PART XII: FLORISTICS OF THE BULLSBROOK NATURE RESERVE.

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FLORISTICS OF RESERVES AND BUSHLAND AREAS IN THE PERTH REGION (SYSTEM 6) PART XII: FLORISTICS OF THE BULLSBROOK NATURE RESERVE (M14)

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ABSTRACT

The Bullsbrook Nature Reserve is the only bushland area known to encompass soils of the Pinjarra Plain and the foothills of Dandaragan Plateau. Seven principal plant communities are present in the area: Jarrah Woodland, Marri Woodland, *Banksia* Woodland, Lateritic Heathland, Flooded Gum Woodland, *Melaleuca rhaphiophylla* Low Forest, *Melaleuca* Shrublands and Wetland mosaic. Five regional floristic community types are represented in the Reserve: type 28 (Spearwood *Banksia attenuata* or *B. attenuata - Eucalyptus* Woodlands), type 23a (Central *Banksia attenuata - B. menziesii* woodlands), type 11 (Wet forests and woodlands), type 7 (Herb rich saline shrublands on clay pans) and type 5 (Mixed shrub damplands). The Reserve contains a vascular flora of 503 taxa; 440 are natives and 63 weeds. Eight of these taxa are non - flowering plants, 186 are monocotyledons (157 natives and 29 weeds) and 309 are dicotyledons (276 natives and 33 weeds). Nine rare taxa are found in the Reserve. Sixty two taxa are characteristic of the eastern side of the Swan Coastal Plain and seven taxa are at their northern or southern limits. This diversity of plant communities and flora in the Bullsbrook Nature Reserve clearly identifies the area as being regionally significant and of outstanding conservation value. The Reserve is also an important part of a series of bushland areas to the south that together provide representation of the vegetation of the flats of the northern Pinjarra Plain through to the uplands of the Dandaragan Plateau.

INTRODUCTION

Bullsbrook Nature Reserve is located on the eastern side of the Swan Coastal Plain, just north of Bullsbrook on the Great Northern Highway (Map 1). Previous to the gazettal of the Nature Reserve in 1992 the area was an unvested reserve for Travellers and Stock. The south western corner has been used as a rubbish disposal site. The area was identified in the System 6 study (M14, Department of Conservation and Environment 1983) in which it was recommended

"That the purpose of Reserve C1654 be amended to Conservation of Flora and Fauna..."

In the early 1990s several studies further identified the Nature Reserve's conservation values and identified the area as being regionally significant on the Swan Coastal Plain (Keighery and Trudgen 1992, Gibson *et al.* 1994).

The eastern side of the Swan Coastal Plain has been more heavily cleared than any other geomorphological units on the Plain. Areas of natural vegetation on the eastern side of the Swan Coastal Plain are so restricted that Beard (1990) who surveyed and mapped the vegetation of the entire state noted that there was "..no virgin vegetation left.." on the eastern side of the Swan Coastal Plain. While this is not entirely correct it was estimated by the Department of Conservation and Land Management (1990) that the area was 97% cleared. Recent mapping of the eastern side of the Plain within the metropolitan area by the Perth Environmental Project (Ministry for Planning 1996) has recorded similar levels of clearance. With less than 5% of the

vegetation remaining the level of clearing is comparable with that of the Wheatbelt which Beard considered to be 93% cleared.

As a consequence the few scattered intact areas of remnant native vegetation on the eastern side of the Plain are generally associated with poorer soils, sumplands and adjacent damplands, undeveloped town sites, recreation reserves, mines (gravel or sand), transport corridors (roadsides, rail verges) and public utilities (SEC lines, drainage channels, rubbish tips).

In recognition of this high level of clearing Keighery and Trudgen (1992) recognised the significant flora conservation values of all remnants on the eastern side of the Swan Coastal Plain with the basic vegetation structure intact or able to be regenerated (Good or better condition). While this study stated that.." the status of all Nature Reserves should be maintained".. and did not make specific recommendations about most Nature Reserves, the Bullsbrook Nature Reserve was seen as part of a larger area recommended for flora conservation, the Bullsbrook Bushland (Map 1). It was recommended that:

"The area be included in a Regional Park, the areas of remnant vegetation being retained and managed for their flora conservation values. The Regional Park should be established and managed according to the guide-lines being developed by DPUD."

The Keighery and Trudgen study was confined to the area of the Swan Coastal Plain between Pinjarra and Gingin. However another more recent regional study of the Swan Coastal Plain from Seabird to the foothills of the Whicher Range (Gibson *et al.* 1994) confirmed the value of areas on the east of the Plain

"As a consequence of the small amount of remnant vegetation on the eastern side of the plain, all such remnants in the study area with the basic vegetation intact or able to be regenerated are of high conservation value."

As a result of these two regional studies and as part of the update of the System 6 recommendations (Department of Conservation and Environment 1983) the Department of Environmental Protection identified all bushland in the 'Bullsbrook Bushland' as containing "Threatened and Poorly Reserved Community (s) in need of interim protection" (Map 1, Department of Environmental Protection 1994 - 1996).

SURVEY METHOD

Survey work in Bullsbrook Nature Reserve was performed over six flowering seasons in 1990 to 1994 and 1996 in conjunction with regional survey work on the Swan Coastal Plain (Keighery and Trudgen 1992, Gibson *et al.* 1994, Keighery 1996).

Sixteen sites were located and described in the Reserve (Map 2, Appendix 1) to sample the range of plant communities identified using aerial photographs and field interpretation. Eleven are permanently located 100m^2 study sites used in the regional floristic survey of the Swan Coastal

Plain (Gibson *et al.* 1994). Groups of conservation volunteers from the Swan Coastal Plain Survey group, each led by a botanist, recorded information in a set format on physical location, vegetation structure and density and the total flora of seven of these study sites (Keighery 1994; Keighery, Keighery and Gibson 1995). A further four permanent sites and four other sites were located by the botanists. The eleven permanent all were sampled on at least two occasions.

Opportunistic plant collections, that is collections from outside the sites, were made during foot transects of the Reserve at various times of the year over the six years of survey. Identification of plant collections was made by the volunteers and the coordinators and verified at the W.A. Herbarium. A field herbarium has been prepared for the area. It is considered that approximately 95% of the flora has been documented.

GEOMORPHOLOGY AND SOILS

The Bullsbrook Nature Reserve is located on two broad geomorphic and soil units, the foothills of the Dandaragan Plateau and the Pinjarra Plain.

The western margin of the Dandaragan Plateau effectively forms the foothills of the Dandaragan Plateau. In the broad maps of McArthur and Bettenay (1960) this area is mapped as the Ridge Hill Shelf. King and Wells (1990) refer to it as the Reagan unit, describing it as a series of gently to moderately inclined slopes of yellow or grey sandy soils formed from the weathering of the sedimentary rocks containing remnant lateritic spurs. In the study area this unit is represented by a series of colluvial sands overlying clay and siltstone (King and Wells 1990, Gozzard 1982). The sands are either grey at the surface and depth (Re7, Re4 King and Wells 1990; S6 Gozzard 1982) or grey at the surface and yellow brown at depth (Re2, Re6 King and Wells 1990; S5 Gozzard 1982). In one section (site 8, Appendix 2) there is an area of sandy laterite which is not mapped by either King and Wells, or Gozzard.

To the west of the Dandaragan Plateau lies the Pinjarra Plain (McArthur and Bettenay 1960) which is generally a series of poorly drained alluvial tracts sloping very gently to the west. In the study area the alluvial clays are overlain by varying depths of sand (Ya1 - 4 King and Wells 1990; Mgs1 Gozzard 1982) or both sand and peat (Cps Gozzard 1982). The occurrence of these sands and peat over clay in a seasonally inundated area results in a complex series of wetlands along the western margin of the study area. The complexity of this area is further compounded by the presence of a ground water seepage area at the base of the colluvial sands. This seepage area extends into the adjacent paddocks to the north (Map 2).

These wetlands are mapped in the Ellen Brook Consanguineous Wetland Suite (Semeniuk 1987) and encompass sumplands, damplands and palusplain wetland types.

Bullsbrook Nature Reserve is the only known conservation reserve that spans the interface between the Dandaragan Plateau and the Pinjarra Plain. The two units are of a very different nature and the interleaving of these units results in a the formation of a complex series of habitats.

VEGETATION

The Vegetation Map

The vegetation map (Map 2) shows the distribution of the principal plant communities based on the vegetation structure descriptions of the 16 sites (Appendix 1).

Essentially the plant communities can be divided into two groups related to the soils and drainage: the wetlands on the sandy clay flats and the woodlands and shrublands on the upland sands.

Upland Woodlands and Shrublands

A series of woodlands occur on the sands in the eastern two thirds of the Reserve. These woodlands are dominated by *Banksia* species, Marri (*Eucalyptus calophylla*) and Jarrah (*E. marginata*). Within these woodlands are areas where the trees are absent and there are areas of shrublands or heaths.

Jarrah Woodland (Map 2: jW, Appendix 2: j)

While this area has been mapped as Jarrah Woodland the Jarrah density varies greatly. At times near the eastern boundary the Jarrah forms a forest or woodland (Site BULL 1) but to the south west the Jarrah is so low and sparse that this area is a shrubland (Site BULL 4). Marri is scattered through some of the area and the Jarrah Woodland grades into Marri Woodland to the north west. These trees have a dense understorey which includes such shrubs as *Xanthorrhoea preissii*, *Hibbertia hypericoides*, *Daviesia nudiflora*, *Eriostemon spicatus*, *Acacia pulchella*, *Grevillea pilulifera*, *Leucopogon australis*, *Daviesia physodes*, *Nemcia capitatum*, *Gompholobium preissii* and *Hibbertia commutata*; and the herbs *Drosera erythrorhiza*, *Thysanotus patersonii*, *Patersonia juncea*, *Lagenifera huegelii*, *Ptilotus manglesii*, *Scaevola canescens*, *Haemodorum laxum*, *Conostylis aculeata* and *Conostylis setigera*. Two sedges dominate the sedge layer *Mesomelaena pseudostygia* and *M. tetragona*.

