INTERIM GUIDELINES FOR NECESSARY OPERATIONS

for the

BEEKEEPERS NATURE RESERVE

AND ADJOINING CROWN LANDS OF THE NORTHERN SANDPLAIN

April 1993

INTERIM GUIDELINES FOR NECESSARY OPERATIONS

BEEKEEPERS NATURE RESERVE AND ADJOINING CROWN LANDS

OF THE NORTHERN SANDPLAINS

COMPILED BY: _____ DISTRICT MANAGER
MOORA DISTRICT
and
MANAGER,
FIRE PROTECTION BRANCH

DATE: _____ SENIOR ENVIRONMENTAL PROTECTION OFFICER

ENDORSED BY: _____ REGIONAL MANAGER
CENTRAL WEST REGION

DATE: 21.4.93

ENDORSED BY: _____ FIRE PROTECTION BRANCH

DATE:

APPROVED BY: _____ DIRECTOR OF NATURE
CONSERVATION

DATE:

APPROVED BY: _____ DIRECTOR OF NATIONAL
PARKS

DATE:

The Interim Guidelines are required to be reviewed and re-endorsed by both directors by April 1998.

INDEX

INDEX (Continued)

PART 2:

APPENDIX:

PREFACE

These Interim Guidelines set out the policy for the fire management of this area until a Management Plan is prepared.

Necessary operations required for the protection or preservation of persons, property, land, flora and fauna within and adjoining Beekeepers Nature Reserve and adjoining Crown lands are proposed.

The duration of approval for these guidelines is five years from the date on the frontispiece or until they are superseded by Area Management Plan. An Area Management Plan for the Mt Lesueur National Park is planned to be completed by 1994.

The Interim Guidelines provide managers with a basis for the annual works programme and job prescriptions for fire and environmental protection in and around the Reserves. During the preparation of the annual works programme, the proposed necessary operations are to be appraised for their likely impact on the environment, or the likelihood that this will pre-empt any future Area Management Plan.

ACKNOWLEDGEMENT:

Descriptive portions of the text are reproduced from Wills (1989) and Froend (1987) with kind permission of the authors.

PART I

1.1 Location and Tenure:

These Interim Guidelines deal with the crown lands which extend along the lower central west coast from immediately north of Cervantes to immediately south of Dongara. The lands contain the following reserves and Vacant Crown Lands (listed from north to south);

- Northern Beekeepers Nature Reserve (↑24496, 69,161 ha);
- Vacant Crown Land immediately inland from Northern Beekeepers Nature Reserve and west of the Brand Highway, and north of Eneabba (approx. 30,000 ha);
- Lake Logue Nature Reserve (↑29073, approx. 4,000 ha);
- Western portion of Lesueur National Park (↑24275, approx. 16,000 ha);
- Stockyard Gully National Park (↑A36419, 1,000 ha);
- Drover's Cave National Park (↑A31302, 2,680 ha);
- Southern Beekeepers Nature Reserve (↑36053)(10,854 ha).

The Nambung National Park is immediately below the Southern Beekeepers Nature Reserves' southern boundary.

The Beekeepers Nature Reserve is vested with the National Parks and Nature Conservation Authority (NPNCA) as a "C" Class Nature Reserve in 1992. Prior to 1992 Northern Beekeepers Reserve ↑24496 was for "Protection of Flora". Now deemed a "Nature Reserve" under the Act. Southern Beekeepers Reserve ↑36053 is gazetted for purposes of "Apiculture and Conservation of Flora".

Map 1 shows the above mentioned reserves and Vacant Crown Land as well as the boundary of the total area covered by these Interim Guidelines.

1.2 Geology & Soils:

The area of concern is in the northern end of the Swan Coastal Plain, a low, gently undulating area covered largely by Holocene and Pleistocene coastal dune and shoreline deposits.

The area has two physiographic units: the Coastal Belt, characterised by dune system established in the Quaternay; and the Eneabba Plain, comprising alluvial fans and associated deposits. The main water course, the Arrowsmith River, and all other minor streams do not reach the coast but drain into large swamps or lakes near the coast. All the soil formations in the area are low in organic matter, a consequence of the sclerophyllous nature of the vegetation, and the unfavourable environmental factors (eg. fires and dry summers) which prevent development of appropriate soil fauna.

The coastal dunes which extend inland up to 3 kilometres are made up of highly calcareous sands. The coastal lagoons are salt lakes less than five metres above sea level.

The older systems of dunes are lithified remnants of aeolian dunes from which the original surface sands have been removed by wind, exposing the accretionary limestone (or kankar) formed by leaching of calcium carbonate from the original surface sands. These limestone ridges run mostly parrallel to the coast and are interrupted by swales of accumulated windblown sands. The width of the limestone belt varies from five to eighteen kilometres.

The percolation of run-off waters seawards through the dune limestone has resulted in the formulation of a number of caves (eg. Stockyard Gully National Park, Drover's Cave National Park).

Figure 1 shows the surface geology of the northern two thirds of the coastal reserves.

