PUBLIC ENVIRONMENTAL REVIEW

PORT BOUVARD

URBAN AND CANAL DEVELOPMENT

Prepared by:

Feilman Planning Consultants
Bowman Bishaw and Gorham
Cossill and Webley
Dames and Moore
Quilty Environmental Consulting
Steedman Science and Engineering

For:

Wannunup Development Nominees Pty Ltd

INVITATION

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

The Public Environmental Review (PER) has been prepared in accordance with Western Australian Government procedures. The PER proposes to establish a residential and canal development including a golf course north and south of the Dawesville Channel, Mandurah. The report will be available for comment for 8 weeks ending on 16th November 1992.

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

Why write a submission?

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

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless confidentiality is requested, and may be quoted either in full or in part in each 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 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 proposals in the PER:

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

Points to keep in mind

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

- attempt to list points so that the 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 wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address; and
- date.

The closing date for submissions is 16th November 1992

Submissions should be addressed to:

The Chairman
Environmental Protection Authority
8th Floor, Westralia Square
39 Mounts Bay Road
PERTH WA 6000

Attention: Ms Eve Bunbury

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Proposal 1

1.2 The Proponent 1

1.3 Existing Zoning 1

1.4 Statutory and Approval Requirements 2

1.4.1 Planning Approval 2

1.4.2 Environmental Approval 3

1.5 Report Structure 4

2.0 BACKGROUND 5

3.0 NEED FOR THE PROJECT 9

3.1 Demand for Residential Land 9

3.2 Dawesville Channel Construction 10

3.3 Development Options 10

4.0 PROJECT DESCRIPTION 12

4.1 Location 12

4.2 Planning Overview 12

4.2.1 Northport 13

4.2.2 Southport 13

4.2.3 Eastport 14

4.3 Population 14

4.4 Estuary Foreshore Reclamation and Excavation 14

4.5 Services 16

4.6 Development of Water Supplies for Golf Course Irrigation 17

4.7 Construction 18

4.7.1 Site Infrastructure 18

4.7.2 Construction Method 18

4.7.3 Construction Programme 19

4.7.4 Construction Workforce 20

5.0 THE EXISTING ENVIRONMENT 21
5.1 Physical 21
5.1.1 Coastal Dunes 21
5.1.2 Caddadup Reserve 22
5.1.3 Estuary Foreshore 23
5.1.4 Hydrogeological Setting 26
5.2 Social 28
5.2.1 Existing Communities 28
5.2.2 Existing Traffic Patterns 29
5.2.3 Land Use 30
5.2.4 Land Characteristics 30
5.2.5 Historical, Archaeological and Ethnographic Sites 31
6.0 ENVIRONMENTAL AND SOCIAL IMPACTS AND MANAGEMENT 32
6.1 Coastal Foreshore 32
6.1.1 Coastal Foreshore Stability 32
6.1.2 Coastal Dunes 32
6.2 Estuary Foreshore 34
6.3 Flora and Fauna Communities and Habitats 36
6.4 Caddadup Reserve 37
6.5 Canal Water Quality 37
6.6 Dawesville Channel 39
6.7 Rubbish Disposal Site 39
6.8 Enhanced Recharge 40
6.9 Effect of Development on Peel-Harvey Catchment Boundary. 40
6.10 Effects of Abstraction 41
6.11 Effects on Groundwater Quality 41
6.11.1 Effluent Discharge from Sewage Treatment Works 42
6.11.2 Golf Course and Turfed Areas 42
6.12 Impact of Canal Construction on the Groundwater Regime 42
6.13 Impact of Marina Construction on the Groundwater Regime 42
6.14 Existing Community 43
6.15 Community Access 43
6.16 Dual Use Paths 44

6.17 Traffic Volumes 44
6.18 Existing Housing 44
6.19 Community and Recreation Facilities 45
6.19.1 Public Open Space 45
6.19.2 District Open Space 46
6.19.3 Community Hall, Public Library and Day Care Centre 46
6.20 Vesting of Land 46
6.21 Construction Traffic and Noise Control 47
6.21.1 Northport 47
6.21.2 Southport 47
6.21.3 Eastport 47
6.22 Construction of Associated Services 47
6.23 Historical, Archaeological and Ethnographic Sites 48
6.24 Aesthetic Appearance 48
7.0 PUBLIC CONSULTATION 49
8.0 COMMITMENTS 51
8.1 Pre-Construction 51
8.1.1 Golf Course Management Plan 51
8.1.2 Foreshore Management Plan 51
8.1.3 Water Quality Management and Monitoring Plan 52
8.1.4 Waterway Management Plan 52
8.1.5 Archeological and Ethnographic Survey 52
8.2 During Construction 53
8.2.1 Dune Protection 53
8.2.2 Estuary Foreshore Vegetation 53
8.2.3 Noise, Traffic Management and Dust Control Measures 53
8.2.4 Community Awareness 53
8.3 Post Construction 53

PLANS

A. Zoning Plan

B. Dawesville Channel Strategy Plan

C. Port Bouvard - Eastport Option

D. Location Plan

E. Land Ownership Details

F. Port Bouvard Options 1 and 2

G. Proposed Reclamation and Excavation

H. ABS Collector Districts

I. Land Use and Ethnographic Information

J. Groundwater Catchment Boundaries

K. Dual Use Path Network

L. Community Assessment Catchment

FIGURES

1. Past / Projected Population Growth - Peel Region

2. City of Mandurah
Production and Consumption of Single Residential Lots

3A. Growth Rate Comparisons 1976 - 1981

3B. Growth Rate Comparisons 1981 - 1986

APPENDICES

1. Outline Development Plan - Option 1

2. Outline Development Plan - Option 2

3. Guidelines for the Public Environmental Review

1.0 INTRODUCTION

1.1 Proposal

The State Government adopted the Dawesville Channel as part of the overall management strategy for the Peel-Harvey Estuarine System. The land required for the Dawesville Channel was largely contained within one ownership - being owned by Wannunup Development Nominees Pty Ltd. In 1991 the Company and State Government agreed upon a number of land exchanges whereby the Company will receive land currently under the control of the government in exchange for the 23 hectares of land required for the Dawesville Channel and the respective bridge and road alignment approaches. Wannunup Development Nominees Pty Ltd proposes to develop an area of land to be known as Port Bouvard immediately adjacent to the Channel, on both the northern and southern sides, for the construction of artificial waterways and associated urban development.

The proposed development will comprise:

- Single residential and medium density development;
- Waterway development;
- Public marina and boat launching area;
- Hotel resort and 18 hole golf course;
- Passive and active recreational areas; and
- Neighbourhood shopping centre and associated commercial and community facilities.

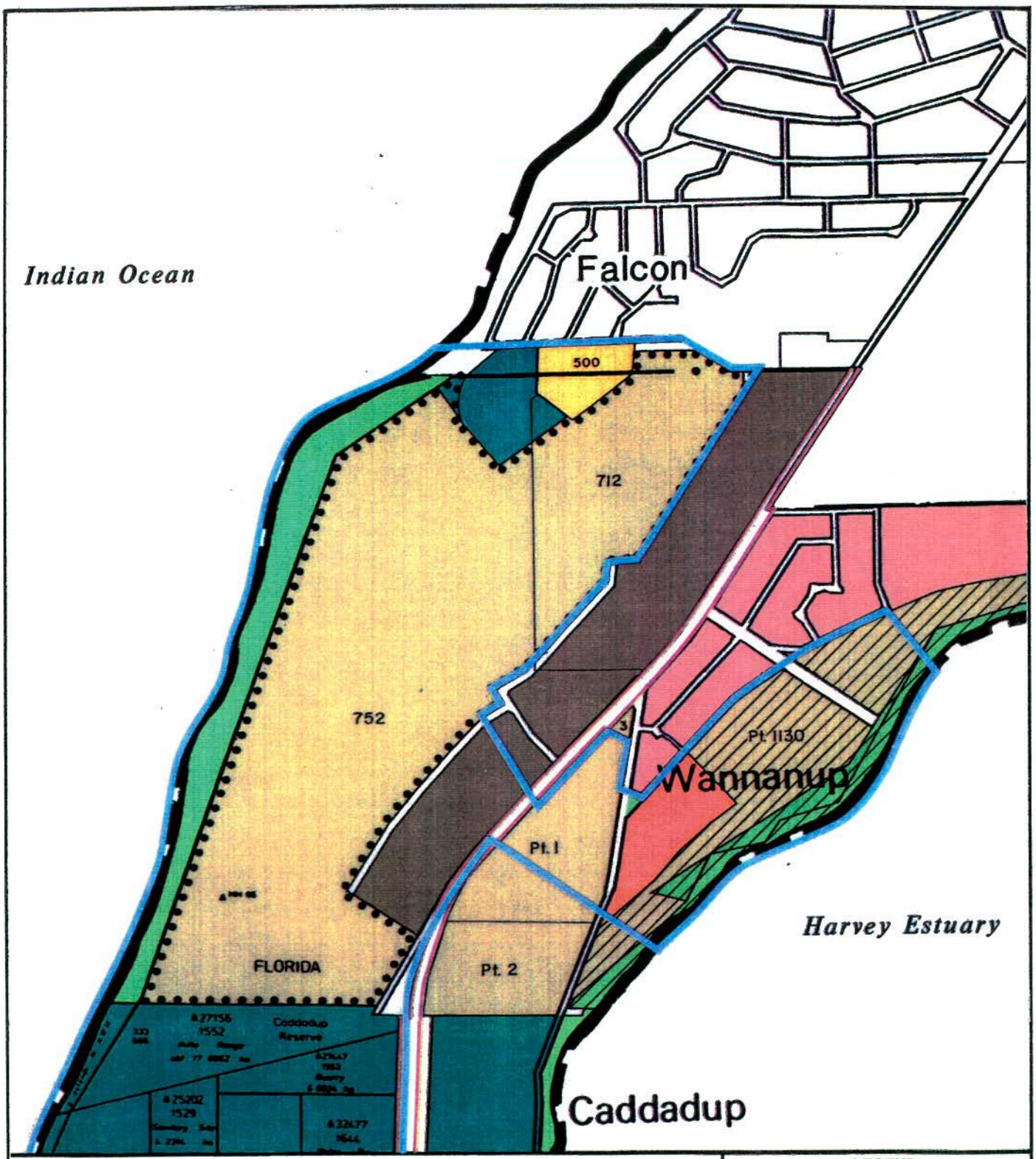
An Outline Development Plan delineating the above and comprising two options is provided at Appendix 1 and Appendix 2.

1.2 The Proponent

The proponent for the Port Bouvard development is Wannunup Development Nominees Pty Ltd. The proponent has owned the land for approximately 15 years, during which time a number of proposals have been submitted for the land's development, but which have proven unsuccessful due to the Governments commitment to protect the alignment of the proposed Dawesville Channel.

1.3 Existing Zoning

The majority of the landholdings comprise vacant land currently included in the Rural Zone in Town Planning Scheme No. 1A (refer Plan A).



SUBJECT LAND

LEGEND

- OVERALL PLANNING AREA
- ARTERIAL ROAD
- RESIDENTIAL ONE
- RURAL
- SPECIAL RURAL
- LOCAL RECREATION
- DISTRICT RECREATION
- TOURIST
- PUBLIC PURPOSES
- LANDSCAPE PROTECTION AREA

PORT BOUVARD

ZONING PLAN

Scale — N.T.S. Date — 4·8·1992
Feilman Planning Consultants Pty. Ltd.

PLAN A

On the Western side of Old Coast Road the land is zoned Rural. However, in recognition of the land's proximity to Mandurah and the existing residential area of Falcon, it is also included as an Overall Planning Area. This represents a significant land area being 164ha in total. The delineation of the area as an Overall Planning Area acknowledges that the future use of the land will be urban.

To the east of Old Coast road, between Queen Parade and the Inlet the Rural zoned land also incorporates a Landscape Protection Area. Throughout the Scheme Landscape Protection areas are created "...primarily to protect areas of scenic ecological value or to provide for landscaped vistas in relation to the built environment."

Within this area, at the intersection of Queen Parade and Estuary Road is a site of approximately seven hectares zoned Tourist. The Policy for the Tourist zone is to encourage the development of tourist facilities "...in keeping with the holiday and tourism and recreational assets of the sub region." In this regard uses such as caravan parks, chalets, private and public recreation, licensed restaurants, hotels, clubs and cinemas are all permitted uses.

Amendment No. 176 to the Scheme was initiated by Mandurah City Council during 1991. The Amendment proposed the creation of the "Dawesville Channel Development Zone" over the subject land. The Amendment is currently in the process of being finalised having been endorsed by Council and lodged with the State Planning Commission for Final Approval in June 1992.

1.4 Statutory and Approval Requirements

1.4.1 Planning Approval

To accommodate the proposals contained within the Port Bouvard project necessitates the following three staged process for planning approval:

(i) Rezoning of the total landholdings to "Dawesville Channel Development Zone";

(ii) Detailed structure planning in the form of an Outline Development Plan; and

(iii) Rezoning of the land proposed for waterways to "Canal Zone".

The creation of the "Dawesville Channel Development Zone" represents the first step in the planning approval process. The new zone requires the preparation of detailed structure planning in the form of an outline development plan prior to the subdivision or development of the land.

The Outline Development Plan requires the approval of the Mandurah City Council and the State Planning Commission and has been lodged with both agencies. Prior to making a determination the Commission has referred the plan to a number of State Government agencies. These agencies include:

- Department of Agriculture
- Ministry of Education
- Environmental Protection Authority
- Main Roads Department
- Water Authority of Western Australia
- Peel Inlet Management Authority
- Waterways Commission
- Department of Marine and Harbours
- Department of Land Administration

Although not a statutory requirement the Mandurah City Council has required that the Outline Development Plan be advertised for public comment for 30 days. The period during which time the public can make a submission on the Outline Development Plan will be completed on 28th August 1992.

Concurrently with the environmental and planning approval process for the Outline Development Plan it will be necessary to initiate an Amendment to the Town Planning Scheme to create a "Canal Zone" over the proposed waterways in accordance with the Statutory requirements of the Scheme and the Canal Guidelines.

1.4.2 Environmental Approval

This document addresses the proposed urban and canal development known as "Port Bouvard" as depicted in the Outline Development Plan (Appendices 1 and 2).

The PER is not required, nor is it intended, to address the environmental acceptability or impact of the Dawesville Channel which was the subject of a separate environmental assessment and approval process completed in 1988.

An 8 week, public advertising and comment period is required for this PER under the Environmental Protection Act.

1.5 Report Structure

This Public Environmental Review has been prepared by Feilman Planning Consultants in association with Cossill and Webley, Dames and Moore, Quilty Environmental Consulting and Steedman Science and Engineering. The Report has been structured as two volumes. Volume 1 is the Public Environmental Review report and addresses the requirements of the Environmental Protection Authority as outlined in the Authority's Guidelines. Volume 2 consists of three appendices representing the separate technical reports of the three sub-consultants to the project.

The Report has been prepared in two volumes allowing Volume 1 to be structured as a general overview providing an accurate and concise summary, which is easily understood and is proposed for the community's general availability. The more technical and specialist information is restricted to Volume 2.

The breakdown of Volume 2 is as follows:

Appendix "A" Groundwater Regime
Dames and Moore

Appendix "B" Coastal Dunes, Caddadup Reserve and Estuary Foreshore
Quilty Environmental Consulting

Appendix "C" Ocean Foreshore Stability, Canal Water Quality, Estuary Reclamation
Steedman Science and Engineering.

2.0 BACKGROUND

The Public Environmental Review for the Port Bouvard Urban and Canal Development, Mandurah effectively represents the third stage in the environmental review and assessment involving the subject land.

From 1976 onwards the former Department of Conservation and Environment produced a number of reports which progressively informed the public of the ongoing research within the Peel-Harvey Estuary. In 1984 the Peel-Harvey Study Group was appointed to establish the necessary measures to reduce the algae problem within the Estuary. The results of the Group's work and its recommendations were reported to Government in the Stage 1 Environmental Review and Management Programme (ERMP).

As well as recommending a number of management strategies, the ERMP included one major engineering recommendation: the construction of a channel from Harvey Estuary to the Indian Ocean, the environmental implications of which were considered sufficiently significant to warrant independent environmental assessment.

In December 1985 the former Department of Conservation and Environment published ***"The Peel-Harvey Estuarine System - Proposals for Management"*** where reference is made to a preliminary concept plan the general principles of which were supported in the Departments conclusions.

As part of the Stage 2 - ERMP prepared in 1987 - 88 the preliminary concept plan was developed further by the Department of Marine and Harbours, resulting in the production of two development options which promoted waterway development to the north and south of the Channel.

Whilst the Environmental Protection Authority's assessment and recommendations were confined to the mechanics of the Channel's operations, no specific objection nor reference was made to the unsuitability of the proposals for the adjoining land's development.

This assessment included the proposal for disposing of approximately 4.6 million cubic metres of fill material on both sides of the proposed channel where the existing vegetation was considered as having low to moderate conservation value. This position was confirmed by the Environmental Protection Authority in its own assessment determining that the environmental impacts of the Channel would be acceptable.

Due to the significance of the Dawesville Channel to the environmental health of the Peel-Harvey Estuary, the Department of Marine and Harbours acting on Cabinet resolutions formed the Dawesville Channel Steering Committee to prepare a Structure Plan for the future development of the area. The Steering Committee comprised the following representatives:

- Department of Marine and Harbours
- Department of Planning and Urban Development;
- City of Mandurah
- Shire of Murray; and,
- Wannunup Development Nominees Pty Ltd

Specialist advice and input was sought from the Environmental Protection Authority, the Water Authority and Department of Conservation and Land Management.

