Travers

bushfire & ecology

Ecological Assessment

PROPOSED RESIDENTIAL SUBDIVSION
LOT 6 DP 244030 & LOT 9 DP 250425

DIAMOND BEACH ROAD,
DIAMOND BEACH

SEPTEMBER 2010
(REF: 9020F)

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ECOLOGICAL ASSESSMENT

LOT 6 DP 244030 & LOT 9 DP 250425

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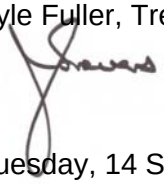
Checked by:



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File: 9020F

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Note: This report was issued in April 2010 and Greater Taree Council has asked that subsequent advice under separate cover be integrated into one all-encompassing report. Therefore this revised report includes all matters relating to the ecological assessment of the subject site inclusive of additional targeted survey undertaken and responses from referred agencies.

EXECUTIVE SUMMARY

An ecological assessment has been undertaken by *Travers bushfire & ecology* to identify the ecological characteristics of Lot 6 DP 244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach for the purposes of a proposed subdivision to create eighty nine (89) residential allotments of between 551-2,005m^2.

An area of 9,521m2 adjacent to the foreshore will remain as an environmental zone (Zone E2) and attached to one of the larger lots for management purposes.

Legislative Requirements

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the *Environmental Planning and Assessment Act 1979*, the *Threatened Species Conservation Act 1995*, the *Environment Protection and Biodiversity Conservation Act 1999* and the *Fisheries Management Act 1994*.

In respect of matters required to be considered under the *Environmental Planning & Assessment Act 1979* and relating to the species / provisions of the *Threatened Species Conservation Act 1995*, one (1) threatened fauna species Little Bentwing-bat (*Miniopterus australis*), no threatened flora species, and one endangered ecological community (EEC) *Swamp Sclerophyll Forest on Coastal Floodplains* were recorded within or in close proximity to the subject site.

In accordance with Section 5A of the *Environmental Planning & Assessment Act 1979*, the 7 part test of significance concluded that the proposed subdivision will not have a significant impact on any threatened species, populations or EECs. Therefore, a Species Impact Statement should not be required for the proposed subdivision.

In respect of matters required to be considered under the *Environment Protection & Biodiversity Conservation Act 1999*, no threatened fauna species, one migratory bird species Rufous Fantail (*Rhipidura rufifrons*), no threatened flora species, and no EECs listed under this Act were recorded within or in close proximity to the subject site.

The proposed subdivision was not considered to have a significant impact on the Rufous Fantail, as likely nesting habitat will be removed. Whilst the Rufous Fantail is not significantly affected by the proposed action a referral to *Department of the Environment, Water, Heritage and the Arts* has been undertaken. DEWHA responded (August 3rd 2010) advising that the proposal was not a Controlled Action.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

The proponent has purchased 32ha of land for offsetting purposes at Darawank. The Hunter-Central Rivers CMA requested that 27.27ha would be required to offset vegetation loss within the subject site, therefore the purchase of land is deemed adequate in satisfying the *Threatened Species Tool.*

Conclusion

It is concluded that the proposed subdivision of Lot 6 DP 244030 and Lot 9 DP 250425 off Diamond Beach Road, Diamond Beach, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats and as such no further assessments are considered to be required under the *Environmental Planning and Assessment Act 1979* or the *Fisheries Management Act 1994*.

Report prepared by:

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Licences

Individual staff members are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Section 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: S10359.

The staff of *Travers bushfire & ecology* are licensed under an Animal Research Authority issued by the Department of Agriculture. This authority allows *Travers bushfire & ecology* staff to conduct various fauna surveys of native and introduced fauna for the purposes of environmental consulting throughout New South Wales.

TABLE OF CONTENTS

1 INTRODUCTION

An ecological assessment has been undertaken by *Travers bushfire & ecology* to identify the ecological characteristics of Lot 6 DP 244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach for the purposes of a proposed subdivision to create eighty nine (89) residential allotments of between 551-2,005m^2.

An area of 9,521m2 adjacent to the foreshore will remain as an environmental zone (Zone E2) and attached to one of the larger lots for management purposes.

Figure 1 provides an aerial appraisal of the subject site showing the vegetation communities, survey effort and threatened species locations.

Figure 2 shows the proposed subdivision layout and ecological constraints (endangered ecological communities and threatened species locations) of the subject site.

1.1 Aims of the assessment

The aims of the flora and fauna assessment are to:

- Carry out a botanical survey to describe the vegetation communities and their conditions in accordance with the guidelines adopted by Greater Taree Council
- Carry out a fauna survey for the detection and assessment of fauna and their habitats in accordance with the guidelines adopted by Greater Taree Council
- Complete target surveys for threatened species, populations and ecological communities
- Assess the conservation value of the site
- Prepare a flora and fauna impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act) and guidelines issued by the National Parks and Wildlife Service (NPWS).

1.2 Information collation

A review of the relevant information pertinent to the subject site was undertaken prior to the initiation of field surveys as background to the study. Information sources reviewed include the following:

Client documents including:

- Survey and mapping undertaken by *Lidbury Summers & Whiteman*

Standard Technical Resources:

- *Flora and Fauna Survey Guidelines – Greater Taree Council 2006*
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (scale 1:25,000) and topographical maps (scale 1:25,000)
- *Atlas of NSW Wildlife 2009 and 2010* (DECCW) 1:100,000 scale map sheet
- The schedules of the *TSC Act*
- The schedules of the *FM Act*
- Lists of threatened species and communities in the *EPBC Act*
- Rare or Threatened Australian Plants (ROTAP)

1.3 Statutory requirements

1.3.1 Threatened Species Conservation Act 1995

The specific requirements of the *TSC Act* must be addressed in the assessment of flora and fauna matters. This requires the consideration of potential impacts on threatened species, populations and ecological communities.

The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *Environmental Planning and Assessment Act 1979* (EPA Act) and are based on a 7 part test of significance.

Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, a Species Impact Statement (SIS) is required to be prepared.

1.3.2 Fisheries Management Act 1994

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

1.3.3 Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the *Department of the Environment, Water, Heritage and the Arts (DEWHA)* for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A significant impact is regarded as being;

> *important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.*
>
> *Source: EPBC Policy Statement*

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

1.4 Subdivision proposal

The proposal is to subdivide Lot 6 DP 244030 and Lot 9 DP 250425 into eighty nine (89) residential allotments varying between 551-2,005m^2.

An area of 9,521m2 adjacent to the foreshore will remain as an environmental zone (Zone E2) and attached to one of the larger lots for management purposes.

An ecological offset proposal (refer to section 4.15.1 for details) that states the proponent has purchased 32.01ha of land at Darawank approximately 12km to the south south-west in order to offset the loss of vegetation within the subject site for the current proposal.

The current proposal is expected to modify or remove an estimated 7.1ha of vegetation of which 0.8ha is considered an endangered ecological community.

The offsetting proposal was enacted after the *Hunter-Central Rivers CMA* undertook an assessment of the site which returned the result (via the threatened species tool) of acquiring 27.27ha of land to offset the loss of vegetation on the subject site. This letter is attached as Appendix 1.

The negotiations on offsetting involved a senior officer from the Coffs Harbour division of the *Department of Conservation Climate Change and Water.*

1.5 Site description

The planning and cadastral details of the subject site are provided in Table 1.1, while Table 1.2 summarises the geographical characteristics of the site.

Table 1.1 – Site details

Location	Lot 6 DP 244030 and Lot 9 DP 250425
Description of location	The subject site is bounded to the north by newly constructed rural residential subdivision, to the east by Diamond Beach foreshore, to the south by Diamond Beach Holiday Park and Diamond Beach Public School, and to the west by Diamond Beach Road.
Area	Approximately 10.9 hectares
Topographic map	Hallidays Point 1:25000
Grid reference	456450E and 6485050N
Local government area	Greater Taree Council
Existing land use	Regrowth forest, cleared paddocks and previous rural residence
Proposed subdivision	See section 1.4

Table 1.2 – Site characteristics

Elevation	Approximately 4.7-26 metres AHD
Topography	The central and eastern portion of the subject site is situated on gentle slopes, mostly less than 5% gradients. Parts of the western portion vary from 5-10%.
Aspect	Various with the highest elevations adjacent to Diamond Beach Road
Geology and soils	Geology - Characterised by a combination of tilted sediments of the Carboniferous period, Quaternary alluvium and recent sand dunes. Soils - Soils vary from moderately shallow loam in the west to deep silt towards the east and deep sand in the eastern edge. No rock outcrops were observed.
Catchment	Khappinghat Creek
Drainage	Overland flow to Khappinghat Creek or direct to Pacific Ocean (Diamond Beach)
Vegetation	The western portion of the site contains heath vegetation typical of fore-dunes and hind-dunes. The central portion contains regrowth open forest with various Eucalypt species, Casuarinas, Melaleucas, Gahnia's and heath species. The western portion is largely cleared with paddock grasses, annual and perennial weeds.

The subject site has been affected by the following impacts:

Table 1.3 – Site disturbance

Clearing	Approximately 85-90% of the site has been cleared in the past with about 7ha of regrowth in the last 20-25 years. Much of the western portion of the site adjacent to Diamond Beach Road remains cleared.
Agriculture / Pastoral	Some of the western portion of the subject site was most likely grazed in the past given the cleared nature of the vegetation.
Introduced weeds	Within the bushland areas, there are very few weeds. There are minor incursions of Lantana within but generally representing less than 5% of the mid storey layer of vegetation. Within cleared patches the vegetation is predominately weedy with annual and perennial weeds and pastoral grasses.
Evidence of feral, introduced or domestic fauna	Dogs, Rabbits, Horse, Hares, Black Rat and Common Starlings have been recorded within or in close proximity to the subject site and likely impact on local native species.

2 SURVEY TECHNIQUES

2.1 Background

It is important to note that field survey data collected during the survey period is representative of species occurring within the subject site for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the subject site outside the nominated survey period.

Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to overcome this survey limitation.

2.2 Survey techniques

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site a variety of assessments were undertaken to supplement previous surveys of the area and literature reviews. The methods utilised included:

- ***Literature review*** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.

- ***Data search*** – A search of the *Atlas of NSW Wildlife* (DECCW, 2009 and 2010) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. This enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables 4.1, 4.2 & 4.3).

- ***Aerial photograph interpretation*** – Aerial photographs at 1:25,000 scale were utilised to identify the extent of vegetation with respect to the site and surrounding areas. Additional, digital sources such as Google Earth Pro and Spatial Information Exchange may have been utilised.

- ***Accuracy of identification*** – Specimens of plants not readily discernible in the field were collected for identification. Structural descriptions of the vegetation were made according to Specht *et al* (1995). Scat and hair samples collected are sent to Barbara Triggs for identification. Invertebrates are sent to Michael Shea at the Malacology Section of the Australian Museum.

2.3 Fauna survey methodology

2.3.1 Diurnal birds

Visual observation and call identification of birds was carried out during visits to the site.

Opportunistic bird counts are also made while undertaking other survey work and during spotlight surveys of the site.

Birds were observed and identified using handheld binoculars. Calls were generally identified in the field by the observer. If an unknown call was heard it was cross-matched to bird call reference libraries taken into the field.

2.3.2 Nocturnal birds

The presence of nocturnal birds is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this and provided no calls were heard call-playback techniques are employed. This involves broadcasting recorded calls through a 15 watt Toa '*Faunatech*' amplifier to evoke a response from species known to reply.

Given the suitability of habitat present, nocturnal bird species targeted by call-playback included Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Grass Owl (*Tyto capensis*), Black Bittern (*Ixobrychus flavicollis*), and Bush Stone-curlew (*Burhinus grallarius*).

Each call was played for 5-minute periods with 5-minute intervals of quiet listening for a response. This was followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Call-playback stations are provided in Figure 1.

Searches for evidence of Owl roosts and potential Owl roosting / breeding hollows were made during surveys of the subject site. Any whitewash, or regurgitated pellets found were noted.

2.3.3 Arboreal and terrestrial mammals

Elliott type A and B traps were used for trapping arboreal and terrestrial mammals during 2003 survey by *Conacher Travers*. Trapping consisted of a total of 70 trap nights including 10 arboreal trap nights and 60 terrestrial trap nights.

Arboreal trap-lines using 10-20 metre separations were placed in the most suitable trees along approximately 80m transects. Elliott type A traps were placed onto platforms that were attached to the trunks of trees 2-3 m above the ground at an incline of 10 degrees to facilitate drainage during inclement weather. A mixture of honey and water was then sprayed onto the trunk 3-5 metres above the trap and around the platform as a lure.

Terrestrial trap-lines of type A and B Elliott traps using 10-20 metre separations were placed along the same line as the arboreal traps in the most suitable terrestrial habitats.

The traps were baited with a mixture of rolled oats, honey and peanut butter.

Six trap-lines were set on the nights of February 11th and 12th 2003. The location of the trap-lines is shown on Figure 1. Trap-lines 1 to 5 consisted of 3 type B terrestrial traps and 2 cage traps. Trap-line 6 consisted of 5 type A arboreal traps, 3 type B terrestrial traps and 2 cage traps.

Hair tubes were used to survey for arboreal and terrestrial mammals during the recent updated 2010 surveys. Three (3) hair tube transect lines were placed from 27th January to 9th February 2010. As the effects of rain and weather on bait and scented luring make hair

tubes less effective in time, only the first four nights are counted in this survey effort amounting to 60 arboreal and 120 terrestrial hair tube nights.

As with Elliott trapping, 5 trap stations were undertaken along each hair tube transect. Approximately 50m separations were used with one large arboreal, one large terrestrial and one small terrestrial placed at each station. Terrestrial hair tubes at each station were placed at least 10m apart.

Arboreal hair tubes were attached to the trunk of trees using rubber bands. As with the previous Elliott trapping, a mixture of honey and water was then sprayed onto the trunk up to 8 metres above the arboreal tube as a lure. Terrestrial hair tubes were placed in suitable areas of dense shrub and ground cover and often near to signs of foraging; burrows or shelters. All hair tubes were baited with a mixture of rolled oats, honey and peanut butter. All large terrestrial tubes were supplemented with sardines to target Spotted-tailed Quoll (*Dasyurus maculatus*).

Double-sided tape was attached around the entry of tubes so hair samples of animals entering the tube were collected. Hair samples collected were sent to Barbara Triggs for identification.

Spotlighting within the subject site

Spotlighting for nocturnal mammalian fauna was carried out using a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the woodland areas of the subject site so that a maximum number of trees could be observed.

Call-playback techniques for nocturnal mammals

The presences of Koala (*Phascolactos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) were targeted by broadcasting taped calls through a 15 watt Toa 'Faunatech' amplifier. Calls were played for 5-minute periods during nocturnal surveys. This was followed by quiet listening and spotlighting. Nocturnal mammal call-playback stations are shown on Figure 1.

Secondary indications within the subject site

Assessment was made of 'found' scats, markings, diggings, runways and scratches during visits to the site. Any scats or pellets not readily identifiable were collected and sent to Barbara Triggs for identification of contents, hair or bone fragments. Feather samples, specifically of potential owls, are sent as scaled photos to the Australian Museum for identification. Habitat was also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site.

Koala assessment

The subject area was assessed for activity by Koalas using the following methods:

- A search of the *Atlas of NSW Wildlife* (DECCW 2009/10) databases.

- Identification and an assessment of the density of tree species listed as Koala feed trees in *State Environmental Protection Policy No. 44 – Koala Habitat Protection* (SEPP 44) was undertaken across the site. An estimate of the percentage density of each tree species within vegetation communities was determined by averaging the percentage of stems counted.

- Given the presence of potential Koala habitat as defined by SEPP 44, one 50x50 metre Koala search quadrats was undertaken within the Swamp Mahogany / Paperbark Open Forest Regrowth community where feed trees were present at suitable densities. All Koala feed trees (being Swamp Mahoganies – *Eucalyptus robusta* – in this case) within the quadrat were search for signs of activity, including characteristic claw marks on the trunk and more specifically scats around the base of each tree. The location and density of droppings if found were documented.

- Koalas were also targeted during call-playback and spotlight surveys.

2.3.4 Bats

Micro-chiropteran bats were surveyed by echolocation using Anabat Mk 2 and SD-1 detectors in fixed passive monitoring positions throughout the subject site. Locations were determined in order to represent different available foraging structures for various micro-chiropteran bat species.

Bat call recordings were interpreted through Anabat V and Anabat CF Storage and Interface Module ZCAIM devices and analysed using Anabat 6 and Analook 3.3q computer software packages.

Anabat recoding stations are shown on Figure 1.

Mega-chiropteran bat species, such as Grey-headed Flying-fox (*Pteropus poliocephalus*), were surveyed by targeting flowering / fruiting trees during spotlighting activities.

2.3.5 Amphibians

Amphibians were surveyed by vocal call identification, spotlighting and opportunistically by driving along sealed roads near waterways. For similar calling species, male calls were compared to recorded calls from a reference library for accuracy of identification. Amphibians were also surveyed by habitat searches.

The presence of Green & Golden Bell Frog and Wallum Froglet were targeted by broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier carried over the shoulder from a CD recording obtained from *Australian Frog Calls – Subtropical East (Nature Sound – David Stewart).* The call was played for a 5-minute period with 5-minute quiet listening for response. This was followed with quiet listening and spotlighting. Frog call-playback stations are shown on Figure 1.

Any amphibians found are visually identified and when required to be examined are handled with latex gloves and kept moist until release. Any tadpoles requiring capture are collected with a scoop net and placed within a snaplock clear plastic bag for analysis of colour and morphological features.

2.3.6 Reptiles

Searches for reptiles in likely localities such as under logs, rubbish debris, and in deep leaf litter were undertaken during diurnal visits to the site.

Spotlighting of terrestrial habitats suitable for reptiles occurred during nocturnal surveys.

Field survey method

Tables 2.1 and 2.2 below detail the flora and fauna survey effort undertaken for the subject site.

Table 2.1 – Flora survey methodology and dates

Flora survey	Method	Dates
Vegetation communities	Survey of the boundaries of all communities Vegetation community refinement and GPS boundary of the Swamp Mahogany / Paperbark Open Forest Regrowth area	10/02/03 25/01/10
Stratified sampling	Transect lines x6 and random meander 20x20 metre quadrats across vegetated areas within proposed subdivided areas and random meander	10/02/03 25/01/10 & 27/01/10
Target searches	Target searches in known habitats	10/02/03, 25/01/10 & 27/01/10

Table 2.2 – Fauna survey methodology and dates

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
Diurnal birds	11/2/03	2/8 cloud, 11-17kph SW, temp 31^{o}C	Diurnal Opportunistic	1hr 15.00 - 16.00
	12/2/03	3/8 cloud, no wind, temp 23^{o}C	Diurnal Opportunistic	1hr 08.00 - 0900
	13/2/03	2/8 cloud, no wind, temp 25^{o}C	Diurnal Opportunistic	1hr 30min 08.00 - 0930
	27/1/10	7/8 cloud, no wind, prev light rain, temp 27-29^{o}C (humid)	Diurnal opportunistic	6hrs 1220 - 1820
			Diurnal opportunistic	25min 1955 - 2020
	9/2/10	4/8 cloud, no wind, previous rain, temp 30^{o}C (humid)	Diurnal opportunistic	4hrs 1405 - 1805
	5/8/10	2/8 cloud, light westerly to no wind, no rain, temp 20-13.5 ^{o}C	Target – Varied Sitella	3hrs 25mins 1415 - 1740
Nocturnal birds	11/2/03	1/8 cloud, no wind, temp 23^{o}C	Owl call playback	30min 20.00 – 20.30
	12/2/03	1/8 cloud, 11-19 kph NE, temp 25^{o}C	Owl call playback	30min 20.00 – 20.30
	27/1/10	7/8 cloud, no wind, no rain, temp 25^{o}C	Owl call playback & spotlighting	1hr 35min 2040 - 2215
	9/2/10	0/8 cloud, no wind, no rain, temp 25^{o}C	Owl call playback & spotlighting	2hrs 5min 2040 - 2245

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
Arboreal mammals	11/2/03	1/8 cloud, no wind, temp 23°C	Spotlighting	1hr 20min 20.00 – 21.20
	12/2/03	3/8 cloud, no wind, temp 23°C	Elliott trapping	5 trap nights
	12/2/03	3/8 cloud, 0-6kph NW, temp 29°C	Targeted scat search	1hr 09.30 – 10.30
	12/2/03	1/8 cloud, 6-11 kph NE, temp 27°C	Targeted scat search	1hr 1830 - 1930
	12/2/03	1/8 cloud, 11-19 kph NE, temp 25°C	Spotlighting	1hr 20min 20.00 – 21.20
	13/2/03	2/8 cloud, no wind, temp 25°C	Elliott trapping	5 trap nights
	27/1/10 – 9/2/10	Various	Hair Tubes (3 lines of 5 large)	60 large hair tube nights
	27/1/10	7/8 cloud, no wind, prev light rain, temp 27-29°C (humid)	Spotlighting + call playback (Koala & Squirrel Glider)	1hr 35min 2040 - 2215
	9/2/10	4/8 cloud, no wind, previous rain, temp 30°C (humid)	Spotlighting + call playback (Koala, Yellow-bellied Glider & Squirrel Glider)	2hrs 5min 2040 - 2245
Terrestrial mammals	11/2/03	1/8 cloud, no wind, temp 23°C	Spotlighting	1hr 20min 20.00 – 21.20
	12/2/03	3/8 cloud, no wind, temp 23°C	Elliott and cage trapping	30 trap nights
	12/2/03	1/8 cloud, 11-19 kph NE, temp 25°C	Spotlighting	1hr 20min 20.00 – 21.20
	13/2/03	2/8 cloud, no wind, temp 25°C	Elliott and cage trapping	30 trap nights
	27/1/10 – 9/2/10	Various	Hair Tubes (3 lines of 5 large) Hair Tubes (3 lines of 5 small)	60 large hair tube nights 60 small hair tube nights
	27/1/10	7/8 cloud, no wind, prev light rain, temp 27-29°C (humid)	Spotlighting	1hr 35min 2040 - 2215
	9/2/10	4/8 cloud, no wind, previous rain, temp 30°C (humid)	Spotlighting	2hrs 5min 2040 - 2245
Bats	11/2/03	1/8 cloud, 11-19 kph NE, temp 26°C	Anabat II	1hr 30min 19.45 – 21.15
	12/2/03	1/8 cloud, no wind, temp 23°C	Anabat II	1hr 30min 19.50 – 21.20
	27/1/10	7/8 cloud, no wind, prev light rain, temp 27-29°C (humid)	Anabat II x2 / Anabat SD-1x1 Spotlighting	3hrs 35min 2000 - 2215 1hr 35min 2040 - 2215
	9/2/10	4/8 cloud, no wind, previous rain, temp 30°C (humid)	Anabat II x2 / Anabat SD-1x1 Spotlighting	7hrs 25min 1950 - 2245 2hrs 5min 2040 - 2245
Reptiles	11/2/03	1/8 cloud, 6-11kph NW, temp 22°C	Spotlighting	1hr 20min 20.00 – 21.20
	12/2/03	3/8 cloud, 0-6kph NW, temp 29°C	Habitat search	1hr 09.30 – 10.30
	12/2/03	1/8 cloud, 6-11 kph NE, temp 27°C	Habitat search	1hr 1830 - 1930
	12/2/03	1/8 cloud, 11-19 kph NE, temp 25°C	Spotlighting	1hr 20min 20.00 – 21.20
	27/1/10	7/8 cloud, no wind, prev light rain, temp 27-29°C (humid)	Habitat search, opportunistic Habitat search, opportunistic	6hrs 1220 - 1820 25min 1955 - 2020

Fauna group	Date	Weather conditions	Survey method	Survey effort / time (24hr)
	9/2/10	7/8 cloud, no wind, no rain, temp 25°C 4/8 cloud, no wind, previous rain, temp 30°C (humid) 0/8 cloud, no wind, no rain, temp 25°C	Spotlighting Habitat search, opportunistic Spotlighting	1hr 35min 2040 - 2215 4hrs 1405 - 1805 2hrs 35min 2040 - 2245
Amphibians	11/2/03 12/2/03 12/2/03 12/2/03 27/1/10 9/2/10 5/8/10	1/8 cloud, 6-11kph NW, temp 22°C 3/8 cloud, 0-6kph NW, temp 29°C 1/8 cloud, 6-11 kph NE, temp 27°C 1/8 cloud, 11-19 kph NE, temp 25°C 7/8 cloud, no wind, prev light rain, temp 27-29°C (humid) 7/8 cloud, no wind, no rain, temp 25°C 4/8 cloud, no wind, previous rain, temp 30°C (humid) 0/8 cloud, no wind, no rain, temp 25°C 2/8 cloud, light westerly to no wind, no rain, temp 20-13.5 °C	Spotlighting Habitat search Habitat search Spotlighting Habitat search, opportunistic Habitat search, opportunistic Spotlighting Habitat search, opportunistic Spotlighting Target Wallum Froglet – Spotlighting, call-playback	1hr 20min 20.00 – 21.20 1hr 09.30 – 10.30 1hr 1830 - 1930 1hr 20min 20.00 – 21.20 6hrs 1220 - 1820 25min 1955 - 2020 1hr 35min 2040 - 2215 4hrs 1405 - 1805 2hrs 5min 2040 - 2245 3hrs 25mins 1415 - 1740

3 SURVEY RESULTS

3.1 Flora results

Seven (7) vegetation communities were identified within the subject site through ground truthing.

- Vegetation Community 1 – Grassland with Scattered Trees
- Vegetation Community 2 – Cleared (tracks)
- Vegetation Community 3 – Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth
- Vegetation Community 4 – Swamp Mahogany / Paperbark Open Forest Regrowth
- Vegetation Community 5 – Coastal Scrub (Hind dune) Regrowth
- Vegetation Community 6 – Coastal Scrub (Fore dune)
- Vegetation Community 7 – Aquatic Herbfield (dam)

Vegetation communities are described in detail in section 4.3.

The plants observed within the vegetation communities of the subject site are listed in the Tables 3.1 (native species) and Table 3.2 (exotic species) below. A total of one hundred and seventy one (171) species have been identified including one hundred and twenty six (126) native species and forty five (45) exotic species. Those landscaping species in close proximity to the old residence on site have not been included with the species lists.

No endangered flora species were observed.

Table 3.1 – Native plant species observed in the subject site

Scientific Name	Common Name	Family
Trees		
Acacia maidenii	Maiden's Wattle	Mimosoideae
Allocasuarina littoralis	Black She-oak	Casuarinaceae
Allocasuarina torulosa	Forest Oak	Casuarinaceae
Banksia integrifolia	Honeysuckle	Proteaceae
Casuarina glauca	Swamp Oak	Casuarinaceae
Corymbia maculata	Spotted Gum	Myrtaceae
Eucalyptus carnea	Broad-leaved White Mahogany	Myrtaceae
Eucalyptus paniculata	Grey Ironbark	Myrtaceae
Eucalyptus pilularis	Blackbutt	Myrtaceae
Eucalyptus robusta	Swamp Mahogany	Myrtaceae
Eucalyptus tereticornis	Forest Red Gum	Myrtaceae
Ficus rubiginosa	Port Jackson Fig	Moraceae
Livistona australis	Cabbage Tree Palm	Arecaceae
Lophostemon confertus	Brush Box	Myrtaceae
Melaleuca quinquenervia	Broad-leaved Tea Tree	Myrtaceae
Melia azedarach var. *australasica*	White Cedar	Meliaceae
Shrubs		
Acacia elongata	Swamp Wattle	Mimosoideae

Table 3.1 – Native plant species observed in the subject site

Scientific Name	Common Name	Family
Acacia irrorata	-	Mimosoideae
Acacia longifolia	Sydney Golden Wattle	Mimosoideae
Banksia ericifolia	Heath-leaved Banksia	Proteaceae
Bossiaea heterophylla	Variable Bossiaea	Fabaceae
Breynia oblongifolia	Breynia	Euphorbiaceae
Callistemon salignus	Willow Bottlebrush	Myrtaceae
Cupaniopsis anacardioides	Tuckeroo	Sapindaceae
Epacris pulchella	NSW Coral Heath	Epacridaceae
Exocarpos cupressiformis	Native Cherry	Santalaceae
Glochidion ferdinandi	Cheese Tree	Euphorbiaceae
Hibbertia aspera	-	Dilleniaceae
Leptospermum laevigatum	Coastal Tea Tree	Myrtaceae
Leptospermum polygalifolium	Tantoon	Myrtaceae
Leucopogon juniperinus	Bearded Heath	Epacridaceae
Maytenus silvestris	-	Celastraceae
Melaleuca linariifolia	Snow in Summer	Myrtaceae
Melaleuca nodosa	-	Myrtaceae
Melaleuca styphelioides	Prickly-leaved Tea Tree	Myrtaceae
Mirbelia rubiifolia	-	Fabaceae
Monotoca elliptica	Tree Broom-heath	Epacridaceae
Myrsine variabilis	Muttonwood	Myrsinaceae
Notelaea longifolia	Mock Olive	Oleaceae
Persoonia lanceolata	Lance-leaved Geebung	Proteaceae
Phebalium squamulosum	Satinwood	Rutaceae
Pittosporum revolutum	Yellow Pittosporum	Pittosporaceae
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae
Polyscias sambucifolia	Elderberry Panax	Araliaceae
Pomaderris elliptica	-	Rhamnaceae
Pomaderris ferruginea	Rusty Pomaderris	Rhamnaceae
Rhodamnia rubescens	Brush Turpentine	Myrtaceae
Rhodomyrtus pisdioides	Native Guava	Myrtaceae
Wilkiea huegeliana	Wilkiea	Monimiaceae
Zieria smithii	Sandfly Zieria	Rutaceae
Vines		
Billardiera scandens	Apple Dumplings	Pittosporaceae
Cassytha pubescens	Devil's Twine	Lauraceae
Cissus antarctica	Native Grape	Vitaceae
Clematis aristata	Clematis	Ranunculaceae
Eustrephus latifolius	Wombat Berry	Luzuriagaceae
Geitonoplesium cymosum	Scrambling Lily	Luzuriagaceae
Glycine clandestina	Twining Glycine	Faboideae
Glycine microphylla	Twining Glycine	Faboideae
Hardenbergia violacea	False Sarsparilla	Fabaceae
Hibbertia dentata	Twining Guinea Flower	Dilleniaceae
Hibbertia scandens	Climbing Guinea Flower	Dilleniaceae
Kennedia rubicunda	Dusky Coral Pea	Faboideae
Morinda jasminoides	-	Rubiaceae
Pandorea pandorana	Wonga Vine	Bignoniaceae
Parsonsia straminea	Common Silkpod	Apocynaceae
Polymeria calycina	Bindweed	Convolvulaceae
Rubus moluccanus	Broad-leaf Bramble	Rosaceae
Stephania japonica	Snake Vine	Menispermiaceae

Table 3.1 – Native plant species observed in the subject site

Scientific Name	Common Name	Family
Herbs		
Baloskion tetraphyllum	Tassel-rush	Restionaceae
Blechnum cartilagineum	Gristle Fern	Blechnaceae
Caustis flexuosa	Curly Sedge	Cyperaceae
Centella asiatica	Swamp Pennywort	Apiaceae
Commelina cyanea	Scurvy Weed	Commelinaceae
Cynodon dactylon	Common Couch	Poaceae
Desmodium varians	Slender Tick-trefoil	Faboideae
Dianella caerulea	Flax Lily	Phormiaceae
Dichelachne crinita	Long-hair Plume Grass	Poaceae
Dichelachne micrantha	Short-hair Plume Grass	Poaceae
Dichondra repens	Kidney Weed	Convolvulaceae
Drosera peltata	Sundew	Droseraceae
Echinopogon ovatus	Forest Hedgehog Grass	Poaceae
Eclipta platyglossa	-	Asteraceae
Entolasia marginata	Bordered Panic	Poaceae
Entolasia stricta	Wiry Panic	Poaceae
Epaltes australis	Spreading Nutheads	Asteraceae
Eragrostis elongata	Clustered Lovegrass	Poaceae
Euchiton sphericus	-	Asteraceae
Fimbristylis dichotoma	Common Fringe-rush	Cyperaceae
Gahnia aspera	Saw Sedge	Cyperaceae
Gahnia clarkei	Saw Sedge	Cyperaceae
Geranium homeanum	-	Geraniaceae
Goodenia bellidifolia	-	Goodeniaceae
Gymnostachys anceps	Settlers Flax	Araceae
Hibbertia aspera	Rough Guinea Flower	Dilleniaceae
Hydrocotyle peduncularis	Pennywort	Apiaceae
Imperata cylindrica	Blady Grass	Poaceae
Juncus usitatus	Common Rush	Juncaceae
Lachnagrostis filiformis	Blown Grass	Poaceae
Lagenifera stipitata	Common Lagenifera	Asteraceae
Lepidosperma concavum	-	Cyperaceae
Leptocarpus tenax	Slender Twine-rush	Restionaceae
Lobelia alata	-	Lobeliaceae
Lomandra filiformis	Wattle Mat-rush	Lomandraceae
Lomandra longifolia	Spiky-headed Mat-rush	Lomandraceae
Microlaena stipoides	Weeping Grass	Poaceae
Oplismenus aemulus	-	Poaceae
Oplismenus imbecillis	-	Poaceae
Oxalis perennans	-	Oxalidaceae
Panicum simile	Two Colour Panic	Poaceae
Pimelea linifolia subsp. *linifolia*	Slender Rice Flower	Thymelaeaceae
Poa sieberiana	Poa Tussock	Poaceae
Pomax umbellata	Pomax	Rubiaceae
Portulaca oleracea	Purslane	Portulacaceae
Pratia purpurascens	Whiteroot	Lobeliaceae
Pseuderanthemum variabile	Pastel Flower	Acanthaceae
Sporobolus elongatus	Slender Rat's Tail Grass	Poaceae
Themeda australis	Kangaroo Grass	Poaceae
Thysanotus tuberosus	Fringed Lily	Anthericaceae

Table 3.1 – Native plant species observed in the subject site

Scientific Name	Common Name	Family
Tricostularia pauciflora	-	Asteraceae
Vernonia cinerea	-	Asteraceae
Viola hederacea	Ivy-leaved Violet	Violaceae
Ferns		
Gleichenia dicarpa	Pouched Coral Fern	Gleicheniaceae
Histiopteris incisa	Bat's-wing Fern	Dennstaedtiaceae
Hypolepis muelleri	Harsh Ground Fern	Dennstaedtiaceae
Pteridium esculentum	Bracken Fern	Dennstaedtiaceae
Selaginella uliginosa	Swamp Selaginella	Selaginallaceae

Table 3.2 – Exotic plant species observed in the subject site

Scientific Name	Common Name	Family
Acacia saligna	Golden Wreath Wattle	Mimosoideae
Ageratina adenophora	Crofton Weed	Asteraceae
Amaranthus viridus	Green Amaranth	Amaranthaceae
Andropogon virginicus	Whisky Grass	Poaceae
Araucaria heterophylla	Norfolk Island Pine	Araucariaceae
Araujia sericifera	Mothvine	Apocnyaceae
Asparagus aetheopicus	Asparagus Fern	Asparagaceae
Axonopus affinis	Narrowleaf Carpet Grass	Poaceae
Bidens pilosa	Cobblers Pegs	Asteraceae
Centaurium erythraea	Pink Stars	Gentianaceae
Chloris gayana	Rhodes Grass	Poaceae
Chrysanthemoides monilifera	Bitou Bush	Asteraceae
Cirsium vulgare	Spear Thistle	Asteraceae
Conyza sumatrensis	Tall Fleabane	Asteraceae
Cyperus congestus	-	Cyperaceae
Cyperus sesquiflorus	-	Cyperaceae
Ehrharta erecta	Panic Veldtgrass	Poaceae
Eragrostis cilianansis	Stinkgrass	Poaceae
Gamochaeta spicata	Cudweed	Asteraceae
Gomphocarpus fruticosus	Narrow Leaf Cotton Bush	Apocnynaceae
Hedera helix	English Ivy	Araliaceae
Hedychium gardnerianum	Ginger Lily	Zingiberaceae
Hydrocotyle bonariensis	Pennywort	Apiaceae
Hypochaeris radicata	Flatweed	Asteraceae
Lantana camara	Lantana	Verbenaceae
Nymphaea sp.	Water Lily	Nymphaceae
Oxalis corniculata	Yellow Wood Sorrel	Oxalidaceae
Paspalum dilatatum	Paspalum	Poaceae
Paspalum urvillei	Vasey Grass	Poaceae
Passiflora caerulea	Blue Passionflower	Passifloraceae
Pennisetum clandestinum	Kikuyu	Poaceae
Phyllostachys aurea	Fishpole Bamboo	Poaceae
Plantago lanceolata	Ribwort	Plantaginaceae
Senecio madagascariensis	Fireweed	Asteraceae
Senna pendula	Cassia	Caesalpinioideae
Setaria sphacelata	Setaria	Poaceae
Sida rhombifolia	Paddy's Lucerne	Malvaceae
Solanum mauritianum	Tobacco Bush	Solanaceae
Solanum physalifolium	-	Solanaceae
Sorghum halepense	Johnson Grass	Poaceae

Table 3.2 – Exotic plant species observed in the subject site

Scientific Name	Common Name	Family
Sporobolus africanus	Parramatta Grass	Poaceae
Stenotaphrum secundatum	Buffalo Grass	Poaceae
Trifolium repens	White Clover	Faboideae
Verbena bonariensis	Purple Top	Verbenaceae
Verbena rigida	Veined Verbena	Verbenaceae

3.2 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed in Table 3.3 below.

