PRINTED: Fri 27 Feb 04

6PT
7PT
8PT
10PT
12PT
14PT
16PT
18PT
20PT

OALOS Degraded
SgOH Good
219m
R U R A L
ArAsAl Degraded
City Of Mandurah
AREA 1
SgOH Deg
ArOH Good
ArCTS Very Good
Foreshore Reserve 16.1585ha.
190m
ApCcOH Degraded
SgOH Good
ArCTS Very Good
SgOH Deg
AREA 2
S T U D Y A R E A
AcOS Degraded
OALOS Degraded
ArCH Good
U R B A N
R U R A L
R.O.S.
INDIAN OCEAN
SgOH Deg
ApCcOH Degraded
SgAcLS Good
SgOH Good
MPE Degraded
135m
120m
ArLOS Degraded
ArCH Good
SWIFTSHIRE RD
AREA 3
AVOCA PL
DIANA PL
ARIEL PL
DIADEM PL
BARDEN ST
U R B A N
RURAL
PRIMARY REGIONAL ROAD
FREMANTLE
U R B A N

metres
0 50 100 150 200 250
SCALE 1 : 5 000

SOURCE: CHAPPELL & LAMBERT, 7-8-03

23131/23_158F2.dgn DATUM: MGA DRAWN BY: TE/GLM 9-2-04 CHECKED BY: SG 9-2-04

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LEGEND

- Study Area Boundary
- Topographic Contour, 1m Interval (mAHD)
- RURAL — Peel Region Scheme Boundary
- AREA 1 — Concept Vegetation Plan Areas
- Vegetation Type Boundary
- Foreshore Reserve Boundary

VEGETATION TYPES

AcOS	*Acacia cochlearis* Open Shrubland
ArOH	*Acacia rostellifera* Open Heath
ArCTS	*Acacia rostellifera* Closed Tall Scrub
ApCcOH	*Acanthocarpus preissii/Conostylis candicans* Open Heath
ArLOS	*Acacia rostellifera* Low Open Shrubland
ArCH	*Acacia rostellifera* Closed Heath
ArAsAl	*Acacia rostellifera Acacia saligna* and *Acacia lasiocarpa* Low Shrubland
MPE	Mixed Planted Eucalyptus sp.
OALOS	*Olearia axillaris* Low Open Shrubland
SgOH	*Spyridium globulosum* Open Heath
SgAcLS	*Spyridium globulosum Acacia cyclops* Low Shrubland

VEGETATION CONDITION
(SOURCE: BUSH FOREVER Govt. of W.A., 2000)

Very Good
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded - Deg
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

ATA Environmental
environmental scientists

MADORA BAY NORTH
ENVIRONMENTAL ASSESSMENT

VEGETATION TYPES & CONDITION
FIGURE 2

ENTERED ON GIS

Name: City of Mandurah - Management Plan – Beacham Reserve (25297)
Date: 29/05/2006
Capture Author: Thomas Leong / Ian Steward

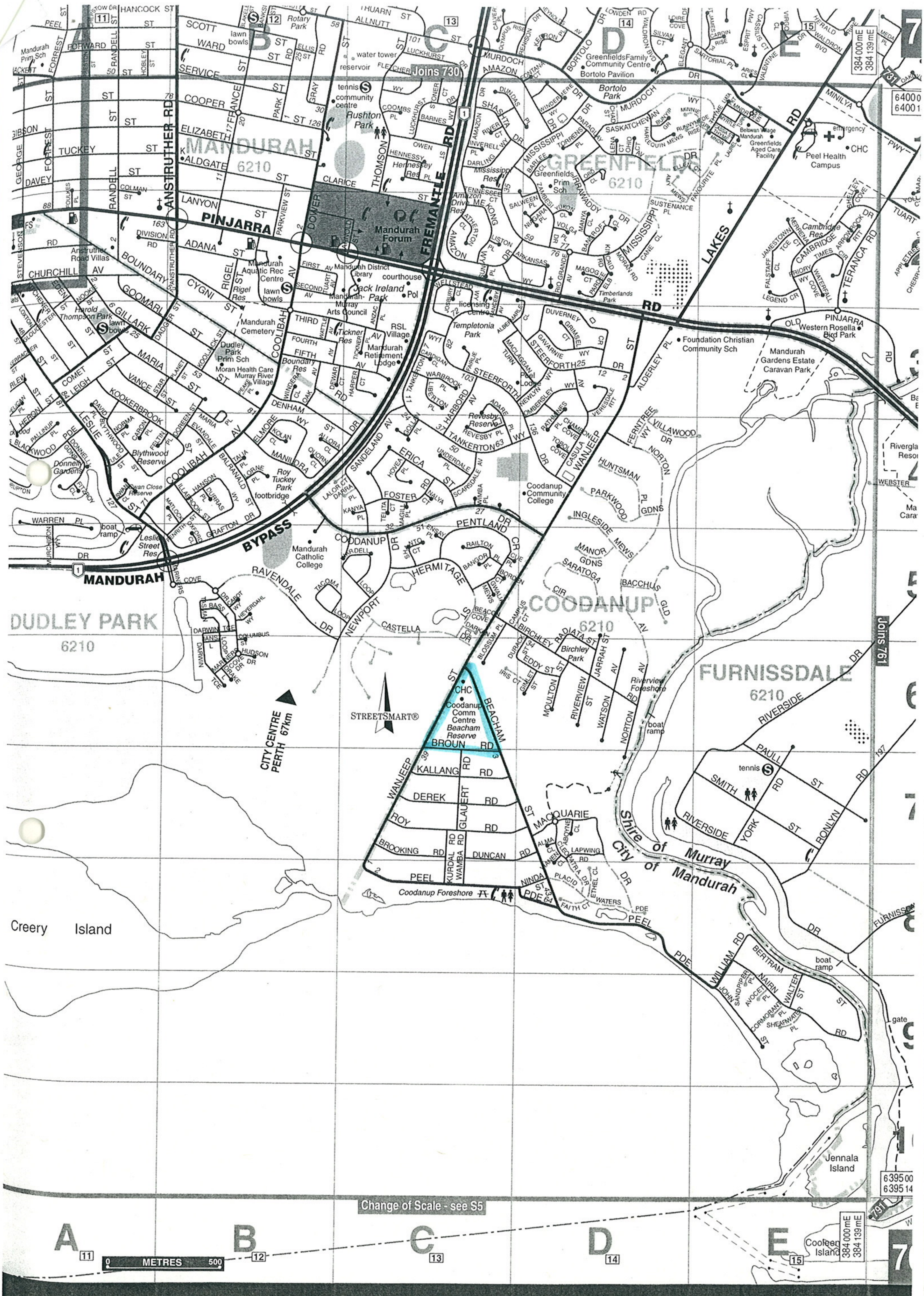
Comments:
Polygon
Created to match documented study area with high level of accuracy

