DRAFT
DEVELOPMENT CONTROL PLAN No.

PARKSIDE AT TERRIGAL

Adopted by Gosford City Council
X xxxx 2009

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1. Name of Plan

This Plan is called Development Control Plan No. XXX Parkside at Terrigal and applies to 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 Avenue, Terrigal.

This Plan consists of this document.

2. Local Environmental Plan

This Plan generally conforms to the provisions of Local Environmental Plan 2009 (LEP 2009).

3. Purpose of Plan

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

4 Operation of Plan

This Plan has been prepared in accordance with Section 72 of the Environmental Planning and Assessment Act, 1979, and accompanying Regulation. This Plan will come into effect upon gazettal of LEP 2009.

5. Application of Plan

Where a development application is lodged which relates to land to which this Plan applies, Council shall take the provisions of this Plan into consideration in determining that application.

Compliance with the provisions of this Plan does not necessarily imply that Council will consent to any application. Council must also take into consideration those matters listed under Section 79C of the Environmental Planning and Assessment Act, 1979 (as amended).

6. Objectives of the Development Control Plan

The objectives of this Development Control Plan are as follows;

a. Provide the opportunity fro 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.

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 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 site does not adversely impact on the surrounding road network and adequate on site car 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 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 of any Home Based Business Estate and other residents.

m. Ensure that the street network is safe and efficient.

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

o. Ensure that any buildings erected on site have due regard for site sensitive design issues.

7. General Subdivision Requirements

7.1 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 create a high quality safe environment for walking and cycling.

d. 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. Vehicular access to the site shall be provided in the locations indicated on the Accompanying Map.

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

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

b. A pathway/ trail is to be dedicated to Council as part of the Kincumba Mountain Reserve so that access into the Reserve is available from the site.

7.3 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, Eatern False Pipistrelle, Greater Broad-nosed Bat, Grey- headed Flying- fox, Little Bentwing- bat, Yellow- bellied Glider, Yellow- bellied Sheathtail- bat and Easern 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, within twenty four months of the site being rezoned.

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.

7.4 Rehabilitation of Riparian Areas

Objective

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

Requirement

a. The recommendations of the Riparian and Buffer Zone Management Plan prepared by the Conacher Environmental Group dated October 2008 must be adopted in any development proposed for the site (see *Appendix A*).

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.

7.5 Mitigation of Bush Fire Risk

Objective

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

Requirements

a. Asset protection zones (APZ) and other requirements specified in the publication “Planning for Bushfire Protection” 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 the Accommpanying Map must be provided for in any development application.

7.6 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 DCP 165 Water Cycle Management.

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. 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.

f. Augmentation of existing mains and pump stations, if required, shall be carried out by the developer and at the developers expense.

7.7 Building Design

Objectives

To identify principles for house design so that cut and fill of house sites is minimized.

Requirements

Dwellings shall be sited and designed with regard to the principles contained in *Appendix B* Design Criteria*..*

7.8 Geotechnical Hazards

Objectives

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

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 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*).

c. The provisions of DCP 122 Cut and Fill Restrictions shall be considered in the preparation of any development applications involving earthworks on the site.

7.9 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.

c. The requirements contained in DCP 115 Flood Liable Areas Building must be considered when preparing any development application over flood liable land.

8 Requirements for Home Based Business Estate

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

8.1 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 on site 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.

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.

8.2 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. 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.

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.

8.3 Traffic Impacts and Car Parking

Objective

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

Requirements

a. All Home Based Businesses 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.

b. The provisions of DCP 111 Car Parking must be considered in preparing any development application which provides car parking on site.

8.4 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.

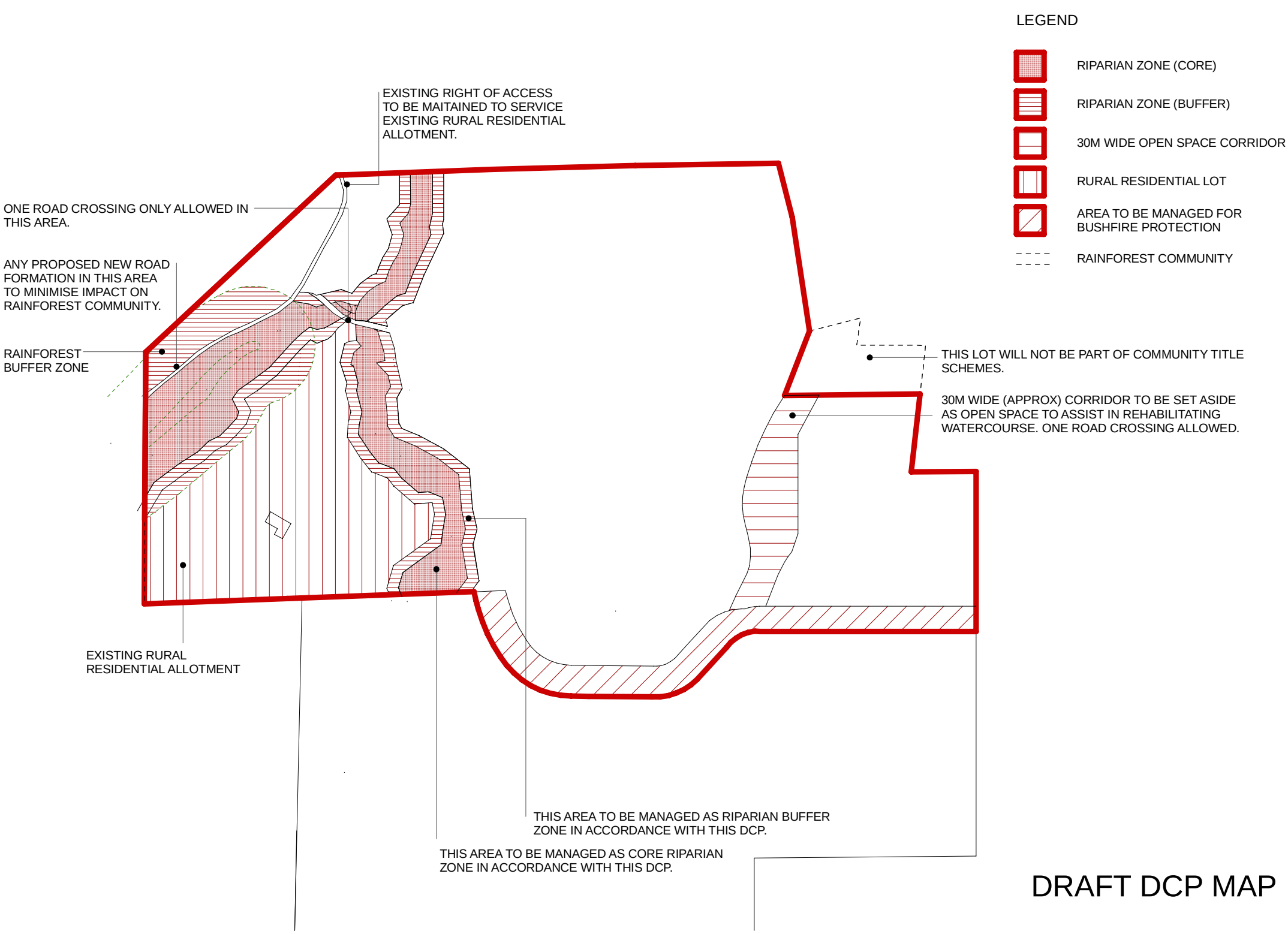
Requirements

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*.

b. The site must be generally developed in the manner shown on the accompanying plan as a Home Based Business Estate comprising approximately 145 residential allotments varying in area between 600 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.

c. The Community Management Statement must be drafted in accordance with the principles outlined in *Appendix D* “Development Standards”.

Accompanying Map



DRAFT DCP MAP

APPENDIX A

RIPARIAN AND BUFFER ZONE MANAGEMENT PLAN

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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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.

2. Landscape and Vegetation Management Policy (Gosford City Council)

The Gosford City Council's Landscape and Vegetation Management Policy has been adhered to in the preparation of this report.

3. Guidelines for Controlled Activities – Vegetation Management Plans

A controlled activity is an activity undertaken within the riparian zone of a water body. The NSW Department of Water and Energy (DWE) has issued guidelines for undertaking Vegetation Management Plans in relation to controlled activities. These guidelines outline the requirements and criteria to be considered within a Vegetation Management Plan. The DWE guidelines were considered and followed when compiling this Vegetation Management Plan.

4. Guidelines for Controlled Activities – Riparian Corridors

This guide produced by the NSW Department of Water and Energy (DWE) outlines the various components of a riparian corridor and defines the widths of Riparian corridors based on the stream size or 'order'.

5. Guidelines for Controlled Activities – Watercourse Crossings

This guide produced by the NSW Department of Water and Energy (DWE) outlines the various requirements and consideration for watercourse crossings of various designs. The proposed development incorporates two watercourse crossings which are expected to comply with these guidelines.

1.2 PROCEDURE FOR PREPARING VEGETATION MANAGEMENT PLAN

This Vegetation Management Plan has been prepared to address the following matters:

- Protection of retained native vegetation, habitat and other elements of biodiversity within the riparian zone, biodiversity buffer areas and private conservation lands;
- Management of the riparian zone vegetation and buffer zones and private conservation lands;
- Noxious and bushland weed control with follow up weeding and maintenance of bushland and riparian vegetation on site;
- Soil erosion and drainage issues that impact on vegetated areas;
- Site management during construction works including silt fencing and exclusion fencing around native vegetation habitats and natural features.

This VMP is the culmination of detailed site investigations, consultations with the client and incorporation of information as required by Council and state government departments.

The following procedures were implemented during the preparation of the VMP:

i) Initial project meeting with client to discuss project;

ii) Site Inspections to locate and identify any significant vegetation and to establish the current condition of the riparian and surrounding vegetation; and

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.

SECTION 2

VEGETATION MANAGEMENT STRATEGY

2.1 DETAILS ON PROTECTIVE MEASURES AND MANAGEMENT STRATEGIES FOR THE VEGETATION IDENTIFIED WITHIN THE SITE

It is considered that the remaining native vegetation within the subject site provides habitat for native flora and fauna species within the canopy, shrub and groundcover layers. The tree and shrub canopy is visible from nearby roads and forms part of a fragmented drainage line vegetation community.

The subject site has been subjected to past as well as more recent placement of fill material. The whole of the subject site also suffers a high level of weed invasion especially within the riparian zone.

Protective measures recommended within the subject site are:

- A Core Riparian Zone (CRZ) be established based on the order of the watercourse. The watercourse on-site is a First Order watercourse and therefore requires a 10 metre wide CRZ. The actual CRZ proposed is wider than this;
- A Vegetated Buffer (VB) of 10 metres width be established on both sides of the CRZ;
- The establishment of Vegetation Protection Zones which shall include all of the Riparian Zone (CRZ) and Buffer Area (VB) as shown on Figure 1;
- Removal of weeds and invasive species from the Riparian Zone and Buffer Areas;
- Replanting of selected indigenous plant species within riparian buffer zone;
- Natural regeneration of the native vegetation within the Riparian Zone;
- Continued monitoring and maintenance of the condition of the vegetation within the Riparian Zone and Buffer Area;
- Installation of access controlling structures (bollards, fences, retaining walls etc) at strategic locations to prevent unauthorised access and disturbance by vehicles;
- Construction of all watercourse crossings, culverts and creek bank stabilisation works to comply with the DWE guidelines;
- Replanting of vegetation on the road batter adjacent to Kings Avenue to consolidate vegetation connectivity to other offsite areas of creekline vegetation;
- Natural regeneration, weed management and assisted revegetation by replanting native plant species within existing cleared areas identified within the 7(a) conservation zone on private lands.

2.2 DETAILED PROPOSED WEEDING ACTIVITIES TO BE CARRIED OUT WITHIN RETAINED VEGETATION OF THE SITE

The objectives of management actions are to manage natural vegetation and rehabilitate the disturbed vegetation within this site. This will primarily involve the removal of weed infestations, replanting of suitable native species and the ongoing maintenance of disturbed areas. There are currently a number of bush regeneration techniques used in bushland management for the removal of weeds. These include (Buchanan, 1989):

- 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		

Other invasive weed species may occur after the initial weeding phase. These species should be removed during the maintenance period for this plan.

The extent of weed infestations present and intensity of weed control/removal works required vary throughout the riparian areas. Figure 2 identifies the extent of areas within the site requiring high, medium and low intensity weed removal and regeneration works.

The initial stages of the weeding phase of this plan are estimated to take approximately four weeks, while the ongoing maintenance period for the restoration process should continue for at least two years in order to be effective.

Monitoring of the progress of weed removal, plant growth and natural regeneration should be undertaken on a minimum of a yearly basis with progress reports, including photographs, prepared and forwarded to Gosford City Council and the Department of Energy and Water.

2.3 DETAILED PROPOSED REGENERATION AND REPLANTING ACTIVITIES TO BE CARRIED OUT WITHIN RIPARIAN AND BUFFER ZONE AND PRIVATE CONSERVATON LAND

The native vegetation within the site subject to this Riparian and Buffer Zone Vegetation Management Plan is generally restricted to the Riparian Zone and the 10 metre wide Buffer Zone between the Riparian Zone and future development. It is expected that removal of the weed species in these areas in accordance with Section 2.2 will allow natural regeneration of the locally endemic native species. Additionally where supplemental planting is required the species identified in Table 2.2 should be considered for replacement planting. Revegetation will ensure bed and bank stability along the subject watercourse and increased biodiversity for cleared land on the upper-slopes of the site.

While a mixture of species have been recommended it would be appropriate that these be planted in groups of at least 10 plants of the same species at appropriate spacing for each species. This will achieve a clumping effect for planted species.

Additionally it is anticipated that natural recruitment of the tree, shrub and groundcover layers will occur within the buffer adjacent to retained native riparian vegetation.

Replanting stock is to be grown from cuttings and seeds of plants growing on the site. Exotic species are not to be used for replanting or rehabilitation works. These plants are then to be planted into suitably prepared areas within the buffer zone. The combination of planting species has been selected to provide a continuation of the moist forest/vegetation with mesic elements characteristic of the riparian vegetation.

This mesic / riparian type vegetation also has a lower bushfire risk to nearby developments than the drier open forests dominated by large eucalypts.

Planting rates for areas to be replanted within the buffer zone will vary according to the presence of existing vegetation. Planting rates greater than 12-18 plants per 100 square metres (for the tree, shrub and ground layers combined) are recommended to achieve the closed forest/rainforest type vegetation proposed.

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.

Following these monitoring inspections a report with accompanying photos (taken at repeatable locations) will be submitted to Council and Department of Water and Energy. Photo points will be located by GPS or shown on survey maps.

Maintenance is to be undertaken within the regenerating bushland every week for the first 12 months. Maintenance will include watering, replacement planting, weeding (herbicide or low impact weeding as required), re-erecting sediment fencing, mulching, removing rubbish and regular inspections and performance assessment.

All monitoring and maintenance post development is to be the responsibility of the Community Association.

2.5 SOIL EROSION AND DRAINAGE ISSUES

The objective of stormwater management is to ensure drainage from upstream and the nearby residential areas and associated infrastructure does not have a negative impact on vegetated areas, dwellings and surrounding waterways.

Erosion and sediment control measures are to be implemented to minimise adverse effects as a result of increased erosion and sediment loading. These include:

- Coordinated work practices aimed at minimising land disturbance;
- Implementation of appropriate erosion and sediment control measures;
- The minimisation of groundcover disturbance through the dedication of vegetation protection zones encompassing the Riparian Zone and the Buffer Area;
- 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;
- Construction of all watercourse crossings in accordance with the DWE guidelines.

The minimisation of soil erosion will be achieved through soil stabilisation measures, sediment fencing and water control techniques. Soil stabilisation measures to be implemented include, immediate revegetation of cleared surfaces via seeding, planting of native species, mulching and the installation of biodegradable blankets.

2.6 SITE MANAGEMENT DURING CONSTRUCTION

Inspections of the site by the supervising consultant should be undertaken prior to and during the construction operations to ensure that vegetated areas designated for retention and exclusion zones are adequately marked and that other appropriate protection procedures are being maintained. Construction and landscape works are likely to alter the environment and soil properties surrounding the vegetation retained on site. Therefore, the following management strategies are proposed to minimise damage to native vegetation retained during the construction period.

Exclusion zones

The compaction of soil surrounding retained vegetation is detrimental to root growth by reducing water infiltration and soil oxygenation rates. A vegetation protection zone will be established containing the Riparian Zone and the Buffer Area in accordance with the vegetation protection guidelines (Section 2.7) using post and wire fencing or suitable high visibility marking tape or orange plastic net fencing. This will reduce the effects of soil

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;

x. Post-construction access control can be achieved using bollards, fences or retaining walls to limit pedestrian access and to control unauthorised vehicular access.

2.8 BUSHFIRE PROTECTION MEASURES

The replanted areas within the riparian buffer zone are not proposed to be managed as a bushfire asset protection zone. The required 10 metre wide asset protection zones are to be located outside of this riparian buffer zone and will include areas incorporated into road reserves, stormwater controls, nutrient control grassed swales and building line setbacks. Rainforest type species have been selected for replanting within the riparian buffer zone areas as these species create a lower bushfire risk to future residential developments than eucalypt species.

The bushfire protection measures to be utilised for future residential development will be specified in the Bushfire Assessment Report prepared in accordance with Planning for Bushfire Protection (RFS, 2006).

2.9 OPERATION OF THE COMMUNITY ASSOCIATION

The site is proposed to be developed as a Community Title subdivision under the NSW Community Land Development Act. Accordingly all open space throughout the site, inclusive of the Riparian Corridors will be designated 'Common Property' (Lot 1).

In accordance with the Act, the Community Association has the power to levy each owner within the Community Scheme, a regular (usually quarterly) fee to manage the Community Association Property (Lot 1 Land) in accordance with the management plans which are registered with the Community Management Statement.

Additionally the Community Association also has the power to levy a fee (if identified from the start of the scheme) to manage any other land within the Community Scheme to which it directs within its management plans as "Special Facilities".

In this instance the Riparian Corridors within the site will form (Lot 1) within the scheme, whilst the private conservation areas will be managed by the community scheme.

As such, the Community Association will (by contract with an external contractor) carry out the actions contained within the vegetation management plan which relate to the Riparian Corridor, both on the site and upon the adjacent site, at it's own expense. The funding for this scheme will be raised in advance by levying the owners within the subdivision a regular budgeted fee. This arrangement will exist in perpetuity upon the formation of the Community Scheme.