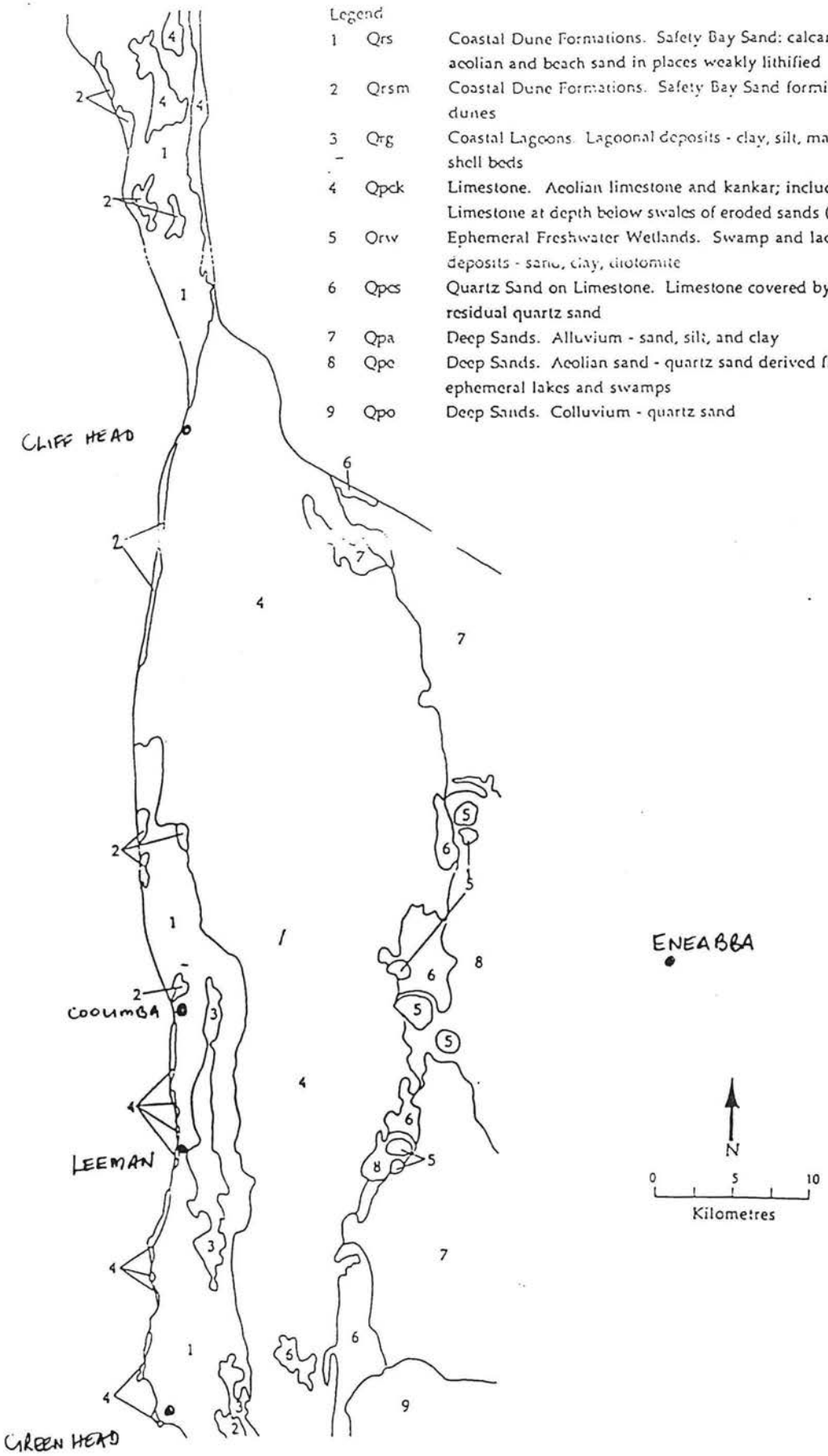

Figure 1: Surface geology of the study region based on ARC/INFO mapping (after Wills, 1989)

Figure 2 shows a diagrammatic west to east cross section of the Beekeepers Nature Reserve near Leeman showing the relationship between the geological and vegetation strata units, as described by Lowry (1974).

The main geological features of economic importance within the region of interest are the substantial gas and coal reserves. The gas is in commercial quantities, with production wells currently operating in the Vacant Crown Land north of Lake Logue. Coal is abundant throughout the region, and although the seams are generally too thin and of too poor a quality to be of commercial significance (Lowry 1974), proposals to mine have been made by CRA in the eastern portion of Lesueur National Park. Also, sands rich in rutile, ilmenite and other heavy minerals have been identified within the region.

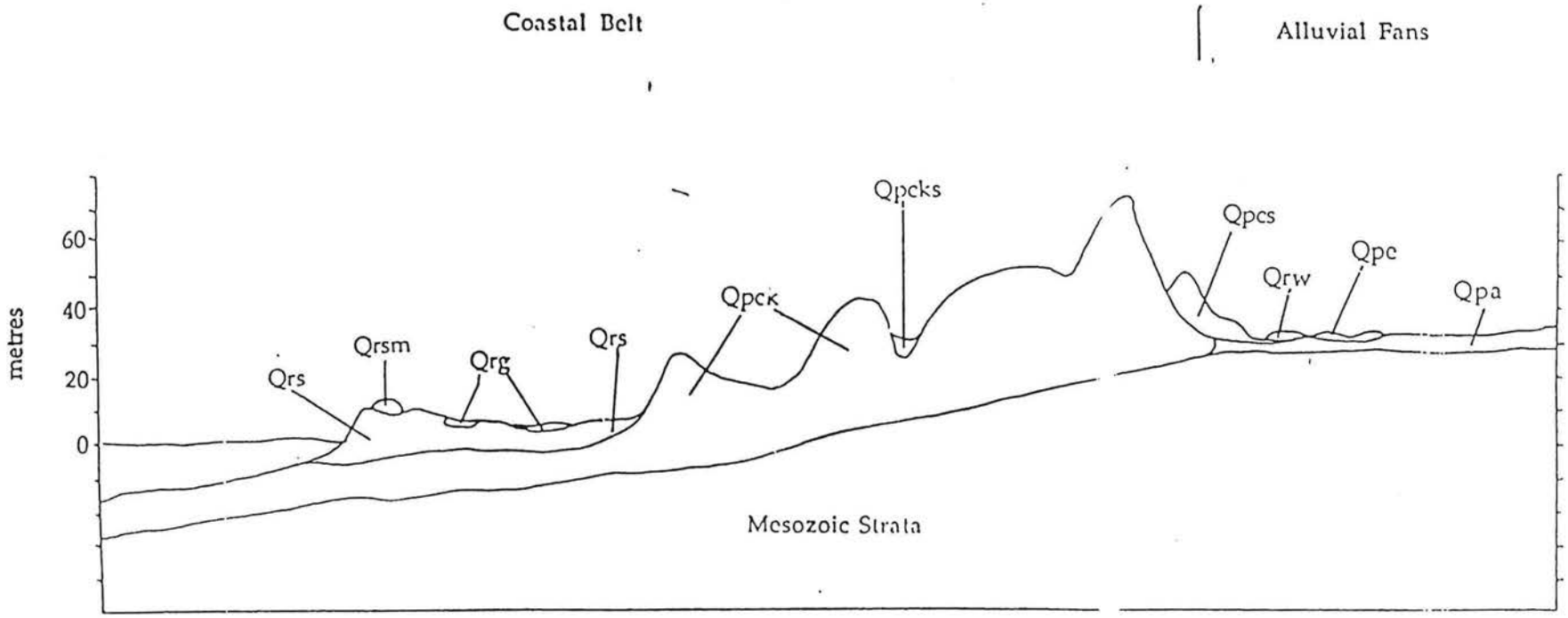

Figure 2: Diagrammatic cross-section of the study region showing the relationship of geomorphic and Cainozoic units (after Lowry 1974)

1.3 Climate:

The region has a true Mediterranean-type climate. The annual rainfall ranges from 470 to 630 mm, with about 85 percent of falls occuring in the six wettest months of April to September. The area has a distinct seasonal pattern with hot, dry summers and cool, wet winters. Total annual rainfall decreases from south to north, and with distance from the coast. Potential annual evaporative water loss exceeds average annual rainfall by three to five times (Wills, 1989).

