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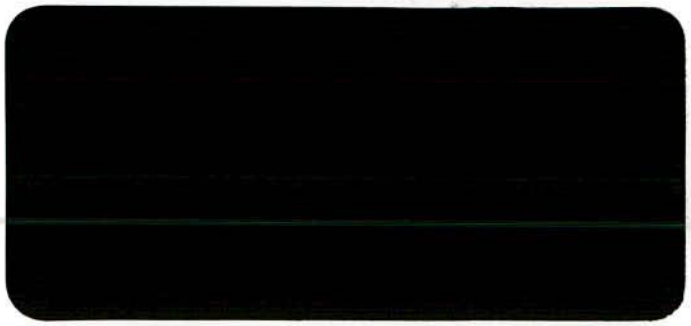

OUR GOAL

To be a leading Australian consulting engineer dedicated to improving service, understanding and meeting our clients' needs and growing with them.

OUR VALUES

Clients ▶ our clients' success is fundamentally important to us.

People ▶ our people are the source of our strength.

Professionalism ▶ our actions respect the wider social responsibilities of our profession.

Integrity ▶ our integrity is paramount.

Profits ▶ profits are required for us to survive and grow.

GUIDING PRINCIPLES

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Continuous improvement is essential to our success. We strive for excellence.

We are collectively one team. We treat each other with trust and respect.

We maintain mutually beneficial relationships with our clients and colleagues.

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CANNING PROPERTY GROUP
RESIDENTIAL SUBDIVISION
ACOURT ROAD, CANNING VALE

CONSULTATIVE ENVIRONMENTAL REVIEW

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WESTRALIA SQUARE
141 ST. GEORGE'S TERRACE, PERTH

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PUBLIC NOTICE

CANNING PROPERTY GROUP

RESIDENTIAL SUBDIVISION

ACOURT ROAD, CANNING VALE

CONSULTATIVE ENVIRONMENTAL REVIEW

(Public Review Period 10 January 1994 to 7 February 1994)

The Canning Property Group proposes to rezone and subdivide land for residential development in Canning Vale. The proposal includes reserving some of the site as a part of the Jandakot Botanic Park.

A Consultative Environmental Review (CER) has been prepared by the proponent to examine the environmental effects associated with the proposal in accordance with Western Australian Government procedures. The CER describes the proposal, examines the environmental effects and the proposed environmental management procedures.

Copies of the CER are available for $5 from:-
Wood & Grieve ENGINEERS
16 Altona Street
WEST PERTH WA 6005

A copy of the CER is available for viewing at:-

Environmental Protection Authority
Library Information Centre
8th Floor
Westralia Square
141 St Georges Tce
PERTH

City of Canning Public Library -
Willetton Public Library
Burrendah Boulevard
WILLETTON

City of Cockburn Public Library -
Spearwood Public Library
9 Coleville Crescent
SPEARWOOD

J S Battye Library of WA Histroy
Perth Cultural Centre
James and Francis Streets
NORTHBRIDGE

Submissions on the CER are invited before 7 February 1994. Please address your submission to:

Chairman
Environmental Protection Authority
Westralia Square
141 St Georges Tce
PERTH WA 6000
Attention: Garry Middle

If you have any queries on how to make a submission, please contact Garry Middle on 222 7103.

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INVITATION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Consultative Environmental Review (CER) proposes the rezoning and subdivision of land at Canning Vale. In accordance with the Environmental Protection Act, a CER has been prepared which describes this proposal and its likely effects on the environment. The CER is available for a public review period of 4 weeks from 10 Jan 1994.

Following receipt of comments from government agencies and the public, the EPA will prepare an assessment report with recommendations to the government, taking into account issues raised in public submissions.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. **Submissions will be treated as public documents and may be quoted in full or in part in each report unless specifically marked "confidential".***

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people), please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the CER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in the CER:

- ★ clearly state your point of view;
- ★ indicate the source of your information or argument if this is applicable;
- ★ suggest recommendations, safeguards or alternatives.

* This has been brought about by requirements of the Freedom of Information procedures.

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By keeping the following points in mind, you will make it easier for your submission to be analysed:

- ★ attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- ★ refer each point to the appropriate section, chapter or recommendation in the CER;
- ★ if you discuss different sections of the CER, keep them distinct and separate, so there is no confusion as to which section you are considering;
- ★ attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- ★ your name,
- ★ address,
- ★ date and
- ★ whether you want your submission to be confidential.

The closing date for submission is 7 Feb 1994.

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Garry Middle

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SUMMARY

This Consultative Environmental Review addressed the impacts and environmental management of a proposal to rezone and subdivide land in Canning Vale for residential purposes. The proposal is designed to set aside land for conservation, protect groundwater resources and provide residential land near existing infrastructure.

Portions of the land have potential for conservation. No declared rare flora or significant priority listed species of concern were found. Vegetation associations and habitat potential have been documented.

Dampland areas on the site contain the Southern Brown Bandicoot. The dampland fall into "High Conservation" or "Conservation" categories following assessment. The dampland areas are proposed for reservation in the Jandakot Botanic Park and their values will be protected.

The proposal is subject to WAWA, EPA, DPUD and City of Canning planning controls and is within the Jandakot Public Water Supply Area. The development will be designed to prevent contamination of public water supplies and groundwater generally. This development has a low potential to pollute groundwater which will be further reduced through implementation of Best Management Practices in Water Sensitive Design. Minimal levels of nutrients from domestic gardens which may recharge to groundwater will flow away from public water supply production facilities and the Jandakot Mound.

The land is adjacent to the Canning Vale kennel zone which generates noise from barking dogs. A vegetated buffer zone is planned and acoustic monitoring demonstrates that this will be effective. Similarly, noise from takeoffs and landings from Jandakot Airport have been monitored. Levels of noise are within Australian design guidelines. Signs will be placed and notification given to potential purchasers to advise of potential aircraft noise.

There are no aboriginal heritage sites on the property. Public consultation has been undertaken with relevant authorities and community groups.

The land is suitable for rezoning and subdivision for residential land use. All necessary services are nearby and have the required capacity for the needs of the proposal. There are no environmental impacts that cannot be managed and made acceptable. Proper environmental management will ensure implementation of the Jandakot Botanic Park and management for conservation and recreation.

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1.0 INTRODUCTION

This Consultative Environmental Review addresses a proposal to develop land in Canning Vale. It describes this proposal and its likely effects on the environment and management of any impacts.

1.1 The Site

The subject land lies to the east of Jandakot airport in Canning Vale and comprises:

- Jandakot Agricultural Area Lot 122 Clifton Road,
- Jandakot Agricultural Area Lot 123 Acourt Road,
- Jandakot Agricultural Area Lot 403 Acourt Road.

Location details are presented in Figure 1 and Figure 2.

1.2 The Proposal

The Canning Property Group propose to rezone the subject land from rural to urban. A portion would be subdivided for residential land with the balance to form a part of the Jandakot Botanic Park (Parks and Recreation). It is proposed that the Parks and Recreation portion would be held and managed by the relevant government authority.

1.3 The Proponent

The proponent is the Canning Property Group Pty Ltd,
1st Floor,
342 Murray Street,
PERTH WA 6000

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2.0 PLANNING PROPOSALS

2.1 Jandakot Land Use Water Management Strategy

Under the draft "Jandakot Land Use and Water Management Strategy" (DPUD, 1992a), the whole of the property (lots 122, 123 & 403) is proposed for inclusion in the Jandakot Botanic Park. The proposed park will comprise a number of discontinuous land parcels. Inclusion of the subject land in the park is largely the result of its uncleared state rather than its specific or identified biological values. Figure 2 shows areas proposed for inclusion in the park.

2.2 Metroplan

Metroplan (DPUD, 1990) nominates a "future urban" wedge northwest of Armadale with which this proposal is consistent.

2.3 Water Authority

The land lies within the Priority 2 Source Protection Area of the Jandakot Underground Water Pollution Control Area (JUWPCA) and the Jandakot Water Supply Area as defined by the Water Authority of Western Australia. Figure 2 presents the JUWPCA boundary and Priority Source Protection Areas. Guidelines outlined in WAWA Brochure WPC 1 1993 lists residential development as a restricted land use but not as unacceptable. The policy states that "restricted development may take place within Water Authority policy guidelines". A production bore exists on the south-west side of Acourt Road adjacent to the site.

2.4 Corridor Amendments

The Proposed South East Corridor Amendment to the Metropolitan Region Scheme plans for urban and urban deferred land in the Canning Vale-Southern River area. The amendment does not include the property although it is a logical addition to the amendment and an application for its inclusion is current.

The Proposed South West Corridor Amendment proposes that the subject land will be reserved for Parks and Recreation.

2.5 Subdivision Application

On 17 May 1993, an application to subdivide the property was lodged with the Department of Planning and Urban Development (DPUD Ref No 89874). The proposal seeks to create 440 residential lots ranging in size from 600m^2 to 3000m^2 with 38.2ha of the property proposed for inclusion in the Jandakot Botanical Park.

Council supported the proposal on technical grounds, but would not recommend it due to the lack of suitable zoning controls.

Further enquiries with Council planning officers revealed that unless and until the proposal has an environmental clearance, Council would not support a change in zoning to allow the subdivision to proceed.

The proponents have lodged an appeal with the Minister for Planning in response to the State Planning Commission's refusal which was given on 17 April 1993.

A request has been lodged with the Town Planning Appeals Committee to defer making a decision on the appeal pending the Minister for the Environment making a decision on this Consultative Environmental Review.

2.6 Environmental Protection Policy

The draft Environmental Protection (Jandakot Mound Groundwater) Policy 1993 includes the property within its "Area B" as presented in Figure 2. The EPP seeks to protect beneficial uses of groundwater including groundwater quality and groundwater level. It seeks to do this by controlling land uses which may contribute contaminants to groundwater and thereby minimise contamination. "Area B" under the policy does not specifically exclude urban development and requires planing authorities to exercise statutory discretion. Authorisation is required for such a proposal to proceed in Area B. An aim of this CER is to document and demonstrate the environmental acceptability of the proposal and its management.

2.7 Basic Raw Materials Policy

The property lies within the Resource Area as defined in the Basic Raw Materials Policy Statement for the Perth Metropolitan Region (DPUD, 1992b) but is designated as "exempt" from extractive industries due to the presence of other land uses. The policy has designated areas to the west and northwest as "Priority Resource Areas" for extractive industries.

Currently, operations in the region consist of the following and their locations are presented in Figure 1.

Lot 186 Acourt Rd; soil blending with completion estimated in 1993.

Lot 166 Acourt Rd; sand extraction for building and silica with completion estimated in 1993.

Lot 167 Acourt Road; sand extraction for silica with completion estimated in 1997.

Lot 287 Acourt Road; sand extraction for silica with completion estimated in 1996.

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3.0 EXISTING ENVIRONMENT

3.1 Geomorphology and Hydrogeology

Geomorphologically, the site can be broadly divided into an elevated Bassendean dune system and a sedge "sumpland" with some seasonal inundation.

The land lies on the north-east shoulder of the Jandakot groundwater mound. Groundwater contours decrease toward the north-east and, as such, groundwater flow is to the north-east and hence, away from the centre of the mound. Activities on the land are therefore unlikely to affect groundwater on the upstream Jandakot mound.

The current hydrogeology of the land is expected to be similar to its original condition. Notwithstanding a small area partially cleared for intensive horticulture adjacent to Fraser Road and selective timber cutting, there has been little clearing on the site which could have influenced the groundwater conditions. Vegetation reduction on adjacent land, eg the kennel zone and adjacent quarries, may have led to a slight increase in groundwater levels.

Water Authority records show that maximum groundwater contours vary from RL28 to RL26m AHD. On site, groundwater lies at between zero and four metres below ground level and is expressed as a seasonal wetland in the eastern portion of the site. Maximum groundwater contours from WAWA records are presented in Figure 3.

Groundwater contours drop 2m from southwest to northeast over the land. This relates to a 1 in 500 groundwater gradient away from the line of WAWA production bores.

A WAWA production bore (J120) is located on the south western side of Acourt Road, adjacent to the property (see Figure 3). Groundwater flow into local drawdown cones of bores is known to occur. Special WAWA restrictions apply to developments within well-head protection zones. These currently require a 100m minimum setback for development and this will be included in the Parks and Recreation reserve (see Commitment 6.7). The proponent understands that bylaws concerning this buffer are currently under review by WAWA and that they are primarily concerned with underground storage tanks and industry.

The sandy nature of the land results in direct on-site recharge to the aquifer. Runoff from the Bassendean dune is expected to be minimal while some flow to the wetland can be expected from the wetland margins and sedge dampland.

During winter, a rise in groundwater level results in inundation of an area of the wetland in the eastern corner of the property. During the 1993 winter of slightly below average rainfall, maximum water depth was approximately 0.3m.

Recharge is expected to be of good quality due to the absence of intensive agriculture or industry.

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3.2 Soils

The site is characterised by the Bassendean dune formation characterised by deep grey sands. Coffee rock layers can be expected at depth. The soil has a high permeability which provides good internal drainage and groundwater recharge potential. Correspondingly, the soil has limited capacity to adsorb or demobilise contaminants such as nutrients, heavy metals and hydrocarbons.

Soils with low to moderate organic and silt content can be found in the eastern wetland area. These commonly have low permeability and can lead to temporary perching of the water table particularly in areas of high groundwater conditions and waterlogged soils. The eastern wetland section is only seasonally inundated and deep layers of peat, often characteristic of Swan Coastal Plain wetlands, are absent.

Soil associations adapted from Environmental Geology mapping by the Department of Minerals and Energy are presented in Figure 3.

3.3 Biology

There are two distinct habitats types on the property comprising an elevated *Banksia* Woodland and a low lying wetland or dampland. The woodland has mixed qualities with established stands of original vegetation. Off road tracks, vegetation destruction, refuse disposal, access by vehicles, bikes, horses, dogs and weeds has contributed to degrading the land.

3.3.1 Flora

A detailed botanic survey of the site has been undertaken in spring 1993 by a professional botanist with expertise in the Canning Vale area (see Appendix 1). The survey revealed no declared rare flora species on the property. The donkey orchid *Diuris purdiei* has been reported in wetlands in the Canning Vale area and was specifically searched for during the survey on the property. Fire is necessary for the species to flower, but despite the property having recently been burned, the species was not found. Specimens of *Gonocarpus pithyoides* was reported and while it currently is a Priority 3 listed plant, it has been recommended for deletion from the list (see Kelly, et al, Appendix 1).

The major vegetation types, as surveyed, are presented in Figure 4 and comprise:-

A. Mixed low heath
B. Banksia low woodland crests
C. Banksia low woodland slopes and swales
D. Banksia-Sheoak-Jarrah woodland
E. Flooded Gum-Moonah fringing woodland
F. *Melaleuca teretifolia* shrubland
FF. Scattered *Melaleuca teretifolia*
G. *Pericalymma elipticum* dense low shrubland
H. *Regelia ciliata* - *M.lateritia* shrubland
I. *Melaleuca* - Spearwood thickets

Reference to the proposal demonstrates that the wetland vegetation has been excluded from the proposal and is intended for conservation as Parks and Recreation. The flora survey recommends that the wetland be preserved and that consideration be given to maintaining vegetation along Clifton Road.

The woodland has some established stands of *Banksia* and Jarrah which have habitat and recreation potential. The woodland could not be accommodated in land proposed for Parks and Recreation due to the commitment on the wetland area. The woodland is therefore included in the development proposal. It should be noted that it does not contain endangered species but that it is representative of the association and provides bird habitat.

A wetland assessment was conducted of the two distinct wetland areas. The sedge palusplain was assigned a Conservation Category H largely due to the presence of endangered fauna (see section 3.3.2). The seasonally inundated wetland was assigned a conservation Category C due to the vegetation types F and FF. Both are recommended for conservation and this proposal has adopted those management objectives.

EPA Bulletin 686 provides the following comments on wetland categories.

"It is possible to identify five different management categories in which to place wetlands, each with specific management objectives.

High Conservation (Category H)

Attributes

These wetlands possess a high degree of naturalness and there is a high level of interest in using the wetlands for various human purposes.

Management Objectives

Active management to maintain and enhance the wetland attributes, particularly natural attributes. Where there is no active management at present it should be put in place as a matter of highest priority.

Active management requires that a detailed management plan is prepared and implemented, with sufficient resources to maintain or improve the wetland's current condition.

This category is recognised as having the highest priority for establishment and implementation as regional park wetlands.

Examples

Loch McNess, Cooloongup, Thomsons Lake.

Conservation (Category C)

Attributes

These wetlands possess a high degree of naturalness.

Management Objectives

To maintain and enhance natural attributes and functions.

Examples

Forrestdale Lake, Gnangara Lake, Star Swamp."

3.3.2 Fauna

Fauna is representative of *Banksia*-Jarrah woodland and wetland communities found on the Swan Coastal Plain. The land supports a range of woodland bird species which are widely reported for the southwest. These are dominated by the honeyeaters of the Meliphagidae family.

Wetland bird species were sparsely represented on the property. This may be the result of insufficient fringing vegetation to provide cover and refuge habitats, the low diversity of the seasonal water body, degraded vegetation or disturbance by dogs, horses and off-road vehicles.

A sighting of a southern brown bandicoot (*Isoodon obesulus)* at the site suggests the presence of a population of the marsupials. Fresh characteristic diggings were also noted in the sedge wetland. The bandicoot is gazetted as an endangered species.

Detailed information is not available on the distribution of the bandicoot on the land. Wetland areas, similar to those in the Canning Vale region and the Swan Coastal plain, are its preferred habitat. Populations in the Perth metropolitan region have been reduced due to habitat loss and predation but are reported elsewhere. The proposal does not directly impact on the bandicoot habitat.

Tracks and droppings also suggest the movement of *Macropus*, most likely the Western Grey kangaroo, through the property. Frequent use of the area by dogs from the adjacent kennel zone, in addition to access by horse riders and off-road vehicles, would affect the use by kangaroos of the area.

3.4 Noise

The proposed development is approximately three kilometres east of Jandakot airport and within the flight training circuit. Federal Airport Corporation has forecast aircraft noise for the facility taking into account future movements, the additional runway and flight patterns. Jandakot has a large number of training take-offs and landings and this is reflected in the forecasts. The forecasts are expressed as ANEF contours and are presented in Figure 5. A small portion of the site, proposed for parkland, falls within the 20 ANEF contours. The FAC recommends notification to residents in these areas by the use of signs on the property boundary. The Australian Standard considers such a zone as conditional for residential housing and recommends further consideration be given to maximum noise levels (monitoring). For residential areas with more than 20 aircraft movements per day the Australian Standard recommends levels of less than 75dB(A). Aircraft noise from monitoring gave maximum levels of 64dB(A) and 66dB(A) within the "conditional" zone. Hence, aircraft noise levels are acceptable.

Nicholson Road is proposed to be upgraded to a dual carriageway. The nearest residence will be 60m to the west of the proposed upgrade which is expected to provide adequate buffering.

The existing quarry operating on Lot 287 Acourt Rd is approximately 900m northeast of Fraser Road and is estimated by for completion in 1996 (DPUD, 1992b) although the City of Cockburn expect it to operate for another 10 to 15 years (*pers comm*). Extraction activities on lots 166 and 167 are one to two km distant and are expected by the City of Canning to cease in two to three years (*pers comm*). These latter areas are proposed for use as a golf course. Traffic on Fraser Road includes a number of haul trucks en route to or from the quarry. The acceptable criteria for traffic noise is 68-63dB(A) and measured traffic noise levels are below this. A detailed noise monitoring programme has been undertaken by acoustic specialists and is presented in Appendix 2.

3.5 Dust

Operations from extractive industries to the northwest of the proposal have limited potential to create a dust nuisance to adjacent residences. Quarry operators have a responsibility under the Department of Minerals and Energy Mining Lease to control dust and ensure environmental amenity. Site observations of the nearest operation (soil blending on Lot 186) were conducted during times of moderate to high south westerly winds, although no measurements have been taken. There was no evidence of a dust nuisance during times of operation. Conventional earthmoving machinery is used to extract sand for export or prior washing in the case of silica sand.

Distance, soil type and vegetation buffers are factors which affect the nuisance potential and the proposal is greater than 400m from the nearest active earthworks. The prevailing wind is from south-southwest and will not exacerbate the issue (see Figure 1). The extractive industries have short term lifetimes. The EPA (Pollution Control, Kwinana and Perth), the City of Cockburn and the City of Canning (pers comm) report no community complaints arising from dust nuisance. Odours have been reported from the soil mixing operations and these are managed by the operators and EPA Kwinana.

Dust nuisance from sand mining is not expected to create an impact to residences.

3.6 Heritage

Several site surveys have been undertaken and no European heritage sites exist on the subject land.

A survey of the site was undertaken in October 1993 to assess the site for archaeological significance (Quatermaine Consultants, 1993). No archaeological sites were reported. The detailed report is attached at Appendix 3.

Two previous anthropological surveys of the Canning Vale region have been undertaken and recorded in O'Connor *et al*, 1990. Both surveys involved examination of the existing data base, consultation with relevant Aboriginal people, site visits with aboriginal people. No sites of significance to Aboriginal people have been reported in the region.

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4.0 PROPOSED DEVELOPMENT

4.1 The Need For the Proposal

The demand for land in the Perth Metropolitan region is forecast at approximately 10,000 lots per annum (Metropolitan Development Programme, Department of Planning and Urban Development). The public demand is particularly strong in the Jandakot-Canning Vale region as evidenced by ongoing land sales and sale prices. The proposal will provide additional land for much needed residential lots, at a location close to the Central Business District and compatible with existing infrastructure.

The proposal has the advantage for a simple implementation of a section of the Jandakot Botanic Park. This can avoid the potentially expensive acquisition of the land for public purposes. The area proposed for the park will be managed for conservation and recreation. The proponent recognises the importance of these functions and will prepare a management plan for approval (see Commitment 6.7).

The land is adjacent to existing residential land for which a high demand has been established.