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

TABLE 3.1 PROPOSED WORKS PROGRAM		
Action	**Responsibility**	**Funded By**
Post-construction		
• Plant new landscape trees recognised within landscape plan.	- Contractor engaged by Community Association	Community Association
• Remove vegetation protection fencing and signs.	- Contractor engaged by Community Association	Community Association
• Continuation of weeding / regeneration within retained vegetation.	- Contractor / suitably qualified Bushland Regenerator engaged by Community Association	Community Association
• Monitoring of retained vegetation *at 3, 6, 9, 12 months, and annually thereafter for 2 years* – conduct maintenance if required.	- Project Supervisor engaged by Community Association	Community Association
• A yearly report on the status of the bushland including photographs shall be sent to Council.	- Project Supervisor engaged by Community Association	Community Association

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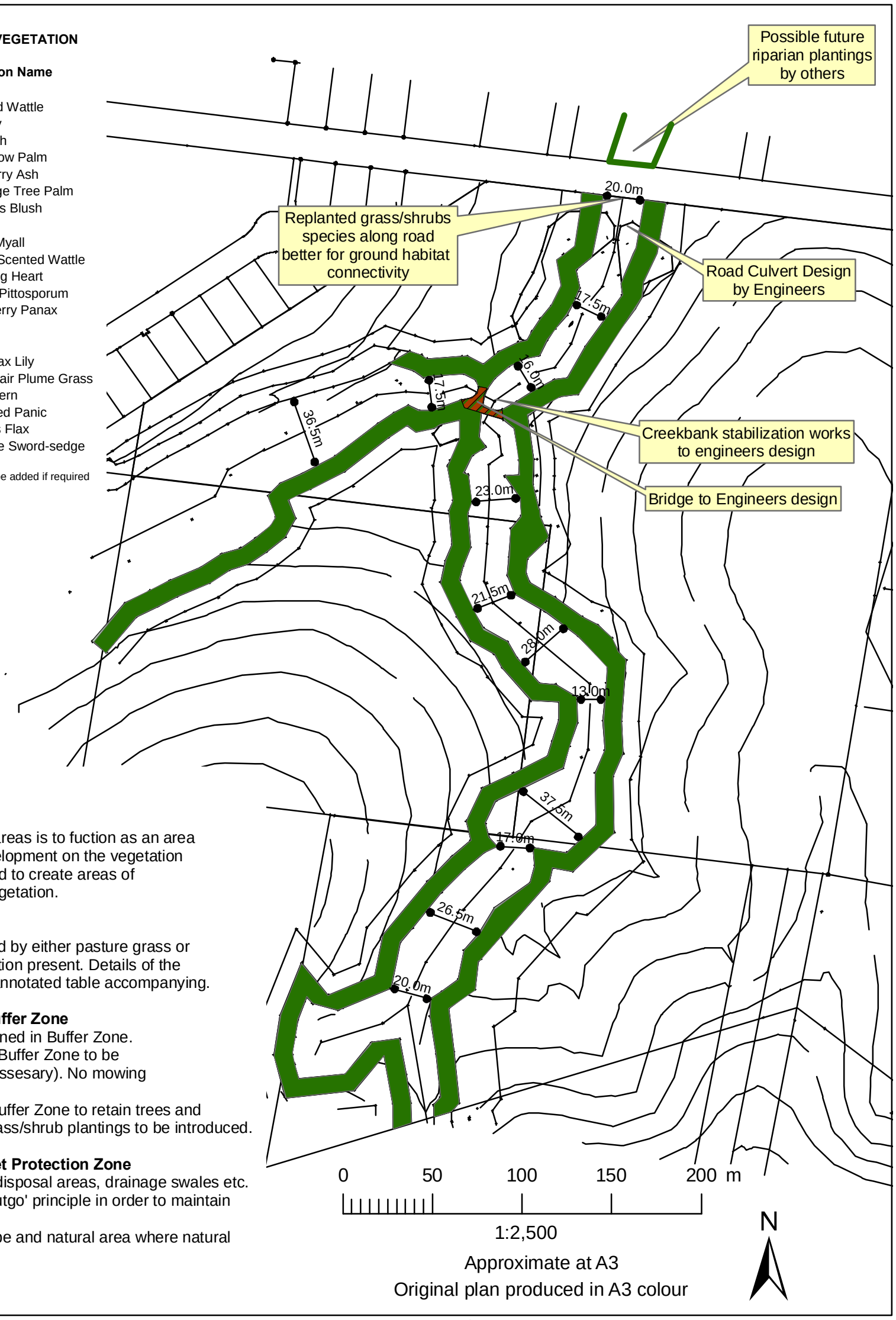
Wright, P. (1991) *Bush Regenerators Handbook*, The National Trust of Australia (NSW)

RECCOMMENDED SPECIES FOR RE-VEGETATION WITHIN BUFFER AREA

Scientific Name	Common Name
Trees	
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
Groundcovers	
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: Other native species present within the site can be added if required



10m Buffer Zone Works

Function

The 10m Buffer Zone to the riparian areas is to fuction as an area to buffer the impacts of adjacent development on the vegetation and habitats of the Riparian Zone, and to create areas of additional vegetation from existing vegetation.

Current Condition

The Buffer Zone is currently vegetated by either pasture grass or large trees with some riparian vegetation present. Details of the vegetation present are provided the annotated table accompanying.

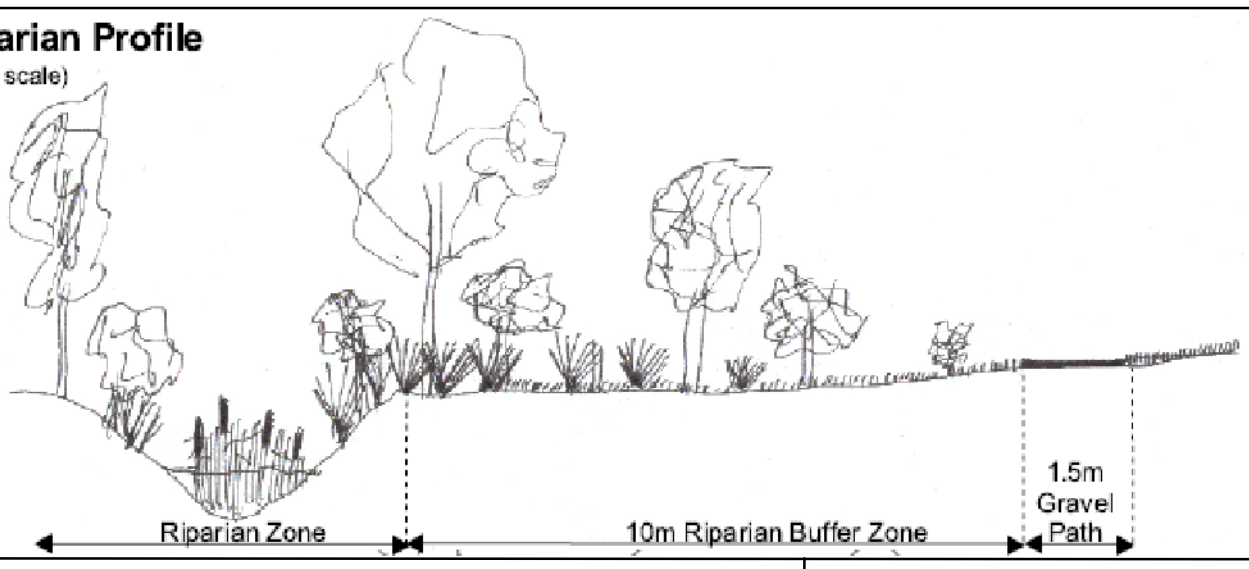
Works within the 10m Vegetation Buffer Zone

- Existing natural vegetation to be retained in Buffer Zone.
- Grassed areas within the Vegetation Buffer Zone to be regenerated and replanted (where nessesary). No mowing or slashing to be permitted.
- Existing vegetated areas within the Buffer Zone to retain trees and natural vegetation, supplementary grass/shrub plantings to be introduced.

Works within the 10m Bushfire Asset Protection Zone

- Nutrient control measures - grassed disposal areas, drainage swales etc. may be permitted only on an 'ingo' 'outgo' principle in order to maintain an APZ width of 10.0m.
  Supplementary plantings to Landscape and natural area where natural regeneration is ocurring.
- Weed removal to be undertaken.

Riparian Profile
(not to scale)



**Subject Site boundary subject to final survey*

Plan for indicative purposes only. Not for detailed measurement.
Map based on survey by Cahill.

Legend

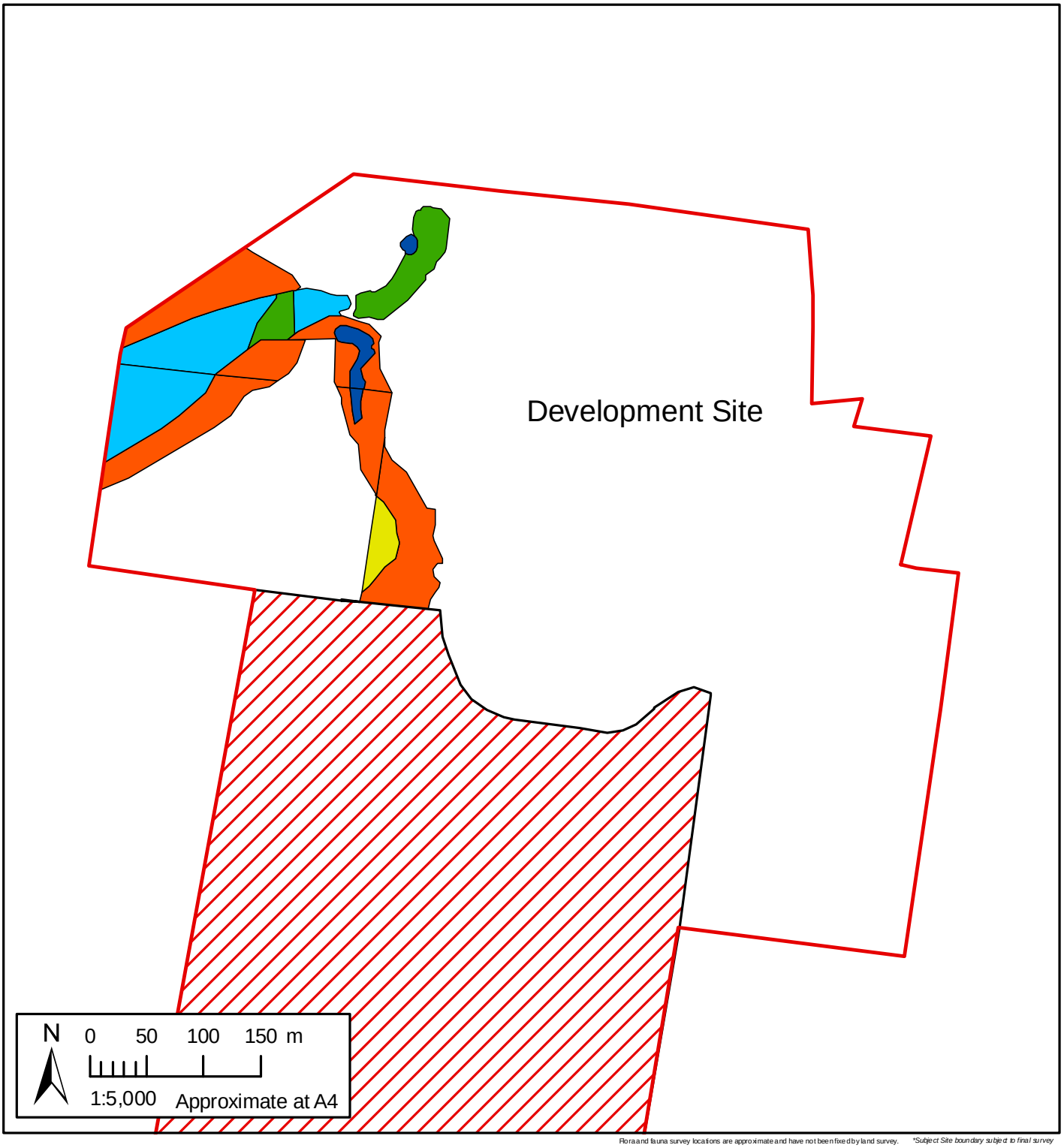
Riparian Buffer Zone (10M Wide)

conacher environmental group
ABN: 62 274 841 042
PO Box 4033
78 York Street
East Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

Figure 1 -
Buffer Zone Management Plan
Parkside, Terrigal

Ver.FX By. JM 13/05/10 Ref.No.CE24

Source: Aerial © Department of Lands (2007)



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

conacher environmental group
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PO Box 4300
78 York Street
East Gosford NSW 2250
Ph: (02) 4324 7888
Fax: (02) 4324 7899
cegconsult@bigpond.com

Figure 2 (a)

Weed Removal and Riparian Bushland Regeneration Works

Kings Avenue, Terrigal

ByJMDC
19/11/10
Ref No.10050

Source: Aerial © Department of Lands (2010)

APPENDIX I

WEED MANAGEMENT TECHNIQUES

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.

Woody Weeds Removal Techniques:

Cut and Paint (Woody weeds to 10 cm basal diameter)
- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:
- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants resprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection
- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping
- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:
- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

Small Hand-Pullable Plants Removal Techniques:

Hand Removal
- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:
- Leave weeds so roots are not in contact with the soil eg. hang in a tree, remove from site or leave on a rock.

Vines and Scramblers Removal Techniques:

Hand Removal
- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

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

herbicides by bush regenerators are those containing glyphosate (ZERO ®, Glyphosate 340 ® and Roundup ®).

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. Another advantage is that the dead weeds may provide some measure of soil stabilisation for a short period of time.

Herbicides should not be applied prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creeklines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

Buchanan (1989), recommends that the use of herbicides should be considered when:

1. there are small areas of dense weeds with few or no native plants to protect;
2. there are large areas of weeds;
3. the weeds are growing too rapidly for physical removal; and
4. the weeds are located in areas with a high potential for erosion if vegetation is removed.

The spraying of weeds must only be undertaken by experienced persons. The success of each treatment must be evaluated by the operator after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use due to the sensitivity of the wetlands and waterways into which runoff will eventually flow.

APPENDIX II

ESTIMATED COSTINGS

Works Required To Implement The Riparian and Buffer Zone Vegetation Management Plan (Pre-Construction Phase)

Task	Description	Effort / units required	Cost per unit	Total Cost (Estimate)
Pre-construction				
Provenance seed collection, storage and management	Collection of provenance seed for tubestock	4 days	$900 per day	$3,600
Site preparation & weed removal	Labour and herbicides for initial weed control (targeting noxious, woody & problem weeds)	6 days	$950 per day	$5,700
Protective Fencing	Supply & Install	1000LM	$10/LM	$10,000
Sub-total				$19,300.00
GST				$1,930.00
Total				**$21,230.00**

Works Required To Implement The Riparian and Buffer Zone Vegetation Management Plan (Construction Phase)

Task	Description	Effort/units required	Cost per unit	Total Cost (Estimate)
Construction				
Initial revegetation works – including the supply and installation of tree guards and native chip mulch and native indigenous tubestock.	Revegetation with Tree species	11,000m^2 @ 1 plant per 40m^2	$5.00 per tree/shrub installed	$1,375.00
	Revegetation with Sub-Canopy species	11,000m^2 @ 1 plant per 20m^2	$5.00 per tree/shrub installed	$2,750.00
	Revegetation with Shrub species	11,000m^2 @ 1 plant per 10m^2	$5.00 per tree/shrub installed	$5,500.00
	Revegetation with Grass species	3,000m^2 @ 3.5 plants per 1m^2	$2.50 per virocell installed	$7,500.00
	Hydro-mulching	3,000m^2	$1.50 per m^2	$4,500.00
Sub-total				$21,625.00
GST				$2,162.00
Total				**$23,787.00**

APPENDIX B

DESIGN CRITERIA

Parkside@Terrigal

DCP 122 - "CUT AND FILL RESTRICTIONS" Compliance

December 2008 – V1

Prepared by
Crighton Properties in conjunction with Peter Andrews and Associates.

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.

1. House design requirements

The LES provides details to the effect that development upon the site would be carried out in the form of a Community Title development. As part of this structure, Architectural and Landscape Design Guidelines will be drafted and enforced by the Community Association. These guidelines provide an effective mechanism for enforcing appropriate design, via a series of requirements which would be in addition to Councils own general requirements for development.

Architectural and landscape controls will be contained within the "Architectural and Landscape Guidelines", which will be annexed to the Community Management Statement. The guidelines will set out specific provisions relating to appropriate house design and the built environment over and above those required by Council.

The Architectural and Landscape Guidelines are implemented by the Design Review Committee (DRC), which is a sub-committee of the Executive Committee of the Community Association. The Guidelines require all plans for development work to be submitted to the DRC for approval, before being submitted to Council, and again before work commences on site. No building can be built upon the site that has not been approved (stamped and written approval issued) by the DRC.

An example of appropriate principles of house design are detailed in the attached drawings SK01 and SK02. These drawings set out in both pictorial and written form, a number principles based on the use of a variety of house structures, including split level and a combination of slab on ground and suspended floor structures. 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 'civil works solutions' – on sites of moderate or greater slope.

A number of options exist with respect to implementation strategies of the above principles, which would be built into the Community Management Statement for perpetuity;

1. Individual DA's to be lodged by land purchasers and considered for compliance with Community requirements by the Design Review Committee (DRC) prior to submission to Council
2. A range of pre-approved (by the DRC) designs could be offered on a house and land package basis.
3. Finished dwellings, either by the developer or in a joint venture arrangement with a particular building company could be offered to the Market.