1.4 Flora:

1.4.1 Vegetation Systems:

The reserve area is dominated by evergreen sclerophyllous shrublands known as Kwongan. The kwongan of the South-west Botanical Province (after Beard 1980) is reknowned for its high levels of species richness. Wills (1989) states that this is the result of a combination of factors including: production of a patchy environment due to the effects of fire and drought; long term historical changes in climate and sea levels; environmental stress; and close packing of species within the habitat.

Beard (1979) mapped vegetation systems in the region including:

- The Cliff Head System - coastal dune formation and coastal lagoons;
- The Ilyarrie System - limestone and quartz sand on limestone formations;
- The Eridoon system on the Eneabba Plain - with deep sands and freshwater wetlands;
- Guilderton system - coastal dense low heaths on recent dunes and sands;
- Jurien system - scrub heaths and Banksia low woodlands on older coastal limestone.

The vegetation varies from coastal dune vegetation through low coastal heath to floristically more diverse heath on sand over limestone, with Banksia woodland and isolated clumps of eucalypt spp (*E. gomphocephala*) on the deeper sands.

1.5 Vegetation and Fire:

The kwongan flora of the Northern Sandplains is extremely rich. Lamont *et al* (1984) suggest that at least 2,540 species occur in kwongan vegetation of the South-west Botanical province. The flora tends to have a high level of endemism, with many local endemics (Hopper and Muir 1984) and the plant taxa are by no means evenly distributed (Griffin *et al* 1983). The floristic composition is influenced primarily by edaphic conditions, but fire does influence community composition and the quantitative structure of the heathland communities (Wills 1989).

Cowling *et al* (1990) studied the fire related reproduction and population biology of 11 banksias of the kwongan vegetation north of Perth. They found that many species of non-sprouting banksias take at least ten years to accumulate seed reserves sufficient for adequate post-fire recruitment. Post-fire seed mortality was higher after spring than autumn burns, although recruitment is well above replacement levels after fires in either season. They concluded that elimination of these non-sprouting banksias from a site is most likely following small fires at short intervals in climates of unreliable rainfall.

Bell (1985) found that because of the large predominance of re-sprouting species in the heathland communities, the above-ground biomass recovers rapidly following fire. He concluded that the high proportion of re-sprouter species reflects the fact that fires have become progressively more common in recent times as a result of human activities. Bell speculates that the mean frequency of fires found under "natural" conditions in the Northern Sandplain kwongan was of the order of 25-50 years (Bell *et al* 1984). However more recent research suggests a fire cycle as short as eight to fifteen years could have occurred in the shrublands near Badgingarra (van de Moezel *et al*, 1987)

McCaw and Smith (1992) studied the impact of scrub-rolling and subsequent fuel reduction burning on shrubland seeder species. They found that the potential for seed losses from such species can be minimised by keeping the period between scrub-rolling and burning to less than a few weeks.

1.6 Fire and Honey Production:

The Beekeepers Reserve has been used for many years by beekeepers, and is regarded as an important area for honey bees in autumn, winter and spring. The Northern Sandplain kwongan is one of the few areas in the world where significant winter production of nectar and pollen can be obtained (Wills 1989). The area boasts one of the highest rates of honey production per hive in Australia, and amongst the highest in the world (Wills 1989). The area has increased in importance since the extensive clearing of native vegetation for agriculture - elsewhere in the south-west land division. The frequency of large scale fires over the past 25 years is a significant threat to the viability of the honey industry.

Many nectar-producing plant species regenerate from seed after fire and take up to 8 years to develop sufficient quantity of viable seed to ensure adequate regeneration. With fires becoming more frequent in the past 30 years, the sought after honey producing species are being reduced and threatened to be completely taken over by fire-tolerant re-sprouter species.

Dr Wills recommended that in order to ensure that important honey-producing species, such as *Dryandra sessilis*, are not eliminated by frequent fires, that a between-fire interval of greater than 13 years be maintained. This period also ensures that there are sufficient suitable plants available as a source of nectar. In areas that have been particularly hard-hit by large fires, the interval between fires may need to be extended much longer to allow for the slower recovery of plants over years with lower rainfall.

1.7 Dieback Disease:

Dieback disease is caused by a soil borne, microscopic pathogenic fungus belonging to the genus *Phytophthora* that destroys the root systems of susceptible plants, resulting in the death of the plant by denying the plant access to nutrient and water.

Over 1000 species of native W.A. flora are considered susceptible to dieback disease. Many of these susceptible plants belong to the Proteaceae (e.g. Dryandra, banksia), and Epacridaceae (the heaths) families of plants which are particularly well represented in the "kwongan" heaths of the Beekeepers Reserve. Many of the honey producing species may be susceptible to *Phytophthora.* The combined effect of fire and *Phytophthora* presents a particularly serious threat to Proteaceae species.

