THIS DEED OF AGREEMENT is made the day of 2014.

This is a planning agreement as defined in Section 93C of the *Environmental Planning and Assessment Act* and is made pursuant to Section 93F of that Act.

PARTIES TO THIS AGREEMENT are:

1. **GOSFORD CITY COUNCIL** of 49 Mann Street, Gosford NSW 2250 ("the Council")

AND

2. **STEVENS HOLDINGS PTY LIMITED** (ACN 002 386 450) of 2/257-259 Central Coast Highway, Erina NSW 2250 ("Landowner 1") and ("Landowner 2")

AND

~~3. **MORRELL KEITH ABELL** and **BARBARA GWENNETH ABELL** of 26 Belar Avenue, Terrigal NSW 2256 ("Landowner 2")~~

AND

4. **JOHN MICHAEL OLZOMER** and **PAMELA ANN OLZOMER** of 20 Belar Avenue, Terrigal NSW 2256 (Landowner 3")

Landowners 1, 2 and 3 are jointly referred to as "the Landowners".

RECITALS

A. (a) Landowner 1 is the Registered Proprietor of Lot 202 in DP 831864 ("Lot 202") Lot 1 in DP 381917 ("Lot 1") and Lot 4 in DP 37914 (Lot 4")

(b) Landowner 2 is the Registered Proprietor of Lot 2 in DP 1111392 ("Lot 2")

(c) Landowner 3 is the Registered Proprietor of Lot 2 in DP 1189881 ("Lot 1189881").

The above Lots are collectively referred to as ("the Land") and it is to this Land that this Agreement applies.

B. The Land is zoned under Gosford LEP 2014 as shown in Annexure "A".

C. The Land is the subject of a Development Control Plan a copy of chapter 5.12 thereof which relates to the Land, together with a copy of Council's document

Pam Olzomer John Olzomer

entitled "Terrigal @ Parkside October 2012 (IR 12538387)" referred to in the said Plan, is annexed and marked "B" ("the Development Control Plan"). The Landowners propose to make a development application *inter alia* to subdivide the Land subject to this Deed, the Development Control Plan and the *Environmental Planning and Assessment Act* 1979.

D. The Landowners have proposed to the Council that the part of the Land indicated on Annexure "A" as being zoned RE1 ("the RE1 Land") should be dedicated or donated for the purposes of enhancing the natural environment to the Council free of cost and free of any mortgages or encumbrances subject to and upon the grant of any development consent for the Land or any part thereof by the Council or by the Land and Environment Court on appeal and in accordance with the aims and objectives of the Development Control Plan (Annexure "B") and any amendment thereof.

E. The Landowners have jointly offered to enter into this Voluntary Planning Agreement and have agreed that it should be a condition of any development consent abovementioned that they enter into it and comply with its terms.

F. This Voluntary Planning Agreement revokes and replaces the Voluntary Planning Agreement entered into between the Council and Landowners 2 and 3 and the predecessor in title to Landowner 1 dated 11 September, 2012.

NOW THIS DEED WITNESSETH THAT:

1.1 The Landowners jointly and severally covenant that they will transfer or do all things necessary, including the making of any development application for a subdivision of the Land, to effect either a transfer or dedication (at the option of the Landowners) of the RE1 Land to the Council, or the donation of the RE1 Land to

the Council as Trustee for the Gosford Environmental Trust, free of cost and free of mortgages and encumbrances ("the Transfer") upon and subject to the following conditions:

(a) that a development consent is granted by the Council applying to the Land or any part of the Land which is in accordance with Gosford LEP 2014 and substantially in accordance with the objectives of the Development Control Plan and any amendments thereof ("Development Consent") PROVIDED THAT this condition is not to be interpreted as fettering the Council's discretion, after proper consideration according to law, to approve or refuse any application for a development consent that it receives in relation to the Land or any part of the Land.

(b) The Transfer shall be made within a reasonable time of the issuing of any Development Consent referred to in (a) above and in any event within a period of not more than two years from the date of issuing of such Development Consent. To guarantee performance of this obligation as well as the obligations in Clauses 1.2(b) and (c), the Landowners will lodge with the Council a bond by way of cash deposit in the amount of $10,000 (interest to be to the account of the Landowners or the Council depending on whether the bond is returned or forfeit) a bank guarantee with the Council upon the making of an application for the Development Consent for the Land or any part thereof. After completion of the Transfer and the works required under Clauses 1.2(b) and (c) and Clause 1.8 the bond will be returned to the Landowners.

(c) The Transfer may be made by prior delivery to the Council of a registrable transfer of the RE1 Land with an authority to add to the transfer the

reference to title of the RE1 Land or by indicating on a plan of subdivision for which Development Consent has been granted and release of which is sought an intention to dedicate the RE1 Land together with an executed and registrable discharge of any mortgage of the RE1 Land.

(d) The Landowners agree that any Development Consent referred to in (a) above shall contain a condition requiring compliance with (b) above.

(e) The Council agrees that if a Development Consent is granted for a plan of subdivision of the Land containing lots one of which comprises the RE1 Land, it will not impose a deferred commencement condition requiring the Transfer.

(f) The Council agrees that after the Transfer of the RE1 Land is effected, it will allow the Landowners reasonable access to that land for the purposes of carrying out any obligations imposed upon them by the Development Control Plan or the conditions of any development consent or complying with any other requirements of law.

1.2 **Management of the RE1 Land**

(a) Land Management Works in accordance with "Table 1 – Pre-development Phase" of the Environmental Management Plan for Lands Proposed to be Dedicated to Council" prepared by Conacher Environmental dated December 2010 which is Annexure "C" hereto are to be completed prior to the Transfer of the RE1 Land to the Council.

(b) Land Management works in accordance with "Table 1 –Development Phase" and "Post Development Phase" of Annexure "C" are to completed as they fall

due for a period of five years after initial works outlined in Table 1 are commenced.

(c) Land Management works in accordance with the "Pre-construction" and "Construction" requirements of the "Riparian Buffer Zone and Private Conservation Areas Vegetation Management Plan Annexure "D" hereto are to be completed as they fall due following the issue of any development consent for the Land.

(d) The Landowners agree that any future subdivision of the Land zoned for urban development will occur subject to an approved preliminary super lot Torrens subdivision under a Community Title Scheme and that any development application for the subdivision of that land will include a draft Community Management Statement.

(e) The Landowners agree to an instrument under Section 88B of the *Conveyancing Act 1919* being registered on the Land restricting subdivision to Community Title.

Date upon which this Agreement comes into effect

1. 3 This agreement takes effect upon execution by all the parties.

Registration and Assignment

1.4 The Landowners severally agree that they will not assign, transfer, convey, mortgage or otherwise alienate or dispose of their interests in the Land or any part thereof without first procuring from the assignee, transferee, conveyee, mortgagee, alienee or disponee at their cost the execution of an agreement containing covenants and undertakings the same *mutatis mutandis* as those

contained herein. Upon the obtaining of an executed agreement pursuant to this Clause the liabilities of the Landowners contained in this agreement shall cease.

1.5 This agreement does not exclude the requirement to pay any contributions pursuant to Section 94 of the *Environmental Planning and Assessment Act* which would otherwise be payable pursuant to any contributions plan made under that Act.

1.6 This Agreement does not exclude the application of Section 94, Section 94A OR Section 94EF of the *Environmental Planning and Assessment Act* to the development permitted by any development consent granted pursuant to Gosford LEP 2009 or the amendments to IDO 122.

1.7 If the Council has not amended Contributions Plan 42 at the time at which the obligation to dedicate the RE1 Land arises, the Landowners agree that in addition to the transfer of the RE1 Land they will pay to the Council, at the point in time when contributions would be payable if CP 42 applied to the Land, an amount of money for the community facilities identified in CP 42 calculated as if CP 42 applied to the Land.

2.1 (a) In accordance with Section 93H(1)(a) of the *Environmental Planning and Assessment Act 1979* the Landowners consent to the registration of this Agreement under that section and to procure the consent of any other person who has an interest in the Land necessary to permit registration should the Council so require.

(b) Council will consent to the release of the registration of this Agreement and, at the request of the Landowners, execute the relevant forms and provide such other assistance as may be reasonably requested to effect the release.

Notices

3.1 (a) Any notice, consent, information, application or request that must or may be given or made to a party under this Agreement is only given or made if it is in writing and sent in one of the following ways:

- Delivered or posted to that party at its address set out below.
- Faxed to that party at its fax number set out below.
- Emailed to that party at its email address set out below:

Council:

Attention: The General Manager

Address: Gosford City Council
49 Mann Street
Gosford NSW 2250

Email: goscity@gosford.nsw.gov.au

Landowners:

Stevens Holdings Pty Limited (ACN 002 386 450)
Suite 2, 257-259 Central Coast Highway
Erina NSW 2250
Tel: 4365 3351
Fax: 4365 3750
Email: www.stevensgroup.com.au

(b) If a party gives the other party 3 business days' notice of a change of its address or fax number or e-mail address any notice, consent, information, application or request is only given or made by that other party if it is

delivered, posted or faxed or emailed to the latest address, fax number or email address.

(c) Any notice, consent, information, application or request is to be treated as given or made at the following time:

- If it is delivered, when it is left at the relevant address.
- If it is sent by post, 2 business days after it is posted.
- If it is sent by fax, as soon as the sender receives from the sender's machine a report of an error free transmission to the correct fax machine.
- If it is sent by email, as soon as a read receipt is received by the sender.

(d) If any notice, consent, information, application or request is delivered, or an error free transmission report or read receipt in relation to it is received, on a day that is not a business day, or on a business day, after 5.00 pm on that day, in the place of the party to whom it is sent, it is to be treated as having been given or made at the beginning of the next business day.

Dispute Resolution

4.1 A party to this agreement at any time may notify the other party of a dispute concerning any matter relating to or arising out of this agreement and require that it be resolved in accordance with this clause.

4.2 The notice pursuant to 2.1 must:

(a) be in writing;

(b) identify the subject matter of the dispute;

(c) set out in detail the facts upon which the dispute is based;

(d) identify the provisions of this agreement relevant to the dispute;

(e) have annexed to it copies of all correspondence and background information relevant to the dispute; and

(f) contain particulars of the quantification of any claim in relation to the dispute.

5 Mediation

5.1 The parties must use their best endeavours to settle the dispute within 14 days of the date of issue of the notice of dispute or such further period as the parties agree.

5.2 If a dispute is not resolved under Clause 5.1 then the parties agree to mediate the dispute in accordance with the 1995 Australian Commercial Dispute Centre (ACDC) Guidelines.

5.3 The mediator must be accredited by a recognised University or Mediation Centre and appointed by agreement between the parties but failing agreement must be appointed by the Chairman of the ACDC or by the Chairman's authorised representative.

5.4 In the event that the dispute has not settled within twenty eight (28) days or such other period as agreed to in writing between the parties after the appointment of the mediator the dispute must be submitted to expert determination in accordance with Clause 7.

6 Nomination of consultant

6.1 Within ten (10) business days of the dispute not being resolved in accordance with Clause 6 the Council must nominate and notify the Applicant in writing of a panel of

three independent consultants reasonably considered by the Council to be expert in the area of dispute.

6.2 Within five (5) business days of notification of the three consultants by the Council, the Applicant must nominate one of them to resolve the dispute.

6.3 If the Applicant fails to nominate one of them to resolve the dispute the Council may nominate one of the consultants and that person shall resolve the dispute.

7 Conduct of Referral

7.1 The independent consultant will act as an expert and not as an arbitrator.

7.2 The independent consultant may (and must if so required by either party) appoint such other consultants as he or she thinks necessary to advise on any aspect of the dispute.

7.3 The decision of the independent consultant will be final and bind on the parties, except as to matters of law.

7.4 The Council and the Applicant may make written submissions to the independent consultant relating to the questions to be determined and costs. Such submissions must be made within ten (10) business days of the appointment of the independent consultant. The party making the submission must provide the other party with a copy of its submission within 24 hours of submission to the independent consultant.

7.5 The parties agree to co-operate with the independent consultant and promptly to provide the independent consultant with such information as requested by the independent consultant as is in the possession of that party and is relevant to the matter to be determined, except where such information would be subject to a claim for privilege if the matter were the subject of legal proceedings.

7.6 Within twenty (20) business days of his or her appointment the independent consultant must determine the matters in dispute having regard to the parties' written submissions, the provisions of this agreement and the independent consultant's own enquiries.

8 **Costs of referral**

The cost of any referral and determination as provided in this part must be paid as determined by the independent consultant or mediator and if no determination is made each pays 50% of the total cost.

9 **No legal proceedings**

Neither party is entitled to commence or maintain any action, whether by way of legal proceedings or arbitration, relating to any dispute until it has been referred and determined as provided in this agreement.

10 Any legal proceedings shall be determined by a Court of competent jurisdiction in the State of New South Wales.

11 **Severance**

(a) If a clause or part of a clause of this Agreement can be read in a way that makes it illegal, unenforceable or invalid, but can also be read in a way that makes it legal, enforceable and valid, it must be read in the latter way.

(b) If any clause or part of a clause is illegal, unenforceable or invalid, that clause or any part is to be treated as not forming part of this Agreement, but its removal does not affect the rest of this Agreement.

12 **Fetter on Discretion**

Nothing in this Agreement is to be construed as constituting a fetter on the discretion of the Council in the exercise of any discretionary power or the fulfilment of any obligation it has at law.

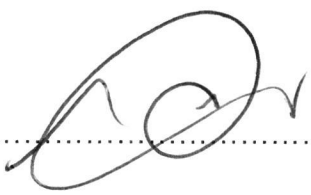
13. **Governing Law**

This Agreement is governed by and is to be construed in accordance with the laws applicable in New South Wales.

IN WITNESS WHEREOF the parties hereto have hereunto set their hands and seals on the day and year first hereinbefore written.

SIGNED BY THE PARTIES AS A DEED

Executed for and on behalf of Gosford City Council:



....

Executed for and on behalf of Stevens Holdings Pty Limited (ACN 002 386 450) pursuant to Section 127 of the Corporations Act 2001 by its directors:

.... John Stevens .....

.... JOHN STEVENS .....

Print full name Print full name

Sole director / Secretary

~~Executed by Morrell Keith Abell and Barbara Gwynneth Abell in the presence of:~~

....

Signature of witness Morrell Keith Abell

.....

~~Print full name of witness~~

....

Signature of witness Barbara Gwynneth Abell

.....

Print full name of witness

Executed by John Michael Olzomer and Pamela Ann Olzomer in the presence of:

....

Signature of witness John Michael Olzomer

.....

Print full name of witness

....

Signature of witness Pamela Ann Olzomer

.....

Print full name of witness


DM
R2
RE1
E3
SP2
1/DP656616
R1
1/DP578124
RE2
262/DP831864
E2
4/DP37914
3/DP37914
7/DP258808
1/DP61971
5/DP706316
101/DP871227
339/DP755234
6/DP715531
90/DP6650
891/DP867371
851/DP850170
A/DP364476
83/DP6650
82/DP6650
86/DP6650
W1
38485
Meters

ANNEXURE A

RECITAL B

RECITAL D

GOSFORD LEP 2014

John Olzomer

Pam Olzomer

ANNEXURE B

RECITAL C

RECITAL D

DEVELOPMENT CONTROL PLAN

Joe Stevens

John Olzomer

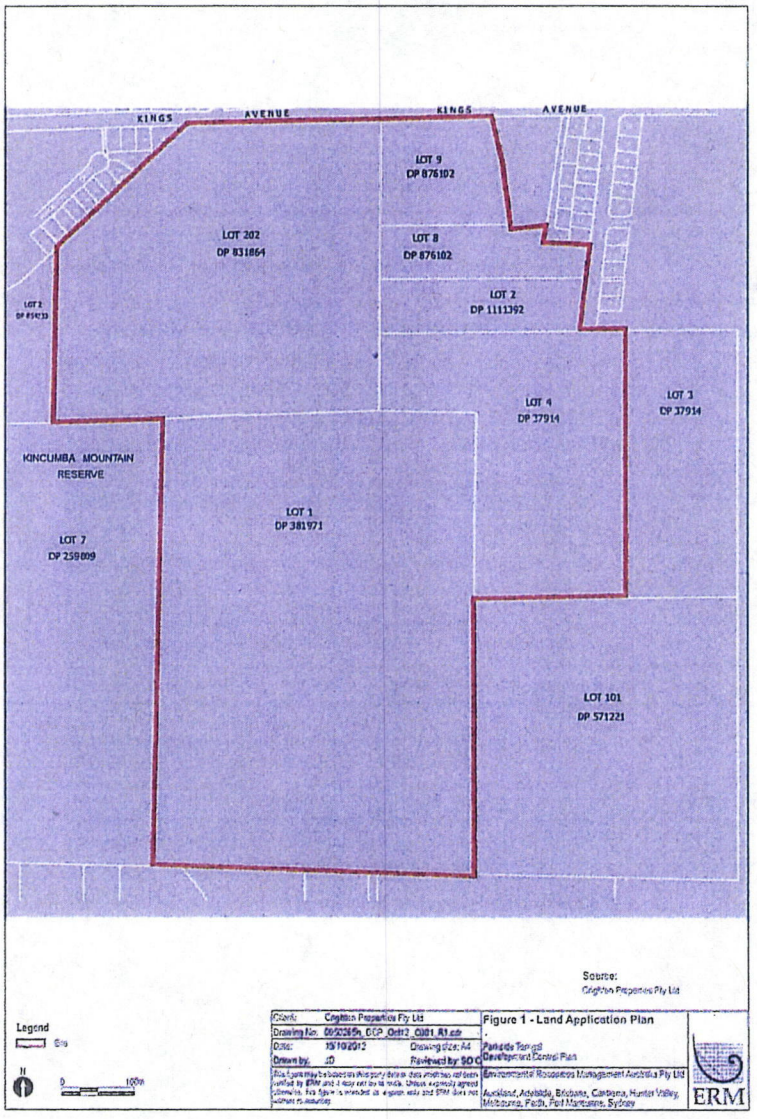
Pam Olzomer

Part 5: Location Specific Development Controls

Chapter 5.12 - Terrigal, Parkside, Kings Avenue

5.12.1 Where this Chapter Applies

This chapter applies to land Lot 2 DP 111392, Lots 8 and 9 DP 87102, Lot 202 DP 831864, Lot 4 DP 37914 and Lot 1 DP 381971 at Kings Ave, Terrigal as indicated on the map below.



5.12.2 Purpose of the Chapter

The purpose of this chapter is to provide more detailed guidelines for the subdivision and development of the land to which this chapter applies including providing for the opportunity for the creation of a Home Based Business Estate and associated facilities in a community title subdivision.

5.12.3 Objectives

The objectives of this chapter are as follows;

a Provide the opportunity for the development of the land as a Home Based Business Estate under Community Title legislation;

b Protect the environmental properties of the site, including mitigating any potential impacts on threatened species and endangered ecological communities (EEC);

c Ensure that the riparian areas of the site are adequately rehabilitated and access is strictly controlled to prevent future degradation;

d Ensure that flood prone land is not developed for residential purposes;

e Ensure that adequate asset protection zones are provided on privately owned land and maintained to mitigate any bush fire hazard on site;

f Ensure that the site is adequately serviced including the provision of sewer services, a stormwater quantity and quality management system;

g Ensure that traffic generated by land uses on the site does not adversely impact on the surrounding road network and adequate on site parking is provided;

h Ensure the development does not adversely impact on the amenity of the area;

i Ensure that when the site is developed the geotechnical constraints of the site are considered and any geotechnical hazard is adequately mitigated;

j Ensure that public access to Kincumba Mountain Reserve is freely available through the site;

k Ensure that, if the site is developed for a Home Based Business Estate, an appropriate, centrally located business support hub will be provided within the boundaries of the site;

l Ensure the provision of appropriate active and passive recreational facilities on site to service the needs of residents, including residents, including residents of any Home Based Business Estate and other residents;

m Ensure that an appropriate pedestrian path is provided which facilitates access to the open space areas on site and the Kincumba Mountain Reserve;

n Ensure that any building erected on site will have due regard for site sensitive design issues; and

o Ensure that the street network is safe and efficient.

5.12.4 General Subdivision Requirements

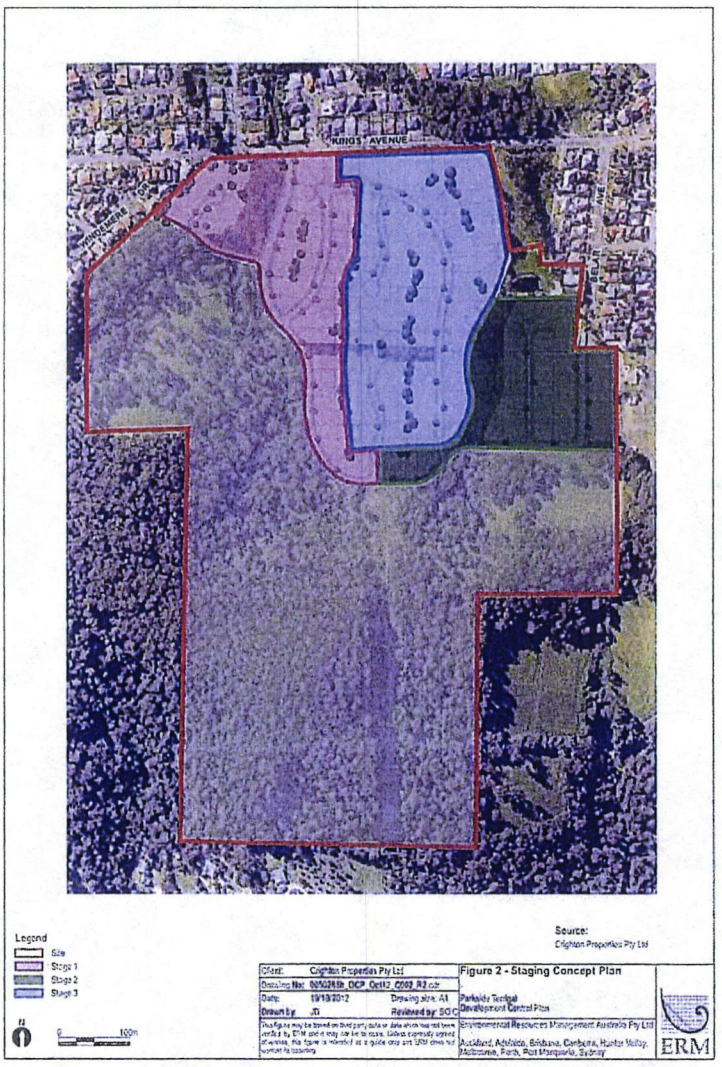
5.12.4.1 Staging Plan

Objective

To enable sustainable development consistent with the objectives of the R2, RE1, RE2, and 7(a)/E2 zones that enhances the existing low density residential character and protects the natural setting of Kincumber Mountain Reserve and Terrigal.

Requirements

Any application for subdivision shall prepare a staging plan. Figure 2 illustrates the potential future development pattern and staging for the estate and should be considered in conjunction with the following document *Parkside@Terrigal October 2012 and associated annexures (GCC Doc No 12538387), and the Single Dwelling and Ancillary Structures, Dual Occupancy Development, Residential Subdivision, Geotechnical Requirements, Water Cycle Management, Carparking and Waste Management chapters of this DCP.*



5.12.4.2 Density and Subdivision Design

Objectives

a Provide subdivision lot sizes that meet community and economic needs, whilst ensuring that environmental and social values are safeguarded;

b Facilitate greater diversity in housing choice;

c Ensure lots are of sufficient size to meet user requirements and to facilitate energy efficiency of the future built form;

d Encourage innovative design;

e Provide subdivisions that are responsive to the site constraints and opportunities;

f Ensure appropriate building siting and access to development; and

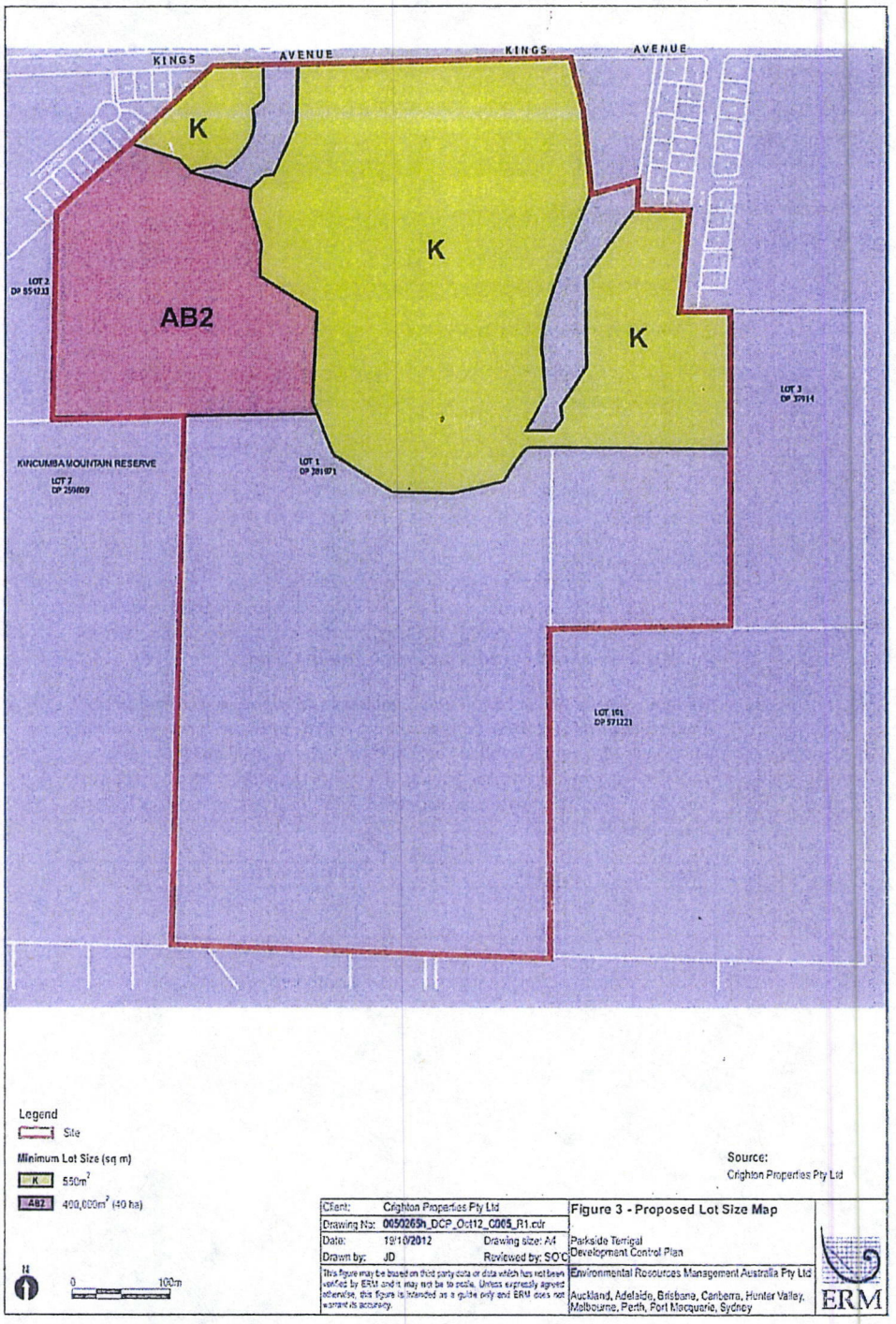
g Provide adequate open space and recreation areas, vehicle access and parking.