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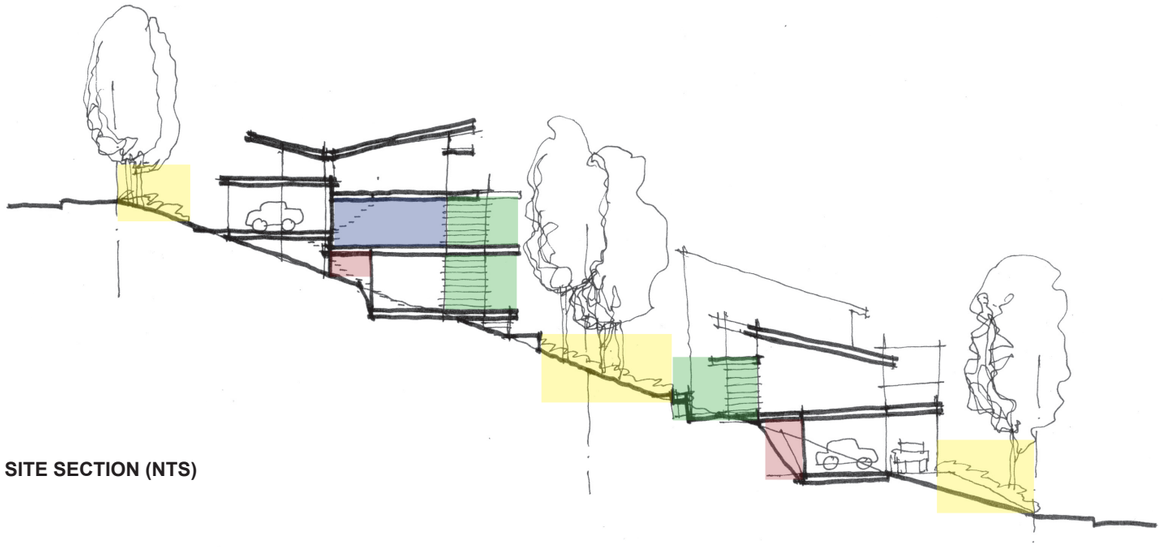
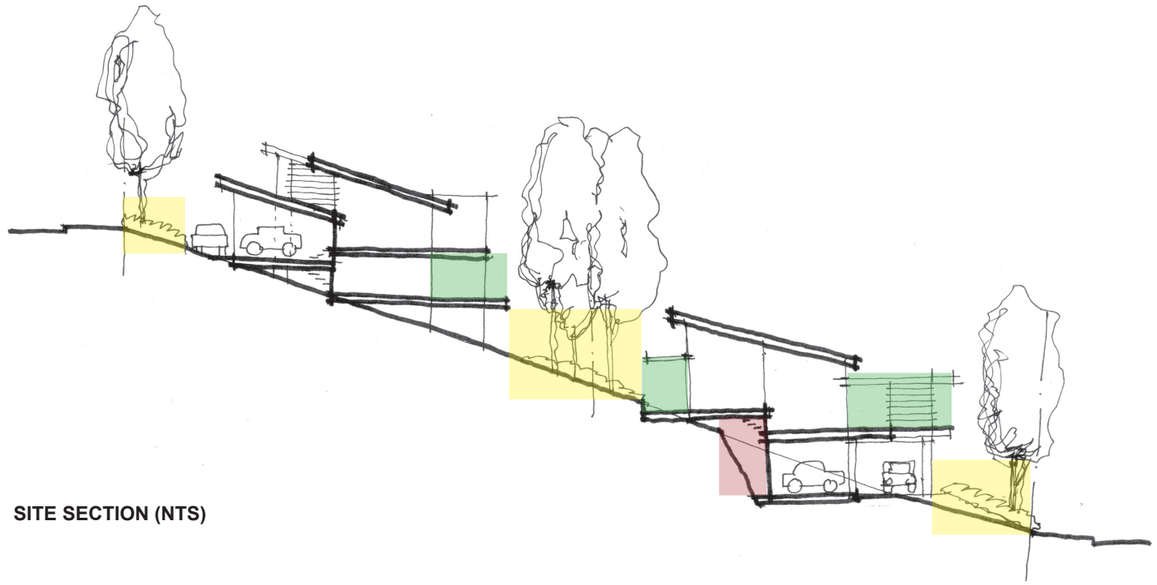
Parkside@Terrigal
COMMUNITY TITLE HOME BASED BUSINESS PARK
for Crighton Properties Pty Ltd

SK01
16 DECEMBER 2008
REVISION D

option A - house design requirements



SITE SECTION (NTS)



SITE SECTION (NTS)

REQUIREMENTS FOR HOUSE DESIGN

4. **CUT AND FILL - CONTINUED**
   - WHERE CUT AND FILL EXCEEDING 1 METRE IS REQUIRED, THESE SHOULD GENERALLY BE RESTRICTED TO UNDERFLOOR AREAS
   - WHERE CUT AND FILL EXCEEDING 1 METRE IS REQUIRED IN AREAS OTHER THAN UNDERFLOOR AREAS, APPROPRIATE DESIGN SOLUTIONS MUST BE ADOPTED TO ENSURE VISUAL AMENITY IS PRESERVED AND STRUCTURAL INTEGRITY OF BUILDINGS AND SITE WORKS IS MAINTAINED, EG THE USE OF APPROPRIATE RETAINING STRUCTURES, LANDSCAPE TREATMENT, AND CONTROLLING SURFACE RUN OFF AND EROSION

5. **HOME OFFICE -**
   LOCATED WITH STREET FRONTAGE, TO ENSURE OPTIMAL VISIBILITY AND ACCESS

   WHEN USED:
   - PREFERRED AREA AT FRONT OF DWELLING OR ADJACENT TO PRIMARY DWELLING ENTRY
   - LOCATED WITHIN EASY PROXIMITY TO VISITOR CARPARKING

6. **CARPARKING -**
   RESIDENT / OWNER OCCUPIER CARPARKING ZONE LOCATED TO REDUCE VISUAL IMPACT AND BUILDING FOOTPRINT

   WHEN USED:
   - CARPARKING ZONE LOCATED IN EITHER UNDERCROFT OR INCORPORATED AS BELOW DECK AREA
   - VISITOR CARPARKING LOCATED TO ALLOW CONVENIENT ACCESS TO HOME OFFICE

7. **PRIVATE OPEN SPACE -**
   LOCATED TO REDUCE VISUAL IMPACT AND BUILDING FOOTPRINT, AND TO MAINTAIN PRIVACY AND MINIMISE VISUAL IMPACT

   WHEN USED:
   - LOCATED AS DECKS OR EXCAVATED PRIVATE COURTS WITH APPROPRIATE RETAINING WALLS AND LANDSCAPING

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for Crighton Properties Pty Ltd

SK02
16 DECEMBER 2008
REVISION D

2. Civil works Solutions

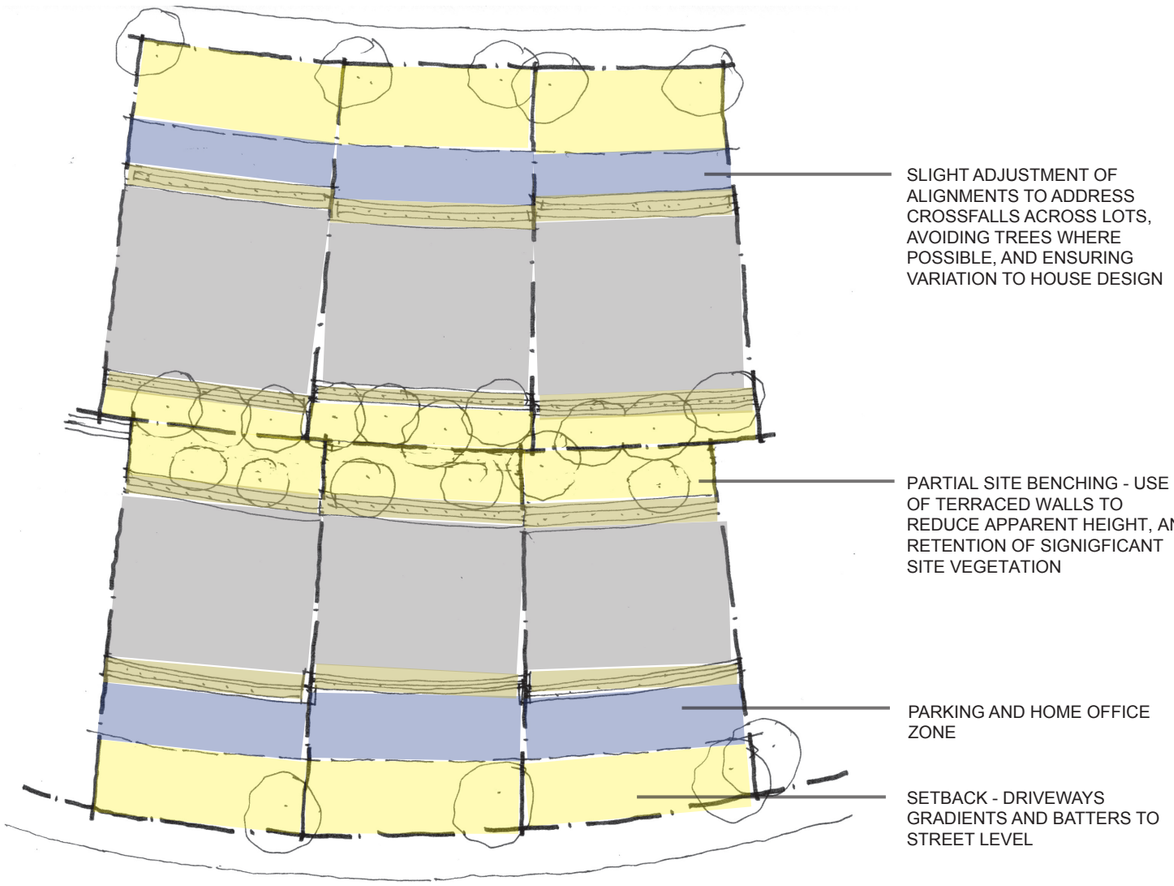
In addition to / instead of house design requirements, a variety of Civil works solutions would be suited to assisting home builders of regular house types to comply with the requirements of DCP 122. These suggested Civil Works Solutions, would be carried out at the time of subdivision construction by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

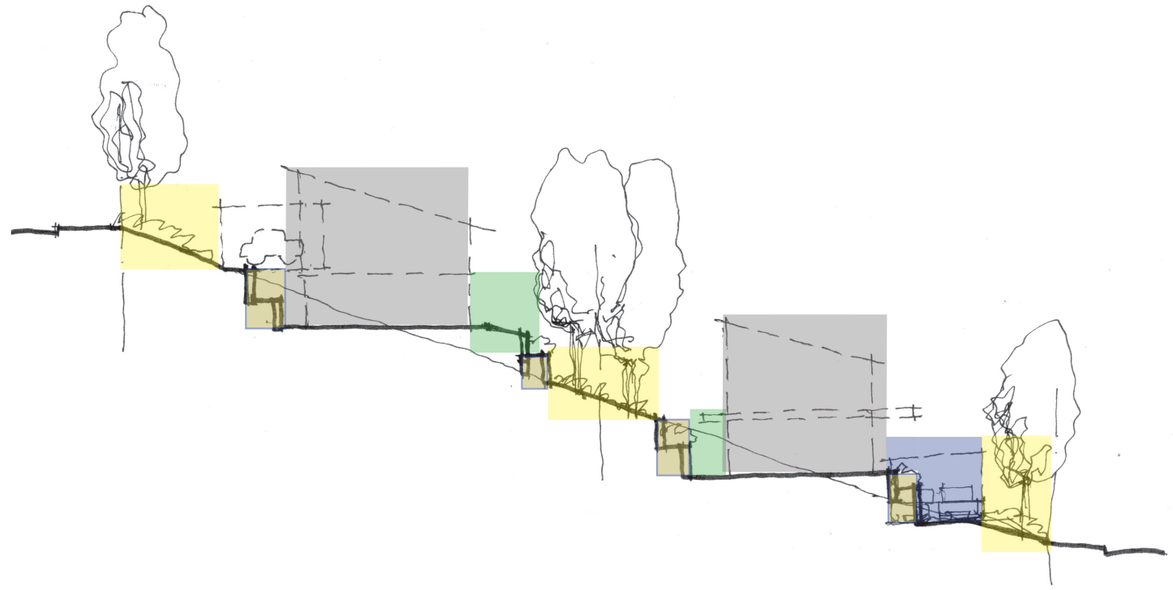
Two such alternatives are detailed within drawings SK03 and SK04, which show two different approaches – there are bound to be many other solutions. If implemented these measures would help to ensure compliance with DCP 122 in the following fashion;

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



SITE PLAN (NTS)



SITE SECTION (NTS)

MEASURES TO BE IMPLEMENTED

OPTION 1

RETAINING STRUCTURES -
TO BE INSTALLED AS PART OF SITE WORKS PROGRAMME, TO ESTABLISH SITE LEVELS PRIOR TO INDIVIDUAL DWELLING SITE WORKS.

WHERE USED:
- MASONRY RETAINING WALLS TO FRONT BOUNDARY

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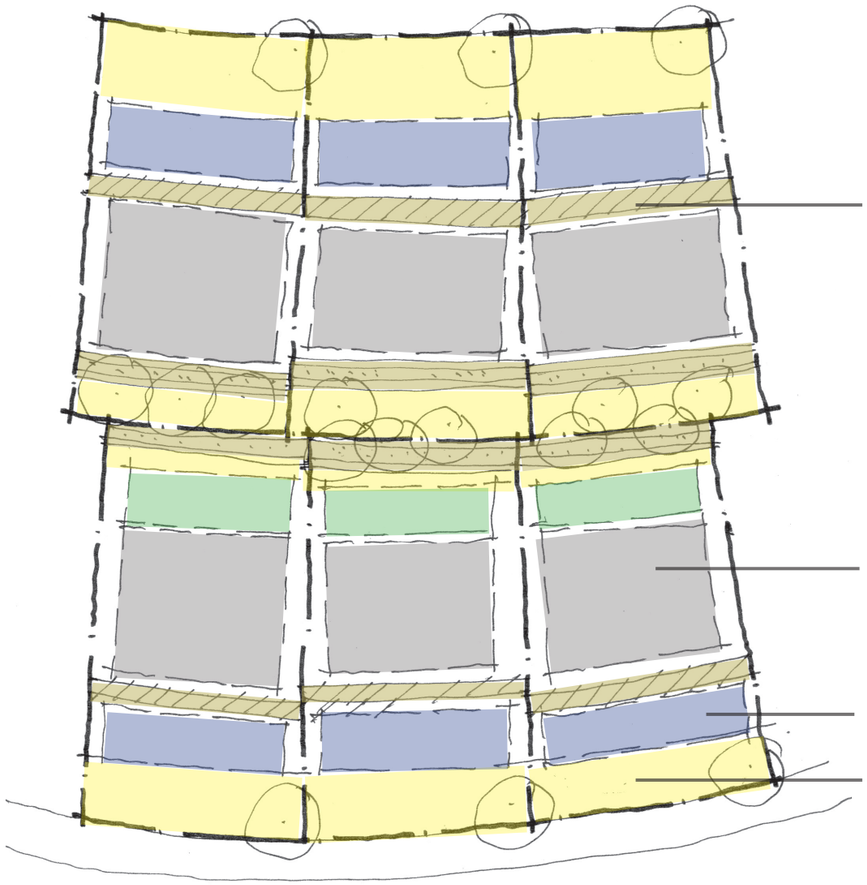
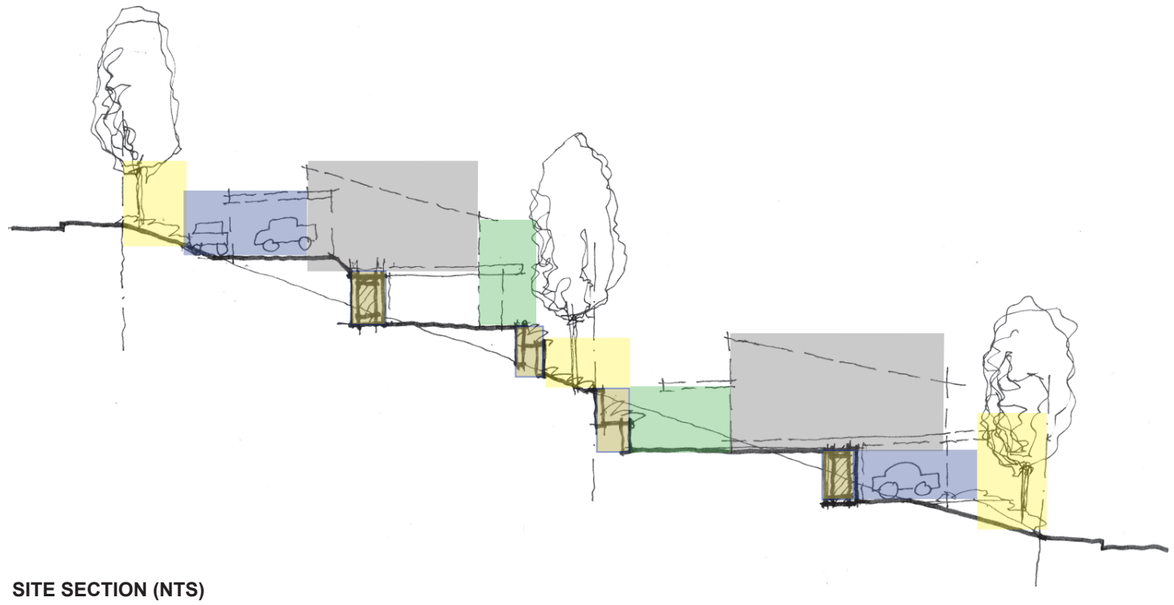
option B - civil works solution



SITE PLAN (NTS)



SITE SECTION (NTS)

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

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REVISION D

3. Conclusion

It is clear from this analysis that a holistic approach to dealing with house design and civil works design upon the Parkside at Terrigal site would result in the ability to comply with the objectives of DCP 122 for Residential development upon the site.

Community Title presents a unique opportunity upon this site for not only enforcing strict design requirements, but also providing an effective ownership and ongoing maintenance mechanism for commonly held assets – in this case, civil works infrastructure such as retaining walls and drainage devices.

Whilst no physical works are proposed as part of the LES, it is clear that a number of opportunities exist, which could be detailed further at the Development Application stage with respect to responsible hillside construction techniques. These opportunities are available at both the subdivision and individual house level.

APPENDIX C

GEOTECHNICAL REPORT

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

PROPOSED SUBDIVISION AT KINGS AVE TERRIGAL

Prepared For

Crighton Properties Pty Ltd

GEOTKARI02083AA-AC
13 February 2008

URBAN CAPABILITY ASSESSMENT WITH RESPECT TO SLOPE RISK

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
Unit 17, Mount Penang Parklands Carinya Road Somersby
NSW 2250 Australia

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:

Ben Seaford

Engineering Geologist

Authorised Signatory:

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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CONTENTS

1 INTRODUCTION

This report presents the results of a geotechnical assessment carried out by Coffey Geotechnics Pty Ltd (Coffey) for Crighton Properties Pty Ltd (Crighton) at the site of a proposed subdivision off Kings Avenue at Terrigal. The investigation was carried out in response to Gosford City Council (GCC) letter reference 3744897, forwarded to Coffey by Crighton.

The purpose of the work was to assess the suitability of the site for proposed residential subdivision with respect to risk of slope instability. This report provides an assessment of the risk of slope instability at the site in its existing condition and the risks associated with subdivision development. Recommendations for individual lot development are beyond the scope of this assessment.

The brief required specifications needed for the local environmental study for the rezoning application. The specifications pertaining to geotechnical issues were contained in Paragraph 3(a) and requested that the report contains assessment of:

- Description and analysis of the slopes, soils and topographical features of the site and its immediate surrounds with particular reference to GCC DCP 163 'Geotechnical Requirements for Development Applications';
- Identification of slopes, soils and topographical features which might impose constraints to future development or require specialised engineering approaches to address site constraints; and
- Location of land displaying slopes in excess of 20%.

Other geotechnical considerations, such as footing requirements, settlement, pavement design, bearing capacity, soil chemistry, soil and groundwater contamination, and the effects of mine subsidence, are beyond the scope of this assessment. These matters will be addressed at a future design stage.

2 PREVIOUS INVESTIGATIONS

In 1992 and 1993 Coffey conducted slope instability risk assessments on different parts of the site (Ref: GO540/1-AB and GO652/1-AB). A total of twenty five test pits were excavated to depths up to 3.3m. Subsurface conditions on slopes generally comprised shallow topsoil and slopewash overlying residual clays and weathered rock. Valley floors were generally underlain by relatively deep alluvium.