Accuracy Levels:

- High = Document contained visual and or described spatial references easily captured, resulting in little or no polygon boundary errors
- Acceptable = Document contained visual and or described spatial references with complex boundaries, resulting in minor boundary errors
- Low = Document contained little or no visual and or described spatial references, resulting in polygon boundary errors

Attributes
Partial copy of section 5 of original document, values entered for attributes below cannot be taken as accurate

Report Info – Captured without problems
Custodial/Contact – Captured without problems
Content – Captured without problems

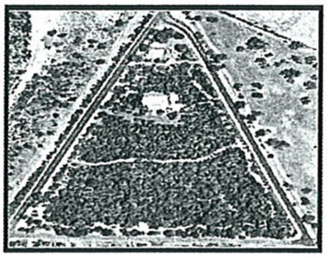


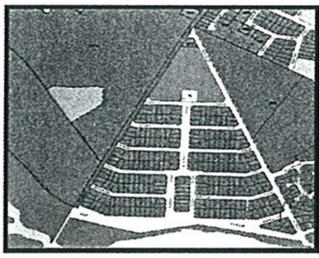
MANDURAH
6210
GREENFIELDS
6210
COODANUP
6210
DUDLEY PARK
6210
FURNISSDALE
6210
PINJARRA RD
FREMANTLE RD
MANDURAH BYPASS
LAKES RD
Mandurah Forum
Peel Health Campus
Coodanup Community College
Mandurah Catholic College
CHC
Coodanup Comm Centre Beacham Reserve
BEACHAM ST
BROUN RD
WANJEEP ST
KALLANG RD
DEREK RD
ROY RD
GLAUERT RD
BROOKING RD
DUNCAN RD
PEEL PDE
Coodanup Foreshore
Creery Island
Jennala Island
Cooleen Island
Shire of Murray
City of Mandurah
CITY CENTRE PERTH 67km
STREETSMART®
Joins 730
Joins 761
Change of Scale - see S5
METRES
0
500
A
B
C
D
E
11
12
13
14
15

DRAFT

City of Mandurah

Management Plan - Beacham Reserve (25297)





Coodanup.

Map 760
Cnr Waijeep St
& Brown Rd.

SMEC

February 2005

5 Reserve Environment and Management

5.1 Climate

The CoM experiences a Mediterranean climate with cool wet winters and hot dry summers. The dry period is usually around mid October to the end of March where the average maximum and minimum temperatures range from 21.2°C to 29.5°C and 10.9°C to 17.0°C, respectively (Bureau of Meteorology, 2001). The average maximum and minimum temperatures during the wet periods range from 17.3°C to 24.4°C and 8.6°C to 13.0°C, respectively (Bureau of Meteorology, 2001).

5.2 Landform and Soils

Beacham Reserve is situated on the Swan Coastal Plain landform unit. The regional geology of the Swan Coastal Plain is primarily alluvial, with shoreline and Aeolian deposits from the Phanerozoic age (approximately 0 to 5 million years ago).

The Reserve has a gentle slope to the south, south-east.

Additional information on landform and soil is provided in Section 5.4.3.4.1 for the various vegetation units of the Reserve.

5.3 Regional Botanical Context

Beard (1980) has defined boundaries for botanical provinces, districts and subdistricts for Western Australia on the basis of his vegetation mapping of the State. In this framework, the Reserve lies in the Drummond Botanical Subdistrict (more or less equivalent to the Swan Coastal Plain and part of the Dandaragan Plateau) of the Darling Botanical District of the South Western Botanical Province of Western Australia.

Heddle et al (1980) mapped the vegetation of part of the Drummond Botanical Subdistrict at a very broad scale, describing the vegetation complexes (related groups of vegetation associations) associated with particular landform-soil units. A total of 38 vegetation complexes on the Swan Coastal Plain were mapped.

Beacham Reserve lies in an area where the Yoongarillup Complex borders on a large occurrence of the Bassendean Complex Central and South, while the Vasse Complex occurs around the edge of the Peel Inlet.

More recently an alternative analysis of the plant assemblages on the Swan Coastal Plain south of Gingin Brook was carried out using a floristic approach (Gibson et al., 1994; Department of Environment Protection, 2000). This work, which is at a similar level of synthesis to that of Heddle et al. (1980), identified 66 floristic community types in four floristic 'Supergroups' for the southern Swan Coastal Plain. The four 'super groups' of sites correlate closely with the major geomorphological units on the Swan Coastal Plain (and also to rainfall), with the exception of one group which contained the seasonal wetlands which includes sites across all geomorphological groups (Gibson et al., 1994).

5.4 Flora

5.4.1 Survey Methodology

First, a search was conducted of the Department of Conservation and Land Management's (CALM's) Threatened (Declared Rare) Flora and Priority Flora database and the Western Australian Herbarium Specimen database for rare (DRF) and Priority species previously collected in the Reserve and an extensive surrounding area. The search area was defined by the coordinates 32° 30' S to 32° 38' S and 115° 37' E to 115° 45' E (GDA94 datum). The database search resulted in a target list of rare and priority flora to look for when conducting the flora and vegetation field work in the Reserve.

