CONSULTATIVE ENVIRONMENTAL REVIEW

WALPOLE WASTEWATER SCHEME

STAGE 1 AT SITE C

ASSESSMENT NUMBER 1154

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INVITATION

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

The Water Corporation proposes to establish the first stage of a Wastewater Treatment Plant at a site north-east of Walpole in order to improve domestic sewage treatment and disposal within the town. A Consultative Environmental Review (CER) has been prepared which describes the proposal and its likely effects on the environment in accordance with the requirements of the *Environmental Protection Act 1986*. The CER will be available for public review for a period of four weeks, commencing on Monday 4 May 1998 and closing on Monday 1 June 1998.

Comments from government agencies and from the public will be forwarded to the EPA to assist its evaluation and the EPA will prepare an assessment report in which it will make recommendations to government.

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 unless provided and received in confidence (subject to the requirements of the *Freedom of Information Act*) and may be quoted in full or in part in the EPA's report.

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 more environmentally 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.

Points to keep in mind
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 recommendations 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 discussing; and
- attach any factual information you may wish to provide and give details of the source, making sure your information is accurate.

Remember to include:
- your name;
- your address;
- the date;
- whether you want your submission to be confidential.

The closing date for submissions is: 1 June 1998.

Submissions should be addressed to:

Department of Environmental Protection
Westralia Square
141 St George's Terrace
PERTH WA 6000
Attention: Mr Wes Horwood

EXECUTIVE SUMMARY

1. The Water Corporation proposes the construction of a new Wastewater Treatment Plant (WWTP) at a site north-east of the Walpole townsite. The WWTP will treat and dispose wastewater derived from staged infill of the existing Walpole townsite, which currently uses septic tank/leach drain systems, and from connection of the recently constructed Boronia Ridge residential development, where reticulated sewerage is installed, but collected wastewater is currently tankered to Albany for disposal. The WWTP will be constructed in up to three stages of 1,000 EP (equivalent person) capacity. Stage 1 comprising 1,000 EP of treatment and disposal capacity is the subject of this assessment.

2. The wastewater treatment process will be carried out in two steps, the first comprising an advanced Biological Nutrient Removal (BNR) process incorporating back-up chemical dosing for phosphorus removal and disinfection, and the second comprising BNR plant effluent "polishing" in a constructed wetland of Reed Bed Treatment System (RBT) design.

3. Disposal of the final treated effluent from Stage 1 will be achieved by on-site disposal to a subsurface soil infiltration facility for the small initial volumes of effluent which are expected. When larger treated effluent volumes arise, final effluent disposal will be by irrigation to an existing Eucalyptus woodlot located some 4km to the north-west of the WWTP site or to an alternative local site. Discussions to secure the use of the existing Eucalyptus woodlot or an alternative site are underway. This CER does not specifically address the woodlot irrigation disposal facility.

4. The wastewater treatment and disposal strategy for the Walpole townsite of which this proposal is the outcome, was developed by consultants for the Water Corporation following an extensive review of available technologies for treatment and disposal and available sites. The Strategy has the core objectives of protecting public health in the strategy area by collecting wastewater for centralised treatment, and protecting water quality in the Walpole and Nornalup Inlets by utilising best available technology for wastewater treatment including nutrient removal, disinfection and disposing treated effluent in a manner which can prevent unacceptable nutrient discharge to local surface waters.

5. Detailed comparative engineering and environmental evaluation of four alternative sites was carried out prior to the identification of Site C (north-east of the townsite) as the preferred site. Subsequent to this selection, botanical survey confirmed that the site was free of Declared Rare or Priority Flora. Site evaluation work concluded that whilst the site supports native vegetation in good condition, clearing requirements are small and large areas of similar representative examples of this vegetation occur in the adjacent Walpole-Nornalup National Park. Archaeological and ethnographic survey confirmed that the site is free of constraint to WWTP construction in regard to these factors.

6. Referral of the proposal to the EPA in March 1997 under Section 38 of the *Environmental Protection Act, 1986*, resulted in a Works Approval level of assessment. This determination reflected the background information accompanying the referral, which described the wastewater treatment technology selection and site selection studies carried out by the Water Corporation. In addition, preliminary nutrient impact analysis demonstrated that the project offered beneficial environmental impacts in terms of water quality protection.

7. Appeals were made to the Minister for the Environment regarding the assessment level on the grounds that the preferred site has special conservation values which derive from vegetation, flora and wetland characteristics. The Minister for the Environment upheld the appeals and set a new assessment level of Consultative Environmental Review (CER).

8. This document fulfills the objectives of the CER by assessing the proposal with reference to the environmental factors identified within the guidelines issued by the EPA.

9. Based on specific botanical and hydrogeological surveys within the site and surrounding region the CER concludes that the preferred site does not have the unique or geographically restricted conservation values claimed in the appeals. The EPA's objectives for the environmental factors can be met, with implementation of the Water Corporation's environmental management commitments.

10. The findings of the environmental assessment of the proposal, with specific reference to the environmental factors cited in the CER guidelines, are summarised as follows:

- in terms of floristic composition, structure, soil substrate structure and hydrological characteristics, the existing sedgeland and woodland vegetation within the site is well represented in adjacent and nearby parts of the Walpole-Nornalup National Park and in other freehold land: the 1ha clearing area required for Stage 1 plant construction compares to approximately 93ha of equivalent vegetation in the Walpole-Nornalup National Park and further large areas in the D'Entrecasteaux National Park to the west of the site comprising a total of around 218ha;

- the presence of unconfined groundwater at relatively shallow depth below surface, seasonal waterlogging at the soil surface and sedgeland vegetation enable parts of the site to be classified as a dampland : soil and groundwater survey in the adjacent Walpole-Nornalup and D'Entrecasteaux National Parks shows that areas with equivalent hydrogeological processes are well represented locally and regionally in secure reserves, whilst available literature confirms that these characteristics are common throughout the region due to prevailing geological and geomorphic conditions and the high rainfall/low evaporation climate;

- in regard to the use of the term "*palusmont*" (a term not used before in peer reviewed published literature) to describe wet terrain on local topographic high points, neither previously submitted data nor recent site evaluation have derived any technical evidence that the site is hydrologically maintained by "artesian upwelling" of groundwater : in contrast, environmental survey and evaluation work carried out for this CER and observed water table conditions beneath the site suggest that rainfall is the dominant source of shallow groundwater;

- evaluation of the impact of the proposal on water quality in Walpole-Nornalup Inlets indicates that implementation will cause a reduction in current discharges of phosphorus and nitrogen as a primary result of infill sewering of the existing Walpole townsite and disposal of the collected effluent following treatment to much higher quality than can be achieved by the current septic tank/leach drain systems;

- odour buffer reviews carried out for the project indicate that the 500m distance between the plant site and residential areas will protect residents from odour nuisance;

- studies of groundwater quality in the area which will receive treated effluent by soil infiltration indicate that changes to groundwater quality will not impair the ability of this groundwater to meet ecosystem maintenance requirements in the receiving environment;

- studies of surface water quality in the area which will receive groundwater baseflow derived in part from treated effluent infiltration in the recharge area, indicate that surface water quality will be maintained consistent with the beneficial uses of the surface waters and the receiving environment for surface water discharge.

11. Appropriate environmental management and monitoring commitments are made by the proponent, consistent with the operational requirements and characteristics of the Wastewater Treatment Plant and the environmental management requirements of the receiving environment.

Summary Table: Consultative Environmental Review – Stage 1 Walpole Wastewater Scheme

Environmental Factor	EPA Objective	Present Status of the Receiving Environment	Potential Impact	Proposed Environmental Management	Predicted Outcome
Vegetation Communities	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.	The site supports terrestrial vegetation and flora in good biological condition.	Claims that the flora and vegetation are unique and significant for conservation have been made but are not supported by detailed survey of flora and vegetation for this CER, which show that the site's vegetation and flora are locally common and well represented in secure reserves.	Vegetation clearing will be minimised in accordance with the direct requirements for the WWTP and infrastructure and the requirements of construction. Contractors will be legally bound to protect vegetation in accordance with protocols agreed by the DEP.	Vegetation clearing will be limited to the absolute minimum required for the proposal to be implemented. The EPA's objective for this factor can be met by the proposal.
Wetlands	Maintain the integrity, functions and environmental values of wetlands.	The site is gently sloping and sandy and is underlain by a shallow (2m depth) low permeability sediment layer with a flat or gently undulating surface, which supports the development of an unconfined aquifer with a perennially shallow water table under the influence of high rainfall recharge and slow groundwater discharge.	Claims that the hydrological processes which prevail at the site are unusual, include artesian upwelling and have special conservation value were not supported by investigations carried out for this CER. The hydrological processes at the site are common in the Walpole region landforms including substantial areas in secure conservation reserves.	Design and construction contracts let by the Water Corporation will include a specification for collected stormwater to be recharged to the shallow aquifer on site in order to minimise changes to recharge beneath the sedgeland vegetation within the treatment plant site.	Changes to the site's existing hydrological processes will be minimal, and intact examples of these processes will remain well represented in existing secure conservation reserves. The EPA objective for this factor can be met by the proposal.
Estuaries	Maintain the integrity, functions and environmental values of estuaries.	The Walpole Inlet, which is considered very sensitive to nutrient loadings, is the receiving water body for discharge from the Walpole townsite. This drainage contains shallow groundwater, which receives septic tank discharges and stormwater. Site C proposed for the WWTP is located some 150m west of a vegetated drainage line which discharges to Walpole Inlet some 1.5km to the south.	Inappropriate treatment and disposal of wastewater could impair water quality in Walpole and Nornalup Inlets.	Initial investigations and planning for the Walpole Sewer Scheme have incorporated the objective of protecting water quality in Walpole Inlet and included detailed investigations of alternative treatment and disposal methods and sites, leading to the identification of the current proposal as the preferred approach. Best available technology is proposed for wastewater treatment and disposal. The Water Corporation will operate the WWTP to achieve optimum performance in regard to contaminant removal for the term of its operating life.	Current discharges of nutrients from the Walpole townsite will be significantly reduced when existing septic tank discharges are diverted to the Stage 1 WWTP for high standard treatment and disposal by soil infiltration.

Environmental Factor	EPA Objective	Present Status of the Receiving Environment	Potential Impact	Proposed Environmental Management	Predicted Outcome
Odour	Odours emanating from the proposed development should not adversely affect the welfare and amenity of other land users.	There are currently no known sources of potential odour nuisance in the vicinity of the site.	Inappropriate siting and operation of a WWTP can cause odour nuisance in residential areas.	Site selection has incorporated the requirement to locate the WWTP sufficiently distant from existing and future residential areas. The site meets Water Corporation requirements for buffer distance to residential uses. The Water Corporation will operate the WWTP so as to minimise odour generation and will implement additional odour control measures in consultation with the DEP if necessary.	The EPA objective for this factor can be met.
Groundwater Quality	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines – National Water Quality Management Strategy].	The site or its immediate environs do not have potential for potable uses because of limited quantities. Groundwater flow from the site proposed for final treated effluent disposal maintains vegetation at the margins of the local surface water drainage 150m to the east.	Disposal of inadequately treated effluent could impair the ability of groundwater to meet beneficial uses, which are confined to ecosystem maintenance.	The Water Corporation will design, construct and operate the WWTP to achieve optimum performance in regard to contaminant removal for the term of its operating life, and will monitor and report groundwater quality in the immediate receiving environment for final effluent discharge in accordance with DEP licence specifications.	Existing and potential uses for the groundwater affected by treated effluent disposal, including ecosystem maintenance, will be maintained. The EPA objective for this factor can be met by the proposal.
Surface Water Quality – water courses and the Walpole/ Nornalup Inlets	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines – National Water Quality Management Strategy].	Groundwater discharge from the area where treated effluent will be disposed by subsurface infiltration, contributes to baseflow to a perennial creek which discharges to Walpole Inlet. This creek drains a catchment comprising cleared stocked agricultural land and natural vegetation.	Disposal of inadequately treated effluent could impair water quality in the perennial creek so as to impair its function for ecosystem maintenance.	The Water Corporation will design, construct and operate the WWTP to achieve optimum performance in regard to contaminant removal for the term of its operating life, and will monitor and report groundwater quality in the immediate receiving environment for final effluent discharge in accordance with DEP licence specifications.	Existing and potential uses for the surface water potentially affected by treated effluent disposal, including ecosystem maintenance, will be maintained. The EPA objective for this factor can be met by the proposal.

Environmental Factor	EPA Objective	Present Status of the Receiving Environment	Potential Impact	Proposed Environmental Management	Predicted Outcome
Construction and Operation	No specific objective listed by the EPA.	The site supports natural vegetation in good biological condition and is located adjacent to the Walpole-Nornalup National Park.	Inadequate planning and control of design and construction could lead to unnecessary clearing or damage to vegetation within the site or adjacent National Park.	Contracts let by the Water Corporation for detailed design and construction of the WWTP Stage 1 will incorporate a requirement to develop and implement protocols for the minimisation of clearing, control of vehicle movements and observation of dieback hygiene procedures.	The design, construction and operation of the WWTP Stage 1 will be completed without unnecessary clearing or damage to vegetation within the site and adjacent National Park.

Summary Table: Key Characteristics Stage 1

Element	Description
Life of Project	Period Until Service Requirement Exceeds 1,000EP
First Phase of Treatment	Extended Aeration/Activated Sludge/BNR 1,000EP (200m^3/d) Final Effluent <1mg/LtotP, <10mg/LtotN, <10mg/LBOD$_5$, <20mg/LSS, <150cfu/100ml
Second Phase of Treatment	Reed Bed Treatment System 1,000EP (200m^3/d) *Potential Final Effluent <0.64mg/LtotP, <0.5mg/LtotN, <2.6mg/LBOD$_5$, <6.8mg/LSS, <15cfu/100ml
Final Effluent Disposal to Subsurface Infiltration Gallery	Length 280m Depth 3m

*Final effluent quality estimated from technical literature and will be monitored. Operating licence is proposed to be based on treatment plant output i.e. First Phase of Treatment.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

LIST OF FIGURES
(complied at rear of Report)

LIST OF TABLES

1.0 INTRODUCTION

1.1 Project Background

The Water Corporation proposes the construction of a new Wastewater Treatment Plant (WWTP) at a site north-east of the Walpole townsite. The WWTP will be constructed in several stages and will treat and dispose wastewater derived from infill of the existing Walpole townsite, which currently uses septic tank/leach drain systems, and from connection of the recently constructed Boronia Ridge residential development. At Boronia Ridge reticulated sewerage is installed, but collected wastewater is currently tankered to Albany for disposal.

The preferred site and strategy for the staged development of wastewater treatment plant and disposal facilities have emerged from a detailed comparative evaluation of alternative treatment and disposal technologies, and sites for these facilities. Evaluation has taken into account relevant environmental, planning and engineering factors for the townsite and its surrounding environment.

Importantly, the strategy has been designed to minimize the discharge of nutrient and faecal contaminants to the Walpole and Nornalup Inlets, which have high values for conservation and recreation.

Detailed comparative engineering and environmental evaluation of four alternative sites was carried out prior to the identification of "Site C" as the preferred site. Subsequent to this selection, botanical survey confirmed that the site was free of Declared Rare or Priority Flora. Site evaluation work concluded that whilst the site supports native vegetation in good condition, clearing requirements are small and large areas of similar representative examples of this vegetation occur in the adjacent Walpole-Nornalup National Park.

Archaeological and ethnographic survey confirmed that the site is free of constraint to WWTP construction in regard to these factors (McDonald Hales and Associates, 1996).

Referral of the proposal to the EPA in March 1997 under Section 38 of the *Environmental Protection Act, 1986*, resulted in a Works Approval level of assessment. This determination reflected the background information accompanying the referral, which described wastewater treatment technology selection and site selection studies which had been carried out by the Water Corporation, and presented preliminary nutrient impact analysis which demonstrate that the project offered beneficial environmental impacts in terms of water quality protection in local estuaries.

Appeals were made to the Minister for the Environment regarding the assessment level on the grounds that the preferred site has special conservation values which derive from vegetation and wetland characteristics. The Minister for the Environment upheld the Appeals and set a new assessment level of Consultative Environmental Review (CER).

This document fulfills the objectives of the CER by assessing the proposal with reference to the environmental factors identified within the guidelines for the document issued by the EPA.

1.2 Project Justification and Benefits to the Community

The proposal has its origin in the determination by the (then) Water Authority of Western Australia that a wastewater collection, treatment and disposal facility was needed to service the Walpole townsite. Important factors which were taken into account in making this determination included:

- the historical use of conventional septic tank/leach drain systems to service existing development in the Walpole townsite was no longer acceptable due to risks of surface water contamination by nutrients and faecal pathogens originating from poorly operating systems: data is available which shows that stormwater flowing out of the residential area into Walpole Inlet is sometimes heavily contaminated;

- rezoning of existing lots in the Walpole townsite to allow a closer form of subdivision consistent with tourist uses could not be supported by on-site effluent disposal; and

- new residential development at Boronia Ridge was considered to require reticulated sewer service.

Establishment of a reticulated sewer system, wastewater treatment plant and treated effluent disposal facilities, designed in accordance with appropriate public health and water quality management objectives, offers significant benefits to the community and

State. These include protecting Walpole and Nornalup Inlets from excessive or unnecessary nutrient loadings and eliminating present potential health risk associated with stormwater contamination by faecal organisms originating from poorly operating septic tank/leach drain systems.

1.3 Site Selection Process

The proposed site for the WWTP, referred to as Site C, was selected from four possible sites identified on engineering and planning grounds.

Appendix A sets out a summary of the factors which led to the selection of Site C as the preferred site.

1.4 Environmental Approvals Process

The Consultative Environmental Review (CER) has been prepared by the Water Corporation to describe the proposal, examine the potential environmental impacts and set out proposed measures to avoid, minimise, manage and monitor these impacts. The CER has been published following review of a draft by the DEP and is available for public review for 4 weeks, during which time individuals and organisations are invited to make written comments and submissions to the EPA concerning the adequacy of the CER and the acceptability of the project.

A summary of these submissions will be forwarded to the proponent, who will prepare a response to issues raised in the submissions. As a result of consideration of these submissions, the proponent may provide additional information, explanation or details of modifications to optimise the environmental acceptability of the project.

The CER and Response to Submissions will be assessed by the EPA. The EPA will make recommendations to the Minister for the Environment as to whether the proposal should be approved and, if so, under what conditions. These recommendations will be published in an EPA Bulletin and will be open to public appeal for two weeks.

At the end of the appeal period (assuming no appeals are received which need to be considered) the Minister will make a decision as to whether the project can proceed and will set conditions relating to environmental management, monitoring and reporting which must be fulfilled either before or following commencement of the project.

1.5 Public Consultation

The Water Corporation has been diligent in its public consultation activities since investigations to identify a site for wastewater treatment and disposal at Walpole began.

The public consultation has included the following meetings and workshops;

23rd July 1996: CALM Office Walpole - General Background Discussions.

Attendees: Councillor from Shire of Manjimup,
Representative from CALM,
Representatives from Walpole - Tynedale LCDC,
Representatives from WANISAC (Walpole and Nornalup Inlets System Advisory Committee),
Trevor McKell– Wood & Grieve Engineers,
Graham Brown and Paul Bendotti - Water Corporation.

28th February 1997: at CALM Office Walpole - Detailed Definition of Project Plans for Site C.

Attendees: Guy Watson - DEP,
Greg Mair - CALM,
Geoff Lush and Andrew Campbell - Shire of Manjimup,
Tony D'Ascanio, Graham Brown and Paul Chan - Water Corporation,
Martin Bowman - Bowman Bishaw Gorham,
Ross Muir, Graeme Robertson - Boronia Ridge,
Joe Burton - Real Estate,
Margaret Hughes and Ivan Edmonds - WANISAC,
Vic Semenuik,
Kaylene Parker - WRC,
Bill Jackson - WNN Parks Assoc.,
Thomas Gerner - LCDC farmer,
Dave Tapley - Shire Councillor,
Trevor McKell - Wood & Grieve Engineers.

28th May 1997: at Shire of Manjimup - Meeting Regarding Environmental Assessment Issues.

Attendees: Garry Middle and Karen Sanders - DEP,
Vic Semeniuk,
Margaret Hughes - WANISAC,
Kaylene Parker - WRC,
Geoff Lush and Andrew Campbell - Shire of Manjimup,
Trevor McKell and Bob Kelliher – Wood & Grieve Engineers,
Tony D'Ascanio - Water Corporation.

25th March 1998: at Shire of Manjimup - Update on Progress with CER.

Atendees: Wes Horwood - DEP,
Geoff Lush and Andrew Campbell - Shire of Manjimup,
Trevor McKell and Bob Kelliher – Wood & Grieve Engineers,
Richard Murton and Tony D'Ascanio - Water Corporation.

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2.0 DESCRIPTION OF THE PROPOSAL

2.1 Stage 1

Figure 1 shows that the preferred site for the WWTP is located on land controlled by CALM, situated to the immediate north of the light industrial area at the north east of the townsite. Land to the east and north of the site lies within the Walpole Nornalup National Park. Land to the west of the site is either National Park or CALM depot whilst land to the south is part of the Walpole light industrial estate.

Stage 1 of the ultimate strategy, which is the subject of this CER, will incorporate three process elements:

- an initial phase of treatment using extended aeration/activated sludge plant (or similar related process) of 1000EP (equivalent persons) capacity, producing final effluent of <1mg/L total phosphorus, <10mg/L total nitrogen, <10mg/L BOD5 (5 day biological oxygen demand), <20mg/L S.S. (suspended solids) and thermo-tolerant coliforms <150cfu/100ml;

- a second phase of treatment using a constructed wetland system using reed bed treatment system (RBTS) design: RBTS comprises a gravel or aggregate bed underlain by an impervious membrane and planted with a dense cover of reeds - effluent flows laterally through the gravel bed containing the root systems of the reeds and during this process it is subjected to physical and biological processes which remove nutrients and other contaminants;

- discharge of a final treated effluent by subsurface infiltration using an infiltration gallery constructed beneath an existing 6m firebreak/access track located along the eastern site boundary.

The first phase of treatment comprises best available technology and will produce a very high quality effluent, significantly better than most WWTP's currently operating throughout Western Australia.

The purpose of using an RBTS for the second phase of treatment is to further reduce nutrient concentrations in the final effluent from the extended aeration/activated sludge plant before disposal by soil infiltration.

This further reduction in nutrient and other contamination levels has been incorporated in recognition that final effluent disposal from the WWTP will take place in the catchment of the Walpole Inlet, which like other south coastal estuaries is considered to be sensitive to nutrient contamination.

Review of the international technical literature (Cooper and Hobson, 1988; Gersberg *et al.,* 1988) indicates removal efficiencies which can be achieved by an RBTS as presented in Table 1, which are superior to alternative designs for constructed wetlands. The final effluent quality possible from the treatment plant on the basis of published research findings is also set out in Table 1 (although it should be noted the WWTP will be licensed based on plant effluent discharge quality rather than from the RBTS).

Table 1

Indicative Removal Efficiency of RBTS Wetland and Final Effluent Quality from Stage 1 WWTP

	BOD	SS	N	P	Pathogens
Treatment Plant Output	<10mg/L	<20mg/L	<10mg/L	<1mg/L	<150cfu/100ml
Indicative Removal Efficiency of RBTS	74%	71%	95%	36%	90%
Possible Final Effluent Quality	<2.6mg/L	<6.8mg/L	<0.5mg/L	<0.64mg/L	<15cfu/100ml

Treatment of wastewater to the standard indicated in Table 1 and disposal by subsurface infiltration will afford the best possible protection to water quality in Walpole Inlet. Figures 2, 3 and 4 depict the process flow charts and physical arrangement of treatment process infrastructure within the site.

2.2 Future Stages

This CER assessment deals only with Stage 1 of the overall strategy. Future expansion of the facility will proceed as described in this section.

When a suitable facility can be made available it is proposed that for Stage 1 and for subsequent stages, treated effluent will be disposed to *Eucalyptus* woodlot irrigation, as is currently practiced at Albany.

Site identification and procurement investigations are currently underway and utilization of the woodlot facility will proceed as soon as is practical. Previous investigations have confirmed that suitable land and soil types exist in several areas to the north of the Walpole townsite, and that a suitable pipeline route through existing cleared firebreaks in the National Park and road reserves or cleared private land is available.

If commissioning of an irrigation woodlot is possible during the early years of operation, when only Stage 1 of the treatment plant has been constructed, then treated effluent will be diverted from soil infiltration for disposal to the woodlot when sufficient volumes are available.

As and when growth in wastewater generation volumes requires, additional treatment capacity will be added in stages. Present planning allows for the addition of a further two treatment plant modules each of 1,000EP capacity. Figures 4 and 5 show how the future treatment plant modules will be positioned on the site and incorporated in the overall process flow chart.

Planning and development of the woodlot facility will allow for total irrigation capacity equal to 3,000EP of treated effluent disposal, consistent with the planned capacity of the three stages of wastewater treatment plant.

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3.0 EXISTING ENVIRONMENT

3.1 Physical Environment

3.1.1 Climate

Temperature

Walpole has a sub-mediterranean climate with mild summers and cool wet winters. The mean maximum temperatures vary from 25.4°C in January to 16°C in July. The mean minimum temperatures vary from 13.6°C in January to 7.4°C in August (Department of Conservation and Land Management, 1992).

Rainfall and Evaporation

Walpole is situated in an area which is notable for being the wettest part of the south west of the State.

Figure 6 reproduced from Churchward *et al.* (1988) shows that Walpole is located within the envelope of land enclosed by the 1400mm/annum rainfall isohyet. Bureau of Meteorology records for Walpole indicate mean annual rainfall is 1340.8mm.

Table 2 presents rainfall and evaporation data for Walpole obtained from the Bureau of Meteorology and the Western Australian Department of Agriculture.

As well as having very high rainfall compared to localities even a short distance to the east (Denmark has 1,000.5mm/annum, whilst Albany has 807.5mm/annum) Walpole is unusual in its south west context in that annual rainfall exceeds annual evaporation.

For most areas, ie. land beyond the approximate 1200mm annual rainfall isohyet, annual evaporation exceeds rainfall.

As is discussed later, this is an important factor in the development and distribution of vegetation complexes and plant associations and communities as the climatic regime provides for a very wet environment compared to land even a short distance to the east and north.

Table 2

Monthly Average Rainfall and Evaporation for Walpole

Month	Rainfall (mm)	Daily Evaporation (mm)	Monthly Evaporation (mm)[1]
January	28.0	6.1	189.1
February	29.9	5.5	154
March	45.3	4.3	133.3
April	103.3	2.6	78
May	171.1	1.8	55.8
June	204.7	1.4	42
July	228.5	1.5	46.5
August	185.7	1.9	58.9
September	129.5	2.3	69
October	110.1	3.1	96.1
November	68.0	4.0	120
December	36.7	5.4	167.4
Total	**1340.8**	**39.9**	**1210.1**

Note 1: Data Generated by Plant Industries Division WA Department of Agriculture. 17th May 1995. Evaporation Data Estimated from average surfaces using ESOCLM.

3.1.2 Landform and Topography

The Walpole region is described as comprising of flat to gently undulating benches with elevations ranging from 10 to 40m, and local relief of 10 to 20m (Churchward *et al.*, 1988). There is a gradual slope towards the south coast.

There are three broad landform zones (CALM, 1992):

- hills, ridges, slopes and plains;
- swampy terrain; and
- parabolic dune systems; and that associated with drainage lines.

Figure 7 depicts the distribution of these landform zones in the coastal area between Windy Harbour and Albany.

Site C is located within a broad tract of land mapped at scale 1:100,000 as swampy terrain, and described as Walpole land unit comprising flat to gently undulating benches with some shallow dissection. Figure 8 presents an extract from the regional soil/landform map developed by Churchward *et al.* (1988).

At a finer scale of description, the site may be described as being near the crest of a broad, gently sloping sandy bench. A shallow dissection supporting a local small-scale drainage line lies to the immediate east, beyond the site.

Figure 9 shows that the highest point on the site is located in the north east corner at an elevation of 30m. There is a very slight sandy ridge running through the centre in a south-south-west direction. The site slopes towards both the south east to an elevation of approximately 25.5m, and to the west to an elevation of approximately 26m.

