage 1

Correspondence from Department of Urban Affairs and Planning

Coverage of Key Issues in Environmental Impact Statement

Key Issue	Covered in Section(s)
• Consideration of the proposal in relation to the objectives and relevant provisions of IREP No. 1	1.5.3, 4.10
• Impact of the proposal on the Minnamurra River and SEPP 14 Wetland No. 374a and proposed water quality management measures	4.1, 4.5.1
• Presence of acid sulfate soils	4.2
• Traffic impacts of the proposal	4.6
• Timing of the proposal in relation to the North Kiama Bypass and cumulative effects	1.4.6, 4.3.4.9, 4.6
• Impacts on the adjacent land uses	4.10

APPENDICES

APPENDIX 3

(No. of Pages Excluding Cover Page = 2)

Coverage of Issues from Government Authorities within the Environmental Impact Statement

APPENDIX 3

DUNMORE LAKES SAND QUARRY

Summary of Relevant Specific Issues Raised by Government Authorities and their Coverage in the EIS

Authority	Relevant Specific Issue to be Covered	Covered in Section(s)
Department of Mineral Resources	* Assessment of quality and characteristics of resource	2.2, 2.1.3
	* Address amount of extracted material and extraction method(s)	2.2, 2.1.3, 2.3.1
	* Anticipated annual production and expected life	2.7.3, 2.3.5
	* Alternative sources to proposal	1.4.3
	* Transport routes	2.6.3
	* Overburden and waste products disposal	2.3.3, 2.8.2
	* Stockpile location and size	2.5.1, 2.5.3, 2.3.4
	* Assessment of noise, vibration, dust and visual impacts	4.3.4, 4.4.5
	* Proposed rehabilitation procedures	2.12
	* Justification of proposal	5.1
Roads and Traffic Authority	* Access to site	2.6.2
	* Stability of North Kiama Bypass	Appendix 4, 2.3
Environment Protection Authority	* Assess acid sulfate soils occurrence	4.2.1
	* Water quality and groundwater issues	4.1
	* Rehabilitation options and final land use	2.12
	* Noise modelling	4.3
	* Statutory requirements under Pollution Control Act	2.14
NSW National Parks and Wildlife Service	* No specific issues	
Telstra	* No specific issues	
Council of the Municipality of Kiama	* Address impact on local hydrology	4.1.5
	* Visual impact	4.8, 2.12.5
	* Impact on North Kiama Bypass	1.4.6
	* Effects of heavy vehicle access	4.6.4, 2.6.4
	* Backfill material	2.4.3
	* Address cumulative impact	5.1.2, 5.2

APPENDIX 3

DUNMORE LAKES SAND QUARRY

Summary of Relevant Specific Issues Raised by Government Authorities and their Coverage in the EIS

Authority	Relevant Specific Issue to be Covered	Covered in Section(s)
Shellharbour City Council	* Impact upon neighbouring wetlands	4.5.1
	* Assessment of impact on heritage	4.9.3, 4.9.6
	* Visual impact	4.8
	* End landform	2.12.3
	* Amount, type and source of fill material	2.4.3
	* Rehabilitation plan and end land use	2.12
	* Impact on surface and groundwater	4.1.5.2, 4.1.5.3
	* Proposed monitoring program	4.16
	* Assessment of vehicle movements	2.6.4, 4.6
	* Information on resource and regional supply and demand	1.4.4, 2.2
Soil Conservation Service	* Soil and water management plan	4.1.4, 4.2.2
	* Detailed drainage plans	4.1.2, 4.1.4
	* Revegetation of topsoil stockpiles	4.2.2.1
	* Temporary revegetation of Stage 1 landfill	2.12.4
	* Address contamination of run-off entering lake	2.5.2
State and Regional Development	* Assess economic benefits of proposal	4.11.3, 5.1.3
Department of Land and Water Conservation	* No specific issues	

APPENDICES

APPENDIX 4

(No. of Pages Excluding Cover Page = 7)