Requirements

A plan illustrating lot layout, road design, open space and recreation areas for each stage of the development shall be submitted with any application in accordance with *Appendix B in Terrigal@Parkside October 2012 (IR 12538387)* Design Criteria.

Minimum lot sizes shall be 550 square metres in areas shown as K and 400,000 square metres (40 hectares) in areas shown as AB2 in Figure 3. In accordance with the Residential Subdivision chapter of this DCP, the minimum lot sizes are to be increased in respect to sites having the following slope characteristics, to provide sufficient area to accommodate the additional requirement for batters, retaining walls, cut/fill, etc.

Slope Zone	Slope	Minimum Area	Minimum Width
K	Less than 15%	550m^2	15m
	15% or greater, but less than 20%	650m^2	18m
	20% or greater	800m^2	20m


KINGS AVENUE
KINGS AVENUE
K
K
K
AB2
LOT 3 DP 854133
KINCUMBA MOUNTAIN RESERVE
LOT 7 DP 259809
LOT 1 DP 201871
LOT 3 DP 37914
LOT 101 DP 571221
Legend
Site
Minimum Lot Size (sq m)
K 550m²
AB2 400,000m² (40 ha)
Source:
Crighton Properties Pty Ltd
N
0
100m
Client: Crighton Properties Pty Ltd
Drawing No: 0650265h_DCP_Oct12_C005_R1.cdr
Date: 19/10/2012
Drawing size: A4
Drawn by: JD
Reviewed by: SO'C
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
Figure 3 - Proposed Lot Size Map
Parkside Terrigal
Development Control Plan
Environmental Resources Management Australia Pty Ltd
Auckland, Adelaide, Brisbane, Canberra, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney
ERM

5.12.4.3 Street Network

Objectives

a To provide safe, legible and efficient vehicle access to and within the site;

b To provide a through road system for emergency vehicles, particularly for bushfire protection;

c To discourage through traffic from using Belar Ave;

d To create a high quality safe environment for walking and cycling and to link in with the existing network; and

e To serve all existing land parcels with a local street that provides connection to the remainder of the site;

Requirements

a Transport networks are to be designed in accordance with the Transport Networks section of the Resiidential Subdivisions chapter of this DCP.

b A road link is to be provided between the site and the property immediately to the east of the site;

c Traffic calming devices are to be installed on all through roads that lead to Belar Ave;

d Vehicular access to the site shall be provided in the locations indicated on the transport movement hierarchy plan in Figure 4; and

e The Kings Avenue intersection is to be designed to accommodate the expected traffic flows from the estate in a safe and efficient manner.

5.12.4.4 Street Network

Objective

To create a pedestrian pathway network that provides safe access to dwellings, open space areas and locations external to the site.

Requirements

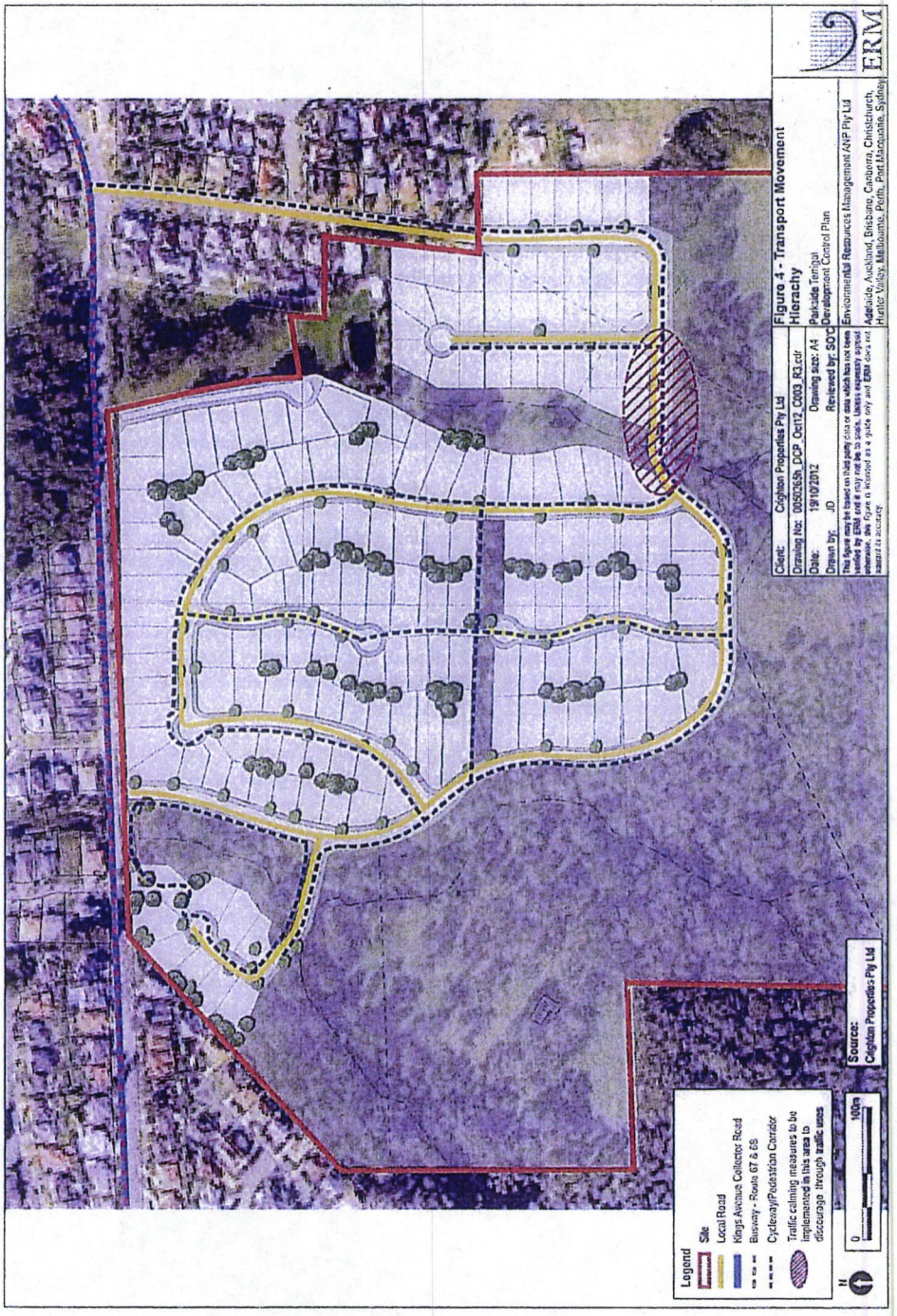
A pedestrian and cycleway network strategy, generally in accordance with Figure 4 and the Riparian and Buffer Zone Management Plan *(see Appendix A Terrigal@Parkside October 2012, GCC Doc No 12538387)* prepared by the Conacher Environmental Group dated October 2008 shall be submitted with any subdivision application detailing the following:

a A network of pedestrian pathways to be constructed generally within the riparian buffer zones in the western portion of the site;

b A network of pedestrian pathways and cycleways around and within the estate;

c All structures, bridges, raised platforms and signage, associated with the implementation of the strategy, and

d A pathway/trail is to be provided or dedicated to Council as part of the Kincumba Mountain Reserve so that access into the Reserve is available from the site consistent with the Gosford City Council Bike Strategy 2011.



5.12.4.5 Services

Objective

To set out Council requirements for the provision of infrastructure to the site.

Requirements

a All new services are to be placed underground;

b A water cycle management plan is to be prepared for the site;

c The stormwater system is to be designed having regard to Water Sensitive Urban Design (WSUD) principles and the Water Cycle Management chapter of this DCP.

d Post development stormwater flows off site are not to exceed the pre development flows up to and including the one in one hundred year storm event;

e A sewer strategy is to be prepared which deals with staging and required augmentation, along with funding and delivery of such augmentation. The sewer strategy is to be signed off by Council prior to development consent being issued for the site;

f Sewer services to the satisfaction of Council (whether they be downstream upgrades or wastewater treatment and reticulation facilities) must be provided to service the development in accordance with the sewer strategy referred to above;

g Augmentation of existing mains and pump stations, if required by the sewer strategy, shall be carried out by the developer at the developer's expense;

h Payment of the current water and sewer headworks and augmentation contributions, in accordance with Council's policy;

i The Developer is to be responsible for the design and construction of water supply and sewerage works as per the sewer strategy;

j The Developer is to be responsible for the full cost of connection to the existing water supply and sewerage systems;

k The Developer is to be responsible for the design and full cost of any augmentation works to the existing water supply and sewerage systems that are required as a result of any extra loading from the proposed development. Augmentation works (if any) may need to be completed before Council could allow the connection to the water supply and sewerage systems.

5.12.4.6 Integrated Water Management

Objectives

a To provide integrated water management infrastructure to the estate in a sustainable and efficient manner;

b Reduce nuisance and high level flooding in urban areas and the cost of providing and maintaining flood mitigation infrastructure whilst improving water quality in streams and groundwater;

c Make efficient use of water resources and increase awareness of water conservation;

d Reduce the erosion of waterways, slopes and embankments and protect the scenic landscape and recreational values of watercourses; and

e Protect and restore aquatic and riparian ecosystems and habitats.

Requirements

a An integrated water management strategy shall be prepared and submitted with any application for subdivision over the site. The strategy shall demonstrate compliance best management practices and with the water management cycle objectives detailed in the following documents:

- *Water Cycle Plan prepared by Cardno Pty Ltd dated June 2005 (GCC Doc No 1750336)*

b The strategy shall demonstrate compliance with the Water Cycle Management chapter of this DCP and the Gosford City Council Water Cycle Management Guidelines. This guideline specifies the following post development pollutant treatment rates for sites draining into the coastal catchments, such as Terrigal Lagoon:

- Suspended Solids - 80% retention;
- Total Phosphorus - 45% retention;
- Total Nitrogen - 45% retention;
- Gross Pollutants - retention of litter greater than 40mm in size for flows up to 25% of the 1 year ARI peak flow; and
- No Oil or Grease to be visible downstream of the site for flows up to 25% of the 1 year ARI peak flow.

c The strategy shall demonstrate that the implementation of both lot and community based stormwater quality measures in a "treatment train" approach to limit post-developed pollutant loads to appropriate levels.

5.12.4.7 Threatened Species and Endangered Ecological Communities

Objectives

To provide habitat for a number of Threatened Fauna Species including the Powerful Owl, Sooty Owl, Eastern Bentwing-bat, Eastern False Pipistrelle,

Greater Broad-nosed Bat, Grey headed Flying-fox, Little Bentwing Bat, Yellow bellied Glider, Yellow-bellied Sheathtail-bat and Eastern Freetail-bat. One Endangered Ecological Community (EEC), the Lowland Rainforest, is also present on the site. Care therefore needs to be taken to ensure that any proposed development mitigates any potential detrimental impacts to these Threatened Species and the EEC.

Requirements

a An Ecological Site Management Plan must be prepared for the site and its recommendations implemented in any development proposed for the site;

b An area of approximately 27.2 hectares adjoining the Kincumba Mountain Reserve is to be dedicated to Council, consistent with the terms of the Voluntary Planning Agreement (VPA) and in conjunction with the issue of development consent for subdivision of the land; and

c The potential impacts on the rainforest community in the western portion of the site are to be considered in any development application lodged for works on land within 50m of this community.

5.12.4.8 Rehabilitation of Riparian Areas

Objectives

To improve the quality of watercourses, riparian and buffer areas.

Requirements

a The recommendations of the Riparian and Buffer Zone Management Plan prepared by the Conacher Environmental Group 2008 dated October 2008 must be adopted in any development proposed for the site *(see Appendix A in Terrigal@Parkside October 2012 GCC Doc No 12538387)*

b The riparian buffers provided in accordance with the Management Plan referred to above must be exclusive of any asset protection zones required for bush fire management purposes.

5.12.4.9 Mitigation of Bushfire Risk

Objective

To provide the necessary protection for people and property from the risk of bushfire.

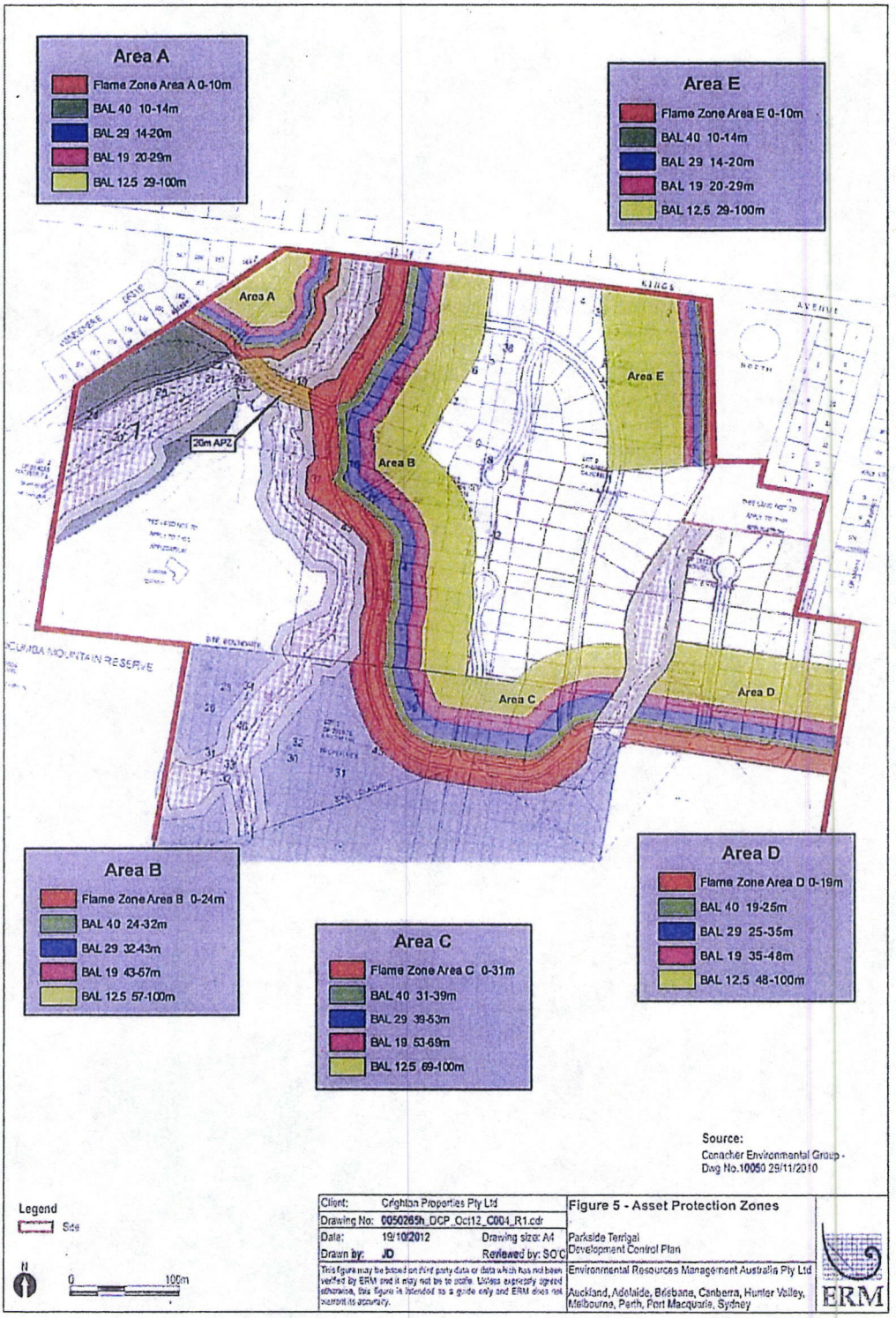
Requirements

a Asset protection zones (APZ) (see Figure 5) and other requirements specified in the publication *"Planning for Bushfire Protection 2006 (or as amended)"* prepared by the New South Wales Rural Fire Service must be incorporated into any development proposals for the site;

b As a minimum the APZ's as shown on Figure 5 must be provided for in any development application;

c Applicants are to ensure that any bushfire protection measures (ie Asset Protection Zones) do not encroach upon any adjoining land zoned for environmental protection purposes or any land intended to be dedicated for public use; and

d Selection of materials and methods of construction must have regard to AS3959-2009 and *Planning for Bushfire Protection 2006 (or as amended).*



5.12.4.10 Building and Landscape Design

Objective

To identify principles for sustainable building and landscape design so that cut and fill of house sites and public areas is minimised.

Requirements

a With any application for subdivision, a landscaping strategy shall be submitted in accordance with the design criteria outlined in *Appendix B in Terrigal at Parkside October 2012(GCC Doc No 12538387)* and the Architectural and Landscape Guidelines; and

b Dwellings shall be sited and designed with regard to the controls of the Architectural and Landscape Guidelines and the principles contained in *Appendix B in Terrigal at Parkside October 2012(GCC Doc No 12538387)* Design Criteria.

5.12.4.11 Geotechnical Hazards

Objective

a To prevent slope instability due to inappropriate land management practices; and

b To ensure that cut and fill is minimised in steeply sloping areas of the site to reduce the potential for land slip to occur.

Requirements

a Any development application submitted to Council must be accompanied by the information required in the Geotechnical Requirements chapter of this DCP which specifies Geotechnical Requirements for Development Applications and generally adopt the guidelines set out in this chapter;

b Any development application submitted to Council must consider the recommendations contained within the geotechnical analysis carried out for the site by Coffey Geotechnics dated February 2008 (see *Appendix C in Terrigal at Parkside October 2012 GCC Doc No 12538387); and*

c The provisions of the Cut and Fill Restrictions in the Single Dwellings and Ancillary Structures section of this DCP shall be considered in the preparation of any development applications involving earthworks on the site.

5.12.4.12 Development of Flood Prone Land

Objective

To identify flood liable land and manage development in flood liable areas.

Requirements

a Land inundated by the one percent probability flood is to be contained within the riparian buffer area. No residential development is to be permitted within the riparian buffer area;

b Any development proposed on flood liable land must be compatible with the potential for this land to be inundated or otherwise acceptable mitigation measures must be implemented to ensure that significant damage to buildings and works and/or the obstruction of flood waters does not occur; and

c The requirements contained in the Water Cycle Management section of this DCP must be considered when preparing any development application over flood liable land.

5.12.5.1 Requirements for Home Based Business Estate

Where a Home Base Business Estate is proposed, the following additional requirements will apply.

5.12.5.1 Provision of a Business Support Hub

Objective

To ensure that business support will be provided to enhance the success of businesses that may be established on the estate.

Requirements

a A business support hub must be constructed in a central location within the Home Based Business Estate and shall contain conference and meeting facilities, retail and commercial outlets and associated infrastructure;

b The business support hub must be constructed and operational within one year of the first dwelling being constructed on site; and

c The necessary financial arrangements must be put in place via funding from the Community Association to ensure the ongoing financial viability of the business support hub.

5.12.5.2 Control of Retail and Commercial Uses

Objective

a To enhance the economic viability of business support hub; and

b Provide a range of small-scale retail, business and community uses that serve the needs of people who live and work in the surrounding neighbourhood.

Requirements

a Any proposal for the development of the business support hub shall be centrally located within the Home Based Business Estate and restricted to a maximum building height of two storeys and a maximum floor area of 600 square metres.

b The business support hub shall be owned and managed by the Community Association, and may include, uses such as:

- Conference rooms;
- Meeting rooms;
- Office;
- Typing/Facilities area;
- Coffee Shop;
- Lounge/Multifunction/Function Space;
- Kitchenette;
- Store;
- Toilet Facilities;
- Additional residential amenity such as pool, gymnasium, library, tennis court; and
- It may even include child minding facilities and children's play areas.

Nothing in this chapter shall restrict the opportunity for the community association to lease, contract, sublet any or all of these services.

5.12.5.3 Provision of Appropriate Active and Passive Recreation Facilities

Objective

To provide access to active and passive recreation facilities on site to enhance the lifestyle associated with living within the proposed Home Based Business Estate.

Requirements

a Passive open space should generally be available for use by members of the public who are not residents of the estate, thereby adding to the recreation assets within the locality;

b The riparian buffer zones must have pedestrian pathways constructed within them to provide opportunities for residents and others to walk along these open space areas;

c Communal open space facilities must be constructed in close proximity to the business support hub for use by residents and others; and

d All active and passive recreation facilities on site must be regularly maintained by the Community Association so that they are available and safe for use by residents and others.

5.12.5.4 Traffic Impacts and Car Parking

Objective

To provide safe access to and egress from Home Based Businesses and Associated Facilities and to ensure that adequate on site car parking is provided.

Requirements

a All Home Based Business must have a minimum of one car parking space on site for customer and/or employee use which is not part of a garage or access driveway to or from the site; and

b The provisions of the Car Parking chapter of this DCP must be considered in preparing any development application which provides car parking on site.

5.12.5.5 Community Title

Objective

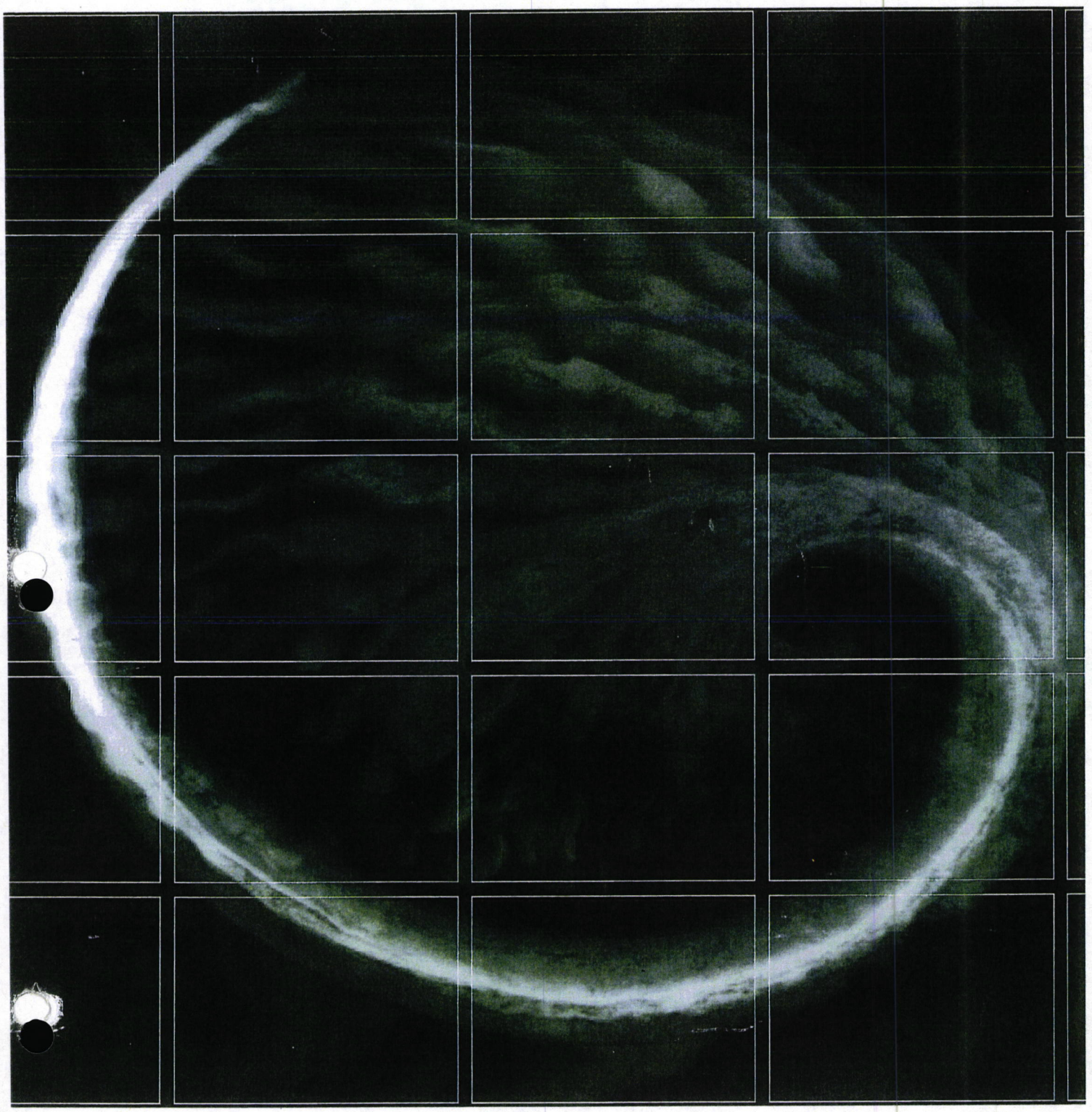
To ensure that the site is developed for the intended purpose and that all the necessary controls and funding arrangements are in place.

Requirements

a The Home Based Business Estate must be developed under the Community Land Management Act 1989. A Community Management Statement as required under the Act must be prepared which deals with issues such as the operation and funding of the business support hub, waste water management system, open space areas, recreation facilities, asset protection zones, the riparian areas and park land areas on site and the Community Association. In addition, architectural and landscape design controls must specify critical requirements which all developments on site must conform to. Architectural and design controls shall take into consideration the building design principles in *Appendix D in Terrigal at Parkside October 2012 GCC Doc No 12538387.*

b The site must be generally developed in the manner shown on the accompanying plan as a Home Based Business Estate comprising 145 residential allotments varying in area between 550 to 2000 square metres. When each residential lot is developed it must have a home business with a floor area of not less than 30 square metres and not more than 60 square metres; and

c The Community Management Statement must be drafted in accordance with the principles outlined in *Appendix D in Terrigal at Parkside October 2012 GCC Doc No 12538387* Development Standards.