3.1.3 Geology

Walpole is located within the Albany-Fraser Province (a geological province) of the Ravensthorpe Ramp (a physiographic division). This is a subdivision of the Great Plateau (CALM, 1992).

The Albany-Fraser Province is a Proterozoic mobile belt that girdles the southern margin of southwestern Australia. The rock types associated with this province include leucocratic granulite, orthoquartzite in association with gneiss rocks, quartz-feldspar-biotite-garnet gneiss, granite orthogneiss, layered gneiss, proterozoic migmatite, and proterozoic granite (Wilde and Walker, 1984).

The Pemberton – Irwin Inlet Geological Series 1:250,000 map (Wilde and Walker, 1984) and explanatory notes describe the site and its surrounds as follows:

- the site is mapped as Unit Tg, which is described as Pliocene estuarine, lagoonal and shallow marine deposits, strongly lateritised in parts, conglomerate, sand and clay (includes and overlies some Werillup formation of the Plantagenet Group: preserved mainly along drainage lines); and

- to the east, north and west of the site the land is mapped as unit Cw and is described as white colluvial sand, in various landscape positions, derived from earlier Tertiary deposits (especially Plantagenet Group).

Underlying bedrock is described as layered gneiss or quartzite.

3.1.4 Soils

The Deep River - Nornalup 1:100,000 Landforms and Soils Sheet maps the Walpole area as podzols and deep sands associated with the flat to gently sloping benches with some shallow dissections, and humus podzols on the broad drainage floors in the lower reaches of streams. Humus podzols usually have dark, often cemented, B horizons at 1.5 to 2m (Churchward *et al.*, 1988).

The soil type of the site is described as Walpole land unit comprising podzols and deep sands. Land to the immediate west is mapped as Kordabup Unit which is described as humus podzols situated in the broad drainage floors of the lower reaches of streams. Figure 8 depicts the distribution of landform/soil units according to Churchward *et al.* (1988).

Soil profile data gathered from the site by soil auger and backhoe excavations during the investigation phase of the project are in direct accordance with regional descriptions provided in the published geological and soil/landscape technical literature.

Appendix B provides soil logs from test pits excavated on the site by Wood and Grieve Engineers during 1997, and a location map for the test pits.

The soil profile logs for the site indicate the following typical soil profile:

- a peaty or light grey topsoil to a depth of approximately 400-500mm overlying light grey sand to an approximate depth of 500-1100mm;
- grey/brown sand to 1900-2000mm; and
- ferruginous hardpan at 1900 to 2000mm.

At the eastern extent of the site, extending beyond the site into the valley and drainage line located approximately 150m to the east, the land is mapped as Walpole land unit, consisting of humus podzols - grey black sands with high organic content (Churchward *et al.*, 1988).

Figure 10 presents a topographic/soil profile cross section for the site interpolated from data gathered from the site.

3.1.5 Surface Water Hydrology

The Walpole area and it's hinterland is drained by three major rivers, the Deep, Walpole and Frankland, as well as several minor creeks and drainage lines. The Walpole River, Junior, TP and Collier Creeks flow into the Walpole Inlet which joins to the Nornalup Inlet, which also receives flows from the Deep and Frankland Rivers and remains open to the sea.

Figure 11 depicts the surface water drainages within the Walpole area and beyond.

The Deep River is fresh water, however the Frankland River is brackish with rising salinity levels due to clearing in the catchment (CALM, 1992).

Measurements of surface water quality carried out during February 1998 showed that the Walpole River and Junior, TP and Collier creeks carry low salinity waters.

The site is flat and sandy and does not display any defined surface drainage channels. It is unlikely that the site produces any significant surface runoff except possibly after sustained heavy winter rainfall, in which case some sheet flow may exit the site, flowing to the west and south west.

The nearest drainage line (which is unnamed but is referred to here as TP creek for convenience) is located approximately 150m east of the site.

TP creek rises on farmland approximately 0.4 km north of the site, and discharges to the Walpole Inlet, located approximately 1.5km to the south. The drainage line is well vegetated and carries groundwater baseflow from the catchment during summer and baseflow plus surface runoff during winter.

3.1.6 Groundwater

Soil profile test pits established by Wood and Grieve (see Appendix B) demonstrate that the site supports a very thin unconfined aquifer with a water table in the superficial sands at around 1.5m below ground level (April, 1997), with a ferruginous hardpan at around 2m below surface level providing an underlying confining layer.

Several groundwater level measurements from 6 piezometers installed throughout the site by Wood and Grieve have been made over the last 12 months.

These measurements show that in the western parts of the site, in the areas mapped as Tp (geology) and Walpole (soil unit) the unconfined aquifer has a watertable at around 1.5 to 2.0m below the ground surface (during summer) and that the surface of the water table slopes to the west, with discharge into a broad drainage line (see Figures 9 and 10).

On the eastern margin of the site, corresponding to areas mapped as Cw (geology) and Walpole (soil unit), the deep quartz sand profile is dry and the underlying basement rock does not support a shallow perched aquifer or a ferruginous hardpan except in low lying land adjacent to TP creek, where groundwater was encountered at 1.5 m below ground level.

Due to an absence of deep drilling logs for the area, published detailed information describing the hydrogeology of the underlying bedrock is not available.

3.2 Biological Environment

3.2.1 Regional Vegetation

The vegetation of the region lies within the Nornalup System (Beard, 1980) / Karri Forest Zone (Smith, 1972). Plant communities are closely linked to the landform and soils and are predominantly influenced by the very high rainfall levels of the region and the associated soil hydrology.

The Nornalup System has been defined as occurring within "plains of leached sand which are seasonally swampy, from which emerge numerous isolated knolls and hillocks" (Smith, 1972). Within the Pemberton-Irwin Inlet area, Smith has classified sixteen structural vegetation units comprising nine Forest/Woodland units and seven Scrub/Heath/Shrubland/Swamp units. However, trees and shrubs, although structurally dominant, only make up a small proportion of the flora. Within the surveyed sector of the coastal high rainfall belt between 1200 and 1400mm, (from Broke Inlet to Parry Inlet and north to latitude approximately 34°50' South) approximately 70% (1,906km^2) of the area comprises landforms of swampy terrain which experience prolonged flooding or waterlogging (Figure 7), of which over 90% of those landform units support sedgeland communities (Figures 12A and 12B) (Churchward *et al.,* 1988).

The sedgeland communities (S) are characterised by *Evandra aristata*, *Leptocarpus scariosus*, *Anarthria scabra*, *Lepidosperma persecans*, *Lygnia barbata* and *Anarthria prolifera*. In some areas the sedgeland is clearly defined, in other areas it merges with heath forming pockets of sedgelands in the wettest part of low open woodland (C4) of stunted jarrah and paperbarks with heath understorey (Smith, 1972).

3.2.2 Site Vegetation

The site is located on a gently undulating, elevated sandplain landform adjacent to a broad valley basin to the west and a seasonal drainage system located in a shallow sandy valley which flows into the Walpole Inlet. The landform contains elements of both the Kordabup and Walpole landform unit described in Churchward *et al.* (1988). Soils are typically humic podzols, grey to dark grey sands containing a cemented B Horizon at depth.

The Walpole landform unit typically contains sedgeland/*Agonis parviceps* scrub in waterlogged soils and *Allocasuarina* Woodland in deeper sandier soils.

Specialist botanical survey of the site was carried out in February 1997 by consultant botanist Dennis Backshall (Backshall, 1997). Descriptions of the vegetation and flora presented here are derived from the survey report.

Vegetation

The most extensive vegetation structural type at the site is a low sedge-heath community. Common heath shrubs and sedges present in the vegetation include *Agonis parviceps, Anarthria prolifera, Anarthria scabra, Adenanthos obovatus, Acacia myrtifolia, Andersonia caerulea, Amphipogon debilis, Boronia crenulata, Beaufortia sparsa, Burchardia umbellata, Dampiera linearis, Dasypogon bromeliifolius, Evandra aristata, Leucopogon obovatus, Leucopogon unilateralis, Lycinema ciliatum, Lyginea tenax, Leptocarpus sp., Melaleuca thyoides, Patersonia occidentalis, Johnsonia lupulina, Thysanotus multiflorus and Xyris lacera.* Stunted *Banksia ilicifolia* and *Banksia quercifolia* were observed on a low sandy rise.

Along the eastern margin of the site there occurs a low forest vegetation of *Eucalyptus marginata, Allocasuarina fraseriana, Agonis flexuosa* and *Banksia ilicifolia* over a shrub understorey of *Agonis parviceps, Kunzea suphurea, Pultenaea reticulata, Hibbertia hypericoides, Leucopogon capitellatus, Jacksonia furcellata, Melaleuca thyoides and*

Xanthorrhoea preissii. Small shrubs and sedges present include *Dampiera linearis, Adenanthos obovatus, Daysypogon bromeliifolius, Dianella revoluta, Opercularia apiciflora, Anarthria scabra, Anarthria prolifera, Conostylis aculeata, Loxocarya flexuosa* and *Lepidoperma sp.*

The vegetation of the site is generally characteristic of vegetation community types 2 (*Agonis parviceps* shrubland) and 7 (*Allocasuarina fraseriana* forest community) described for the Walpole-Nornalup National Park by Wardell-Johnson *et al.* (1989).

Conservation Flora

The Department of Conservation and Land Management Endangered Flora Database at Walpole was reviewed for conservation flora specific to the Kordabup and Walpole landform units. Nine species were known to be associated with these landforms, and are shown in Table 3 together with information on flowering period.

The species include *Alexgeorgea ganopoda, Andersonia auriculata, Amperea protensa, Boronia virgata, Microtis globula, Pterostylis turfosa, Schizaea rupestris, Sphagnum molliculum* and *Taraxis glaucescens*. Of these *Microtis globul*a is the only declared rare flora, the remaining taxa are priority listed. Five of the species are generally associated with wet swampy areas and three are associated with drier sandy sites similar to the project area.

The Department of Conservation and Land Management's Declared Rare and Priority Flora List of Western Australia was also reviewed for species known to occur on other landforms in the Walpole-Nornalup region, although they have not as yet been observed on the Kordabup and Walpole landforms.

Conservation flora listed include *Billardiera* sp. "Walpole", *Chamaexeros longicaulis, Gastrolobium brownii, Gonocarpus simplex, Restio crascens, Sphenotoma parviflorum, Stylidium mimeticum and Thelymitra jacksonii* (m.s.). Species associated with granite outcrops were not included.

None of the conservation species were observed to occur on the proposed project area during the February survey.

Table 3
Endangered Flora associated with the Kordabup and Walpole Landforms in the vicinity of Walpole

SPECIES	STATUS	FLOWERING PERIOD	FLOWERS REQUIRED FOR ID
Alexgeorgea ganopoda	P2	December-February	No
Andersonia auriculata	P2	N/A	No
Amperea protensa	P2	October-January	Yes
Boronia virgata	P3	September-February	Yes
Microtis globula	DRF	December-January	Yes
Pterostylis turfosa	P1	September-October	Yes
Schizaea rupestris	P2	June-January	Yes
Sphagnum molliculum	P2	N/A	No
Taraxis glaucescens	P3	September-April	No

3.2.3 Wetlands

The Walpole geographic region features the highest rainfall of the southwest, receiving around 1400mm/year. The very high rainfall, in combination with poorly drained soils with underlying cemented B horizons, have formed predominantly swampy and seasonally inundated terrain. This high level of moisture retention in the soils is predominantly due to the occurrence of hardpans or cemented layers from 1-2m below the soil surface, the high rainfall and low evaporation regime.

Due to the very high rainfall, low evaporation and poorly drained soils, wetlands within the Walpole-Nornalup region occur over all landform types, namely plateaux, hilly terrain and drainage slopes, low lying convex or concave plains and drainage floors, and broad swampy valleys. A total of 70% of the landforms of the Walpole area (from Broke Inlet to Parry Inlet) are classified as swampy terrain (Churchward *et al.,* 1988) (see Figures 12A and 12B).

Typical of the lower parts of the landscape in the Walpole region, the majority of the site comprises seasonally waterlogged soils which support sedgeland vegetation.

3.2.4 Habitats and Fauna

Site survey indicates that there are two main habitat types on the site; sedgeland plant communities on broad sandy benches, which form the main habitat type and Jarrah and

Sheoak (*Allocasuarina*) woodland which occupies the gentle sandy rise along the eastern margin of the site and extends to the east.

Comprehensive surveys have been conducted for the Walpole-Nornalup National Park which abuts the site (CALM, 1992). Given the similarity in habitat type, some species which occur within the Park may also potentially occur on the site.

3.2.5 Walpole and Nornalup Inlets

The Nornalup Inlet and Walpole Inlet are two linked coastal lagoons which, together with the tidal reaches of the Deep and Frankland Rivers, form an estuarine system. The small, shallow Walpole Inlet is linked to the larger, deeper Nornalup Inlet by a kilometre-long channel between steep rocky headlands. The Nornalup Inlet is connected to the ocean by a narrow channel to the west. To the east is a sand spit extending from Bellanger Beach, which never fully encloses resulting in a tidal estuary (EPA, 1988).

Surface water of the inlets is equal to marine salinity (35ppt) in the summer, but freshens greatly in the winter when the Deep and Frankland Rivers discharge a large volume of fresh water. The deep water of the Nornalup Inlet is seldom less than 30ppt salinity.

Limited water quality data is available for the estuary, however nutrient levels are generally higher in the Walpole Inlet than the Nornalup Inlet, probably due to inputs from the Walpole River and from septic tanks from the Walpole townsite (EPA, 1988). The Walpole Inlet has the potential to become eutrophic due to these inputs, it's shallowness, and restricted water exchange with Nornalup Inlet. An algal bloom occurred in the Inlet in 1990 which indicates that this estuary, on occasions, may be approaching assimilative capacity for nutrients (CALM, 1992).

3.3 Social and Economic Characteristics

3.3.1 Surrounding Landuse

The site is freehold land owned by DOLA and currently vested in CALM. Surrounding areas have the following landuses:

- Walpole-Nornalup National Park to the north and the east; and
- CALM depot to the south and west.

The Walpole Light Industrial Area is located south of the CALM depot.

At its closest boundary, the site is 500m from the Walpole townsite residential area, 1500m from west Walpole and the new development area (Boronia Ridge), and 1500m from the proposed future residential area to the north-east of the site (Wood and Grieve 1995). The closest farm residence, which is directly north, is 600m from the site (Department of Land Administration aerial photograph, 1993).

Figure 13 depicts land uses in the periphery of the site.

3.3.2 Aboriginal Heritage

Potential Aboriginal heritage issues associated with the proposed sewerage infill areas, pump station locations and the proposed wastewater treatment plant site were addressed through archaeological and ethnographic surveys by a specialist consultant.

In summary, the field surveys did not locate any Aboriginal cultural material or significant sites in the study area. Similarly, examination of archival material at the Department of Aboriginal Affairs found no record of Aboriginal sites in the vicinity (McDonald Hales and Associates, 1997).

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4.0 ENVIRONMENTAL IMPACTS AND MANAGEMENT

This section assesses the proposal in accordance with the environmental factors identified by Guidelines for the CER issued by the DEP (see Appendix C).

For each environmental factor and site specific factor, environmental impact assessment and management proposals are presented under the following headings,

(i) EPA Objectives and Additional Comment
(ii) Work Required for the Environmental Review
(iii) Assessment of Potential Impacts
(iv) Environmental Management Strategy and Management Plans
(v) Environmental Management Commitments

4.1 Terrestrial Flora – Vegetation Communities

4.1.1 EPA Objectives and Additional Comment

"Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities. Applies to area of proposal and areas of the national park directly adjacent."

4.1.2 Work Required for the Environmental Review

"Determine the significance of the vegetation on the preferred site which could be lost because of the construction of the WWTP. The vegetation's representation in existing conservation reserves should be discussed. Reference should be made to information provided in the appeal on level of assessment.

Determine the level of impact, indirect or otherwise, on the vegetation within the proposal area and adjacent National Park and indicate how these impacts will be managed."

4.1.3 Assessment of Potential Impacts

Section 3.2.1 describes the site in conventional botanical terms and notes that sedgeland communities on waterlogged sandy benches are common in the locality and region and are represented in the adjacent Nornalup National Park.

This section examines the site's vegetation with regard to the matters raised in appeals to the Works Approval assessment level. These included:

- the habitat is unusual, ie it contains a mix of species that are locally and regionally unusual;
- the vegetation is unique as a wetland type, i.e. combines characteristics of a sandy wetland vegetation suite and a sandy dryland vegetation suite;
- the site represents an important component of the variability in wetland vegetation assemblages.

As discussed in Sections 3.1.3 and 3.1.4, the site is located within the Walpole landform unit (Churchward *et al.,* 1988) which typically supports both sedgeland over winter-waterlogged, poorly drained soils and Jarrah/Sheok (*Allocasuarina*) woodland over deeper or drier sand. Elements of the Kordabup landform unit encroach on the west of the site.

The observed shift in vegetation structure and composition over a gradual topographic and soil profile change to higher/drier soil profiles is recognised as a catena.

The significance and representation of the vegetation communities on the site were assessed for the Windy Harbour to Parry Inlet coastal area by sampling during January 1998 of similar vegetation from 18 sites over six landform units described on maps presented in Churchward *et al.* (1988) and analysed for similarity of species composition.

The six landform units were:

- Angove;
- V_4 (Valley floor);
- Burnett;
- Quagering;
- Walpole; and
- Kordabup.

Particular attention was paid to sampling over the catena sequence in the Walpole landform units. Species lists and sampling locations are provided in Appendix D.

The findings of comparative analysis of species composition at the 18 sampling sites to determine whether the site supports unusual or otherwise especially valuable vegetation indicate as follows:

- the same vegetation communities which occur on the site were found in all other examples of the Walpole landform unit which were examined in the region;
- the species composition of the sedgeland communities was remarkably similar across four of the five landform units sampled and it is noted that each of the landform units containing similar sedgeland communities is commonly derived from Eocene Tertiary shallow deposits;
- *Melaleuca thymoides* (typical of well drained soils) and *Banksia quercifolia* (typical of poorly drained soils) occurred within each catena of the Walpole landform unit sampled;
- *Melaleuca thymoides* is also common to Jarrah Woodland of the Keystone and Barrow Landform Units (Churchward *et al.,* 1988);
- *Banksia quercifolia* is common and widespread and was found to occur associated with poorly drained soils over hardpan or clay in sedgelands of the Burnett, Quagering and Angove landform units (Appendix D), and has also been described as typical of swampy terrain within the Pingerup and Caldyanup landform units (Churchward *et al.,* 1988); and
- *Eucalyptus marginata* (Jarrah) is typically associated with sedgeland in all Walpole landform units sampled, and in the Quagering and Burnett landform units.

In conclusion, there is no evidence available from either published information, or following botanical survey and analysis, which supports the proposition that the site has special or unique values in regard to flora and vegetation. In contrast, the structural and floristic characteristics of the site are well represented in the region, including extensive areas in Walpole-Nornalup National Park.

Approximately 1ha of the sedgeland will need to be cleared for Stage 1 and when all future stages are constructed, 3-4ha would have been cleared.

Figures 12A and 12B show that on a regional basis, sedgeland communities equivalent to those found on the site characterised by *Evandra aristata*, *Leptocarpus scariosus*, *Anarthria scabra, Loxocarya flexuosa* and *Anarthria prolifera* (Smith, 1972) potentially occur over eight landform units between Broke Inlet and Parry Inlet and comprise 71% (1,020km^2) of the total mapped land area which was examined (around 1,437km^2), including the six landform units sampled for the vegetation survey.

For the Walpole landform unit sedgeland vegetation, comparison of the Churchward *et al.* (1988) maps to recent colour aerial photography indicates that:

- the original area of Walpole land unit was approximately 1,320ha;
- approximately 218ha of vegetated Walpole land unit remain;
- approximately 93ha of sedgeland occurs within the Walpole-Nornalup National Park (Figure 14).

Vegetation survey and analysis as described above confirms the preliminary assessments made during project planning and are summarised below.

- The vegetation on the site is not unique but is typical of the Walpole landform unit, which contains scrub, woodland and sedgeland, and which over 10% of the original plant community is represented in the Walpole-Nornalup National Park. Species claimed to be "diagnostic" of unique flora composition are common and widespread.

- The sedgeland vegetation is typical of the wetland sedgeland communities which occur over 71% in area of the landforms in the survey area between Broke Inlet and Parry Inlet, and has the same wetland vegetation assemblage as that occurring in four other landform units.

4.1.4 Environmental Management Strategy and Management Plan

The environmental management strategy for terrestrial vegetation was incorporated in the investigation and planning phase of the project and included selection of a site which does not support vegetation or flora with special conservation value. The detailed analysis presented here confirms the efficacy of this earlier work. The management plan for terrestrial vegetation to be implemented during the construction phase of the project will ensure that clearing within the site will be limited to the minimum area required to construct and locate the necessary items of WWTP plant and infrastructure and unnecessary damage to vegetation will be prevented by control of construction machinery and vehicle movements. Dieback hygiene protocols agreed with CALM will also be implemented.

4.1.5 Environmental Management Commitments

The Water Corporation will ensure that clearing of vegetation is limited to the minimum practical area required for construction of the WWTP and infrastructure through incorporation of clearing protocols, control of construction machinery and vehicle movements and dieback hygiene procedures in contracts let for the design and construction of the WWTP Stage 1, in consultation with the DEP and CALM.

4.2. Wetlands

4.2.1 EPA Objective and Additional Comment

"Maintain the integrity, functions and environmental values of wetlands. Applies to area of proposal and areas of the national park directly adjacent."

4.2.2 Work Required for the Environmental Review

"Determine the significance of the wetland on the preferred site which could be lost because of the construction of the WWTP. The wetland's representation in existing conservation reserves should be discussed. The significance of the wetland should be discussed in terms of its type based on an accepted wetland classification system. Reference should be made to information provided in the appeal on level of assessment.

Determine the level of impact, indirect or otherwise, on the wetland within the proposal area and indicate how these impacts will be managed."

4.2.3 Assessment of Potential Impacts

Wetlands are areas of seasonally, intermittently or permanently waterlogged soils or inundated land whether natural or otherwise, fresh or saline (Wetlands Advisory Committee; DCE 1977).

Due to the very high rainfall, the excess of annual rainfall over evaporation and poorly drained soils, wetlands within the Walpole-Nornalup region occur over all landform types, namely plateau, hilly terrain and drainage slopes, low lying convex or concave plains and drainage floors, and broad swampy valleys.

4.2.3.1 Definition and Classification of Wetlands

Inland wetlands are naturally classified on the basis of hydrology (permanence of water).

Additional criteria for sub-classification are generally formulated to the local regional characteristics and study objectives. For example, Paijmans (1978) in his feasibility report on the Australian National Wetland Survey concluded that main river channels did not constitute wetlands and should be excluded from the survey. In contrast, this is an inappropriate exclusion in the Pilbara region (Masini, 1988; Masini and Walker, 1989) where river pools are a significant part of the inland surface water resource. The use of indicator vegetation and water quality parameters were used in this study in correlation with persistence and frequency of surface water.

On the Swan Coastal Plain, classification of wetlands has been primarily based on permanence or seasonality of water (hydroperiod) and distinctiveness of boundaries (Hill *et al.,* 1996). However, a geomorphic approach has also been applied relating to cross sectional shape (WAWA, 1992), leading to seven major wetland types as presented in Table 4.

Table 4

Wetland Types Based on Geomorphology and Cross Section

Water Permanence	Cross-Sectional Shape		
	Basin	Channel	Flat
Permanent	Lake	River	-
Seasonally flooded	Sumpland	Creek	Floodplain
Seasonally waterlogged	Dampland	-	Palusplain

In areas of higher rainfall (e.g. Southern Coastal Plain between Blackwood and Nornalup Estuaries) where wet areas are extensive and have less defined boundaries, the use of cross-sectional shape and geomorphology is less useful as a classification criteria. In a study conducted in 1996, geomorphologists V & C Semeniuk Research group classified the wetlands of this area on the basis of geophysical attributes. In this study, the underlying Quaternary and Tertiary geology were used as a primary framework to define "consanguineous suites". In addition, the geomorphological term "paluslope" was introduced to describe a "seasonally waterlogged slope". The difference between a paluslope and palusplain other than grade was not defined.

However, wetland categories generated with this level of emphasis on the underlying geology or geomorphology, at the exclusion of other ecological parameters, may not necessarily reflect the surface features of the wetlands. "Wetland" categories may therefore be simply an expression of "geodiversity", even though similarities between categories in terms of hydrological expression, biodiversity, vegetation communities, habitat values and ecological function can and do occur. Within the Swan Coastal Plain for example, single vegetation communities can occur across different landforms and "consanguineous suites", being predominantly differentiated by depth to groundwater and soil moisture rather than geomorphology (Gibson *et al.,* 1994).

Within the high rainfall Walpole - Nornalup regions (between Broke Inlet and Parry Inlet and north to latitude 34°50') a total of 71% (1906km^2) of the total land area is comprised of landform units which contain swampy terrain. Although Churchward *et al.* (1988) identify wetlands with distinctive boundaries (ie: rivers, creeks, lakes, permanent swamps, seasonal swamps, and ephemeral swamps) which tend to function as drainage channels and sumps, most of the area contains poorly drained tracts, drainage slopes and broad drainage floors which either have a shallow unconfined watertable and/or contain a hardpan layer or basement bedrock close to the surface and are seasonally waterlogged. These areas are mainly identified by the presence of sedgeland/heath vegetation complexes. Direct survey and soil map analysis concluded that these complexes are generally indiscriminate in their location with respect to geomorphology (paluslope or palusplain) or landform unit.

4.2.3.2 Significance of Project Site Sedgeland or "Wetland"

As discussed previously, the vegetation which will be affected by the construction of the WWTP is described as sedgeland located on a gently sloping seasonally waterlogged sandy bench.

Appeals to the Minister for the Environment regarding the EPA assessment level claimed that the site is described as a "palusmont" which has regional and statewide significance as an unusual wetland type. The following comments derive from investigations carried out for this CER to examine this proposition, including the vegetation analysis, soil profile examinations at a range of locations between Windy Harbour and Parry Inlet and analysis of existing soil/landform maps published by Churchward *et al.* (1988). Appendix E presents the findings of soil profile and shallow water table investigations.

- The term "palusmont" has not appeared previously in peer reviewed literature. Nevertheless, the term may be used to describe a "hill-based" wetland.

- The site is mapped as Walpole landform unit which is described as forming flat to gently sloping sandy benches. The topography of the site ranges from 30mAHD at the highest point in the north east of the site to 25.5mAHD at the southern and western boundaries; a relief of 4.5m.

- Land areas with topographic height and local relief exist within the site, which may be described as sandy benches or rises which slope away gently on several or all sides. These characteristics are common throughout the region particularly within the Angove and Quagering landform units.

- Areas of sedgeland vegetation situated on flat, gently sloping, convex or concave sandy benches comprising 1 to 2m of sand or silty sand overlying a confining layer and supporting a thin aquifer which has a perennial shallow water table are common in the coastal region between Broke Inlet and Parry Inlet.

- The claim that the site is sustained by local subartesian upwelling is not supported by any data. In contrast, the available data for the site including soil profile logs, water table measurements and flow pattern analyses drawn from topographic cross sections of the site suggests that the shallow groundwater is maintained by high rainfall, low evaporation and very low gradients at the land surface and the surface of the underlying bedrock or confining layer. Aquifer recharge is high and drainage to the inlet and local streams is low due to low gradients causing persistent high water table levels.

- Assessment of shallow soil profiles and water tables at selected coastal sites between Windy Harbour to Parry Inlet as reported in Appendix E indicate that similar hydrological processes occur extensively throughout the region (see Figure D, Appendix D). Each of the landform units containing equivalent topographic soil/profile settings and hydrological processes is derived from Eocene shallow marine deposits.