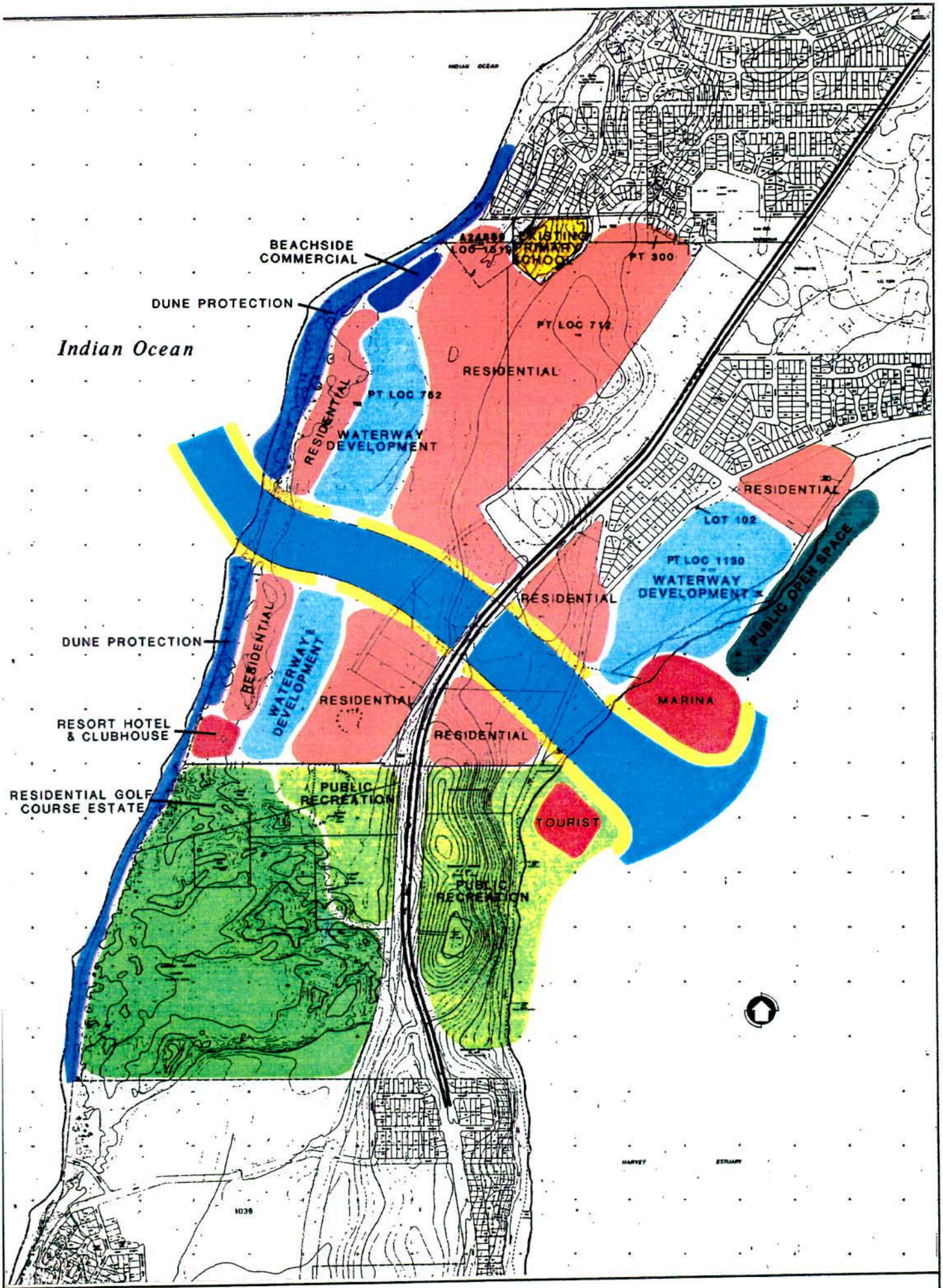
At its meeting of 18th December, 1990 the Committee considered a number of planning objectives which led to the development of a Concept Plan forming the basis for the further detailed planning assessment. A Strategy Plan was then prepared which outlined the general objectives for the development of the Dawesville Channel locality. The Strategy Plan promoted urban development centred around the Dawesville Channel and comprised the following uses:

- single residential and medium density development;
- waterway development;
- regional marina and ocean sailing club;
- public boat launching area and boatel;
- hotel resort and 18 hole golf course;
- passive and active recreational areas;
- beachside tavern and local shopping centre; and,
- tourist / recreation complex.

The Strategy Plan was refined further to form the basis for Amendment No. 176 to the City of Mandurah Town Planning Scheme No. 1A. The Amendment proposed the creation of the "Dawesville Channel Development Zone" and was supported by the Strategy Plan (refer Plan B) which outlined the general planning objectives for the future development within the zone.

The Strategy Plan was referred to the Environmental Protection Authority in June 1991 as part of the formal rezoning of the land affected by construction of the Channel. This was presented in conceptual form and detailed proposed channel alignment, and associated urban land and waterway development adjacent to the Channel.

In view of the previous assessment of the Channel in 1988, the Authority determined that the Strategy Plan should be subject to informal assessment, to provide the following advice:



DAWESVILLE CHANNEL STRATEGY PLAN

Scale — N.T.S. Date — 4·6·1992
Feilman Planning Consultants Pty. Ltd.

Plan B

- Publicly outline what had previously been assessed by the EPA in relation to the Dawesville Channel;

- Provide an indication of the status of the Peel-Harvey catchment management in relation to EPA recommendations made in 1988; and

- Publicly identify aspects of the development associated with construction of the Channel and Strategy Plan which would require further input by the EPA. This included:

  (i) Further specific advice on aspects of the proposal such as changes to the dredge spoil and disposal management plans, in accordance with Condition 7 of the 1988 environmental conditions set for the Stage 2 ERMP; and

  (ii) Identify components of the proposed development associated with the Strategy Plan which may require further environmental impact assessment by the EPA in view of potential impacts associated with their construction on adjacent waterways. These included the proposed canal development adjacent to the Channel, and a proposed marina and tourist development located on the proposed reclamation area adjacent to the estuary.

In April 1992, concept plans detailing the form of urban and waterway development proposed for the land north and south of the Channel, known as "Port Bouvard", was referred to the EPA for determination of level of assessment by Feilman Planning Consultants.

The Outline Development Plan provided definition for all proposed landuses more specifically delineating the following land uses:

i) residential development and densities

ii) canal estates

iii) 18 hole public golf course

iv) resort hotel

v) local shopping area

vi) marina (proposed by the Department of Marine and Harbours and subject to separate assessment).

vii) public recreation areas

In view of potential environmental impacts associated with the Port Bouvard proposal, level of assessment was set by the EPA as "formal" under Section 38 of the Environmental Protection Act, as "Public Environmental Review" (PER). Guidelines for the preparation of the PER were subsequently prepared by the EPA and are included in Appendix 3.

The PER will be released for an 8 week public review period. Following consideration of issues raised in the submissions and the proponents response to these issues the PER will be assessed by the EPA. A report and recommendations on the environmental acceptability of the proposal will be prepared by the EPA and submitted to the Minister for the Environment at the conclusion of this assessment.

3.0 NEED FOR THE PROJECT

3.1 Demand for Residential Land

The City of Mandurah has one of the fastest and strongest urban growth rates in Western Australia. This is evidenced by comparison of Mandurah's population growth with that of the Peel Region (which incorporates the City of Mandurah and Shires of Murray, Waroona and Boddington). As shown in Figure 1 - Comparative Past / Projected Population Growth - the total population of the Peel region in 1966 was almost 10,000 with the Shire of Murray's total of 3300 representing the largest proportion just slightly ahead of Mandurah Shire's total of about 2700. Since that time, Mandurah has accounted for an increasing proportion of regional growth, recording total populations of 8,296 in 1976, 19,186 in 1986 and an estimated 27,700 in 1991.

Mandurah's average annual growth rate since 1966 has been 9.7% compared to the State and Perth Metropolitan Region average of 2.5% and 2.9% respectively over the same period. Mandurah presently accommodates about 65% of the Peel Region's total population.

The population projections shown in Figure 1 were those adopted in the Peel Region Plan (DPUD, 1990) and suggest that Mandurah will accommodate just over 51,000 residents by the year 2001, almost double the existing population and accounting for 73% of the total Peel Region population.

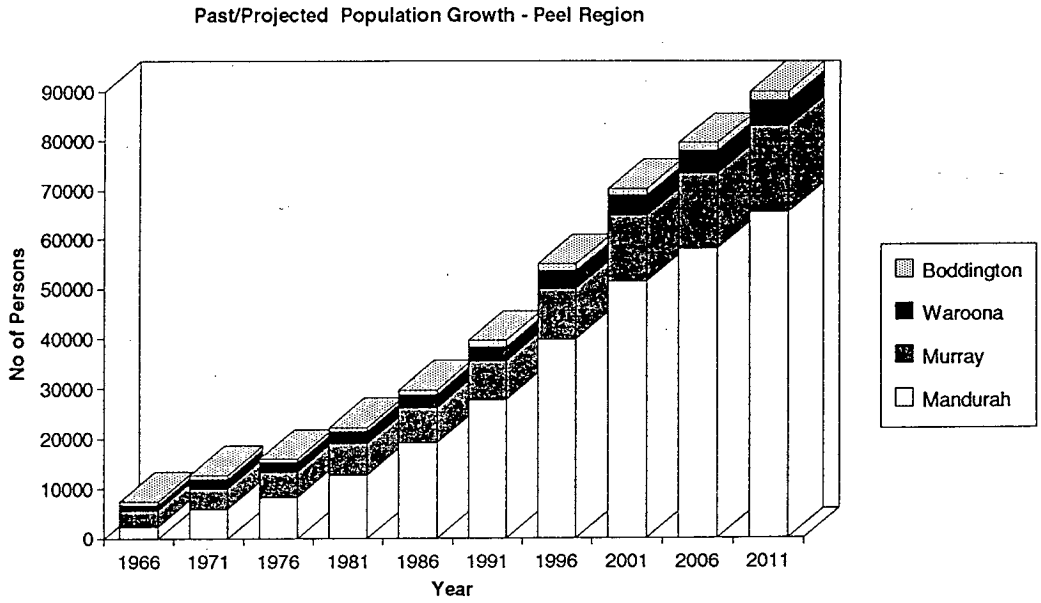
With regard to the future development of Mandurah, the Peel Region Plan makes the following statement:

> *"Continued strong growth in Mandurah will ensure the City's development as the primary regional service centre. Mandurah should continue to provide a range of residential and lifestyle opportunities for the residents and visitors".*

Over the past 15 years Mandurah and its environs has experienced a transition from being primarily a popular holiday destination to urban growth centre. Lower land prices compared to the Metropolitan Region, a desirable lifestyle and continued decrease in journey time to Perth have all contributed to present Mandurah as an alternative suburban centre.

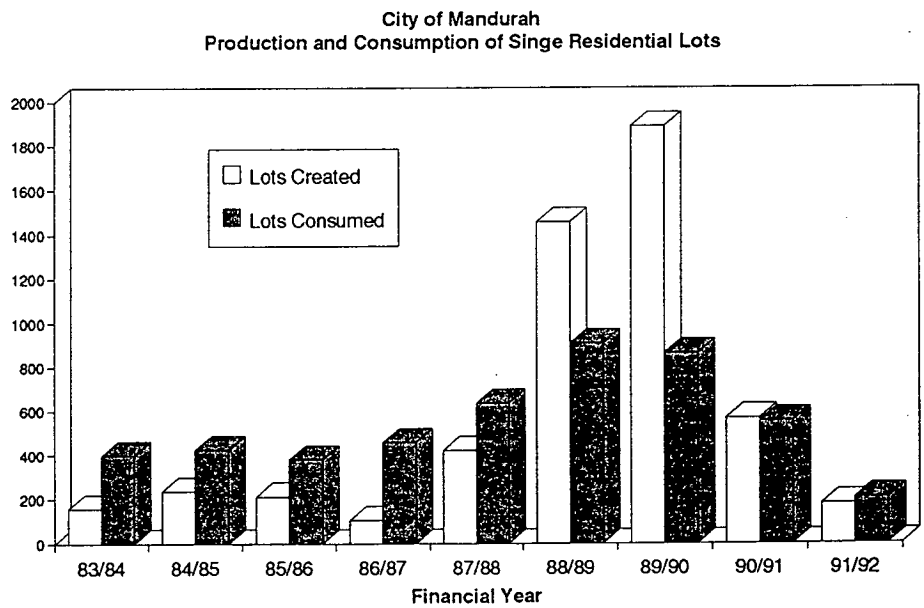
The Department of Planning and Urban Development's Land Analysis and Monitoring Branch has been able to provide single residential lot "production and consumption" information for the City of Mandurah. Data for the period 1983 / 84 through to 1991 / 92 is graphically represented in Figure 2. The graph shows a clear boom period in lot production and consumption during the 1988 / 89 and 1989 / 90 financial years. However, this period also produced an apparent oversupply of lots given that lots created far exceeded lots consumed. Whilst the overall situation over the more recent 1990/ 91 and 1991 / 92 period has slowed in terms of lots produced,

Figure 1



Source: Peel Region Plan

Figure 2



Source: DPUD

importantly the "gap" between the production and consumption rates has closed to the point where in 1991 / 92 more lots were consumed than created.

The stabilising of single residential lot creation and consumption within the City of Mandurah should continue into the short term.

3.2 Dawesville Channel Construction

In the mid 1980's the construction of the Dawesville Channel was identified as the most significant and realistic opportunity for the long term rehabilitation of the Peel-Harvey Estuary.

An important part of the Government's decision to proceed with the construction of the Dawesville Channel was its negotiations with the proponent whereby it secured a significant developer contribution to the cost of the contract. The contribution was agreed by the proponent subject to achieving all zoning and other approvals necessary for development of its land generally in accordance with the agreed Strategy Plan (refer Plan B). This plan promoted urban development around the Channel as a means to achieving accommodation of the spoil from the Channel excavation as well as the developer contribution.

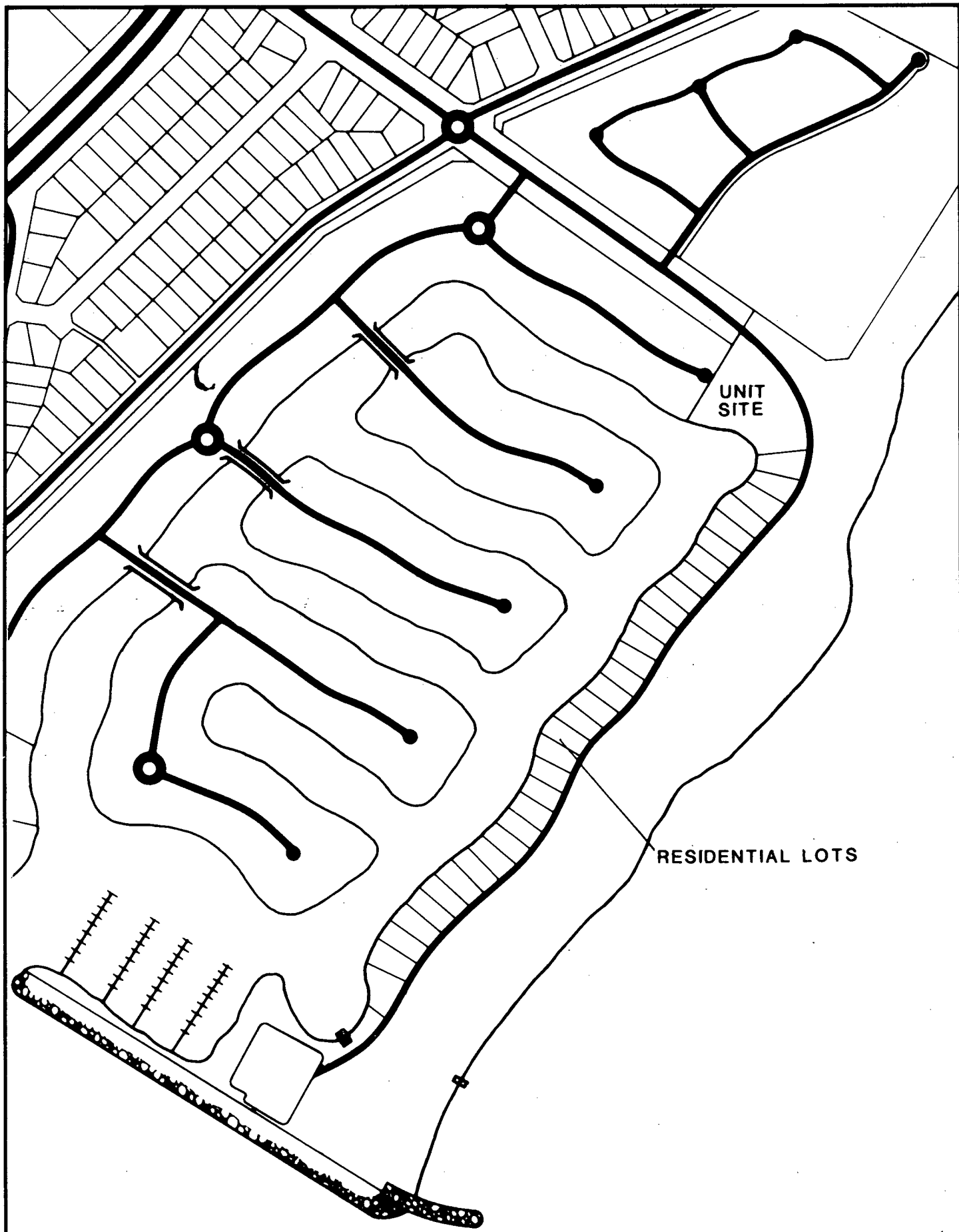
This has enabled the construction of the Channel to be brought forward and completed at least three years ahead of the Government's most optimistic development programme. Accordingly a fundamental basis of achieving the Dawesville Channel has been the corresponding urban development of the abutting land owned by the proponent.

3.3 Development Options

In considering proposals for the land's development, one of the options involved the development of the land south of the Channel (Southport) for canals. This reflected the preliminary concept plan produced as part of the Stage 2 - ERMP which promoted waterway development to the north and south of the Channel.

The proposal represents a logical and desirable option, in view of the land's accessibility to the Channel and the proven attraction and demand that exists with such estates in Western Australia. Whilst the canal option for Southport is still submitted for assessment it is not the favoured option due to the unacceptable levels of contaminated water which originate from the existing rubbish tip. The high level of contaminants, some of which exceed the levels found in primary sewers, are viewed as a potential threat to the development of a significant water body, to the extent that the future water quality may not be able to be guaranteed. However the alternative of canals at Southport is retained as a development option if it is considered environmentally acceptable by the Environmental Protection Authority.

A further option considered was the inclusion of residential waterside lots at Eastport on the reclaimed land now proposed as a 15 hectare foreshore reserve. The proposal utilised the access road to the marina to service approximately 33 lots and one unit site, all of which had frontage to the proposed canal (refer Plan C). Whilst this option offered an additional commercial benefit, it was deleted in favour of the present proposal due mainly to the recognition of the importance to provide a definitive "edge" between private and public land and to maximise the recreational potential offered by this significant area of reclaimed land. This reflects the findings of the original ERMP for the Dawesville Channel in 1988 which highlighted the potential provided by the Channel for regional recreational opportunities at Dawesville on the land adjacent to the Channel.



PORT BOUVARD

EASTPORT OPTION

Scale — 1:5000 Date — 1·9·1992
Feilman Planning Consultants Pty. Ltd. **PLAN C**

4.0 PROJECT DESCRIPTION

4.1 Location

The subject land is located adjacent to the southern boundary of the existing Falcon residential area and is approximately 12 kilometres south of the Mandurah townsite (refer Plan D).

The land has two kilometres of ocean frontage along its western boundary, is bisected by Old Coast Road and has the Peel-Harvey Estuary as its eastern boundary. The Caddadup regional recreation reserve abuts the southern boundary of the land.

The majority of the land is owned by Wannunup Development Nominees Pty Ltd with a total area of approximately 205 hectares. The remainder of the land is currently under the ownership of the Crown or State Government authorities, however these portions form part of a Land Transfer agreement to be transferred to Wannunup Development Nominees Pty Ltd in exchange for the land required for the Dawesville Channel and the respective bridge and road alignment approaches.

In addition to the above land areas, is the Caddadup Reserve which is included in the proposals for development contained within the Outline Development Plan.

4.2 Planning Overview

As outlined in Section 1.4.1 the Outline Development Plan is the second stage in the planning process and is required prior to the subdivision or development of the land.