Terrigal @ Parkside

Development Control Plan

Crighton Properties Pty Ltd

October 2012

0050265 Final

www.erm.com

Delivering sustainable solutions in a more competitive world

ERM

Prepared for Gosford City Council

Parkside @ Terrigal
Development Control Plan

October 2012

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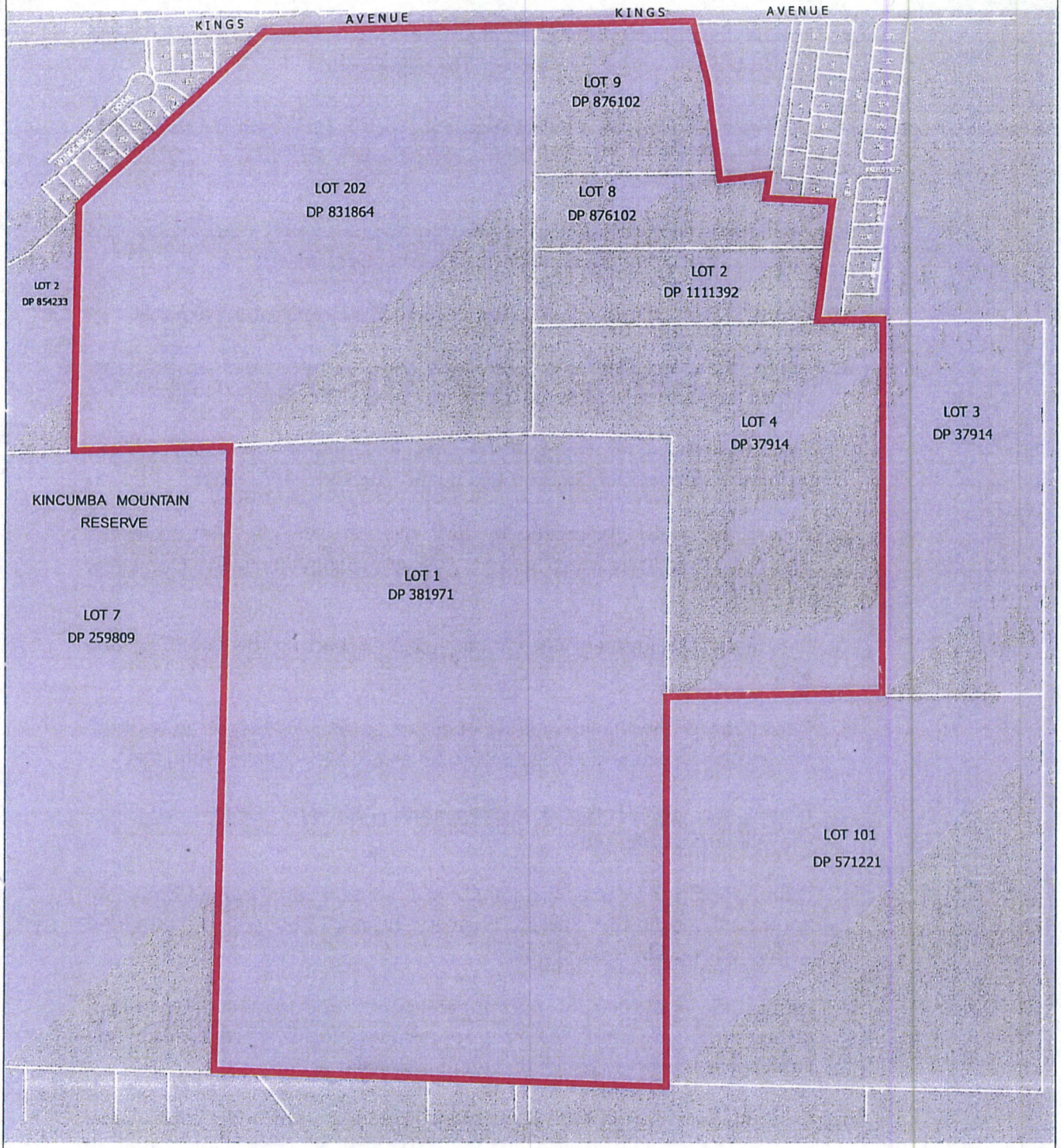

Source:
Crighton Properties Pty Ltd

Legend
Site

N
0 100m

Client:	Crighton Properties Pty Ltd		**Figure 1 - Land Application Plan**
Drawing No:	0050265h_DCP_Oct12_C001_R1.cdr		
Date:	19/10/2012	Drawing size: A4	Parkside Terrigal Development Control Plan
Drawn by:	JD	Reviewed by: SO'C	

Environmental Resources Management Australia Pty Ltd

Auckland, Adelaide, Brisbane, Canberra, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

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6 GENERAL SUBDIVISION REQUIREMENTS

6.1 STAGING PLAN

Objective:

To enable sustainable development consistent with the objectives of the 2a, 6a 6c and 7a zones that enhances the existing low density residential character and protects the natural setting of Kincumber Mountain Reserve and Terrigal.

Requirements:

Any application for subdivision shall prepare a staging plan. *Figure 2* illustrates the potential future development pattern and staging for the estate and should be considered in conjunction with the following documents:

- Parkside @ Terrigal LES and associated annexures;
- Waste Management DCP No.106;
- Energy Smart Homes DCP No.108;
- Car Parking DCP No.111;
- Subdivision DCP No.112;
- Flood Liabile Areas Building DCP No. 115;
- Cut and Fill Restrictions (Amendment 1) DCP No.122;
- Dual Occupancy DCP No.126;
- Geotechnical Requirements DCP No.163; and
- Water Cycle Management DCP No.165.

6.2 *DENSITY AND SUBDIVISION DESIGN*

Objectives:

a. Provide subdivision lot sizes that meet community and economic needs, while ensuring that environmental and social values are safeguarded;

b. Facilitate greater diversity in housing choice;

c. Ensure lots are of sufficient size to meet user requirements and to facilitate energy efficiency of the future built form;

d. Encourage innovative design;

e. Provide subdivisions that are responsive to site constraints and opportunities;

f. Ensure appropriate building siting and access to development; and

g. Provide adequate open space and recreation areas, vehicle access and parking.

Requirements:

A plan illustrating lot layout, road design, open space and recreation areas for each stage of the development shall be submitted with any application for subdivision in accordance with *Appendix B* Design Criteria.

Minimum lot sizes shall be 550 square metres in areas shown as K and 400,000 square metres (40 hectares) in areas shown as AB2 in *Figure 3*. In accordance with Gosford Council Subdivision DCP No.112, the minimum lot sizes are increased in respect to sites having the following slope characteristics, to provide sufficient area to accommodate the additional requirement for batters, retaining walls, cut/fill, etc.

Slope Zone	Slope	Minimum Area	Minimum Width
K	less than 15%	550m^2	15m
	15% or greater, but less than 20%	650m^2	18m
	20% or greater	800m2	20m

6.3 *STREET NETWORK*

Objectives:

a. To provide safe, legible and efficient vehicle access to and within the site;

b. To provide a through road system for emergency vehicles, particularly for bushfire protection;

c. To discourage through traffic from using Belar Ave;

d. To create a high quality safe environment for walking and cycling and to link in with the existing network; and

e. To serve all existing land parcels with a local street that provides connection to the remainder of the site.

Requirements:

a. Transport networks are to be designed in accordance with Clause 5 of DCP 112, Residential Subdivisions;

b. A road link is to be provided between the site and the property immediately to the east of the site;

c. Traffic calming devices are to be installed on all through roads that lead to Belar Ave;

d. Vehicular access to the site shall be provided in the locations indicated on the transport movement hierarchy plan in *Figure 4*; and

e. The Kings Avenue intersection is to be designed to accommodate the expected traffic flows from the estate in a safe and efficient manner.

6.4 *PEDESTRIAN NETWORK*

Objective:

To create a pedestrian pathway network that provides safe access to dwellings, open space areas and locations external to the site.

Requirements:

A pedestrian and cycleway network strategy, generally in accordance with *Figure 4* and the Riparian and Buffer Zone Management Plan (see *Appendix A*) prepared by the Conacher Environmental Group dated October 2008 shall be submitted with any subdivision application detailing the following:

a. A network of pedestrian pathways to be constructed generally within the riparian buffer zones in the western portion of the site;

Client:	Crighton Properties Pty Ltd		
Drawing No:	0050265h_DCP_Oct12_C003_R3.cdr		
Date:	19/10/2012	Drawing size:	A4
Drawn by:	JD	Reviewed by:	SO'C

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 4 - Transport Movement Hierachy

Parkside Terrigal
Development Control Plan

Environmental Resources Management ANP Pty Ltd

Adelaide, Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

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6.6 *INTEGRATED WATER MANAGEMENT*

Objectives:

a. To provide integrated water management infrastructure to the estate in a sustainable and efficient manner;

b. Reduce nuisance and high level flooding in urban areas and the cost of providing and maintaining flood mitigation infrastructure whilst improving water quality in streams and groundwater;

c. Make efficient use of water resources and increase awareness of water conservation;

d. Reduce the erosion of waterways, slopes and embankments and protect the scenic, landscape and recreational values of watercourses; and

e. Protect and restore aquatic and riparian ecosystems and habitats.

Requirements:

a. An integrated water management strategy shall be prepared and submitted with any application for subdivision over the site. The strategy shall demonstrate compliance best management practices and with the water management cycle objectives detailed in the following documents:

   - Water Cycle Plan prepared by Cardno Pty Ltd dated June 2005; and
   - Report prepared by Cahill & Cameron Pty Ltd dated 28 September 2007.

b. The strategy shall demonstrate compliance with the Gosford City Council publication "Water Cycle Management Guidelines", which is complimentary to Council's DCP 165 - Water Cycle Management. This guideline specifies the following post development pollutant treatment rates for sites draining into the coastal catchments, such as Terrigal Lagoon :

   - Suspended Solids - 80% retention;
   - Total Phosphorus - 45% retention;
   - Total Nitrogen - 45% retention;
   - Gross Pollutants - retention of litter greater than 40mm in size for flows up to 25% of the 1-year ARI peak flow; and
   - No Oil or Grease to be visible downstream of site for flows up to 25% of the 1-year ARI peak flow.

6.9 *MITIGATION OF BUSH FIRE RISK*

Objective:

To provide the necessary protection for people and property from the risk of bushfire.

Requirements:

a. Asset protection zones (APZ) (see *Figure* 5) and other requirements specified in the publication *"Planning for Bushfire Protection 2006 (or as amended)"* prepared by the New South Wales Rural Fire Service must be incorporated into any development proposals for the site;

b. As a minimum the APZs as shown on *Figure 5* must be provided for in any development application;

c. Applicants are to ensure that any bushfire protection measures (ie Asset Protection Zones) do not encroach upon any adjoining land zoned for environmental protection purposes or any land intended to be dedicated for public use; and

d. Selection of materials and methods of construction must have regard to AS 3959-2009 and Planning for Bushfire Protection 2006 (or as amended).

6.10 *BUILDING AND LANDSCAPE DESIGN*

Objective:

To identify principles for sustainable building and landscape design so that cut and fill of house sites and public areas is minimised.

Requirements:

a. With any application for subdivision, a landscaping strategy shall be submitted in accordance with the design criteria outlined in *Appendix B* and the Architectural and Landscape Guidelines; and

b. Dwellings shall be sited and designed with regard to the controls of the Architectural and Landscape Guidelines and the principles contained in *Appendix B* Design Criteria.

Geotechnical Hazards

Objectives:

a. To prevent slope instability due to inappropriate land management practices; and

b. To ensure that cut and fill is minimized in steeply sloping areas of the site to reduce the potential for land slip to occur.

Requirements:

a. Any development application submitted to Council must be accompanied by the information required in DCP No.163 which specifies Geotechnical Requirements for Development Applications and generally adopt the guidelines this DCP sets out;

b. Any development application submitted to Council must consider the recommendations contained within the geotechnical analysis carried out for the site by Coffey Geotechnics dated February 2008 (see *Appendix C*); and

c. The provisions of DCP No.122 Cut and Fill Restrictions shall be considered in the preparation of any development applications involving earthworks on the site.

6.11 DEVELOPMENT OF FLOOD PRONE LAND

Objective:

To identify flood liable land and manage development in flood liable areas.

Requirements:

a. Land inundated by the one percent probability flood is to be contained within the riparian buffer area. No residential development is to be permitted within the riparian buffer area;

b. Any development proposed on flood liable land must be compatible with the potential for this land to be inundated or otherwise acceptable mitigation measures must be implemented to ensure that significant damage to buildings and works and/ or the obstruction of flood waters does not occur; and

c. The requirements contained in DCP No.115 Flood Liable Areas Building must be considered when preparing any development application over flood liable land.

- Meeting rooms;
- Office;
- Typing / Facilities area;
- Coffee shop;
- Lounge / Multifunction / Function Space;
- Kitchenette;
- Store;
- Toilet Facilities;
- Additional residential amenity such as a pool, gymnasium, library, tennis court; and
- It may even include child minding facilities and children's play areas.

Nothing in this DCP shall restrict the opportunity for the community association to lease, contract, sublet any or all of these services.

6.14 *PROVISION OF APPROPRIATE ACTIVE AND PASSIVE RECREATION FACILITIES*

Objective:

To provide access to active and passive recreation facilities on site to enhance the lifestyle associated with living within the proposed Home Based Business Estate.

Requirements:

a. Passive open space facilities should generally be available for use by members of the public who are not residents of the estate, thereby adding to the recreation assets within the locality;

b. The riparian buffer zones must have pedestrian pathways constructed within them to provide opportunities for residents and others to walk along these open space areas;

c. Communal open space facilities must be constructed in close proximity to the business support hub for use by residents and others; and

d. All active and passive recreation facilities on site must be regularly maintained by the Community Association so that they are available and safe for use by residents and others.

- the Bradley Method of minimal soil disturbance during weed removal;
- clearing and stabilising techniques;
- the use of herbicides;
- the use of fire; and
- biological controls.

The weed removal / bush regeneration technique that is most suitable for this situation is a variation of the Bradley Method. This method identifies that weed removal should be accomplished with minimal disturbance to the soil and surrounding native plants, an ideal situation in areas sensitive to erosion and where native plants can regenerate. The Bradley Method incorporates three basic philosophies:

- Work from areas containing less disturbed native vegetation towards more weed infested areas;

- Minimal disturbance to the soil and surrounding native plants. This is an important aspect especially in this situation as the topography and riparian morphology of the site makes it susceptible to erosion once plant cover has been removed;

- Allow natural native plant regeneration to occur throughout the native plant community. In some cases it may be necessary to assist regeneration by replanting areas of weed removal with locally occurring native species.

It is expected that weed removal within the subject site will be undertaken in accordance with methods described below and in Appendix I.

Exotic species targeted for removal throughout the duration of the management plan are listed in Table 2.1. General management strategies enabling appropriate removal of these species are provided in Appendix I.

TABLE 2.1
EXOTIC SPECIES TARGETED FOR REMOVAL

On Site	Scientific Name	Common Name
#	*Ageratina adenophorum*	Crofton Weed
	Bambusa sp.	Bamboo
#	*Cirsium vulgare*	Spear Thistle
#	*Impatiens walleriana*	Busy Lizzie
#	*Lantana camara*	Lantana
#	*Ligustrum sinense*	Small-leaved Privet
#	*Lonicera japonica*	Japanese Honeysuckle
	Musa sp.	Banana
#	*Nephrolepis cordifolia*	Fishbone Fern
#	*Nicotiana glauca*	Tobacco Bush
#	*Paspalum dilatatum*	Paspalum
#	*Paspalum urvillei*	Vasey Grass
#	*Cortaderia selloana*	Pampas Grass
#	*Protasparagus aethiopicum*	Asparagus Fern
#	*Rubus anglocandicans*	Blackberry
#	*Senna pendula var. glabrata*	Cassia
#	*Thunbergia alata*	Black-eyed Susan
#	*Tradescantia fluminensis*	Wandering Jew
#	*Zantedeschia aethiopica*	White Arum Lily
# = Species observed on site		

TABLE 2.2 RECOMMENDED SPECIES FOR RE-PLANTING	
Scientific Name	**Common Name**
Trees	
Eucalyptus saligna	Blue Gum
Eucalyptus pilularis	Blackbutt
Acacia prominens	Gosford Wattle
Acmena smithii	Lillypilly
Alphitonia excelsa	Red Ash
Archontophoenix cunninghamiana	Bangalow Palm
Elaeocarpus reticulatus	Blueberry Ash
Livistona australis	Cabbage Tree Palm
Sloanea australis	Maidens Blush
Shrubs	
Acacia binervia	Coast Myall
Acacia suaveolens	Sweet Scented Wattle
Omalanthus populifolius	Bleeding Heart
Pittosporum revolutum	Yellow Pittosporum
Polyscias sambucifolia	Elderberry Panax
Wilkiea heugeliana	Wilkiea
Dianella caerulea var. *producta*	Blue Flax Lily
Dichelachne micrantha	Short-hair Plume Grass
Doodia aspera	Rasp Fern
Entolasia marginata	Bordered Panic
Gymnostachys anceps	Settlers Flax
Lepidosperma laterale	Variable Sword-sedge
Note: Natural germination and establishment of other native species is to be encouraged Note: Other native species present within the site can be added if required	

In addition to the riparian and buffer areas, vegetation replanting is proposed for the road batters above the creek culvert that flows under Kings Avenue. This area is to be revegetated to consolidate the connectivity of creekline vegetation with other areas offsite.

2.4 DETAILS OF ANY ONGOING MONITORING AND MAINTENANCE ACTIVITIES TO BE CARRIED OUT WITHIN RETAINED VEGETATION OF THE SITE

It is recommended that regular monitoring inspections be undertaken at 6 monthly intervals for 2 years after weeding and replanting works have been undertaken. This will allow the determination of the health of the vegetation and may include identification of any areas suffering from disturbance or in need of rehabilitation, weed control, sediment or storm water control, bank and soil stabilisation or maintenance of rehabilitated or regenerating areas.

Monitoring and review will include a performance evaluation of the works and will include assessment for replanting where losses have occurred, addressing any deficiencies observed, and determining a successful outcome. A successful outcome is usually defined as a minimum of 80% survival rate for all plantings and a maximum of 5% weed cover for the treated riparian corridor is achieved.

compaction by prohibiting vehicle access and the stockpiling of construction material such as soil and woodchips within the vegetation protection zone.

Silt Fencing
Erosion and sediment control measures are to be implemented to minimise adverse effects of increased erosion and sediment loading. These include: the safe disposal of waste products, coordinated work practices aimed at minimising land disturbance, the disposal of 'clean' water off site, the minimisation of vegetation disturbance through the dedication of 'no go areas', routine site inspections of drains, channels, sediment control structures and water quality, identification of potential erosion areas, installation and maintenance of flow control structures and soil stabilising vegetation wherever required.

The minimisation of soil erosion will be achieved through soil stabilisation measures and water control techniques. Suitable soil stabilisation measures to be implemented include the immediate revegetation of cleared surfaces via seeding, planting of native species, mulching or the installation of biodegradable blankets. Suitable water control measures include construction of earth banks, catch drains, detention and sediment ponds (including Gross Pollutant Traps), grassed and armoured waterways, rock earth and sand bag dams and outlet protection systems to prevent scouring.

Mulching
Mulching is an efficient method to impede the establishment of weed species, soil erosion, compaction and desiccation. Woodchip or other suitable mulch is to be placed at a depth of 75-100mm covering any areas of tree replanting or landscape areas. Areas surrounding the stems/trunks of plants are to be kept free from mulch, thereby reducing the incidence of collar rot on retained or planted flora.

2.7 VEGETATION PROTECTION GUIDELINES

The following guidelines are proposed in relation to retained vegetation on the site and the proposed development:

i. Implementation of an adequate ***Vegetation Protection Zone (VPZ)*** will be required surrounding any retained vegetation. This *vegetation protection zone* can generally be provided by preserving an area around the vegetation with a radius of at least 1.25 x the average canopy radius from the trunk (of typical tree forms) or 0.5 x the tree height. *British Standard BS 5837* (1991);
ii. The boundary of the Vegetation Protection Zone is to be established at the outer boundary of the Vegetation Buffer Zone as shown in Figure 1;
iii. Before construction commences vegetation protection zones should be adequately marked and sign posted using star pickets and wire or high visibility tape or plastic net fencing;
iv. All trees not nominated for retention are to be removed prior to any construction activity or bulk earthworks. Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction. Such works are to be supervised by a qualified Arborist;
v. Stumps are to be ground - not dozed or dug out;
vi. All trenches footings and major earth movement should avoid *vegetation protection zones*;
vii. Stockpiling materials and soils within *vegetation protection zones* is to be avoided;
viii. Machinery is to avoid *vegetation protection zones* during all operations;
ix. Any trenching or construction works undertaken within *vegetation protection zones* should be witnessed, supervised and recorded (photographed and documented) by a qualified Ecologist or Arborist;

SECTION 3

WORKS PROGRAM

3.1 WORKS PROGRAM

A proposed works program is outlined in Table 3.1.

TABLE 3.1
PROPOSED WORKS PROGRAM

Action	Responsibility	Funded By
Pre-construction		
• Collection of seed/plant propagation.	- Contract grower	Developer
• Identification (flagging) of vegetated areas to be retained (VPZ).	- Project Supervisor	Developer
• Erection of erosion control fencing.	- Contractor with advice of Project Supervisor	Developer
• Installation of protective fencing and signs around adjacent bushland (VPZ).	- Contractor with advice of Project Supervisor	Developer
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
• Preparation of a landscape/tree planting program if required.	- Contractor / Project Supervisor	Developer
Construction		
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
• Monitor erosion control fencing (weekly – and after rain) and replace if required.	- Contractor with advice of Project Manager	Developer
• Monitor vegetation protection fencing and signs and replace if required.	- Contractor with advice of Project Supervisor	Developer
• Implementation of tree/shrub planting program	- Contract landscaper/bush regenerator	Developer

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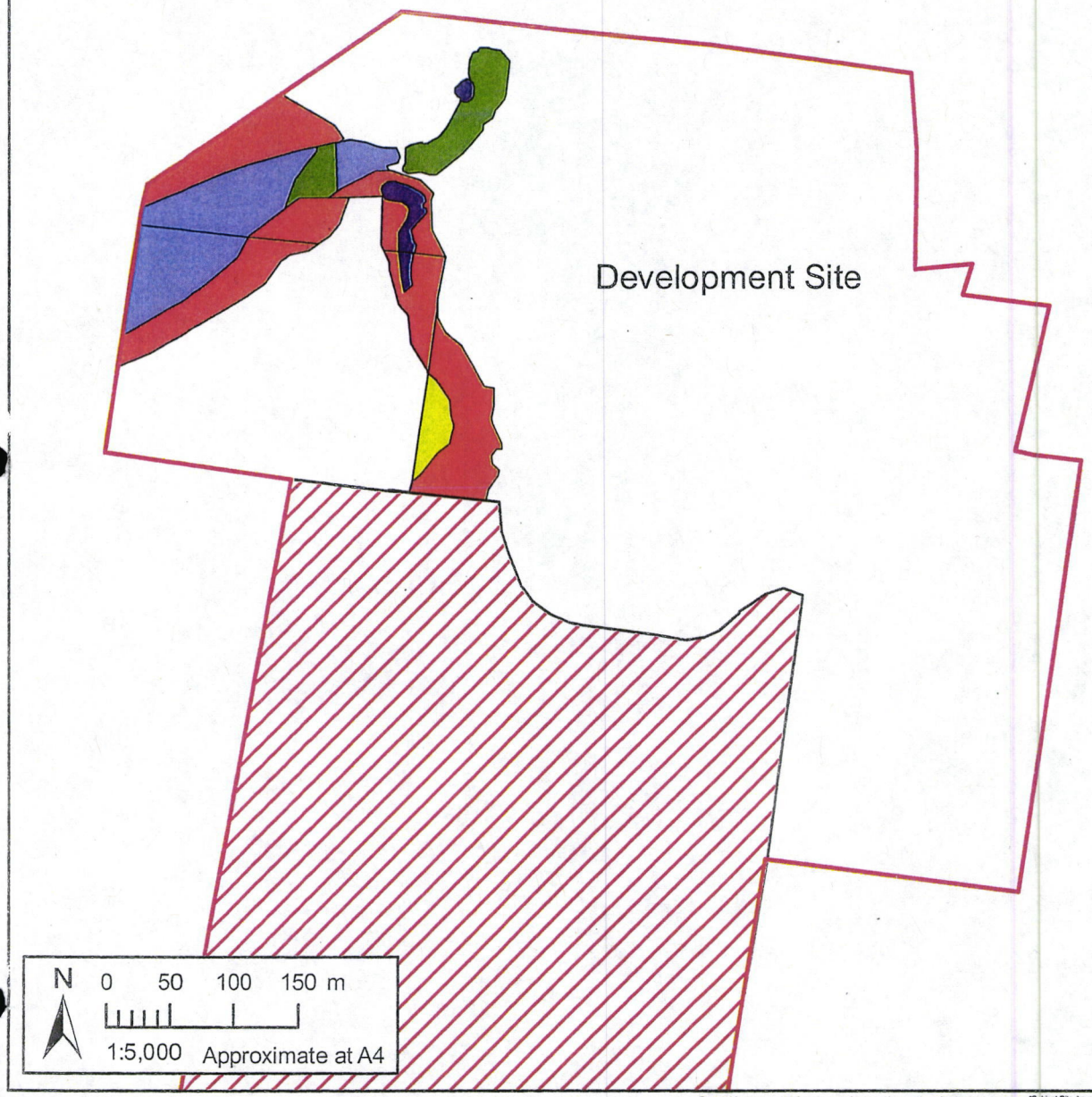

Flora and fauna survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey
Plan for indicative purposes only. Not for detailed measurement.

Legend

- Subject Site Boundary
- **Low Intensity Works** Reasonably intact vegetation with low levels of weed invasion. Targeted weed removal required with encouragement of natural bushland regeneration. Occasional works undertaken on a part-time programmed basis, works to be identified in Community Plan and sourced form Community funding.
- Dam (community land)
- **Medium Intensity Works** Partially intact vegetation with moderate levels of weed invasion. Ongoing weed removal targeting specific weeds (e.g. Lantana, Blackberry and Privet). Some areas requiring replanting with assisted natural regeneration, works to be identified in Community Plan.
- **High Intensity Works** Disturbed and extensively weed infested areas. Significant weed removal, assisted regeneration and replanting. Long-term commitment to weeding / regeneration programs required. Enrichment of fauna habitat recources required. Detailed works and funding program needed to establish procedures / costings / timing etc as identified in Community Plan.
- Private Conservation Land
- Area to be Dedicated to Council

Original plan produced in A4 colour

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cegconsult@bigpond.com

Figure 2 (a)

Weed Removal and Riparian Bushland Regeneration Works

Kings Avenue, Terrigal

BJ/MOC
19/11/10
Ref.No.10050

Source: Aerial © Department of Lands (2010)

WEED MANAGEMENT TECHNIQUES FOR USE IN AREAS OF VEGETATION RETENTION

Employing the Bradley Method for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three components:

Primary Weeding
Primary weeding is the initial weeding. It is recommended that primary weeding should be carried out on the subject land to remove the majority of dominant weeds. This involves removal of weeds through herbicide use and hand removal. It is important to note primary weeding usually initiates new growth of both weeds and native species. Primary weeding of the site may take up to four weeks and it is recommended that this work either be carried out by a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Secondary or Follow-up Weeding
Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work to remove weed regrowth or overlooked weeds. It is recommended that secondary weeding be conducted 3-6 months after primary weeding. Secondary weeding of the site may take up to two weeks and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Maintenance Weeding
After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from birds, wind and water transporting seed and other propagules into the site. Maintenance weeding should be undertaken once or twice a year until such time as the resistance of the bushland to weeds increases, then only requiring hand-weeding every two to three years. Maintenance weeding of the site may take up to one week and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Natural regeneration of the dominant native plant species is expected to occur over time provided ongoing management works are maintained.

