4 FLORA

The IHAP report issued by DECC (Bell 2008) and some public submissions identified flora species and vegetation communities that may require further investigation and assessment in relation to the proposal. In response to these concerns, additional field surveys were undertaken on 22 and 23 May 2008 to address issues in relation to threatened or significant flora habitat and vegetation community delineation including EECs.

The results of the field surveys and subsequent analysis have resulted in the modification, amendment and/or re-delineation of significant species and ecological communities on the Catherine Hill Bay site and these are discussed below.

4.1 Vegetation Removal / Retention at Catherine Hill Bay

Given the amended concept plan, areas of individual vegetation communities have been amended in Table 4-1 below and illustrated in Figure 4-1 overleaf. The following headings have been utilised within the Vegetation Removal Table.

The boundaries of vegetation communities were re-delineated during additional field surveys through further ground-truthing using a Differential GPS to mark out transitional areas for use during mapping.

'Vegetation Community' – Name of Vegetation Community which may be impacted upon by the proposal.

'TSC Act' – Provides the status of the species / community / population described with relation to the *TSC Act 1995.*

'EPBC Act' – Provides the status of the species / community / population described with relation to the *EPBC Act 1999.*

'Potential KTP' – Lists the Key Threatening Processes (KTP), which are listed within the *TSC Act 1995*, that have the potential to occur as a consequence of the proposal. These are as follows:

1. Loss of Hollow-bearing trees;
2. Clearing of native vegetation;
3. Human-caused climate change;
4. Infection of native plans by *Phytophthora cinnamomi*;
5. Invasion of native plant communities by exotic perennial grasses;
6. Removal of dead wood and dead trees;
7. Predation by the Feral Cat;
8. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
9. Invasion of Native Plant Communities by Bitou and Boneseed;
10. Exotic Vines and Scramblers; and
11. *Lantana camara*.

'Area in Development Estate (Ha / %)' – Displays the area of vegetation that will be removed as part of the development estate.

'Area Conservation Land (Ha / %)' – Displays the area of vegetation that will be conserved for each of the delineated vegetation communities.

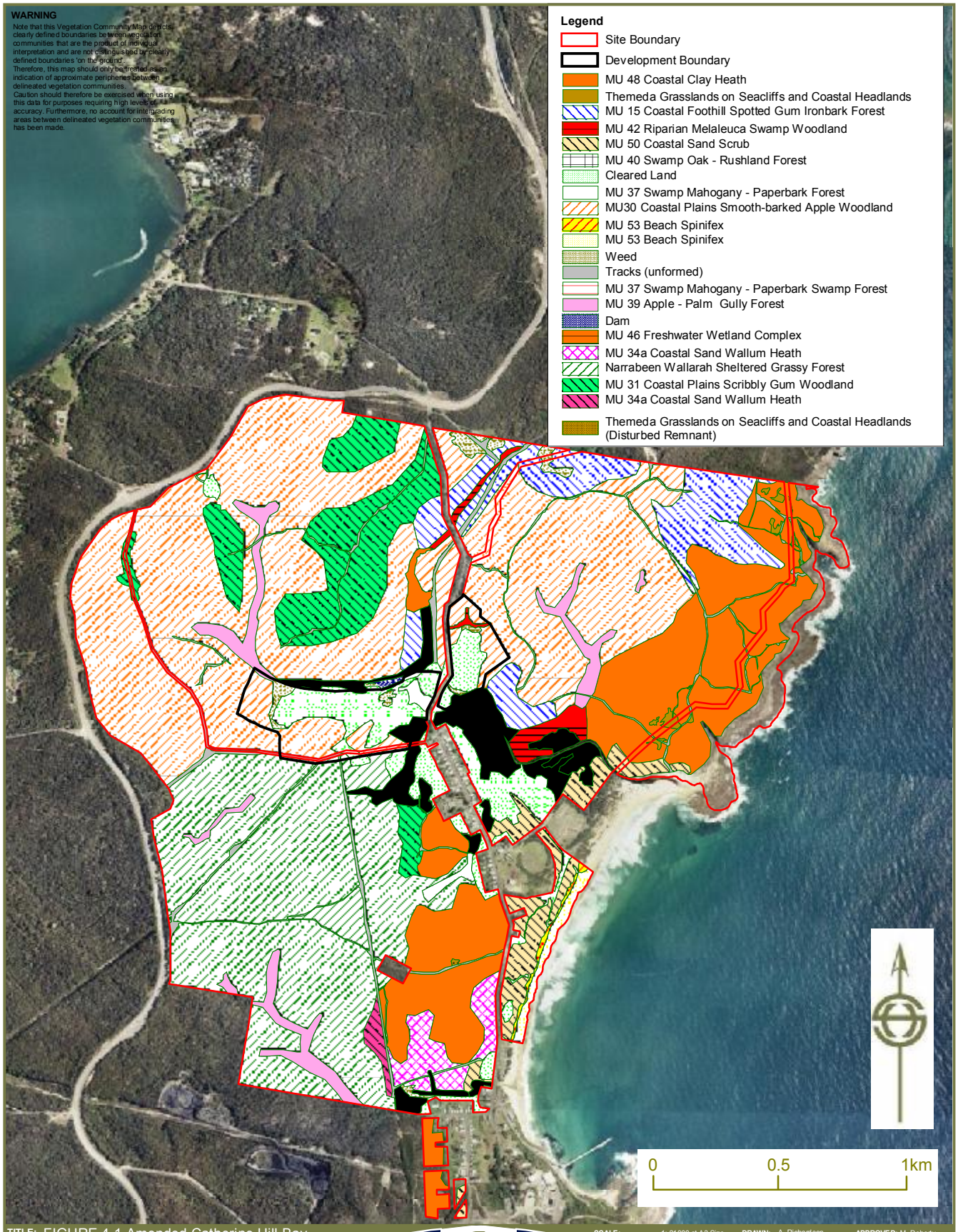
'Total Area' – Represents the total area of each vegetation community within the site, thus the sum of the preceding two columns.

'Comments' – Provides a brief discussion on the key characteristic of the vegetation where relevant.

Table 4-1: Catherine Hill Bay Vegetation Removal / Retention

Vegetation Community	1. TSC Act 2. EPBC Act 3. Other	Potential KTP	Vegetation Outcome (ha)		
			Area in Development Estate	Area in Conservation Land	Total Area
Coastal Plains Smooth-barked Apple Woodland		1-7, 9, 11	7.46 (6%)	124.3 (94%)	131.75
Narrabeen Wallarah Sheltered Grassy Forest		1-7, 9-11	0.53 (1%)	175.17 (99%)	175.7
Coastal Plains Scribbly Gum Woodland		9, 11	0	36.08 (100%)	36.08
Swamp Oak Rushland Forest	**EEC - SOFF**	**5, 7-9, 11**	**0**	**3.48 (100%)**	**3.48**
Swamp Mahogany – Paperbark Forest	**EEC - SSF**	**1-11**	**1.99 (10%)**	**18.03 (90%)**	**20.02**
Riparian Melaleuca Swamp Woodland	**EEC - SSF**	**5, 7-9, 11**	**0.33 (7%)**	**4.36 (93%)**	**4.69**
Coastal Foothills Spotted Gum - Ironbark Forest		7, 9, 11	0	31.68 (100%)	31.68
Freshwater Wetland Complex	**EEC - FRESHWATER WETLANDS**	**9, 11**	**0**	**1.47 (100%)**	**1.47**
Apple – Palm Gully Forest		1-4, 6, 9, 11	0.11 (1%)	13.97 (99%)	14.08
Coastal Clay Heath		1-5, 6, 9, 11	0	82.44 (100%)	82.44
Themeda Grassland on Seacliffs and Coastal Headlands	**EEC - TGSCH**	**2-4, 7, 9, 11**	**0**	**1.17 (100%)**	**1.17**
Coastal Sand Wallum Heath		9	0	8.62 (100%)	8.62
Coastal Sand Wallum Woodland		9	0	1.82 (100%	1.82
Coastal Sand Scrub		2-7, 9	0	14.28 (100%)	14.28
Beach Spinifex		9	0	1.01 (100%)	1.01
Weeds and Cleared Areas		3-9, 11	15.3948%)	16.35 (52%)	31.74
Dam		5, 9, 11	0	0.3 (100%)	0.3

*NOTE: The “Area in Development Estate” is based on the current masterplan, and should be viewed as a maximum figure. It is likely that some these figures will be reduced as a result of retention of areas of native vegetation within the final ‘development area.