The extent of the Port Bouvard Outline Development Plan comprises the following land areas:

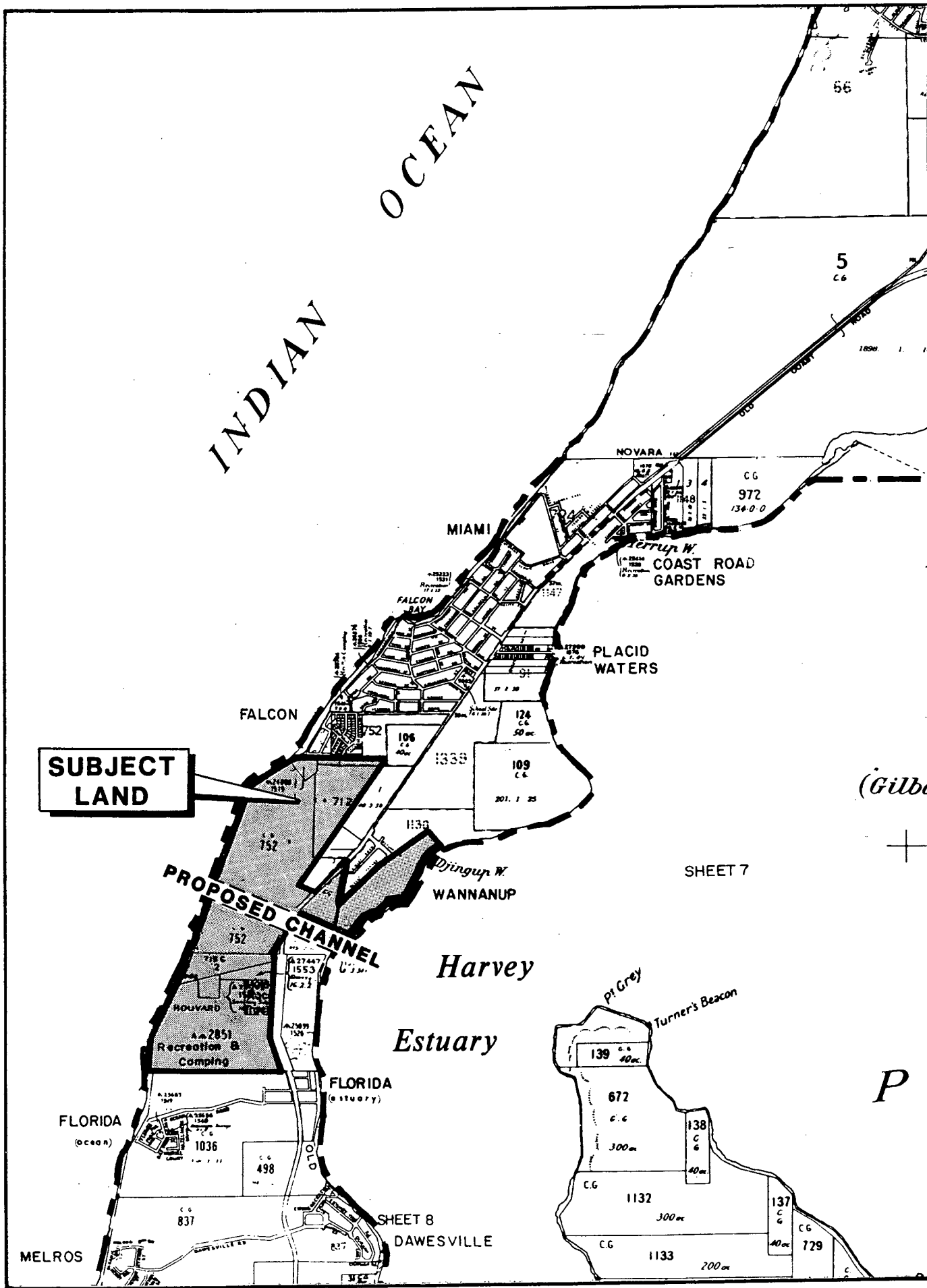
(i) land owned by Wannunup Development Nominees Pty Ltd;

(ii) land currently under the ownership of the Crown or State Government authorities which is to be transferred to Wannunup Development Nominees Pty Ltd;

(iii) land to be reclaimed from the Peel-Harvey Estuary and to be purchased by Wannunup Development Nominees Pty Ltd or retained by the Crown; and;

(iv) portion of the Caddadup Reserve.

The existing land ownership details are defined by Plan E.

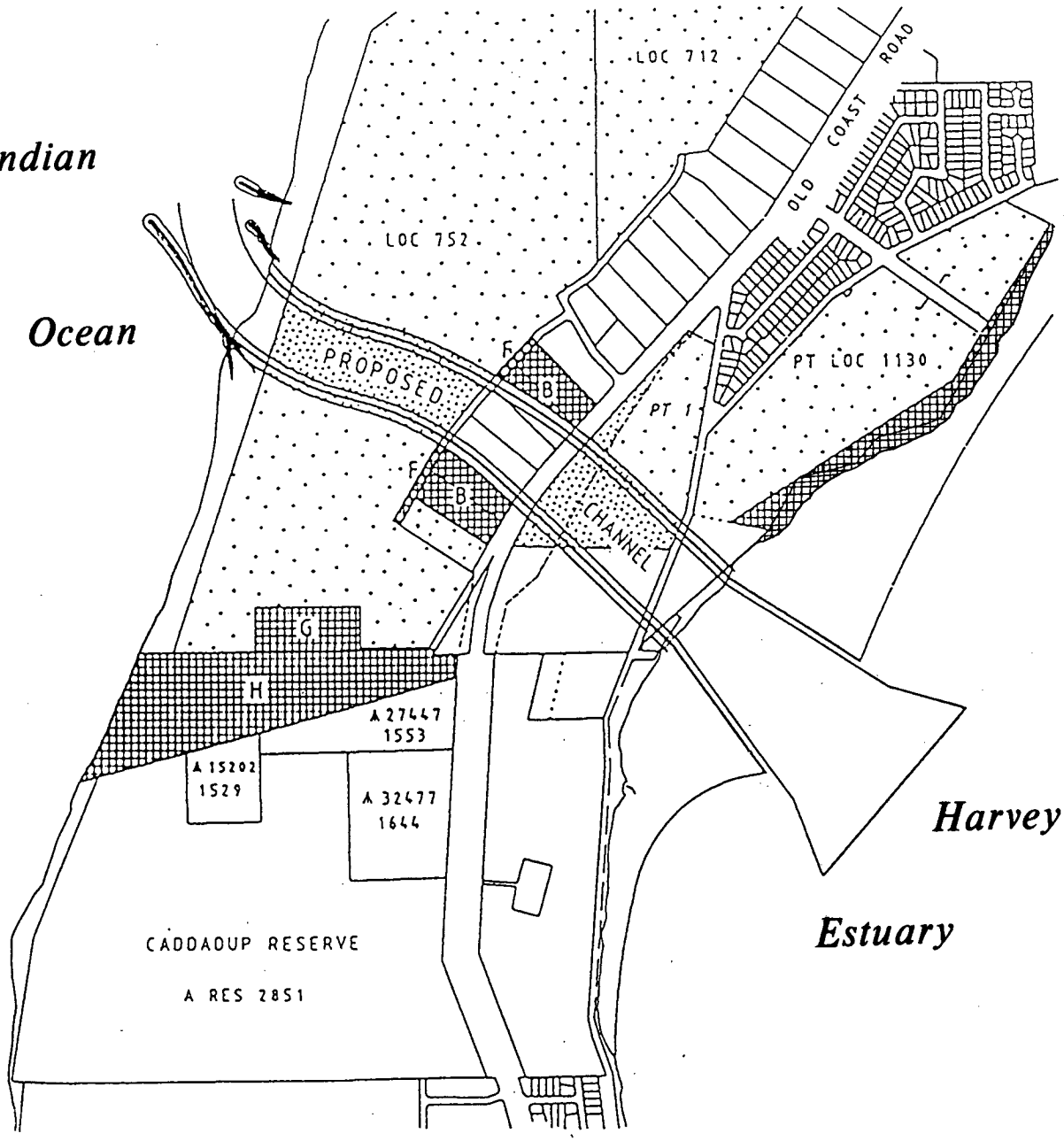


LOCATION PLAN

PORT BOUVARD

Scale —1:50 000 Date — 4·8·1992
Feilman Planning Consultants Pty. Ltd.

PLAN D



500 0 1000
METRES

LAND CONTROLLED BY GOVERNMENT.....

LAND OWNED BY WANNUNUP DEVELOPMENTS AND REQUIRED FOR THE DAWESVILLE CHANNEL CONSTRUCTION.....

WANNUNUP DEVELOPMENTS LAND HOLDINGS.....

PORT BOUVARD

LAND OWNERSHIP DETAILS

Scale — N.T.S. Date — 4·8·1992
Feilman Planning Consultants Pty. Ltd.

PLAN E

The location of the proposed Dawesville Channel and the existence of the Old Coast Road effectively divides the Outline Development Plan into three distinct development areas (refer Plan F). These are:

(i) **Northport**

The land areas located north of the Channel and west of Old Coast Road.

(ii) **Southport**

Comprises the land south of the Channel and west of Old Coast Road.

(iii) **Eastport**

Includes the land north of the Channel and east of Old Coast Road.

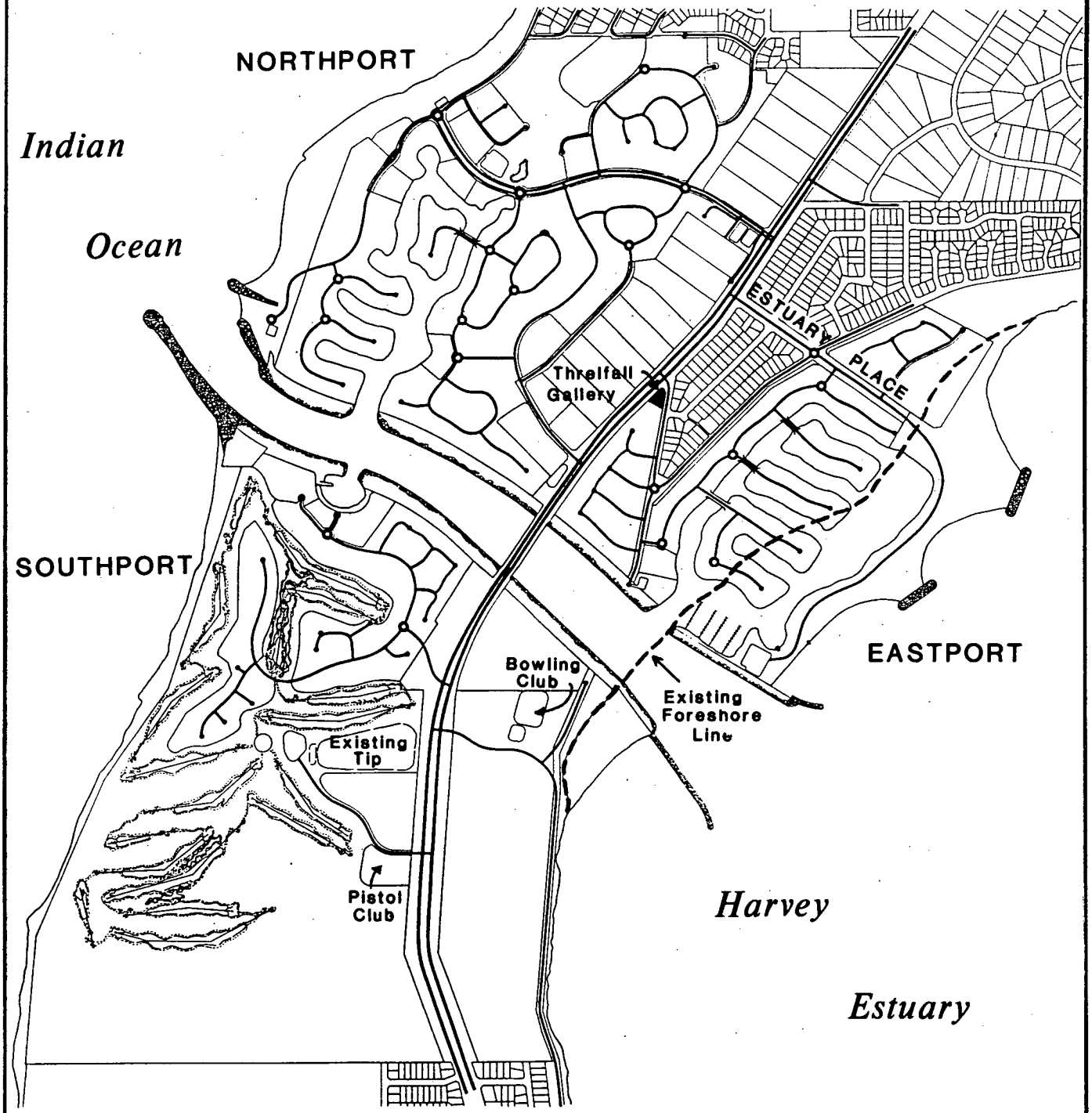
4.2.1 Northport

Northport is the largest sector and comprises a blend of canal estates and traditional residential subdivision centred around a Neighbourhood Shopping Centre, associated commercial uses and community facilities comprising public hall, library and day care centre. The development proposes a range of residential densities resulting in the creation of approximately 640 residential lots and six group housing sites (approximately 125 units). The proposal involves approximately 11.5 hectares of waterway servicing approximately 115 lots and four group housing sites. The plan promotes the public's access to the existing popular beach immediately south of Falcon and creates a new opportunity for beach access to the newly formed and protected beach created by the two northern breakwaters.

4.2.2 Southport

Option 1 for Southport proposes a residential golf course estate comprising nine holes on private land and nine holes in the Caddadup Reserve. Approximately 230 residential lots are proposed within the private land together with a Resort Hotel (200 rooms), a small boat haven and sheltered beach surrounded by approximately 90 units, and the golf course clubhouse. Option 2 transfers all 18 holes of the golf course onto the Caddadup Reserve, and proposes approximately 340 lots and three group housing sites (110 units) within the proponents land. Approximately seven hectares of waterway is proposed servicing 90 lots.

In both options the area of golf course comprising fairways, tees, greens and lakes involves approximately 40 hectares.



PORT BOUVARD

NOTE: For More Detail Refer to Appendix 1 and 2

Scale — N.T.S. Date — 4·8·1992
Feilman Planning Consultants Pty. Ltd.

PLAN F

4.2.3 Eastport

The proposed locality of Eastport combines canal estates and traditional residential lots with a Department of Marine and Harbour's initiative for a public marina and boat launching facilities. Approximately 360 residential lots and one group housing site (30 units) are proposed, of which 170 lots are adjacent to the waterway system which has an area of 14.5 hectares.

Within the three development areas a number of community and recreational facilities are provided. A dual-use path network is proposed which ensures pedestrian access on a north-south and east-west axis within each area and provides a safe and efficient pedestrian connection between each area. The dual-use path system provides links between residential areas and the beaches, the public open space; the estuary foreshore; the Channel; community facilities; the commercial precinct and localised convenience stores.

4.3 Population

The Port Bouvard Project proposes a range of residential densities with a base code of R20 (20 residential units per hectare) proposed for the majority of the land, however a variety and range of lot sizes is ensured through the provision of Codes ranging from R12.5 to R50. The ultimate settlement pattern will be similar to that which has occurred throughout Mandurah over the past 10 years.

Based upon the above densities a lot yield in the vicinity of 1400 lots is proposed resulting in an ultimate population of approximately 4000 people. It is anticipated that settlement of the project will take place over a 10 year time frame and that the first stage of development will be completed within 2 years of approval.

Due to the broad and varied range of lots proposed the characteristics of the population will be similarly varied. The project offers an assortment of lifestyles as determined by the different components which comprise canal estates, golf course estate, group housing development and traditional residential development. It is expected that due to the combination of the allotment variation offered and the land's location 12 kilometres south of Mandurah the makeup of the population will reflect current trends in the Mandurah District, whereby a combination of young families, first home-buyers, retirees and holiday-makers are attracted to the general area.

4.4 Estuary Foreshore Reclamation and Excavation

The Eastport precinct of the Port Bouvard Project proposes the reclamation and excavation of the estuary foreshore. The proposals involve an extension to the area of reclaimed land approved in 1988 and to the Department of Marine and Harbours proposed extension to the Estuary foreshore as recently assessed by the EPA (Bulletin 640). The additional reclamation is required to provide suitable public access to the marina proposed by the Department

of Marine and Harbours and the extensive recreation reserves, as well as to enable the canal estates to be orientated for optimal flushing by wind-driven currents.

The planning for the proposed development has acknowledged the need to provide sufficient recreational facilities. The ERMP for the Dawesville Channel identified that there would be significant opportunity for water based recreation. The Estuary shore to the north of the Dawesville Channel is ideally located to create beaches for swimming, wading and windsurfing in addition to passive recreation. A consequence of the Dawesville Channel will be to change the tidal regime of the Harvey Estuary. Resulting from this there will be periods of low tides when the mud flats become even more extensive to the northern end of the development. These factors have led to the proposed reclamation of a small part of the mud flats (23.3 hectares) in the estuary to create safe swimming beaches with reasonable access to the water during all tides.

The breakdown of the areas required for reclamation and excavation for Eastport are as follows:

- Public Foreshore 15.05 ha
- Public Marina 5.05 ha
- Public Waterway 9.0 ha
- Private Land 3.2 ha

32.3 ha

The areas of land required for reclamation and excavation for Eastport, when combined with the reclamation area south of the Channel represents an area of 11 hectares more than the 25 hectares proposed by the Department of Marine and Harbours and considered acceptable by the Environmental Protection Authority in Bulletin 640.

The majority of the reclaimed and excavated areas will remain in the public domain. A small portion (less than 10%) will be utilised for private development, forming part of the Land Exchange Agreement between the proponent and Government.

In forming, rehabilitating and developing the new foreshore area a maximum level of 2 metres AHL is proposed, with particular attention being paid to the importance of establishing a stable foreshore, providing an aesthetically pleasing environment and servicing diverse recreational demands. The reclamation of the Estuary and creation of public foreshore will be sourced from the spoil dredged from the Estuary in creating the Channel.

The reclamation line originally proposed represented an indicative line to meet the general objectives of providing recreational opportunities to the Estuary as well as public access to the proposed marina. As part of this PER report Steedman Science and Engineering were commissioned to address the foreshore line to ensure the creation of useable swimming beaches within a stable foreshore.

Plan G represents the recommended new foreshore line now reflected in the Outline Development Plan. By providing headlands and by orientating the beaches to face the dominant southerly wave direction the beaches would be stable. Inherent in this proposal is the creation of an additional body of inland water further enhancing the recreational opportunities offered at Eastport.

4.5 Services

All new services, water, sewer, power, Telecom, within the development will be underground.

All roads servicing the development will be constructed by the Proponent, to City of Mandurah standards.

Water supply for development would be provided from the existing 600mm diameter trunk main located on Old Coast Road adjacent to the site. This main is supplied from the existing high level tank at Caddadup, which is in turn supplied from the Mandurah water supply system. For the proposed development, water supply to each area would be via a reticulation system off the trunk main, to be provided as part of normal subdivision works.

The Dawesville / Wannanup area is currently not serviced by a sewerage system and existing development utilises either septic tanks or tankering for waste disposal. For the scale and nature of development it is proposed that a sewerage and reticulation system be supplied as part of the subdivision works.

The Water Authority of Western Australia's (WAWA) future planning for the area includes the construction of a new sewage treatment plant within the Tims Thickett area. The plant would serve a catchment covering all areas of the proposed development as well as parts of existing development, Falcon, Wannanup, etc north to the catchment boundary of Halls Head.

The development would be sewered via a gravity system of underground pipes draining to a number of pumping stations located within the lower areas of each region of the development. These would then discharge to the treatment works via rising mains through and adjacent to the development areas.