Geotechnical Report by Pells Sullivan Meynink Pty Ltd

Pells Sullivan Meynink Pty Ltd
Engineering Consultants
Rock-Soil-Water

ACN 061 447 621

Suite 11, 10 East Parade
Eastwood NSW 2122
Ph: 61-2 9874 8855
Fax: 61-2 9874 8900
Email: pjnp@psm.com.au

Our Ref: PSM318.L2
Date: 7 January 1999

Dunmore Sand & Soil Pty Ltd
P O Box 106
HUNTERS HILL NSW 2110

Dear Sirs,

RE: DUNMORE LAKES SAND EXTRACTION PROPOSAL

Further to various communications over the last few months, we now confirm the geotechnical advice provided.

We have reviewed:

- Dunmore Sand Project exploration drill logs.
- Logs of two boreholes, DUN1 and DUN2, drilled and logged by the RTA.
- The final proposal for sand extraction and back filling. This proposal has not changed in substance from that in the draft EIS.

A typical profile shown in the exploration logs consists of:

- Sand, fine to medium sized, to depths typically between 5 and 14m, overlying.
- Clay, dark grey, plastic.

The RTA boreholes indicate that the sands are typically medium dense but vary from very loose to medium dense. We estimate than an angle of internal friction, ϕ, of at least 30 degrees can conservatively be adopted for such materials. In DUN1 the underlying clay is firm to very stiff. The Standard Penetration Test (SPT) results in this material in DUN2 are zero. We believe the clays would be of at least soft consistency and have adopted an undrained shear strength, S_u, of 20 kPa for these clays in our analyses. We believe these strength parameters are quite conservative.

Agree - Include in Final EIS
11/1/99

P.J.N. Pells BSc(Eng) MSc DSc(Eng) DIC FIEAust CPEng
T.D. Sullivan BA MSc DIC MIEAust CPEng FAusIMM MICA
W.J.C. Meynink BE MEngSc MIEAust CPEng RPEQ

It is proposed to extract the sand using the procedure outlined in the figure attached as annexure A; this is in accordance with our advice and involves:

- Perimeter extraction using an excavator (Step 1). This should approach not closer than 3m to the toe of the North Kiama Bypass, be no deeper than AHD-2m and be excavated at not steeper than 3H:1V.

- Leaving a berm at the perimeter of the extraction area (Step 2). This should be over a naturally rough excavated base with a key at the toe. The crest of the berm should be 5m horizontally from the toe of the North Kiama Bypass and the temporary batter constructed at 1.5H:1V.

- Dredge sand extraction (Step 3). This should be no steeper than 3H:1V.

- Placement of fill materials and final profiling (Step 4). This should incorporate a berm 40m wide and the batter can consist of:

  - Surface to 1m depth at 3H:1V.

  - The next metre at 4H:1V

  - The zone of possible water level variation, which we understand is 2m, at 6H:1V

  - 3H:1V below this.

Porous zones to maintain pore pressure equalisation can be constructed out of material satisfying the specifications for "Coarse Inert Aggregate Rubble". Use of inferior material is possible but would require further advice.

Stability of the proposed mining procedure can be assessed using infinite slope models. These indicate that the proposed intermediate and final profiles have factors of safety approximately equal to or greater than 1.5. The potential impact of a deep soft clay layer has been examined using SCOPE/W, a computer based stability analyses program. An example output is included as Annexure B. The analyses indicate that the deep clay layer does not have any impact on stability.

We conclude that extraction, in accordance with the above procedure, should result in stable batters, and will have no effect on the stability of the North Kiama By Pass.

We trust this advice meets your requirements. Should you have any questions please do not hesitate to contact us.