Marri Woodlands (Map 2: mW, Appendix 2: ec)

The Marri Woodland also has a dense understorey of shrubs, herbs and sedges. The characteristic shrubs are *Xanthorrhoea preissii*, *Allocasuarina humilis*, *Calothamnus sanguineus*, *Calytrix variabilis*, *Conospermum stoechadis*, *Hibbertia hypericoides*, *Daviesia nudiflora*, *Acacia pulchella*, *Grevillea pilulifera*, *Daviesia physodes* and *Hibbertia acerosa* and the herbs *Drosera erythrorhiza*, *Patersonia occidentalis*, *Scaevola canescens*, *Haemodorum laxum*, *Conostylis aurea* and *Conostylis setigera*. Two sedges dominate the sedge layer: *Mesomelaena pseudostygia* and

M. tetragona.

Banksia Woodlands (Map 2: bW, Appendix 2: b)
Three *Banksia* species are characteristic of these woodlands: *Banksia attenuata, B. menziesii* and *B. ilcifolia. Banksia attenuata* and *B. menziesii* dominate the drier areas to the east and *B. ilicifolia* is the dominant species towards the wetland. *Eucalyptus todtiana* is scattered through the drier woodlands. The trees occur over a dense and diverse shrub, herb and sedge layer. Characteristic shrubs are *Stirlingia latifolia, Allocasuarina humilis, Eremaea pauciflora, Hibbertia hypericoides, Synaphea spinulosa, Hovea trisperma* var. *trisperma, Hibbertia acerosa, Eriostemon spicatus, Daviesia nudiflora, Leucopogon conostephioides, Bossiaea eriocarpa, Petrophile linearis, Hibbertia aurea, Calytrix strigosa* and *Hemiandra pungens.* Herbs in the understorey include *Patersonia occidentalis, Johnsonia pubescens, Drosera erythrorhiza, Drosera macrantha, Dasypogon bromeliifolius, Conostylis juncea, Conostylis setigera, Stylidium brunonianum* (pink form), *Phlebocarya ciliata, Phlebocarya filifolia, Burchardia congesta* and *Anigozanthos humilis* and the sedges *Lyginia barbata, Schoenus curvifolius, Hypolaena exsulca, Alexgeorgea nitens* and *Mesomelaena pseudostygia.*

Lateritic Heathland (Map 2: LH, Appendix 2: not distinguished separately, within ec)
Although there are areas of dense shrubland throughout the Jarrah and Marri Woodlands the individual areas of these is generally too small to map except where this community occurs on sandy lateritic soils. This Lateritic Heathland is characterised by *Xanthorrhoea drummondii, Calothamnus sanguineus, Hakea stenocarpa* and *Daviesia nudiflora. Mesomelaena tetragona* and *Mesomelaena pseudostygia* are the common sedges.

Wetlands
Relatively small changes in topography, the depth of the sand over the clay and drainage in the seasonally waterlogged and inundated areas has resulted in a complex series of communities in the wetland areas. These communities include Flooded Gum Woodland, *Melaleuca rhaphiophylla* Low Forest, *Melaleuca* Shrublands, *Actinostrobus* Tall Shrubland and a series of heaths, sedgelands and herblands. Four units have been mapped: Flooded Gum Woodland, *Melaleuca rhaphiophylla* Low Forest, *Melaleuca* Shrublands and Wetland Mosaic (Map 2). However even where the first three units are mapped there is a mosaic of smaller units embedded within them.

Flooded Gum Woodland (Map 2: rW, Appendix 2: er)
Flooded Gum (*Eucalyptus rudis*) Woodlands to Forest occur on the wettest areas of the Reserve. It appears that ground water seepage (Map 2) on the eastern margins of this area maintain this water regime, keeping the area wet well into summer. This community is very variable but not very species rich. The Flooded Gums may have a low forest to woodland layer of *Melaleuca rhaphiophylla* and sedges such as *Lepidosperma longitudinale* and *Baumea vaginalis.* To the south west this community gradually merges into the *Melaleuca* Shrubland and Wetland Mosaic.

Melaleuca rhaphiophylla Low Forest (Map 2: mrLF, Appendix 2: mr)
In the wettest area associated with the seepage *Melaleuca rhaphiophylla* Low Closed Forest occurs. In spring the roots of the *Melaleuca* form mats in the water between open *Baumea vaginalis* and the ferns, *Cyclosorus interruptus* and *Pteris vittata.*

Melaleuca Shrublands (Map 2: meS, Appendix 2: p, m, u)
The *Melaleuca* Shrublands are dominated by a mixture of *Melaleuca rhaphiophylla* (shrub form), *Melaleuca viminea* and *Melaleuca uncinata.* Low *Melaleuca preissii* trees are scattered through this community. The shrubs *Astartea* aff. *fascicularis, Hypocalymma angustifolium* and *Melaleuca lateriflora* are also commonly present. In the *Melaleuca* Shrublands the shrubs are generally clumped and a variety of herbs and sedges form dense herblands and sedgelands between the clumps. More open herblands and sedgelands occur under these clumps. Herbs common in this layer are *Tribonanthes australis, Brachycome pusilla, Stylidium petiolare, Drosera gigantea* and *Eryngium pinnatifidum* subsp. *palustre* ms. The most common rush in the sedge layer is *Restio stenostachyus.*

Wetland Mosaic (Map 2: WM, Appendix 2: a, s, u & m)
In the southern end of the wetlands the areas of individual communities are so small and interleaved that at the scale of mapping this community can only be mapped as a mosaic. However this area is characterised by a series of slightly raised sandy ridges interleaved with flat areas where the clay is closer to the surface. While the communities on the rises merge with the flats, different communities can be described from the two areas.

Sandy Rise (Sites BULL 5, 7 & 14)
Actinostrobus pyramidalis is most abundant on the rises and is often found with *Melaleuca uncinata.* Other shrubs found in these areas are *Eriostemon spicatus, Hypocalymma angustifolium, Kunzea recurva, Dryandra lindleyana, Grevillea obtusifolia* and *Melaleuca scabra.* Common herbs are *Drosera macrantha, Stylidium dichotomum, Scaevola lanceolata, Stylidium brunonianum* (purple flowered form) and *Burchardia congesta. Restio stenostachyus* is also common.

Flats (Sites BULL 6, 8 & 15)
While many of the shrubs found on the sandy rises also occur in these areas there are significantly different suites of species in the herb and sedge layers. The herbs and sedges on the flats are species characteristic of areas where seasonal inundation is more prolonged. Herbs include *Samolus junceus, Thelymitra antennifera, Tribonanthes australis, Brachycome pusilla, Philydrella pygmaea, Anigozanthos viridis, Eryngium pinnatifidum* subsp. *palustre,* and *Burchardia bairdiae,* while the sedge layer contains *Leptocarpus aristatus, Leptocarpus canus, Leptocarpus coangustatus, Restio stenostachyus, Lepidosperma longitudinale, Triglochin muelleri, Triglochin calcitrapa, Aphelia cyperoides, Centrolepis aristata* and *Hypolaena exsulca.*

Floristic Community Types

Eleven of the sites are permanent sites which were included in the regional floristic survey of the Swan Coastal Plain (Gibson *et al.* 1994).

While the mapping units are structural units they are very broadly related to the floristic units identified by Gibson *et al.* (Table 1). Five floristic community types are identified:

Table 1: Floristic Community Types in the Study Area
Floristic community types in the study area, as determined in the regional survey (Gibson *et al.* 1994), and the relationship between the structural units used for mapping. An * indicates the floristic community type is inferred.

Vegetation Mapping Unit	Floristic Community Type
Upland Woodlands and Shrublands	
Jarrah, Marri and *Banksia* Woodlands and Lateritic Heath	
Sites 1, 4, 9, 10 &11	28 (Spearwood *Banksia attenuata* or *B. attenuata - Eucalyptus* Woodlands)
Banksia Woodland	
Site 3	23a (Central *Banksia attenuata - B. menziesii* woodlands)
Wetlands	
Flooded Gum Woodland to Forest, *Melaleuca rhaphiophylla* Low Forest,	
Sites 11, *16 & *17	11 (Wet forests and woodlands)
Melaleuca Shrubland, Wetland Mosaic (flats)	
Sites 6, 8 & *15	7 (Herb rich saline shrublands on clay pans)
Wetland Mosaic (sandy rises)	
Sites 5, 7 & *14	5 (Mixed shrub damplands)

* floristic community type inferred.

type 28 (Spearwood *Banksia attenuata* or *B. attenuata - Eucalyptus* Woodlands), type 23a (Central *Banksia attenuata - B. menziesii* woodlands), type 11 (Wet forests and woodlands), type 7 (Herb rich saline shrublands on clay pans) and type 5 (Mixed shrub damplands).

FLORA

The Bullsbrook Nature Reserve contains a vascular flora of 503 taxa (Appendix 2). Of these, 440 are natives and 63 weeds. Eight of these taxa are non-flowering vascular plants, 186 are monocotyledons (157 natives and 29 weeds) and 309 are dicotyledons (276 natives and 33 weeds). The Myrtaceae (37 natives, 2 planted), Cyperaceae (36 natives, 2 weeds), Proteaceae (35 natives), Papilionaceae (30 natives, 6 weeds), Asteraceae (28 natives, 10 weeds), Orchidaceae (20 natives, 1 weed), Anthericaceae (20 natives), Stylidiaceae (19 natives), Goodeniaceae (16 natives), Haemodoraceae (15 natives), Apiaceae (14 natives), Restionaceae (14 natives), Poaceae (13 natives, 17 weeds) and the Droseraceae (12 natives) are the most species diverse families.

Significant Flora

Nine rare taxa (Appendix 2, priority species listed by CALM, Atkins 1996) are recorded for the Reserve: *Conostephium minus*, *Anthotium junciforme*, *Tripterococcus paniculatus* ms, *Myriocephalus appendiculatus*, *Lambertia multiflora* var. *darlingensis* , *Grevillea althoferi*, *Eryngium pinnatifidum* subsp. *palustre* ms, *Haemodorum loratum* and *Stylidium longitubum.*

Four taxa are at the southern limit of their range: *Myriocephalus appendiculatus, Persoonia angustiflora, Grevillea obtusifolia* and *G. althoferi.* Three taxa at the northern limits: *Hakea cristata, Cyathochaeta avenacea* and *Pultenaea ericifolia.* In addition, the populations of *Haemodorum loratum, Pteris vittata* and *Cyclosorus interruptus* are well outside their normal ranges.

Sixty two taxa are characteristic of sands and clays (Appendix 2) on the eastern side of the Swan Coastal Plain. Also of interest is a group of widespread taxa with distinctive forms found in the Reserve (Appendix 2). Some of these taxa have several of these forms occurring in the Reserve.