Slopes observed were generally between 5° to 18° with locally steeper slopes (up to 35°) in gully flanks. Minor slumping and erosion was observed on some of the gully flanks. Each respective area was assessed as having a “moderate” risk of overall slope instability based on the classification system that Coffey Geoscieces adopted at the time (based on system published in Australian Geomechanics News, Number 10, 1985).

Copies of the previous reports by Coffey have been included in Appendix C.

3 PROPOSED DEVELOPMENT

The entire site is about 50ha. It is understood that the proposed subdivision involves the construction of 146 residential lots with some allotments set aside for community space and future development. Plans of the proposed development by Geolyse (Ref: 403089 Sheets D01 to D13) were provided.

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.

The three spurs are located in the western, central and eastern portions of the site. The eastern and western spurs extend only partway across the site with the central spur intersecting the entire length of site. The crest of the central spur has been cleared for power lines. Two broad valleys occupy the areas between the spurs.

The vegetation comprises paddocks cleared of trees, light woodland areas cleared of undergrowth with grass cover and localised scrub areas. Woodland areas comprise mature native trees with the area further to the south, beyond the property boundary, being moderately vegetated by mature native species. Tree trunks are generally vertical. Some lantana and blackberry scrub occur at scattered locations around the site. Site drainage (runoff and infiltration) was judged to be good. No evidence of seepage (spring activity) was observed, except locally near the eastern boundary, however this appears to be related to runoff from adjacent development.

6.3 Terrain Elements

Based on the site surface features and inferred subsurface profiles from the test pits, the site has been split up into three Land Areas. The inferred Land Areas are shown on Figure 2.

6.3.1 Land Area 1 (LA1)

LA1 comprises the valley floors and flatter footslopes located in the central eastern and central western portions of the site. The valleys are grassed paddocks. Two dams are located in the centre of the eastern valley. The valley floors are generally flat but minor slopes of about 10° were recorded where the flanks of the surrounding spurs intersect with valley floor.

Table 1 presents the inferred geotechnical model for LA1, based on test pits TP13 and TP15 and test pits from the previous investigations referenced in Section 2.

TABLE 1 – INFERRED GEOTECHNICAL UNITS FOR LA1

Unit	Typical Properties
Alluvium/Colluvium	Silty SAND and Clayey SAND, fine to medium grained, low plasticity. Ranging from 1.5m thick to greater than 3.5m thick.
Residual Soil	Sandy CLAY, low to medium plasticity, stiff to very stiff consistency. Fine to medium grained sand.

In summary, test pits excavated in LA1 generally encountered deep soils comprising silty sand colluvial soil overlying low to medium plasticity sandy clays. It is likely that the soil depth in LA1 in the western portion of the site will encounter similar soil depths.

Groundwater inflows were not encountered in test pits excavated in LA1, in this episode of fieldwork but minor flows were encountered in the western valley in 1992.

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.

TABLE 3 – INFERRED GEOTECHNICAL UNITS FOR LA3

Unit	Typical Properties
Colluvium	Silty SAND/Clayey SAND, fine to medium grained, low plastic clay fines. Gravelly CLAY of low to medium plasticity in TP12 and TP16. Thickness range between 0.2m to 0.8m.
Residual Soil and Extremely Weathered Rock	SAND, Clayey SAND, CLAY/Silty CLAY, medium to high plasticity, grey-orange-red, generally very stiff to hard consistency, fine to medium grained sand, some fine to medium gravel. Grades into extremely weathered sandstone. Thicknesses range between 0.5m and 1.1m.
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 between 0.9 to 1.6m depth.

6.4 Slopes Greater than 20%

GCC DCP 163 'Geotechnical Requirements for Development Applications' requires identification of land with slopes in excess of 20%. Geolyse Plan 403089 Sheet D03 shows slopes on site that exceed 20%. This plan is included as Figure 3. The land is part of LA2.

7 LABORATORY TESTING

Three undisturbed (U50 tube) samples of clay were assessed for shrink / swell potential (AS1289 7.1.1). The results of shrink / swell index (I_{ss}) testing are included in Appendix B and summarised in Table 4.

TABLE 4 – SUMMARY OF SHRINK / SWELL INDEX (I_{SS}) TEST RESULTS

Location	Depth (m)	I_{ss} (%)
TP4	0.8 – 1.1	1.3
TP8	0.9 – 1.2	2.0
TP12	0.7 – 1.0	2.0

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

In accordance with GCC requirements the geotechnical assessment is summarised in Table 5.

TABLE 5 – SUMMARY OF GEOTECHNICAL ASSESSMENT

Site Data	LA1	LA2	LA3
Location	Valley floors	Spur flanks	Spur crest
Likely Site Classification (AS 2870)	Class P Potential soft soils	Class P Potential slope risk	Class S or M Depending on soil depth
Land Slope	Flat to ~ 15°	12° to 28°	Up to 8°
Underlying Bedrock	Rnt (Terrigal Formation)		
Soils	Deep Silty SAND colluvial and residual CLAY soils	Shallow Silty SAND colluvial and residual CLAY soils	
Type of Stability Risk	Deposition from slumps in LA2	Slumping of colluvium Slips from excessive cutting and filling	Slips from excessive cutting and filling
Risk Assessment (Note 1)	Low	Medium	Low
Drainage	Judged to be good, occurring by runoff and infiltration	Judged to be good, occurring by predominately by runoff with some infiltration	Judged to be good, occurring by some runoff and infiltration
Risk from Adjacent Land	Medium	Low	Low
Geotechnical Inspections Required During Construction	Yes		

Note 1: Using the terminology defined in Attachment 1 'Classification of Risk of Slope Instability'

8.5 Geotechnical Risk Management for Subdivision Development

The proposed subdivision is considered feasible from a slope risk viewpoint. However, subdivision development on the site may increase the risk of instability. Nevertheless, Coffey consider that after subdivision development the risk of slope instability should not exceed the risks assessed in Table 5 above provided that development is carried out in accordance with good hillside practice (as set out in Attachments 2 and 3) and the geotechnical recommendations below.

The following recommendations are specific to the proposed subdivision development shown on the drawing by Geolyse Ref: 403089 Sht D01-D13 supplied. Theses plans show the proposed road alignments and lot layout. Long sections and selected cross sections are provided, but road chainages are not indicated on the plans provided so it is difficult to determine the proposed location of the specific cuts or fills.

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

monitoring as described in AS 3798. Fill batters should be constructed by overfilling and then cutting back to the required slope.

8.5.3 Building platforms

Cutting and filling for building platforms for houses should be limited to a maximum depth of 1m unless site specific investigation and geotechnical assessment is conducted. The cut and fill batters should be battered at 1V:2H or flatter and protected against erosion, or supported by properly designed and constructed retaining walls as described below.

8.5.4 Retaining Walls

Retaining walls in excess of 1m height should be designed by a structural engineer familiar with the site conditions and should be designed for surcharge loading from slopes and structures and other existing or future improvements in the vicinity of the wall.

Excavations for the construction of retaining walls up to 1.5m high may adopt a temporary excavation batter of 1V:1H provided that appropriate construction planning, control of drainage and staged excavation minimises the extent of unsupported excavation. Excavations in excess of 1.5m high will require specific assessment as outlined in Section 8.5.1.

Adequate subsurface and surface drainage should be provided behind all retaining walls unless they are designed to resist hydrostatic pressures. Any subsoil drainage used on site behind retaining walls should at a minimum consist of filter sock-wrapped slotted pipe surrounded in free-draining, coarse granular backfill and should be provided around the perimeter of all excavations. Subsoil drains should be fitted with flushing and clean out points. Gradient along all drains should be sufficient to promote self-cleaning.

8.5.5 Drainage and Sewage Disposal:

Guidelines for surface and subsurface drainage are provided in the attachments to this report.

There should be no disposal of stormwater or liquid wastes on site, without further specific geotechnical assessment.

9 OTHER GEOTECHNICAL CONSIDERATIONS

9.1 Reactive Soils

The results of the shrink/swell testing indicate that the clay material encountered onsite is generally of low to moderately reactivity. It is considered that clay from cuts on site can be used as general fill. It is recommended that any material won from cuts on the site be inspected by a geotechnical authority prior to placement.

9.2 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are soils containing significant concentrations of pyrite, which when it oxidises, generates sulfuric acid. Unoxidised pyritic soils are referred to as potential ASS (PASS). When the soils are exposed, the oxidation of pyrite occurs and sulfuric acids are generated, and the soils are said to be actual ASS (AASS).

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.

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SPECIALISTS MANAGING THE EARTH

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

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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

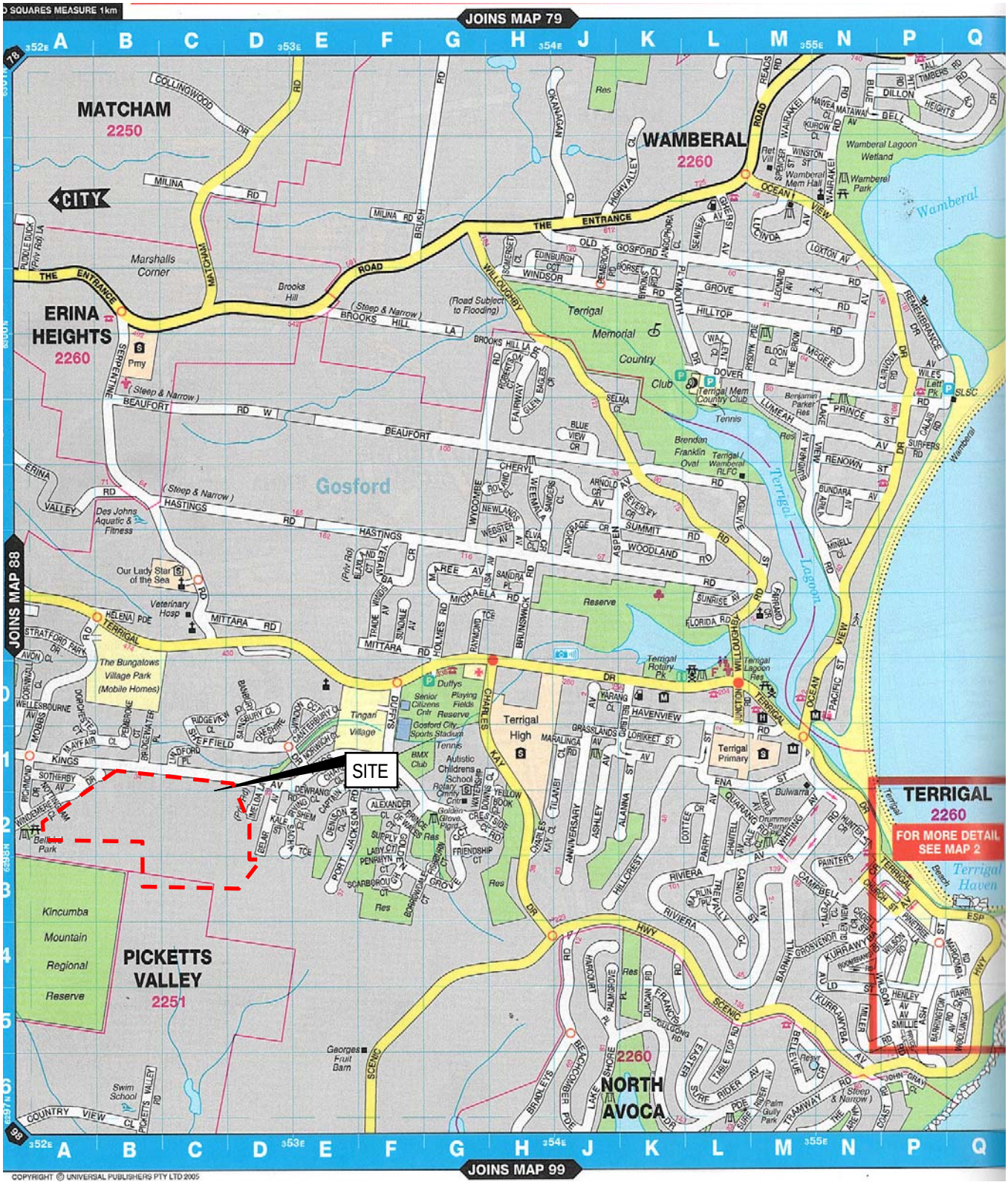
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As 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.

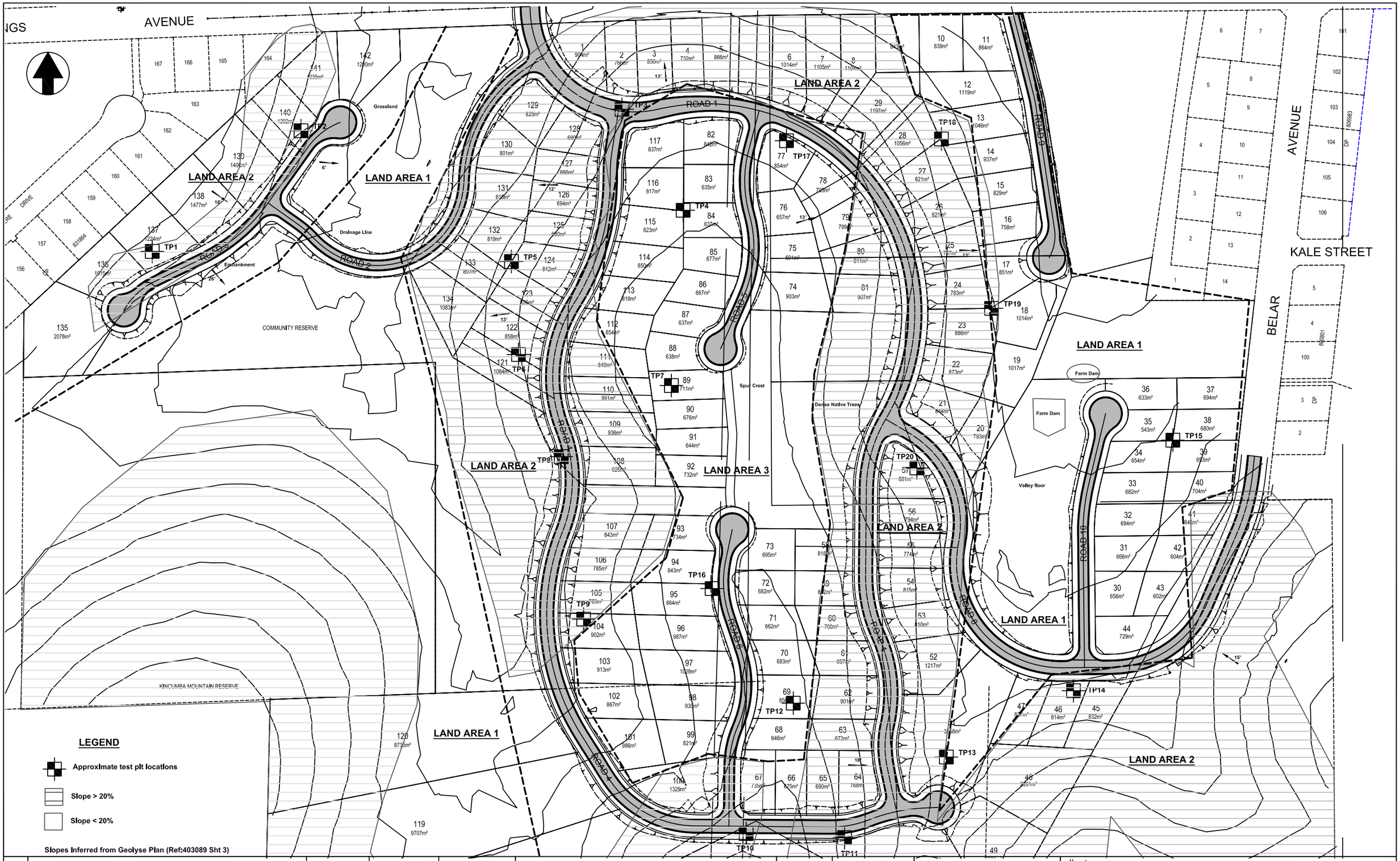
* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures



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**			



revision	description	drawn	approved	date

0 5 10 20 30
Horizontal Scale (metres)

0 5 10 20 30
Vertical Scale (metres)

drawn	BS
approved	RMT
date	30/11/07
scale	AS SHOWN
original size	A3

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SPECIALISTS MANAGING THE EARTH

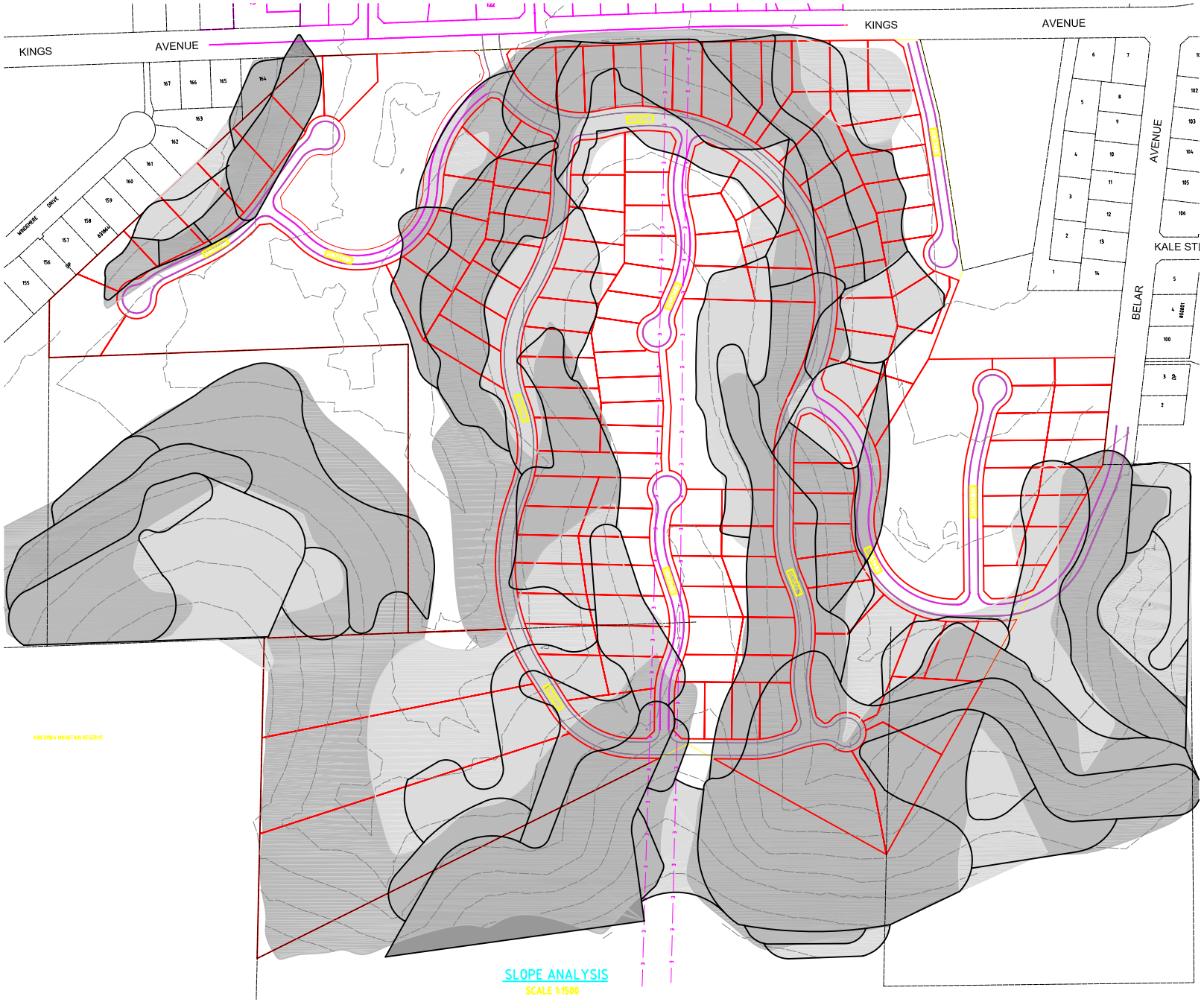
client: CRIGHTON PROPERTIES PTY LTD

project: PROPOSED SUBDIVISION
KINGS AVENUE, TERRIGAL
URBAN CAPABILITY ASSESSMENT

title: SITE PLAN AND INVESTIGATION LOCATIONS

project no: GEOTKARI02083AA

drawing no:/figure no: FIGURE 2



SLOPE ANALYSIS

SCALE 1:1500

APPROVAL

No	DATE	DRAFTING CHECK	DESIGN REVIEW	REV'D P.MGR	APP'D P.MGR	DETAILS
A	15/04/2004					ISSUED FOR INCLUSION IN SUBMISSION
B	23/06/2004					ISSUED FOR CLIENT APPROVAL
C	29/06/2004					REISSUE FOR CLIENT APPROVAL