The disease is currently known to exist in the Northern Sandplain Zone with 98 separate known infections (Northern Sandplains Dieback Working Party 1992). The infections are widespread but limited in size. Most known infections are associated with roads and tracks or areas with a history of cultural disturbance. Only 12 infections are known to exist inside Beekeepers Reserve as at early 1993. All these infections are on the eastern side of the reserve on the higher hazard landforms.
Seven different taxa of *Phytophthora* have been isolated in the region to date:

- *P. cinnamomi*
- *P. citricola*
- *P. megasperma var megasperma*
- *P. megasperma var sojae*
- *P. dreschleri*
- *P. nicotianae var nicotianae*
- *P. nicoteanae var parasitica*

P. cinnamomi is the most virulent species and has only been found in moisture gaining sites. *P. megasperma* is also virulent in the northern sandplains, is found in moisture gaining sites and is often found in association with other species of *Phytophthora.* These two species cause the most damage and are, therefore, a high priority for management. *P. citricola* is widespread in the area and is commonly found on upland, dry sites which is of major concern. The species has only exhibited a low impact on vegetation to date. The other species constitute a minor proportion of recoveries, exhibit a low impact on vegetation but are of concern due to the very small amount of information that is available on their potential to damage native ecosystems.

The disease is spread predominantly by the transfer of infected soil and plant root material adhering to vehicles, plant and machinery. The disease can also spread downslope in water, by both overland and sub-surface flows.

The pathogen requires a host, moisture and warmth to survive and propagate. All these requirements are met in various ecological niches represented in the Beekeepers Reserve.

1.8 Existing Use:

1.8.1 Honey Production:

Apiary sites are extensively located within the coastal reserves. For example there are 81 sites within ^24496. It is estimated that honey production in the area provides for an income of more than $500,000 per year (Burking & Kessell, 1984).

Beekeeping will be managed in accordance with Policy Statement No 41 "Beekeeping in Public Lands" and Policy Guidelines (January 28, 1993). This policy places a moratorium on additional apiary sites within vested conservation lands.

1.8.2 Wildflower Picking:

Commercial flora harvesting is not permitted on nature reserves and national parks. However, there is a substantial area of Vacant Crown Land east of Beekeepers Nature Reserve where picking, particularly of *Banksia hookeriana*, occurs. It is estimated that 20 pickers regular pick *B. hookeriana* from late July to early September and in 1992 took an estimated 600,000 stems.

1.8.3 Visitation:

Visitor use of the reserves is very limited due to the very poor access and difficult terrain. Most visitation occurs in spring months. The most popular visitor destinations are along the coastline.

1.8.4 Coastal Settlement:

A number of coastal towns, settlements and smaller groups of squatters shacks exist along the coastline. These settlements include Cliff Head, Coolimba, Leeman, Green Head, Jurien and Cervantes.

1.8.5 **Basic Raw Materials**:

The reserves contain limestone, sand, gravel and shellgrit resources. CALM's Basic Raw Material (BRM) Policy No 2 limits the use of this material, when on a conservation reserve, to roads within and part of that reserve (this policy is under review). In the current Policy, proposals to use material for works outside the reserves requires a mining tenement, Environmental Protection Authority (EPA) assessment and Ministerial approval, alternatively excision may be sought, requiring the approval of the NPNCA and Minister. In the case of National Park and A Class Reserve approval of both Houses of Parliament is required.

Several reserves (adjacent to Lesueur National Park) have been vested in the National Parks & Nature Conservation Authority (NPNCA) for "Gravel Resource Management, Restoration and Conservation" for use by the Dandaragan and Coorow Shires and Main Roads Department for a limited period (5 + 3 years respectively). Applications by private operators for mining tenements in these reserves are normally opposed.

Any decision on BRM allocation is dependant on the completion of a planning study by DPUD which includes the development of a BRM strategy by the Department of Minerals & Energy (DOME).

1.8.6 **Mining**:

Development of the extensive lime sands deposits and the Jurien gypsum deposit on ^24496 will be assessed according to the EPA Act and managed under the Mining Act. Any application for mining or significant ground disturbing exploration is to be referred to the NPNCA for recommendations.

1.8.7 **Petroleum**:

Consolidated Gas operates the Woodada Gas field north of the Lake Logue Nature Reserve. Liaison with Consolidated Gas is ongoing to ensure that exploration and production activities are undertaken with full regard to existing *Phytophthora* infections and the potential for further spread. Consolidated Gas are subject to existing environmental approvals from the EPA.

Sagasco are another major gas exploration company in this area. All proposals for seismic surveys or drilling are to be in accordance with standard conditions agreed with the Department of Minerals and Energy (DOME) and are to be referred to the NPNCA via the Environmental Protection Branch. Seismic programs are permitted on condition that these operations are planned to minimise soil disturbance, dieback spread, and controlling access by third parties.

PART 2

2.0 GENERAL MANAGEMENT OBJECTIVES:

The management goals of Nature Reserves and National Parks are set out in the CALM Act and Departmental Policies.

Within this context the management objectives of both Nature Reserves and National Parks are to protect and conserve the natural resources of the reserves.

Use of these reserves is to be regulated to ensure the protection of natural resource values and to minimise conflict between users.

3.0 FIRE PROTECTION:

3.1 Factors Affecting Fire Management:

- Given usual seasonal patterns, the vegetation is usually dry enough to burn from August/September through to May. High fire danger normally occur from October to April.

- Kwongan vegetation of the Northern Sandplains is extremely flammable, and will burn rapidly and with high intensity. However the discontinuous nature of scrub heath and mallee heath vegetation makes it difficult and often risky to backburn against the wind. The discontinuous fuels can be burnt most effectively by head firing.

- Scrub rolling is a proven technique for establishing fuel reduced buffer strips in shrubland fuel types, particularly where fuels are discontinuous (McCaw & Smith, 1992). Scrub rolling assists prescribed burning operations by creating a more continuous fuel bed. Fires are more readily controlled in scrub rolled fuels because flame heights are reduced, and because strong winds are not required for fires to spread.
- Lightning strikes are a common cause of fire on the west coastal plain. Since records have been maintained from 1985 onwards, lightning caused fires have occurred every 2 or 3 years in the general region. The lightning strikes in January 1993 resulted in more than 50 fires from Geraldton to Perth, which burnt out almost 100,000 hectares of crown lands and farmlands.

- The opening-up of the west coastal plain for agriculture since the early 1970's has resulted in many fires along the coast as a result of clearing operations, and other human activity.

- Human caused fires have occurred regularly. The specific causes are many and vary widely. They include fires deliberately lit by individuals who feel threatened by large areas of dense vegetation.