An initial flora survey of the Reserve was then conducted in April 2004. It comprised recordings of flora at vegetation sites and opportunistic recordings while walking between the vegetation description sites or while undertaking vegetation and weed mapping activities.

Informal vegetation recording sites (releves) were selected in a representative area of each type of vegetation unit. The releve descriptions were based on an estimated 10m x 10m area. Plant species were recorded at the releve sites in the estimated 10m x 10m areas and where time permitted, in the surrounding part of 30m x 30m areas (nested 'plots'). Where plant species were not well known, flora specimens were collected and allocated a specimen number.

Plant specimens were also recorded and where necessary, collected, wherever a species was seen in the survey area that had not already been recorded. An effort was made to note the GPS coordinates for these specimens if it was thought the species may prove to be of particular importance.

Collected specimens were pressed and subsequently dried. They were then sorted and identified. The identifications were made by comparison to specimens in the reference and research collections of the Western Australian Herbarium, by the use of keys in various papers and books and by relevant experts on various groups of flora of the Swan Coastal Plain (see the acknowledgments section below).

A follow-up Spring survey was conducted between the 28th of September and the 11th of October 2004. Each of the sites previously described was revisited and any plant species observed that had not been previously recorded was noted and if necessary, a specimen collected for identification. Observations of species not previously recorded in the Reserve were also made while walking between sites and on general reconnaissance walks and these were added to the species list.

5.4.2 Survey Limitations

The major limitation of the flora survey is that any such survey is a sampling procedure of a variable environment with plant populations of variable growth habit, life span and flowering season. Some species, including annuals, are only available for collection for part of the year. This means that to locate all species that grow in an area is a substantial task, the success of which is related to the time available and the size and diversity of habitat in the survey. Consequently, it is possible that there are species present on the subject land that were not recorded during this survey as they only have low abundance on the land.

A particular limitation of this flora survey is that it was initially conducted in March/April when few plant species are flowering and when the annual plants have died or 'died back and are generally difficult to observe and have often disintegrated to the point that they are difficult to identify. However, as part of this study, a second visit to the survey area was undertaken in spring (late September, early October) when annual grasses, cryptophytes and many of the perennials are flowering or setting seed.

The third limitation of the flora survey was that it was restricted to flowering plant species and a few other groups (cycads, and ferns). Fungi, mosses, liverworts, lichens and algae are not generally surveyed systematically for environmental assessments in Western Australia, as surveying these groups (which form a small part of the biomass of the vegetation) is a specialist task and the level of information available to assess them against is quite poor.

Given the above limitations, it is likely that this survey recorded more than 80% of the vascular flora in the survey area. Once a spring survey has been conducted in the survey area, it is likely that more than 85% to 90% of the vascular flora in the survey area will have been recorded. That is, while the flora survey is relatively thorough, it is possible that some species occurring on the subject land have not been recorded.

5.4.3 Beacham Reserve Survey Results

The Department of Conservation and Land Management database searches found four priority plant species had been recorded in the area containing Janis St Reserve, Tindale Reserve, Dawesville Reserve and Beacham Reserve. Table 3 lists these species. None of these species were recorded in Beacham Reserve.

Table 3: Priority flora previously recorded in survey area

Plant Species	Conservation Status
Chamaescilla gibsonii	P3
Dillwynia dillwynioides	P3
Laseopetalum membranaceum	P3
Villarsia submersa	P4

The total number of species recorded in this Reserve was 121, of which 103 (or 85 percent) were native species. The species list for Beacham Reserve is provided in Table 4.

No Declared Rare Flora were recorded in the survey areas. However, one Declared Rare Flora species, the Grand Spider Orchid (*Caladenia huegelii*) was observed in Beacham Reserve near site BR1 during the Spring survey. It had been recently transplanted from another area that was about to be cleared for development (Jane O'Malley, *pers. comm.*). It was not included in the Beacham Reserve species list. *Caladenia arenicola* (another spider orchid) and *Stylidium schoenoides* plants had also been transplanted into the area.

No priority flora were recorded in Beacham Reserve during this survey.

No species of other particular conservation interest were recorded in Beacham Reserve during the survey.

Table 4: Flora Species List for Beacham Reserve

FAMILY/TAXA	Common names	Priority Status
GYMNOSPERMAE		
016A ZAMIACEAE		
Macrozamia riedlei	Zamia	
ANGIOSPERMAE		
MONOCOTYLEDONS		
031 POACEAE (grasses)		
Amphipogon turbinatus		
Austrodanthonia sp.		
Austrostipa flavescens		
* Avena barbata	Wild oats	
* Briza maxima	Blowfly grass	
* Bromus diandrus	Great brome grass	
* Cynosurus echinatus	Rough dogs tail	
* Ehrharta calycina	Perennial veldt grass	
*Ehrharta longiflora	Annual veldt grass	
* Eragrostis curvula	Love grass	
* Lagurus ovatus	Hair's tail grass	
032 CYPERACEAE (sedges)		
Lepidosperma pubisquameum		

Mesomelaena tetragona		
Schoenus grandiflorus		
Tetraria octandra		
039 RESTIONACEAE (rushes)		
Desmocladus fasciculatus		
Desmocladus flexuosus		
Lyginia imberbis		
Alex mitens		
054C DASYPOGONACEAE		
Dasypogon bromeliifolius		
Lomandra caespitosa		
Lomandra sericea		
Lomandra suaveolens		
054E PHORMIACEAE		
Dianella revoluta var. divaricata	Blueberry lily	
054F ANTHERICACEAE		
Chamaescilla corymbosa var corymbosa		
Sowerbaea laxiflora	Purple tassels	
Thysanotus manglesianus	Fringed lily	
Thysanotus multiflorus		
Thysanotus sparteus		