For and on behalf of
PELLS SULLIVAN MEYNINK PTY LTD

G. MOSTYN

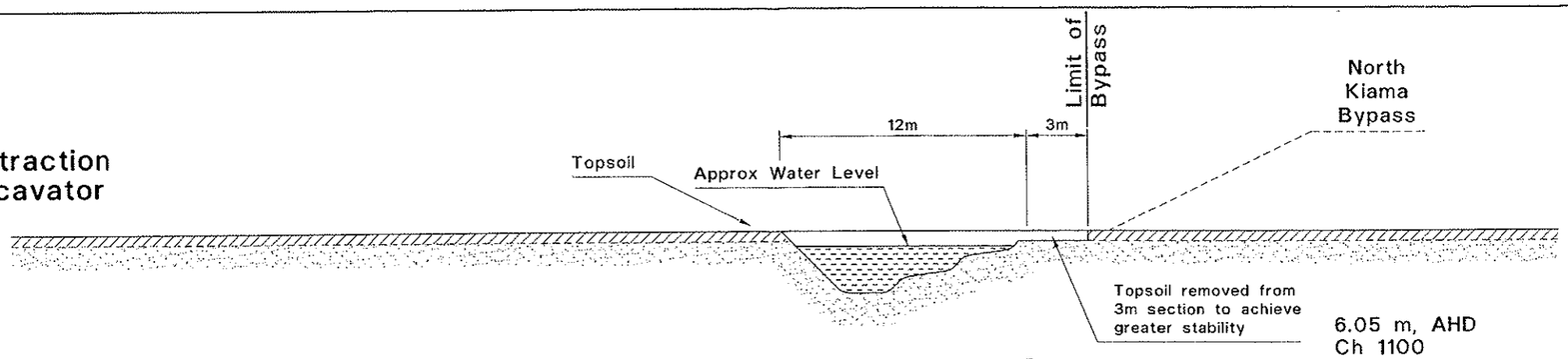
cc R.W. Corkery & Co
P O Box 80
ORANGE NSW 2800
By Fax. 02 6361 3622

ANNEXURE A

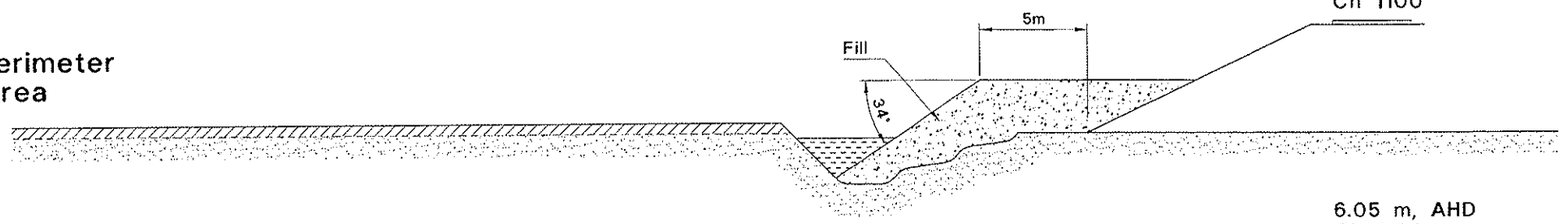
SAND EXTRACTION, SLOPE STABILISATION AND BACFILLING PROCEDURES

\\SERVER\RWC\475\CAD\47501204.DWG

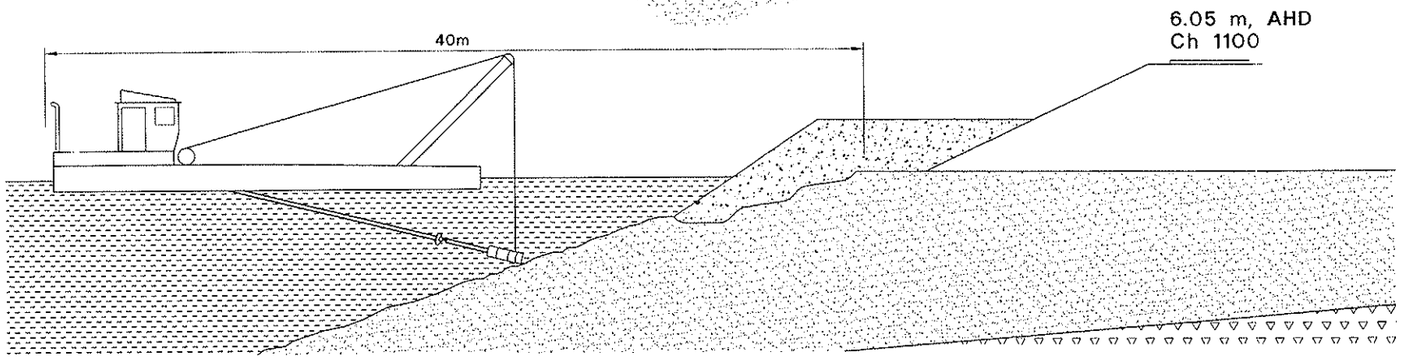
STEP 1: Perimeter Extraction Using An Excavator



