PEEL INLET MANAGEMENT AUTHORITY

Reserve 40109 Management plan

Waterways Commission
Report No 51
1994

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RESERVE 40109 MANAGEMENT PLAN

Report to the Peel Inlet Management Authority

G Davis, T Rose, J Byrne

Waterways Commission
216 St Georges Terrace
Perth WA 6000

Report No 51,
August, 1994

ACKNOWLEDGEMENTS

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FOREWORD

Foreshore reserves are provided in accordance with State Government philosophy to allow the community of Western Australia to enjoy the State's waterways. Foreshore areas are highly valued by the community for their aesthetic appeal and high conservation values, as well as for their attraction for tourism and leisure activities. Reserves also protect remnant vegetation, act as a buffer against erosion, provide a habitat for fauna, and enhance the health of waterways by attenuating nutrients. However, reserves are subject to a wide range of competing pressures.

In 1987 the Peel Inlet Management Authority, through the Waterways Commission, accepted vesting of Reserve 40109. As part of its role PIMA is required to prepare a plan outlining how the reserve will be managed.

This plan makes recommendations to conserve, protect and rehabilitate the foreshore area whilst maintaining public access and recreational opportunities for the community in a manner sympathetic with the surrounding environment as well as recognising the adjoining residents historical association with the area.

A draft management plan was prepared in the summer of 1993/94. Public comment was invited on this draft and a number of written submissions were received. Concerns focused on the lease option, fencing, maintenance of the foreshore reserve, public access and a general concern about a decline in privacy of residents and an increase in theft and vandalism, and the issue of shared jetties.

The document has been amended to clarify these issues. Of particular importance is Recommendation 15 which provides for the development of a strategy to implement the plan in consultation with the public and local government.

PIMA appreciates the effort people made in preparing submissions and hopes that the community continues to work with PIMA in its efforts to manage the reserve and achieve the objectives of the plan.

J E Hughes APM
Acting Chairman

CONTENTS

1. INTRODUCTION

In 1961, Lot 2, Cockburn Sound Location 16 was subdivided to form residential lots, plus a foreshore reserve - Lot 66. Lot 66 was subsequently indentured to the original owners of Lot 2 for a period of twenty one years. On expiry (1982) it was to be surrendered to the Crown "free of all encumbrances" for the purpose of Public Open Space.

Prior to the expiry date, some adjacent land owners entered into lease agreements with the covenantors for the sublease of that part of the reserve which abutted their property boundary. Under the terms of the lease, the subject land was to be surrendered to the Crown under the terms of the original indenture.

During this twenty one year period, the adjacent owners developed some of the reserve. The developments included jetties (licensed by the Department of Marine and Harbours and approved by the Peel Inlet Management Authority (PIMA)), construction of retaining walls (usually to PIMA's satisfaction and at the applicants' cost), outbuildings - sheds and barbecue areas - (sometimes with Shire of Murray approval) and extensive landscaping. No formal approvals have however been issued for many of the above developments.

Prior to expiry of the indenture, the Shire of Murray undertook to accept vesting of the reserve (now Reserve 40109). Map 1 depicts Reserve 40109 and surrounding areas. One of the conditions set by the then Department of Lands and Survey was that prior to vesting, the Shire would have to prepare a management plan for the reserve.

Subsequently, various management plans were proposed, but none officially adopted. During this period the Shire of Murray reversed its decision to accept vesting.

In 1987 the Waterways Commission accepted vesting for the purpose of "foreshore management and recreation" and subsequently delegated management responsibility to PIMA. While PIMA accepted that many of the developments do not have formal approval, it has tolerated their existence. It is important that a workable management plan be prepared and adopted by all interested parties.

Section 34(A) of the Land Act (1933) requires, in part, "any person in whom land has been ... vested under Section 33(2) ... to submit a management plan to the satisfaction of the Minister...". This document is designed to meet that requirement.

A draft document was released for public comment in December 1993. Following examination of public submissions this modified plan has been prepared and was endorsed by the Authority at its meeting on July 22, 1994.