- Direct site survey including soil augering, floristic sampling and correlation of geological and landform/soil map data indicate that the representation within Walpole-Nornalup National Park of areas which display equivalent hydrologic processes to Site C may be generally depicted as shown on Figure 14. Appendices D and E describe and locate areas in the region where sampling has shown equivalent soil profile/hydrologic conditions to Site C.

In summary the findings of the investigations and analysis presented here conclude that Site C does not present hydrologic processes which are unique and therefore the project can meet the EPA's objectives for this factor.

4.2.4 Environmental Management Strategy and Management Plans

The environmental management strategy for this factor has been incorporated in the investigation and planning phase of this project. The strategy incorporated the objective of selecting a site for the WWTP which did not possess significant or unique conservation values in regard to wetland characteristics, or hydrogeological processes.

The conclusions made during the project investigation and planning phase were that Site C did not display any hydrogeological process characteristics or attributes which were not extensively represented elsewhere in the region, particularly in the adjacent National Park, and was therefore an acceptable site.

Environmental management planning for the site in regard to maintenance of hydrogeological processes, will be implemented during the detailed design and construction phase of the project. This management planning incorporates the following objectives:

- Construction of the WWTP structures and associated services so that new physical structures do not impede the lateral flow of shallow groundwater such that the changes to natural flow of shallow groundwater are minimised.

- Direct local recharge of collected stormwater from buildings, roads and other impervious surfaces to the superficial soil profile using appropriate infiltration structures including soak wells and linear swale drains, so as to minimise changes to groundwater recharge within the site.

4.2.5 Environmental Management Commitments

The Water Corporation will issue tender documents for the design and construction of the WWTP Stage 1 which incorporate specifications requiring detailed design and construction of WWTP and stormwater management structures which minimise changes to existing shallow groundwater flow and groundwater recharge in consultation with the DEP.

4.3 Estuaries

4.3.1 EPA Objectives and Additional Comments

"Maintain the integrity, functions and environmental values of estuaries. Applies to area of the Walpole/Nornalup Inlets."

4.3.2 Work Required for the Environmental Review

"Determine the level of impact, indirect or otherwise that the proposal will have on the Walpole/Nornalup Inlets and indicate how these potential impacts will be managed."

4.3.3 Assessment of Potential Impacts

The impact of establishment and operation of the proposed WWTP on Walpole and Nornalup Inlets is assessed here by comparing the nutrient discharges to Walpole Inlet, before and after implementation of the proposal. Whilst this CER is concerned only with Stage 1 of the treatment plant, nutrient loads from Stages 2 and 3 and also examined in order to consider longer term impacts.

4.3.3.1 Nutrient Discharges from Walpole Townsite's Septic Tank/Leach Drain Systems

Walpole currently relies on conventional septic tank/leach drain systems which discharge minimally treated wastewater into the soil and shallow groundwater system which then discharges into the adjacent Walpole Inlet.

Nutrient removal during effluent percolation through the soil profile is expected to be minimal because the nutrient concentrations in the septic tank outflow will be very high and the shallow receiving sediments are comprised of a thin layer of siliceous sands over low permeability sediments (refer Section 3.1). When winter rainfall saturates the superficial sediment profile, leach drain discharges may be carried laterally to surface drainage systems which discharge to Walpole Inlet, in addition to the groundwater discharge.

Anecdotal references to failing or poorly operating leach drain systems in the townsite, particularly during wet winter weather, have been supported by measurement of high nutrient contamination in stormwater which flows into the Walpole Inlet. These samples were collected by this firm and the data is presented in Table 5 and the sampling locations in Figure 11.

The magnitude of current phosphorus and nitrogen export to Walpole Inlet from existing septic tank/leach drain systems in the townsite may be estimated as set out below.

Volumetric effluent production rates used in the calculations are consistent with those used for design purposes for the wastewater treatment plant.

It has been estimated as a part of Stage 1 that 298 lots within the existing townsite will be connected as a part of the infill sewering program (Wood and Grieve, 1996). Each lot is estimated to support 3.5 persons, yielding a total potential population of 1,043 persons. The design per capita rate of wastewater production is 180L/day, which yields a potential wastewater production volume of 188,000L/day.

This figure may be used as an estimate of the potential hydraulic loading of wastewater discharges from existing septic tank/leach drain systems to the soil/groundwater system within the existing townsite. In combination with information describing nutrient concentrations in septic tank discharges, the hydraulic loading estimate can be used to develop an annual nutrient loading estimate from these systems.

Typical accepted figures for nutrient concentrations in septic tank outflows are 12mg/L for phosphorus and 50mg/L for nitrogen (Gerritse *et al.,* 1990, Whelan *et al.,* 1981). These figures yield potential nutrient loading to the soil/groundwater system of 2.25kg/day for phosphorus and 9.4kg/day for nitrogen, which equate to annual potential loading of nutrients to the soil/groundwater system of approximately 821kg of phosphorus and approximately 3,431kg of nitrogen.

(i) Maximum Potential Annual Nutrient Load

The highest potential nutrient load to the Walpole Inlet is 100% of the loading of septic tank/leach drain discharges to the soil/groundwater system, which would occur in the event that no nutrient removal takes place during groundwater and stormwater discharge to Walpole Inlet. These circumstances would yield annual export of 821 kg of phosphorus and 3,431 kg of nitrogen.

(ii) Typical Potential Annual Nutrient Load

Four stormwater samples from drainage flows from the Walpole townsite to Walpole Inlet were collected in October 1993. Figure 11 shows sampling locations and Table 5 lists the phosphorus and nitrogen concentrations found by analysis. The stormwater samples exhibited very high nutrient concentrations. There are no other known specific sources of nutrients in the townsite and the data tend to confirm septic tank/leach drain discharges as a source of nutrient export to the inlet.

Table 5
Nutrient Concentrations in Walpole Stormwater - October 1993

Sample	Total P mg/L	Total N mg/L
L51	0.838	10.203
L52	1.084	3.942
L53	0.722	67.323
L54	1.660	67.323
Average	**1.076**	**37.197**

See Figure 11 for sampling locations.

If the dilution factors indicated by the ratio of septic tank nutrient concentrations to measured stormwater concentrations are taken as an estimate of the proportion of nutrients applied to the soil/groundwater system which are transmitted to Walpole Inlet, the following annual loadings may be derived:

- Average phosphorus concentration from four samples was 1.08mg/L which represents an export proportion of 9% of the applied phosphorus in septic tank leachates (12mg/L). This yields a daily loading of 0.2kgP/day (188,000L x 1.08mg/L), and an annual loading of 74kg of phosphorus (0.2kg/day x 365 days).

- Average nitrogen concentration from four samples was 37mg/L which represents an export proportion of 74% of the applied nitrogen in septic tank leachates (50mg/L). This yields a daily loading of 7kgN/day (188,000 L x 37mg/L), an annual loading of 2,555kg of nitrogen (7kg/day x 365 days).

It is recognised that this method of estimating nutrient export is based on only a few samples and makes no account of annual stormwater discharge volumes or variations in stormwater concentrations, and that other scattered water quality data may also be available. However the outcome of the analysis, which indicates export potential of about 9% and 74% of phosphorus and nitrogen respectively, is generally consistent with contemporary scientific views on the transmission of nutrients from septic tank discharges through shallow siliceous sand soil profiles (Gerritse *et al.,* 1990).

In general terms, the export of phosphorus and nitrogen to Walpole Inlet from existing septic tank/leach drain systems is likely to be in the order of the estimates set out below:

- phosphorus: 74 - 821kg /annum;

- nitrogen: 2,555 - 3,431kg/annum.

Further, the actual loadings may be near the upper limit of the estimates due to the limited nature of existing wastewater treatment in septic systems.

4.3.3.2 Nutrient Discharges from Stage 1 of the Wastewater Treatment Plant

The proposed wastewater treatment plant will collect wastewater from the existing septic tank/leach drain systems and will treat this wastewater as described elsewhere in this document. Treatment will remove nutrients from the wastewater to predictable levels, which can be used to develop nutrient output estimates for the WWTP.

The calculated nutrient loadings in discharges from Stage 1 of the wastewater treatment plant are presented below.

The Water Corporation will utilize the best available technology for this project and will seek wastewater treatment technology from suppliers to achieve maximum final effluent nutrient concentrations at 1mg/L phosphorus and 10mg/L nitrogen. These final levels are at the lower end of the achievable performance of BNR plants (Hartley, 1998).

Effluent from this first stage of treatment will then pass to a reed-bed treatment system (RBTS) where further nutrient removal will occur.

Review of performance of RBTS technology indicates that removal efficiencies of 36% for phosphorus and 95% for nitrogen are possible (Cooper and Hudson, 1988; Gersberg *et al.,* 1988; Watson *et al.,* 1988).

Consequently, the final nutrient concentrations in treated effluent which has passed through the wastewater treatment plant and RBTS can be estimated at 0.64mg/L for phosphorus and 0.5mg/L for nitrogen.

At these nutrient concentrations the final effluent resulting from treatment of 188m^3/day (68,620m^3/annum) of wastewater re-routed from existing Walpole townsite septic tanks would carry 0.12kg/day of phosphorus (44kg/annum) and 0.09kg/day of nitrogen (34kg/annum).

It is intended to discharge this final treated effluent into the dry sandy soil profile some 150m up-gradient of TP Creek.

Additional nutrient removal will occur as the effluent flows through the vegetated soil profile towards TP Creek and then travels downstream to the estuary through the heavily vegetated groundwater/surface water system in the drainage line. It is most difficult to quantify the amount of nutrient removal by this third process. However, the flow path of effluent to the estuary consists of approximately 1.5km of dense vegetation.

It is recognised that nutrient removal by polishing in the RBTS and during subsurface flow of discharged final effluent cannot be quantified with the same degree of reliability as for the first phase of treatment in the BNR plant. Therefore the comparison of nutrient discharge from existing septic tank systems to discharges from the Stage 1 WWTP assumes only that nutrient concentrations in discharged effluent will be 1mg/L P and 10mg/L N.

Therefore comparison of the effect of collecting existing septic tank discharges from Walpole townsite and treatment/disposal as proposed in Stage 1 (excluding the effects of RBTS treatment and nutrient removal following subsurface discharge) is summarised in Table 6 below.

Table 6

Comparison of Nutrient Discharge from Septic Tanks and Stage 1 WWTP

Wastewater Disposal Method	Load (kg/annum)	% Reduction
Existing annual phosphorus export potential - 298 lots on septic tank	74 - 821kg	-
Projected phosphorus export from Stage 1 WWTP - 298 lots on sewer	68kg	8 - 92
Existing annual nitrogen export potential - 298 lots on septic tank	2,555 - 3,431kg	-
Projected nitrogen export from Stage 1 WWTP - 298 lots on sewer	680kg	73 - 80

This conservative comparison of nutrient loadings to Walpole Inlet demonstrates that a very significant reduction will result from implementation of the proposal. It should also be noted that the proposal will remove current septic tank discharges which occur at the edge of the inlet, to a site which is 1.5km inland.

For the key nutrient phosphorus, the potential loading reduction will be between 8% and 92%. For nitrogen, the reduction will be between 73% and 80%.

4.3.3.3 Comparative Evaluation of Future Nutrient Loadings from Treated Effluent Disposal

In order to further gauge the significance of nutrient loadings to the estuary from Stage 1 of the treated effluent disposal, a comparison can be made of the total nutrient loadings from treated effluent to estimates of loadings from stream flows into the estuary. This section estimates the current annual nutrient loadings to Walpole Inlet from surface water flows which drain to the inlet.

The CALM 1:50,000 topographic map of the area (see Figure 11) indicates there are four water catchments which drain into Walpole Inlet. These are:

- Walpole River;
- Junior Creek;
- An unnamed creek (which will receive groundwater discharge containing treated effluent from the infiltration structure and is referred to as TP creek here for convenience);
- Collier Creek.

The Environmental Protection Authority document "Estuaries and Coastal Lagoons of South Western Australia-Nornalup and Walpole Inlet" (EPA, 1988), lists a figure of $76km^2$ for the catchment areas of the Walpole River and an average annual total runoff for the catchment of 91mm. The CALM 1:50,000 topographic map indicates that the catchment area of the three remaining drainages is approximately $25km^2$.

The total catchment area of the Walpole Inlet is approximately $100km^2$ and the annual average inflow of surface water can be calculated by multiplying the catchment area by the annual runoff. This yields an estimate of approximately $9.1 \times 10^7 m^3$ for the surface water discharges to Walpole Inlet.

Estimation of nutrient loadings within these flows is a more difficult and complex task. The 1988 EPA document provides some very limited data on water quality for Walpole River which was collected in 1975. No other published information on nutrient concentrations for streams entering Walpole Inlet has been located. Enquiries to other likely sources of data (Water and Rivers Commission, Albany Waterways Management Authority, Murdoch University) did not uncover further information.

In order to at least extend the historical data, two water samples were collected for this project from each of the streams which drain into the Walpole Inlet in January, 1998. The stream sampling results are presented in Table 7 and sampling locations are shown on Figure 11. Samples were analysed for phosphorus and nitrogen to assist in developing a broad <u>indication</u> of nutrient loads from these streams to the Walpole Inlet. It is recognised that a rigorously developed sampling programme which covers all seasons and accounts for flow variations is required to develop an accurate estimate and the collected data are only put forward as broad (but nonetheless useful) estimates.

The average annual inflow of surface water multiplied by the average nutrient concentration in the streams leading into Walpole Inlet measured by sampling for this CER give a general indication of annual nutrient loads to the Walpole Inlet. The estimated nutrient loads are as follows:

- Total Phosphorus 11,800kg/annum (9.1×10^{10}L x 0.130mg P/L)
- Kjeldahl Nitrogen* 90,400kg/annum (9.1×10^{10}L x 0.993mg N/L)

* Note: Kjeldahl Nitrogen includes organic nitrogen species and ammonium, but not nitrate and nitrite. Therefore this measurement of nitrogen is lower than measurements of Total Nitrogen which include all nitrogen species.

Table 7
Nutrient Concentrations in Samples taken from Streams leading into Walpole Inlet

Location	Site No.	Total Phosphorus mg/L	Kjeldahl Nitrogen mg/L	Electrical Conductivity mS/cm	pH
Walpole River	W1	0.045	0.756	3802	8.2
	W2	0.058	0.905	58.4	8.1
Junior River	W12	0.046	0.440	0.8	8.8
	W5	0.406	3.130	0.6	8.4
TP Creek	W13	0.017	0.213	0.8	8.1
	W14	0.028	0.240	0.9	7.7
Collier Creek	W15	0.309	1.265	0.4	7.3
Average	-	**0.130**	**0.993**	-	-

See Figure 11 for sample locations.

Earlier sections of this report indicate that when the backlog sewer program diverts current septic tank flows to the treatment plant, the nutrient loads from Stage 1 on the strategy will fall to approximately 68kg/annum of phosphorus and 680kg/annum of nitrogen.

Data presented above for the river and stream loadings to Walpole Inlet indicate that the projected treatment plant nutrient loadings are very small in comparison to broad estimates of existing surface water loadings:

- maximum total annual phosphorus loading expected from Stage 1 is 0.6% of current surface water loading; and
- maximum total annual nitrogen loading expected from Stage 1 is 0.75% of current surface water loading.

4.3.3.4 Nutrient Discharges from Stages 2 and 3 of the Wastewater Treatment Plant

In the future, the flow to the treatment plant will increase as the density of the Walpole townsite increases and as development at Boronia Ridge progresses.

The scope of the wastewater treatment strategy proposed by the Water Corporation is for the establishment of up to three 200kL/day wastewater treatment modules comprising extended aeration/activated sludge plants.

Whilst Stage 1 of the treatment plant will initially dispose treated effluent by soil infiltration, future stages will dispose treated effluent by irrigation to a *Eucalyptus* woodlot. Negotiations to obtain access to an existing bluegum woodlot located to the north of Walpole are currently underway. Treated effluent from Stage 1 will be diverted to woodlot irrigation when a site is available and when flows are sufficient to justify the expense of establishing the infrastructure. (The proposal to establish the woodlot irrigation facility will be separately referred to the EPA for assessment).

The irrigation strategy for the woodlot will apply treated effluent at a rate equal to the evapotranspiration potential of the woodlot, such that surface runoff will not normally occur and any phosphorus not taken up by tree growth will be sorbed by the soil profile.

During winter, when rainfall equals or exceeds woodlot evapotranspiration potential, treated effluent will be stored in a surface impoundment, and will be recovered and used for irrigation the following summer.

Technical investigations to be carried out as part of the woodlot procurement will include studies of soil profiles and soil properties to confirm initial indications that the local lateritic soils have very high phosphorus sorption capacity. Furthermore, the woodlot will be designed and planted, based on contemporary modelling, to take up all delivered nutrients.

Export of nutrients from the woodlot into the Walpole Inlet from the WWTP at full development is therefore assumed to be nil.

The information and resultant conclusion presented here therefore confirms that the EPA's objective for this factor can be achieved.

4.3.4 Environmental Management Strategy and Management Plans

The environmental management strategy for wastewater treatment and disposal to be carried out so as to meet the EPA objective for the Walpole-Nornalup Inlet is embodied in the Water Corporation's proposal for Stage 1 of the Walpole Wastewater Scheme.

The proposal incorporates:

- recognition that Walpole and Nornalup Inlets require protection from nutrient contamination;
- application of best available technology for wastewater treatment using conventional engineered treatment plant;
- incorporation of effluent polishing for further nutrient removal using a constructed wetland system to be arranged in Reed Bed Treatment System format, which the international technical literature indicates is the best available design approach;
- selection of a WWTP site which is distant from Walpole Inlet and its contributing streams and rivers, compared to alternative sites; and
- disposal of final treated effluent by subsurface infiltration into a vegetated valley with deep unsaturated soil profiles and dense phreatophytic vegetation along a perennial stream line, where even further nutrient removal can be expected to take place.

The WWTP will be operated with an ongoing objective for optimum process efficiency with regard to nutrient removal performance.

4.3.5 Environmental Management Commitments

The Water Corporation will design, construct and operate Stage 1 of the Walpole Wastewater Scheme to maintain optimum process efficiency for nutrient removal and final effluent disposal by subsoil infiltration, and will monitor and report groundwater quality in the immediate receiving environment in accordance with DEP licence specifications to the satisfaction of the Pollution Control Branch of the DEP.

4.4 Odour Emissions

4.4.1 EPA Objectives and Additional Comments

"Odours emanating from the proposed development should not adversely affect the welfare and amenity of other land users. Applies to the Walpole townsite and surrounding community."

4.4.2 Work Required for the Environmental Review

"An odour study should be carried out to demonstrate that the Walpole community will not be adversely effected by odours emanating from the proposed treatment plant."

4.4.3 Assessment of Potential Impacts

4.4.3.1 Underlying Principles

Any wastewater treatment plant can emit odours at times under normal operation, but this is dependent on many factors. These include size of the plant, temperature and age of wastewater, and treatment process employed, among others.

The nuisance level of odours from wastewater treatment systems is subjective, being very dependent on the sensitivity of individuals to odours. Odour emissions can be measured and odour dispersion modelling can be carried out if the relevant data is available, but the level of acceptance by any community, defined as the threshold level, can only be set as a guide, even after extensive investigations.

Treatment plants are therefore generally provided with odour buffer areas, from which residential development should be excluded. These buffer areas are however, suitable for compatible uses such as for industry and for regional or public open space and parklands. These areas are defined by setting a specific distance from the facilities at which the odour dispersion would be reduced to the established threshold level under normal operating condition.

4.4.3.2 Wastewater Odours

Fresh wastewater has the odour of soapy dishwater. Once discharged to a sewer the dissolved oxygen which keeps it fresh and relatively odour free, is rapidly used up by the bacteria (aerobic) in the wastewater. When the oxygen is taken up, other bacteria (anaerobic) become active breaking down compounds and the wastewater becomes stale (septic) and foul smelling. The longer the wastewater is in the system prior to treatment, the greater the septicity. Wastewater should therefore be delivered to the treatment plant as quickly as possible, especially through pumping systems where oxygen is absent.

For the facility planned for Walpole, the wastewater will have a relatively short detention time in the conveyance system to the treatment plant. At the plant inlet the wastewater will have low levels of dissolved sulphides, and hence a low risk of releasing hydrogen sulphide, the dominant odour compound.

For the proposed plant a modern advanced treatment system is planned which utilises a biological process operating in an oxygen rich environment. The biological process may give rise to an earthy type odour, which may be of nuisance to some people. Generally, however, this is seldom detected for the process proposed here.

Over the past 30 years the Water Corporation has built up a large data bank of information on odour emissions, odour control and odour complaints. This has led the Corporation to produce standard guidelines for buffer distances for odour emissions. These distances are measured from the perimeter of the inner plant area and are very dependent on the size of the plant and on the treatment processes employed, as shown in Table 8 below.

Table 8

Water Corporation Buffer Distances for Wastewater Treatment Plants

Type of Plant	**Treatment Plant capacity (equivalent persons)**			
	< 1,000	< 5,000	< 50,000	> 50,000
Mechanical and biological systems	250m	500m	800m	1000m
Facultative pond systems	300m	700m	1400m	-
Treated wastewater disposal sites:				
- spray irrigation	250m	300m	400m	500m
- flood or channel irrigation	100m	100m	150m	200m

Similar guidelines are used elsewhere in Australia, such as by the Environmental Protection Authority of Victoria.

In recent years the Corporation has developed a more scientific approach utilising olfactometry and odour dispersion modelling using the AUSPLUME model, which is used Australia-wide.

Olfactometry is the science of quantifying odour intensity by the use of sensory means. Six member odour panels are used to express the strength of an odour by the number of dilutions required with clean air to reduce the original odour intensity to the threshold level. This threshold level is the level at which the odour impact will be minimal and acceptable to the community. Work undertaken to date has resulted in a threshold level of 5 odour units per cubic metre (OU's/m^3) at 99.5 percentile basis, ie the threshold level could be exceeded on 1.8 days per year.

AUSPLUME modelling of odour dispersion in the wastewater situation requires the input of local meteorological data and the odour emission rates from the various locations in the plant where odours could be released. The computer modelling then produces a series of contours of odour concentrations expressed in OU's/m^3.

4.4.3.3 Buffer Distance for the Proposed Walpole WWTP

In order to define the inner plant area, all the land required for the staged facilities in the long term has to be taken into account. This area includes the initial and all future treatment modules, the roofed sludge drying bed area and the office and laboratory building, as shown on Figure 5.

It has not been possible to undertake a computer run of the AUSPLUME model for the Walpole plant as the meteorological data required is currently not available and would take some twelve months of recording to secure. It should be noted that this data is more detailed than the normal weather data produced. The nearest location with suitable data is for Albany, some 100 kilometres to the east. It was considered that using this data for Walpole would result in incorrect findings as local conditions, geography and topography are critical to the modelling process, and differ considerably between Walpole and Albany.

The Bureau of Meteorology advises that wind data is not recorded at the Post Office or Forestry weather stations in Walpole. Limited existing wind frequency data recorded for Windy Harbour from 1984 to 1998 (70 kilometres to the west) and Denmark from 1965 to 1984 (55 kilometres to the east) is of little help for assessing the situation at Walpole. For example, the percentage of time of calm or no wind periods at Windy Harbour is 1-

2% and at Denmark 5-15%. Gentle winds (1 - 10kph) occur from all directions but predominantly southerly during summer and northerly during the winter.

The Water Corporation is continuing to use AUSPLUME modelling where possible, to refine the extent of odour buffer areas for wastewater treatment facilities. It should be noted that the output from the model is only as good as the data used. By continuously building up a larger data bank, greater reliance can be placed on the results. The ongoing work is mainly done by the use of external consultants, who also work for other water authorities in Australia. Although the results so far are limited, they do indicate that the currently defined guidelines provide effective buffer distances.

It is therefore considered that the 500m buffer distance around the inner plant area is acceptable for the proposed Walpole facility. On the basis of the site plan the areas covered by this exclude any present or future urban areas of the townsite. The principal land use in the buffer area is the Walpole - Nornalup National Park, some existing and proposed industrial lots, and a small area of rural land. Industry, rural park and recreation areas are compatible land uses for buffer areas.

On the basis of the standard Water Corporation guideline the buffer distance would be less than 500m for the ultimate 3,000 person plant. Allowing the full 500m is therefore considered conservative. The buffer area is shown on Figure 15. This 500m zone would also cover the 100m required for the reed bed and infiltration trench, although these sources are considered to have very low (if any) risk of odour.

It has been speculated that the rural land to the north of the site may be rezoned to rural-residential living. If this is the case, then a small section of this land occurs within the buffer and may be excluded from the rezoning.

It is therefore concluded, that apart from this small area, the odour buffer distance of 500m from the plant in the proposed location would ensure that the plant will not adversely impact on the welfare and the amenity of surrounding land users, nor adversely affect the wider community.

4.4.4 Environmental Management Strategy and Management Plans

The Water Corporation will operate the plant to meet the corporate objective of providing quality wastewater services to its customers. This will include meeting the operating licence conditions for the plant set by the DEP. Should odour nuisance from the plant be recorded outside the buffer area under normal operating conditions, the Water Corporation can implement odour control facilities at the plant.

4.4.5 Environmental Management Commitments

The Water Corporation will design, construct and operate the Stage 1 WWTP to meet the operating licence conditions for the plant set by the Department of Environmental Protection, and will implement odour control facilities in the event of unacceptable odour nuisance to the satisfaction of the DEP.

4.5 Groundwater Quality

4.5.1 EPA Objective

"Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines – National Water Quality Management Strategy]."

4.5.2 Work Required for the Environmental Review

"Groundwater under the site is likely to flow into the Walpole/Nornalup Inlets. The impact on the quality of groundwater should be determined and appropriate management proposed to ensure that contamination of groundwater will meet appropriate standards."

4.5.3 Assessment of Potential Impacts

Measurements were made in January 1998 of background nutrient concentrations in groundwater beneath the site and in the periphery of TP creek where groundwater outflow from the treated effluent infiltration area will tend to emerge. A number of groundwater samples from other locations in the Walpole townsite area were also taken and analysed for comparative purposes.

Groundwater samples were collected by hand augering to the water table and extraction of groundwater samples using a simple baler.

Table 9 presents the result of nutrient analyses of groundwater samples. Sampling locations are shown on Figure 16.

The data show that in general, groundwater flows in the vicinity of the site and in the general Walpole townsite area have acidic pH, low salinity (EC), and low to moderate phosphorus and nitrogen concentrations.

Table 9
Nutrient Analysis of Groundwater Samples

Site	Location	Total P (mg/L)	Kjeldahl N (mg/L)	Ammonium (mg/L)	E.C. (mS/cm)	pH
S5	Bore WG 1	0.053	2.711	1.092	0.1	5.1
S6	Next to TP Creek - Upstream	0.021	0.866	0.223	0.5	5.4
S3	Next to TP Creek – Downstream	0.012	0.307	0.114	0.6	6.7
G3	Groundwater at town foreshore	0.214	1.798	-	0.4	5.5
G2	Walpole Boat Ramp	0.131	2.999	-	0.4	5.5
G5	Coalmine Beach	0.014	0.489	-	1.7	4.3
	Averages	**0.074**	**1.528**	**0.476**	**1.13**	**5.4**

See Figure 16 for sampling locations.

In comparison, final effluent from the treatment plant is expected to have the following characteristics at its point of discharge into the soil profile:

- pH will be near neutrality;
- EC will be determined principally by the source water for town water supply, which is abstracted from the sandy superficial aquifer adjacent to the Walpole River at Plain Road, and should be similar to groundwater at the site;
- final phosphorus around 0.6mg/L; and
- final nitrogen around 0.5mg/L.

Discharge of final effluent into the shallow soil profile will be followed by subsurface flow through the sandy soil profile, east towards TP creek.

Analysis of geology, landform and soil profiles and the presence of *Eucalyptus marginata* woodland vegetation indicate that the soil profile in this area consists of deep siliceous sands (4-6m) overlying bedrock. The slope of the bedrock is inferred to be to the east at a grade approximating the surface grade, but becoming shallower towards the base of the valley and supporting the emergence of TP creek. A water table at 1.5m was found to the west of the creek at Site S3.

The soil profile and slope conditions indicate that treated effluent discharged into the soil profile will drain to the base of the sandy soil profile and flow across the surface of the bedrock in an easterly direction towards TP creek.