4.2 The Proposal

The proposal allows optimal use of the property for development and conservation. It comprises subdivision of the elevated land roughly above the 28m AHD contour and reservation of the wetland (dampland) area. The latter would form part of the Jandakot Botanic Park. The subdivision to 440 lots would consist of:-

- 381 single residential lots from 600 to 1410 m^2
- 22 lots from 1460 to 1800m^2
- 37 lots 2650 to 3000 m^2 with frontage to Fraser Road.

The remaining 38.2ha of land would be set aside for parks and recreation and ceded at nominal cost to the public.

A preliminary plan of subdivision for the proposal is presented in Figure 6. The plan is yet to be finalized and, as such, has flexibility to accommodate changes to the internal layout.

The alternatives include the land remaining in private ownership and retaining a rural zone which will not achieve needed residential land and does not provide early implementation of the wetland in the Jandakot Botanic Park. The third alternative comprises acquisition of the land and reservation as Parks and Recreation. This alternative is currently subject to the Proposed South-West Corridor Amendment - Stage A (DPUD) and would require public acquisition of the property at market rates. It would fail to achieve the early implementation and management of a parkland and the land would continue to degrade.

The development proposal achieves a compromise of land use planning, conservation and hence resource sharing. The proposal is not included in current corridor amendments and an application is current to have it included in the South-East Corridor Amendment.

5.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

This CER proposes that this proposal does not present a significant pollution potential to the groundwater mound or to public water supplies. Since the proposal is downgradient of production facilities, it does not represent a major threat to public water supplies. There are no current or proposed borefields planned on the downgradient side (northeast) of the proposal. Wellhead protection buffers will be maintained and land uses will be controlled to prevent or monitor underground storage tanks and other unacceptable developments. This proposal will be properly managed and is not expected to produce a threat to the mound or public water supplies.

The proposal includes reservation of a large portion of the site for parks and recreation which will conserve a significant dampland wildlife habitat.

5.1 Planning and Groundwater Management

There are a number of planning controls which cover the subject land with the aim of managing land use and protecting groundwater supplies. The proposal will be a properly designed and managed residential development which is not expected to provide a significant pollution threat.

Planning and environmental conditions including groundwater quality, parks and recreation, noise, dust, servicing, flora and fauna can be managed.

5.1.1 Environmental Protection Policy

The EPP seeks to protect Beneficial Uses of groundwater which comprise:

A groundwater levels to achieve the protection of native vegetation and wetlands and

B groundwater quality to protect water supplies.

The proposal conforms with this policy by setting aside the wetland area and implementing a drainage management plan to protect this and the groundwater resource.

This proposal will comprise a properly designed and managed residential development which is not expected to contribute toxic chemicals or significant levels of contaminants to groundwater. It is therefore compatible with groundwater production for drinking supplies, general groundwater resource protection and environmental protection in the area.

Beneficial Use A - Vegetation and Wetlands

The proposal will set aside 38 ha of native wetland (palusplain) for reservation as Parks and Recreation for inclusion in the Jandakot Botanic Park. The land would be ceded to DPUD at rezoning and provides the opportunity to further establish this sector of the botanic park in the region as outlined in the Jandakot Land Use and Water Management Strategy. This strategy has considerable public benefit, including acquisition of reserved land for public use, public access, improved management and rehabilitation. The alternatives will see the area continue to degrade.

The proposal would undertake development of the *Banksia*-Jarrah woodland and retention of the more sensitive sedge dampland habitat. The importance of the wetland habitat is recognised and is reflected by inclusion in the proposal. The management objectives of Category H and Category C wetlands are to maintain and enhance natural attributes (EPA, Bulletin 686) and this forms part of the proposal.

The quality of the wetland would be maintained through drainage design and management (see Commitment 6.4). Removal of litter and car bodies in addition to replanting would be undertaken. Replanting would include species efficient at groundwater control such as *Melaleuca teretifolia, M raphiophylla, Eucalyptus rudis, Allocasuarina fascicularis, Kunzea.* Others such as macrophytes like *Baumea articularis, Schoenus, Juncus pallidus* would be established at wetland fringes and are especially efficient at nutrient uptake. *Typha orientalis* is established in a small area of the wetland and while the species is also suited to nutrient uptake, it is an aggressive coloniser. It should be completely removed from site and replaced with a native species, eg *Baumea*, or a containment strategy put in place, eg a deep moat constructed to prevent its spread. This would be examined as part of the Management Plan (Commitment 6.7).

The habitat value of the existing *Banksia*-Jarrah woodland is also recognised. Retention of large trees will be implemented through a "no clearing" condition on large lots facing Clifton and Fraser Roads. This will provide nesting and refuge sites for woodland bird species and provide a wildlife corridor to other adjacent areas.

Beneficial Use B - Groundwater Quality

The second Beneficial Use the EPP seeks to protect is groundwater quality. This residential development does not have a significant potential to affect groundwater supplies as seen through fuel storage tanks and industrial areas. Recharge of runoff to groundwater under sewered residential subdivisions has been demonstrated to not significantly affect quality (Gerritse *et al*, 1990). Sediment and low contaminant loads from road runoff will flow to a pretreatment basin adjacent to the wetland.

The EPP allows for authorisation of such a proposal in Area B following referral to the EPA.

High quality groundwater recharge can be expected from this properly managed urban development through proper design and the implementation of Best Management Practice for Water Sensitive Design (see Commitment 6.4).

5.1.2 Jandakot Land Use and Water Management Strategy

The JLUWMS (DPUD,1992) rates urban (residential) development as a having a "low to moderate" potential to impact groundwater quality. By implementing modern water sensitive urban design, this potential is further reduced.

The JLUWMS also initiates the implementation of the Jandakot Botanic Park to reserve land for conservation and recreation. The botanic park would include land adjacent to the proposed parks and recreation reserve on this property. This would provide valuable continuity for wildlife movement.

5.1.3 Water Authority

The land lies within the Priority 2 area of the Jandakot Underground Water Pollution Control Area and the Jandakot Water Supply Area as defined by the Water Authority of Western Australia. The minimum level of protection of a Priority 2 Source Protection Area is outlined below along with the strategy for management which achieves compliance.

(i) **WAWA Guideline.** Installation of reticulated sewerage in urban areas with off site disposal of wastewater.
Compliance. The development will be serviced with a reticulated sewer system to WAWA design and discharge to WAWA treatment plant at Woodman Point.

(ii) **WAWA Guideline.** Septic tank densities and locations to comply with WAWA recommendations.
Compliance. The proposal does not include the use of septic systems.

(iii) **WAWA Guideline.** Exclusion of industrial and commercial activities handling or processing noxious, toxic or polluting substances with adverse organoleptic properties in water.
Compliance. The proposal does not include any industrial or commercial activities. Residential development does not release such pollutants.

(iv) **WAWA Guideline.** Commercial areas should be designed to prevent catchment contamination through stormwater runoff or discharge of wastes.
Compliance. The proposal does not include any commercial zoning so runoff from this source will not occur. Runoff from residential development will be discharged to basins designed with best management practice.

(v) **WAWA Guideline.** Restrictions on the establishment of underground and above ground storage tanks.
Compliance. The proposal does not include any underground or above ground storage tanks.

(vi) **WAWA Guideline.** Restrictions on intensive agricultural development.
Compliance. The proposed zoning is urban and no intensive agriculture is planned. Control of land use on larger lots will remain with the authorities for approval.

(vii) **WAWA Guideline.** Exclusion of disposal sites for polluting wastes.
Compliance. The proposal does not include any sites for the disposal of polluting wastes.

The proposal easily complies with the minimum protection required in a Priority 2 area. The Drainage Management Plan to be documented will address stormwater disposal through basins with the purpose of sedimentation, recharge and nutrient stripping and selective planting all of which have been proven highly successful elsewhere. These measures are expected to provide recharge water of acceptable quality.

Land uses with the greatest potential to contribute contaminants are service stations, heavy industry, waste disposal sites and processing of noxious or toxic substances. These are documented as "unacceptable" land uses by the Water Authority. "Restricted" land uses on the other hand may take place if they fall within guidelines and they are approved by WAWA.

5.1.4 Urbanisation and Groundwater Quality

Urbanisation is generally associated with increased groundwater recharge and can result in a rise in the groundwater level. Increases are a result of reduced groundwater loss through evaporation due to vegetation removal and imported scheme water. Significant groundwater increases sometimes cause changes in vegetation structure in wetlands. The proposal is not expected to significantly increase the groundwater level in the dampland due to recharge and small drainage volumes.

Input of chemicals and salts also increases due to activities associated with residential, commercial and industrial activities. Residential land-use contributes through fertilisers, pesticides and heavy metals in road runoff. Industrial land use has greater potential for release of pollutants. A full discussion can be found in Gerritse *et al* (1990).

(i) Nutrients

Fertilisers from domestic gardens and public open spaces contribute nitrogen and phosphorus in various forms. Impacts from nutrients in surface and groundwater can affect the health of wetlands but are rarely recorded as a significant human health problem. The direction of groundwater flow is not toward the Jandakot Mound or to wetlands.

The allowable maximum level of Nitrate in drinking water is 10mg/L.

(ii) Well-Head Protection Zones

The aquifer surrounding production bores has the greatest potential to contaminate potable water supplies and require the highest level of protection. Buffers are required to prevent inflow of contaminants, particularly toxic substances from industry and fuel storage tanks.

Currently, the bylaws require a radius of 100 metres to a potentially polluting land use. The Water Authority is proposing to amend the bylaws and increase this buffer to 300 metres. WAWA has advised that industry and service stations are of major concern.

The proposal will include a minimum of 100m buffer from residential development to the production bore in accordance with WAWA recommendations. No service stations, underground storage tanks, intensive agriculture, commercial or industrial development is planned as part of this proposal. Development of these land uses are subject to approval by the City of Canning so additional planning control exists. Further consultation with the WAWA on the buffer zone will be undertaken if required.

(iii) Current Developments

Present local authority and government standards require design of urban development which manage discharges to the environment. Septics are rarely approved in residential zones and this results in significant reductions to potential contamination. Public awareness in the use of pesticides and fertilisers has increased. Drainage will be carefully managed with expected reductions in sediments and contaminant load. Sedimentation and nutrient removal ponds, soil amendment and swale drains will be used in this proposal.

Operating production bores exist immediately adjacent to recent residential development in the Mirrabooka area. Production bores in the Perth Coastal UWPCA are planned to co-exist with urban development. This constitutes recognition by the Water Authority that groundwater production and properly managed urban development can co-exist.

The Gwelup UWPCA has been successfully operating for many years adjacent to industry, service stations, septic tanks and market gardens. Only recently at Gwelup have elevated levels of contaminants been detected. Development in the region employed few of the built-in safeguard designs currently seen in urban design. Of particular concern at Gwelup are the by products of leaking underground storage tanks - trace organics. Such toxic contaminants are not usually associated with domestic residences, notwithstanding ambiguous chemical spills.

Groundwater quality near borefields is closely monitored by WAWA which allows it to detect contaminant concentrations near production bores. This provides an extra degree of protection to drinking water supplies.

Specific studies (Gerritse *et al,* 1990) in established sewered residential areas of Subiaco/Shenton Park and Nedlands/Dalkeith demonstrate that groundwater has remained well within NHRMC/AWRC drinking water quality standards.

This development does not present a real potential for pollution with toxic chemicals and presents only a low potential to discharge non-toxic nutrients to the aquifer.

5.2 Drainage Management

Drainage from urban developments can contain elevated levels of contaminants including nutrients and heavy metals. Incremental build-up of nutrients in wetlands is known to occur over time which can produce unacceptable aesthetic conditions, and in severe circumstances, offensive odours, midge breeding, algal growth and toxic by-products.

Stormwater flow will be directed to basins designed to maximise sedimentation, retention and recharge and nutrient uptake. The basins will be integrated into the existing dampland area or adjacent to it. Existing degraded sites will be chosen for the east basin (figure 6) for pretreatment of stormwater, sedimentation and partial nutrient assimilation. Sufficient denuded area exists in this location and the constructed pretreatment pond will comprise rehabilitation of the existing degraded area of wetland. Design will follow the draft Water Sensitive Urban (Residential) Design Guidelines - Schedule of Best Management Practice (DPUD, WAWA, EPA; 1993). This will include measures to promote infiltration, nutrient bio-assimilation and sedimentation (Commitment 6.4). Soil amendment will be used in the pretreatment basins to increase nutrient adsorption, if necessary (See Figure 7). Physical characters of the site allow considerable potential for implementation of the measures which are often precluded at other sites due to gradient and space constraints.

Applicable native vegetation species will be planted where necessary and particularly adjacent to all drainage structures.

Gross pollutant traps will be constructed on drainage routes at strategic locations to intercept litter flow to the wetland.

It is expected that the above will result in high quality recharge to groundwater.

That residential development and groundwater production can be mutually coexistent has been made possible through modern techniques including best management practices in drainage and water sensitive urban design. This proposal, being downgradient from the production facilities, is ideally situated to use these techniques for management and control of water quality.

5.3 Flora and Fauna

The flora survey confirmed a high conservation value of the wetland areas and recommended reservation. Management of flora and fauna is based on the proposal to retain 38 ha of the property to be reserved and zoned as parks and recreation for the Jandakot Botanic Park.

The wetland vegetation would be conserved and rehabilitated and replanted where necessary to maintain and improve its important environmental functions (see Commitment 6.7).

A vegetation buffer is proposed along Fraser Road for managing noise from the kennel zone. Large lots with clearing controls and building envelope locations are planned. Similar treatment along Clifton Road is proposed and these will provide important wildlife corridors. Due to the size of the proposed wetland reserve, the development cannot support additional reservation of woodland tracts.

The dampland and margins are the preferred habitat of the bandicoot and a large 38.2ha area of this site is proposed for inclusion in the botanic park. An area of this size is sufficient to maintain a limited population. Discussions have been held with the Department of Conservation and Land Management and a population and location survey would be required. Following the survey, an assessment of the need for relocation can be made by CALM. Should this be necessary, trapping and relocation would be undertaken by the proponent to a suitable location as nominated by CALM (see Commitment 6.9).

Adjacent land to the southeast and southwest of the wetland is proposed for the Jandakot park and is also suitable bandicoot habitat. This would provide continuity and security for the animals.

Special attention will be paid during construction to prohibit disturbance to habitat areas and this may include fencing. Construction of fencing would be discussed with the future Park Manager and erected, if necessary, prior to development (see Commitment 6.3). The management plan would prohibit the exercise of unleashed dogs within the park in order to protect native fauna.

Currently the area is not managed and there is no control of access. The proposal would see the area managed as a portion of the Jandakot Botanic Park. Access and use by horses, trail bikes, off-road vehicles and dogs would be controlled and the area managed as a fauna habitat. Fencing and signs will be constructed as part of the development and documented in the management plan.

5.4 Noise

Environmental noise levels at proposed dwellings are below appropriate criteria.

Residential development on this site is compatible with noise levels from current and future aircraft movements at Jandakot Airport. Noise contours are forecast for the year 2005 and noise monitoring for this study were based on these. The Federal Airports Commission have advised that they may require the placement of signs to notify of aircraft noise. The signs will be placed strategically at the boundary and entrances to the subdivision. In addition, the potential for aircraft noise will be included in an information brochure for distribution to potential purchasers.

A recommended setback of 30m to buffer the effect of barking dogs at the kennel zone will be implemented. This land will consist of uncleared vegetation which will function to effectively attenuate noise. Methods to ensure the maintenance of this strip as uncleared vegetation are being investigated and include notification of potential purchasers and placement of caveats on titles.

Noise from the activity of earthmoving machinery at quarry sites in the region will not be significant. The quarries are 0.6 and 1.5km distant and buffered by vegetation and dunes to the northeast and north respectively. The prevailing wind will greatly attenuate any noise.

Interestingly, noise from native birds (parrots) was found to exceed that of aircraft, dogs and traffic and greatly increased environmental noise at the monitoring sites.

By ensuring that noise criteria are met, an equal environmental amenity of the proposed residences to others in the metropolitan area is achieved.

5.5 Dust and Smoke

Construction activities involving earthworks can create a dust nuisance to adjacent residences during specific weather conditions. Residences in the kennel zone adjacent to the northeast boundary of the site have potential to be impacted by dust generated by southeast winds from an unmanaged site. Dust will be closely managed during construction.

The dust nuisance potential and management of all urban developments are assessed according to the Dust Control Guidelines of the Environmental Protection Authority. This takes into account the soil type, wind potential, distance to adjacent residences and sets management criteria for the development. Construction contracts have dust control clauses which allows for dust control measures to be implemented by the contractor. These include use of watercarts and hydromulching. In addition, a considerable vegetation buffer of about minimum 30m will remain along Fraser Road as part of the noise buffer to the kennel zone. This would have the effect of preventing any errant dust nuisance. Hence, no significant dust events are expected as a result of proper site management.

Similarly, any burning of vegetation is closely managed to prevent smoke pollution and nuisance. EPA guidelines for burning on site call for particular treatment of cleared vegetation prior to ignition and consideration of weather conditions and adjacent residences.

Quarry operations have effective site management and do not provide a dust nuisance potential. The EPA and local authorities (Canning and Cockburn) report no dust related community complaints. Previous occasional notice has been received of odours from soil blending operations and the EPA advises that this is now being managed.

5.6 Heritage

Specific studies have been undertaken by anthropological and archaeological consultants. No sites have been reported and they have made no recommendations. Appendix 3 presents details of the studies.

The Aboriginal Heritage Act 1972-1980 provides obligations on reporting of sites including artefacts, burial grounds and ceremonial objects. The Act makes it an offence to destroy or excavate an Aboriginal site. The proponents are committed to observing the Act. If a site or object is discovered, work would cease and the Museum notified (see Commitment 6.5).

5.7 Services

The proposed rezoning is well suited to make use of available service headworks capacity.

5.7.1 Sewer

It is proposed that all lots will be provided with a connection to sewer reticulation system connected and discharging to a system operated by the Water Authority of WA.

The proposed urban development can be readily included in the sewer planning for the Canning Vale area.

5.7.2 Water Supply

It is proposed that all lots will be provided with a water supply by reticulated mains connected to and fed from the water supply system operated by the Water Authority of WA.

The Serpentine Trunk Main, which is the water supply feeder main from the Serpentine Dam to the central metropolitan area, passes the eastern extremity of the site.

A pressure reducing valve connection exists in Nicholson Road to provide a service to the Canning Vale Prison and local areas. A pressure reducing valve exists at Bannister Road which provides a supply to the existing 600mm dia main in Ranford Road. A pressure reducing valve is proposed at Wilfred Road adjacent to Ranford Road. These will provide the points of supply from the Serpentine Main for the Canning Vale area.

The main water supply network is currently being evaluated and will comprise a system of 400mm, 500mm and 600mm dia mains connecting the pressure reducing valves, the existing main in Ranford Road and existing main in Warton Road to create a water supply network for the Canning Vale area.

This land can be readily included in the network to achieve a water supply to every lot.

Progressive construction of the network will be possible allowing staged development of the site.

The site is within the Jandakot Underground Water Pollution Control Area and the proponent acknowledges that private bores will be strictly controlled. The proponent will include these controls in sales documentation and provide covenants on titles.

5.7.3 Drainage

The stormwater drainage system will be designed with water conservation and groundwater recharge principles as the principal philosophy. These are aligned with the perceived need to ensure recharge to the groundwater to maintain groundwater levels and the need to control the quality of the groundwater.

The initial action is proposed to be by the disposal of stormwater from each lot within the lot. This will be achieved by soakwells connected to downpipes and driveways constructed by the lot owner at the time of housing construction.

The major action is the disposal of stormwater from the road pavements and road reserves. This will be collected by a piped stormwater system.

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The site has a natural topographic boundary creating runoff in two directions. These are shown in Figure 7.

The northern runoff is included in the catchment for the Amherst Road Branch Drain which is currently under construction. The catchment for this drain as presented in Figure 7 is a sub-catchment. In this instance each sub-catchment compensates its drainage discharge to its area based share of the available capacity where the drain crosses the Standard Gauge Kewdale to Kwinana railway line. The northern catchment 1:5 year runoff will be retained in a basin of 3100m^2 prior to entering the system to be constructed within the Ranford Estate.

The southern portion of the catchment does not have an outfall to a major waterway and drainage disposal will be by retention and recharge. The use of a recharge basin will also provide for quality control by selective planting on the basin peripheries aimed at nutrient stripping and natural filtration techniques. Two basins are proposed to limit size, improve aesthetics and minimise pipework depths. These basins are proposed to be 4,000m^2 area which would contain the 1:5 year storm event.

The drainage systems will be designed in accordance with the City of Canning and Water Authority of WA standards.

Drainage will include the documentation and implementation of a Drainage Management Plan (DMP) which proposes to address water quality and detail of nutrient filter basins (see Commitment 6.4). It would include drainage modelling, routing, basin sizing and depth, soil amendment, vegetation treatment and comprise best management practice guidelines.

Total runoff volumes are not great and no significant changes are expected to groundwater level in the wetland. A slightly longer period of shallow seasonal inundation may occur and will benefit waterbirds.

5.7.4 Electric Power

It is proposed that all lots will be provided with an electricity supply by connection to the State Energy Commission of WA's electricity supply grid.

The supply for the Canning Vale area is provided from a switching yard in Magnet Road, Canning Vale, and mains have been extended in Ranford Road to supply the Livingston and Ranford Estates.

The main aerial feeder system can be extended to supply the proposed development in accordance with State Energy Commission practice.

5.7.5 Telecommunication Services

It is proposed that all lots will have access to the telecommunication system operated by Telecom.

Currently Telecom services are provided from a local exchange located at the corner of Nicholson Court and Birnam Road, Canning Vale. Main cables are being installed in Nicholson Road and Ranford Road to service the Livingston and Ranford Estates. Further mains exist in Nicholson Road to service the Canning Vale Prison and surrounding areas.

5.7.6 Gaseous Fuel

It is proposed that all lots will be provided with a supply of gaseous fuel by a reticulation system connected to the State Energy Commission of WA's gas supply grid.