WAWA's current programme for construction of the new treatment plant at Tims Thickett is during 1992, but the Authority has indicated that this programme may slip by several years. In the interim period to accommodate residential development in the locality and on the Proponent's land, which may require sewage service as early as the first half of 1994, WAWA proposes that a temporary sewage treatment facility be established in Caddadup Reserve just south of the proposed golf course. WAWA has had preliminary discussions with DOLA in regard to temporary use of this land.

The facility would take the form of lined, open ponds and would be pressure fed by the pumping stations located within the development and rising mains along service corridors e.g. Old Coast Road.

The existing 22KV overhead main in Old Coast Road has the capacity to service the development as proposed.

Telecom has an existing exchange at Wannanup and main underground cables in Old Coast Road. These would be extended into the development areas.

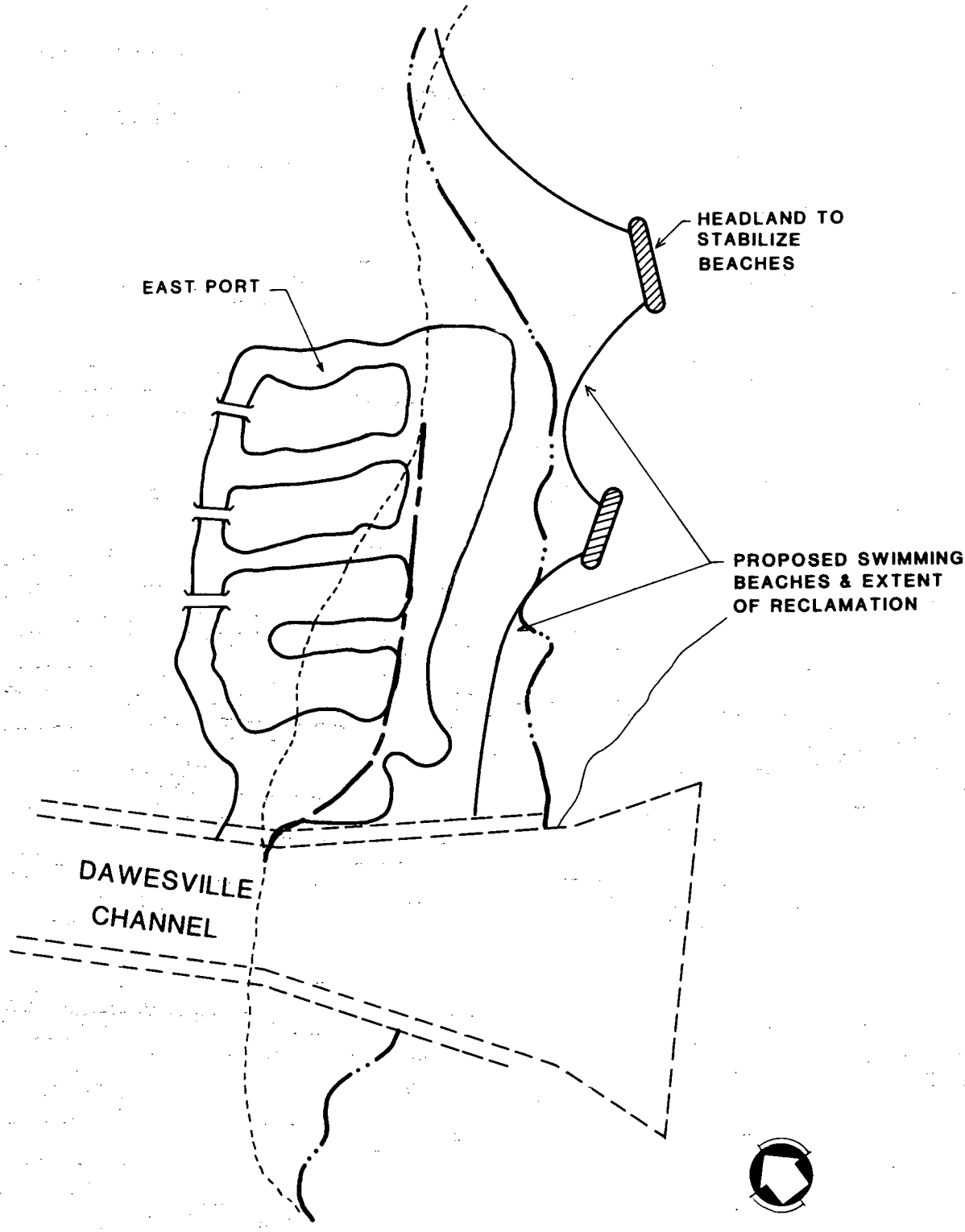
Stormwater runoff will be collected from roads and carparks via gullies and piped drainage system that will discharge to ground. Traps will be installed in all gullies to prevent sand and debris from entering the drainage system and contain oil residues which may enter stormwater system via road pavements. In addition to the gully traps, the manhole immediately upstream of each discharge point will be trapped. This will reduce flow speed and allow transported debris to settle.

4.6 Development of Water Supplies for Golf Course Irrigation

Development of the groundwater resource in the Leederville Formation is planned for irrigation of the 18-hole public golf course and the regional recreational reserve. Treated residential wastewater may be a supplementary source in the long-term, but will not be available for the first few years during the construction and establishment phase.

The total water requirement for the irrigation of the golf course and recreation reserve is estimated to be 440,000kL/annum with a peak demand of 2,900kL/day.

Abstraction from the Leederville Formation for irrigation in the development area has been approved by the Water Authority of W.A. and a licence will be issued when water requirements have been finalised and bores have been drilled and tested. Groundwater from the Leederville Formation will be pumped into lakes which will be lined and will form temporary water storage facilities from which the reticulated water supplies will be drawn. These lakes will be located at selected sites around the golf course to facilitate the distribution of water across terrain where differences in surface elevation of up to 30m are encountered. If necessary, the irrigation supply will be treated by aeration for iron removal.



PROPOSED RECLAMATION AND EXCAVATION

Scale — 1:10000 Date — 14·7·1992
Feilman Planning Consultants Pty. Ltd.

Plan G

4.7 Construction

Ministerial Conditions were applied to the ERMP - Stage 2 for the Dawesville Channel to control impacts of the construction. Prior to the commencement of construction a Dredging and Spoil Disposal Management Plan was prepared and approved by the Environmental Protection Authority for the works and spoil disposal associated with the Dawesville Channel. As such the work currently being undertaken on the land, including bulk earthworks, vegetation stripping, spoil disposal, top soil storage and burning off are subject to previous environmental approvals and as such do not form part of this PER.

4.7.1 Site Infrastructure

Theiss Contractors has already established a site compound for construction of the Dawesville Channel. The fenced compound, with it's facilities, will remain for at least the bulk earthworks phase of the Dawesville development. These facilities include demountable offices, workshop, hardstand for plant storage, ablutions connected to septic tanks and provision for fuel storage. The demountables are connected to mains power and Telecom where appropriate.

4.7.2 Construction Method

Major aspects of construction for the development include bulk earthworks, canal excavation and edging (Northport and Eastport), marina beach and golf course construction (Southport) and conventional land subdivision and servicing in all three areas.

Bulk Earthworks and Canals

It is presently proposed that bulk earthworks involving cut on the Proponent's land take place concurrently with Thiess Contractors commission to construct the Dawesville Channel. The excavation work on Wannunup land, including canal excavation, is essentially the same as for the Channel, hence some of the plant already mobilised will also be utilised for the proposed development.

The scraper / bulldozer fleet is programmed to carry out bulk excavation as required for the development either side of the Channel. As for the Channel, dewatering of the canals by pumping is proposed so that scrapers may continue working below AHD 0.0 in dry conditions.

In view of the dimensions of the Channel compared with that of the Canals, and the difference in hydraulic head of up to 3.5 metres, the discharge from dewatering of the Canals will be considerably less than that generated from the Channel.

The contractors proposed method for Channel dewatering was not developed at the time of the preparation of this PER however issues associated with the dewatering programme will be addressed in a separate submission by the contractor in accordance with the requirements of the 1988 ERMP.

Fill will be compacted by vibratory rollers and final surfaces trimmed with graders. As for similar earthworks sites, ancillary plant will include graders, on and off road trucks and excavators.

Edge treatments for canals may, as well as limestone rubble rip-rap, include concrete and/or limestone retaining walls, which would be prefabricated in a casting yard on or off site. Rip-rap material would be delivered from offsite quarries and installed by excavators and loaders on site. These walls would be positioned, on prepared earth beds, by crane.

Subdivisions

Residential subdivision, comprising construction of roads, canals, drainage, services and landscaping, would commence in stages; the size and timing determined by market demand for housing allotments.

Golf Course

In Southport, golf course construction is expected to take place at the same time as residential subdivision. The golf course works include earthworks, installation of irrigation ducting, grassing and landscaping. Generally the golf course construction will be lower key and of lesser impact than the bulk earthworks for the Channel. The fairway, tees and greens will be located, either on a landform modified by placement of fill from the Channel or, where possible, to best fit natural landforms, thereby minimising the extent of major additional earthworks.

4.7.3 Construction Programme

The intent of the Dawesville Channel agreements, that Government, the Proponent and Contractor benefit from the efficiency of combined construction operations will be pursued. As such initial work on Wannunup land is expected to run concurrently with the Channel construction to maximise these efficiencies.

The construction of the Channel is underway, with fill being placed on Wannunup land to preliminary design contours. Earthworks are expected to cease around September 1992 as a result of the contractually agreed lead times to gain statutory approvals (including environmental approval). At this time all available material for excavation above groundwater level (nominally AHD 0.0) will have been exhausted.

Without approvals the Proponent cannot provide the contractor with final design contours which would enable continuation of fill placement (and therefore Channel excavation). The Project Agreement was compiled with the premise that economy of scale and parallel construction were primary considerations in assembly of reduced construction costs of the Channel. A major component of the above is the combined use of the dewatering process, and this relies heavily upon the Proponent's Outline Development Plan and PER being approved as presented or with no substantial amendments.

When environmental and canal rezoning approvals are granted, bulk earthworks for the Channel as well as the development, including canal construction, could recommence. On this basis the Proponent's construction programme would be commenced with earthworks early in the new year and continue through to the end of 1993 and beyond with canal and dry lot subdivisional development to meet market demand over a 10 year period.

In regard to the potential construction and settlement timetable it is intended to stage development in response to market forces. At this stage it is proposed that initial work commence in Northport working in stages from the Channel northwards. The proposed completion date for earthworks including canals and contouring will be early 1994 at which time the subdivision works for first stage of subdivision will be commenced. This will result in the first release of lots onto the market in mid 1994. Government decisions on the construction of the marina will be the major factor determining the commencement of development at Eastport.

The development and settlement of Southport will follow development of Northport and Eastport, however could be brought forward should a decision be made to construct the golf course and / or the resort.

4.7.4 Construction Workforce

The contractor's workforce required to conduct the bulk earthworks on the Proponents land, including canal and golf course construction will total approximately 60 during 1993.

The make up of the workforce comprises approximately two-thirds construction workers (operators, labourers, fitters etc) and one third staff (project manager, engineers, survey personnel etc). The workforce will be sourced from existing Thiess employees interspersed with local labour.

A workforce of this size and makeup would likely continue into 1994.

5.0 THE EXISTING ENVIRONMENT

5.1 Physical

The characteristics of the existing physical environment were addressed extensively as part of the Stage 2 - ERMP prepared in 1987 - 1988 for the Dawesville Channel. The conclusions of the ERMP (and as confirmed by the EPA) particularly in regard to the existing vegetation, was that the existing environment had low to moderate conservation value and that the environmental impacts of the channel and associated spoil disposal on the land owned by Wannunup Development Nominees Pty Ltd would be acceptable.

The purpose of this report is to address the environmental values of the land area not previously considered and which may be impacted upon by the proposed development.

5.1.1 Coastal Dunes

The coastal dunes in the project area are unconsolidated sands overlying limestone. They are covered by a healthy and vigorous community of diverse coastal vegetation.

South of the Dawesville Channel the foreshore dunes are particularly large, rising to a height of over 20 metres, with a width of up to 150 metres. North of the Channel they are of similar dimensions as far as Avalon Point before dropping to a lower elevation of 5 to 8 metres and a width of about 50 metres beyond the Point towards Falcon.

The dunes are underlain by three distinct limestone units deposited during separate marine phases.

South of the channel the uppermost of these three limestone units rises to 5 metres AHD within 80 metres of the vegetation line on the beach. The second limestone unit rises to 0.5 metres AHD beneath the beach, extending seawards to outcrop as a wave-cut platform.

North of the channel as far as Avalon Point the uppermost limestone unit outcrops as a cliff along the back of the beach and is at about 4 metres AHD beneath the dunes. Beyond the Point the stratigraphy changes, with the uppermost unit rising from below or close to sea level at the shoreline to an elevation of 0.5 - 0.75 metres AHD 70 to 80 metres from the vegetation line. Here the second unit is removed offshore, separated from the beach by a protected lagoon.

Vegetation

The vegetation sequence across the foreshore dunes is a reflection of the comparative exposure of their different sectors: the strand immediately behind the beach, the intermittent berm at the toe of the frontal dune, the steep face of that dune and its more gentle upper slopes, the crest and the protected hind slopes.

Within the strand the fleshy annual succulents sea rocket, saltwort and dune arclotheca occur.

Where it is present, the berm is colonised by a healthy cover of grasses and succulents - predominantly sand spinifex hirsutus and sea spinach.

Behind this the exposed face of the frontal dune is dominated by these same species with the herbaceous pigface, geranium and the shrubs smoke bush and fan flower also appearing.

Behind the immediate frontal face in the sometimes broken and semi-sheltered terrain rising to the crest a wider variety of dunes species is evidenced. A well developed shrub storey in the substantial dunes south of Avalon Point has smoke bush, fan flower and coastal acacias and spyridium as the dominant species amongst a diverse range of dunal shrubs, ground covers and creepers providing a well developed, diverse and stable vegetation cover over the crest and slopes.

To the north of Avalon Point the lower dunes carry a lesser diversity of vegetation, with sand spinifex and sea spinach the most prominent groundcovers and smoke bush and coastal acacias the predominant shrubs.

On the protected eastern slope of the high frontal dunes acacias tend to dominate. Spyridium, smoke bush and fan flower are also prominent amongst a wide variety of shrub species, with honey myrtle dominating in some lower slope situations which leads into low-lying melaleuca scrub behind the dunes.

5.1.2 Caddadup Reserve

The north end of Caddadup Reserve has been degraded where a rubbish tip, sullage disposal pit, rifle range and miscellaneous vehicle tracks have impacted on it. Across a ridge to the south, however, the vegetation is in good condition. Here healthy and attractive tuart / peppermint forest towards the east changes to peppermint forest westwards, with acacia saligna, A. truncata, A rostellifera, Olearia axillaris, and Spyridium globulosum the most prominent shrubs amongst the rather open understorey.

Further south is a wide valley where there is more open scrub dominated by a shrub storey in which acacias are most prominent with spyridium honey myrtle and jacksonia also prominent.

To the west of the reserve the frontal dunes have a vegetation assembly similar to that previously described. These dunes are, however, degraded in numerous places by vehicle tracks and blowouts which are advancing eastwards into the reserve.

The worst of these blowouts have been partly stabilised by marram which, judging by its extent and growth status, was presumably introduced some years ago to attempt to check the sand advance.

5.1.3 Estuary Foreshore

The estuary foreshore at the development site comprises marshy flats and depressions interspersed by minor beach ridges.

Foreshore Vegetation

In the tidal zone on the estuarine edge Sarcocornia predominates with saltwater couch and sedges dominant on slightly higher ground immediately behind it. The marshy ground beyond is a low melaleuca forest with sedges and rushes beneath it.

Beach ridge scrub interspersed amongst the melaleuca woodland includes dense growth of jacksonia, Kunzea vestita, regelia, firlweed and occasional acacias and swamp oaks.

It should be noted that the existing vegetation is all regrowth, the land having been previously cleared approximately 7 years ago.

Estuarine Biota

The estuarine environment in the vicinity of the eastern end of the Dawesville Channel consists of a broad, shallow sandflat, which is essentially similar to very expansive sandflats that occur throughout the margins of this shallow estuarine system. More than one-third of the Peel-Harvey estuary is less than 0.5 metres water depth.

Typical of estuaries in the southwest of Western Australia, the biological community in the Peel-Harvey system is productive, but not very diverse. The large variations in salinity, from almost fresh in winter to hypersaline in summer, greatly constrain the number of species of plants and animals that can inhabit the estuary. In addition, the relatively homogenous sand and mud sediments of the estuary offer few hard surfaces to which organisms can attach.

Benthic invertebrates, comprising animals that live upon and within the sediments, are an important component of the biological community of the Peel-Harvey estuary system: they are a large component of the faunal biomass and provide a major food source for the abundant fish, crustacean and water bird populations that inhabit the estuary.

The ecological importance of benthic fauna, together with the fact that benthic animals tend to be sessile, deem them an important indicator of the relative importance of any area to the ecology of the estuary.

Quantitative data on the benthic communities of the Peel-Harvey system is patchy, most research having been qualitative or taxonomic. However recent unpublished research by T. Rose includes quantitative time-series measurements of benthic community composition at four sites within the estuary: Boodalan Island, Falcon-Sticks, Dawesville and Greys Beach. The Dawesville site, near the Dawesville boat ramp, is approximately 2.5km south from the Dawesville Channel and is representative of the nearshore shallows in the north-western shores of Harvey Estuary. Rose's data are reviewed in the following to provide an indicative description of the existing estuarine environment that may be affected by the present proposal.

Rose identified 23 species of Macrobenthic invertebrates in the shallows at Dawesville, including six species of polychaete worms, ten species of crustaceans (amphipods, prawns, shrimp) and four species of molluscs. The species composition at the site varied greatly on a seasonal basis, and a maximum of only ten species was represented at any one time. This result is reasonably typical of shallow areas throughout the estuary, which tend to be dominated by opportunistic species. Adaptation to the variable conditions of the estuary usually includes a capability to rapidly colonise and reproduce when conditions are favourable, which results in highly fluctuating species representation and population sizes.

Although Rose's data show high variability in the benthic faunal composition at each of the four surveyed sites, the data indicate that the Dawesville area suffers especially severe impacts from the effects of eutrophication. The nearshore flats at Dawesville are frequently the site of large accumulations of algae that is driven onshore by southerly winds, resulting in very fine, reduced sediments and a frequent occurrence of deoxygenation of the water column. Impacts upon the benthic faunal assemblage that are associated with these adverse consequences of eutrophication include the following:

1. During summer, when the effects of eutrophication are most severe, the number of species and species diversity at Dawesville is substantially lower than at Rose's other sites.

2. The Macrobenthic fauna at Dawesville during the summer tends to be dominated by a few species of polychaete worms that are able to either withstand highly reduced sediments (eg *Prionospio cirrifera*) or are highly opportunistic (e.g. *Capitella capitata)*.

3. Relatively large number of *spionid polychaete, Prionospio cirrifera*, were also found at Dawesville during winter and autumn. This worm is a deposit feeding detritovore that is particularly adapted to reduced sediments that receive a high detrital load.

4. The Dawesville site was uniquely devoid of *Grandidierella* amphipods and showed generally low abundances of other crustaceans during the summer survey. Crustaceans tend to be more susceptible to deleterious effects from entrophication than polychaetes, which remained abundant.

Rose's data indicate that the shallow nearshore sandflats at Dawesville have no greater intrinsic environmental significance than that of other areas of shallow sandflats that occur throughout the estuary's margins.