CHECKED/APPROVED	NAME	SIGNATURE	DATE
SURVEY BASEPLAN	CAHILL & CAMERON	-	26/11/03
DRAFTING	JIM ARMSTRONG		29/06/04
DESIGNER	JIM ARMSTRONG		29/06/04

CP Logo & Tag.JPG

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

DRAWING: SLOPE ANALYSIS

PROJECT NUMBER:	403089	12D FILE:	DATUM: A.H.D.
DRAWING NUMBER:	403089_D03	AUTOCAD FILE:	ORIGINAL: A1 SIZE
STATUS:	APPROVAL	Sheet 03 of 13 Sheets	

Appendix A

Engineering Logs and Explanation Sheets

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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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Soil Description Explanation Sheet (2 of 2)

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)							USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.			GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing			SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.					
		SILTS & CLAYS Liquid limit less than 50	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**			
			None to Low	Quick to slow	None		ML	SILT
			Medium to High	None	Medium		CL	CLAY
			Low to medium	Slow to very slow	Low		OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium		MH	SILT
			High	None	High		CH	CLAY
			Medium to High	None	Low to medium		OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			Readily identified by colour, odour, spongy feel and frequently by fibrous texture.				Pt	PEAT

• Low plasticity – Liquid Limit W_L less than 35%. • Modium plasticity – W_L between 35% and 50%.

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.	

TERM	DEFINITION	DIAGRAM
SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	
TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

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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 penetro-meter kPa (100 200 300 400)	structure and additional observations
E		N	None Observed			0.5		SM	**Silty SAND:** Fine to medium grained, dark brown. Grading to	D			COLLUVIUM
						1.0		CH	**CLAY:** High plasticity, orange with some red mottling.	<<Wp	VSt/H	×	RESIDUAL High dry strength
						1.5			Red colour increasing at 1.5m			×	Sandstone floater at 1.1m in northern portion of the pit
									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

TESTPIT GEOTKARI02083AA.GPJ COFFEY.GDT 13.2.08

Form GEO 5.2 Issue 3 Rev.2

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Engineering Log - Excavation

Excavation No. **TP002**

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 penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None Observed			0.5		SM	**Silty SAND:** Fine to medium grained, pale brown. Fine to medium grained angular sandstone and iron gravel.	D			COLLUVIUM Moderate root system to 0.3m
						1.0		CH	**Sandy CLAY:** Medium to high plasticity, orange and red, fine grained sand. Extremely weathered sandstone gravel at base of test pit.	<Wp	VSt/H	× × × × × ×	RESIDUAL
						1.5			Test pit TP002 terminated at 1.5m				Refusal on interpreted highly weathered sandstone at 1.5m
						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

TESTPIT GEOTKARI02083AA.GPJ COFFEY.GDT 13.2.08

Form GEO 5.2 Issue 3 Rev.2

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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
E		N	None			0.0		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. **TP004**

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					SM	**Silty SAND:** Fine grained, dark brown.	M			COLLUVIUM Thick root system to 0.7m
						0.5		SC	**Silty Clayey SAND:** Fine to medium grained, brown-grey-dark red, low plasticity clay fines.				
				U_{50}		1.0		CL-CH	**Silty CLAY:** Medium plasticity, grey with some pale orange. Sandstone gravel content increasing with depth.	<<Wp	VSt/H	× × × × ×	RESIDUAL
						1.5			Test pit TP004 terminated at 1.1m				Refusal at 1.1m on clayey gravel interpreted as extremely weathered sandstone
						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	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		0.5		SM	**Silty SAND:** Fine grained, dark brown. Becoming pale grey with depth.	M			COLLUVIUM Thick root system to 0.2m
							CH	**CLAY;** High plasticity, dark orange, some fine to medium grained angular sandstone gravel.	<<Wp	VSt/H	×	RESIDUAL Refusal on gravel at 0.8m
					1.0			Test pit TP005 terminated at 0.8m				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

coffey geotechnics

Engineering Log - Excavation

Excavation No. **TP006**

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 penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None			0.5		SM	**Silty SAND:** Fine grained, dark brown. Some fine to medium grained angular gravel from 0.4m.	M			COLLUVIUM Thick root system to 0.4m
								CL-CH	**Silty CLAY:** Medium plasticity, orange and red mottling. Sandstone gravel at 0.8m	<<Wp			RESIDUAL
						1.0 1.5 2.0 2.5			Test pit TP006 terminated at 0.9m				Refusal on gravel at 0.9m 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

coffey geotechnics

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 penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None			0.5		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
								SP	**SAND:** Fine to coarse grained, orange and red. Fine to coarse sandstone gravel throughout.		VD		EXTREMELY WEATHERED SANDSTONE
						1.0 1.5 2.0 2.5			Test pit TP007 terminated at 0.9m				

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. **TP008**

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, some fine to coarse grained angular sandstone gravel.	D			COLLUVIUM Some sandstone cobbles and boulders in top 0.4m
						1.0		CH	**Silty CLAY:** High plasticity, orange and grey. Sandstone gravel content increasing with depth.	<<Wp	VSt/H	× × × × ×	RESIDUAL
						1.5			Test pit TP008 terminated at 1.5m				Refusal on gravel at 1.5m
						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	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 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. **TP010**

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 penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None Observed			0.5		SM	**Silty SAND:** Fine to medium grained, dark brown. Some fine to medium grained angular sandstone from 0.4m.	D			COLLUVIUM
						1.0		CH	**CLAY:** Medium to high plasticity, pale grey with red and orange mottling. Some fine to medium grained sandstone gravel from 1m.	>Wp		× × ×	RESIDUAL
						1.5 2.0 2.5			Test pit TP010 terminated at 1.2m			×	Refusal on gravel at 1.2m 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. **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	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			0.5		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			Test pit TP011 terminated at 1.1m				Refusal on gravel at 1.1m interepreted as being highly weathered sandstone
						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

coffey geotechnics

Engineering Log - Excavation

Excavation No. **TP012**

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			0.5		SM	**Silty SAND:** Fine grained, brown, some fine to medium grained angular gravel.	D			COLLUVIUM
								CL	**Gravelly CLAY:** Low to medium plasticity, dark red, fine grained angular gravel.	<Wp			COLLUVIUM/RESIDUAL
						1.0		CH	**CLAY:** Medium to high plasticity, pale grey and orange and red mottling, some silt.	<=Wp	VSt/H	× × ×	RESDIUAL
						1.5		CH	**Silty CLAY:** High plasticity, pale grey with some red and orange mottling.	<<Wp	VSt/H	×	
						2.0			Test pit TP012 terminated at 1.6m				Refusal on sandstone in northern end of TP at 1.6m
						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. **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	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			0.5		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

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Engineering Log - Excavation

Excavation No. **TP014**

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			0.5		SM	**Silty SAND:** Fine grained, dark brown. Some fine to coarse grained up to cobble size sandstone from 0.5 - 0.8m.	D			COLLUVIUM Thin root system throughout
						1.0		CH	**CLAY:** Medium to high plasticity, orange and red mottling, some fine to medium grained angular ironstone gravel.	<Wp	VSt/H	× × × ×	RESIDUAL
						1.5		CH	**Silty CLAY:** High plasticity, pale grey with some red-orange mottling.	<Wp			Fine to coarse sandstone gravel from 1.7m
						2.0			Test pit TP014 terminated at 1.8m				Refusal on gravel at 1.8m interepreted as being highly weathered sandstone
						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. **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 penetrometer 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				
						2.0		CL	**Sandy CLAY:** Low to medium plasticity, orange and red, fine to medium grained sand.	>Wp	St/Vst	× 150 × 200 × 150	RESIDUAL
						2.5			Test pit TP015 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. **TP016**

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 grained, dark brown.	M			COLLUVIUM
						0.5		CL-CH	**Gravelly CLAY:** Medium plasticity, pale grey and red, fine to medium grained angular gravel, some silt.	<Wp	St/Vst	×	COLLUVIUM/RESIDUAL
						1.0						×	
								CH	**Silty CLAY:** Medium to high plasticity, pale grey with some red mottling.	<Wp	VSt/H	×	RESIDUAL
						1.5						×	
									Test pit TP016 terminated 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

TESTPIT GEOTKARI02083AA.GPJ COFFEY.GDT 13.2.08

Form GEO 5.2 Issue 3 Rev.2

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 penetro-meter kPa 100 200 300 400	structure and additional observations
E		N	None Observed					SM	**Silty SAND:** Fine to medium grained, grey, some fine to medium grained angular gravel.	D			COLLUVIUM Thick root system
						0.5		CH	**CLAY:** High plasticity, grey-orange-red mottling, some silt.	<<Wp	VSt/H	× × ×	RESIDUAL High dry strength
						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

coffey geotechnics

Engineering Log - Excavation

Excavation No. **TP018**

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					SM	**Silty SAND:** Fine to medium grained, brown.	D			COLLUVIUM Thick root system
						0.5		CL-CH	**Sandy CLAY:** Medium plasticity, pale orange and pale grey, fine to medium grained sand. Grading to	<Wp	VSt/H	×	RESIDUAL
						1.0		CL-CH	**CLAY:** Medium plasticity, pale orange and pale grey.	<Wp		×	
								CH	**CLAY:** High plasticity, pale grey with some pale orange.	<Wp	VSt/H	×	Very slow progress in high plastic clay
									Test pit TP018 terminated at 1.3m			×	
						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

coffey geotechnics

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 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
								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
								CH	**CLAY:** High plasticity, pale grey with red and orange mottling, some silt.	>Wp			
						1.5			Test pit TP019 terminated at 1.5m				Very slow progress in high plastic clay
						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

coffey geotechnics

Engineering Log - Excavation

Excavation No. **TP020**

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.	M			COLLUVIUM
								SC	**Clayey SAND:** Fine to medium grained, pale orange and grey mottling, low plasticity clay fines. Grading to	M			COLLUVIUM/RESIDUAL
						1.0		CL CH	**Sandy CLAY:** Low to medium plasticity, pale orange and grey mottling, fine to medium grained sand. **CLAY:** High plasticity, orange.	=Wp		× × ×	RESIDUAL
						1.5			Test pit TP020 terminated at 1.1m				Refusal on sandstone floater
						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

Appendix B

Laboratory Results

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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

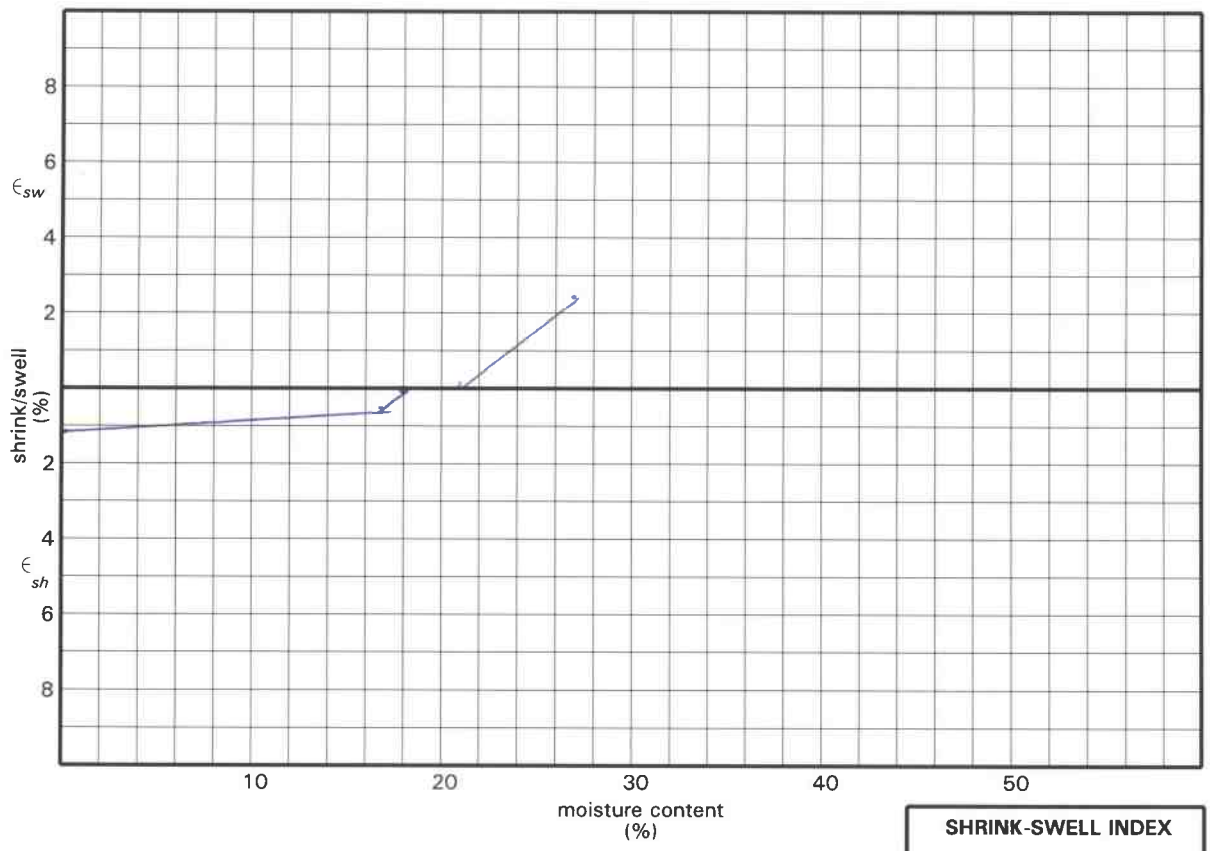
shrink swell index test

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*

test procedure : *AS1289.7.1.1*

borehole : *TP4* depth : *0.8-1.1* date tested : *30/11/07*
material classification : *(CL/CH) Silty CLAY, medium plasticity, grey-brown, trace roots.*

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				
2.4	*21.1*	*27.2*	*>400*	*200*	*1.1*	*<5%*	*Minor*	*Moderate #*



SHRINK-SWELL INDEX
I_{ss} = *1.3* %

remarks: *#: Transverse*

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

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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

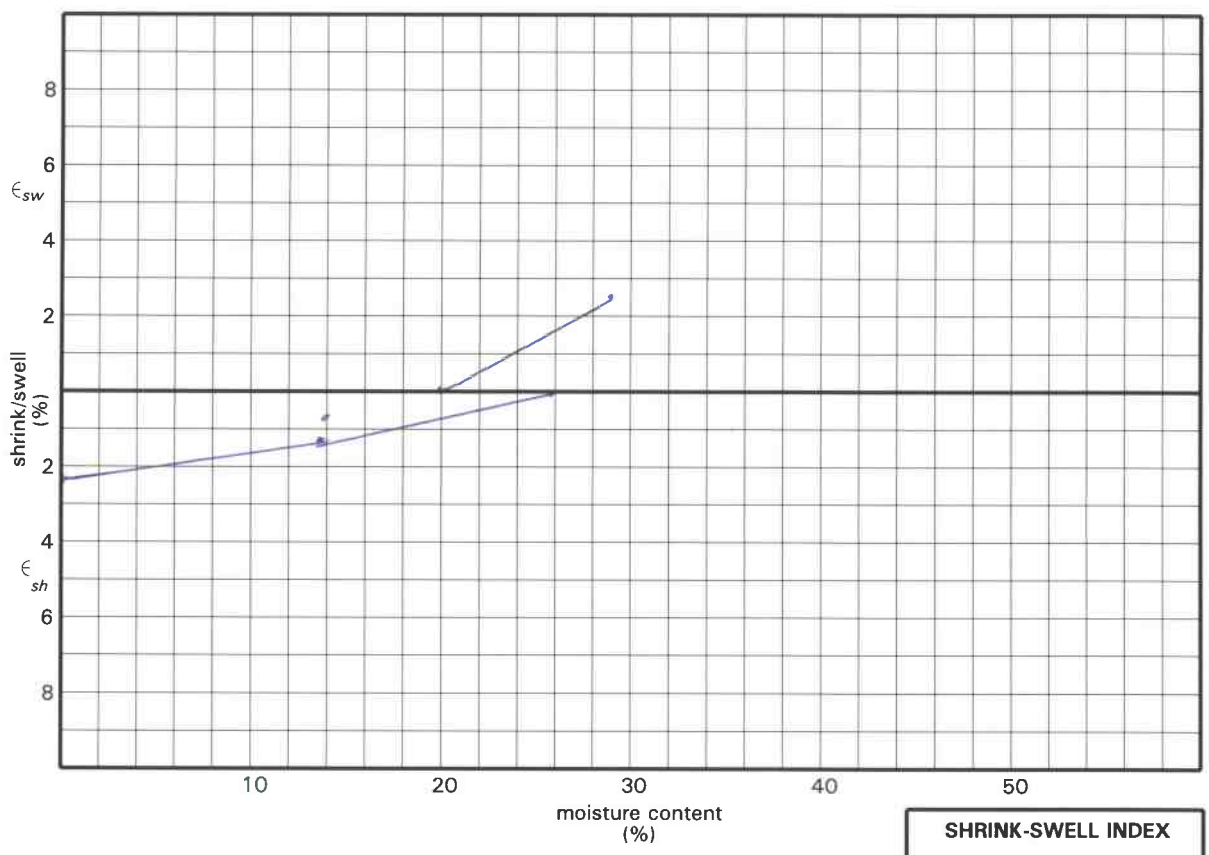
shrink swell index test

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*

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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