- As a result of these fire sources much of the west coastal sandplain has been subjected to an intense wildfire every 6 to 8 years over the past 25 years. The worst example was the wildfire on 16-21 January 1984 which burnt 117,000 ha between Jurien Bay and Cliff Head. This was followed by several other human-caused fire burnt 63,400 ha in the period February to May 1985. In January 1993, 50,000 ha of the Beekeepers Nature Reserve north of Coolimba Road was burnt following four lightning strikes within the reserve.

- The presence of limestone ridges and coastal dune formations parallel to and inland from the coastline, presents a serious barrier to access for fire fighters into much of the coastal reserves and, prevents most fires from being confined to small areas. The formidably bad terrain, and the fire intensity normally exhibited by coastal fires makes it impossible for a direct attack with water and even bulldozers.

Back-burning from established roads often many kilometres from the actual fire results in dramatic increase in fire areas, and other unfortunate consequences such as escapes from the back-burns.

- In the past 7 years, the fire protection of the Beekeepers Reserve and vacant crown land areas has been organized under the Central West Coastal Fire Protection Plan co-ordinated by the Bush Fires Board. Participating agencies and groups including local bushfire brigades, beekeepers and CALM have undertaken some fire prevention work. However the finance committed by the Bush Fires Board to these tasks has not been sufficient to enable the annual fire prevention works programs to be realized. To their credit, several individual beekeepers have been most active in maintaining the limited access network and establishing narrow scrub-rolled buffers.

- The change in tenure in 1992 of the Beekeepers Reserve to a Nature Reserve managed by CALM, has placed a further burden of responsibility on the Department of CALM which already has approximately 300,000 ha of Reserves to manage on the central west coast. Although some increase in CALM's management resources have been provided, CALM must continue to rely strongly on support from local Government Authorities, bushfire brigades, beekeepers, Bush Fires Board and neighbours. The co-operative arrangements for fire control of Crown lands (including Vacant Crown Land) that are spelled out in the Central West Coastal Fire Protection Plan co-ordinated by the Bush Fires Board, need to be further strengthened.

3.2 Fire Management Objectives:

3.2.1 To meet the general fire management objectives of the Department *viz*:

- to protect life, community and environmental values from damage or destruction from wildfire;

- to use fire as a management tool to achieve land management objectives, in accordance with designated land use priorities.

Additionally, the following are specific objectives for the Beekeepers Nature Reserve and adjoining crown lands along the central west coast:

3.2.2 Prevent wildfires from entering the reserves.

3.2.3 Prevent wildfires that originate in the reserves from spreading onto adjoining property including coastal towns and settlements, squatters shacks, farmlands and exploration and mining facilities.

3.2.4 Prevent large areas of the reserves from being burnt in any one wildfire and enable the between-fire interval of most of the vegetation on the reserves to exceed 13 years.

3.2.5 Reduce the risk and frequency of wildfires starting within or near the reserves resulting from human activity.

3.3 Fire Protection Strategies:

Six fire management strategies have been developed, these are listed below:

- Development and maintenance of low fuel buffers;
- Maintenance of firebreaks and fire access tracks;
- Prescribed burning operations;
- Fire suppression;
- Liaison between fire organisations;
- Fire research and monitoring.

3.4 Fire Protection Actions:

The fire prevention and suppression actions required to meet the objectives are given below and shown on Map 2. The works program and priorities over the next 5 years are listed on Table 1.

3.4.1 Development and Maintenance of Low Fuel Buffers:

Actions required are:

- Create fuel reduced buffers on the boundaries of the reserves as well as along management block boundaries as indicated on Map 2. The block areas range from 3,000 to 12,000 ha depending on the values at risk, the presence of existing tracks and nature of the terrain.

- Within the kwongan heath vegetation, the buffers will comprise of burnt scrub-rolled strips up to 100 metres wide. In order to ensure the buffers are effective over time, it will be necessary to widen the buffers. To provide for the extra width (upto 400m) required to stop intense fires, edge burns will be run into the scrub-rolled low-fuel buffers.

- In large blocks (10,000 ha+) where access roads are currently absent, low fuel buffers are to be established either by aerial ignited wind driven buffers, or by scrub-rolling and burning downed vegetation.

- Where good access tracks already exist within woodland vegetation, "open-edge" burns will be applied. The open-edge burns will need to be at least 400 metres deep. This can be achieved with judicious application of fire under mild conditions.

- Where double firebreaks exist, the buffer between the firebreaks will be burnt to maintain scrub fuel at suitable levels.

3.4.2 Maintenance of Fire Access and Firebreaks:

Actions required are:

- Existing tracks regarded as acceptable from a dieback hygiene perspective are to be maintained to 4 wheel-drive standard. This is to be achieved by grader, or front-end loader tractors. Use of herbicides will be considered where mechanical means are not suitable.

- In the large unroaded block of the Beekeepers Nature Reserve and Vacant Crown Land north of Coolimba Road, two east-west road alignments are to be pegged through the area burnt in January 1993. These roads will be required from 1998 onwards when the vegetation in the area burnt in 1993 will become available to burn.

- All road maintenance work and other soil disturbance work will be conducted in dry soil conditions and under strict dieback hygiene operations.

- Sign-posting of public roads and fire access tracks will be carried out and maintained as funds become available to enable safe access for fire fighters and Reserve users (eg. beekeepers).

3.4.3 Prescribed Burning Operations:

Actions required are:

- Reburning of buffers will not occur until vegetation is more than eight years since the last fire. In order to maintain low-fuel buffers that are effective in fire suppression operations, a system of parallel buffers are to be created by scrub rolling and burning so that at any time one of the buffer strips is no more than four years old.

- All burns must comply with a written prescription approved by the District Manager. These must include the Departmental Pre-burn Checklist (CLM 32) to take into consideration the environmental impacts of burning.

- If burning of known locations of declared rare flora and fauna is unavoidable, an application for a Ministerial permit to "take" the flora and fauna will be required.

- Dr R Wills (Herbarium) is to be advised of any proposed burning and scrub-rolling to allow him to carry out re-measurement of his study plots in the Northern Beekeepers Nature Reserve.

- Monitoring of weather conditions and fire behaviour by operations staff to be conducted during prescribed burns particularly where new techniques are being tested. This is useful for validating information from studies undertaken elsewhere, and for providing training material for staff new to the area.