Currently a high pressure gas main parallels the Serpentine Trunk Main in this part of Canning Vale and provides the supply for the area. Gas reticulation mains are being installed in the adjoining Ranford Estate.

It is proposed that the gas reticulation mains will be installed by arrangement with the State Energy Commission of WA in accordance with their policies on supply to subdivision.

5.8 Public Consultation

During the preparation of the Consultative Environmental Review and formulation of the proposal, relevant public bodies have been consulted and their input sought. The liaison has been undertaken through personal meetings, correspondence and telephone calls. The aim has always been to communicate fully the proposal and management of any impacts. The following bodies have been consulted:

- Department of Planning and Urban Development
- Environmental Protection Authority
- Water Authority of Western Australia
- City of Canning
- Federal Airports Corporation
- Department of Conservation and Land Management
- Kennel Owners Group

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6.0 COMMITMENTS

The proponent makes the following commitments to the proposal to ensure proper Environment management of the proposal:

6.1 Contingencies to control dust from earthworks will be included in construction contract by the engineer for implementation by the construction contractor. The EPA Dust Control Guidelines and draft Smoke Control Guidelines will be implemented including a site management plan.

6.2 Signs notifying that the land is subject to aircraft noise will be erected at the boundary of the residential areas by the proponent to the satisfaction of the Federal Airports Corporation. Potential purchasers will also be notified by the proponent or his agent through a brochure containing information relevant to the site and the development.

6.3 Construction disturbance to the wetland and fringe areas will be prohibited. Temporary fencing and signs will be constructed where necessary by the proponent prior to construction as recommended by the future Park Manager.

6.4 A Drainage Management Plan will be documented prior to development and implemented during construction by the proponent to the satisfaction of the City of canning and the Water Authority. The management plan will include Best Management Practices of Water Sensitive Design Guidelines.

6.5 The proponents will observe the Aboriginal Heritage Act. Heritage sites will be reported to the WA Museum and work would cease.

6.6 An information brochure will be issued to all interested and potential purchasers containing data on regional groundwater issues, the Jandakot Botanic Park and the need for management. The brochure would be prepared by the proponent and consultants.

6.7 A Management Plan for the appropriate portion of the Jandakot Botanic Park will be prepared by the proponent to the satisfaction of DPUD and CALM by the proponent at subdivision. The plan would address fencing, signs, drainage, replanting, rehabilitation, litter removal, weed control, access, fire control, buffers to production bores and other relevant issues.

6.8 The proponent will manage the relevant portion of the park for a period of two years from the issue of titles to conform with the management plan.

6.9 The proponent will fund a bandicoot population survey on the property and a relocation programme, if necessary, in conjunction with CALM prior to development.

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7.0 CONCLUSION

The subject land has been shown to have excellent potential for residential development as well as some wildlife habitat and conservation values. The proposal achieves the reservation of the dampland environment along with some urban development. Residential lots will be created and land will be added to the Jandakot Botanic Park.

There are no major environmental impacts or technical issues preventing the development of the land which cannot be managed or made acceptable. Environment management has been addressed through proposed total conservation of the wetland areas of the site and noise management buffers.

Planning issues require protection of public and groundwater supplies, implementation of the Jandakot Botanic Park and coordination of servicing infrastructure. Appropriate residential design and proper drainage management will provide groundwater recharge of high quality and maintenance of wetland systems.

The proposed residential development can be designed and managed to achieve stated environmental and planning requirements. The proponent believes that this is a responsible approach to developing much needed urban land along with parks and recreation reserves in the metropolitan area.

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8.0 REFERENCES

Department of Planning and Urban Development, Water Authority of Western Australia and Environmental Protection Authority, (1993). Draft Water Sensitive Urban (Residential) Design Guidelines for the Perth Metropolitan Region. Schedule of Best Management Practices. Perth, WA.

Department of Planning and Urban Development, (1992a). Jandakot Land Use Water Management Strategy. Perth, WA.

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O'Connor R, Quatermaine G, & Bodney C (1990) Aboriginal Site Survey. Report on a Survey for Aboriginal Sites, Livingston Estate, Canning Vale. Perth, WA.

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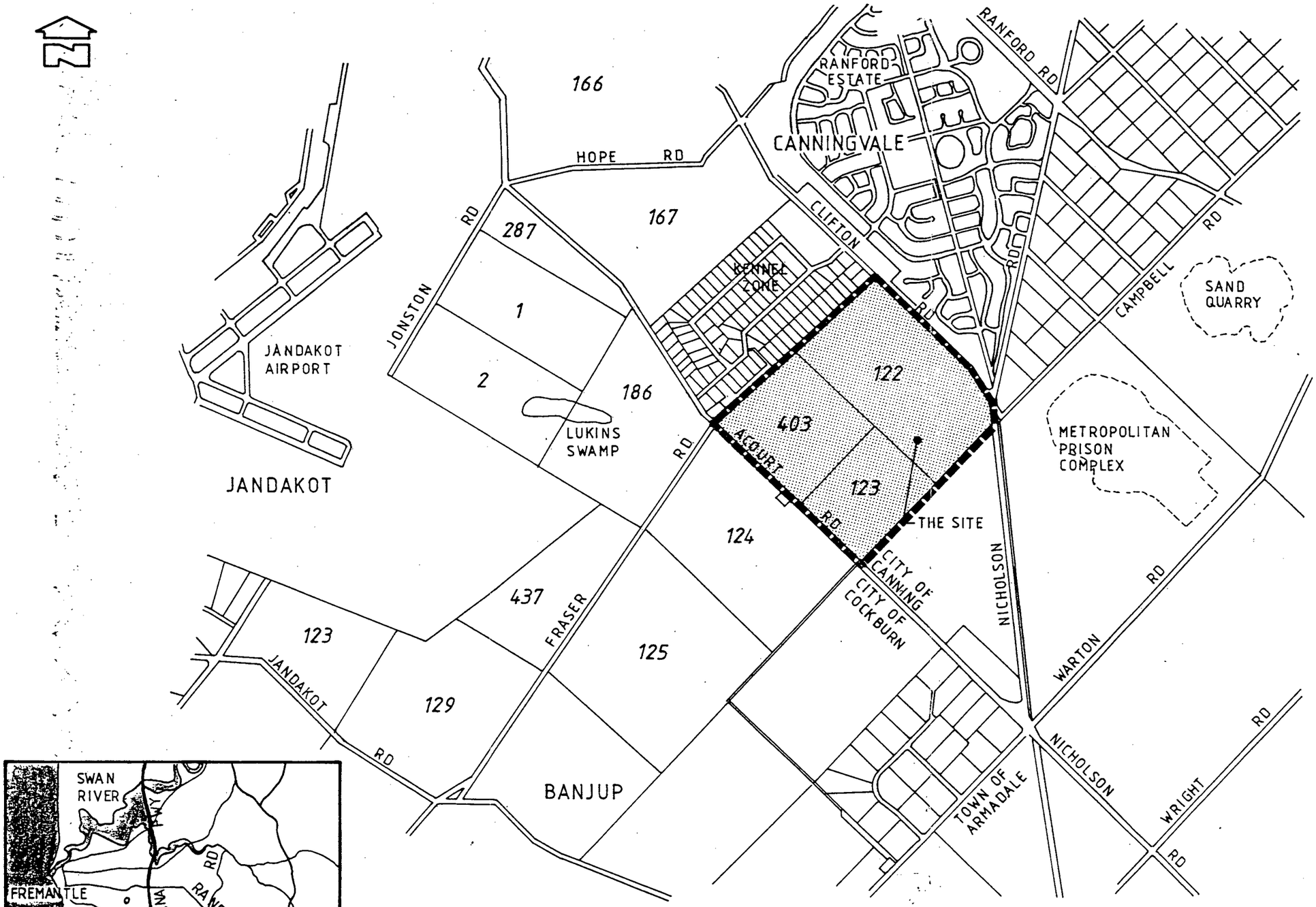
FIGURES 1 to 7



GENERAL LOCALITY PLAN

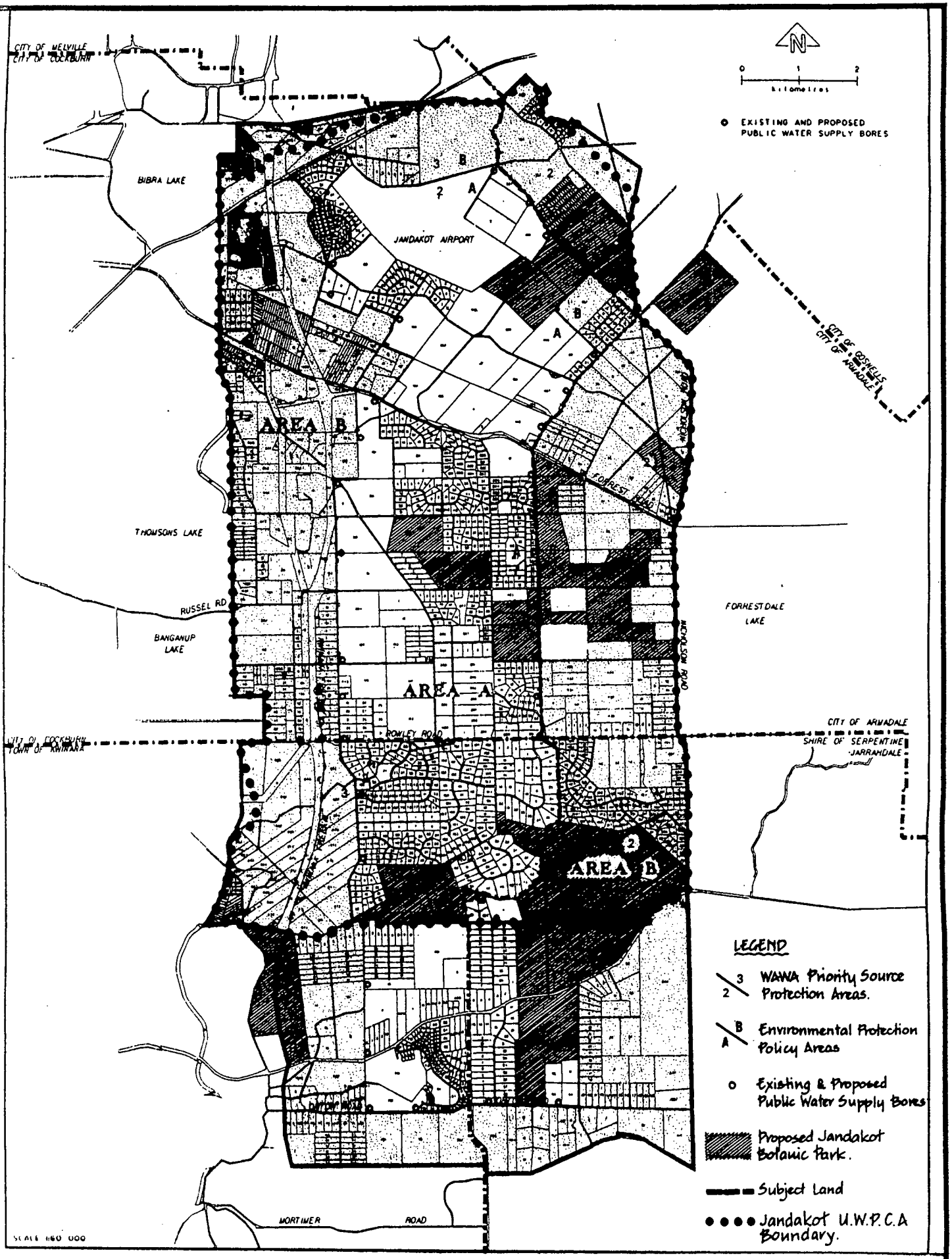
Wood & Grieve ENGINEERS

CANNING PROPERTY GROUP, CANNING VALE

FIG 1 LOCATION PLAN

SCALE 1:20,000

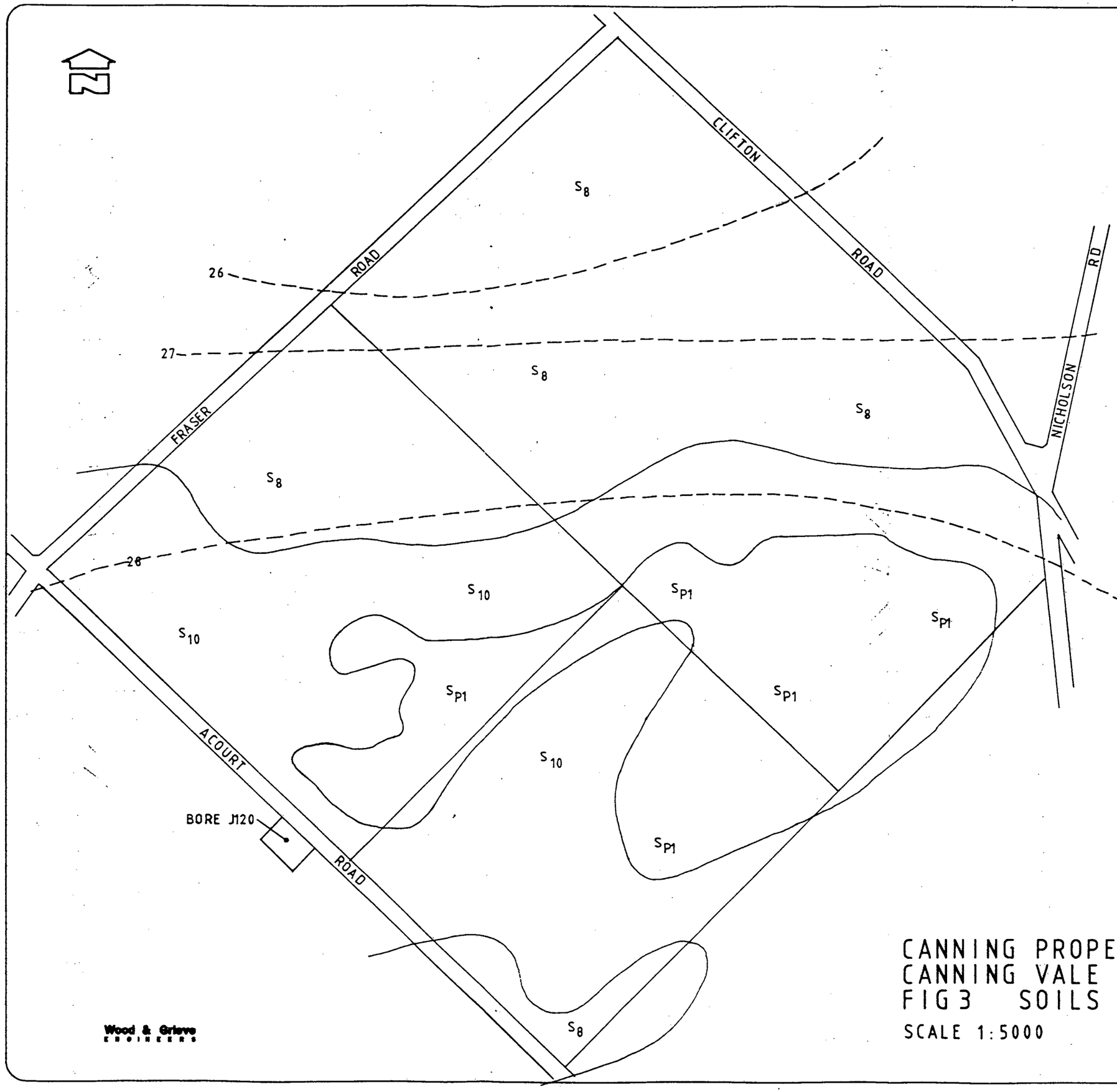
REF 13900C



CANNING PROPERTY GROUP
CANNING VALE

FIGURE 2 - JANDAKOT MOUND GROUNDWATER PLAN & BOTANIC PARK PROPOSALS

LAND PLANNING CONSULTANTS



LEGEND

S_8	SAND-BASSENDEAN DUNES
S_{10}	SAND-BASSENDEAN DUNES OVER GUILDFORD CLAYS
S_{P1}	PEATY SAND-SLIGHTLY PEATY SWAMP DEPOSITS
----	GROUNDWATER CONTOURS

SOURCE

GROUNDWATER CONTOURS - WAWA
SOILS - DEPARTMENT OF MINERALS AND ENERGY.

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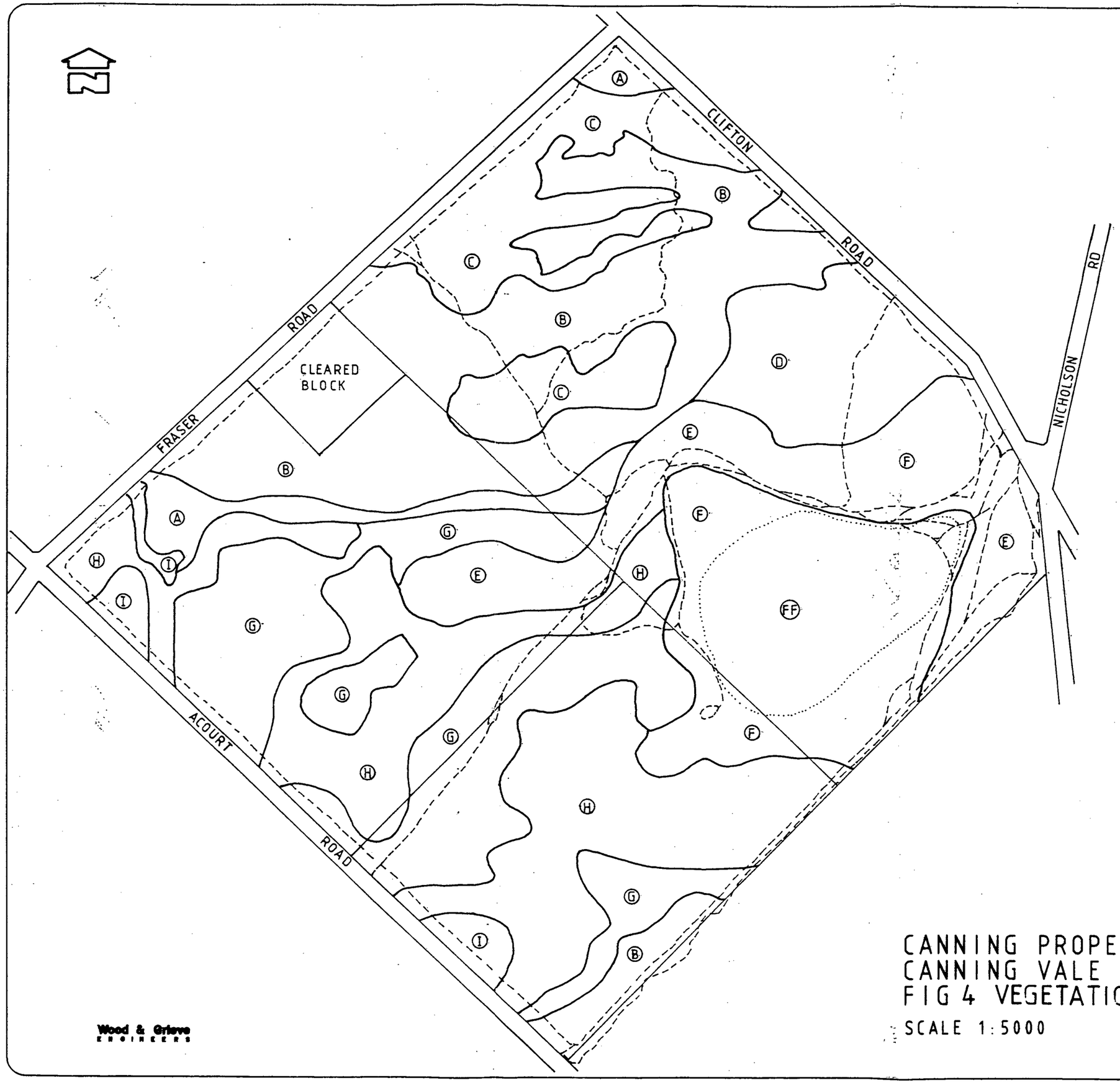
CANNING PROPERTY GROUP, CANNING VALE
FIG 3 SOILS DISTRIBUTIONS

SCALE 1:5000

REF 13900C



LEGEND

VEGETATION TYPES

A	MIXED LOW HEATH
B	BANKSIA LOW WOODLAND OF THE CRESTS
C	BANKSIA LOW WOODLAND OF THE SLOPES AND SWALES
D	BANKSIA-SHEOAK-JARRAH WOODLAND
E	FLOODED GUM-MOONAH FRINGING WOODLAND
F	MELALEUCA TERETIFOLIA SHRUBLAND
FF	OPEN PEATY AREAS WITH SCATTERED MELALEUCA TERETIFOLIA
G	PERICALYMMA ELIPTICUM DENSE LOW SHRUBLAND
H	REGELIA CILIATA-MELALEUCA LATERITIA SHRUBLAND
I	MELALEUCA-SPEARWOOD THICKETS