TITLE: FIGURE 4-1 Amended Catherine Hill Bay Vegetation Map

CLIENT: COAL & ALLIED OPERATIONS PTY LTD

SCALE: 1: 21000 at A3 Size **DRAWN:** A. Richardson **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 20/8/2007

LAYOUT REF: P:\JOBS\24530 Hunter Valley\Darling\Ecology\Southern Lands\ALL WORKS\ACEB1 Addendum Report Figures\CHB\24530 FIG.4-1 VEGETATION MAP B-A3270808

CONTOUR INTERVAL: N/A

JOB REF: 24530-1

PLANNING SURVEYING ECOLOGY

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4.2 Additional EEC's and Assessment

4.2.1 Low Woodland with Heathland on indurated Sand at Norah Head

The IHAP report (DECC 2008) outlined that the Coastal Clay Heath vegetation community, in part, has some affinities with the EEC Low Woodland with Heathland on Indurated Sand at Norah Head. The reduction of the development layout has resulted in an increase of the Coastal Clay Heath vegetation by 5.68 ha. To this end no Coastal Clay Heath vegetation will be cleared for development under the amended proposal (Refer to Figure 3-1). It is difficult to determine if any of this EEC occurs within the Catherine Hill Bay area, however some of the headlands contain hard setting sand and vegetation to 3m in height. The Scientific Determination for Low Woodland with Heathland EEC, lists 33 flora species which occur within this community and 16 (48%) occur with Coastal Clay Heath at Catherine Hill Bay.

Bell (2002) investigated this community, within the Wyong LGA, and found that a number of vegetation units occurred where the original community was mapped, at Norah Head, by Payne and Duncan (1999). These include, Narrabeen Impeded Wet Heath, Narrabeen Doyalson Coastal Woodland, Coastal Sand Robusta-Paperbark Swamp Forest and Coastal Sand Wallum Heath-Scrub. The map unit from the Wyong Vegetation Mapping which is most relevant within Catherine Hill Bay vegetation is the Coastal Sand Wallum Heath-Scrub. Two variants have been described within this variant, the type variant which corresponds to the Coastal Sand Wallum Heath Vegetation Community which was mapped as such within the Catherine Hill Bay site. The second variant is the Norah Head variant which is described as occurring on indurated sands or where a thin mantle of sand overlies bedrock material and is primarily comprised of heath. This variant is described as being dominated by clay-based heath species such as *Melaleuca nodosa*, *Banksia oblongifolia* and *Callistemon linearis* and various sedges (Bell 2002). This vegetation community could occur within the conservation lands within the Coastal Clay Heath vegetation community as thickets of *Melaleuca nodosa* were noted within several of the drainage depressions within this community. Bell (2002) comments that this Norah Head community has similarities to other Aeolian sand deposits elsewhere in the region and that there is insufficient data to clarify how strong these similarities are. He does note that parts of the vegetation at Norah Head are unique to Wyong Shire, and that the community is restricted to the creeklines and drainage depressions.

It is the opinion of the author that it is highly probable that portions of this EEC occur within the Coastal Clay Heath vegetation community. However the extent of the community will need further investigation when clear delineation of the EEC has been determined. Due to the change in development layout, all of the Coastal Clay Heath vegetation community that occurs within Catherine Hill Bay will be retained as part of the proposal. No part of the development proposal adjoins any of the Coastal Clay Heath vegetation community and therefore it is considered highly unlikely that this EEC will be impacted upon by the proposal.

4.3 Regionally Significant Vegetation Communities

4.3.1 Narrabeen Wallarah Sheltered Grassy Forest

This vegetation community is considered to be regionally significant as it only occurs at the junction of Permian and Triassic geologies. This community was first described in 1998 and has been included in the Wyong LGA mapping by Bell (2002). This vegetation community only occurs on the Wallarah Peninsula and thus is considered regionally significant. The majority of this vegetation community is being retained as part of the proposal with only 0.53 ha (1%) being removed as part of the proposal. As 175.17 ha (99%) of this vegetation community will be retained as part of the proposal the impact is unlikely to be significant.

4.4 Significant Flora

Bell (2008) discussed several threatened flora species which were not addressed completely within the Environmental Assessment (RPS HSO 2007c) and these species are discussed in detail below.

4.4.1 Threatened Cryptic Orchid Species

Following the precautionary approach, areas of vegetation communities that have been known to support these cryptic orchids have been included in calculations of potential habitat within the Catherine Hill Bay lands.

Caladenia tessellata
Potential habitat for this species occurs within Coastal Plains Scribbly Gum Woodland, Coastal Plains Smooth-barked Apple Woodland and Narrabeen Wallarah Sheltered Grassy Forest. Approximately 7.99 ha (2%) of potential habitat for this species will be removed within the development estate. However, over 335.55 ha (98%) of habitat will be retained as part of the conservation lands. Thus, whilst it cannot be determined if this species is present within the development estate without numerous return surveys over many years, as there are large tracks of habitat to be retained within the conservation lands it is unlikely that the proposal will have a significant impact upon this species.

Caladenia porphyrea
Potential habitat for this species occurs within the coastal habitats of Coastal Clay Heath, Coastal Plains Scribbly Gum Woodland and Narrabeen Wallarah Sheltered Grassy Forest. Targeted surveys were undertaken within the development estate during the September flowering season for this species, with no individuals being located. During surveys, the similar species *Caladenia carnea* was checked when it was encountered to ensure it was not *C. porphyrea*. Approximately 0.53 ha (1%) of potential habitat for this species (Narrabeen Wallarah Sheltered Grassy Forest only) will be removed as part of the development proposal. However, over 293.84 ha (99%) of habitat for this species is being retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Cryptostylis hunteriana
Potential habitat for this species occurs within the Catherine Hill Bay site. This species was surveyed for within the 2007 flowering period using parallel searches in the development estate and no specimens were located. RPS HSO found a small population of this species on the edge of Narrabeen Doyalson Coastal Woodland (Coastal Plains Scribbly Gum Woodland) on adjacent lands to the south of the Coal and Allied lands within the Catherine Hill Bay locality in November 2007. Thus, this species was known to be flowering in 2007 and targeted surveys were undertaken within the Catherine Hill Bay development estate in late November 2007 with no specimens located. Potential habitat for this species occurs within Coastal Plains Scribbly Gum Woodland, Coastal Plains Smooth-barked Apple Woodland and Narrabeen Wallarah Sheltered Grassy Forest. Approximately 7.99 ha (2%) of potential habitat for this species will be removed for the proposal at Catherine Hill Bay. However over 335.55 ha (98%) of potential habitat for this species will be retained within the conservation lands at Catherine Hill Bay. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Diuris praecox
Two records from the NSW Atlas of Wildlife database for *D. praecox* occur within the Catherine Hill Bay lands. One record from 1998 occurs within the Coastal Plains Smooth-barked Apple Woodland to the west of the cleared areas within the Catherine Hill Bay development estate. A second record exists within the Narrabeen Wallarah Sheltered Grassy Forest in the Catherine Hill Bay conservation estate. However, DECC database atlas records are only accurate to ± 1 km and therefore it is difficult to determine the actual location of the records and whether the species actually exists within the development estates. Over six visits were made in the vicinity of records to try to detect *D. praecox* within the Catherine Hill Bay development estate, however, it is a difficult species to detect, as it does not necessarily flower every year.