Table 3.3 – Fauna observations for the study area

Common name	Scientific name	Method Observed	
Birds		**Feb 2003**	**Jan/Feb 2010**
Australian Magpie	*Gymnorhina tibicen*	O	O C
Australian Magpie-Lark	*Grallina cyanoleuca*	O	O C
Australian Raven	*Corvus coronoides*	O	C
Australian Wood Duck	*Chenonetta jubata*		C
Bar-shouldered Dove	*Geopelia humeralis*		O C
Brown Thornbill	*Acanthiza pulsilla*		O C
Common Starling *	*Sturnus vulgaris*	O	
Crested Pigeon	*Ocyphaps lophotes*	O	O
Crested Tern	*Sterna bergii*	O	
Double-barred Finch	*Taeniopygia bichenovii*		O C
Eastern Rosella	*Platycercus eximius*		C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O C	O C
Eastern Whipbird	*Psophodes olivaceus*	O C	O C
Eastern Yellow Robin	*Eopsaltria australis*		O C
Figbird	*Sphecotheres viridis*	O C	C
Galah	*Cacatua roseicapilla*	O	O C
Golden Whistler	*Pachycephala pectoralis*	O C	O C
Grey Butcherbird	*Cracticus torquatus*		C
Grey Fantail	*Rhipidura fuliginosa*	O C	O C
Grey Shrike-thrush	*Colluricincla harmonica*		O C
Jacky Winter	*Microeca fascinans*	O	
Laughing Kookaburra	*Dacelo novaeguineae*	O C	O C
Lewin's Honeyeater	*Meliphaga lewinii*		C
Little Wattlebird	*Anthochaera chrysoptera*	O C	O C
Masked Lapwing	*Vanellus miles*	O C	O C
New Holland Honeyeater	*Phylidonyris novaehollandiae*		O C
Noisy Friarbird	*Philemon corniculatus*	O C	C
Olive-backed Oriole	*Oriolus sagittatus*		O
Pelican	*Pelecanus conspicillatus*	O	
Pheasant Coucal	*Centropus phasianinus*	O	
Pied Butcherbird	*Cracticus nigrogularis*	O	O
Pied Currawong	*Strepera graculina*	O	C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C	C
Red-browed Finch	*Neochmia temporalis*	O	O C
Rufous Fantail	*Rhipidura rufifrons*		O C
Satin Bowerbird	*Ptilonorhynchus violaceus*		O
Scaly-breasted Lorikeet	*Trichoglossus haematodus*	O C	O C
Silver Gull	*Larus novaehollandiae*	O	

Table 3.3 – Fauna observations for the study area

Silvereye	*Zosterops lateralis*		O C
Sooty Shearwater	*Puffinus griseus*	O	
Superb Fairy-wren	*Malurus cyaneus*	O	O C
Tawny Frogmouth	*Podargus strigoides*		Sp
Tree Martin	*Hirundo nigricans*		O
Variegated Fairy-wren	*Malurus lamberti*	O	O C
Wedge-tailed Eagle	*Aquila audax*		O
Welcome Swallow	*Hirundo neoxena*	O	
White-browed Scrubwren	*Sericornis frontalis*		C
White-faced Heron	*Egretta novaehollandiae*	O	
White-throated Needletail	*Hirundapus caudacutus*	O	
Willie Wagtail	*Rhipidura leucophrys*	O	O C
Yellow-faced Honeyeater	*Lichenostomus chrysops*		O
Yellow Thornbill	*Acanthiza nana*	O	O C
Mammals			
Black Rat *	*Rattus rattus*	E	
Brown Antechinus	*Antechinus stuartii*		S HT
Brown Hare *	*Lepus capensis*	O Sc	
Common Brushtail Possum	*Trichosurus vulpecula*		HT
Common Ringtail Possum	*Pseudocheirus peregrinus*		Sp
Dog *	*Canis familiaris*	Sc	Sc
Eastern Broad-nosed Bat	*Scotorepens orion*		A^{PR}
Eastern Forest Bat	*Vespadelus pumilus*		A^{PO}
Eastern Freetail-bat	*Mormopterus ridei*		A^{PR}
Forest Bat	*Vespadelus sp.*		A
Gould's Wattled Bat	*Chalinolobus gouldii*		A^{PR}
Horse *	*Equus caballus*	Sc	Sc
Little Bentwing-bat^{TS}	*Miniopterus australis*		A
Little Forest Bat	*Vespadelus vulturnus*	A	A^{PR}
Northern Brown Bandicoot	*Isoodon macrourus*	E	
Rabbit *	*Oryctolagus cuniculus*		O
Red-necked Wallaby	*Macropus rufogriseus*	O Sc Sp	O Sp
Swamp Rat	*Rattus lutreolus*		HT
Swamp Wallaby	*Wallabia bicolor*		O
Reptiles			
Delicate Skink	*Lampropholis delicata*		O
Eastern Long-necked Turtle	*Chelodina longicollis*		O
Garden Skink	*Lampropholis guichenoti*	O	
Red-tailed Calyptotis	*Calyptotis ruficauda*		S
Amphibians			
Common Eastern Froglet	*Crinia signifera*		C
Dainty Tree Frog	*Litoria gracilenta*		C
Dusky Toadlet	*Uperoleia fusca*		C
Dwarf Tree Frog	*Litoria fallax*		C
Green Tree Frog	*Litoria caerulea*		C
Laughing Tree Frog	*Litoria tyleri*		C
Peron's Tree Frog	*Litoria peronii*		C
Striped Marsh Frog	*Limnodynastes peronii*		C
Striped Rocket Frog	*Litoria nasuta*		C

Table 3.3 – Fauna observations for the study area

Note: * indicates introduced species
[TS] indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

[PR] indicates species identified to a 'probable' level of certainty
[PO] indicates species identified to a 'possible' level of certainty

A	-	Anabat II/SD-1	C	-	Call Identification
O	-	Observation	P	-	Call Playback Response
E	-	Trap (Elliott, cage, etc)	S	-	Habitat Search
Sp	-	Spotlight	Sc	-	Scat, Track or Sign Identification
HT	-	Hair Tube			

4 ECOLOGICAL ASSESSMENT

4.1 Previous surveys reviewed

Greater Taree City Council Draft Comprehensive Koala Plan of Management Part 1: The CKPoM (*Callaghan et al, 2002 - Australian Koala Foundation & Greater Taree City Council*, September 2002)

Vegetation for this plan has been mapped into Koala habitat classes. The Koala Habitat Atlas has mapped the subject site as 'Other Vegetation'. This vegetation has no significance for Koala habitat within the Greater Taree LGA.

Hallidays Point Habitat Study (*Greater Taree City Council*, December 1998)

In this survey and previous surveys, fourteen (14) threatened species have been recorded in the study area. These species include, Koala (*Phascolarctos cinereus*), Common Planigale (*Planigale maculata*), Squirrel Glider (*Petaurus norfolcensis*), Little Bentwing-bat (*Miniopterus australis*), Eastern Blossum Bat (*Syconycteris australis*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Osprey (*Pandion haliaceus*), Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Eastern Grass Owl (*Tyto capensis*), Glossy Black-cockatoo (*Calyptorhynchus lathami*), Australasian Bittern (*Botaurus poiciloptilus*), Pied Oystercatcher (*Haematopus longirostris*) and Sooty Oystercatcher (*Haematopus fuliginosa*).

Flora and Fauna Assessment – 'Diamond Beach North', 357 Diamond Beach Road, Diamond Beach (*Travers bushfire & ecology* 2008)

Travers bushfire & ecology were engaged to carry out a Flora and Fauna Assessment within the property known as "Diamond Beach North". This property comprises of Lot 2 DP 856418, Part of Lot 32 DP 1098858 and Part of Lot 200 DP 740455 (357) Diamond Beach Road, Diamond Beach. This site is approximately 0.5km to the north-west of the currently assessed site.

Parts of the Diamond Beach North site contained the endangered ecological community *Swamp Sclerophyll Forest on Coastal Floodplains* and there was one threatened species recorded, Wallum Froglet.

One specimen thought to have been of *Allocasuarina defungens* found within the study area but away from the proposed development footprint was sent to the Royal Botanical Gardens for confirmation. The specimen was identified as "probably *Allocasuarina littoralis x defungens*".

4.2 Flora species

A total of one hundred and seventy one (171) flora species were observed within the subject site during the survey including one hundred and twenty six (126) native species and forty five (45) exotic species. No threatened flora species were recorded during various observations. All species are listed in Table 3.1.

4.3 Vegetation communities

Seven (7) vegetation communities were identified within the subject site through ground truthing.

- Vegetation Community 1 – Grassland with Scattered Trees
- Vegetation Community 2 – Cleared (tracks)
- Vegetation Community 3 – Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth
- Vegetation Community 4 – Swamp Mahogany / Paperbark Open Forest Regrowth
- Vegetation Community 5 – Coastal Scrub (Hind dune) Regrowth
- Vegetation Community 6 – Coastal Scrub (Fore dune)
- Vegetation Community 7 – Aquatic Herbfield (dam)

Grassland with Scattered Trees

Occurrence - This vegetation community occurs in an irregular area along Diamond Beach Road.

Structure – Dense groundcover of herbs and grasses with occasional trees and small patches of shrubs.

Disturbances - This vegetation community is the result of clearing for previous agricultural or pastoral activities and has a high incidence of exotic species.

Photo 1 – Scattered Eucalypt trees in the north-eastern portion of the subject site with an understorey of Bracken, Blady Grass, herbs and annual weeds

Common Species

Trees: *Casuarina glauca* (Swamp Oak), *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* (Grey Ironbark) *Eucalyptus tereticornis* (Forest Red Gum) and *Ficus rubiginosa* (Port Jackson Fig).

Shrubs: *Acacia longifolia* (Sydney Golden Wattle), *Glochidion ferdinandi* (Cheese Tree) and *Leucopogon juniperinus* (Bearded Heath).

Groundcovers: *Cynodon dactylon* (Common Couch), *Imperata cylindrica* (Blady Grass), *Lomandra longifolia* (Spiky-headed Mat-rush), *Pteridium esculentum* (Bracken Fern) and *Themeda australis* (Kangaroo Grass).

Weeds: *Chloris gayana* (Rhodes Grass), *Paspalum dilatatum* (Paspalum), *Paspalum urvillei* (Vasey Grass) and *Pennisetum clandestinum* (Kikuyu).

Cleared (tracks)

As the name suggests, the vegetation is cleared for tracks, as part of an asset protection zone or bare ground (on the hind dune).

- There is a pronounced track running north to south through the central portion of the subject site.

- There is a cleared patch possibly as an asset protection zone or for emergency service access along the northern perimeter of the subject site abutting neighbouring residences. The width varies from 2-20 metres.

- There are some cleared areas within the hind dune area immediately north of the Diamond Beach Holiday Park.

Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth

Occurrence - This vegetation community occurs from the west of the caravan park and the prolongation of its western boundary to the clearing along Diamond Beach Road.

Structure – Open Forest with a canopy cover of approximately 50% and height of approximately 12-20 metres with occasional emergent. The understorey consists of a sparse to dense shrublayer to 8 metres and a sparse to dense groundcover of herbs and grasses.

Disturbances - This vegetation community is regrowth from a past history of clearing. A narrow strip has been cleared for construction of a sewer main. It has a generally low incidence of weeds apart from areas of moderate incursions of Lantana and incursions of a variety of weeds along the sewer line clearing.

Common Species

Trees: *Casuarina glauca* (Swamp Oak), *Eucalyptus paniculata* (Grey Ironbark) and *Melaleuca quinquenervia* (Broad-leaved Tea Tree).

Shrubs: *Breynia oblongifolia* (Coffee Bush), *Callistemon salignus* (Black She-oak), *Leucopogon juniperinus* (Bearded Heath), *Melaleuca nodosa* (Ball Honeymyrtle) and *Notelaea longifolia* (Large Mock Olive).

Groundcovers: *Dichondra repens* (Kidney Weed), *Gahnia aspera* (Saw Sedge), *Gahnia clarkei* (Saw Sedge), *Lomandra longifolia* (Spiky-headed Mat-rush), *Pratia purpurascens* (Whiteroot) and *Viola hederacea* (Ivy-leaved Violet).

Weeds: *Chloris gayana* (Rhodes Grass), *Lantana camara* (Lantana) and *Senna pendula* (Senna).

Photo 2 – Sclerophyll vegetation near the northern boundary looking south-west.

Photo 3 – Paperbark vegetation with few Eucalypts and a sparse to moderate ground layer of Gahnias and Lomandras near quadrat 8 (2010 survey).

Swamp Mahogany / Paperbark Open Forest Regrowth

Occurrence - This vegetation community occurs immediately north of the caravan park on the lowest contours of the subject site to the west of the sand dunes.

Structure – Open forest with a canopy cover of approximately 60 % and height of approximately 13-18 metres (higher for emergent trees). The understorey consists of a sparse shrublayer and a dense groundcover of herbs and ferns.

Disturbances - This vegetation community appears to be regenerating from a past history of clearing. It has a low incidence of weeds apart from incursions of Lantana and an incursion of Rhodes Grass near the north western corner of the caravan park.

Common Species

Trees: *Casuarina glauca* (Swamp Oak), *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Tea Tree).

Groundcovers: *Gahnia clarkei* (Saw Sedge), *Hypolepis muelleri* (Harsh Ground Fern) and *Viola hederacea* (Ivy-leaved Violet).

Weeds: *Chloris gayana* (Rhodes Grass) and *Lantana camara* (Lantana).

Photo 4 – Vegetation typical of the Swamp Mahogany / Paperbark Open Forest.

Coastal Scrub (Hind dune) Regrowth

This vegetation community is composed of Coastal Scrub native vegetation that has a high level of disturbance.

This community is comprised of Sydney Golden Wattle, Coastal Tea Tree and Tree Broom heath and a variety of groundcovers such as Flax Lilly, Saw Sedge and Lomandra.

Occurrence - This vegetation community occurs on the dunes behind Diamond Beach.

Structure - Open scrub with a canopy cover of approximately 35-60% and height of approximately 2-5 metres with occasional emergent Banksias. The understorey consists of a sparse groundcover of herbs and ferns.

Disturbances - This vegetation community appears to be regrowth from sand mining activities. It has a moderate incidence of weeds around disturbed areas including the southern edge of the community including Lantana.

Habitat - This community consists of June to October flowering *Acacia longifolia* (Sydney Golden Wattle), August to October flowering *Leptospermum laevigatum* (Coastal Tea Tree) and July to September flowering *Monotoca elliptica* (Tree Broom-heath).

These provide foraging habitat for birds, bats and arboreal and terrestrial mammals. No hollow bearing trees were observed within this vegetation community. This shrub layer provides suitable protective and foraging habitat for birds, arboreal mammals and terrestrial mammal species.

Common Species

Shrubs: *Acacia longifolia* (Sydney Golden Wattle), *Banksia integrifolia* (Coast Banksia), *Leptospermum laevigatum* (Coastal Tea Tree) and *Monotoca elliptica* (Tree Broom-heath).

Groundcovers: *Dianella caerulea* (Flax Lily), *Gahnia clarkei* (Saw Sedge), *Lomandra longifolia* (Spiky-headed Mat-rush), *Portulaca oleracea* (Purslane), and *Pteridium esculentum* (Bracken Fern).

Weeds: *Chloris gayana* (Rhodes Grass), *Chrysanthemoides monilifera* (Bitou Bush), *Lantana camara* (Lantana) and *Senna pendula* (Senna).

Photo 5 – Heath vegetation on the fore dune near quadrat 3 (2010 survey) looking north-east.

Coastal Scrub (Fore dune)

This vegetation community is composed of Coastal Scrub native vegetation that has not been cleared. This relates to the beach fore dune area approximately 15-20 metres in width.

This community is comprised of Sydney Golden Wattle, Coastal Tea Tree and Tree Broom heath and a variety of groundcovers such as Flax Lilly, Saw Sedge and Lomandra.

Occurrence - This vegetation community occurs on the dunes behind Diamond Beach.

Structure – Open scrub with a canopy cover of approximately 50% and height of approximately 2-5 metres. The understorey consists of a sparse groundcover of herbs and ferns.

Disturbances - This vegetation community appears to be regrowth from sand mining activities. It has a generally low incidence of weeds apart from areas of moderate incursions of Lantana.

Habitat - This community consists of June to October flowering *Acacia longifolia* (Sydney Golden Wattle), August to October flowering *Leptospermum laevigatum* (Coastal Tea Tree) and July to September flowering *Monotoca elliptica* (Tree Broom-heath).

These provide foraging habitat for birds, bats and arboreal and terrestrial mammals. No hollow bearing trees were observed within this vegetation community. This shrub layer provides suitable protective and foraging habitat for birds, arboreal mammals and terrestrial mammal species. A sparse groundcover of herbs and ferns as well as tree litter provides suitable habitat for small terrestrial mammals, ground foraging birds, reptiles and amphibians.

Common Species

Shrubs: *Acacia longifolia* (Sydney Golden Wattle), *Leptospermum laevigatum* (Coastal Tea Tree) and *Monotoca elliptica* (Tree Broom-heath).

Groundcovers: *Dianella caerulea* (Flax Lily), *Gahnia clarkei* (Saw Sedge), *Lomandra longifolia* (Spiky-headed Mat-rush), *Portulaca oleracea* (Purslane), and *Pteridium esculentum* (Bracken Fern).

Weeds: *Chloris gayana* (Rhodes Grass), *Lantana camara* (Lantana) and *Senna pendula* (Cassia).

Aquatic Herbfield (dam)

A complete vegetation assessment was not conducted upon this vegetation community as it was only just fringing the site's northern boundary and away from the proposed subdivision area.

Occurrence - This vegetation community occurs within and immediately surrounding a dam in the north-eastern corner of the subject site (and beyond to the north).

Structure – The dam contains a habitat of sedges and lilies with some open water area suitable for waterbirds. The vegetation immediately surrounding the dam consisted of a band of *Melaleuca quinquenervia* (Broad-leaved Paperbark).

Photo 6 – Aquatic herbfield vegetation with fringing Melaleuca quinquenervia trees along the northern boundary looking east.

4.4 Threatened flora legislation

No threatened flora species were recorded on site in either the 2003 or 2010 survey.

One (1) endangered ecological community – Swamp Sclerophyll Forest on Coastal Floodplains was observed within the subject site (shown on Figure 2).

4.4.1 State legislative matters

TSC Act – A search of the *Atlas of NSW Wildlife* (DECCW 2009 and 2010) database indicated that six (6) species have been recorded within a 10 km radius of the study area. Those species are listed in Table 4.1 below.

Of those six (6) threatened flora species, one (1) has the potential to occur within the subject site – *Allocasuarina defungens.* Despite searches undertaken for this species it was not observed within the subject site.

4.4.2 Endangered populations

There is one (1) known endangered flora population within the Greater Taree Local Government Area (LGA).

- *Eucalyptus seeana population in the Greater Taree local government area*

Atlas database records show the nearest recording of this species is 17km away to the north north-west. The endangered population is considered to be 17-25km away to the north north-west.

This species was not recorded within the subject site.

4.4.3 National legislative matters

A review of the schedules of the *EPBC Act* indicated the potential for six (6) threatened flora species to occur within a 10km radius of the site (Table 4.1).

Of those six (6) threatened flora species, two (2) have the potential to occur within the subject site. Those species are *Allocasuarina defungens* and *Cryptostylis hunteriana.* Neither of these species were observed within the study area.

The EPBC coordinate search returned the presence of habitat within 10km of the subject site for the endangered ecological community (critically endangered) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.* The vegetation within the subject site does not support this vegetation community.

The actions associated with the proposal are not likely to significantly affect any nationally listed threatened species or ecological communities.

Conclusion*:* A referral to DEWHA is not required with respect to flora.

4.5 Regional significance

Eucalyptus robusta is generally classed as regionally significant because of its high value as a winter food source for a wide range of fauna species including several threatened species such as Regent Honeyeater, Swift Parrot, Squirrel Glider and Grey-headed Flying Fox. It is also listed as a Koala feed tree in SEPP 44, although within the subject site, the combination of isolation and small area would make it unsuitable for use by Koalas. The profuse blossoms in winter attract a large number of insects which in turn attract other fauna species including some threatened species such as threatened species of microchiropteran bats.

One of the other prominent trees in that vegetation community is *Melaleuca quinquenervia* which is also an important nectar producer in autumn, although not as important as *Eucalyptus robusta* as there is a much higher availability of nectar in autumn than is available in winter.

It is recommended that Swamp Mahogany trees be located by a botanist and registered surveyor.

4.6 Endangered ecological communities

One (1) EEC was located onsite, namely;

- *Swamp Sclerophyll Forest on Coastal Floodplains*

This EEC is equivalent to the vegetation community titled *Swamp Mahogany / Paperbark Open Forest Regrowth.* Refer to section 4.3 for a detailed description.

The vegetation community titled *Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth* contains some vegetative characteristics of this same endangered ecological community. In fact, five (5) of the six (6) flora quadrats undertaken in both these communities contained greater than 50% of the species listed for the EEC in the Scientific Committees final determinations.

The vegetation in both these communities has formed as a result of regrowth over the time period of approximately 20 years. It is known that both *Casuarina glauca* and *Melaleuca quinquenervia* are very opportunistic and will grow readily outside of their natural range of creek lines and floodplains provided there is sufficient soil moisture available.

The site elevation data shows that the *Swamp Mahogany / Paperbark Open Forest Regrowth* was recorded at the lowest elevations on site (4.7 – 5.5m AHD). The *Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth* was recorded at elevations from 5.5 – 20m AHD on gradients between 5-10%.

Our opinion on the vegetation titled *Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth* is that this is not EEC vegetation based on;

- The elevation is above the 1:100 year flood level

- Vegetative clearing has provided a niche for Swamp Sclerophyll species to occur, in particular *Casuarina glauca* and *Melaleuca quinquenervia* as these can be opportunistic provided there is sufficient soil moisture. It is highly likely that there is a permanently high water table across the central portion of the subject site providing such soil moisture.

- Whilst there is a moderate affiliation vegetatively to the EEC, in particular canopy species, there are several mid-storey and groundcover species that could occur in moist or drier environments therefore not necessarily only restricted to a Swamp Sclerophyll Forest. For example, *Themeda australis* (Kangaroo Grass), *Pimelea linifolia* (Slender Rice Flower), *Leptospermum polygalifolium* (Tantoon), *Pratia purpurascens* (Whiteroot), *Imperata cylindrica* (Blady Grass), etc. In addition, there were a number of atypical floodplain species also present such as *Eucalyptus paniculata* (Grey Ironbark), *Acacia maidenii* (Maiden's Wattle), *Kennedia rubicunda* (Dusky Coral Pea), etc.

In summary, an area of approximately 0.80 hectares (7.3% of the subject site) has been classified as part of the EEC Swamp Sclerophyll Forest on Coastal Floodplains and is shown on Figure 2 as a constraint to the proposed subdivision.

- *Swamp Oak Floodplain Forest*

On the 14th May 2010 this firm wrote to *Coastplan* in regard to their query on Swamp Oak species and the possibility of that species being a constituent to the *Swamp Oak floodplain forest endangered ecological community*.

> "I advised that the *Hunter-Central Rivers CMA* (CMA) undertook a floristic assessment to determine biodiversity offset requirements. They calculated the loss of native vegetation to be 6.7 ha in August 2009 and also advised that some of the vegetation on site may include an over cleared vegetation type, Swamp Oak Forest, which may represent an EEC.
>
> They also advised that they by passed this fact in their assessment and recommended consultation with Greater Taree City Council and DEECW. Notwithstanding this the CMA required an offset size of 27.27 ha. With this in mind our client purchased 32 ha of land at Darawank as an offset measure for the loss of Swamp Sclerophyll EEC.
>
> Consultation then occurred with DECCW (Estelle Blair), CMA and GTCC in September of 2009 to discuss the suitability of the intended offset arrangements. No discussion occurred in relation to the presence of not of Swamp Oak as an EEC.
>
> On April 30th 2010 and again on May 5th 2010 I spoke with Ms Blair to clarify the point about the presence of the Swamp Oak EEC. Ms Blair affirmed that it was not her intention to make an assertion about the presence or not of any EEC but rather recognition that swamp oak species were present such that there was a need to ensure that this matter has been adequately addressed. Ms Blair advised that the CMA also recognised this point but that they had assumed the larger matter of total native vegetation as their priority.
>
> My discussion with Ms Blair also recognised the ecotonal variation on site between the Swamp Sclerophyll community and the presence of Swamp Oak species interspersed with mixed eucalypts.
>
> It is well known that both *Casuarina glauca* and *Melaleuca quinquenervia* are very opportunistic and will grow readily outside of their natural range of creek lines, floodplains and or estuarine fringes. Indeed these species grow not only on floodplain soils and or tidal estuaries but also in peripheral landscapes not associated with high water tables or land subject to irregular inundation.

The Scientific Committee in its final determination states that Swamp Oak Floodplain Forest is the ecological community "*associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains*".

Floodplains are again defined by the Scientific Committee to be "*level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less*" (paragraph 1). There is no such presence of clay loams and or saline or sub saline groundwater underlying the area that contains Swamp Oak species.

Site elevation data shows that the *Swamp Sclerophyll Forest on Coastal Floodplains* was recorded on the lower elevations between 4.7–5.5m AHD. On the other hand the *Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth* was recorded at a higher elevation between 5.5–20m AHD.

From the outset it is the lack of alluvial soils on the rising slopes and upper plateau that is significant to the opinion on any presence of a Swamp Oak floodplain community. Test Pits 6, 7, 8, 9, 10, 11 & 13 analysed by *Coffee geotechnics* (Figure 1 *GEOTTUNC01754AA 11/2008*) indicate no presence of alluvial material.

Alluvial and colluvial soils were located in test pits BH1 and TP12 in the vicinity of the area mapped as containing *Swamp Sclerophyll Forest on Coastal Floodplains*.

There was a minor edge effect of alluvial soils drifting into the mapped Swamp Oak vegetation community by this firm on Figure 1 dated March 2010 however this is best described as an ecotonal edge and could not be regarded as being commensurate with the scientific committee definition.

In keeping with the NSW Scientific Committee criteria it is the lack of alluvial soils, the lack of floodplain fluvial structures that guides one to determine that the swamp oak mapped vegetation community is not an EEC. This is reflected in the *Gale v's Tweed Council (2008)* where the Chief Judge of the *Land & Environment Court* Preston, B. found that the matters of the scientific committee had to be fully dealt with and reviewed rather than consider only vegetative similarity and or association (Sic. as was the case with *Motoplex Vs Port Stephens City Council, 2007)*.

In *Gale vs Tweed* Preston, B. went onto say that the endangered ecological community has four components:

1. An edaphic component (gray-black clay-loams and sandy loams),
2. A hydrologic component (the groundwater is saline or sub-saline),
3. A topographical component (waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes) and
4. A locational component (associated with coastal floodplains).

In view of the scientific committees criteria the following is offered.

- Firstly the soils do not meet the edaphic criteria of the Scientific Committee in its final determination for *Swamp Oak Floodplain Forest* endangered ecological community. The site is "underlain by weathered siltstone and sandstone covered by residual clayey soils on the elevated slope in the west of the site with shallow colluvial / alluvial clays in the depression in the centre of the site, with Aeolian sands to the east of the depression" (*Coffey geotechics* 2010).

Keith and Scott "Native Vegetation of Coastal Floodplains – a diagnosis of the major plant communities in New South Wales", *Pacific Conservation Biology*, *2005, Vol 11:81-104* Pp 87 advise that Swamp Oak Floodplain Forest occurs on soils of 'humic grey-black clays and sandy loam' origin.

- Secondly the Scientific Committee in the description in its final determination to list *Swamp Oak* as an endangered ecological community refers to the work of "*Keith & Scott 2005", namely D A Keith and J Scott, "Native Vegetation of Coastal Floodplains – a diagnosis of the major plant communities in New South Wales"*, *Pacific Conservation Biology*, *2005, Vol 11:81-104*.

- Thirdly the subject site is not one which is subject to the fluvial processes referred to in the Scientific Committee's definition of floodplains, namely active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less.

- Finally, the particular soils underlying the Swamp oak community are not associated with coastal floodplains. There is no association between the fluvial processes referred to in the Scientific Committee's definition of floodplains and the soils or topographical features on the subject site to which the Swamp Oak species are located. The soils and topographical features for this part of the site have not been formed by such fluvial processes. Thus the vegetation is not a product of such fluvial processes for the area covered by the Swamp Oak species.

4.7 Threatened flora species habitat assessment

Table 4.1 below provides an assessment of threatened flora species habitat likely to occur within the subject site.

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Allocasuarina defungens DECCW EPBC	A shrub 1-2 metres high which grows in heath and open woodland on sand on the lower north coast.	Khappinghat NR, Booti Booti NP, Crowdy Bay NP	The regrowth is generally dense (canopy) with a suppressed and sparse mid-storey layer. The regrowth including the heath communities are mostly atypical of the vegetation structure and assemblage this species would normally be found in. Past clearing / grazing activities would reduce its potential to occur also. Many local occurrences within 2km of the subject site but very marginal habitat exists at best. Not observed but assessed in the 7 part test.	E1	E

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Allocasuarina simulans DECCW	A shrub 1-3 metres high which grows in heath on sand between Forster and Crowdy Head.	Booti Booti NP	Nearest record is 10km away. The subject site is thought to be just south of its known primary occurrence. Extremely low potential habitat on site. Not recorded and not assessed in the 7 part test.	V	V
Asperula asthenes DECCW EPBC	Decumbent herb with weak branches often trailing to 30 cm. Grows in damp places, often along river banks between Taree and Bulahdelah.	Wallis Island Nature Reserve.	Only 2 records of this species within 10km, the nearest 5.5km away. Due to past vegetation disturbance and lack of suitable habitat, this species has been ruled out and not assessed in the 7 part test.	V	V
Cryptostylis hunteriana EPBC	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	Gibraltar Range NP, Ku-ring-gai Chase NP, Ben Boyd NP	Marginal habitat exists in the eastern portion of the subject site around the lower contours. Although no records within 10km, and surveys in 2003 and 2010 during summer (flowering period), it has not been observed. Assessed in the 7 part test.	V	V
Cynanchum elegans DECCW EPBC	Climber or twiner to 1 m. Grows in rainforest gullies, scrub & scree slopes. Distribution limits N-Gloucester S-Wollongong.	Camel's Hump NR, Woko NP, Booti Booti NP, Oxley Wild Rivers NP, Goulburn River NP, Glenrock SRA, Kooragang Island NR, Camels Hump NR, New England NP, Sea Acres NR, Wollemi NR Darawank NR Khappingaht NR	Only two records within 10km. No gullies or rainforest present therefore no potential habitat. Not observed and not assessed in the 7 part test.	E1	E
Melaleuca biconvexa EPBC	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	Bouddi NP, Wyrrabalong NP	Whilst some of the lower lying habitat would be suitable for this species, it has been ruled out as the nearest recording is 36km away and very little chance for establishment over such a large break in distribution. Not observed and not assessed in the 7 part test.	V	V

Table 4.1 – Threatened flora habitat assessment

Scientific name	Growth form and habitat requirements	Conservation status	Comments	TSC Act	EPBC Act
Senna acclinis DECCW	Shrub to 3 metres high which occurs in subtropical rainforest. Distribution limits N-Border Ranges S-Gloucester.	Darawank NR	There are some close records of these species (under 2km away) however the vegetation type is not typical habitat for this species. Not observed and not assessed in the 7 part test.	E1	-
Syzygium paniculatum DECCW EPBC	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	Booti Booti NP, Myall Lakes NP, Wamberal Lagoon NR, Wyrrabalong NP, Captain Cooks Landing Place HS, Jervis Bay NP, Munmorah SRA, Glenrock SRA	Nearest record is approximately 2.5km away. There is no littoral or subtropical rainforest within the subject site. Not observed and not assessed in the 7 part test.	V	V

DECCW	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	- Denotes *vulnerable* species
E	- Denotes *endangered* species

4.8 Fauna species

A total of eighty-four (84) fauna species were observed within or in close proximity to the subject site during the survey.

This number comprised 52 species of bird, 19 species of mammal, 4 species of reptile and 9 species of amphibian.

All species are listed in Table 3.3.

4.9 Habitat types

The fauna habitats present throughout the site include:

- Vegetated areas of forest
- Year round nectar producing tree species, principally *Eucalyptus, Corymbia, Acacia, Banksia* and *Melaleuca*
- Sparse to dense shrub layers
- Sparse to dense ground covers
- Limited large, medium and small hollows
- Fallen logs and branches
- Loose soil suitable for foraging
- Perennial creek with moderate to dense riparian vegetation along the margins
- Dam with well vegetated natural margins

- Depressions close to the water table providing soaks and small ephemeral pools
- Sparse to low density dense litter layers
- Exfoliated bark on trunks and piles at the base of smooth-barked *Eucalyptus* species
- Artificial debris and refuse

4.10 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was not conducted as part of surveys undertaken. The available size range and quality of hollows were noted during site visits.

Only two trees were observed to contain large and medium hollows. These were dead stags located on either side of a small dam located in the western site portions to the rear of Lot 9. No other hollows were observed due to the young age of vegetation throughout the majority of the site, but likely to occur.

4.11 Koala habitat assessment

Four Koala food tree species – Swamp Mahogany (*Eucalyptus robusta*) and Forest Red Gum (*Eucalyptus tereticornis),* as listed on Schedule 2 of SEPP 44 – were recorded within the subject site. Swamp Mahogany comprised greater than 15% of the total number of trees within the Swamp Mahogany/Paperbark Open Forest Regrowth vegetation community and therefore this community is classified under SEPP 44 as 'potential Koala habitat'. Forest Red Gum occurred at low than 15% density within its constituent community.

Target searches were conducted within the Swamp Mahogany/Paperbark Open Forest Regrowth vegetation community along with other opportunistic methodologies throughout the subject site. No Koalas were observed during fauna surveys and there was no evidence of previous Koala habitation within the subject site. A search of the *Atlas of NSW Wildlife* (DECCW 2010) database found over 130 records of Koala habitation within a 10km radius from the study area since 1972. The most recent record was 2.3km to the south in 2009. The closest record to the subject site is approximately 460m to the west recorded in 1998.

A local population of Koalas is well known in the Hallidays Point area as depicted from local records; however the subject site is not considered to comprise 'core Koala habitat' as defined under SEPP 44 due to the absence of recordings in connective habitats. Furthermore, the subject site is not considered suitable to contribute to available habitat for Koalas within the locality due to its isolated nature.

4.12 Threatened fauna legislation

One (1) threatened fauna species – Little Bentwing-bat (*Miniopterus australis*) – was recorded within the subject site. A single individual was recorded foraging over the hind dune dam located in the north-eastern corner of the subject site.

It is considered that the subject site provides potential habitat for the following threatened fauna species:

- Wallum Froglet
- Green and Golden Bell Frog
- Square-tailed Kite
- Osprey
- Black Bittern
- Black-necked Stork
- Brush-tailed Phascogale
- Spotted-tailed Quoll
- Long-nosed Potoroo
- Koala
- Squirrel Glider
- Grey-headed Flying-fox

- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Regent Honeyeater
- Powerful Owl
- Grass Owl
- Masked Owl
- Common Blossom-bat
- Large-footed Myotis
- Little Bentwing-bat
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- East-coast Freetail Bat
- Eastern Falsistrelle

4.12.1 State legislative matters

TSC Act – A search of the *Atlas of NSW Wildlife* (DECCW, 2010) database for threatened species resulted in records of thirty (30) threatened fauna species within a 10km radius of the subject site. These species are listed in Table 4.3 and are considered for potential habitat within the subject site.

Strictly oceanic threatened species found within 10km have not been included.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

4.12.2 Endangered populations

There are no endangered fauna populations within the Greater Taree LGA.

4.12.3 National legislative matters

EPBC Act – A review of the schedules of the *EPBC Act* identified the presence of ten (10) threatened fauna species or species habitat likely to occur within a 10km radius of the subject site.

These species have been listed in Table 4.3, and those with potential to utilise the subject site will be considered in the seven-part test within Section 5.

Of those ten (10) species, 6 were considered to have potential habitat within the subject site. No nationally listed threatened fauna species were recorded within the subject site. Based on this the actions associated with the proposal, these are not likely to significantly affect any nationally listed threatened fauna species.

Additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site are assessed in Table 4.2.

Table 4.2 - Migratory fauna habitat assessment

COMMON NAME *Scientific Name*	PREFERRED HABITAT	COMMENTS
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. Sedentary; dispersive	Suitable foraging, nesting, and roosting habitat present. Not recorded during surveys.
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. Breeds Siberia, Himalayas, e to Japan. Summer migrant to e Aust	Suitable foraging habitat present. Recorded foraging in airspace over the subject site during 2003 surveys. This species is not known to roost within Australian habitats and is considered to continually remain on-the-wing during migration. A loss of foraging habitat throughout the majority of the subject site will result from the proposal. This loss is not considered significant in consideration to the availability of high quality foraging habitats within the locality.
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sand ridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. Breeding resident in n Aust. Summer breeding migrant to se & sw Aust.	Suitable roosting, breeding and foraging habitat present. Not recorded during surveys.
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. Summer breeding migrant to coastal se Aust. otherwise uncommon.	Suitable roosting, breeding and foraging habitat present. Not recorded during surveys.
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. Breeds mostly se Aust & Tas over warmer months, winters in ne Qld.	Suitable roosting and foraging habitat during migration present. Not recorded during surveys.

Table 4.2 - Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests/wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. Breeding migrant to se Aust. over warmer months. Altitudinal migrant in ne NSW in mountain forests during warmer months.	Suitable roosting, breeding and foraging habitat present. Recorded during the first visit of recent surveys on the 27th January 2010 within the Coastal Scrub (Hind Dune) community. Two birds were observed on this occasion and as such there is potential that the subject site is utilised as nesting habitat. The birds were not recorded at this location during the second field visit in August 2010 suggesting that if nesting is taking place within the subject site it is most likely within the more suitable forested areas. This species is assessed below.
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. Dispersive; cosmopolitan	Suitable roosting, nesting and foraging habitat present. Not recorded during surveys.
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. Breeds in summer in warmer parts of range incl. NSW.	Suitable roosting, nesting and foraging habitat present. Not recorded during surveys.
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2000m; samphire on saltmarshes; mangrove fringes. Breeds Japan. Regular summer migrant to Aust. Some over winter	No suitable habitat.
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. Breeds Siberia, Himalayas to Japan se Asia. Summer migrant to e Aust. Mass movements associated with late summer low pressure systems into e Aust. Otherwise uncommon.	Suitable foraging habitat present. Not recorded during surveys.

In accordance with the DEWHA - *Significant Impact Guidelines* (*EPBC Act* Policy Statement 2006), an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify, destroy or isolate an area of important habitat for a migratory species;

- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species;
- Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

Regarding bullet point 1 the site may represent “important habitat” for the species which are further defined below. The species is not considered under threat in Australia and although the population numbers are in decline, it is not listed as a vulnerable species by the IUCN.

Regarding bullet Point 2, the development increases the risk of an invasive species.

Regarding bullet point 3, given that only one pair of birds have been observed on site, the subject site is not expected to represent an ecologically significant proportion of the population of Rufous Fantail. The known records of Rufous Fantail in addition to the onsite record indicates two records between 1 and 1.6 km to the west and south west of the site in semi-cleared agricultural lands, 1 record 9km to the north at Old Bar (urban siting) and 3 records 10 km to the west in Khappinghat Nature Reserve. The existing records demonstrate that the local population is spread throughout the local area and is also utilising significant habitat in Khappinghat Nature Reserve.

An area of ‘important habitat’ for a migratory species is:

a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
b) habitat that is of critical importance to the species at particular life-cycle stages; and/or
c) habitat utilised by a migratory species which is at the limit of the species range; and/or
d) habitat within an area where the species is declining.

Regarding Point a) is not applicable as established above because the siting of the Rufous Fantail onsite does not represent an ecologically significant proportion of the population.

Regarding Point c) is not relevant given the known distribution of Rufous Fantail during its summer migrations extends to Melbourne with roughly equal reporting rates for observed and breeding records in south-east Australia (Blakers, Davies and Riley 1984 – the Atlas of Australian Birds). Further targeted field survey was undertaken in August 2010 which did not record the presence of the Rufous Fantail nesting on site.

Regarding Point d) the area is not known as being an area where the species is declining and consequently point d) is not relevant.

Point b) is considered in the following paragraphs.

Figure 4 – Recorded Rufous Fantail locations within 10 km of the site
(Source - EPBC Atlas Search accessed 31 March 2010)

Point b) pertains to whether the habitat is of critical importance to the species at particular life–cycle stages. Evidence of nesting was not recorded during surveys undertaken however two (2) individuals were recorded interacting in the later stages of the recognised breeding period (Oct-February). This may suggest that a portion of the subject site may be utilised for nesting activity, particularly given the site's isolated nature.