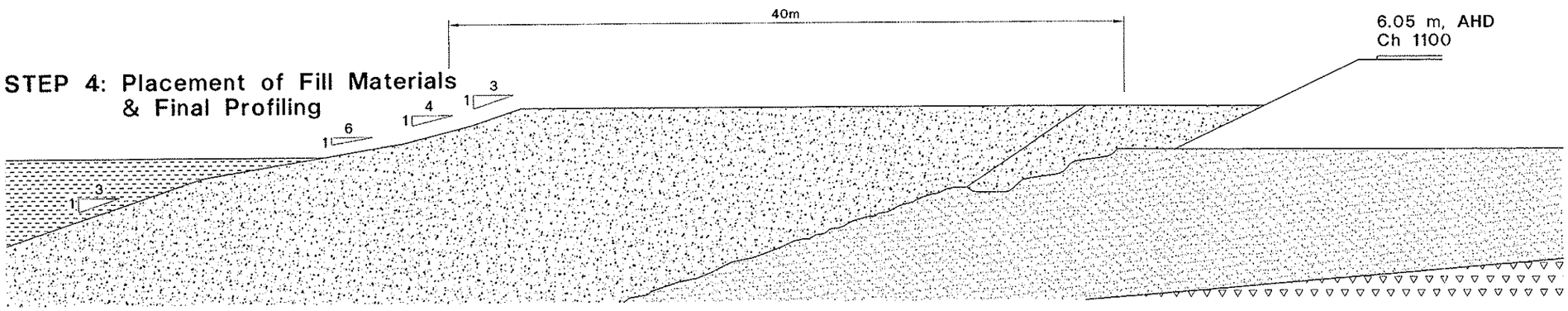
STEP 2: Stabilising Perimeter Extraction Area