The total abundances of benthic macroinvertebrates at Dawesville tended to be very similar to those at Greys Beach, and only marginally greater than at Boodalan Island and Falcon Sticks. The benthic macroinvertebrate biomass at Dawesville varied seasonally over a wide range, similar to the other three of Rose's monitoring sites. Polychaetes tended to dominate the macroinvertebrate biomass at Dawesville and Greys Beach whilst molluscs tended to be predominant at Boodalan Island.

Species diversity and evenness at Dawesville varied more than at the other three sites: each was higher than the other sites during spring but substantially lower than the other sites during summer.

Similar to other shallows within the estuary, the shallows at Dawesville support benthic macroinvertebrate communities that are highly productive but highly variable. These are typical for a eutrophic estuarine system. The shallows at Dawesville appear to be particularly prone to adverse effects from occasional weed accumulation and resultant anoxia due to the eutrophic state of the estuary, however apart from this occasional difference, no greater nor lesser environmental significant can be ascribed to this area than to the other extensive areas of shallows that occur throughout the estuary's margins.

Completion of the Dawesville Channel will cause very dramatic but uncertain changes to communities inhabiting the shallow sandflats throughout the estuary, and particularly in the immediate vicinity of the Channel. An incursion of more marine species should result in an increasingly stable and more diverse community, probably similar to the Sticks area near the Mandurah Channel. However if the shallows at Dawesville continue to incur occasional or seasonal inundation of decaying algae sufficient to cause temporary anoxia that will affect resident fauna, then the existing variable community of opportunistic estuarine invertebrates would merely be replaced by a similarly variable community of opportunistic marine invertebrates. This continued instability would preclude the development of a rich and diverse community that usually characterises a healthy and resilient ecosystem.

5.1.4 Hydrogeological Setting

The project area is underlain by three main aquifers, namely, the superficial formations, the Leederville Formation and the Cockleshell Gully Formation. The superficial formations are underlain by the Leederville Formation, either directly or more likely with an intervening sequence of shales and siltstones of the Osborne Formation which has a total thickness of about 30 - 40 metres in this area. Low permeability sediments of the South Perth Shale form a major aquitard which underlies the Leederville Formation and separates it from the Cockleshell Gully Formation.

Superficial Formations

The project area is underlain by the superficial formations which extend from the ground surface to about -15m AHD and consist mainly of calcarenite and sand. The superficial formations comprise the Tamala Limestone and Safety Bay Sand in this area. On the ocean side, the Tamala Limestone is overlain by the Safety Bay Sand which consists of unconsolidated calcareous sand forming the Quindalup Dune System. On the inland side, the Tamala Limestone is exposed and consist of calcarenite and sand which form the Spearwood Dune System. These sediments form an inhomogeneous unconfined aquifer of generally high permeability.

The groundwater system in the superficial formations comprises a thin freshwater lens above brackish to saline groundwater in the lower part of the formation. The maximum thickness of the freshwater lens is only about 5 metres. The water table reaches a maximum level in August to September at about 0.5 metres AHD and is at or slightly below AHD in the summer.

The superficial aquifer is recharged by percolating rainfall which maintains the freshwater lens. The annual average rainfall surplus (excess of rainfall over evaporation during winter) is 336mm at Mandurah. Allowing for runoff and evapotranspiration losses, the maximum available recharge is expected to be about 250mm per annum. The water table reaches a maximum level in August to September of about 0.5 metres AHD in response to winter rainfall and declines to slightly below Om AHD in the summer.

Groundwater flows away from the central part of the peninsula westwards towards the Peel Inlet. Groundwater discharge occurs across seawater interfaces along the shores of the ocean and the inlet.

The freshwater lens in the superficial formations is currently exploited by means of a number of shallow private bores. Yields are low as higher pumping rates result in upconing of the underlying saline groundwater.

An operational domestic refuse disposal site is located about 800m south of the Dawesville Channel. Leachates generated by percolating rainfall are likely to be causing contamination of the superficial aquifer.

Leederville Formation

The Leederville Formation is a major regional aquifer, consisting of interbedded sandstone, silstone and clay. In the Mandurah area, the Leederville Formation contains a distinct marker horizon, 3 to 6m thick known as the "green clay". The horizon is readily identifiable on natural gamma logs, enabling correlation between boreholes. In the Dawesville area the green clay appears to be downthrown about 90m to the south, along an east-west trending fault line. The general dip of the Leederville Formation is about half a degree, to the west-southwest.

In the vicinity of Mandurah, groundwater in the Leederville Formation is generally saline above the green clay horizon, and fresh, becoming brackish with depth, below it. At Dawesville, however, borehole logs indicate that fresh groundwater occurs both above and below the green clay, which is at a depth of about 265m in Bore Miami 2/75, just south of Dawesville. The general groundwater flow direction is westwards, so the occurrence of freshwater above the green clay, downgradient of saline groundwater east of the Peel Inlet itself is anomalous. The fresh groundwater may be derived from below the green clay, either by upward leakage, or laterally from the north, across the inferred fault. Alternatively, it may represent fossil groundwater remaining from a previous period of lower sea level, which has not as yet been flushed out by subsequent more saline recharge from the east.

The groundwater in the Leederville Formation is artesian, with hydraulic heads generally 3 to 4 metres above AHD in the strata above the green clay, and 7 to 8 metres AHD in the strata below it.

Groundwater in the Leederville Formation probably has a salinity in the range of 400 to 3,500mg/L TDS and may contain significant concentrations of dissolved iron.

Cockleshell Gully Formation

The Cockleshell Gully Formation consists predominantly of sandstone and shale in the Dawesville area and occurs at a depth of about 250 - 300 metres below ground surface. It is unconformably overlain by the South Perth Shale which forms a major aquitard between the Leederville Formation and Cockleshell Gully Formations. The Cockleshell Gully Formation contains only brackish to saline groundwater in this area.

5.2 Social

5.2.1 Existing Communities

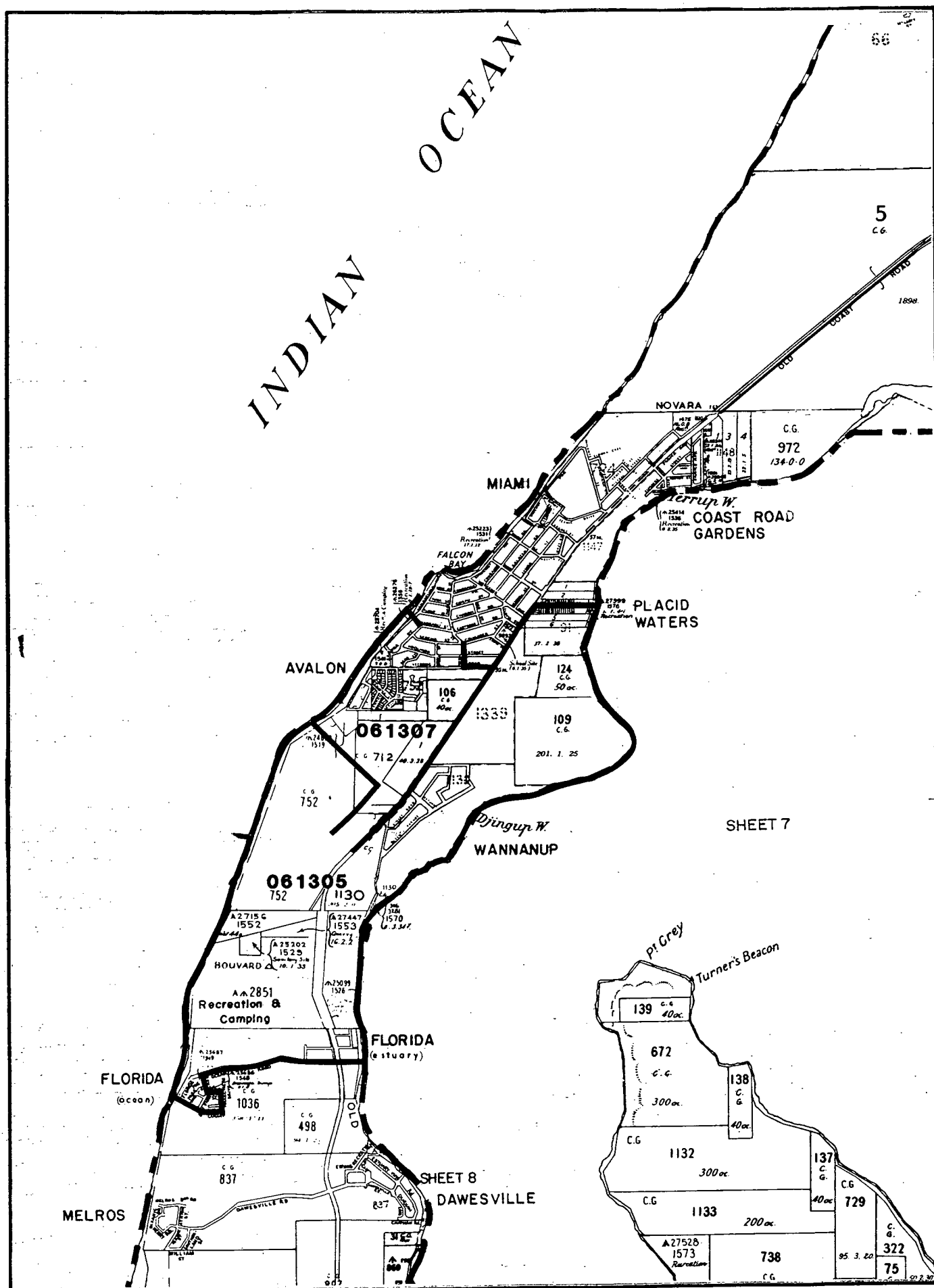
The characteristics of the existing population have been assessed as they relate to the localities of Caddadup and Wannanup, reflecting the area covered by ABS Collector District 061305. The South Falcon area (ABS CD 061307) is also briefly analysed for further comparative purposes (refer Plan H).

Total population statistics for the selected CD 061305 study area indicated the following growth trends:

In 1976 the total population of the area was 128 persons, comprising of 68 males and 60 females. By 1981 this number had more than doubled to a total number of 271 persons, comprising 135 males and 136 females. At the 1986 census the population of this area had once again doubled totaling 465 persons, comprising 244 males and 221 females.

As such, the total population within the study area has increased significantly from 128 people to 465 in a timespan of only 10 years.

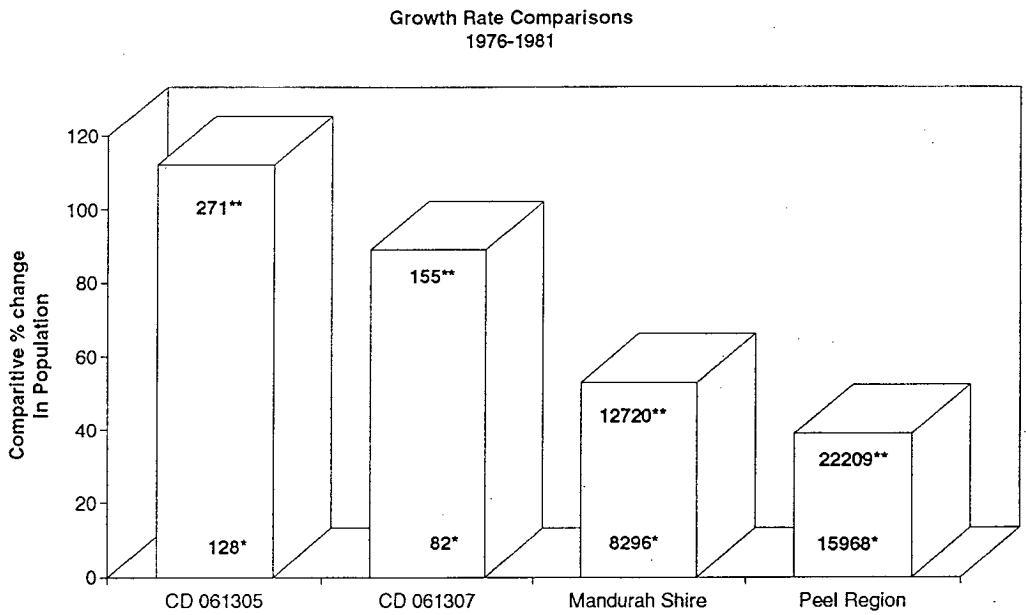
The significant rate of increase is confirmed in Figures 3a and 3b where the study area's performance is plotted against the City of Mandurah's and the Peel Region's recent population growth trends. The results clearly show that the comparative population increase sustained within the study area over the period spanning 1976 - 1981 was about double that experienced by the City and nearly three times that recorded by the Peel Region (111.7% versus 53.3% and 39.1% respectively). The 1981 to 1986 comparison was less dramatic although the study area again experienced a significantly stronger per



A.B.S. COLLECTOR DISTRICTS

Scale — **1:50,000** Date — **11.8.1992**
Feilman Planning Consultants Pty. Ltd. **Plan H**

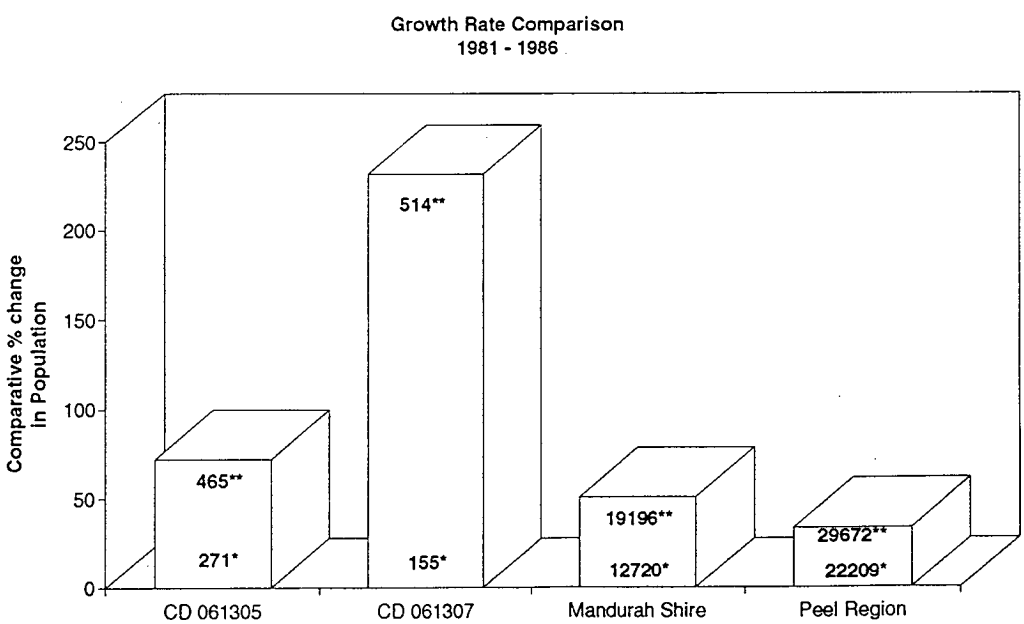
Figure 3 [a]



* denotes 1976 Census Total
** denotes 1981 Census Total

Source: ABS

Figure 3[b]



* denotes 1981 Census Total
** denotes 1986 Census Total

Source: ABS

capita growth increase that the regional populations (71.6% versus 50.9% and 33.6% respectively).

The character of the local population (based on the 1986 census data) is dominated by the group classified as "the retirees", being those aged 60 and over who account for 26.6% of the total population. This is a considerable proportion representing over twice the 1986 state average of 13.2% for the "over 60" category.

The significant "retiree" component is an indication of the attractiveness of this area as a retirement community. The Mandurah region generally boasts an assortment of water-based recreational opportunities and is one of the state's largest tourist / holiday destinations, particularly during the summer months.

In 1986, the study area had a total of 313 dwellings, all of which were private dwellings. Of these dwellings, 119 were unoccupied, supporting the notion of tourists and holiday homes being established in the area. Of the occupied dwellings, 146 were either owned or being purchased, with the remaining 23 in the form of rental housing with the strong possibility that the majority were used as tourist and holiday accommodation.

With respect to the adjacent locality of South Falcon, a relatively similar demographic profile to the combined Caddadup / Wannanup localities is evident. A total 1986 population of 514 persons was recorded for the area, representing continued strong growth on the corresponding 1976 and 1981 totals of 82 and 155 respectively. Figures 3a and 3b confirm that this locality has also experienced a considerably stronger per capita growth rate compared to the City of Mandurah and the Peel Region. This is particularly evident in the 1981 to 1986 period where local population almost trebled in size.

The local South Falcon population however is generally of a younger character than that of CD 061305, with the 30 - 39 age group dominating by accounting for 21.9% of the total, closely followed by the 0 - 4, 5 - 9 and 10 - 14 groups which comprise 11.5%, 9.7% and 12.6% of the total respectively. The larger component of younger residents can in part be attributed to the presence of the Falcon Primary School. Despite the younger population profile, the South Falcon area accommodates a "retiree" component of 14.8%, which is still above the state average.

5.2.2 Existing Traffic Patterns

The existing traffic patterns are dominated by Old Coast Road, the regional road which divides the subject land and provides the land's connection to Mandurah and the Perth Metropolitan Region.

At the local level, the existing communities are serviced by residential streets with Yeedong Road (Falcon) and Estuary Road and Estuary Place (Wannanup) providing the respective links to Old Coast Road (refer plan I). Princeton, Buckingham and Windsor Drives have provided access to the western portion of the subject land as well as to a number of small rural holding lots.

5.2.3 Land Use

In the 15 years that the proponent has owned the land, it has remained vacant land with the exception of the land adjacent to Avalon Bay where a number of informal car parks (serviced by a limestone track) have been established to provide access to the beach (refer plan I).

Over the years several portions of land have been subdivided from the original landholdings for the creation of the Falcon Primary School site and a number of small rural holding lots along the western side of Old Coast Road (refer plan I).

The majority of Crown Land intended for transfer to the proponent and as such part of the proposals for development is currently vacant land. The exceptions are the road reserves which were formerly part of Windsor Drive.