054J COLCHICACEAE		
Burchardia umbellata		
055 HAEMODORACEAE		
Conostylis aculeata subsp. aculeata	Prickly Conostylis	
Conostylis juncea		
Conostylis setigera subsp. setigera		
Haemodorum spicatum		
066 ORCHIDACEAE (orchids)		
Caladenia arenicola	Carousel spider orchid	
Caladenia flava subsp. flava	Cowslip orchid	
Caladenia latifolia	Pink fairy orchid	
Caladenia paludosa (transplanted)	Swamp spider orchid	
Elythranthera brunonis	Purple enamel orchid	
Eriochilus dilatatus subsp. multiflorus	White bunny orchid	
Leporella fimbriata	Hare orchid	
Microtis media subsp. media	Common mignonette orchid	
Prasophyllum parvifolium	Autumn leek orchid	
Pterostylis ? vittata	Banded greenhood	
Pterostylis aff. sanguinea	Coastal banded greenhood	
Pterostylis nana complex	Snail orchid	

Pyrorchis nigricans	Elephant's ears	
Thelymitra ?benthamiana	Leopard orchid	
DICOTYLEDONS		
070 CASUARINACEAE		
Allocasuarina fraseriana	Sheok	
090 PROTEACEAE		
Banksia attenuata	Slender banksia	
Banksia grandis	Bull banksia	
Banksia ilicifolia	Holly-leaved banksia	
Banksia menziesii		
Dryandra lindleyana var. lindleyana		
Persoonia saccata		
Petrophile linearis	Pixie mops	
Stirlingia latifolia	Blueboy	
Synaphea spinulosa subsp. spinulosa		
092 SANTALACEAE		
Exocarpos sparteus		
097 LORANTHACEAE		
Nuytsia floribunda	Christmas tree	

105 CHENOPODEACEAE		
Rhagodia baccata subsp. baccata X		
119 RANUNCULACEAE		
Clematis pubescens X	Common Clematis	
136 FUMARIACEAE		
*Fumaria capreolata X	White fumitory	
143 DROSERACEAE		
Drosera erythrorhiza subsp. erythrorhiza	Red ink sundew	
Drosera menziesii	Pink rainbow	
Drosera stolonifera subsp. stolonifera	Leafy sundew	
152 PITTOSPORACEAE		
Marianthus candidus X		
Pronaya fraseri var. fraseri X		
163 MIMOSACEAE		
Acacia huegelii X		
Acacia pulchella var. glaberrima	Prickly moses	
Acacia saligna X	Golden wreath wattle	
Acacia stenoptera	Narrow winged wattle	

165 PAPILIONACEAE		
Bossiaea eriocarpa	Common brown pea	
* Chamaecytisus palmensis	Tree lucerne	
Daviesia decurrens		
Daviesia physodes		
*Gastrolobium bilobum (?planted)		
Gastrolobium capitatum		
Gompholobium tomentosum		
Hardenbergia comptoniana	Native Wisteria	
Hovea trisperma	Common Hovea	
Isotropis cuneifolia subsp. cuneifolia	Granny bonnets	
Jacksonia furcellata	Grey stinkwood	
Jacksonia sternbergiana	Stinkwood	
Kennedia prostrata	Scarlet runner	
*Medicago polymorpha	Burr medic	
168 OXALIDACEAE		
*Oxalis pes-caprae	Soursob	
175 RUTACEAE		
Boronia ramosa subsp. anethifolia		
Philotheca spicata	Pepper and salt	
185 EUPHORBIACEAE		

* Euphorbia terracina	Geraldton carnation weed	
226 DILLENIACEAE		
Hibbertia acerosa		
Hibbertia hypericoides	Yellow buttercups	
Hibbertia vaginata		
263 THYMELAEACEAE		
Pimelea rosea	Rose banjine	
*273 MYRTACEAE		
*Chamelaucium uncinatum	Geraldton wax	
Corymbia calophylla		
Eucalyptus marginata subsp. marginata	Jarrah	
Kunzea glabrescens		
281 APIACEAE		
Trachymene pilosa	Native parsnip	
Xanthosia ciliata		
288 EPACRIDACEAE		
Astroloma pallidum		
Conostephium pendulum	Pearl flower	
Leucopogon propinquus		

Leucopogon racemulosus		
293 PRIMULACEAE		
*Anagallis arvensis var. caerulea		
313 LAMIACEAE		
Hemiandra pungens	Snakebush	
320 OROBANCHACEAE		
* Orobanche minor	Lesser broomrape	
331 RUBIACEAE		
Opercularia vaginata		
340 LOBELIACEAE		
Lobelia tenuior	Slender lobelia	
341 GOODENIACEAE		
Dampiera linearis	Wedge-leaved Dampiera	
Scaevola repens var. repens		
343 STYLIDIACEAE (trigger plants)		
Levenhookia pusilla	Midget stylewort	
Stylidium piliferum subsp. piliferum	Common butterfly	

	triggerplant	
Stylidium schoenoides	Cow kicks	
345 ASTERACEAE		
Asteridea pulverulenta		
Lagenifera huegelii		
Podolepis gracilis		
Podolepis lessonii		
Podotheca chrysantha	Yellow Podotheca	
* Ursinia anthemoides		

Notes:

1. The numbers in front of the plant families are the numbers for families used at the Western Australian Herbarium.

2. An asterisk (*) beside the taxon name indicates an introduced species (weed).

3. The priority status column shows the conservation code of any rare or priority plants in the list.

5.5 Vegetation

5.5.1 Survey Methodology

5.5.1.1 Vegetation Units and Condition

The description of the vegetation units in the study areas was undertaken as a basis for the vegetation unit mapping and to enable inference of the Gibson et al (1994) floristic community to which those units would belong and hence whether any of the vegetation units would be Threatened Ecological Communities (TEC's).

The vegetation survey was based on informal releve recordings located in an area of vegetation that was considered representative of a particular vegetation unit. The releve areas were based on estimated distances from a centre point. The use of estimated 10 metre by 10 metre areas meant the releve data is, in that regard, consistent with Gibson et al's (1994) data set for the Swan Coastal Plain on which Gibson et al's floristic community analysis was based.