—— VEGETATION TYPES BOUNDARIES

– – – – TRACKS / FIREBREAKS

..... APPROXIMATE LIMIT OF OPEN WATER IN NOVEMBER

ADAPTED FROM APPENDIX 1

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FIG 4 VEGETATION TYPES

SCALE 1:5000

REF 13900C

N

JANDAKOT AIRPORT

20
25
30
35
25

JANDAKOT RD

FRASER

CLIFTON RD

ROAD

A.COURT RD

NICHOLSON RD

RANFORD RD

THE SITE

LEGEND

—20— ANEF CONTOURS PREDICTED FOR ADDITIONAL RUNWAY AND AIRTRAFFIC TO THE YEAR 2005

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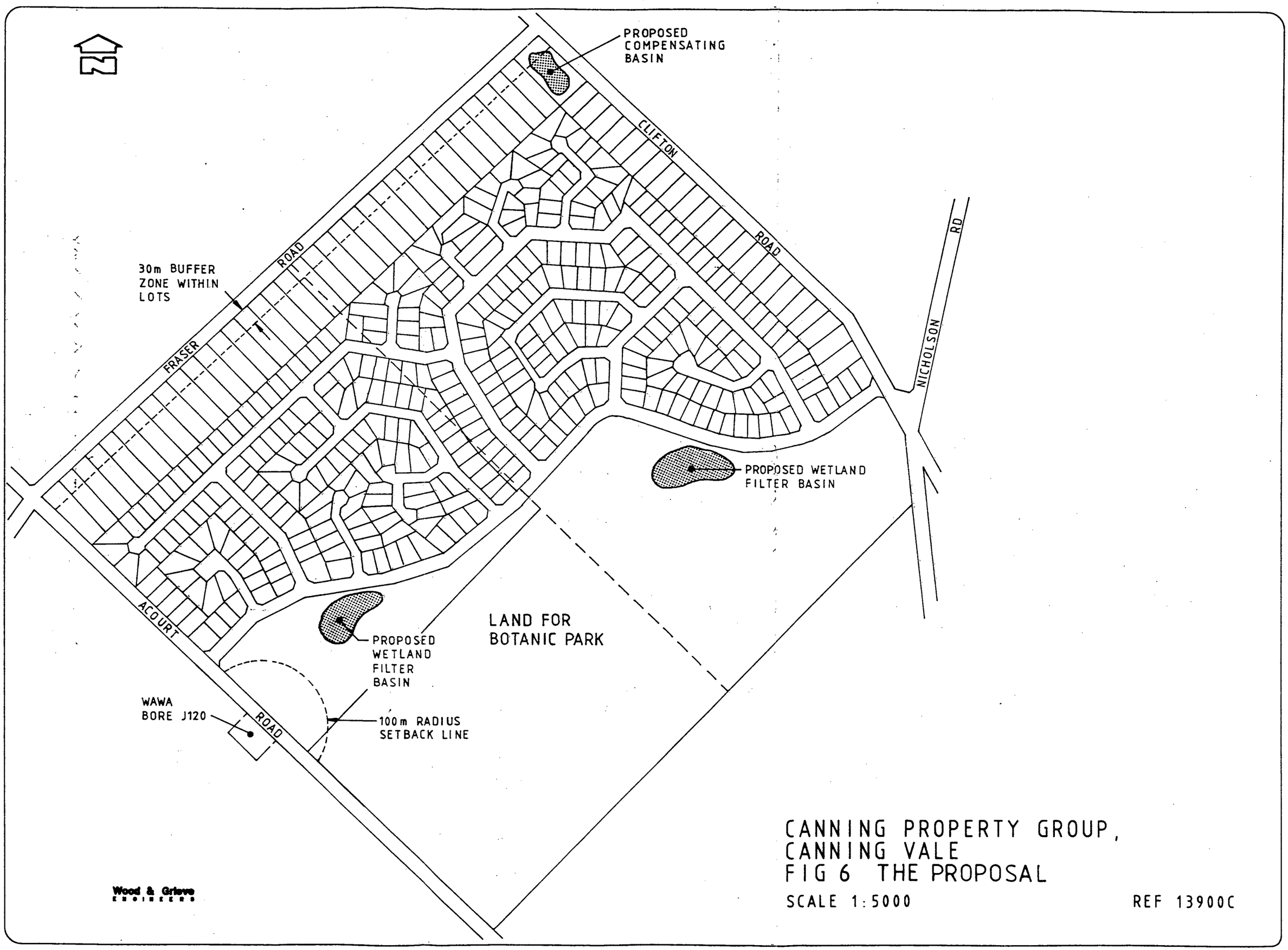
CANNING PROPERTY GROUP, CANNING VALE
FIG 5 ANEF CONTOURS

SCALE 1:20,000

REF 13900C


PROPOSED COMPENSATING BASIN
CLIFTON ROAD
NICHOLSON RD
30m BUFFER ZONE WITHIN LOTS
FRASER ROAD
PROPOSED WETLAND FILTER BASIN
ACOURT ROAD
LAND FOR BOTANIC PARK
PROPOSED WETLAND FILTER BASIN
WAWA BORE J120
100m RADIUS SETBACK LINE
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CANNING PROPERTY GROUP,
CANNING VALE
FIG 6 THE PROPOSAL
SCALE 1:5000
REF 13900C

PROPOSED COMPENSATING BASIN TO CONTROL OUTLET FLOW TO AMHERST ROAD BRANCH DRAIN SYSTEM.

CATCHMENT FOR NORTHWARD DRAINAGE FLOW MANAGEMENT

CATCHMENT FOR SOUTHWARD DRAINAGE FLOW MANAGEMENT

CLIFTON ROAD

FRASER ROAD

NICHOLSON RD

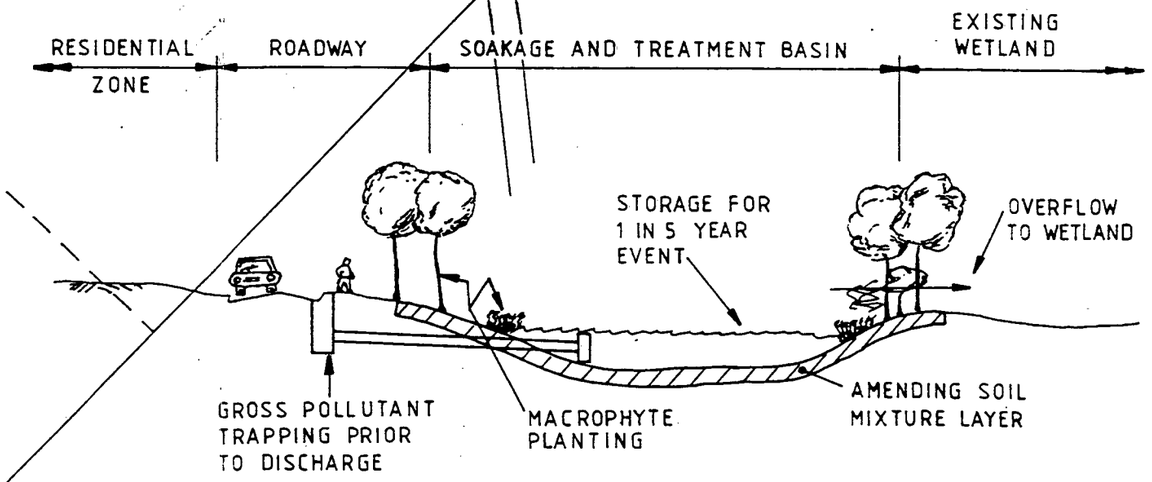
SUB CATCHMENT

SUB CATCHMENT

PROPOSED WETLAND FILTER BASIN

PROPOSED WETLAND FILTER BASIN

ACOURT ROAD



TYPICAL DETAIL THROUGH SOAKAGE BASIN

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FIG 7 DRAINAGE MANAGEMENT PLAN

SCALE 1:5000

REF 13900C

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APPENDIX 1

FLORA SURVEY

D Goble-Garratt

REPORT ON A SURVEY OF THE FLORA AND VEGETATION OF LOTS 122, 123 & 403 ACOURT ROAD, CANNING VALE.

PREPARED FOR WOOD AND GRIEVE ENGINEERS

BY E. M. GOBLE-GARRATT

November 1993.

TABLE OF CONTENTS

1. GENERAL INTRODUCTION

The following pages provide a report on a flora and vegetation survey commissioned by Wood and Grieve Engineers. The survey is required for inclusion in a Consultative Environmental Review (CER) of a proposal to develop Lots 122, 123 and 403 Acourt Road, Canning Vale for residential purposes.

The survey area is situated on the eastern side of the Swan Coastal Plain on the Geomorphic Unit known as the Bassendean Dunes (McArthur and Bettenay, 1960). The soils are classified as belonging to the Southern River Association which forms the easternmost fringe of the Bassendean Dune system (Bettenay *et al*, 1960). The Southern River Association consists of leached siliceous sandy dunes and numerous sandy and clayey swamp flats. Many of the dunes have a clay basement, the result of the dunes having been formed by wind-blown sand movement over the clayey swamps. The Armadale map sheet of the Perth Metropolitan Region 1:50 000 Environmental Geology Series (Jordan, 1986) shows that the greater portion of the site has Bassendean sand at the surface. The south-eastern portion of the area where the seasonal open water occurs, is covered by fine to medium-grained sand rich in brown to black peaty material. This is surrounded by a band of less peaty, but still fine grained sand, which also extends in a tongue along a weakly defined drainage line in a south-westerly direction towards Acourt Road.

A large dune crosses the northern portion of the site running roughly in an east-west direction. The northern corner is low-lying and seasonally waterloggged with water at the surface for short periods following rainfall events. A similar situation is found over most of the southern half of the site with the exception of the peaty area along the south western border which is inundated in winter and where there is water at the surface till well into November, and possibly later.

Tracks/firebreaks surround and cross the site, and are especially noticeable around the peaty, seasonally indated area. The tracks appear to be used by horse riders, and there is a small cleared exercise ring close to Fraser Road. The tracks on the flat areas are used extensively by trailbike riders.

The eastern part of the site closest to Nicholson Road is fairly heavily invaded by weedy grass species, and may have been grazed at some time in the past. The western corner (Acourt/Fraser Rds) is also very weedy, as are some parts of the flats. A large area at the south of the site was burnt in the Summer of 1992/93.

Surrounding landuse includes the special residential (Canning Vale Kennel Area) across Fraser Road, a new residential subdivision to the north and north-east across Clifton Road, the Canning Vale Prison Complex and large areas of uncleared bush to the east, and uncleared bush to the south-east and across Acourt Road on the south-west.

The line of an existing Water Authority of Western Australia wellfield runs along the south-western border of the site.

This site, along with the uncleared bush areas to the south-west and south-east have been suggested for inclusion in the Jandakot Botanic Park (Department of Planning and Urban Development, 1992).

2. FLORA AND VEGETATION

2.1 Introduction and Objectives

The general characteristics of the vegetation in the region have become fairly well known over the past few years as a result of specific areas being surveyed for rare flora, from wider ranging planning related surveys, and through the Water Authority of Western Australia's monitoring of wetland vegetation. The Banksia Woodlands at Jandakot Airport have long history of scientific study (Milewski and Davidge, 1981).

Beard (1979) mapped the area as supporting Sheoak-Banksia Low Woodland with scattered Jarrah, and classified the vegetation as belonging to the Bassendean Vegetation System. He noted that freshwater swamps between the dunes comprise a large proportion of this System.

Eleven species currently on the Schedule of Declared Rare Flora occur in the Metropolitan area. Of these, the following five occur in the general southern Metropolitan area and could possibly be expected on the site; *Diuris purdiei, Aponogeton hexatepalus, Hydrocotyle lemnoides, Drakea elastica,* and *Caladenia huegelii.*

The objectives of the current survey were:

- to provide a checklist of the vascular flora of the site,
- to describe the vegetation communities present in broad terms, and
- to comment on the importance of the site with respect to the flora and vegetation in a local and regional context.

2.2 Methods and Limitations

The site was surveyed opportunistically over several days in late September and early October, and was visited again in late October. The survey included walking many of the tracks/firebreaks, and also several traverses through the Banksia Woodland area and across the burnt southern portion. A checklist was compiled of the species encountered. Where field identification was not possible a voucher specimen was pressed for later identification or verification at the Western Australian Herbarium. As the survey took place over a limited period and was of necessity not systematic, the species list cannot be considered complete. The very young post fire nature of the vegetation along the south-western boundary also made identification of some of the plants present difficult. Notes were taken of the vegetation changes, and these were used in conjunction

with aerial photography to map the community types in broad terms. No attempt has been made to relate the vegetation types recognised for the mapping to any other published descriptions. They were chosen to give a practical description of the vegetation present on the site. In some cases the mapped vegetation boundaries must be considered approximate as boundaries between the recognised units were not distinct.

2.3 Results

2.3.1 Flora

A total of 148 taxa of vascular plants were identified during the survey. Of these 117 were native taxa, and 31 were naturalised exotics (See Appendix 2). This compares with some 180 native species and 33 exotics encountered in the Water Authority of Western Australia's vegetation monitoring in the region (E. M. Mattiske, pers comm.). The suite of species found during this survey is generally similar to that recorded in the WAWA study with most of the genera common to both.

There are 85 genera from 35 families of native vascular plants represented in the checklist. The families best represented are the Myrtaceae (18 taxa), the Papilionaceae (9 taxa), the Asteraceae and Proteaceae (8 taxa), and the Stylidaceae with 7 taxa. Systematic surveying would undoubtedly add to the checklist, especially in the case of less conspicuous herbaceous species.

None of the species of Declared Rare Flora mentioned in the introduction were found on the site. The *Pericalymma elipticum* dominated, wet heath appears to be suitable habitat for *Diuris purdiei*, and a special search was made of this vegetation type. The first Spring following a Summer burn is when this orchid flowers and is visible, and it would have been recorded if present.

The Department of Conservation and Land Management maintains a Priority flora list which provides priorities for the survey of species of uncertain conservation status. Priority 1 to 3 taxa are under consideration for gazettal. One Priority 3 species *Gonocarpus pithyoides* was identified during this survey. The Priority 3 taxa are defined as follows:

> *Taxa which are known from several populations, at least some of which are not believed to be under immediate threat. these taxa are under consideration for declaration as "rare flora" but are in need of further survey.*

Gonocarpus pithyoides has recently been recorded from numerous sites in the Metropolitan area and has been recommended for deletion from the priority list (Kelly *et al*, 1993).

2.3.2 Vegetation

Because of the topographic variation contributed by the east-west trending

dune, the vegetation on the site is fairly diverse. Three variants of Banksia Woodland were recognised in the mapping. The differences between them are in both species composition and stature. These differences result mainly from differences in water availability, and are due to textural differences in the sandy substrate, and varying depths to the watertable. The Mixed Heath and Flooded Gum-Moonah Fringing Woodland types occupy intermediate positions in the topographic continuum between the dune and the flats. The flats are occupied by a mosaic of mostly low shrub communities of varying densities. The open peaty flats where the water remains longest into the Summer is considered to be a sub-type of one of these because of shared species, but is in habitat terms very different to the rest of the flats.

The following vegetation/community types were used as mapping units. The letters which identify them correspond to the letters appearing on the map (Figure 1).

A. **Mixed Low Heath.** Mixed Low Heath occurs as a small confined area at the northernmost point of the site, and over a larger area at the foot of the dune near the western end. These areas are topographically intermediate between the dunes and the flats, and the vegetation present contains elements of Banksia Woodland flora and species more common on the wetter flats. Soils tend to be slightly peaty. Common shrubs include *Hypocalymma elipticum, Eriostemon spicatus, Astartea fascicularis, Dasypogon bromeliifolius, Platytheca galioides* and *Latrobea tenella.* Small *Melaleuca preissiana* and *Xanthorrhoea preissii* occur as emergents.

B. **Banksia Low Woodland of the Crests.** This occurs across the central-northern part of the site (the highest lying area), and also in elongated and interconnected patches towards the north. Soils are coarse, free-draining, and deep. All three of the Banksia Woodland variants recognised for the mapping share the presence of the canopy dominants *Banksia attenuata* and *Banksia menziesii.* The woodland on the crests tends to be more open, and the trees of a lower stature. Many understorey species such as *Dampiera linearis, Hemiandra pungens, Petrophile linearis, Dasypogon bromeliifolius,* and *Macrozamia riedlei* are also common to all three types. However, the open canopy encourages an abundance of some understorey species on the crests such as the ephemeral daisies (*Brachycome iberidifolia* and *Asteridea pulverulenta*) and the grass species *Amphipogon turbinatus* and *Neurachne alupecuroides.* The shrubs *Scholtzia involucrata* and to some extent *Adenanthos cygnorum* were restricted to this Woodland type.

C. **Banksia Low Woodland of the Slopes and Swales.** This form of the Banksia Woodland occurs slightly lower in the landscape than type B as described above. On the northern portion of the site it merges into the Mixed Heath and the Flooded Gum-Moonah Fringing Woodland downslope, and grades into the Banksia Woodland of the crests. It also occurs on the small dune at the southern end of the site. The two common Banksias are joined in the canopy by *Banksia ilicifolia* and an occasional

Nuytsia floribunda and *Eucalyptus todtiana*. The trees tend to be denser and taller than on the crests. The shrubs *Regelia inops*, *Melaleuca thymoides* and *Leucopogon sprengeloides* appear restricted to this woodland type. The first two are abundant and provide a magnificent show of flowers in Spring.

D. **Banksia-Sheoak-Jarrah Woodland** This woodland type occurs on the gentle slope down to the open flat area at the western end of the site. The soils here are possibly finer textured, leading to better soil-plant water relations, and may also be more fertile than the dunes proper. This vegetation type merges downslope with the Flooded Gum-Moonah Fringing Woodland. It is a woodland in which the three Banksia species still dominate. The other canopy species previously mentioned (*Banksia ilicifolia*, *Nuytsia floribunda* and *Eucalyptus todtiana*) also occur. However two additional species are also important components. These *Eucalyptus marginata* and *Allocasuarina fraseriana*, both of which tend to be taller than the other canopy species. Species common in the understorey which were not noted elsewhere are *Hibbertia hypericoides*, *Conostylis aculeata*, *Bossiaea eriocarpa* and *Calytrix fraseri*.

E. **Flooded Gum-Moonah Fringing Woodland.** This community type occurs in a band along the edge of the dune area, and broadens out around northern end of the open peaty flat along Nicholson Road. This is probably the most disturbed community on the site. The tracks which skirt the open flat are situated on the boundary of this community. The area may also have been grazed in the past, and the understorey is very weedy. The canopy is formed by a broken band of large *Eucalyptus rudis* with an accompanying band of *Melaleuca preissiana* present on the upslope side in some areas. *Banksia littoralis* occurs sporadically. The native understorey is in the form of dense beds of the sedge *Schoenus globifer*. Other sedge-like plants which are common are *Lepidosperma longitudinale* and *Lyginia barbata*. *Hypocalymma angustifolium*, *Jacksonia furcellata* and *Astartea fascicularis* which are shrubs typical of the wet heaths also occur as an understorey to the Paperbarks.

F. ***Melaleuca teretifolia* Shrubland.** This community type occurs in a dense band on the periphery of the open peaty flat. The canopy is completely closed, about two to three metres high and almost monospecific. An occasional clump of *Melaleuca lateritia* is also present. As with the previous community the understorey, where it occurs on the edges and in openings, is very weedy with the grass *Sporobolus indicus* prominent. Native species include *Drosera ?menziesii* and *Baumea juncea*.

FF. **Open Peaty Areas with scattered *Melaleuca teretifolia*.** The vegetation on the open peaty flats consists of scattered dense clumps of *Melaleuca teretifolia* and beds of *Typha orientalis* and some *Villarsia albiflora* in the areas of deepest (and longest) inundation.

G. ***Pericalymma elipticum* Dense Low Shrubland.** This community type and the following one (H) form a mosaic on the flats of the southern half of the site. The distribution of the two communities is determined by small differences in topography, with *Pericalymma elipticum* dominant on slightly higher ground. Much of this community type was burnt in a fire during the summer of 1992/93. When mature, this community is composed of a dense canopy of shrubs to approximately 1.5 metres high. *Pericalymma elipticum* is the main species present with other shrubs such as *Adenanthos obovatus, Hypocalymma angustifolium, Pimelea imbricata* and *Hibbertia stellaris* important components. In the first few seasons after fire numerous sedges, rushes and small herbaceous species, (*Stipa ?compressa, Schoenus curvifolius, Lobelia tenuior, Gnaphalium sphericum, Stackhousia monogyna* and *Anigozanthos humilis*) are prominent. Occasional trees such as *Banksia littoralis* and *Melaleuca priessiana* occur as emergents.

H. ***Regelia ciliata-Melaleuca lateritia* Shrubland.** When mature, this community type is similar in structure to the previous one, but is often taller. The shrubland may appear monospecific over large areas, but in the wettest sites *Melaleuca lateritia* also occurs. Herbs and sedges are also prominent in the post fire succession in this community, and many of the shrubs and herbaceous species mentioned above (G), are common to both.

I. **Melaleuca-Spearwood Thickets.** This type occurred at the western corner of the site, and as small pockets along Acourt Road and in the centre of the site (not mapped). *Melaleuca raphiophylla* grows at the centre of the thicket with *Kunzea ericifolia* on the edges. Kangaroo Paws and other smaller species may be present. This community type has been affected by fires - neither of the dominant species is fire resistant. The area at the western corner of the site is severely weed infested, with no native understorey species visible.

2.3.3 Vegetation Condition

The vegetation condition varies widely in different parts of the survey area. An indication of this variation is given on the vegetation map by the use of indices of condition. Allocation of these indices was subjective, and they are to some extent relative to other areas of remnant vegetation in the surrounding area. They are a measure of the degree of disturbance and invasion by weedy species, and are not indicators of significance.

The Banksia Woodland on the main dune at the north of the site and the Mixed Heath are in surprisingly good condition. Weed invasion is limited to a few metres along the roads, and to a limited extent along the tracks on the site. Away from the roads and tracks there are occasional occurrence of *Gladiolus caryophyllaceus* and *Briza maxima*. There does not appear to be any sign of infection by dieback (*Phytophthora cinnamomi*) - many of the understorey plants which are sensitive to the pathogen (Family Epacridaceae, *Macrozamia riedlei* and

Xanthorrhoea preissii) are common and in good health.

The Banksia-Sheoak-Jarrah area is far more disturbed, with the understorey very weedy, and numerous loads of rubbish and old car bodies dumped near the main track. The Jarrah has been cut over in the past, and some standing dead (and very large) trees have been harvested recently.

The periphery of the open peaty flat, including the fringing woodland areas is similarly disturbed and weedy. Some of the *Melaleuca teretifolia* down the western side of the open flat are dead. This is possibly due to a previous fire.

The southwestern portion of the site appears to have a greater diversity, if not density of weedy species, and rabbit activity is also very evident in this burnt area. These may be a short-term, post-fire phenomena. However, as mentioned above, the western corner of the site is heavily weed infested. None of the bulbous garden escapes commonly found in remnant bush areas appear to be a problem on this site.