Significant flora of particular interest

Ferns

Four ferns were found growing in the *Melaleuca rhaphiophylla* Low Closed Forest. Three of these are native ferns, *Pteris vittata, Cyclosorus interruptus* and *Anogramma leptophyllum*, and the fourth is the introduced Tree fern *Sphaeropteris cooperi.*

Pteris vittata (Pteridaceae) Chinese Brake Fern

Chinese Brake Fern was found growing in the seepage area. Within the Perth Region this fern was previously only recorded for Yanchep (Marchant *et al.* 1987). It is also known from the Leeuwin - Naturalist Ridge and Pilbara Gorges.

Cyclosorus interruptus (Thelypteridaceae)

Known from the Lennard and Gingin Brooks, Moore River, Murchison River and the Kimberley. This is the southern most record.

Flowering Plants

Platysace ramosissima (Apiaceae)

This is a poorly known species, closely related to *P. xerophila* recorded from Boonanarring Nature Reserve, Gingin and Yalgorup National Park.

Podolepis gracilis (Swamp form) (Asteraceae)

This is a robust glabrous form of this species with large pink or white flowers from the seasonally waterlogged and inundated heavy soils of the Pinjarra Plain from Gingin to Busselton. Further studies on this form are required to establish if it can be distinguished taxonomically.

Schoenus sp.2 (GJK 3739) (Cyperaceae)
A recently recognised annual *Schoenus* species (B. L. Rye pers. comm.) found on the seasonally waterlogged and inundated heavy soils of the Pinjarra Plain from Gingin to Busselton.

Eucalyptus marginata subsp. *thalassica* (Myrtaceae)
This is a glaucous (blue) leaved form of Jarrah. The Bullsbrook Nature Reserve population is the only known population on the Swan Coastal Plain. On the other foothills areas near Perth the form of Jarrah is either *E. marginata* subsp. *marginata* or *E. marginata* subsp. *elegantissima.*

Hovea trisperma var. *grandiflora* and *H. trisperma* var. *trisperma* (Papilionaceae)
A large flowered, lax, ovate leaved variety of this widespread species found on the Ridge Hill Shelf in six floristic community types in the study area. It was placed in synonymy under *H. trisperma* in the latest revision of the genus *Hovea.* In Bullsbrook the normal variant is found in the *Banksia* woodland and var. *grandiflora* in the Jarrah woodland. They co-occur in the area between these vegetation types, and the variants should be re-instated.

Grevillea althoferi (Proteaceae)
Grevillea althoferi is a newly described species previously known from a single population on a road verge near Badgingarra (Olde and Marriot 1993). A large population of this taxon (approximately 200 plants) is found in *Banksia* Woodland on the eastern margin of the Reserve. Considering that this is the only secure population, this taxon should be considered for gazettal as Declared Rare Flora.

Grevillea obtusifolia (Proteaceae)
This is an uncommon species which is only known from wetlands in Muchea and near Gingin and near Pinjarra. The herbarium specimen from Pinjarra was collected in 1897 and this population has not been relocated (Gibson *et al.* 1994, Olde and Marriot 1995). At present the only secure population known is in the Bullsbrook Nature Reserve. As this species is currently only known from seven specimens from six localities it should be considered for gazettal as Declared Rare Flora.

Hakea cristata (Proteaceae)
This taxon is normally found on the Darling Range and Scarp between Red Hill and Toodyay. The population at Bullsbrook is the northern most occurrence and the only record on the Swan Coastal Plain.

Stirlingia latifolia (Proteaceae)
On the Swan Coastal Plain the width of the divisions of the leaves of *Stirlingia latifolia* vary from broad to narrow. Plants growing on sands have narrow leaves and plants growing in wetlands have broad leaves. Other species with swamp and sand forms present at Bullsbrook include *Eriostemon spicatus* and *Stylidium brunonianum.*

Stylidium brunonianum - pink and purple flowered forms (Stylidiaceae)
Stylidium brunonianum on the sandplains north of Perth is purple flowered, whereas on sands around and south of Perth it is pink flowered. At Bullsbrook the purple flowered form is found in the wetlands, while the pink flowered form is on the sandy soils in the *Banksia* and Jarrah Woodlands.

Tetratheca nuda (Tremandraceae)
This taxon is very uncommon on the Plain, being confined to a few localities on the foothills of the Darling Range and Dandaragan Plateau.

Eriostemon spicatus (Rutaceae)
This widespread taxon has a variety of forms which are difficult to allocate to consistent groups. However in the Bullsbrook Nature Reserve there are two distinct forms that show ecological preferences - a large flowered form in the wetlands and a small flowered form on the sandy uplands.

VEGETATION CONDITION

General Condition

Most of the Reserve is in excellent condition. Most of the communities present in the Reserve have dense shrub, herb and sedge strata which, unless disturbed, are able to resist weed invasion. While there are widespread generally non-aggressive weeds present in the bushland, the density of these is generally low.

However there are some areas of the Reserve that have been disturbed significantly and these are weed invaded. Disturbance is associated with rubbish dumping, fire, partial clearing in the north western corner associated with grazing and weed invasion along the road, dump and private property margins.

Three areas are significantly disturbed. These are:
(i) Rubbish Dump - The south western corner of the Reserve has been used as a rubbish dump. While the area has been graded there has been no rehabilitation of the area and it is colonised by a series of weeds characteristic of waste areas on the Plain: annual grasses, Castor Oil (*Ricinus communis*), Lupins (two species) and Paterson's Curse (*Echium plantagineum*). This area is in need of some active revegetation with suitable species from the adjacent *Banksia* Woodland. Direct seeding after weed control would be best but planting would be adequate.
(ii) Grazed Area: On the northern boundary the native vegetation is partially cleared and the weeds *Bromus diandrus*, *Briza maxima* and *Lotus angustissimus* have significant cover. These weeds will need to be controlled for regeneration to occur. This area was area was undoubtably grazed

by stock until relatively recently.
(iii) Tracks: There are far too many tracks in the Reserve for such a small area. All tracks have the potential to create avenues for weed invasion, especially when they are a focus for the dumping of rubbish. The tracks also provide avenues for the introduction and spread of dieback as has occurred on the substantial track along the eastern margin of the wetland. Unfortunately over the course of this study a new track was cleared in the centre of the Reserve that connected this track to the western boundary. It is apparent from the rubbish dumping and dieback patterns that the Reserve is in need of fencing to prevent vehicle movement through the Reserve. Also the new track should be closed and allowed to rehabilitate before dieback is spread along its length.

Weeds

Sixty three weeds are recorded for the Reserve (Appendix 2). All of these weeds are non- native taxa.

The weeds of greatest concern are in the wetland areas and the track and road edges. Weeds of significance in the wetlands are *Sparaxis bulbillifera, Bromus diandrus, Briza maxima, Lotus angustissimus* and a series of pasture grasses on the northern boundary.

Two species of eucalypt (*E. conferruminata* and *E. camaldulensis*) have been planted alongside the private property but these should be removed as they are not native to the area and are known to be invasive (Keighery 1995, Dixon and Keighery 1995).

DISCUSSION

Vegetation

All remaining natural vegetation on the eastern side of the Swan Coastal Plain has conservation value (see Introduction). Furthermore, the condition and complexity of the vegetation along Bullsbrook Nature Reserve identifies the area as being of regional conservation value.

Two of the five floristic community types identified in the regional floristic study of the southern Swan Coastal Plain (Table 1) can considered to be "vulnerable" (they are likely to move into the endangered category in the near future if factors leading to the loss of these community types continue to operate) (Table 2).

Community type 7 is a community characteristic of the eastern side of the Swan Coastal Plain (Map 3a) and all community types on the eastern side of the Plain are greater than 90% cleared.

Floristic community type 28 is also considered vulnerable. Type 28 is generally confined to the

western side of the Plain on sands of the Spearwood Dunes. However a series of sites from the eastern side of the Plain can be allocated to this type. These are found from Perth Airport Bushland to Dandaragan Plateau near the Moore River (Map 3b, Department of Environmental Protection 1994 - 1996). These sites are allocated to this type as they contain a series of taxa that are characteristic of Spearwood sands such as *Mesomelaena pseudostygia* and *Scaevola canescens*. The floristic similarities between the communities of these eastern sands and the sands of the Spearwood Dunes appears to be related to the presence of potash rich yellow sands underlying the sands of both systems (E.A. Griffin pers. comm.).

Table 2:
Regional Conservation Status of the Floristic Community Types from Gibson *et al.* 1994.

Floristic Community Type	Reservation Status*	Conservation Status
Upland Woodlands and Shrublands		
28 (Spearwood *Banksia attenuata* or *B. attenuata - Eucalyptus* Woodlands)	Present in two or more Cons. Reserve	#Vulnerable
23a (Central *Banksia attenuata - B. menziesii* woodlands)	Present in two or more Cons. Reserves	Low risk
Wetlands		
11 (Wet forests and woodlands)	Present in two or more Cons. Reserves	Low risk
7 (Herb rich saline shrublands on clay pans)	Present in two or more Cons. Reserves	Vulnerable
5 (Mixed shrub damplands)	Present in two or more Cons. Reserves	Low risk

* Conservation Reserves are National Parks or Nature Reserves
# see Discussion below

Of additional significance is the presence of community type 23a in the Reserve. This *Banksia* Woodland type is almost exclusively confined to Bassendean Dunes and has a limited geographic distribution on the Plain (Map 3c). The area of this community type in the Reserve is small (Map 2). However to the south of the Reserve is an area of *Banksia* Woodland in very good to excellent condition which is considered to be predominantly this type (Shire Reserve 27583 as far as the golf course). The addition of this area to the Reserve would ensure that a significant area of this community types was reserved.

The road verge between Great Northern Highway and the private land is in excellent condition to very good condition and contains an area of Wetland Mosaic similar to those in the Reserve and this should also be incorporated into the Reserve.

The bushland in the Bullsbrook Nature Reserve has added significance as it forms the only known area where vegetation characteristic of the eastern side of the Plain occurs with vegetation characteristic of the sands of the Dandaragan Plateau and vegetation characteristic of the sands of the Bassendean Dunes (Map 3).

The areas of *Melaleuca rhaphiophylla* Low Forest and Flooded Gum Woodland found in the ground water seepage area (Map 2) are of particular significance as naturally vegetated seepage areas are rare on the Plain. These seepage areas occur where the dune systems of the Plain meet

the Pinjarra Plain. Such areas were a focus for stock watering and few remain in a vegetated condition.