Potential habitat exists for this species occurs within the Coastal Plains Smooth-barked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Coastal Foothills Spotted Gum Ironbark Forest and the Narrabeen Wallarah Sheltered Grassy Woodland vegetation communities within the Catherine Hill Bay lands. Targeted searches for *Diuris praecox* were conducted throughout the development estate during the flowering period for this species. No individuals of this species were located during any of the targeted searches. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate. However, over 367.23 ha (98%) of potential habitat for the species will be retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Genoplesium insignis
Potential habitat for this species occurs within Coastal Plains Scribbly Gum Woodland within the Catherine Hill Bay site. This vegetation community does not occur within the development estate at Catherine Hill Bay and therefore this species will not be impacted upon by the development and 36.08 ha of potential habitat will be retained within the Catherine Hill Bay conservation lands.

Microtis angusii
Potential habitat for this species occurs within Coastal Plains Scribbly Gum Woodland within the Catherine Hill Bay site. This vegetation community does not occur within the development estate at Catherine Hill Bay and therefore this species will not be impacted upon by the development and 36.08 ha of potential habitat will be retained within the Catherine Hill Bay conservation lands.

4.4.2 Regionally Significant Orchid Species

The following orchids which are listed in this section have not been listed under state (TSC Act) or federal (EPBC Act) legislation as threatened. However, these species have been addressed further to clarify their significance within the Catherine Hill Bay site.

Acianthus exertus
Jones (2006) describes this orchid as occurring in QLD, NSW, ACT and Victoria. It is widespread and locally common occurring in coastal areas in forest and woodlands on well drained soils. Jones (2006) also notes that this species rarely occurs with *Acianthus fornicatus,* which was found to be common in the forest and woodland communities within Catherine Hill Bay. Bell (2008) notes that there is a lack of records for this species along the coastal strip between Newcastle and the Hawkesbury River; however, Gunninah (2003) notes a record for this species at the Colongra Wetland near Doyalson. A submission to list an endangered population of

this species has been submitted to the Scientific Committee (Bell 2008), but at the time of writing, this endangered population has not yet been listed as either a preliminary or a final determination on the DECC web site. The location of this endangered population in the locality is also unknown in relation to published or informal literature at the time of writing. Potential habitat exists for this species occurs within the Coastal Plains Smooth-barked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Coastal Foothills Spotted Gum Ironbark Forest and the Narrabeen Wallarah Sheltered Grassy Woodland vegetation communities within the Catherine Hill Bay lands. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate with over 367.23 ha (98%) to be retained within the conservation lands. Thus, it is considered unlikely that the proposal will have a significant impact upon this species.

Genoplesium ruppii
One public submission reports that this species has been located within the Wallarah Peninsula, however, no location information was provided with this submission. This species has been recorded at Wyee Road in Wyong and several other records exist from Paterson in the lower Hunter Valley. No targeted surveys for this species in particular have been undertaken within the development estate. The habitat within which the species has been previously recorded varies from open grassland, heathlands (Gunninah 2003) to moist swampy forests (Jones 2006). Potential habitats within the Catherine Hill Bay site include, Narrabeen Wallarah Sheltered Grassy Woodland, Coastal Scribbly Gum Woodland, Coastal Plains Smooth-barked Apple Woodland and Coastal Foothills Spotted Gum Ironbark Forest. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate. However, over 367.23 ha (98%) of potential habitat for the species will be retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Pterostylis alveata* syn. *Diplodium alveata
There may be potential for this species to occur within the development estate at Catherine Hill Bay. It is generally found within Teatree heathland on sand dunes (Bishop 2000). Bell (2008) suggests that an endangered population nomination has been submitted for this species. At the time of writing this report no preliminary to final determination for this species or population has been listed on either the TSC Act or the EPBC Act. Sub-optimal habitat for this species occurs within the Coastal Sand Wallum Heath, Coastal Sand Wallum Woodland and Coastal Sand Scrub within the Catherine Hill Bay site. These vegetation communities do not occur within the development estate at Catherine Hill Bay and therefore this species will not be impacted upon by the development and 24.72 ha of potential habitat will be retained within the Catherine Hill Bay conservation lands.

Pterostylis daintreana* syn. *Pharochilum daintreanum
This species has been found along the edges of sandstone outcrops growing under healthy vegetation or in moss and lichen fringing this vegetation (Bishop 2001). Habitats such as these are common within the Hawkesbury sandstone vegetation communities in the vicinity of the Hawkesbury River. The Catherine Hill Bay site may contain some habitat for this species on the edges of the vegetation where it adjoins the conglomerate headlands. The majority of this type of habitat occurs within the Coastal Clay Heath vegetation community. This community will be retained within the Catherine Hill Bay conservation lands in its entirety and thus the proposal is unlikely to have a significant impact upon this species.

4.4.3 Regionally Significant Undescribed Cryptic Orchids

Bell (2008) identified several undescribed orchids which may have habitat within the Catherine Hill Bay site. These orchids have been discussed below.

Caladenia* sp. aff. *fuscata
This species has been reported from three locations on the Central Coast with records also from the Wallarah Peninsula (Bell 2008). This species has wider petals than the common species, *Caladenia fuscata*. *Caladenia fuscata* was not detected by RPS HSO during the vegetation surveys, however, as it is similar to *Caladenia carnea* it is possible that it occurs within the habitats within the Wallarah Peninsula and may have been overlooked during surveys due to similarities. Limited information is available on the habitat of this species to enable a full assessment of the suitable habitats for this species. Further taxonomic investigations are required to determine if this is indeed a new species. Thus a precautionary approach has been taken in this instance to assume that *Caladenia* sp. aff *fuscata* occurs within similar habitats to *Caladenia fuscata.* Potential habitats for this species within the Catherine Hill Bay area are considered most likely to be Coastal Plains Smooth-barked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Coastal Foothills Spotted Gum Ironbark Forest and Narrabeen Wallarah Sheltered Grassy Woodland. Approximately 7.99 ha (2%) of potential habitat will be removed within the Catherine Hill Bay development estate with over 367.23 ha (98%) to be retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Caladenia catenata* var. *'warnervalensis'
Records for this species occur on the Central Coast and have been reported from the Wallarah Peninsula (Bell, 2008). A nomination has been made for this species to be listed as endangered; however, at the time of writing this report a preliminary or final determination for this species had not yet been listed on either the TSC Act or the EPBC Act. Further taxonomic investigations are required to determine if this is indeed a new species. Thus a precautionary approach has been taken in this instance to assume that *Caladenia catenata* var. *'warnervalensis'* occurs within similar habitats to *Caladenia catenata.* Habitats within the Catherine Hill Bay area are most likely to be Coastal Plains Smooth-barked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Coastal Foothills Spotted Gum Ironbark Forest and Narrabeen Wallarah Sheltered Grassy Woodland. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate with over 367.23 ha (98%) to be retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Calochilus* sp. aff. *paludosus
This species has been identified as occurring on the Wallarah Peninsula; however, no information on the exact location is known (Bell 2008). The similar species *Calochilus paludosus* is common and occurs in open forest, woodland and heathland (Bishop 2001). *Calochilus paludosus* has not been recorded within the Catherine Hill Bay site and surveys were conducted during the flowering period for this species. Thus a precautionary approach has been taken in this instance to assume that *Calochilus* sp. aff. *paludosus* occurs within similar habitats to *Calochilus paludosus.* Potential habitats within the Catherine Hill Bay site are most likely to be Coastal Plains Smooth-barked Apple Woodland, Coastal Plains Scribbly Gum Woodland, Coastal Foothills Spotted Gum Ironbark Forest and Narrabeen Wallarah Sheltered Grassy Woodland. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate with over 367.23 ha (98%) to be retained

within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

Diuris* sp. aff. *alba
Bell (2008) reports that this species has been recorded at several locations on the Central Coast and at Chain Valley Bay and Gwandalan. Little information is available on the description of this taxon and thus it is difficult to determine if this species is present. Thus a precautionary approach has been taken in this instance to assume that *Diuris* sp. aff *alba* occurs within similar habitats to *Diuris alba.* Potential habitat for this species within the Catherine Hill Bay site is most likely to be Coastal Plains Scribbly Gum Woodland. This vegetation community does not occur within the development estate at Catherine Hill Bay and therefore this species will not be impacted upon by the development and 36.08 ha of potential habitat will be retained within the Catherine Hill Bay conservation lands