3. WETLAND CLASSIFICATION

Over the years the Environmental Protection Authority has produced a number of publications which provide broad management outlines for wetlands on the Swan Coastal Plain, and also a method by which individual wetlands can be allocated to a specific management category. Wetlands are defined as areas of permanent, seasonal or intermittent inundation. The definition covers natural and modified or artificial wetlands, and fresh, brackish or saline water. It also includes areas of land which are intermittently waterlogged, where surface water may or may not be present, known as damplands, such as the wet heath areas found on the survey site.

The wetland evaluation method as set out in the most recent publication, Bulletin 686 (Environmental Protection Authority, 1993), uses natural and human use attributes to assign each wetland to one of five management categories.

The three categories relevant to the survey area are:

H - High Conservation. The management objectives for these wetland areas are given as follows. Active management to maintain and enhance the wetland attributes, particularly natural attributes. Where there is no active management at present it should be put in place as a matter of priority. Active management requires that a detailed management plan is prepared and implemented, with sufficient resources to maintain or improve the wetland's current condition.

C - Conservation. Management objectives for these wetlands are given as the maintenance and enhancement of natural attributes and functions.

R - Resource Enhancement. Management objectives for these wetlands are given as the maintenance and enhancement of existing ecological functions.

The questionnaire in Bulletin 686 was applied to the wetlands on the survey site in two ways. The flat peaty area at the western end of the site was taken as an entity in it's own right, and the survey was also applied to the rest of the seasonally waterlogged heathy areas. The field record sheets for these evaluations are in Appendix 1.

The presence of Declared Rare Flora or Fauna in the assessment area automatically allocates that area to the Management Category H (High Conservation). This would apply to the wet heath areas on the southern portion of the site. The scores of other attributes for this area are; natural attributes - 17½, human use attributes - 10. These categorise the area as being transitional between Category C (Conservation) and Category R (Resource Enhancement). If these wet heath areas are considered to be of limited distribution this shifts the area in the Conservation category.

The open peaty area at the western end of the survey site which is seasonally inundated is considered to be a Category C wetland (Natural Attribute Score - 46, Human Use Score - 9). Should the presence of the Southern Brown Bandicoot be confirmed in this area it would also be considered a High Conservation wetland (See comment on the field record sheet at E).

4 GENERAL DISCUSSION AND RECOMMENDATIONS

All areas of remnant native vegetation in the Metropolitan Area should be considered as having conservation significance. This is especially so for large, relatively intact, and diverse areas such as the project site.

Wetland areas have received prominence in the last few years due to their rapid disappearance, and to the fact that they often fulfil a multiplicity of ecological functions, as well as having aesthetic and human use attributes.

The conservation of Banksia Woodlands, especially on the southern Swan Coastal Plain has also been seen as a priority. Hopper (1989), for the Bassendean Central and South Complex, gave a figure of 14.5% of the original area of woodland still extant in 1986. More recently, Trudgeon estimated that 95% of the Banksia Woodland and associated wetland vegetation on the coastal plain south of Perth has been cleared (Department of Planning and Urban Development, 1992). These facts, in part, resulted in the provisional identification of areas for inclusion in the Jandakot Botanic Park. The project site, as well as the adjacent uncleared areas to the south-east and south-west are included in these provisional areas.

Given this background, and that the project area supports good quality Banksia Woodland as well as two distinct types of wetland and associated vegetation, the Conservation/Development question should only be resolved after consideration of the planning proposals for other areas of remnant native vegetation in the

surrounding area which may be considered to have similar or higher conservation priorities. This can only be done by the Planning Authorities.

Consideration must be given to the following factors:

- The site supports a large stand of good quality Banksia Woodland;

- The Banksia-Sheoak-Jarrah community type is probably the least common of the Banksia Woodland types. Although this community on the project area is disturbed, it does still have native understorey elements present. It also has passive recreational potential because the larger timber present and the open woodland aspect are aesthetically pleasing. The area could be cleared of rubbish and rehabilitated to some extent;

- The fringing woodland community, though degraded in the understorey is possibly less so than some similar areas further south and is possibly habitat for the Gazetted Rare Fauna species *Isoodon obesulus* (the Southern Brown Bandicoot);

- The open peaty area which retains water well into Summer, though somewhat weedy is still categorised as a C Class Wetland using the Environmental Protection Authority's Bulletin 686. This area, along with the fringing woodland may have importance as habitat for birds;

- Due to the presence of the Southern Brown Bandicoot, the wet heath areas at the south of the site are classified as High Conservation Wetlands using the Environmental Protection Authority's Bulletin 686;

- The entire site has value from a vegetation diversity point of view, but must also be considered with respect to the fauna habitat it provides. Aside from the Bandicoot, Kangaroos are also present, and there may be other native mammals resident. The area is undoubtedly home to many reptile species, and because of the larger trees and dense shrubs in some areas may be of residential significance to birds;

Should the decision be to develop the site, it is recommended that a substantial portion be retained for conservation and passive recreation purposes. Two options could be considered.

1. The open peaty wetland area and associated *Melaleuca teretifolia* shrubland along with a contiguous corridor **at least** 200 metres wide along Clifton Road be retained.

   This option has the following good and bad points:

   i. The wetland area identified as a C category wetland along with some of the peripheral vegetation is conserved;
   ii. A substantial portion (some 16ha.) of good quality Banksia Woodland, including most of the Banksia-Sheoak-Jarrah type is retained;

iii. Topographic and landscape diversity of the reserved area is maximised;
iv. The greatest diversity of habitat types, including areas which suppport the Southern Brown Bandicoot (Mixed Heath, Fringing Woodland) are retained;
v. The wet heath areas (H category wetlands) at the southern end of the site are lost;
vi. Future development scenarios for adjacent land may leave the conserved area isolated from other remnants of native vegetation.

2. The open peaty wetland area and associated *Melaleuca teretifolia* shrubland, and a contiguous area of the wet heath vegetation at the southern end of the site be retained.

This option has the following characteristics:

i. The wetland area identified as a C category wetland is conserved;
ii. A portion of the wet heath vegetation (Category H Wetland and Southern Brown Bandicoot habitat) is retained;
iii. All the remnant Banksia Woodland on the site is lost;
iv. Future develepment scenarios for adjacent land may leave the conserved area isolated from other remnants of native vegetation.

A management plan for the reserved areas will need to be prepared in consultation with the Environmental Protection Authority and the Department of Conservation and Land Management. This management plan must include the prohibition of horses and trailbikes from the reserved areas.

Whichever portion of the site is retained for conservation if the development proposal proceeds, the reserved area must not be included in the entry statement or other urban landscaping plans prepared for the subdivision.

CALM must also be consulted regarding the resident population of the Southern Brown Bandicoot.

5. ACKNOWLEDGEMENTS

Ms B Koch provided assistance with the identification of voucher material.

6. REFERENCES

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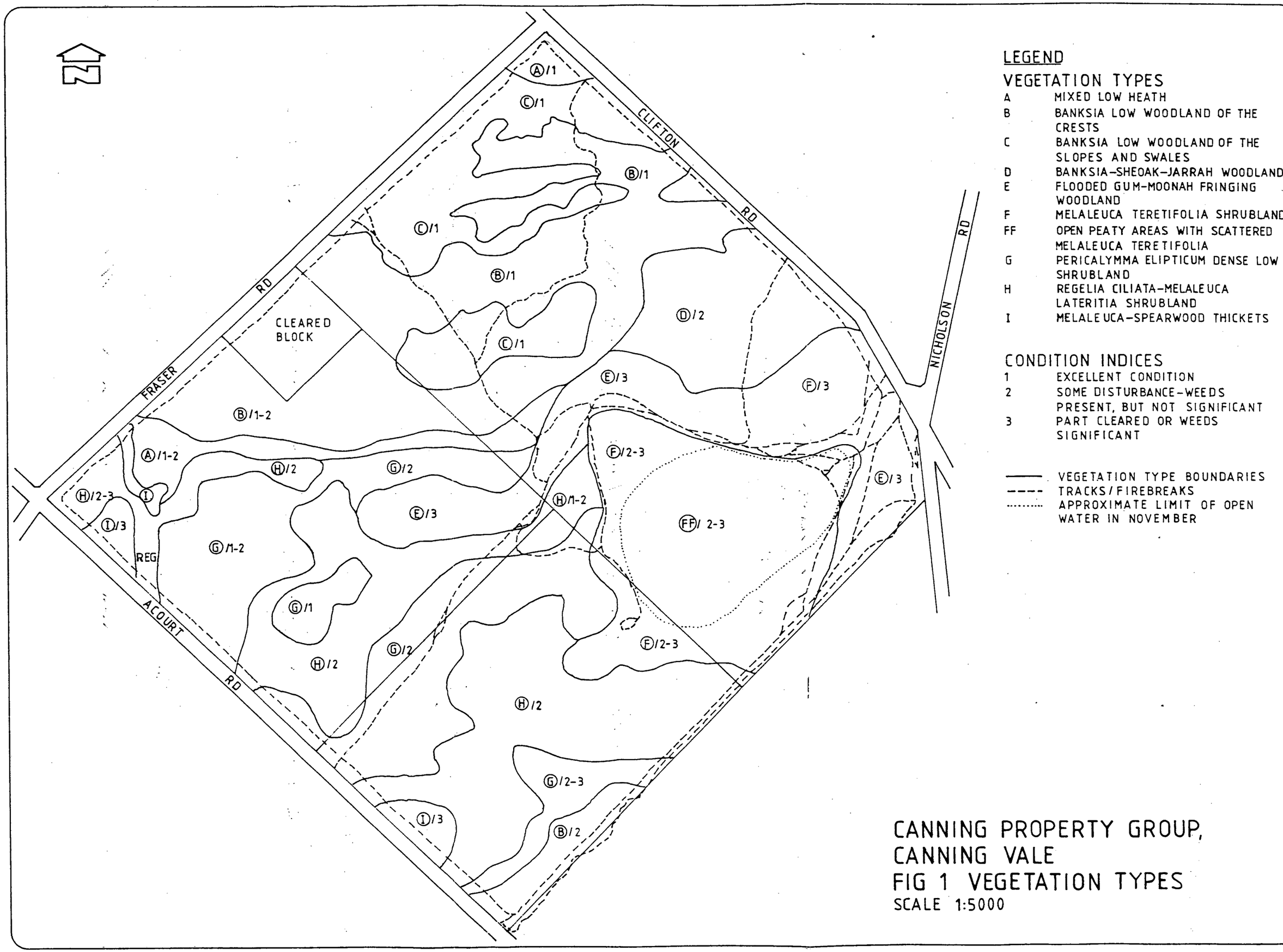

LEGEND

VEGETATION TYPES

- A MIXED LOW HEATH
- B BANKSIA LOW WOODLAND OF THE CRESTS
- C BANKSIA LOW WOODLAND OF THE SLOPES AND SWALES
- D BANKSIA–SHEOAK–JARRAH WOODLAND
- E FLOODED GUM–MOONAH FRINGING WOODLAND
- F MELALEUCA TERETIFOLIA SHRUBLAND
- FF OPEN PEATY AREAS WITH SCATTERED MELALEUCA TERETIFOLIA
- G PERICALYMMA ELIPTICUM DENSE LOW SHRUBLAND
- H REGELIA CILIATA–MELALEUCA LATERITIA SHRUBLAND
- I MELALEUCA–SPEARWOOD THICKETS

CONDITION INDICES

1. EXCELLENT CONDITION
2. SOME DISTURBANCE–WEEDS PRESENT, BUT NOT SIGNIFICANT
3. PART CLEARED OR WEEDS SIGNIFICANT

——— VEGETATION TYPE BOUNDARIES
– – – – TRACKS/FIREBREAKS
..... APPROXIMATE LIMIT OF OPEN WATER IN NOVEMBER

CANNING PROPERTY GROUP, CANNING VALE
FIG 1 VEGETATION TYPES
SCALE 1:5000

APPENDIX 1

FIELD SCORE SHEETS FOR WETLAND EVALUATION

FIELD AND SCORE SHEET

A. RESOURCE DATA

WETLAND NAME Parts of LOTS 122, 123 & 403 ACOURT RD

IS THE BOUNDARY WELL DEFINED OR POORLY DEFINED? (Underline correct response) CANNING VALE

LOCATION (nearest road or junction) ACOURT & FRASER RDS.

DATE(S) VISITED SEPT - Nov 93 FIELD WORKER EIM, GOBLE-GARRATT

LOCAL GOVERNMENT AUTHORITY CANNING.

MAP REFERENCE _____

AERIAL PHOTOGRAPH RUN _____ NUMBER _____

B. NATURAL ATTRIBUTES — SCORE

@ 1 Environmental geology classification

Geology _____ Soil type B/SANDS Distribution restricted? Yes/No NO — 1

@ 2 ADJACENT WETLANDS

Are there wetlands within a 2 km radius? Yes/No YES — —

3 HABITAT DIVERSITY

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands? (refer to Q5) YES/NO NO — 1

4. DROUGHT REFUGE

Is the wetland important as a drought refuge for water birds? (Tick appropriate box) Major [ ] Minor [ ] None [ ]

@ 5. AREA OF WETLAND (or wetland unit for Part IIB wetlands)

Estimate the diameter of the wetland [m], and/or its length [m] and breadth [m],

or calculate the area of the wetland, and tick the appropriate box.

0-10ha [ ] 10-26ha [ ] 25-50ha [ ] 50-100ha [ ] >100ha [ ]

@ 6. HABITAT TYPE

No. of habitat types visible from the aerial photo _____

Tick the appropriate boxes for habitat types present.

a. Vegetation over one hectare in area.

Large paperbarks (>2.5m tall) in dense clumps	[ ]
Low thickets of *Melaleuca, Kunzea* or *Astartea* spp.	[✓]
Paperbark fringe	[ ]
Typha	[ ]
Extensive inlake beds of sedges	[ ]
Extensive beds of *Typha* or rushes	[ ]
Scattered 'clumps' of rushes or sedges	[✓]
Fringing rushes and sedges	[ ]
Samphire or saltmarsh	[ ]

b. Other habitats

Flooded grasslands in winter/spring	[ ]
Mud flats or seasonally dry open water	[ ]
Islands — natural or human made	[ ]
Fringing woodland or heath	[✓]
Permanent shallow open water (<0.5m deep)	[ ]
Permanent deep open water (>0.5m deep)	[ ]
Scattered paperbarks	[✓]

SCORE 3½

7. EMERGENT VEGETATION

How much of the wetland is covered with emergent vegetation?

Calculate $\frac{\text{AREA OF EMERGENT VEGETATION}}{\text{AREA OF WETLAND}} \times 100$

Tick the appropriate box

40-60%	[ ]	30-40% or 60-70%	[ ]		
20-30% or 70-80%	[ ]	10-20% or 80-90%	[ ]	<10% or >90%	[ ]

8. ADVERSE WATER QUALITY

Have any of the following been observed/recorded by fieldworkers or locals?

Algal blooms (free-floating)	[ ]	Algal mats (filamentous)	[ ]		
High nutrient levels	[ ]	Pollution slicks	[ ]	Botulism	[ ]

@ 9. DRAINAGE

Are there any drains coming in or out? (circle correct response)

Drains in drains out (No drains) — 5

If drains come into the wetland circle type(s) of drains present

off-road stormwater drains open drains from urban/industrial land open drain from rural land

10. ADJACENT NUTRIENT SOURCES

Note the presence of any of the following:

Septic tanks within 100m	[ ]	Seasonally fertilised lawns or grazing areas	[ ]
Unbunded rubbish tips/landfill	[ ]	Agriculture with high nutrient output	[ ]

@ 11. AREA OF WETLAND MODIFIED (or wetland unit for Part IIB)

What percentage of the wetland and buffer has been modified within the boundaries you have chosen? To determine this you may need to calculate as follows. Tick the appropriate box after calculation.

$\frac{\text{TOTAL AREA MODIFIED} \times 100}{\text{AREA OF WETLAND + BUFFER}}$ NOTE: Ignore buffer size for Part IIB wetlands — 4

0-10%	[ ]	11-20%	[✓]	21-30%	[ ]
31-40%	[ ]	>40%	[ ]		

12. RESERVE AREA

Wetland area (refer to question 10) _____

Calculate the area of reserved land containing the wetland, AND/OR area of private land allocated to the wetland by the landowner(s) _____

(Show calculation in margin)

@ 13. NATIVE VEGETATION BUFFER

What is the total perimeter of the wetland? _____ m

What percentage of the property boundary chosen is at least 50m from the wetland edge and is covered with native vegetation?

100-90%	[ ]	79-70%	[ ]	59-50%	[ ]
89-80%	[ ]	69-60%	[ ]	50%	[ ]

II B (vii) WETLAND AREA. — 3

TOTAL — 17½

C. HUMAN USE — SCORE

@ 1. AESTHETICS

Record any of the following aspects related to aesthetics:

Little if any artificial noise	[ ]
Steep ridge visible as part of scenery	[ ]
Ridge accessible giving view of wetland	[✓]
Wetland is a lake & open water easy to view	[ ]
Understorey mostly intact	[✓]
Few or no roads or buildings obvious from wetland	[ ]
A section of wetland exists where few people visit	[ ]

3

@ 2. HISTORICAL/ARCHAEOLOGICAL FEATURES

Note the presence of any of the following:

Aboriginal site	[ ]	Pioneer relics	[ ]
National Trust site	[ ]	National Estate listing	[ ]

0

@ 3. SECURITY OF WETLAND

Total No. of owners _____

Using the codes below list the owner types

PO - private; LA - local authority; VA - vested res or DPUD land; CL - vacant Crown land

Owner 1 _____ Owner 2 _____ Owner 3 _____

Major owner PO — 1

Reserve class and number _____

Reserve purpose:

a In full

b Summary: tick the appropriate box.

A Class Reserve for conservation/recreation	[ ]
MRS owned by local authority or government department	[ ]
other vested reserve	[ ]
other (eg private or vacant Crown land)	[ ]

System 6 Recommendation No. _____ MRS Zone _____ (use codes below)

PAR - parks & recreation; PUB - public purposes; RRL - rural; SF - State Forest; IND - industry & special industry:

TRS - transport (road and rail); URB - urban, urban deferred, civic and cultural

@ 4. PROTECTION GROUPS

Are there active protection groups for this wetland? Yes/No No. — 0

If yes give the details below.

NAME(S) _____

CONTACT PERSON(S) _____

_____

ADDRESS(ES) _____

_____

_____

PHONE NUMBER(S) _____

SCORE

@ 5. PASSIVE RECREATION

Is the wetland used or has it facilities for the following — tick the appropriate box(es)?

nature study/bird watching	[✓]	education (school < 500m)	[ ]
picnic/barbecue facilities	[ ]	recognised tourist venue	[ ]
conservation of flora	[✓]	conservation of fauna	[✓]
recognised research site	[ ]	protection/preservation of other attributes	[ ]

3

@ 6. ACTIVE RECREATION

Is the wetland used or has it facilities for any of the following active recreational pursuits:

walking, jogging or cycling [ ] horse riding [✓] trail bikes [✓]

playground [ ] oval [ ] other [ ] — 2

@ 7. OTHER HUMAN USES

Is the wetland used for any of the following? - tick box(es)

agriculture	[ ]
mining (check for mining leases)	[ ]
water supply	[ ]
existing/proposed service corridors (roads, SEC)	[ ]
proposed urban/housing	[✓]
private purpose other than above	[ ]

1

@ E. Presence of rare species. List here rare species (gazetted and other priority) known at the site. Note 1. species name, priority number, and source of information

One Priority 3 Species — Gonocarpus pithyoides — This species is recommended for deletion from Priority list.

@ F. Private human uses. Note here any evidence of private use for wetlands on private land. Also note comments of land owner.

@ G MAKE A ROUGH SKETCH OF THE AREA, BELOW OR ATTACHED, INCLUDING IF YOU CAN THE BOUNDARIES YOU CHOSE, DIMENSIONS, NORTH DIRECTION, RESERVES, WATERBODY, VEGETATION ZONES, TRACKS, ROADS, FENCES, ETC.

MISCELLANEOUS COMMENTS

See Vegetation map (Figure 7) TOTAL 10

This assessment covers all the wet heath areas on the southern portion of the Project area.

Banded coots definitely present.

FIELD AND SCORE SHEET

A. RESOURCE DATA

WETLAND NAME Lot 122 Alcourt Rd, Canning Vale

IS THE BOUNDARY WELL DEFINED OR POORLY DEFINED? (Underline correct response)

LOCATION (nearest road or junction) Nicholson & Clifton Rds.

DATE(S) VISITED Sept – Nov 93 FIELD WORKER E.M. Goode-Garratt

LOCAL GOVERNMENT AUTHORITY Canning

MAP REFERENCE _____

AERIAL PHOTOGRAPH RUN _____ NUMBER _____

B. NATURAL ATTRIBUTES — SCORE

@ 1 Environmental geology classification

Geology _____ Soil type B/Sands Distribution restricted? Yes/No No — 1

@ 2 ADJACENT WETLANDS

Are there wetlands within a 2 km radius? Yes/No Yes — –

3 HABITAT DIVERSITY

Is the composition and structure of the vegetation significantly different to that found at nearby wetlands? (refer to Q5) YES/NO YES — 3

4. DROUGHT REFUGE

Is the wetland important as a drought refuge for water birds? (Tick appropriate box) Major [ ] Minor [✓] None [ ] — 2

@ 5. AREA OF WETLAND (or wetland unit for Part IIB wetlands)

Estimate the diameter of the wetland [m], and/or its length [m] and breadth [m],

or calculate the area of the wetland, and tick the appropriate box.