The survey undertaken to date, does not identify the full population size on site or location of nesting. The vegetation on site potentially represents breeding habitat for the species and the removal of vegetation will displace the species from the site. Although there are likely to be suitable nesting habitat within the locality within its dispersal range, the Significant Impact Guidelines (2006) do not define what is considered to be "critically important" for a determination of significant impact for an individual migratory species.

The recorded Rufous Fantail will potentially be directly affected if vegetation removal works are undertaken during the breeding season which extends from Mid September to April. Therefore the timing of vegetation clearance can be undertaken within key foraging and breeding areas outside of mid September to April.

In consideration to the definitions outlined in the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (2006), *Travers bushfire & ecology* considers that the migratory species Rufous Fantail (*Rhipidura rufifrons*) may be significantly affected by the proposed action.

This is given that the subject site may be defined as 'important habitat' for the species as nesting habitat is of importance at a particular life-cycle stage.

As Rufous Fantail migrates to the north during winter seasons, the potential impact of the breeding lifecycle of this species can be avoided by scheduling vegetation clearance works. To avoid impacting this species during the summer breeding period, vegetation removal works to be undertaken outside of the key breeding months.

An offsetting arrangement has been proposed for this site after discussions with the Catchment Management Authority (CMA), Greater Taree Council, the proponent and the Department of Conservation Climate Change and Water (DECCW).

The CMA has undertaken an assessment of the site, running through the *Threatened Species Tool* which came to the conclusion that some 27.27ha of land would be required to offset the loss of Swamp Sclerophyll Forest on Coastal Floodplains vegetation and its potential threatened flora and fauna habitat for development within the subject site.

The proponent has purchased 32.01ha of land at Darawank, approximately 12km to the south south-west of the subject site which contains a small amount of Swamp Oak Floodplain Forest, and at least 30ha of Swamp Sclerophyll Forest on Coastal Floodplains. The removal or modification of approximately 7.1ha of the subject site will be offset through the protection in perpetuity of 32.01ha of land nearby containing mature stands of EEC that will be handed over to DECCW.

Travers bushfire & ecology considers that the provision of the offset which includes suitable habitat for Rufous Fantail, compensates for the loss of Rufous Fantail habitat onsite.

A referral to DEWHA was made specifically for the Rufous Fantail (refer to Appendix 3). The response from DEWHA (03.08.2010) was that this was not a Controlled Action (Appendix 4).

4.13 Threatened fauna species habitat assessment

Table 4.3 below provides an assessment of threatened fauna species habitat likely to occur within the subject site.

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Wallum Froglet *Crinia tinnula* DECCW	Found in acidic paperbark swamps and wallum country with dense groundcover. Breeds in temporary and permanent pools and ponds of high acidity. Distribution Limit: N-Tweed Heads S-Kurnell.	Sub-optimal habitat present. Not recorded during surveys. Survey has been undertaken during the breeding peak period. 4 Atlas records within 10km. Recordings in the nearby locality by *Travers environmental* (2008) suggest the site may be utilised for dispersal if not breeding.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Green and Golden Bell Frog *Litoria aurea* EPBC	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. Distribution Limit: N-Byron Bay S-South of Eden.	Suitable habitat present. Not recorded during surveys. No records within 10km. Not likely to occur.	E	V
Stuttering Frog *Mixophyes balbus* EPBC	Terrestrial inhabitant of rainforest and wet sclerophyll forests. Distribution Limit: N-near Tenterfield S-South of Bombala.	No suitable habitat present.	E	V
Giant Barred Frog *Mixophyes iteratus* EPBC	Terrestrial inhabitant of rainforest and open forests. Distribution Limit: N-Border Ranges National Park. S-Narooma.	No suitable habitat present.	E	E
Square-tailed Kite *Lophoictinia isura* DECCW	Utilises mostly coastal and sub-coastal open forest, woodland or lightly timbered habitats and inland habitats along watercourses and mallee that are rich in passerine birds. Distribution Limit: N-Goondiwindi. S-South of Eden.	Sub-optimal nesting and foraging habitat present. Not recorded during surveys. 4 records within 10km with 2 records in the nearby locality in 1995 & 1998. Potential to occur based on nearby records.	V	-
Osprey *Pandion haliaetus* DECCW	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. Distribution Limit: N-Tweed Heads. S-South of Eden.	Suitable roosting and sub-optimal nesting habitat present. Not recorded during surveys. 13 records within 10km with 5 records in the nearby locality in 1997, 98, 99 & 2000. Potential to occur based on nearby records.	V	-
Little Tern *Sterna albifrons* DECCW	An almost exclusively coastal species inhabiting open beaches, sheltered inlets, estuaries and occasionally lakes. Distribution Limit: N-North of Tweed Heads. S-South of Eden.	No suitable habitat present.	E	-
Terek Sandpiper *Xenus cinereus* DECCW	Almost exclusively coastal species feeding along estuarine mudflats, coral reefs, mangrove swamps and beaches. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Lesser Sand-plover *Charadrius mongolus* CT	A migratory coastal species found along coastal beaches, mangroves and mudflats. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Sooty Oystercatcher *Haematopus fuliginosus* DECCW	Exclusively coastal in distribution foraging along rocky coastlines and estuaries. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Pied Oystercatcher *Haematopus longirostris* DECCW	Inhabits coastal beaches and estuarine flats. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	-
Black Bittern *Ixobrychus flavicollis* DECCW	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater & brackish streams & ponds, sheltered mudflats and oyster slats. Distribution Limit: N-Tweed Heads. S-South of Eden.	Sub-optimal habitat present surrounding the eastern hind dune dam. Not recorded during surveys. 1 record just beyond 10km. Not likely to occur.	V	-
Black-necked Stork *Ephippiorhynchus asiaticus* DECCW	Occurs in tropical to warm temperate terrestrial wetlands, estuarine and littoral habitats such as mangroves, tidal mudflats, flood plains, open woodlands, irrigated lands, bore drains, sub-artesian pools, farm dams and sewerage ponds. Distribution Limit: N-Tweed Heads. S-Nowra.	Suitable habitat present at the eastern hind dune dam. Not recorded during surveys. 20 records within 10km with 3 records in the nearby locality in 1998, 2005 & 2006. Potential to occur.	E	-
Australian Painted Snipe *Rostratula australis* EPBC	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. Distribution Limit: N-Tweed Heads. S-South of Eden.	No suitable habitat present.	V	V
Glossy Black-Cockatoo *Calyptorhynchus lathami* DECCW	Open forests with *Allocasuarina* species and hollows for nesting. Distribution Limit: N-Tweed Heads. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 11 records within 10km with 3 records in the nearby locality in 1997 & 98. Potential to occur.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Little Lorikeet *Glossopsitta pusilla* DECCW	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. Distribution Limit: N-Tweed Heads. S-South of Eden.	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 1 record within 10km at 7km away in 2003. Potential to occur.	V	-
Swift Parrot *Lathamus discolour* DECCW EPBC	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging, habitat present. Not recorded during surveys. 1 record just beyond 10km. Potential to occur.	E	E
Regent Honeyeater *Xanthomyza Phrygia* EPBC	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit: N-Urbanville. S-Eden.	Suitable foraging, habitat present. Not recorded during surveys. No records within 10km. Low potential to occur.	E	E
Powerful Owl *Ninox strenua* DECCW	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. Distribution Limits: N-Border Ranges National Park. S-Eden	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 11 records within 10km with 1 record within a local home range in 2006. Potential to occur.	V	-
Grass Owl *Tyto capensis* DECCW	Inhabits grassland, coastal heath and lignum swamps, sheltering in dense grass tussocks by day. Distribution Limit: N-Tweed Heads. S-Lithgow.	Suitable foraging, roosting and low potential nesting habitat present. Not recorded during surveys. 1 record within 10km at 3.5km away in 1997. Low potential to occur.	V	-
Masked Owl *Tyto novaehollandiae* DECCW	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. Distribution Limit: N-Border Ranges National Park. S-Eden	Suitable foraging, roosting and nesting habitat present. Not recorded during surveys. 5 records within 10km with 2 records within a local home range in 1997. Potential to occur.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Sooty Owl *Tyto tenebricosa* DECCW	Tall, dense, wet forests containing trees with very large hollows. Distribution Limit: N-Border Ranges National Park. S-South of Eden	No suitable habitat present.	V	-
Speckled Warbler *Chthonicola sagittata* DECCW	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. Distribution Limit: N-Urbanville. S-Eden	No suitable habitat present.	V	-
Brush-tailed Phascogale *Phascogale tapoatafa* DECCW EPBC	A largely arboreal mammal of open forests and woodlands using hollows as nesting in hollow bearing trees. Distribution Limit: N-Border Ranges National Park. S-Eden.	Sub-optimal habitat present. Not recorded during surveys. 13 records within 10km with 2 records within the nearby locality in 1998. 8 records with 4km. Low potential to occur.	V	-
Spotted-tailed Quoll *Dasyurus maculatus* DECCW EPBC	Dry and moist open forests containing rock caves, hollow logs or trees. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	Suitable foraging habitat present however habitat is not obvious for denning/shelter and also isolated if within a range and therefore sub-optimal. 5 records within 10km, none in the nearby locality. Not likely to occur.	V	V
Long-nosed Potoroo *Potorous tridactylus* EPBC	Coastal heath and dry and wet sclerophyll forests with a dense understorey. Distribution Limit: N-Mt Warning National Park. S-South of Eden.	Marginally suitable habitat present. Not recorded during surveys or previously within 10km. Not likely to occur.	V	V
Koala *Phascolarctos cinereus* DECC	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. Distribution Limit: N-Tweed Heads. S-South of Eden.	Suitable habitat present. Not recorded during targeted surveys. Several records occur within the local area however the subject site is unlikely to be utilised due to its isolation.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
Squirrel Glider *Petaurus norfolcensis* DECCW	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. Distribution Limit: N-Tweed Heads. S-Albury.	Suitable foraging, denning and nesting habitat present. Not recorded during surveys. 11 records within 10km with 1 record in the nearby locality in 2003. Potential to occur.	V	-
Yellow-bellied Glider *Petaurus australis* DECCW	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. Distribution Limit- N-Border Ranges National Park. S-South of Eden.	No suitable habitat present.	V	-
Grey-headed Flying-fox *Pteropus poliocephalus* DECCW EPBC	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. Distribution Limit: N-Tweed Heads. S-Eden .	Suitable foraging habitat present. Not recorded during surveys. 22 records within 10km with 4 records in the nearby locality in 2002, 03 & 06. All records likely of individuals on nightly foraging forays and not of roosting camps. Potential to occur.	V	V
Common Blossom-bat *Syconycteris australis* DECCW	Roosts in dense foliage in rainforest and moist hardwood forests and forages for nectar and pollen in coastal forests and heaths. Distribution Limit: N-Tweed Heads. S-Foster.	Suitable foraging habitat present. Not recorded during surveys. 2 records within 10km just with 4km away both in 1992. Low potential to occur.	V	-
Large-footed Myotis *Myotis macropus* DECCW	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. Distribution limits: N-Border Ranges National Park. S-South of Eden.	Suitable foraging, roosting and breeding habitat present. Not recorded during surveys. 3 records within 10km all on the same date and location suggesting a roost at 8.8km in 2008. Low potential to occur.	V	-

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	PREFERRED HABITAT	COMMENTS	TSC Act	EPBC Act
Little Bentwing-bat *Miniopterus australis* DECCW	Roosts in caves, old buildings and tree hollows in the higher rainfall forests along the south coast of Australia. Distribution Limit: N-Border Ranges National Park. S-Sydney.	Suitable foraging habitat present. Recorded above the eastern hind dune dam during survey on the 27th January 2010.	V	-
Eastern Bentwing-bat *Miniopterus orianae oceansis* DECCW	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well timbered areas. Distribution Limit: N-Border Ranges National Park. S-South of Eden.	Suitable foraging habitat present. Not recorded during surveys. 6 records within 10km at just over 3 and 9km away between 1999 and 2002. Potential to occur.	V	-
Greater Broad-nosed Bat *Scoteanax rueppellii* DECCW	Inhabits areas containing moist river & creek systems especially tree lined creeks. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Suitable roosting, breeding and foraging habitat present. 1 record at just over 10km away in 2006. Low potential to occur.	V	-
East-coast Freetail Bat *Micronomus norfolkensis* DECCW	Inhabits open forests and woodlands foraging above the canopy and along the edge of forests. Roosts in tree hollows, under bark and buildings. Distribution Limit: N-Woodenbong. S-Pambula.	Suitable roosting, breeding and foraging habitat present. 6 records within 10km with 4 records just over 3km away between 1999 and 2003. Potential to occur.	V	-
Eastern Falsistrelle *Falsistrellus tasmaniensis* DECCW	Recorded roosting in caves, old buildings and tree hollows. Distribution Limit: N-Border Ranges National Park. S-Pambula.	Sub-optimal roosting, breeding and foraging habitat present. 1 record at just over 10km away in 2006. Not likely to occur.	V	-
Large-eared Pied Bat *Chalinolobus dwyeri* EPBC	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. Distribution Limit: N-Border Ranges Nation Park. S-Wollongong.	No suitable habitat present.	V	V

DECCW	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search

Table 4.3 - Threatened fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT**	**COMMENTS**	**TSC Act**	**EPBC Act**
CT	- Denotes additional species not listed within 10km searches but previously considered by *Conacher Travers* (2003)			
NOTE:	- 'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database map sheet requests to DECC are undertaken every 3 months as recommended. - 'nearby locality' refers to distances within 2km from the subject site.			

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Section 5 of this report.

4.14 Potential ecological impact

Whilst the subdivision of the land will cause very few environmental and biodiversity impacts, the impacts listed below more so relate to the actual development stage of works.

These include;

- Loss of EEC (Swamp Sclerophyll Forest on Coastal Floodplains) vegetation within some of the proposed eastern lots. To lessen the impact, the lots within this area are typically larger in size.

- Removal/modification of 7.1ha of isolated habitats providing maturing native regrowth vegetation. The currently proposed subdivision layout will result in almost complete removal of terrestrial habitats resulting in displacement or destruction of resident fauna.

- Erosional processes might be increased through development on the hind dune in on the far eastern lots. The subdivision proposal will however retain approximately 50% of the hind dune coastal scrub regrowth within a reserve that extends from the foreshore.

- Loss of foraging habitat for threatened species, specifically the loss of autumn-summer flowering stands of *Melaleuca quinquenervia* (Broad-leaved Tea Tree) and the winter flowering stands of *Eucalyptus robusta* (Swamp Mahogany). Both trees flower in high yields.

- Increased threat of key threatening processes.

- Potential loss of hollow-bearing resources.

- Implementation of asset protection zones (APZ's) and wastewater management systems may cause further vegetation loss.

The subdivision plan (Figure 2) shows the location of some of the larger trees on the subject site. Almost all of the trees shown in the eastern portion are Swamp Mahoganies. The proposed offset acts as an offset to the loss of Swamp Mahoganies.

There are some larger Eucalypt trees fringing the western edges of the Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth community. Many of these trees particularly in the southern portion of the subject site are located at the back of a proposed lot indicating that they have a higher likelihood of being retained post development. Those that are not will have a high chance of being removed.

4.15 Potential for better environmental outcomes

An offsetting arrangement has been proposed for this site after discussions with the *Catchment Management Authority*, *Greater Taree Council*, the proponent and the *Department of Conservation Climate Change and Water*.

The CMA has undertaken an assessment of the site, running through their *Threatened Species Tool* which came to the conclusion that some 27.27ha of land would be required to offset the loss of vegetation for development within the subject site.

The proponent has purchased 32.01ha of land at Darawank, approximately 12km to the south south-west of the subject site which contains a small amount of Swamp Oak Floodplain Forest, and at least 30ha of Swamp Sclerophyll Forest on Coastal Floodplains.

The removal or modification of approximately 7.1ha of the subject site will be offset through the protection in perpetuity of 32.01ha of land nearby containing mature stands of EEC. This will be further discussed in Section 4.15.1.

Retention of the two mature Port Jackson Figs and mature representations of the remaining fourteen species of native trees recorded will further supplement year-round foraging resources for birds and Flying-foxes.

A hollow-bearing tree survey should be undertaken to determine the presence and location of this valuable resource across the subject site prior to the issuing of a construction certificate. Due to the immature nature of the landscape the potential for large and or mature hollows is low.

Erosion protection measures to ensure the stabilisation of the hind dune need to be investigated further.

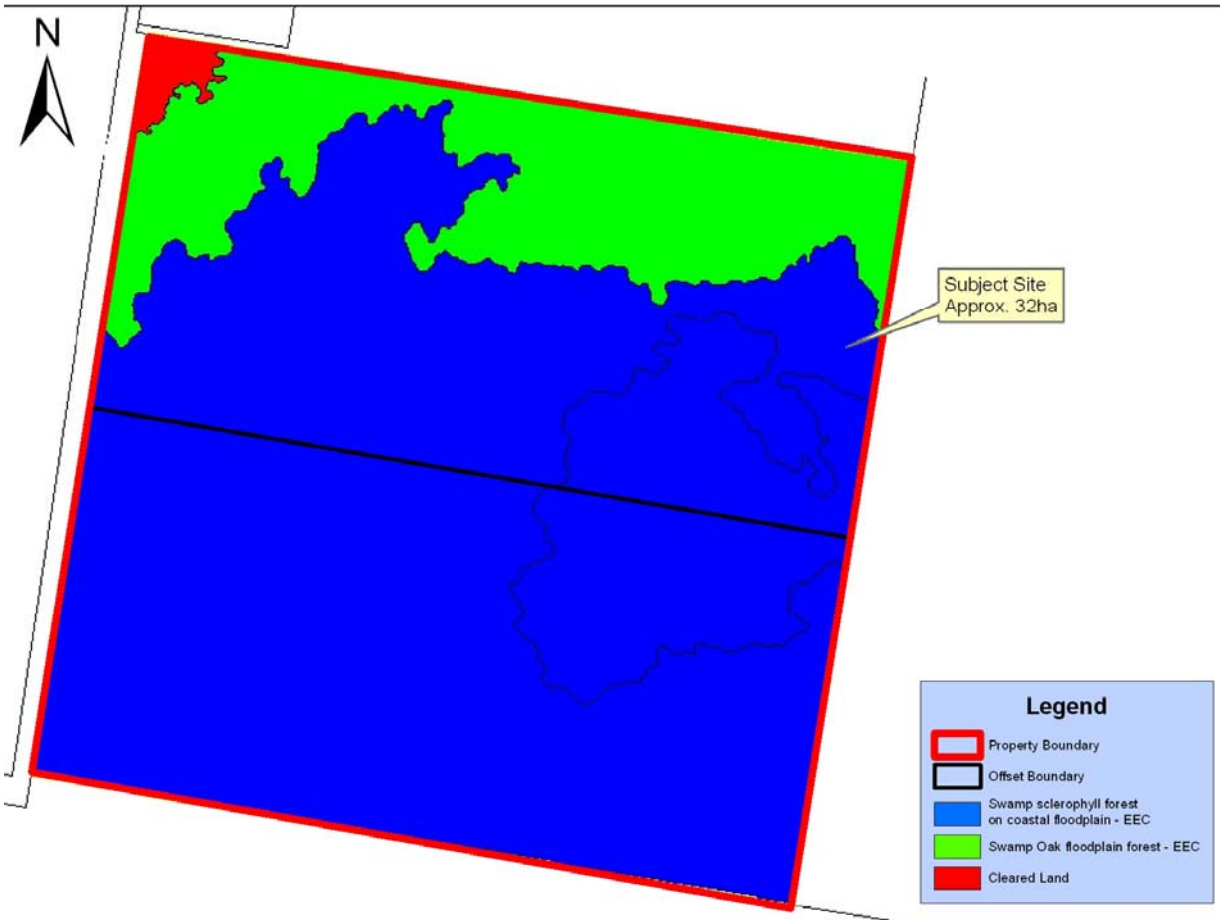
4.15.1 Offsetting Arrangements

The proponent has purchased land at Darawank some 12km south south-west of the subject site as an offset measure for the current proposal. The offset site is at Lot 47 DP 753207 and has a total area of 32.01ha.

The offset ratio of vegetation being removed to that being conserved and passed onto DECCW is 32.0/7.1 which is approximately 4.5:1.

The proposed offset area of 32ha satisfies the correspondence provided for in Appendix 1 saying that 27.27ha was required after a representative had run the *Threatened Species Tool.*

A response to the thirteen (13) offsetting principles required to be addressed is provided herewith.



Vegetation Communities of the Offset Site at Darawank

Principles for the Use of Biodiversity Offsets in NSW

1. Impacts must be avoided first by using prevention and mitigation measures

The subject site has undergone clearing in the past, most like 20-25 years ago and the subsequent vegetation that currently exists is regrowth. Existing vegetation is in an immature state with only a few mature trees remaining on higher grounds around the western fringe of the regrowth area.

Whilst the proposal will create mostly standard sized residential blocks of some 500-900m2, several proposed lots within the eastern portion of the subject site are two to three times in area that will allow for the retention of a majority of the larger Swamp Mahoganies as surveyed by *Lidbury Summers & Whiteman.*

Part of the eastern portion of the subject site will be retained as part of the coastal foreshore reserve. A vegetation management plan is recommended to ensure soil stability, control weed outbreaks and to enhance currently cleared areas within.

These mitigation measures within the subject site as well as the proposed offsetting of the vegetation within the Darawank site will result in the retention of habitat connectivity for native fauna recorded within the locality and the protection of high quality EEC vegetation within the offset lands.

2. All regulatory requirements must be met

The site has been ecologically assessed in accordance with the requirements of the *Threatened Species Conservation (TSC) Act (1995)*, *Fisheries Management (FM) Act (1994)* and the *Environment Protection and Biodiversity Conservation (EPBC) Act (1999)*. The results of survey and assessment have been presented in a Flora and Fauna Assessment (*Travers bushfire & ecology*, 2010).

A Bushfire Protection Assessment has also been completed (*Travers bushfire & ecology,* 2010) in accordance with *Planning for Bush Fire Protection* (PBP 2006).

3. Offsets must never reward ongoing poor performance

As the subject site is located within an expanding urbanised area it is therefore subject to the threat of land clearing, habitat fragmentation and isolation, increased drainage modifications and weed invasion.

4. Offsets will compliment other Government programs

It is proposed to transfer ownership of the offset lot to DECCW for protection in perpetuity under a Conservation Agreement. The proposed offset Lot 47 DP753207, Darawank contains two (2) endangered ecological communities (Swamp Sclerophyll Forest on Coastal Floodplains and Swamp Oak Floodplain Forest) which are in pristine condition.

The dedication of this lot will compliment other Government programs by ensuring the protection of these endangered communities in perpetuity.

5. Offsets must be underpinned by sound ecological principles

The regrowth on site is in a relatively good condition but has poor connectivity values. Whilst there is foreshore connectivity to the north and south along the beach front, there is no vegetative connectivity of any of the regrowth communities outside of the subject site.

The lack of threatened species records, poor connectivity values and regrowth status means that the value of the vegetation on site is not of high value generally. With new rural residential properties adjoining the subject site to the north (along Edgewater Drive and Dune Springs Lane) and south (along Anniversary Drive) there are or will be increased pressures on the remnant vegetation.

The vegetation within the proposed offset area constitutes vegetation representative of high quality EEC's. This vegetation provides enhanced habitat for native flora and fauna within the locality.

The offset ratio of that removed within the subject site to that being retained and passed on to Council at the Darawank site is approximately 4.5:1.

6. Offsets should aim to result in a net improvement in biodiversity over time

The total area of vegetation to be removed or modified on site is considered to be approximately 7.1ha in a regrowth state. The offset site contains matured forest of 32ha. This is a ratio of approximately 4.5:1. Of the 7.1ha to be removed or modified, approximately 0.8ha is Swamp Sclerophyll Forest on Coastal Floodplains. Part of the offset site contains the same EEC as the subject.

The proposed offset area Lot 47 DP753207, Darawank is located within an undisturbed landscape and is therefore considered capable of providing increased biodiversity potential resulting in a net improvement in biodiversity over time.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs

The proposed offsetting area Lot 47 DP753207, Darawank will be transferred to DECCW ownership and protected in perpetuity.

8. Offsets should be agreed to prior to the impact occurring

The subject site proponent has already purchased the land after consultation between the various agencies. The offset site is approximately 32ha.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated

The area of Impact: Approximately 7.1ha of vegetation will be impacted on the subject site; this will be offset by the 32ha of high quality and mature vegetation as well as a large proportion of EEC vegetation within Lot 47 DP753207. Approximately 1ha of land within the subject site (eastern portion) will become public open space with linkage to the foreshore.

The types of ecological communities affected:

An estimated 0.8ha of EEC will be removed or modified for the proposal. The vegetation at the offset site comprises of approximately 95% EEC vegetation over an area of almost 32ha.

The condition of habitat: Assessment undertaken within the subject site indicates that the subject site provides foraging habitat for birds, bats and arboreal mammals. A few hollow-bearing trees were also observed which may provide potential denning, roosting or nesting habitat for birds, micro-chiropteran bats, arboreal mammals and some arboreal reptile species. A moderate shrublayer and dense groundcover of herbs and grasses as well as tree litter provides protective and foraging habitat for birds, arboreal mammals, terrestrial mammals, reptiles and amphibian species. The winter flowering *E. robusta* provides potential foraging habitat for threatened migratory bird species, Swift Parrot and Regent Honeyeater.

The proposed offset site is in an undeveloped landscape with no history of past disturbance. This site provides similar habitat to the subject site, but is considered to have a higher habitat value due to the undeveloped nature of the surrounding landscape. As such, securing this habitat via transfer to DECCW ownership is considered a quantifiable offset under the Guidelines.

The conservation status and/or scarcity/rarity of ecological communities: as previously stated Lot 47 DP753207, Darawank contains vegetation representative of both Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest on Coastal Floodplain EEC's. The vegetation on the subject site contains some Swamp Sclerophyll Forest on Coastal Floodplains but is not considered scare / rare in the local area. There is greater than 500ha of this EEC reserved in the nearby Khappinghat Nature Reserve.

Level of security afforded to the site: The offset area will be transferred to DECCW ownership and protected in perpetuity via a conservation agreement as a condition of consent.

10. Offsets must be targeted

The vegetation to be offset in Lot 47 DP753207, Darawank constitutes high quality EEC. The vegetation on the subject site is considered to be abundant in the surrounding area and as such is not considered as ecologically valuable as the EEC vegetation within the offset site with only 0.8ha representative of Swamp Sclerophyll Forest. The ecological community to be offset is therefore greater in conservation status to the ecological community on the development site.

11. Offsets must be located appropriately

The proposed offsetting area in Lot 47 DP753207, Darawank is located with the Great Lakes LGA approximately 12km to the south south-west of the proposed development with similar vegetation characteristics but of a more mature age. It is therefore located in an area that has the "*same or similar*" ecological characteristics as the area affected by the proposal. For example, the offset area Lot 47 DP753207, Darawank will provide habitat for similar native species and be subject to the same or similar weather patterns (based on knowledge gained from many nearby ecological assessments).

12. Offsets must be supplementary

The proposed offset area Lot 47 DP753207 Darawank is not under any other conservation agreements or funded under another scheme. The applicant has recently purchased the offset area and will transfer it to DECCW for future ownership.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conserving agreements or a contract

The offset area Lot 47 DP753207, Darawank is intended to be transferred directly to DECCW ownership and protected in perpetuity via a Conservation Agreement as a condition of consent.

Conclusions

It is noted that this proposal is in accordance with the requirements of the DECCW *Guidelines for Biodiversity Certification of Environmental Planning Instruments*.

5 7 PART TEST OF SIGNIFICANCE

Council is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed species impact statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 and 4 of this report and should be read as such.

The 7 part test of significance is as follows.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Detailed flora and fauna investigations of the subject site, together with habitat assessments, have resulted in the identification of potential habitat for a variety of threatened species. An assessment of these species is as follows:

Threatened flora

- *Allocasuarina defungens*
- *Cryptostylis hunteriana*

Endangered ecological communities

- *Swamp Sclerophyll Forest on Coastal Floodplains*

Threatened fauna

- Wallum Froglet
- Green and Golden Bell Frog
- Square-tailed Kite
- Osprey
- Black Bittern
- Black-necked Stork
- Glossy Black-Cockatoo
- Little Lorikeet
- Swift Parrot
- Regent Honeyeater
- Powerful Owl
- Grass Owl
- Masked Owl
- Brush-tailed Phascogale
- Spotted-tailed Quoll
- Long-nosed Potoroo
- Koala
- Squirrel Glider
- Grey-headed Flying-fox
- Common Blossom-bat
- Large-footed Myotis
- Little Bentwing-bat
- Eastern Bentwing-bat
- Greater Broad-nosed Bat
- East-coast Freetail Bat
- Eastern Falsistrelle

Endangered populations

- *Eucalyptus seeana* population in the Greater Taree local government area

Species indicated with a "*" were recorded within the subject site during surveys. Despite the presence of potential habitat, the remaining listed species were not recorded during the flora and fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction.

Summary of threatened species recorded

Little Bentwing-bat *(Miniopterus australis)*

The Little Bentwing-bat forages below the canopy within open forests and woodlands, feeding on small insects (Dwyer 1995b). This species roost in caves, tunnels, old mines and occasionally old buildings (Dwyer 1995b). One record exists of this species utilising a tree hollow however hollows are not currently considered as preferred habitat for this species (pers. com. Brad Law).

For this species, caves are a particularly important resource where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer 1995). No caves are present within the study area and as such no critical breeding habitat requires particular consideration in planning provisions. Roosting habitat may be present within the wall or ceiling cavities of the old house within Lot 9 that fronts to Diamond Beach Road, although Anabat detectors placed nearby on two separate nights during recent surveys and mobile Anabat during 2003 surveys did not detect the species at this location.

The subject site provides suitable forest structures for the foraging requirements of this highly mobile species as well as water resources within the two dams present. A single pass from an individual was recorded on the 27th January 2010 at the dam located in the far north-eastern corner of the subject site. This dam will be retained with adequate buffers as part of the proposed subdivision layout.

The proposed subdivision will remove habitat values for this species that specifically include the loss of 7.1ha of forest structure for foraging and the removal of the western dam located in Lot 9 as a water resource. If the old house in Lot 9 is identified for removal then potential roosting habitat will also be removed.

It is considered that the proposed subdivision will not likely cause a significant impact on a local population of this species for the following reasons:

- The habitat values where this species was recorded will be retained.
- Most importantly, no suitable breeding habitat will be impacted upon and
- A single recording of an individual by one of eight Anabat recording devices over two separate years summer surveys suggests that the subject site does not provide habitat central to or of high use by a local population.

Summary of threatened species with high potential to occur

Wallum Froglet *(Crinia tinnula)*

Of the threatened species recorded previously in the nearby locality, the Wallum Froglet is considered with the highest potential to occur. Surveys were not undertaken during the peak winter breeding period for this species and as such the precautionary principle on presence should apply. This is based primarily on recordings by *Travers environmental* in more suitable habitats approximately 300m to the north and ideal habitat approximately 900m to the north in 2008.

The Wallum Froglet is mainly confined to acid paperbark swamps and "wallum" areas with poor drainage (Barker et al. 1995). This species is associated with melaleuca and wet heath (Robinson 2005, Cogger 1996) and also known from within sedge swamps (DECCW website). This species breeds in late winter and is restricted to coastal areas of southern Qld and NSW (Cogger 2000).

Habitat for the Wallum Froglet within the proposed development areas of the subject site are not considered ideal. Whilst activity or presence should not be ruled out within low lying soaks present within the Swamp Mahogany/Paperbark Open Forest Regrowth community, the more suitable habitat is present on the fringes of the north-eastern dam and to a lesser extent along constructed drainages along the north-eastern boundary.

Although the subject site may be colonised during ideal dispersal conditions, the habitats available are somewhat isolated due to rural-residential development to the north. A gently rising topography and further surrounding development to the south and west make areas beyond the subject site in remaining aspects unsuitable. Thus the subject site has no value en-route to other high quality local habitats.

The habitat fringing the north-eastern dam will be retained and the presence of more suitable breeding habitats to the north where this species is known to occur will ensure a local population will not be significantly impacted as a result of the subdivision proposal.

Further targeted survey for the Wallum Froglet was undertaken during the suitable weather conditions in the known breeding period – winter. No recording of Wallum Froglet was made during the survey undertaken and therefore it could be concluded that the proposal is not constrained by this species and thus is not likely to cause a significant impact on a local population of the species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

There are no endangered fauna populations within the Greater Taree LGA.

There is one (1) known endangered flora population within the Greater Taree LGA.

- *Eucalyptus seeana population in the Greater Taree local government area*

Atlas database records show the nearest recording of this species is 17km away to the north north-west. The endangered population is considered to be 17-25km away to the north north-west.

This species was not recorded within the subject site.

Therefore, it is considered that the action proposed is not likely to have an adverse effect on the life cycle of these species that constitute the endangered populations such that a viable local population of these species is likely to be placed at risk of extinction.

c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

One (1) EEC – Swamp Sclerophyll Forest on Coastal Floodplains was observed within the subject site.

The Swamp Sclerophyll Forest on Coastal Floodplains occurs within the eastern portion of the subject site is associated with the Swamp Mahogany / Paperbark Open Forest Regrowth vegetation community. This community occupies approximately 0.80 ha (7.3%) of the site. The proposed subdivision and consequent future development will occupy all of this community's extent within the subject site.

Whilst the proposal is unlikely to clear-fell this vegetation community, there will be modifications to allow for building envelopes, services, roads and asset protection zones.

It should be noted that vegetation making up the EEC is regrowth from approximately 20 years and as such has not reached maturity.

The vegetation within the subject site has limited connectivity as discussed in Section 4, only along the foreshore to the immediate north and south. There is residential development to the immediate north which may only have a few scattered trees. To the south the school grounds only contain trees along the perimeter boundary abutting the subject site. To the west is a 20 metre plus wide road corridor of Diamond Beach Road with only scattered trees along the road edge (western side of road) providing very limited value to local fauna movements.

The suburb of Diamond Beach is known to contain a significant area of Swamp Sclerophyll Forest on Coastal Floodplains. *Travers bushfire & ecology* observed approximately 2.2 hectares within an almost adjacent site as described in Section 4.1. Additionally there would be some contained within the foreshore reserve of Diamond Beach even as remnant trees.

Diamond Beach adjoins Khappinghat Nature Reserve to the north which occupies just over 3,500 hectares. At least 500 hectares of this reserve is Swamp Sclerophyll Forest in association with the floodplain of the Khappinghat Creek. Most of this falls within 5km of the subject site.

In essence it could be concluded that the proposed subdivision and consequent development is unlikely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

As described throughout the report, the Swamp Mahogany tree is considered a significant fixture of the landscape because of its value for a number of threatened fauna species. It is likely that the majority of these trees will be retained in a post development landscape as larger lot sizes are proposed for this vegetation community to reduce habitat loss.

As noted previously, the vegetation on site is in a regrowth state with lower biodiversity than generally experienced in a mature stand of Swamp Sclerophyll Forest.

Given the amount of reserved EEC within the nearby Khappinghat Nature Reserve, the already modified vegetation status due to past clearing and the partial representation of the community post development, it is unlikely that the proposed subdivision and consequent development will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Allocasuarina defungens, Cryptostylis hunteriana,* Swamp Sclerophyll Forest on Coastal Floodplains*,* Wallum Froglet, Green and Golden Bell Frog, Square-tailed Kite, Osprey, Black Bittern, Black-necked Stork, Glossy Black-Cockatoo, Little Lorikeet, Swift Parrot, Regent Honeyeater, Powerful Owl, Grass Owl, Masked Owl, Brush-tailed Phascogale, Spotted-tailed Quoll, Long-nosed Potoroo, Koala, Squirrel Glider, Grey-headed Flying-fox, Common Blossom-bat, Large-footed Myotis, Little Bentwing-bat, Eastern Bentwing-bat, Greater Broad-nosed Bat, East-coast Freetail Bat and Eastern Falsistrelle.

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The subject site encompasses and area of approximately 10.9 hectares. The proposed subdivision development occupies approximately 92-93% of the site with the remainder in the eastern portion to be dedicated as public open space.

As described throughout the report, the vegetation has been cleared previously until approximately 20 years ago where the vegetation has been maturing since. By no means is the vegetation present at the time of the survey mature and it lacks hollow-bearing resources throughout the majority.

Approximately 3.0 hectares as shown on Figure 1 is grassland with scattered trees that forms very little foraging, roosting or breeding resource for fauna.

Essentially, it is estimated that approximately 7.1 hectares of vegetated lands in a regrowth state, providing varying amounts of habitat for the above listed threatened species, will be removed or modified for the action proposed.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The subject site in its existing vegetated state is already isolated from remaining naturally vegetated forest areas in the locality. Fore and hind dune scrub vegetation in the far eastern portion of the site extends to both the north and south as dune vegetation along the entirety of Diamond Beach at varying widths. With the exception of Khappinghat Nature Reserve 1km to the north, this vegetation is at its widest at the subject site and will continue as such a coastal reserve outside of the proposed subdivision layout.

Forest regrowth fragmentation will occur as a result of the subdivision, but not from other areas of forest habitat. Fragmentation and isolation of habitats within the subject site have already occurred due to previous surrounding land clearances.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

In terms of threatened flora species, the habitat components only provided marginal habitat for *Allocasuarina defungens.* Searches undertaken in 2003 and 2010 have failed to locate this species with the subject site therefore it could be said that despite any type of habitat present, no specimens exist and therefore removing habitat for this species on site is considered inconsequential.

With respect to *Cryptostylis hunteriana,* whilst suitable habitat exists on site there have been no recordings made during previous surveys (the 2010 survey being within the flowering period and the 2003 survey being at the end limit of the flowering period) and no detections noted within 10 kilometres. Therefore it unknown to the area and the removal of habitat for this species on site is again considered inconsequential.

In terms of endangered communities, the significance was discussed in point (c). It was concluded that the loss of EEC vegetation was not considered significant given its regrowth status, lower than average diversity and representation of at least 500 hectares within the nearby Khappinghat Nature Reserve, less than 5km away.

In respect to threatened fauna, only one species – the Little Bentwing-bat has been recorded during surveys undertaken. This species is not dependent upon the subject site for breeding habitat. Forest foraging habitat removed is not well represented for this species in the immediate locality but well represented in the greater locality. An old house located within the existing Lot 9 may provide roosting habitat for this species, although not considered of higher likelihood than any other old rural buildings in the locality.

The subject site provides the lesser quality habitat for Wallum Froglet in the locality. If present within the subject site, activity is not likely to be to the scale or value of nearby high quality habitats to the north where the species has been recorded.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

There are no draft or approved recovery plans for the flora species with habitat potential on the subject site.

Draft recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Barking Owl (*Ninox connivens*) (DECC 2003)
- Green and Golden Bell Frog (*Litoria aurea*) (DECC 2005)
- Koala (*Phascolarctos cinereus*) (DECC 2003)

Approved recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Bush Stone Curlew (*Burhinus grallarius*) (DECC 2006)
- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DECC 2006).