While the centre of each releve was not permanently marked, it was referenced by recording the releve centre point coordinate (WGS84 datum), using an Etrex GPS unit. GPS coordinate readings were recorded when the GPS unit indicated the locational error was (+/-) 4 to 5 meters. Photographs of each releve are provided in Appendix B. A description of the releve location, the habitat, surface soil texture and colour and any rock outcropping (and rock type) were all recorded and the time since the site was last burnt was estimated. The vegetation structure was described using a modification by Mr M Trudgen (pers comm.) of Aplin's (1979) modification of Specht's vegetation description table (Appendix C). These are the same structural units used in the Bush Forever documentation (Department of Environmental Protection, 2000b), although there are some minor differences in the wording of some of the cover classes. To obtain more representative data for the overstorey cover, the tree layer(s) cover was estimated over a larger area around the releve. All plant species occurring in the releve area were recorded along with their height and percentage cover. Plant species recorded for the releve which were outside the 10 meter by 10 meter estimated area were listed separately.

The condition of vegetation in the releve was recorded using the same scale used by Bush Forever Volume 2 (Department of Environmental Protection, 2000b). The vegetation condition scale and description are provided in Appendix D. Other notes were made regarding vegetation health and any indications of the presence of dieback or indeed other plant diseases. Impacts of dieback on the condition of the vegetation should be included in assessing vegetation condition (Keighery 1994, reproduced in Department of Environmental

Protection Vol 2 (2000)), but where the cause of tree deaths was inconclusive the occurrence of deaths were not given great weight in the assessment of vegetation condition.

The information recorded for each vegetation unit was consistent with the templates developed as part of the Perth Biodiversity Project and should enable completion of the templates if desired.

5.5.1.2 Inferring Floristic Community Types (FCT)

The Floristic Community Type of a vegetation unit was inferred by looking at the floristic communities that had been recorded in the area and a list of the floristic communities on the Swan Coastal Plain with their generalised descriptions and the geomorphological unit on which they occurred (Gibson et al. 1994). Then the site species list was compared in detail with a two way table that only showed species which occurred in any one community type with frequencies of at least 50% (Gibson et al., 1994).

5.5.1.3 Determining Floristic Community Type using PATN analysis

Because of difficulties in inferring floristic community type, FCT's are best determined by running computer-based PATN analysis on the site data and the Gibson *et al.* (1994) Swan Coastal Plain data set to generate a grouping of the sites against the Gibson *et al.* floristic community groupsThe floristic analysis carried out was based on species presence/absence data from sixteen sites in the four City of Mandurah reserves combined in a database with the 509 sites from Gibson *et al.* (1994). The sixteen sites from the City of Mandurah reserves included three from Beacham Reserve (BR1-BR3).

5.5.1.3.1 Data Preparation and Compatibility

The vegetation site data from the sixteen sites in four City of Mandurah reserves was entered into a specially designed computer database developed by E. A. Griffin using Microsoft Access.

To conduct the analysis on the data from the four City of Mandurah reserves and Gibson *et al.* (1994) datasets, it was first necessary to reconcile the flora species names. This step was necessary because of changes in the nomenclature over the last ten years and the potential for survey specific variations in the application of names (Griffin and Trudgen, 2004). The reconciliation involved reducing some infra-specific names to the relevant species name, combining some taxa where confusion is known to have occurred in field observations and identifications and omitting some names (mostly where a taxon had only been identified to genus).

It should be noted that the data from the four reserves was compatible with the Gibson *et al.* (1994) data. Both datasets were based on data collected from sites of similar sizes, with the Gibson *et al.* (1994) sites being 10 metre by 10 metre quadrats and the City of Mandurah reserve sites being releves of estimated 10 metre by 10 metre areas. The Gibson *et al.* (1994) sites and the City of Mandurah reserve sites were visited twice to record plant species present, including a spring visit. Weed species were included in both the Gibson *et al.* (1994) and City of Mandurah reserve data sets.

5.5.1.3.2 PATN Analysis

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification), DEND (representation of classification) and NNB (determination of sites most similar to each site) (Griffin and Trudgen, 2004). The results of the analyses were imported into a database so that site characteristics and previous classifications (eg Floristic Community Types derived in earlier classifications) could be associated with them.

Two types of PATN analysis were used. The first method (using the PATN ASO, FUSE and DEND modules) ran an analysis of the combined City of Mandurah reserves and Gibson *et al.* (1994) data sets to produce a classification of the sites vegetation in the form of a dendrogram of the combined data sets, with the Floristic Community Types defined by Gibson *et al.* (1984) assigned to the Gibson *et al.* (1994) sites. The appropriate Floristic Community Type to assign to the City of Mandurah reserve sites could then be interpreted by the relative position of those sites to the Gibson *et al.* sites in the dendrogram.

The second method (Nearest Neighbours method) used the NNB module of PATN to investigate which 20 sites in the combined data set were most similar to each of the City of Mandurah reserve sites.

A final assignment of a Floristic Community Type was then made to each of the City of Mandurah reserve sites taking into account the results of both methods and the fact that the dendrogram relationships can be arranged in a more 'spread out' and less easily interpretable manner.

5.5.1.4 Identification of Threatened Ecological Communities (TEC)

Once each of the City of Mandurah reserve sites was assigned to a Floristic Community Type, a table of Floristic Communities Types on the Swan Coastal Plain and their TEC status (Department of Environmental Protection, 2000) was consulted to determine if any of the City of Mandurah Reserves sites were TEC's. No new TEC's have been assessed for the

western part of the Swan Coastal Plain (which includes the survey area) since the publication of Bush Forever Vol 2 (B.J. Keighery, pers. comm.).

5.5.2 Survey Limitations

5.5.2.1 Vegetation Survey

There is a limit to the accuracy of the assignment of the different strata in the vegetation descriptions to structural units (for example, low open woodland, low woodland, low open forest, open shrubland, shrubland etc.). Referral of a stratum to a structural category depends on assessment of its cover. Such estimation is notoriously imprecise and it is not unusual for different observers to give quite different estimates of the cover of a species, or stratum in a stand. However, descriptive exercises such as that carried out for this report require only a moderate level of accuracy, sufficient to determine which of a few cover categories a species or stratum falls into (or close to).