STEP 3: Sand Extraction Using A Dredge



STEP 4: Placement of Fill Materials & Final Profiling



REFERENCE

- Topsoil
- Water
- Backfill
- Quaternary Sediments
- Bumbo Latite

SCALE 1:300

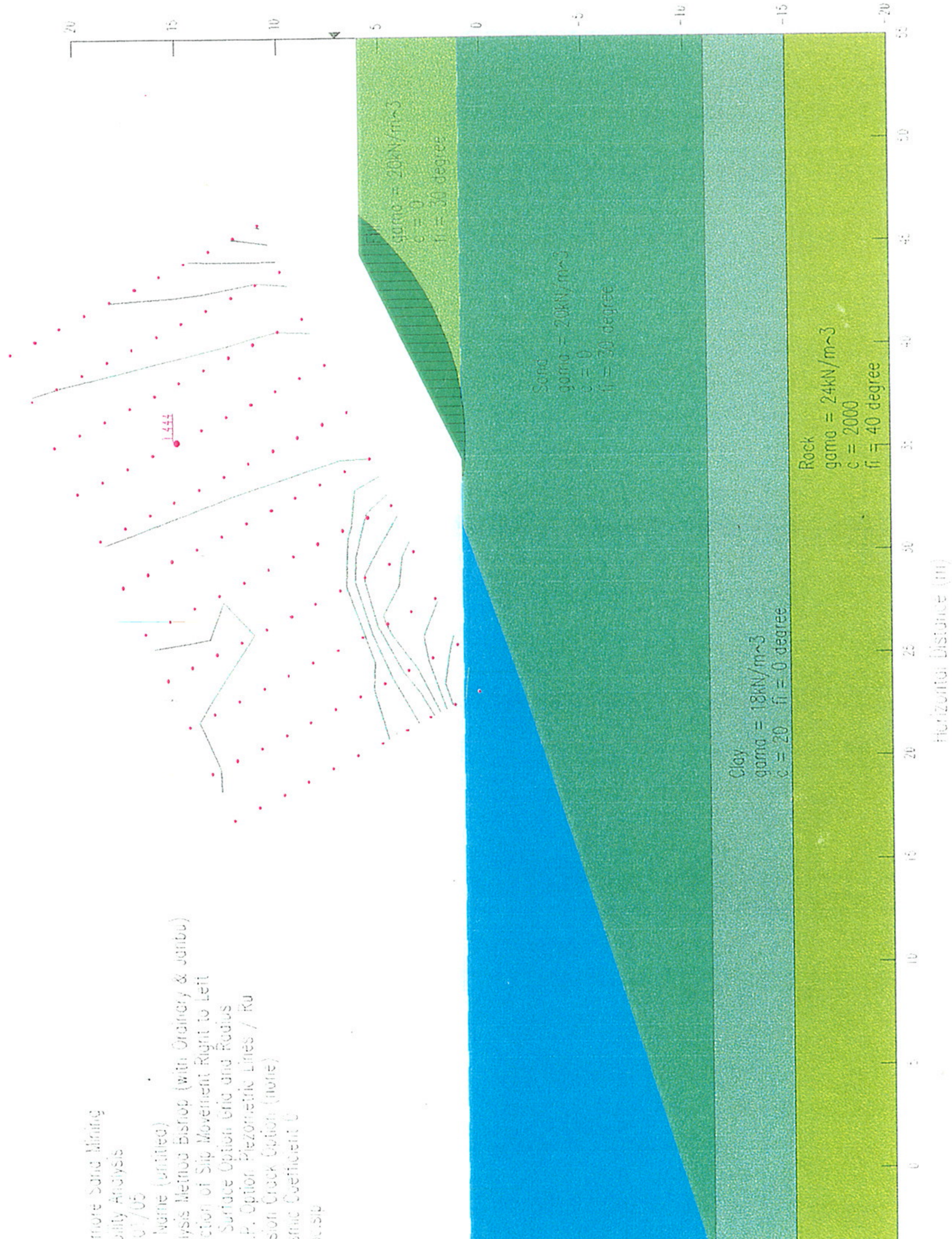
5 0 5 10 15m

See Figure 1.5 for Chainage 1100 Location

RECOMMENDED SAND EXTRACTION, SLOPE STABILISATION AND BACKFILLING PROCEDURES

ANNEXURE B

EXAMPLE STABILITY ANALYSIS


Sand
gamo = 20kN/m^3
c = 0
fi = 30 degree
Clay
gamo = 18kN/m^3
c = 20 fi = 0 degree
Rock
gamo = 24kN/m^3
c = 2000
fi = 40 degree
1.444
Horizontal Distance (m)

APPENDICES

APPENDIX 5

(No. of Pages Excluding Cover Page = 3)

Energy Statement

ENERGY STATEMENT

PREAMBLE

This Energy Statement has been prepared in accordance with the requirements of the Office of Energy and provides a concise assessment of the impact of Stage 1 of the proposed Dunmore Lakes sand extraction proposal on energy resources, particularly liquid fuels.

1.0 BACKGROUND INFORMATION

The Applicant, Dunmore Sand & Soil Pty Ltd proposes to develop a sand extraction operation adjacent to Swamp Road and the Princes Highway near Dunmore to produce high quality sand products for use in the construction industry for a period of approximately 10 to 15 years.