It is considered that the proposed development is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined in the *TSC Act* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes under the *TSC Act*, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	✓		
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Ecological consequences of high frequency fires			✓
Entanglement in, or ingestion of anthropogenic debris in			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	**Possible**	**Unlikely**
marine and estuarine environments			
Herbivory and environmental degradation caused by feral deer			✓
Human-caused Climate Change	✓		
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*		✓	
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion, establishment and spread of *Lantana camara*		✓	
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Loss of Hollow-bearing trees		✓	
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the Feral Cat (*Felis catus*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki)*			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees	✓		

"Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands" is a key threatening process. The proposal is likely to modify and re-divert stormwater runoff from development areas (impermeable road and property surfaces) into retention basins along the proposed northern site entry off Edgewater Drive along the northern boundary and adjacent to the boundary of the caravan park which are located near to the lowest contours of the subject site.

"Clearing of native vegetation" is a key threatening process under the *TSC Act* and as such the proposal is of a class of development recognised as a threatening process. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to the extent of better quality natural vegetation within the local area particularly that contained within the nearby Khappinghat Nature Reserve. The reserve is just over 3,500 hectares.

"Human-caused Climate Change" is a Key Threatening Process. The proposal will require the removal of a small amount of vegetation which would provide a small and almost incomparable contribution to climate change. Nonetheless, whilst almost insignificant in size, the proposal is part of the accumulative effect and thus should be considered as contributing to this threatening process.

"Infection of native plants by *Phytophthora cinnamomi"* is listed as key threatening processes under the *TSC Act*. The precautionary principal is applied in this instance to suggest that any proposed future development may increase the potential for this infection to occur on site. It is somewhat difficult to detect and ameliorate therefore it cannot be neglected.

"Invasion of native plant communities by *Chrysanthemoides monilifera*" is a key threatening process under the *TSC Act*. This species is present on the subject site in small sporadic locations. The proposed development may provide an opportunity to ameliorate the effect of this key threatening process by the application of suitable weed control measures in remnant bushland areas post development.

"Invasion of native plant communities by exotic perennial grasses" is a key threatening process under the *TSC Act*. The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Pennisetum clandestinum* (Kikuyu). The proposed development may provide an opportunity to ameliorate the effect of this key threatening process by the application of suitable weed control measures in remnant bushland areas post development.

"Invasion, establishment and spread of *Lantana camara*" is a key threatening process under the *TSC Act*. The site currently contains this species in small sporadic locations. The proposed development may provide an opportunity to ameliorate the effect of this key threatening process by the application of suitable weed control measures in remnant bushland areas post development.

"Loss of Hollow-bearing Trees" is a key threatening process under the *TSC Act*. As a hollow-bearing tree assessment has not been conducted, the level of hollow-bearing tree loss is unknown. It is estimated that there would be very few hollows on site given the young nature of vegetation, however there are some older remnant trees within the grassland with scattered trees vegetation community and edge of that community immediate adjacent. No hollow-dependent threatened species were recorded during surveys undertaken.

"Predation by feral cat (*Felis catus*)" is listed as a key threatening process under the *TSC Act.* The proposed development may alter impacts on adjoining lands by increasing the numbers of domestic cat ownership and as such the action proposed may increase the impact of this threatening process.

"Removal of dead wood and dead trees" is a key threatening process under the *TSC Act*. The potential removal of dead wood and dead trees cannot be eliminated but given the young nature of the vegetation on site the potential amount to be removed would be very low. Two stags were noted surrounding the dam located within the existing Lot 9. These stags were observed to also provide hollows and have potential to be utilised by threatened hollow-dependent species.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The document forms the basis of assessment required under Section 5A of the *EPA Act*. This assessment determines if future development of the site is likely to have a significant effect on threatened species, populations and / or EECs.

EPA Act and TSC Act

In respect of matters required to be considered under the *EPA Act* and relating to the species / provisions of the *TSC Act.*

- One (1) threatened fauna species – Little Bentwing-bat (*Miniopterus australis*) – was recorded on the north-eastern boundary of the subject site.
- No threatened flora species were recorded within or in close proximity to the subject site
- One EEC – *Swamp Sclerophyll Forest on Coastal Floodplains* was recorded within or in close proximity to the subject site
- No endangered populations have been observed

As a result of ecological assessment and 7 part test of significance (section 5 of this report) has concluded that the proposed development will not have a significant impact on any threatened species, populations or EEC's. Therefore, an SIS should not be required for the proposed development.

EPBC Act

In respect of matters required to be considered under the *EPBC Act:*

- No threatened fauna species were recorded within the subject site
- One (1) migratory fauna species listed under the *EPBC Act* – Rufous Fantail (*Rhipidura rufifrons*) – was recorded within the subject site. In accordance with legislative requirements a referral was made to DEWHA with regards to the Rufous Fantail. DEWHA responded that the proposal was not a Controlled Action.
- No threatened flora species were recorded within or in close proximity to the subject site
- No endangered populations or EEC's listed under the *EPBC Act* were recorded within or in close proximity the subject site.

Assessment of these species within Section 4 of this report concluded that the proposed subdivision was not significant. A formal referral was provided to DEWHA and DEWHA responded by advising that the development was not a 'controlled action'.

FM Act

In respect of matters relative to the *FM Act,* no suitable habitat for threatened aquatic species was observed within the subject site, and there are no matters requiring further consideration under this Act.

Conclusion

It is concluded that the proposed subdivision of Lot 6 DP 244030 and Lot 9 DP 250425 off Diamond Beach Road, Diamond Beach, is unlikely to result in a significant impact on any threatened species, populations or EEC's or their habitats.

As such no further assessments are considered to be required under the *Environmental Planning & Assessment Act 1979* or the *Fisheries Management Act 1994* and or the *Environment Protection and Biodiversity Conservation Act 1999*.

The proposal has potential to significantly impact on a nationally listed migratory species therefore further assessment is required under the

6.2 Recommendations

- Any hollow that is required to be removed should be replaced as a nest box at a ratio of 2:1 within retained trees or adjoining bushland areas within the subject site.

- The felling of all hollow-bearing trees is to be conducted under the supervision of a fauna ecologist. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. Re-used hollows or those with likely occupation are to be relocated to natural areas within close proximity to the site.

- Loss of foraging habitat for threatened species, specifically the loss of autumn-summer flowering stands of *Melaleuca quinquenervia* (Broad-leaved Tea Tree) and the winter flowering stands of *Eucalyptus robusta* (Swamp Mahogany) is to be minimised. The subdivision plan (Figure 2) shows the location of some of the larger trees on the subject site. Almost all of the trees shown in the eastern portion are Swamp Mahoganies. These are located on larger sized lots which increase their potential for some being retained post development.

- Loss of Swamp Sclerophyll Forest vegetation is to be minimised through selective retention of remnant vegetation throughout the landscape particularly within larger lots and public spaces. To lessen the impact, the lots within the eastern portions of the site are typically larger in size.

- Removal/modification of 7.1ha of isolated habitats providing maturing native regrowth vegetation is to be offset in accordance with the NSW *Guidelines for Biodiversity Certification of Environmental Planning Instruments*. A like for like vegetation offset has been secured in accordance with the CMA recommendations.

BIBLIOGRAPHY

Auld, B. A. & Medd, R. W. (1996) *Weeds.* Inkata Press.

Barker, J., Grigg, G. C. & Tyler, M. J. (1995) *A Field Guide to Australian Frogs* Surrey Beatty & Sons.

Bishop, T. (1996) *Field Guide to the Orchids of New South Wales and Victoria.* UNSW Press.

Briggs, J. D. & Leigh, J. H. (1995) *Rare or Threatened Australian Plants.* CSIRO.

Churchill, S. (2008) *Australian Bats*, 2nd Ed., Jacana Books, Crows Nest, Sydney

Cogger, H. G. (1996) *Reptiles and Amphibians of Australia*. Reed Books Australia.

DECCW (2009 and 2010) *Atlas of NSW Wildlife* for the relevant 1:100,000 scale map sheet

Department of Conservation & Climate Change, Bio-banking Methodology 2008

Dwyer, P. D. (1995b) Little Bentwing-bat (*Miniopterus australis)*. In *The Mammals of Australia*. R. Strahan (Ed.) Reed Books, Chatswood.

Ehmann, H. (1997) *Threatened Frogs of New South Wales.* FATS Group.

EPBC (1999) Environmental Protection and Biodiversity Conservation Act 1999 - Interactive Map Database Search - http://epbcweb.ea.gov.au/image/otherbatch.html

Griffiths, K. (1997) *Frogs and Reptiles of the Sydney Region.* University NSW Press.

Harden, G. (1993) *Flora of New South Wales.* University NSW Press.

Hoser, R. (1989) *Australian Reptiles and Frogs*, Pierson & Co.

Lamp, C. & Collett, F. (1996) *A Field Guide to Weeds in Australia.* Inkata Press.
Lunney, D., Urquart, C .A. & Reed, P. (1988) *Koala Summit,* NPWS.

Marchant, S., & P. J. Higgins (Eds) (1990). *Handbook of Australian, New Zealand and Antarctic Birds.* Volumes 1-7 Oxford University Press, Melbourne.

Morrison, R. G. B. (1981) *A Field Guide to the Tracks & Traces of Australian Animals.* Rigby.

National Parks and Wildlife Service (1999) Threatened Species Management, Species Information (NPWS 1999).

NSW National Parks and Wildlife Service (1997) *Urban Bushland Biodiversity Survey* NSW NPWS, Hurstville.

Parnaby, H. (1992) *An interim guide to identification of insectivorous bats of south-eastern Australia.* The Australian Museum, Sydney, Technical Report, No. 8.

Pizzey, G. & Knight, F. (1997) *A Field Guide to the Birds of Australia.* Angus & Robertson.

Reader's Digest (1976) *Complete Book of Australian Birds.*

Richardson, F. J., Richardson, R. G. & Shepherd, R. C. H (2007) *Weeds of the South-East: an Identification Guide for Australia.* Everbest Printing Co. Pty. Ltd. China.

Robinson, L. (1994) *Field Guide to the Native Plants of Sydney.* Kangaroo Press.

Robinson, M. (1996) *A Field Guide to Frogs of Australia.* Reed.

Schodde, R. and Tidemann, S. (Eds) (1986). Readers Digest complete book of Australian Birds. Second Edition. Reader's Digest Services Pty Ltd, Sydney.

Simpson & Day (1996*) Field Guide to the Birds of Australia.* Viking.

Specht, R. L., Specht, A., Whelan, M. B. & Hegarty, E. E. (1995) *Conservation Atlas of Plant Communities in Australia.* Southern Cross University Press, Lismore.

Triggs, B. (1996) *Tracks, Scats & Other Traces: A Field Guide to Australian Mammals*. Oxford University Press, Melbourne.

Trounson, Donald & Molly (1998) *Australian Birds Simply Classified*. Murray David Publishing Pty Ltd, NSW.

Van Dyke, S. and Strahan, R. (Eds) (2008) *The Mammals of Australia* (3rd Edn.). Reed New Holland: Sydney.

Wheeler, D. J. B., Jacobs, S. W. L. & Norton, B. E. (1994) *Grasses of New South Wales.* University of New England.

Wilson, K. W. and Knowles, D. G. (1988) *Australia's Reptiles - A Photographic Reference to the Terrestrial Reptiles of Australia*. Cornstalk Publishing.

FIGURES

Legend

- Property Boundary
- 20m x 20m or 20m x 50m Flora Quadrat

Vegetation Communities

- Grassland with Scattered Trees
- Cleared (tracks)
- Swamp Oak/Mixed Eucalypt /Paperbark Open Forest Regrowth
- Swamp Mahogany/Paperbark Open Forest Regrowth (EEC - Swamp Sclerophyll Forest on Coastal Floodplains)
- Coastal Scrub (Hind dune) Regrowth
- Coastal Scrub (Fore dune)
- Aquatic Herbfield (Dam)

Fauna Survey (Winter 2010)

- F))) Frog Call-playback
- = = = = Spotlight Transect

Fauna Survey (Summer 2010)

- Anabat Station
- Nocturnal Bird & Mammal Call-playback
- M))) Nocturnal Mammal Call-playback
- F))) Frog Call-playback
- LBB Little Bentwing-bat
- RF Rufous Fantail
- Hair Tube Transects
- = = = = Spotlight Transect
- 50m x 50m Koala Activity Search Quadrat

Flora & Fauna Survey (2003)

- Anabat Station
- Nocturnal Call-playback Station
- Fauna Trapline
- Vegetation Transect
- = = = = Spotlight Transect

Flora and fauna survey locations are approximate and have not been fixed by land survey.

*Subject Site boundary subject to final survey

Travers bushfire & ecology
38A, The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 5331 Fax (02) 4340 2151
e-mail: info@traversecology.com.au

0 25 50 75 100 m

1:2,000

Original plan produced in A3 colour

Drawing No.	9020F	Date
Drawn By	TM	06/08/10
Amendment		Date
A		
B		
C		

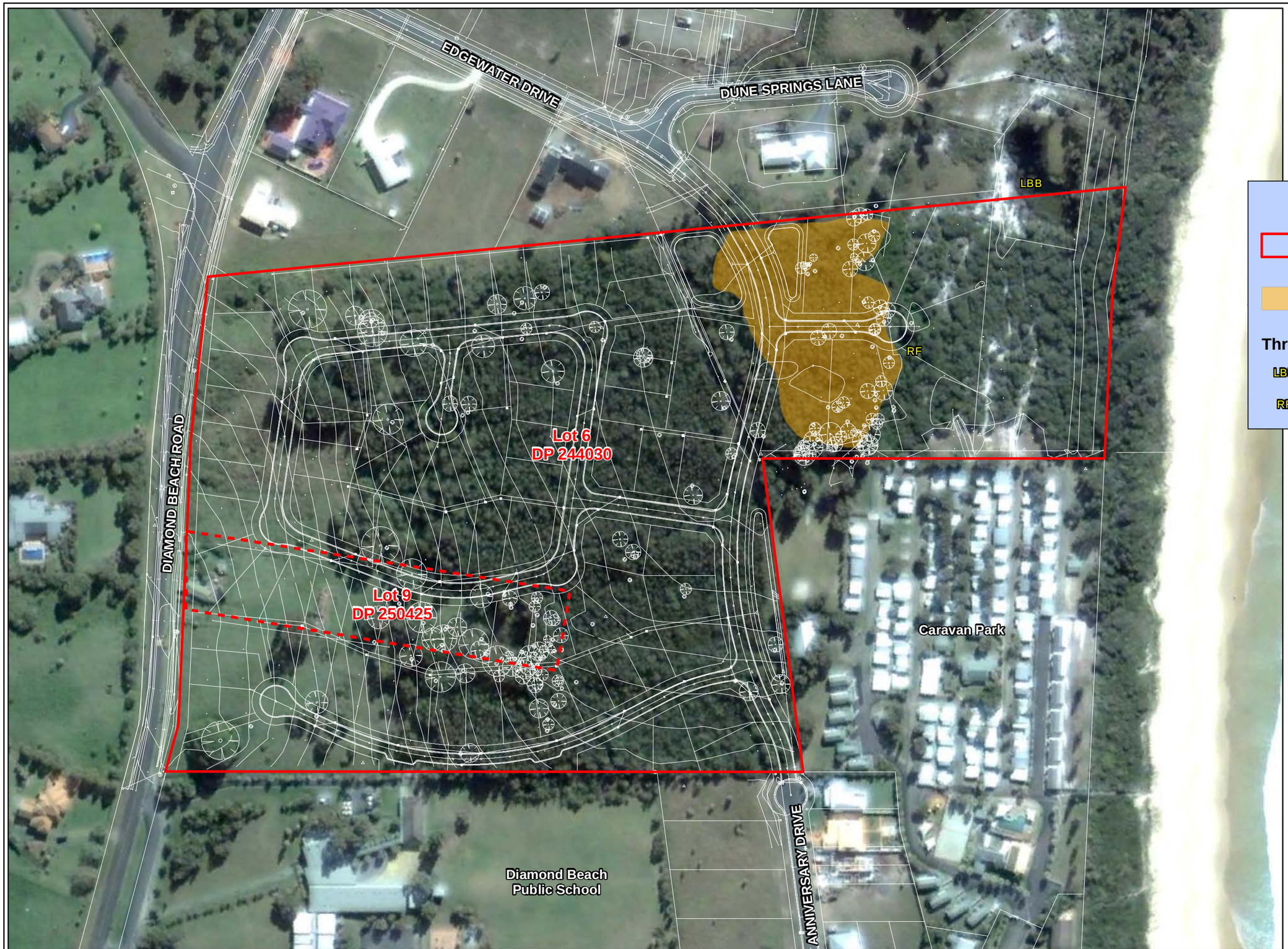
Figure 1 -

Flora & Fauna Survey Effort & Results

Diamond Beach Road, Diamond Beach

Source: Google Earth Pro, Satellite Imagery.

Location: N:/A10012



Legend

- Property Boundary
- Swamp Mahogany/Paperbark Open Forest Regrowth (EEC - Swamp Sclerophyll Forest on Coastal Floodplains)

Threatened Species (2010)

- LBB — Little Bentwing-bat
- RF — Rufous Fantail

N

Flora and fauna survey locations are approximate and have not been fixed by land survey.

*Subject Site boundary subject to final survey

Travers bushfire & ecology

38A, The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 5331 Fax (02) 4340 2151
e-mail: info@traversecology.com.au

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1:2,000

Original plan produced in A3 colour

Drawing No.	9020F	Date
Drawn By	TM	19/02/10
Amendment		Date
A		
B		
C		

Figure 2 -
Proposed Development & Ecological Constraints
Diamond Beach Road, Diamond Beach

Source: Google Earth Pro, Satellite Imagery.

Location: N:/A10012

APPENDIX 1

LETTER FROM HUNTER – CENTRAL RIVERS CMA

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Hunter-Central Rivers
CMA CATCHMENT MANAGEMENT AUTHORITY

Mr Brian Lidbury
Managing Director
Lidbury, Summers and Whiteman
3 Wharf Street
FORSTER NSW 2428

27th August 2009

Contact: T.Millen
File: Request Number: 10811

Re: Proposed vegetation clearing on land located at Diamond Beach Road, Diamond Beach, Lot 6 DP 244030 and Lot 9 DP 250425 associated with proposed subdivision.

Dear Mr Lidbury,

With reference to your meeting on 3rd June 2009 with Mr Tony Millen of the CMA (and more recent telephone conversations and email correspondence) where the CMA agreed to undertake an assessment of the subdivision proposal in order to advise an indicative likely outcome under the *Native Vegetation Act 2003* (NVA). As you are aware, the CMA has no formal regulatory role in this particular development, however the CMA does have a statutory role under the EP & A Act as a public authority with an interest in the proposal.

The Native Vegetation Assessment Tool (NVAT) was used to provide an indication to whether or not the 'Improve or Maintain' principal of the Act is demonstrated, not to actually develop a Property Vegetation Plan. The methodology used for applying the 'Improve or Maintain' test is set out in the Native Vegetation Regulation 2005 Environmental Outcomes Assessment Methodology (EOAM). NVAT is the computer program that delivers the EOAM.

Under the EOAM there are certain circumstances where clearing cannot be approved. This includes clearing of an over cleared vegetation type or an EEC not in low condition as defined in the EOAM. At this meeting, it was agreed that some of the vegetation on site may include an over cleared vegetation type, *Swamp Oak Forest,* which may represent an EEC. In order to be able to run the (EOAM) the CMA has by passed the fact that these conditions may exist and recommend further consultation between your client, GTCC and DEECW to resolve these issues.

During the assessment the following points were noted:

- From the data provided, the CMA has assessed:
  - A proposed clearing area of 6.67 ha, which comprises remnant native vegetation and regrowth. The CMA considers most of the vegetation pre 1990 regrowth. The regrowth is discontinuous and there is no clear demarcation between pre 1990 and post 1990 regrowth.
  - An area of 16.64 ha is available for offset. This consists of approximately 1.8 ha on site and 14.84 ha of land at North Tuncurry/Darawakh (Lot 47 DP 753207) owned by Gary Beisser.
- The assessment assumes all 6.67 ha of remnant native vegetation would be cleared.
- As the matter under consideration is not a statutory PVP some divergence from strict application of the *Threatened Species Tool* and considerations under c27 of the Act was accepted.
- The assessment also assumes that:
  - all the offset area would contain habitat suitable for the threatened species predicted as having potential habitat on the clearing site.

- The development is assumed to meet the 'improved or maintain' principle for water quality and soils with appropriate management actions.
- The salinity tool is not applicable to the site.

The CMA has carried out the assessment using the PVP assessment models *Biometric* and *Threatened Species Tool* using data collected by staff and information submitted on behalf of your client. Please note the following summaries:

Biometric Summary:

The proposal received a **green light** in the *Biometric Tool.* The clearing with offsets has no significant change to regional or landscape conditions, and is sufficiently offset by the proposed offset site.
For the offset areas to achieve the improved score that is used in the Biometric the following management actions will need to be initiated:

- An approved weed management plan and implementation of the plan.
- An approved feral animal management plan and implementation of the plan.
- Permanent exclusion of all stock.
- Retention of all standing and fallen dead timber.
- Retain all trees with hollows.
- Supplementary planting of native species from an approved list.
- Exclusion of apiaries.
- Retention of all rocks.

Threatened Species (TS) Summary:

Notes on principles of the TS tool and comparison with 7 part test.

1. The test applied by the PVP TS tool is **no net loss of individuals of any threatened species**. In contrast to the TS 7 part test, the PVP test is **no reduction in the size of a local population** rather than **maintaining the viability of a local population**.
2. In applying this test, the TS tool uses a habitat element (eg tree hollows, area of foraging habitat) as a surrogate for individuals of a particular species. Only the most limiting or important habitat element is used (eg breeding habitat over foraging habitat).
3. Additionally, in applying the test, the TS tool assumes the "local population" to be the area of the particular habitat element present on the property. Thus, the assessment does not consider the sum of available habitat in the locality adjacent to the property under assessment such as may the case in a 7 part test.
4. The TS tool does not consider the presence/absence of species, but rather the potential of a species to occupy the habitat. This contrasts with a 7 part test which would only consider those species regarded as likely to be present on the site at least seasonally.

The proposal received a **red light** in the *Threatened Species Tool.*

The assumption that all management actions required for the predicted species would occur in the proposed offset area was made. Even with these management actions considered, the proposed offset area still did not have a Net Gain and therefore deemed not to have met improve or maintain environmental outcomes.

The tool does calculate the size of the largest offset required for the most limiting species, with all management actions considered. This was 27.27 ha, which means approximately a further 10.6 ha is required.

Conclusion and Recommendations

The proposal as submitted, does not meet the IoM principal of the NVA. The offset requirements of the biometric tool are met but those of the threatened species tool are not.

The CMA recommends that:

- The additional offset required for threatened species is provided.

If you require any clarification of the points raised above or seek further information please contact Tony Millen on 6551 8994.

Yours faithfully

David Green for
Dean Chapman
Acting General Manager

APPENDIX 2

LETTER FROM DECCW

Our reference: DOC10/21312.emb.FIL07/4149
Contact: Estelle Blair, 6659 8256
Date: 18 May 2010

Mr Brian Lidbury
Lidbury Summers and Whiteman
PO Box 510
FORSTER NSW 2428

Dear Mr Lidbury

Re: Rezoning of Lot 6 DP 244030, 310 Diamond Beach Road, Diamond Beach

I refer to our telephone conversation on 29 April 2010 where you requested clarification of the Department of Environment and Climate Change's (DECCW) position with respect to the proposed rezoning of the Lot 6 DP 244030. It is assumed that the rezoning application also includes Lot 9 DP 250425, which is surrounded by the above Lot

At a site inspection on 3 June 2009 and subsequent meetings that year at Greater Taree City Council offices, the occurrence, extent and significance of vegetation on the subject site were discussed. It was acknowledged that, amongst the regrowth, there were examples of both an overcleared vegetation type (Swamp Oak forest) as well as an endangered ecological community (Swamp Sclerophyll Forest). The potential for threatened fauna use of the site was also discussed.

Notwithstanding that avoidance of some high conservation value areas could be achieved with the subdivision design and mitigation measures could also be applied, there would still be some unavoidable impacts on the high conservation values identified above.

During the meeting on 29 September 2009, Lot 47 DP 753207 at Darawank was nominated as a potential offset. Ecological survey of this proposed offset confirmed that it included the same or similar vegetation types as the subject site, and was large enough to address offset requirements, provided that the entire lot was provided as an offset. DECCW supports this lot being used to offset vegetation loss at Diamond Beach.

It is understood that Greater Taree City Council were also supportive, and a voluntary planning agreement (VPA) would be developed as a supporting document to the rezoning proposal. DECCW provided some information on VPAs to Council and yourself in an email dated 16 October 2009, but the form and content of such an agreement is still to be ascertained.

The future ownership and ongoing management of the proposed Darawank offset were also discussed. It is understood that a number of Lots in the Darawank and Minimbah areas have been proposed to be transferred to DECCW under Part 11 of the *National Parks and Wildlife Act 1974*

Locked Bag 914, Coffs Harbour NSW 2450
Federation House, Level 7, 24 Moonee Street
Coffs Harbour NSW
Tel: (02) 6651 5946 Fax: (02) 6651 6187
ABN 30 841 387 271
www.environment.nsw.gov.au

(NPW Act), for addition to the DECCW reserve system. It is understood that Lot 47 was one of these proposed lots and thus may be accepted as an addition to the DECCW reserve system.

As previously discussed, this is subject to the approval of the Minister for Climate Change and the Environment, as only he can accept lands under Part 11 of the NPW Act. This aspect is still under review within the Department. If the Minister does not approve the transfer, then an alternative conservation agreement, such as a conservation agreement under Section 69B of the NPW Act, may need to be developed, because, if land is to be considered an offset, it must be managed for conservation in perpetuity. Discussions with both Great Lakes and Greater Taree Councils may be required in this event.

I hope this clarifies the issues. If you wish to discuss this matter further please contact me on telephone 6659 8256.

Yours sincerely

Estelle Blair

ESTELLE BLAIR
Acting Head, North Coast Planning Unit
Planning and Aboriginal Heritage - North East
Environment Protection and Regulation

cc. Ms Tanya Cross, Greater Taree City Council

APPENDIX 3

EPBC REFERRAL

REFERRAL OF PROPOSED ACTION

Project title: **Residential Subdivision - Lot 6 DP 244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach**

1 SUMMARY OF PROPOSED ACTION

NOTE: You must also attach a map/plan(s) showing the location and approximate boundaries of the area in which the project is to occur. Maps in A4 size are preferred. You must also attach a map(s)/plan(s) showing the location and boundaries of the project area in respect to any features identified in 3.1 & 3.2, as well as the extent of any freehold, leasehold or other tenure identified in 3.3(j).

1.1 ***Short description***

The proposal is to subdivide Lot 6 DP 244030 and Lot 9 DP 250425 into eighty nine (89) residential allotments varying between 551m^2 and 2,005m^2. One (1) residual lot of 9241m2 adjacent to the foreshore will be a dedicated public reserve.

The current proposal is expected to modify or remove an estimated 7.1ha of vegetation of which 0.8ha is considered an endangered ecological community - *Swamp Sclerophyll Forest on Coastal Floodplains*.

The Hunter-Central Rivers CMA undertook a Biometric Assessment of the site, pursuant to the Native Vegetation Act 2000, which required a minimum offset of 27.27ha of land to offset the loss of vegetation on the subject site.

The proponent has subsequently purchased 32.01ha of land at Darawank approximately 12km to the south-south-west in order to offset the loss of vegetation for the current proposal.

In respect of matters required to be considered under the *Environment Protection & Biodiversity Conservation Act 1999*, the Flora and Fauna Assessment Report concluded that no threatened fauna species, one migratory bird species Rufous Fantail (*Rhipidura rufifrons*), no threatened flora species, and no EECs listed under this Act were recorded within or in close proximity to the subject site.

The proposed subdivision was considered to have a potential significant impact on the Rufous Fantail, as likely nesting habitat will be removed. Nesting habitat is considered to be important habitat for the life-cycle of this species under the definitions of the EPBC Act. As such a referral to *Department of the Environment, Water, Heritage and the Arts* has been prepared.

1.2 ***Latitude and longitude***

	Latitude (South)			Longitude (East)		
location point	degrees	minutes	seconds	degrees	minutes	seconds
NW Corner	32	2	18.53	152	32	12.51
NE Corner	32	2	19.21	152	32	31.24
Mid East Corner	32	2	23.51	152	32	29.68
Mid SE Corner	32	2	22.77	152	32	22.94
SE Corner	32	2	28.26	152	32	22.46
SW Corner	32	2	26.76	152	32	10.05

1.3 ***Locality***

The site is located approximately 3.5 km north of Blackhead on the NSW North Coast. The subject site is bounded to the north by newly constructed rural residential subdivision, to the east by Diamond Beach foreshore, to the south by Diamond Beach Holiday Park and Diamond Beach Public School, and to the west by Diamond Beach Road.

Figure 1 *- Site Location & Coordinates*

Location	Lot 6 DP 244030 and Lot 9 DP 250425
Area	Approximately 10.9 hectares
Topographic map	Hallidays Point 1:25000
Grid reference	456450E and 6485050N
Local government area	Greater Taree Council
Existing land use	Regrowth forest, cleared paddocks and previous rural residence

1.4	***Size of the development footprint or work area (hectares)***	Approximately 10.9 hectares
1.5	***Street address of the site***	Lot 6 DP 244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach

1.6 ***Lot description***

Lot 6 DP 244030 and Lot 9 DP 250425

1.7 ***Local Government Area and Council contact (if known)***

Greater Taree Council

1.8 ***Timeframe***

Approximately 2011 to 2014 – subject to staging and release of lots for sale

1.9	***Alternatives***	NO	No - the project has gone through a comprehensive design process that has resulted in the proposed layout.
			Yes, you must also complete section 2.2
1.10	***State assessment***		No
		YES	Yes, you must also complete Section 2.4
1.11	***Component of larger action*** Is the proposed action a component of a larger action?	NO	No
			Yes, you must also complete Section 2.6
1.12	***Related actions/proposals*** Is the proposed action related to other actions or proposals in the region (if known)?	NO	No
			Yes, provide details:
1.13	***Australian Government funding*** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	NO	No
			Yes, provide details:
1.14	***Great Barrier Reef Marine Park*** *Is the proposed action inside the Great Barrier Reef Marine Park?*	NO	No
			Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 DETAILED DESCRIPTION OF PROPOSED ACTION

2.1 Description of proposed action

The proposal is to subdivide Lot 6 DP 244030 and Lot 9 DP 250425 into eighty nine (89) residential allotments varying between 551m^2 and 2,005m^2. One (1) residual lot of 9,241m2 adjacent to the foreshore will be a dedicated public reserve.

The proposed subdivision also includes the provision of road works, services and stormwater management and drainage works (**Figure 2**).

A Biodiversity Offset of 32.01ha of land at Darawank, approximately 12km to the south-south-west, has been secured as an offset for the loss of vegetation and habitat as a result of the proposed development.

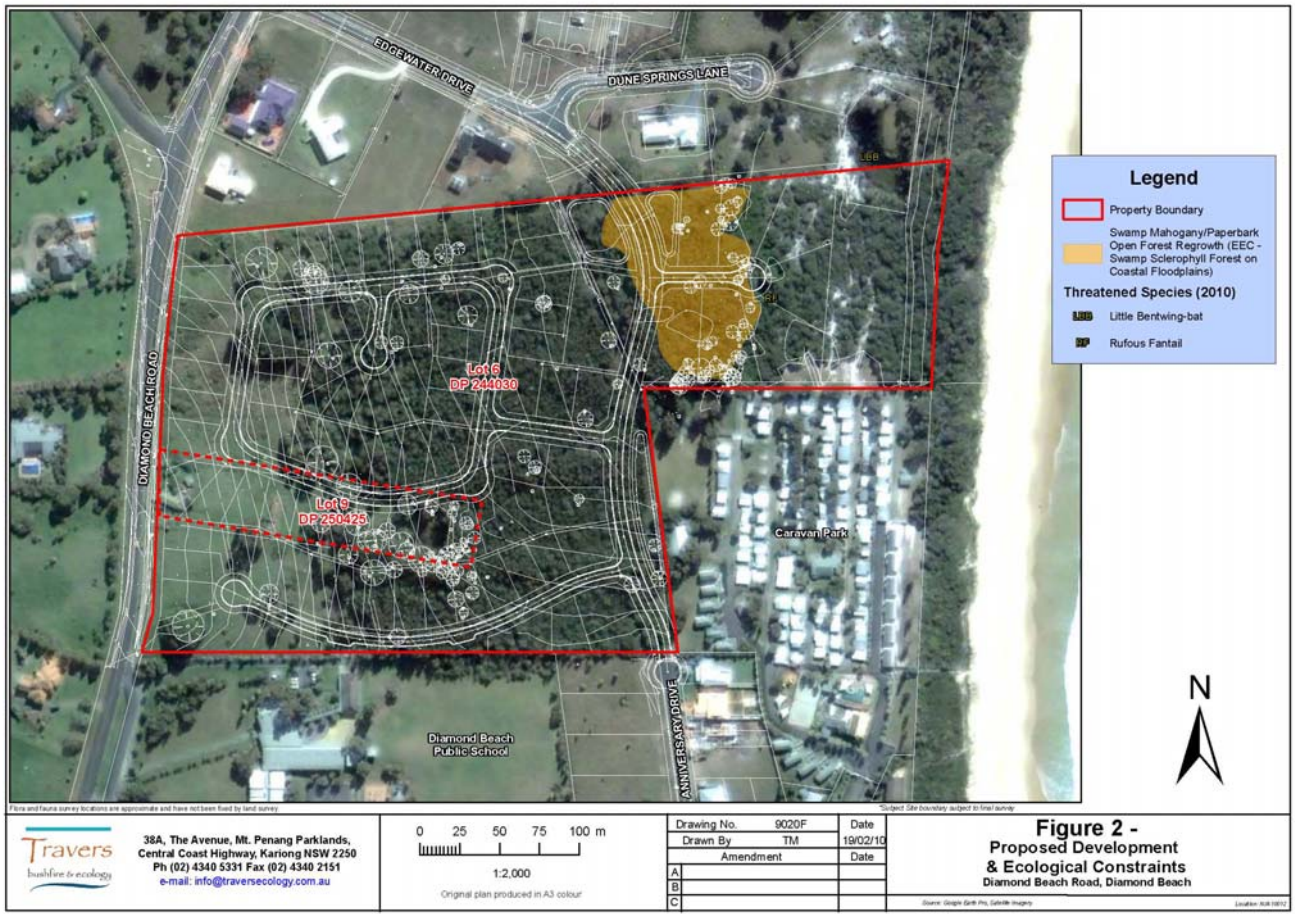


Figure 2 *– Proposed Development*
(Source – Figure 2 of the Flora and Fauna Assessment Report (Travers bushfire & ecology 2010)

2.2 Alternative locations, time frames or activities that form part of the referred action

Although alternative designs are considered as part of the preliminary scoping for the project, no further alternatives have been proposed at this point in time.

2.3 Context, planning framework and state/local government requirements

Greater Taree Local Environmental Plan (GTLEP 1995)

The subject site is zoned Rural 1(a) in accordance with Greater Taree Local Environmental Plan (GTLEP 1995). In accordance wit the objectives of the GTLEP, any development other than "Agriculture, forestry or oyster farming", requires consent.

The proposed subdivision is being assessed for the purposes of a rezoning application to rezone the subject lands to a residential zone under the GTLEP.

Threatened Species Conservation Act 1995

The specific requirements of the *TSC Act* must be addressed in the assessment of flora and fauna matters. This requires the consideration of potential impacts on threatened species, populations and ecological communities.

The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *Environmental Planning and Assessment Act 1979* (EPA Act) and are based on a 7 part test of significance.

Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, a Species Impact Statement (SIS) is required to be prepared.

A Flora and Fauna Assessment (*Travers Bushfire & Ecology 2010*) has been prepared and includes a 7 part test on threatened species matters and an assessment for EPBC listed matters.

Fisheries Management Act 1994

The *FM Act* provides a list of threatened aquatic species that require consideration when addressing the potential impacts of a proposed development. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, an SIS is required to be prepared.

In respect of matters relative to the *Fisheries Management Act 1994*, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

Native Vegetation Act (2003) and Regulations

In accordance with the principles of Ecologically Sustainable Development (ESD), the *Native Vegetation* Act (2003) and Regulations controls the clearing of native vegetation throughout NSW.

Under Schedule 1 of the *Native Vegetation Act* (2003) lands that are excluded from application of the Act include;

- National Parks estate and other conservation areas
- State Forest Land
- Specific Local Government Areas (LGAs) listed below:

  Ashfield, Auburn, Bankstown, Baulkham Hills, Blacktown, Botany Bay, Burwood, Camden, Campbelltown, Canterbury, Concord, Drummoyne, Fairfield, Hawkesbury, Holroyd, Hornsby, Hunters Hill, Hurstville, Kogarah, Ku-ring-gai, Lane Cove, Leichhardt, Liverpool, Manly, Marrickville, Mosman, Newcastle, North Sydney, Parramatta, Penrith, Pittwater, Randwick, Rockdale, Ryde, South Sydney, Strathfield, Sutherland Shire, Sydney City, Warringah, Waverley, Willoughby, Woollahra,

- Land zoned residential (not rural residential), village, township, industrial or business under an environmental Planning instrument.

The proposed development within this report falls within the Greater Taree LGA, and is zoned rural hence the *Native Vegetation Act* (2003) applies.

The CMA referral process under the *Native Vegetation Act* (2003) is a parallel referral process to the Development Application (DA) process. A written application is made to the relevant Catchment Management Authority (CMA) for assessment, utilising the 'Biometric Test'. Key factors assessed under the Biometric Test include; water quality, salinity, biodiversity and land degradation. Any fail results under the Biometric Test trigger the preparation of a Property Vegetation Plan (PVP).

The improve and maintain test is assessed using the biometric test to positive or negative net change in the roosting, breeding or foraging habitat of specific threatened species with potential to occur within the site. This process has significant implications for the amount vegetation that can be cleared or modified for the purposes of a development proposal and may result in significant offset protection and restoration works to achieve a net positive gain.

The relevant Catchment Management Authority has undertaken a formal assessment of the proposed development and required a sizeable offset for the removal of vegetation onsite. A suitable offset has been secured and accepted by DECCW and the CMA.

Environment Protection and Biodiversity Conservation Act 1999

The *EPBC Act* requires that Commonwealth approval be obtained for certain actions. It provides an assessment and approvals system for actions that have a significant impact on matters of *national environmental significance* (NES). These may include:

- World Heritage Properties and National Heritage Places
- Wetlands of International Importance protected by international treaty
- Nationally listed threatened species and ecological communities
- Nationally listed migratory species
- Commonwealth marine environment

Actions are projects, developments, undertakings, activities, and series of activities or alteration of any of these. An action that needs Commonwealth approval is known as a controlled action. A controlled action needs approval where the Commonwealth decides the action would have a significant effect on an NES matter.