Flora

With a native flora of 440 native taxa in 117 hectares, the Bullsbrook Nature Reserve has an outstandingly rich and diverse flora. This high level of diversity is related to a series of factors.

(i) Diversity of floristic community types

This high level of diversity is related to the diversity of floristic groups in the area, the floristic community types in the area being typical of three of the geomorphological units on the Plain (Table 3). While these groups are not the most species diverse of the communities on the Plain (most diverse are from Supergroup 1, woodlands centred on the Pinjarra Plain and Ridge Hill Shelf, Gibson *et al.* 1994), they are very different groups and only share a limited number of taxa.

Table 3: Floristic Community Types and Species Diversity (Gibson *et al.* 1994)

Key : Column 1 Floristic community type
Column 2 Phrase name floristic community type
Column 3 Average species diversity of floristic community type
Column 4 Average weed frequency of floristic community type
Column 5 Average condition rating of floristic community type

Supergroup 2 - Seasonal Wetlands

5	Mixed shrub damplands	38.4	5.8	2.1
7	Herb rich saline shrublands in clay pans	46.4	8	2.3
11	Wet forests and woodlands	27.7	6.9	2.7

Supergroup 3 - Uplands, centred on Bassendean Dunes and the Dandaragan Plateau

23a	Central *Banksia attenuata - B. menziesii* woodlands	62.8	5.2	2

Supergroup 4 - Uplands centred on Spearwood and Quindalup Dunes

28	Spearwood *B. attenuata* or *B. attenuata - Eucalyptus* woodlands	55.2	8	2.5

Also, the representation in the Reserve of floristic community type 28 is somewhat atypical of this group as the Bullsbrook sites contain many taxa which are characteristic of Ridge Hill Shelf and Pinjarra Plain communities. Sixty two taxa present in the Reserve are characteristic of sands and clays (Appendix 2) on the eastern side of the Swan Coastal Plain. However these taxa are not shared by sufficient sites to influence grouping at the regional level. Examples of such taxa are: *Grevillea althoferi, Haemodorum loratum, Persoonia angustiflora, Hakea cristata* and *Pultenaea ericifolia* . The presence of these taxa in the Reserve results in this community type having a higher than average species diversity for type 28. The species diversity in these sites ranges from 60 - 80 taxa per site. It is likely that these *Banksia* Woodlands are in fact more closely related to the *Banksia* Woodlands of the Dandaragan Plateau (Department of Environmental Protection 1994 - 1996).

(ii) High level of species diversity of Pinjarra Plain communities

The Pinjarra Plain communities have high levels of species diversity (Keighery and Trudgen 1992, Gibson *et al.* 1994). Floristic community type 7 of the Wetland Mosaic is rich in herb and sedge species with significant representations from the Myrtaceae, Stylidiaceae, Apiaceae, Droseraceae, Anthericaceae, Cyperaceae and Restionaceae (Appendix 2).

The floristic diversity in the wetlands is related to the seasonal changes within the wetlands. These cycles of waterlogging and drying and the small changes in topography and drainage within the one location provide a series of conditions that will support a varied flora (Keighery and Trudgen 1992).

(iii) Presence of a large number of taxa of restricted distribution

Nine rare taxa (Appendix 2, priority species listed by CALM, Atkins 1995) are recorded for the Reserve *Conostephium minus*, *Anthotium junciforme*, *Tripterococcus* sp. Cannington, *Myriocephalus appendiculatus*, *Lambertia multiflora* var. *darlingensis* ms, *Grevillea althoferi*, *Eryngium pinnatifidum* subsp. *palustre* ms, *Haemodorum loratum* and *Stylidium longitubum.*

Four taxa are at the southern limit of their range: *Myriocephalus appendiculatus, Persoonia angustiflora, Grevillea obtusifolia* and *G. althoferi* and three taxa at the northern limits; *Hakea cristata, Cyathochaeta avenacea* and *Pultenaea ericifolia.* In addition, the disjunct populations of *Haemodorum loratum*, *Pteris vittata* and *Cyclosorus interruptus* are significant records.

(iv) Large number of poorly known taxa

More than 15 taxa are newly described, recently recognised undescribed taxa or forms of taxa (Appendix 2) which were not treated in the Flora of the Perth Region (Marchant *et al.* 1987). Some of these taxa are sufficiently distinct to be considered separate species, others are less distinctive and will be described as subspecies or varieties and others recognised as forms.

CONCLUSION

Bullsbrook Nature Reserve is regionally significant and of outstanding conservation value as this bushland area has:

- a unique combination of floristic community types, representing types from the Pinjarra Plain, the Dandaragan Plateau and the Bassendean Sands
- an outstandingly rich and diverse flora of 440 native taxa
- a significant number of highly restricted taxa.

Also the Reserve is an important part of a series of bushland areas that together provide an important representation of the vegetation of the flats of the northern Pinjarra Plain through to the Reagan landforms of the foothills and then Mogumber units comprising uplands of the

Dandaragan Plateau (Map 1). The Pinjarra Plain associations include: Flooded Gum and *Melaleuca rhaphiophylla* Forest to Woodland, Wandoo Woodland, Wandoo and Marri Woodland, *Casuarina obesa* Woodland, Wetland Mosaic associations, *Banksia* Low Woodlands, Marri Woodland, and Jarrah Woodland. The Dandaragan Plateau supports Heaths, Wandoo and Powderbark Wandoo Woodlands, Marri and Jarrah Low Woodland to Open Forest, Jarrah Woodland, Jarrah and Powderbark Wandoo Woodland, and Marri Open Woodland. Thus the area provides an important illustration of vegetation succession from the Pinjarra Plain to the Dandaragan Plateau as the junction of these two major landforms occurs in the area.

This study supports previous studies that identified the Bullsbrook Nature Reserve as an important area of remnant bushland in the metropolitan area and regionally on the Swan Coastal Plain (Department of Conservation and Environment 1983, Keighery and Trudgen 1992, Gibson *et al.* 1994, Department of Environmental Protection 1994 - 1996).

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Appendix 1: Vegetation Descriptions and Condition

General Information

Broad mapping units are used for the vegetation mapping (Map 2). The determination of these units is based on vegetation descriptions from the sites. The actual location of the sites is indicated on the map. The vegetation descriptions for each of the mapped units are from the areas considered to best illustrate these units, being 'typical' and in the best condition.

Sites are grouped on the basis of the mapping units and the floristic community type. An * indicates that the floristic community type for the unit and/or site has been inferred from the floristics.

Keys to the terminology used for the vegetation descriptions and specific condition ratings are given in Keighery (1994).

Site Descriptions

Floristic Community Type 28

Mapping Unit - Jarrah Woodlands

Site BULL 1 (Gibson *et al.* 1994)
Jarrah Woodland with scattered Marri over *Xanthorrhoea preissii* Shrubland over *Hibbertia hypericoides* and *Daviesia nudiflora* Open Low Heath over *Mesomelaena tetragona* and *Mesomelaena pseudostygia* Open Sedgeland.
Condition Rating Excellent
Soils: brown sand over yellow sand, Re 2(King and Wells, 1990)
Drainage: good
Aspect: gentle, W

Site BULL 4 (Gibson *et al.* 1994)
Jarrah Low Open Woodland over *Allocasuarina humilis* and *Hakea ruscifolia* Open Shrubland over *Hibbertia hypericoides* and *Daviesia nudiflora* Low Shrubland over mixed Very Open Herbland and *Mesomelaena pseudostygia* Very Open Sedgeland.
Condition Rating Excellent to Very Good
Soils: brown sand over yellow sand, Re 2(King and Wells, 1990)
Drainage: good
Aspect: gentle, W

Mapping Unit - Lateritic Heath

Site BULL 9 (Gibson *et al.* 1994)
Scattered Jarrah and Marri over *Xanthorrhoea drummondii* Shrubland over *Calothamnus sanguineus*, *Hakea stenocarpa* and *Daviesia nudiflora* Open Low Heath over *Mesomelaena tetragona* and *Mesomelaena pseudostygia* Open Sedgeland.
Condition Rating Excellent
Soils: pale brown loamy sand with lateritic pebbles over laterite, Re 6(King and Wells, 1990)
Drainage: well
Aspect: gentle, W

Mapping Unit - Marri Woodlands

Site BULL 10 (Gibson *et al.* 1994)
Marri Woodland over *Hibbertia hypericoides*, *Calytrix variabilis* and *Daviesia nudiflora* Open Low Heath over *Mesomelaena tetragona* and *Mesomelaena pseudostygia* Open Sedgeland.
Condition Rating Excellent
Soils: pale brown loamy sand over pale orange yellow sand, Re 2(King and Wells, 1990)
Drainage: well
Aspect: gentle, NW

Mapping Unit - *Banksia* Woodland

Site BULL 11 (Gibson *et al.* 1994)
Banksia attenuata and *Banksia menziesii* Woodland over *Hibbertia hypericoides* and *Scaevola phlebopetala* Open Heath over *Mesomelaena pseudostygia* Open Sedgeland.
Condition Rating Excellent
Soils: orange sand, Re 2(King and Wells, 1990)
Drainage: well
Aspect: gentle, NW

Floristic Community Type 23a

Mapping Unit - *Banksia* Woodland

Site BULL 3 (Gibson *et al.* 1994)
Scattered *Eucalyptus todtiana* over *Banksia attenuata* and *Banksia menziesii* Open Forest over *Stirlingia latifolia* and *Allocasuarina humilis* Shrubland over *Eremaea pauciflora*, *Hibbertia hypericoides* and *Synaphea spinulosa* Low Shrubland over Open Herbland and *Lyginia barbata* Open Sedgeland.
Comments: Beside the road there is an understorey layer of *Adenanthos cygnorum* Open Scrub in response to disturbance. Towards the wetlands *Banksia ilicifolia* becomes common.
Condition Rating Very Good
Soils: grey sand over white sand, Re 7(King and Wells, 1990)
Drainage: good
Aspect: gentle, W

Floristic Community Type 11

Mapping Unit - Flooded Gum Woodland to Forest

Site BULL 12 (Gibson *et al.* 1994)
Eucalyptus rudis Woodland over *Lepidosperma longitudinal* Closed Sedgeland
Condition Rating Excellent
Soils: black peaty sand, Ya 4(King and Wells, 1990)
Drainage: poor
Aspect: flat