Diuris* sp. aff. *aurea/Diuris* sp. aff. *chrysantha
The Taxonomy of this species is currently under investigation as it is unknown if the affinities of this species is closer to *Diuris aurea* or *Diuris chrysantha* (Bell 2008). This species has been recorded in the local area including Gwandalan, Chain Valley Bay, Charmhaven, Warnervale, Munmorah and Norah Head (Gunninah 2003). As taxonomy of this species has not yet been determined for this species habitat has been assumed to be as for *Diuris aurea. Diuris aurea* was recorded within the Themeda Grassland on Coastal Headlands, Coastal Clay Heath and Narrabeen Wallarah Sheltered Grassy Woodland. Other vegetation communities which are present within the Catherine Hill Bay site which are considered to be potential habitat include Coastal Scribbly Gum Woodland, Coastal Plains Smooth-barked Apple Woodland, Coastal Foothills Spotted Gum Ironbark Forest. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate with over 450.84 ha (98%) to be retained within the conservation lands. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species

Thelymitra* sp. aff. *purpurata
This species shows affinities to both *Thelymitra purpurata* and *Thelymitra ixioides.* Neither of these common species have been located within the Catherine Hill Bay site. However, potential habitat and records exist for *Thelymitra ixioides* in the locality. Thus, a precautionary approach has been taken in this instance to assume that *Thelymitra sp. aff. purpurata* occurs within similar habitats to *Thelymitra ixoides.* Potential habitats within the Catherine Hill Bay site include, Narrabeen Wallarah Sheltered Grassy Woodland Coastal Scribbly Gum Woodland, Coastal Plains Smooth-barked Apple Woodland and Coastal Foothills Spotted Gum Ironbark Forest. Approximately 7.99 ha (2%) of habitat will be removed within the Catherine Hill Bay development estate with over 367.23 ha (98%) to be retained within the conservation lands at Catherine Hill Bay. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

4.4.4 Pultenaea maritima

This species has previously been detected on a headland to the north of Pinny Beach. Potential habitat for the species occurs within Coastal Clay Heath within the Catherine Hill Bay site. Searches for this species were conducted by RPS HSO on the headlands and grassy areas within the Catherine Hill Bay site whilst undertaking vegetation surveys in late 2007. Two individuals located on the headlands in the north eastern portion of the conservation lands were suspected to be *Pultenaea maritima* and were sent to the Royal Botanic Gardens in Sydney for identification. The Royal Botanic Gardens in Sydney identified these two individuals as *Pultenaea*

villosa (see Appendix A). Further searches utilising the random meander technique across the headland did not result in the location of any further individuals suspected to be *Pultenaea maritima.* As outlined in section 3.1 of this report, amendments to the development layout (removal of development precinct C) have resulted in all of the Coastal Clay Heath vegetation community being retained as part of the conservation lands at Catherine Hill Bay. Whilst this species cannot be discounted as occurring within the conservation lands as targeted parallel searches have not been conducted all of the potential habitat (82.44 ha) for this species will be retained. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

4.4.5 Rutidosis heterogama

The potential for the existence of this species within the Coastal Clay Heath vegetation community within the Catherine Hill Bay site has been raised as an issue during the public consultation process. As outlined in section 3.1 of this report amendments to the development layout (removal of development precinct C) have resulted in all of the Coastal Clay Heath vegetation community being retained as part of the conservation lands at Catherine Hill Bay. Bell (2008) notes that this species tends to disappear from the above ground flora for months at a time and despite searches for the species during flora surveys, it is difficult to discount the possibility of this species occurring within the Coastal Clay Heath vegetation community at Catherine Hill Bay. Whilst this species cannot be discounted as occurring within the conservation lands, all of the potential habitat (82.44 ha) for this species will be retained. Therefore, it is considered unlikely that the proposal will have a significant impact upon this species.

4.4.6 Tetratheca juncea

Given the reduced development proposal at Catherine Hill Bay, the total number of *Tetratheca juncea* plant clumps to be impacted upon by the proposal will be reduced. A total of 8,013 *Tetratheca juncea* plant clumps were located during the targeted surveys within the Catherine Hill Bay site (Figure 4-2 shows the distribution). Of these 7,596 (95%) will be retained within the proposed conservation estate, whilst, 417 (5 %) are located within the proposed development estate thus will be removed under the proposal. Furthermore, it is estimated that 350 ha of potential *T. juncea* habitat, within the Catherine Hill Bay site, remains to be surveyed. It is considered that this population is significant due to the large size of the population and the likely high content of genetic diversity. Other similar sized *T. juncea* counts of 25,000 have been located within other areas of the Wallarah Peninsula by Conacher Travers (2007). Of these other plant clumps, over 9,900 have been conserved within Wallarah National Park, with more individuals to be retained within the bush parks of the Murrays Beach development estates.

In conclusion, it is estimated that the population within the Wallarah Peninsula is at least 49,000 plant clumps to date (RPS HSO (2007c, 2007d) and Conacher Travers (2007) data combined). Table 4-2 is a breakdown of the surveyed numbers of *Tetratheca juncea* currently within established and proposed conservation reserves. This number is expected to be an underestimation with less than half of the habitat for this species surveyed at Catherine Hill Bay as previously mentioned. Furthermore there are still some areas to be surveyed in the conservation lands at Gwandalan and Nords Wharf. In addition to these populations, Wildthing (2003) located further populations of *Tetratheca juncea* within Catherine Hill Bay area and the lands to the south of Nords Wharf. Thus whilst the population within the development estate is

large, over 95% of the *T. juncea* recorded within the Catherine Hill Bay site will be conserved within the conservation lands. Within the Wallarah Peninsula this will increase the current known conservation of *Tetratheca juncea* numbers from 10,225 (Conacher Travers 2007, Payne (2000)) to over 30,000. Thus the removal of less than 1% of the total recorded Wallarah Peninsula population as a result of the Catherine Hill Bay development estate is unlikely to have a significant effect upon the Wallarah Peninsula *T. juncea* population. Such a large number of known plants protected in several disjunct but proximate conservation areas as shown in Table 4-2 bodes well for the long term security of the species in this locality.