Where a proposed activity is located in an area identified to be of NES, or such that it is likely to significantly affect threatened species, ecological communities, migratory species or their habitats, then the matter needs to be referred to the *Department of the Environment, Water, Heritage and the Arts (DEWHA)* for assessment. In the case where no listed federal species are located on site then no referral is required. The onus is on the proponent to make the application and not the Council to make any referral.

A significant impact is regarded as being;

> *important, notable, or of consequence, having regard to its context or intensity and depends upon the sensitivity, value, and quality of the environment which is impacted and upon the duration, magnitude, and geographical extent of the impacts. A significant impact is likely when it is a real or not a remote chance or possibility.*
>
> *Source: EPBC Policy Statement*

Guidelines on the correct interpretation of the actions and assessment of significance are located on the department's web site http://www.environment.gov.au/epbc/publications.

In respect of matters required to be considered under the *Environment Protection & Biodiversity Conservation Act 1999*, no threatened fauna species, one migratory bird species Rufous Fantail (*Rhipidura rufifrons*), no threatened flora species, and no EECs listed under this Act were recorded within or in close proximity to the subject site.

The proposed subdivision was not considered to have a significant impact on the Rufous Fantail, as the affected Rufous fantail is not an ecologically significant proportion of the population and affected habitat is not considered to be critical to this species or its population. Whilst the Rufous Fantail is not considered to be significantly impacted a referral to *Department of the Environment, Water, Heritage and the Arts is recommended*. The assessment of significance is considered further within this referral.

2.4 Environmental impact assessments under Commonwealth, state or territory legislation

No Approvals have been granted at the time of submission of the EPBC Referral. The proposed subdivision assessment has been undertaken for the purposes of rezoning the subject site from Rural (1a) to a Residential zoning.

2.5 Consultation with Indigenous stakeholders

Not applicable for this referral.

2.6 A staged development or component of a larger project

The proposed project is not staged or part of a larger action.

3 DESCRIPTION OF ENVIRONMENT & LIKELY IMPACTS

These include:-

- Loss of the endangered ecological community - *Swamp Sclerophyll Forest on Coastal Floodplains* vegetation within selected proposed eastern lots. To lessen the impact, the lots within this area are typically larger in size to allow the facilitation and retention of a large majority of Swamp Mahogany trees.

- Removal/modification of 7.1ha of isolated habitats providing maturing native regrowth vegetation. The currently proposed subdivision layout will result in almost complete removal of terrestrial habitats resulting in displacement and or potential destruction of resident fauna.

- Loss of potential breeding and known foraging habitat of the migratory species Rufous fantail.

- Best practice sediment and erosion control measures will be implemented. In additional the e subdivision proposal will protect the coastal foreshore through the retention of Coastal Hind Dune vegetation in the proposed foreshore reserve.

- Loss of foraging habitat for threatened species, specifically the loss of autumn-summer flowering stands of *Melaleuca quinquenervia* (Broad-leaved Tea Tree) and the winter flowering stands of *Eucalyptus robusta* (Swamp Mahogany). Both trees flower in high yields and are key foraging species. The inclusion of these species in the sites landscaping within lots and within the proposed tree scape will assist in minimising the loss of local foraging resources. A large offset has also been provided conserving similar habitat in the local area.

- Increased threat of key threatening processes. Measures are implemented to minimise key threatening processes.

- Potential loss of hollow-bearing resources. Measures are implemented to minimise the impacts resulting from loss of hollow bearing trees.

- Implementation of asset protection zones (APZ's) and wastewater management systems may cause further vegetation loss and potential impacts on groundwater quality. Like wise ameliorative measures are proposed to minimise the impacts of the asset protection zones and wastewater management systems.

3.1 Matters of national environmental significance

Matters of National Environmental Significance were considered within the attached Flora and Fauna Assessment (*Travers bushfire & ecology* 2010).

Fauna

EPBC Act – A review of the schedules of the *EPBC Act* identified the presence of ten (10) threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table 4.3, and those with potential to utilise the subject site will be considered in the seven-part test within Section 5 of the Flora and Fauna Assessment (*Travers bushfire & ecology* 2010).

Of those ten (10) species, six (6) were considered to have potential habitat within the subject site. No nationally listed threatened fauna species were recorded within the subject site. Based on this the actions associated with the proposal, these are not likely to significantly affect any nationally listed threatened fauna species.

Additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site are assessed in Table 4.2 (*Travers bushfire & ecology* 2010). One species – Rufous Fantail was recorded within the Coastal Scrub (Hind Dune) vegetation community in 2010.

Flora

The flora and fauna assessment report (*Travers bushfire & ecology* 2010) states that a review of the schedules of the *EPBC Act* indicated the potential for six (6) threatened flora species to occur within a 10km radius of the site (Table 4.1).

Of those six (6) threatened flora species, two (2) have the potential to occur within the subject site. Those species are *Allocasuarina defungens* and *Cryptostylis hunteriana*. Neither of these species was observed within the study area.

The EPBC coordinate search returned the presence of habitat within 10km of the subject site for the endangered ecological community (critically endangered) *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.* The vegetation within the subject site does not support this vegetation community.

The actions associated with the proposal are not likely to significantly affect any nationally listed threatened species or ecological communities.

3.1 (a) World Heritage Properties

Description

NOT APPLICABLE – World Heritage Properties will not be affected by the proposed action.

Nature and extent of likely impact

NOT APPLICABLE – World Heritage Properties will not be affected by the proposed action.

3.1 (b) National Heritage Places

Description

NOT APPLICABLE –National Heritage Properties will not be affected by the proposed action.

Nature and extent of likely impact

NOT APPLICABLE – National Heritage Properties will not be affected by the proposed action.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)
Description

NOT APPLICABLE – Wetlands of International Importance (declared Ramsar Wetlands) will not be affected by the proposed action.

Myall Lakes National Park is located approximately 50 km to the south and is not affected directly or indirectly by the proposed action.

Nature and extent of likely impact

NOT APPLICABLE – Wetlands of International Importance (declared Ramsar Wetlands) will not be affected by the proposed action.

3.1 (d) Listed threatened species and ecological communities

Description

The critically endangered ecological community - *Littoral rainforest and Coastal Vine Thickets of Eastern Australia,* does not occur onsite and is not directly or indirectly impacted by the proposed action.

Nature and extent of likely impact

NOT APPLICABLE

3.1 (e) Listed migratory species

Rufous Fantail (*Rhipidura rufifrons*) was recorded within the Coastal Scrub (Hind Dune) vegetation community in 2010 by *Travers bushfire & ecology*. There is an additional six records within 10 km of the subject site.

Description

Preferred habitat – Rufous Fantail
Undergrowth of rainforests/wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings.

Migration Pattern
Breeding season in Australia varies across the range Oct-Feb, migrates to se Aust. In September to October over warmer months and moves to SW Pacific from March to April. This species is also Altitudinal migrant in NSW in mountain forests during warmer months when temperatures exceed their preferred temperature range.

Feeding Ecology & Diet
Insectivorous, favours lower and middle levels of foliage. Forages mainly by gleaning occasionally by fly catching. Works quietly along slender branches, from the inner section to the extreme tip. May join mixed feeding parties.

Conservation Status
Not listed as vulnerable by the IUCN – species of "least concern". In Australia the species is common in the north, decreasing in abundance southwards, it is not considered under threat. Several Micronesian populations exist in low numbers and are potentially susceptible to loss of habitat an introduced predators. There is no listed "Critical Habitat" within Australia or in close proximity to the subject site.

Comments & observations
Suitable roosting, breeding and foraging habitat present. Recorded during the first visit of surveys on the 27th January 2010 within the Coastal Scrub (Hind Dune) community. Two birds were observed adjoining the Swamp Sclerophyll Forest vegetation on this occasion and as such there is potential that the subject site is utilised as nesting habitat. The birds were not recorded at this location during the second field visit suggesting that if nesting is taking place within the subject site it is most likely within the more suitable forested gully areas. The impact of the proposed action on Rufous fantail is assessed below.

Figure 3 – Location of Rufous Fantail Observation
(Source – extract from Figure 2 of the Flora and Fauna Assessment Report - Travers bushfire & Ecology 2010)

Nature and extent of likely impact

In accordance with the DEWHA - *Significant Impact Guidelines* (*EPBC Act* Policy Statement 2006), an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify, destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species;
- Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

Regarding bullet point 1 the site may represent “important habitat” for the species which are further defined below. The species is not considered under threat in Australia and although the population numbers are in decline, it is not listed as a vulnerable species by the IUCN.

Regarding bullet Point 2, the development increases the risk of an invasive species.

Regarding bullet point 3, given that only one pair of birds have been observed on site, the subject site is not expected to represent an ecologically significant proportion of the population of Rufous Fantail. The known records of Rufous fantail in addition to the onsite record indicates two records between 1 and 1.6 km to the west and south west of the site in semi-cleared agricultural lands, 1 record 9km to the north at Old Bar (urban siting) and 3 records 10 km to the west in Khappinghat Nature Reserve. The existing records demonstrate that the local population is spread throughout the local area and is also utilising significant habitat in Khappinghat Nature Reserve.

An area of ‘important habitat’ for a migratory species is:

a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
b) habitat that is of critical importance to the species at particular life-cycle stages; and/or
c) habitat utilised by a migratory species which is at the limit of the species range; and/or
d) Habitat within an area where the species is declining.

Regarding Point a) is not applicable as established above because the siting of the Rufous Fantail onsite does not represent an ecologically significant proportion of the population.

Regarding Point c) is not relevant given the known distribution of Rufous fantail during its summer migrations extends to Melbourne with roughly equal reporting rates for observed and breeding records in south-east Australia (Blakers, Davies and Riley 1984 – the Atlas of Australian Birds).

Regarding Point d) the area is not known as being an area where the species is declining and consequently point d) is not relevant.

Point b) is considered in the following paragraphs.

Figure 4 – Recorded Rufous Fantail locations within 10 km of the site
(Source - EPBC Atlas Search accessed 31 March 2010)

Point b) pertains to whether the habitat is of critical importance to the species at particular life–cycle stages. Evidence of nesting was not recorded during surveys undertaken however two (2) individuals were recorded interacting in the later stages of the recognised breeding period (Oct-February). This may suggest that a portion of the subject site may be utilised for nesting activity, particularly given the site's isolated nature.

The survey undertaken to date, does not identify the full population size on site or location of nesting. The vegetation on site potentially represents breeding habitat for the species and the removal of vegetation will displace the species from the site. Although there are likely to be suitable nesting habitat within the locality within its dispersal range, the Significant Impact Guidelines (2006) do not define what is considered to be "critically important" for a determination of significant impact for an individual migratory species.

The recorded Rufous Fantail will potentially be directly affected if vegetation removal works are undertaken during the breeding season which extends from Mid September to April. Therefore the timing of vegetation clearance can be undertaken within key foraging and breeding areas outside of mid September to April.

In consideration to the definitions outlined in the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (2006), *Travers bushfire & ecology* considers that the migratory species Rufous Fantail (*Rhipidura rufifrons*) may be significantly affected by the proposed action. This is given that the subject site may be defined as 'important habitat' for the species as nesting habitat is of importance at a particular life-cycle stage.

As Rufous Fantail migrates to the north during winter seasons, the potential impact of the breeding lifecycle of this species can be avoided by scheduling vegetation clearance works. To avoid impacting this species during the summer breeding period, vegetation removal works to be undertaken outside of the key breeding months.

An offsetting arrangement has been proposed for this site after discussions with the Catchment Management Authority (CMA), Greater Taree Council, the proponent and the Department of Conservation Climate Change and Water (DECCW).

The CMA has undertaken an assessment of the site, running through the *Threatened Species Tool* which came to the conclusion that some 27.27ha of land would be required to offset the loss of Swamp Sclerophyll Forest on Coastal Floodplains vegetation and its potential threatened flora and fauna habitat for development within the subject site.

The proponent has purchased 32.01ha of land at Darawank, approximately 12km to the south south-west of the subject site which contains a small amount of Swamp Oak Floodplain Forest, and at least 30ha of Swamp Sclerophyll Forest on Coastal Floodplains. The removal or modification of approximately 7.1ha of the subject site will be offset through the protection in perpetuity of 32.01ha of land nearby containing mature stands of EEC that will be handed over to DECCW.

Travers bushfire & ecology considers that the provision of the offset which includes suitable habitat for Rufous Fantail, compensates for the loss of Rufous Fantail habitat onsite.

3.1 (f) Commonwealth marine area

Description

NOT APPLICABLE – A commonwealth marine area not be affected by the proposed action directly or indirectly.

Nature and extent of likely impact

NOT APPLICABLE – A commonwealth marine area not be affected by the proposed action directly or indirectly.

3.1 (g) Commonwealth land

(If the action is on Commonwealth land, complete 3.2(d) instead. This section is for actions taken outside Commonwealth land that may have impacts on that land.)

Description

NOT APPLICABLE – Commonwealth wealth land will not be affected by the proposed action directly or indirectly.

Nature and extent of likely impact

NOT APPLICABLE – Commonwealth wealth land will not be affected by the proposed action directly or indirectly.

3.1 (h) The Great Barrier Reef Marine Park

Description

NOT APPLICABLE –The Great Barrier Reef Marine Park will not be affected by the proposed action directly or indirectly.

Nature and extent of likely impact

NOT APPLICABLE –The Great Barrier Reef Marine Park will not be affected by the proposed action directly or indirectly.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

NOT APPLICABLE – Nuclear Actions are not proposed.

3.2 (a)	***Is the proposed action a nuclear action?***	NO	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	***Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?***	NO	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	***Is the proposed action to be taken in a Commonwealth marine area?***	NO	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	***Is the proposed action to be taken on Commonwealth land?***	NO	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		

3.2 (e)	***Is the proposed action to be taken in the Great Barrier Reef Marine Park?***	NO	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))		

3.3 Other important features of the environment

3.3 (a) Soil and vegetation characteristics

Geology and soils Geology - Characterised by a combination of tilted sediments of the Carboniferous period, Quaternary alluvium and recent sand dunes. Soils - Soils vary from moderately shallow loam in the west to deep silt towards the east and deep sand in the eastern edge. No rock outcrops were observed.

Vegetation The western portion of the site contains heath vegetation typical of fore-dunes and hind-dunes. The central portion contains regrowth open forest with various Eucalypt species, Casuarinas, Melaleucas, Gahnias and heath species. The western portion is largely cleared with paddock grasses, annual and perennial weeds.

3.3 (b) Water flows, including rivers, creeks and impoundments

Catchment Khappinghat Creek

Drainage Overland flow to Khappinghat Creek or direct to Pacific Ocean via Diamond Beach

3.3 (c) Outstanding natural features, including caves

The site contains the endangered ecological community – *Swamp Sclerophyll Forest on Coastal Floodplains*. The site abuts hind dune habitat adjoining Diamond Beach.

3.3 (d) Gradient (or depth range if action to be taken in a marine area)

Elevation Approximately 4.7-26 metres AHD

Aspect Various with the highest elevations adjacent to Diamond Beach Road

Gradients The central and eastern portion of the subject site is situated on gentle slopes, mostly less than 5% gradients. Parts of the western portion vary from 5-10%.

3.3 (e) Buildings or other infrastructure

With the exception of an existing house and shed adjoining Diamond Beach Road, there are no other buildings or infrastructure within the site.

3.3 (f) Marine areas

The eastern boundary of the site adjoins the coastal foreshore of Diamond Beach (Pacific Ocean)

3.3 (g) Kinds of fauna & flora

Flora

Seven (7) vegetation communities were identified within the subject site (Figure 2).

- Vegetation Community 1 – Grassland with Scattered Trees
- Vegetation Community 2 – Cleared (tracks)
- Vegetation Community 3 – Swamp Oak / Mixed Eucalypt / Paperbark Open Forest Regrowth
- Vegetation Community 4 – Swamp Mahogany / Paperbark Open Forest Regrowth
- Vegetation Community 5 – Coastal Scrub (Hind dune) Regrowth
- Vegetation Community 6 – Coastal Scrub (Fore dune)
- Vegetation Community 7 – Aquatic Herbfield (dam)

Vegetation communities are described in detail in section 4.3 of the Flora and Fauna Assessment Report (*Travers bushfire & ecology 2010*).

The plants observed within the vegetation communities of the subject site are listed in the Tables 3.1 (native species) and Table 3.2 (exotic species) of the Flora and Fauna Assessment Report (*Travers bushfire & ecology 2010*). A total of one hundred and seventy one (171) species have been identified including one hundred and twenty six (126) native species and forty five (45) exotic species. No endangered flora species were observed.

Fauna

A total of eighty-four (84) fauna species were observed within or in close proximity to the subject site during the survey. This number comprised 52 species of bird, 19 species of mammal, 4 species of reptile and 9 species of amphibian.

All species are listed in Table 3.3 of the Flora and Fauna Assessment Report (*Travers bushfire & ecology 2010*). One threatened mammal species the Little Bentwing-bat and the migratory species – Rufous fantail were recorded within or immediately adjacent to the subject site (Figure 3).

3.3 (h) Current state of the environment in the area

Clearing	Approximately 85-90% of the site has been cleared in the past with about 7ha of regrowth in the last 20-25 years. Much of the western portion of the site adjacent to Diamond Beach Road remains cleared.
Agriculture / Pastoral	Some of the western portion of the subject site was most likely grazed in the past given the cleared nature of the vegetation.
Introduced weeds	Within the bushland areas, there are very few weeds. There are minor incursions of Lantana within but generally representing less than 5% of the mid storey layer of vegetation. Within cleared patches the vegetation is predominately weedy with annual and perennial weeds and pastoral grasses.
Evidence of feral, introduced or domestic fauna	Dogs, Rabbits, Horse, Hares, Black Rat and Common Starlings have been recorded within or in close proximity to the subject site and likely impact on local native species.

3.3 (i) Other important or unique values of the environment

Khappinghat Nature Reserve occurs approximately 1km to the north and Darawank Nature Reserve occurs approximately 4.6 km to the south (Figure 5).

Figure 5 – *Nature Reserves adjoining the subject site.*
*(*Source Google Earth Pro – accessed 30. October 2010*).*

3.3 (j) Tenure of the action area (eg freehold, leasehold)

Tenure of the proposed action area is “freehold”.

3.3 (k) Existing land/marine uses of area

The existing land use is rural consisting of remnant native vegetation, regrowth forest, cleared areas and rural residence.

3.3 (l) Any proposed land/marine uses of area

Residential subdivision and public foreshore reserve

4 Measures to avoid or reduce impacts

With respect to matters of National Environmental Significance the following measures are to be implemented to minimise the potential impacts. The measures specifically address threatening processes, specific impacts identified in the Flora and Fauna Assessment and procedural measures to maximise the retention and restoration of foraging, breeding and roosting habitat in general.

Threatening processes

"Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands"

- The proposed subdivision is to include a Total Quality and Quantity stormwater management system that results in a 'maintain or improvement' in the quality and quantity of runoff from the site.

"Clearing of native vegetation" is a key threatening process under the *TSC Act* and as such the proposal is of a class of development recognised as a threatening process.

- The clearing of native vegetation is to be offset in accordance with the requirements of the Native Vegetation Act 2000 in the form of a protection and restoration offsets. A protection offset of 32 ha has been secured by the proponents that provide a like for like conservation outcome.

"Human-caused Climate Change"

- The proposed subdivision is to demonstrate that the risks of climate change including sea level rise, temperature change, increased bushfire risk and the need for wildlife movement corridors has been provided.

"Infection of native plants by *Phytophthora cinnamomi"*

- *Phytophthora cinnamomi control protocols are to be implemented as part of the site works to avoid the translocation of infected soils and materials into existing vegetated or restored areas.*

"Invasion of native plant communities by *Chrysanthemoides monilifera*"

- A target weed control and bush regeneration program is to be implemented within the site to avoid the spread of Bitou Bush from or into adjoining properties and reserves.

"Invasion of native plant communities by exotic perennial grasses"

- A target weed control and bush regeneration program is to be implemented within the site to avoid the spread of exotic grass from or into adjoining properties and reserves. The use of sediment fencing on the boundary of protected vegetation areas as well as competitive planting of native canopy species is effective strategies to mitigate the potential of invading exotic grasses.

"Invasion, establishment and spread of *Lantana camara*"

- A target weed control and bush regeneration program is to be implemented within the site to avoid the spread of Lantana from or into adjoining properties and reserves.

"Loss of Hollow-bearing Trees"

- Artificial nest boxes are to be installed in retained trees of adjoining protected vegetation areas in suitable locations and utilising a wide range in size of hollows.

"Predation by feral cat (*Felis catus*)"

- Domestic pets in particular cats are to be controlled and excluded from protected habitat areas.

"Removal of dead wood and dead trees"

- All dead would in the form of on-ground logs, standing dead trees and trunks are to be retained and relocated into suitable adjoining protected areas or within large lots.

- An assessment of hollow-bearing tree locations and available size of hollows.

Threatened & Migratory Species

- Survey during suitable conditions in the winter period is recommended to target the Wallum Froglet & Rufous fantail so that core habitat areas can be identified and protected during breeding seasons.

- Any hollow that is required to be removed should be replaced as a nest box at a ratio of 2:1 within retained trees or adjoining bushland areas within the subject site.

- The felling of all hollow-bearing trees is to be conducted under the supervision of a fauna ecologist. Hollows of high quality or with fauna recorded residing within should be sectionally dismantled and all hollows should be inspected for occupation, activity and potential for reuse. Re-used hollows or those with likely occupation are to be relocated to natural areas within close proximity to the site.

- Loss of foraging habitat for threatened species, specifically the loss of autumn-summer flowering stands of *Melaleuca quinquenervia* (Broad-leaved Tea Tree) and the winter flowering stands of *Eucalyptus robusta* (Swamp Mahogany) is to be minimised. The subdivision plan (Figure 2) shows the location of some of the larger trees on the subject site. Almost all of the trees shown in the eastern portion are Swamp Mahoganies. These are located on larger sized lots which increase their potential for being retained post development. Foraging tree and shrub species are to be actively retained and replanted throughout the landscape to maximise post development foraging resources.

- A vegetation management plan is to be written to manage protected vegetation areas within the landscape.

Endangered Ecological Communities

- Loss of Swamp Sclerophyll Forest vegetation is to be minimised through selective retention of remnant vegetation throughout the landscape particularly within larger lots.
- Removal/modification of 7.1ha of isolated habitats providing maturing native regrowth vegetation is to be offset in accordance with the NSW *Guidelines for Biodiversity Certification of Environmental Planning Instruments*. A like for like vegetation offset of 32 ha has been secured in accordance with the CMA recommendations.

Vegetation Offsets

Whilst biodiversity offsets are not considered under the EPBC Act 1999 as a mitigation measure prior to the determining the significance of an impact on a matter of national Environmental Significance, the secured offsets are summarised below are in accordance with the requirements of the DECCW *Guidelines for Biodiversity Certification of Environmental Planning Instruments*. In addition, the secured biodiversity offset has been accepted by NSW DECCW.

The offset area Lot 47 DP753207, Darawank is intended to be transferred directly to DECCW ownership and protected in perpetuity via a Conservation Agreement as a condition of consent.

An offsetting arrangement was proposed for this site after discussions with the *Catchment Management Authority*, *Greater Taree Council*, the proponent and the *Department of Conservation Climate Change and Water*. The secured offset has been accepted by DECCW and the CMA to enable the removal of the Swamp Sclerophyll Forest on Coastal Floodplain vegetation and associated habitat

The CMA has undertaken an assessment of the site, running through their *Threatened Species Tool* which came to the conclusion that some 27.27ha of land would be required to offset the loss of vegetation for development within the subject site.

Confirmed Offsetting Arrangements

The proponent has purchased 32.01ha of land at Darawank, approximately 12km to the south south-west of the subject site which contains a small amount of Swamp Oak Floodplain Forest, and at least 30ha of Swamp Sclerophyll Forest on Coastal Floodplains.

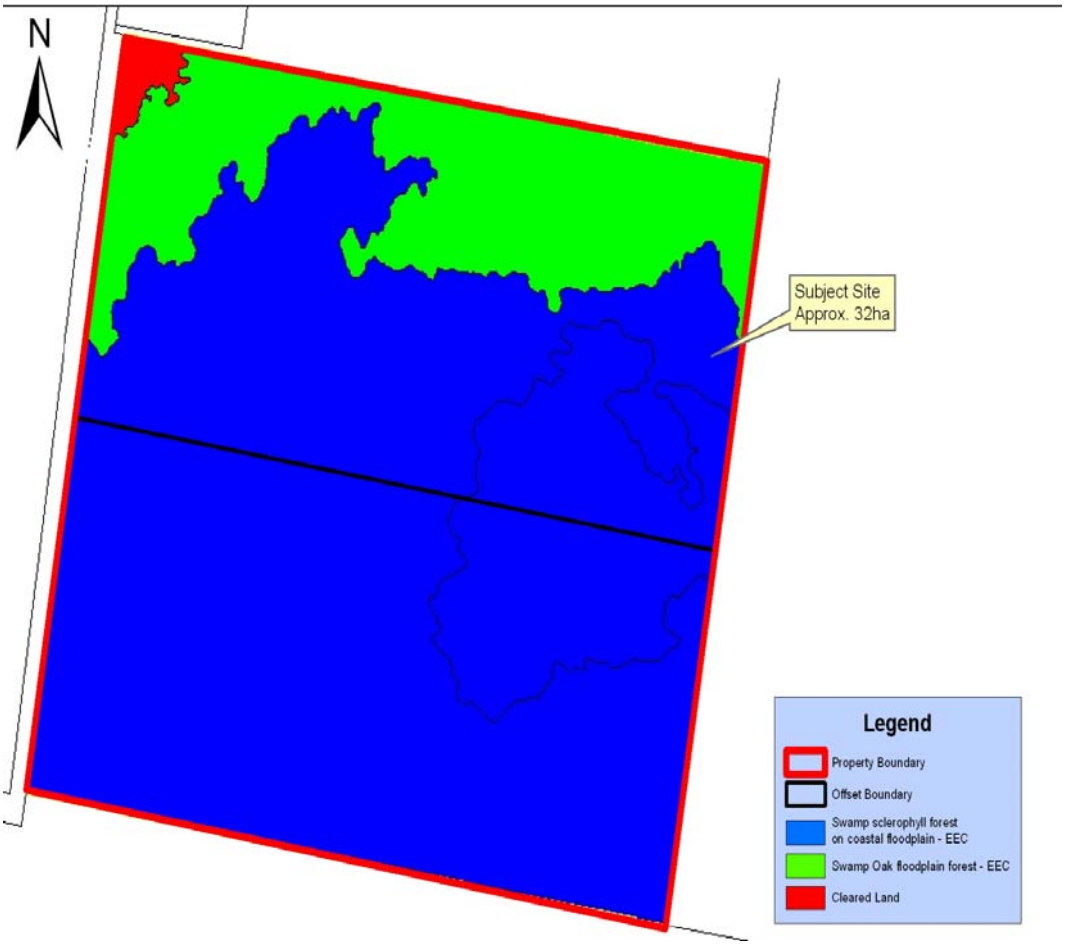


Figure 6 - *Vegetation Communities of the Offset Site at Darawank*
(Source: Flora and Fauna Assessment Report – Travers bushfire & ecology2010)

The offset ratio of vegetation being removed to that being conserved is approximately 4.5 to 1.

The proposed offset area of 32ha satisfies the Catchment Management Authority correspondence provided for in Appendix 1 of the Flora and Fauna Assessment (*Travers bushfire & ecology* 2010) which stipulated that that 27.27ha was required to offset the loss of 7.1 ha of Swamp Sclerophyll Forest vegetation.

5 CONCLUSION ON THE LIKELIHOOD OF SIGNIFICANT IMPACTS

Identify whether or not you believe the action is a controlled action (i.e. whether you think that significant impacts on the matters protected under Part 3 of the EPBC Act are likely) and the reasons why.

5.1 Do you THINK your proposed action is a controlled action?

YES	See reasons stated below

5.2 Proposed action IS NOT a controlled action.

5.3 Proposed action IS a controlled action

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
	Listed threatened species and communities (sections 18 and 18A)
Yes	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

Specify the key reasons why you think the proposed action is likely to have a significant adverse impact on the matters identified above.

The proposal impacts on an area of potential breeding habitat of a migratory species - Rufous fantail within the site. The proposal does not provide sufficient protection to conserve the nesting habitat, supporting foraging area and is likely to force the species to find alternative breeding locations in the next breeding season.

Travers bushfire & ecology considers that the migratory species Rufous Fantail (*Rhipidura rufifrons*) may be significantly affected by the proposed action. This is given that the subject site may be defined as 'important habitat' for the species as nesting habitat is of importance at a particular life-cycle stage.

Further target survey may need to be undertaken to verify the ongoing use of vegetation onsite as a breeding area, to establish the location of potential nest sites and establish the importance of the site to ongoing breeding of Rufous Fantail. The proposed action may be a controlled action to firmly establish the breeding habitat value of the site to the Rufous Fantail.

6 ENVIRONMENTAL HISTORY OF THE RESPONSIBLE PARTY

NOTE: If a decision is made that a proposal needs approval under the EPBC Act, the Environment Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach.

		Yes	No
6.1	***Does the party taking the action have a satisfactory record of responsible environmental management?*** ***Provide details***	YES	
6.2	***Has the party taking the action ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?*** ***If yes, provide details***	NO	
6.3	***If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?*** ***If yes, provide details of environmental policy and planning framework*** The proponent is required to comply with the statutory framework of the NSW Environmental Planning and Assessment Act (NSW) and the Threatened Species Conservation Act 1995 (NSW), Native Vegetation Act (NSW) 2003 and Regulations (NSW) 2005, council policies and the Greater Taree Local Environmental Plan (GTLEP 1995). Conditions of consent will be imposed as appropriate.	YES	
6.4	***Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?*** ***Provide name of proposal and EPBC reference number (if known)***	NO	

7 INFORMATION SOURCES AND ATTACHMENTS

(For the information provided above)

7.1 References

- Flora and Fauna Assessment Report – *Travers bushfire & ecology 2010*
- Bushfire Protection Assessment - *Travers bushfire & ecology 2010*

7.2 Reliability and date of information

The information supplied was correct up until the date of issue of the attached reports.

7.3 Attachments

Indicate the documents you have attached. All attachments must be less than two megabytes (2mb) so they can be published on the Department's website. Attachments larger than two megabytes (2mb) may delay the processing of your referral.

		attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	**Inserted into the referral and the attached reports** **Figure 1** – Flora and Fauna Survey Results **Figure 2** – Proposed Development & Ecological Constraints **Schedule 1 –** Bushfire Protection Measures
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	**Inserted into the referral and the attached reports**
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.3)		No approvals issued to date
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.4)	✓	CMA Assessment DECCW Correspondence - see attached
	copies of any flora and fauna investigations and surveys (section 3)	✓	Flora and Fauna Assessment Report – *Travers bushfire & ecology 2010* - see attached
		✓	Submission to NSW DECCW on 'principles of offsetting' - see attached

technical reports relevant to the assessment of impacts on protected matters and that support the arguments and conclusions in the referral (section 3 and 4)	✓	Bushfire Protection Assessment - *Travers bushfire & ecology 2010* - see attached
report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		Letters from CMA and DECCW.

8 CONTACTS, SIGNATURES AND DECLARATIONS

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action (which can include a person acting on their behalf); or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action[1].

Project title: **Residential Subdivision - Lot 6 DP 244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach**

8.1 *Person proposing to take action*

This is the individual, government agency or company that will be principally responsible for, or who will carry out, the proposed action.

If the proposed action will be taken under a contract or other arrangement, this is:

- the person for whose benefit the action will be taken; or
- the person who procured the contract or other arrangement and who will have principal control and responsibility for the taking of the proposed action.

If the proposed action requires a permit under the Great Barrier Reef Marine Park Act[2], this is the person requiring the grant of a GBRMP permission.

The Minister may also request relevant additional information from this person.

If further assessment and approval for the action is required, any approval which may be granted will be issued to the person proposing to take the action. This person will be responsible for complying with any conditions attached to the approval.

If the Minister decides that further assessment and approval is required, the Minister must designate a person as a proponent of the action. The proponent is responsible for meeting the requirements of the EPBC Act during the assessment process. The proponent will generally be the person proposing to take the action[3].

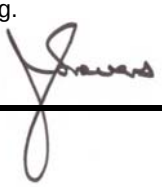
Name	
Title	
Organisation	Machiko Pty Ltd
ACN / ABN (if applicable)	
Postal address	
Telephone	
Email	
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be the proponent for this action.
Signature	Date

[1] *If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

[2] *If your referred action, or a component of it, is to be taken in the Great Barrier Reef Marine Park the Minister is required to provide a copy of your referral to the Great Barrier Reef Marine Park Authority (GBRMPA) (see section 73A,* EPBC Act*). For information about how the GBRMPA may use your information, see* http://www.gbrmpa.gov.au/privacy/privacy_notice_for_permits.

[3] *If a person other than the person proposing to take action is to be nominated as the proponent, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

8.2 *Person preparing the referral information* ***(if different from 8.1)***

Name & Title	John Travers - Director & Chief Ecologist Michael Sheather-Reid - Senior Ecologist
Organisation	Travers bushfire & ecology
Postal address	PO Box 7138 Kariong, NSW, 2350
Telephone	02 43405331
Email	info@traversecology.com.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading.
Signature	 Date 9.4.2010

APPENDIX 4

EPBC RESPONSE

Australian Government

Department of the Environment, Water, Heritage and the Arts

Notification of REFERRAL DECISION – not controlled action

Residential Subdivision of Lot 6 and Lot 9, Diamond Beach Road, Diamond Beach, NSW - EPBC No: 2010/5557

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person named in the referral	Machiko Pty Ltd ACN 068 588 269
proposed action	The proposed action involves the subdivision and development of lot 6 DP 244030 and lot 9 DP 250425, Diamond Beach Road, Diamond Beach, NSW, into approximately 89 residential lots including roads and services and a public reserve, as described in the referral documentation received on 2 July 2010.

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	Fiona Beynon Acting Assistant Secretary Environment Assessment Branch
signature	Fiona Beynon
date of decision	3 / 8 / 2010

APPENDIX 5

COFFEE GEOTECHNICS (2008)

Lot 6 DP244030 & Lot 9 DP250425 Diamond Beach Road, Diamond Beach

Machiko Pty Ltd

Environmental Assessment and Land Capability Study

GEOTTUN01754AA-AD

30 November 2008

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
1/4 Douglas Avenue, TUNCURRY NSW 2428 Australia

30 November 2008

Machiko Pty Ltd
C/- Orogen Pty Ltd
PO Box 280
TUNCURRY NSW 2428

Attention: Tony Fish

Dear Tony,

RE: LOT 6 DP244030 & LOT 9 DP250425 DIAMOND BEACH ROAD, DIAMOND BEACH

PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT AND LAND CAPABILTY STUDY

Coffey Geotechnics Pty Ltd (Coffey) is pleased to provide our Preliminary Environmental Site Assessment (PESA) and Land Capability Study (LCS) report for the above site.

We draw your attention to the enclosed sheet entitled *'Important Information about your Environmental Report'*, which should be read in conjunction with this report.

If you have any questions regarding this matter, please do not hesitate to contact Tim Morris or the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd

Steve Morton

Principal

CONTENTS

CONTENTS

CONTENTS

1 INTRODUCTION

1.1 General

This report presents the results of a Stage 1 Preliminary Environmental Site Assessment (PESA) carried out by Coffey Geotechnics Pty Ltd (Coffey) for Orogen Pty Ltd at Lot 6 DP244030 and Lot 9 DP250425 Diamond Beach Road, Diamond Beach, as shown in Figure 1.

The site is irregular in shape and is bound to the west by Diamond Beach Road, residential properties of the north, Hallidays Point Primary School to the south and a caravan park and the Pacific Ocean to the east. The site occupies an approximate area of 10.5 hectares and is Zone 2(a1), Residential.

The purpose of the investigations was to alert the parties involved in the project to the environmental issues at this site and provide data in a format that will assess capability / suitability of the land for urban uses.

1.2 Objectives and Scope of Work

The objectives of the work were to provide an assessment of the following:

- Potentially contaminating activities that are currently being performed on the site and that may have been performed on the site in the past;
- Preliminary assessment of site contamination;
- Need for further investigations.
- Suitability for future subdivision usage with regard to potential human health and environmental impacts of soil contamination.
- Risks associated with slope instability;
- Erosion characteristics and susceptibility to erosion;
- Presence of Acid sulphate soils (ASS);
- General foundation conditions;
- Preliminary Site Classification as per AS 2870;
- Excavatability and presence of rock;
- General pavement subgrade and road construction conditions.
- Drainage and water table depth;

The Preliminary Environmental Site Assessment meets the requirements of a Stage 1 Preliminary Environmental Site Assessment (PESA) as detailed in the NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites*.

The work was carried out in accordance with the following guidelines:

- NSW EPA Guidelines for Consultants Reporting on Contaminated Sites, 1997;
- NSW EPA Guidelines for the NSW Site Auditor Scheme, 1998;
- NEPM Guideline on Investigation levels for Soil & Groundwater, December, 1999;
- NSW EPA Guidelines for Assessing and Managing Service Station Sites, 1994; and

- NSW EPA Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes.

2 SITE IDENTIFICATION

2.1 Location and Setting

The site is located to the east of Diamond Beach Road, south of its intersection with Edgewater Drive. At the time of the field work it was densely vegetated with paper bark trees over three quarters of the site and an abandoned single storey weather board house in poor condition was present in the cleared area in the west of the site. The site was accessed from Diamond Beach Road, on the western frontage of the site. We understand that approximately 85 residential lots with associated access roads are proposed for the site. The site has a total area of approximate of 11.1ha.

The site is located in a region of gently to moderately undulating topography, situated on the upper convex slopes to mid and lower concave slopes of an east facing hill that breaks in the north east of the site to a flat coastal sand plain, draining to the east. Over the majority of the site the land surface has an overall slope of 15^{o} from west to east with elevations ranging from 27m AHD at the western boundary to 5m AHD in the centre of an intermittent drainage line before gradually rising up towards sand dunes present on the eastern boundary of the site that have a maximum elevation of 9m AHD.

The western part of the site is used for grazing horses. To the east, the slopes on the lower half of the site are densely vegetated which restricted access at the time of the investigation.

Surface drainage appears to be predominantly by way of overland flow following the natural contours of the land towards the intermittent drainage line that flows north. Infiltration would occur in the east of the site where surface sands are present. An earth embankment dam was present mid slope on the property, surrounded by trees and was full at the time of the investigation.

Trafficability at the time of the investigation was only possible by tracked excavator due to soft ground conditions in the low lying area of the site and the stands of thick vegetation.

2.2 Current Surrounding Land Use

Surrounding land uses include:

- Hallidays Point Primary School on the southern boundary of the property;
- An existing caravan park to the east and south east of the site;
- Diamond Beach Road on the western boundary;
- Rural residential subdivisions along Edgewater Drive to the north and;
- Diamond Beach bounds the east of the site.

2.3 Local Geology

The site is underlain by weathered siltstone and sandstone covered by residual clayey soils on the elevated slope in the west of the site with shallow colluvial/alluvial clays in the depression in the centre of the site, with aeolian sands to the east of the depression. An approximate boundary between these terrain units is delineated on Figure 1.

2.4 Local Hydrogeology

A groundwater bore search indicated that no licensed bore is located on the site, or near to the site.