For this report, vegetation cover was estimated for each plant species recorded in the quadrats by estimating each species canopy cover. The assumption was made that for most species, canopy cover and projected foliar cover are reasonably similar, or that the difference is less than the level of accuracy of the estimates. Conducting the main survey in March and April meant that the estimation of cover of the annual grasses was particularly difficult because they were in various stages of break down and decomposition and had often at least partial collapsed and were lying across the ground. This was not a significant problem in Beacham Reserve because the cover was low. However, weed cover was checked during the Spring revisit when weed condition was good.

5.5.2.2 Inferring Floristic Community Type

Inferring floristic community type is not an easy process. Many species can be common to a number of floristic communities. The method depends on using existing floristic communities and a poor outcome might occur if sites are forced into existing floristic communities.

Another problem arises for floristic communities that have been determined more recently and which cannot be accessed from the Gibson *et al.* (1994) data set.

5.5.2.3 PATN Floristic Analysis

It has been found in other floristic analysis that the addition of new sites to the Gibson *et al.* (1994) data set to produce a combined classification may disrupt the original classification of sites (Griffin and Trudgen, 2004). The more data entered, the higher the level of disruption.

If this occurs it can make it difficult to assign the new sites to the Floristic Community Types of Gibson *et al.* (Griffin and Trudgen, 2004).

Another limitation in conducting a PATN floristic analysis using the above methods may arise depending on the degree of success in reconciling the two data sets. A further limitation may arise from any significant differences in data collection methods between the two surveys. This is unlikely to have caused a material difference in the results for this study.

5.5.3 Mapping

5.5.3.1 Vegetation Units

Vegetation units were recorded generally between plant community and plant association level. Vegetation unit boundaries were noted on computer generated aerial photographs while traversing between vegetation releve sites. The aerial photographs were at 1:1000 scale, colour, orthocorrected and overlain with the UTM coordinate grid (GDA94 datum). GPS coordinate readings were sometimes used to confirm boundary locations. In each reserve, the alignment of GPS readings and coordinates of points on the aerial photographs were checked at least once. Some additional traversing of the survey areas was undertaken, as required, to complete vegetation unit boundaries.

Vegetation mapping unit descriptions were based on the releve vegetation descriptions. In some cases where the vegetation was ecotonal or very variable, it was mapped as a mosaic of described vegetation units.

Mapping vegetation units is very subjective and the vegetation boundaries mapped for the survey areas are a particular interpretation of the vegetation of the area. However, boundaries should delineate areas of vegetation with consistently different dominant species, significantly different percentage cover of the dominants or significantly different species composition.

5.5.3.2 Vegetation Condition

The vegetation condition was mapped using the vegetation condition assessment at each of the releves and using the same approach as outlined for the vegetation unit mapping in Section 3.4.3.3.2.

5.5.4 Beacham Reserve Survey Results

5.5.4.1 Vegetation Units

Two vegetation units occur within the Reserve. Figure 3 delineates the location of the vegetation units. Beacham Reserve appeared to predominately be a Spearwood/Bassendean unit of scattered *Eucalyptus marginata* (jarrah) over *Banksia attenuata, Allocasuarina fraseriana* (sheok) low woodland. Photos of the vegetation units are provided in Appendix B. Appendix E provides additional information for each site and the species within these sites.

The vegetation units include:

- **EmBa -** (unit represented by site BR1 and BR2)

  Eucalyptus marginata subsp. *marginata* scattered (occasional) trees over *Banksia attenuata, Allocasuarina fraseriana, (Banksia menziesii)* low woodland over *Kunzea glabrescens* high open shrubland over *Acacia pulchella* var. *glaberrima* open shrubland over *Hibbertia hypericoides, (Bossiaea eriocarpa)* low open heath over *Lepidosperma pubisqameum, Desmocladus flexuosa* very open sedgeland. See photograph in Appendix B.

  Habitat and Soil: Flat plain area. Grey sand (not tested at depth).

  Notes: BR1 and BR2 are very similar sites; the difference is *Eucalyptus marginata* subsp. *marginata* occurred at site BR2.

- **CcAsBa –** (unit represented by sites BR3 and BR4)

  Corymbia calophylla, (*Eucalyptus marginata* ssp. *marginata*) woodland over *Acacia saligna, Allocasuarina fraseriana (Banksia attenuata)* low woodland over *Kunzea glabrescens, (Jacksonia sternbergiana)* scattered tall shrubs over *Lepidosperma pubisquameum, Desmocladus flexuosus* scattered sedges and very open annual weeds. See photograph in Appendix B.

  Habitat and Soil: Flat plain area. Grey sand (not tested at depth).

The codes for the vegetation units that discriminate the vegetation units are shown on the vegetation map (Figure 3). The codes are derived from the generic and species names of the more abundant genera or species in the different strata present in the unit. Where there is more than one species in the genus, or where two genera have the same initial, a lower case letter is used to distinguish which species is being referred to (see Table 5).

Table 5: Species Abbreviations and Names

As	*Acacia saligna*	**Cc**	Corymbia calophylla
Ba	*Banksia attenuata*	**Em**	*Eucalyptus marginata* (Jarrah)

The vegetation structure/species dominance/floristic units defined for the area are considered to be mostly described at the plant community level but may represent broader units. Some stands of some of the vegetation units occurring in the areas mapped for vegetation units are quite small and as a result are not shown on the vegetation maps.

5.5.4.2 Vegetation Condition

The vegetation in the Reserve is in Excellent to Pristine condition. There was a low cover of non-aggressive weeds. Weed density was higher along the edges of firebreak (**Avena barbata* (wild oats), **Ehrharta calycina* (perennial veldt grass) and occasional patches of **Eragrostis curvula* (love grass)). Several shrub weeds occurred in the Reserve.

Figure 4 delineates the condition of vegetation within the Reserve.

Dieback may be an issue in the Reserve; this is further discussed in Section 5.8.2.