Table 4-2: Known Distribution of *Tetratheca juncea* within the Wallarah Peninsula within Conservation Reserves

Site at Wallarah Peninsula	**Numbers of *Tetratheca juncea***
Wallarah National Park and Habitat Corridor at Murrays Beach*	9900
Munmorah State Conservation Area**	296
Lake Macquarie State Conservation Area**	29
Catherine Hill Bay Proposed Conservation Lands	7,596
Gwandalan Proposed Conservation Lands	8,222
Nords Wharf Proposed Conservation Lands	5,933
Total in Conservation Reserves at Wallarah Peninsula	**31,976**

* Data from Conacher Travers (2007)
** Data from Payne (2000)

TITLE: Figure 4-2 Catherine Hill Bay
Distribution of *Tetratheca juncea*

CLIENT: Coal & Allied Operations Pty Ltd

PLANNING SURVEYING ECOLOGY

SCALE: 1: 7000 at A3 Size DRAWN: S. Bishop APPROVED: M. Doherty

DATUM: MGA Zone 56 (GDA 94) DATE: 23/06/2008

LAYOUT REF:J:\JOBS\24k\24630 Hunter Valley\Drafting\Ecology\Southern Lands\ALL WORKSPACES \Addendum Report Figures\CHB\24630 CHB Fig 4-2 Distribution of TJ A3 270808

CONTOUR INTERVAL: N/A

JOB REF: 24530-1

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4.5 Groundwater Dependent Ecosystems

The potential presence of Groundwater Dependent Ecosystems (GDE's) within the Southern Lands was raised by DEWHA during the consultation stage of the project and is addressed in the following discussion.

GDE's is a broad definition covering all ecosystems which are dependent upon groundwater either permanently or occasionally to survive (DLWC, 2002). Several of the vegetation communities on the Catherine Hill Bay site have been identified as GDE's (Refer to Figure 4-3). Identification GDE's depends upon the location of the vegetation communities in relation to groundwater. GDE's are typically the communities which are located in drainage depression, swamps and creeklines, where groundwater comes up to the surface.

Douglas Partners (2008) have undertaken groundwater and soil studies within the Catherine Hill Bay development estate and surrounding area (Douglas Partners 2008). The alluvial soils which have been mapped by Douglas Partners (2008) surround Middle Camp Gully which is the main creekline which flows generally from west to east into the Pacific Ocean. These alluvial soils are expected to contain unconfined aquifers perched above the less permeable underling residual soils and rock. The source of recharge to the aquifers is from surrounding surface runoff and direct rainfall, with recharge from residual soils to be minor (Douglas Partners 2008). The majority of the development estate occurs on residual soils, thus currently recharge to the aquifers from within the development estate is likely to be minor. However, surface runoff from Development Estate A will recharge the aquifer that occurs to the south within the alluvial soils of Middle Camp Gully. The vegetation communities located within Middle Camp Gully would be dependent upon this aquifer for a water source include Swamp Mahogany Paperbark Forest, Riparian Melaleuca Swamp Woodland and Swamp Oak Rushland Forest. Whilst only the Swamp Mahogany Paperbark Forest occurs within the development estate, the two remaining vegetation communities occur downstream and Douglas Partners (2008) note that groundwater will flow with the fall of the gully. In times of low rainfall, groundwater may provide base flow back into the gully and help maintain water levels. This base flow would be a vital water resource for these wetter vegetation communities to survive drought periods. Thus it is vital to ensure that surface water flow rates within Middle Camp Gully are maintained to ensure the survival and maintenance of ecosystem function of the GDE's downstream of the development estate.

The northern portion of the Riparian Melaleuca Swamp Forest located within Development Estate A is located in a shallow gully over residual soils and the presence of this moist community is likely to be attributed to surface runoff rather than any groundwater dependence (Douglas Partners, 2008). The Apple Palm Gully Forest vegetation community is located in a shallow gully over residual soils and the presence of most of this community is likely to be a result of surface runoff rather than groundwater dependence. However, in the north western portion of Development Estate B, this vegetation community occurs within alluvial soils which contains perched aquifers and as such is likely to be dependent upon groundwater. The Freshwater Wetland Complex does not occur within development estate and will not be affected by the proposal; however, it is most likely that this community occurs within alluvial soils (broad scale mapping by Murphy 1993) and therefore would be dependent upon groundwater.

GDE's have been classified into several different types according to DLWC (2006). These classes take into consideration aquifer, ecological and geomorphic types. The GDE's that have been identified on this site include Freshwater Wetland Complex, Swamp Mahogany - Paperbark Forest, Riparian Melaleuca Swamp Woodland, Apple – Palm Gully Forest and Swamp Oak- Rushland Forest (as shown in Figure 4-3).

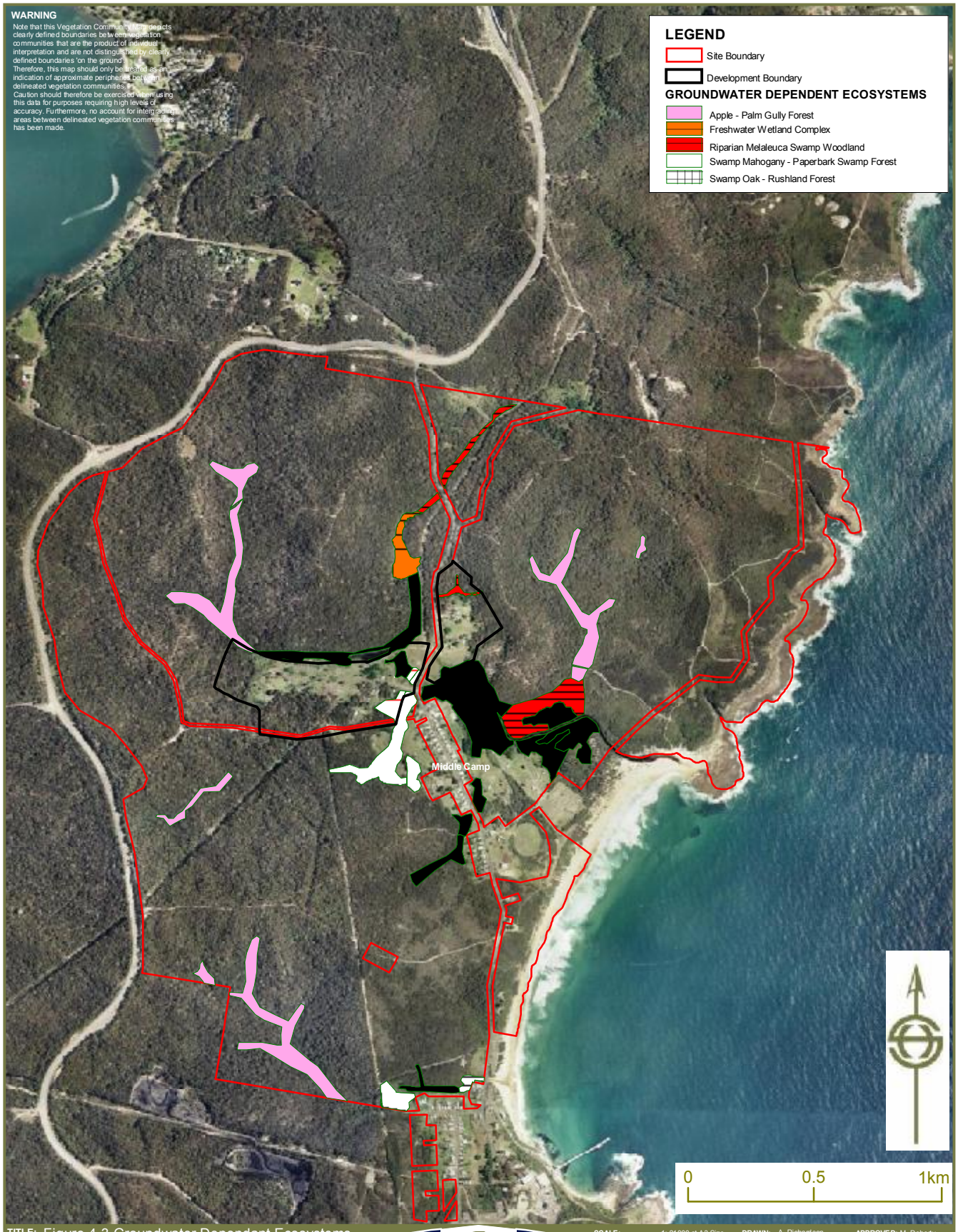
Table 4-3 below outlines the GDE types, classes and sub-classes which occur within the Catherine Hill Bay Site.