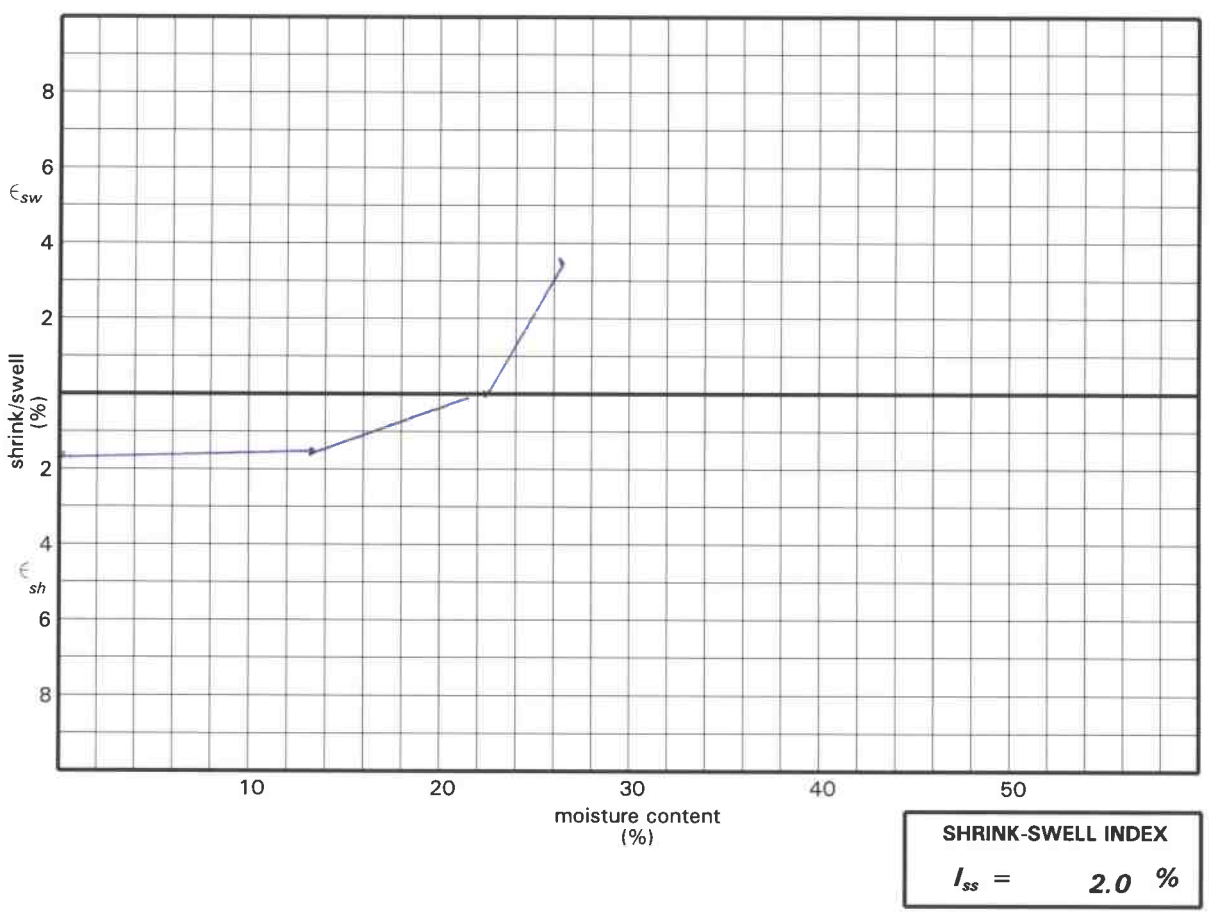
shrink swell index test

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. : *DEC07-01/3*

test procedure : *AS1289.7.1.1*

borehole : *TP12* depth : *0.7-1.0* date tested : *30/11/07*
material classification :
(CL/CH) Silty sandy CLAY, medium plasicity, orange/brown, some fine to medium grained gravel.

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				
3.7	*22.3*	*26.4*	*>400*	*330*	*1.7*	*<5%*	*Minor*	*Moderate #*



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

remarks: *#: Transverse*

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

CRIGHTON PROPERTIES PTY LTD

PROPOSED SUBDIVISION
LOT 22 KARALTA ROAD, PART PORTION 104
TERRIGAL
GEOTECHNICAL ASSESSMENT

REPORT NO.GO540/1-AB MARCH, 1992

Coffey Partners International Pty Ltd

Consulting Engineers
in the Geotechnical Sciences

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
26 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

CONTENTS

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.GO540/1-1, 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.

Valley formation along two incised gullies has resulted in the existing site landform. Two prominent gullies originate at the upper slopes of the above ridgeline and fall to the north/north-east to join in the central part of the site. The combined watercourse discharges to the north of the site, into a broad flat watercourse that drains to the east towards Duffy's Road.

Valley side slopes across the site are convex in profile with surface slopes generally 10° over the upper slopes increasing up to 15° over the lower slopes. Surface slopes of 5° to 9° occur along the crest and upper slopes of the ridgeline that trends along the eastern lot boundary. The base of the above valley side slopes are characterised by;

* Flat alluvial areas of surface slope less than 3° adjacent to the watercourses across the central to northern part of the site. The transition from the valley side slopes to the flat alluvial areas is marked by a sharp concave slope break, or

* Steep gully side slopes ranging from 25° to 35°. The gullies are V-shaped in profile and are incised up to an estimated 5m to 6m in depth.

The site has been undersrcubbed with vegetation currently comprising mainly grasses with a sparse to moderate cover of mature eucalypts. The gullies and gully sides are generally covered with thick vegetation which includes palms and lantana.

Existing development on the site comprises a transmission easement along the eastern boundary and two small "farm" dams at the confluence of the two watercourses. The dams have been breached during recent heavy rain, most likely the result of piping at the contact between earth embankment and 600mm diameter concrete overflow pipes. A unformed section of Karalta Road runs along the northern site boundary.

3.2 Geology & Subsurface Conditions

Geologically, the site is situated in the Triassic Age Gosford Formation which is characterised by sandstone (often lithic) and siltstone rock types.

On the basis of surface features and subsurface conditions encountered in the test pits, the site can be divided into two units, namely

* UNIT A - comprising predominately residual soils overlying sandstone/siltstone rock at about 1m to 1.5m depth,

* UNIT B - comprising deep alluvial soils up to or greater than 3.5m in depth.

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.

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

4.2 Geotechnical Constraints on Development

4.2.1 Area for Development

From a slope stability viewpoint, the entire site is considered suitable for development undertaken in accordance with good hillside construction practices and sound engineering principles as outlined in the attached Table 2.

There should be specific geotechnical investigation to assess local stability and foundation parameters for any proposed development along or adjacent to the steep to very steep gully banks. It is recommended that this constraint apply to the area situated within a line that projects upwards at 2H:1V (26.5°) from the toe of gully banks.

4.2.2 Type of Structure

Flexible structures of timber, brick veneer or similar construction would be preferred on the Unit A hillslopes. Development should be designed to accommodate natural slope profiles with split level or suspended designs so as to limit the need for slope modification.

There are no particular geotechnical constraints on the type of structures within the flat Unit B alluvial areas or for structures founded on rock on the Unit A hillslopes provided they are supported on footings designed and constructed in accordance with AS2870 "Residential Slabs and Footings".

4.2.3 Foundation Types

Foundations should be designed and constructed in accordance with the recommendations and advice of AS2870 "Residential Slabs and Footings".

Pad/strip or pier and beam footing systems are considered appropriate for split level structures on Unit A moderate to steep hillslopes. Stiffened raft or piered slab footing systems may also be adopted provided the resulting slope modifications comply with the geotechnical constraints set out below. It is recommended that foundations for structures on slopes in excess of 4H:1V (14°) be taken to rock.

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).

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 1.5m 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.

4.2.8 Drainage & Sewerage Disposal

Stormwater should be prevented from ponding adjacent to structures. All collected stormwater runoff should be piped into a street or inter-allotment drainage system that discharges into existing watercourses in a controlled manner that limits erosion.

Domestic effluent should be connected to a reticulated sewerage system or to a pump-out septic system. There should be no on-site disposal of domestic effluent.

For and on behalf of
COFFEY PARTNERS INTERNATIONAL PTY LTD

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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A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT *

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

* 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.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

Published by

ASFE THE ASSOCIATION OF ENGINEERING FIRMS PRACTICING IN THE GEOSCIENCES

8811 Colesville Road/Suite G106/Silver Spring, Maryland 20910/(301) 565-2733

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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.

	GOOD ENGINEERING PRACTICE	POOR ENGINEERING PRACTICE
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the Risk of Instability and Implications for Development in mind.	Plan development without regard for the Risk of Instability.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements.
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use and compact clean fill materials. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may become unstable. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOUNDATIONS	Support on or within rock where practicable. Use rows of piers or strip foundations oriented up and down slope. Design for lateral creep pressures. Backfill foundation excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide generous falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some low risk areas. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant.	
SITE VISITS	Site Visits by consultant may be appropriate during construction.	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident seek advice. If seepage observed, determine cause or seek advice on consequences.	

This table is an extract from GEOTECHNICAL RISKS ASSOCIATED WITH HILLSIDE DEVELOPMENT as presented in Australian Geomechanics News, Number 10, 1985 which discusses the matter more fully.

APPENDIX A

results of field investigation

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.).

Incorporated in NSW

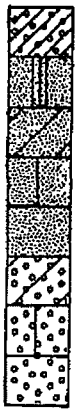
graphic symbols soil and rock

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)

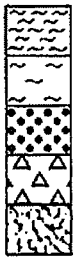


- Gravelly Clay (CL, CH)
- Sandy Silt (ML)
- Clayey Sand (SC)
- Silty Sand (SM)
- Sand (SP, SW)
- Clayey Gravel (GC)
- Silty Gravel (GM)
- Gravel (GP, GW)

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

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ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP1
sheet 1 of 1

office job no: GOSFORD GO540/1

client: CRIGHTON 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: 3.0m long, 0.6 m wide

R.L. surface: Approx. 22 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	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	SILTY SAND, fine to coarse, black, some fine to coarse gravel	M			TOPSOIL
					1		CL	GRAVELLY SANDY CLAY, medium plasticity, brown, sand mostly fine, fine to coarse gravel	M > Wp	VSt		RESIDUAL One floating boulder and some cobbles
										VSt/H		
								SANDSTONE, coarse grained, orange stained yellow				ROCK - extremely weathered
					2			TP1 terminated at 1.7m depth.				
					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 cm 75 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: TP2
sheet 1 of 1

office job no: GOSFORD G0540/1

client: ORIGHTON PROPERTIES PTY LTD
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL
pit location: REFER TO DRAWING NO.G0540/1-1

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: 3.0 m long, 0.6 m wide

R.L. surface: Approx. 25 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	hand penetrometer 100 kPa 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED		0		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
							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
					1			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
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

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

COFFEY

pit no: TP3
sheet 1 of 1

office job no: GOSFORD G0540/1

client: CRIGHTON PROPERTIES PTY LTD
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL
pit location: REFER TO DRAWING NO.G0540/1-1

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: 3.0 m long, 0.6 m wide

R.L. surface: Approx. 45 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests,etc.	depth m	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components	moisture condition	consistency, density index	hand penetrometer kPa 100 200 300 400	structure and additional observations
BH		NIL	NONE ENCOUNTERED		0		SM	GRAVELLY SILTY SAND, fine to coarse, black, fine to coarse gravel	M			TOPSOIL
							CL	GRAVELLY SANDY CLAY, low plasticity, grey-brown, fine to coarse gravel				SLOPEWASH
							CL/CH	CLAY, medium to high plasticity, yellow, some silt /fine sand	M > Wp	VSt		RESIDUAL Numerous large tree roots
					1			CLAY, as above but becoming red-brown mottled yellow-white		H		
								SILTSTONE, white with red and orange staining	M	H/Fb		ROCK Extremely weathered
					2					Fb		ROCK Extremely to highly weathered
								TP3 terminated at 2.2m depth.				
					3							

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

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP4
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. 23 m
excavation dimensions: 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	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 buildozer blade
R ripper
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
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engineering log excavation

COFFEY

pit no: TP5
sheet 1 of 1

office job no: GOSFORD G0540/1

client: CRIGHTON PROPERTIES PTY LTD
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104 KARALTA ROAD, TERRIGAL
pit location: REFER TO DRAWING NO.G0540/1-1

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: 3.0 m long, 0.6 m wide

R.L. surface: Approx. 53 m
datum: AHD

method	penetration 1 2 3	support	water	notes samples, tests,etc.	depth m 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 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED		0		SM	SILTY SAND, mostly fine, black, gravel fine to coarse	M			TOPSOIL
							SC	GRAVELLY CLAYEY SAND, brown				SLOPEWASH
							CL	CLAY, medium plasticity, orange-brown, some fine sand and fine to coarse gravel increasing with depth	M > Wp	H		RESIDUAL
					1					VSt		Some rock structure below 0.9m depth
								SILTY SANDSTONE, pale grey-white,		Fb		ROCK Extremely to highly weathered
								TP5 terminated at 1.5m (practicle refusal on highly weathered SILTY SANDSTONE).				
					2							
					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
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
	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.GC540/1-1	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	hand penetrometer 100 200 300 400 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
					2			SANDY CLAY/SILTSTONE-SANDSTONE, fine grained, red-orange & grey white mottling	M	Fb		RESIDUAL/ROCK Extremely weathered
								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
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: TP7
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. 26 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	hand penetrometer 100 200 300 400 kPa	structure and additional observations
BH		NIL	NONE ENCOUNTERED				SM	SILTY SAND, mostly fine, black, some gravel with depth	M			TOPSOIL
							SC/CL	CLAYEY SAND/SANDY CLAY, fine, low plasticity, brown, local gravel				SLOPEWASH
					1		CH	SANDY CLAY, medium plasticity, red-orange and brown mottled, fine to medium becoming gravelly with depth	M > Wp	VSt		RESIDUAL With increasing number of sandstone boulders.
					2			SANDSTONE, medium to coarse, yellow	M			ROCK Highly weathered
								TP7 terminated at 2.1m 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
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: 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
		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.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
							SC/CL	CLAYEY SAND/SANDY CLAY, as above but becoming locally sandy clay, mottled grey and brown,	(M > Wp)			
					2		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: TP9
sheet 1 of 1

office job no: GOSFORD GO540/1

client: CRIGHTON PROPERTIES PTY LTD
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104
pit location: KARALTA ROAD, TERRIGAL
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: 3.0 m long, 0.6 m wide

R.L. surface: Approx. 20 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		0		SM	SILTY SAND, mostly fine, dark grey- brown	M			TOPSOIL/ FILL
								SILTY SAND, fine, grey-brown, some clay				ALLUVIUM
					1		SP/SC	SAND, fine, yellow-grey, some silt/clay fines	D/M	Fb		
							SC	CLAYEY SAND, as above but increased clay fines and with brown mottles	M			
					2		CL	SANDY CLAY, medium plasticity, mottled grey and brown-orange, mostly fine sand	M > Wp	St/ VSt		
					3			TP9 terminated at 2.9m 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 73 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.	depth m	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
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: TP10
sheet 1 of 1

office job no: GOSFORD G0540/1

client: CRIGHTON PROPERTIES PTY LTD
pit commenced: 02/03/92
pit completed: 02/03/92
project: PROPOSED SUBDIVISION, LOT 22 PART PORTION 104
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.23.5m
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					SM	SILTY SAND, mostly fine, black becoming dark grey, some fine to coarse gravel	M			TOPSOIL/SLOPEWASH
												ALLUVIUM
					1		SC/CL	CLAYEY SAND/SANDY CLAY, low plasticity, mostly fine, mottled brown-grey	M/W			minor inflow
									M	VSt/St		
								—becoming				
					2		CL	SANDY CLAY, medium plasticity, mottled grey and red-brown, some gravel	M > Wp			
					3			TP10 terminated at 3.0m depth.				
					4							

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

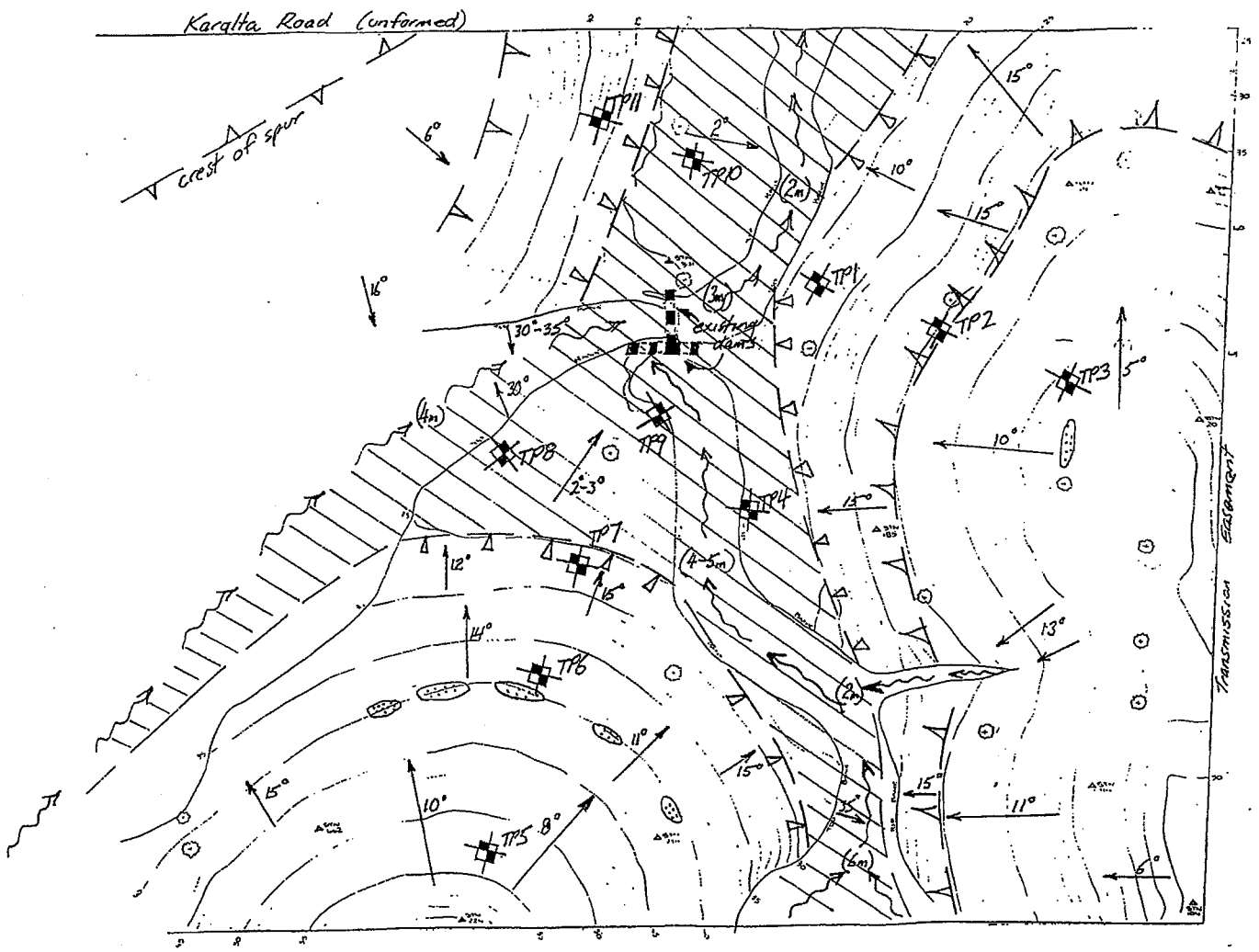
support
T timbering N nil
penetration 1 2 3 — no resistance ranging to refusal
water
10 Jan 78 water level on date shown
water inflow
water outflow

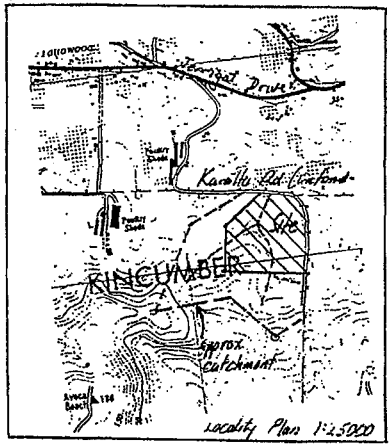
notes samples and tests
U50 undisturbed sample 50mm diameter
D disturbed sample
N standard penetration tests:
N* SPT + sample recovered
N: SPT with solid cone
V vane shear
P pressuremeter
Bs bulk sample
R refusal

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

scale (metres) 20 0 20 40 60 80 100

revision	description	drawn	approved	date

drawn	RJK
checked	
date	13·2·92

CRIGHTON 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

CRIGHTON PROPERTIES PTY LTD
PROPOSED SUBDIVISION
LOT 2 BELAR AVENUE, TERRIGAL

STABILITY ASSESSMENT

REPORT NO GO652/1-AB 7 MAY 1993

Coffey Partners International Pty Ltd

Consulting Engineers
in the Geotechnical Sciences

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

TABLE OF CONTENTS

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. GO652/1-1, 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.