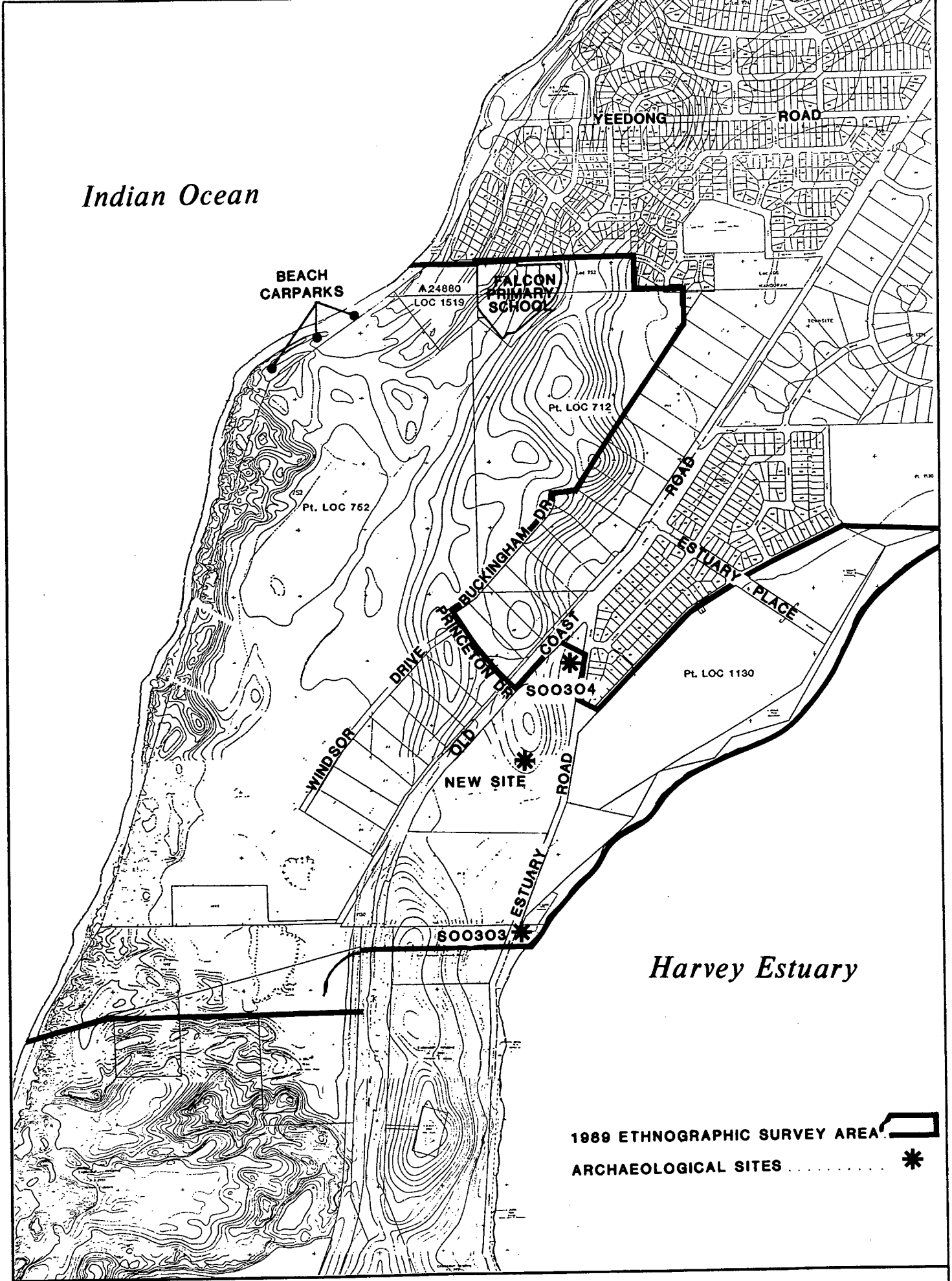
5.2.4 Land Characteristics

The subject land is of limited local and regional significance. Except for the State Government's deliberations and desire to protect a future alignment for the Dawesville Channel, the land would have been developed for urban purposes. Whilst Town Planning Scheme No. 1A zoned the land Rural, the majority of the land was also included in an Overall Planning Area to facilitate development, and was earmarked for development as urban, special rural and public purpose uses in the District Structure Plan.

From a regional perspective, once the Government made the commitment for the construction of the Dawesville Channel, the urban development of the surrounding land was ensured. The Peel Regional Plan nominates the locality as a Strategic Planning Area in recognition of the regional significance of the Dawesville Channel and "....the opportunities it will create for recreational, residential and tourist development".

Locally the land provides access to popular surfing and fishing points along the coast.

Visually, parts of the landscape have provided an undisturbed backdrop to views from the ocean and the Estuary. The construction of the Dawesville Channel has had an impact upon the significance of this visual amenity.



LAND USE AND ETHNOGRAPHIC INFORMATION

Scale 1:12 500 Date 10.8.1992
Feilman Planning Consultants Pty. Ltd.

Plan 1.

5.2.5 Historical, Archaeological and Ethnographic Sites

In 1989 the Centre for Prehistory at the University of Western Australia was commissioned by the Department of Marine and Harbours to undertake two archaeological and ethnographic surveys on the land impacted by the Dawesville Channel (refer Plan I).

The study's confirmed the existence of two previously recorded sites (S00303 and S00304) and identified a new site (refer Plan I).

6.0 ENVIRONMENTAL AND SOCIAL IMPACTS AND MANAGEMENT

The urbanisation of the subject land as proposed by the Port Bouvard project will have an impact upon the existing environment and social framework. This section addresses the potential impacts of development and where relevant outlines appropriate forms of management.

6.1 Coastal Foreshore

6.1.1 Coastal Foreshore Stability

The general ocean foreshore is considered to be relatively stable. The historical evidence consists of the following:

- HWM surveys in 1909 and 1992.
- Shoreline movement plans prepared by Department of Marine and Harbours based on aerial photography taken in 1955 and 1982.

Both suggest a stable coastline which is further supported by the fact that a large proportion of the coastline has natural protection in the form of extensive beach rock. The natural protection is generally more extensive as the higher primary dunes have substantive areas of limestone to generally 2 to 2.5 metres above AHD.

Given this data the development line has been restricted to a distance generally 100 metres behind the vegetation line. To the north the coastal development has been reduced in accordance with the existing setback of subdivisions at Falcon (Avalon Beach) where the minimum set back is restricted to approximately 70 metres.

6.1.2 Coastal Dunes

Development that will impact on the coastal dunes comprise the following (refer also to Appendix 1 and Appendix 2):

- the establishment of residential development impinging on the eastern slopes and associated reshaping of the mid and lower slopes of this face;
- establishment of a carpark at the protection beach immediately north of the channel mouth and road access to that carpark;
- development of pedestrian access pathways through and within the dunes;
- development of a limited number of fairways within the dunes.

Development will also remove some dunal vegetation for establishment of roads, access paths and residential allotments and the hind slopes of the dunes will be reshaped by cutting and filling to accommodate residential development which extends onto these.

As previously mentioned in Section 6.1.1, the development allows an adequate foreshore reserve within the dunes to accommodate any long term erosion, bearing in mind the size and stability of these dunes and the underlying limestone basement. Building allotments are generally to be located on the rear slopes of the high frontal dunes, thereby ensuring that the natural skyline is retained for aesthetic benefit when viewed from both the beach on the one side and subdivided land on the other.

The most significant impact of development will be the increased recreational pressure which it places on the foreshore dunes and the beach as increasing numbers of residents and visitors use it for fishing, surfing and general recreation.

Where development activities do enter the dunes, the area of disturbance will be minimised to ensure that the majority of existing vegetation cover is retained. Such vegetation as is cleared for roads and pathways through the dunes, golf course fairways, and for residential development on their rear slopes will be stockpiled. This can be used later as stabilising brush cover on areas which are to be rehabilitated.

Two options for development are proposed (Appendix 1 and Appendix 2). In both options the development line for Northport is the same, proposing a distance generally 100 metres behind the vegetation line in accordance with the Department of Planning and Urban Development coastal setback policy (Policy No. DC 6.1). Further north the development line is reduced to approximately 70 metres in line with the setback for existing development at Falcon. As outlined in Section 6.1.1 this line can be sustained by the evidence of a stable coastline and the natural protection afforded to the coastline by the extensive beach rock.

The two options differ in the proposals for the development of Southport. Option 1 (Appendix 1) proposes nine holes of the golf course on the proponents land with three fairways parallel to the coast located in the swale between the dunes. The three fairways will complement the proposed foreshore reserve and will variously be located between 40 and 80 metres behind the vegetation line. Significantly the location of the fairways will result in the building development line being located between 100 metres and 200 metres behind the vegetation line.

Exact location of the fairways will be determined on the ground however the object will be to site them in areas where they will not detract from the existing foreshore vegetation.

The coastal fairways will be preferentially located to capitalise on areas of dunal erosion where native vegetation is being inundated by sand drift. This is an attractive option as it affords the opportunity to reinstate a degraded dunal area whilst providing an attractive ocean frontage environment for users of the course.

Option 2 (Appendix 2) proposes the location of the 18 hole golf course entirely within the Caddadup Reserve. Whilst this results in a more extensive foreshore reserve in Southport it also results in a greater impact on the dunes through a uniform building development line of 100 metres.

Prior to development proceeding for either option a detailed foreshore management plan will be prepared outlining:

- areas to be treated;
- the nature of such treatment including earthworks, temporary stabilisation measures, stockpiling of vegetation, revegetation species and techniques;
- location, design and management of accessways; and
- ongoing maintenance requirements to preserve the stability and vegetation cover of the dunes.

6.2 Estuary Foreshore

Changes in the estuary foreshore associated with the Eastport development are described in Section 4.4. The proposed development was selected from a range of alternatives with due consideration of environmental, planning and engineering considerations (Sections 3.3 and 4.4).

The environmental effects of the proposed Eastport development upon the estuary foreshore area are principally twofold:

1. An area of fringing estuarine vegetation and degraded woodland within the upland part of the site will be either excavated or filled with spoil material. The Stage 2 ERMP for the Peel Inlet and Harvey Estuary Management Strategy found that this area had no intrinsic conservation value, however it provides an important buffer between the estuary and urban development. The proposed development will replace and augment this buffer function by the creation of 15 hectares of public foreshore reserve upon reclaimed land to the east of the canal waterway. The northerly extension of the waterway within the eastern part of the Eastport development will further separate residential development from

the estuary, so will maximise the security provided to estuarine flora and fauna by this buffer.

2. The area proposed to be reclaimed from the shallow estuarine sand flats to the north and south of the Dawesville Channel will extend into the estuary. The total area of estuarine sand flats to be affected is approximately 32 hectares, of which 9 hectares will be public canal waterway, 5 hectares will be public marina and 15 hectares will be public foreshore. Only 3.2 hectares (10%) of the reclaimed area will be developed for non-public purposes.

The proposed design of the Eastport development has recognised the desire to minimise the requirement for reclamation to intrude upon the existing estuary. The rationale for the preferred proposal includes the following:

1. The shallow sand flats that will be reclaimed have no intrinsic conservation value beyond that of other very extensive areas of shallows around the estuary's margins. The reclaimed area is equivalent to only 0.19% of the total area of the estuary, or less than 0.6% of the area of the estuary that is less than 0.5 metres deep. Moreover the shallows in the Dawesville region are particularly affected by weed accumulation associated with the estuary's eutrophic state. Deoxygenation associated with the decaying weed results in a massive decline in the benthic faunal assmblage each summer, which precludes the development of a stable community structure.

2. The Dawesville sandflats are presently prone to large accumulations of algae that are driven onshore by southerly winds. This problem would increase substantially if the groynes proposed to protect the entrance to the Dawesville Channel were left to create large pockets within their lee, and decaying algae would cause severe nuisance to local residents. (It is noted that nuisance macro algae growth in the estuary is expected to substantially increase for some time following the construction of the Dawesville Channel, prior to the eventual anticipated improvement). The present proposal will relocate the reclaimed shoreline further to the east, so will greatly reduce the area susceptible to weed accumulation. If the eastward relocation of the reclaimed foreshore reserve is not allowed, the area of shallows that is preserved would probably become regularly inundated with decaying algae so would have negligible conservation value. Conversely, it would most likely become a source of considerable ecological and public detriment.

3. The eastward relocation of the area of reclamation will be fully compensated by the development of a public waterway to the west of the proposed foreshore reserve. As discussed previously, the northerly extension of the waterway within the eastern part of the Eastport will augment the important buffer between the estuary and the urban environment.

4. The creation of the waterway along the western side of the proposed foreshore reserve will also enable the development of an internal public beach, a feature not normally associated with Peel Inlet and Harvey Estuary. Beach profiles adopted will ensure stability of this edge of the waterway. Protected beaches elsewhere within public waterways have proven very popular (eg Hillarys Marina at Sorrento).

5. The proposal creates a stable estuary foreshore line through the provision of headlands and by the orientation of the beaches to face the dominant southerly wave direction.

6. The integration of the Eastport development with the proposed public marina to be developed by the Department of Marine and Harbours will provide funds that will be utilised to significantly improve the public facility of the marina without additional cost to the community.

The proposed foreshore reserve that will be established upon the reclaimed land will be developed as a parkland for public recreation, interspersed with nodes of natural foreshore vegetation. The proponent will be responsible for landform creation and initial stabilisation, while vegetation and development of recreation facilities will be undertaken by the Department of Marine and Harbours.

Contouring of the fill along the estuary interface will be designed to match the anticipated shoreline form, which natural erosion and accretion would otherwise establish in time. Engineering measures will be adopted, as and where appropriate, to protect this form from seasonal erosion, with concurrent attention to any impacts such measures may have on the neighbouring shoreline to the north.

Once fill has been placed, topsoil which was prestripped from the original foreshore will be respread to provide a satisfactory surface medium from plant regeneration. At this point the future revegetation and landscaping for the foreshore will become the responsibility of the Department of Marine and Harbours.

6.3 Flora and Fauna Communities and Habitats

The majority of the subject land has already been impacted upon by the requirement to facilitate the construction of the Dawesville Channel through the stripping of the existing vegetation and placement of spoil. These particular works currently being undertaken were approved as part of the ERMP Stage 2 prepared for the Dawesville Channel. As such the impact of the proposed development on the existing flora and fauna will be minimal except for those areas not already cleared such as the Coastal Dunes and the Caddadup Reserve. The impact upon these areas are dealt with in Sections 6.1.2 and 6.4 respectively.

6.4 Caddadup Reserve

In Option 1 (Appendix 1) nine holes of the public golf course are located in the Caddadup Reserve. The Caddadup Reserve is an "A" Class Reserve vested in the Mandurah City Council for the purpose of "Camping and Recreation". The use of part of the Reserve for a public golf course complies with the vesting order.

The majority of the fairways will be located in the northern sector of the Reserve which are now disturbed by past use by off-road vehicles. The golf course also extends into the better vegetated central portion of the Reserve and westwards into the foreshore zone.

The development of the golf course will provide a sound approach to rehabilitation of those degraded areas to a productive recreational use which will reinstate vegetative cover and enhance the visual amenity of the area. In the better vegetated areas siting of fairways will be undertaken to ensure the retention of vegetation.

A substantial natural link between the ocean and the estuary will remain through the southern-most portion of the reserve which will be unaffected by the golf course (Appendix 1). Furthermore, aesthetic values will be protected: the terrain is such that a high ridge following Old Coast Road will hide the golf course development from the estuary, while to the west of this ridgeline the perspective over the southern end of the reserve remains unchanged and to the north judicious siting of fairways, as previously mentioned, will contain impacts so that prominent areas of vegetation can be retained in locations between the proposed fairways.

The impact of the golf course is acceptable in that the development will reinstate vegetation cover in degraded areas whilst incorporating the more valued aspects within the total design.

In Option 2 (Appendix 2) the impact of the golf course will be far greater as the entire course will be located in the Caddadup Reserve. Whilst the same opportunities will apply in respect to the reinstatement of vegetation cover in degraded areas this will be offset by the need to substantially modify the existing environment in the southern portion of the Reserve and will result in the natural link between the ocean and the estuary being severed.

6.5 Canal Water Quality

The resultant water quality in canal estates is dependant upon quality of:

- source water
- management of nutrient and pollutant inflow
- water mixing and exchange

The source water for the canal estates will be ocean water during incoming tides and Harvey Estuary water for outgoing tides and river flows. Because of the anticipated mixing patterns in the Harvey Estuary around the Dawesville Channel, the outgoing water will generally be a mix of ocean and estuary water and be of significantly higher quality than that presently experienced in the estuary. The source water is suitable for canal estates and is expected to improve with time because of the effects of the Dawesville Channel and the catchment management strategies for the Peel-Harvey system.

Minimisation of nutrient and pollutant inputs to the canals will be achieved by careful design and management of the water bodies. The design elements will include;

- reticulated sewerage with no septic tanks
- boat pump and facilities in the DMH marina
- runoff from roads and verges will be collected and infiltrated into the groundwater for all flows up to the 1 year flood event, and
- only run off from roofs will be discharged directly into the canals

The management of nutrient and pollutant inputs will comprise:

- regulation and policing of rubbish disposal into canals
- prohibiting the use of TBTO anti fouling on boats, and
- encouragement of the use of low fertiliser vegetation and slow release fertilisers

The orientation of the canals is such as to enhance the physical processes of water exchange and mixing. At these sites the two dominant mechanisms will be;

- wind driven currents, and
- density driven currents

Secondary mechanisms will be;

- astronomical tidal currents
- meteorological tidal currents, and
- groundwater inflow

The size and orientation of the canals is such that the exchange and mixing mechanisms will be strong and persistent.

Given these features the northern canals are anticipated to have good water quality.

An environmental management and monitoring programme will be implemented following the construction of Port Bouvard. The primary purpose of the monitoring will be to confirm the predictions concerning water quality in the proposed canals. The design of the monitoring programme will be undertaken in consultation with PIMA and the EPA and will include the following:

- Summer and winter monitoring of the water quality at four sites in the canal estates and two reference stations. One reference station would be located in the ocean and the other in the estuary. The surface and bottom water at each site would be analysed for salinity, temperature pH, dissolved oxygen, total phosphorous phosphate, total nitrogen and copper.

- The surface sediments from all six sites would be analysed for build up of total phosphorous and copper. This would be undertaken two years after the completion of construction of the canal estates.

The monitoring programme would span five years and the results submitted to PIMA and the EPA for review. The plan would also include procedures for the investigation and introduction of appropriate measures if unacceptable water quality occurs.

In accordance with the Department of Planning and Urban Development Policy for Canal Estates (Policy No. DC1.8) a management agreement will be prepared with the City of Mandurah to address responsibilities for long term maintenance of the canal estates. This normally requires the proponent to attend to general maintenance for the first 5 years and the Local Authority thereafter. The Management agreement will be prepared as part of the statutory documentation for the Canal Zoning

6.6 Dawesville Channel

The proposed urbanisation of the land has had the impact of bringing forward the construction and completion of the Dawesville Channel at least three years ahead of the Government's most optimistic development programme. A fundamental basis of achieving the Dawesville Channel has been the corresponding urban development of the abutting land owned by the proponent.

6.7 Rubbish Disposal Site

The existing rubbish disposal site, managed and utilised by the Mandurah City Council presents an environmental risk to future development. The land area is proposed as a golf driving range (refer Appendix 1).

Option 2 proposes a canal estate in the low lying land south of the Dawesville Channel. This option for Southport results in canals within 0.5km of the existing rubbish disposal site. The tip was an "open" tip with little or no control over the nature of material deposited. However, even if there are no "exotics' in the fill, the tip will still have a significant effect on the quality of the groundwater.

The groundwater consultants, Dames & Moore have reported that preliminary estimates suggest that approximately 500m^3/day of groundwater would flow from the tip area into the canal estate south of the Dawesville Channel. This groundwater would be high in BOD and some nutrients and pollutants, which would exceed the levels found in primary sewers. Consequently it would be very difficult to achieve acceptable water quality in this canal estate. Because of the contaminated groundwater from the rubbish disposal site, the proposal for a southern canal estate is not the favoured option.

As a result of the Environmental Protection Authority's assessment of this PER it would be appropriate for the Authority to investigate the acceptability of the future operation of the tip with the Mandurah City Council.

6.8 Enhanced Recharge

Land clearing and urban development will result in a rise of water table levels due to the following factors:

- reduced evapotranspiration losses following removal of vegetation;
- enhanced recharge from roofed and paved areas which have higher runoff potential than uncleared land; and
- enhanced recharge as a result of losses from domestic and irrigation water reticulation systems and discharge to ground of stormwater drainage.

Enhanced recharge to the superficial aquifer will potentially increase the thickness of the freshwater lens. However, the construction of the Dawesville channel and also the canals will reduce the thickness of this lens in the immediate vicinity of the development.