5.5.4.3 Determination of Floristic Community Types

One floristic community type, FCT 21a, was inferred for Beacham Reserve. Table 6 indicates the inferred floristic communities and their TEC status.

The dendrogram generated by the PATN analysis from the combined data set of the City of Mandurah Reserves survey area sites and Gibson et al. (1994) Swan Coastal Plain sites, grouped the Beacham Reserve sites BR1, BR2 and BR3 together (Appendix H), indicating they are floristically similar to each other. The grouping of the Beacham Reserve sites is most probably because they are very geographically close (within 200 to 300 metres of each other) relative to the distance between them and the other Gibson et al. (1994) sites.

Both the dendrogram and the nearest neighbour analysis (Appendix H) grouped the Beacham Reserve sites with Floristic Community Type (FCT) 21a. FCT 21a. is described as the 'Central Banksia attenuata-Eucalyptus marginata woodlands' type, which occurs predominantly on both the Bassendean and Spearwood Dune landform elements (Gibson et al. 1994). The presence of this FCT at Beacham Reserve corresponds to the location of Beacham Reserve within the mapped Yoongarillup landform element (associated with the Spearwood element), with a large area of Bassendean Sand element just to the east and with the occurrence of grey (Bassendean) surface sands in the Reserve.

Table 6: The inferred floristic community, the floristic community generated from the PATN dendrogram and nearest neighbour analysis and the overall assigned Floristic Community Type for vegetation units in the Beacham Reserve.

fc= floristic community

TEC=Threatened Ecological Community

Vegetation sites	Inferred fc	fc from Dendrogram	fc from Nearest Neighbr	Floristic Community Types Assigned	TEC's
BR1	21a	21a	21a	21a	
BR2	21a	21a	21a	21a	
BR3		21a	21a	21a	

5.5.4.4 Threatened Ecological Communities

The Department of Conservation and Land Management has developed a procedure for identifying TEC's (Department of Environmental Protection 2000b; English and Blythe 1997). Threatened ecological communities are assigned to one of four categories: 'Presumed Totally Destroyed'; 'Critically Endangered'; 'Endangered' or 'Vulnerable' (Department of Environmental Protection, 2000b).

On the Swan Coastal Plain, twenty five ecological communities delineated by a number of floristic studies and freshwater organism studies have been assessed for TEC status. Twenty four of these have assessed as 'threatened' (Department of Environmental Protection 2000b). Sixteen of these are floristic community types as identified by Gibson et al. (1994) (Department of Environmental Protection 2000b).

The TEC database search resulted in two records of TEC's in a wide area, which incorporated the Reserve, including SCP15 (Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain) and SCP07 (herb rich saline shrublands in clay pans). Neither of these TEC's were recorded in the Reserve.

The vegetation of Beacham Reserve belongs to the Floristic Community Type 21a. FCT 21a is not a TEC (Table 6 above).

LEGEND:
- VEGETATION RECORDING SITE (RELEVES)
- CONTOURS

0 25 50 75 100m

VEGETATION UNITS (SEE SECTION 5.5.4) :

CcAsBa - CORYMBIA CALOPHYLLA OVER ACACIA SALIGNA AND BANKSIA ATTENUATA

EmBa - EUCALYPTUS MARGINATA OVER BANKSIA ATTENNUATA

SMEC
ACN:065 475 149
Level 6, 12 St Georges Terrace
PERTH WA 6000
Tel:(08) 9323 5900 Fax(08) 9323 5901

BEACHAM RESERVE VEGETATION UNITS

Project Number: 36413

Figure Number: FIGURE 3

PHYSICAL DISTURBANCE AND ANNUAL WEEDS

RUBBISH - BURNT OUT CAR

AREA OF BANKSIA DEATHS - FIRE SCARING IN SOME TREES. POSSIBILITY OF DIEBACK.

WANJEEP ST.

BEACHAM ST.

RUBBISH

VG ADJACENT TO FIRE BREAK WHERE HIGHER WEED COVER

BROUN RD.

N

LEGEND:

- PRISTINE
- EXCELLENT
- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED
- PRISTINE - EXCELLENT
- EXCELLENT - VERY GOOD

0 25 50 75 100m

SMEC
ACN:065 475 149
Level 6, 12 St Georges Terrace
PERTH WA 6000
Tel:(08) 9323 5900 Fax(08) 9323 5901

BEACHAM RESERVE VEGETATION CONDITION

Project Number: 36413

Figure Number: FIGURE 4

ENTERED ON GIS

Name: Classification of Plants: On the area of Land Proposed for the Coodanup Community Hall
Date: 29/05/2006
Capture Author: Thomas Leong / Ian Steward

Comments:
Polygon
Created to match documented study area with high level of accuracy

Accuracy Levels:

- High = Document contained visual and or described spatial references easily captured, resulting in little or no polygon boundary errors
- Acceptable = Document contained visual and or described spatial references with complex boundaries, resulting in minor boundary errors
- Low = Document contained little or no visual and or described spatial references, resulting in polygon boundary errors

Attributes
Partial document only, values entered below cannot be taken as accurate

Report Info – Captured without problems
Custodial/Contact – Captured without problems
Content – Captured without problems

COPY FOR YOUR INFORMATION

Flora Study

1997

Jan to March

* page 3 missing

Classification of plants:

On the area of land proposed for the Coodanup Community hall.