0-10ha [✓] 10-25ha [ ] 25-50ha [ ] 50-100ha [ ] >100ha [ ] — 1

@ 6. HABITAT TYPE

No. of habitat types visible from the aerial photo _____

Tick the appropriate boxes for habitat types present.

a. Vegetation over one hectare in area. ? 0.1ha

Large paperbarks (>2.5m tall) in dense clumps	[ ]
Low thickets of *Melaleuca, Kunzea* or *Astartea* spp.	[✓]
Paperbark fringe	[✓]
Typha	[✓]
Extensive inlake beds of sedges	[ ]
Extensive beds of *Typha* or rushes	[ ]
Scattered 'clumps' of rushes or sedges	[ ]
Fringing rushes and sedges	[ ]
Samphire or saltmarsh	[✓]

b. Other habitats

Flooded grasslands in winter/spring	[✓]
Mud flats or seasonally dry open water	[✓]
Islands — natural or human made	[ ]
Fringing woodland or heath	[✓]
Permanent shallow open water (<0.5m deep)	[ ]
Permanent deep open water (>0.5m deep)	[ ]
Scattered paperbarks	[ ]

SCORE — 7

7. EMERGENT VEGETATION

How much of the wetland is covered with emergent vegetation?

Calculate AREA OF EMERGENT VEGETATION x 100 / AREA OF WETLAND

Tick the appropriate box

40-60%	[ ]	30-40% or 60-70%	[✓]		
20-30% or 70-80%	[ ]	10-20% or 80-90%	[ ]	<10% or >90%	[ ]

— 4

8. ADVERSE WATER QUALITY

Have any of the following been observed/recorded by fieldworkers or locals?

Algal blooms (free-floating)	[✓]	Algal mats (filamentous)	[ ]		
High nutrient levels	[ ]	Pollution slicks	[ ]	Botulism	[ ] — 2

@ 9. DRAINAGE

Are there any drains coming in or out? (circle correct response)

Drains in drains out (No drains)

If drains come into the wetland circle type(s) of drains present

off-road stormwater drains open drains from urban/industrial land open drain from rural land — 5

10. ADJACENT NUTRIENT SOURCES

Note the presence of any of the following:

Septic tanks within 100m	[ ]	Seasonally fertilised lawns or grazing areas	[ ]
Unbunded rubbish tips/landfill	[ ]	Agriculture with high nutrient output	[ ] — 5

@ 11. AREA OF WETLAND MODIFIED (or wetland unit for Part IIB)

What percentage of the wetland and buffer has been modified within the boundaries you have chosen? To determine this you may need to calculate as follows. Tick the appropriate box after calculation.

TOTAL AREA MODIFIED x 100 / AREA OF WETLAND + BUFFER — NOTE: Ignore buffer size for Part IIB wetlands

0-10%	[ ]	11-20%	[ ]	21-30%	[ ]
31-40%	[ ]	>40%	[✓]		

— 1

12. RESERVE AREA

Wetland area (refer to question 10) _____

Calculate the area of reserved land containing the wetland, AND/OR area of private land allocated to the wetland by the landowner(s) _____

(Show calculation in margin) Boundary taken as that of project site — 5

@ 13. NATIVE VEGETATION BUFFER

What is the total perimeter of the wetland? _____ m

What percentage of the property boundary chosen is at least 50m from the wetland edge and is covered with native vegetation?

100-90%	[✓]	79-70%	[ ]	59-50%	[ ]		
89-80%	[ ]	69-60%	[ ]	50%	[ ]		

— 10

TOTAL 46.

C. HUMAN USE — SCORE

@ 1. AESTHETICS

Record any of the following aspects related to aesthetics:

Little if any artificial noise	[ ]
Steep ridge visible as part of scenery	[ ]
Ridge accessible giving view of wetland	[✓]
Wetland is a lake & open water easy to view	[ ]
Understorey mostly intact	[ ]
Few or no roads or buildings obvious from wetland	[✓]
A section of wetland exists where few people visit	[ ]

— 3

@ 2. HISTORICAL/ARCHAEOLOGICAL FEATURES

Note the presence of any of the following:

Aboriginal site	[ ]	Pioneer relics	[ ]
National Trust site	[ ]	National Estate listing	[ ]

— 0

@ 3. SECURITY OF WETLAND

Total No. of owners _____

Using the codes below list the owner types

PO - private; LA - local authority; VA - vested res or DPUD land;

CL - vacant Crown land

Owner 1 _____ Owner 2 _____ Owner 3 _____

Major owner PO — 1

Reserve class and number _____

Reserve purpose:

a In full

b Summary: tick the appropriate box.

A Class Reserve for conservation/recreation	[ ]
MRS owned by local authority or government department	[ ]
other vested reserve	[ ]
other (eg private or vacant Crown land)	[ ]

System 6 Recommendation No. _____ MRS Zone _____ (use codes below)

PAR - parks & recreation; PUB - public purposes; RRL - rural; SF - State Forest; IND - industry & special industry:

TRS - transport (road and rail); URB - urban, urban deferred, civic and cultural

@ 4. PROTECTION GROUPS

Are there active protection groups for this wetland? Yes/No No

If yes give the details below. — 0

NAME(S) _____

CONTACT PERSON(S) _____

_____

ADDRESS(ES) _____

_____

_____

PHONE NUMBER(S) _____

SCORE

@ 5. PASSIVE RECREATION

Is the wetland used or has it facilities for the following — tick the appropriate box(es)?

nature study/bird watching	[✓]	education (school < 500m)	[ ]
picnic/barbecue facilities	[ ]	recognised tourist venue	[ ]
conservation of flora	[ ]	conservation of fauna	[✓]
recognised research site	[ ]	protection/preservation of other attributes	[ ]

— 2

@ 6. ACTIVE RECREATION

Is the wetland used or has it facilities for any of the following active recreational pursuits:

walking, jogging or cycling	[ ]	horse riding	[✓]	trail bikes	[✓]
playground	[ ]	oval	[ ]	other	[ ]

— 2

@ 7. OTHER HUMAN USES

Is the wetland used for any of the following? - tick box(es)

agriculture	[ ]
mining (check for mining leases)	[ ]
water supply	[ ]
existing/proposed service corridors (roads, SEC)	[ ]
proposed urban/housing	[✓]
private purpose other than above	[ ]

— 1

@ E. Presence of rare species. List here rare species (gazetted and other priority) known at the site. Note 1. species name, priority number, and source of information

Southern Brown Bandicoot present in surrounding area but not confirmed in the area covered by this assessment. Probably present however.

@ F. Private human uses. Note here any evidence of private use for wetlands on private land. Also note comments of land owner.

@ G MAKE A ROUGH SKETCH OF THE AREA, BELOW OR ATTACHED, INCLUDING IF YOU CAN THE BOUNDARIES YOU CHOSE, DIMENSIONS, NORTH DIRECTION, RESERVES, WATERBODY, VEGETATION ZONES, TRACKS, ROADS, FENCES, ETC.

MISCELLANEOUS COMMENTS

See Vegetation Map (Figure 1.)

This assessment is for Open peaty areas at western end of project site which are seasonally inundated

TOTAL 9

Department of Planning and Urban Development. (1992). *Draft Jandakot Land Use and Water Management Stategy.*

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Kelly, A. E., Taylor, A., Langley, M. A., Spooner, A. and Coates, D. (1993). Declared Rare Flora and Other Plants in Need of Special Protection in the Metro Area. *Wildlife Management Program No 10,* Department of Conservation and Land Management, Western Australia.

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APPENDIX 2

CHECKLIST OF THE VASCULAR FLORA

APPENDIX 2

CHECKLIST OF THE VASCULAR FLORA ON THE LOTS 122, 123 & 403 ACOURT ROAD, CANNING VALE

FAMILY ZAMIACEAE
Macrozamia riedlei

FAMILY TYPHACEAE
* Typha orientalis

POACEAE
* Aira caryophyllea
Amphipogon turbinatus
* Avena fatua
* Briza maxima
* Briza minor
* Cynodon dactylon
Danthonia setacea
* Ehrharta longiflora
* Lolium perenne
Neurachne alupecuroides
* Pennesetum clandestinum
* Sporobolus ?indicus
Stipa ?compressa

FAMILY CYPERACEAE
Baumea juncea
* Cyperus tenellus
Lepidosperma longitudinale
Schoenus curvifolius
Schoenus globifer
Schoenus radwayanus

FAMILY RESTIONANCEAE
Hypolaena exsulca
Loxocarya flexuosa
Leptocarpos scariosus
Lyginia barbata

FAMILY CENTROLEPIDACEAE
* Centrolepis aristata

FAMILY DASYPOGONACEAE
Dasypogon bromeliifolius
Lomandra ?hermaphrodita

FAMILY XANTHORRHOEACEAE
Xanthorrhoea preissii

FAMILY PHORMIACEAE
Dianella revoluta

FAMILY ANTHERICACEAE

Chamaescilla corymbosa
Corynotheca micrantha
Laxmannia squarrosa
Thysanotus manglesianus
Tricoryne elatior

FAMILY COLCHICACEAE
Burchardia umbellata

FAMILY HAEMODORACEAE
Anigozanthos humilis
Anigozanthos manglesii
Conostylis aculeata
Phlebocarya cilliata

FAMILY IRIDACEAE
* Gladiolus caryophyllaceus
Patersonia occidentalis
* Romulea rosea

FAMILY ORCHIDACEAE
Caladenia flava
Caladenia paludosa
Microtis unifolia
Pterostylis nana
Thelymitra flexuosa
Thelymitra pauciflora

FAMILY CASUARINACEAE
Allocasuarina fraseriana

FAMILY PROTEACEAE
Adenanthos cygnorum
Adenanthos obovatus
Banksia attenuata
Banksia ilicifolia
Banksia littoralis
Banksia menziesii
Petrophile linearis
Stirlingia latifolia

FAMILY LORANTHACEAE
Nuytsia floribunda

FAMILY AIZOACEAE
* Carpobrotus edulis

FAMILY CARYOPHYLLACEAE
* Petrorhagia velutina

FAMILY BRASSICACEAE
* Raphanis raphanistrum

FAMILY DROSERACEAE
Drosera ?menziesii

FAMILY CRASSULACEAE
Crassula colorata

FAMILT MIMOSACEAE
Acacia pulchella

FAMILY PAPILIONACEAE
Bossiaea eriocarpa
Daviesia preissii
Euchilopsis linearis
Gompholobium tomentosum
Hardenbergia comptoniana
Jacksonia furcellata
Kennedia prostrata
Latrobea tenella
* Lotus sp.
* Lupinus consentinii
Pultenaea reticulata

FAMILY GERANIACEAE
* Pelargonium capitatum

FAMILY OXALIDACEAE
* Oxalis pes-caprae

FAMILY RUTACEAE
Boronia crenulata
Boronia dichotoma
Eriostemon spicatus

FAMILY TREMANDRACEAE
Platytheca galioides

FAMILY EUPHORBIACEAE
* Euphorbia peplus
* Ricinus communis

FAMILY STACKHOUSIACEAE
Stackhousia huegelii

FAMILY DILLENIACEAE
Hibbertia aff. helianthemoides
Hibbertia hypericoides
Hibbertia racemosa
Hibbertia subvaginata
Hibbertia stellaris

FAMILY THYMELAEACEAE
Pimelea imbricata
Pimelea rara

FAMILY MYRTACEAE
Astartea fascicularis
Calytrix flavescens
Calytrix fraseri
Eucalyptus calophylla
Eucalyptus marginata
Eucalyptus rudis
Eucalyptus todtiana
Hypocalymma angustifolium
Kunzea ericifolia
Melaleuca lateritia
Melaleuca preissiana
Melaleuca raphiophylla
Melaleuca teretifolia
Melaleuca thymoides
Pericalymma ellipticum
Regelia ciliata
Regelia inops
Scholtzia involucrata

FAMILY HALORAGACEAE
Gonocarpus pithyoides

FAMILY APIACEAE
Daucus glocciatus
Eryngium rostratum
Platysace compressa
Trachymene pilosa

FAMILY EPACRIDACEAE
Conostephium pendulum
Leucopogon conostephioides
Leucopogon ?sprengelioides
Leucopogon sp.

FAMILY PRIMULACEAE
* Anagallis arvensis

FAMILY LOGANIACEAEA
Mitrasacme paradoxa

FAMILY MENYANTHACEAE
Villarsia albiflora

FAMILY BORAGINACEAE
* Echium plantagineum

FAMILY LAMIACEAE
Hemiandra pungens

FAMILY SCROPHULARIACEAE
* Parentucellia latifolia

FAMILY CAMPANULACEAE
* Wahlenbergia capensis

FAMILY LOBELIACEAE
Lobelia tenuior

FAMILY GOODENIACEAE
Dampiera linearis
Lechenaultia floribunda

FAMILY STYLIDACEAE
Levenhookia stipitata
Stylidium brunonianum
Stylidium divaricatum
Stylidium junceum
Stylidium perpusillum
Stylidium piliferum
Stylidium repens

FAMILY ASTERACEAE
* Arctotheca calendula
Asteridea pulverulenta
Brachycome iberidifolia
Gnaphalium spericum
Hyalosperma cotula
* Hypochaeris glabra
Podotheca chrysantha
Podotheca gnaphalioides
Rhodanthe citrina (Waitzia citrina)
Siloxerus humifusus
* Sonchus sp.
* Ursinia anthemoides

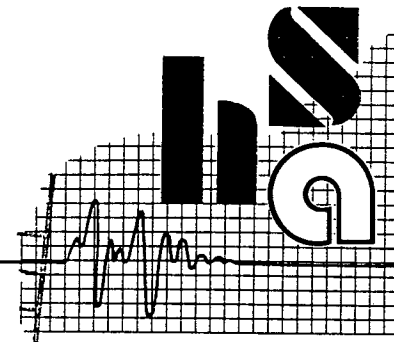
Wood & Grieve
ENGINEERS

APPENDIX 2

ACOUSTIC STUDY

Herring Storer Acoustics

HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, A.C.N. 009 049 067
Western Australia, 6152.
Telephone: (09) 367 6200
Facsimile: (09) 474 2579



ALLAN HERRING M.I.E. AUST. M.A.A.S.
LYNTON STORER M.A.I.E.A., M.A.A.S.

CANNING VALE - RESIDENTIAL DEVELOPMENT

ENVIRONMENTAL NOISE STUDY

FOR

WOOD & GRIEVE ENGINEERS

BY

HERRING STORER ACOUSTICS

L.J. STORER

OCTOBER 1993

Reference: 1149A-93086

1.0 PREFACE

An acoustic study has been made of the proposed Residential Development located between Clifton, Fraser and Acourt Roads, Canning Vale.

This reports assess the effect of :-

1) Traffic Noise
2) Aircraft Noise
3) Noise emanating from Dog Kennels

on the proposed residential development.

The report comments on the acceptable noise criteria and the acceptability of the area for residential housing.

2.0 CONCLUSION

It is the conclusion of this study that the noise levels to the proposed dwelling and their inhabitants is below the appropriate criteria. However, to reduce the effect of dogs barking, we recommend that housing along the south side of Fraser Road be set back from the road a distance of 30m. We also suggest that the area along Fraser Road be heavily vegetated as not only is a small amount of attenuation gained through a significant depth of trees, but also the back ground noise is increased due to wind and hence the effect of any intrusive noise lessened.

3.0 NOISE LEVEL MEASUREMENTS

In order to assess the suitability of the area for residential development, noise level measurements were taken at the following two location of various activities and the measurements are listed in Table 1:-

Location 1 - approximately 30m south of Fraser Road
Location 2 - corner of Fraser and Acourt Roads

TABLE 1 - NOISE LEVEL MEASUREMENTS

ACTIVITY	LOCATION 1 dB(A)	LOCATION 2 dB(A)
Dogs Barking	40-45 (50 max)	49-53
Planes Overhead	58-64	
Birds	55 to over 60	49 to over 60
Trucks	48	80 (max)
Cars	45	71 (max)

To obtain a noise profile of the noise generated in the area, a noise data logger was located in the proposed residential development approximately 30m south of Fraser Road between the 08/09/93 and 15/09/93 and the data collected is attached as Chart 1.

4.0 ANALYSIS

ROAD TRAFFIC

The Main Road's Interim Statement on Traffic Noise Policy and Practice cites a noise level of 68 dB(A) as being reasonably acceptable and practically achievable for traffic noise intrusion to residential locations.

The Environmental Protection Authority have expressed the view that the above criteria merits review and have intimated that a level of 58 dB(A) should be considered on a 10% acceptability criteria (ARRB internal report AIR 206-6) however concedes that 63 dB(A) is the likely practically achievable result.

Trends in the other states of Australia are for an acceptable criteria of 63 dB(A).

The L10 18 hour value of 63 dB(A) has been used as the prime criteria for residential locations in this study.

The L_{10}(18hour)(0600 - 2400 hrs), noise level at the proposed residences was calculated using the logged L_{10}(hourly) noise levels and the results are listed below in Table 2.

TABLE 2 - L_{10}(18hour) NOISE LEVELS

DAY		L_{10}(18hour) noise level dB(A)
Thursday	9/9/93	54
Friday	10/9/93	51
Saturday	11/9/93	52
Sunday	12/9/93	51
Monday	13/9/93	53
Tuesday	14/9/93	51

Given the measured noise levels listed in Table 2, the proposed development therefore meets the criteria of 63 dB(A).

AIRCRAFT

The current ANEF maps for Jandakot airport indicate a portion of the said land is within the 20 ANEF zone. This is the result of the high number of training circuit being performed by aircraft at this airport.

In accordance with Australian Standard 2021-1985 such, a zone is considered conditional for residential housing and further consideration is necessary. The main consideration in this instance is that the maximum noise levels due to aircraft flyovers are below those recommended in Appendix F of the Standard. For residential use and aircraft movements greater than 20 per day levels of less than 75 dB(A) are recommended.

Monitored levels at Location 1 showed only 9 occasions when the level exceeded 75 dB(A) during the week of measurements. From observations, as indicated in Table 1, these maximum levels are due to other than aircraft. Measurements of aircraft at this location recorded a maximum level of 64 dB(A).

Observations and measurements were also made at the North East portion of the land, which is within the ANEF 20 zone. The maximum level recorded from overhead aircraft was 66 dB(A) and typically the level was around 58 dB(A).

Clearly maximum aircraft noise levels are below 75 dB(A) and are therefore classified "Acceptable" in terms of AS 2021.

DOGS BARKING (KENNEL AREA)

Under the Environmental Protection Act 1986 and through it, the Noise Abatement (Neighbourhood Annoyance) Regulations 1979, this area would be categorised B1 and as such, the assigned outdoor noise levels would be:

Monday to Friday	0700 - 1900 hrs	50 dB(A)
Monday to Friday	1900 - 2200 hrs	45 dB(A)
Weekends & Public holidays	0700 - 2200 hrs	45 dB(A)
Always	2200 - 0700 hrs	40 dB(A)

The above noise levels do not allow for any penalties which would be applied to tonal components and/or amplitude or frequency modulations.

To assess the effect of the barking dogs on the residential we have used the L_{90} values over the times of day indicated above. The range of measurements are shown in Table 3 below.

TABLE 3 - L_{90} RANGE OF NOISE LEVELS

DAY	TIME OF DAY		
	Monday-Friday 0700-1900 Hrs [50 dB(A]	Monday-Friday 1900-2200 Hrs Weekends 0700-2200 Hrs [45 dB(A)]	Always 2200-0700 Hrs [40 dB(A)]
Wednesday 8/9/93	37 - 44	36 - 38	34 - 49 *
Thursday 9/9/93	40 - 52 *	39 - 41	35 - 47 *
Friday 10/9/93	36 - 48	38 - 39	34 - 46 *
Saturday 11/9/93		36 - 47 *	33 - 41 *
Sunday 12/9/93		36 - 48 *	33 - 47 *
Monday 13/9/93	37 - 47	37 - 37	34 - 46 *
Tuesday 14/9/93	35 - 43	34 - 38	33 - 47 *

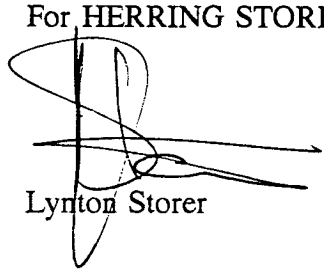
* Noise levels exceed the above guidelines

The above table indicates that noise levels due to dogs barking would be acceptable, for most of the time, the main exception being the period 2200 to 0700 hrs. The high noise levels measured between 2200 - 0700 hrs actually occurred between 0600 and 0700 hrs, and from our observations on site, we believe that the exceedances were caused by birds within the area and not barking dogs - refer Chart 2 which is a typical trace of this period.

Therefore, we conclude that noise due to dogs barking, for areas greater than 30m from Fraser Road are within the above guidelines.

The introduction of dense vegetation along the south side of Fraser Road would help to reduce the effect of dogs barking, by providing a small amount of attenuation and by increasing the background noise due to wind and wildlife.