Site BULL 16
Eucalyptus rudis Woodland over *Melaleuca rhaphiophylla* Low Woodland over *Lepidosperma longitudinale* Closed Sedgeland
Condition Rating Very Good
Soils: black peaty sand, Ya 4(King and Wells, 1990)
Drainage: poor
Aspect: flat

Mapping Unit - *Melaleuca rhaphiophylla* Low Forest

Site BULL 17
Melaleuca rhaphiophylla Low Closed Forest over *Baumea vaginalis* Sedgeland and *Cyclosorus interruptus* and *Pteris vittata* Open Fernland
Condition Rating Very Good
Soils: black peaty sand, Ya 4(King and Wells, 1990)
Drainage: poor
Aspect: flat

Floristic Community Type 7

Mapping Unit - *Melaleuca* Shrubland

Site BULL 13 (Gibson *et al.* 1994)
Melaleuca rhaphiophylla, Melaleuca viminea and *Melaleuca uncinata* Tall Shrubland over *Astartea fascicularis* and *Hypocalymma angustifolium* Shrubland over *Restio stenostachyus* Sedgeland
Condition Rating Excellent
Comments: Adjacent to the road this vegetation association has been substantially disturbed and the herbs and sedges are replaced with exotics.
Soils: black humus rich sand, Ya 4 (King and Wells, 1990)
Drainage: poor, water to 2 cm
Aspect: flat

Mapping Unit - Wetland Mosaic

Site BULL 6 (Gibson *et al.* 1994)
Melaleuca uncinata Shrubland over *Melaleuca* sp B Open Low Heath over Mixed Herbland and Mixed Sedgeland
Condition Rating Excellent
Soils: grey brown sandy clay, Ya 3(King and Wells, 1990)
Drainage: poor
Aspect: flat

Site BULL 8 (Gibson *et al.* 1994)
Actinostrobus pyramidalis Tall Open Shrubland over *Melaleuca uncinata* and *Astartea* aff. *fascicularis* Shrubland over Mixed Open Low Shrubland over Mixed Herbland and Mixed Sedgeland
Condition Rating Excellent
Soils: black sand, Ya 3(King and Wells, 1990)
Drainage: poor
Aspect: flat

Site BULL 15
Open Sedgeland to Sedgeland and Herbland
Condition Rating Very Good to Excellent
Comments: Many annual weedy grasses and herbs such as **Ursinia anthemoides*, **Hypochaeris glabra* , **Briza maxima*, **Briza minor*, **Sonchus oleraceus* and **Anagallis arvensis* are associated with these areas but the cover of individual species is not large. However the potential exists for the cover of these species to expand if the area is disturbed.
Soil: grey sandy clay, Ya 2 (King and Wells, 1990)
Drainage: poor, water to 5cm
Aspect: flat

Floristic Community Type 5

Mapping Unit - Wetland Mosaic

Site BULL 5 (Gibson *et al.* 1994)
Actinostrobus pyramidalis and *Kunzea recurva* Open Low Heath over mixed Herbland and over mixed Sedgeland
Condition Rating Excellent
Soils: grey sand, Ya 2(King and Wells, 1990)
Drainage: moderate
Aspect: flat

Site BULL 7 (Gibson *et al.* 1994)
Actinostrobus pyramidalis, Melaleuca scabra and *Verticordia densiflora* Open Low Heath over mixed Herbland and mixed Sedgeland
Condition Rating Excellent
Soils: grey sand, Ya 2(King and Wells, 1990)
Drainage: moderate
Aspect: flat

Site BULL 14
Melaleuca uncinata and *Actinostrobus pyramidalis* Open Heath to Shrubland over *Eriostemon spicatus* Low Open Heath over *Restio stenostachyus* Sedgeland
Condition Rating Excellent
Soils: grey sandy clay, Ya 2(King and Wells, 1990)
Drainage: poor
Aspect: flat

Appendix 2: Flora List

Key

Column 1: Family, Conservation Status and Regional distributions

Conservation Status
Conservation and Land Management Declared Rare Flora and Priority Taxa (Atkins 1996)
R = Declared Rare Flora
1 = Priority 1: Poorly Known Taxa
2 = Priority 2: Poorly Known Taxa
3 = Priority 3: Poorly Known Taxa
4 = Priority 4: Rare Taxa

Regional distributions

Regional ecological preferences
e = taxa endemic to the eastern side* of the Swan Coastal Plain
H = taxa characteristic of sandy clay soils on the eastern side* of the Swan Coastal Plain
s = taxa characteristic of sandy soils on the eastern side* of the Swan Coastal Plain
P = non-local planted taxa

*Southern side south of Busselton

Geographical Location (range ends)
N = population at the northern limit of their known geographic range
S = population at the southern limit of their known geographic range
D = populations disjunct from their known geographic range

Column 2: Taxon

Names follow Gibson *et al.* (1994) unless indicated otherwise. Taxa yet to be named have an attached reference collection number from the relevant collector. A * preceding the name indicates a weed. An "ms" after the name indicates that this is a manuscript name which is yet to be published.

Columns 3 - 13: Plant communities

er =	Flooded Gum Woodland	(Map 2: rW)
p =	Scattered *Melaleuca preissiana*	(Map 2: meS)
j =	Jarrah Woodland	(Map 2: jW)
b =	*Banksia* Woodland	(Map 2: bW)
a =	*Actinostrobus pyramidalis* Shrubland	(Map 2: WM)
m =	*Melaleuca* Shrubland	(Map 2: meS, WM)
ec =	Marri Woodland	(Map 2: mW)
s =	Sedgeland	(Map 2: WM)
u =	*Melaleuca uncinata* Shrublands	(Map 2: meS, WM)
mr =	*Melaleuca rhaphiophylla* Low Forest	(Map 2: mrLF)
D =	Degraded	(Map 2: D)

		er	p	j	b	a	m	ec	s	u	mr	D
Adiantaceae												
	Anogramma leptophyllum										•	
Amaranthaceae												
	Ptilotus manglesii			•	•		•					
	Ptilotus polystachyus			•								
Anthericaceae												
	Agrostocrinum scabrum			•								
H	Arthropodium preissii		•				•					
H	Borya scirpoidea						•	•				
	Caesia micrantha			•								
	Caesia aff. micrantha GJK 10857	•										
	Chamaescilla corymbosa		•									
	Corynotheca micrantha				•							
	Johnsonia pubescens				•							
H	Laxmannia grandiflora			•								
	Laxmannia ramosa		•					•				
	Laxmannia squarrosa			•	•							
	Sowerbaea laxiflora		•	•			•					
	Thysanotus arbuscula		•									
	Thysanotus manglesianus			•	•							
	Thysanotus patersonii			•								
	Thysanotus sparteus				•							
	Thysanotus thyrsoideus			•	•		•					
	Thysanotus triandrus		•									
	Tricoryne elatior			•								
	Tricoryne tenella				•							
Apiaceae												
	Actinotus glomeratus		•									
	Actinotus leucocephalus			•	•							
	Eryngium pinnatifidum subsp. pinnatifidum			•								
1HN	Eryngium pinnatifidum subsp. palustre ms	•	•				•					
	Homalosciadium homalocarpum			•								
	Hydrocotyle alata		•			•	•					
	Hydrocotyle callicarpa					•						
	Hydrocotyle diantha					•						
	Hydrocotyle pilifera		•									
	Platysace ramosissima		•		•							
H	Schoenolaena juncea						•					
	Trachymene pilosa			•	•							
	Xanthosia huegelii				•							
	Xanthosia ciliata		•	•								
Araceae												
*	Zantedeschia aethiopica		•									
Asteraceae												
	Angianthus preissianus						•					
	Angianthus preissianus (flat green GJK 13527)						•					
*	Arctotheca calendula											•
*	Aster subulatus		•									
	Brachyscome bellidioides					•	•					

		er	p	j	b	a	m	ec	s	u	mr	D
	Brachyscome iberidifolia			•	•							
*	Conyza albida											•
	Cotula coronopifolia	•					•					
	Cotula cotuloides	•					•		•			
*	Dittrichia graveolens											•
	Gnephosis drummondii						•					
	Gnephosis tenuissima							•				
	Hyalosperma cotula			•			•					•
*	Hypochaeris glabra			•	•		•					•
	Lagenifera huegelii			•								
*	Leontodon saxatilis			•								
	Millotia myosotidifolia				•		•					
	Millotia tenuifolia			•			•					
3HN	Myriocephalus appendiculatus						•					
e	Myriocephalus helichrysoides				•							
	Podolepis gracilis	•					•					
	Podotheca angustifolia			•								
	Podotheca chrysantha			•	•							
	Podotheca gnaphalioides			•								
	Pogonolepis stricta						•					
*	Pseudognaphalium luteoalbum	•	•									
	Pterochaeta paniculata (= Waitzia paniculata Gibson *et al.*)		•									
	Quinetia urvillei				•							
	Senecio hispidulus					•	•					
	Senecio minimus						•					
	Siloxerus filifolius				•							
	Siloxerus humifusus					•						
	Sonchus hydrophilus		•									
*	Sonchus oleraceus						•					
s	Trichocline spathulata			•								
*	Ursinia anthemoides			•	•							
*	Vellereophyton candissimum	•										•
	Waitzia suaveolens			•			•	•				
Boraginaceae												
*	Echium plantagineum											•
Brassicaceae												
*	Rhaphanus rhaphanistrum											•
Campanulaceae												
*	Wahlenbergia capensis			•	•							
	Wahlenbergia preissii				•		•					
Caryophyllaceae												
*	Spergularia rubra	•										
Casuarinaceae												
	Allocasuarina humilis			•	•							
	Allocasuarina fraseriana				•							
Centrolepidaceae												
	Aphelia cyperoides		•			•						
	Centrolepis aristata		•		•							
	Centrolepis drummondiana				•							

		er	p	j	b	a	m	ec	s	u	mr	D
	Centrolepis glabra						•					
	Centrolepis inconspicua						•					
	Centrolepis mutica					•						
	Centrolepis pilosa					•						
	Centrolepis polygyna					•	•		•			
Chenopodiaceae												
	Sarcocornia quinqueflora						•					
Colchicaceae												
H	Burchardia bairdiae		•	•			•					
	Burchardia multiflora						•					
	Burchardia congesta (= B. umbellata Gibson *et al.*)			•	•	•						
H	Wurmbea dioica subsp. alba						•					
Crassulaceae												
	Crassula colorata				•	•						
*	Crassula natans		•									
	Crassula pedicellosa			•		•						
Cupressaceae												
E	Actinostrobus pyramidalis					•						
Cuscutaceae												
*	Cuscuta epithymum						•		•			
Cyperaceae												
	Baumea juncea		•									
	Baumea vaginata			•								
E	Caustis dioica				•	•		•				
HN	Cyathochaeta avenacea			•	•		•					
*	Cyperus tenellus		•	•		•	•					
	Isolepis cernua		•	•	•	•						
	Isolepis cyperoides		•	•								
	Isolepis marginata		•									
	Isolepis oldfieldiana						•					
*	Isolepis prolifera			•								
	Isolepis setiformis		•									
	Isolepis stellata			•			•					
	Lepidosperma angustatum				•	•						
	Lepidosperma leptostachyum		•									
	Lepidosperma longitudinale				•							
	Lepidosperma tenue				•							
s	Mesomelaena graciliceps						•					
	Mesomelaena pseudostygia				•	•						
E	Mesomelaena tetragona				•			•				
	Schoenus asperocarpus						•					
	Schoenus aff. breviculmis					•						
	Schoenus brevisetis						•					
	Schoenus clandestinus				•	•						
	Schoenus curvifolius					•						
	Schoenus discifer					•						
	Schoenus elegans		•				•					
	Schoenus humilis						•					
	Schoenus nanus						•					