Mandurah Map 760

(SE Mandurah Bypass)

In Veadan Reserve

By A. Dixon Dip Hort

& J. Gunn

Computer assistance by :

D J Clulow AIIP, Associate Dip Elron Eng

TREES

Common name	Botanical name	Area Density
Tuart	Eucalyptus gomphocephala	low
Marri	Eucalyptus calophylla	medium
Jarrah	Eucalyptus marginata	medium
Holly Banksia	Banksia ilicifolia	high
Menzies Banksia	Banksia menziesii	high
Yellow Banksia	Banksia attenuata	high
Bull Banksia	Banksia grandis	high
Woody Pear	Xylomelum occidentale	medium
Pepperment Tree	Agonis flexuosa	medium
Orange Wattle	Acacia saligna	high
Christmas Tree	Nuytsia floribunda	medium*
Fraser's Sheoak	Allocasuarina fraseriana	high

SHRUBS
CYCADS

Zamia	Macrozamia riedlei	high#

SHRUBS
DICOTYLEDONS

(Woody plants less than 2 meters tall and much branched from the base)

Tangle Daisy	helichrysum cordatum	medium
Dwarf Sheoak	Casuarina humilis	medium
	Hibbertia hugelii	medium
Yellow Buttercup	hibbertia hypericoides	medium
Stalked Guinea Flower	Hibertia racemosa	low
Moss-leaved Heath	Astroloma ciliatum	low
Swan Berry	Astroloma macrocalzx	high
Kick Bush	Astrolama pallidum	high #
Perl Flower	conostephium pendulum	high
	Leucopogon propinquus	high#
	Monotaxis grandiflora	high
False Boronia	Phyllanthus calycinus	high
Common Brown Pea	Bossiaea eriocarpa	medium
Broad Leaved Brown Pea	Bossiaea ornata	low
	Daviesia decurrens	medium
	Daviesia divaricata	medium
	Daviesa nudiflora	medium

# Denotes plants wholly or partially edible.
+ Denotes introduced plants.
* Denotes parasitic plants.

Hairy Yellow Pea	Gompholobium tomentosum	high
Common Hovea	Hover trisperma	medium
Granny Bonnets	Isotropis cuneifolia	medium
Stinkwood	Jacksonia sternbergiana	medium
	Jacksonia furcellata	medium
	Jacksonia sericea	medium
Bacon and Egg	Oxylobium capitatum	medium
Rose Pelargonium	Pelargonium capitatum	low+
Common Dampiera	Dampiera linearis	high
Grey Scaevola	Scaevola canescens	medium
Silky Scaevola	Scaevola holosericea	medium
Snake Bush	Hemiandra pungens	medium
Swan River Mytle	Hypocalymma robustum	medium
Blueboy	Stirlingia latifolia	high
Couch Honeypot	Dryandra niver	medium
Parrot Bush	Dryandra sessilis	medium
Honey Bush	Hakea lissocarpha	medium
Snottygobble	Persoona saccata	high
Pixie Mops	Petrophile linearis	medium
	Bronia ramosa	low
Pepper and Salt	Eriostemon spicatus	high
Wild Violet	Hybanthus calycinus	medium

TWINING AND PROSTRATE PLANTS

Bridal Rainbow	Drosera macrantha	high
Pale Sundew	Drosera pallida	high
Pink Rainbow	Drosera penicillaris	medium
Native Wisteria	Hardenbergia comptoniana	medium
Red Runner	Kennedia prostrata	medium#

HERBS
FERNS

Annual Fern	Angoramma leptophylla	low

FLOWERING PLANTS
MONOCOTYLEDONS

Cats Paw	Anigozanthos humilis	low
Mangles Kangaroo Paw	Anigzanthos manglesii	medium

# Denotes plants wholly or partially edible.
+ Denotes introduced plants.
* Denotes parasitic plants.

Tuart Spider Orchid	Caladenia georgei	medium
Dancing Orchid	Caladenia discoidea	low
Cowslip Orchid	Caladenia flava	high
Silky Blue Orchid	Cyanicula sericea	low
Common Spider Orchid	Caladenia varians	low
Blue China Orchid	Cyanicula gemmata	low
King Spider Orchid	Caladenia pectinata	medium
Purple Enamel Orchid	Elythranthera brunonis	low
Rattle Beaks	Lyperanthus serratus	low
Rabbit Orchid	Leptoceras menziesii	medium
Hare Orchid	Leporella fimbriata	high
Bunny Orchid	Eriochilus dilatatus	low
Carousel Spider Orchid	Caladenia arenicola	medium
Sugar candy Orchid	Caladenia hirta	low
Red Beaks	Burnetta nigricans	medium
Midge Orchid	Cyrtostylis huegelii	low
Leopard Orchid	Thelymitra benthamiana	low
Autumn Leek Orchid	Prasophyllum parvifolium	medium
Scented Autumn Leek Orchid	Prasophyllum aff. parvifolium	low
Dark Banded Greenhood	Pterostylis sanguinea	medium
Coastal Banded Greenhood	Pterostylis aff. sanguinea	medium
Banded Greenhood	Pterostylis vittata	medium
Common Donkey Orchid	Diuris corymbosa	medium
Jug Orchid	Pterostylis recurva	low
Pansy Orchid	Diuris magnifica	medium

# Denotes plants wholly or partially edible.
+ Denotes introduced plants.
* Denotes parasitic plants.

to be continued ...
as per classification contam Pelt hill

File

COODANUP RESERVE 25297

NATIVE SPECIES IDENTIFIED AT BEACHAM RD ^ 7/2/96

	BOTANIC NAME	COMMON NAME
1	*Acacia pulchella*	Prickly Moses
2	*Acacia saligna*	Golden Wreath Wattle/Orange Wa
3	*Banksia attenuata*	Coast Banksia
4	*Banksia menziesii*	Firewood Banksia
5	*Casuarina sp.*	She Oak
6	*Conostylis candicans*	Cottonhead
7	*Dasypogon bromeliifolius*	Drumsticks
8	*Eucalyptus marginata*	Jarrah
9	*Hardenbergia comptonia*	Native Wisteria/Happy Wanderer
10	*Hibbertia hypericoides*	Buttercups
11	*Jacksonia furcellata*	Grey Stinkwood
12	*Jacksonia sternbergiana*	Green Stinkwood
13	*Kennedia prostrata*	Running Postman
14	*Kunzea ericifolia*	Spearwood
15	*Lepidosperma gladiatum*	Coast Sword-sedge
16	*Macrozamia reidlei*	Zamia Palm
17	*Patersonia occidentalis*	Purple Flag
18	*Petrophile linearis*	Pixie Mops
19	*Stirlingia latifolia*	Blueboy
20	*Xylomelum occidentale*	Woody Pear