6.9 Effect of Development on Peel-Harvey Catchment Boundary.

It is difficult to accurately define the pre-development position of the Peel-Harvey groundwater catchment boundary since it migrates seasonally and the maximum difference in the elevation of the water table across the peninsula is only about 0.5 metres.

The construction of the Dawesville Channel will alter the hydrology of the surrounding area and change the position of the Peel-Harvey Catchment Boundary. Currently, groundwater discharges to the Indian Ocean and the Peel Inlet. The proposed development will create additional groundwater discharge areas which comprise the proposed canal system and marina in addition to the construction of the Dawesville Channel. The positions of the groundwater catchment boundaries following development are difficult to predict accurately (refer Plan J). The positions shown on Plan J were predicted using preliminary design information for the development to assess the impact on the groundwater flow regime. These positions can only be regarded as approximate since the factors which make it difficult to define the pre-development catchment boundary affect the post-development boundary positions and in addition, the accuracy to which it is possible to make predictions is limited at this stage.

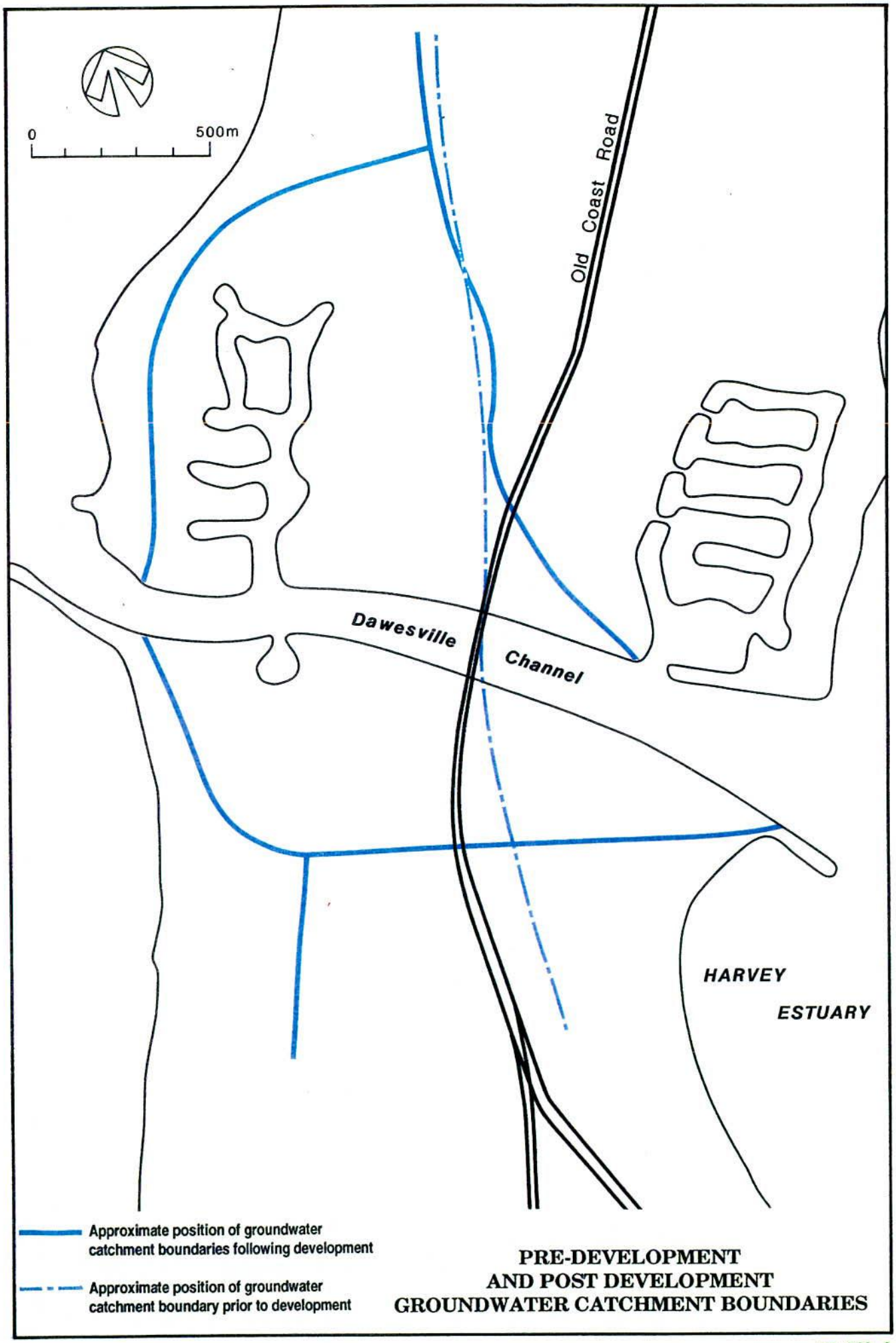
Future development will be undertaken in accordance with the requirements of the Department of Planning and Urban Development's Statement of Planning Policy No. 2 (February 1992) and the EPA's "Draft Environmental Protection Policy for the Peel Harvey Estuarine System 1992".

6.10 Effects of Abstraction

The proposed borefield will be at least 2,000m from the nearest existing user of groundwater from the Leederville Formation. Groundwater exploration and aquifer testing are planned prior to golf course construction to obtain aquifer parameters and to enable the borefield to be designed to minimise the effects of abstraction on existing users. Abstraction from the Leederville Formation is unlikely to have any measurable effect on the superficial aquifer.

6.11 Effects on Groundwater Quality

Stormwater drainage systems will be designed to prevent the introduction of oils and other noxious chemicals into the superficial aquifer. Consequently, the only effect of the development on groundwater quality which is potentially of significance is the addition of nutrients to the shallow groundwater system in the superficial aquifer. The sands and limestones in the unsaturated zone underlying the development area have a high capacity to remove phosphorus by absorption due to the nature of the sediments (high phosphorus retention indices are likely, based on previous testing of similar materials at other locations) and the thickness of the unsaturated zone (5m to 40m). Attenuation of any phosphorus reaching the saturated zone will also occur by absorption and dilution as groundwater flows through the aquifer.



PRE-DEVELOPMENT AND POST DEVELOPMENT GROUNDWATER CATCHMENT BOUNDARIES

PLAN J

6.11.1 Effluent Discharge from Sewage Treatment Works

The development is to be serviced by a reticulated sewerage scheme constructed, operated and maintained to Water Authority of Western Australia standards. The sewerage scheme will be connected to the proposed treatment plant which will be located adjacent to the golf course and constructed and operated by the Water Authority.

Treated effluent from the plan may be utilised in 10 - 15 years time for the irrigation of some areas of the public golf course using a low pressure irrigation system. The golf course is underlain by Tamala Limestone which is highly permeable. Consequently, high infiltration rates can readily be maintained without generating surface runoff of treated effluent. Attenuation of nutrients by absorption is also likely to occur as discussed above.

6.11.2 Golf Course and Turfed Areas

Fertiliser applied to the golf course and turfed areas is a potential source of nutrient loading to the shallow groundwater system.

Application rates will form part of a detailed fertiliser programme which will be drawn up when soil analyses are carried out. Key components of the programme will be use of slow release fertilisers, tissue testing and foliar feeding to minimise the leaching of nutrients to the water table.

6.12 Impact of Canal Construction on the Groundwater Regime

The construction of the canals will alter the groundwater flow regime in the upper section of the superficial aquifer. Construction of the canals will result in groundwater discharge to the canal systems as well as the ocean inlet.

6.13 Impact of Marina Construction on the Groundwater Regime

A marina complex is to be constructed on the Harvey Estuary foreshore on reclaimed land adjacent to the Dawesville Channel entrance. This land will be created by the disposal of spoil associated with excavation of the Channel. The reclamation of land will enhance aquifer recharge locally and cause the seawater interface present in the basal section of the superficial acquifer to migrate eastwards to a new equilibrium position. The impact on the groundwater regime is expected to be localised and confined to the immediate vicinity of the marina because of the moderate to high permeability and low hydraulic gradient of the superficial aquifer. Groundwater inflow to the marina is estimated to be about 44,500m3/annum.

However the environmental acceptability of the proposed marina is not addressed as part of this PER as it's construction and future management is the responsibility of the Department of Marine and Harbours, and as such will be the subject of a separate environmental assessment.

6.14 Existing Community

The urbanisation of the subject land with a population in the vicinity of 4000 people will have an impact on the existing community. As was outlined in Section 5.2.1, a large proportion of the existing population are retirees or non-permanents. However the impacts associated with urbanisation will be limited in that they will occur over a 10 year time frame and will not be dissimilar to the transition of Mandurah and Halls Head from holiday destinations to an urban community.

Whilst similar lifestyles to those currently being experienced in the general area would continue to be accommodated, it is inevitable that the development will also attract a younger population element to the locality. This would create a more balanced and socially diverse local population, however an obvious consequence would be the generation of more competition for the use of existing facilities - particularly "resource based" (ie ocean/estuary) recreation facilities.

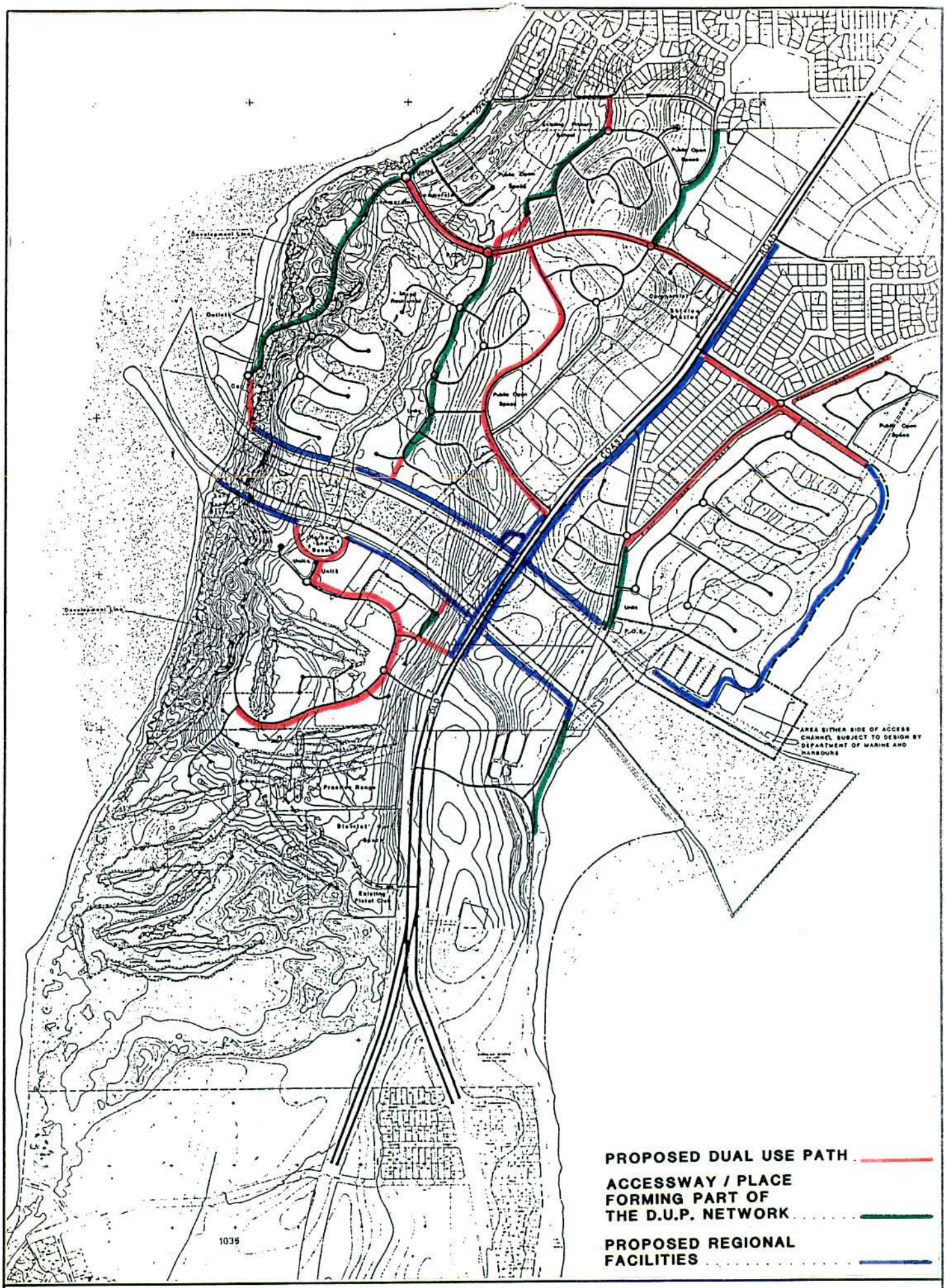
This "competition" impact is common where major residential development is proposed in an existing community but can be minimised by careful management and the provision of new recreation facilities as part of the development. Importantly, the provision of significant recreational and community type facilities to cater for future requirements is an integral part of the Port Bouvard Project.

6.15 Community Access

In recognition of the regional recreational opportunity afforded by the construction of the Dawesville Channel, the community's access to the beaches, the Dawesville Channel and the Estuary has been maintained and enhanced.

A Dual-Use Path network ensures that the public has appropriate access to both sides of the Channel. Focal points affording recreational opportunities are created along the Channel at the beach created by the two northern breakwaters, at the public open space on Estuary Road, at the Marina, at the public beach near the boat harbour and at the permanent carpark and viewing area adjacent to Old Coast Road (refer Section 6.16 and Plan K).

The community's access to the Estuary is enhanced by the reclamation of approximately 15 hectares for recreation purposes. This area of land will permit access to deep water, suitable for swimming, wading and windsurfing and will also offer the public passive recreational opportunities. As part of the reclamation process it is proposed to create a series of small, sandy beaches on the canal side ensuring a sheltered and protected swimming environment.



DUAL USE PATH NETWORK

Scale — N.T.S. Date — 4·6·92
Feilman Planning Consultants Pty. Ltd.

Plan K

The existing access to the coastal beaches is maintained. Car parks and direct access are provided at the existing popular beach immediately south of Falcon, at the new beach created by the two northern breakwaters and to the beaches in Southport.

6.16 Dual Use Paths

A comprehensive network of dual-use paths is provided throughout the Port Bouvard development ensuring easy movement of both pedestrians and cyclists through the estate. The dual-use path system combines a series of access ways and constructed paths to provide public access to Falcon Primary School, the beaches, community and recreation facilities and to the Dawesville Channel. The system is planned to link into the dual-use path to be provided along Old Coast Road and the Dawesville Channel Bridge. Throughout the estate the dual-use paths follow the contour lines to ensure effective and comfortable movement.

The implementation of the dual-use path network proposed is dependent upon a three tiered approach (see also Plan K):

(i) Dual Use Paths - constructed by Wannunup Development Nominees Pty Ltd and usually located within the road reserve.

(ii) Accessways and Places - utilisation of the proposed road system where traffic volumes are low.

(iii) Proposed Regional Facilities - dual use paths to be constructed by State and /or Local Government Authorities.

6.17 Traffic Volumes

The increased urbanisation of the general locality will also result in increased traffic volumes, however in a separate study undertaken by the traffic engineers Sinclair Knight Buchanan it was shown that the increases will be accommodated within the stipulated guidelines of the Mandurah City Council and the State Planning Commission.

6.18 Existing Housing

The steady urban development of the project area will have an impact on existing housing where a steady rise in property value can be expected. This is associated with the general improvements provided by new development such as the provision of recreational and community facilities but also results from prospective purchasers seeking alternative housing product where the attraction will be to purchase property in what is perceived as an established character area. However increases in property values attributed to the proposed development need to be viewed in light of the general increase in values associated with the construction of the Dawesville Channel and the resultant improvement in overall water quality.

6.19 Community and Recreation Facilities

In establishing the future needs of the community of Port Bouvard a Community Services Assessment was undertaken. Whilst the assessment was undertaken to primarily focus upon the needs of the population proposed by the Port Bouvard development, the scoping was widened for certain facilities to include the greater community in response to the requirements of the Mandurah City Council and information received from local community groups.

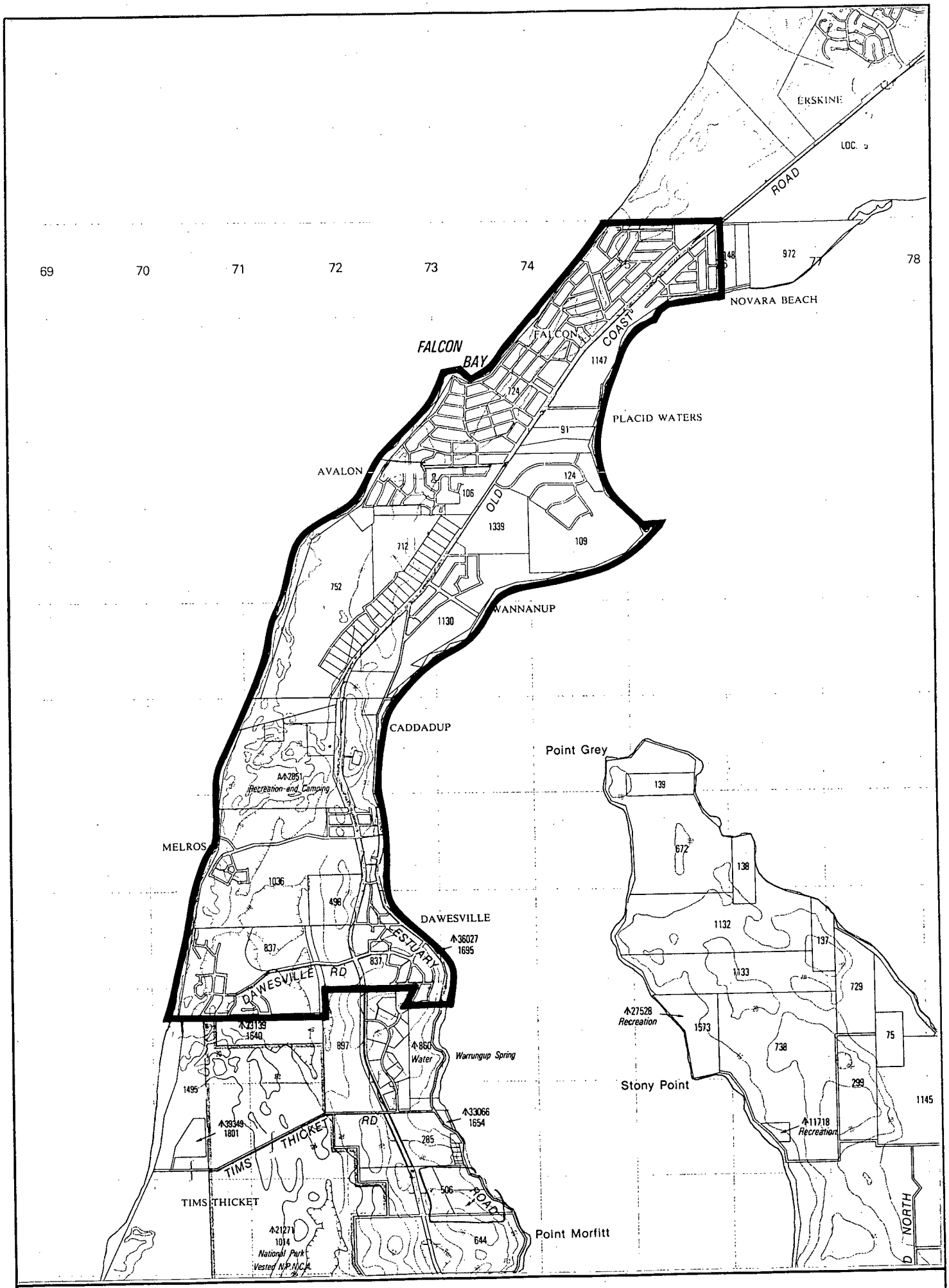
The study area for assessment was defined from the southern boundary of Halls Head to the existing settlement of Dawesville (see Plan L). The boundaries were defined on the basis that Halls Head was either located sufficiently close to Mandurah Town Centre or was developing in its own right to ensure appropriate servicing, and that Dawesville represented the southern most extremity of intensive development.