Weed removal should be undertaken using small tools such as spades, mattocks, garden forks and saws to reduce soil disturbance and minimise damage to nearby plants. In addition to hand removal of weeds in some situations where weeds are abundant, such as for many of the grass species and when native plants will not be affected by spray drift, the use of Glyphosate herbicide is recommended in accordance with the manufacturers specifications. Herbicides should not be applied prior to rain occurring as this reduces the herbicides' effectiveness and increases the potential to enter creeks and drainage lines in runoff.

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques:

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Use of Herbicides

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used biodegradable

APPENDIX II

ESTIMATED COSTINGS

Appendix B

Design Criteria

1. INTRODUCTION

Development Control Plan No. **DCP 122 - "Cut and Fill Restrictions"** is currently in operation within the Gosford LGA having come into effect on the 16th December 1999.

The plan sets out restrictions with regard to cut and fill upon residential sites for the purpose of residential development. The stated objectives of the plan are in summary, to restrict cut and fill to;

A. preserve existing topography and neighbourhood amenity
B. ensure appropriate building design
C. avoid dangerous excavations
D. minimise siltation of waterways and erosion
E. allow site rehabilitation
F. minimise resultant spoil
G. preserve topsoil resources
H. ensure adequate provision for drainage.

Whilst the plan is intended to be taken into consideration at the time of assessing a Development Application upon land to which this plan applies, Council has requested that the principles within this plan be considered within the LES for the Parkside@Terrigal site, due to the slope of some areas of the site being in excess of 20%.

In keeping with this request, this report has been prepared to consider 'in principle' the likely options which may be further explored, in the preparation of a Development Application for actual development upon the site.

As the current process involves that of a rezone proposal (in the form of a Local Environment Study) no actual development upon the site is proposed at this point in time. The report therefore takes the form of identifying a number of design directions which may be adopted at the point of making a development application in order to address the provisions of this DCP.

It should be noted, that these design options are NOT proposed at this point in time, instead they demonstrate that a path to compliance would likely be available.

Design options generally fall into two classifications;

1. House design requirements
2. Civil works solutions

Due to the wide range of slope conditions across the site varying from flat to over 20%, further detailed analysis may show that no specific requirements need be put in place for some areas of the site, whilst others may require one of / or a combination of both of the above referred measures. They are explained in further detail in the following chapters.

option A - house design requirements

PRIVATE OPEN SPACE
ALTERNATE LOCATION USING DECKS OR EXCAVATED PRIVATE COURTS

REAR SETBACK
PREFERRED AREA FOR TRANSITON OF SLOPE BETWEEN ADJACENT PROPERTIES

UNDERFLOOR UTILITY ZONE
TO INCORPORATE RAINWATER TANKS / ENERGY MANAGEMENT / PLANT AND STORAGE EQUIPMENT

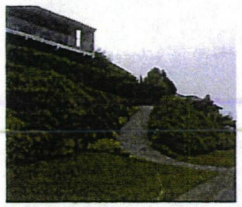
HOME OFFICE
WITH STREET FRONTAGE

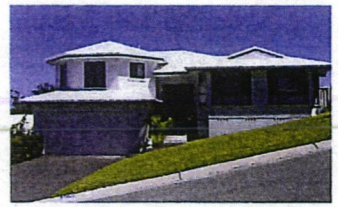
FRONT SETBACK
SETBACK GENERALLY 7.5M METRES. POSSIBLE LOCATION FOR VISITOR PARKING, SUBJECT TO APPROPRIATE LANDSCAPE SCREENING AND TREATMENT OF RETAINING WALLS TO ENSURE VISUAL AMENITY TO STREETSCAPE IS PRESERVED AND STRUCTURAL INTEGRITY OF BUILDING AND ASSOCIATED SITE WORKS IS MAINTAINED

BOUNDARY TRANSITION ZONE
WHERE INTEGRATED SITE DEVELOPMENT OCCURS ON A NUMBER OF ADJOINIING LOTS, THIS ZONE CAN BE DESIGNED TO FURTHER REDUCE THE NEED FOR RETAINING ALONG SIDE BOUNDARIES AND MAXIMISE THE EFFICIENT USE OF SIDE SETBACKS FOR UTILITY AND AMENITY PURPOSES

CARPARKING
RESIDENT / OWNER OCCUPIER CARPARKING ZONE

SITE PLAN (NTS)





REQUIREMENTS FOR HOUSE DESIGN

1. **TRANSITION ZONE BETWEEN LOTS -**
SIDE AND REAR SETBACKS TO BE USED TO ACCOMMODATE A TRANSITION ZONE BETWEEN PROPERTIES TO FACILITATE CHANGES IN SITE LEVELS, AND ENSURE ADEQUATE SEPARATION, BY USE OF RETAINING WALLS AND LANDSCAPING

   WHEN USED:
   - SIDE SETBACK - ALLOWS SIDE ACCESS FOR UTILITY PURPOSES
   - REAR SETBACK - PREFERRED AREA FOR RETENTION AND ENHANCEMENT OF EXISTING VEGETATION
   - REAR SETBACK - WHERE ADJUSTMENT TO EXISTING SURFACE LEVELS AND RETAINING WALLS ARE NOT REQUIRED

2. **UNDERFLOOR UTILITY ZONE -**
TO MITIGATE AND ADJUST SITE LEVELS AND RETAINING TO MINIMISE VISUAL AND ENVIRONMENTAL IMPACT AND ENSURE STRUCTURAL INTEGRITY OF THE BUILDING AND ASSOCIATED SITEWORKS

   WHEN USED:
   - PREFERRED AREA FOR RAINWATER TANKS / ENERGY MANAGEMENT / PLANT AND STORAGE EQUIPMENT

3. **MULTIPLE LEVEL DESIGN -**
ARTICULATION OF BUILDING FORM TO ADDRESS CHANGES IN LEVEL, ACCOMMODATING EXISTING AND PROPOSED SITE LEVELS

   WHEN USED:
   - TO ADDRESS CHANGES IN SITE LEVEL
   - TO PROVIDE CONTAINED SINGLE LEVEL SPACES FOR INDIVIDUAL FUNCTIONS, SUCH AS PRIVATE OPEN SPACE OR HOME OFFICE
   - SCREENING TO UNDERCROFT SPACES, TO MAINTAIN VISUAL AMENITY TO STREETSCAPE

4. **CUT AND FILL -**
TO BE USED PRUDENTLY TO ADJUST EXISTING SITE LEVELS TO ACHIEVE OPTIMAL DWELLING DESIGN OUTCOME

   WHEN USED:
   - WHERE ADJUSTMENT TO SURFACE LEVELS AND RETAINING WALLS IS REQUIRED, RETAINING WALLS OVER 1 METRE IN HEIGHT SHOULD BE TERRACED WITH APPROPRIATE LANDSCAPE

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Parkside@Terrigal
COMMUNITY TITLE HOME BASED BUSINESS PARK
for Crighton Properties Pty Ltd

SK01
16 DECEMBER 2008
REVISION D

2. Civil works Solutions

In addition to / instead of house design requirements, a variety of Civil works solutions would be suited to assisting home builders of regular house types to comply with the requirements of DCP 122. These suggested Civil Works Solutions, would be carried out at the time of subdivision construction by the developer as part of the subdivision works.

The benefit of this approach would be that the civil works would be carried out to a consistent standard and could form part of the Community association property – thereby being regularly maintained by the community association and its revenue raising mechanism.

Two such alternatives are detailed within drawings SK03 and SK04, which show two different approaches – there are bound to be many other solutions. If implemented these measures would help to ensure compliance with DCP 122 in the following fashion;

1. If used in isolation – on sites of low to moderate slope.
2. If used in combination with 'housing design requirements' – on sites of moderate or greater slope.

option B - civil works solution

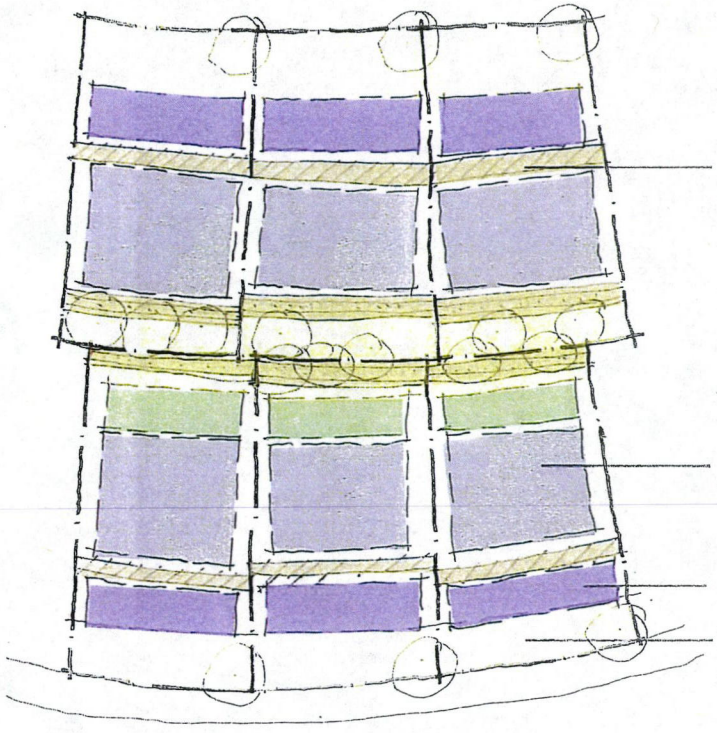
MEASURES TO BE IMPLEMENTED

OPTION 2

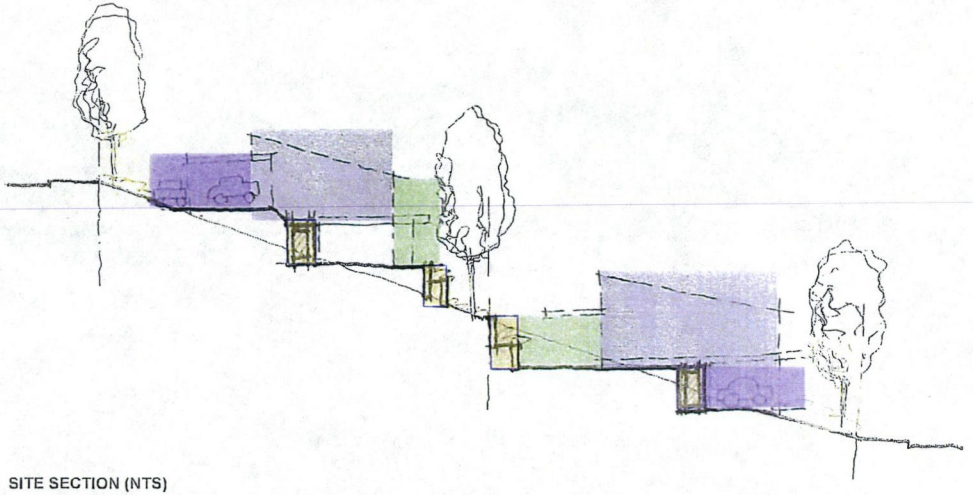
TALLER RETAINING STRUCTURES WITH INTEGRATED WATER MANAGEMENT STORAGE -
TO BE INSTALLED AS PART OF SITE WORKS PROGRAMME, TO ESTABLISH A MAJOR RETAINING STRUCTURE WITHIN AND / OR BETWEEN LOTS

WHERE USED:

- WATER STORAGE TANKS UP TO 3 METRES IN HEIGHT, BOUNDED BY MASONRY RETAINING WALLS, TO BE PLACED ALONG SIDE BOUNDARIES OR WITHIN SITE



SITE PLAN (NTS)



SITE SECTION (NTS)

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paa.design architecture . planning . urban design

Parkside@Terrigal
COMMUNITY TITLE HOME BASED BUSINESS PARK
for Crighton Properties Pty Ltd

SK04
16 DECEMBER 2008
REVISION D

Appendix C

Geotechnical Report

13 February 2008

Crighton Properties Pty Ltd
PO Box 3369
TUGGERAH NSW 2259

Attention: Peter Childs

Dear Peter

RE: PROPOSED SUBDIVISION AT KINGS AVENUE, TERRIGAL

URBAN CAPABILITY ASSESSMENT WITH RESPECT TO SLOPE RISK

Coffey Geotechnics Pty Ltd is pleased to present our urban capability assessment report for a proposed subdivision off Kings Avenue at Terrigal.

Should you have any questions regarding this report, please contact Ben Seaford on 4340 1811.

For and on behalf of Coffey Geotechnics Pty Ltd

Report prepared by:

Authorised Signatory:

Ben Seaford

Engineering Geologist

Strider Duerinckx

Senior Engineering Geologist

Distribution List for Final Report: Original copy Coffey Geotechnics Pty Ltd
1 copy Coffey Geotechnics Pty Ltd
4 copies Crighton Properties Pty Ltd (3 hardcopies, 1 electronic)

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Figure 1: Site Location

Figure 2: Site Plan and Investigation Locations

Figure 3: Site Plan by Geolyse showing slopes > 20%

Appendices

Appendix A: Engineering Borehole Logs and Explanation Sheets

Appendix B: Laboratory Results

Appendix C: Copy of reports GO540/1-AB and GO652/1-AB

Important Information about your Coffey Report

Attachments 1, 2 & 3

Landslide likelihood, consequence and risk terms for property

4 SCOPE OF ASSESSMENT REQUIRED BY GCC

Gosford City Council (GCC) Development Control Plan No.163 (DCP163) *'Geotechnical Requirements for Development Applications'* nominates four categories of properties and the associated minimum geotechnical assessments required to support Development Applications.

The categories are defined in Tables M1 and M2 of DCP163 and are based primarily on site geology and general slope conditions. For the geology and slope conditions assessed (outlined below), the site in its current condition is considered to be a Category 2 (medium hazard) site.

A Category 2 site requires a Class 2 geotechnical report (as defined by GCC) to support future DA for the site. Coffey has prepared a report that conforms to the Class 2 guidelines.

5 METHODOLOGY

The slope risk assessment was based on the following:

- A review of relevant geology maps and previous reports referenced in Section 2 of this report;
- Observations of surface features on the property and the surrounding area by a Principal Geotechnical Engineer on 28 November 2007;
- Twenty test pits excavated across the site to depths up to 2.5m. Test pits were generally excavated in only areas where development is proposed.

The engineering logs of the test pits are presented in Appendix A, together with explanation sheets defining the terms and symbols used. Reduced levels shown on the engineering logs were inferred from contour levels on the plan prepared by Geolyse. Test pits were located using tape measurements from site features shown on the plan by Geolyse.

The risk of slope instability has been assessed from the observed site conditions using methods consistent with those presented in the Australian Geomechanics Society publication Landslide Risk Management Concepts and Guidelines, in Australian Geomechanics News, March 2000. Based on those methods, the risks to property associated with slope instability on the subject site have been assessed using the terms presented in Coffey Attachment 1, 'Classification of Risk of Slope Instability', which has been adapted from the classification system formulated by the Australian Geomechanics Society and published in Australian Geomechanics News, Number 10, 1985.

6 SITE CONDITIONS

6.1 Local Geology

The Gosford 1:25000 Geological Map (unpublished) indicates that the locality is underlain by rocks belonging to the Terrigal Formation of the Narrabeen Group, consisting of interbedded lithic sandstone and siltstone.

6.2 Surface Features

The site is situated on the north eastern flank of a moderately to steeply undulating ridge. This site features three roughly northeast/southwest trending spurs which forms the northeastern extent of the Kincumba Mountain Reserve. The site is located on the southern side of Kings Avenue. Existing residential development is located to the east and west, and to the north of Kings Avenue.

6.3.2 Land Area 2 (LA2)

LA2 encompasses the flanks of each spur and the steeper terrain to the south. Field slope measurements ranged from about 12° to 28°. Steeper slopes were observed further to the south of the proposed development.

Table 2 presents the inferred geotechnical model for LA2, based on test pits TP1 to TP3, TP5, TP6, TP8 to TP11, TP14 and TP16 to TP20.

TABLE 2 – INFERRED GEOTECHNICAL UNITS FOR LA2

Unit	Typical Properties
Colluvium	Silty SAND/SAND/Silty clayey SAND, fine to medium grained, low plastic clay fines. Thickness range between 0.2m to 1m.
Residual Soil and Extremely Weathered Rock	Sandy CLAY/CLAY/Silty CLAY, medium to high plasticity, grey-orange-red, generally very stiff to hard consistency, some fine to medium gravel. Grades into extremely weathered sandstone. Thicknesses range between 0.2m and 1.3m.
Distinctly Weathered Rock	SANDSTONE, inferred below the depth of excavator refusal. Estimated to be very low to medium strength, highly to moderately weathered. Excavator refusal was generally between 0.7 to 2m below the existing surface level.

6.3.3 Land Area 3 (LA3)

LA3 comprises the crest of the central spur extending through the centre of the site. The crest is relatively flat with slopes extending gently in all directions at a maximum of about 8°. A stand of dense native trees was observed on the central eastern portion of the spur.

Table 3 presents the inferred geotechnical model for LA3, based on test pits TP4, TP7, TP12, TP16 and TP17.

Some scattered sandstone outcrops were observed at the crest of the ridge, and rock was generally encountered at shallower depths in LA3 compared to LA1 and LA2.

8 SLOPE RISK ASSESSMENT

8.1 Definitions

A qualitative risk assessment involves identification of the hazard event, and a qualitative estimation of the consequences and frequency of occurrence of the event.

The terms used in the risk assessment process are defined below:

Hazard: A condition with the potential for causing an undesirable consequence.

Consequence: Outcome arising from a hazard, expressed as loss or damage.

Risk: A term combining the probability and severity or consequence of any event causing adverse effects to property or the environment.

8.2 Property Elements at Risk

The principal elements at risk for the identified hazard would be the proposed roads and houses. The following consequence assessment addresses the risks associated with potential damage to these structures.

The consequences associated with loss of life of occupants of the dwelling are a separate issue and are not addressed by this urban capability assessment.

8.3 Hazard Identification

Deep seated, large scale slope instability is not expected to occur naturally due to the shallow depth to weathered bedrock and the generally good drainage. The principal hazards that could potentially impact on a proposed development would include shallow slumping of colluvium in existing steeper slopes, or deeper slumping that could be mobilised by excessively deep or steep cuttings and deep filling associated with the subdivision development.

8.4 Risk Evaluation for Existing Site Conditions

In assessing risk, the descriptors used are from Australian Geomechanics Society publication Landslide Risk Management Concepts and Guidelines, Australian Geomechanics News, March 2000.

Consequence	Medium
Likelihood/Frequency	Possible in LA2 Unlikely in LA1 and LA3
Risk	Medium in LA2 Low in LA1 and LA3

8.5.1 Road Excavations

For general consistency with the reports referenced in Section 2, Coffey recommends that excavation should generally be limited to less than 1.5m vertical depth with excavation batters not steeper than 2H:1V.

In the plans provided, the long sections show excavation in excess of 1.5m depth at the centreline for:

- Road 01 Ch 70m to 110m (depth locally up to about 2.2m)
- Road 04 Ch 0m to 20m (depth locally up to about 2.5m)
- Road 04 Ch 400m to 540m (depth locally up to about 4m)
- Road 06 Ch 0m to 10m (depth locally up to about 3m)

Where these cuts occur across the slope, deeper cuts than indicated above may occur on the upslope side of the road. Other cuttings in excess of the general maximums indicated above may also occur locally on the upslope side of the roads, and should also be investigated.

Deep cuttings are likely to intersect weathered rock. Steeper batters than 2H:1V may be feasible, but retaining walls may be preferable depending on specific assessment.

Where cuts exceed 1.5m depth, further investigation will be required to assess the risk associated with deeper excavation, the need for engineer designed retaining walls and suitable types of wall construction for the slope and subsurface conditions.

For excavations to 2.5m depth investigation by backhoe may suffice, but for excavations greater than 2.5m, cored boreholes are likely to be necessary. The scope of investigation needed at each location will depend on the local slope and ground conditions.

8.5.2 Fill Embankments

Fill embankments for road construction should not exceed 1.5m vertical height with batters not steeper than 1V:2H and protected against erosion, or supported by engineer designed retaining walls.

Where filling is required to exceed 1.5m depth, specific investigation is recommended to assess the impact on slope stability. The cross sections provided show deeper filling is required at:

- Road 01 in the vicinity of Ch 310m (about 3m fill)
- Road 01 in the vicinity of Ch 530m (about 2.5m fill)
- Road 03 in the vicinity of Ch 75m (about 3.5m fill with batters at 1H:1V)
- Road 04 in the vicinity of Ch 290m (about 1.7m fill)
- Road 08 in the vicinity of Ch 320m (about 3.2m fill)

There is also a risk of embankment instability where roads cross potential soft soils in LA1 if significant embankments are constructed. Presently the embankments do not appear to exceed 1m at the centrelines.

Fill areas should be prepared by removing topsoil, and benching into the slope to create a level platform on which to place fill. Fill should be compacted in accordance with GCC specifications under Level 1

Pyritic soils typically form in waterlogged, saline sediments deposited during the Holocene period (10,000 years ago to present day). Typical these soils occur in environments below about RL 5m AHD such as tidal flats, salt marshes, mangrove swamps and bottom sediments in coastal rivers and creeks.

Disturbance of acid sulfate soils can generate significant amounts of sulfuric acid, which can lower soil and water pH and produce acid salts, which affects vegetation and aquatic life and can produce aggressive soils that may be detrimental to concrete and steel in buildings and services.

The Gosford 1:25000 Scale Acid Sulfate Soil Risk Map (Reference 1) indicates that the site is not in an area known to have occurrence of Acid Sulfate Soils.

Based on the site geology, site elevation (above RL11m) and ASS risk map review, actual or potential ASS are not likely to be encountered within the areas of the site proposed for development. Based on this observation and the proposed development details, it is considered that no ASS Management Plan is required.

10 CONCLUSION

The scope of work for this assessment was to identify soil and landscape limitations for urban development to address slope issues raised by GCC. No significant areas of instability were noted over the area. Based on the results of this assessment, it is considered that the land is generally suitable for the type of urban use proposed subject to the geotechnical constraints on development detailed in section 8.5.

11 LIMITATIONS

The onus is on the owner, potential owner or interested parties to decide whether the assessed level of risk of slope instability is acceptable taking into account likely economic consequences of the risk and the recommended geotechnical constraints.

The findings contained in this report result from methodologies used in accordance with normal practices and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points. If site conditions encountered during construction vary significantly from those discussed in this report, Coffey should be advised.

Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

Guidance on the uses and limitations of this assessment is presented in the attached document '*Important information about your Coffey Report*', in accordance with which this report should be read.

REFERENCES

1 Department of Land and Water Conservation (1997), Gosford 1:25000 Acid Sulfate Soil Risk Map, Edition 2

2 Ahern C R, Stone Y and Blunden B (1998) Acid Sulfate Soil Manual, Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW, August.

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Important information about your Coffey Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.
Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Reference: Map 89 of UBD Central Coast Street Directory (2006 edition)

drawn	BS	coffey geotechnics SPECIALISTS MANAGING THE EARTH	client:	CRIGHTON PROPERTIES PTY LTD
approved			project:	PROPOSED SUBDIVISION KINGS AVENUE, TERRIGAL URBAN CAPABILITY ASSESSMENT
date	20/12/07		title:	SITE LOCATION
scale	NTS		project no: GEOTKARI02083AA	figure no: FIGURE 1
original size	A4			

SLOPE ANALYSIS

SCALE 1:1500

APPROVAL

No	DATE	DRAFTING CHECK	DESIGN REVIEW	SDV'S P/NUM	APP'D P/NUM	DETAILS
A	13/06/2024					ISSUED FOR INCLUSION IN SUBMISSION
B	27/08/2024					ISSUED FOR CLIENT APPROVAL
C	29/08/2024					REISSUE FOR CLIENT APPROVAL

DESIGN/APPROVED	NAME	SIGNATURE	DATE
SURVEY DATUM AHD	CAHILL & CAMERON	-	28/10/23
DRAFTING	JM ARMSTRONG		23/08/24
DESIGNED	JM ARMSTRONG		23/08/24

CP Logo & Tag.JPG

CRIGHTON
PROPERTIES PTY. LTD.
PO BOX 344
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GEOLYSE

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newcastle@geolyse.com
www.geolyse.com

PROJECT: REZONING SUBMISSION
KINGS AVENUE - TERRIGAL, N.S.W.

DRAWING: SLOPE ANALYSIS

PROJECT NUMBER	403089	DATUM	A.H.D.
DRAWING NUMBER	403089_D03	ORIGINAL	A1 SIZE
STATUS	APPROVAL	Sheet 03 of 13 Sheets	

coffey

Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH s_u (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	–	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

GEOLOGICAL ORIGIN

WEATHERED IN PLACE SOILS

Extremely weathered material Structure and fabric of parent rock visible.

Residual soil Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian soil Deposited by wind.

Alluvial soil Deposited by streams and rivers.

Colluvial soil Deposited on slopes (transported downslope by gravity).

Fill Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.

Lacustrine soil Deposited by lakes.

Marine soil Deposited in ocean basins, bays, beaches and estuaries.