Table 4-3 GDE's Types and Classes

Vegetation Community at CHB	GDE TYPE	Class	Description of Class	Habitat
Freshwater Wetland Complex	Wetlands (W)	W6	Permanent Freshwater Pond	Epigean
Swamp Mahogany – Paperbark Forest	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Riparian Melaleuca Swamp Woodland	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Apple – Palm Gully Forest	Riparian & Terrestrial Vegetation (T)	T1	Riparian Vegetation Community	Terrestrial
Swamp Oak Rushland Forest	Marine Estuarine Habitats (M)	M4	Tidal Freshwater swamp forests	Epigean

If existing surface water flow rates are maintained there will be minimal impact upon the GDE's present within the Catherine Hill Bay. As recommended by Douglas Partners (2008) this can be achieved by appropriate water sensitive design via the provision of surface water detention basins or swales to limit peak flows.

In conclusion several of the vegetation communities within the Catherine Hill Bay development estate have been classed as GDE's. However, it must be noted that whilst some communities are generally reliant on surface water runoff, when groundwater is available these communities would utilise this water source for their moisture requirements.



TITLE: Figure 4-3 Groundwater Dependant Ecosystems
Catherine Hill Bay

CLIENT: COAL & ALLIED OPERATIONS PTY LTD

PLANNING SURVEYING ECOLOGY

SCALE: 1: 21000 at A3 Size DRAWN: A. Richardson APPROVED: M. Doherty

DATUM: MGA Zone 56 (GDA 94) DATE: 05/8/2008

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\Southern Lands\ALL W ORKSPACES.GDE Figures\24530-1 CHB Veg Comms A.A3

CONTOUR INTERVAL: N/A

JOB REF: 24530-1

HARPER SOMERS O'SULLIVAN

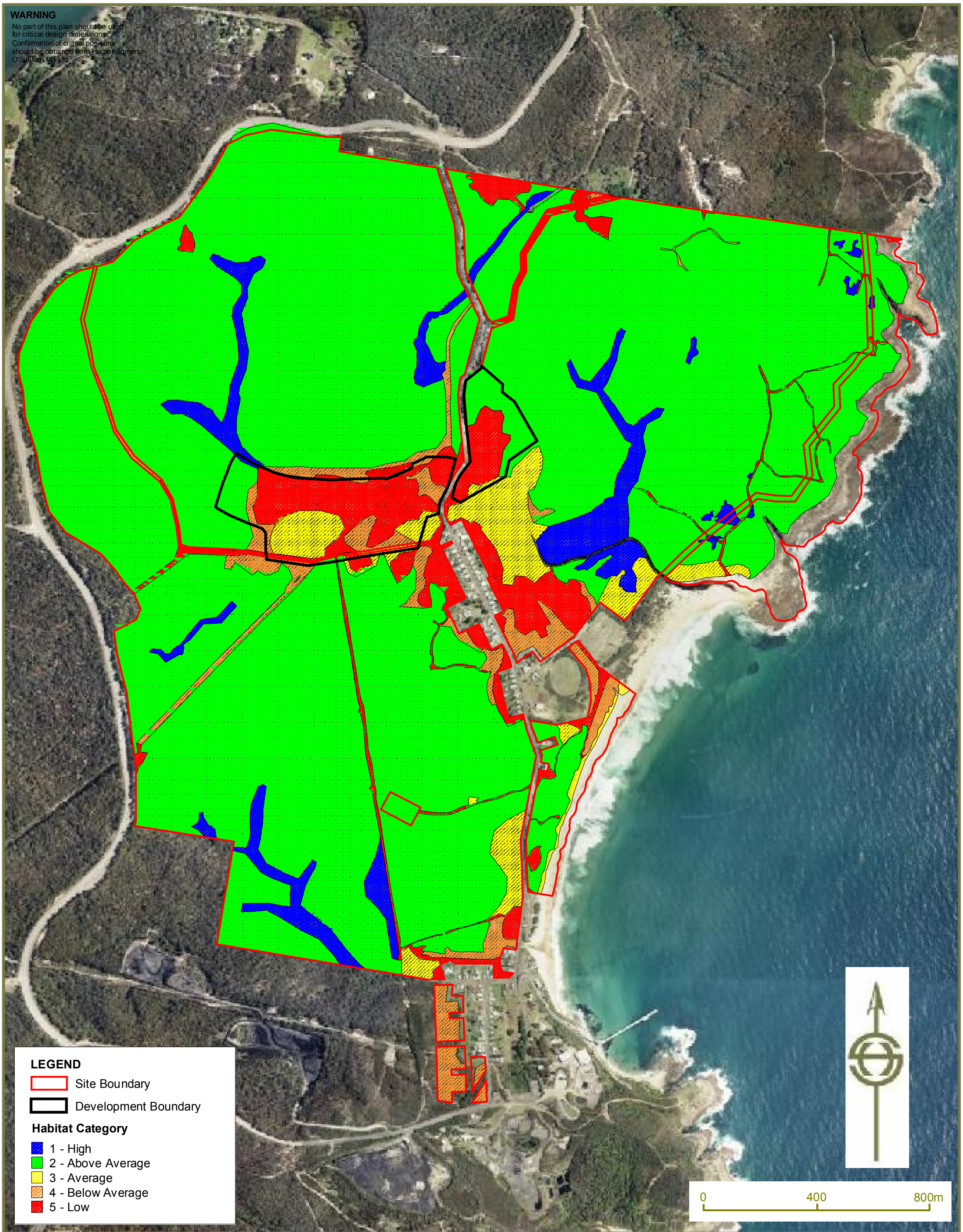
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

5 HABITAT

Table 5-1 outlines the quality of habitat that will be removed as part of the proposal and Figure 5-1 shows the habitat quality within the Catherine Hill Bay site. The habitat to be removed / retained has been revised to reflect the updates and amendments outlined throughout this report.

Table 5-1: Habitat Removal / Retention Catherine Hill Bay

Habitat	Area in Development Estate (ha)	Area in Conservation Lands (ha)
1 – High	0.11	25.96
2 – Above Ave	5.79	458.50
3 – Average	4.79	17.09
4 – Below Ave	3.07	17.96
5 – Low	14.75	24.92
TOTALS	**28.51**	**544.43**



TITLE: Figure 5-1 Habitat Map
Catherine Hill Bay

CLIENT: Coal & Allied Operations Pty Ltd

SCALE:	1: 12000 at A3 Size	DRAWN: S. Bishop	APPROVED: M. Doherty
		DATUM: MGA Zone 56 (GDA 94)	DATE: 22/8/2007

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Drafting\Ecology\Southern Lands\ALL WORKSPACES \Addendum Report Figures\CHB\24530 FIG.5-1 amended HABITAT MAP A-A3270808

CONTOUR INTERVAL: N/A

JOB REF: 24530

HARPER SOMERS O'SULLIVAN
PLANNING SURVEYING ECOLOGY
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

6 FAUNA

In response to public concerns over survey effort and potential habitat for a number of threatened fauna species, additional field surveys were undertaken to supplement previous fauna surveys that have been undertaken across the Southern Lands and which have been discussed within the previously submitted EAR (RPS HSO 2007c). The fauna survey methods and outcomes undertaken within the Catherine Hill Bay site are discussed below.