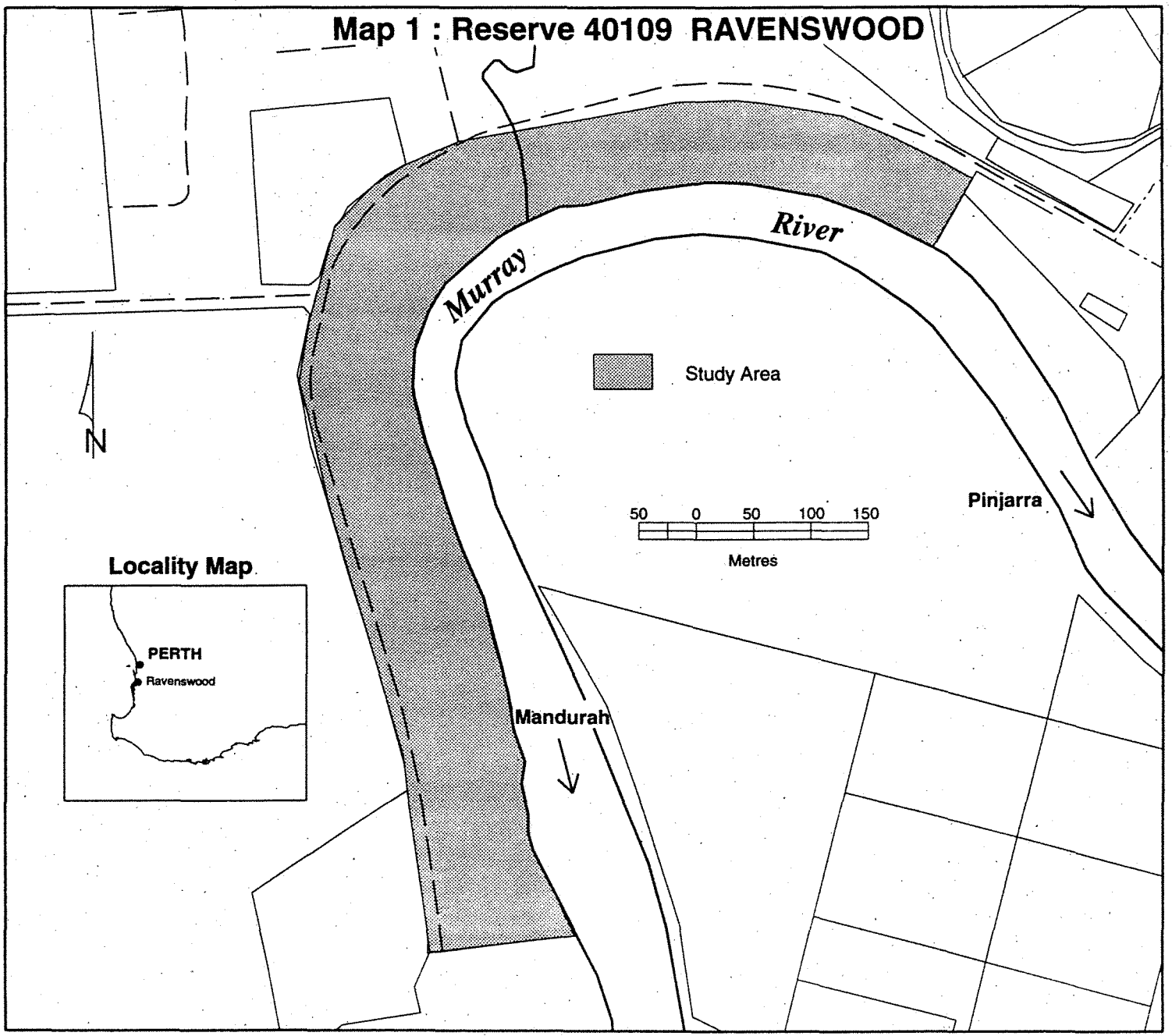
1.1 Aim

It is the aim of the management plan to conserve and enhance the waterways, banks and foreshores of Reserve 40109 whilst maintaining the historical association of adjoining residents' and ensuring provision for public access.

2. THE NEED FOR FORESHORE RESERVES

Foreshores play an important part in maintaining the health of waterways. It is vital that they are managed in a way that ensures they function as an integral part of the waterway environment. Foreshore areas are important because:

- they include plant and animal communities and physical features which form an integral part of the estuarine/riverine ecosystem.
- fringing vegetation within the reserve provides a buffer between the waterway and possible sources of water pollution and reduces the severity of erosion processes.
- they contain features which are part of the waterway landscape.
- they enable public access in a manner consistent with the multiple use of the waterway.


Map 1 : Reserve 40109 RAVENSWOOD
Murray River
Study Area
N
50 0 50 100 150
Metres
Pinjarra
Mandurah
Locality Map
PERTH
Ravenswood

3 PUBLIC CONSULTATION

The draft document was released for comment from late 1993 to early 1994. Advertisements were placed in the three local papers on several successive occasions. In addition all people owning property abutting the reserve were forwarded a copy of the report.

The main issues raised in the submissions were:

- the lease option,
- fencing;
- maintenance of the foreshore reserve,
- public access and a general concern about a decline in privacy of residents and an increase in theft and vandalism, and
- the issue of shared jetties was also of concern to many residents.

As a result of the public submissions received, the draft was modified in the following manner:

- a technical appendix is to be included in the planning of the reserve which specifies design guidelines for criteria such as uniform fencing and other developments.
- the option to lease the foreshore reserve was removed from the draft plan and replaced with the principal of joint management of the reserve by PIMA, the local authority and residents through the community liaison committee.
- the draft plan was also modified through the inclusion of the requirement to develop an implementation strategy to guide development of the foreshore reserve, in consultation with a community liaison committee.

Appendix 1 provides a more detailed summary of public submissions received.

4. ISSUES AND RECOMMENDATIONS

4.1 Management of the reserve

Long term management and ultimate decision-making rests with the Waterways Commission through the Peel Inlet Management Authority (PIMA) in which the reserve is vested. Various committees have been formed to consider management of the reserve. Committees enhance communications between interest groups and the vestee and it is desirable that a management committee for this reserve continue to operate.

In order to ensure effective operation of the committee a set of guidelines for operation should be developed and adopted at the first meeting. These guidelines should cover issues such as voting procedure, minute taking, recording recommendations adopted by the committee and distribution of this information to the community.

Recommendations

1. Ongoing management of the reserve be undertaken by the Peel Inlet Management Authority.
2. PIMA establish a community liaison committee which comprises delegates from :
   (i) PIMA (3)
   (ii) Shire of Murray (2)
   (iii) Ravenswood Society (1)
   (iv) Res. 40109 Preservation Soc. (1).

It would be the responsibility of this committee to liaise with residents and other members of the community to assist PIMA in implementing the management plan. The committee should also be responsible for preparing guidelines to regulate its operation.

4.2 Foreshore erosion

There is concern amongst residents that the foreshore of Reserve 40109 is eroding and that remedial work would be costly.

In 1989 PIMA commissioned the Department of Marine and Harbours to conduct a study into the erosion stress on the foreshore. A copy of the report is attached although it is recognised the report is somewhat dated (Appendix 2). The main findings of the report were:

(i) erosion was minor and that extensive foreshore protection works are not required.

(ii) it was due primarily to river scour which varied in intensity throughout the river bend.

(iii) Two methods of foreshore protection were recommended depending on location:

a) on steep slopes where scour is more evident a form of hard walling may be necessary (PIMA also encourages the use of loose stone over matting walls).

b) on shallow slopes the preferred method is re-vegetation.

(iv) It was not possible to quantify the rate of erosion due to inadequate historical survey data but inherent in the recommendations is a subjective engineering assessment that the rate is relatively low. This was manifested by an absence of any large or prevalent escarpments and by the ability of vegetation to adjust gradually to any underlying erosion.