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Engineering Log - Excavation

Excavation No. **TP001**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **28.11.2007**

Principal:

Date completed: **28.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None Observed		0.5		SM	**Silty SAND:** Fine to medium grained, dark brown.	D			COLLUVIUM
								Grading to				
					1.0		CH	**CLAY:** High plasticity, orange with some red mottling.	<<Wp	VSt/H	x	RESIDUAL High dry strength
											x	Sandstone floater at 1.1m in northern portion of the pit
					1.5			Red colour increasing at 1.5m			x	
								Test pit TP001 terminated at 1.6m				Refusal on extremely to highly weathered sandstone at 1.6m
					2.0							
					2.5							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP003**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **28.11.2007**

Principal:

Date completed: **28.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
EI		N	None					SM	**Silty SAND:** Fine to medium grained, dark brown.	M			COLLUVIUM Moderate root system to 0.3m
								SP	**SAND:** Fine to medium grained, pale grey and pale orange, some low plasticity clay fines.				
						0.5		CH	**Sandy CLAY:** Medium to high plasticity, orange, fine grained sand.	<Wp	VSt/H	×	RESIDUAL
									Test pit TP003 terminated at 0.7m				Refusal on interpreted highly weathered sandstone at 0.7m
						1.0							
						1.5							
						2.0							
						2.5							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on Unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP005**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **28.11.2007**

Principal:

Date completed: **28.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth metres (RL)	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None		0.0		SM	**Silty SAND:** Fine grained, dark brown.	M			COLLUVIUM Thick root system to 0.2m
								Becoming pale grey with depth.				
					0.5		CH	**CLAY;** High plasticity, dark orange, some fine to medium grained angular sandstone gravel.	<<Wp	VSt/H	×	RESIDUAL Refusal on gravel at 0.8m
								Test pit TP005 terminated at 0.8m				interepreted as being highly weathered sandstone
					1.0							
					1.5							
					2.0							
					2.5							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. TP007

Sheet 1 of 1

Project No: GEOTKARI02083AA

Client: Crighton Properties Pty Ltd

Date started: 28.11.2007

Principal:

Date completed: 28.11.2007

Project: Proposed Subdivision

Logged by: BS

Test pit location: Refer to Figure

Checked by: RMT

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None			0.0		SC	**Silty Clayey SAND:** Fine to medium grained, pale brown, low plasticity clay fines.	M			COLLUVIUM
								SC	**Clayey SAND:** Fine to coarse grained, pale brown and pale orange.	M			RESIDUAL
						0.5		SP	**SAND:** Fine to coarse grained, orange and red. Fine to coarse sandstone gravel throughout.		VD		EXTREMELY WEATHERED SANDSTONE
						1.0			Test pit TP007 terminated at 0.9m				
						1.5							
						2.0							
						2.5							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP009**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **28.11.2007**

Principal:

Date completed: **28.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth metres (RL)	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None Observed		0.0		SM	**Silty SAND:** Fine grained, dark brown.	M			COLLUVIUM Thin root system
							SC	**Clayey SAND:** Fine to medium grained, grey, low plasticity clay fines.	M			
					0.5		CL-CH	**Gravelly CLAY:** Medium plasticity, brown with some orange and red, fine to medium grained angular sandstone gravel.	>Wp			COLLUVIUM/RESIDUAL
					1.0		CH	**Silty CLAY:** Medium to high plasticity, pale grey and pale orange.	<Wp		×	RESIDUAL
					1.5			Some fine to medium grained angular sandstone and iron from 1.4m			×	
					2.0						×	Very slow progress in clay and gravel
					2.5			Test pit TP009 terminated at 2m				

Sketch

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

support
S shoring N nil

penetration
1 2 3 4
no resistance ranging to refusal

water
water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP011**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **28.11.2007**

Principal:

Date completed: **28.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: ' 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth RL / metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None Observed		0.5		SM	**Silty SAND:** Fine grained, dark brown.	D			COLLUVIUM Thick root system top 0.2m
					1.0		SP	**SAND:** Fine to medium grained, orange. Fine to coarse grained sandstone gravel from 1m. Pale grey and red colour at 1m.	D	VD		RESIDUAL
					1.5 2.0 2.5			Test pit TP011 terminated at 1.1m				Refusal on gravel at 1.1m interepreted as being highly weathered sandstone

Sketch

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

support
S shoring N nil

penetration
1 2 3 4
no resistance ranging to refusal

water
water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP013**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: **Crighton Properties Pty Ltd**

Date started: **29.11.2007**

Principal:

Date completed: **29.11.2007**

Project: **Proposed Subdivision**

Logged by: **BS**

Test pit location: **Refer to Figure**

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	depth RL / metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None Observed		0.5		SM	**Silty SAND:** Fine grained, dark brown.	D			COLLUVIUM Thin root system throughout
					1.0		SM	**Silty SAND:** Fine grained, pale brown.	M			
					1.5		SC	**Clayey SAND:** Fine to medium grained, pale grey and orange, medium plasticity clay fines.	M			
					2.0							
					2.5							

Test pit TP013 terminated at 2.5m

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration
1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Excavation

Excavation No. TP015

Sheet 1 of 1

Project No: GEOTKARI02083AA

Client: Crighton Properties Pty Ltd

Date started: 29.11.2007

Principal:

Date completed: 29.11.2007

Project: Proposed Subdivision

Logged by: BS

Test pit location: Refer to Figure

Checked by: RMT

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None Observed			0.0		SM	**Silty SAND:** Fine to grained, dark brown.	D			COLLUVIUM
						0.5		SM	**Silty SAND:** Fine to medium grained, pale brown, some low plasticity clay fines.	M			
						1.0		SC	**Clayey SAND:** Fine to medium grained, orange, low to medium plastic fines.	M			COLLUVIUM/RESIDUAL
						1.5			Red colour rising from about 1.5m Grading into				
								CL	**Sandy CLAY:** Low to medium plasticity, orange and red, fine to medium grained sand.	>Wp	St/Vst	×	RESIDUAL
						2.0						×	
						2.5			Test pit TP015 terminated at 2.5m			×	

Sketch

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method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration 1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Excavation

Excavation No. TP017

Sheet 1 of 1

Project No: GEOTKARI02083AA

Client: Crighton Properties Pty Ltd

Date started: 29.11.2007

Principal:

Date completed: 29.11.2007

Project: Proposed Subdivision

Logged by: BS

Test pit location: Refer to Figure

Checked by: RMT

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information | **material substance**

method	penetration 1 2 3	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None Observed			0.0		SM	**Silty SAND:** Fine to medium grained, grey, some fine to medium grained angular gravel.	D			COLLUVIUM Thick root system
								CH	**CLAY:** High plasticity, grey-orange-red mottling, some silt.	<<Wp	VSt/H	×	RESIDUAL High dry strength
						0.5						×	
												×	
						1.0		CH	**Silty CLAY:** Medium to high plasticity, pale grey with orange and red mottling, some fine to medium grained angular gravel.	<Wp	VSt/H	×	
									Test pit TP017 terminated at 1.1m			×	Refusal on gravel at 1.1m interepreted as being highly weathered sandstone
						1.5							
						2.0							
						2.5							

Sketch

method
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

support
- S shoring
- N nil

penetration
1 2 3 4 — no resistance ranging to refusal

water
- water level on date shown
- water inflow
- water outflow

notes, samples, tests
- U_{50} undisturbed sample 50mm diameter
- U_{63} undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

classification symbols and soil description
based on unified classification system

moisture
- D dry
- M moist
- W wet
- Wp plastic limit
- W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

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Engineering Log - Excavation

Excavation No. **TP019**

Sheet 1 of 1

Project No: **GEOTKARI02083AA**

Client: *Crighton Properties Pty Ltd*

Date started: **29.11.2007**

Principal:

Date completed: **29.11.2007**

Project: *Proposed Subdivision*

Logged by: **BS**

Test pit location: *Refer to Figure*

Checked by: **RMT**

equipment type and model: Kubota 4t | Pit Orientation: | Easting: m | R.L. Surface: Not Measured

excavation dimensions: 2m long 0.6m wide | Northing: m | datum: AHD

excavation information						material substance						
method	penetration 1 2 3	support	water	notes samples, tests, etc	RL / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	pocket penetrometer kPa 100 200 300 400	structure and additional observations
E		N	None Observed		0.5		SM	**Silty SAND:** Fine grained, dark brown.	D			COLLUVIUM
							SM	**Silty SAND:** Fine to medium grained pale brown, some low plasticity clay fines.	M			
					1.0		CL-CH	**CLAY:** Medium plasticity, orange and red.	<=Wp	VSt/H		RESIDUAL
					1.5		CH	**CLAY:** High plasticity, pale grey with red and orange mottling, some silt.	>Wp			
					2.0			Test pit TP019 terminated at 1.5m				Very slow progress in high plastic clay
					2.5							

Sketch

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

support
S shoring N nil

penetration
1 2 3 4
no resistance ranging to refusal

water
water level on date shown
water inflow
water outflow

notes, samples, tests
U_{50} undisturbed sample 50mm diameter
U_{63} undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Appendix B

Laboratory Results

DEC07-02

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Unit 17 Mt Penang Parklands, Kariong NSW 2250
Ph: (02) 4340 1811 Fax: (02) 4340 1411

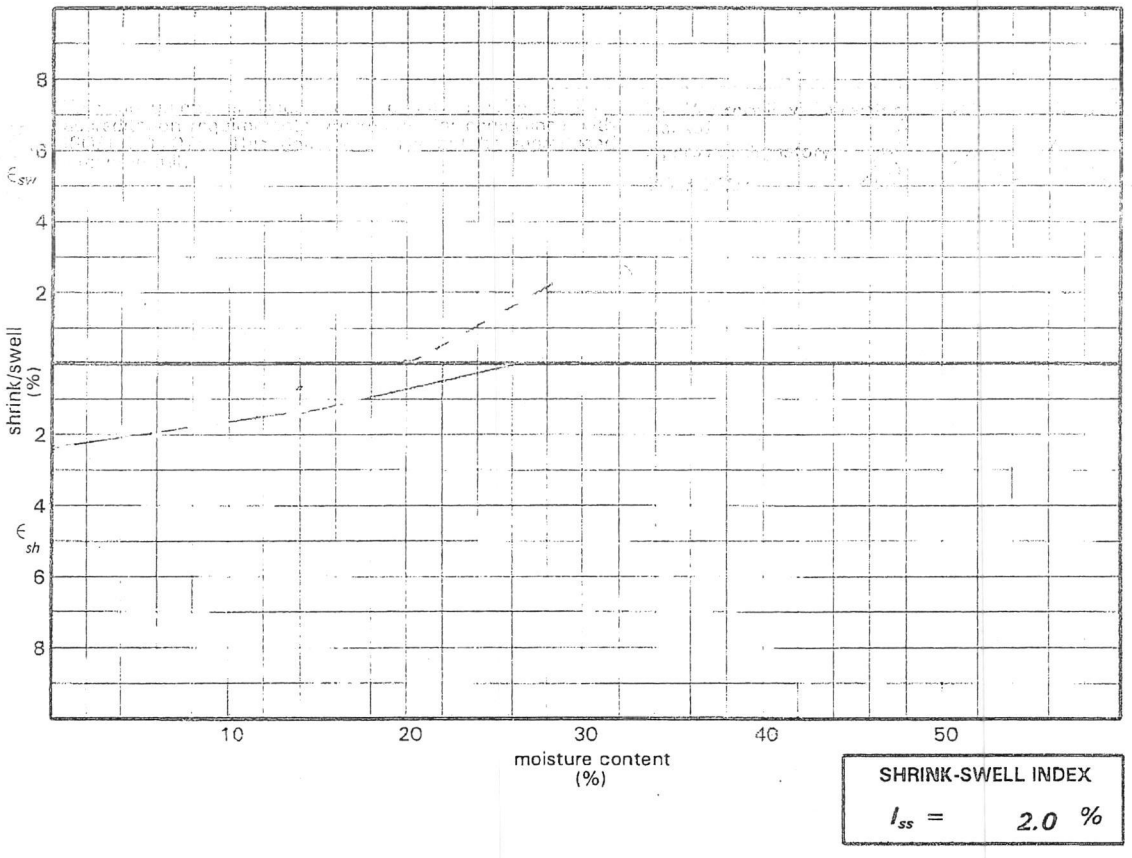
shrink swell index test

client : *Crighton Properties Pty Ltd*
job no : *GEOTKARI02083AA*
principal :
laboratory : *GOSFORD*
project : *Proposed Subdivison*
report date : *December 07, 2007*
location : *King Av, Terrigal*
test report no. : *DEC07-02/2*

test procedure : *AS1289.7.1.1*

borehole : *TP8* depth : *0.9-1.2* date tested : *30/11/07*
material classification : *(CH) Silty CLAY, high plasticity, grey with orange/brown mottling, trace of organic materials, roots(0.5-5mm diameter).*

SWELL TEST					SHRINK TEST			
swell on saturation (%)	moisture content (%)		estimated unconfined compressive strength (kPa)		shrink on drying %	estimated inert material present %	extent of crumbling during shrinkage	extent of cracking during shrinkage
	before test	after test	before test	after test				
2.6	*19.7*	*28.9*	*>400*	*250*	*2.3*	*<5%*	*Moderate*	*Minor ##*



SHRINK-SWELL INDEX
I_{ss} = *2.0* %

remarks: *#: Transverse & longituinal.*

NATA Accredited Laboratory No. 431
Approved Signatory: *Brian Miller*
Date : *7 December 2007*

Appendix C

Copy of reports GO540/1-AB and GO652/1-AB

Coffey Partners International Pty Ltd
ACN 003 692 019

Consulting Engineers
in the geotechnical sciences

42 Hills Street
Gosford New South Wales
Australia 2250

Fax (043) 23 6477
Telephone (043) 23 3585

Your Reference

Our Reference GO540/1-AB MGD:SG

Date 13th March, 1992

The Manager
Crighton Properties Pty Ltd
28 Dalgetty Crescent
GREEN POINT NSW 2251

ATTENTION: MR GEOFFERY COX

Dear Sir

RE: Proposed Subdivision, Lot 22 Karalta Road, Terrigal

We are pleased to submit our report on geotechnical studies carried out for the above proposed subdivision.

The site is assessed to have a Moderate Risk of overall slope instability and is unlikely to be affected by landslip provided development is carried out in accordance with the recommendations of this report. Geotechnical constraints on residential development have been outlined in Section 4.2 and are not considered to be of an unusual nature.

Please do not hesitate to contact the undersigned if you have any queries regarding this report.

For and on behalf of
COFFEY PARTNERS INTERNATIONAL PTY LTD

R J KING

1.0 INTRODUCTION

This report presents an assessment of slope stability carried out for Crighton Properties Pty Ltd on Lot 22 (Part Portion 104) Karalta Road, Terrigal. The work was commissioned by Mr Geoffery Cox of Crighton Properties Pty Ltd. A 1:900 scale contour plan of the lot was provided by Cahill & Cameron Pty Ltd.

It is understood that development plans have not been finalised for the site. However, it is understood to be likely that development will include residential allotments on moderately steep portions of the site, several large lakes with adjacent residential construction in low lying generally flat portions of the site and possibly terraced/split level units on the steeper portions of the site. It is also understood that roads are to be aligned generally across hillslopes on the steeper areas of the site.

This report assesses the suitability of the lot for development from a geotechnical viewpoint, provides a risk assessment in relation to slope stability and provides geotechnical constraints for development.

2.0 FIELDWORK

Field work initially involved a walk-over survey/site appraisal by a Senior Engineering Geologist on the 26th February, 1992, in which surface features were mapped. Utilising this information a program of test pitting was carried out on the 3rd March, 1992 by a Geotechnical Engineer to assess subsurface profiles.

Eleven test pits (TP1 to TP11) were excavated to depths ranging from 1.5m to 3.4m by a rubber tyred backhoe. The approximate location of the test pits is shown on Drawing No.G0540/1-1, together with the results of surface mapping. Test pit levels have been interpolated from the contour plan (A.H.D.).

Engineering Logs of the test pits are presented in Appendix A, together with explanation sheets defining the terms and symbols used.

Groundwater conditions were noted at the time of field work in test pits which were open only for a short time. Variations may occur due to fluctuations in rainfall, temperature and other factors.

3.0 SITE DESCRIPTION

3.1 Topography, Drainage & Vegetation

Topographically, the lot is situated in an area of moderate to steeply undulating terrain on the north-eastern end of a prominent south-west trending ridgeline. A secondary rounded spur/ridgeline forms the eastern site boundary.

The approximate extent of the above units is shown on Drawing No.GO540/1-1.

The subsurface profile encountered within Unit A (Test Pits 1,2,3,5,6,7 and 11) can be summarised as follows;

* TOPSOIL: Comprising Silty SAND to depths ranging from 0.25m to 0.5m; fine to coarse grained, with some gravel, moist, overlying

* SLOPEWASH: Where encountered, comprising Gravelly Sandy CLAY of low plasticity and Gravelly Clayey SAND to depths generally of 0.5m and locally up to 0.9m, moist, overlying

* RESIDUAL: Comprising CLAY, Sandy CLAY and Gravelly Sandy CLAY to depths ranging from 1.1m to 2.0m, medium to high plasticity, with some sandstone rock fragments, estimated very stiff to hard consistency, overlying

* ROCK: Comprising SANDSTONE and SILTSTONE, extremely to highly weathered. Backhoe refusal on sandstone was encountered in Test Pits 1,5,6,7 and 11 at depths ranging from 1.5m to 2.8m.

The subsurface profile encountered within Unit B (Test Pits 4,8,9 and 10) can be summarised as follows;

* ALLUVIUM: Comprising interbedded Silty Clayey SAND, Clayey SAND and Sandy CLAY to depths up to or greater than 3.4m; sand mostly fine grained, clays are of low to medium plasticity, moist; overlying topsoil appears to be up to 0.5m thick.

Fill, probably from underscrubbing operations and comprising Gravelly Silty SAND mixed with timber and charcoal, was encountered at the crest of steep gully banks in Test Pits 4 and 9 to depths of 0.6m and 0.4m respectively.

Minor groundwater seepage/inflows was only encountered in Test Pit 10 at about 1.0m depth.

4.0 SLOPE STABILITY ASSESSMENT

4.1 Risk Assessment

No evidence of overall slope instability was observed during the walk-over survey and backhoe test pitting. Minor localised instability was noted along some very steep gully banks where small scale slumping and erosion has occurred.

Strip/pad, stiffened raft or piered footing systems would be appropriate for residential structures located within the flat Unit B alluvial areas. Further geotechnical work will be required to assess foundation parameters within Unit B areas for structures other than conventional one or two storey residences and for structures located adjacent to steep gully banks (Refer to 4.2.1).

4.2.4 Excavation

Within Unit B areas and Unit A areas with hillslopes less than 4H:1V (14°) excavations should preferably not exceed 1.5m depth and should be either supported by a properly designed and constructed retaining wall or battered no steeper than 2H:1V and protected from erosion. Within Unit A areas with hillslopes greater than 4H:1V (14°) excavations should preferably not exceed 1m depth.

Excavations exceeding the above recommended depths should be supported by engineer designed retaining walls or battered as directed after assessment by a qualified geotechnical engineer.

4.2.5 Filling

The maximum depth of fill on residential lots should preferably be limited to 1.5m and should be either supported by a properly designed and constructed retaining wall or battered no steeper than 2H:1V and protected from erosion.

Engineering supervision and testing will be required where fill is to be regarded as "controlled fill" in accordance with AS2870 "Residential Slabs and Footings". Allowance should be made for an average 0.5m depth of stripping within the flat Unit B alluvial areas and for a 0.2m to 0.4m depth of stripping within Unit A hillslope areas. A prepared surface will need to be benched/stepped into the natural slope when placing fills on slopes exceeding 4H:1V (14°). Fill should be placed in layers having a maximum loose thickness of 200mm to 300mm depending on the type of fill and compaction equipment. Each fill layer should be thoroughly and uniformly compacted to a minimum dry density ratio (AS1289 5.4.1-1982) of 95% Standard within 2% of Standard Optimum moisture content. Further advice should be sought if deep gully areas are to be infilled as higher compaction standards may be warranted.

Residual clay soils and weathered rock excavated during road construction would be suitable for use as fill on residential lots if placed at a moisture content within 2% of Standard Optimum. However, consideration should be given to the reactivity of clay fills in relation to potential shrink-swell movements. Further investigation and advice will be required to enable comment on the suitability of the above materials for use in water retaining embankments. As a guideline, such materials should have at least 30% passing the 75 micron sieve, a Plasticity Index not less than 15% and should be non-dispersive (Emerson Class 3 or better).

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

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TABLE 1. CLASSIFICATION OF RISK OF SLOPE INSTABILITY

ASSESSMENT OF RISK

A landslip (or landslide) is a downslope movement of a soil or rock mass as a result of shear failure at the boundaries of the moving mass. The dominant movement is lateral and failure takes place over a relatively short period. Soil creep, which is slow and occurs without a well defined failure surface, is not included as a landslip.

Natural hill slopes are formed by processes which reflect the site geology, environment and climate. These processes include downslope movement of the near surface soil and rocks; in geological time all slopes are unstable. The area of influence of these downslope movements may range from local to regional and are rarely related to property boundaries. The natural processes may be affected by human intervention in the form of construction and related activities.

It is not technically feasible to assess the stability of a particular site in absolute terms such as stable or unstable. However the degree of risk of slope movement can be assessed by the recognition of surface features supplemented by limited information on the regional and local subsurface profile and with the benefit of experience gained in similar geological environments. The degree of risk is categorised below.

CLASSIFICATION OF RISK OF LANDSLIP WITHOUT DEVELOPMENT

CLASS	EXPLANATION
LOW	A landslip is very unlikely
MODERATE	A landslip is unlikely
HIGH	There is some risk of a landslip

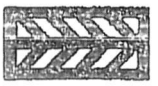
CONSEQUENCES OF HILLSIDE CONSTRUCTION

It must be accepted that the risks associated with hillside construction are greater than construction on level ground in the same geological environment. The impact of development may be adverse and imprudent construction techniques can increase the potential for movement.

Australian Standard AS 2870 - 1986 provides a damage classification that relates to essentially vertical movements of masonry walls and is thus not directly applicable to hillside movements. In the absence of a suitable classification for hillside movements the range of damage categories from negligible to very severe can be used as a general guide for damage potential related solely to landslip.

CLASS	DEVELOPMENT CONSTRAINTS	DAMAGE POTENTIAL EXTENT	DAMAGE POTENTIAL PROBABILITY
LOW	Good Hillside Practice	Slight	Very Low
MODERATE	Good Hillside Practice and site specific restrictions	Slight Moderate	Low Very Low
HIGH	No development unless major engineering remedial works	Moderate Severe	High Moderate

Damage to structures may occur due to a number of causes additional to that attributable to landslip. In the absence of a landslip slight damage might be expected even for good construction. If a landslip occurs damage would probably reach at least a moderate level.



APPENDIX A

results of field investigation

Incorporated in NSW

graphic symbols soil and rock

COFFEY

Explanation Sheet 2

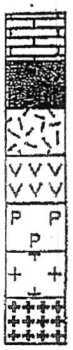
SOIL

- Asphaltic Concrete or Hotmix
- Concrete
- Topsoil
- Fill
- Peat, Organic Clays and Silts (Pt, OL, OH)
- Clay (CL, CH)
- Silt (ML, MH)
- Sandy Clay (CL, CH)
- Silty Clay (CL, CH)

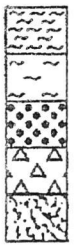
- Gravelly Clay (CL, CH)
- Sandy Silt (ML)
- Clayey Sand (SC)
- Silty Sand (SM)
- Sand (SP, SW)
- Clayey Gravel (GC)
- Silty Gravel (GM)
- Gravel (GP, GW)

ROCK

- Claystone (massive)
- Siltstone (massive)
- Shale (laminated)
- Sandstone (undifferentiated)
- Sandstone, fine grained
- Sandstone, coarse grained
- Conglomerate



- Limestone
- Coal
- Dolerite, Basalt
- Tuff
- Porphyry
- Granite
- Pegmatite



- Schist
- Gneiss
- Quartzite
- Talus
- Alluvium

SEAMS

Seam >0.1 m thick (on a scale 1:50)

Seam 0.01 m to 0.1 m thick (on a scale 1:50)

INCLUSIONS (Special purposes only)

- Rock Fragments
- Swamp

- Ironstone Gravel, Laterite
- Shale Breccia in Sandstone

Water Level

Surfaces ——— Known Boundary — — — Probable Boundary ——?——? Possible Boundary

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP2
sheet 1 of 1

office job no: GOSFORD G0540/1

client:	CRIGHTON PROPERTIES PTY LTD	pit commenced:	02/03/92
project:	PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL	pit completed:	02/03/92
pit location:	REFER TO DRAWING NO.G0540/1-1	logged by:	SGF
		checked by:	RJK

equipment type and model: MF 50D Backhoe
R.L. surface: Approx. 25 m
excavation dimensions: 3.0 m long, 0.6 m wide
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	GRAVELLY SILTY SAND, fine to coarse, black, fine to coarse gravel becoming	M			TOPSOIL
							CL	GRAVELLY SANDY CLAY, low plasticity, brown-grey, fine sand				SLOPEWASH
					1		CL/CH	CLAY/SANDY CLAY, high plasticity, orange-brown, some red staining, sand fine, trace to some fine to coarse gravels	M > Wp	H		RESIDUAL
								SILTY CLAY/SILTSTONE, low plasticity, white & red	M	Fb		ROCK Extremely weathered -some rock structure becoming rock
					2			TP2 terminated at 1.9m depth (refusal on highly weathered siltstone).				
					3							
					4							

key
\ natural exposure
X existing excavation
BH Backhoe bucket
BE bucket or side
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil

penetration 1 2 3 — no resistance ranging to refusal

water
10 Jan 76 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Partners International Pty Ltd
ACN 003 592 019

engineering log excavation

COFFEY

pit no: TP4
sheet 1 of 1

office job no: GOSFORD GO540/1

client: ORIGHTON PROPERTIES PTY LTD
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL
pit location: REFER TO DRAWING NO.GO540/1-1

pit commenced: 02/03/92
pit completed: 02/03/92
logged by: SGF
checked by: RJK

equipment type and model: MF 50D Backhoe
excavation dimensions: m long, 0.6 m wide

R.L. surface: Approx. 23 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	100 200 300 400 kPa hand penetrometer	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	GRAVELLY SILTY SAND, fine to coarse, black	M			TOPSOIL/FILL -with pieces of timber, charcoal, rock and clay
					1		SC	SILTY CLAYEY SAND, mostly fine, brown, low plasticity				ALLUVIUM
					2		SC/CL	SILTY CLAYEY SAND, brown and grey mottled becoming locally sandy CLAY, low plasticity				
					3		SC	CLAYEY SAND, fine to medium, mottled grey with black silty/ charcoal inclusions		Fb		Some weakly cemented structure below 2.7m depth.
					4			TP4 terminated at 3.2m depth.				