The addition of treated effluent to natural groundwater flow will cause a change in the quality of the groundwater. This change will be more pronounced during the dry months of the year, when treated effluent will form a larger portion of recharge to the aquifer than during the wet winter months when aquifer recharge will be high.

In the immediate vicinity of the infiltration structure, groundwater quality will be close to final effluent quality, and as downgradient flow occurs this quality will shift back towards existing background quality as the processes of biological water/nutrient uptake by overlying vegetation, dilution, filtration, cation exchange, oxidation and reduction proceed as groundwater flows through the sandy sediment at the base of the soil profile.

The change in groundwater quality which occurs due to treated effluent disposal by soil infiltration needs to be considered in the context of water quality guidelines for the existing and potential uses of the groundwater.

In this regard the following conclusions may be made:

- the existing superficial aquifer is very thin and does not present potential for potable use, therefore the NHMRC/ARMCANZ Australian drinking water guidelines are not applicable;

- although the *Eucalyptus* woodland vegetation which overlies the groundwater flow-path does not rely on shallow groundwater, maintenance of heath vegetation at the margins of TP creek is the core function of this localised groundwater flow system and therefore water quality guidelines for this objective would be appropriate; and

- the Australian Water Quality Guidelines for Fresh and Marine Waters do not contain any guidelines for groundwater maintenance of phreatophytic vegetation.

Assessment of the acceptability of groundwater quality changes due to treated effluent discharge must therefore anticipate the effect of the change in groundwater quality on the phreatophytic vegetation at the margins of the creek.

Comparison of final effluent quality to background shallow groundwater quality for the site and for the area indicates that the pH and EC of the groundwater and final treated effluent are likely to be similar, but that treated effluent should contain more phosphorus and similar or less nitrogen than groundwater.

As noted earlier, flow through the soil profile will subject the effluent to natural processes which will tend to shift groundwater quality towards background water quality.

The precise effect in terms of final effluent quality is difficult to predict. However, recognising that the effluent quality will be very high at the point of entry to the soil/groundwater system, it is reasonable to conclude that upon arrival at the zone of phreatophytic vegetation, following some 150m of flow through the soil profile, the groundwater will be close to background quality. The presence of slightly above background phosphorus concentrations is possible.

It is likely that the effect of this quality change may be expressed as increased biological productivity in the zone of phreatophytic vegetation adjacent to the creekline.

In this regard, it is reasonable to conclude that the ecosystem maintenance beneficial use of the groundwater will not be impaired, consistent with the EPA objective for this factor.

4.5.4 Environmental Management Strategy and Management Plans

The environmental management strategy for groundwater quality protection is encompassed in the proposal by the Water Corporation to utilize best available technology for wastewater treatment, and to dispose treated effluent in an area where the existing and potential beneficial uses will not be impaired.

The Water Corporation will design, construct and operate the Stage 1 WWTP to its optimum design treatment performance in accordance with this strategy.

The Water Corporation will monitor groundwater quality on the western margin of TP creek at quarterly intervals for the first five years of operation, and thereafter at intervals determined by experience, and report the findings to the DEP.

4.5.5 Environmental Management Commitments

The Water Corporation will design, construct and operate Stage 1 of the Walpole Wastewater Scheme to maintain optimum process efficiency for nutrient removal and final effluent disposal by subsoil infiltration and will monitor groundwater quality on the western margin of TP creek in accordance with DEP licence specifications, to the satisfaction of the Pollution Control Branch of the DEP.

4.6 Surface Water Quality – Watercourses and the Walpole/Nornalup Inlets

4.6.1 EPA Objective

"Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines – National Water Quality Management Strategy]."

4.6.2 Work Required for the Environmental Review

"An appropriate study of the surface water should be undertaken to determine the level of impact on water quality that may result from development. Where necessary, indicate the nature and extent of possible impacts, management and control strategy.. This should ensure that contamination of groundwater and the Walpole/Nornalup Inlets will be minimised." Cross reference to impact on groundwater may also be required.

4.6.3 Assessment of Potential Impacts

The portion of treated effluent discharged to soil infiltration which is not lost to evapotranspiration by the existing vegetation, or infiltration into underlying low permeability sediments and bedrock during its easterly subsurface flow, will emerge as groundwater baseflow into TP creek, adding to existing natural flows.

It is noted in Section 4.5 that as a result of the very high quality of the final effluent discharged to the soil profile, and the contaminant uptake processes which will take place during flow through the soil profile and aquifer, the quality of any treated effluent which emerges into the creek is likely to be very close to existing background groundwater quality.

Also, as is noted in Section 4.4, the overall effect of implementing Stage 1 of the project, including the collection of current septic tank/leach drain system discharges in the Walpole townsite and treatment to high standard by the Stage 1 WWTP, will be a significant reduction in nutrient loadings to Walpole Inlet.

As a further element to assessment of the potential impact of Stage 1 final effluent discharge, water quality data from existing surface water flows into Walpole and Nornalup Inlets may be compared to final effluent quality at the point of disposal, and to Water Quality Guidelines for Fresh and Marine Waters in Western Australia (EPA, 1993).

Table 10 presents the analytical results of water samples taken from each of the surface water drainages into Walpole Inlet during January 1998, and of stormwater samples collected in October 1993 from drains in the Walpole townsite which discharge directly to Walpole Inlet. Indicative concentration ranges proposed in the Water Quality Guidelines for Fresh and Marine Waters in Western Australia (EPA, 1993), at or above which water quality problems have been known to occur, are also presented in the table. Sampling locations are shown on Figure 11.

Final effluent will be discharged to the soil profile at around 0.64mg/L total P and 0.5mg/L total N. It is noted in Section 4.4 that treated effluent would be higher in phosphorus and lower in nitrogen than background groundwater quality. Further, although precise estimates of the effect of biological uptake and soil purification processes which will proceed during flow to TP creek can not be reliably predicted, at the point of discharge to TP creek groundwater baseflow nutrient concentrations would likely resemble natural background levels.

Table 10

Comparison of Nutrient Concentrations in Existing Surface Water Flows into Walpole Inlet with EPA Guidelines

LOCATION	SITE NO.	TOTAL P mg/L	TOTAL N mg/L
T.P Creek above Site	W13	0.017	0.213*
T.P Creek below Site at highway	W14	0.028	0.240*
Collier Creek	W15	0.309	1.265*
Junior River upstream	W12	0.046	0.440*
Junior River downstream	W5	0.406	3.130*
Walpole River at highway bridge	W1	0.045	0.756*
Walpole River at outfall to inlet	W2	0.058	0.905*
Walpole Stormwater Site L51	L51	0.838	10.203
Walpole Stormwater Site L52	L52	1.084	3.942
Walpole Stormwater Site L53	L53	0.722	67.323
Walpole Stormwater Site L54	L54	1.660	67.323
River and Stream Guidelines Advice EPA Bulletin 711		0.01 - 0.1	0.1 - 0.75
Estuary Guidelines Advice EPA Bulletin 711		0.005 - 0.015	0.01 - 0.1

* Note: Kjeldahl Nitrogen includes organic nitrogen species and ammonium, but not nitrate and nitrite. Therefore this measurement of nitrogen is lower than measurements of Total Nitrogen which include all nitrogen species.

See Figure 11 for sample locations.

Comparison of the data within Tables 9 and 10 indicates natural groundwater baseflow is generally similar in phosphorus but higher in nitrogen than surface water flows in TP creek.

Any change in groundwater baseflow quality resulting from effluent disposal needs to be considered in the context of the relative volume of surface water flow in TP creek to the volume of effluent disposed.

The surface catchment of TP creek is approximately 350ha. If the runoff factor for TP creek is similar to that asigned to the nearby Walpole River catchment (EPA, 1988), the total volume of stream flow (91mm average runoff/annum) would be 318,500m^3 (3,500,000m^2 x 0.091m = 318,500m^3). This compares to a maximum disposal rate from Stage 1 (1,000EP) of 65,700m^3/year. On average there will be a fivefold dilution of treated effluent entry to TP creek (if there is 100% transmission) by existing flows in the creek. It should also be noted that treated effluent will be diluted by natural groundwater flow following its discharge to the soil profile.

Comparison of the data in Table 10 to the final effluent concentrations, along with recognition of the anticipated additional nutrient reduction which will take place during aquifer flow, and the fivefold dilution by existing surface water flows in TP creek, leads to the conclusion that the quality of surface water discharge from TP creek to Walpole Inlet will not significantly change. Therefore treated effluent disposal can proceed whilst maintaining surface water quality to ensure that existing and potential uses, including ecosystem maintenance, are protected.

4.6.4 Environmental Management Strategy and Management Plans

The environmental management strategy for groundwater quality protection is encompassed in the proposal by the Water Corporation to utilize best available technology for wastewater treatment, and to dispose treated effluent by subsurface soil infiltration in an area where the existing and potential beneficial uses will not be impaired.

The Water Corporation will operate the Stage 1 WWTP to its optimum design treatment performance in accordance with this strategy.

The Water Corporation will monitor surface water quality in TP Creek at quarterly intervals for the first five years of operation, and thereafter at intervals determined by experience, and report the findings to the DEP.

4.6.5 Environmental Management Commitments

The Water Corporation will design, construct and operate Stage 1 of the Walpole Wastewater Scheme to maintain optimum process efficiency for nutrient removal and final effluent disposal by subsoil infiltration, and will monitor and report surface water quality in TP Creek in accordance with DEP licence specifications, to the satisfaction of the Pollution Control Branch of the DEP.

4.7 Other Environmental Factors – Construction and Operation

4.7.1 Assessment of Potential Impacts

Construction of the wastewater treatment plant will incorporate clearing of existing vegetation and topsoil, and construction of the physical elements of the plant, access roads, boundary fences and firebreaks using conventional heavy machinery and civil engineering methods. If inadequately controlled and managed, these operations may result in unnecessary clearing or damage to vegetation within the site or in the adjacent National Park. Soil imports also create the risk of dieback or weed introduction to the site.

It is possible to prevent these potential impacts by careful planning of clearing methods, fill selection and machinery movements prior to construction, and implementation of appropriate management controls during construction.

4.7.2 Environmental Management Strategy and Management Plans

Preliminary planning for this site has incorporated the objective of minimising clearing and unnecessary damage to vegetation within the site and particularly in the adjacent National Park by:

- utilising existing cleared areas as far as possible for plant and associated infrastructure; and
- including in the tender document issued for the project the requirement for the contractor to include in the tender (and abide by specifications) which require control of construction to minimise clearing and to confine machinery movements to the immediate confines of the construction site, and to manage soil and machinery movements in accordance with CALM dieback hygiene protocols.

4.7.3 Environmental Management Commitment

The Water Corporation will include in tender documents issued for design and construction of the Walpole Wastewater Scheme Stage 1 the requirement for the contractor to develop and implement clearing, machinery movement control and dieback hygiene protocols in accordance with CALM procedures, in consultation with DEP.

5.0 SUMMARY OF ENVIRONMENTAL MANAGEMENT COMMITMENTS

Environmental management commitments proposed by the Water Corporation in support of project implementation to meet EPA objectives for the nominated environmental factors are summarised as follows (see also Table 11):

1. The Water Corporation will issue tender documents for the design and construction of the WWTP Stage 1 which incorporate specifications requiring detailed design and construction of WWTP and stormwater management structures which minimise changes to existing shallow groundwater flow and groundwater recharge within the treatment plant site so as to maintain sedgeland vegetation in consultation with the DEP.

2. The Water Corporation will design, construct and operate Stage 1 of the Walpole Wastewater Scheme to maintain optimum process efficiency for nutrient removal and final effluent disposal by subsoil infiltration and will monitor groundwater quality on the western margin of TP creek and within TP Creek, to the satisfaction of the Pollution Control Branch of the DEP.

3. The Water Corporation will operate the Stage 1 WWTP to meet the operational licence conditions for the plant set by the DEP, and will implement odour control facilities in the event of unacceptable odour nuisance in consultation with the DEP.

4. The Water Corporation will include in tender documents issued for design and construction of the Walpole Wastewater Scheme Stage 1 the requirement for the contractor to develop and implement clearing and machinery movement control to minimise clearing and unnecessary damage to vegetation, and dieback hygiene protocols in accordance with CALM procedures, in consultation with the DEP.

Table 11

Summary of Proponent's Commitments

	Commitment	Objective	Action	Timing	Advice	Compliance Criteria
1	The Water Corporation will issue tender documents for Walpole WWTP Stage 1 with special requirements.	Minimise changes to existing shallow groundwater flow and groundwater recharge within the treatment plant site to maintain sedgeland vegetation.	Incorporate special design and construction requirements in tender documents for Stage 1 WWTP design and construction.	During tender document preparation and tender assessment.	DEP.	Maintain existing soil profiles below ground surface to ensure groundwater throughflow. Recharge stormwater on-site using soak wells and infiltration swales.
2	The Water Corporation will operate the Stage 1 WWTP to meet performance targets and license conditions.	Protect public health in the Walpole area and minimise contaminant discharge to Walpole Inlet.	Incorporate stringent plant performance requirements in tender documents and operate Stage 1 WWTP to maintain optimum process efficiency including monitoring and reporting of groundwater and surface water quality in the immediate receiving environment.	During tender document preparation and for the operational life of the WWTP.	DEP Pollution Control Branch.	Target Performance Phase 1 <1mg/LtotP <10mg/LtotN <10mg/LBOD$_5$ <20mg/LSS <150cfu/100ml
3	The Water Corporation will operate the Stage 1 WWTP to minimise odour generation.	Maintain odour characteristics within residential areas at ambient or non nuisance conditions.	The Water Corporation will operate the Stage 1 WWTP to meet licence conditions and will implement odour control in the event of unacceptable odour nuisance.	For the operational life of Stage 1 of the WWTP.	DEP Pollution Control Branch.	No odour complaints from nearby residential areas, liaison with DEP and implementation of odour control following confirmed odour nuisance from the WWTP.
4	The Water Corporation will issue tender documents for design and construction with special conditions.	Minimise clearing and unnecessary damage to vegetation and observe dieback hygiene protocols.	Incorporate special requirements for clearing and machinery movement control during construction.	During tender document preparation, site preparation, construction and operation.	CALM, DEP.	Clearing minimised, unnecessary vegetation damage eliminated, dieback hygiene observed.

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FIGURES

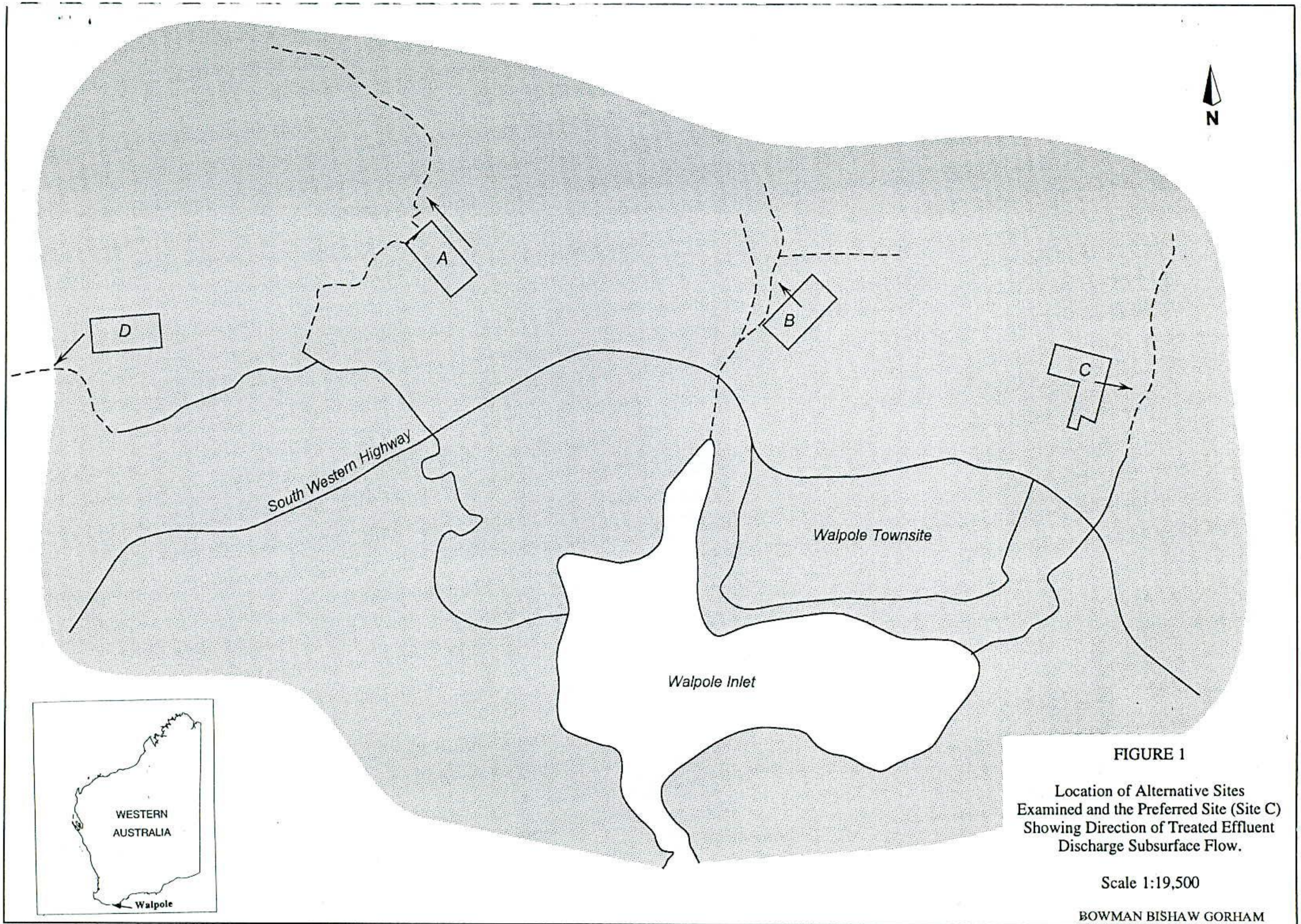

FIGURE 1

Location of Alternative Sites Examined and the Preferred Site (Site C) Showing Direction of Treated Effluent Discharge Subsurface Flow.

Scale 1:19,500

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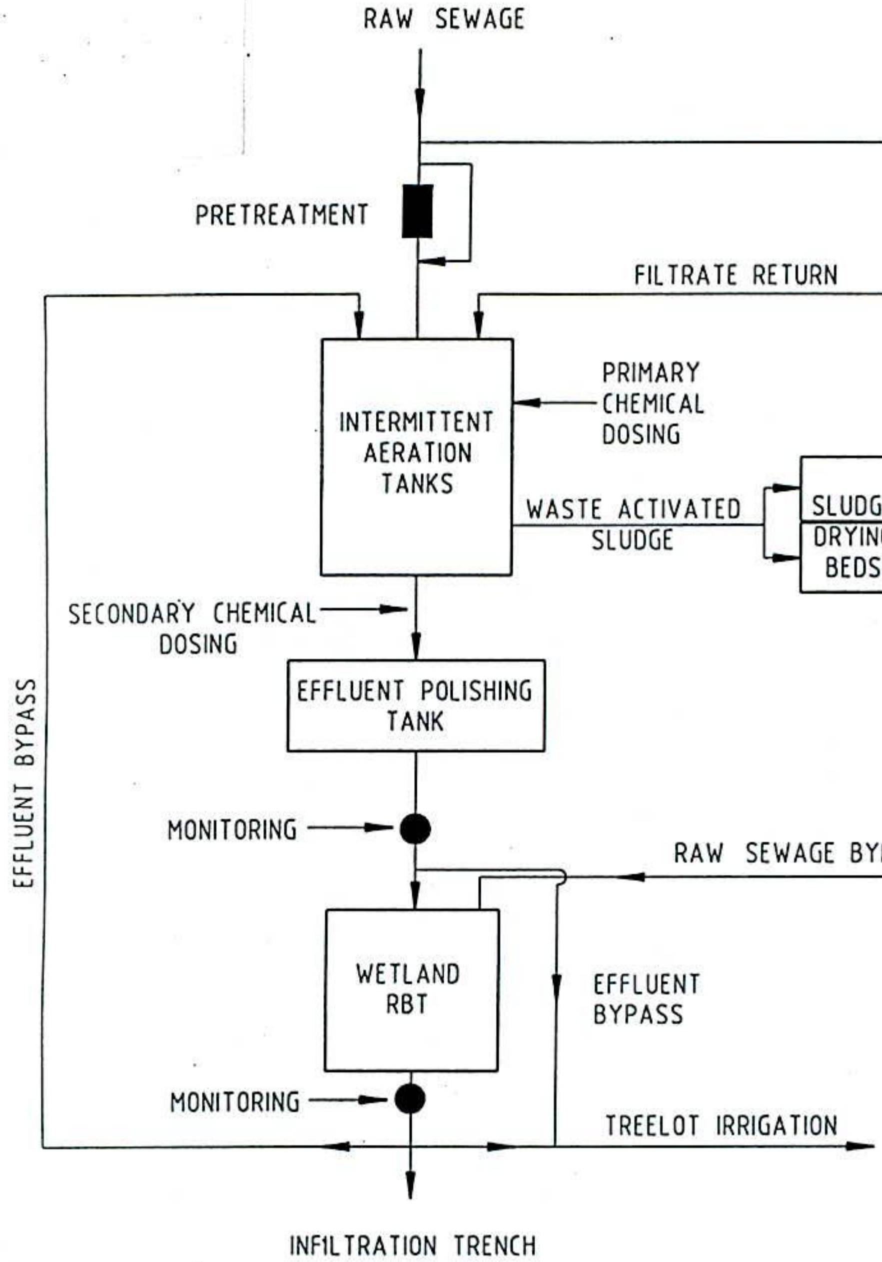

FIGURE 2

Indicative Flow Process Diagram - Stage 1

Source: Wood and Grieve

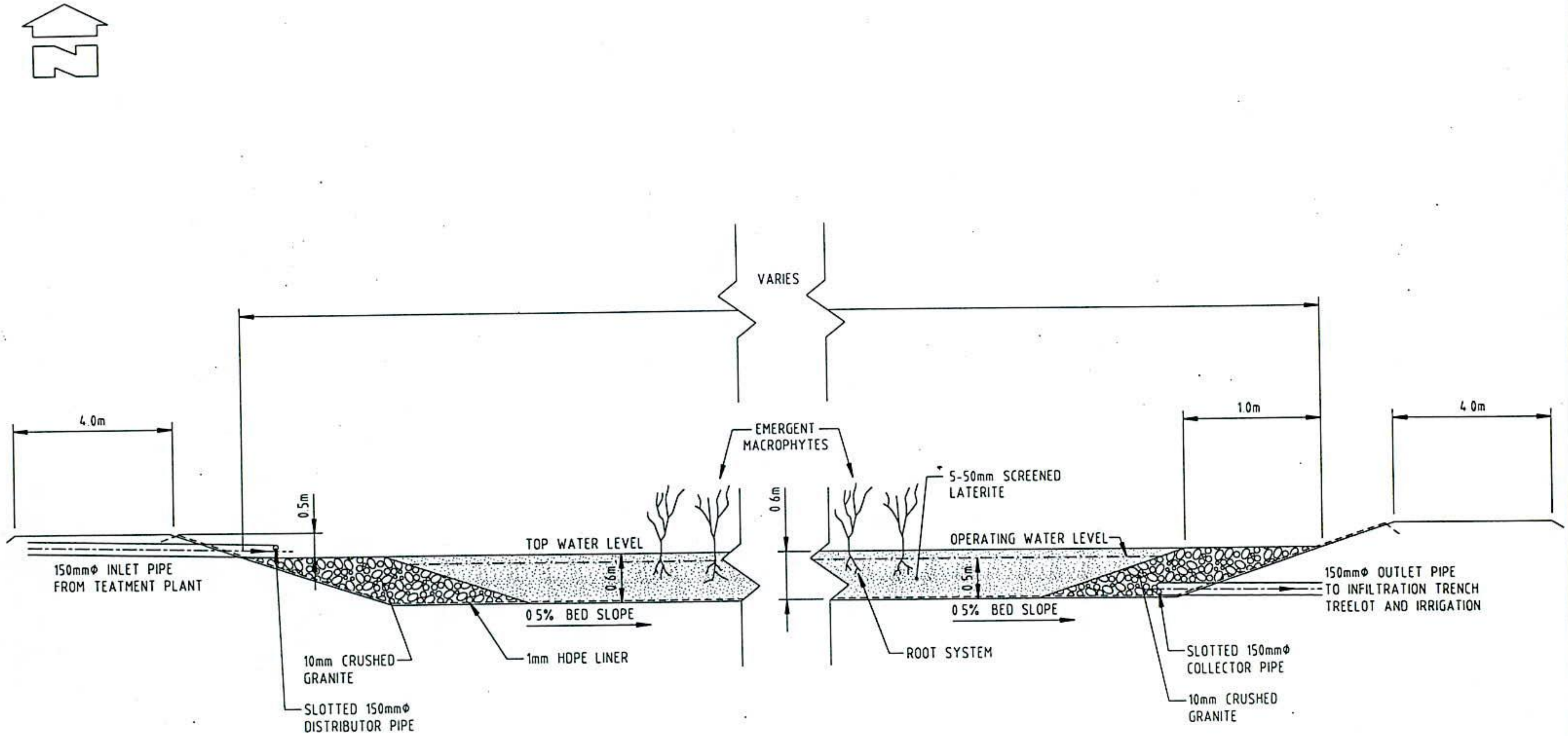

FIGURE 3

Typical RBTS Section Along Flow Route

Source: Wood and Grieve

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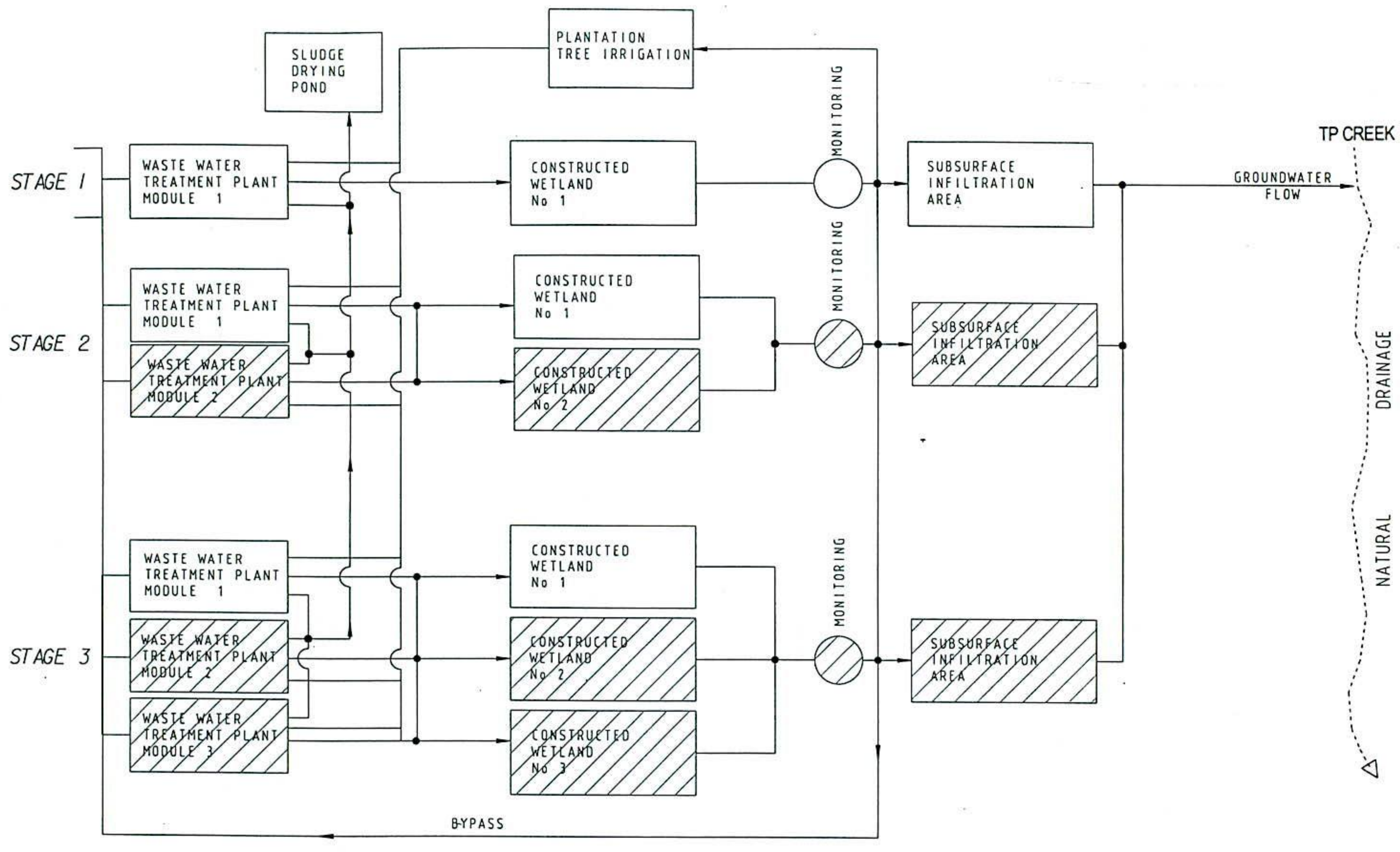