(v) It was observed that human activity such as destruction of vegetation increases the rate of erosion. Erosion due to boat wash was not investigated specifically.

(vi) It was observed that isolated foreshore protection works may have caused increased erosion at their end points by swirling back eddies.

(vii) The report also recommended with respect to existing works that all man-made obstacles in the floodway (or flood plain) be removed. This does not include licensed jetties and other essential marine structures.

Structures within the floodway can impede the flow of floodwaters causing water to bank up upstream. This can result in flooding to areas not normally flood prone. Structures built without the proper approvals (hence not to an approved standard) may not be able to withstand floodflows. The resultant debris is a threat to people and other structures as it is swept downstream.

Recommendations

3. The form of erosion protection works to be approved by PIMA in consultation with the community iaison committee prior to any works commencing. Any other engineering works would require special approval.

4. All obstacles to flood flows be assessed for impact on erosion during flood and either be removed or designed to minimise impact to an acceptable level.

5. A baseline survey of embankment profiles be carried out to serve as a basis to monitor erosion processes.

4.3 Funding of erosion protection works

The cost of river bank erosion protection works can be quite substantial. Decisions for allocation of funding necessary for erosion protection works should be made in conjunction with the community liaison committee.

Recommendations

6. Implementation of foreshore reserve works to be conducted by PIMA in conjunction with the Shire of Murray through the proposed Implementation Strategy (see Section 4.8).

Until recent years, owners of property abutting this reserve have been allowed to construct jetties. Upon vesting of the reserve in the Waterways Commission in 1987, applications for private jetties were refused by Department of Transport (previously the Department of Marine and Harbours) in accordance with agreed PIMA/DOT policy which states, with regard to jetties abutting foreshore reserves, "no new structures be allowed". However there may be grounds for an exception to this policy because of the special circumstances of this reserve. PIMA's requirements for new jetties include consideration of design, location, erosion, environmental and visual impacts. It should be clear that if this policy is wavered for Reserve 40109 it should not be considered a precedent for other reserves and that each individual application for a licence will be considered upon its merits.

Recommendations

7. Holders of jetty licences should continue to enjoy the use of their jetty provided it is kept in good repair. (Alterations to or removal of existing structures will still require the approval of DOT and PIMA).

8. PIMA policy for new jetties abutting foreshore reserves may be wavered for this reserve due to its special circumstances. Applications will be subject to approval by PIMA and DOT.

4.4 Vandalism and theft

There is some concern that vandalism and theft may increase as a result of any increased public access to the reserve. However, advice from local police indicates that illegal activities are no worse where similar foreshore reserves exist (eg. Banksia Terrace and River Road, South Yunderup). The Police have advised that the Neighbourhood Watch program operates in Rodoreda Crescent. Also the erection of fencing on lot boundaries abutting the reserve would hinder access of unauthorised persons on to private property. If at a later stage it becomes apparent that access along the reserve is contributing to security problems, PIMA, the liaison committee and local police should consider other options.

Recommendations

9 PIMA and the community liaison committee encourage residents to construct fencing along their common boundary with the reserve. Guidelines on the type of fencing should be developed by the community liaison committee as part of the Implementation Strategy proposed in Recommendation 15.

4.5 Maintenance of the reserve

Historically, the reserve has been maintained and developed by the adjacent land owners at their own cost. It is recognised that interest in the reserve by local residents has been a positive influence. Unfortunately, some development has been contrary to the purpose for which the reserve was vested in PIMA, ie. foreshore management and recreation. Development should be restricted to jetties, foreshore protection, provision for public access and the enhancement of native vegetation. Guidelines for maintenance and development as part of the Implementation Strategy must include consideration of:

(i) Importance of foreshore vegetation to the integrity of river banks and native fauna.

(ii) Visual amenity of the reserve from and to the river.

(iii) Native versus exotic vegetation.

(iv) Fire, litter and other debris.

(v) The long term integrity and purpose of the reserve.

(vi) Access by residents and visitors.

(vii) Erosion processes.

(viii) The prevention of pollution such as fertilisers and other chemicals, air conditioning discharge and hardstand (pavement) hydrocarbon runoff entering the river.

Recommendations

10. Details and priorities for reserve maintenance shall be discussed and resolved through the community liaison committee and PIMA.

11. All development on and abutting the reserve will be subject to assessment by the community liaison committee.

4.6 Public nature of the reserve

Since the creation of the Reserve and subsequent signing of the original indenture (1961), it has always been stipulated that the reserve should have provision for public access. This is inferred in the original indenture by the words "for the purposes of Public Open Space" and in the subsequent Vesting Order (1987) "foreshore management and recreation". The WA Land Act and the Department of Land Administration's policy does not allow exclusive private use of public foreshore reserves.

With regard to recreation reserves, Waterways Commission Policy states, in part, "reserves along the state's waterways are of regional significance and cannot be considered exclusively as local open space". However the public nature of the reserve should be balanced against its historical use and regional setting.

Currently there is increasing pressure for public access to, and facilities on, the reserve. This is due in part to the expansion of the local population due to increasing development in the Ravenswood locality. Although developments (eg. constructed pedestrian access) are not considered appropriate at this stage, the ultimate "public nature" of the reserve should be appreciated and understood by the residents.

To provide public access to the reserve in the long term, it is proposed that a two metre wide pedestrian access way be pegged along the reserve and that no development be allowed to interfere with this survey path. This may necessitate the removal or alteration of obstacles along the agreed route. Any proposed developments must take into account proximity to the intended pathway. Structures that give the appearance that the reserve is private property must be removed (eg trespassers prosecuted signs, fences).

Apart from the path, it is considered that no other public development is required at this time. This should be reviewed regularly by the community liaison committee.

Recommendations

12. A two metre wide public pedestrian access way be pegged along the reserve, and no development be permitted which would interfere with the route of this path. Fencing or other developments impeding the path's route be removed. The path would be constructed as funding becomes available.