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	Schoenus odontocarpus					•	•					
	Schoenus rigens		•			•						
	Schoenus rodwayanus						•					
	Schoenus subbulbosus		•					•				
	Schoenus tenellus	•									•	
	Schoenus unispiculatus					•						
	Schoenus sp. 2 (GJK 3739)						•					
	Tetraria capillaris			•				•				
	Tetraria octandra			•	•							
	Tricostularia neesii				•							
Cyatheaceae												
*	Sphaeropteris cooperi										•	
Dasypogonaceae												
	Calectasia cyanea			•								
	Dasypogon bromeliifolius			•	•							
	Lomandra caespitosa			•	•							
	Lomandra hermaphrodita			•	•			•				
	Lomandra micrantha subsp. micrantha					•						
	Lomandra nigricans											
	Lomandra purpurea											
	Lomandra preissii			•								
	Lomandra sericea							•				
	Lomandra suaveolens			•	•							
Dilleniaceae												
	Hibbertia acerosa			•	•							
	Hibbertia aurea			•								
	Hibbertia commutata			•								
	Hibbertia huegelii			•								
	Hibbertia hypericoides			•	•			•				
	Hibbertia stellaris		•			•						
	Hibbertia subvaginata				•							
	Hibbertia vaginata			•								
Droseraceae												
	Drosera bulbigena						•					
	Drosera erythrorhiza			•	•							
	Drosera gigantea					•	•		•			
	Drosera glanduligera							•				
	Drosera helodes						•					
	Drosera heterophylla						•					
	Drosera macrantha			•	•							
	Drosera menziesii subsp. menziesii					•	•		•			
	Drosera menziesii subsp. penicillaris			•	•							
	Drosera paleacea subsp. paleacea			•								
	Drosera pallida			•			•					
	Drosera stolonifera subsp. porrecta							•				
Epacridaceae												
	Andersonia lehmanniana			•	•							
	Astroloma ciliatum							•				

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	Astroloma pallidum			•	•							
s	Astroloma stomarrhena			•								
4	Conostephium minus			•	•							
	Conostephium pendulum			•	•							
	Conostephium preissii			•	•							
	Leucopogon conostephioides				•							
	Leucopogon propinqus			•	•							
	Lysinema ciliatum			•	•							
s	Styphelia tenuiflora			•								
Euphorbiaceae												
	Amperea ericoides		•									
	Monotaxis grandiflora		•									
	Phyllanthus calycinus			•								
	Poranthera microphylla				•							
*	Ricinus communis											•
Gentianaceae												
*	Cicendia filiformis					•	•					
Geraniaceae												
*	Erodium botrys											•
Goodeniaceae												
4 H	Anthotium junciforme					•						
	Dampiera linearis				•							
	Dampiera alata		•									
H	Goodenia micrantha		•									
H	Goodenia pulchella	•	•		•							
s	Lechenaultia biloba			•								
	Lechenaultia expansa		•									
	Scaevola calliptera			•			•					
	Scaevola canescens			•								
H	Scaevola glandulifera			•			•					
H	Scaevola lanceolata				•							
	Scaevola phlebopetala				•							
	Scaevola repens var. repens			•	•							
	Scaevola striata			•								
H	Velleia trinervis		•									
	Verreauxia reinwardtii			•								
Haemodoraceae												
	Anigozanthos humilis			•	•		•					
	Anigozanthos manglesii			•								
H	Anigozanthos viridis				•	•						
	Conostylis aculeata				•		•					
	Conostylis aurea			•								
	Conostylis juncea			•	•							
	Conostylis setigera			•								
s	Haemodorum discolor				•							
	Haemodorum laxum											
3 s	Haemodorum loratum			•	•							
H	Haemodorum simplex						•					
	Haemodorum spicatum			•	•							
	Phlebocarya ciliata				•							
	Phlebocarya filifolia				•							

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	Tribonanthes australis						•					
Haloragaceae												
	Gonocarpus pithyoides		•		•							
Hydatellaceae												
H	Trithuria bibracteata						•					
Iridaceae												
*	Ferraria undulata										•	
*	Gladiolus caryophyllaceus			•	•							
*	Homeria flaccida						•				•	
	Patersonia juncea			•								
	Patersonia occidentalis				•							
*	Romulea rosea			•		•	•				•	
*	Sparaxis bulbifera		•								•	
Juncaceae												
*	Juncus bufonius						•					
	Juncus caespiticus	•										
*	Juncus capitatus						•					
	Juncus holoschoenus	•	•									
	Juncus pallidus	•										
Juncaginaceae												
	Triglochin calcitrapum						•		•			
	Triglochin centrocarpum						•		•			
	Triglochin mucronatum						•		•			
	Triglochin nanum		•									
	Triglochin procera		•									
Lamiaceae												
	Hemiandra linearis				•							
	Hemiandra pungens (This taxon was combined with H. linearis in Marchant *et al.* but there are two taxa in the Reserve)						•	•				
Lauraceae												
	Cassytha flava					•	•					
	Cassytha racemosa		•			•						
	Cassytha glabella	•										
Lentibulariaceae												
	Polypompholyx multifida		•					•				
	Utricularia inaequalis						•					
	Utricularia menziesii						•					
	Utricularia violacea						•					
Lobeliaceae												
	Isotoma hypocrateriformis				•							
	Isotoma scapigera						•					
	Lobelia alata		•									
	Lobelia tenuior			•	•							
*	Monopsis debilis		•					•				

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Loganiaceae												
	Phyllangium paradoxum (= Mitrasacme paradoxa in Gibson *et al.* 1994, Dunlop 1996)		•	•				•				
Loranthaceae												
	Nuytsia floribunda			•	•							
Lycopodiaceae												
H	Phylloglossum drummondii		•				•					
Malvaceae												
	Lawrencia squamata						•					
Menyanthaceae												
	Villarsia capitata	•										
Mimosaceae												
	Acacia applanata			•	•							
	Acacia auronitens			•								
	Acacia huegelii				•							
	Acacia pulchella var. glaberrima			•	•							
	Acacia pulchella var. reflexa					•	•					
	Acacia saligna	•		•				•				
	Acacia sessilis			•	•							
	Acacia stenoptera		•	•	•							
	Acacia wildenowiana				•	•						
Molluginaceae												
	Macarthuria australis			•								
Moraceae												
*	Ficus carica										•	
Myrtaceae												
	Astartea aff. fascicularis	•					•					
s	Baeckea camphorosmae			•								
	Calothamnus sanguineus			•	•							
	Calytrix fraseri			•								
	Calytrix stipulosa			•	•							
	Calytrix strigosa											
	Calytrix variabilis			•								
	Eremaea asterocarpa				•							
	Eremaea pauciflora				•							
	Eucalyptus calophylla							•				
P	Eucalyptus camaldulensis										•	
P	Eucalyptus conferruminata										•	
	Eucalyptus marginata subsp. thalassica			•								
	Eucalyptus rudis	•										
	Eucalyptus todtiana				•							
	Hypocalymma angustifolium		•				•					
	Hypocalymma robustum				•							
	Kunzea ericifolia			•	•							
	Kunzea recurva		•			•						
	Leptospermum erubescens			•								
	Leptospermum spinescens			•	•							

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H	Melaleuca bracteosa		•									
	Melaleuca lateriflora						•					
	Melaleuca lateritia						•					
	Melaleuca preissiana		•									
	Melaleuca rhaphiophylla	•					•				•	
	Melaleuca scabra					•						
	Melaleuca sp. (GJK 13491)					•	•					
	Melaleuca sp. B (BJK & NG 054)					•	•					
	Melaleuca thymoides			•	•							
	Melaleuca trichophylla					•						
H	Melaleuca uncinata						•					
H	Melaleuca viminea						•					
	Pericalymma ellipticum		•									
	Regelia ciliata	•	•									
	Scholtzia involucrata		•	•	•							
	Verticordia densiflora					•						
	Verticordia nitens				•							
H	Verticordia plumosa var. brachyphylla						•					
Onagraceae												
	Epilobium billardierianum		•									
*	Oenothera stricta											•
Orchidaceae												
	Caladenia deformis			•								
	Caladenia discoidea				•							
	Caladenia flava			•	•							
	Caladenia gemmata						•					
	Caladenia longicauda						•					
	Caladenia paludosa ms					•						
	Caladenia varians subsp. varians											
	Diuris laxiflora						•					
	Diuris longifolia			•								
	Elythranthera brunonis				•							
	Eriochilus dilatatus				•							
	Eriochilus scaber		•									
	Leporella fimbriata			•	•							
	Lyperanthus nigricans				•							
	Microtis unifolia											
*	Monadenia bracteata		•	•								
	Prasophyllum drummondii						•					
	Pterostylis aff. nana											
	Pterostylis recurva			•	•							
	Pterostylis vittata			•								
	Thelymitra pauciflora			•								
Orobanchaceae												
*	Orobanche minor		•									
Oxalidaceae												
*	Oxalis pes - caprae											•
Papilionaceae												
	Aotus gracillima		•									
	Aotus procumbens		•									