FIGURE 4

Walpole WWTP Indicative Process Flow

Source: Wood and Grieve

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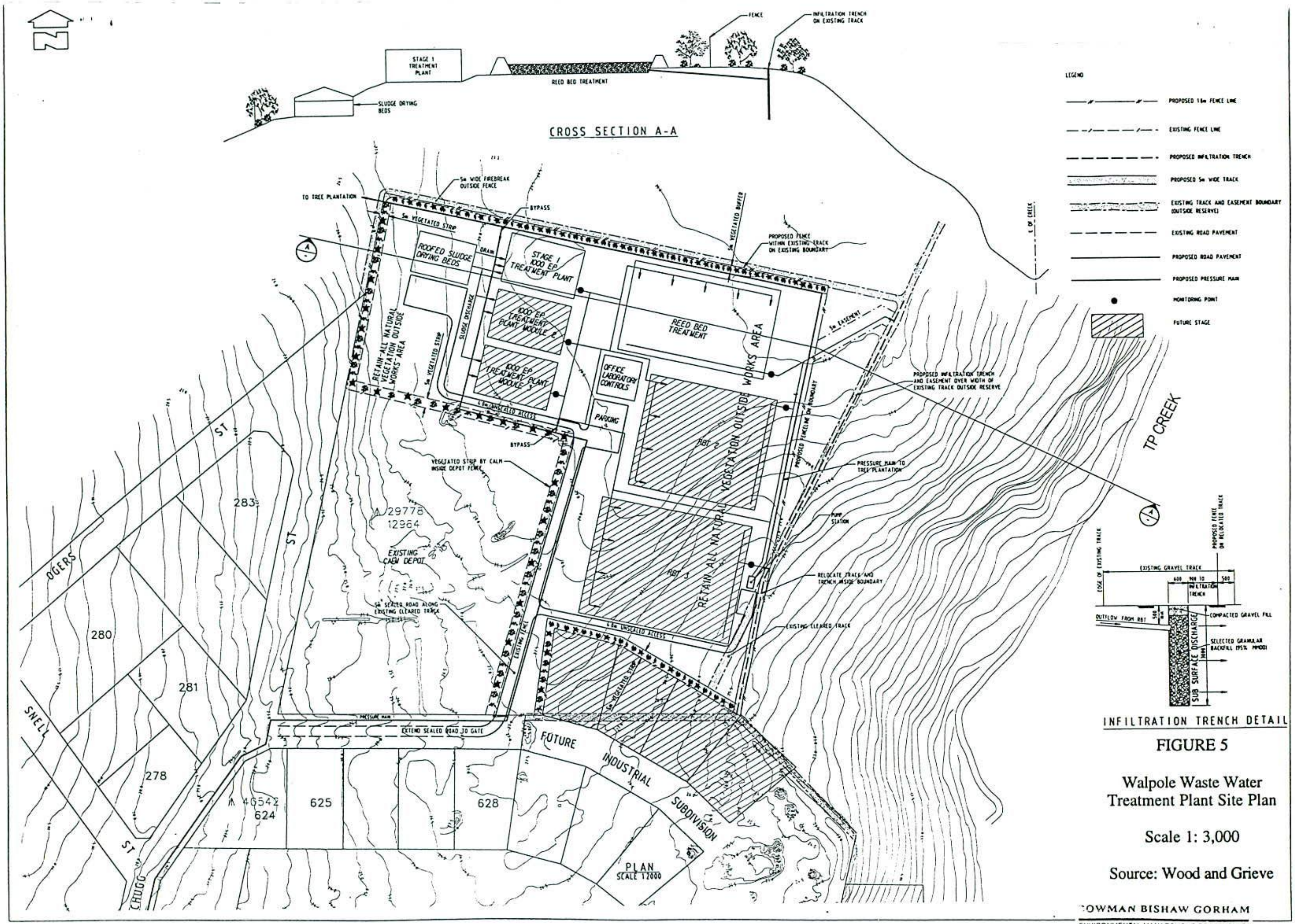

FIGURE 5

Walpole Waste Water Treatment Plant Site Plan

Scale 1: 3,000

Source: Wood and Grieve

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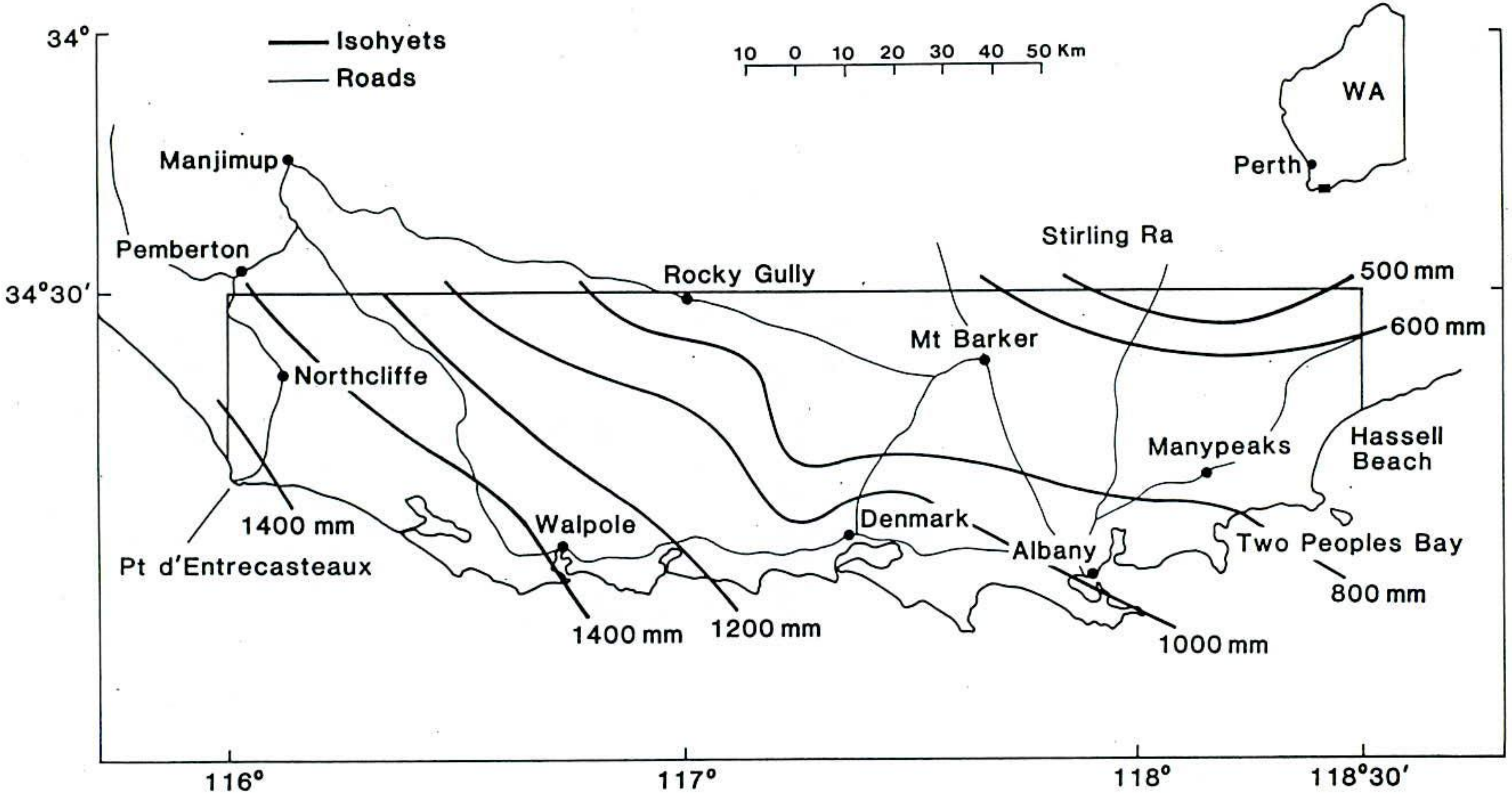


FIGURE 6

Rainfall Patterns for the South Coast of Western Australia

Source: Chruchward *et al.*, 1988

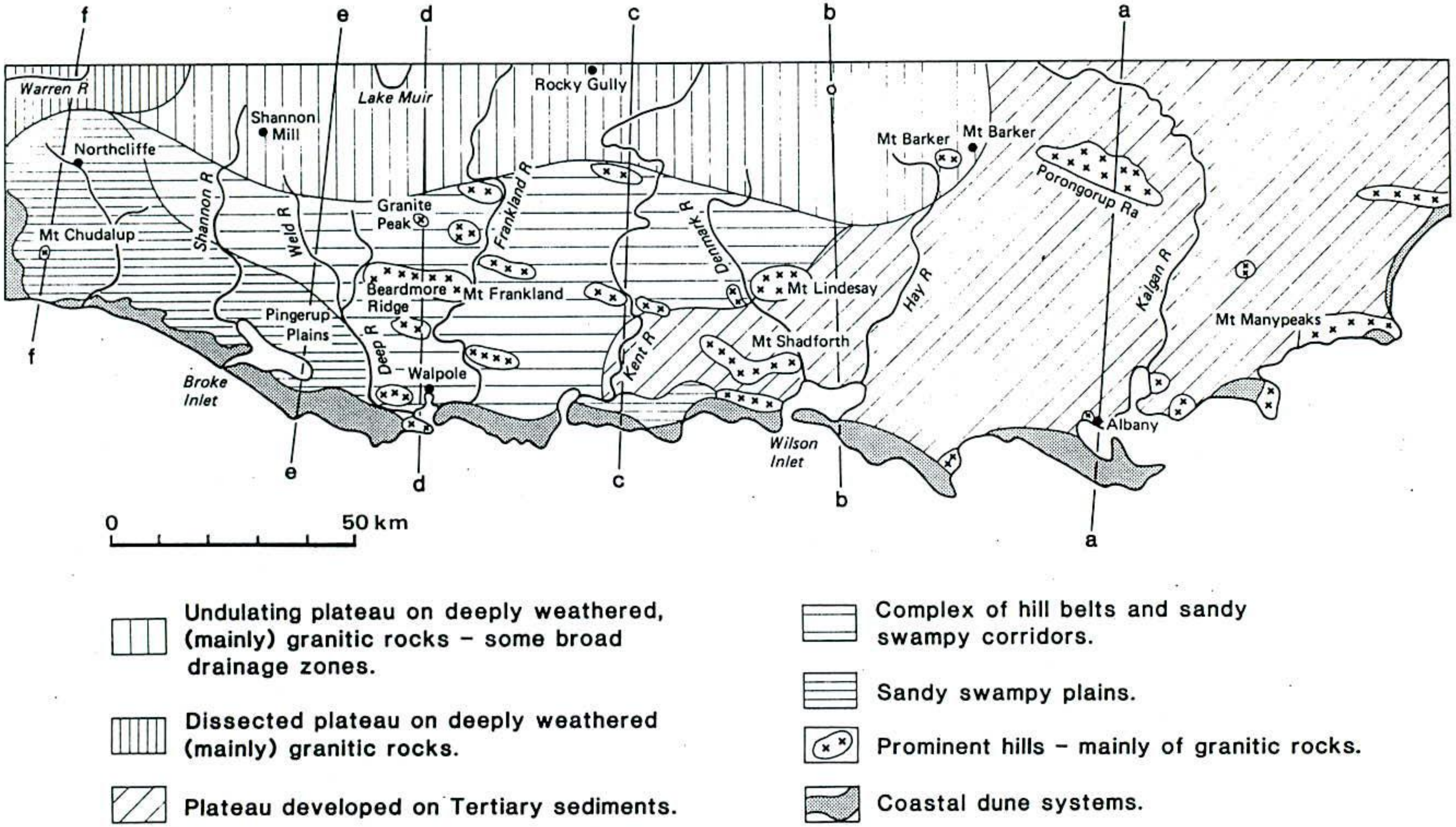
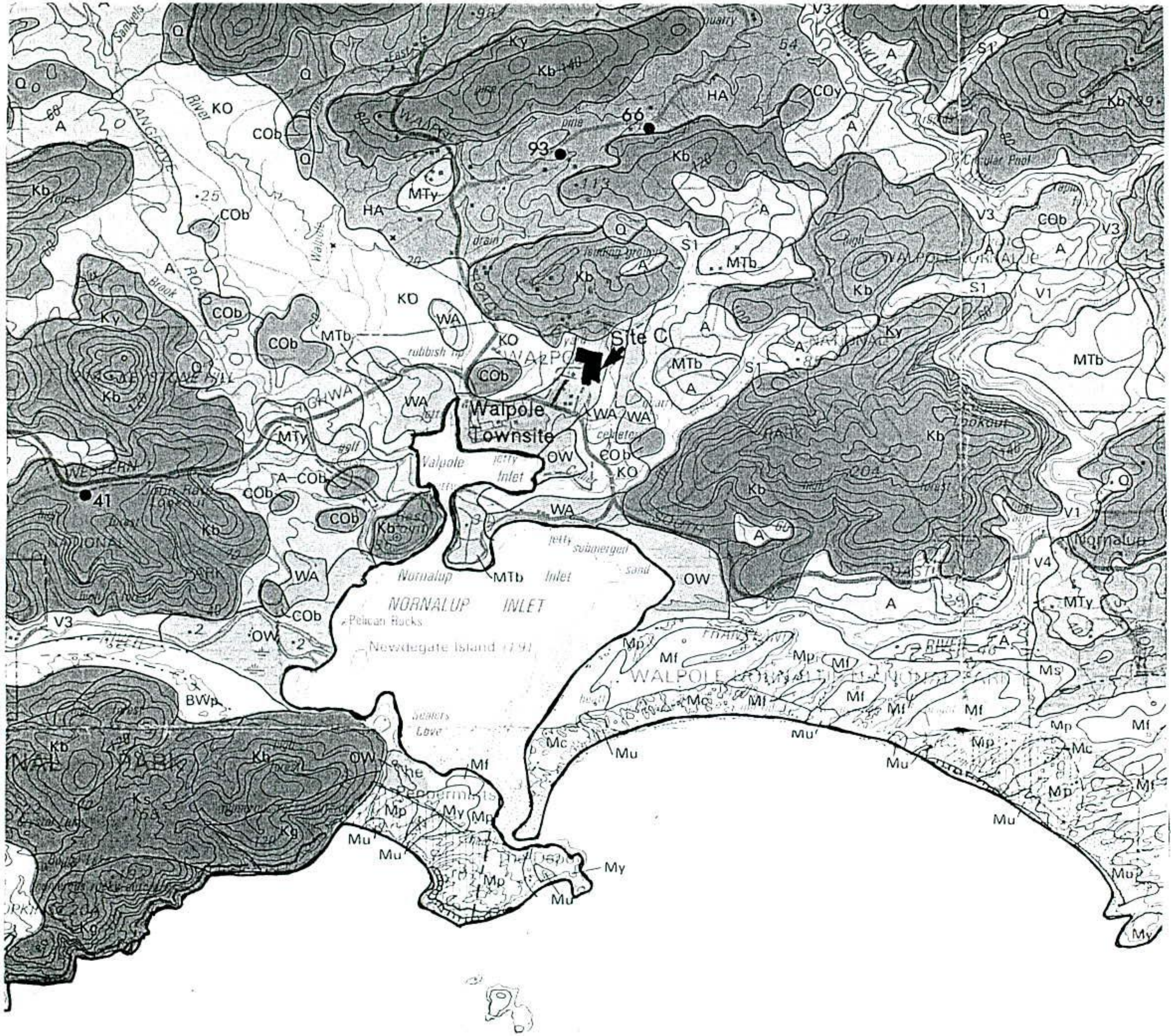


FIGURE 7

Regional Scale Distribution of Landform Zones

Source: Churchward *et al*, 1988



LEGEND

Bu	Burnett - Plains with drainage floors; scattered granite.
Kb	Keystone - Brown gravelly duplex soils and red or yellow earths
Kg	Keystone - Granite outcrop
Ky	Keystone - Grevelly yellow duplex soils
MTb	Mattaband - Brown Gravelly duplex soils
MTy	Mattaband - Gravelly yellow and yellow duplex soils
COb	Collie - Sandy yellow duplex soils
Q	Quagering
A	Angrove
HA	Hazelvale
WA	Walpole
BWp	Blackwater - Humus podsols on plains
OW	Owingup
KO	Kordabup
Mc	Meerup - Calcareous sand with shallow leaching
Mf	Meerup - Podzols on interdune plains
Mp	Meerup - Podzols over calcareous sand
Mu	Meerup - Unstable sand
V1	Major Valleys - >40m relief
V3	Major Valleys - 20m relief
V4	Major Valleys - <10m relief
S1	Minor Valleys - <20m relief

FIGURE 8

Distribution of Landform/Soil Units

Scale 1: 100,000

Source: Churchward *et al.*, 1979

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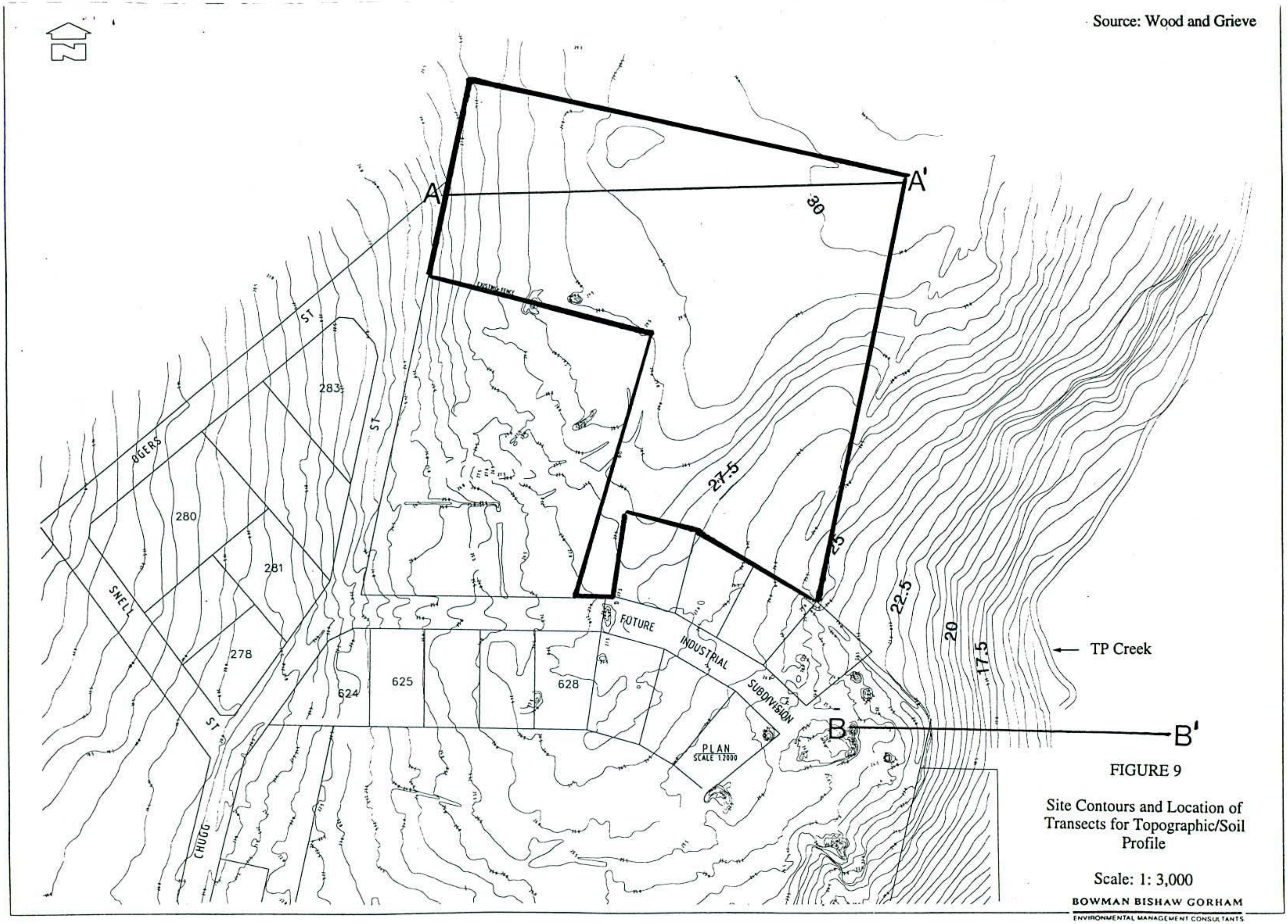

FIGURE 9

Site Contours and Location of Transects for Topographic/Soil Profile

Scale: 1: 3,000

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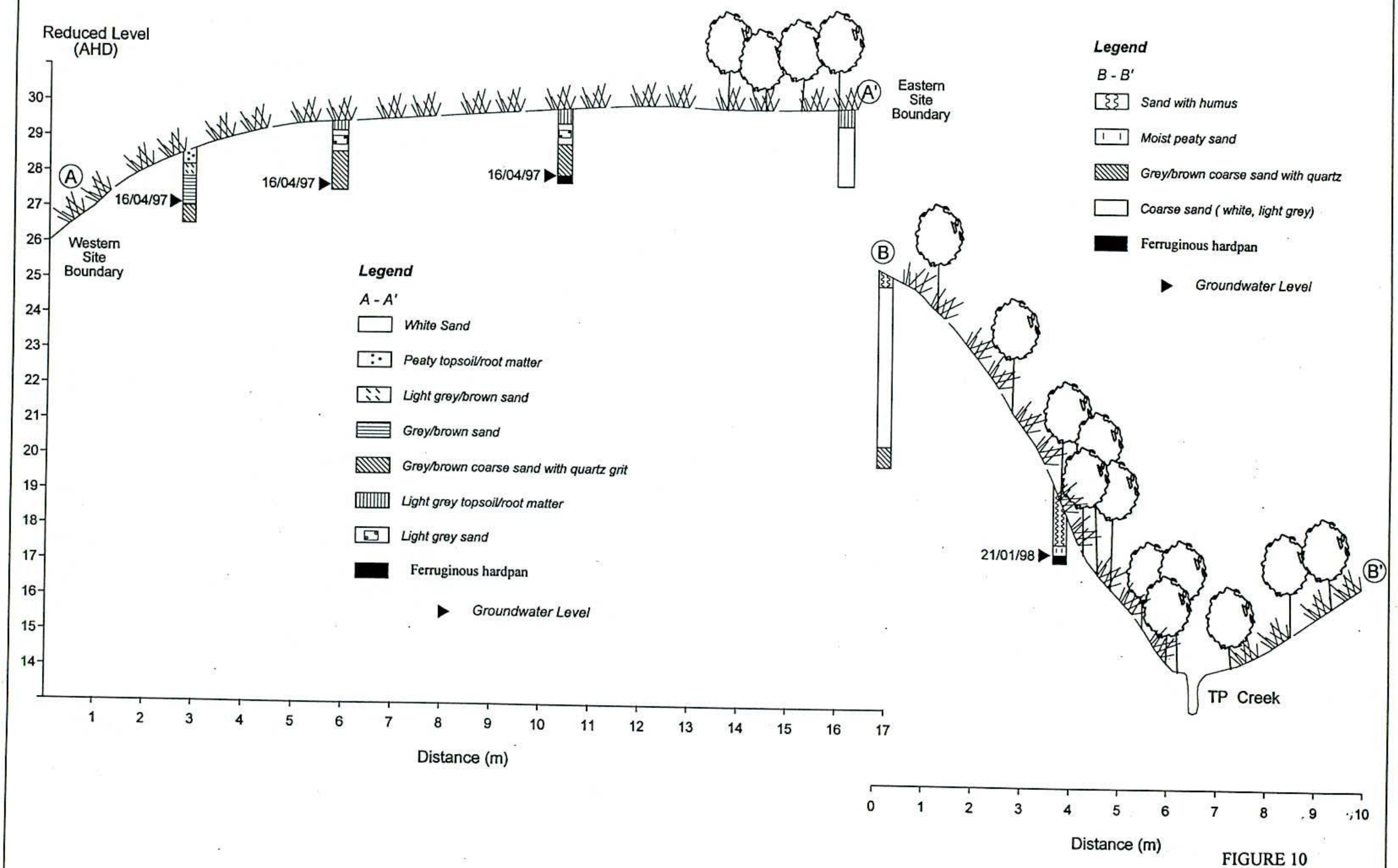

See Figure 9 for Location of Transects

FIGURE 10

Cross Section of Topographic and Soil Profiles

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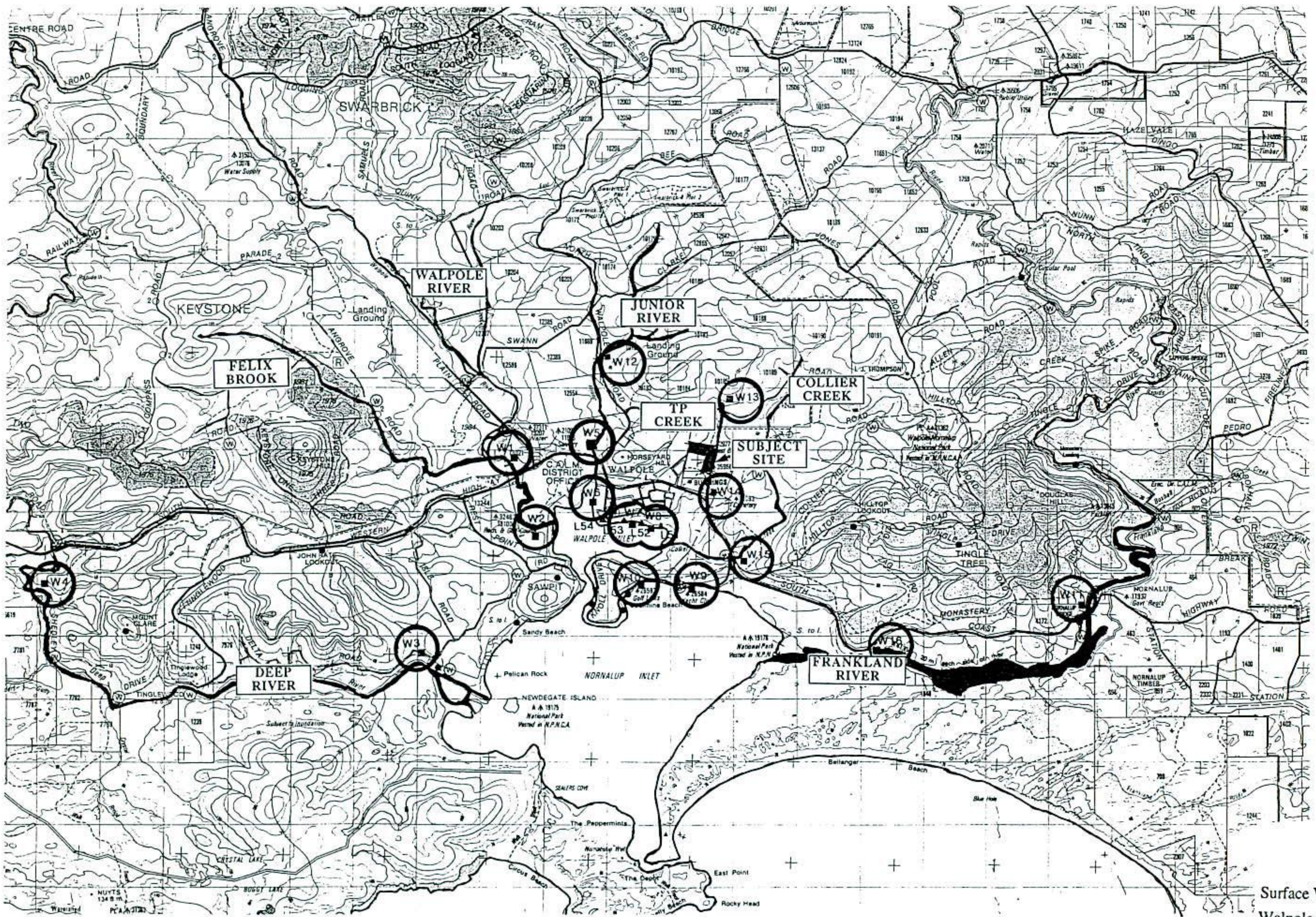