13. No signs should be permitted on the reserve other than those permitted by PIMA. All unacceptable signs to be removed (eg. 'trespassers prosecuted', 'private property').

14. In the event of subdivisions of land abutting the reserve, foreshore reserves, of widths not less than that of Reserve 40109, to be acquired by the Crown.

4.7 Implementation

In order to implement the above recommendations it is proposed that an implementation strategy be developed. This should be developed by the community liaison committee and should identify priorities for action, joint works programs, timing, recommendations for budget, and guidelines for structures and facilities.

Recommendations

15 Prepare an Implementation Strategy in association with the community liaison committee.

5. CONCLUSION

Reserve 40109 is under the management of the Peel Inlet Management Authority. In 1992 the Authority resolved to prepare a management plan. This plan was subject to public comment and modified in accordance with submissions received. The plan was endorsed by the Authority at its meeting on July 22, 1994. The Authority will liaise with residents and local government through the community liaison committee to implement recommendations of contained in the plan.

Appendix 1

Public submissions

NUMBER AND THEME OF SUBMISSIONS

A total of nine public submissions were received on the management plan. These submission were both verbal and written. The submission are outlined as follows:

1	M Brown	Individual
2	D Hickman	Individual
3	G W Pride	Individual
4	Reserve 40109 Preservation Society	Community organisation
5	J Pride	Individual
6	R Klauss	Individual
7	J Murdoch	Individual
8	M Delacosta	Individual
9	N Forster	Individual

The comments received in the submissions covered a broad range of topics and addressed various aspects of the draft Management Plan. The submissions generally supported the concept of managing the foreshore reserve, but there was no consensus as to the most appropriate manner in which to manage the reserve. Overall, the response was positive, as most submissions supported the aim of the plan.

SUBMISSION ANALYSIS AND METHODOLOGY

The receipt of the submissions, by the Authority, on the draft management plan were acknowledged in writing, and the authors were advised that their concerns would be considered when revising the plan. A list of criteria was used when determining whether amendments were necessary to the draft plan base on comments contained in the submissions. The majority of comments received pertained to the fourth and fifth criteria. These criteria were as follows:

- Change to government policy or philosophy.
- Supply of additional information.
- Identified lack of clarity in the draft.
- Identified changes to recommendations.
- Identified changes to implementation of recommendations.

The submissions were tabled and presented to the Authority together with recommendations regarding whether or not the plan should be modified in accordance with the submissions. The table identified the author of the submission, the nature of the submission, the assessing officer's comments, a recommendation to the Authority based on those comments, and the Authority's recommendation to the Waterways Commission to modify the plan where deemed necessary.

AMENDMENTS TO THE DRAFT MANAGEMENT PLAN

The primary criticisms of the report focused upon the issues of privacy, theft and vandalism, the lease back option, the liaison committee, and the formation of an implementation strategy.

Privacy, theft and vandalism

Many of the submissions received made comments regarding the likelihood of increased crime in the form of theft and vandalism if the general public had access to the foreshore reserve.

Although the draft management plan made recommendations regarding the use of fencing to address perceived increases in crime and theft, many of the submissions refuted the effectiveness of fencing and also claimed that it resulted in a loss of the amenity by encroaching on the views of the river.

In general, it would appear that most residents do not want public access and believe that they alone should enjoy the exclusive use of the foreshore reserve. This attitude is contrary to State Government philosophy of the right of access to all the states waterways to the public. The situation is also against the Waterways Commission policy and consequently did not represent an option.

Two good examples of situations similar to Rodereda Crescent where residents live in close proximity to the water are Halls Head and South Yunderup The public have access t these waterways, and residents do not have a problem with theft and crime. The only vandalism is some minor graffiti of a small section of uniform fencing in Halls Head, where there are very large numbers of people seeking access to the ocean. This is not a likely scenario for Rodoreda Crescent. Indeed there are very few street scapes in WA where residents have exclusive frontage to the waterway in an urban setting. Rodoreda Crescent is not different from any of these areas.

Lease back option

The lease back option was one of the issues that drew the most response from residents. There was no consensus among residents, but instead a variety of conflicting opinions. No resident supported the lease back option in its current form.

Some residents suggested that the lease back option was not viable unless they had unrestricted and exclusive use of the foreshore reserve.

Other residents suggested that the lease back option was a possible option, but that the term of the lease had to be longer - perhaps 21 years, and that there needed to be a positive gain in accepting the lease. Currently all that residents perceive they could receive is the encumbrance of maintenance and public liability.

Given the residents comments, it was clear that the lease back option would not be accepted by the majority of residents. It was therefore recommended that it be deleted from the foreshore management plan and that PIMA manage the reserve in consultation with residents, through the liaison committee.

Liaison committee

Due to the number of submissions that either rejected the proposed lease back arrangement outright or suggested modifications which were unacceptable as they conflict with Commission Policy, it was recommended that the lease back option be deleted. In its place, the liaison committee was emphasised as a suitable mechanism for ensuring input by residents into the overall management of the reserve by PIMA. The management plan was modified to include more detail as to the composition and operation of the liaison committee in accordance with the above mentioned recommendations.

Implementation strategy

Many of the submissions received indicated that residents felt unsure and anxious as to the types of works to be carried out in the maintenance of the reserve, and the timing of these works. Consequently, it was recommended that the Management Plan include an implementation strategy which would address these details.

Appendix 2

Rodoreda Crescent Foreshore Erosion Investigation

An Engineering Report Prepared for the Waterways Commission

November 1989

Department of Marine and Harbours
Marine House, 1 Essex Street
Fremantle WA 6160

CONTENTS

1. INTRODUCTION

Rodoreda Crescent is a residential street located on the northern bank of the Murray River at Ravenswood. Riverside properties are separated from the river by a narrow foreshore reserve (#40109) which has been vested in the Waterways Commission since early 1988. The Waterways Commission is developing a management plan for Reserve 40109 and has requested the Department of Marine and Harbours (DMH) to prepare a short engineering report on the need for bank erosion mechanisms, control measures and available options.