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
E excavator
HA hand auger
DT diatube

support
T timbering
N nil

penetration 1 2 - no resistance ranging to refusal

water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP6
sheet 1 of 1

office job no: GOSFORD GO540/1

client:	CRIGHTON PROPERTIES PTY LTD	pit commenced:	02/03/92
project:	PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL	pit completed:	02/03/92
pit location:	REFER TO DRAWING NO.GO540/1-1	logged by:	SGF
		checked by:	RJK

equipment type and model: MF 50D Backhoe
R.L. surface: Approx. 37 m
excavation dimensions: 3.0m long, 0.6 m wide
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests,etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	100 200 300 400 hand penetrometer kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	SILTY SAND, mostly fine, trace of gravel, black -becoming- grey-brown, clayey and gravelly	M			TOPSOIL SLOPEWASH
					1		CL/CH	SANDY CLAY, medium to high plasticity, orange-brown, sandy mostly fine, some fine to coarse gravel	M > Wp	H		RESIDUAL Some large sandstone boulders
								SANDY CLAY/SILTSTONE-SANDSTONE, fine grained, red-orange & grey white mottling	M	Fb		RESIDUAL/ROCK Extremely weathered
					2			SILTSTONE, white with red-orange staining, massive, clayey, trace of fine sand				ROCK Extremely weathered
					3			SANDSTONE, coarse, yellow stained white				ROCK Highly weathered
								TP6 terminated at 2.8m depth (refusal on sandstone).				
					4							

Key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil

penetration 1 2 3 — no resistance ranging to refusal

water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
USO undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP8
sheet 1 of 1

office job no: GOSFORD G0540/1

client:	CRIGHTON PROPERTIES PTY LTD	pit commenced:	02/03/92
project:	PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL	pit completed:	02/03/92
pit location:	REFER TO DRAWING NO.G0540/1-1	logged by:	SGF
		checked by:	RJK

equipment type and model: MF 50D Backhoe — R.L. surface: Approx.22.5m

excavation dimensions: 3.0 m long, 0.6 m wide — datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED		1		SC	SILTY CLAYEY SAND, fine, grey at first becoming brown, low plasticity	M			ALLUVIUM
					2		SC/CL	CLAYEY SAND/SANDY CLAY, as above but becoming locally sandy clay, mottled grey and brown,	(M > Wp)			
							CL	SANDY CLAY, low plastiicty, mottled orange-red and brown-grey		Fb		
					3							small black carbonaceous inclusions, possibly charcoal
								TP8 terminated at 3.4m depth.				
					4							

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering
N nil
penetration 1 2 3 – no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP11
sheet 1 of 1

office job no: GOSFORD G0540/1

client:	CRIGHTON PROPERTIES PTY LTD	pit commenced:	02/03/92
	PROPOSED SUBDIVISION, LOT 22 PART PORTION 104	pit completed:	02/03/92
project:	KARALTA ROAD, TERRIGAL	logged by:	SGF
pit location:	REFER TO DRAWING NO.G0540/1-1	checked by:	RJK

equipment type and model: MF 50D Backhoe
R.L. surface: Approx. 27 m
excavation dimensions: 3.0 m long, 0.6 m wide
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	SILTY SAND, mostly fine, black, some gravel	M			TOPSOIL with sandstone boulders
					1		CL	GRAVELLY SANDY CLAY, medium plasticity, red-orange, fine to coarse sand and gravel	M > Wp	H		RESIDUAL Sandy clay with sandstone boulders
								SANDSTONE, medium to coarse grained, brown stained yellow	M			ROCK Highly weathered
					2			TP11 terminated at 1.6m depth (refusal on sandstone).				
					3							
					4							

Key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil

penetration 1 2 3 — no resistance ranging to refusal

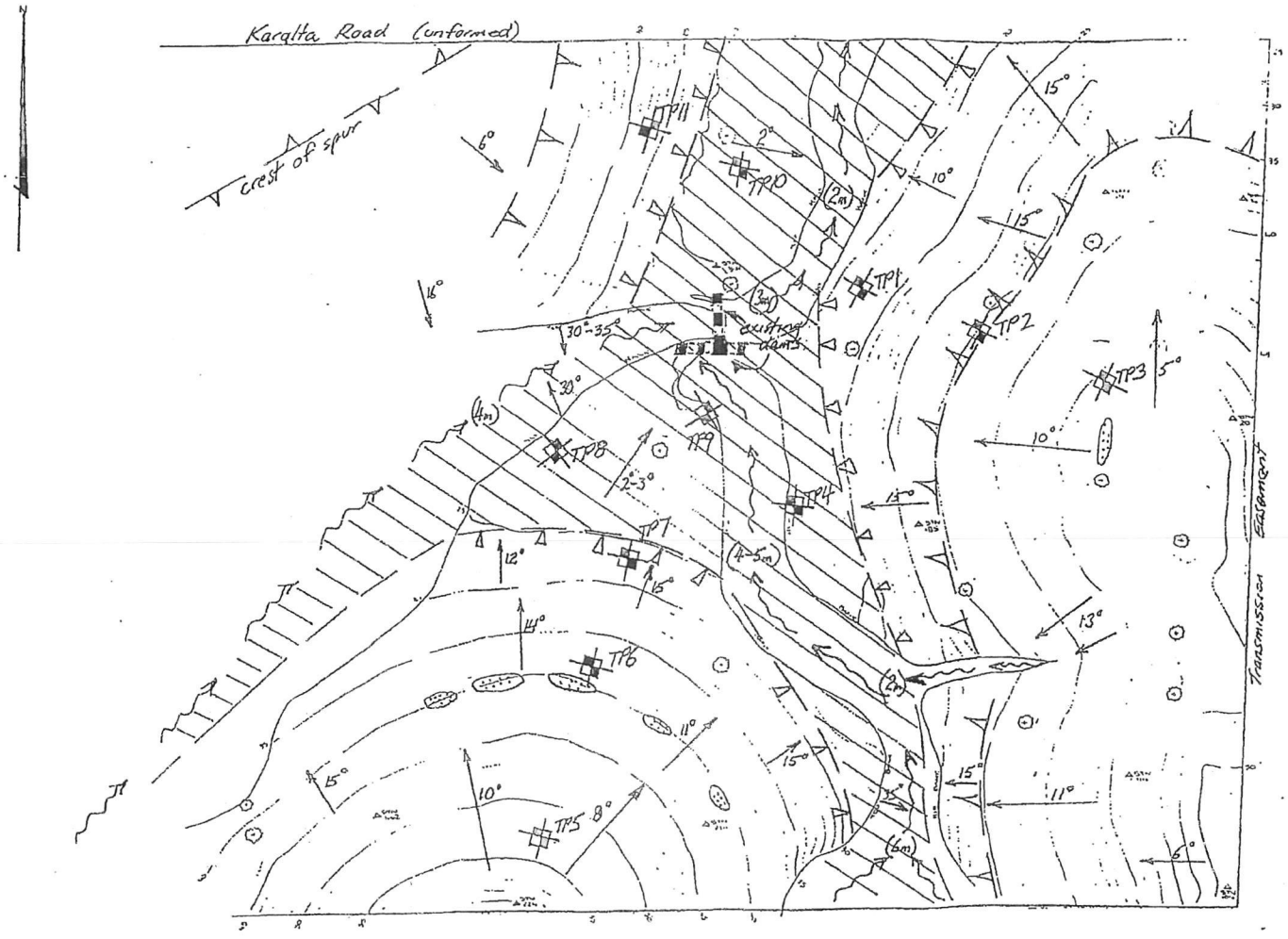
water
10 Jan 78 water level on date shown
water inflow
water outflow

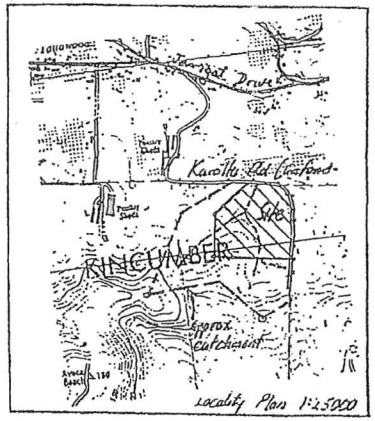
notes samples and tests
USO undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests.
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense





LEGEND

- Approximate location of test pit
- 10° direction and fall of ground surface
- (2m) Watercourse (estimated depth of incision in metres)
- Sharp concave slope change
- Rounded convex slope change
- Sandstone outcrop
- approximate extent of Unit B areas (Unit A areas are unhatched)

Coffey Partners International Pty Ltd Consulting Engineers in the geotechnical sciences Incorporated in NSW

20 0 20 40 60 80 100
scale (metres)

revision	description	drawn	approved	date

drawn	R.J.K
checked	
date	13-2-92

ORIGHTON PROPERTIES PTY LTD
PROPOSED SUBDIVISION
LOT 22 OF PART PORTION 104 KARALTA ROAD
TERRIGAL
SITE PLAN

COFFEY

drawing no. G0540/1-1
job no. G0540/1

Coffey Partners International Pty Ltd
A.C.N. 003 692 019

Consulting Engineers
in the geotechnical sciences

42 Hills Street
Gosford New South Wales
Australia 2250

Fax (043) 23 6477
Telephone (043) 23 3585

Your Reference

Our Reference GO652/1-AB BAS:EB

Date 6 May 1993

The Manager
Crighton Properties Pty Ltd
28 Dalgetty Crescent
GREEN POINT NSW 2251

ATTENTION: MR GEOFFREY COX

Dear Sir

RE: PROPOSED SUBDIVISION - LOT 2 BELAR AVENUE, TERRIGAL

We are please to submit our report on geotechnical studies carried out for the above proposed subdivision.

The site is assessed to have a Medium Risk of overall slope instability and is unlikely to be affected by landslip provided development is carried out in accordance with the recommendations of this report. Geotechnical constraints on residential development have been outlined in Section 4.2.

Please do not hesitate to contact the undersigned should you have any queries regarding this report.

For and on behalf of
COFFEY PARTNERS INTERNATIONAL PTY LTD

B A STEPHENS

1.0 INTRODUCTION

This report presents an assessment of slope stability carried out for Crighton Properties Pty Ltd on Lot 2 Belar Avenue, Terrigal. The work was commissioned by Mr Geoffrey Cox of Crighton Properties Pty Ltd. A 1:1000 scale contour plan of the lot was provided by Cahill & Cameron Pty ltd.

It is understood that development plans have not been finalised for the site. However, it is understood the proposed development is to comprise approximately 60 residential allotments. It is understood from the supplied drawings that the roads are to be aligned generally across the hillslopes in the steeper sections of the site.

This report assesses the suitability of the lot for development from a geotechnical viewpoint, provides a risk assessment in relation to slope stability and provides geotechnical constraints for development.

2.0 FIELDWORK

Fieldwork involved a walk over assessment, surface mapping and a program of test pitting to assess surface features and subsurface profiles. This work was carried out on the 4th May, 1993 by a Geotechnical Engineer from this Company.

Fourteen test pits (TP1 to TP14) were excavated to depths ranging from 0.6m to 3.3m by a rubber tyred backhoe. The locations of the test pits are shown on Drawing No. G0652/1-1, together with the results of the surface mapping. Test pit levels have been interpolated from the contour plan provided. The test pits were located by Cahill & Cameron Pty Ltd.

Engineering logs of the test pits are presented in Appendix A, together with explanation sheets defining the terms and symbols used in their preparation.

3.0 SITE DESCRIPTION

3.1 Topography, Drainage and Vegetation

Lot 2 occupies an "L" shaped area of approximately eight hectares. Topographically, the site comprises a valley with a generally north-west to north aspect. The terrain is moderate to steeply sloping around the central drainage depression which crosses the site in a north-westerly direction. A northerly trending spur is located in the west of the site adjacent to the western boundary.

RESIDUAL:	CLAY, medium plasticity, orange brown and red brown, very stiff, observed unit thickness varied from 0 to 1.3m; overlying
BEDROCK:	SANDSTONE and SILTSTONE, extremely to highly weathered. Backhoe refusal on sandstone was encountered in Test Pits 4, 6 to 10 and 12 to 14.

The subsurface profile encountered within Unit B (Test Pits 1 and 2) can be summarised as follows;

TOPSOIL:	Silty SAND, fine to medium grained, light grey to grey, some roots, observed unit thickness varied from 0.2m to 0.3m; overlying
SLOPEWASH/ALLUVIUM:	Clayey SAND/Sandy CLAY, fine to medium grained, medium plasticity, orange brown and red brown, observed unit thickness varied from 0.7m to 1.6m; overlying
RESIDUAL:	CLAY, medium plasticity, red brown, orange brown and light grey, observed unit thickness was approximately 1m; overlying
BEDROCK:	SANDSTONE, fine to coarse grained, extremely to highly weathered, orange brown and red brown. Bedrock was encountered at depths between 2.0m to greater than 3.3m.

No groundwater inflows were observed during the test pitting. It should be noted that pits were open only for a short time and variations may occur due to fluctuations in rainfall, temperature and other factors.

4.0 SLOPE STABILITY ASSESSMENT

4.1 Risk Assessment

No evidence of overall slope instability was observed during the walk over assessment and backhoe test pitting. Minor localised instability was observed in steep cuts upslope of the horse stable where slumping appears to have occurred.

On the basis of the features of geology, topography and drainage presented in Section 3.0, the site is assessed as having a Medium Risk of overall slope instability as defined in the attached Table 1. The risk of localised instability associated with future cuts and fills in assessed as moderate and can be limited by adopting the recommendations of this report.

Excavations exceeding the above recommended depths should be supported by engineer designed retaining walls or battered as directed after assessment by a qualified Geotechnical Engineer.

4.2.5 Filling

The maximum depth of fill on residential lots should preferably be limited to 1.0m and battered no steeper than 2H:1V and protected from erosion. Filling greater than 1.0m should be supported by a properly designed and constructed retaining wall.

Engineering supervision and testing will be required where fill is to be regarded as "controlled fill" in accordance with AS2870 "Residential Slabs and Footings". Allowance should be made for an average 0.5m depth of stripping within the flat Unit B alluvial areas and for a 0.2m to 0.4m depth of stripping within Unit A hillslope areas. A prepared surface will need to be benched/stepped into the natural slope when placing fills on slopes exceeding 4H:1V (14^0). Fill should be placed in layers having a maximum loose thickness of 200mm to 300mm depending on the type of fill and compaction equipment. Each fill layer should be thoroughly and uniformly compacted to a minimum dry density ratio (AS1289 5.4.1-1982) of 95% Standard within 2% of Standard Optimum moisture content.

Residual clay soils and weathered rock excavated during road construction would be suitable for use as fill on residential lots if placed at a moisture content within 2% of Standard Optimum. However, consideration should be given to the reactivity of clay fills in relation to potential shrink-swell movements.

4.2.6 Retaining Walls

Retaining walls should be designed for surcharge loading from sloping ground and/or structures above the wall. Adequate subsurface and surface drainage must be provided behind all retaining walls. Retaining walls in excess of 1.0m in height should be designed by an engineer.

4.2.7 Access/Site Clearance

The subdivision layout should be such that all residential lots have potential driveway access at a grade of 4H:1V or less. Any required slope modifications should comply with the above recommendations.

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/The Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report

- when the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation, or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consultant to learn if additional tests are advisable before construction starts.Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS

Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY

The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Because actual subsurface conditions can be discerned only during earthwork, you should retain your geotechnical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE

Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations

descriptive terms soil and rock

Explanation Sheet 1

SOIL DESCRIPTIONS

Classification of Material based on Unified Classification System (refer SAA Site Investigation Code AS1726—1975 Add. No. 1 Table D1).

Moisture Condition based on appearance of soil

dry	Looks and feels dry; cohesive soils usually hard, powdery or friable, granular soils run freely through hands.
moist	Soil feels cool, darkened in colour; cohesive soils usually weakened by moisture, granular soils tend to cohere, but one gets no free water on hands on remoulding.
wet	Soil feels cool, darkened in colour; cohesive soils weakened, granular soils tend to cohere, free water collects on hands when remoulding.

Consistency based on unconfined compressive strength (Qu) (generally estimated or measured by hand penetrometer).

term	very soft	soft	firm	stiff	very stiff	hard
Qu kPa	25	50	100	200	400	

If soil crumbles on test without meaningful result, it is described as friable.

Density Index (generally estimated or based on penetrometer results).

term	very loose	loose	medium dense	dense	very dense
density index I_D %	15	35	65	85	

ROCK DESCRIPTIONS

Weathering based on visual assessment

term	criterion
Fresh:	Rock substance unaffected by weathering.
Slightly Weathered:	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Moderately Weathered:	Rock substance affected by weathering to the extent that staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Highly Weathered:	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
Extremely Weathered:	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.

Strength based on point load strength index, corrected to 50 mm diameter - Is(50) (refer I.S.R.M., Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1). (Generally estimated: x indicates test result).

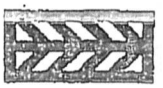
classification	extremely low	very low	low	medium	high	very high	extremely high
Is (50) MPa	0.03	0.1	0.3	1	3	10	

The unconfined compressive strength is typically about 20 x I_{S50} but the multiplier may range, for different rock types, from as low as 4 to as high as 30.

Defect Spacing

classification	extremely close	very close	close	medium	wide	very wide	extremely wide
spacing m	0.03	0.1	0.3	1	3	10	

Defect description uses terms contained on AS1726 table D2 to describe nature of defect (fault, joint, crushed zone, clay seam (etc.) and character (roughness, extent, coating etc.):



APPENDIX A
results of field investigation

Coffey Partners International Pty Ltd
ACN 003 592 019

engineering log excavation

COFFEY

pit no: TP2

sheet 1 of 1

office job no: G0652/1

client: ORIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8 m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests,etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		N	NONE OBSERVED				SP	Silty SAND, fine grained, light grey, some roots	D			TOPSOIL
							SP	Silty SAND, fine to medium grained, light grey, some orange brown, trace clay				SLOPEWASH
					1.0		SC/CL	Clayey SAND/Sandy CLAY, fine to medium grained, medium plasticity orange brown & red brown	M <Wp	MD/D H		ALLUVIUM
					2.0							
							CL	CLAY, medium plasticity, mottled red brown, orange brown & light grey	M <Wp	H		RESIDUAL
					3.0			Becoming EW Sandstone near bottom of pit				
								END TEST PIT TP2 AT 3.3m				

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP4

sheet 1 of 1

office job no: G0652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		N	NONE OBSERVED				SP	Silty SAND, fine to medium, grey some sandstone cobbles to 100mm	D	MD		TOPSOIL/SLOPEWASH
					1.0			SANDSTONE, fine to coarse grained extremely to highly weathered				BEDROCK
								END TEST PIT TP4 AT 1.6m REFUSAL ON SANDSTONE				

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
OT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP6
sheet 1 of 1

office job no: GO652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	100 200 300 400 kPa hand penetrometer	structure and additional observations
BH		N	NONE OBSERVED					Silty Clayey SAND, fine to medium grained, grey, some roots	D			TOPSOIL/SLOPEWASH
					1.0			Silty CLAY, medium to high plasticity orange brown & red brown	M	H	x x x	RESIDUAL
								SANDSTONE, fine to coarse grained highly weathered, orange brown	M			BEDROCK
								END TEST PIT TP6 AT 1.7m REFUSAL ON SANDSTONE				

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
USO undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

COFFEY

pit no: TP8
sheet 1 of 1

office job no: G0652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8 m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		N	NONE OBSERVED				SP	Silty SAND, fine to medium grained, grey brown				TOPSOIL
							CL	CLAY, medium plasticity, grey, orange brown & red brown				RESIDUAL
					1.0			SANDSTONE, fine to coarse grained light grey, orange brown & red brown				BEDROCK
								END TEST PIT TP8 AT 1.1m REFUSAL ON SANDSTONE				

key
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

pit no: TP10
sheet 1 of 1

office job no: G0652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: RAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8 m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		N	NONE OBSERVED					Silty SAND, fine to medium grained, dark grey	M			TOPSOIL
								CLAY, medium plasticity, orange brown, some gravel	M <Wp			RESIDUAL
					1.0			SANDSTONE, fine to med grnd, org brown	D			BEDROCK
								END TEST PIT TP10 AT 1.0m REFUSAL ON SANDSTONE.				

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 76 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

78 403

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP12
sheet 1 of 1

office job no: GO652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8 m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	100 200 300 400 kPa hand penetrometer	structure and additional observations
BH		N	NONE OBSERVED					Silty Clayey SAND, fine grained grey, some roots	M			TOPSOIL
								Silty CLAY, medium plasticity, orange brown and light grey	M <Wp	H		RESIDUAL
					1.0			SANDSTONE, fine to medium grained, extremely to highly weathered, orange brown & light grey	M			BEDROCK
					2.0			END TEST PIT TP12 AT 2.0m SLOW RATE OF PROGRESS				
					3.0							

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description
based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

1...003

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

pit no: TP14
sheet 1 of 1

office job no: G0652/1

client: CRIGHTON PROPERTIES
principal:
project: PROPOSED RESIDENTIAL SUBDIVISION
pit location: LOT 2 BELAR AVENUE, TERRIGAL

pit commenced: 4.5.93
pit completed: 4.5.93
logged by: BAS
checked by: PJNP

equipment type and model: CASE 580E BACKHOE
excavation dimensions: 3 m long, 0.8 m wide

R.L. surface: m
datum:

method	penetration 1 2 3	support	water	notes samples, tests, etc.	R.L. / depth metres	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		N	NONE OBSERVED					Silty CLAY, low plasticity	D			TOPSOIL
								CLAY, medium plasticity, mottled orange brown & grey brown	M	H		RESIDUAL
					1.0			SANDSTONE, fine to coarse grained highly weathered, orange brown	D			BEDROCK
								END TEST PIT TP14 AT 1.1m REFUSAL ON SANDSTONE				
					2.0							
					3.0							

key
N natural exposure
X existing excavation
BH Backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger
DT diatube

support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
Nc SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

classification symbols and soil description based on unified classification system

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

TABLE 1. CLASSIFICATION OF RISK OF SLOPE INSTABILITY

ASSESSMENT OF RISK

A landslip (or landslide) is a downslope movement of a soil or rock mass as a result of shear failure at the boundaries of the moving mass. The dominant movement is lateral and failure takes place over a relatively short period. Soil creep, which is slow and occurs without a well defined failure surface, is not included as a landslip.

Natural hill slopes are formed by processes which reflect the site geology, environment and climate. These processes include downslope movement of the near surface soil and rocks; in geological time all slopes are unstable. The area of influence of these downslope movements may range from local to regional and are rarely related to property boundaries. The natural processes may be affected by human intervention in the form of construction and related activities.

It is not technically feasible to assess the stability of a particular site in absolute terms such as stable or unstable. However the degree of risk of slope movement can be assessed by the recognition of surface features supplemented by limited information on the regional and local subsurface profile and with the benefit of experience gained in similar geological environments. The degree of risk is categorised below.

CLASSIFICATION OF RISK OF LANDSLIP WITHOUT DEVELOPMENT

CLASS	EXPLANATION
LOW	A landslip is very unlikely
MODERATE	A landslip is unlikely
HIGH	There is some risk of a landslip

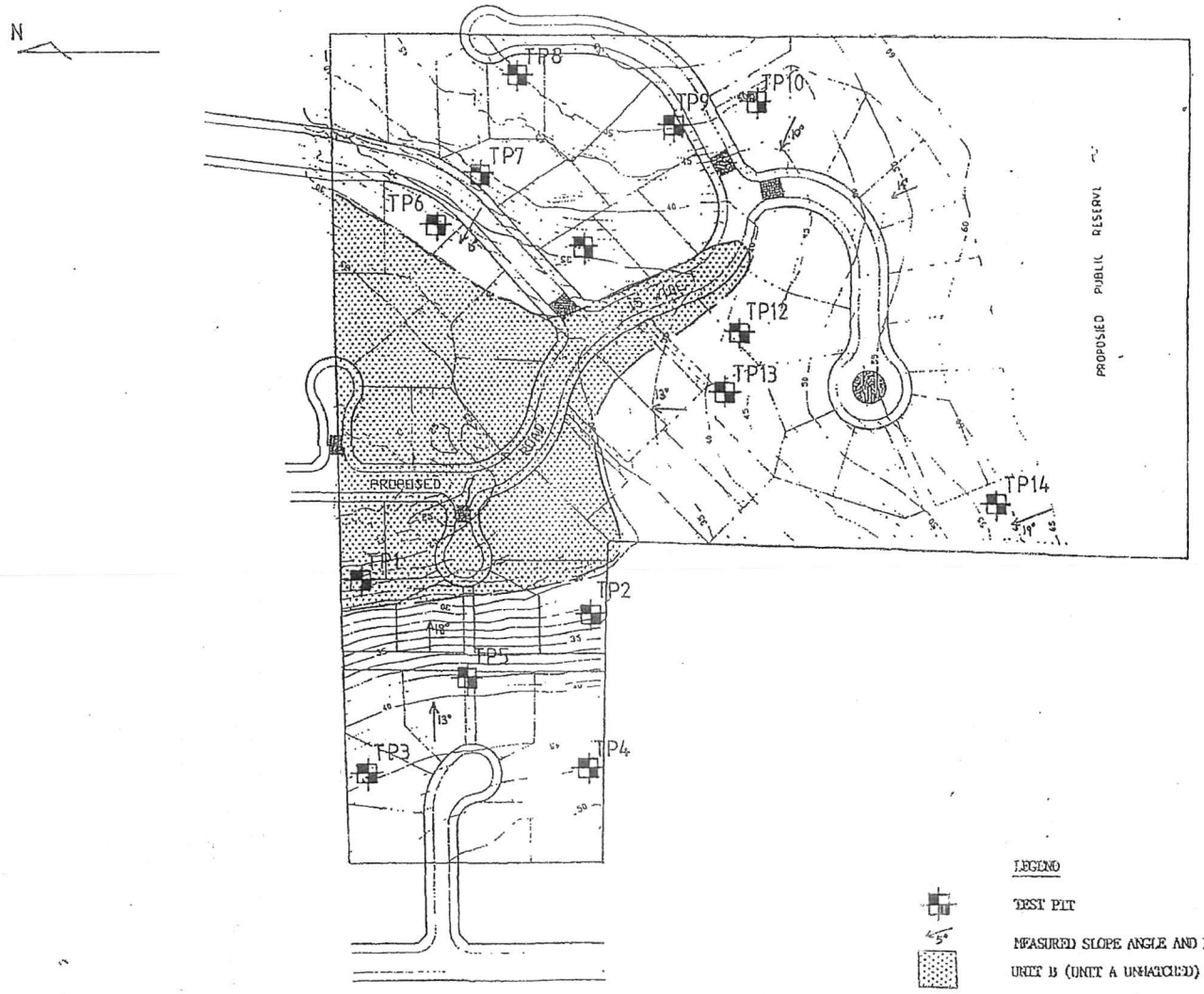
CONSEQUENCES OF HILLSIDE CONSTRUCTION

It must be accepted that the risks associated with hillside construction are greater than construction on level ground in the same geological environment. The impact of development may be adverse and imprudent construction techniques can increase the potential for movement.

Australian Standard AS 2870 - 1986 provides a damage classification that relates to essentially vertical movements of masonry walls and is thus not directly applicable to hillside movements. In the absence of a suitable classification for hillside movements the range of damage categories from negligible to very severe can be used as a general guide for damage potential related solely to landslip.

CLASS	DEVELOPMENT CONSTRAINTS	DAMAGE POTENTIAL EXTENT	DAMAGE POTENTIAL PROBABILITY
LOW	Good Hillside Practice	Slight	Very Low
MODERATE	Good Hillside Practice and site specific restrictions	Slight Moderate	Low Very Low
HIGH	No development unless major engineering remedial works	Moderate Severe	High Moderate

Damage to structures may occur due to a number of causes additional to that attributable to landslip. In the absence of a landslip slight damage might be expected even for good construction. If a landslip occurs damage would probably reach at least a moderate level.