Figure 11

Surface Water Drainage within Walpole Area and Beyond, and Water Sampling Points

Scale 1: 100,000

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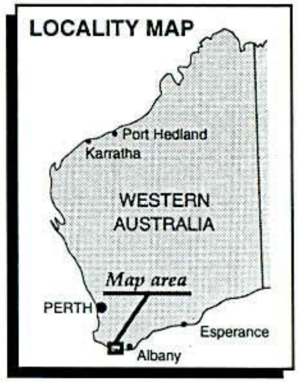

Legend

Landform Units possibly containing sedgelands

*See Figure 8 and/or Churchward *et al.*, (1979) for Soil Unit Definitions

NORTH

0 1 2 3 4 5

KILOMETRES

Figure 12A

Distribution of Landform Units Supporting Sedgeland Communities

(Broke Inlet - East of Nornalup Inlet)

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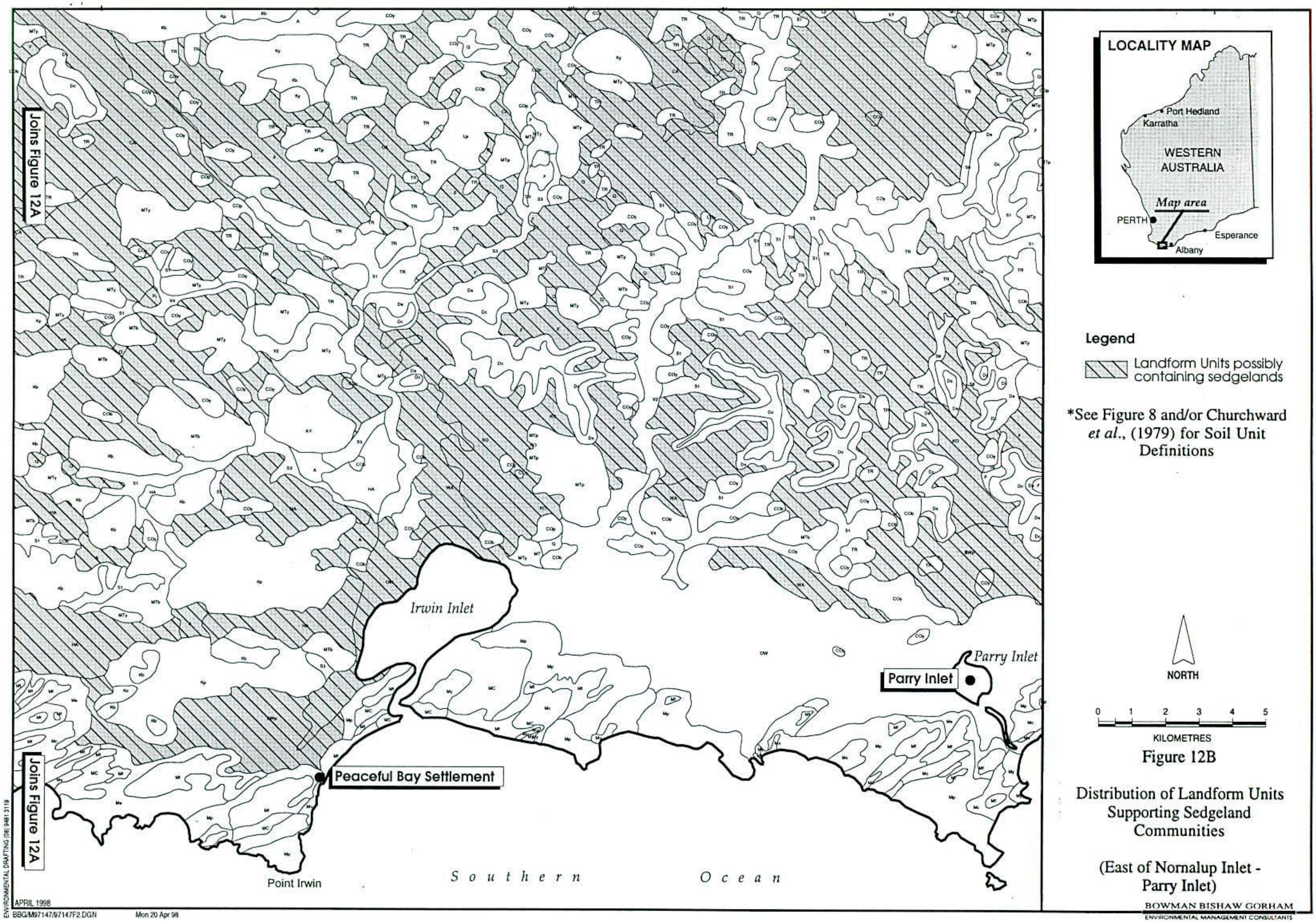

*See Figure 8 and/or Churchward *et al.*, (1979) for Soil Unit Definitions

Figure 12B

Distribution of Landform Units Supporting Sedgeland Communities

(East of Nornalup Inlet - Parry Inlet)

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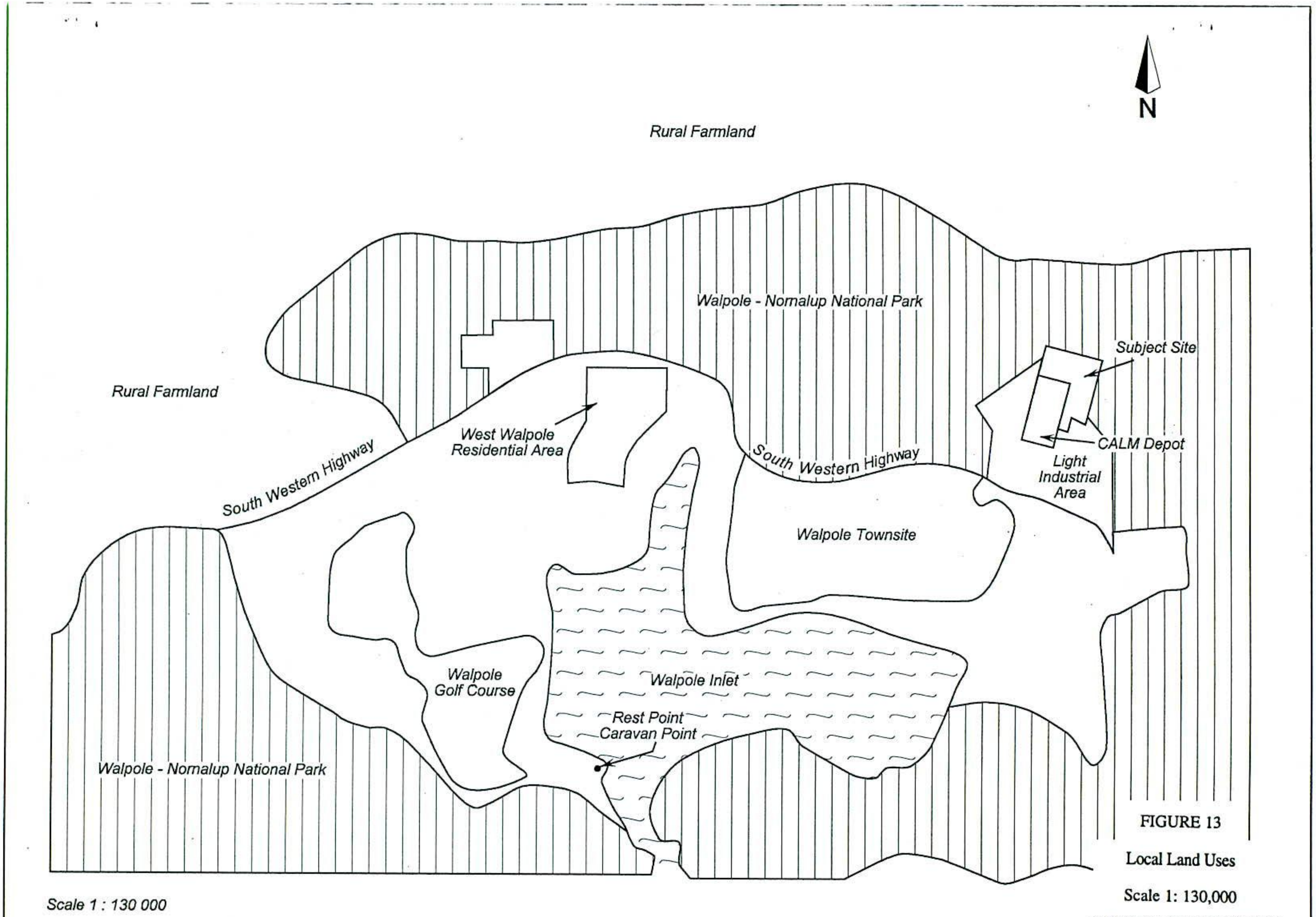

FIGURE 13

Local Land Uses

Scale 1: 130,000

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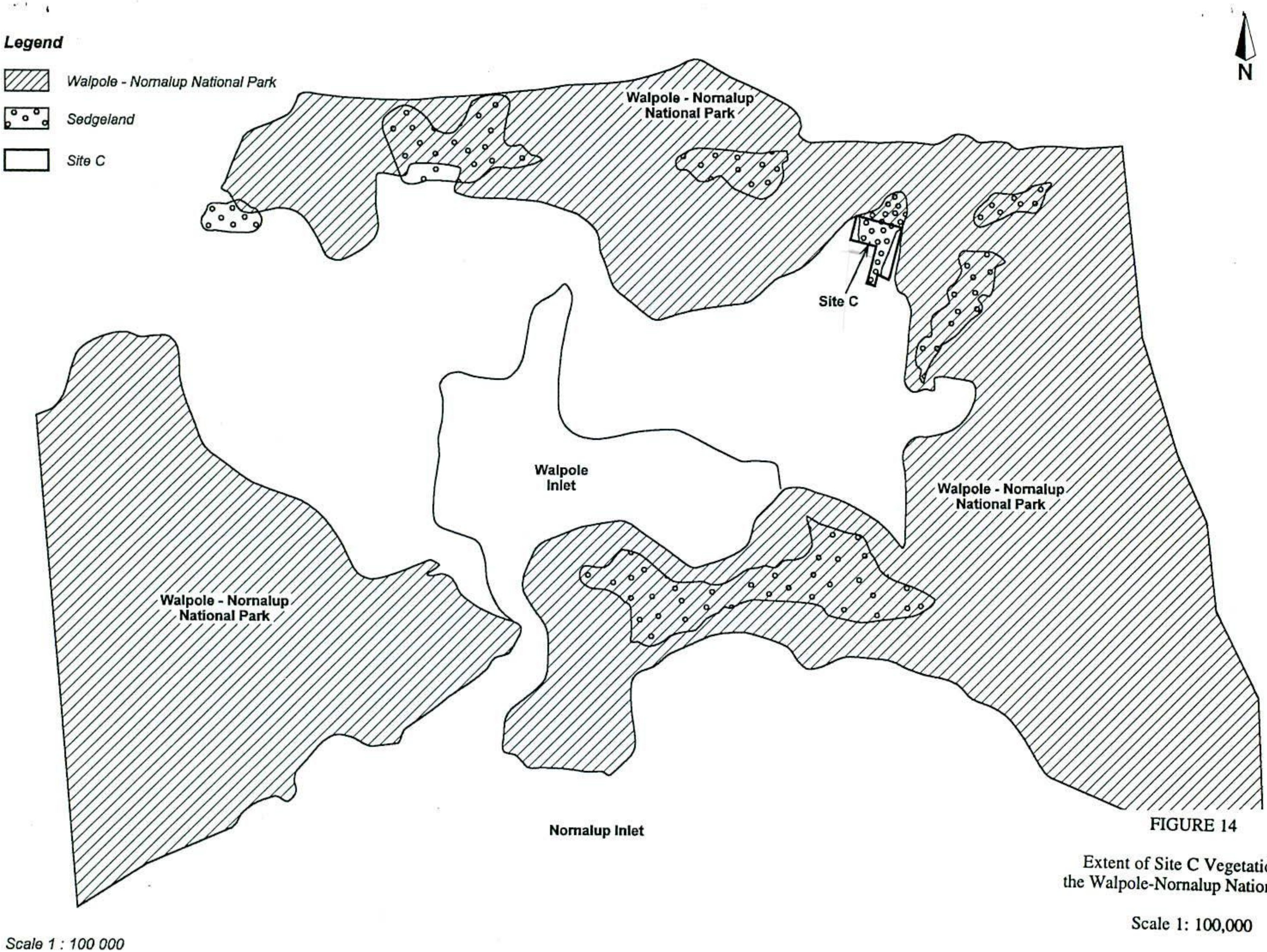

FIGURE 14

Extent of Site C Vegetation of the Walpole-Nornalup National Park

Scale 1: 100,000

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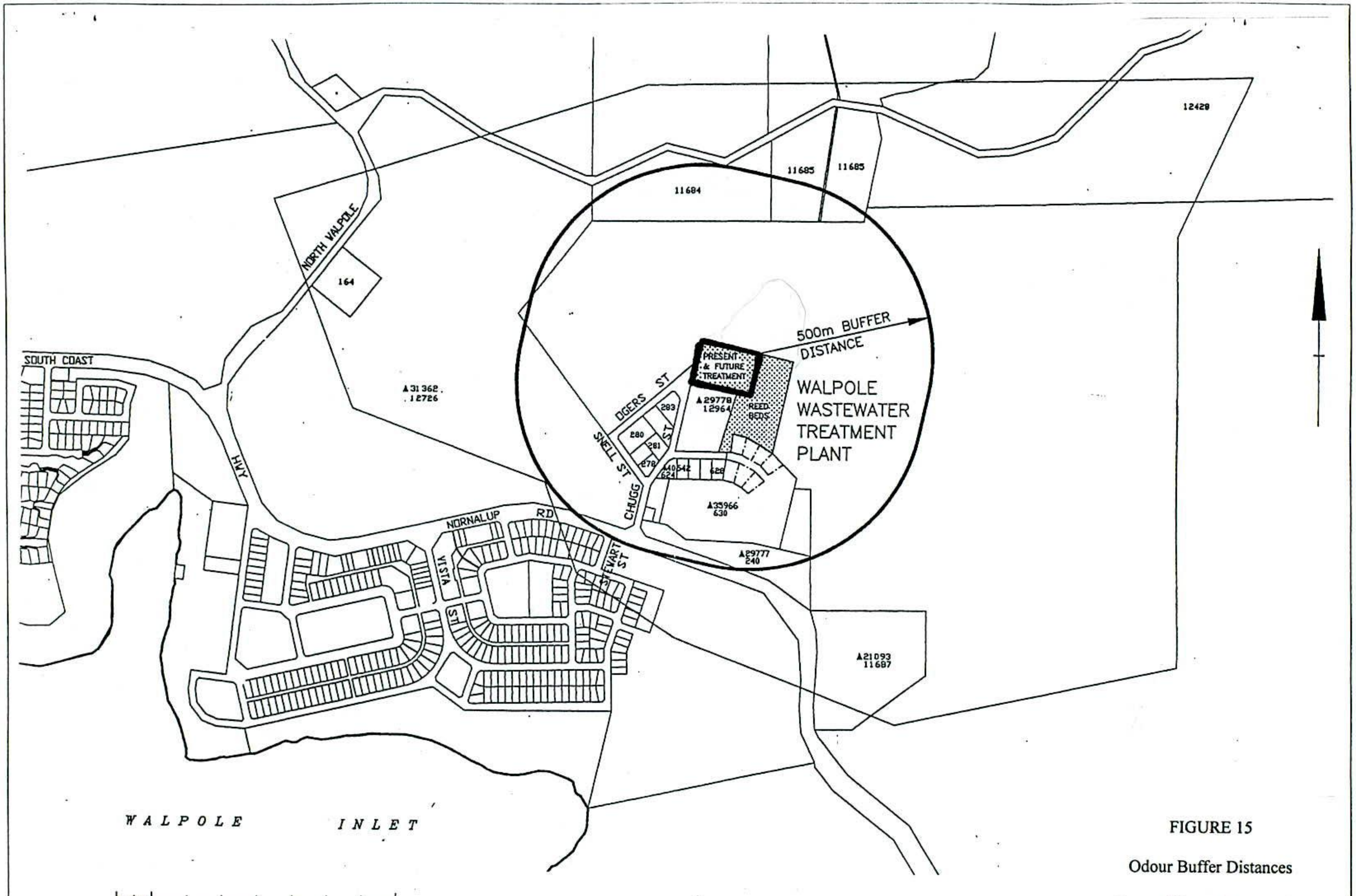

FIGURE 15

Odour Buffer Distances

Source: Water Coorporation

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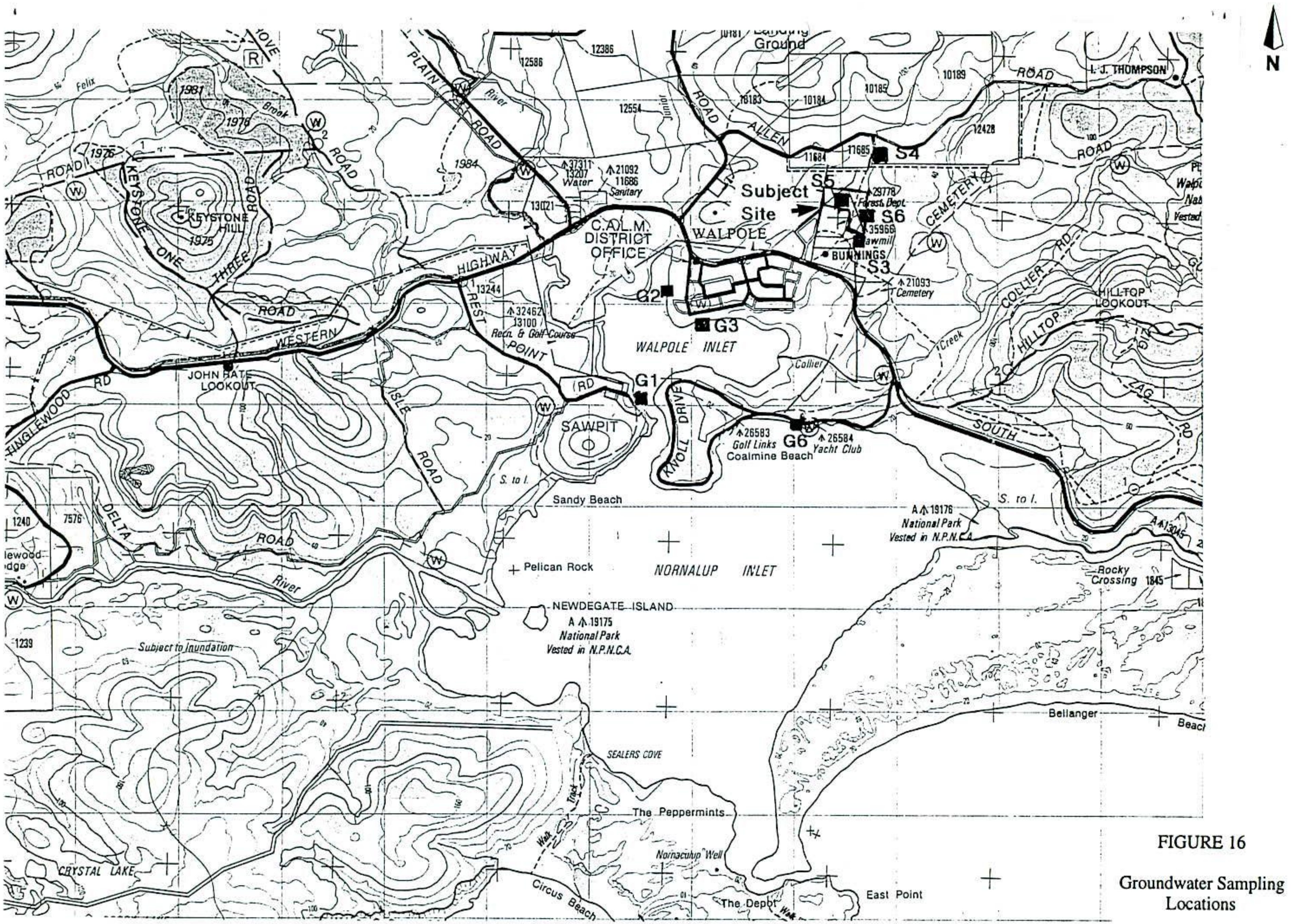

FIGURE 16

Groundwater Sampling Locations

Scale 1: 50,000

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APPENDICES

APPENDIX A

Site Selection Study Report

1.0 ASSUMPTIONS

To assist in the selection of suitable WWTP sites the following assumptions have been made in regard to the most likely treatment method and disposal system.

2.0 WASTEWATER TREATMENT

It has been assumed that the most likely treatment method will be an intermittent extended aeration/activated sludge plant. This assumption is based on the likely effluent criteria that will be required by the Department of Environmental Protection. For design purposes the effluent criteria has been assumed to be similar to those specified in the Pollution Control Licence for Denmark WWTP. This plant discharges into an inland waterway and eventually into Wilson Inlet, an area with similar environmental sensitivities to the Walpole-Nornalup Inlets.

The effluent criteria for Denmark WWTP is:

- Suspended Solids < 30mg/L;
- BOD5 < 20mg/L;
- Total Nitrogen < 15mg/L;
- Total Phosphorus < 1mg/L;
- Thermo - tolerant coliforms < 150/100ml.

3.0 DISPOSAL SYSTEM

In the first report, Review of Wastewater Disposal Options, the options considered can be broadly categorised into two main areas:

- Effluent Reuse - woodlots, horticulture, golf courses, parks and gardens;
- Disposal to groundwater/inland waterways - via constructed wetlands, deep well injection, infiltration basins, Ecomax.

It has been assumed that the most likely disposal system for the short to medium term disposal system is to an inland waterway via either a constructed wetland or a series of Ecomax cells if needed.

It is envisaged that in the future, once there is sufficient volumes of effluent to make a reuse option viable, that an effluent reuse scheme will be introduced. However, it is likely that the original disposal method will still be required during the winter months.

4.0 SELECTION CRITERIA

The following criteria were used to select suitable WWTP sites:

(i) Ensuring that there is an adequate buffer to existing and future residential and special rural developments

A 500m buffer would be required around the WWTP to dissipate any noise or odour that may be generated by the plant. (It is also preferable if the surrounding native bushland provides a visual buffer when viewed from any development or main road).

Discussions were held with the Shire of Manjimup to determine the location of any proposed residential or special rural developments in the area.

The prevailing winds in Walpole are predominantly from the south-west and south-east. Hence, it is preferable to site the WWTP to the north of Walpole.

(ii) Minimising capital and operating costs associated with wastewater (and effluent if applicable) conveyance works

The two key factors that were considered were the length of pressure main (both in terms of capital costs and increased operating costs due to friction head losses) and the static head the pump station(s) will be required to pump against. On this basis, sites were selected that were less than 2km from the existing Walpole townsite and below the 40m contour line.

It should be noted that as it is considerably more efficient to pump effluent rather than raw wastewater, the WWTP and disposal site could be at different locations. This is particularly the case if an effluent reuse scheme (e.g. wood lots) is introduced.

(iii) Minimising the cost of WWTP site works

The factors that were considered here were:

Location of existing services i.e. water, power, telecom, roads; topography of site; geotechnical considerations i.e. soil types, depth to water table; and general site conditions.

(iv) Current land tenure

Ensuring that the selected site is suitable given the current land tenure and that of the neighbouring property.

(v) Environmental Impact

Ensuring the environmental impact of the works is minimised. Consideration has been taken of: the existing vegetation and possible clearing required, soil profile characteristics, distance to nearest inland waterway etc.

5.0 ASSESSMENT OF SITES FOR WASTEWATER TREATMENT PLANT - GENERAL PLANNING AND ENGINEERING ASPECTS

Based on the site selection criteria three sites were selected. All three sites are within 2km of the existing Walpole townsite, are at least 500m from existing or future residential development and are below the 40m contour line (see attached plan).

The location of the three sites has been discussed with CALM and the Shire of Manjimup who could see no significant problems at this preliminary stage.

Based on a request from some local residents, a fourth site to the west of the townsite in the Keystone State Forest was also considered.

5.1 Site A - Plain Rd (Beside Water Treatment Plant)

This site is on Plain Road nestled in between the Water Corporation's Water Treatment Plant and the Shire of Manjimup's tip. The land is currently vested in CALM. The site is heavily vegetated with Sheok, Jarrah, and other native species. The site is dry, reasonably flat and the soil profile consists of a thin layer of topsoil overlying coarse, white sand with weathered quartz particles.

Water, power and telephone are all available at the neighbouring Water Treatment Plant and access is via a gravel road in good condition.

Advantages

- Close to existing Water Corporation facilities. Good for operations and maintenance purposes.
- Besides clearing, minimal construction costs.
- Due to location of Water Treatment Plant and tip site CALM has indicated that land acquisition should not be a problem.
- Close to Boronia Ridge subdivision. Lower initial capital and operating costs for the conveyance system.
- Minimal on-site drainage required.

Disadvantages

- Treated effluent can not be disposed of on-site due to location of Water Authority bores. Effluent will need to be pumped to an off-site disposal area.
- Septage is currently dumped at adjacent tip site. Odour generated from the tip could be wrongly associated with the WWTP.
- Being to the west of Walpole odours (if generated) could cause a problem.

5.2 Site B - North Walpole Road

This site is privately owned land situated on the North Walpole Road. The surrounding land is currently vested in CALM.

The land was purchased approximately 12 months ago for around $80,000, since then the landowner has constructed a residence, sheds and a large farm dam. The site is reasonably dry, slopes away to the north-west and the soil profile consists of grey silty sands on top of coarse grey sand overlying a layer of laterite. Water, power and telephone are all available although the power may need upgrading depending on the treatment option selected. Access is via North Walpole Road which is bituminised.

Advantages

- Centrally located with regard to Walpole townsite and the Boronia Ridge subdivision. Hence, has least capital and operating costs in regard to the conveyance system.
- Site is already cleared. No environmental concerns.
- Has a good buffer of native forest between the site and town.

Disadvantages

- May be difficult to purchase/resume land. Estimated costs are in the order of $200,000 - $250,000.
- On site disposal of effluent may not be practical due to size of site. Effluent would need to be pumped to an off-site disposal area.
- Site has reasonably high visibility along North Walpole Road.
- Earthworks will be required due to the slope of the land and to remove the existing farm dam.

5.3 Site C - Behind the Light Industrial Area

This site is to the north of the CALM depot and is at the rear of Walpole's light industrial area. The land is currently vested in CALM.

The land appears to have been cleared at some time and has a covering of low lying vegetation consisting mainly of sedges and rushes. Much of the site is damp, flat and the soil profile is dark grey silty sand overlying grey sand. In the two test pits that were dug water was encountered at between 0.5m - 1.0m. Being a perched water table the groundwater is not expected to cause significant problems if the site is built up slightly and subsoil drainage is installed.