1.1 Programme

This investigation was essentially a desk top study which included several site visits. A file and plan search was conducted together with a review of previous reports. Site inspections were conducted on the shore and on the water. The existing environment was videotaped to provide a visual record, and river depth cross sections were measured at various points along the reserve to gain an understanding of the erosion processes.

2. LITERATURE REVIEW

The following review is a summary of existing information which exists in files, drawings and reports held by the Department of Marine and Harbours, the Waterways Commission and the Peel Inlet Management Authority (PIMA).

2.1 Files

A search of DMH and PIMA files revealed that most of the file documents refer to foreshore lease agreements between the local residents and management authorities. Only a few documents were found which referred to foreshore erosion protection measures.

A description of the reserve river bank and associated structures relative to each property fronting the reserve is included in a 1985 PIMA inspector's report. This information was useful for identifying those sections of Reserve 40109 on which rock retaining walls, jetties and other structures have been built by the local residents. A second PIMA file document included rock walling specifications recommended by PIMA to applicants who were granted permission to build such structures. Some of these specifications have been incorporated in the foreshore protection measures recommended herein.

2.2 Drawings

Drawings of the Murray River at Rodoreda Crescent were drawn up as part of the 1984 Murray River Flood Study and are held in Public Works Department plan books 51796 and 54586. These drawings identify flood prone areas, stage discharge relationships and suggested development limits.

The Rodoreda Crescent section of the Murray River experiences a 1 in 100 year flood level of about + 5.1m AHD and the associated flood prone areas are shown in Figure 2.1. The backwater curve for this section of the Murray River is such that the 1 in 100 year flood level at the Ravenswood Bridge is + 4.3m AHD as shown in Figure 2.2. Flood levels for other recurrence intervals are shown in Figure 2.3, but they are only valid at the Ravenswood Bridge. The flood levels for other recurrence intervals at Rodoreda Crescent were determined using the difference in the 1 in 100 year flood level between the bridge and Rodoreda Crescent.

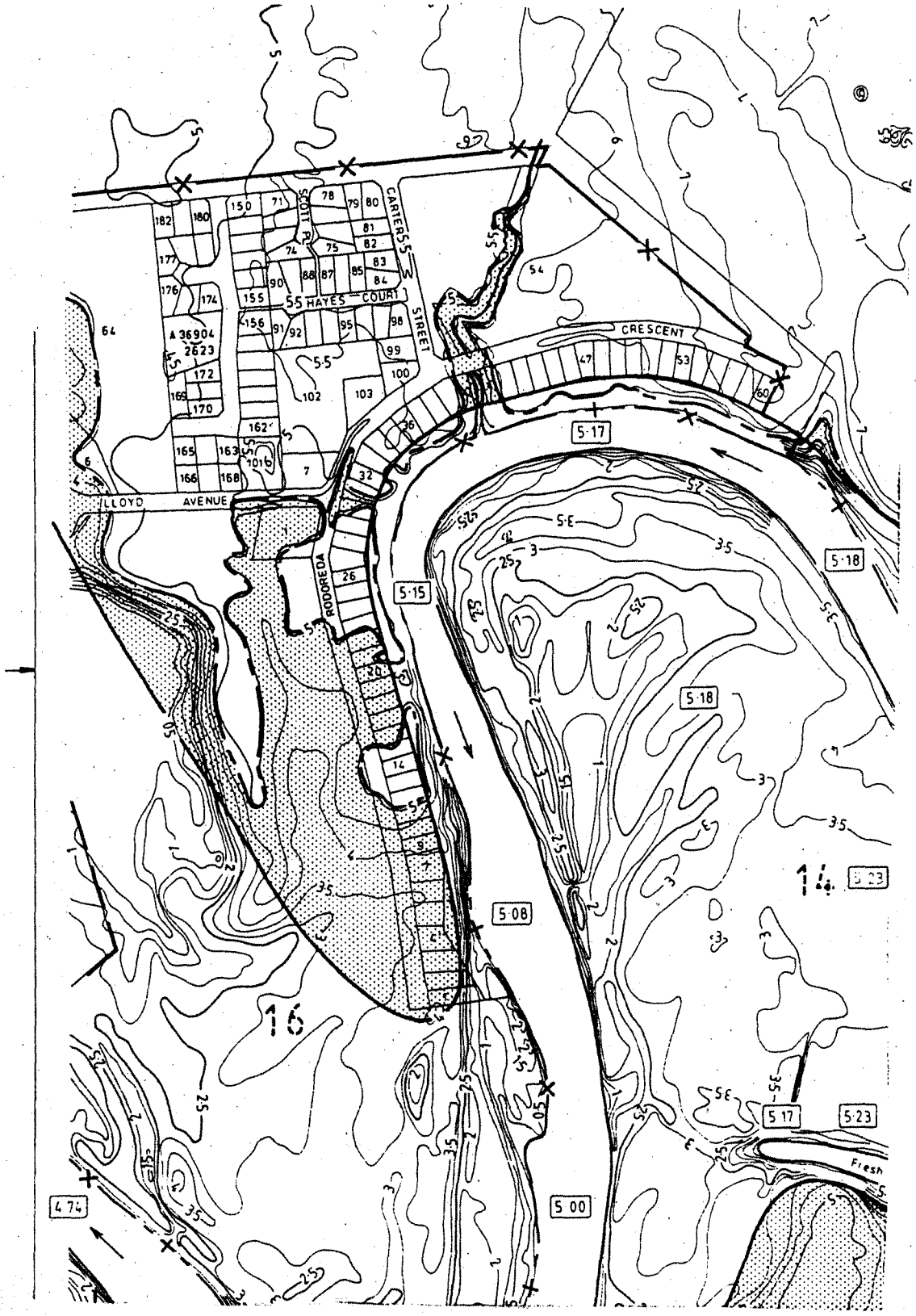
The existing development and physical features of Reserve 40109 are shown on a PIMA drawing which is included herein as Figure 2.4. This drawing identifies the erosion areas along the reserve and illustrates the river flow characteristics along with locations where river bed profiles were measured.