6.19.1 Public Open Space

The Public Open Space (refer Appendix 1) will be developed to ensure that there is no "time lag" between the development of the public open space and the growth and recreational demands of the future community and will be staged as required by the Mandurah City Council and the State Planning Commission as a condition of subdivision approval.

In Northport the majority of the public open space is provided by expanding upon the existing public open space (Reserve No. 24880). This provides a pedestrian link between residents and the Falcon Primary School, the Neighbourhood Shopping Centre and the Community Facilities. A portion of this public open space is proposed to incorporate a children's swimming beach in the north-east corner of the canal estate. Two further significant areas of public open space are provided in the north - east and south - east sectors, the latter located on a high point providing a community recreational area with views over the estate and the Ocean. This latter area may be adjusted in size due to the difficulty of establishing and maintaining vegetation on this high exposed location.

Although not forming part of the public open space contribution, the dominant recreation feature in the Southport sector is the proposed golf course. As such only small localised pockets of public open space are provided in this sector.



COMMUNITY ASSESSMENT CATCHMENT

Scale — N.T.S. Date — 4·6·1992

Feilman Planning Consultants Pty. Ltd.

Plan L

At Eastport, public open space is provided in two forms. In the north-east corner an area of public open space is provided for active recreation. Public open space is also proposed in a 10 metre strip along Queen Parade providing both existing and future residents with a pedestrian link to the proposed "shop-house" on the corner of Queen Parade and Estuary Place and further south to the Dawesville Channel. The public open space will be complemented by the extensive area of foreshore reserve proposed along the Estuary.

6.19.2 District Open Space

The Community Services Assessment identified the need for provision of sportsgrounds, local parks and ancillary open space. Whilst these facilities form a part of the normal public open space requirements, an area of five hectares for District Open Space is provided for in the Caddadup Reserve (refer Appendix 1). The District Open Space will supplement the public open space provided at Port Bouvard and the surrounding district and will allow Mandurah City Council to develop the land for district facilities. This will enable a district sports ground to be developed and the five hectares will allow for the additional provision of special activity courts, such as tennis and basketball courts to be provided in this location. The use of the land in the Caddadup Reserve as District Open Space is appropriate as it conforms to the vesting and purpose of the Reserve which is "Camping and Recreation".

6.19.3 Community Hall, Public Library and Day Care Centre

The Community Services Assessment identified the need for a community hall, public library and day care centre. These facilities will be located in the Public Open Space adjoining the neighbourhood shopping centre due to its accessibility and to maximise the parking facilities offered by the shopping centre (refer Appendix 1). The proponent has also agreed to make a contribution of $300,000 to the Mandurah City Council towards the construction of community facilities at Port Bouvard.

6.20 Vesting of Land

The vesting of land proposed for public use, such as the public open space and the foreshore reserves is normally directed to the local authority and it would be expected that this will be the case for those areas proposed in Port Bouvard. Vesting will occur as a standard condition at the relevant stage of subdivision approval.

6.21 Construction Traffic and Noise Control

The large majority of plant and machinery which will be mobilised to and deployed at Dawesville will be used in construction of the Channel and the bridge. Following the bulk earthworks including canals on the Proponents land, the remainder of the work will be no different from standard residential subdivision development. Because of the relatively more isolated nature of the proposed development in the three areas, impact on residents is likely to be less than for other residential development in the Mandurah area, however such impacts (ie noise and traffic movements) will be contained within Local Authority standards.

6.21.1 Northport

No existing residences on ocean and Channel sides; proposed development to north contiguous with existing only over a relatively short front; proposed development to the east abuts on existing road (Buckingham Drive) serving large lots with dwellings located a considerable distance from the road; materials delivery will be in the main via the proposed new access road through Lot 9 Old Coast Road which has been purchased by the Proponent specifically for provision of access.

6.21.2 Southport

No existing residences on all four sides, ocean, Channel, Old Coast Road and Caddadup Reserve to the south; access will be via temporary construction roads and / or the proposed new access road off Old Coast Road which will serve this area.

6.21.3 Eastport

No existing residences on estuary and Channel sides; proposed development to west contiguous with existing subdivision but separated by existing road and proposed P.O.S. buffer; access will be via Estuary Place and Estuary Road.

6.22 Construction of Associated Services

Provision will be made to accommodate all services presently crossing the alignment of the Channel, as well as those proposed for the future, within the structure of the Dawesville Channel Bridge.

The existing services involving SECWA power, the 600mm diameter water main and Telecom have been rerouted, temporarily for the period of construction of the bridge. It is not anticipated that disconnection and reconnections will create any undue disruptions to local supply. Similarly, permanent connection across the bridge as well as take offs for development, are anticipated to create only minor inconvenience for local residents.

Services which presently do not exist and will be created for the development, as outlined under section 4.5 of this report, will have minimal adverse impact, in terms of disruptions on existing services to nearby dwellings. The installation of these services during the construction period of the development will also have only limited impact on residents where seen in the context of the proposed activity over the period at the Dawesville site.

6.23 Historical, Archaeological and Ethnographic Sites

The surveys commissioned by the Department of Marine and Harbours in 1989 ("An Archaeological and Ethnographic Survey for Aboriginal Site sin the Area of the Dawesville Channel Project" [L. Strawbridge] and Addendum Report [P. Veth]) identified three sites. The sites however are either badly disturbed or considered of low importance and as such do....."not warrant any further attention".

Whilst these findings allow development to proceed a further survey will be required to be undertaken for the southern portion of the Caddadup Reserve.

6.24 Aesthetic Appearance

The Port Bouvard project will have a minimal impact on the existing aesthetic appearance of the landscape. The construction of the Channel and the associated works involved in the disposal of spoil from the Channel have had a dramatic impact upon the existing landscape. The works involved with the Channel have resulted in the clearance of vegetation and a change in the level of the landscape on the majority of the land proposed for development as part of this PER. In view of these circumstances the proposals contained within the Port Bouvard project will only impact upon a landscape which has already been substantially modified to accommodate the construction of the Dawesville Channel.

The area will change from a denuded "earthworked" landscape in terms of form and colour to a suburban area with streets, individualised planting and landscaping on separate blocks. The general openness of the landscape will be replaced by a suburban form. Some areas which formerly had an aspect over bushland will look out on residential estates.

There will be increased dominance of the present dryland areas by waterways (canal estates). The waterways created will be dominated by residential housing. The currently denuded and spoil covered areas will be markedly improved in appearance as streets, dual use pathways and public spaces are landscaped and planted in accordance with a consistent theme.

7.0 PUBLIC CONSULTATION

An extensive programme of public consultation has already been undertaken by the proponent. This has involved individual briefing sessions to community groups; presentation of the project to public meetings; hosting public workshops and responding to written requests for information - as well as responding to the requests of the local media.

The objectives of the Port Bouvard development were first advertised as part of Amendment No. 176 to the City of Mandurah Town Planning Scheme 1A. The Amendment was advertised for six weeks during December 1991 and January 1992 during which time the public had the opportunity to comment on the proposal. Six submissions were received, only two of which stated objections to the proposed development.

On March 17, 1992 the proponent responded to a request from the Falcon Progress Association to address a public meeting. The meeting was held at the Falcon Community Hall and was attended by 106 members of the public. The meeting involved a presentation by the proponent followed by questions from the public and served as a general information forum.

During June 1992 a questionnaire was circulated to community groups considered as being representative of the local community. Follow up public workshops were held on June 6th and 7th 1992 at which the development proposal was explained and the concerns raised by the responses to the questionnaire and by attendees at the respective workshops were addressed. The main issues and concerns raised comprised the following:

- provision of public access to the beaches including parking;
- provision of public access to the estuary foreshore;
- the amount of estuary reclamation;
- the need for public consultation, environmental approvals and careful planning;
- dune protection;
- provision of cycleways and public transport; and
- provision of community facilities

Direct reference of the above issues to the relevant parts of Section 6.0 of this report outlines that these particular community concerns have been addressed.

The workshops were attended by representatives of the following groups:

- Southern Estuary Progress Association
- Southern Coastal Progress Association

- Channel Surf Committee
- Falcon Parents and Citizens Association
- Peel Preservation Group
- South Mandurah Sporting and Recreation Club
- Mandurah Chamber of Commerce
- Mandurah Pistol Club.

Mr Keith Read, Member for Murray also attended.

The proponent has responded to requests for information and will continue to do so. In the past month the proponent has addressed the following groups:

- Mandurah Chamber of Commerce
- Mandurah Rotary Club
- The Institute of Valuers
- Radio 6MM Public Talk-Back Programme.

The proponent has and will continue to promote the public's awareness of the proposed development.

8.0 COMMITMENTS

Commitments which can be made by the project proponents include the following:

8.1 Pre-Construction

The following management plans will be prepared prior to construction of the relevant components:

8.1.1 Golf Course Management Plan

A staged nutrient management programme will be prepared to minimise nutrient export which will:

- minimise fertiliser application through the use of slow release fertilisers and foliar feeding.
- involve regular soil sampling and tissue testing to assess soil and plant nutrient levels.

The management plan will detail fairway layouts and proposed water usage and will be prepared upon receipt of development approval for the golf course. The management plan will be prepared to the satisfaction of the Environmental Protection Authority.

8.1.2 Foreshore Management Plan

A foreshore management plan will be prepared for the coastal dunes for the extent of the proponents land and will detail:

- areas to be managed and rehabilitated;
- the nature of rehabilitation including earthworks, temporary stabilisation including earthworks, temporary stabilisation measures, stockpiling of vegetation, revegetation species and techniques;
- location, design and management of accessways;
- maintenance requirements; and
- maintenance of golf course fairways where these impact on the dunes.

The management plan would be prepared as a condition of subdivision approval for the land immediately adjoining the coast and would be prepared to the satisfaction of the EPA and the Coastal Planning Branch of the Department of Planning and Urban Development.

8.1.3 Water Quality Management and Monitoring Plan

A water quality management and monitoring programme will be prepared to confirm the predictions concerning water quality in the proposed canals. The programme will be prepared following the lands rezoning to "Canal Zone". The design of the programme will be undertaken in consultation with PIMA and the EPA and will include the following:

Summer and winter monitoring of the water quality at four sites in the canal estates and two reference stations. One reference station would be located in the ocean and the other in the estuary. The surface and bottom water at each site would be analysed for salinity, temperature pH, dissolved oxygen, total phosphorus phosphate, total nitrogen and copper.

The surface sediments from all six sites would be analysed for build up of total of phosphorous and copper. This would be undertaken two years after the completion of construction of the canal estates.

The plan will also include procedures for the investigation and introduction of appropriate measures if unacceptable water quality occurs.

The monitoring programme would span five years and the results submitted to PIMA and the EPA for review.

8.1.4 Waterway Management Plan

In accordance with the Department of Planning and Urban Development Policy for Canal Estates (Policy No. DC1.8) a management agreement will be prepared with the City of Mandurah to address responsibilities for a long term maintenance of the canal estates. This normally requires the proponent to attend to general maintenance for the first 5 years and the Local Authority thereafter. The Management Agreement would be prepared as part of the statutory documentation for the "Canal Zone" and would be prepared in consultation with the Mandurah City Council and the Department of Planning and Urban Development.

8.1.5 Archeological and Ethnographic Survey

Following development approval for the proposed golf course an archaeological and ethnographic survey will be undertaken over the southern portion of the Caddadup Reserve in accordance with the requirements of the Aboriginal Heritage Act and in consultation with the relevant authorities.

8.2 During Construction

8.2.1 Dune Protection

Where development enters the dunes the area of disturbance will be minimised to ensure that the majority of existing vegetation cover is retained. Vegetation which is cleared to facilitate roads and pathways, golf course fairways and residential development will be stockpiled to be used as stabilising brush cover on areas which are to be rehabilitated.

8.2.2 Estuary Foreshore Vegetation

Where the existing estuary foreshore vegetation is not affected by proposals for development it will be protected and included in the newly created foreshore reserve.

8.2.3 Noise, Traffic Management and Dust Control Measures

Work involved in the bulk earthworks and residential subdivision development will be undertaken in accordance with the Local Authority's standards and where required the Environmental Protection Authority's standards for noise, traffic management and dust control measures.

8.2.4 Community Awareness

The proponent will respond to local enquires or complaints regarding elements relevant to the construction of the canals and urban development.

8.3 Post Construction

- All development within the Port Bouvard project will be undertaken in accordance with the requirements and conditions of the Peel-Harvey Statement of Planning Policy 1992 and the Environmental Protection Policy (Peel-Harvey Estuarine System) 1992.

- The Water Quality Management and Monitoring Plan as referred to in Section 8.1.3 will be implemented to provide a management and monitoring programme for five years following construction of the respective canals.

- The Waterway Management Plan (Section 8.1.4) will be implemented in accordance with the requirements of the Department of Planning and Urban Development Policy Number DC 1.8 and to the satisfaction of the Mandurah City Council and the Department of Planning and Urban Development.

APPENDIX 1

APPENDIX 2

APPENDIX 3

GUIDELINES FOR THE PUBLIC ENVIRONMENTAL REVIEW FOR THE PROPOSED PORT BOUVARD URBAN AND CANAL DEVELOPMENT, MANDURAH

Overview

In Western Australia, all environmental reviews are about protecting the environment, which for this proposal means that the environmental values associated with the Mandurah area between Dawesville and Falcon, adjacent to the Dawesville Channel including the Ocean and Estuary foreshore, are protected.

These Guidelines have been prepared in response to a proposal forwarded to the Environmental Protection Authority (EPA) by Feilman Planning Consultants Pty Ltd on behalf of Wannunup Development Nominees Pty Ltd to develop an area of land immediately north and south of the Dawesville Channel for the construction of artificial waterways and associated urban development.

The primary purpose of the Public Environmental Review (PER) is to provide information on the proposal to the EPA within a local and regional framework. The Authority will assess this information and then provide advice to the Government on the environmental acceptability of the proposal. An additional function of the PER is to communicate clearly with the public so that the EPA can obtain informed public comment. As such, environmental impact assessment is quite deliberately a public process. It also seeks to inform decision makers, to identify risks and minimise adverse environmental impacts, to achieve environmentally sound proposals through research, management and monitoring, and to manage potential conflict through the provision of the means for effective public participation.

It is the responsibility of the proponent to design and implement a proposal which protects the environment and to present this proposal for review by all interested members of the public. The proponent should describe what is proposed, discuss the potential environmental impacts of the proposal, and then describe how these environmental impacts are going to be managed so that the environment is protected.

These Guidelines have been prepared to assist the proponent in identifying issues which should be addressed within the PER. They are not intended to be exhaustive, and the proponent may consider that other issues should also be considered within the document.

The discussion in the PER should be concise, accurate, and easily understood. Specialist information should be included where it assists in the understanding of technical aspects of the proposal. A copy of these Guidelines should be included in the PER.

Objectives of the PER

The PER should have the following objectives :

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

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

Key Issues

Key issues include :

1. Justification

• an evaluation of alternative locations and scales, including discussion of previously identified options, and constraints associated with potential sites; and
• justification of preferred site, including scale.

2. Proposal

This should include a discussion of the following points:

• precise location of preferred option (s);
• description of construction workforce, including size, source and make up;
• number and area of proposed artificial waterways;
• size / area of proposed Estuary foreshore reclamation;
• source of fill for reclamation;
• details of proposed infrastructure associated with the site;
• services (roads, telephone, power);
• construction method;
• anticipated construction timetable;
• description of size and nature of human settlement proposed to be created by the urban and canal development;
• anticipated settlement timetable;
• final land use;
• provision of recreational facilities available to the public (e.g. fishing platforms, DUP's etc.);
• description of the newly created landform as a result of Estuary reclamation, including contours of reclaimed land; and
• identification of decision making authorities.

3. Existing Environment

• soils;
• geology;
• anticipated hydrological characteristics of adjacent water body (i.e. Dawesville Channel);
• redefined boundary of the Peel Harvey catchment as a result of the construction of the Dawesville Channel (as per Minister for the Environment's existing Conditions pertaining to development within the Peel Harvey Catchment);
• groundwater flow (particularly in view of potential leachate contamination as a result of existing tip south of Channel alignment);
• coastal and estuarine flora / fauna - species list and density (per m^2) of terrestrial, semi-aquatic and aquatic flora and fauna in the area to be impacted by the development proposal;
• description of the existing communities in the vicinity of the proposed development, including population size, character, lifestyles and values of existing residents, local social organisation, properties and housing;

• existing traffic patterns;
• land use, including past land uses and reservation ;
• local and regional significance of the land, including recreation, landscape and visual amenity; and
• historical, archaeological and ethnographic sites;

4. Environmental Impacts and Management

The following impacts should be addressed :

• impact on coastal and estuary foreshore, and associated management strategies to protect and minimise on-going impact during and post construction;
• incremental loss of estuary foreshore (? ha);
• rehabilitation of reclaimed foreshore area, including final contour lines, vegetation planting programmes (this should be related to the proposed foreshore reclamation as proposed by the Department of Marine and Harbours in February 1992);
• biological aspects including predicted impact on flora already present, statements regarding succession sequences, and management plans to minimise or ameliorate impact on flora and fauna;
• flushing characteristics of artificial water bodies and management strategy to maintain acceptable water quality within them;
• potential impact of contaminated groundwater flow from tip site south of Channel alignment;
• groundwater availability, golfcourse requirements and long term sustainability of golfcourse in relation to water requirements;
• effect of construction of artificial waterbodies on adjacent existing water bodies (i.e. Ocean and Estuary);
• effect on existing urban community north and south of site;
• maintenance of public access to Channel alignment, Estuary foreshore and coast, and location of dual use paths within proposed subdivision;
• impact on existing traffic movement and associated safety issues;
• impact of the urban development on the communities in the vicinity of the site, including population size and character, lifestyles and values, and local social organisation;
• nutrient management associated with urban subdivision, POS, and golfcourse;
• impact on existing housing, including property values;
• impact on local social and commercial services;
• impact on recreational users;
• proposed vesting of land included within the development proposal;
• construction of associated services;
• control of traffic and noise associated with construction; and
• impact on the aesthetic appreciation of the area.

5. Public Participation and consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the PER. It should describe the activities previously undertaken or proposed to be undertaken by Wannunup Development Nominees Pty Ltd to promote public awareness and support for the proposal, the dates, groups and individuals involved, and the objectives of the activities.

Cross reference should be made with the description of the environmental management for the proposal which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures, outside the Environmental Protection Authority process, these can be noted and referenced here.

6. Detailed list of environmental commitments

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

(a). who will do the work;

(b). what the work is;

(c). when the work will be undertaken; and

(d). to whose satisfaction the work will be carried out.

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