Water, power and telephone are all available to the light industrial area. A short access track would need to be constructed to connect the roads in the light industrial area to the rear of the CALM depot.

Advantages

- Effluent can be disposed of on-site. Treated effluent could be disposed by infiltration to an area where natural groundwater flows beneath jarrah woodland and health before reaching a small stream. This would supply an additional buffer for contaminant removal before reaching the Nornalup Inlet. The site is also adjacent to land with suitable soil characteristics for a wood lot if this is considered viable in the future.

- Close to Walpole townsite.
- Minimal clearing required.
- A WWTP is compatible with the surrounding land use. CALM has indicated that land acquisition should not be a problem.

Disadvantages

- Slightly damp conditions. The site will need to be built up slightly and possibly drainage installed.
- Site will be visible from the North along Allen Road.
- Distance from Boronia Ridge subdivision will result in higher initial capital and operating costs for the conveyance system.

5.4 Site D - Angove Road (Keystone State Forest)

Several sites were investigated along Angove Road, west of Walpole. The land is in Keystone State Forest.

Although in State Forest, this area contains several gravel and sand pits plus a large area of regenerated Karri Forest. The most suitable site along Angove Road appears to be at one of the regenerated gravel pits which is approximately 200m from South Western Highway.

This site has been previously cleared to enable the extraction of gravel. The site has then been subsequently regenerated to match the surrounding vegetation. The site is reasonably dry, slopes away to the north-east and the soil profile is a thin layer of topsoil (except where removed for gravel) overlying gravel and clay.

Water is not readily available to this site and would need to be extended a considerable distance to service the site. Power and telephone are nearby, however the power will need upgrading. Access is via Angove Road which is currently a gravel road. This would need to be upgraded, particularly at the intersection of South Western Highway.

Advantages

- Reasonably close to Boronia Ridge subdivision.
- Has a good buffer of native forest between the site and town.
- Little visual impact.
- The site has been previously cleared.
- There is sufficient area so that effluent can be disposed of on-site.

Disadvantages

- Site is the furthest away from the Walpole townsite. Hence has highest capital cost in regard to the conveyance system.
- Initial capital costs of the WWTP site works is very high due to the cost of servicing the site (water, power, access).

- Considerable earthworks will be required due to the slope of the land.
- A large area of regenerated forest will need to be cleared.
- Treated effluent would be discharged overland into Walpole River or Felix Brook, which directly feeds into the Walpole River and subsequently into Walpole Inlet.
- Any future woodlot site would be a considerable distance away. (Note: there are large areas of nearby State Forest that have soils with good phosphorus retention capabilities. However, disposal of treated effluent on to existing native forest is not recommended and is unlikely to be accepted by CALM or DEP).

6.0 ASSESSMENT OF SITES FOR WASTEWATER TREATMENT PLANT - ENVIRONMENTAL AND DISPOSAL ASPECTS

6.1 Introduction

Four possible sites for the wastewater treatment plant have been identified by Wood and Grieve on engineering and general planning/land-use grounds. This section compares environmental suitability aspects of the sites using data from the published literature, information obtained during inspection of the locality during the early part of the study, colour aerial photographs at scale 1:25,000 dated February 1993 and a series of oblique colour photographs of the sites produced by Wood and Grieve during recent site evaluation work.

Key environmental attributes evaluated for each site include:

- topography and slope,
- vegetation type and condition,
- potential for the presence of flora with conservation interest or significance,
- soil type,
- proximity of seasonal or permanent streams,
- groundwater conditions,
- soil/vegetation type between the site and the nearest surface drainage.

The following sections describe each site in regard to these factors leading to comments in regard to site preferences on environmental grounds.

6.2 Site A - Plain Road

The site is located adjacent to and to the south east of the existing water treatment plant for the Walpole townsite. The terrain is flat to gently sloping towards the north-west and is at approximately RL 15m.

The site is naturally vegetated with a woodland of jarrah, sheoak and peppermint, with a shrub understorey and appears to be in good condition.

Floristic survey carried out by this firm on nearby land mapped as the same soil type found one priority flora species *Amperia protensa.* Flora survey data for this specific site are not available.

Soil types are mapped on the Deep River to Nornalup 1:100,000 sheet as Walpole soil type described as podzols and deep sands - developed on flat to gently sloping benches with some shallow dissections.

The site is located approximately 300m south east of the Walpole River which appears to have perennial flow at this location. The locality of the site is approximately 2.5km (of river channel) upstream of the Walpole River's confluence with Walpole Inlet.

It is understood that the Walpole townsite water supply is drawn from bores located immediately adjacent to the river. Whilst we do not have any specific groundwater data for the site, by direct inference, site A might be underlain by good quality groundwater in a sandy superficial aquifer. Surface contours indicate any groundwater beneath the site is likely to flow directly towards the Walpole River and the town water supply bores.

Colour aerial photographs (scale 1:25,000) show that the land between the site and the Walpole River is naturally vegetated except for the cleared area in which the water treatment plant is located. However, recognising that the soil types are sandy, little improvement to the quality of any effluent discharged to the soil profile could be expected during flow to the river.

6.3 Site B - North Walpole Road

This site is located on flat to gently undulating land at RL 10m. The site appears to be largely or fully cleared and is under rural residential land-use, with one residence and a dam.

There is minor re-growth of understorey vegetation together with bracken and remnant individuals and groups of trees. Vegetation and flora values are therefore low to absent. Land to the south of the site supports Karri forest.

The site's soil type is mapped as Kordabup soil type - humus podzols which are developed in a landform described as broad drainage floors in lower reaches of streams. Photographs of the site confirm dark organic stained sandy soils at the surface. The presence of a dam suggests clay is present at quite shallow depth.

The western boundary of the site is located approximately 200m to the east of the nearest drainage line, mapped as the Junior River.

Topographic contours suggest the land drains due west at gentle slope towards this feature. The available aerial photography suggest that this drainage does not support significant permanent streamflow in the vicinity of this site although heavy vegetation cover may obscure any channels from ready identification.

There is no groundwater data for the site. The presence of a dam may indicate shallow groundwater although surface water may be the dominant source of dam water.

Land located between the site and the Junior River to the west comprises consistent soil types to the site itself and supports natural vegetation in apparently good condition.

The apparent high organic content of the humus podzol soils may impart significant nutrient removal capability although no confirmatory data is available. High humus content is traditionally associated with increased nutrient removal ability.

The location where any drainage from the site would enter the Junior River is some 750m away from the drainage's confluence with the Walpole River.

6.4 Site C - Light Industrial Area

This site is located on flat land at about RL 29m.

The site has a cover of native sedgeland vegetation with occasional emergent shrubs and small paperbark trees, suggesting poor drainage. The site may be described as a dampland.

Whilst there is no flora list for the site, informal advice from consultant botanist Malcolm Trudgen who has carried out local flora surveys in association with this firm indicates that damplands in this area are more prospective than other vegetation types for declared rare flora and species of conservation interest, including the Albany Pitcher Plant *Cephalotus folicularis* which was identified in similar vegetation in the district.

Soil type is mapped as Walpole podzols and deep sands developed on flat to gently sloping benches with some shallow dissections.

The site is located some 100m to the west of the nearest drainage line, an unnamed depression which discharges to the Walpole Inlet which is located approximately 1.5km to the south. There does not appear to be any significant surface flow channel within this depression in the vicinity of the site.

There is no groundwater data for this site although as previously mentioned the vegetation is indicative of poor drainage and therefore a shallow seasonal perched water table is expected to develop.

Land located between the site and this drainage comprises Walpole soils type although the drainage line itself is mapped as Kordabup soil - humus podzols - grey black sands with high organic content. There is a small low dune located east of the site between the drainage line. This dune supports a Sheoak woodland.

6.5 Site D - Angove Road (Keystone State Forest)

Site D is an area of land generally located on the western slopes of a broad crest within the State Forest. The site is located at elevation RL 20m, and drains towards the south west where Felix Brook and its minor feeder streams lie at about RL 18m.

Site survey by Wood & Grieve together with aerial and oblique photographic analysis indicate that large areas within the general area have previously been cleared for gravel extraction. Whilst we are uncertain of the original vegetation type, the site is surrounded by Karri forest and cleared areas have been re-colonised by indigenous species. It is not known whether the re-growth arises from a specific rehabilitation programme or by natural processes. The vegetation mapped for the site is described as Karri, Marri forest, with possibly Red and Yellow Tingle.

The site is mapped as Angove landform at scale 1:100,000 but from the aerial photos, soil colours, vegetation and former gravel mining, it resembles more closely the Keystone landform type which is described as brown gravelly duplex soils and red or yellow earth, with much laterite (Angove landform is described as gently sloping sandy terrain). At 1:20,000 scale, photographic analysis suggests that the Angove landforms are confined to the drainage lines to the south (Felix Brook) and to the north of the site (Walpole River).

The southern limits of the area generally indicated (to be the site), lie as close as 150m from the main channel of Felix Brook, which flows in an easterly direction and joins the Walpole River around 1km upstream of its point of discharge to Walpole Inlet. The site lies around 2-3km upstream from the Inlet. A minor tributary of Felix Brook which appears to be a seasonal drainage line, lies along the western side of the general site area, and drains to the south.

There is no groundwater data for the site of which we are aware.

In the area between the site and Felix Brook, the land appears to be naturally vegetated and to be comprised of soil types which mark a transition between the gravels and loams of the Keystone landform to the sands of the Angove landform.

6.6 Comments on Comparative Suitability

Site A on Plain Road would appear to be readily identifiable as unsuitable based on the presence of the water supply bores for the township downgradient of the site. The site is also fully vegetated although conservation values on the basis of floristic composition may not be significant.

Site B presents the benefit of a fully cleared site with the consequence that there are no constraints to construction based on vegetation or flora values. The soil types at the site and in the intervening land between the site and the nearest drainage have high organic content and may have valuable nutrient removal capability.

This intervening land is heavily vegetated and would appear to provide a valuable buffer in regard to residual contaminant uptake prior to entry to the Walpole Inlet.

Site C is located on sandy soils similar to site A. The sedgeland vegetation is prospective for flora with conservation interest and would need detailed floristic survey to confirm that the site is free of flora constraints.

Site C is located near to a natural drainage depression which does not appear to have any significant surface flow, although a channel develops in the drainage at its crossing under South Coast Highway, some 600m south of the site. The drainage is heavily vegetated as is the surface flow path between the site and the drainage, offering the potential for a contaminant uptake buffer between the site and the Walpole Inlet.

Site D supports regrowth vegetation and might also require clearing of some forest vegetation in order to establish the treatment plant and provide necessary servicing.

Whilst the existing tree vegetation surrounding the site may have potential to support treated effluent irrigation, it is also possible that there would be undesirable effects on the understorey vegetation which would not meet management objectives for State forest. Therefore for the purposes of this investigation it is not possible to assume that irrigation of treated effluent to existing forest could be a disposal option, and long term disposal to woodlot irrigation at another location must be assumed.

The site is distant (2 to 4km) from any cleared areas of Keystone landform, which supports the soil types which are considered to be the best for treated effluent irrigation to woodlots.

On the basis of the available data, both sites B and C appear to have desirable attributes for wastewater treatment plant siting.

If botanical survey was to confirm that the site did not support any significant flora, site C would emerge as the preferred site. Site C is located further "upstream" of the Walpole Inlet (1.3km compared to 750m for site B) and would be considered to offer a greater residual contaminant removal buffer between the site and the Walpole Inlet.

If botanical survey was to identify flora species within site C, which could not be accommodated by careful site planning and future management, site B would then be the preferred site.

7.0 CONCLUSIONS & RECOMMENDATION

- From a planning and engineering perspective all three sites are suitable for a wastewater treatment plant. They have an adequate buffer to existing and future residential rural development, the capital and operating costs associated with the wastewater conveyance works are minimised due to the proximity to the townsite, and the cost of site works is reasonable due to the location of existing services and the ground profile.

  Sites A and C are both vested in CALM and preliminary indications are that they would be willing to allow the Water Corporation to acquire the land. Site B is privately owned and acquiring the land would possibly be difficult and expensive.

  The site costs associated with sites A and C are comparable, so the determination of the best site will be based more on the environmental and disposal aspects. Site D has considerably higher site costs due mainly to the cost of servicing the site.

- In assessing the environmental and disposal aspects, both sites B and C appear to have desirable attributes for siting of a Wastewater Treatment Plant. Site C is preferable due to the reduced environmental impact of disposing effluent from this site. However, a botanical survey will need to be carried out to confirm that no declared rare flora exist on the land.

  Site D is considered suitable, however the higher initial capital costs combined with need for extensive clearing and the unsuitability of the surrounding land for long term disposal, makes it less desirable than sites B and C.

Site A is considered unsuitable as the site is fully vegetated and on-site disposal is not possible due to the presence of the water supply bores. Consequently it would be necessary to pump the treated effluent to an off-site location.

- The recommended site is Site C situated behind the CALM depot at the rear of the light industrial area. Disposal from this site would be by soil infiltration. However, as mentioned previously a botanical survey will need to be carried out to confirm the suitability of the site.

APPENDIX B

Soil Logs for Site C

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ENGINEERS

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GEOTECHNICAL INVESTIGATION

WALPOLE WASTEWATER TREATMENT PLANT

A geotechnical investigation was carried out on 16 April 1997 to determine the suitability of the proposed site for a wastewater treatment plant and for effluent disposal by means of an infiltration trench.

GENERAL

The proposed site is located in the industrial area to the north east of Walpole. The site is on Reserve 29778 which is vested in CALM but excludes the fenced off portion in the south west corner which is currently used as the CALM Depot. A drawing showing the site and the proposed WWTP layout is attached.

The site is gently sloping and is predominantly covered with reeds, sedges and scattered heath shrubs. Along the eastern border and south eastern corner is a low woodland comprising of sheok, peppermints, marri & other assorted trees & shrubs.

TEST HOLES

Eight test holes were dug across the site and along the track situated near the eastern boundary using a backhoe to a depth of a ~ 2.0m. Piezometers were placed in 6 of these holes to enable monitoring of groundwater levels in this area. The location of the test holes is shown on the attached plan. The soil profile of the hole is given below.

Test Hole	Depth (mm)	Description	Comments
1.	0-400 400-800 800-1600 1600-2100	Peaty topsoil/root matter Light grey/brown sand Grey/brown sand (damp) Grey/brown coarse sand with quartz stone	Water was encountered at 1.6m. After 2 hours the water level had risen to 1.1m.
2.	0-300 300-900 900-2000	Light grey topsoil/root matter l Light grey sand Grey brown course sand (damp) with quartz stone	Water was encountered at 1.9m. Piezometer installed after 2 hours the level in the piezometers had risen to 1.6m.
3.	0-400 400-1000 1000-1900 1900	Light grey topsoil/root matter Light grey sand Light grey/brown coarse sand with quartz stone (damp) Coffee rock	Water was encountered at 1.9m Piezometers installed, after 2 hrs the level in the piezometers had risen to 1.7m.
4.	0-400 400-1100 1100-2000 2000	Grey topsoil/root matter Light grey sand Light grey/brown coarse sand with quartz stone (damp) Coffee rock	Water encountered at 2.0m. Piezometer installed, after 2 hrs the level had risen to 1.7m.

5.	0-400 400-1100 1100-1200 1200-1700 1700-1900 1900-2000	Peaty sandy topsoil/root matter Light grey/brown sand Light grey/brown coarse sand with quartz sand Fine white sand Peat (damp) Coffee rock	Peat layer damp but no visible groundwater.
6.	0-500 500-2200	Light grey topsoil/root matter White sand	No groundwater encountered Piezometer installed
7.	0-500 500-1000 1000-1200 1200-2000	Light grey topsoil/root matter Light grey sand Light grey coarse sand with quartz stone White sand	No groundwater encountered Piezometer installed.
8.	0-800 800-2300	Light grey topsoil/root matter White sand	Piezometer installed Piezometer installed.

CONCLUSIONS/RECOMMENDATIONS

1. The soil profile appears suitable for the construction of the WWTP. However, the following site works should be undertaken:

    a) all topsoil & root matter removed to a minimum depth of 400mm in the construction area. The site should then be raised to 300mm or greater above the existing ground level using clean, free draining granular backfill. The fill should be placed in layers not exceeding 300mm and compacted to 95% MMDD;

    b) subsoil drainage (or open table drains) be installed to a depth of 500mm + below the existing ground level;

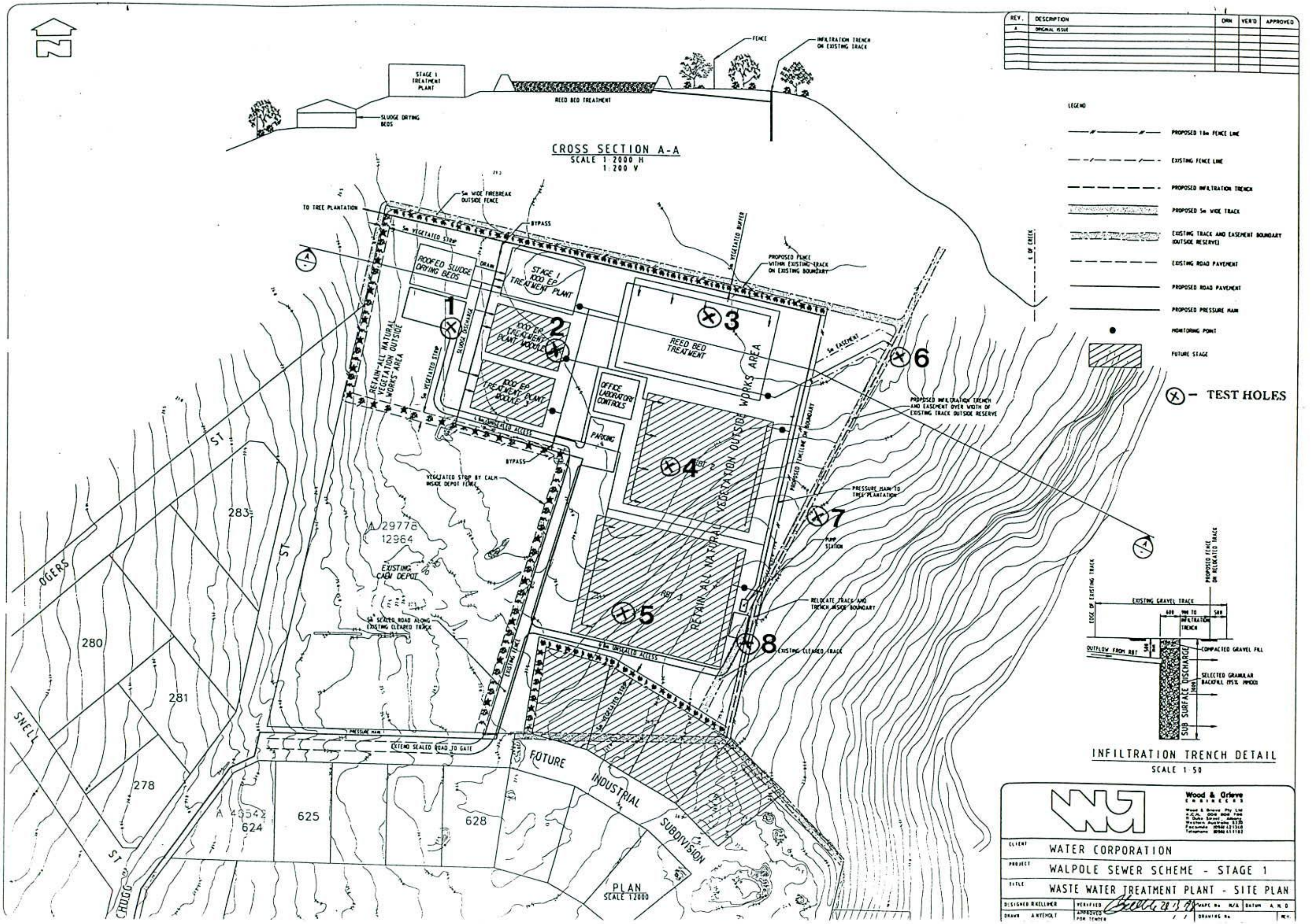
    c) any imported backfill, clay or gravel will need to be approved by CALM to ensure it is dieback free. All earthworks to be undertaken in accordance with CALM's procedures to prevent the spread of dieback.

2. The natural vegetation, soil profile and water table levels encountered suggests a perched water table exists over the majority of the site with the exception of the eastern boundary & south eastern corner. The direction of groundwater flows appears to roughly correlate with the surface contours, as shown on the attached plan. However, this will need to be confirmed by utilising the piezometers to monitor ground water levels.

3. The ground conditions appear suitable for effluent disposal via infiltration along the existing track along the eastern boundary of the site.

Mackell

T. MACKELL
for Wood & Grieve ENGINEERS



REV.
DESCRIPTION
DRN
VER'D
APPROVED
A
ORIGINAL ISSUE
STAGE 1 TREATMENT PLANT
SLUDGE DRYING BEDS
REED BED TREATMENT
FENCE
INFILTRATION TRENCH ON EXISTING TRACK
CROSS SECTION A-A
SCALE 1:2000 H
1:200 V
LEGEND
PROPOSED 1.8m FENCE LINE
EXISTING FENCE LINE
PROPOSED INFILTRATION TRENCH
PROPOSED 5m WIDE TRACK
EXISTING TRACK AND EASEMENT BOUNDARY (OUTSIDE RESERVE)
EXISTING ROAD PAVEMENT
PROPOSED ROAD PAVEMENT
PROPOSED PRESSURE MAIN
MONITORING POINT
FUTURE STAGE
TEST HOLES
TO TREE PLANTATION
5m WIDE FIREBREAK OUTSIDE FENCE
BYPASS
5m VEGETATED STRIP
ROOFED SLUDGE DRYING BEDS
DRAIN
STAGE 1 1000 EP TREATMENT PLANT
1000 EP TREATMENT PLANT MODULE 2
1000 EP TREATMENT PLANT MODULE 3
SLUDGE DISCHARGE
RETAIN ALL NATURAL VEGETATION OUTSIDE WORKS AREA
OFFICE LABORATORY CONTROLS
PARKING
REED BED TREATMENT
PROPOSED FENCE WITHIN EXISTING TRACK ON EXISTING BOUNDARY
5m EASEMENT
PROPOSED INFILTRATION TRENCH AND EASEMENT OVER WIDTH OF EXISTING TRACK OUTSIDE RESERVE
RBT 2
RBT 3
PRESSURE MAIN TO TREE PLANTATION
PUMP STATION
RELOCATE TRACK AND TRENCH INSIDE BOUNDARY
EXISTING CLEARED TRACK
VEGETATED STRIP BY CALM INSIDE DEPOT FENCE
5m SEALED ROAD ALONG EXISTING CLEARED TRACK
EXISTING CALM DEPOT
A 29778
12964
6m UNSEALED ACCESS
PRESSURE MAIN
EXTEND SEALED ROAD TO GATE
FUTURE INDUSTRIAL SUBDIVISION
283
280
281
278
625
628
A 46542
624
ROGERS ST
SNELL ST
CHUGG
ST
PLAN
SCALE 1:2000
1
2
3
4
5
6
7
8
EXISTING GRAVEL TRACK
EDGE OF EXISTING TRACK
PROPOSED FENCE ON RELOCATED TRACK
INFILTRATION TRENCH
OUTFLOW FROM RBT
COMPACTED GRAVEL FILL
SELECTED GRANULAR BACKFILL (95% MMDD)
SUB SURFACE DISCHARGE
INFILTRATION TRENCH DETAIL
SCALE 1:50
Wood & Grieve ENGINEERS
CLIENT
WATER CORPORATION
PROJECT
WALPOLE SEWER SCHEME - STAGE 1
TITLE
WASTE WATER TREATMENT PLANT - SITE PLAN
DESIGNED
DRAWN
VERIFIED
APPROVED FOR TENDER
SCALE
DATUM
DRAWING No
REV.

APPENDIX C

CER Guidelines

Environmental Protection Authority
Guidelines

WALPOLE WASTE WATER SCHEME, STAGE 1 AT SITE "C".

(Assessment Number 1154)

Part A	Specific Guidelines for the preparation of the Consultative Environmental Review
Part B	Generic Guidelines for the preparation of an environmental review document

Attachment 1	Example of the invitation to make a submission
Attachment 2	Advertising the environmental review

These guidelines are provided for the preparation of the proponent's environmental review document. The specific environmental factors to be addressed are identified in Part A. The generic guidelines for the format of an environmental review document are provided in Part B.

Part A: Specific Guidelines for the preparation of the Consultative Environmental Review

1. The proposal

The Water Corporation (the proponent) intends to construct a waste water treatment plant at Site "C" in Walpole as Stage 1 of the Walpole Waste Water Scheme. The proposed location of the plant is indicated on the attached plan (Attachment 2).

The objective of the strategy is to provide sewerage treatment and disposal facilities which can accept flows from an infill sewerage program for the town of Walpole, including the Boronia Ridge subdivision and expected future population growth.

2. Environmental factors relevant to this proposal

At this preliminary stage, the Environmental Protection Authority (EPA) believes the relevant environmental factors, objectives and work required is as detailed in the table below:

CONTENT		SCOPE OF WORK		
Factors	**Site specific factor**	**Work required for the environmental review**	**Objectives**	**Additional comments**
BIOPHYSICAL				
Terrestrial Flora	Vegetation communities	Determine the significance of the vegetation on the preferred site which could be lost because of the construction of the WWTP. The vegetation's representation in existing conservation reserves should be discussed. Reference should be made to information provided in the appeal on level of assessment. Determine the level of impact, indirect or otherwise, on the vegetation within the proposal area and adjacent national park and indicate how these impacts will be managed.	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.	Applies to area of proposal and areas of the national park directly adjacent.

Wetlands	Wetlands	Determine the significance of the wetland on the preferred site which could be lost because of the construction of the WWTP. The wetland's representation in existing conservation reserves should be discussed. The significance of the wetland should be discussed in terms of its type based on an accepted wetland classification system. Reference should be made to information provided in the appeal on level of assessment. Determine the level of impact, indirect or otherwise, on the wetland within the proposal area and indicate how these impacts will be managed.	Maintain the integrity, functions and environmental values of wetlands.	Applies to area of proposal and areas of the national park directly adjacent.
Wetlands	Estuaries	Determine the level of impact, indirect or otherwise that the proposal will have on the Walpole/ Nornalup Inlets and indicate how these potential impacts will be managed.	Maintain the integrity, functions and environmental values of estuaries.	Applies to area of the Walpole/ Nornalup Inlets.
POLLUTION				
Air	Odour	An odour study should be carried out to demonstrate that the Walpole community will not be adversely effected by odours emanating from the proposed treatment plant.	Odours emanating from the proposed development should not adversely affect the welfare and amenity of other land users.	Applies to the Walpole township and surrounding community.
Water	Groundwater quality	Groundwater under the site is likely to flow into the Walpole/Nornalup Inlets. The impact on the quality of groundwater should be determined and appropriate management proposed to ensure that contamination of groundwater will meet appropriate standards.	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy].	

Water	Surface water quality - water courses and the Walpole/ Nornalup Inlets	An approporiate study of the surface water should be undertaken to determine the level of impact on water quality that may result from development. Where necessary, indicate the nature and extent of possible impacts, management and control strategy. This should ensure that contamination of groundwater and the Walpole/Nornalup Inlets will be minimised. Cross reference to impact on groundwater may also be required.	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) [and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy].	

These factors should be addressed within the environmental review document for the public to consider and make comment to the EPA which expects to address these in its report to the Minister for the Environment.

The EPA expects the proponent to take due care in ensuring any other relevant environmental factors which may be of interest to the public are addressed.