2.3 Reports

The purpose of the Murray River Flood Study (PWD, 1984) was to provide detailed information on flood flow behaviours to facilitate the formulation of management strategies in flood prone areas along the Murray River. The study recommended that floodways be kept clear of excess scrub growth and structural developments so as to minimise the obstructions in the flood flow path.

The various flow regimes of the Murray River are discussed in the Water Quality of the Murray River Estuary Study (D'Adamo and Lukatelich, 1985). The report describes the water level variation in the Murray River as predominantly diurnal with a range of order 0.1m.

Foreshore erosion problems caused by natural processes and boating activities are presented in a report by the Waterways Commission entitled Effects of Increased Boat Populations on Foreshore Erosion and Congestion, Particularly in the Murray and Serpentine Rivers (Dick, 1978).


LLOYD AVENUE
HAYES COURT
CRESCENT
STREET
RODRIGA
SCOTT RD
CARTERS
5·17
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5·08
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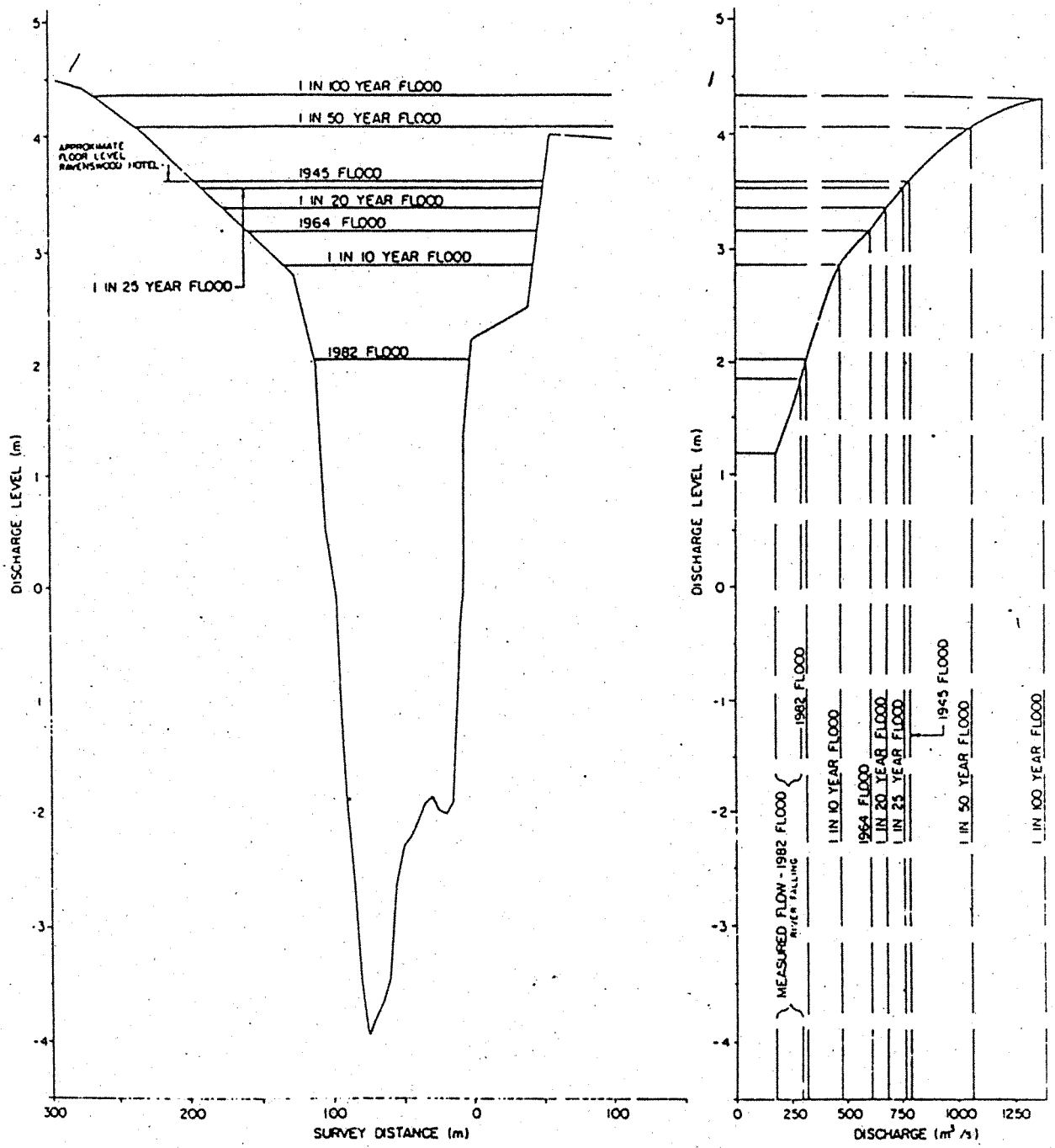
4·74
5·23
16
14
Fresh