3.4.4 Fire Suppression:

Actions required are:

- Wildfires in or threatening the Park will be contained, either by direct attack (where fire behaviour permits, and access and suitable machinery are available), or by allowing fires to burn into buffers, or by backburning from established low fuel buffers or firebreaks/access tracks.

- The suppression priority and strategies applied will be decided on the basis of likely threats to life, property and conservation values; the fire suppression resources available; and on the likely impact of the suppression activity on the environmental values. Specifically, the risk of spreading of Phytophthora spp. during suppression operations is to be minimized.

- Suppression arrangements between CALM, Local Shires, Bushfire Brigades, Bush Fires Board, Beekeepers, and neighbours are to be reviewed annually, and detailed in the Central West Coast Fire Protection Plan. The arrangements apply to all land tenures.

. Procedures and arrangements for actions by CALM staff in case of wildfires are reviewed annually and detailed in the Fire Control Working Plans for both the Midwest Region and Moora District.

3.4.5 Liaison:

District staff will maintain close liaison with the Shires of Irwin, Dandaragan, Coorow and Carnarmah and their volunteer bushfire brigade organisation, Bush Fires Board, Beekeepers, and Reserve neighbours to encourage mutual aid in fire prevention, detection and suppression activities in or near the coastal reserves.

3.4.6 Fire Research:

Actions required are:

. Selected burns are to be monitored by District staff in association with scientists from Science and Information Division to determine the impacts of the burning operations on vegetation structure and biomass, as well as selected "keystone" and melliferous plant species. Priority for monitoring will be given to those burn areas where vegetation is old (greater than 15 years), and where there exists a rich array of different species.

. Investigations and operational trials will continue into the feasibility and effectiveness of fuel modification treatments as a means of fuel reduction. Alternatives include edge scrub-rolling; aerial ignition of wind-driven buffers; open edge burning in various vegetation types; use of chemicals for vegetation control on access tracks.

. Funding will be sought for detailed, systematic flora and fauna surveys of those sections of the Beekeepers Nature Reserve where this data is lacking.

- Any research trials established must be written up as a Research Project Plan by Science and Information Division, following consultation with the Regional Manager and District Manager. Adequate protection will be provided to all research and monitoring plots. Plot location maps are to be held at the District and Park staff offices.

3.5 Implementation and Approval:

- Midwest Region and Moora District staff will conduct annual meetings with other involved agencies and individuals to develop and review annual works programs using the strategies in Section 3.4 to achieve the objectives.

- Table 1 lists the agreed five year works program decided at the combined meeting at Moora on March 2, 1993.
- Approval for any of the listed works on CALM managed lands must be provided by CALM's District Manager at Moora. Work proposed on the Vacant Crown Lands must be approved by the Senior Bush Fire Liaison Officer in the Geraldton Region of the Bush Fires Board.

- Any major changes of operations on CALM lands must be re-endorsed by the respective Director of Nature Conservation (for nature reserves) or the Director of National Parks (for national parks).

Table 1: Proposed 5 year Fire Prevention Program from Autumn 1993 to 1997/98

BEEKEEPER'S RESERVE AND ADJOINING V.C.L.

Strategies	*Priority*	*When*	*Who Responsible*
A. **North of Coolimba Road**:			
1. Establish E-W Road Alignment (Peg following recent fire):			
. Extend Mt Adam's Road to Coast	3	1994/95	Beekeepers/CALM (Borland)
. Beekeepers Road (western extension)	1	1993/94	Beekeepers/CALM/PSummer
. Woodada Survey line (extend westward)	2	1993/94	H East/CALM
2. Maintain Carpenter's Track to Beekeeper Road	1	1993/94	H East/CALM
3. Prepare Future Buffer Plan (Burn after 5 to 7 years)	3	1995/96	CALM/BFB/Beekeepers
4. Buffer Burn (open edge) - Norm's Track	2	1993	P Summer/CALM
5. Finalize Burn Buffer. Westward along Coolimba Road	3	1996/97	Beekeepers/CALM/Shire
B. **Coolimba Road --> Greenhead Road**:			
1. Burn scrub-roll along Morgan Track	1	1993	R Pollard/CALM
2. Burn E-W scrub-roll from Little Three Springs	2	1993	R Pollard/CALM
3. Complete Knights Track Buffer Burn	1	1993	J Davies/CALM
4. Maintain Existing Tracks	2	1994	Beekeepers/CALM
5. Scrub-roll and Burn Buffer on Birrell Track	1	1993/94	J Davies/CALM
6. Burn E-W boundary of Stockyard Gully NP to Morgan's Track	1	1993	R Pollard/CALM
7. Name & Signpost all Tracks (applies to all areas)	1	5 year Program	CALM (D Rose)

Table 1: Proposed 5 year Fire Prevention Program from Autumn 1993 to 1997/98 (continued)

BEEKEEPER'S RESERVE AND ADJOINING V.C.L.

Strategies	*Priority*	*When*	*Who Responsible*
C. **Greenhead --> Jurien Road**:			
1. Open-edge buffer N-E of Jurien against 3 y.o. buffer (Drover's Cave NP N and E (?) boundaries)	1	Aug '93	CALM (K Hockey)
2. Construct buffer strip N-E of Jurien	1	1993	Jurien Bushfire Brigades
D. **Southern Beekeepers**:			
1. Buffer 200m buffer along PP boundary to Nambung	1	1993	CALM/Brigades Dandaragan Shire
2. Possible wind-driven buffer Noolah Hill (ground/helicopter)	2	1994 +	CALM

4. DISEASE PROTECTION:

The Beekeepers Nature Reserve is covered by the Moora District Dieback Protection Plan 1990-1994. The Plan sets out objectives and strategies for the management of disease in the Moora district. The majority of the reserve falls into the B Zone of the plan which denotes a median priority for management due the area having a lower rainfall, limited known infections, moderate to low hazard sites, limited public access and minimal management capability compared to other areas within the District.

A subjective assessment of the predicted impact of the disease on the vegetation associations of the Beekeepers Reserve has been made using information on disease biology and ecological requirements, underlying geology, soils, climate and vegetation associations. The results are depicted in figure 2 which shows the disease hazard ratings for the reserve. These hazard ratings will allow the reserve manager to determine the approximate impact on the vegetation of dieback disease being introduced to a site within the reserve.