Regional groundwater flow in the vicinity of the site would be expected to flow in a similar direction to the slope of the hills towards the east.

One small farm dam is located at the approximate centre of the site, close to the bottom of the east facing slope and appears to be recharged by the collection of water from overland flow.

3 POTENTIAL FOR SITE CONTAMINATION

3.1 Scope

The site history study undertaken by Coffey included:

- A site visit by a Coffey Principal Engineering Geologist and Senior Technical Officer;
- A review of previous site ownership (Title Search);
- A review of historical aerial photography over the past 30 years
- A review of EPA notices under the Contaminated Land Management Act (1997);
- A review of published information related to soils geology, hydrogeology and also a groundwater bore search of the site.

3.2 Site Visit

A Coffey Principal Engineering Geologist visited the site on 28 August 2008. Observations made during the site visits are summarised below. The main features of the site were as follows:

- A former dwelling near the western boundary of the site.
- A sewer main crosses the eastern half of the site, in a north-south direction;
- Isolated piles of dumped rubbish, bulky household waste, minor building rubble and former farm equipment were observed in isolated locations on the site.

3.3 Titles Search

A list of past registered proprietors and lessors of the site was obtained from the Land Titles Office. The current title details and cadastral plan are included in Appendix A.

The title history search for Lot 6 DP 244030 revealed the following:

- Between 1910 and 1948 the property was Crown Land held as Conditional Purchase Lease before passing onto the Rural Bank of New South Wales from 1948 to 1951.
- Between 1951 to 1971 the property was owned by various farmers.
- From 1971 to 2004 the property has had three groups of owners.
- In 2004 the property was purchased by its current owner Machiko Pty Ltd.

3.4 Aerial Photograph Review

Aerial Photographs of the site were purchased from the Department of Land and Water Conservation and reviewed by a Coffey Geologist. The results of the assessment are summarised in Table 1.

TABLE 1 – AERIAL PHOTOGRAPH REVIEW

Year	Site	Surrounding Land
1952	Cottage visible with densely wooded area to north, east and south of site.	Road alignment separates cottage from larger grouping of buildings to the west which appear to be associated with surrounding farm land
1963	As above.	Land appears cleared in future caravan park area to east of site and area to south of site, behind future school site has been cleared and subdivision road alignment is proceeding.
1980	As above.	Caravan park appears to be under construction and subdivision has approximately twenty houses constructed along road alignment. School site appears to have structure on it.
1991	Cottage still visible with little disturbance to trees on site. Sheds have been erected to east of cottage.	Caravan park clearly developed and subdivision increasing in size. School site only has one structure on it in photo. Area to the north of the site is showing signs development, possibly resort. Building directly to west of site are removed and semi rural development of western area appears to be taking place.
2003	As above.	Caravan park has increased in size and subdivision has also increased in size. School site has been developed and now has large school building visible. Area to west of site has increased development size with more complex infrastructure and increased density of housing. Road alignment for subdivision to north of site appears in photo.
2006	As above.	Caravan park has increased in size and subdivision has also increased in size. School site remains developed. Area to west of site continues to grow with increased development size and more complex infrastructure. Subdivision to north of site has been developed with six dwelling appearing in the photo.

3.5 NSW EPA Records

A check with the NSW EPA website (www.environment.nsw.gov.au) revealed that no notices have been issued on the site under the Contaminated Land Management Act (1997).

3.6 Potential Areas and Chemicals of Concern

Based on the site walkover and the site history assessment, the main visible potential contamination sources on the Site are outlined in Table 2 below.

TABLE 2 – SUMMARY OF AREAS OF CONCERN AND CHEMICALS OF CONCERN

AREA OF CONCERN	DESCRIPTION OF POTENTIALLY CONTAMINATING ACTIVITY	CoCs*	LIKELIHOOD OF CONTAMINATION (BASED ON SITE HISTORY STUDY ONLY)**	COMMENTS
1 Residence	Minor storage of	Asbestos	High	Minor fuels oils or pesticides
2. Paddocks	Use of agricultural chemicals for pasture improvement	Herbicides	Low	

NOTE:

**CoC - Chemicals of Concern*

*** It is important to note that this is not an assessment of the financial risk associated with the AEC in the event contamination is detected, but a qualitative assessment of the potential for contamination being detected at the potential AEC based on the site history study.*
Heavy Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc
BTEX - Benzene, Toluene, Ethylbenzene and Xylene, TPH - Total Petroleum Hydrocarbons
PAH – Polycyclic Aromatic Hydrocarbons
OC/OPP – Organochlorine and Organophosphorus Pesticides

3.7 Conclusions from Environmental Site Assessment

Based on the site walkover and the site history assessment, it is considered that the majority of the site was used in the past for general grazing, and there has not been significant change to the site since 1965. It is considered unlikely, based on the available information, that the site would contain contamination likely to impact on potential future residential usage.

There are some areas of environmental concern as outlined in Table 2, with the main areas of concern being due to minor storage and use of farm chemicals near the residence and possible spraying of pesticides and herbicides around the site.

In these areas there is a potential for localised soil contamination exceeding the residential guidelines (NEHF F) from the NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme, although such contamination would be considered highly unlikely given the site conditions and usage observed.

It is further recommended that a hazardous building survey is carried out prior to any proposed building demolition to assess the building materials. Should asbestos be present then a suitably qualified demolition contractor, experienced in asbestos removal and disposal, should be engaged to carry out the work.

4 FIELD INVESTIGATIONS

Investigation of subsurface conditions involved the following:

- Drilling three boreholes using a 4WD mounted drilling rig. Temporary standpipe piezometers were installed in each of the boreholes to allow monitoring of groundwater levels and testing of in situ permeability;
- Ten test pits excavated using a tracked mini-excavator. These test pits were sampled and logged by a Senior Geotechnician.

Engineering logs of the boreholes and test pits are presented in Appendix B together with explanation sheets defining the term and symbols used in their preparation. The locations of the investigations are shown on Figure 1. They were located by measuring relative to features shown on the site plan provided.

5 SITE CONDITIONS

5.1 Geotechnical Terrain Units

The proposed development site has been divided into three geotechnical terrain units based on the subsurface investigation and likely surface and subsurface conditions. The classification into geotechnical units is based on the extent that conditions will impact on potential development. The geotechnical units are described below and delineated over the site in Figure 1.

- Terrain Unit A – Well structured clays underlain by slightly weathered silty sandstone are located on the mid to upper slopes and covers the majority of the site.
- Terrain Unit B – Alluvial plain, with some low lying areas in the east of the site.
- Terrain Unit C – Aeolian Sand dunes.

5.1.1 Terrain A

Is situated on the moderately undulating ridge and upper slopes along the western boundary down to the mid and lower slopes, with surface slopes of between 10° and 15°, and elevations of between 5m and 26m.

Investigations revealed a profile of approximately 0.3m of hard silty topsoil, overlying well structured hard residual clays to approximate depths of 2.5m on the lower slope, which decrease in depth up slope to depths of approximately 0.8m in the west of the site, overlying extremely weathered silty sandstone. Surface soils appear well structured and drained. Minor erosion was noticed in areas of poor grass cover.

Terrain A is vegetated mostly by mature trees with improved pasture grass. Trafficability of this terrain unit was poor due to thick vegetation.

5.1.2 Terrain B

Terrain B is situated on the alluvial plains to the east of the site below the 5.5m RL contour. Investigations revealed colluvial clay soils overlying alluvial clays with lenses of aeolian sands that have blown over from adjacent sand dunes to the east. Groundwater inflow was observed at the interface of the clay and sand horizons. Vegetation present comprised swamp forest species, including paper barks which are indicative of poor drainage. Trafficability of this terrain was poor or non-trafficable due to soft ground conditions and thick vegetation.

5.1.3 Terrain C

Terrain C consists of aeolian sand dunes and is situated in the east of the site as interpreted from the available aerial photographs. Site access was restricted by thick vegetation.

5.2 Subsurface Conditions

A summary of the soil types encountered over the site is presented in Tables 3 and 4.

TABLE 3 - SUMMARY OF SOIL TYPES ENCOUNTERED

GEOLOGICAL UNIT	SOIL/ROCK TYPE	MATERIAL DESCRIPTION
UNIT 1	TOPSOIL	SILT and CLAY , low to medium plasticity, brown/grey, some organics (rootlets), trace fine grained sand, hard consistency
UNIT 2A	COLLUVIAL	CLAY, medium to high plasticity, pale brown/brown, trace organics (rootlets) and fine grained sub-angular gravel, very stiff consistency
UNIT 2B	COLLUVIAL	CLAY, medium to high plasticity, pale grey with red and pale brown mottling ,some fine grained sand, trace organics (rootlets) and low plasticity silt, very stiff consistency
UNIT 3A	ALLUVIAL	Sandy CLAY, low to medium plasticity, grey, trace low plasticity silt and organics (rootlets), very stiff consistency
UNIT 3B	ALLUVIAL	Clayey SAND, fine to medium grained, pale brown/yellow, some low plasticity silt, medium dense
UNIT 3C	ALLUVIAL	CLAY, medium to high plasticity, grey/blue, some fine grained sand, very stiff consistency
UNIT 3D	ALLUVIAL	SAND, fine to medium grained, dark brown, trace of organics (roots) and medium shell grit
UNIT 4A	RESIDUAL	CLAY, high plasticity, orange/red with grey mottling, some fine grained sub-rounded gravel, trace organics (rootlets) and low plasticity silt, hard consistency
UNIT 4B	RESIDUAL	CLAY, high plasticity, pale grey, trace fine grained sub angular gravel and low plasticity silt, very stiff consistency
UNIT 5	HIGHLY WEATHERED SILTY SANDSTONE	Silty SANDSTONE, medium grained, pale grey with orange/brown and green mottling, 3mm low plasticity clay and silt unfiled seams, bedding plane 65^{o},low to very low strength

TABLE 4 – SOIL TYPES AT TEST PIT LOCATIONS (Depths in Metres)

LOCATION	UNIT 1A TOPSOIL	UNIT 2A COLLUVIAL CLAY	UNIT 2B COLLUVIAL CLAY	UNIT 3A ALLUVIAL SANDY CLAY	UNIT 3B ALLUVIAL CLAYEY SAND	UNIT 3C ALLUVIAL CLAY	UNIT 3D ALLUVIAL SAND	UNIT 4A RESIDUAL CLAY	UNIT 4B RESIDUAL CLAY	UNIT 5 HIGHLY WEATHERED SANDSTONE	GROUND WATER
Terrain A											
TP 4	0.0 – 0.4	0.4 – 0.72	-	-	-	-	-	0.72 – 1.4	-	1.4 – 2.1	-
TP 6	0.0 –0.25	-	-	-	-	-	-	0.25 – 1.85	-	-	-
TP 7	0.0 – 0.4	0.4 – 0.63	-	-	-	-	-	0.63 - 1.48	-	1.48 – 1.79	-
TP 8	0.0 – 0.3	-	-	-	-	-	-	0.3 – 0.7	-	0.7 – 0.9	-
TP9	0.0 –0.18	0.18 – 0.6	-	-	-	-	-	-	-	0.6 – 0.9	-
TP10	0.0 -0.15	0.15 – 0.37	-	-	-	-	-	-	-	0.37 – 0.64	-
TP11	0.0 – 0.2	-	-	-	-	-	-	0.2 – 0.85	0.85 – 1.0	1.0 – 1.15	-
Terrain B											
BH 1	-	-	-	0.0 – 1.1	1.1 – 2.5	2.5 – 3.0		-	-	-	1.45
BH 2	0.0 – 0.3	-	-	0.3 – 0.5	-	0.5 – 1.5	1.5 – 2.5	-	-	-	1.50
BH 3	0 - 0.15	-	-	-	-	0.15 – 0.4	-	0.4 – 0.9	0.9 – 5.0	-	-
TP5	0.0 –0.29	0.29 – 0.58	0.58 – 1.5	1.5 – 2.1							2.05
TP12	0.0- 0.29	0.29 – 0.9	-	0.9 – 1.2	1.2 – 1.8	-	-	-	-	-	1.2
TP13	0.0 -0.38	0.38 – 0.74	-	0.74 –1.55	1.55 – 1.8	-	1.8 – 2.1	-	-	-	1.8

5.1 Water Levels

Groundwater was encountered at the depths summarised in Table 4. The groundwater was typically encountered within the interbedded alluvial sands and clays of Terrain B at depths of between 1m and 2m below ground surface. No groundwater was observed during the investigation in the higher westerly part of the site (Terrain A).

Depth to the water table will vary with rainfall and other similar factors, the influence of which may not have been apparent at the time of field work. The field investigation was conducted following a period of wet weather.

6 LABORATORY TESTING

Samples obtained during the field investigations were returned to Coffey's NATA registered Tuncurry Laboratory or dispatched to the Scone Soil Research Laboratory for testing. The testing program comprised of:

- 4 x CBR tests;
- 4 x shrink / swell tests;
- 6 x field moisture tests;
- 4 x particle size distribution tests;
- 2 x Earthworks Suites that included particle size analysis, unified soil classification system, dispersion percentage, Emerson aggregate, volume expansion.

The results of the laboratory testing are presented in Appendix C.

7 SLOPE STABILITY

7.1 Risk assessment

This report provides an assessment of the risk of slope instability on the property and immediate surrounding area. The report also recommends some geotechnical constraints for the site development in light of the assessed risk of slope instability. The onus is on the owner, potential owner or interested party to decide whether the assessed level of risk is acceptable taking into account likely economic consequences of the risk and the recommended geotechnical constraints.

Risk assessment is a process where potential hazards are observed and / or assessed, a judgement made as to the likelihood of that event occurring, and an assessment made of what the consequences of such an event might be. The 'risk' assigned is a way of explaining the combination of likelihood and consequences in a simple form.

For land capability studies of this nature there are many unknowns in terms of what the ultimate development of the site will entail, and therefore elements at risk and subsequent consequence assessments are not feasible. Therefore, to assess the potential for slope instability to impact on urban land capability, a hazard zoning study has been undertaken. This study identifies and delineates potential landslide hazards at the site, and assesses their likelihood and potential to impact on future residential development.

For the purposes of this assessment slope instability hazards have been identified from the observed site conditions using methods consistent with those formulated by the Australian Geomechanics Society and published in Australian Geomechanics (Vol. 42, No.1) “Guidelines for Landslide Susceptibility, Hazard, and Risk Zoning for Landuse Planning”. The report also recommends some geotechnical constraints for the site development in light of the assessed slope instability hazards.

7.2 Evidence of Slope Instability (at the time of investigation)

No evidence of slope instability was observed on the site at the time of the fieldwork.

7.3 Assessed Hazards

Slope stability is controlled by slope angle, material strength, subsoil profile and surface and subsurface water concentration. In the sloping areas of the site (Terrain A) large scale slope instability is not expected to occur. There is the potential for some soil creep to occur. Creep movements are imperceptibly slow movements that occur within the upper part of the soil profile on sloping sites. There is also the potential for instability in poorly managed or unretained cuts and fills in this part of the site.

No specific slope stability hazards were encountered in Terrain B.

No specific slope stability hazards are anticipated in Terrain C while development is restricted to the area west of the toe of the sand dunes, however there is the potential for instability in poorly managed or unretained cuts and fills in this part of the site.

The risk of slope instability in both terrain areas can be managed by normal good hillside construction practices. It would be normal for development to proceed on slopes of this nature.

7.4 Recommended Geotechnical Constraints for Residential Development

For Terrains A, B and C there are no particular constraints on the type of structure considered appropriate for the site from a slope stability point of view. Development should be undertaken in accordance with good hillside construction practice and sound engineering principles.

8 SOIL EROSION

8.1 Soil Erodibility / Dispersivity

Dispersible soils greatly limit water movement through the soil, resulting in poor drainage and water logging. The Emerson Aggregate Class is used as a general guide to sodicity and dispersibility of a soil; however dispersion is also influenced by factors such as soil type, exchangeable cations, salinity and sodicity. When wet, sodic soils lose their structure and disperse into very small particles that fill pore spaces and create an impermeable layer that can severely impede water movement through the soil profile. Thus, dispersible soils often result in poor drainage and waterlogging.

Emerson Aggregate Class numbers are presented in Appendix C and summarised in Table 6.

TABLE 6 - SUMMARY OF SOIL DISPERSIBILITY TESTING

TEST PIT LOCATION	SAMPLE DEPTH (m)	UNIT	CLAY %	EMERSON AGGREGATE CLASS	DISPERSIBILITY	INDICATIVE DISPERSION	INDICATIVE SODICITY
TP11	0.2 – 0.3	4A	74	6	5%	Negligible	Non-sodic
TP13	0.4 – 0.5	2A	34	3(1)	33%	Moderate	Unlilkely

TABLE 7 - SUMMARY OF PARTICLE SIZE DISTRIBUTION

Soil Type	Fraction	Material Passing Sieve Size (mm)	TP6 0.3 – 0.6 Unit 4A	TP8 0.3 – 0.7 Unit 4A	TP10 0.15 – 0.37 Unit 5	TP12 0.3 – 0.6 Unit 2A
Gravel		19.0	100	100	100	100
		13.2	100	100	99	100
		9.5	99	99	95	100
		6.7	98	98	92	99
		4.75	97	97	89	99
Sand	Coarse grained	2.36	96	95	85	99
		1.18	95	93	82	99
		0.600	94	92	81	97
Sand	Medium grained	0.425	93	91	80	94
		0.300	93	91	79	80
Sand	Fine grained	0.150	91	89	76	60
Clay / Silt	Fines	0.075	90	89	76	59

Based on the results of laboratory testing, soils in Terrain A and B are unlikely to be sodic or significantly dispersive.

8.2 Management of Erosion

Soil erosion during and after construction on the site will require careful management. Levels of erosion should be able to be maintained within normally acceptable levels by adopting good soil erosion and sedimentation control practices, including:

- Plan for soil and water management concurrently with engineering design and in advance of any earthworks;

- Minimise the area and duration of soil exposure by staged development and controlled clearing;
- Stockpile stripped soil for reuse and protect from erosion;
- Control stormwater run-off by diverting clean run-off from denuded areas, minimising slope gradient, length and run-off velocities;
- Trap soil and water pollutants using silt traps, sediment basins, perimeter banks, silt fences and nutrient traps as appropriate;
- Promote regeneration of native vegetation in gullies and on steep slopes (>10°) and in areas previously cleared;
- Quick rehabilitation of disturbed areas.

All personnel on the site involved with earthworks, land clearing or construction should be made fully aware of the issues associated with sediment and erosion control.

8.3 Management of Site Drainage

Adequate surface and stormwater drainage should be installed and maintained on the building sites. The site has low-lying areas and geotechnical Terrain Unit B is poorly drained.

Dispersible soils such as those present in Terrain Unit A greatly limit water movement through the soil, resulting in poor drainage and waterlogging. To limit water logging, and rising water table, the following principles should be considered in development of the site:

- Planting of deep rooted native trees to prevent rising of the water table in the gullies;
- Retaining or planting native vegetation where possible;
- Treating potentially sodic soils with gypsum before landscaping;
- Designing storm water detention ponds and water features to reduce infiltration;
- Minimising soils disturbance, including reduced cut and fill;
- Improving or maintaining drainage around gully regions or natural drainage paths.

Provision of site stormwater management may incorporate some subsurface infiltration. For the purposes of subsurface infiltration design in situ permeability testing was undertaken in boreholes BH1 to 3. Results are presented in Appendix D and summarised in Table 8.

Table 8. Results of in situ Permeability Testing

Location	Permeability
BH1	6×10^{-5} m/sec
BH2	1×10^{-4} m/sec
BH3	2×10^{-6} m/sec

9 ACID SULPHATE SOILS

9.1 Background Information

Acid Sulfate Soils (ASS) are soils which contain significant concentrations of pyrite which, when exposed to oxygen, in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as Potential ASS.

When the soils are exposed, the oxidation of pyrite occurs and sulphuric acids are generated, the soils are said to be actual ASS.

Pyritic soils typically form in waterlogged, saline sediments rich in iron and sulfate. Typical environments for the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL 5m AHD. They can also form as bottom sediments in coastal rivers and creeks.

Pyritic soils of concern on low lying NSW and coastal lands have mostly formed in the Holocene period (ie 10,000 years ago to present day) predominantly in the 7,000 years since the last rise in sea level. It is generally considered that pyritic soils which formed prior to the Holocene period (ie >10,000 years ago) would already have oxidised and leached during periods of low sea level which occurred during ice ages, exposing pyritic coastal sediments to oxygen.

9.2 Significance of ASS

Disturbance or poorly managed development and use of acid sulfate soils can generate significant amounts of sulfuric acid, which can lower soil and water pH to extreme levels (generally <4) and produce acid salts, resulting in high salinity.

The low pH, high salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive soil conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works.

Generation of the acid conditions often releases aluminium, iron and other naturally occurring elements from the otherwise stable soil matrices. High concentrations of some such elements, coupled with low pH and alterations to salinity can be detrimental to aquatic life. In severe cases, affected waters flowing off-site into aquatic ecosystems can have detrimental effect on aquatic ecosystems.

9.3 ASS Risk Map

Reference to the Nabiac/Hallidays Point 1:25,000 Acid Sulfate Soil Risk Map published by the DLWC indicates where the majority of the site is situated on residual soil slopes or elevated aeolian dunes, with no known occurrence of ASS. However there is a low risk of acid sulphate soils within 3m of the ground surface associated with the low lying depression in the east of the site.

9.4 ASS Sampling and Laboratory Testing

Acid Sulfate Soils (ASS) samples were obtained at varying depths in the boreholes. The samples were tightly sealed in plastic bags, placed on ice and transported to our Port Macquarie laboratory.

To assess the probability of ASS a sample was submitted for detailed analysis by the Chromium Reducible Inorganic Sulfur technique. The testing was undertaken by Southern Cross University Environmental Analysis Laboratory, a NATA accredited specialist chemical laboratory. The test results are presented in Appendix B and are summarised in Table 9.

TABLE 9 - RESULTS OF CHROMIUM REDUCIBLE SULFER ANALYSIS

SAMPLE LOCATION	SAMPLE DEPTH (m)	TEXTURE	TITRATIBLE ACTUAL ACIDITY (mole H+ /ton)	REDUCED INORGANIC SULFUR (%S_{cr})	LIME CALCULATION (kg $CaCO_3$ / m^3)
BH2	1.50 – 2.00	Coarse	22	<0.005	3

9.5 ASS Conclusions

Results of the CRS Analysis indicate that Chromium reducible Sulfur (S_{CR}) analysis results did not exceed the relevant ASSMAC Action Criteria Value, however the Titratible Actual Acidity value did exceed the relevant ASSMAC Action Criteria Value in BH2, indicating the possible presence of Actual ASS or naturally acidic soils. Naturally acidic soils are common in coastal environments on the mid-north coast of NSW, such as the coastal terrain represented by Terrain B on this site.

Initial testing indicates the site soils are not likely to be ASS. It is recommended, however, that wherever excavations are to take place in low lying Terrain B areas, some further specific ASS sampling and testing should be undertaken to determine whether an ASS Management Plan is required.

10 GEOTECHNICAL CONSTRAINTS ON DEVELOPMENT

The following geotechnical constraints are based on slope stability and soil erosion considerations. The constraints are aimed at providing broad guidelines to assist in development planning. It is envisaged that further refinement and delineation of geotechnical constraints, including pavement and foundation designs, will occur with more detailed assessment of separate areas of the site as development proceeds.

10.1 Area for Development

Areas occupied by Terrain A and Terrain C are considered suitable for development from a geotechnical viewpoint. The low lying areas within Terrain B may be suitable for development provided natural surface and subsurface drainage paths are modified and controlled appropriately.

Development of the site should be undertaken in accordance with good hillside construction practice and sound engineering principles. Development in gully areas should minimise disturbance to slopes, and general constraints and recommendations in this report would apply.

10.2 Type of Structure and Foundations

There are no particular geotechnical constraints on the type of structures considered appropriate for the site provided they are founded on footings designed and constructed in accordance with the principals of AS2870-1996, '*Residential Slabs and Footings'*. Where clays soils were present in Terrains A and B, they

were moderately to highly reactive as indicated by laboratory shrink-swell testing presented in Appendix C and summarised in Table 10.

TABLE 10 – SUMMARY OF SHRINK / SWELL (I_{ss}) INDEX TEST RESULTS

LOCATION	DEPTH (m)	UNIT	I_{ss} (%)
Terrain Unit A			
TP4	0.4 - 0.7	2A	3.6
TP7	0.65 - 1.1	4A	5.0
TP11	0.2 - 0.6	4A	3.7
Terrain Unit B			
TP12	0.3 – 0.7	2A	2.6

A site classification should be undertaken once site layout and regrade designs are known. Provided footings are designed in accordance with AS2870-1996, high level footings would be appropriate for Geotechnical Terrains A, B and C.

Site classification to AS2870-1996 “Residential Slabs and Footings” would be expected to be predominantly Class H (Highly Reactive) in Terrain A and predominantly Class M (Moderately Reactive) in Terrain B. Reuse of highly reactive residual clay from Terrain A in fill platforms may result in Class H sites. Terrain Unit C would be expected to be Class A (Non- Reactive), however density testing of the sands would be required to ensure no loose sand zones are present and investigation would also be required to ensure no underlying residual clays are present within 1.5m of surface.

10.3 Excavation

Where excavation is required, it is anticipated that all materials could be excavated by conventional dozer blade or backhoe bucket at least to the depths indicated on the attached field logs.

The near surface soils on-site particularly in Terrain B are expected to be moisture sensitive and it is also possible that water inflows or seepages may be encountered within the depth of the excavation. Therefore, if wet weather is encountered prior to or during earthworks, over-excavation and placement of a working platform of granular fill will be required to allow site trafficability. Filling might be required to bring subgrade back to design level. Dewatering may also be required, depending on the depth of excavation.

Excavation wall collapse in Terrain C, such as for service trenching, may be a problem in the aeolian sands. For shallow excavations such as trenches, dewatering may also be required and could consist of localised shallow spear points within the water table, with shoring used to support the trench.

Excavations should preferably not exceed 1.5m in depth and should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected against erosion.

10.4 Reuse of Materials

The following comments are made regarding the suitability of the site materials for reuse in filled areas:

- Where site regrade is proposed, all existing topsoil, vegetation or other potentially deleterious material should be removed to spoil or stockpiled for reuse as landscaping materials only;
- Stripping is generally expected to be required to depths of about 0.1m to 0.4m (topsoil layer), but may be significantly deeper where wet, silty soils are encountered;
- Underlying very stiff clays should be carefully stripped as necessary and stockpiled for reuse as general site fill;
- The clayey soils on-site are expected to be highly reactive (susceptible to volume changes with variation in moisture content) and will need to be placed and compacted to a minimum density ratio of 95% Standard Compaction within ±2% of OMC to minimise reactive soil movements;
- Where excavation of weathered rock is required there may be some oversize material that requires sorting prior to re-use as an engineering fill.

10.5 Filling

Filling should be undertaken in accordance with sound engineering principles as set out in AS3798.

The residual clay soils that would be derived from cuts on the site are typically useful for site regrade fill with good moisture control during placement and compaction. The topsoil and colluvial soils are generally suitable for landscaping use only.

Where site regrading is proposed, the following general course of action should be taken:

- Strip existing topsoil, root affected material and deleterious material to spoil. Following stripping, the surface should be inspected for trafficability;
- Following stripping, the exposed subgrade materials should be proof rolled to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved select material. The near surface soils onsite are expected to be moisture sensitive and therefore, if wet weather is encountered prior to or during earthworks, over excavation and placement of a working platform of granular fill may be required to assist site trafficability;
- Approved fill should be placed in layers not exceeding 300mm loose thickness and compacted to a minimum dry density ratio of 98% Standard (AS1289 5.1.1 or equivalent) beneath structures and 95% Standard as general site fill.

The expertise of the contractor, the nature of the fill material and the degree of supervision of the filling will determine the footing design required for any structures placed on the fill constructed in the manner discussed above.

Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007, '*Guidelines for Earthworks for Commercial and Residential Developments'*. If specific earthworks

requirements are required for industrial development, then earthworks specification should be designed by an experienced engineer familiar with the site conditions.

10.6 Retaining Walls

Retaining walls should be designed for surcharge loading from slopes, retaining walls, structures and other existing or future improvements in the vicinity of the wall.

Adequate subsurface and surface drainage should be provided behind all retaining walls. All retaining walls in excess of 1.5m should be designed by an experienced engineer familiar with the site conditions.

10.7 Access and Road Construction

Access and site modifications should comply with the recommendations above.

Testing for pavement design included four CBR samples, the results are presented in Appendix B and summarised below in Table 11.

TABLE 11: SUMMARY OF CALIFORNIA BEARING RATIO AND COMPACTION RESULTS

Site	Depth	Unit	Moisture Content (%)		Swell %	CBR (%)
			Field	Optimum		
Terrain Unit A						
TP4	0.4 – 0.7	4A	18.4	21.6	0.1	8
TP7	0.4 – 0.6	4A	27.5	24.5	1.1	6
TP10	0.15 – 0.37	5	28.8	25.9	1.7	3.5
Terrain Unit B						
TP12	0.3 – 0.6	2A	25.5	19.2	0.7	6

Placement of roads through Terrain Unit B is likely to require some over-excavation of wet and/or silty material, and subsequent subgrade replacement or elevation over inundated areas. Water logging of these layers, particularly after wet weather, may require use of geofabric and placement of a granular working platform prior to placement and compaction of subsequent fill or pavement layers. Surface and sub-soil drains will also be required to improve drainage.

Further geotechnical assessment is required to identify areas where specific design requirements will be needed, such as recommendations regarding provision of drainage and evaluation of subgrade conditions for pavement thickness design.

10.8 Drainage

All collected stormwater run-off should be piped into an inter-allotment drainage system utilising the existing watercourse, in a controlled manner that limits erosion. Surface and sub-soil drains will be required to improve drainage.

10.9 Sewage Disposal

Septic wastes should be connected to a reticulated disposal system.

11 DISCUSSION AND CONCLUSIONS

The site history assessment indicated that the site has been a grazing property and that there has not been significant change to the site since 1965.

Based on the site walkover and the site history assessment, it is considered that the majority of the site was used in the past for general grazing, and would not contain contamination likely to impact on potential future residential usage. There are some areas of environmental concern as outlined in Section 4, with the main areas of concern being due to storage and use of farm chemicals on site and presence of possible asbestos cement sheeting products.

In these areas there is a potential for localised soil contamination exceeding the residential guidelines (NEHF F) from the NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme. It is therefore recommended that surface soil sampling be undertaken in the vicinity of the chemical storage areas, with analysis for heavy metals, hydrocarbons, herbicides, pesticides prior to deeming the site suitable for residential land use.

It is further recommended that a hazardous building survey is carried out prior to any proposed building demolition to assess the building materials. Should asbestos be present then a suitably qualified demolition contractor, experienced in asbestos removal and disposal, should be engaged to carry out the work.

Development of the site for residential use is considered feasible from a geotechnical point of view.

The development area is assessed to have an overall low risk of slope instability and it is considered that the site is appropriate for development subject to the geotechnical constraints on development detailed herein.

Minor surface erosion was noted on site however such impacts could be reduced if development is appropriately managed. The site management procedures should be constantly reviewed to ensure that opportunities for erosion are minimised.

Further geotechnical investigations will be required at the design stage to allow pavement design and lot classifications to AS2870-1996.

12 LIMITATIONS

The findings contained within this report are the result of a site history review, site walkover and limited boreholes and test pits. To the best of our knowledge, they represent a reasonable interpretation of the

general condition of the site. Under no circumstances can it be considered that these findings represent the actual state of the site at all points.

Contactors 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.

For and on behalf of Coffey Geotechnics Pty Ltd

Steven Morton

Principal

coffey geotechnics
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.

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Important information about your **Coffey** Report

Interpretation by other design professionals

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

Data should not be separated from the report*

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

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

Geoenvironmental concerns are not at issue

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

Rely on Coffey for additional assistance

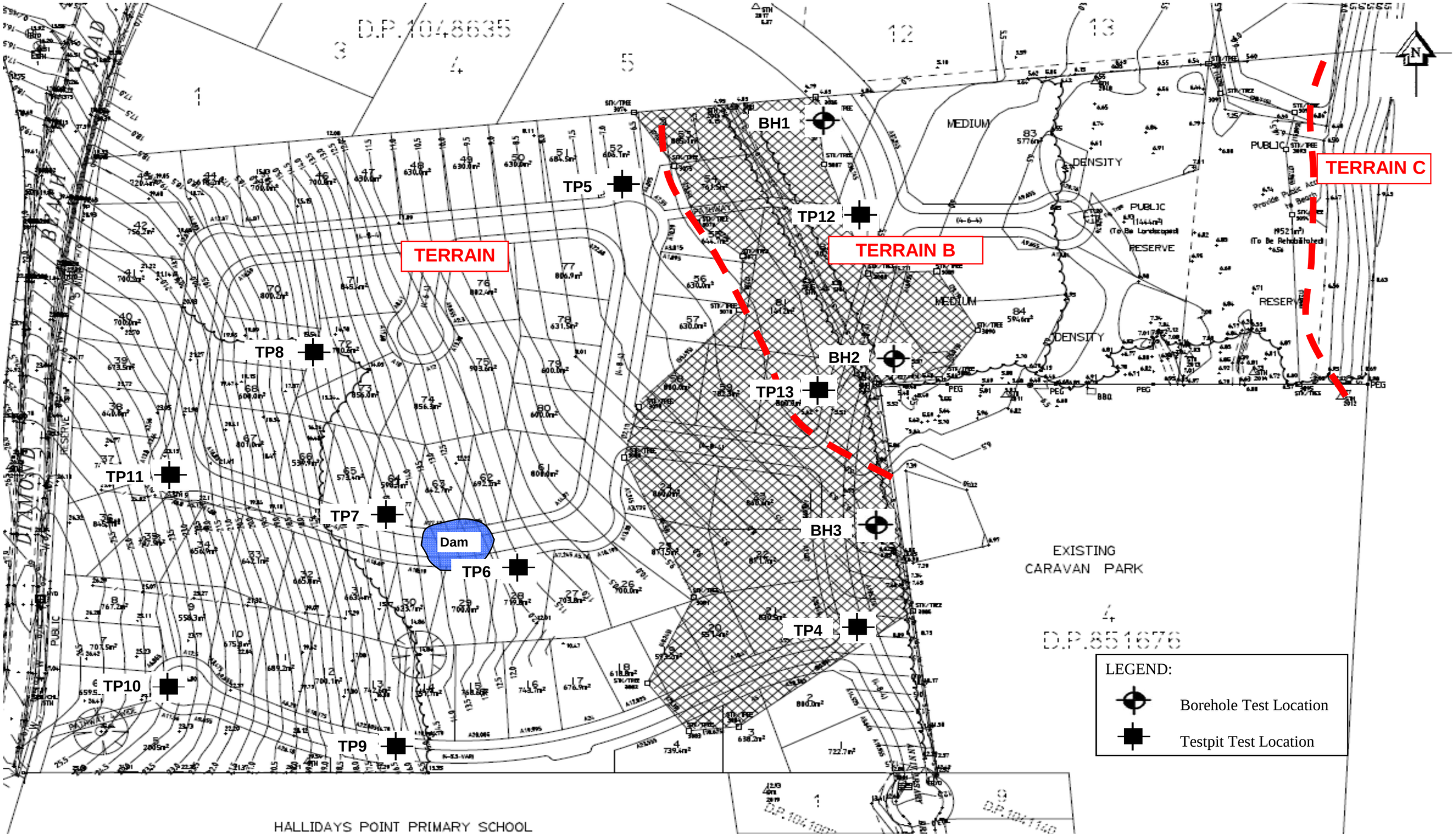
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As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

Responsibility

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

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

Figures



revision	description	drawn	approved	date
	Drawing No. DWG7420D	RD		27.07.06

Scale: 0 10 20 30 40 50 60

drawn	PE
approved	
date	22.11.08
scale	1:1000
original size	A3

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client:	Orogen
project:	Proposed Subdivision
title:	Lot 6 DP244030 and Lot 9 DP 250425 Diamond Beach Road, Diamond Beach
project no:	GEOTTUNC01754AA
figure no:	FIGURE 1

F:\GEOT\TUNC-Data\GEOT\TUNC job files\GEOTTUNC\TUNC01700-1799\TUNC01750-01799\TUNC01754AA\Report and appendices\[GEOTTUNC01754AA Figure 1.xls]A3 Landscape Figure

Appendix A

Title History Search

Information Provided Through
Advance Legal Search Pty Ltd
Ph. 0297541590 *Fax.* 0297541364

Title Search

LEAP Legal
An Approved LPI *NSW*
Information Broker

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 6/244030

SEARCH DATE	TIME	EDITION NO	DATE
24/9/2008	5:59 PM	5	19/7/2007

LAND

LOT 6 IN DEPOSITED PLAN 244030
AT RED HEAD
LOCAL GOVERNMENT AREA GREATER TAREE
PARISH OF BERYAN COUNTY OF GLOUCESTER
TITLE DIAGRAM DP244030

FIRST SCHEDULE

MACHIKO PTY LTD (T AA417658)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 LAND EXCLUDES MINERALS AND IS SUBJECT TO RESERVATIONS AND CONDITIONS IN FAVOUR OF THE CROWN - SEE CROWN GRANT(S)
2 AD282000 MORTGAGE TO NATIONAL AUSTRALIA BANK LIMITED

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

COFFEY - DIAMOND BEACH ALSP PRINTED ON 24/9/2008

ADVANCE LEGAL SEARCH PTY LIMITED

(ACN 077 067 068)
ABN 49 077 067 068

P.O. Box 149
Yagoona NSW 2199

Telephone: +612 9754 1590
Mobile: 0412 169 809
Facsimile: +612 9754 1364
Email: alsearch@optusnet.com.au

29th. September, 2008

COFFEY GEOTECHNICS
1/4 Douglas Avenue,
Tuncurry, NSW 2428

Attention: Paul Edmed

RE: **Diamond Beach Road**
Diamond Beach
PO 08336

Current Search

Folio Identifier 6/244030 (title attached)
DP 244030 (plan attached)
Dated 24th. September, 2008
Registered Proprietor:
MACHIKO PTY LTD

Title Tree
Lot 6 DP 244030

Folio Identifier 6/244030

Certificate of Title Volume 12226 Folio 36

Certificate of Title Volume 9381 Folio 60

Crown Grant Volume 5831 Folio 47

Summary of proprietor(s)
Lot 6 DP 244030

Year	Proprietor
	(Lot 6 DP 244030)
2004 to date	Machiko Pty Ltd
2000 – 2004	Ivan Jelacic Katherina Jelacic
1987 – 2000	Ivan Jelacic Kathy Jelacic
	(Lot 6DP 244030 - CT Vol.12226 36
1986 – 1987	Ivan Jelacic Kathy Jelacic
1975– 1986	Ian Gavin Platt-Hepworth, real estate agent Garry Walter Platt-Hepworth, gardener John Rutherford, developer Tralian Pty Ltd
1973 – 1975	Sparkle Estates Pty Limited
	(Lot 2 DP 500952 – CT Vol 9381 Fol 60)
1971 – 1973	Sparkle Estates Pty Limited
1963 – 1971	Esme Madge Beddows, widow John William Ormsby Martin, farmer
	(part Portion 50 Parish of Beryan County of Gloucester – Crown Grant Vol 5831 Fol 47)
1962 – 1963	Esme Madge Beddows, widow John William Ormsby Martin, farmer
1951 – 1962	Frederick Thomas Beddows, farmer
1951 – 1951	Frederick William Cummins, dairy farmer

1948 – 1951	Rural Bank of New South Wales
1910 – 1948	Crown Land held as Conditional Purchase Lease

****

Department of Lands
Reliable from the ground up

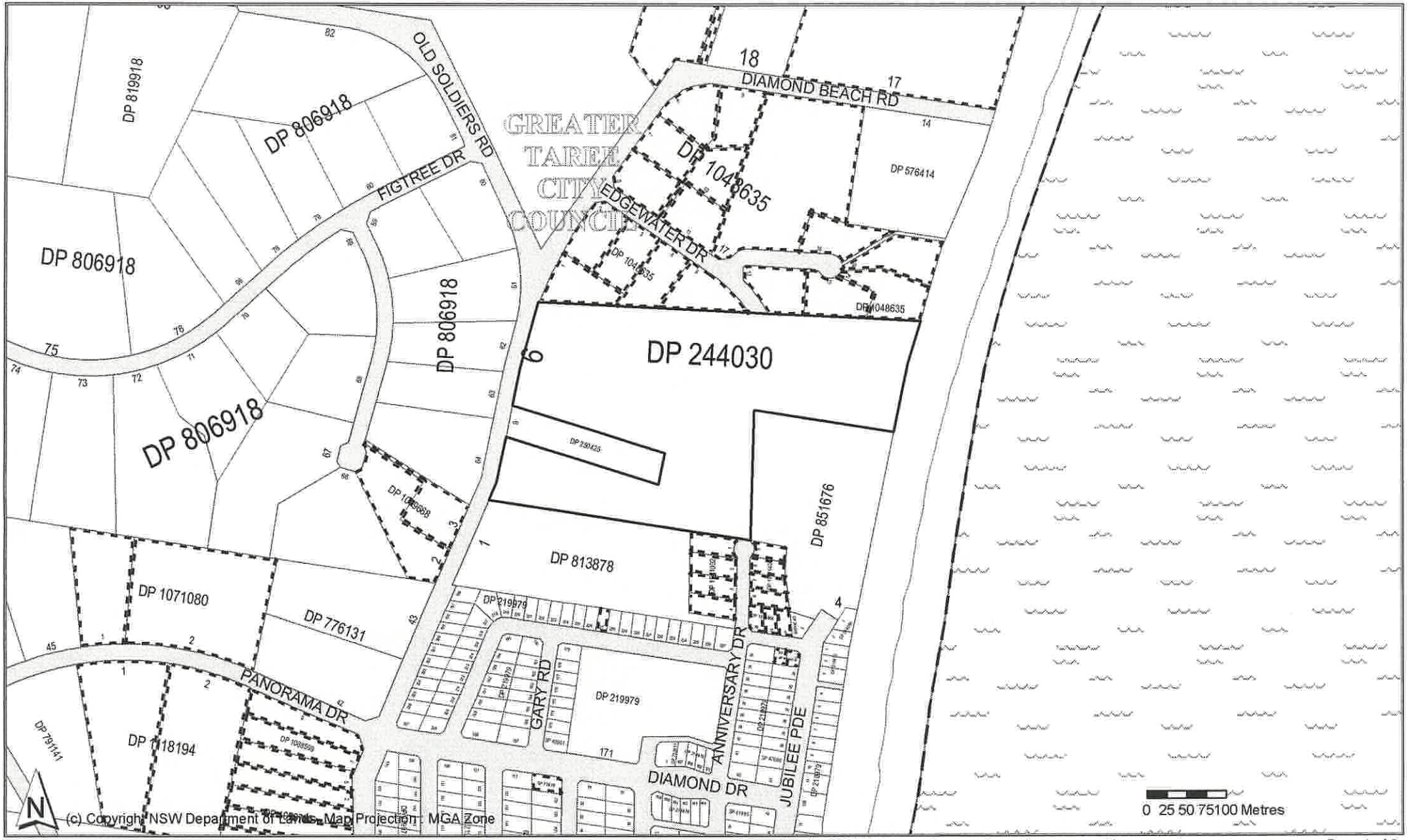
Cadastral Records Enquiry Report

Ref : 97 - DIAMOND BEACH

Requested Parcel : Lot 6 DP 244030

Identified Parcel : Lot 6 DP 244030

Locality : DIAMOND BEACH **LGA :** GREATER TAREE **Parish :** BERYAN **County :** GLOUCESTER



Report Generated 10:40:59 AM, 26 September, 2008

This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided. For all ACTIVITY PRIOR to SEPT 2002 you must refer to the RGs Charting and Reference Maps.