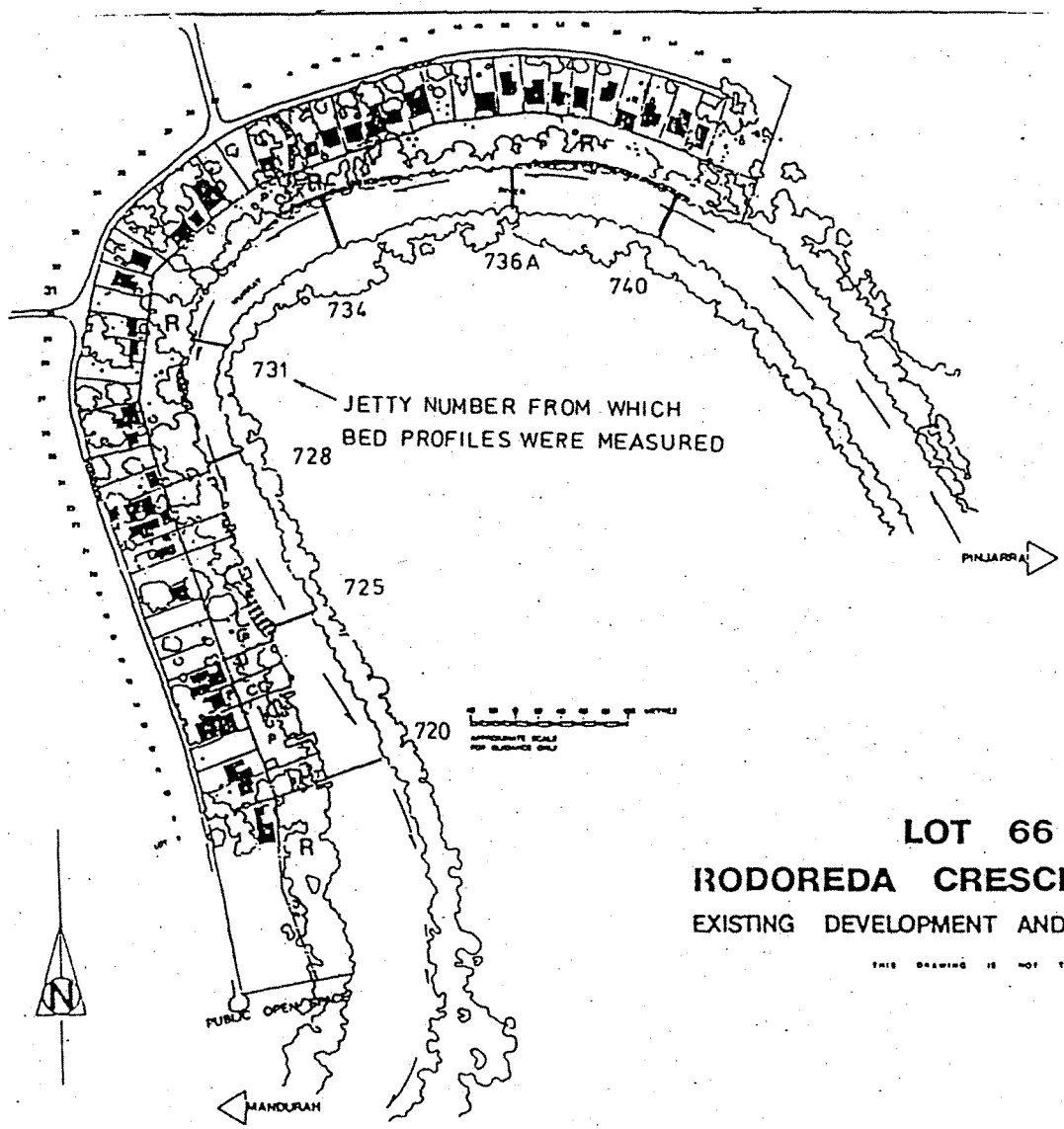


CROSS SECTION UPSTREAM OF RAVENSWOOD BRIDGE (WATERWAY DISTANCE 7690m).

SCALE OF METRES (1:30,000)

SCALES AS SHOWN	DESIGN CALC	BOOK & FILE	PUBLIC WORKS DEPARTMENT — WESTERN AUSTRA
MICROFILMED	CHECKED	BOOK	MURRAY RIVER FLOOD STUDY
DATUM	DRAWN TMD	CHECKED	WEST MURRAY AREA
A.H.D.	TRACED	CHECKED	STAGE DISCHARGE RELATIONSHIPS
	SUBMITTED DATE	APPROVED DATE 17-6-83	P.W.D.,W.A. 5796-5-2

FIGURE 7.3



GENERAL PROBLEMS

- EXISTING FENCES PREVENTING FREE PUBLIC ACCESS.
- STRUCTURES AND BUILDINGS ON CROWN LAND.
- LANDINGS.
- ERODED AREAS AND RELATED PROBLEMS.
- UNDEVELOPED LOTS.
- P AREAS REQUIRING PHYSICAL REPAIR OR ALTERATIONS.
- R SITES SUITABLE FOR REST AREAS.

LOT 66
RODOREDA CRESCENT RAVENSWOOD
EXISTING DEVELOPMENT AND PHYSICAL FEATURES

THIS DRAWING IS NOT TRUE TO SCALE

PEEL INLET MANAGEMENT AUTHORITY — RAV 1

WORKS DEPARTMENT OF W.A. - ARCHITECTURAL DIVISION

3.0 EROSION PROBLEM

3.1 General description

Soil erosion in a river system is caused by several natural processes. The turbulence of a river flow can be strong enough to dislodge individual sediment particles from the river bed and banks. This is referred to as stream channel erosion. Another manner in which erosion takes place is the mass movement of soil by creep, slumps and landslides. The effects of these natural erosion processes are often exaggerated by man-made forces such as the trampling of banks by man and domestic livestock together with wash from boating activities.