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	Bossiaea eriocarpa			•	•							
*	Cytissus proliferus											•
	Daviesia decurrens			•								
	Daviesia divaricata				•							
	Daviesia nudiflora			•				•				
	Daviesia physodes				•							
	Daviesia preissii			•								
	Daviesia triflora			•	•							
	Dillwynia aff. cinearascens			•								
	Euchilopsis linearis		•									
	Gompholobium aristatum				•							
	Gompholobium confertum			•								
	Gompholobium knightianum				•			•				
	Gompholobium marginatum			•								
s	Gompholobium preissii			•								
	Gompholobium shuttleworthii			•								
	Gompholobium tomentosum			•	•							
s	Hovea trisperma var. grandiflora			•								
	Hovea trisperma var. trisperma				•							
	Isotropis cuneifolia				•							
	Jacksonia densiflora			•	•							
	Jacksonia furcellata				•	•						
	Jacksonia sternbergiana				•							
	Kennedia prostrata			•	•	•						
*	Lotus angustissimus					•	•					
*	Lupinus angustifolius											•
*	Lupinus consentinii											•
	Nemcia capitata			•	•							
	Pultenaea ericifolia			•								
*	Ornithropis compresus						•					•
	Sphaerolobium vimineum			•	•							
s	Templetonia biloba			•	•							
*	Trifolium campestre											•
H	Viminaria juncea		•			•						
Philydraceae												
H	Philydrella drummondii						•					
H	Philydrella pygmaea						•					
Phormiaceae												
	Dianella revoluta						•					
Pittosporaceae												
s	Billardiera variifolia			•								
	Pronaya fraseri			•								
Poaceae												
	Agrostis avenacea		•									
*	Aira caryophyllea			•	•							
*	Aira cupaniana						•					
	Amphipogon debilis			•				•				
	Amphipogon turbinatus			•								
*	Avena barbata										•	
*	Briza maxima			•		•	•					
*	Briza minor						•					
*	Bromus diandrus						•					

		er	p	j	b	a	m	ec	s	u	mr	D
*	Cynodon dactylon		•				•					•
	Danthonia occidentalis			•	•							
	Dichelachne crinita								•			
*	Ehrharta calycina				•							•
*	Ehrharta longiflora											•
	Hemarthria uncinata										•	
*	Holcus linatus										•	•
*	Lolium perenne										•	•
	Microlaena stipoides			•	•							
	Neurachne alopecuroidea			•				•				
*	Parapholis incurva						•					
*	Paspalum dilatatum		•									
*	Pentaschistis airoides	•			•							
*	Pennisetum clandestinum		•									•
	Poa drummondiana			•				•				
	Poa porphryoclados		•									
*	Polypogon monspeliensis					•					•	•
H	Polypogon tenellus	•				•	•					
	Stipa compressa			•	•							
	Stipa semibarbata			•								
*	Vulpia myuros			•								
Polygalaceae												
	Comesperma calymega			•	•							
E	Comesperma virgatum	•	•									
Portulacaceae												
	Calandrinia calyptrata						•					
	Calandrinia composita						•					
	Calandrinia corrigioloides				•		•					
	Calandrinia granulifera			•								
	Calandrinia liniflora			•	•							
Primulaceae												
*	Anagallis arvensis var. arvensis							•				
*	Anagallis arvensis var. caerulea					•	•					
	Samolus junceus						•					
Proteaceae												
	Adenanthos cygnorum				•							
H	Adenanthos obovatus		•									
	Banksia attenuata				•							
	Banksia grandis			•								
	Banksia ilicifolia		•		•							
	Banksia littoralis	•										
	Banksia menziesii				•							
H	Banksia telmatiaea					•						
	Conospermum stoechadis			•								
	Conospermum triplinervium			•	•							
	Dryandra lindleyana		•	•	•							
1 sS	Grevillea althoferi			•								
s	Grevillea bipinnatifida							•				
	Grevillea obtusifolia					•						
s	Grevillea pilulifera											
	Grevillea pulchella			•			•					
sN	Hakea cristata			•								

		er	p	j	b	a	m	ec	s	u	mr	D
	Hakea incrassata						•					
	Hakea lissocarpha			•								
	Hakea ruscifolia			•	•							
H	Hakea stenocarpa			•								
H	Hakea sulcata											
	Hakea trifurcata			•				•				
	Hakea varia		•			•						
H	Isopogon asper			•								
s	Lambertia multiflora var. darlingensis			•								
s	Persoonia angustiflora			•								
	Persoonia saccata			•	•							
	Petrophile linearis			•	•							
	Petrophile macrostachya			•								
H	Petrophile seminuda							•				
	Petrophile striata			•	•							
	Stirlingia latifolia			•	•	•	•					
	Synaphea spinulosa			•	•							
	Xylomelum occidentale			•								
Pteridaceae												
	Pteris vittata										•	
Rhamnaceae												
	Cryptandra pungens			•								
Restionaceae												
	Alexgeorgea nitens			•	•							
	Anarthria laevis					•						
	Chaetanthus leptocarpoides						•					
	Hypolaena exsulca				•							
	Lepidobolus preissianus			•								
	Leptocarpus aristatus					•						
	Leptocarpus canus						•					
	Leptocarpus coangustatus						•					
	Lepyrodia macra		•									
	Loxocarya fasciculata			•		•						
	Loxocarya flexuosa			•								
	Lyginia barbata				•							
	Restio sinuosus ms			•	•							
H	Restio stenostachyus		•									
Rubiaceae												
	Opercularia vaginata			•	•			•				
Rutaceae												
	Boronia ramosa		•									
	Eriostemon spicatus		•	•	•							
Santalaceae												
	Leptomeria cunninghamii				•							
Scrophulariaceae												
H	Gratiola peruviana	•										
*	Parentucella viscosa						•					

		er	p	j	b	a	m	ec	s	u	mr	D
Selaginellaceae												
	Selaginella gracillima	•	•				•	•				
Stackhousiaceae												
	Stackhousia pubescens		•	•								
	Tripterococcus brunonis		•					•				
1 s	Tripterococcus paniculatus ms		•					•				
Stylidiaceae												
	Levenhookia leptantha						•					
	Levenhookia pusilla			•								
	Levenhookia stipitata							•				
	Stylidium brunonianum			•	•		•	•				
H	Stylidium bulbiferum			•				•				
	Stylidium calcaratum			•	•							
	Stylidium carnosum			•	•			•				
H	Stylidium dichotomum						•					
	Stylidium diuroides			•								
H	Stylidium divaricatum					•						
H	Stylidium ecorne						•		•			
	Stylidium guttatum							•				
	Stylidium inundatum						•					
	Stylidium obtusatum								•			
3 H	Stylidium longitubum						•					
	Stylidium piliferum			•				•				
	Stylidium repens				•							
	Stylidium schoenoides			•	•							
H	Stylidium utricularioides						•					
Thelypteridaceae												
	Cyclosorus interruptus										•	
Thymelaeaceae												
	Pimelea imbricata var. major						•					
	Pimelea imbricata var. piligera			•								
Tremandraceae												
	Platytheca galioides		•									
	Tetratheca hirsuta			•	•							
	Tetratheca nuda			•								
Typhaceae												
	Typha domingensis	•										
*	Typha orientalis	•										
Violaceae												
	Hybanthus calycinus			•								
Xanthorrhoeaceae												
	Xanthorrhoea drummondii							•				
	Xanthorrhoea preissii			•	•							
Zamiaceae												
	Macrozamia riedlei			•	•							

Map 1: Bullsbrook Nature Reserve Location.

Key

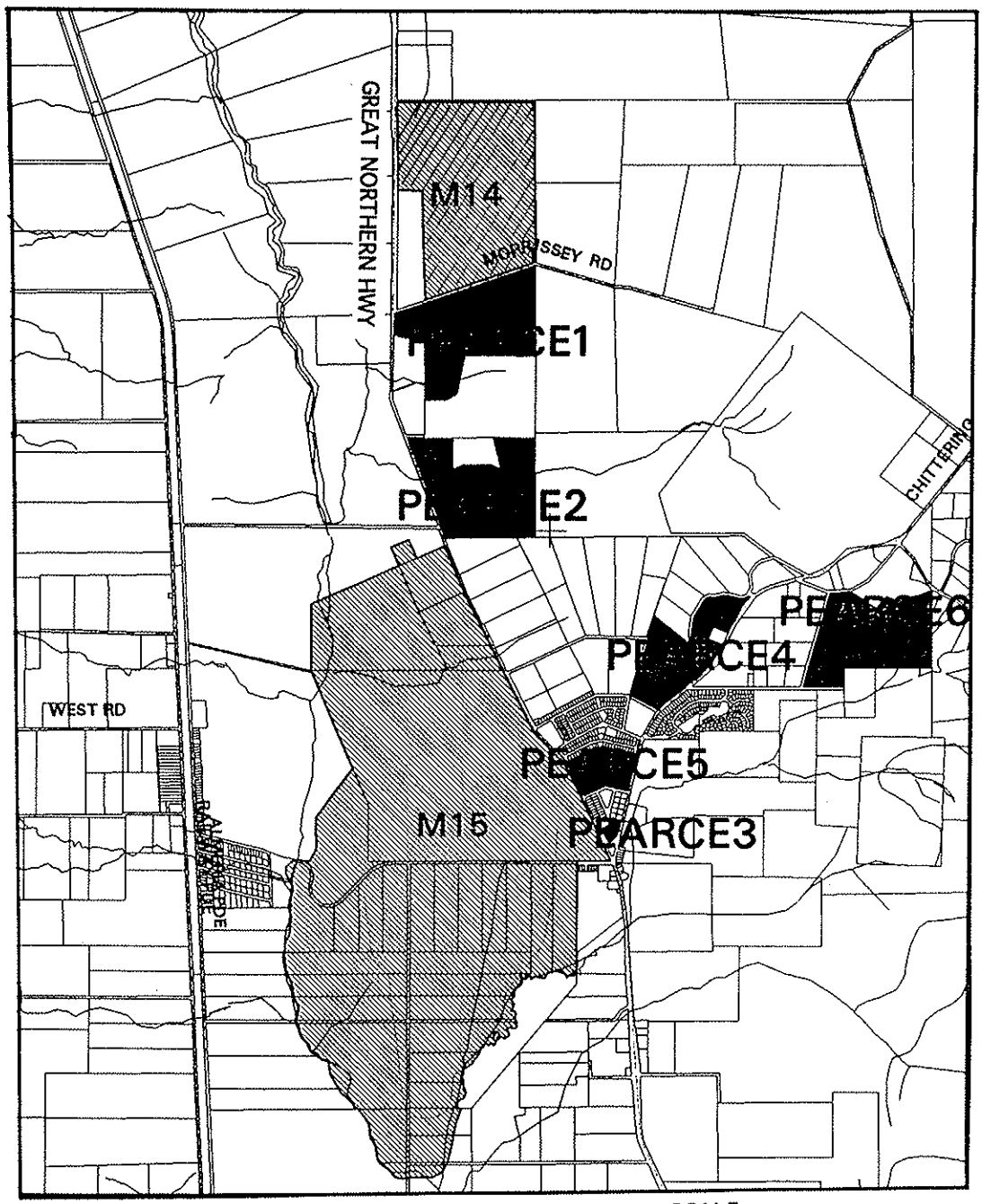
Bullsbrook Nature Reserve

Areas of bushland identified by the Department of Environmental Protection (1994 - 1996) as being "..threatened and poorly reserved community types requiring interim protection.."