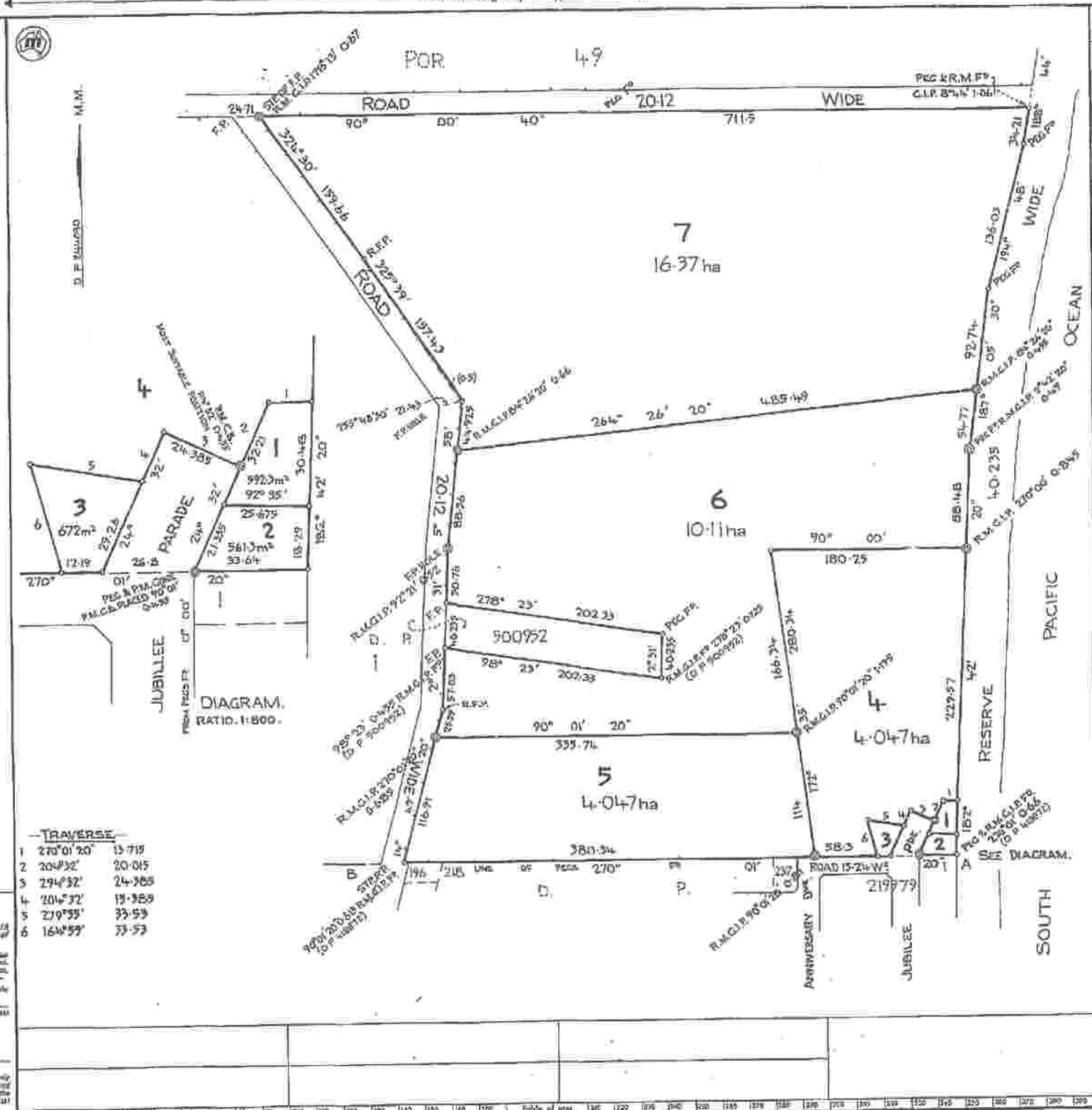
PLAN FORM 2

Plan Drawing only to appear in this space

*OFFICE USE ONLY

Signatures and seals only.

(Common Seal: SPARKE ESTATES PTY. LIMITED — Director, Director)



Council Clerk's Certificate

I hereby certify that —

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

*(b) ~~the requirements of section 343 of the Metropolitan Water, Sewerage and Drainage Act, 1924, as amended, (Hunter District Water, Sewerage, and Drainage Act, 1938, as amended)~~

have been complied with by the applicant in relation to the proposed NEW ROAD – SUBDIVISION

Resolution No. 2037

Date 23.10.72

(Signature) Council Clerk

MPO

D P 244030

Registered: RG 29·8·1973

C.A.: Nº 2057 OF 23·10·1972

Title System: TORRENS

Purpose: SUBDIVISION

Ref. Map: PARISH

Last Plan: D P 500952

PLAN OF

SUBDIVISION OF LOT 2 D. P. 500952 C.T. VOL. 9351 FOL. 60.

Reduction Ratio 1: 2500

Lengths are in metres.

Mun./Shire MANNING

Locality: RED HEAD

Parish: BERYAN

County: GLOUCESTER

William Herbert Stewart McGlashan

of Taree

a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan is accurate and has been made by me in accordance with the Survey Practice Regulations, 1933, and was completed on 9th October 1972

Signature [signature]

Panel for use only for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to user.

IT IS INTENDED TO DEDICATE THE EXTENSION OF JUBILEE PARADE TO THE PUBLIC AS ROADWAY.

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

I, Bruce Richard Davies, Registrar General for New South Wales, certify that this negative is a photograph made of a permanent record of a document in my custody this 22nd day of August, 1977

1

Historical Search

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
24/9/2008 5:57PM

FOLIO: 6/244030

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 12226 FOL 36

Recorded	Number	Type of Instrument	C.T. Issue
5/6/1987		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
15/12/1987		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
4/6/1990	Z35981	MORTGAGE	EDITION 1
18/8/1992	E687768	MORTGAGE	EDITION 2
13/1/2000	6485107	DISCHARGE OF MORTGAGE	
13/1/2000	6485108	CHANGE OF NAME	
13/1/2000	6485109	MORTGAGE	EDITION 3
14/2/2004	AA417657	DISCHARGE OF MORTGAGE	
14/2/2004	AA417658	TRANSFER	
14/2/2004	AA417659	MORTGAGE	EDITION 4
19/7/2007	AD281999	DISCHARGE OF MORTGAGE	
19/7/2007	AD282000	MORTGAGE	EDITION 5

*** END OF SEARCH ***

COFFEY - DIAMOND BEACH ALSP PRINTED ON 24/9/2008

CERTIFICATE OF TITLE

NEW SOUTH WALES — PROPERTY ACT, 1900

Vol. 12226 Fol. 36

Crown Grant Vol.5831 Fol.47

Prior Title Vol.9381 Fol.60

Edition issued 3-10-1973.

(Page 1) Vol. 12226 Fol. 36

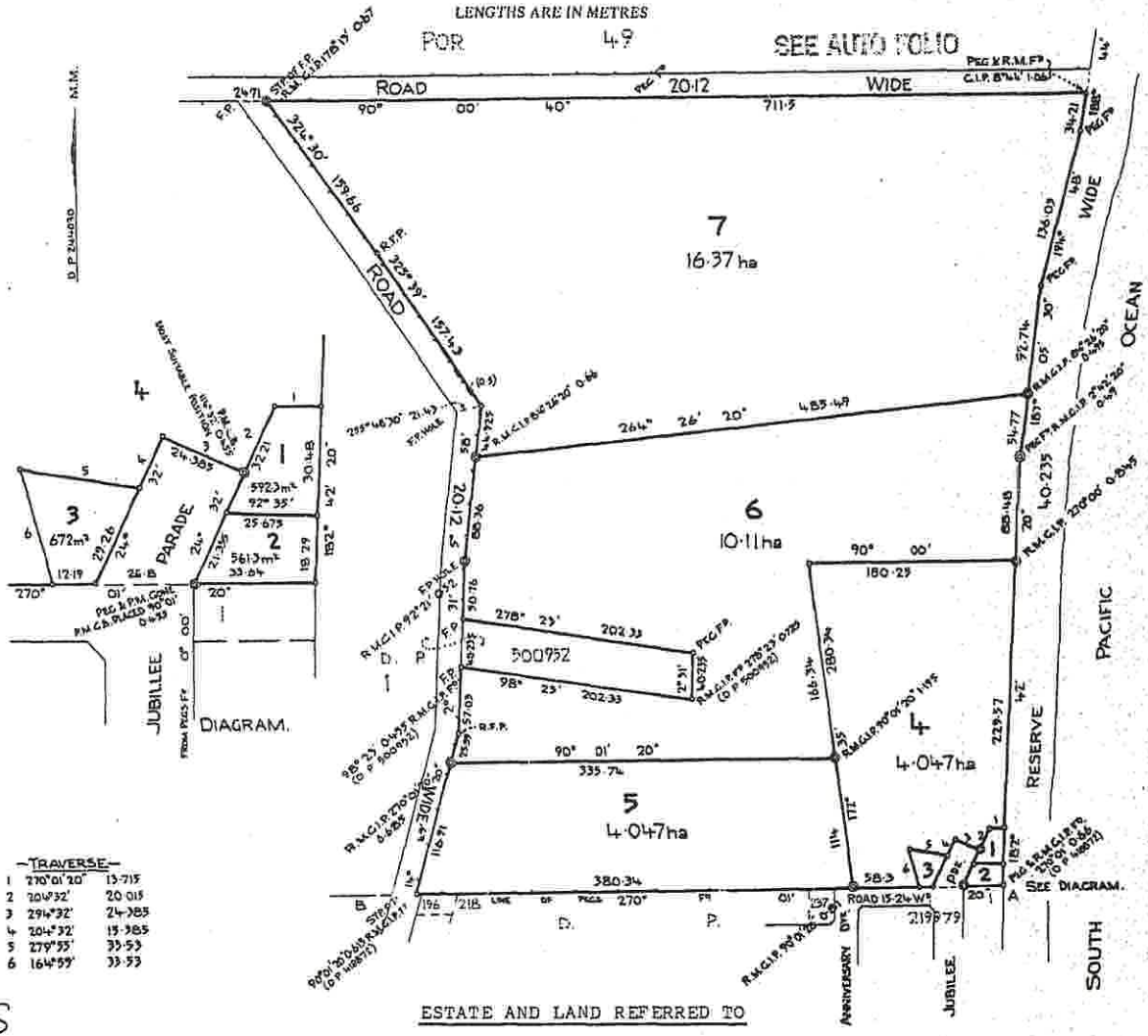
I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General

CANCELLED

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 6 in Deposited Plan 244030 at Red Head in the Shire of Manning Parish of Beryan and County of Gloucester. EXCEPTING THEREOUT the minerals reserved by the Crown Grant.

FIRST SCHEDULE

~~SPARKLE [illegible] PTY. LIMITED.~~

GRM

SECOND SCHEDULE

1. Reservations and conditions, if any, contained in the Crown Grant above referred to.
2. Attention is directed to Section 8 Land Aggregation Tax Management Act, 1971. See M531064

BA

Registrar General

Vol. 12226 Fol. 36

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
~~Ian Gavin Platt-Hepworth, Real Estate Agent, Carry Walter Platt-Hepworth, Gardener, both of Rose Bay, John Rutherford of Neutral Bay, Developer each as to one undivided one eighth share and Tralian Pty.Ltd. as to the five remaining undivided one eighth shares, AS TENANTS IN COMMON~~ Ivan Jelacic and Kathy Jelacic as joint tenants by Transfer W573664. Registered 23-10-1986	~~Transfer~~	~~P458603~~	~~-------~~	~~28-11-1975~~	

P458603T
R 4M
Q660864M,
R
W573664T
R

SECOND SCHEDULE (continued)

NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
~~Mortgage~~	~~P458604~~	~~-------~~	~~to Paul Francis Connery of Vaucluse, Solicitor, as regards the shares of Ian Gavin Platt-Hepworth and Carry Walter Platt Hepworth~~	~~28-11-1975~~		Discharged	Q660864	

(Page 2 of 2 pages)

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

CERTIFICATE OF TITLE

...PERTY ACT, 1900, as amended.

Vol. 9381 Fol. 60

CANCELLED

1st Edition issued 26-2-1963

Deposited Plan.)

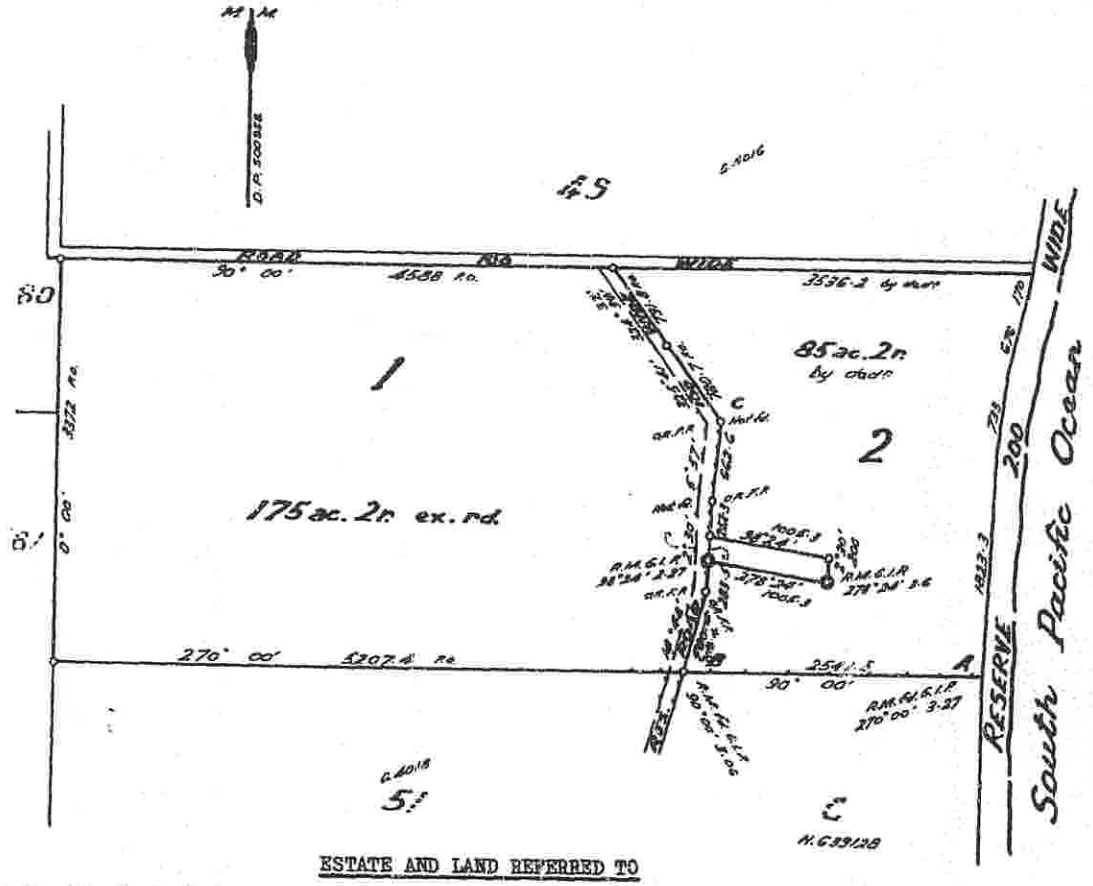
Vol. 9381 Fol. 60 (Page 1)

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Witness B Bailey

Registrar-General.

PLAN SHOWING LOCATION OF LAND



ESTATE AND LAND REFERRED TO

Estate in Fee Simple in lot 2 in Deposited Plan 500952 at Red Head in the Shire of Manning Parish of Beryan and County of Gloucester excepting thereout the minerals reserved by the Crown Grant.

FIRST SCHEDULE (Continued overleaf)

~~ESMIE MADGE BEDDOWS of Gentleman, Widow and JOHN WILLIAMS ORMSBY MARTEN of Burrell Creek, Farmer, as Joint Tenants.~~

Registrar General

SECOND SCHEDULE (Continued overleaf)

1. Reservations and conditions, if any, contained in the Crown Grant(s) referred to in the said Deposited Plan.
2. ~~Restrictions on transfer - See Section 47C Crown Lands Consolidation Act, 1913.~~ Cancelled M531064
3. ~~Caveat No. H956827 by the Registrar General entered 3-1-1962.~~ Withdrawn M553356.

Registrar General

BY 1000 V. C. N. BLIGHT, GOVERNMENT PRINTER

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar-General
Sparkle Estates Pty. Limited	Transfer	M553356	10-12-1971	24-1-1972	J. Watson

This deed is cancelled as to whole (ex road)
New Certificates of Title have issued on 3/10/1973
for Deposited Plan No. 244030 as follows:-
Lots 1 to 7 Vol 12226 Fol 31 to 37 respectively.

J. Watson
REGISTRAR GENERAL

The residue of land in this folio comprises road in DP 244030

J. Watson
REGISTRAR GENERAL

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar-General	CANCELLATION		
REQUEST	M531064		Attention is directed to Section 8, Land Aggregation Tax Management Act, 1971.	21-12-1971	J. Watson			
~~Mortgage~~	~~M553357~~	~~9-12-1971~~	~~to Esme Madge Caddows? of Clarence? [illegible], Widow and John Williams Ormsby? Harling? of [illegible], Farmer~~	~~24-1-1972~~	J. Watson	Discharged	N431694	J. Watson
			the interests of the Council of the Shire of Manning in the new road shown in DP 244030	29.8.1973	J. Watson			

M53 [illegible] Request
DP244030.
Regd. 29/1/73?
Prog. fol'd
DP 244030
(whole ex road)

FORM No. 184A NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR-GENERAL ARE CANCELLED

Licence: 10V/0167/95
Edition: 9804

CHANGE OF NA

New South Wales
Real Property Act 1900

6485108S

(A) **TORRENS TITLE** folio Identifier 6/244030

(B) **REGISTERED DEALING** If applicable

(C) **LODGED BY**

LTO Box	Name, Address or DX and Telephone	CODE
	BURKHART & COMPANY PTY LTD BOX 155S TEL: 9231 0122 FAX: 9262 1904 Reference (optional): state/Jelacic	CN

(D) **REGISTERED PROPRIETOR** Whose name is to be changed; show the name as it currently appears on the Torrens Title
Kathy Jelacic.

(E) **NEW NAME** Of the above registered proprietor in full
Katherine Jelacic.

(F) I, the registered proprietor referred to above, apply to have my new name recorded in the Register in respect of the above land/ registered dealing.

(G) **STATUTORY DECLARATION BY THE APPLICANT**

I [new name] Katherine Jelacic solemnly and sincerely declare that-

1. I am identical with the registered proprietor referred to above;
2. on ... at ...
   in the State of ... I married ...;
3. X I AM NOWN AS KATHY JELACIC & KATHERINE JELACIC HOWEVER IN LEGAL DOCUMENTS USUALLY DISCRIBED AS KATHERINE JELACIC

I make this solemn declaration conscientiously believing the same to be true and by virtue of the Oaths Act 1900, and I certify this application to be correct for the purposes of the Real Property Act 1900.

X Made and subscribed at SMITHFIELD in the state of NSW
on 10.11.1999 in the presence of -

Signature of witness: [signature] Signature of applicant: [signature]

Name of witness: IVAN JELACIC

Address of witness: 3 BRENTWOOD WAY
CASTLE HILL

Qualification of witness: J.P.

To be witnessed by a JP

May be accepted [signature]

All handwriting must be in block capitals.

Checked by (LTO use): gb.

10

PLAN OF PORTION 50

County of Gloucester Parish of Beryan

Land District Taree Land Board District Maitland Eastern Division

~~RESUMED AREA No~~ ~~PASTORAL HOLDING~~

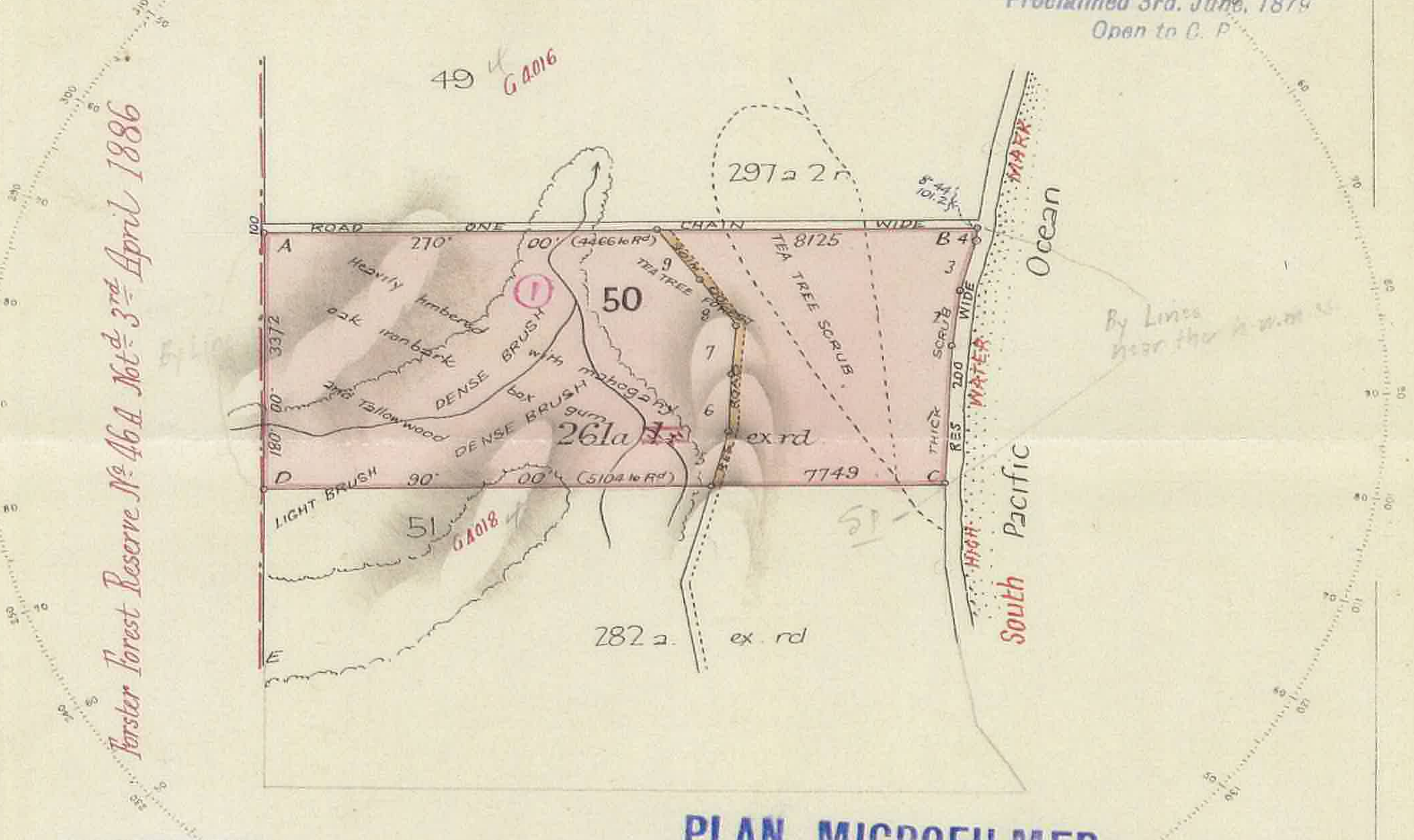
Applied for under the Section of the Crown Lands Act of by

Within Forster Forest Reserve No. 46A Notd. 3rd. April 1886 Revoked 29th Decr 1909

Within R.44669 from Sale generally Notified 29th Decr 1909. Revoked 2nd February 1910.
Within Cond! Pur: Lease Area No. 227 (Cap: Value £239.5.0. at 1 8/4 p.a.) notd. 2nd February 1910.

(1) Por 50. O.C.P.L. 10.25 Mch. 24th Robert Bennett Now CP. 11/45. Mar 29, conversion now Rural Bank of New South Wales Sale completed Sales 46.11895

Within the Gloucester Gold Field Proclaimed 3rd. June, 1879 Open to C. P.



Azimuth taken from DE
Field Book Vol. 8306 Folio 87, 94 to 97 incl.

Reference to Corners

Corner	Bearing	From	Links	No. on Tree
A	249° 20'	Blackbutt	18.8	50
B	Numbered Peg (No tree near)			50
C	Numbered Peg (No tree near)			50. 51
D	12° 26'	Mahogany	39.9	50. 51

Reference to Traverse

Line	Bearing	Distance
1	2° 42'	1824
2	7° 05'	733
3	14° 46'	676
4	8° 44'	170
5	14° 48'	724
6	2° 30'	728
7	5° 57'	629
8	325° 41'	745
9	324° 32'	864

I hereby certify that I in person made and on the 14th July 09 completed the survey represented on this plan on which are written the bearings and lengths of the lines measured by me and I declare that the survey has been executed in accordance with the regulations published for the guidance of Licensed Surveyors and the practice of the Department of Lands.

William L. Keil Licensed Surveyor

Transmitted to the District Surveyor with my letter of 16th Aug 1909 No. 48

Voucher No. 09.55 Passed £16.1.8 [signature] 21.10.09
Calculation Book No. ~ Folio ~
Checked and Charted W. Wilson 25th Sept 09
Examined [initials]
Plan approved 21 October 1909
[signature]
Draftsman-in-Charge

Improvements

[signature] 1 Nov 09 Scale 20 Chains to an Inch.

2 Nov 1909

Cat. No. G 40171497

Conversion of C.P.L.

No. 1946/1922

Mortgage to 38255

NEW SOUTH WALES
Three pounds
STAMP DUTY
SYDNEY, N.S.W.

State of New South Wales

[LAND GRANT]

CANCELLED

REGISTER BOOK
VOL. 5831 FOL. 47

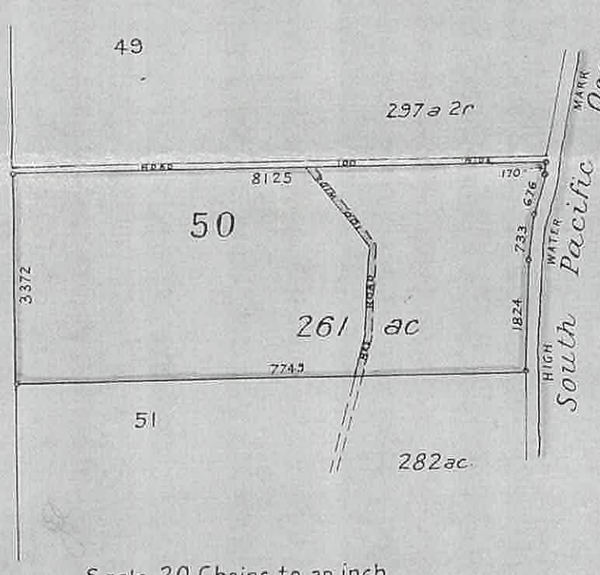
CANCELLED

GRANT OF LAND PURCHASED BY CONDITIONAL SALE.

C.P. 1911/45
Taree

GEORGE VI. by the Grace of God, of Great Britain, Ireland, and the British Dominions beyond the Seas, King, Defender of the Faith, Emperor of India:—
TO ALL to whom these Presents shall come, Greeting:—

Whereas the RURAL BANK OF NEW SOUTH WALES hereinafter called the said BANK ~~in Our State of New South Wales~~ claims to be entitled to the Parcel of Land hereinafter described in virtue of a Conditional Purchase of the same acquired by the conversion of a Conditional Purchase Lease under the provisions of the Crown Lands Amendment Act of 1905 which Conditional Purchase Lease was applied for on the twenty fourth day of March 1910 **And Whereas** a certificate of compliance with the conditions attaching to such purchase has been issued **And** the sum of two hundred and thirty nine pounds five shillings Sterling being the purchase money payable for the said Land has been paid into the Office of the Treasurer of Our said State And all things required by law to be done to entitle the said BANK to a Grant of the fee simple of the said Land subject to the Reservations and Exceptions hereinafter contained have been done and performed **Now Know Ye** That for and in consideration of the said sum for and on Our behalf well and truly paid into the Treasury of Our said State before these Presents are issued and of all and singular the premises WE HAVE GRANTED and for Us Our Heirs and Successors DO HEREBY GRANT unto the said BANK and its ~~Heirs and~~ Assigns Subject to the Reservations and Exceptions hereinafter contained ALL THAT Piece or Parcel of Land in Our said State containing by admeasurement two hundred and sixty one acres be the same more or less situated in the County of Gloucester and Parish of Beryan



Scale 20 Chains to an inch

PORTION 50

COMMENCING at the North Eastern corner of portion fifty one of two hundred and eighty two acres and bounded thence on the South by the Northern boundary of portion fifty one bearing West seventy seven chains forty nine links on the West by a line bearing North thirty three chains seventy two links on the North by a road one chain wide dividing this land from portion forty nine of two hundred and ninety seven acres two roods bearing East eighty one chains twenty five links and on the South East and East by lines near the high water mark of the South Pacific Ocean bearing South eight degrees forty four minutes West one chain seventy links South fourteen degrees forty six minutes West six chains seventy six links South seven degrees five minutes West seven chains thirty three links and thence South two degrees forty two minutes West eighteen chains twenty four links to the point of commencement EXCLUSIVELY of a road one chain wide passing through this land in a North Easterly and thence in a North Westerly direction the area of which has been deducted from the total area

As per Plan in the margin hereof With all the Rights and Appurtenances whatsoever thereto belonging To Hold unto the said BANK and its ~~Heirs and~~ Assigns for ever **Provided Nevertheless** AND WE DO HEREBY RESERVE AND EXCEPT unto Us Our Heirs and Successors all minerals which the said Land contains with full power and authority for Us Our Heirs and Successors and such person or persons as shall from time to time be authorised by Us or Them to enter upon the said Land and to search for mine dig and remove the said minerals **And also** all such parts and so much of the said Land as may hereafter be required for public ways viaducts canals railways tramways dams sewers or drains in over and through the same to be set out by Our Governor for the time being of Our said State or some person by him authorised in that respect **And also** all sand clay stone gravel and indigenous timber and all other materials the natural produce of the said Land which may be required at any time hereafter for the construction and repair of any public ways bridges or canals or for naval purposes or railways and tramways or any fences embankments viaducts dams sewers or drains necessary for the same together with the right of taking and removing all such materials by such person or persons as may be authorised in that behalf by Our Governor as aforesaid **Provided Lastly** AND WE DO HEREBY RESERVE for Us Our Heirs and Successors and for Our Governor as aforesaid by such person or persons as shall be by Us Them or him authorised in that behalf full power to make and conduct through in under upon or over the said Land or any portion thereof all public ways viaducts railways tramways canals and all common or public drains and sewers which may be deemed expedient And the right of full and free ingress egress and regress into out of and upon the said Land for the several purposes aforesaid or any of them **In Testimony Whereof** We have caused this Our Grant to be Sealed with the Seal of Our said State the word "seven" at the commencement of the twenty third line hereof having been previously typed over an erasure

Witness Our Trusty and Well-beloved JOHN NORTHCOTT, Esquire, Companion of Our Most Honourable Order of the Bath, Member of Our Royal Victorian Order, Lieutenant-General in Our Australian Military Forces, Governor of Our State of New South Wales and its Dependencies in the Commonwealth of Australia, at Sydney in Our said State, this third day of May in the twelfth year of Our Reign, and in the year of Our Lord one thousand nine hundred and forty eight.

Northcott.
Governor.

RECORDED and ENROLLED in the Registrar General's Office, at Sydney, in New South Wales, this Eighteenth day of May 1948.

J. Wells
Registrar General.

Attention is hereby directed to the provisions of Sec. 272 of the Crown Lands Consolidation Act, 1913, relating to transfer.

No. D&L6568 CAVEAT dated 7th June, 1948 by the Registrar General.
Regulation 222A under the Crown Lands Consolidation Act, 1913.
Produced and entered 9th June 1948 at 28 mts pt 3 o'clock in the after noon.

J. Wells
REGISTRAR GENERAL.

The within Caveat No. D&L6568 is hereby withdrawn
Dated 5th April 1951

J. Wells
REGISTRAR GENERAL

No. F403980 TRANSFER dated 9th February 1951 from the said Rural Bank of New South Wales to Frederick William Cummins, of Black Head near Gosford, Dairy Farmer of the land within described
Produced 27th February 1951 and entered 5th April 1951 at 12 o'clock in the noon.

J. Wells
REGISTRAR GENERAL

No. F403982 TRANSFER dated 27th November 1950 from the said Frederick William Cummins to Frederick Thomas Beddows of Halliday Point near Forster, Farmer of the land within described
Produced 27th February 1951 and entered 5th April 1951 at 12 o'clock in the noon.

J. Wells
REGISTRAR GENERAL

No. F403982 MORTGAGE dated 9th February 1951 from the said Frederick Thomas Beddows to RURAL BANK OF NEW SOUTH WALES
Produced and entered 27th February 1951 and entered at 12 o'clock in the noon.

J. Wells
REGISTRAR GENERAL.

MORTGAGE No. F403982 has been discharged.
See H956825 Entered 3rd January 1962.

Jan Watson
REGISTRAR GENERAL

Esme Madge Beddows of Mosman, Widow and John Williams Ormsby Martin of Burrell Creek, Farmer, are now the registered proprietors of the land within described.
as joint tenants
See Section 94 Application No. H956826
Entered 3rd January 1962.

Jan Watson
REGISTRAR GENERAL

No. H956827 CAVEAT by the Registrar General
Entered 3rd January 1962.

Jan Watson
REGISTRAR GENERAL

This deed is cancelled as to Whole
New Certificates of Title have issued for Lots 1 & 2 in Deposited Plan No. 500952 as follows:
Lots 1 & 2 Vol. 9381 Fol. 59 & 60 respectively

Jan Watson
REGISTRAR GENERAL

Appendix B

Field Investigation Logs

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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)

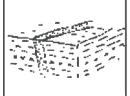
SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

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			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%. • Medium 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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Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

DEFINITIONS: Rock substance, defect and mass are defined as follows:

Rock Substance	In engineering terms roch substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.
Defect	Discontinuity or break in the continuity of a substance or substances.
Mass	Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

SUBSTANCE DESCRIPTIVE TERMS:

ROCK NAME	Simple rock names are used rather than precise geological classification.
PARTICLE SIZE	Grain size terms for sandstone are:
Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mm to 0.6mm
Fine grained	Mainly 0.06mm (just visible) to 0.2mm
FABRIC	Terms for layering of penetrative fabric (eg. bedding, cleavage etc.) are:
Massive	No layering or penetrative fabric.
Indistinct	Layering or fabric just visible. Little effect on properties.
Distinct	Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric.