Groundslopes at the site vary from about 3° to 7° to the horizontal near the drainage depression, to 15° to 18° to the horizontal in the higher slopes. The contour plan provided shows the site elevation to vary from about RL22m AHD in the north of the site to greater than RL70m in the south of the site.

The area of the proposed residential development is generally open and well grassed, with the exception of an area to the east of the site and on a northerly facing slope towards the centre of the site where these areas are moderately wooded. Heavily wooded areas with thick undergrowth, generally corresponding to the steeper areas, are located on the properties adjoining the site.

Existing development comprises a dwelling and horse stable located in the north-east of the site. Cuts of up to 3m are located to the east of the above structures. The horse stable appears to be founded partly on fill materials won from these cuts.

Access to the site is via a dirt track from the end of Belar Avenue located to the north. This track appears to have been formed by cutting and filling and runs across the slope of the hill.

Other man made features on the site include an existing farm dam located near the centre of the northern boundary.

3.2 Geology and Subsurface Conditions

The 1:25000 Geological Map of Gosford indicates the site to be underlain by lithic-quartz to quartz sandstone, siltstone, minor sedimentary breccia, claystone and conglomerate of the Terrigal Formation.

On the basis of the surface features and the subsurface conditions encountered in the test pits, the site can be divided into two units, namely;

- Unit A - Comprising predominantly slopewash and residual soils overlying sandstone/siltstone rock at about 0.7m to 1.7m depth; and
- Unit B - Comprising alluvial soils up to or greater than 2.4m in depth, overlying deeply weathered residual soils to depths in excess of 3.3m.

The approximate extent of the above units is shown on Drawing No. GO652/1-1.

The subsurface profile encountered in Unit A (Test Pits 3 to 14) can be summarised as follows;

TOPSOIL/SLOPEWASH: Comprising Silty Sand, fine to medium grained, light grey and grey, some roots, observed unit depth varied from 0.2m to 0.8m; overlying

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.

4.2 Geotechnical Constraints on Development

4.2.1 Area for Development

From a slope stability viewpoint, the entire site is considered suitable for development undertaken in accordance with good hillside construction practices and sound engineering principles as outline in the attached Table 2.

4.2.2 Type of Structure

Flexible structures of timber, brick veneer or similar construction would be preferred on the Unit A hillslopes. Development should be designed to accommodate natural slope profiles with split level or suspended designs so as to limit the need for slope modification.

There are no particular geotechnical constraints on the type of structures within the flat Unit B alluvial area or for structures founded on rock on the Unit A hillslopes, provided they are supported on footings designed and constructed in accordance with AS2870 "Residential Slabs and Footings".

4.2.3 Foundation Types

Foundations should be designed and constructed in accordance with the recommendations and advice of AS2870 "Residential Slabs and Footings".

Further site specific assessment will be required to assess foundation characteristics within the Unit B alluvial soils. In particular, shrink-swell potential of these soils should be addressed due to the thickness of alluvial and residual soils.

Pad/strip or pier and beam footing systems are considered appropriate for split level structures on Unit A moderate to steep hillslopes. Stiffened raft or piered slab footing systems may also be adopted provided the resulting slope modifications comply with the geotechnical constraints set out below. It is recommended that foundations for structures on slopes in excess of 4H:1V (14^0) be taken to rock.

Strip/pad, stiffened raft or piered footing systems would be appropriate for residential structures located within the flat Unit B alluvial areas.

4.2.4 Excavation

Excavations in soil should preferably not exceed 1.0m depth and battered no steeper than 2H:1V and protected from erosion. Excavations greater than 1.0m should be supported by a properly designed and constructed retaining wall.

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.

4.2.8 Drainage and Sewerage Disposal

Stormwater should be prevented from ponding adjacent to structures. All collected stormwater runoff should be piped into a street or inter-allotment drainage system that discharges into existing watercourses in a controlled manner that limits erosion.

Domestic effluent should be connected to a reticulated sewerage system or to a pump-out septic system. There should be no on-site disposal of domestic effluent.

For and on behalf of
COFFEY PARTNERS INTERNATIONAL PTY LTD

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

about the potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to perform a geoenvironmental exploration differ substantially from those applied in geotechnical engineering. Contamination can create major risks. If you have no information about the potential for your site being contaminated, you are advised to speak with your geotechnical consultant for information relating to geoenvironmental issues.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid misinterpretations, retain your geotechnical engineer to work with other project design professionals who are affected by the geotechnical report. Have your geotechnical engineer explain report implications to design professionals affected by them, and then review those design professionals' plans and specifications to see how they have incorporated geotechnical factors. Although certain other design professionals may be familiar with geotechnical concerns, none knows as much about them as a competent geotechnical engineer.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT *

Geotechnical engineers develop final boring logs based upon their interpretation of the field logs (assembled by site personnel) and laboratory evaluation of field samples. Geotechnical engineers customarily include only final boring logs in their reports. Final boring logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes, and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. (If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing construction cost estimates was not one of the specific purposes for which it was prepared. In other words, while a contractor may gain important knowledge from a report prepared for another party, the contractor would be well-advised to discuss the report with your geotechnical engineer and to perform the additional or alternative work that the contractor believes may be needed to obtain the data specifically appropriate for construction cost estimating purposes.) Some clients believe that it is unwise or unnecessary to give contractors access to their geotechnical engineering reports because they hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems. It also helps reduce the adversarial attitudes that can aggravate problems to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical engineers. To help prevent this problem, geotechnical engineers have developed a number of clauses for use in their contracts, reports, and other documents. Responsibility clauses are not exculpatory clauses designed to transfer geotechnical engineers' liabilities to other parties. Instead, they are definitive clauses that identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report. Read them closely. Your geotechnical engineer will be pleased to give full and frank answers to any questions.

RELY ON THE GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Most ASFE-member consulting geotechnical engineering firms are familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a construction project, from design through construction. Speak with your geotechnical engineer not only about geotechnical issues, but others as well, to learn about approaches that may be of genuine benefit. You may also wish to obtain certain ASFE publications. Contact a member of ASFE of ASFE for a complimentary directory of ASFE publications.

* 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.

ASFE THE ASSOCIATION OF ENGINEERING FIRMS PRACTICING IN THE GEOSCIENCES
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DEC0592/3 5M

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 - $I_S(50)$ (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
I_S (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, extant, coating etc.):

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Incorporated in NSW

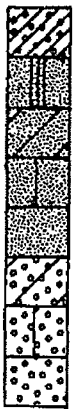
graphic symbols soil and rock

COFFEY

Explanation
Sheet 2

SOIL

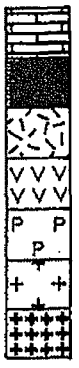
Asphaltic Concrete or Hotmix
Concrete
Topsoil
Fill
Peat, Organic Clays and Silts (Pt, OL, OH)
Clay (CL, CH)
Silt (ML, MH)
Sandy Clay (CL, CH)
Silty Clay (CL, CH)



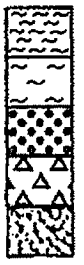
Gravelly Clay (CL, CH)
Sandy Silt (ML)
Clayey Sand (SC)
Silty Sand (SM)
Sand (SP, SW)
Clayey Gravel (GC)
Silty Gravel (GM)
Gravel (GP, GW)

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

APPENDIX A
results of field investigation

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ACN 003 692 019

engineering log
excavation

COFFEY

pit no: TP1
sheet 1 of 1

office job no: 20652/1

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							SP	Silty SAND, fine to medium grained light grey to grey, some roots	D	(MD)		TOPSOIL
							SC	Clayey SAND, fine to medium grained, light orange brown, some sandstone floaters in matrix				SLOPEWASH/ALLUVIUM
					1.0		CL	CLAY, medium plasticity, red brown, orange brown & grey brown some gravel	M	VSt		RESIDUAL
					2.0			SANDSTONE, fine to coarse grained extremely to highly weathered, orange brown & red brown				BEDROCK
								END TEST PIT TP1 AT 2.4m				
					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

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

pit no: TP2
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
R.L. surface: m
excavation dimensions: 3 m long, 0.8 m wide
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

pit no: TP3
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								Silty Clayey SAND, fine to medium grained, light grey, some rounded gravel				TOPSOIL/SLOPEWASH
								CLAY, medium plasticity, orange brown & red brown				RESIDUAL
					1.0			Silty CLAY, medium to high plasticity, light grey				EW SILTSTONE
					2.0			Siltstone, extremely to highly weathered, light grey & orange brown				BEDROCK
								END TEST PIT TP3 AT 2.3m				

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	100 200 300 400 kPa hand penetrometer	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
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: TP5
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	100 200 300 400 kPa hand penetrometer	structure and additional observations
BH		N	NONE OBSERVED				SP	Silty SAND, fine to coarse grained light grey & grey, some gravel	D			TOPSOIL
					1.0		CH	CLAY, medium to high plasticity, orange brown and red brown	M <Wp	H		RESIDUAL/SLOPEWASH
					2.0			CLAY, medium to high plasticity, light grey, some orange brown				
								some gravel content at depth				EW Siltstone
								END TEST PIT TP5 AT 2.8m				

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: TP6
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	100 kPa hand 200 kPa 300 kPa penetrometer 400	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
US0 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: TP7
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 Clayey SAND, fine to medium grained, grey, brown				TOPSOIL
								Silty CLAY, medium to high plasticity, orange brown & red brown				RESIDUAL
					1.0			Gravel fragments near base of unit				
								SANDSTONE, fine to coarse grained extremely to highly weathered, light grey & orange brown				BEDROCK
								END TEST PIT TP7 AT 1.7m 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

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 kPa 100 200 300 400	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

COFFEY

pit no: TP9
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							SP	Silty SAND, fine to medium grained	D			TOPSOIL/SLOPEWASH
								SANDSTONE, fine to coarse, orange brown, light grey	D			BEDROCK
					1.0			REFUSAL ON SANDSTONE. END TEST PIT TP9 AT 0.6m				
					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

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Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

COFFEY

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: 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						Silty SAND, fine to medium grained, dark grey	M			TOPSOIL
			NONE OBSERVED					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 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: 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 100 200 400 kPa	structure and additional observations
BH		N	NONE OBSERVED					Silty Sandy CLAY, low plasticity brown, some roots				TOPSOIL
								CLAY, high plasticity, red brown and orange brown	M	H		× RESIDUAL × >500 kPa
					1.0			Siltstone, extremely to highly weathered, light grey & orange brown, some interbedded sandstone to 200mm				BEDROCK
					2.0			END TEST PIT TP11 AT 2.5m				
					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

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Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

pit no: TP12
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 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

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log
excavation

COFFEY

pit no: TP13
sheet 1 of 1

office job no: G0652/1

client:	CRIGHTON PROPERTIES	pit commenced:	4.5.93
principal:		pit completed:	4.5.93
project:	PROPOSED RESIDENTIAL SUBDIVISION	logged by:	BAS
pit location:	LOT 2 BELAR AVENUE, TERRIGAL	checked by:	PJNP
equipment type and model:	CASE 580E BACKHOE	R.L. surface:	m
excavation dimensions:	3 m long, 0.8 m wide	datum:	

method	penetration 1 2 3	support	water	notes samples, tests,etc.	R.L. / depth in 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, trace clay, some roots	M			TOPSOIL
							CL	Silty CLAY, medium plasticity, mottled red brown & orange brown some gravel	M >Wp	H		RESIDUAL
					1.0			Gravel content increasing with depth				
								SANDSTONE, fine to coarse grained red & orange brown	M			BEDROCK
								END TEST PIT TP13 AT 1.7m 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

003

Coffey Partners International Pty Ltd
ACN 003 692 019

engineering log excavation

COFFEY

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			NONE ORSERVED					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

RISK OF INSTABILITY	EXPLANATION	IMPLICATIONS FOR DEVELOPMENT
VERY HIGH	EVIDENCE OF ACTIVE OR PAST LANDSLIPS OR ROCKFACE FAILURE; EXTENSIVE INSTABILITY MAY OCCUR	UNSUITABLE FOR DEVELOPMENT UNLESS MAJOR GEOTECHNICAL WORK CAN SATISFACTORILY IMPROVE THE STABILITY. EXTENSIVE GEOTECHNICAL INVESTIGATION NECESSARY. RISK AFTER DEVELOPMENT MAY BE HIGHER THAN USUALLY ACCEPTED.
HIGH	EVIDENCE OF ACTIVE SOIL CREEP OR MINOR SLIPS OR ROCKFACE INSTABILITY; SIGNIFICANT INSTABILITY MAY OCCUR DURING AND AFTER EXTREME CLIMATE CONDITIONS	DEVELOPMENT RESTRICTIONS AND/OR GEOTECHNICAL WORKS REQUIRED. GEOTECHNICAL INVESTIGATION NECESSARY. RISK AFTER DEVELOPMENT MAY BE HIGHER THAN USUALLY ACCEPTED.
MEDIUM	EVIDENCE OF POSSIBLE SOIL CREEP OR A STEEP SOIL COVERED SLOPE; SIGNIFICANT INSTABILITY CAN BE EXPECTED IF THE DEVELOPMENT DOES NOT HAVE DUE REGARD FOR THE SITE CONDITIONS.	DEVELOPMENT RESTRICTIONS MAY BE REQUIRED. ENGINEERING PRACTICES SUITABLE TO HILLSIDE CONSTRUCTION NECESSARY. GEOTECHNICAL INVESTIGATION MAY BE NEEDED. RISK AFTER DEVELOPMENT GENERALLY NO HIGEER THAN USUALLY ACCEPTED.
LOW	NO EVIDENCE OF INSTABILITY OBSERVED; INSTABILITY NOT EXPECTED UNLESS MAJOR SITE CHANGES OCCUR.	GOOD ENGINEERING PRACTICES SUITABLE FOR HILLSIDE CONSTRUCTION REQUIRED. RISK AFTER DEVELOPMENT NORMALLY ACCEPTABLE.
VERY LOW	TYPICALLY SHALLOW SOIL COVER WITH FLAT TO GENTLY SLOPING TOPOGRAPHY.	GOOD ENGINEERING PRACTICES SHOULD BE FOLLOWED.

THIS TABLE IS AN EXTRACT FROM 'GEOTECHNICAL RISKS ASSOCIATED WITH HILLSIDE DEVELOPMENT' AS PRESENTED IN 'AUSTRALIAN GEOMECHANICS NEWS', NUMBER 10, DECEMBER, 1985, WHICH DISCUSSES THE MATTER MORE FULLY.

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.

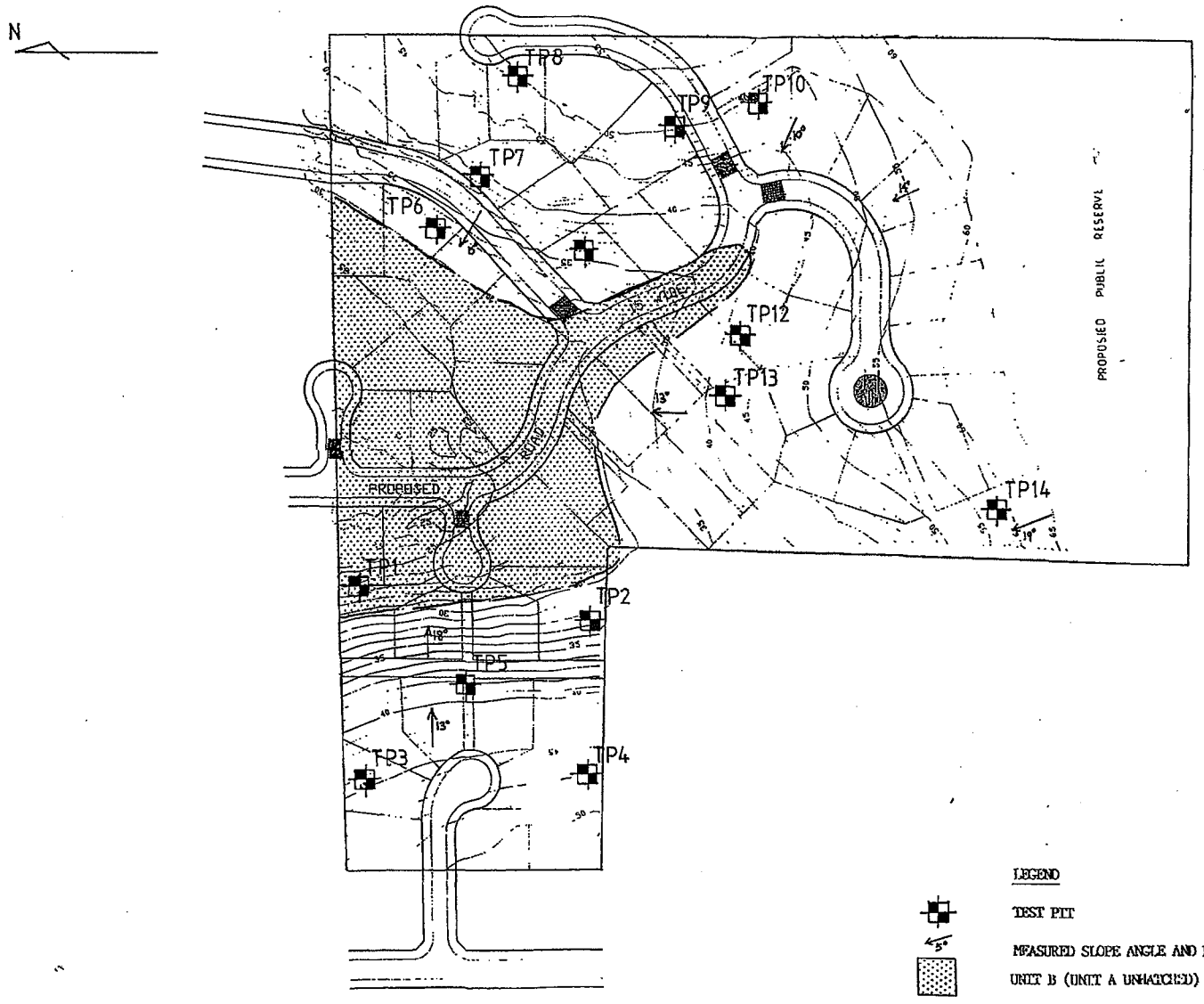
CLASS	DEVELOPMENT CONSTRAINTS	DAMAGE POTENTIAL EXTENT	DAMAGE POTENTIAL PROBABILITY
LOW	Good Hillside Practice	Slight	Very Low
MODERATE	Good Hillside Practice and site specific restrictions	Slight Moderate	Low Very Low
HIGH	No development unless major engineering remedial works	Moderate Severe	High Moderate

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.