Cadastre

Drainage lines

Major and secondary roads



Map 2: Bullsbrook Nature Reserve Vegetation Map

Key

Nature Reserve boundary

plant community boundary

tracks

④ Site location (see Appendix 1)

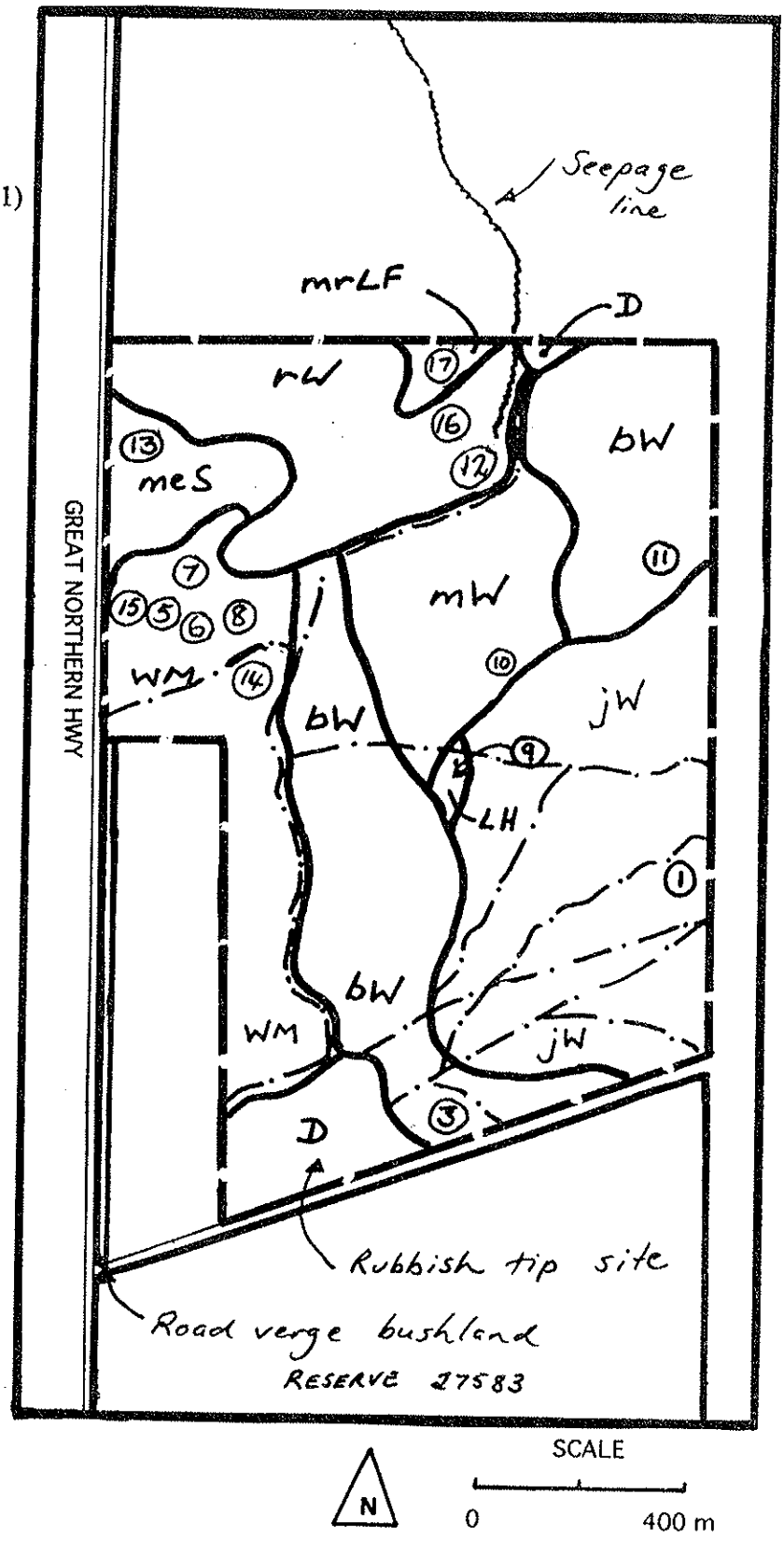
Woodlands and Shrublands

mW = Marri Woodland
jW = Jarrah Woodland
bW = *Banksia* Woodland
LH = Lateritic Heath

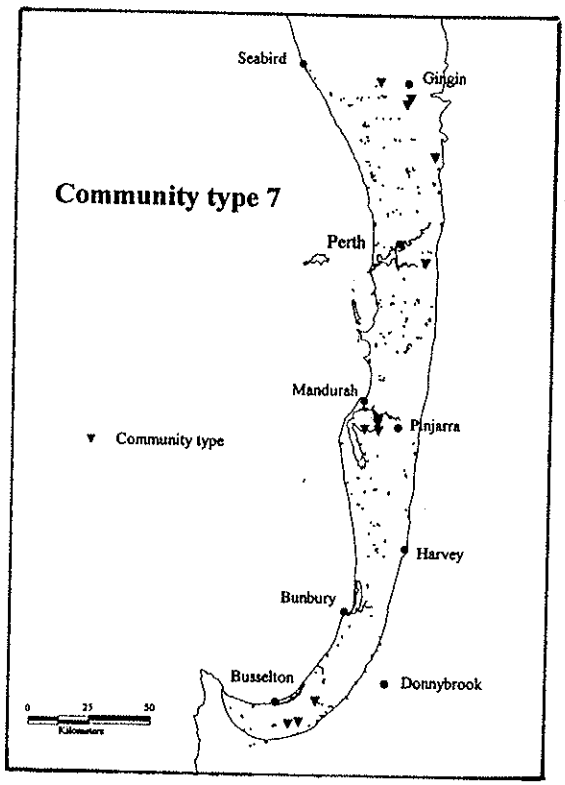
Wetlands

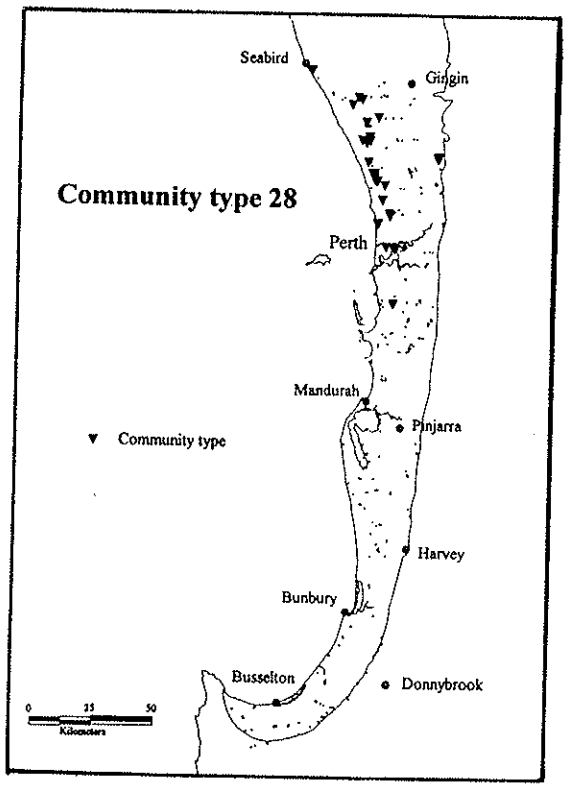
rW = Flooded Gum Woodland
mrLF = *Melaleuca rhaphiophylla* Low Forest
meS = *Melaleuca* Shrubland
WM = Wetland Mosaic

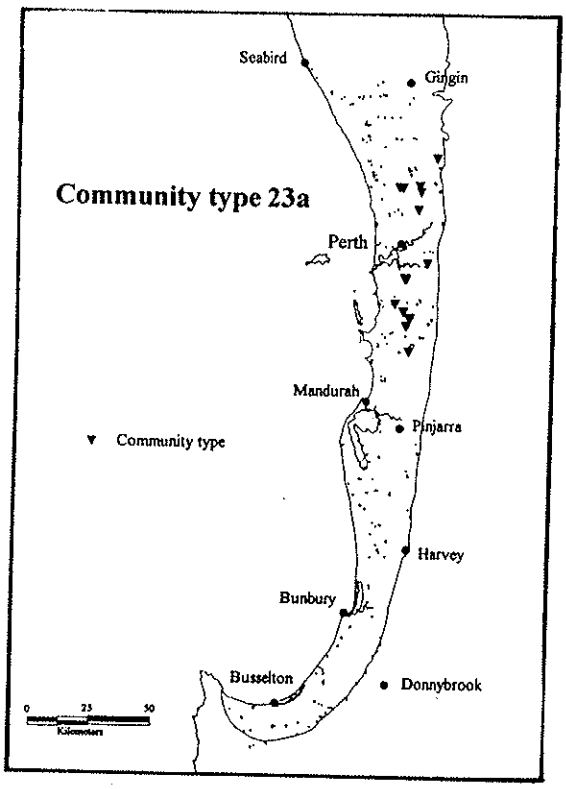
D = Completely Degraded



Map 3: Regional Distribution of the Floristic Community Types from Bullsbrook Nature Reserve (Gibson *et al.* 1994)







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FLORISTICS of RESERVES and BUSHLAND AREAS

of the

PERTH REGION (SYSTEM 6)

PARTS XI - XV

by

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February 1997

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