Table 1 lists descriptions of the soil and landforms represented in the reserve and allocates disease hazard ratings.

4.1 Disease Management Objectives:

To meet the general management objectives set out in the Moora Dieback Disease Protection Plan viz:

- prevent the introduction of dieback disease into disease free areas; and

- minimize spread in areas where the disease already occurs.

4.2 Disease Management Strategies and Actions:

The following are specific strategies and actions for the Beekeepers Nature Reserve and adjoining crown lands along the central west coast:

- A system of essential roads and firebreaks to be retained will be defined, based wherever possible on existing roads and firebreaks.

- Construction of new roads and firebreaks will take place only where essential. Where new roads and firebreaks are necessary, they will be located and constructed so as to minimize the risk of disease introduction or impact of additional spread.

- Off road vehicular access on the reserve will be prohibited. Off road access for management purposes (e.g. fire control) will also be strictly controlled and will be based on a consideration of hygiene requirements where this is possible.

- Before any operations are permitted the following factors will be considered:

  . the need for the work proposed;
  . the risk of introducing or spreading the dieback fungus;
  . the hazard rating for the area (using vegetation and landform information);
  . the consequence on the landuse and ecological values of the reserve of introducing dieback disease;
  . the hygiene that is most appropriate to be applied to the operation;
  . evaluation and approval by Regional Manager.

- Sanctioned operations will utilise hygiene tactics specified in the Dieback Disease Hygiene Manual and such specific prescriptions as are required in special circumstances.

- All operations will be closely supervised by competent, well trained CALM staff.

- Access to the reserve by apiarists will be by arrangement, on routes and under hygiene conditions specified by CALM in accordance with Policy 41 - Guidelines and the Apiarist Code of Practice.

TABLE 2a: SOILS

Northcote et at., 1967 (from Froend R.H., 1987)

HAZARD	MAP UNIT	DESCRIPTION
LOW	A13	sandy soil of minimal development. Coastal dune formations backed by low lying deposits of inlets and esturies. Chief soils are calcarious sands on dunes.
LOW	A16	Sandy soil of minimal development. Broad swales and characterised by salt lakes. Chief soils are shallow calcarious sands with aeolianite occurring as a continuous substrate within 40cm of the surface.
LOW	B24	Sandy soil of minimal development. Undulating dune landscape underlain by aeolianite which is frequently exposed. Small swales of estuarine deposits are included. Chief soils are silicious sands with smaller areas of brown sands and leached sands in the water sites.
MODERATE HIGH	Ca27	Leached sand soil without a compacted or pan-like layer below the bleach. Sandy plains with the occasional pockets of sand dunes, a few small swamps, and stream courses. Chief soils are leached sands often with a sandy clay substrate between 1 and 2m in depth.
HIGH	JK9	Sandy soil with an unbleached A2 horizon, B horizon present. Undulating dune landscape with some steep dune slopes and underlain by aeolianite at depth. chief soils are brown sands. Associated are silicious sands on the deeper dunes, especially on the western side of the unit, and leached on the more subdued dunes on the eastern side of the unit.
HIGH	Ub97	hard setting loamy soil with mottled yellow clayey subsoils, bleached A2 horizon. Very gently undulating plain. Chief soils are neutral, and also alkaline, yellow mottled soils overlying siliceous pans at depth.
HIGH	Wd9	Sandy soil with mottled yellow clayey subsoils. Acid reaction trend with a bleached A2 horizon. Broad valleys and undulating interfluvial areas with some discontinuous breakaways and occasional mesas. Lateritic materials mantle the area. Chief soils are sandy acidic yellow mottled soils containing much ironstone gravel in the A horizons. Associated are leached sands underlain by lateritic gravels and mottled clays that occur at a progressively greater depth down slope.

HIGH	Wd10	Sandy soil with mottled yellow clayey subsoils. Acid reaction trend with a bleached A2 horizon. Broad valleys and interfluvial areas, some evenly sloping pediments with exposures of sandstone and shale. Chief soils are sandy acidic yellow mottled soils containing much ironstone in the A horizons. Associated are leached sands underlain by lateritic gravels and mottled clays that occur about 1m in depth and are shallower than unit Wd9.

TABLE 2b: VEGETATION

Beard, 1976, 1979 (from Froend R.H. 1987)

THE CLIFF HEAD SYSTEM:

LOW HAZARD

Occupies a narrow belt along the coast south of Dongara, 1 to 5km wide. It is situated upon limestone slightly above present sea level forming elongated dune ridges trending north-south. Most of the dunes are consolidated and vegetated but some are still mobile. the limestone is covered by grey sand and low heath of small shrubs 30-60cm in height, with some small patches of Acacia and mallee thickets. The principal species are *Acacia lasiocarpa* and *Melaleuca acerosa* but frequently *Scaevola spp.* are dominant. In places larger shrubs of *Acacia rostellifera, A. xanthina, Allocasurina baxteriana, Melaleuca cardiophylla* and *M. huegelii* form dense thickets on the sand ridges together with *Eucalyptus dongarrensis* in mallee form in small patches. On ridges of exposed limestone there is heath consisting of *Melaleuca acerosa, Beaufortia elegans, Eremophila glabra, Baekea sp., Thryptomene sp.* and *Carpobrotus aequilaterus*. the salt lakes near the coast have samphire at the margins. Adjacent to the lake is a swampy area of thickets containing *Melaleuca huegelii, M. thyoides, M. lanceolata* with sedges as a ground layer and trees of *Casuarina obesa* scattered singularly or in groves.