6.1 Targeted Swift Parrot Surveys

Lathamus discolor (Swift Parrot) occurs in south-eastern Australia within a well-defined seasonal migratory regime. The whole population occurs within Tasmania from spring to autumn and it is during their Tasmanian residence that the species breeds. From autumn to spring the Swift Parrot is a nomadic species and disperses into the south-eastern mainland where it roams widely in search of foraging opportunities. During its northward movements the species is attracted to winter-flowering *Eucalyptus* sp. and related species for their blossom, but they also forage for lerps where infestations occur. Forests occurring within the Catherine Hill Bay Conservation and Development Estates contain potential foraging resources for *L. discolor*, including two winter flowering tree species, being *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia maculata* (Spotted Gum) as well as a small number of other tree species for which flowering times coincide with at least part of the Swift Parrot's northern movements. Within forested areas occurring on the Central Coast, some sclerophyllous tree species have been noted as a source of lerps for the Swift Parrot (RPS HSO ecologist pers. obs.). A number of habitats occurring within both proposed Conservation and Development Estates contain tree species carrying lerps, which in some areas is identified by the presence of Bell Miners. The lower drainage lines that traverse the Catherine Hill Bay Conservation and Development Estates contain Swamp Sclerophyll assemblages dominated by *E. robusta*, while northern Conservation Estate lands contain stands of *C. maculata*. Both of these winter-flowering species are known feed tree species for Swift Parrots and another threatened Central Coast visitor the Regent Honeyeater.

Methods

Swift Parrot surveys were undertaken within proposed Conservation Lands and Development Estates June 2008. The survey period coincided with known Swift Parrot movements into south-eastern Australia. Surveys encompassed two different methodologies to ensure adequate coverage of potential Swift Parrot habitat was made, and included:

- Targeting of small discrete vegetation community areas containing potential foraging species, such as occur in riparian zones; and

- Traverses through more widespread foraging habitat to locate indicators (foraging aggregations of Honeyeaters / Lorikeets or the presence of blossom) that specific areas may have the potential to attract Swift Parrots during the current season.

As a component of the survey and in lieu of surveys across the entire Swift Parrot season, habitat evaluation was also undertaken to determine if and where the most favourable areas of potential Swift Parrot habitat occur across the Coal and Allied Lands.

Results

The Conservation and Development Estates of the Catherine Hill Bay site encompass lower drainage lines that are flanked by riparian habitats. Swamp forest habitats containing *E. robusta* occur on lower drainage flats in the Conservation Estate and represent relatively linear areas of potential foraging habitat for Swift Parrots. Surveys conducted in June 2008 found that *E. robusta* blossom was in short supply, although these forests are likely to represent local resources for Swift Parrots and other nectivorous birds during seasons when *E. robusta* is blossoming strongly. Observation of nectivorous bird species during the June 2008 survey were limited to sedentary honeyeater species.

Discussion

Although no Swift Parrots were observed within the Catherine Hill Bay site during the June 2008 survey these results are not considered to be a representative indication of the capacity of these lands to support the Swift Parrot or indeed Regent Honeyeaters on at least an intermittent basis. The movements of these species are determined by the distribution of foraging resources and as such their presence within the site in some years cannot be discounted. Although there have been small numbers of Swift Parrots occurring in eastern Lake Macquarie during the 2008 season, there have been few Swift Parrot records within the region compared with previous years and no Regent Honeyeaters during the 2008 winter period apart from a small number of records in the Quorrobolong area in early August.

Summary Statement

Swift Parrot surveys were undertaken during June 2008 within both the conservation lands and development estates to coincide with the annual winter migration of the species into mainland Australia. Whilst no Swift Parrots were recorded within the Catherine Hill Bay site during surveys, the conservation lands were found to contain suitable foraging trees for the species. Habitat assessment during field investigations found that the development estate lacked feed tree habitats and as such the species was considered unlikely to occur within the development estate.

7 CONCLUSION

The additional ecological studies discussed within this Addendum Report have supplemented the detailed information presented within the EAR (RPS HSO 2007c) in addressing the potential impacts of the proposal on threatened species, populations and EECs listed under the TSC Act. The development of a small portion of the site will provide a mechanism for adequate ecological outcomes within the proposed conservation lands for the vast majority of species and communities contained therein. The quantum of the offset lands, when viewed holistically with proximate existing and proposed conservation reserve areas, provides a robust long-term outcome for all species and communities. The analyses presented within this Addendum Report provide further quantification of the proportions of EEC and threatened species habitat to be protected within the conservation lands compared to that impacted within the development estate.

The field and desktop studies have expanded on the following parameters of ecological significance within both the conservation lands and the development estate:

- native vegetation commensurate with those listed as EEC's;
- threatened and significant flora species recorded within and adjacent to the proposed development;
- threatened fauna species recorded within and adjacent to the proposed development;
- habitat for threatened flora and fauna species known from within and adjacent to the proposed development; and
- other areas containing native vegetation with varying degrees of modification / degradation.

Given that additional measures have been taken to avoid ecological impacts and that where native vegetation may be affected, efforts have been made to avoid particularly sensitive areas where practical, it is considered unlikely that any significant impacts would occur upon threatened species, communities or populations. The large areas of conservation lands that have been set aside as part of the development provide excellent ecological outcomes across the site. As a result of conservation of these offset lands, a large vegetation corridor will be conserved stretching from Gwandalan in the south and linking up with Wallarah National Park in the north. These conservation lands will link three conservation areas of Lake Munmorah State Conservation Area, Lake Macquarie State Conservation Area and Wallarah National Park. This large tract of native vegetation will provide habitat for a wide variety of common and threatened native flora and fauna species.

Therefore, it has been concluded that the proposed development will not significantly impact upon threatened or regionally significant flora and fauna, ecological communities or populations listed under the TSC act. The implementation of operative environmental management practices should also ensure that the overall ecological impact of the project is minimised.

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APPENDIX A Letter from Royal Botanical Gardens Sydney

ROYAL BOTANIC GARDENS SYDNEY

Mr Sam BISHOP
Harper Somers O'Sullivan
PO Box 428
Hamilton, NSW 2303
AUSTRALIA

Inquiry No: 12820
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph No: (02) 9231 8111
Date: 9 August 2007

Dear Mr BISHOP,

In reply to your inquiry of 01-Aug-07 the following information is supplied:

Your ref: 24530:DL:SB

Your plant specimen from Catherine Hill Bay is *Pultenaea villosa*, "Hairy Bush-pea"

An invoice for $27.50 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Thank you for your inquiry.

Yours sincerely

Barbara Wiecek
Identification Botanist
Botanical Information Service

APPENDIX B Qualification of Personnel

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Craig Anderson
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Director - Environment
Qualifications / Memberships:	Bachelor Applied Science (Environmental Assessment & Management) University of Newcastle, NSW (1994) Currently undertaking Graduate Diploma in Archaeological Heritage through UNE Ecological Consultants Association of NSW (ECA) Planning Institute of Australia (PIA) Frog and Tadpole Study Group (FATS) Hunter Birds Observers Club (HBOC) Committee Member 2008 Bird Observers Club of Australia (BOCA) Hunter Heritage Network (HHN) RFS/PIA NSW Consulting Planners Bushfire Training

Areas of Expertise:

- Production of complex ecological impact assessment documents
- Detailed understanding of environmental legislation
- Conflict resolution and environmental impact mediation
- Land and Environment Court hearings
- Flora, habitat, and fauna surveys including threatened species
- Bushfire Threat Assessment & Management reporting
- Project Management (including areas outside environmental concern)

Experience Includes:

Craig is the Director of the Environment Division at RPS HSO, and has over 14 years experience in a wide range of environmental consulting. He has undertaken and managed commissions for a diverse range of projects, including State Significant Developments such as the Hunter Economic Zone (HEZ).