After vegetation and soil removal, the sand deposit would be extracted using a dredge, with minor quantities moved by an excavator and loader loading into dump trucks. The dredged sand would be pumped to the processing plant, and the small quantity of excavated sand which would be trucked to the Applicant's Dunmore Sand Quarry. From the processing plant, the product would be distributed predominantly throughout the Illawarra Region either directly from the site or after it is blended with other materials at the Dunmore Sand Quarry.

The dredge and mobile equipment involved in stockpiling and transporting product on-site would be powered by diesel fuel. The processing plant would be powered by electricity. Electrical power would also be used for security lighting. The sand products produced on-site would be transported from the Project Site in highway trucks and trailers.

2.0 OPERATIONAL ENERGY REQUIREMENTS

The site preparation and extraction, handling, processing and transportation of both the raw materials and sand products would necessitate the consumption of petroleum products and electricity.

2.1 Site Preparation and Sand Extraction

The Applicant estimates that the fuel usage by plant and equipment involved in site preparation, soil removal and sand extraction activities at the average production rate would be as follows:

Dredge	75 000 L per year
Excavator	22 000 L per year
Bulldozer	50 000 L per year
Front-end Loaders	1 000 L per year
TOTAL:	148 000 L per year

2.2 On-Site Activities

The Company estimates that on-site activities involving mobile eqiupment such as the front-end loaders and small trucks would utilise approximately 70 000 L of diesel fuel per year. This mainly relates to the large capacity loader loading washed sand.

2.3 Processing

Electrical power usage for processing and lighting is estimated to be approximately 45 000 kWh per month.

2.4 Product Transportation

Product transportation and subsequent fuel usage involve both Company and/or contracted trucks and other customers using their own trucks.

The Applicant estimates a fuel usage of approximately 5 000 L per year for Company product transportation to the existing Dunmore Sand Quarry, assuming an average load of 25 tonnes, 333 trips per month and an average of 12 000 km travelled per year. Other customers travel between 3 km and 300 km to and from the Project Site. Assuming an average round trip of 60 km, an average load of 30 tonnes, 6 000 loads per year, a total of approximately 360 000 km per year would be travelled by other customers. This equates to a fuel usage of approximately 145 000 L per year.

Hence total fuel usage for product transportation would average approximately 150 000 L per year ranging probably from 100 000 to 200 000.

3.0 JUSTIFICATION OF FUEL AND ENERGY USAGE

3.1 Sand Extraction

The method of sand extraction used is the most effective and feasible method of recovery of the sand resource on the Project Site.

3.2 Processing

Use of electricity to power the processing plant is seen as the most economic and practical means to operate the plant as opposed to diesel-fuelled generators.

3.3 Transportation

There is no feasible alternative form of product transportation for the market network supplied. Truck transportation is the only feasible form of product delivery, especially since many sales are relatively small and within the local area and the Illawarra Region.

APPENDICES

APPENDIX 6

(No. of Pages Excluding Cover Page = 1)

Correspondence from Illawarra Local Aboriginal Land Council

Illawarra Local Aboriginal Land Council

22 Kenny Street, Wollongong NSW 2500. ✦ PO Box 5458 Wollongong NSW 2500. ✦ ☎ (02) 4227-6101 Fax (02) 4227-6121

R.W Corkery & Co. PTY Limited
P.O BOX 80
Orange NSW 2800

14/10/98

Dear David

RE: Dunmore Lakes Proposal

The Illawarra Local Aboriginal Land Council have considered your proposal agree with the original survey conducted by Kerry Navin in 1989. We don't regard sites 4 and 5 as sensitive areas or burial grounds, however should this area be excuvated we would requirer that an Aboriginal monitor be employed on site and that we be consulted in this process and provide a suitable applicant to carrie out this task.

Your Sincearly

Basil Smith (Coordinator ILALC)

ENVIRONMENTAL IMPACT STATEMENT

PLATE A

\\SERVER\RWC\475\CAD\47501PLA.DWG

TN

MN

APPROX. SCALE

100 0 100 200 300 400 500 m

Plate A

R.W. CORKERY & CO. PTY. LIMITED