THE ILLYARRIE SYSTEM:

MAJORITY LOW HAZARD - MODERATE TO HIGH HAZARD IN THE BANKSIA COMPONENT

Like the previous system is associated with the coastal limestone and occurs on undulating hilly country of lithified calcarenite overlain by variable depth of yellow siliceous sand. *Eucalyptus erythrocorys* forms isolated groves usually 8-10m in height. the groves have an en shrub understorey containing *Acacia blakelyi, A. pulchella, A. spathulata, Dryandra sessilis, Hakea costata, Hibbertia hypericoides, Alyogyne huegelii, Hybanthus calycinus, Scholtzia sp.* and *Restionaceae species*. In some areas *Beaufortia sqarrosa* and *Banksia sphaerocarpa* appear to be dominant species, with some small trees of *Banksia attenuata* and *B. prionotes*. Other shrub species include *Allocasuarina humilis, Hakea trifurcata, H. prostrata, H. lissocarpa* and *Jacksonia furcellata.*

TABLE 2b: VEGETATION (continued)

Beard, 1976, 1979 (from Froend R.H. 1987)

THE ERIDOON SYSTEM:

HIGH HAZARD

Occupies a flat coastal plain between the coastal limestone deposits and the dissected region to the east. The soil generally consists of yellow sands overlying clay loam at 90cm. The structure of the sandplain communities consists of scattered small trees up to 5m tall, an open layer of tell shrubs of 1-3m and a closed layer of small shrubs <1m. Owing to the frequency of fires this mature structure is seldom seen, more commonly there are very scattered trees of *Eucalyptus todtiana* and low shrubs with the emphasis on *Conospermum* species. Small trees include *Banksia menziesii, B. prionotes, Eucalyptus todtiana* and *Xylomelum angustifolium.* Shrubs include *Adenanthos cygnorum, Banksia attenuata, B. candolleana, B. sphaerocarpa, Beaufortia elegans, Allocasurina humilis, Eremaea pauciflora, Macrozamia reidlei, Xanthorrhoea preisii.* Many small herbaceous species are also present. On sand ridges the dominants are *Banksia hookerana* and *Xylomelum angustifolium*, and the number of species appears more limited. In the low lying winter wet depressions are clumps of *Melaleuca thyoides*, up to 2.5m in height, also *M. lanceolata, M. rhaphiophylla* and scattered trees of *Casuarina obesa* and *Eucalyptus cameldulensis.*

VEGETATION - (Hill T.C.J., 1990)

Vegetation types as described by Martinick and Associates 1988 were allocated hazard ratings by Hill.

VEGETATION TYPE	HAZARD RATING
Banksia low woodland	High
Heterogeneous scrub heath	Moderate
Illyarrie scrub heath	Low
coastal thicket	Low

TABLE 2c: LANDFORM

QUINDALUP DUNE SYSTEM:	LOW HAZARD
SPEARWOOD DUNE SYSTEM:	LOW TO MODERATE HAZARD
BASSENDEAN DUNE SYSTEM:	HIGH HAZARD

REFERENCES

Beard, J S (1976). The vegetation of the Moora and Hill River Areas, Western Australia Maps and explanatory memoirs 1:250,000 series (Vegmap Publications, Perth)

Bell, D T (1985). Aspects of Response to Fire in the Northern Sandplain Heathlands In: "Fire Ecology and Management in Western Australia Ecosystems". Proc. of May 19885 Symposium (J R Ford, Ed.) May 1985. p.33-40.

Burbidge, A A. Nature Conservation, Landscape and Recreation Values of the Lesueur Area. EPA Bulletin 424.

Burbidge, A H, and L J Boscacci (1989). A Spring Reconnaissance Survey of the Flora and Fauna of the Southern Beekeepers Reserve. Tech Report 22. Dept of CALM.

Burking, R and A Kessell (1984). Damage Report of the West Coastal Wildfire (Jan 16-21, 1984) and its Effects on the Western Australian Beekeeping Industry. Dept of Agriculture of WA.

Bush Fires Board of WA. Central West Coastal Region: Regional Fire Protection Plan.

Bush Fires Board of WA. Central West Coastal Region: Co-ordination and Mutual Aid Procedures.

Chapman, A, J Dell, R E Johnstone and D J Kitchener (1977). A Vertebrate Survey of Cockleshell Gully Reserve, Western Australia.
In: Records of Western Australian Museum Supplementary No 4.

Cowling, R. M., B. B. Lamont and N. J. Enright (1990). Fire and Management of South-western Australian Banksias. Proc. Ecol. Soc. Aust 1990 - 16: 177-183

Davies, J (1985). The Impact of Fire on the Apiary Industry. In: Fire Ecology and Management in WA Ecosystems. Proc. of May 1985 Symposium. (J R Ford, Ed) May 1985. p.209-214.

Department of Conservation and Land Management (1990). Moora District Dieback Protection Plan 1990-94.

Froend, R.H., (1987). Patterns of Species Richness on the Northern Sandplains of western Australia. PhD thesis, University of Western Australia.

Griffin, E A, A J M Hopkins and R J Hnatiuk (1983). Regional Variation in Mediterranean Type Shrublands near Eneabba, South-western Australia. Vegetatio 52: 103-127.

Hart Simpson And Associates, (1992). Dieback Infections in the Northern Sandplains 1991/2. A report for the Northern Sandplains Working Party

Hill, T.J.C. (1990). Dieback disease and other Phytophthora in the northern Kwongan. In: Burbidge, A.A., Hopper S.D. and Van Leeuwen, S. (EDs), Nature Conservation, Landscape and Recreation Values of the Lesueur Area. A report to the environmental Protection Authority from the Department of Conservation and Land Management. Bulletin 424 environmental Protection Authority, Perth pp89-97

Hopper, S D and B G Muir (1984). Conservation of the Kwongan. In: Kwongan - Plant Life of the Sandplain: 253-266. Pate, J S and J S Beard, Eds. Univ. West. Aust. Press, Nedlands.

REFERENCES (continued)

Lamont, R B, A J M Hopkins and R J Hnatiuk (1984). The Flora - Composition, Diversity and Origins. In: Kwongan - Plant Life of the Sandplain: 27-50. Pate, J S and J S Beard, Eds. Univ. West. Aust. Press, Nedlands.

Lowry, D C (174) 1:250,000 Geological Services - Explanatory Notes: Dongara - Hill River, Western Australia (Aust. Govt. Publishing Service, Canberra).

McCaw, W L and R H Smith (1992). Seed Release from Banksia baxteri and Hakea crassifolia following scrub-rolling and burning. J Roy. Soc. of WA. 75:47-50.

Van de Moezel, P. G., W A Loneragan, D. T. Bell (1987) Northern Sandplain Kwongan: Regeneration following fire, juvenile period and flowering phenology. J. Royal Soc. W.A: 69; 123 -132.

Wills R T (1989). Management of the flora utilized by the European honey bee in Kwongan of the North Sandplain of Western Australia. PhD Thesis - Uni. of WA, Nedlands.