3. Availability of the environmental review

3.1 Copies for distribution free of charge

Supplied to DEP:

- Library/Information Centre.......................................9
- EPA members...6
- Officers of the DEP (Perth)......................................6

Distributed by the proponent to:

Government departments

- [list all government departments who are DMA's or IA's]..x

Local government authorities

- [list all local authorities the proposal impacts on]...x

Libraries

- J S Battye Library 3
- The Environment Centre...................................2
- [list local libraries]..........................2 (each at least)

Other

- Conservation Council of WA 1

- Australian Conservation Foundation 1
- [list any others] x

3.2 Available for public viewing

- J S Battye Library;
- [local libraries];
- Department of Environmental Protection Library; and
- [anywhere else]

Part B: Generic Guidelines for the preparation of an environmental review document

1. Overview

All environmental reviews have the objective of protecting the environment. Environmental impact assessment is deliberately a public process in order to obtain broad ranging advice. The review requires the proponent to describe:

- the proposal;
- receiving environment;
- potential impacts of the proposal on factors of the environment; and
- proposed management strategies to ensure those environmental factors are appropriately protected.

Throughout the assessment process it is the objective of the Environmental Protection Authority (EPA) to help the proponent to improve the proposal so the environment is protected. The DEP will co-ordinate, on behalf of the EPA, relevant government agencies and the public in providing advice about environmental matters during the assessment of the environmental review for this proposal.

The primary purpose of the environmental review is to provide information on the proposal within the local and regional framework to the EPA, with the aim of emphasising how the proposal may impact the relevant environmental factors and how those impacts may be mitigated and managed.

The language used in the body of the environmental review should be kept simple and concise, considering the audience includes non-technical people, and any extensive, technical detail should either be referenced or appended to the environmental review. It should be noted that the environmental review will form the legal basis of the Minister for the Environment's approval of the proposal and therefore the environmental review should include a description of all the main and ancillary components of the proposal, including options where relevant.

Information used to reach conclusions should be properly referenced, including personal communications. Assessments of the significance of an impact should be soundly based rather than unsubstantiated opinion, and the assessment should lead to a discussion of the management of the environmental factor.

2. Objectives of the environmental review

The objectives of the environmental review are to:

- place this proposal in the context of the local and regional environment;
- adequately describe all components of the proposal, so that the Minister for the Environment can consider approval of a well-defined project;
- provide the basis of the proponent's environmental management programme, which shows that the environmental impacts resulting from the proposal, including cumulative impact, can be acceptably managed; and
- communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government.

3. Environmental management

The EPA expects the proponent to develop and implement an Environmental Management System appropriate to the proposal consistent with the principles outlined in the AS/NZS ISO 14000 series, including provisions for accountability review and a commitment to continuous improvement.

The key components which should be included in environmental review documentation, depending on the scale of the proposal, are environmental management:

- policy;
- resources budget;
- programme;
- plan(s);
- training programme;
- monitoring programme;
- contingency plan(s); and
- improvement plan(s).

Documentation on the relevant components should be proportional with the scale of the proposal and the potential environmental impacts. If appropriate, the documentation can be incorporated into a formal environmental management system and provision made for periodic performance review. Public accountability is a principle that should be incorporated into the approach on environmental management.

The environmental management programme is the key document that should be appropriately defined in an environmental review. The environmental management programme should provide plans to manage the relevant environmental factors, define the performance objectives, outline the operational procedures and outline the monitoring and reporting procedures which would demonstrate the achievement of the objectives.

4. Format of the environmental review document

The environmental review should be provided to the DEP officer for comment. At this stage the document should have all figures produced in the final format and colours.

Following approval to release the review for public comment, the final document should also be provided to the DEP in an electronic format.

5. Contents of the environmental review document

The contents of the environmental review should include an executive summary, introduction and at least the following:

5.1 The proposal

Justification and alternatives

- justification and objectives for the proposed development;
- the legal framework, including existing zoning and environmental approvals, and decision making authorities and involved agencies; and
- consideration of alternative options.

Key characteristics

The Minister's statement will bind the proponent to implementing the proposal in accordance with any technical specifications and key characteristics[1] in the environmental review document. It is important therefore, that the level of technical detail in the environmental review, while sufficient for environmental assessment, does not bind the proponent in areas where the project is likely to change in ways that have no environmental significance.

Include a description of the components of the proposal, including the nature and extent of works proposed. This information could be presented in the form of a table as follows:

Table 1: Key characteristics (example only)

Element	Description
Life of project (mine production)	55 months
Size of ore body	682 000 tonnes
Area of disturbance	100 hectares
Ore mining rate • maximum • average	 • 200 000 tonnes per year • 160 000 tonnes per year
Background gamma radiation levels • maximum • average	 • 0.52 µGrey per hour • 0.16 m 0.08 µGrey per hour
Water supply • source • maximum hourly requirement • maximum annual requirement	 • Yarloop borefield, shallow aquifer • 180 cubic metres • 1 000 000 cubic metres
Heavy mineral concentrate transport • truck movements (maximum)	 • 75 return truck loads per week

[1] Changes to the key characteristics of the proposal following final approval, would require assessment of the change and can be treated as non-substantial and approved by the Minister, if the environmental impacts are not significant. If the change is significant, it would require assessment under section 38 or section 46. Changes to other aspects of the proposal are generally inconsequential and can be implemented without further assessment. It is prudent to consult with the Department of Environmental Protection about changes to the proposal.

The key characteristics table should be supplemented with figures to ensure that the proposal is clearly explained. Figures that should always be included are:

- a map showing the proposal in the local context - an overlay of the proposal on a base map of the main environmental constraints;
- a map showing the proposal in the regional context;

and, if appropriate:

- a process chart / mass balance diagram showing inputs, outputs and waste streams.

All figures should include a north arrow, a scale bar, a legend, grid coordinates, the source of the data, a title and (where applicable) the date of aerial photo.

Other logistics

- timing and staging of project; and
- ownership and liability for waste during transport, disposal operations and long-term disposal (where appropriate to the proposal).

5.2 Environmental factors

The environmental review should focus on the relevant environmental factors for the proposal, and these should be agreed in consultation with the EPA and DEP and relevant public and government agencies. Preliminary environmental factors identified for the proposal are shown in Part A of these guidelines.

Further environmental factors may be identified during the preparation of the environmental review, therefore on-going consultation with the EPA, DEP and other relevant agencies is recommended. The DEP can advise the proponent on the recommended EPA objective for any new environmental factors raised. Minor matters which can be readily managed as part of normal operations for the existing operations or similar projects may be briefly described.

Items that should be discussed under each environmental factor are:

- a clear definition of the area of assessment for this factor;
- the EPA objective for this factor;
- a description of what is being affected - why is this factor is relevant to the proposal;
- a description of how this factor is being affected by the proposal - the predicted extent of impact;
- a description of where this factor fits into the broader environmental / ecological context (only if relevant - this may not be applicable to all factors);
- a straightforward description or explanation of any relevant standards / regulations / policy;
- environmental evaluation - does the proposal meet the EPA's objective as defined above;
- if not, environmental management proposed to ensure the EPA's objective is met;
- predicted outcome.

The proponent should provide a summary table of the above information for all environmental factors, under the three categories of biophysical, pollution management and social surroundings:

Table 2: Environmental factors and management (example only)

Environ-mental Factor	EPA Objective	Existing environment	Potential impact	Environ-mental management	Predicted outcome
BIOPHYSICAL					
vegetation community types 3b and 20b	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation community types 3b and 20b	Reserve 34587 contains 45 ha of community type 20b and 34 ha of community type 3b	Proposal avoids all areas of community types 20b and 3b	Surrounding area will be fully rehabilitated following construction	Community types 20b and 3b will remain untouched Area surrounding will be revegetated with seed stock of 20b and 3b community types
POLLUTION MANAGEMENT					
Dust	Ensure that the dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards	Light industrial area - three other dust producing industries in close vicinity Nearest residential area is 800 metres	Proposal may generate dust on two days of each working week.	Dust Control Plan will be implemented	Dust can be managed to meet EPA's objective
SOCIAL SURROUNDINGS					
Visual amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal	Area already built-up	This proposal will contribute negligibly to the overall visual amenity of the area	Main building will be in 'forest colours' and screening trees will be planted on road	Proposal will blend well with existing visual amenity and the EPA's objective can be met

5.3 Environmental management commitments

The implementation of the proposal and all commitments made by the proponent become legally enforceable under the conditions of environmental approval issued in the statement by the Minister for the Environment. All the key environmental management commitments should be consolidated in the public review document in a list (usually in an Appendix). This list is attached to the Minister's statement and becomes part of the conditions of approval.

The proponent's compliance with the key environmental management commitments will be audited by the DEP, so they must be expressed in a way which enables them to be audited.

A commitment needs to contain most of the following elements to be auditable:

- who (eg. the proponent)
- will do what (eg. prepare a plan, take action)

- why (to meet an environmental objective)
- where/how (detail the action and where it applies)
- when (in which phase, eg. before construction starts)
- to what standard (recognised standard or agency to be satisfied)
- on advice from (agency to be consulted).

The proponent may make other commitments, which address less significant or non-environmental matters, to show a commitment to good general management of the project. Such commitments would not normally be included in the list appended to the statement. The EPA expects that the proponent will audit these commitments by internal processes. Though the DEP would not subject the less significant environmental commitments to routine audit, it may periodically request that compliance with these commitments be demonstrated, so as to verify satisfactory environmental performance in the proponent's implementation of the proposal.

With the implementation of continuous improvement, the procedures to implement the commitments may need to be changed. These changes can be made in updates to the environmental management plan, whilst ensuring the objective is still achieved.

Once the proposal is approved changes to the commitments constitute a change tot he proposal and should be referred to the DEP.

Examples of the preferred format for typical commitments are shown in the following table:

Table 3: Summary of proponent's commitments (example only)

Commitment (Who/What)	Objective (Why)	Action (How/Where)	Timing (When)	Whose advice	Measurement/ Compliance criteria
1. XYZ Mining will develop a rehabilitation plan	to protect the abundance, species diversity, geographic distribution and productivity of the vegetation community types 3b and 20b	by limiting construction to a small area (10 ha) of Reserve 34587 and rehabilitating the area	before construction	CALM, NPNCA	fences built; species distribution and density consistent with vegetation community types 3b and 20b
2. XYZ Mining will minimise dust generation	to maintain the amenity of nearby land owners	by preparing and implementing a Dust Control Plan which meets EPA Dust Control criteria	before the start of construction phase	preparation: DEP; implementation: Shire	Letter from Shire submitted with Performance and Compliance Report.

These commitments should be written in tabular form, preferably with some specification of ways in which the commitment can be measured, or how compliance can be demonstrated.

Draft commitments which are not in a format that can be audited will not be accepted by project officers for public review documentation. Proponents will be assisted to revise inadequate commitments.

5.4 Public consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the environmental review. It should describe the activities undertaken, the dates, the groups/individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management of the factors which should clearly indicate how community concerns have been addressed. Those concerns which are dealt with outside the EPA process can be noted and referenced.

Attachment 1

The first page of the proponent's environmental review document must be the following invitation to make a submission, with the parts in square brackets amended to apply to each specific proposal. Its purpose is to explain what submissions are used for and to detail why and how to make a submission.

Invitation to make a submission

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

[the proponent] proposes [the rezoning of land and the development of a Marina Complex in the City of Bunbury]. In accordance with the Environmental Protection Act, a [PER] has been prepared which describes this proposal and its likely effects on the environment. The [PER] is available for a public review period of [8] weeks from **[date]** closing on **[date]**.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

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 unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group 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 [PER] 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 elements of the [PER]:

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

Points to keep in mind

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 [PER];
- if you discuss different sections of the [PER], 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 submissions is: **[date]**

Submissions should be addressed to:

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

Attention: **[Project Officer name]**

Attachment 2

Advertising the environmental review

The proponent is responsible for advertising the release and arranging the availability of the environmental review document in accordance with the following guidelines:

Format and content

The format and content of the advertisement should be approved by the DEP before appearing in the media. For joint State-Commonwealth assessments, the Commonwealth also has to approve the advertisement. The advertisement should be consistent with the attached example.

Note that the DEP officer's name should appear in the advertisement.

Size

The size of the advertisement should be 2 newspaper columns (approximately 10 cm) wide by approximately 14 cm long. Dimensions less than these would be difficult to read.

Location

The approved advertisement should, for CER's, appear in the news section of the main local newspaper and, for PER's and ERMP's, appear in the news section of the main daily paper's ("The West Australian") Saturday edition, and in the news section of the main local paper at the commencement of the public review period and again two weeks prior to the closure of the public review period.

Timing

Within the guidelines already given, it is the proponent's prerogative to set the time of release, although the DEP should be informed. The advertisement should not go out before the report is actually available, or the review period may need to be extended.

Example of the newspaper advertisement

SCM CHEMICALS LTD

Consultative Environmental Review

EXTENSION TO DALYELLUP RESIDUE DISPOSAL PROGRAMME

(Public Review Period: **[date]** to **[date]**)

SCM Chemicals Ltd is planning to extend the company's existing residue disposal programme at Dalyellup, south of Bunbury, from March 1992 to March 1993.

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

SCM has prepared a project summary which is available free of charge from the company's office on Old Coast Road, Australind.

Copies of the CER may be purchased for $5 from:

SCM Chemicals Ltd
Old Coast Road
AUSTRALIND WA 6230
Telephone: (08) 9467 2356

Copies of the complete Consultative Environmental Review will be available for examination at:

- Environmental Protection Authority
  Library Information Centre
  8th Floor, Westralia Square
  38 Mounts Bay Road
  PERTH WA 6000
- Environmental Protection Authority
  65 Wittenoom Street
  BUNBURY WA 6230
- City of Bunbury public libraries
- Shire of Capel libraries
- Shire of Harvey library (Australind)
- Shire of Dardanup (Eaton)

Submissions on this proposal are invited by **[closing date]**. Please address your submission to:

Chairman
Environmental Protection Authority
8th Floor, Westralia Square
38 Mounts Bay Road
PERTH WA 6000
Attention: **[Project Officer name]**

If you have any questions on how to make a submission, please ring the project officer, **[Project Officer name]**, on (08) 9222 7xxx.

APPENDIX D

Botanical Survey Findings

APPENDIX D

BOTANICAL SURVEY FINDINGS

D.1 Introduction and Background

A botanical survey was carried out during January 1998 to examine the floristic composition of Site C and to compare this to a range of other locations between Broke Inlet and Parry Inlet where regional scale landform/soil maps prepared by Churchward *et al.* (1988) indicate sedgeland vegetation and soil/groundwater conditions were similar to Site C.

D.2 Method

Survey incorporated review of regional maps, aerial survey by light aircraft and initial reconnaissance by 4WD vehicle leading to the selection of a range of locations for botanical survey where vegetation, landform, topographic and soil conditions resembled Site C.

At each site, flora samples were collected, identified and species lists compiled. Figure D and Table 1 describe each site's location and soil landform unit and Table D2 presents the flora list. Corresponding soil profile and water table depth for each site are presented in Appendix E.

D.3 Results and Discussion

A total of 46 species were identified from 16 sites, over six landform units.

All Walpole units demonstrated the catena sequence from sedgeland to *Allocasuarina* woodland, with near identical species composition to that detected at Site C.

Sedgeland species within the Walpole, Angove, and Burnett Landform Units were characterised by the presence of *Evandra aristida* and *Banksia quercifolia,* with *Agonis parviceps, Leptocarpus tenax, Anarthria scabra, Lyginia barbata* and *Anarthria prolifera* common across all units. Although similar with respect to other species, the Kordabup and V4 Units did not contain the distinctive *Evandra aristida* or *Banksia quercifolia,* while the Quagering Unit contained *Banksia quercifolia,* but not *Evandra aristida.*

Stunted, depauperate jarrah was commonly detected in association with sedgelands of the Walpole, Burnett and Angove units.

D.4 Conclusions

- The same vegetation communities which occur on the project site were found in all other examples of the Walpole landform unit which were examined in the region.

- The species composition of the sedgeland communities was remarkably similar across five of the six landform units sampled. Sedgeland species within the Walpole, Angove, and Burnett Landform Units were characterised by the presence of *Evandra aristida* and *Banksia quercifolia.* Each of the landform units containing similar sedgeland communities is commonly derived from Eocene Tertiary shallow deposits

- *Melaleuca thymoides* (typical of well drained soils) and *Banksia quercifolia* (typical of poorly drained soils) occurred together across every catena sequence where it occurred within the sites on the Walpole landform unit.

- *Melaleuca thymoides* is also common to jarrah woodland of the Keystone and Burnett Landform Units (Churchward *et al.*, 1988).

- *Banksia quercifolia* is common and widespread and was found to occur associated with poorly drained soils over hardpan or clay in sedgelands of the Burnett, Quagering and Angove Landform Units and has also been described as typical of swampy terrain within the Pingerup and Caldyanup Landform Units (Churchward *et al.*, 1988).

- Stunted *Eucalyptus marginata* (jarrah) was found to be associated with sedgeland over sites sampled in the Walpole, Burnett and Angove units.

Table D1
Vegetation Sampling Sites

Site #	Landform Unit		Location
1	Walpole	Wa	WNNP: Paluslope South East of Site C
2	Walpole	Wa	WNNP: *Allocasuarina* (Sheoak) Woodland South East of Site C
3	Walpole	Wa	SITE C: Sedgeland
4a	Walpole	Wa	SITE C: *Allocasuarina* (Sheoak) Woodland
4b	Walpole	Wa	SITE C: Ecotone between sedgeland and *Allocasuarina* (Sheoak) Woodland
5	Walpole	Wa	WNNP: Coalmine Beach
6	Kordabup	K	North of Boronia Ridge
7	Angove	A	Angove St West
8	Angove	A	Angove St East
9	Walpole	Wa	West of Boat Harbour Road
10	Walpole	Wa	Kenton Road
11	Walpole	Wa	Rubbish Tip
12	Quagering	Q	Crystal Springs
13	Major Valley	V4	Inlet River
14	Burnett	BU	Broke Inlet Road (East)
15	Burnett	BU	Chesapeake Road
16	Burnett	BU	Broke Inlet Road (West)

APPENDIX D

Table D2
Vegetation Species collected over sedgeland landform units
January 1998

	Sedgeland - Ecotone - Allocas/Jarrah															
	WNNP: Palusiope	SITE C: Sedgeland	WNNP: Coalmine Beach	SITE C: ecotone	Rubbish Tip	W of Boat Harbour Road	Kenton Road	WNNP: Allo/Jarrah	SITE C: Allo/Jarrah	N. of Boronia Ridge	Angove St West	Angove St. East	Crystal Springs	Inlet River	Broke Inlet Road	Chesepeake Road
Landform Unit	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	K	A	A	Q	V4	Bu	Bu
Species/Site No.	1	3	5	4b	11	9	10	2	4a	6	7	8	12	13	14	15
Acacia divergens											x					
Acacia myrtifolia	x	x	x	x	x	x	x			x			x		x	
Adenanthos obovatus						x	x	x	x				x			x
Agonis flexuosa			x	x		x			x	x				x		
Agonis linearifolia											x			x		x
Agonis parviceps	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Allocasuarina fraseriana						x	x	x	x							
Amphipogon debilis	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anarthria prolifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anarthria scabra	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Andersonia caerulea				x		x		x	x							
Astartea fascicularis				x		x	x			x				x		
Banksia illicifolia				x			x	x	x					x	x	x
Banksia quercifolia		x	x			x	x				x	x			x	x
Beaufortia sparsa	x	x	x	x	x	x	x			x	x	x	x		x	
Boronia crenulata	x		x	x		x				x					x	
Bossiaea rufia	x	x				x	x			x						
Burchardia umbellata		x		x	x	x		x	x	x		x				
Conostylis aculeata						x		x	x							
Dampiera linearis	x	x	x	x	x	x	x	x	x	x	x		x		x	
Daniella revoluta					x	x		x	x							
Dasypogon bromelifolius			x		x	x		x	x				x		x	x
Eucalyptus marginata			x	x	x	x	x	x	x		x	x	x		x	
Evandra aristida		x	x	x	x	x	x				x	x			x	x
Hibbertia hypericoides				x		x		x	x							
Homalaspermum firmum	x	x			x					x	x	x		x		x
Jacksonia furcellata				x	x	x		x	x	x					x	x
Johnsonia lupilina				x	x	x	x			x			x		x	
Kingia australis												x		x		
Kunzea sulpherea								x	x							
Lepidosperma sp	x					x	x	x	x					x	x	
Leptocarpus tenax	x	x	x	x	x	x	x	x		x	x	x		x	x	x
Leucopogon capitellatus				x				x	x							
Leucopogon obovatus	x	x	x	x	x	x	x	x								
Leucopogon unilateralis	x	x	x		x	x		x		x						
Loxacarya flexuosa	x	x	x	x	x	x	x	x	x	x	x		x		x	x
Lycinema ciliatum	x	x	x			x		x						x		
Lyginia barbata/?tenax	x	x	x	x	x	x				x	x			x	x	
Melaleuca thymoides			x			x	x	x		x						
Mesomelaena tetragona										x					x	x
Opercularia apiciflora					x	x	x	x	x							
Patersonia occidentalis			x		x											
Pultenaea reticulata	x		x		x	x	x	x	x	x						
Thysanotus multiforus	x		x	x		x		x	x	x	x		x		x	x
Xanthorrhoea preissii			x					x	x	x	x	x		x		
Xyris lacera	x	x	x								x	x		x		

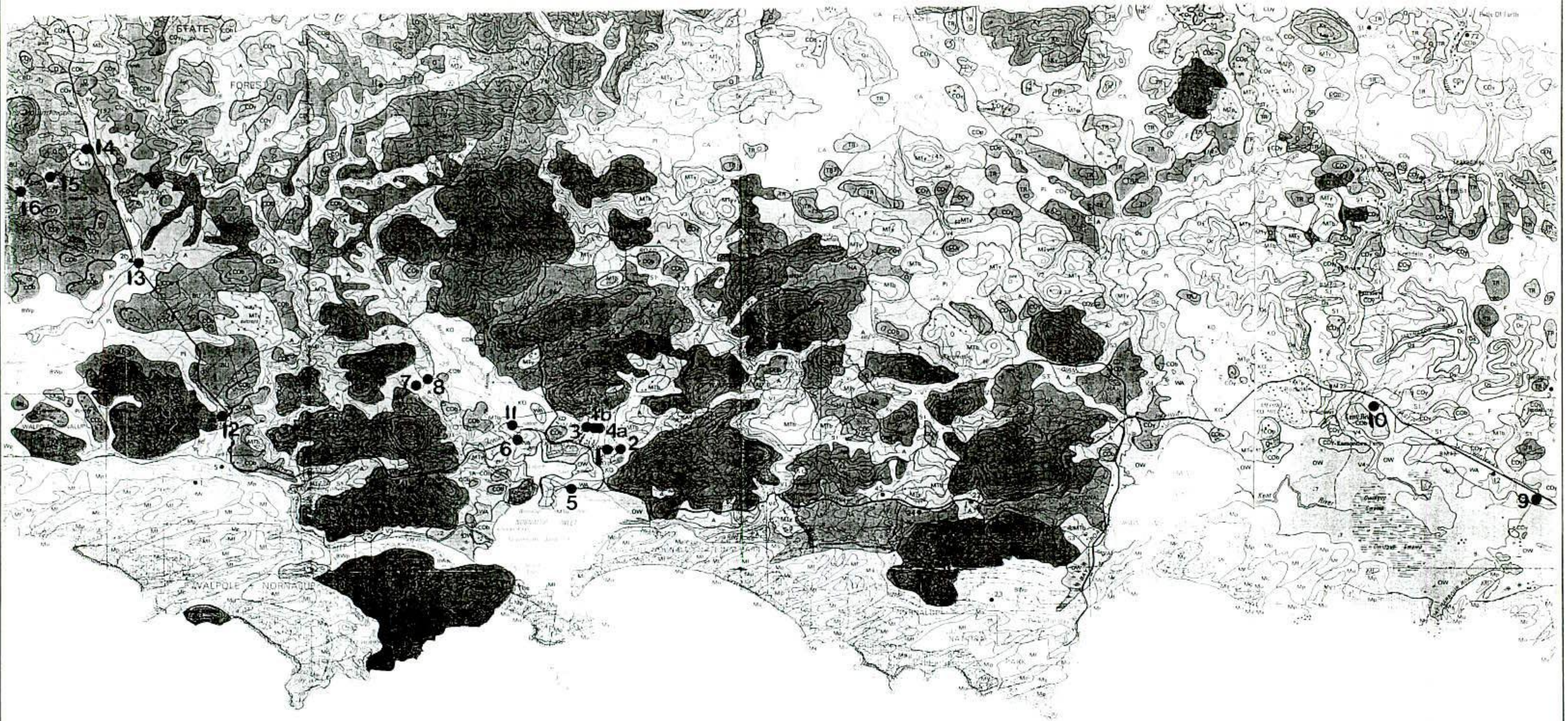


Figure D

Vegetation Sampling Locations

Scale 1: 240,000

BOWMAN BISHOP GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

APPENDIX E

Soil/Groundwater Sampling Survey Findings

1.0 INTRODUCTION

Each location chosen for botanical survey was also surveyed for soil profile/shallow groundwater conditions by hand augering using conventional soil survey equipment.

2.0 METHODS

Hand auger sampling was carried out to maximum achievable depth and soil profiles and types recorded using the Unified Soil Classification System.

3.0 RESULTS

Table E presents the results whilst Figure D in Appendix D shows the location of sampling sites.

4.0 CONCLUSION

Shallow soil/groundwater conditions typical of Site C i.e. around 2m of sandy permeable soils overlying a confining layer with a water table at 0.7m to 1.7m below ground level, and supporting sedgeland vegetation were found widely throughout the survey region, as depicted on Figure D, Appendix D.

TABLE E

Soil Profiles and Water Table Depths at Vegetation Sampling Sites Between Broke Inlet and Parry Inlet

SITE (See Appendix D, Figure D for locations)	Landform/ Soil Unit	Description	Depth (mm) Below surface	Soil Type	Depth toWater Table (mm)
5 (Coal Mine Beach) Sedgeland	Walpole	Sedgeland – broad sandy beach sloping gently to north west	0 - 300 300 - 1600 1600+	Dry brown humus sand Coarse brown sand Hard pan	700
6 (Boronia Ridge North)	Walpole	Gently sloping to north, sandy slopes, sedgeland and vegetation	0 – 500 500 – 1000 1000+	Grey brown silty sand Pale brown sand, quartz Fat clays, light brown	Not encountered, but profile moist
7 (Angove Road South)	Walpole/Kordabup	Mound of peat on broad easterly sloping plain	0 – 1500	Black peat (site not representative of area)	Full profile wet – infers water table near surface
8 (Angove Road North)	Walpole/Kordabup	Broad sandy plain sloping gently eastwards	0 – 400 400 – 1300 1300 – 2000 2000+	Fine grey/brown sand Grey/black silty sand Grey quartz sand Coffee rock (black cemented sand)	1800
9 (West of Boat Harbour Road)	Walpole	Sedgeland, flat	0 – 200 200 – 400 400 – 500 500+	Silty sand, light brown Coarse sand, light brown Mottled sandy clay & quartz Hardpan	Not encountered

Table E (Continued)

SITE (See Appendix D, Figure D for locations)	Landform/ Soil Unit	Description	Depth (mm) Below surface	Soil Type	Depth toWater Table (mm)
10 (Kenton Road)	Walpole	Sedgeland, flat	0 – 300 300 – 1700+	Grey/brown silty sand Brown/cream sand, coarser with depth	1000
11 (Rubbish Tip)	Walpole	Gently sloping sedgeland	0 – 300 300 – 700 700+	Grey silty sand Coarse quartz sand Cemented quartz sand	Not encountered
12 Crystal Springs	Quagering	Sedgeland, flat	0 – 200 200 -	Grey silty sand Grey sand.	1200
13 Inlet Road	Major Valley (V4)	Sedgeland, flat	0 – 200 200 – 1300 1300 -	Grey silty sand Grey sand Coarse quartz layer	1000
*Access track opposite quarry at Site C	Walpole	Shallow sandy valley	0 – 400 400 – 1700	Sand, humus Grey brown sand, coarse	1700
*Within drainage line opposite Site C	Walpole	Sample collected from within dense Ti tree thicket immediately adjacent to TP creek	0 – 1200 1200 – 1300 1800 – 2200 2200+	Black peat Peat, sand Gravelly clay with quartz clayey sand Bedrock	1200

Sites 1, 2, 3, 4, 14, 15 and 16 not sampled for soils. *Location not shown on Figure D, Appendix D