TABLE 2 SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	POOR ENGINEERING PRACTICE
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the Risk of Instability and Implications for Development in mind.	Plan development without regard for the Risk of Instability.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements.
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use and compact clean fill materials. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may become unstable. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOUNDATIONS	Support on or within rock where practicable. Use rows of piers or strip foundations oriented up and down slope. Design for lateral creep pressures. Backfill foundation excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide generous falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to disipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer system; absorption trenches may be possible in some low risk areas. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant.	
SITE VISITS	Site Visits by consultant may be appropriate during construction.	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident seek advice. If seepage observed, determine cause or seek advice on consequences.	

This table is an extract from GEOTECHNICAL RISKS ASSOCIATED WITH HILLSIDE DEVELOPMENT as presented in Australian Geomechanics News, Number 10, 1985 which discusses the matter more fully.



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

scale (metres)

revision	description	drawn	approved	date

drawn	BAS
checked	
date	6.5.93

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

Parkside@Terrigal

Development Controls and Community structure

October 2010 – V2

Prepared by
Crighton Properties Pty Ltd.

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 b) VPA commitments c) Conditions of Consent	Behavioural and Built Form Behavioural and Built Form Behavioural and Built Form	Council / DOP Council / DOP Council	Council Council / Land owner 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

Collectively, each of these four methods of control are (over and above the usual Planning controls that already exist at the local Govt and State level) are intended to regulate;

1. Behaviour of residents within the development in accordance with the intention of the project, the conditions of consent and in a socially responsible manner to protect the well being of other residents and neighbours.
2. The Built form within the development in accordance with the intention of the project, the conditions of consent and so as not to detract from the amenity of the surrounding neighbourhood.
3. Proper land management practices, through responsible maintenance regimes delivered by funding mechanisms which do not impact upon rate payers.

Each of these four methods of control are set out in the following chapters.

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.

2. Community Title Structure

• What is Community Title?

Community Title is a means of subdividing and titling land and improvements to allow for the individual ownership of some portions of the site (typically being the individual lots) and the communal ownership of other portions of the site (typically being the community amenity areas).

Community Title then provides the mechanism for the raising of, and management of funds (via the Community Levy) from the Community Members in order to cover the cost of management of the Community Assets.

Community Title then provides a lawful mechanism (through the use of By-Laws) to regulate housing types and finishes and some actions of its members for the security and benefit the Community. These By-Laws, once established (upon registration of the subdivision), are enforceable under the Community Land Management Act 1989 and can only be changed by unanimous resolution by all Community Members.

• What is Proposed at Parkside?

Parkside is proposed to be subdivided under a Community Title Scheme in accordance with the Community Land Development Act 1989. All roads through the development are proposed to be Public, however, all other land and open space within the development will form part of the Community Scheme. The scheme will operate in accordance with the Community Management Statement which contains the 'rules' (by-laws) by which the scheme will operate.

1. Community Property and Special Facilities

The Community Parcel is proposed to include most of the site which is currently zoned 7c2, part of that portion of the site which is currently zoned 2A and part of the site which is currently zoned 7a (refer to Fig 1.0 for detail). Some areas of the existing property will not form part of the community scheme, including the land which is proposed to be dedicated to Council as COSS.

The community Parcel is proposed to be subdivided to form a number of private lots within the Community Scheme as well as a communal lot (Community Association Property) known as Lot 1 within the community scheme. This Community Lot (Lot 1) will be made up of the following;

1. The Riparian Areas – incorporating the Core Riparian Zone (CRZ) and Riparian Buffer areas.
2. The Communal open space areas – incorporating recreational open space adjacent the riparian areas, primary recreational and business open spaces (site of the business hub and common facilities) as well as the pocket park on top of the ridge.
3. Areas of bushland to be conserved for biodiversity purposes (currently zoned 7c2)

The extent of Community Association Property, land subject to specific management requirements and the Special Facilities Proposed are represented in Fig 1.1 below.

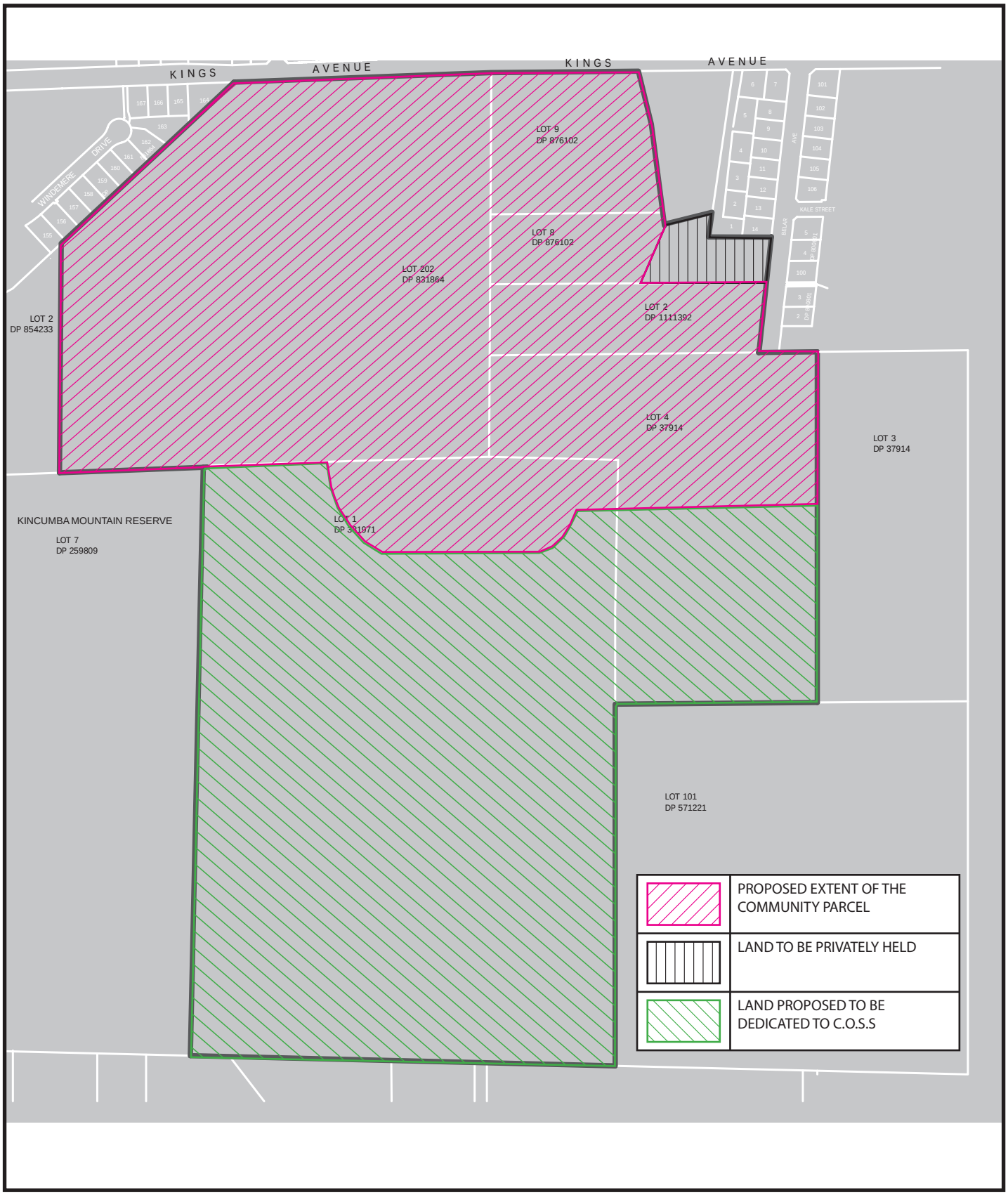
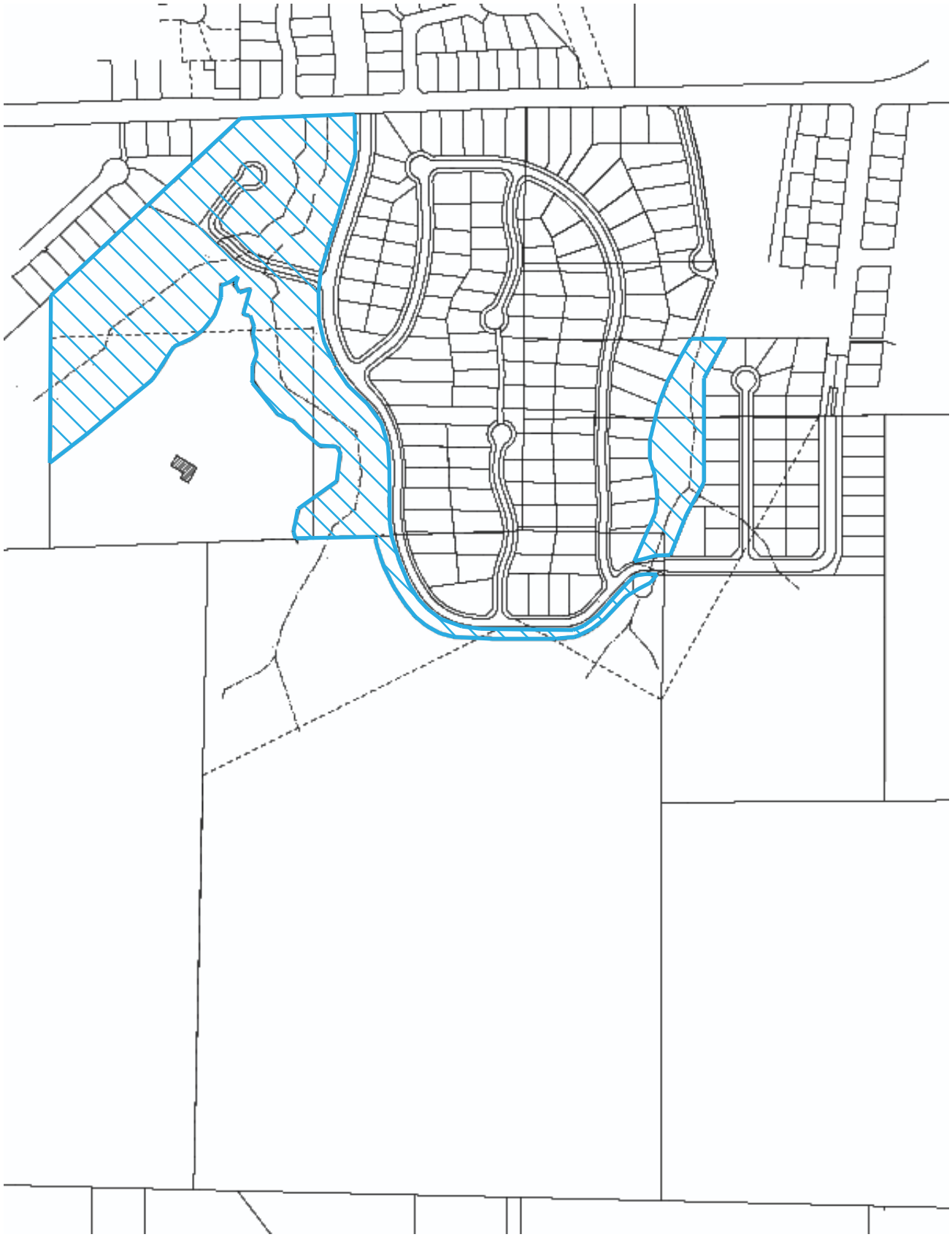

KINGS AVENUE
KINGS AVENUE
LOT 9
DP 876102
LOT 8
DP 876102
LOT 202
DP 831864
LOT 2
DP 1111392
LOT 4
DP 37914
LOT 3
DP 37914
LOT 2
DP 854233
KINCUMBA MOUNTAIN RESERVE
LOT 7
DP 259809
LOT 1
DP 571971
LOT 101
DP 571221
KALE STREET
PROPOSED EXTENT OF THE COMMUNITY PARCEL
LAND TO BE PRIVATELY HELD
LAND PROPOSED TO BE DEDICATED TO C.O.S.S

FIGURE 1.0

In addition to the ownership and management of open space areas, Community Property is also proposed to include a range of improvements (building works) which will be owned and managed by the Community Association, this Community Property will include;

1. A Business Support Hub facility containing;
    i. Conference rooms
    ii. Meeting rooms
    iii. Office
    iv. Typing / Facilities area
    v. Coffee shop
    vi. Lounge / Multifunction / Function Space
    vii. Kitchenette
    viii. Store
    ix. Toilet Facilities
    x. Additional residential amenity such as a pool, gymnasium, library, tennis court etc
    xi. It may even include child minding facilities and children's play areas.
2. High speed communication network consisting of
    - Hub distribution point located within business support hub, containing hardware and software
    - The network of private underground optic fibre communication cables and associated hardware
3. A wastewater reclaim system providing recycled water to all of the homes within the HBBP
4. Outdoor space
5. Water management Ponds and Swales
6. Walkways / Cycleways



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

Figure 1.1

4. General Provisions

The following general provisions will be considered / included within the drafting of the Community Management Statement.

Access
The following access provisions will apply to users;

User Group	Type of access	Facilities	Cost Associated
All Community Title members	Unfettered	All residential amenity	FOC (covered by Levy)
All Community Title members	Unfettered	All business support facilities and services	Base level of services FOC (covered by Levy). Specialised services (such as room rental and typing assistance etc. subsidised user pays cover charge (collected on a do and charge basis through levy)
General Public	Unfettered	Unstructured open space, cycle ways, walkways etc.	FOC
General Public	Restricted by area or by occasion	Selected residential and business support amenity.	User pays or on subsidised event basis, such as a visiting speaker etc.

Maintenance

- Maintenance and upkeep of Community assets will be the responsibility of the Community Association across the board at no cost to rate payers.
- Behavioural provisions will be made to allow for breakage or replacement of damaged / lost items by responsible parties – particularly the HBB support services.
- In additional to general maintenance a sinking fund will also be structured to cover the future cost of upgrades and technological advancement and replacement.
- A maintenance and management plan will be prepared which details the Maintenance and Management requirements of the Community Assets. This plan will form the basis of any sinking fund and future investment schedule.

Financial Management

- All Community members will be charged a quarterly levy to cover the financial costs of operation of the Community Scheme. This levy covers every thing from maintenance to running costs, insurance to marketing, and technological advancement to consumables.
- It is intended that the base levy will be approximately $3,200.00 p/a (based on 145 homes) – a major portion of which would likely be tax deductable to any legitimate HBB. Over and above this base levy, specific services will be available on site on a user pays basis.
- It is intended that all user pays services will be accessible by a unique security code device which logs usage (such as a swipe card) for later debiting of the user or adding to the value of the levy
- The Community Association is to be free to generate revenue through it's business activities, which may be returned to its members in the form of a levy subsidy or even a financial return, should one eventuate, such commercial activities may include, the leasing of space, the provision of business support services – such as typing etc, or the holding of an event – such as a conference.

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.

3. Architectural and Landscape Design and Business Management Controls

Architectural and Landscape controls

Architectural and landscape controls will be contained within the "Architectural and Landscape Guidelines", which will be annexed to the Community Management Statement. The guidelines will set out specific provisions relating to the built environment (over and above those required by Council) designed to;

1. Ensure a HBB is provided in every house.
2. Ensure the quality of the built Environment
3. To protect the amenity of neighbours

The Architectural and Landscape Guidelines are implemented by the Design Review Committee (DRC), which is a sub-committee of the Executive Committee of the Community Association. The Guidelines require all plans for development work to be submitted to the DRC for approval, before being submitted to Council, and again before work commences on site. No building can be built upon the site that has not been approved (stamped and written approval issued) by the DRC.

The DRC will comprise of the developer, during the initial development phase followed by a committee of 4 people;

1. 2 members of the Community Scheme (1 of which will be the developer whilst ever it owns a lot)
2. 1 registered Architect
3. A member of Gosford City Council Planning Dept – whilst ever it chooses to act in this capacity (this could be by a concurrence role)

The Architectural and Landscape Guidelines will be drafted in both a written technical format as well as a graphic representative format, see appendix 2 for an example of Architectural and Landscape Design Guidelines applying to another recent project.

The Architectural and Landscape guidelines will specifically contain requirements relating to the following.

Category	Provision
Business	A home office must be provided in each house which; 1. Is no less than 25 sqm in size 2. Is no more than 60 sqm in size 3. Is located at the front of the house 4. Has a separate front access door 5. Is not part of a garage.
Car Parking	At least one visitor's space, which is not part of a garage or part of an access driveway, must be provided on site.
Car Parking	Houses must be set back at least 7.5m to facilitate off street parking for visitors and staff.
Signage	Up to 2 business signs may be located on any lot, not having a combined area of more than 1.0 sqm.

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.

Parking	Garages not to be used for business purposes.
Staffing	A maximum of 2 employees in addition to the home occupants may be employed upon the site.
Staffing	Any staff vehicle must stand upon the site during business hours.
Sales	No business is to solicit upon the street, signage is limited to that contained within the Architectural Guidelines.

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 1.

Sample Community Management Statement

Appendix 2.

Sample Architectural and Landscape Guidelines.