CLASSIFICATION OF WEATHERING PRODUCTS

Term	Abbreviation	Definition
Residual Soil	**RS**	Soil derived from the weathering of rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely Weathered Material	**XW**	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible.
Highly Weathered Rock	**HW**	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
Moderately Weathered Rock	**MW**	The whole of the rock substance is discoloured, usually by iron staining or bleaching , to the extent that the colour of the fresh rock is no longer recognisable.
Slightly Weathered Rock	**SW**	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.
Fresh Rock	**FR**	Rock substance unaffected by weathering.

Notes on Weathering:

1. AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no advantage in making such a distinction. DW may be used with the definition given in AS1726.
2. Where physical and chemical changes were caused by hot gasses and liquids associated with igneous rocks, the term "altered" may be substituted for "weathering" to give the abbreviations XA, HA, MA, SA and DA.

ROCK SUBSTANCE STRENGTH TERMS

Term	Abbrev-iation	Point Load Index, I_S50 (MPa)	Field Guide
Very Low	**VL**	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
Low	**L**	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	**M**	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	**H**	1 to 3	A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High	**VH**	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
Extremely High	**EH**	More than 10	Specimen requires many blows with geological pick to break; rock rings under hammer.

Notes on Rock Substance Strength:

1. In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
2. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
3. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index (Is50). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.

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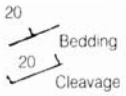
Rock Description Explanation Sheet (2 of 2)

COMMON DEFECTS IN ROCK MASSES

Term	Definition	Diagram	Map Symbol	Graphic Log (Note 1)
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (eg bedding) or a planar anisotropy in the rock substance (eg, cleavage). May be open or closed.			
Joint	A surface or crack across which the rock has little or no tensile strength. but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.			
Sheared Zone (Note 3)	Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.			
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.			
Crushed Seam (Note 3)	Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.			
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.			
Extremely Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.			

DEFECT SHAPE TERMS

Planar	The defect does not vary in orientation
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps
Irregular	The defect has many sharp changes of orientation

Note: The assessment of defect shape is partly influenced by the scale of the observation.

ROUGHNESS TERMS

Slickensided	Grooved or striated surface, usually polished
Polished	Shiny smooth surface
Smooth	Smooth to touch. Few or no surface irregularities
Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.

COATING TERMS

Clean	No visible coating
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.

BLOCK SHAPE TERMS

Blocky	Approximately equidimensional
Tabular	Thickness much less than length or width
Columnar	Height much greate than cross section

Notes on Defects:

1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.

coffey geotechnics

Engineering Log - Excavation

Excavation No. **TP12**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 5.5

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N						CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, brown, some organics (rootlets), trace Sand, fine grained.	>Wp	St	×	TOPSOIL
				U_{50} Bs	5.0	0.5		CH	**CLAY:** medium to high plasticity, pale grey with red and pale brown mottling, some Sand, fine to medium grained, trace organics (roots) and Silt.		VSt	×	COLLUVIAL
			►		4.5	1.0		CH	**Sandy CLAY:** low to medium plasticity, grey, trace Silt and organics (roots).		St	×	ALLUVIAL
					4.0	1.5		SP	**Clayey SAND:** fine to medium grained, pale brown/yellow, some Silt.	W		×	ALLUVIAL
					3.5	2.0			TP12 terminated due to collapse Test pit TP12 terminated at 1.8m				
					3.0	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 GEOTTUNC01754AC LOGS.GPJ COFFEY.GDT 25.11.08

Form GEO 5.2 Issue 3 Rev.2

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Engineering Log - Excavation

Excavation No. **TP11**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 23.25

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed					ML	**TOPSOIL:** SILT, brown, some organics (rootlets) and Sand, fine grained.	<Wp	H		TOPSOIL
				U_{50} and Bs	23.0	0.5		CH	**CLAY:** high plasticity, red, trace Silt and Gravel, fine grained.	>Wp		550	RESIDUAL
					22.5			CH	**Silty CLAY, medium to high plasticity, pale grey with orange/brown mottling, trace Sand, fine grained.**				RESIDUAL (EXTREMELY WEATHERED SILTY SANDSTONE)
						1.0			**Silty SANDSTONE:** coarse grained, orange/brown with grey mottling, slightly weathered, some Clay, low plasticity, and Silt seam.	M	VL	600	RESIDUAL (SLIGHTLY WEATHERED SILTY SANDSTONE) Defect spacing 5-10 mm.
					22.0				TP11 terminated due to refusal. Test pit TP11 terminated at 1.15m				
						1.5							
					21.5								
						2.0							
					21.0								
						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. **TP10**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 24.25

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed					ML	**TOPSOIL:** SILT, brown, some organics (rootlets), and Sand, fine grained, trace Clay, low plasticity.	<Wp	VSt	×	TOPSOIL/SLOPEWASH
				Bs	24.0			CH	**CLAY:** medium to high plasticity, grey/brown with pale grey and orange/brown mottling, some Sandstone Gravel, subangular and subrounded, trace Silt and organics (roots).	>Wp	H	×	SLOPEWASH/COLLUVIAL
						0.5			**Silty SANDSTONE:** fine grained, orange/brown, some Clay, low plasticity, and Silt seams.	D	VL	600 ×	RESIDUAL SLIGHTLY WEATHERED SANDSTONE Slightly weathered becoming weathered. Defect spacing 5-12 mm.
					23.5	1.0			TP10 terminated due to refusal Test pit TP10 terminated at 0.64m				
					23.0	1.5							
					22.5	2.0							
					22.0	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. **TP9**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 15.5

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed					ML	**TOPSOIL:** Silt, brown, some organics (rootlets), Sand, fine grained, and Clay, low plasticity.	<Wp	H		TOPSOIL
				Bs	15.0	0.5		CH	**CLAY:** medium to high plasticity, pale brown with red/orange and yellow mottling, some Sandstone Gravel, fine to medium grained, subrounded and subangular, and Silt.	>Wp		600	SLOPEWASH/COLLUVIAL
									Silty SANDSTONE: medium grained, pale grey with orange/brown and green/blue mottling, some Clay, low plasticity, and Silt seams, trace organics (rootlets).		VSt / VL		RESIDUAL Extremely weathered becoming slightly weathered
					14.5	1.0			TP9 terminated due to refusal Test pit TP9 terminated at 0.9m				
					14.0	1.5							
					13.5	2.0							
					13.0	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. **TP8**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 14.75

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed		14.5	0.0		CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, dark grey, some organics (rootlets), and Gravel, fine to medium grained, subangular.	>Wp	VSt	×	TOPSOIL
				Bs U_{50}		0.5		CH	**CLAY:** high plasticity, red/brown with pale brown mottling, trace organics (rootlets) and Gravel, fine grained, subangular.			×	RESIDUAL
					14.0			CH	**Gravelly CLAY:** high plasticity, pale grey with orange brown mottling, Gravel, subangular.		H	× 600	RESIDUAL
					13.5	1.0			TP8 terminated due to refusal Test pit TP8 terminated at 0.9m				
					13.0	1.5							
					12.5	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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Form GEO 5.2 Issue 3 Rev.2

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Engineering Log - Excavation

Excavation No. **TP7**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 10.5

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed					ML	**TOPSOIL:** Clayey SILT, brown, some organics (rootlets), trace Sand, fine grained.	<Wp	H	×	TOPSOIL
				Env Bs	10.0	0.5		CH	**CLAY:** medium to high plasticity, pale brown, trace Gravel, fine grained, subangular, and Silt.	>Wp		×	COLLUVIAL
				U_{50}	9.5	1.0		CH	**CLAY:** high plasticity, pale brown/grey with red mottling, trace Sand, medium grained, and Silt.		VSt	×	RESIDUAL
					9.0	1.5		CL	**Silty CLAY:** low to medium plasticity, orange/brown, some Sand, fine to medium grained, trace Gravel, medium grained, subangular.	<Wp	H	×	RESIDUAL
								SAST	**Silty SANDSTONE:** medium to coarse grained, slightly weathered, some Sandstone Gravel, medium grained, subangular, trace iron staining.	D	VL	600 ×	
					8.5	2.0			TP7 terminated due to refusal. Test pit TP7 terminated at 1.79m				
					8.0	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. **TP6**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 8.5

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed					ML	**TOPSOIL:** Clayey SILT, low plasticity, grey/brown, some organics (rootlets), trace Sand, fine grained.	<Wp	H	600	TOPSOIL
				Bs U_{50}	8.0	0.5		CH	**CLAY:** medium to high plasticity, grey with orange/red mottling, some organics (roots), trace Gravel, fine grained, subrounded.	>Wp	H/Fb	600	RESIDUAL
					7.5	1.0						600	
					7.0	1.5		CH	**CLAY:** high plasticity, orange/red with grey mottling, some Gravel, fine to medium grained, subrounded, trace organics (roots) and Silt.		H	600	RESIDUAL
					6.5	2.0			Test pit TP6 terminated at 1.85m				
					6.0	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. **TP5**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***23.9.2008***

Principal:

Date completed: ***23.9.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface:

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N				0.5		CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, brown, some organics (rootlets), trace Sand, fine grained.	>Wp	H	×	TOPSOIL
								CH	**CLAY:** high plasticity, pale brown with grey mottling, trace Sand, fine grained, Silt and organics (roots).		VSt	×	COLLUVIAL
						1.0		CH	**CLAY:** medium to high plasticity, pale grey with red and pale brown mottling, some Sand, fine to medium grained, trace organics (roots), and Silt.			×	COLLUVIAL
			►			1.5		CL	**Sandy CLAY:** low to medium plasticity, grey, trace Silt and organics (roots).			×	ALLUVIAL
						2.0			Test pit TP5 terminated at 2.1m				
						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. **TP4**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: **OROGEN PTY LTD**

Date started: **23.9.2008**

Principal:

Date completed: **23.9.2008**

Project: **PROPOSED SUBDIVISION, DIAMOND BEACH ROAD**

Logged by: **PE**

Test pit location: **Refer to Figure**

Checked by: **TLM**

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 9.25

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N	None observed		9.0	0.5		CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, brown/grey, some organics (rootlets), trace Sand, fine grained.	<Wp	H	550	TOPSOIL
				Bs				CH	**CLAY:** medium to high plasticity, pale brown/brown, trace organics (rootlets) and Gravel, fine , subrounded.	Wp			COLLUVIAL
				U_{50}	8.5	1.0		CH	**CLAY:** high plasticity, pale grey with red mottling, trace Sand, coarse grained, and Gravel, fine grained, subangular.	>Wp	VSt		RESIDUAL
					8.0	1.5		CH	**CLAY:** high plasticity, pale grey/brown, with orange/brown mottling, some Gravel, fine to medium grained, subangular, (Sandstone/Siltstone), trace Sand, medium grained and organics (roots).				RESIDUAL (EXTREMELY WEATHERED SILTSTONE/SANDSTONE)
					7.5	2.0							
					7.0	2.5			Test pit TP4 terminated at 2.1m				

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. **BH3**

Sheet 1 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 6.5

excavation dimensions: m long m wide | Northing: m | datum:

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
AST		N	None observed					CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, dark brown, some organics (rootlets), trace Sand, fine grained.	>Wp	F		TOPSOIL
				E				CH	**CLAY:** medium to high plasticity, brown.		St		ALLUVIAL
				E	6.0	0.5		CH	**CLAY:** high plasticity, red/orange with grey mottling.		VSt		RESIDUAL
				E	5.5	1.0		CH	**CLAY:** high plasticity, pale grey with brown mottling, trace Gravel, fine grained.		VSt-H		
				E	5.0	1.5							
				E	4.5	2.0		CH	**CLAY:** high plasticity, blue/grey with aple brown mottling, trace Silt.		VSt		
				E	4.0	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. **BH3**

Sheet 2 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 6.5

excavation dimensions: m long m wide | Northing: m | datum:

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
AST				E	3.5	3.0		CH	**CLAY:** high plasticity, pale blue/grey, some Silt, trace Gravel, fine grained, angular.	>Wp	H		RESIDUAL Note: Moisture Content increasing.
				E	3.0	3.5		CH	**CLAY:** high plasticity, pale grey with pale brown mottling, Trace Gravel, fine grained and Silt.		VSt		
				E	2.5	4.0		CH	**CLAY:** high plasticity, pale grey, trace Silt, and Gravel, fine grained.				
				E	2.0	4.5		CH	**CLAY:** high plasticity, pale grey with green mottling, trace Silt.				
					1.5	5.0			Test pit BH3 terminated at 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. **BH2**

Sheet 1 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 5.5

excavation dimensions: m long m wide | Northing: m | datum:

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
AST		N			5.0 / 0.5		CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, dark grey/brown, some organics (rootlets), trace Sand, medium grained.	>Wp	S		TOPSOIL
				E			CL	**Silty CLAY:** low to medium plasticity, dark grey/brown, some organics (rootlets).				ALLUVIAL
				E	4.5 / 1.0		CH	**CLAY:** medium to high plasticity, brown with pale brown/orange mottling, trace Silt.				
				E	4.0 / 1.5		CH	**Sandy CLAY:** medium to high plasticity, dark grey.		F		
			▶	E			SP	**SAND:** fine to medium grained, dark brown, trace organics and shell grit.	W	L		
				E	3.5 / 2.0							
				E	3.0 / 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. **BH2**

Sheet 2 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 5.5

excavation dimensions: m long m wide | Northing: m | datum:

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
					2.5	3.0			BH2 terminated due to collapse Test pit BH2 terminated at 2.5m				
					2.0	3.5							
					1.5	4.0							
					1.0	4.5							
					0.5	5.0							

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. **BH1**

Sheet 1 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 5.0

excavation dimensions: m long m wide | Northing: m | datum:

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
AST		Nil		E	4.5 / 0.5		CH	**Sandy CLAY:**medium to high plasticity, brown/grey, some organics (rootlets).	>Wp	VSt		ALLUVIAL
				E	4.0 / 1.0		CH	**Sandy CLAY:**medium to high plasticity, pale grey.				
				E			SP	**Clayey SAND:**Fine to medium grained, orange/brown.	M	M-MD		
			▶	E	3.5 / 1.5		SP	**Clayey SAND:**fine to medium grained, pale brown, some Gravel, fine grained, rounded.	W	D		
				E	3.0 / 2.0		SP	**Clayey SAND:**fine to medium grained, pale brown, trace Gravel, fine grained. Note - interbedded Sand and Clay.		D-MD		
					2.5 / 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. **BH1**

Sheet 2 of 2

Project No: **GEOTTUNC01754AC**

Client: ***OROGEN PTY LTD***

Date started: ***25.8.2008***

Principal:

Date completed: ***25.8.2008***

Project: ***PROPOSED SUBDIVISION, DIAMOND BEACH ROAD***

Logged by: ***PE***

Test pit location: ***Refer to Figure***

Checked by: ***TLM***

equipment type and model: | Pit Orientation: | Easting: m | R.L. Surface: 5.0

excavation dimensions: m long m wide | Northing: m | datum:

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
AST				E	2.0 / 3.0		CH	**CLAY:** medium to high plasticity, grey/blue, with some Sand, fine to medium grained.	>Wp	VSt		ALLUVIAL
					1.5 / 3.5			Test pit BH1 terminated at 3m				
					1.0 / 4.0							
					0.5 / 4.5							
					0.0 / 5.0							

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. **TP13**

Sheet 1 of 1

Project No: **GEOTTUNC01754AC**

Client: **OROGEN PTY LTD**

Date started: **23.9.2008**

Principal:

Date completed: **23.9.2008**

Project: **PROPOSED SUBDIVISION, DIAMOND BEACH ROAD**

Logged by: **PE**

Test pit location: **Refer to Figure**

Checked by: **TLM**

equipment type and model: Mini Excavator | Pit Orientation: | Easting: m | R.L. Surface: 6.0

excavation dimensions: 2m long 1m wide | Northing: m | datum:

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
BH		N						CL	**TOPSOIL:** Silty CLAY, low to medium plasticity, brown, some organics (rootlets), trace Sand, fine grained.	>Wp	H	×	TOPSOIL
				Bs	5.5	0.5		CH	**CLAY:** high plasticity, pale brown with grey mottling, trace Sand, fine grained, Silt and organics (roots).		VSt	×	COLLUVIAL
					5.0	1.0		CH	**CLAY:** medium to high plasticity, pale grey with red and pale brown mottling, some Sand, fine to medium grained, trace organics (roots) and Silt.			×	ALLUVIAL
					4.5	1.5		CL	**Sandy CLAY:** low to medium plasticity, grey, trace Silt, and organics (roots).			×	
			▶					SP	**Clayey SAND:** fine to medium grained, grey.	M		×	
					4.0	2.0		SP	**SAND:** fine to medium grained, pale brown/grey, some Clay, low plasticity.	W		×	Note: Possible Sand and Clay lense.
					3.5	2.5			Test pit TP13 terminated at 2.1m				

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 C

Laboratory Testing Results

RESULTS OF ACID SULFATE SOIL ANALYSIS (Page 1 of 1)

1 sample supplied by Coffey Tuncurry on 26th September, 2008 - Lab. Job No. A0361

Analysis requested by Paul Edmed. - **Your Job Number: Tunc01754AA Purchase Order Number: 08337**

Sample Site	Depth (m)	EAL lab code	Texture (note 6)	Moisture Content (% moisture)	Lab. Bulk Density tonne DW/m^3	TAA pH_{kcl}	Titratable Actual Acidity (TAA) mole H^+/tonne (to pH 6.5)	Reduced Inorganic Sulfur (% chromium reducible S) (%Scr) (note 2)	Reduced Inorganic Sulfur (Scr) mole H^+/tonne	NET ACIDITY Chromium Suite mole H^+/tonne (based on %Scrs)	LIME CALCULATION Chromium Suite kg $CaCO_3/m^3$ (includes 1.5 safety Factor)
Method No.						*23A*	*23F*	*22B*	*a- 22B*	*note 5*	*note 5*
BH 2	**1.5 - 2.0**	*A0361/1*	Coarse	17.9	1.5	5.17	22	<0.005	0	22	3

NOTE:

1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)

2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)

3 - Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). ***Acid Sulfate Soils Laboratory Methods Guidelines.*** QLD DNRME.

4 - Bulk density was determined immediately on arrival to laboratory (insitu bulk density is preferred)

5 - **ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)**

6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)

7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays

8 - .. denotes not requested or required

9 - SCREENING, CRS, TAA and ANC are NATA certified but other SPOCAS segments are currently not NATA certification

10- Results at or below detection limits are replaced with '0' for calculation purposes.

11 - Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H+/t; medium Scr≥0.06%S or 37mole H+/t; fine Scr≥0.1%S or 62mole H+/t)

checked: .....

Department of Lands

Land Administration & Management
Property & Spatial Information

Paul Edmed
Coffey Geotechnics
1 / 4 Douglas Avenue
Tuncurry NSW 2428

Soil Conservation Service
Scone Research Centre
709 Gundy Road
PO Box 283
Scone NSW 2337
Telephone: (02) 6545 1666
Facsimile: (02) 6545 2520
www.lands.nsw.gov.au

14 October 2008

SCO08/393

Dear Paul Edmed

Analysis of two soil samples – Job No: TUNC01754AA

The analysis of two soil samples (Job No: TUNC01754AA) has been completed (Soil test report SCO08/393R1). These samples were analysed for: particle size (clay, silt, very fine sand, coarse fine sand, coarse sand and gravel); dispersion percentage (D%); Emerson aggregate test (EAT); particle size-mechanical dispersion (clay, silt, very fine sand, coarse fine sand, coarse sand and gravel); and organic carbon (OC).

The soil erodibility factor (K factor) has been determined using the particle size analysis-mechanical dispersion (P7C/1) and organic carbon (OC) (as described by Rosewell 1993). The surface soil structure was assumed to be fine or medium granular and the profile permeability was assumed to be moderate or moderate to slow.

Lab No	Sample Id	K factor	Rating
1	TP11 0.2-0.3m	0.068	Very high
2	TP13 0.4-0.5m	0.033	Moderate

This interpretation was based on the sample supplied being representative, and literature guidelines. If you have any queries, please contact me on (02) 6545 1666.

Yours sincerely

SR Young
Laboratory Manager
Scone Research Centre

SOIL AND WATER TESTING LABORATORY
Scone Research Service Centre

Report No: SCO08/393R1
Client Reference: P Edmed
Coffey Geotechnics
1 / 4 Douglas Avenue
Tuncurry NSW 2428

Lab No	Method	P7B/1 Particle Size Analysis (%)						P8A/2	P9B/2
	Sample Id	clay	silt	vf sand	cf sand	c sand	gravel	D%	EAT
1	TP11 0.2-0.3m	74	12	4	3	5	2	5	6
2	TP13 0.4-0.5m	34	25	10	6	25	<1	33	3(1)

Lab No	Method	P7C/1 Particle Size Analysis- mechanical dispersion (%)						C6A/2
	Sample Id	clay	silt	vf sand	cf sand	c sand	gravel	OC (%)
1	TP11 0.2-0.3m	3	42	26	10	17	2	0.76
2	TP13 0.4-0.5m	30	29	10	7	24	<1	0.53

END OF TEST REPORT

Department of Lands

Land Administration & Management
Property & Spatial Information

Soil Conservation Service

SOIL TEST REPORT

Scone Research Centre

REPORT NO:	SCO08/393R1
REPORT TO:	P Edmed Coffey Geotechnics 1 / 4 Douglas Avenue Tuncurry NSW 2428
REPORT ON:	Two soil samples Job No: TUNC01754AA
PRELIMINARY RESULTS ISSUED:	Not issued
REPORT STATUS:	Final
DATE REPORTED:	9 October 2008
METHODS:	Information on test procedures can be obtained from Scone Research Centre

TESTING CARRIED OUT ON SAMPLE AS RECEIVED

G Holman
(Technical Officer)

Scone Research Centre, PO Box 283 Scone 2337, 709 Gundy Road Scone 2337
Ph: 02 6545 1666, Fax: 02 6545 2520

Appendix D

Results of Permeability Testing

CLIENT: Orogen
PROJECT: Proposed Subdivision
LOCATION: Lot 6 Diamond Beach Road, Diamond Beach
SUBJECT: Falling Head Permeability Testing
JOB NO: GEOTTUNC01754AA

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Borehole Number **BH2**

Borehole/casing diameter	0.05	m
Elevation at borehole location	5.50	m,RL

Depth below top of casing/standpipe to:

bottom of borehole	2.05	m
bottom of casing	2.05	m
height of casing above surface	0.15	m
initial ground water level	0.43	m

The method of calculation is outlined in BS5930:1999

$$k = \frac{A}{F(t_2 - t_1)} \ln\left(\frac{H_1}{H_2}\right)$$

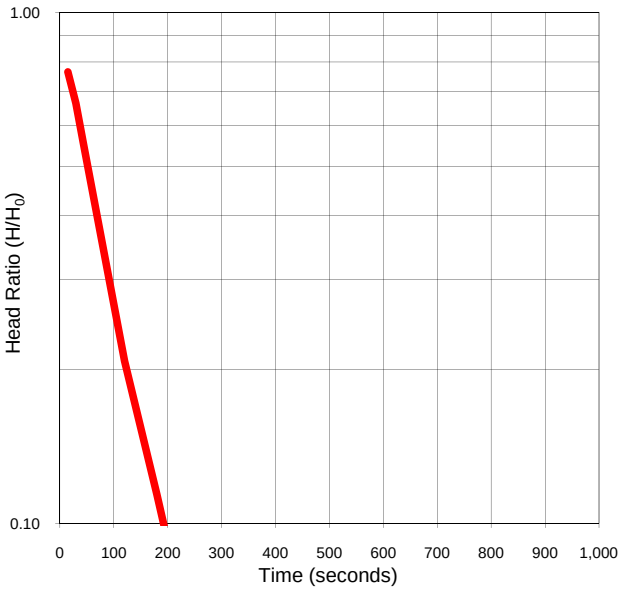
where:
k = permeability of the soil
A = cross-sectional area of borehole or casing (m^2).
F = intake factor (refer to chart)
H_1 = variable head at time t_1
H_2 = variable head at time t_2

Intake Factor Case (b)

No.	Time (mins)	Time (secs)	Depth (m)	Water Level	Head (m)	H/H_0	k (m/s) (from H_0)	k (m/s) (previous)
1	0.0	0	1.92	3.73	-1.49	-3.47		
2	0.3	15	1.57	4.08	-1.14	0.77	2.55E-04	2.55E-04
3	0.5	30	1.42	4.23	-0.99	0.66	1.95E-04	1.34E-04
4	0.8	45	1.24	4.41	-0.81	0.54	1.93E-04	1.91E-04
5	1.0	60	1.10	4.55	-0.67	0.45	1.90E-04	1.81E-04
6	2.0	120	0.74	4.91	-0.31	0.21	1.87E-04	1.83E-04
7	3.0	180	0.60	5.05	-0.17	0.11	1.72E-04	1.43E-04
8	4.0	240	0.52	5.13	-0.09	0.06	1.67E-04	1.51E-04
9	6.0	360	0.47	5.18	-0.04	0.03	1.43E-04	9.65E-05
10	8.0	480	0.46	5.19	-0.03	0.02	1.16E-04	3.42E-05
11	10.0	600	0.45	5.20	-0.02	0.01	1.03E-04	4.83E-05
12	15.0	900	0.43	5.22	0.00	0.00	#DIV/0!	#DIV/0!

Length of open hole (m)	0.00
Depth of soil in casing (m)	1.90
Cross-sectional area (m^2)	1.96E-03
Groundwater level (m)	5.2
Intake Factor	0.1375

HEAD RATIO vs ELAPSED TIME



Permeability Calculations

Case	Range	k (m/s)
1	1 - 11	1.0E-04
2	1 - 5	1.9E-04
3	5 - 10	1.1E-04
4	6 - 11	8.2E-05

PERMEABILITY vs ELAPSED TIME

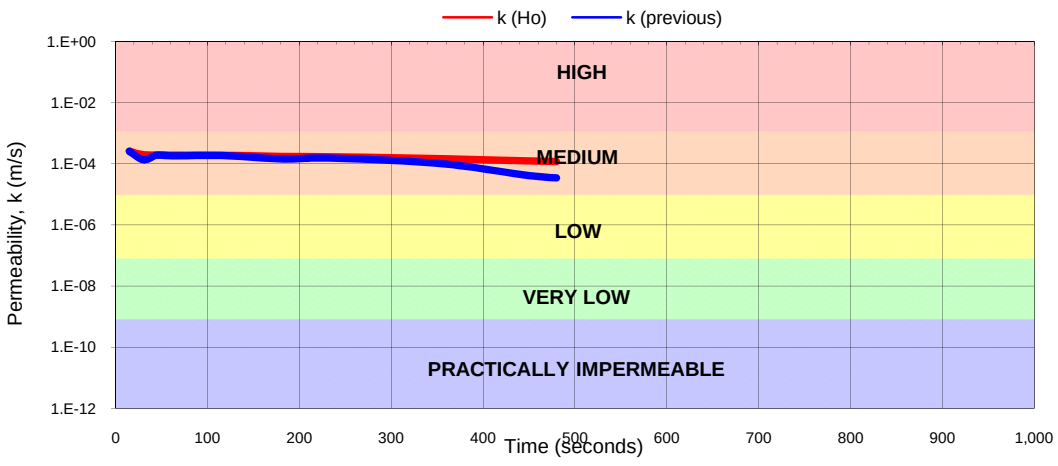


FIGURE 2

CLIENT: Orogen
PROJECT: Proposed Subdivision
LOCATION: Lot 6 Diamond Beach Road, Diamond Beach
SUBJECT: Falling Head Permeability Testing
JOB NO: GEOTTUNC01754AA

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Borehole Number **BH1**

The method of calculation is outlined in BS5930:1999

Borehole/casing diameter	0.05	m
Elevation at borehole location	5.00	m,RL

$$k = \frac{A}{F(t_2 - t_1)} \ln\left(\frac{H_1}{H_2}\right)$$

where:
k = permeability of the soil
A = cross-sectional area of borehole or casing (m^2).
F = intake factor (refer to chart)
H_1 = variable head at time t_1
H_2 = variable head at time t_2

Depth below top of casing/standpipe to:

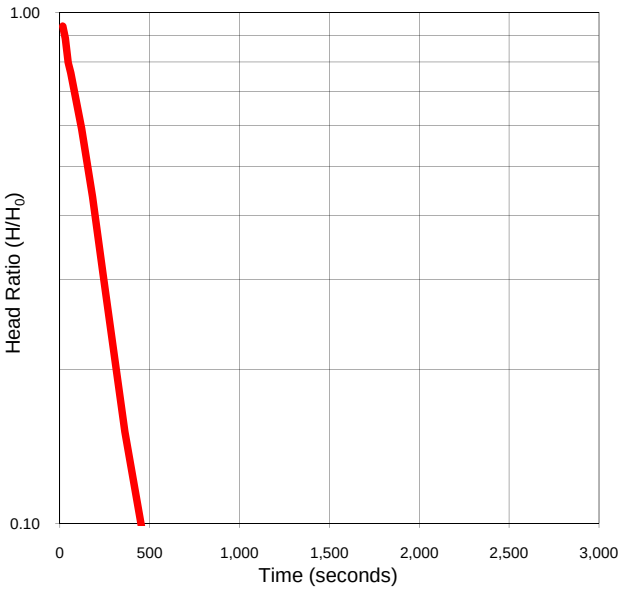
bottom of borehole	2.97	m
bottom of casing	2.97	m
height of casing above surface	0.23	m
initial ground water level	0.71	m

Intake Factor Case (b)

No.	Time (mins)	Time (secs)	Depth (m)	Water Level	Head (m)	H/H_0	k (m/s) (from H_0)	k (m/s) (previous)
1	0.0	0	2.89	2.34	-2.18	-3.07		
2	0.3	15	2.76	2.47	-2.05	0.94	5.85E-05	5.85E-05
3	0.5	30	2.65	2.58	-1.94	0.89	5.55E-05	5.25E-05
4	0.8	45	2.45	2.78	-1.74	0.80	7.15E-05	1.04E-04
5	1.0	60	2.37	2.86	-1.66	0.76	6.49E-05	4.48E-05
6	2.0	120	2.00	3.23	-1.29	0.59	6.24E-05	6.00E-05
7	3.0	180	1.66	3.57	-0.95	0.44	6.59E-05	7.28E-05
8	4.0	240	1.38	3.85	-0.67	0.31	7.02E-05	8.31E-05
9	6.0	360	1.04	4.19	-0.33	0.15	7.49E-05	8.43E-05
10	8.0	480	0.90	4.33	-0.19	0.09	7.26E-05	6.57E-05
11	10.0	600	0.78	4.45	-0.07	0.03	8.18E-05	1.19E-04
12	15.0	900	0.76	4.47	-0.05	0.02	5.99E-05	1.60E-05
13	20.0	1200	0.74	4.49	-0.03	0.01	5.10E-05	2.43E-05
14	25.0	1500	0.73	4.50	-0.02	0.01	4.47E-05	1.93E-05
15	30.0	1800	0.72	4.51	-0.01	0.00	4.27E-05	3.30E-05
16	45.0	2700	0.72	4.51	-0.01	0.00	2.85E-05	0.00E+00

Length of open hole (m)	0.00
Depth of soil in casing (m)	2.74
Cross-sectional area (m^2)	1.96E-03
Groundwater level (m)	4.5
Intake Factor	0.1375

HEAD RATIO vs ELAPSED TIME



Permeability Calculations

Case	Range	k (m/s)
1	1 - 16	2.8E-05
2	1 - 5	6.5E-05
3	5 - 10	7.4E-05
4	6 - 12	6.0E-05

PERMEABILITY vs ELAPSED TIME

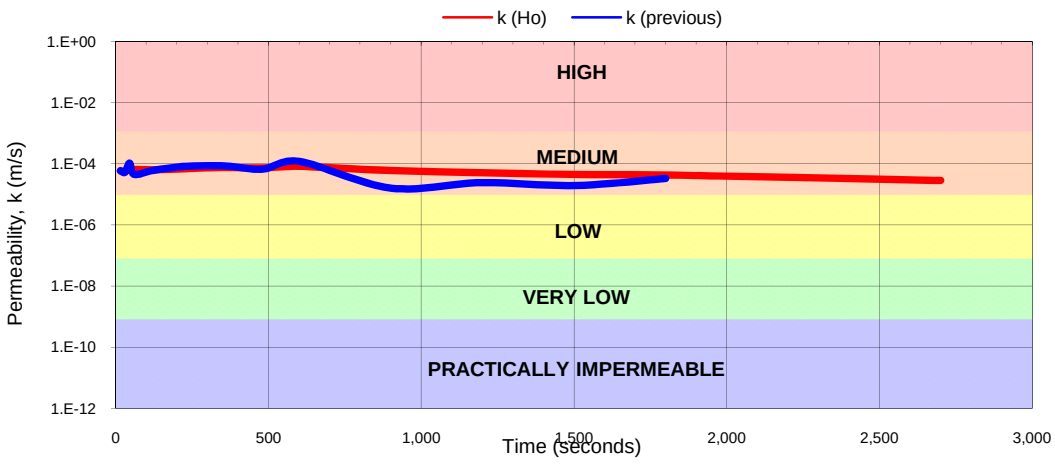


FIGURE 1

CLIENT: Orogen
PROJECT: Proposed Subdivision
LOCATION: Lot 6 Diamond Beach Road, Diamond Beach
SUBJECT: Falling Head Permeability Testing
JOB NO: GEOTTUNC01754AA

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

Borehole Number **BH3**

The method of calculation is outlined in BS5930:1999

Borehole/casing diameter	0.05	m
Elevation at borehole location	6.75	m,RL

$$k = \frac{A}{F(t_2 - t_1)} \ln\left(\frac{H_1}{H_2}\right)$$

where:
k = permeability of the soil
A = cross-sectional area of borehole or casing (m^2).
F = intake factor (refer to chart)
H_1 = variable head at time t_1
H_2 = variable head at time t_2

Depth below top of casing/standpipe to:

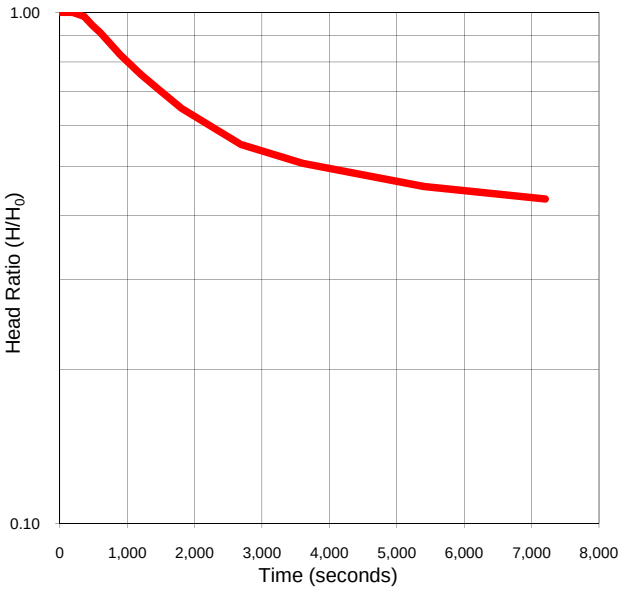
bottom of borehole	2	m
bottom of casing	2	m
height of casing above surface	0.88	m
initial ground water level	1.12	m

Intake Factor Case (b)

No.	Time (mins)	Time (secs)	Depth (m)	Water Level	Head (m)	H/H_0	k (m/s) (from H_0)	k (m/s) (previous)
1	0.0	0	2.72	4.91	-1.60	-1.43		
2	0.3	15	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
3	0.5	30	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
4	0.8	45	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
5	1.0	60	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
6	2.0	120	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
7	3.0	180	2.72	4.91	-1.60	1.00	0.00E+00	0.00E+00
8	4.0	240	2.71	4.92	-1.59	0.99	3.73E-07	1.49E-06
9	6.0	360	2.69	4.94	-1.57	0.98	7.51E-07	1.51E-06
10	8.0	480	2.63	5.00	-1.51	0.94	1.72E-06	4.64E-06
11	10.0	600	2.58	5.05	-1.46	0.91	2.18E-06	4.01E-06
12	15.0	900	2.44	5.19	-1.32	0.83	3.05E-06	4.80E-06
13	20.0	1200	2.33	5.30	-1.21	0.76	3.32E-06	4.14E-06
14	25.0	1500	2.24	5.39	-1.12	0.70	3.40E-06	3.68E-06
15	30.0	1800	2.16	5.47	-1.04	0.65	3.42E-06	3.53E-06
16	45.0	2700	2.00	5.63	-0.88	0.55	3.16E-06	2.65E-06
17	60.0	3600	1.93	5.70	-0.81	0.51	2.70E-06	1.32E-06
18	90.0	5400	1.85	5.78	-0.73	0.46	2.08E-06	8.25E-07
19	120.0	7200	1.81	5.82	-0.69	0.43	1.67E-06	4.47E-07

Length of open hole (m)	0.00
Depth of soil in casing (m)	1.12
Cross-sectional area (m^2)	1.96E-03
Groundwater level (m)	6.5
Intake Factor	0.1375

HEAD RATIO vs ELAPSED TIME



Permeability Calculations

Case	Range	k (m/s)
1	1 - 19	1.7E-06
2	1 - 5	0.0E+00
3	7 - 14	3.9E-06
4	7 - 19	1.7E-06

PERMEABILITY vs ELAPSED TIME

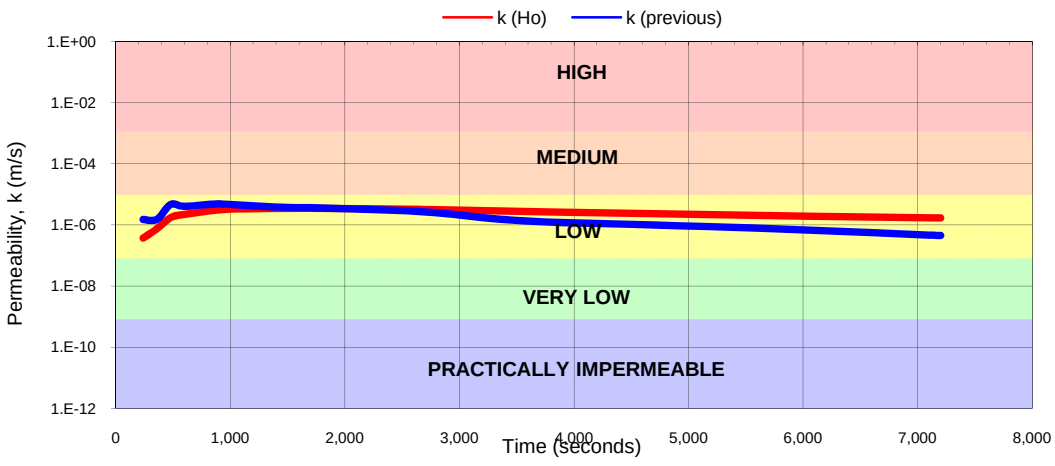


FIGURE 3