For HERRING STORER ACOUSTICS

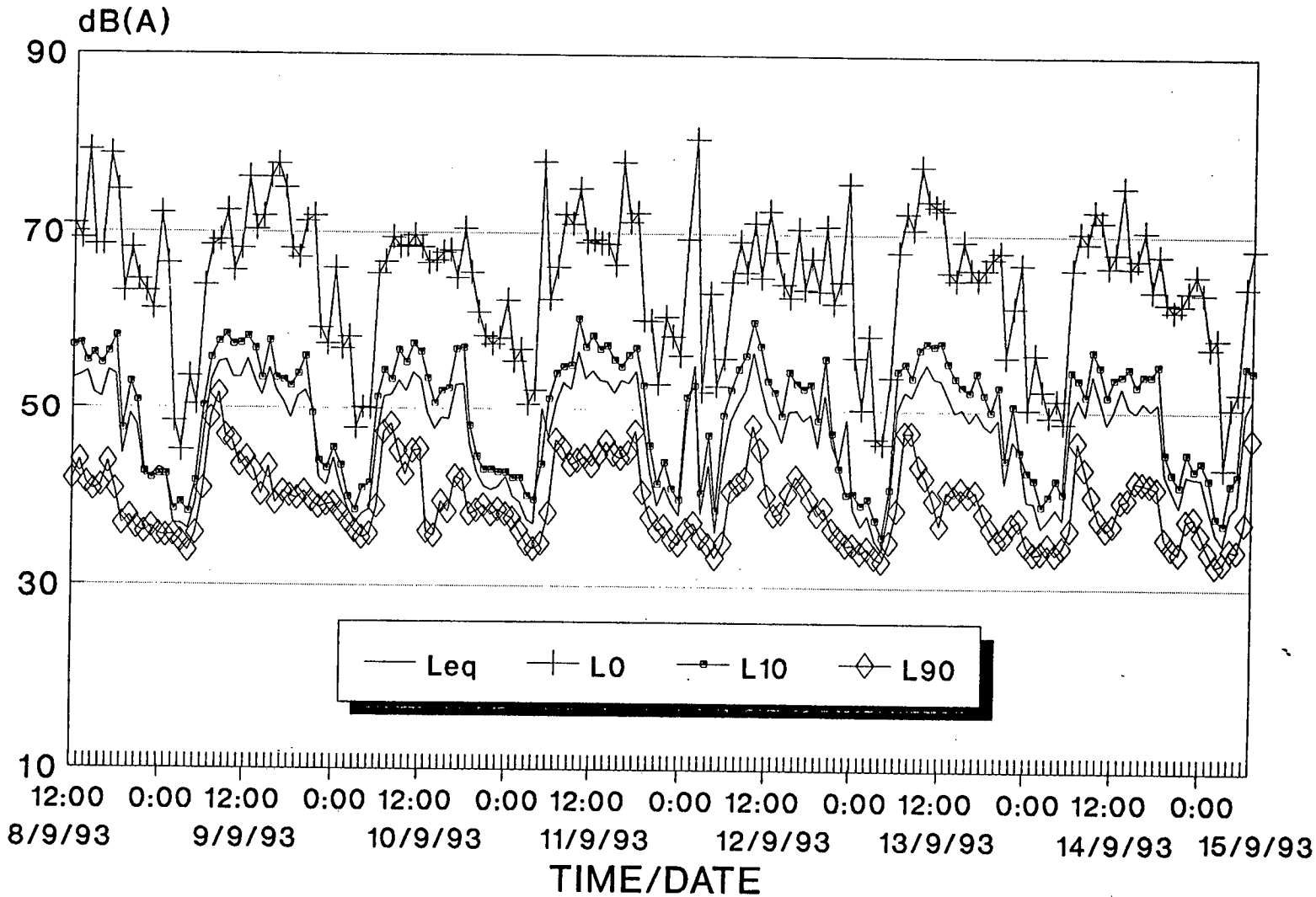


Lynton Storer

29 October 1993

CHART 1 - CANNING VALE DEVELOPMENT

LOGGER No. 039 8 TO 15 SEPTEMBER 1993

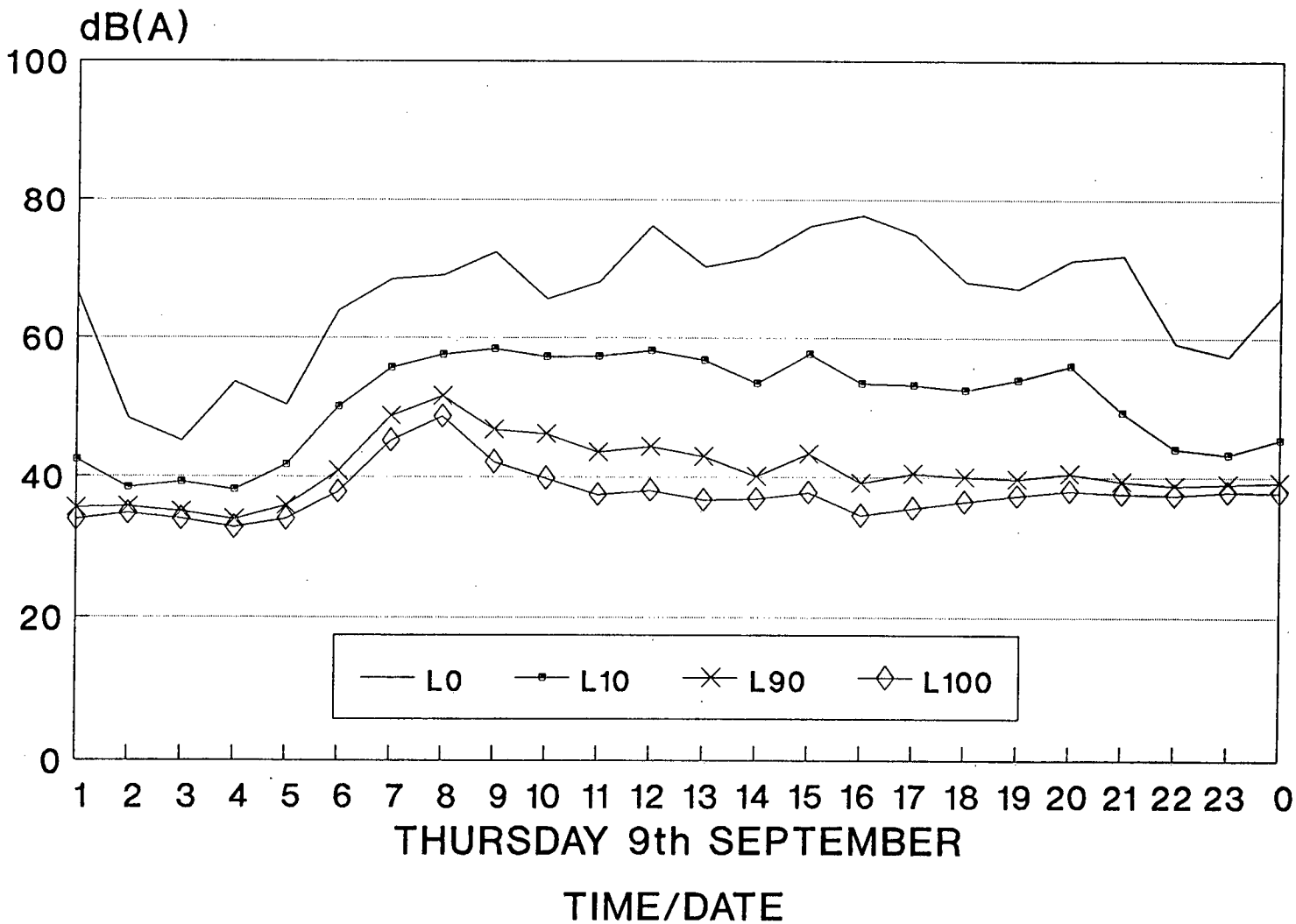


HERRING S[illegible] ...JSTICS
Suite 34, 11 Preston Street, Como,
Western Australia, 6152

Telephone: (09) 367 6200
Facsimile (09) 474 2579

CHART 2 - CANNING VALE DEVELOPMENT

LOGGER No.039 THURSDAY 9th SEPT 1993



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Wood & Grieve
ENGINEERS

APPENDIX 3

ARCHAEOLOGICAL SURVEY

Quatermaine Consultants

REPORT
ON AN ARCHAEOLOGICAL SURVEY
AT ACOURT ROAD, CANNING VALE

Prepared for Wood & Grieve Engineers

By Jacqueline Harris
Quartermaine Consultants

October, 1993

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background to Survey

An Aboriginal site survey of a proposed housing development at Canning Vale, City of Canning in the Perth Metropolitan Area was commissioned by Wood & Grieve Engineers. Jacqueline Harris of Quartermaine Consultants conducted the archaeological survey with Caroline Heine as research and field assistant. The survey was undertaken in September, 1993. Mr Rory O'Connor, an anthropologist, has previously conducted several ethnographic surveys in adjacent properties (O'Connor, Quartermaine & Bodney 1989b, 1990a, 1990b, O'Connor, Quartermaine & Bennell 1990). In previous surveys the ethnographic assessment covered a wider area than the specific brief, thus encompassing the land within this present survey. Therefore, the ethnographic component for Aboriginal Heritage has been fulfilled.

The purpose of the investigation was to facilitate planning of the housing development programme. The work was done in two phases: firstly, data was assembled from previous work in the region, including information from W.A. Museum Aboriginal site files, previous survey reports, maps and environmental data; and secondly, a total survey of the project area was undertaken.

1.2 Location

The proposed development at Canning Vale includes Lot 122, Lot 123 and Lot 403 and is bounded by Clifton, Fraser and Acourt Roads. Nicholson Road abuts the eastern corner of the project area at Clifton Road, just opposite Canning Vale Prison. The roughly square area of land, measuring 910 X 1000 metres, comprises 91 hectares of flat, low lying woodland, sedgeland and swamp.

1.3 Environment

The south-west region of Western Australia is characterised as a dry Mediterranean climate consisting of hot dry summers and mild wet winters. Rainfall occurs between May and October, followed by summer droughts from January to April when little or no precipitation eventuates (Beard 1990).

The survey area lies within the Swan Coastal Plain of the Perth Basin, a deep trough filled with Phanerozoic sedimentary rocks. The surface of the Swan Coastal Plain consists of Quaternary alluvial and aeolian sediments of varying age. The landform system of the Swan Coastal Plain wherein the survey area is located is the Bassendean Dunes (Biggs et al. 1980. McArthur & Bettenay 1960). The Bassendean

Dunes consist of undulating sandy plains with low, vegetated hills of quartz sand with numerous interdunal swamps.

Typical vegetation of the area is Banksia low woodland consisting of *Banksia attenuata, B. ilicifolia, B. menziesii, Casuarina fraseriana* and *Nutsia floribunda.* A rich understorey of sclerophyll shrubs is present, together with scattered trees of *Eucalyptus marginata* (jarrah). Teatree and paperbark *(Melaleuca rhaphiophylla)* flourish on freshwater swamps between the dunes (Beard 1990).

The survey area consisted of low woodland in the northern sector and a reed sedgeland and swamp in the southern sector. Vegetation was moderately dense over the northern woodland which formed the greater proportion of the survey area but increased to a higher density around the swamp. A small plot on the northern border has been previously used for horticultural activities. Disturbance to the survey area has occurred from grazing of stock, recent bushfire, dumping of rubbish as well as numerous vehicle tracks and firebreaks.

1.4 Previous Archaeological Research

The earliest evidence for prehistoric occupation of the South-West of Australia is dated at 38,000 years ago, for a stratified site at Upper Swan, located 25 km north-east of Perth (Pearce and Barbetti, 1981). Two other sites in the south-west have also yielded Pleistocene dates, Devil's Lair and Helena River, with length of occupation at Devil's Lair ranging from 33,000 years B.P. to 6,500 years B.P. and Helena River yielding an early date of 29,000 B.P. years from the basal level and a mid-Holocene date of 4,000 B.P closer to the surface (Dortch 1977, Schwede 1983).

In the metropolitan region a number of Holocene sequences have yielded data on possible cultural and environmental changes during, and after, the recent transgression of the sea (Clarke and Dortch 1977, Pearce 1978). This work postulates increased populations on the Coastal Plain, rising to a peak just before European contact.

As part of an extensive regional survey of the Metropolitan area, Hallam (1986) was able to conclude that the majority of sites lie around rivers, lakes and swamps of the Bassendean Sands and Pinjarra Plains landforms of the Swan Coastal Plain, and that site numbers double in the last few hundred years. Four phases of occupation are suggested for the Coastal Plain. These are:

a. Early - low number of sites centred towards the coast. Artefacts include steep scrapers on flakes and scrapers made from an Eocene fossiliferous chert. This phase was up to 5000 years ago.

b. Middle - from 5000 - 500 years ago. Showed a contraction of occupation to sites near permanent water. Artefacts were made of quartz and green chert and included backed blades, adzes, scrapers and flakes.

c. Late - from 500 years ago. Concentration of sites on the Coastal Plain. Fabricators (bipolar cores) were introduced and a large percentage of assemblages were made up of quartz flakes, chips and debitage.

d. A recent historic phase, which was characterised by the use of European introduced material, such as glass and pottery, for the manufacture of artefacts, encompasses the last 150 years.

Prehistoric stone tool industries in the South-West have been classified into early and late phases. (Dortch 1977). The early phase industries have only been documented from a few well-dated sites. They include small thick flake scrapers, bipolar cores, notched denticulated pieces, flakes from discoidal cores, and single and multi-platform cores. These artefacts have been manufactured from a range of lithic material, including a distinctive Eocene fossilferous chert. It appears that access to this chert was lost after the last marine transgression (Dortch 1977, Glover 1975). However some of this chert may have been subject to curation over a period of time; thus loss of access to the source does not necessarily indicate a complete halt of its use in archaeological assemblages.

Later phase stone industries, generally found in archaeological contexts dating from 4,000 years ago, include the addition of geometric microliths, backed blades, and a variety of adze flakes, which are part of the Australian "small tool tradition" (Dortch 1977, Mulvaney 1975).

In another study, Anderson (1984) proposed a land-use model for prehistoric exploitation of the Swan Coastal Plain, and its hinterland, based on regional research into the relative proportions of surface artefact scatters and their associated artefact densities. This model suggests that, due to the variation in resources available in the three different environmental zones investigated, there was more intensive use of the coastal plain than either the adjacent forest or open woodland plateau. Pearce's (1982) study in jarrah forest around Collie supports Anderson's model of a low density of small camps suggesting highly mobile hunting groups exploiting the uplands.

A variety of ethnohistorical sources describe the activities of Aboriginal people on the coastal plain, their subsistence techniques and semi-permanent camps about wetlands during summer. Several sources mention that Aboriginal people dispersed in winter and hunted in the forested uplands. Based on these accounts Hallam (1979) has proposed that the forest was little exploited and the less dense

woodland further inland was targeted.

From such research, a predictive model of site location can be proposed for the project area. However, it is necessary to take into account the high level of disturbance caused by intensive use by European colonists in the coastal plain which may have largely obliterated archaeological sites.

No archaeological sites have been previously recorded in the project area. As a result of previous surveys and independent research 4 archaeological sites and 1 ethnographic site have been recorded and registered with the W.A. Museum within 2 kms of the proposed development (O'Connor, Quartermaine & Bodney 1990a, O'Connor, Quartermaine & Bennell 1990, Hallam 1986).

The only ethnographic site in the immediate region consists of a mythological area at Gosnells Golf Club. The four archaeological sites consist of small artefact scatters. Artefacts such as primary and utilised flakes, cores, scrapers, fabricators, adzes and chips made of fossiliferous chert, quartz and basalt were found at these sites. According to Hallam's model, the recorded sites cover the time span of early, middle and late Holocene, with intensity of artefacts suggesting ephemeral or transient occupation (Hallam 1986, Strawbridge 1987). All four archaeological sites are located on devegetated areas, having been disturbed from quarrying activities or firebreak tracks.

Table 1. Archaeological sites in the vicinity of the proposed development

Site No.	Grid Ref	Eth/Arc	Site Type	Site Name
SH50-2	1:250,000 PINJARRA			
S2603	395 447	A	Artefacts/Campsite	Lukin Swamp
SO776	395 448	A	Artefacts	Acourt Road
SO775	395 448	A	Artefacts	Kelso Road
SO749	397 446	A	Artefacts	Warton Road, Banjup
S2212	398 448	E	Mythological	Gosnells Golf Club

From the existing information, it is possible to make the following observations:

i. Small, low density surface artefact scatters are the most numerous recorded archaeological sites;

ii. Quartz is the dominant lithic material used for the manufacture of artefacts;

iii. Flakes and chips form the major class of artefacts types in the recorded artefact assemblages; and

iv. River banks, swamp and lake margins, and areas of devegetated sand are the predominant site locations.

2.0 METHODS

2.1 Obligations under the Act

The Western Australian Aboriginal Heritage Act, 1972-80, makes provision...

> " ... for the preservation on behalf of the community of places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants, or associated therewith, and for other purpose incidental thereto."

The Act defines the obligations of the community relating to sites (see Appendices 1 & 2). An archaeological survey is aimed at identifying the effects of proposed disturbance of the physical environment on historic and prehistoric Aboriginal sites.

The consultant is obliged to submit site documentation on appropriate forms for lodgement and submission to the Department of Aboriginal Sites, W.A. Museum, for any newly recorded Aboriginal sites.

2.2 Survey Methodology

The survey design involved the following stages of operation.

Background research - this involved familiarisation with W.A. Museum site files, survey reports, plus maps and environmental information for the area to be surveyed. Previously recorded Aboriginal sites, registered with the W.A. Museum, are listed in Table 1.

Survey strategy - this consisted of a total pedestrian survey of the proposed development area, following initial reconnaissance in a 4WD vehicle. The field survey was conducted using a 1:2,000 aerial map and a 1:20,000 topographical map of the survey area.

Vehicle access was possible from a well defined track running off the corner of Nicholson and Clifton Roads. One track, dissecting the property in half, was used as a baseline. From the baseline pedestrian transects in a north-west/south-east orientation were conducted at 50 metre intervals. Because of poor visibility, particularly in the wetland and woodlands, tracks and firebreaks were also followed wherever they occurred. In addition, swamp margins were intensively surveyed at 25 metre intervals. At the time of survey, conditions were unfavourable as the swamp areas were inundated from recent and current rainfall.

The survey area consisted of woodland in the northern sector, reed sedgeland in the south-western sector and swampland in the south-eastern sector. Disturbance was moderate and consisted of a firebreak surrounding the property, vehicle tracks, an horticultural plot, grazing of stock, numerous rubbish dumps and derelict car bodies. An area east of the swamp suffered the most severe disturbance as a result of regular usage from motor cycles.

Over the majority of the area visibility was poor at approximately 10-30% due to thick groundcover and leaf litter in the woodlands and dense clumps of reeds around the swamp. However, in the reed sedgeland visibility improved to around 50%, the result of a recent bushfire. It is considered that the area received approximately 80% survey coverage, notwithstanding the low visibility factor.

2.3 Site Definitions

Aboriginal material culture is based, to a large extent, on non-durable materials, such as wood, bark, fibre and skins, that have a limited life in the archaeological record. Stone tools, conversely, remain as often the only evidence of prehistoric activity. Bone, either as a tool, as refuse, or as a burial falls somewhere between these extremes. Lofgren (1975) describes spears, spear-throwers and clubs for men and digging sticks, wooden carrying dishes and grindstones for women, as the basic implements of Aboriginal life. Therefore, stone artefact sites reflect only one aspect of Aboriginal material culture which utilised a wide range of materials from the natural environment.

For the purpose of this investigation, an archaeological site is defined as " any place containing traces of past human activity" (Fagan 1980). This is manifested in a number of different site components which may occur singularly or with one or more of the others to form an archaeological site. The most common of these are surface artefact scatters, quarries, art sites, stone arrangements, rockshelters with evidence of occupation, grinding patches, shell middens, burials and marked trees. An artefact scatter is recorded as a site if it contains three or more artefacts in association. Areas of solitary artefacts, called Isolated Finds, are reported but not recorded as Aboriginal sites.

The above definition of archaeological sites is a scientific definition. The assessment as to whether such sites are covered by the provisions of the W.A. Aboriginal Heritage Act 1972-90 , Section 5, is made for the Trustees of the W.A. Museum by the Aboriginal Cultural Material Committee. Such assessment is undertaken as part of a Section 18 application for site disturbance. When sites are discussed in this report, it is in the context of the scientific definition and not Section 5 of the above Act.

3.0 RESULTS

No archaeological sites, as defined by Section 5 of the Aboriginal Heritage Act 1972-80, were located in the field survey. No sites have been previously recorded in the survey area.

Considering the number of sites recorded within 2 kms of the survey area and the predilection around swamp margins for the location of Aboriginal campsites, it was conjectured that the project area held some potential for archaeological sites. However, the topography of the land displayed little relief, being a relatively flat, low-lying expanse of land, with only a single small patch in the south-eastern corner exhibiting a slight rise. This would suggest that when the highly ephemeral water source reached its capacity, there would be little refuge for camping and tool preparation activities within these swampy conditions in the immediate surrounding area.

Within the neighbouring region, sites tend to occur on disturbed, devegetated sandhills. No such locations or conditions were represented in the survey area. Applying a survey strategy that encompassed the total area, it is considered that the survey methods were more than adequate. Notwithstanding the low visibility factor and the many patches of dense woodland which may have camouflaged sites as well as the disturbed nature of parts of the woodland, it is considered that the lack of sites reflects a real absence of archaeological material in the survey area. One possible explanation for an absence of sites in this specific survey may be that the large and resource rich Bibra Lake, some seven kms west of the survey area, may have been the preferred occupation/hunting and gathering site in the area.

4.0 CONCLUSIONS

4.1 Discussion

An Aboriginal site survey of a proposed housing development at Canning Vale, City of Canning in the Perth Metropolitan Area was commissioned by Wood & Grieve Engineers. The proposed development at Canning Vale includes Lot 122, Lot 123 and Lot 403 and is bounded by Clifton, Fraser and Acourt Roads. The roughly square area of land, measuring 910 X 1000 metres, comprises 91 hectares of flat, low lying woodland, sedgeland and swamp.

The archaeological survey strategy involved an investigation of previous research in the area, a total field survey of the project area consisting of a series of transects spaced 50m apart, as well as, intensive sampling around swamp margins. As a result of a recent bushfire, surface visibility was moderate over the sedgelands in the south-western sector. Surface visibility, however, changed to a low percentage in the reminder of the project area, particularly around the margins of the swamp and within the woodlands.

No archaeological sites have been previously recorded within the survey area No archaeological sites were located in this field survey. Therefore the issue of significance does not arise.

Because of the presence of an ephemeral swamp in the survey area, the potential for the location of Aboriginal archaeological material was considered high. As a result of the field survey revealing little relief to an essentially flat low-lying area, it is considered that any archaeological potential was significantly reduced. Furthermore, it is proposed that the major focus of the area would have been Bibra Lake, a large permanent expanse of water, some seven kilometres distant, that was rich in resources such as wildfowl and kangaroo and possibly the preferred hunting and food gathering place in the region (O'Connor, Quartermaine & Bodney 1989a).

4.2 Recommendations

The recommendations which follow are based on field observations and investigations of previously recorded sites in the area.

1. Given the lack of any archaeological sites within the boundaries of the proposed development area, it is therefore recommended that adequate archaeological investigations have been carried out and that in terms of the archaeological component the development be allowed to proceed.