Coffey Partners International Pty Ltd Consulting Engineers in the geotechnical sciences
Incorporated in NSW

scale (metres)

revision	description	drawn	approved	date

drawn	RAS
checked	
date	5.5.93

CRIGHTON PROPERTIES
PROPOSED RESIDENTIAL SUBDIVISION
LOT 2 BELAR AVENUE, TERRIGAL
SITE PLAN

COFFEY

drawing no. G0652/1 - 1

job no. G0652/1

APPENDIX D

COMMUNITY TITLE DEVELOPMENT STANDARDS

1. INTRODUCTION

Parkside@Terrigal is a proposed Community Title Home Based Business Park (HBBP). The project is specifically designed for the needs of HBBP users, whether they be those:

1. Running a small business
2. Starting off a small business with a view to growth
3. Winding back a larger business to a self managed size
4. Looking for a lifestyle change through part / full time telecommuting
5. Individuals returning to the work force without severing domestic commitments – such as recent mothers or
6. Semi-retirees looking to remain in private employment on a full or part time basis.

Whilst each of the above groups has slightly different needs, the project seeks as close as possible to fulfil the requirements of each of these user groups.

Most importantly, Parkside doesn't just seek to encourage these user groups to reside within the project, it demands through it's own structure compliance from residents of the project with a number controls which will all bar require residents to be engaged in some form of HBB activity. It is expected that the project will have a take up rate of at least 75% of homes by legitimate HBBP users

The controls referred to above consist of four key mechanisms, below is a general description of these mechanisms and the roles they each play.

Name	Description	Nature of control	Approval authority	Enforcement Authority
1) Planning Controls	a) Zoning	Behavioural and Built Form	Council / DOP	Council
	b) VPA commitments	Behavioural and Built Form	Council / DOP	Council / Land owner
	c) Conditions of Consent	Behavioural and Built Form	Council	Council
2) Community Title Structure	The Community Management Statement (CMS) sets out a number of By-laws being the rules of operation	Generally behavioural, but some built form controls	Council	Community Scheme
3) Architectural and Landscape design Controls	The Architectural and Landscape design Guidelines are empowered by the CMS, a committee is convened within the Community scheme to oversee the operation	Generally Built Form, but some behavioural controls	Council	Community Scheme
4) Covenants	Instruments such as 88B and 88E.	Behavioural and Built Form	Council	Council

1. Planning Controls

The zoning of the site within the Gosford LEP will provide Council with a degree of security of implementation of the Home Based Business Park Concept.

The Definition of "Home Office" / "Home Business" (contained within the draft instrument brings with it a degree of restrictions which are enforceable by Gosford Council, linked to the uses permissible upon the site.

Refer to the LES for further discussion of LEP and VPA details.

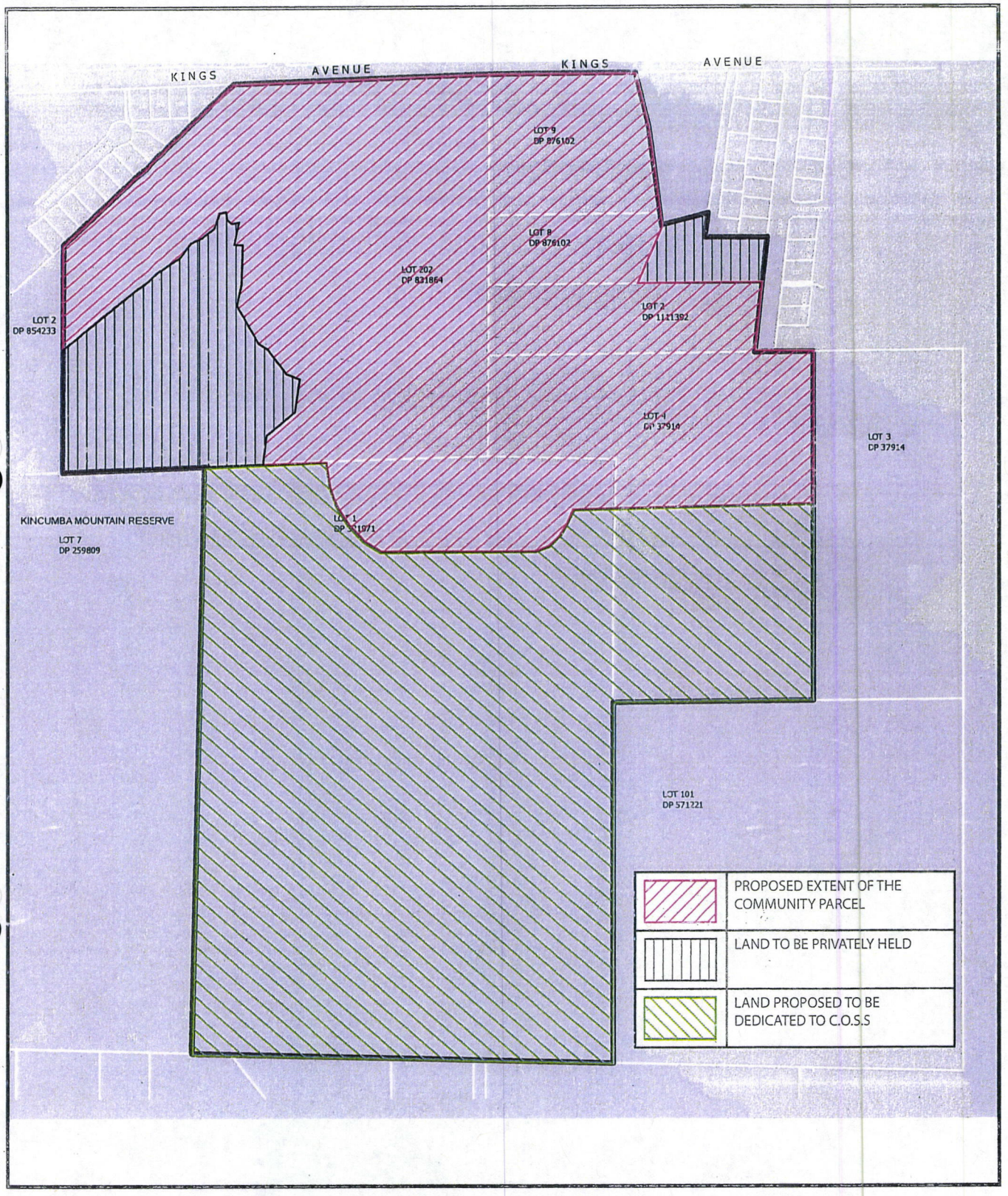
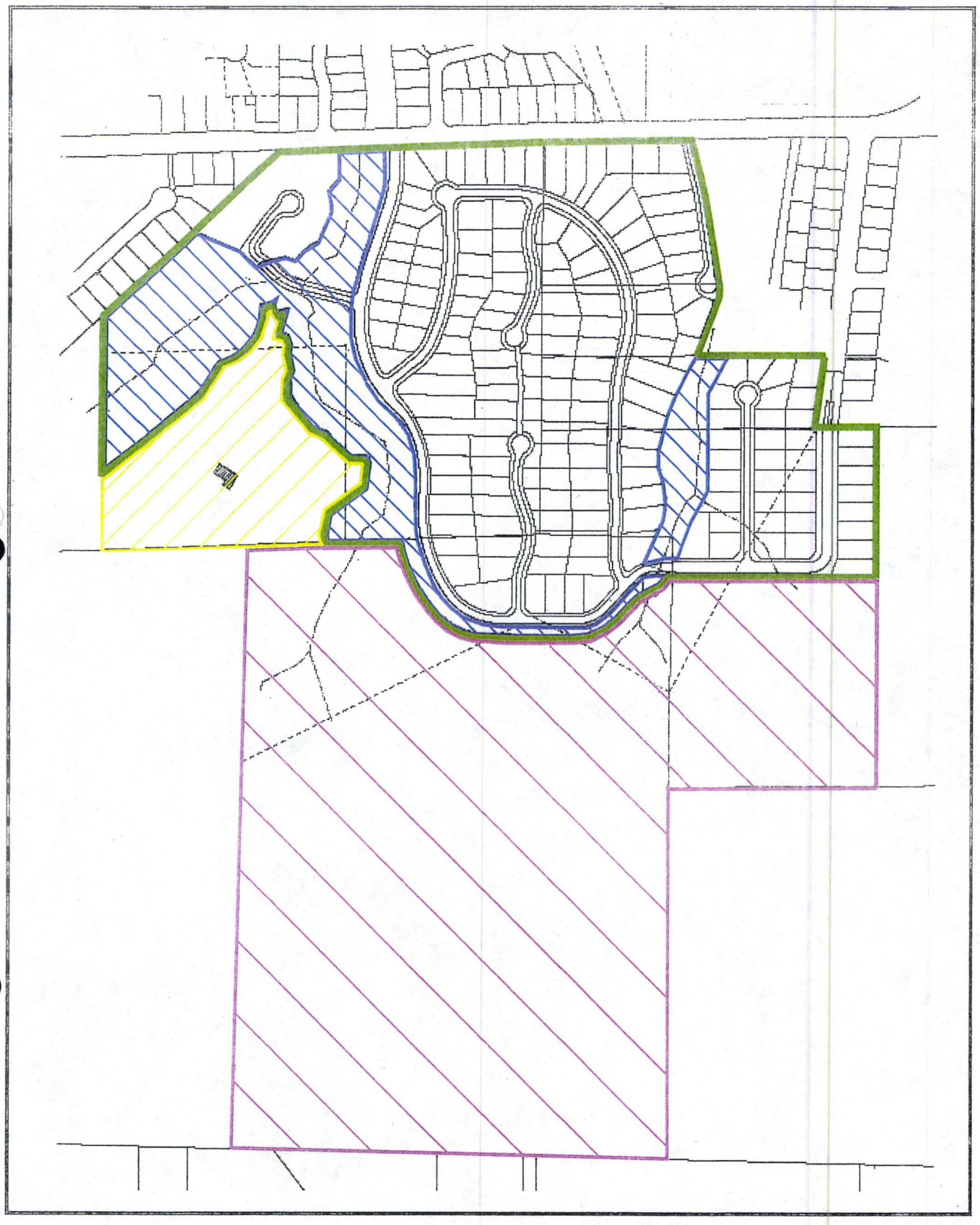

KINGS AVENUE
KINGS AVENUE
LOT 9
DP 876102
LOT 8
DP 876102
LOT 202
DP 831864
LOT 2
DP 1111392
LOT 2
DP 854233
LOT 4
DP 37914
LOT 3
DP 37914
KINCUMBA MOUNTAIN RESERVE
LOT 7
DP 259809
LOT 1
DP 571071
LOT 101
DP 571221
PROPOSED EXTENT OF THE COMMUNITY PARCEL
LAND TO BE PRIVATELY HELD
LAND PROPOSED TO BE DEDICATED TO C.O.S.S

FIGURE 1.0



AREA PROPOSED TO BE LOT 1 (COMMUNITY PROPERTY) UNDER COMMUNITY SCHEME

OUTLINE OF PROPOSED COMMUNITY SCHEME

RURAL RESIDENTIAL LOT OUTSIDE OF COMMUNITY SCHEME

LAND TO BE DEDICATED TO COUNCIL

Figure 1.1

5. Specific Provisions

Additional Management Plans required

It is anticipated that the following management plans will be drafted / have been drafted to facilitate ongoing management of the Community assets and scheduling of amenity. These plans will be empowered by Community Management Statement;

- Asset Management Plan – to incorporate;
  - Water Quality Management Plan – in accordance with the integrated water cycle management plan.
  - Vegetation / Bushfire Management Plan – in accordance with the BTA and Ecological reports
  - Asset Maintenance Schedule – to be prepared by a qualified building inspector and Engineers on completion of Civil and Architectural works.
  - Resource Management Plan – to be prepared which details the ongoing management of the Home Based Business Hub as a resource and considers issues such as staffing, event scheduling, consumables, investments, revenue raising etc.
- Architectural and Landscape Guidelines
- Business Management Guidelines

See appendix 1 for an example of a Community Management Statement that has dealt with similar issues on recent project in the LGA.

Home Based Business Controls

Business operation controls will be contained within the "Business Management Guidelines", which will be annexed to the Community Management Statement. The guidelines will set out specific provisions relating to the operational issues of Home Based Business designed to;

1. Ensure an appropriate HBB is provided in every house.
2. To protect the amenity of neighbours
3. To assisting in providing a growth path and transition to a business outside of the HBBP.

The Business Management Guidelines are implemented by the Design Review Committee (DRC), which is a sub-committee of the Executive Committee of the Community Association. The Guidelines will require a business impact statement be prepared and be submitted to the DRC for approval, before business operations can commence on site. No business can operate upon the site that has not been approved by the DRC.

The DRC is the same DRC that over sees the implementation of the Architectural and Landscape Design Guidelines and will comprise of the developer, during the initial development phase followed by a committee of 4 people;

4. 2 members of the Community Scheme (1 of which will be the developer whilst ever it owns a lot)
5. 1 registered Architect / or Business Management consultant at the desgression of the ARC
6. A member of Gosford City Council Planning Dept – whilst ever it chooses to act in this capacity (this can be a concurrence role)

The Business Management Guidelines will be drafted in a written technical format.

The Business Management Guidelines will specifically contain requirements relating to the following;

Category	Provision
Business Type	Business types must not be offensive (noise, odour, light emmitance etc) and consistent with a residential environment.
Business Type	No Retail outlets (shops) allowed, so as to limit traffic usage. Some consideration to be given to retail frontage in row of houses adjacent community facilities.
Business Type	Single customer service providers such as General Practitioners, Hair Dressers, and Accountants Etc would be permissible.
Business Type	No Industrial / semi industrial uses allowed such as panel beaters, engineering, spray painting etc.
Business Type	No businesses, such as whare housing etc. which rely upon regular delivery and / or despatch of goods
Parking	All private vehicles to be contained within the lot.

4. Covenants

To ensure that the Home Based Business Park is operated under the proposed Community Scheme, the site would be subject to an 88E restriction requiring it to be developed and managed in accordance with the Community Title legislation. In the drafting of this restriction Gosford Council would be the only authority with the power to vary the restriction. In addition to this restriction a range of other restrictions under 88b or 88e would be registered in order to provide an additional level of control over a range of different aspects of the development. Below is a brief description of these restrictions;

Restriction Type	Description	Burden	Benefit	Authority Empowered To vary
88E	Site to managed as a Community Scheme in accordance with the Community Management Statement	Entire site	Community Association	Council
88B / 88E	Riparian Corridor to be managed in accordance with the Riparian and Buffer zone Management Plan / Community Association to do the work	Riparian Corridors on site	Community Association	Council
88B / 88E	Access to lots and Riparian Corridor to be managed in accordance with the Riparian and Buffer zone Management Plan / Community Association to do the work	Riparian Corridors off site (special facilities)	Community Association	Council
88B	APZs to be managed in accordance with RFS requirements and findings of the BTA	APZ on individual lots	Individual lot owners / Community Association upon default	RFS
88B	Management of APZ in accordance with RFS requirements and findings of the BTA	APZ on Community Lot	Community Association	RFS

Appendix 2.

Sample Architectural and Landscape Guidelines.

Joel Stevens

John O'Connor

Pam O'Connor

ANNEXURE C

CLAUSE 1.2(a)

CLAUSE 1.2(b)

Joel Stevens

John Olgers.

Pam Olgers

ENVIRONMENTAL MANAGEMENT PLAN
FOR
LANDS PROPOSED FOR TRANSFER TO COUNCIL

"PARKSIDE"
KINGS AVENUE
TERRIGAL

DECEMBER 2010

Conacher Environmental Group

Environmental and Land Management Consultants

Suite E, 78 York Street, East Gosford NSW 2250
PO Box 4300, East Gosford NSW
Phone: 02 4324 7888 Fax: 02 43247899

1. INTRODUCTION

This Management Plan has been prepared in respect to the lands proposed to be transferred to Council as shown in Figure 1. The whole of this land is proposed to be transferred to Gosford City Council as Public Reserve. The transfer of these lands will extend the Kincumba Mountain Reserve by approximately 27.28 hectares. The Kincumba Mountain Reserve is also part of Gosford Council's Coastal Open Space System (COSS).

This plan outlines some of the issues and strategies to be employed for the management of part of the land to be transferred.

2. AREA SUBJECT TO THIS PLAN

The area subject to this plan (subject site) that part of Lot 1 DP 381971, 131 Pickett's Valley Road, Pickett's Valley zoned 7(a) of which approximately 4.72ha requires active management to control weed levels. The land is situated north of the trail which roughly runs in an east to west direction and south of the proposed development area. The subject site is bisected north to south by a power line easement of forty metres in width. Location of the land subject to this management plan is shown in Figure 1.

3. EXISTING VEGETATION

The subject site requiring weed control contains the following vegetation types as shown in Figure 2.

Disturbed Vegetation (Regenerating) – 2.05ha
Grassland with Scattered Trees - 0.17ha, and
Map Unit E22a - Narrabeen Coastal Blackbutt Forest – 1.5ha

These vegetation communities have been described in detail within the Flora and Fauna Assessment Report (Conacher Environmental Group 2010), while Map Unit E22a has been mapped and described by Bell (2004).

Weed invasion by exotic grasses and weed species such as Lantana are dominant throughout the subject site. The levels of weed invasion over the whole of land proposed for transfer to Council including the subject site are shown in Figure 3.

4. EXISTING EASEMENTS

Part of the subject site is affected by an electricity easement in favour of the power supply authority (shown in Figure 3). This area will need to be continued to be managed by that authority in accordance with its own easements for the land.

5. FENCING

It is proposed to erect a post and wire fence separating the subject site from land proposed for development. This fence will form the northern boundary of the land subjected to this management plan. The proposed fence will consist of a minimum of 4 plain wire strands with steel picket posts and timber or concrete straining posts at bends and corners.

The purpose of this fencing is to delineate the boundary and to separate the proposed Public Reserve from any developed areas likely to be maintained by mowing or slashing for the purposes of bushfire asset protection fuel management.

The fence will have gated access at convenient locations to allow for access by bushland regenerators and other relevant contractors and land managers.

6. WATER QUALITY MANAGEMENT

The subject site drains overland to the north into unnamed drainage lines which drain north into Terrigal Lagoon.

As previously mentioned the subject site contains high levels of weeds such as Lantana. The weeding of the subject site may pose a minor threat of erosion and sedimentation due to soil disturbance associated with weed removal and native plant regeneration; however there are strategies that can ameliorate or prevent this from occurring (see Section 7 - Weed Control).

A water quality management strategy has been developed to reduce the level of nutrients flowing into the aquatic areas of the site. This strategy includes the use of filtration swales, water quality treatment ponds and detention ponds integrated into the drainage system of areas to be developed. This will ensure protection of water quality both within aquatic habitats of the site and downstream areas.

7. STORMWATER CONTROL

Stormwater from the subject site flows overland to the north into unnamed drainage lines which drain north into Terrigal Lagoon. Presently there are no stormwater flow controls except several dams located to the north-west and east of the proposed development. These dams discharge into the local un-named drainage lines which flow through culverts in a northerly direction under Kings Avenue then easterly into Terrigal Lagoon.

8. TREE / VEGETATION PROTECTION

A post and wire fence is recommended along the northern boundary of the subject site. This fence will delineate the Reserve from the adjoining development area and will also limit the extent of any future mowing or slashing.

It is recommended that the whole of the proposed Public Reserve be treated as a tree / vegetation protection area with the exception of vegetation (weed) management activities identified in this Management Plan and the vegetation management requirements for the power line easement.

9. WEED CONTROL

The active management area of this subject site has incurred medium and high levels of weed invasion of mostly lantana (Figure 3). It is recommended that this area will be managed by the implementation of a low impact weed removal strategy such as hand pulling and cut and paint poisoning. It is recommended that a qualified bush regenerator be engaged to undertake these works

10. REVEGETATION AND REGENERATION OF DISTURBED AREAS

The primary revegetation method for the subject site will be natural regeneration assisted by weed management.

Weed management is critical to the process of natural regeneration. Natural recruitment of native species will be encouraged via the creation of space by initial and ongoing weeding activities within the disturbed / weed infested areas. It is expected that removal of the weed species within the subject site will provide space and allow natural regeneration of the locally endemic native species.

Areas containing predominately pasture grass will be supplementary planted with tree and shrub seedlings in selected revegetation areas of 100 square metre patches (50m long by 20m wide) orientated generally along the slope contours. A minimum width of 30 metres between patches will provide areas of replanted eucalypts to assist with the overall revegetation and regeneration of the site. This revegetation should be undertaken in a manner that does not increase the bushfire hazard to future development.

The planting species composition for these areas of replanting is to comprise mixture of tree and shrub species predominantly on the site selected from the species list provided in the Flora and Fauna Survey Report (Conacher Environmental Group 2010). Actual species composition planting density, planting procedures and ongoing management requirements are to be detailed in Site Environmental Management Plan to be prepared for the site following rezoning.

This strategy assisted by long-term, ongoing inspections, weeding and other maintenance activities will restore and maintain high quality habitat and connectivity for native flora and fauna species throughout the local area. All regeneration works are to be undertaken by a qualified Bushland Regenerator.

11. FAUNA HABITAT ENHANCEMENTS

No hollow bearing or native endemic trees will be removed from the area covered by this Management Plan.

As part of the fauna habitat amelioration process nest boxes will be installed in suitable trees within the subject site and the proposed area for transfer to Council to compensate for the loss of tree hollows within the development area. As well hollows removed from trees will be placed on the ground within the subject site and the area proposed for transfer to Council to compensate for the loss of terrestrial fauna habitat from the development area. The hollow logs will be spaced such that they do not form a log-pile.

It is recommended that hollows be spaced at a density of not more than 1 log per 900m2 area (30 x 30m).

12. FUEL MANAGEMENT

Bushfire fuel management will not be undertaken within the areas proposed to be transferred to Council. Bushfire Asset Protection Zones (APZs) for the proposed development are to be located to north of the subject site within the proposed development areas. A Bushfire Assessment Report has been prepared for the proposed development (Conacher Environmental Group 2008).

13. MONITORING, MAINTENANCE AND REPORTING

Regular monitoring inspections are to be undertaken at 3 months, 6 months, 1 year, 2 years, 3 years, and 5 years after the initial weeding and replanting works have been commenced.

Monitoring is to include inspections of the fencing, water quality management infrastructure, stormwater controls, erosion hazards, weeds and native vegetation regeneration works. Regular monitoring and any remedial works required will be undertaken by a Council approved ecologist / bush regenerator engaged by the Community Association.

14. WORKS PROGRAM

A proposed works program is outlined in Table 1.

TABLE 1
PROPOSED WORKS PROGRAM

PRE-DEVELOPMENT PHASE

Action No.	Action	Location	Phase	Responsibility
1	Marking and fencing of the subject site. Allow for gated access for maintenance works and access to the electricity easement.	Active Management Area (AMA)	Pre-development	Proponent, Project Ecologist and qualified Bushland Regenerator
2	Establish any Tree Protection Zones.	Generally coincides with a) above	Pre-development	Proponent and relevant contractor
3	Erection of erosion control fencing (if required).	In locations subject to erosion within the subject site	Pre-development	Proponent
4	Commencement of Bushland Regeneration / weeding /	AMA as shown in Figure 2. (generally north of the fire trail)	Pre-development	Proponent or contractor under the direction of a qualified

TABLE 1 PROPOSED WORKS PROGRAM				
	revegetation			Bushland Regenerator
5	Installation of nest boxes	Subject site	Pre-development	Proponent, Project Ecologist
DEVELOPMENT PHASE				
Action No.	**Action**	**Location**	**Phase**	**Responsibility**
6	Continuation of Bushland Regeneration / weeding	AMA Figure 2. (generally north of the fire trail)	Development	Proponent or contractor under the direction of a qualified Bushland Regenerator.
7	Re-use of hollow logs removed from the development area.	Re-locate hollow logs from the development area and place them throughout the proposed reserve.	Development	Proponent or contractor under the direction of an Ecologist.
8	Maintenance of Erosion and Sediment control devices	Construction Areas and any areas of disturbed soil within the subject site.	Development	Proponent and relevant contractor.
9	Monitoring of condition of vegetation within the subject site and progress reports to Council	Subject site as shown in Figure 2. (generally north of the fire trail)	After initial works commence at 6 months, 1 year, 2 years, 3 years 4 years and 5 years.	Proponent and qualified Bushland Regenerator / Ecologist
POST-DEVELOPMENT PHASE				
Action No.	**Action**	**Location**	**Phase**	**Responsibility**
10	Remove temporary tree protection flagging tape &/or temporary fencing	Areas adjacent to the development area (if required).	Post-development	Proponent and relevant contractor
11	Maintenance of Erosion and Sediment Control Devices	Any areas not yet protected by adequate groundcover and any areas of disturbed soil	Post-development	Proponent and relevant contractor

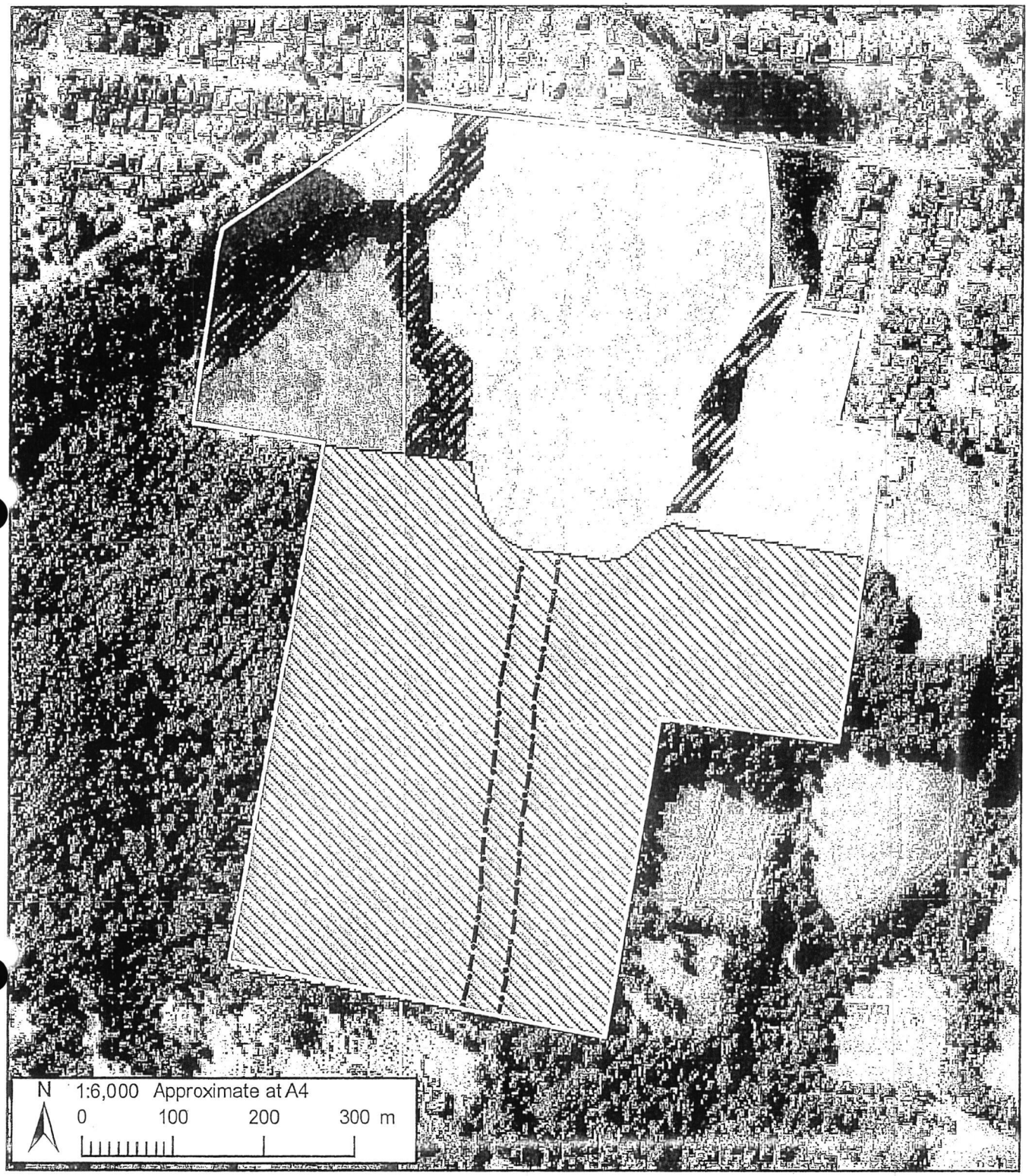
TABLE 1 PROPOSED WORKS PROGRAM				
POST-DEVELOPMENT PHASE				
Action No.	**Action**	**Location**	**Phase**	**Responsibility**
12	Ongoing monitoring of condition of vegetation.	Subject site as shown in Figure 2. (generally north of the fire trail)	After initial works commence at 6 months, 1 year, 2 years, 3 years, 4 years and 5 years.	Proponent and qualified Bushland Regenerator
13	Undertake monitoring report recommendations	Subject site as shown in Figure 2. (generally north of the fire trail)	As required by the monitoring report	Proponent and qualified Bushland Regenerator

15 REFERENCES

Bell. S.A.J. (2004) The Natural Vegetation of the Gosford Local Government Area, Central Coast, NSW.