Extensive background in ecological field surveys, encompassing all aspects of flora and fauna identification, targeted surveying and mapping. Involved in the initial formulation of an Association of Consulting Ecologists for NSW in 1998. Elected member on the Inaugural Council (served two terms). Has acted as an expert witness in several Land and Environment Court matters relating to ecology and bushfire assessment. An experienced negotiator of ecological / development outcomes, and has a detailed understanding of legislation related to ecological matters. Craig has been actively involved in representations to the Department of Environment on behalf of the NSW Urban Taskforce in regards to proposed changes to the NSW Threatened Species Conservation Act.

Craig has also been involved in submissions on bushfire legislation and represented industry groups such as the NSW Urban Taskforce and Urban Development Institute of Australia (UDIA) on matters relating to issues such as the proposed listing of the Lower Hunter Spotted Gum – Ironbark Forest (LHSGIF) as an endangered ecological community, and regional environmental biodiversity strategies. Craig has also recently provided advice and submission material to the UDIA in relation to the Native Vegetation Act 2003 and the operations of the Catchment Management Authority (CMA).

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Matthew Doherty
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Environmental & GIS Manager
Qualifications / Memberships:	BLMC (Land & Water Conservation Major) Bush Regeneration Cert II Spikeless Tree Climbing Techniques NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Project Design & Management
- Environmental Impact Assessment and Reporting
- Liaison and Mediation with Clients, Stakeholders & Governing Bodies
- Archaeological (European/ Aboriginal Heritage) coordination and negotiation
- Expert GIS/ GPS for Project Design and Mapping
- Ecological Flora, Fauna & Habitat Surveys (Terrestrial & Aquatic)
- Tree Climbing to Install, Monitor and Maintain Supplementary Habitat (Nestboxes)

Experience Includes:

Matthew has eight years experience in the ecological consulting industry with key skills in project management, survey design and GIS. In his position as Environmental and GIS Manager, Matthew manages the day to day running of projects, verification of reports and other outputs and ensures clients are well informed of project progress and key findings. Matthew's background in local and state government and private consultancy gives him a high level of appreciation of the development sector and allows him to take a pragmatic approach to providing successful conservation and development outcomes.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Deborah Landenberger
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist/ Botanist
Qualifications / Awards	B. Sc (Hons – First Class) NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority
Memberships:	Australian Plant Society Australian Network for Plant Conservation Australasian Native Orchid Society

Areas of Expertise:

- Flora identification and habitat assessment
- Targeted threatened flora surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Threatened Flora Management Plans
- Experience in PATN Statistical package
- Ecological Monitoring and Reporting
- Vegetation and Bushland Management Plans
- Project Management and quote preparation
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Deborah Landenberger has broad range of Ecological Assessment reporting experience underpinned by over 10 years of ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Debbie has a strong grounding in threatened flora species ecology and vegetation mapping ranging from the South Coast of NSW to Guyra in the north west and Port Macquarie on the north coast of NSW.

Debbie's strong botanical interests have been central in a number of important projects, these include major vegetation mapping projects in the south of Lake Macquarie, Minmi to the west of Newcastle, Ben Lomond (near Guyra), Oberon, North Arm Cove, Singleton and Bulahdelah. Her knowledge of non-parametric statistics, such as PATN statistical program has enabled RPS HSO to undertake large mapping projects using sound scientific methodology. Her knowledge of threatened flora species includes 2 years research on the threatened flora species *Tetratheca juncea.* Debbie's wide ranging knowledge and experience of Australian flora is a vital part of RPS HSO's ability to meet the consultation and regulatory needs of the development community.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Sam Bishop

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships: B. Env. Sc. (EAM)

Member of the Fire Protection Association Australia (FPA)
Society of Frogs & Reptiles (SOFAR)
Hunter Bird Observers Club (HBOC)
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Conducting Field Surveys for Flora, Fauna and Habitat Identification.
- Flora identification and targeted threatened flora species searches
- Geographical Information Systems project design and mapping
- Report Preparation including Threatened Species Assessment, Endangered Ecological Communities assessment, and Vegetation Management Plans
- Detailed understanding of environmental legislation and threatened flora species issues
- Bushfire Threat Assessment & Management reporting
- Bushfire Risk Management Plans
- Fuel Management Plans
- Tree Clearance Supervision and Fauna Handling
- Nestbox Installation & Maintenance

Experience Includes:

Sam has over 3 years experience as an ecological and bushfire consultant, working on projects across NSW. Sam has designed and undertaken flora and fauna surveys including targeted surveys for threatened flora species within the Hunter, Central Coast and Tablelands regions. Additionally, Sam has undertaken assessments of vegetation to meet Native Vegetation Act requirements. Key experience includes assessment of derelict mines for DPI for rehabilitation purposes.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Anna McConville
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist
Qualifications / Memberships:	B.Env. Sc. M.Phil. (Env. Sc.) Candidate "The Ecology of the East Coast Freetail Bat (*Mormopterus norfolkensis*) in the Hunter Region" Member of the Australasian Bat Society Member of the Royal Zoological Society of Australia Member of the Wildlife Preservation Society of Australia

Areas of Expertise:

- Terrestrial Flora and Fauna Surveys
- Targeted threatened flora and fauna surveys
- Ecological impact assessment and reporting
- Ecological condition and threatened species monitoring
- Geographic Information Systems mapping and analyses
- Detailed understanding of legislation and threatened species issues

Experience Includes:

Anna has over three years experience as an ecological consultant across the Hunter, Central Coast and North Coast regions of NSW. Anna is experienced in designing and conducting flora and fauna surveys for environmental impact assessment and ecological monitoring. Key experience includes large infrastructure projects such as Pacific Highway Upgrades, ecological constraints and opportunities investigations for local environmental studies and implementation of ecological monitoring programs. Anna has also recently undertaken Biodiversity Certification and BioBanking feasibility investigations in the Hunter.

Anna is also currently completing a research degree investigating the habitat preferences of the East Coast Freetail Bat (*Mormopterus norfolkensis*), a threatened species, in the Hunter Region. The project investigates landscape-scale habitat use, roost selection and diet and aims to provide essential information to develop management strategies for the species.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Allan Richardson
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist
Qualifications / Awards	B.Env.Sc. (Environmental Management) B.Env.Sc. (Hons) (Biology) – Migratory Wading Bird Study 2002 Hunter Environmental Institute Scholarship Waterways Authority Boating Licence OH&S Induction Training (Green Card) NSW Driver's Licence (Class C) NPWS Scientific Licence NSW Animal Ethics Research Authority
Memberships:	Hunter Bird Observers Club

Areas of Expertise:

- Ornithological Surveys and Research
- Targeted and general Terrestrial flora and fauna surveys
- Threatened Flora & Fauna Assessment, Reporting and Legislation
- GPS Survey and GIS Mapping Projects
- High Level Nature Photography
- Tertiary and General Ecological Tutoring, Demonstrating and Presenting

Project Experience Includes:

Allan Richardson has broad range of Ecological Assessment reporting experience underpinned by over 25 years of ecological field experience. Project experience has primarily included a range of flora and fauna assessment disciplines as required by a wide range of corporate to domestic client requirements. Allan has a strong grounding in threatened species ecology in both coastal and western NSW regional areas, with specialist migratory wader studies expertise in Central NSW and Roebuck Bay in North Western Australia.

Allan's wide ranging interest across different ecological disciplines, has been a central part of important threatened species projects, including, the Critically Endangered North Rothbury Persoonia, Hunter Estuary Green and Golden Bell Frog populations, Migratory Wader habitat usage surveys and seasonal Swift Parrot movements. Allan's broad ecological experience also represents an important part of RPS HSO's threatened flora and vegetation community mapping, targeted fauna survey works and threatened species habitat assessments over both small and large spatial areas for a range of client needs. His depth of experience and a strong knowledge of Australian fauna and regional vegetation contribute strongly to RPS HSO's ability to meet the consultation and regulatory needs of the development community.