2. It is recommended that developers take adequate measures to inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 15 of the Aboriginal Heritage Act 1972-80.

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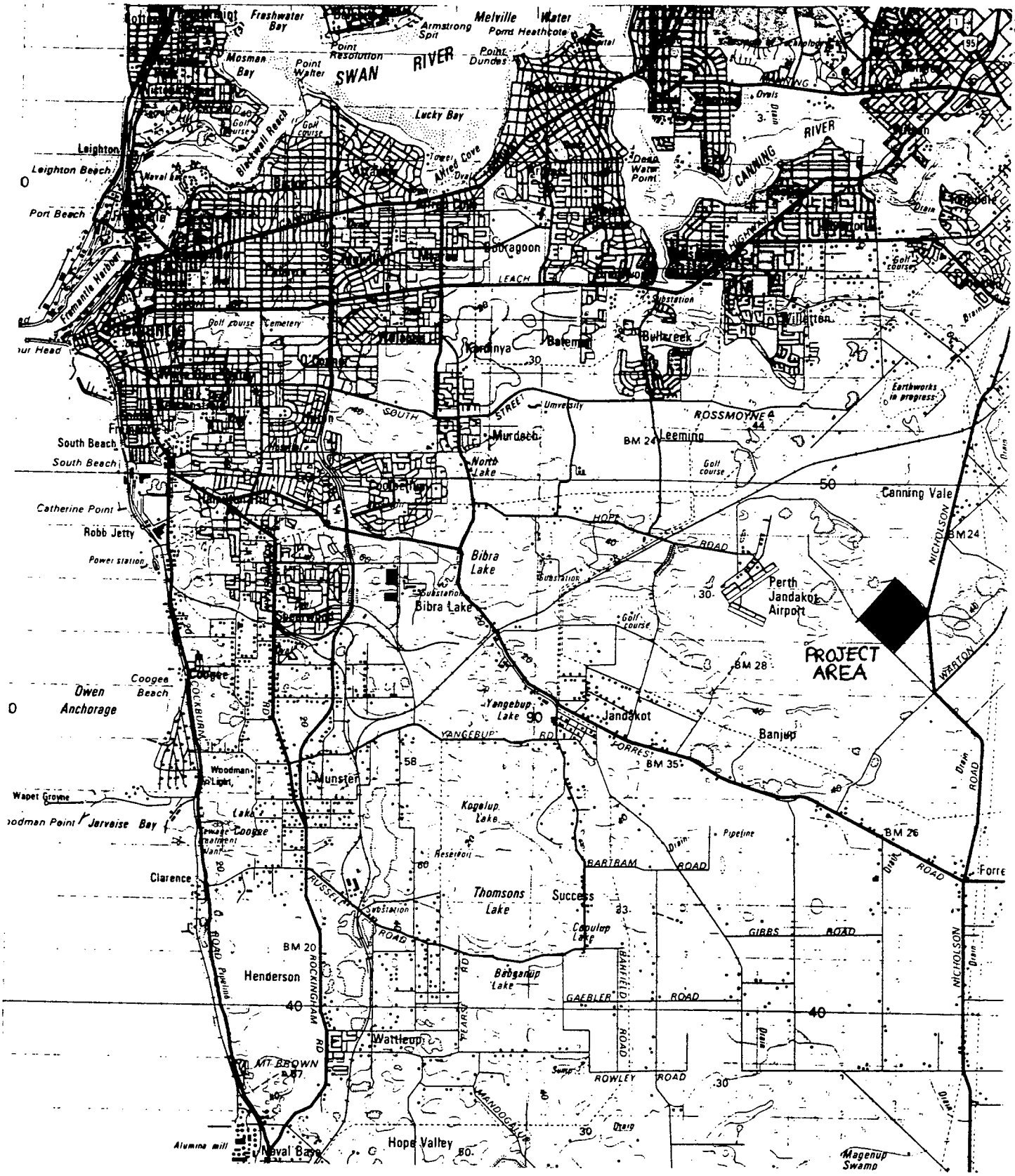

FIGURE 1 : LOCATION PLAN SCALE 1: 100,000

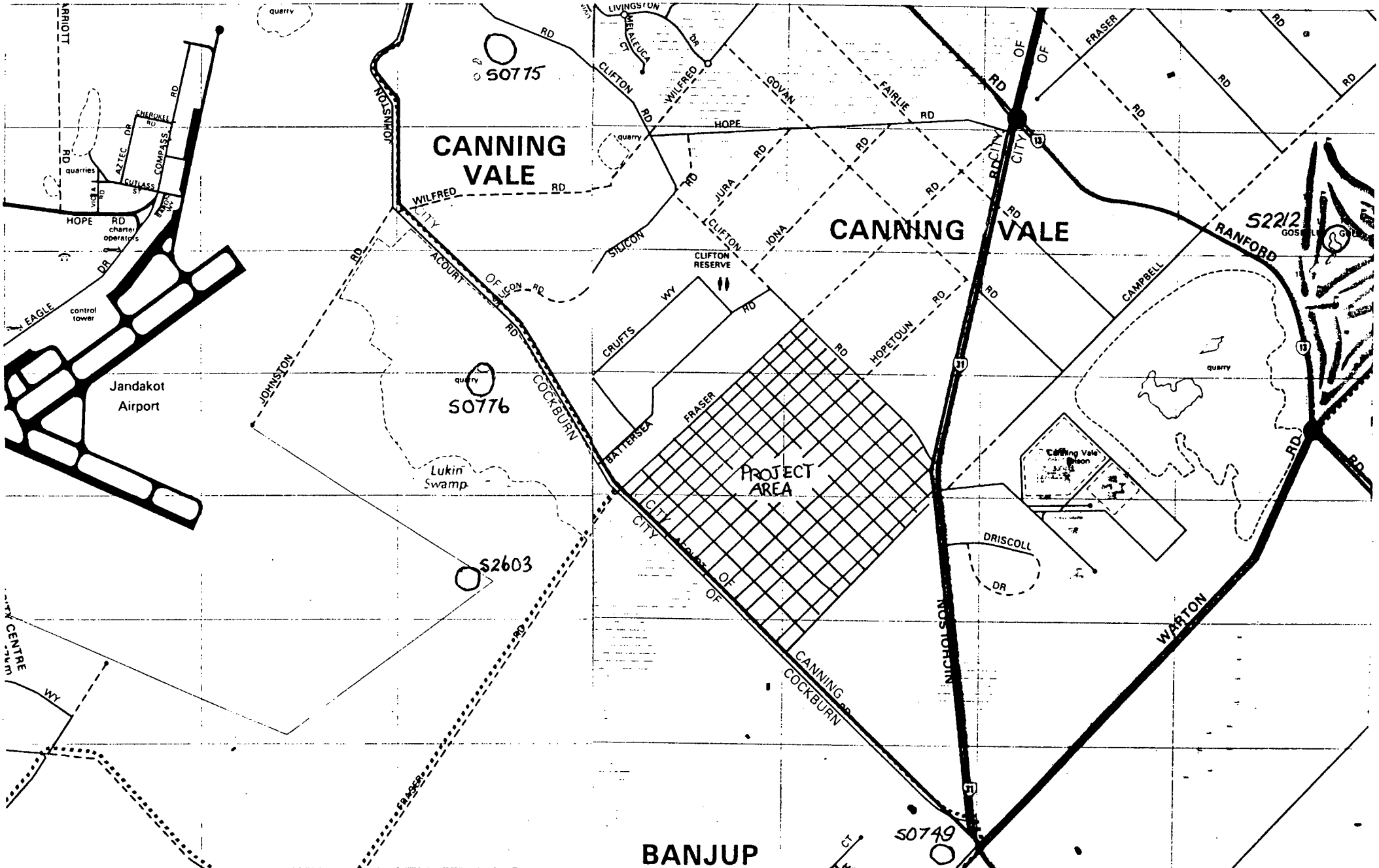

FIGURE 2 : PROJECT AREA ▦ SCALE 1 : 20,000

APPENDIX 1

OBLIGATIONS RELATING TO SITES UNDER THE ABORIGINAL HERITAGE ACT 1972-1980

"Report of Findings

15. Any person who has knowledge of the existence of anything in the nature of Aboriginal burial grounds, symbols or objects of sacred, ritual or ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any place or thing to which this Act applied or to which this Act might reasonably be suspected to apply shall report its existence to the Trustees, or to a police officer, unless he has reasonable cause to believe the existence of the thing or place in question to be already known to the Trustees.

Excavation of Aboriginal Sites

16. (1) Subject to Section 18, the right to excavate or to remove any thing from an Aboriginal site is reserved to the Trustees.

(2) The Trustees may authorise the entry upon and excavating of an Aboriginal site and the examination or removal of any thing on or under the site in such manner and subject to such conditions as they may direct.

Offences Relating to Aboriginal Sites

17. A person who-

(a) excavates, destroys, damages, conceals or in any way alters any Aboriginal site; or

(b) in any way alters, damages, removes, destroys, conceals, or who deals with in a manner not sanctioned by relevant custom, or assumes the possession, custody or control of, any object on or under an Aboriginal site, commits an offence unless he is acting with the authorisation of the Trustees under Section 16 or the consent of the Minister under Section 18.

Consent To Certain Uses

18. (1) For the purposes of this section, the expression "the owner of any land" includes a lessee from the Crown, and the holder of any mining tenement or mining privilege, or of any right or privilege under the Petroleum Act 1967, in relation to the land.

(2) Where the owner of any land gives to the Trustees notice in writing that he requires to use the land for a purpose which, unless the Minister gives his consent under this section, would be likely to result in a breach of Section 17 in respect of any Aboriginal site that might be on the land, the Trustees shall, as soon as they are reasonably able, form an opinion as to whether there is any Aboriginal site on the land, evaluate the importance and significance of any such site, and submit the notice to the Minister together with their recommendation in writing as to whether or not the Minister should consent to the use of the land for that purpose, and, where applicable, the extent to which and the conditions upon which his consent should be given.

(3) Where the Trustees submit a notice to the Minister under subsection (2) of this section he shall consider their recommendation and having regard to the general interest of the community shall either-

(a) Consent to the use of the land the subject of the notice, or a specified part of the land, for the purpose required, subject to such conditions, if any, as he may specify; or

(b) wholly decline to consent to the use of the land the subject of the notice for the purpose required, and shall forthwith inform the owner in writing of his decision.

(4) Where the owner of any land has given to the Trustees notice pursuant to subsection (2) of this section and the Trustees have not submitted it with their recommendation to the Minister in accordance with that subsection the Minister may require the Trustees to do so within a specified time, or may require the Trustees to take such other action as the Minister considers necessary in order to expedite the matter, and the Trustees shall comply with any such requirement.

(5) Where the owner of any land is aggrieved by a decision of the Minister made under subsection (3) of this section he may, within the time and in the manner perscribed by rules of court, appeal from the decision of the Minister to the Supreme Court which may hear and determine the appeal.

(6) In determining an appeal under subsection (5) of this section the Judge hearing the appeal may confirm or vary the decision of the Minister against which the appeal is made or quash the decision and substitute his own decision which shall have effect as if it were the decision of the Minister, and may make such an order as to the costs of the appeal as he sees fit.

(7) Where the owner of the land gives notice to the Trustees under subsection (2) of this section, the Trustees may, if they are satisfied that it is practicable to do so, direct the removal of any object to which this Act applies from the land to a place of safe custody.

(8) Where consent has been given under this section to a person to use any land for a particular purpose nothing done by or on behalf of that person pursuant to, and in accordance with any conditions attached to, the consent constitutes an offence against this Act."

APPENDIX 2

Notes on the Recognition of Aboriginal Sites

There are various types of Aboriginal Sites, and these notes have been prepared as a guide to the recognition of those sites that may be located in the survey area.

An Aboriginal Site is defined in the Aboriginal Heritage Act 1972-80 in Section 5 as:

(a) Any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made for or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;

(b) Any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;

(c) Any place which, in the opinion of the Trustees is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the state;

(d) Any place where objects to this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

Habitation Sites

These are commonly found throughout Western Australia and usually contain evidence of tool-making, seed grinding and other food processing, cooking, painting, engraving or numerous other activities. The archaeological evidence for some of these activities is discussed in detail under the appropriate heading.

Habitation sites are usually found near an existing or former water source such as gnamma hole, rock pool, spring or soak. They are generally in the open, but they sometimes occur in shallow rock shelters or caves. It is particularly important that none of these sites be disturbed as the stratified deposits which may be found at such sites can yield valuable information about the inhabitants when excavated by archaeologists.

Seed Grinding

Polished or smoothed areas are sometimes observed on/near horizontal rock surfaces. The smooth areas are usually 25cm wide and 40 or 50cm long. They are the result of seed grinding by the Aboriginal women and indicate aspects of a past economy.

Habitation Structures

Aboriginal people sheltered in simple ephemeral structures, generally made of branches and sometimes grass. These sites are rarely preserved for more than one occupation period. Occasionally rocks were pushed aside or were used to stabilise other building materials. When these rock patterns are located they provide evidence of former habitation sites.

Middens
When a localised source of shellfish and other foods have been exploited from a favoured camping place, the accumulated ashes, hearth stones, shells, bones and other refuse can form mounds at times several metres high and many metres in diameter. Occasionally these refuse mounds or middens contain stone, shell or bone tools. These are most common near the coast but examples on inland lakes and river banks are not unknown.

Stone Artefact Factory Sites
Pieces of rock from which artefacts could be made were often carried to camp sites or other places for final production. Such sites are usually easily recognisable because the manufacturing process produces quantities of flakes and waste material which are clearly out of context when compared with the surrounding rocks. All rocks found on the sandy coastal plain, for example, must have been transported by human agencies. These sites are widely distributed throughout the state.

Quarries
When outcrops of rock suitable for the manufacture of stone tools were quarried by the Aborigines, evidence of the flaking and chipping of the source material can usually be seen in situ and nearby. Ochre and other mineral pigments used in painting rock surfaces, artefacts and body decoration are mined from naturally occuring seams, bands and other deposits. This activity can sometimes be recognised by the presence of wooden digging sticks or the marks made by these implements.

Marked Trees
Occasionally trees are located that have designs in the bark which have been incised by Aborigines. Toeholds, to assist the climber, were sometimes cut into the bark and sapwood of trees in the hollow limbs of which possums and other arborial animals sheltered. Some tree trunks bear scars where sections of bark or wood have been removed to make dishes, shields, spearthrowers and other wooden artefacts. In some parts of the state wooden platforms were built in trees to accomodate a corpse during complex rituals following death.

Burials
In the north of the state it was formerly the custom to place the bones of the dead on a ledge in a cave after certain rituals were completed. The bones were wrapped in sheets of bark and the skull placed beside this. In otther parts of Western Australia the dead were buried, the burial position varying according to the customs of the particular area and time. Natural erosion, or mechanical earthmoving equipment occasionally exposes these burial sites.

Stone Structures
If one or more stones are found partially buried or wedged into a position which is not likely to be the result of natural forces, then it is probable that the place is an Aboriginal site and that possibly there are other important sites nearby. There are several different types of stone arrangements ranging from simple cairns or piles of stones to more elaborate designs. Low weirs which

trap fish when tides fall are found in coastal areas. Some rivers contain similar structures that trap fish against the current. It seems likely that low stone slab structures in the south-west jarrah forests were built to provide suitable environments in which to trap some small animals. Low walls or pits were sometimes made to provide a hide or shelter for hunting.

Elongated rock fragments are occasionally erected as a sign or warning that a special area is being approached. Heaps or alignments of stones may be naturalistic or symbolic representations of animals, people or mythological figures.

Paintings
These usually occur in rockshelters, caves or other sheltered situations which offer a certain degree of protection from the weather. The best known examples in Western Australia occur in the Kimberley region but paintings are also found throughout most of the State. Several coloured pigments may have been used at a site. Stencilling was a common painting technique used throughout the state. The negative image of an object was created by spraying pigment over the object which was held against a wall.

Engravings
This term describes designs which have been carved, pecked or pounded into a rock surface. They form the predominant art form of the Pilbara region but are known to occur in the Kimberleys in the north to Toodjay in the south. Most engravings occur in the open but some are situated in rock shelters.

Caches
It was the custom to hide ceremonial objects in niches and other secluded places. The removal of objects from these places, the taking of photographs of the places or objects or any other interference with these places is not permitted.

Ceremonial Grounds
At some sites the ground has been modified in some way by the removal of surface pebbles, or the modeling of the soil, or the digging of pits and trenches. In other places there is no noticeable alteration of the ground surface and Aborigines familiar with the site must be consulted concerning its location.

Mythological Sites
Most sites already described have a place in Aboriginal mythology. In addition there are many Aboriginal sites with no man-made features which enable them to be recognised. They are often natural features in the landscape linked to the Aboriginal account of the formation of the world during the creative "Dreaming" period in the distant past. Many such sites are located at focal points in the creative journeys of mythological spirit beings of the Dreaming. Such sites can only be identified by the Aboriginal people who are familiar with the associated traditions.

Wood & Grieve
ENGINEERS

APPENDIX 4

EPA GUIDELINES

164

AN ENVIRONMENT WORTH PROTECTION

Mr Chris Warrener
Land Planning Consultants
Unit 3 / 226 Carr Place
LEEDERVILLE WA 6007

Your ref: 1336.005
Our ref: TP93.24
Enquiries: Simon Smalley

Dear Sir

PROPOSAL TO SUBDIVIDE JANDAKOT AA LOTS 122, 123 AND 403 ACOURT ROAD (803)

Further to our earlier discussions regarding the above proposal, please find enclosed the final guidelines for preparation of the proponent's document.

Should you need any further information please contact Simon Smalley on 222 7143 in the first instance.

Yours faithfully

R A D Sippe
DIRECTOR
EVALUATION DIVISION

14 June 1993

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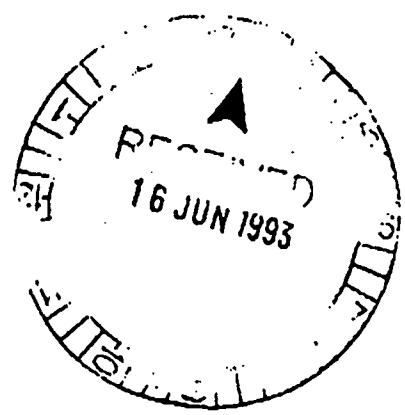
5-Guidelines 140693 SSm



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URBAN SUBDIVISION - LOTS 122, 123 AND 403 ACOURT ROAD, CANNING VALE (803)

CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES

Overview

In Western Australia all environmental reviews are about protecting the environment. The fundamental requirement is for the proponent to describe what they propose to do, to discuss the potential environmental impacts of the proposal, and then to describe how those environmental impacts are going to be managed so that the environment is protected.

If the proponent can demonstrate that the environment will be protected then the proposal will be found environmentally acceptable; if the proponent cannot show that the environment would be protected then the Environmental Protection Authority (EPA) would recommend against the proposal.

Throughout the process it is the aim of the EPA to advise and assist the proponent to improve or modify the proposal in such a way that the environment is protected. Nonetheless, the environmental review in Western Australia is proponent driven, and it is up to the proponent to identify the potential environmental impacts and design and implement proposals which protect the environment.

For this proposal, protecting the environment means that the water quality of the Jandakot Mound is maintained and that the proposal for residential development is compatible with the expanded Jandakot Airport. Where these requirements cannot be met, proposals to mitigate the impacts are required.

Purpose of a CER

The primary function of an CER is to provide the basis for the EPA to provide advice to Government on protecting the environment. An additional function is to communicate clearly with the public so that EPA can obtain informed public comment. As such, environmental impact assessment is quite deliberately a public process. The CER should set out the series of decisions taken to develop this proposal at this place and time and why.

Objectives of the review

The Consultative Environmental Review should have the following objectives:

- to place this project in the context of the regional environment and the progressive development of resources in the region, including the cumulative impact of this development;
- to explain the issues and decisions which led to the choice of this project at this place at this time;
- to set out the environmental impacts that the project may have; and
- for each impact, to describe any environmental management steps the proponent believes would avoid, mitigate or ameliorate that impact.

The CER should focus on the major issues for the area and anticipate the questions that members of the public will raise. Data describing the environment should be directly related to the discussion of the potential impacts of the proposal. Both should then relate directly to the actions proposed to manage those impacts.

Key issues

The critical issue for the proposal is likely to be the compatibility of the land use with the

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proposed expansion of Jandakot Airport. It is critical therefore that the CER shows a detailed understanding of the expected noise emissions from the Jandakot. An additional factor is that the land has been identified for inclusion in the Jandakot Botanic Park.

The key issues for this project should be clearly identified and the content of succeeding sections determined by their relevance to these issues.

In this case the key issues should include:

- compatibility of residential development within the context of the expansion of the Jandakot Airport;
- impacts from noise, dust and vibrations from nearby quarry activities;
- compatibility with noise buffer zones associated with the adjacent kennel zone;
- management of nutrients and stormwater flows;
- impacts upon groundwater quantity and quality in the Jandakot Mound associated with the draft Environmental Protection (Jandakot Mound Groundwater) Policy 1993;
- flora, fauna and ecosystems:
  - conservation and recreation values associated with the lands inclusion in the Jandakot Botanical Park;
  - protection of remnant vegetation;
  - identification and management of rare flora and fauna (shown on distribution maps) and those species which are either poorly known or inadequately represented in secured conservation reserves;
  - inter-relationships of the biota and environment;

plus any other key issues raised during the preparation of the report.

Public partition and consultation
A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. It should describe the activities undertaken, the dates, the groups and individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management for the proposal which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures, outside the EPA process, these can be noted and referenced here.

Detailed list of environmental commitments
The commitments being made by the proponent to protect the environment should be clearly defined and separately listed. Where an environmental problem has the potential to occur, there should be a commitment to rectify it. They should be numbered and take the form of:

a who will do the work;

b what the work is;

c when the work will be carried out; and

d to whose satisfaction the work will be carried out.

- All actionable and auditable commitments made in the body of the document should be numbered and summarised in this list.

END