Conacher Environmental Group (2010). Ecological Site Assessment Information for Local Environmental Study. "Parkside" Kings Avenue, Terrigal (Ref: 10050).

Conacher Environmental Group (2008) Bushfire Assessment Report: Proposed Rezoning & Residential Subdivision, "Parkside" Kings Avenue, Terrigal (Ref: 8124B).



Original plan produced in A4 colour. Plan for indicative purposes only not for detailed measurement.

Legend

- Subject Site Boundary
- Power-Easement
- Area Subject to Management Plan
- Buffer to Rainforest Vegetation
- Transfer to Council
- Development Area
- Environment Conservation
- Riparian/Drainage Reserve

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Figure 1

Proposed Land Use Areas

Kings Avenue, Terrigal

By:MDC
9/12/10
Ref No.10124

Source: Aerial © Department of Lands (2009)

Flora and fauna survey locations are approximate and have not been fixed by land survey. *Subject Site boundary subject to final survey
Plan for indicative purposes only. Not for detailed measurement

Legend

Subject Site Boundary
Weed Mangement and or Replanting
Existing Trail (Approximate Location)
Power-Easement

Original plan produced in A4 colour

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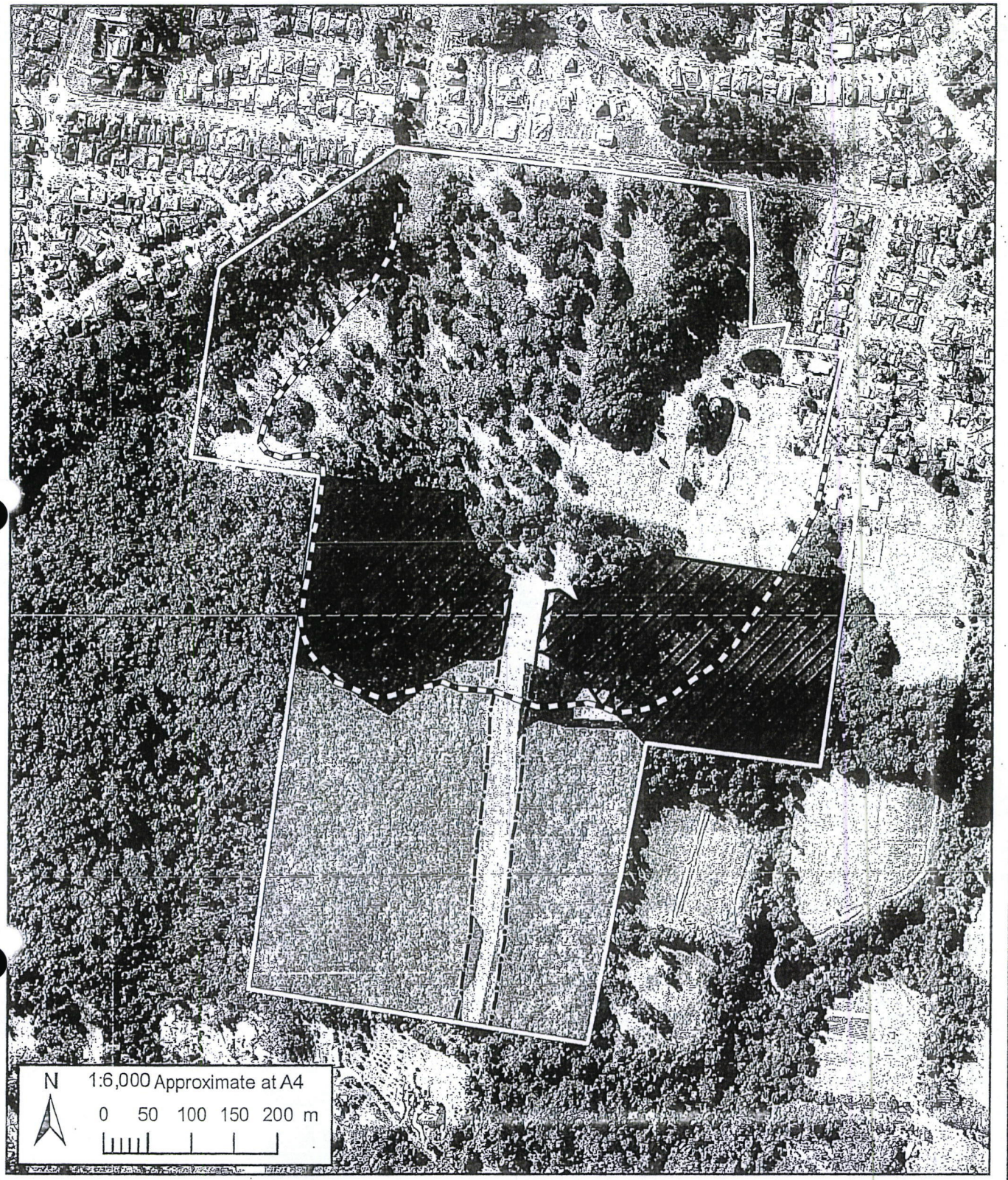
Figure 2
Area of Weed Control/Replanting

Kings Avenue, Terrigal

ByJJHDC
6/7/10
Ref No 10050

Source: Aerial © Department of Lands (2010)



Legend

- Subject Site Boundary
- Existing Trail (Approximate Location)
- Area Subject to Active Management
- High Weed Cover
- Medium Weed Cover
- Low Weed Cover

Original plan produced in A4 colour

Flora and fauna survey locations are approximate and have not been fixed by land survey. Subject Site boundary subject to final survey. Plan bridging purposes only. Not for detailed measurement.

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Figure 3
Management Area and Weed Cover Mapping

Kings Avenue, Terrigal

By:JMDC
6/12/10
Ref No 10050

Source: Aerial © Department of Lands (2010)

ANNEXURE D

CLAUSE 1.2(c)

LAND MANAGEMENT WORKS

Pre-Construction & Construction requirements of the Riparian, Buffer Zone & Private Conservation Areas Vegetation Management Plan

Neil Stevens

John Ozoman

Pam Ozoman

conacher
environmental group

RIPARIAN, BUFFER ZONE AND PRIVATE CONSERVATION AREAS VEGETATION MANAGEMENT PLAN

"PARKSIDE"
KINGS AVENUE
TERRIGAL

DECEMBER 2010
(REF: 10134)

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PREFACE

This Vegetation Management Plan has been prepared by *Conacher Environmental Group* to identify matters in relation to the management of riparian vegetation and private conservation land proposed to be retained, rehabilitated and managed on the site.

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NPWS Scientific Licence Number: S10618
Director
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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Vegetation Management Plan (VMP) provides details on the management of vegetation within riparian areas, buffer zones and private conservation areas during and after the proposed residential subdivision.

Riparian corridors form a transition zone between terrestrial and aquatic environments and perform a range of important environmental functions. Riparian corridors:

- Provide bed and bank stability and reduce bank and channel erosion;
- Protect water quality by trapping sediment, nutrients and other contaminants;
- Provide a diversity of habitat for terrestrial, riparian and aquatic flora and fauna species;
- Provide connectivity between wildlife habitats;
- Allow for conveyance of flood flows and control the direction of flood flows;
- Provide an interface between developments and waterways.

Measures and management strategies for the protection of native riparian vegetation within the site are outlined within this document. These include:

- Proposed weeding activities to be carried out within retained vegetation of the riparian area and buffer zone;
- Proposed regeneration activities to be carried out within and adjacent to retained vegetation;
- Ongoing monitoring and maintenance activities to be carried out within retained vegetation of the site;
- Relevant sediment/erosion control measures.

Private Conservation areas seek to enhance biodiversity connectivity and fauna movement across the site. Proposed biodiversity improvement measures include:

- Weed management;
- Natural regeneration;
- Assisted revegetation;
- Habitat enhancement by additional groundcover and nest boxes.

In preparing this VMP, a number of existing reports have been utilised. Brief details on these are provided below:

1. ***Urban Bushland Management Guidelines (Dept. of Planning, 1991)***

   The Department of Urban Affairs and Planning's Guidelines for Preparing Management Plans for Urban Bushland have been followed when preparing this management plan. The Urban Bushland Management Guidelines (Dept. of Planning, 1991) contain a number of relevant strategies, which are aimed at maintaining and enhancing native flora and fauna and their habitats.

iii) Consideration of the proposed development to minimise the impact on areas of natural vegetation and enhance current stands of natural vegetation where possible.

The following sections of this VMP identify issues relevant to proposed development and future management of the site in relation to retained vegetation.

1.3 SITE DETAILS

The riparian and buffer areas subject to this Vegetation Management Plan consist of the 7(c2) – Conservation and Scenic Protection zoned land and 7(a) Conservation zone land located in and adjacent to the creeklines within 'Parkside' at Kings Avenue Terrigal and within the corridor areas identified Figure 2.

1.4 PROPOSED DEVELOPMENT

It is proposed to subdivide the land to create residential building allotments with associated infrastructure such as access, electricity and water. The proposed development will also provide for a Riparian Zone with retained vegetation that will be managed together with its associated 10 metre vegetated buffer on both sides with a further 10 metre wide bushfire asset protection zone outside the vegetation buffer zone as shown in Figure 1. Additionally some areas to be privately owned will be managed in accordance with this plan by the community association.

The overall objective of this Vegetation Management Plan is to provide details on how the site can be managed to create a mosaic of vegetation, including trees, shrubs and grass cover within a weed reduced riparian area and adjoining buffer areas and corridor areas.

The areas included within this Vegetation Management Plan will become the responsibility of a combination of the Community body covered under the Community Title Management Statement and the private landholders in the rural residential parts of the site. Figure 2 identifies the approximate areas covering the future community land, private land within the development area and private land not included within the area of proposed works. The works required in the adjoining, but off-site lands 7(a), would require agreement with the adjacent landowner to be undertaken. We understand that mutual consent by adjacent land owners has been formalised.

- the Bradley Method of minimal soil disturbance during weed removal;
- clearing and stabilising techniques;
- the use of herbicides;
- the use of fire; and
- biological controls.

The weed removal / bush regeneration technique that is most suitable for this situation is a variation of the Bradley Method. This method identifies that weed removal should be accomplished with minimal disturbance to the soil and surrounding native plants, an ideal situation in areas sensitive to erosion and where native plants can regenerate. The Bradley Method incorporates three basic philosophies:

- Work from areas containing less disturbed native vegetation towards more weed infested areas;

- Minimal disturbance to the soil and surrounding native plants. This is an important aspect especially in this situation as the topography and riparian morphology of the site makes it susceptible to erosion once plant cover has been removed;

- Allow natural native plant regeneration to occur throughout the native plant community. In some cases it may be necessary to assist regeneration by replanting areas of weed removal with locally occurring native species.

It is expected that weed removal within the subject site will be undertaken in accordance with methods described below and in Appendix I.

Exotic species targeted for removal throughout the duration of the management plan are listed in Table 2.1. General management strategies enabling appropriate removal of these species are provided in Appendix I.

TABLE 2.1
EXOTIC SPECIES TARGETED FOR REMOVAL

On Site	Scientific Name	Common Name
#	*Ageratina adenophorum*	Crofton Weed
	Bambusa sp.	Bamboo
#	*Cirsium vulgare*	Spear Thistle
#	*Impatiens walleriana*	Busy Lizzie
#	*Lantana camara*	Lantana
#	*Ligustrum sinense*	Small-leaved Privet
#	*Lonicera japonica*	Japanese Honeysuckle
	Musa sp.	Banana
#	*Nephrolepis cordifolia*	Fishbone Fern
#	*Nicotiana glauca*	Tobacco Bush
#	*Paspalum dilatatum*	Paspalum
#	*Paspalum urvillei*	Vasey Grass
#	*Cortaderia selloana*	Pampas Grass
#	*Protasparagus aethiopicum*	Asparagus Fern
#	*Rubus anglocandicans*	Blackberry
#	*Senna pendula var. glabrata*	Cassia
#	*Thunbergia alata*	Black-eyed Susan
#	*Tradescantia fluminensis*	Wandering Jew
#	*Zantedeschia aethiopica*	White Arum Lily
# = Species observed on site		

TABLE 2.2
RECOMMENDED SPECIES FOR RE-PLANTING

Scientific Name	Common Name
Trees	
Eucalyptus saligna	Blue Gum
Eucalyptus pilularis	Blackbutt
Acacia prominens	Gosford Wattle
Acmena smithii	Lillypilly
Alphitonia excelsa	Red Ash
Archontophoenix cunninghamiana	Bangalow Palm
Elaeocarpus reticulatus	Blueberry Ash
Livistona australis	Cabbage Tree Palm
Sloanea australis	Maidens Blush
Shrubs	
Acacia binervia	Coast Myall
Acacia suaveolens	Sweet Scented Wattle
Omalanthus populifolius	Bleeding Heart
Pittosporum revolutum	Yellow Pittosporum
Polyscias sambucifolia	Elderberry Panax
Wilkiea heugeliana	Wilkiea
Dianella caerulea var. *producta*	Blue Flax Lily
Dichelachne micrantha	Short-hair Plume Grass
Doodia aspera	Rasp Fern
Entolasia marginata	Bordered Panic
Gymnostachys anceps	Settlers Flax
Lepidosperma laterale	Variable Sword-sedge

Note: Natural germination and establishment of other native species is to be encouraged

Note: Other native species present within the site can be added if required

In addition to the riparian and buffer areas, vegetation replanting is proposed for the road batters above the creek culvert that flows under Kings Avenue. This area is to be revegetated to consolidate the connectivity of creekline vegetation with other areas offsite.

2.4 DETAILS OF ANY ONGOING MONITORING AND MAINTENANCE ACTIVITIES TO BE CARRIED OUT WITHIN RETAINED VEGETATION OF THE SITE

It is recommended that regular monitoring inspections be undertaken at 6 monthly intervals for 2 years after weeding and replanting works have been undertaken. This will allow the determination of the health of the vegetation and may include identification of any areas suffering from disturbance or in need of rehabilitation, weed control, sediment or storm water control, bank and soil stabilisation or maintenance of rehabilitated or regenerating areas.

Monitoring and review will include a performance evaluation of the works and will include assessment for replanting where losses have occurred, addressing any deficiencies observed, and determining a successful outcome. A successful outcome is usually defined as a minimum of 80% survival rate for all plantings and a maximum of 5% weed cover for the treated riparian corridor is achieved.

compaction by prohibiting vehicle access and the stockpiling of construction material such as soil and woodchips within the vegetation protection zone.

Silt Fencing
Erosion and sediment control measures are to be implemented to minimise adverse effects of increased erosion and sediment loading. These include: the safe disposal of waste products, coordinated work practices aimed at minimising land disturbance, the disposal of 'clean' water off site, the minimisation of vegetation disturbance through the dedication of 'no go areas', routine site inspections of drains, channels, sediment control structures and water quality, identification of potential erosion areas, installation and maintenance of flow control structures and soil stabilising vegetation wherever required.

The minimisation of soil erosion will be achieved through soil stabilisation measures and water control techniques. Suitable soil stabilisation measures to be implemented include the immediate revegetation of cleared surfaces via seeding, planting of native species, mulching or the installation of biodegradable blankets. Suitable water control measures include construction of earth banks, catch drains, detention and sediment ponds (including Gross Pollutant Traps), grassed and armoured waterways, rock earth and sand bag dams and outlet protection systems to prevent scouring.

Mulching
Mulching is an efficient method to impede the establishment of weed species, soil erosion, compaction and desiccation. Woodchip or other suitable mulch is to be placed at a depth of 75-100mm covering any areas of tree replanting or landscape areas. Areas surrounding the stems/trunks of plants are to be kept free from mulch, thereby reducing the incidence of collar rot on retained or planted flora.

2.7 VEGETATION PROTECTION GUIDELINES

The following guidelines are proposed in relation to retained vegetation on the site and the proposed development:

i. Implementation of an adequate ***Vegetation Protection Zone (VPZ)*** will be required surrounding any retained vegetation. This *vegetation protection zone* can generally be provided by preserving an area around the vegetation with a radius of at least 1.25 x the average canopy radius from the trunk (of typical tree forms) or 0.5 x the tree height. *British Standard BS 5837* (1991);
ii. The boundary of the Vegetation Protection Zone is to be established at the outer boundary of the Vegetation Buffer Zone as shown in Figure 1;
iii. Before construction commences vegetation protection zones should be adequately marked and sign posted using star pickets and wire or high visibility tape or plastic net fencing;
iv. All trees not nominated for retention are to be removed prior to any construction activity or bulk earthworks. Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction. Such works are to be supervised by a qualified Arborist;
v. Stumps are to be ground - not dozed or dug out;
vi. All trenches footings and major earth movement should avoid *vegetation protection zones*;
vii. Stockpiling materials and soils within *vegetation protection zones* is to be avoided;
viii. Machinery is to avoid *vegetation protection zones* during all operations;
ix. Any trenching or construction works undertaken within *vegetation protection zones* should be witnessed, supervised and recorded (photographed and documented) by a qualified Ecologist or Arborist;

SECTION 3

WORKS PROGRAM

3.1 WORKS PROGRAM

A proposed works program is outlined in Table 3.1.

TABLE 3.1
PROPOSED WORKS PROGRAM

Action	Responsibility	Funded By
Pre-construction		
• Collection of seed/plant propagation.	- Contract grower	Developer
• Identification (flagging) of vegetated areas to be retained (VPZ).	- Project Supervisor	Developer
• Erection of erosion control fencing.	- Contractor with advice of Project Supervisor	Developer
• Installation of protective fencing and signs around adjacent bushland (VPZ).	- Contractor with advice of Project Supervisor	Developer
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
• Preparation of a landscape/tree planting program if required.	- Contractor / Project Supervisor	Developer
Construction		
• Commencement of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator	Developer
•		
• Monitor erosion control fencing (weekly – and after rain) and replace if required.	- Contractor with advice of Project Manager	Developer
• Monitor vegetation protection fencing and signs and replace if required.	- Contractor with advice of Project Supervisor	Developer
• Implementation of tree/shrub planting program	- Contract landscaper/bush regenerator	Developer

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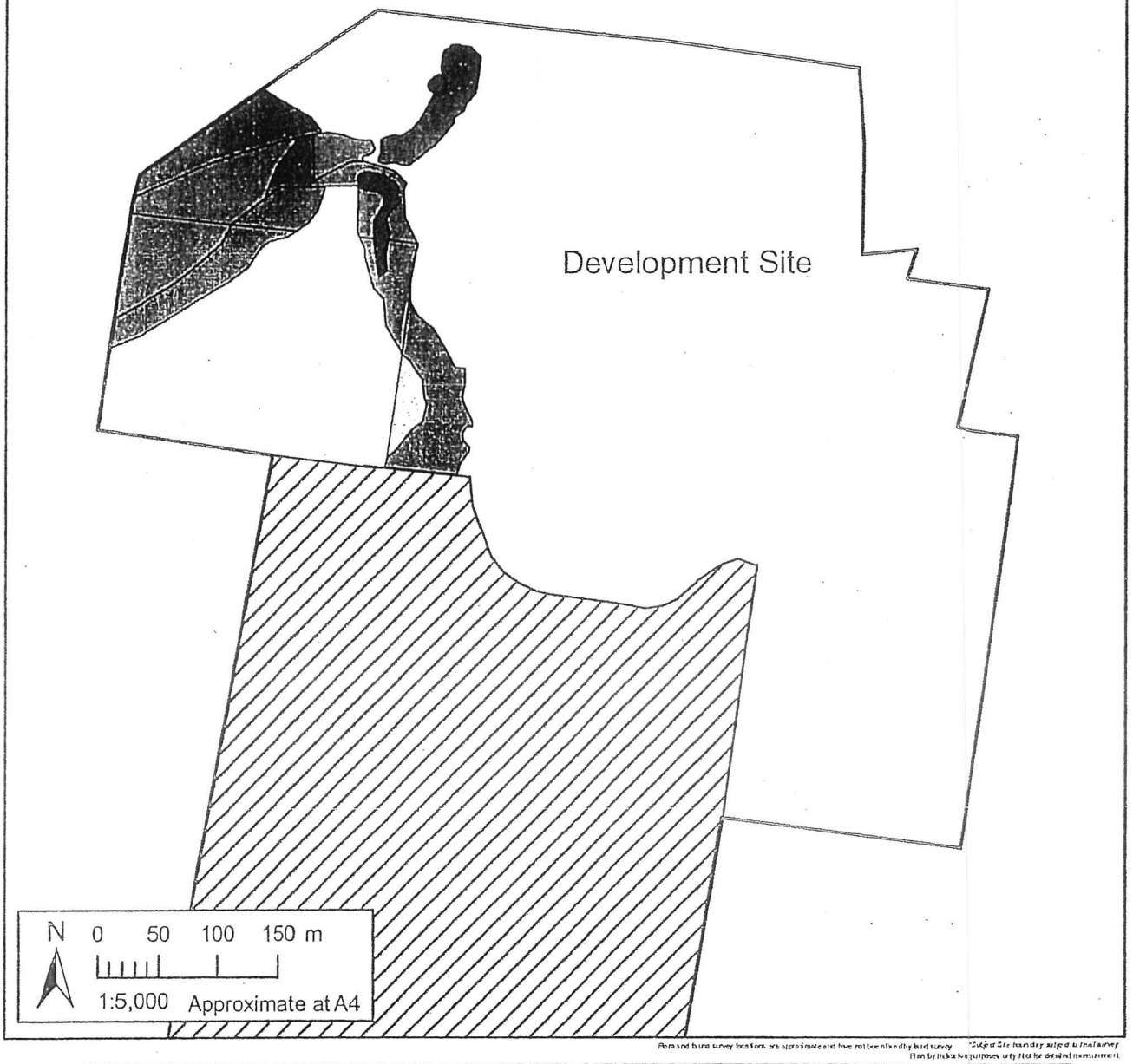

Flora and fauna survey locations are approximate and have not been verified by field survey. *Subject Site boundary subject to final survey. Plan for indicative purposes only. Not for detailed measurement.

Legend

- Subject Site Boundary
- **Low Intensity Works**: Reasonably intact vegetation with low levels of weed invasion. Targeted weed removal required with encouragement of natural bushland regeneration. Occasional works undertaken on a part-time programmed basis, works to be identified in Community Plan and sourced form Community funding.
- Dam (community land)
- **Medium Intensity Works**: Partially intact vegetation with moderate levels of weed invasion. Ongoing weed removal targeting specific weeds (e.g. Lantana, Blackberry and Privet). Some areas requiring replanting with assisted natural regeneration, works to be identified in Community Plan.
- **High Intensity Works**: Disturbed and extensively weed infested areas. Significant weed removal, assisted regeneration and replanting. Long-term commitment to weeding / regeneration programs required. Enrichment of fauna habitat recources required. Detailed works and funding program needed to establish procedures / costings / timing etc as identified in Community Plan.
- Private Conservation Land
- Area to be Dedicated to Council

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Figure 2 (a)

Weed Removal and Riparian Bushland Regeneration Works

Kings Avenue, Terrigal

Source Aerial © Department of Lands (2010)

WEED MANAGEMENT TECHNIQUES
FOR USE IN AREAS OF VEGETATION RETENTION

Employing the Bradley Method for regeneration requires the removal of weeds in phases. Stages of weed removal can be broken into three components:

Primary Weeding
Primary weeding is the initial weeding. It is recommended that primary weeding should be carried out on the subject land to remove the majority of dominant weeds. This involves removal of weeds through herbicide use and hand removal. It is important to note primary weeding usually initiates new growth of both weeds and native species. Primary weeding of the site may take up to four weeks and it is recommended that this work either be carried out by a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Secondary or Follow-up Weeding
Secondary or follow-up weeding involves intensive weeding in areas that have already received primary work to remove weed regrowth or overlooked weeds. It is recommended that secondary weeding be conducted 3-6 months after primary weeding. Secondary weeding of the site may take up to two weeks and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Maintenance Weeding
After primary and secondary weeding and natural regeneration of the bushland, the area should be able to resist most weeds. However, weeds will re-establish on the site from birds, wind and water transporting seed and other propagules into the site. Maintenance weeding should be undertaken once or twice a year until such time as the resistance of the bushland to weeds increases, then only requiring hand-weeding every two to three years. Maintenance weeding of the site may take up to one week and should be carried out by either a licensed bushland regeneration company or by the owners under the direction of a qualified Bushland Regenerator.

Natural regeneration of the dominant native plant species is expected to occur over time provided ongoing management works are maintained.

Weed removal should be undertaken using small tools such as spades, mattocks, garden forks and saws to reduce soil disturbance and minimise damage to nearby plants. In addition to hand removal of weeds in some situations where weeds are abundant, such as for many of the grass species and when native plants will not be affected by spray drift, the use of Glyphosate herbicide is recommended in accordance with the manufacturers specifications. Herbicides should not be applied prior to rain occurring as this reduces the herbicides' effectiveness and increases the potential to enter creeks and drainage lines in runoff.

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques:

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Use of Herbicides

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used biodegradable

APPENDIX II

ESTIMATED COSTINGS

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