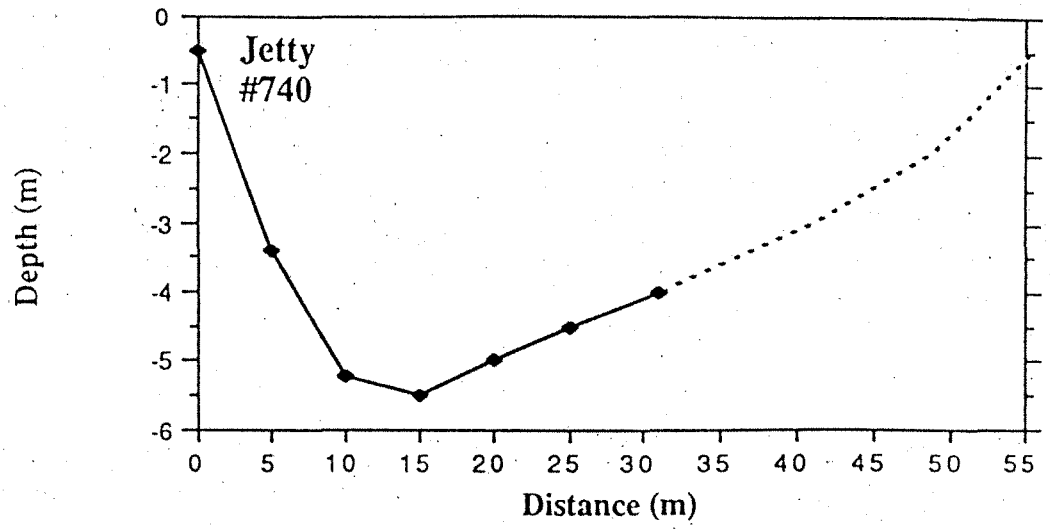
The factors which affect the rate of erosion are vegetation cover, soil type and land slope. The erosion process is initiated by the removal of vegetation along the river foreshores, and the extent of erosion is determined by the soil type and bank slope. A course sandy river bank is more susceptible to erosion than a silt or clay river bank. Furthermore, a steep bank will erode faster than a gently sloping bank of similar soil type.

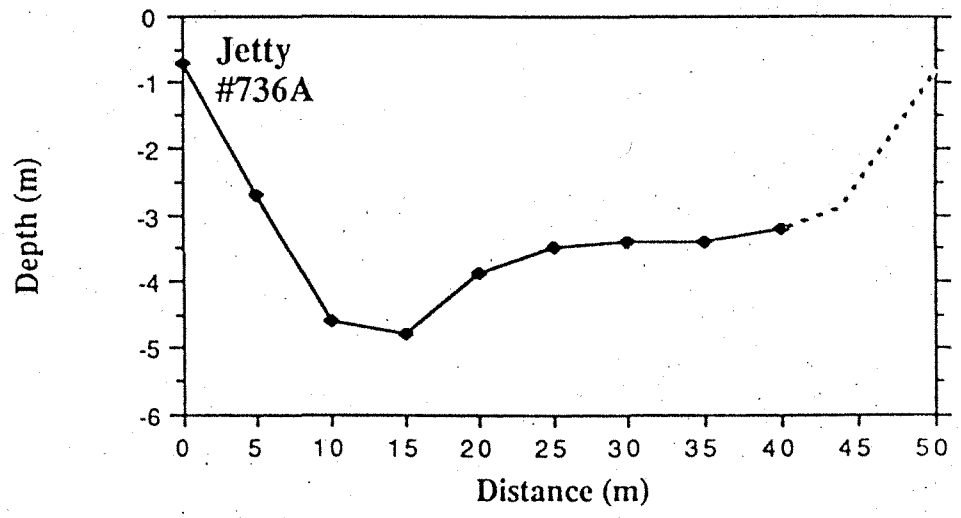
The outer bank of a river bend usually has more pronounced erosion problems. This is because the outer bank is exposed to a scour circulation which exists due to centripetal acceleration effects on the river flow through a bend. The centripetal acceleration required to keep a column of water in a circular path is greater at the surface than at the bottom due to a difference in velocities caused by bottom friction. Therefore, the near surface water particles tend to move toward the outer bank and a return flow is created near the bottom towards the inner bank. This three dimensional flow structure is referred to as helical flow pattern which causes scouring of the outer bank in a river bend with deposition of eroded material occurring further downstream and closer to the inner bank.

3.2 Cross sections

The signature of a helical flow structure through the Rodoreda Crescent bend of the Murray River can be identified from a series of river bed cross sections which were measured from the face of several jetties as shown in Figure 2.4. The measured profiles are presented in Figures 3.1 - 3.4 wherein it can be seen that a deep flow channel has been scoured out near the outer bank in the bend, and the outer bank slope is steeper. Further downstream, the bed profile is more uniform and consequently the bank slope is flatter.

Sediment transport rates are impossible to quantify from the existing data because the existing records are inadequate. An estimate of the erosion rate requires data collection on a long term basis which is beyond the scope of this investigation.





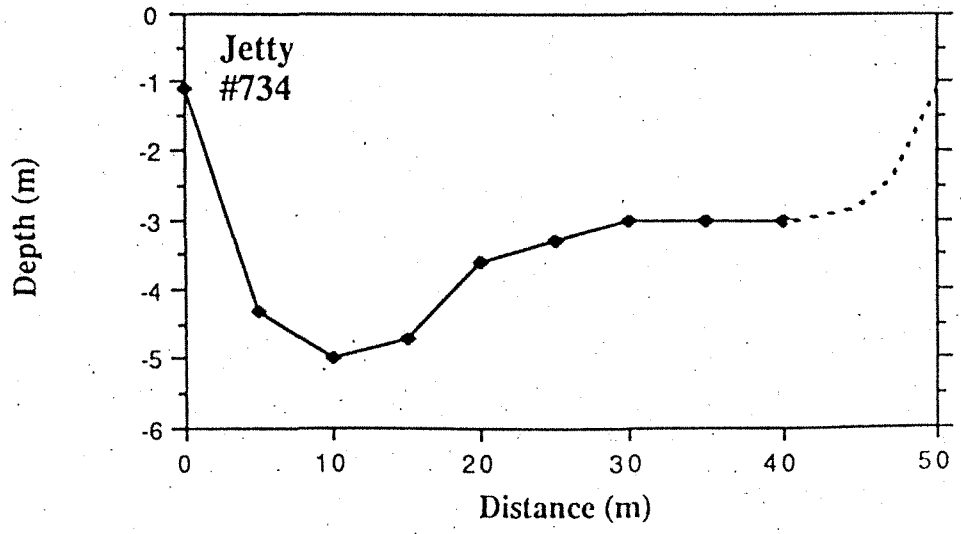


FIGURE 3.1 "RIVER BED PROFILES"

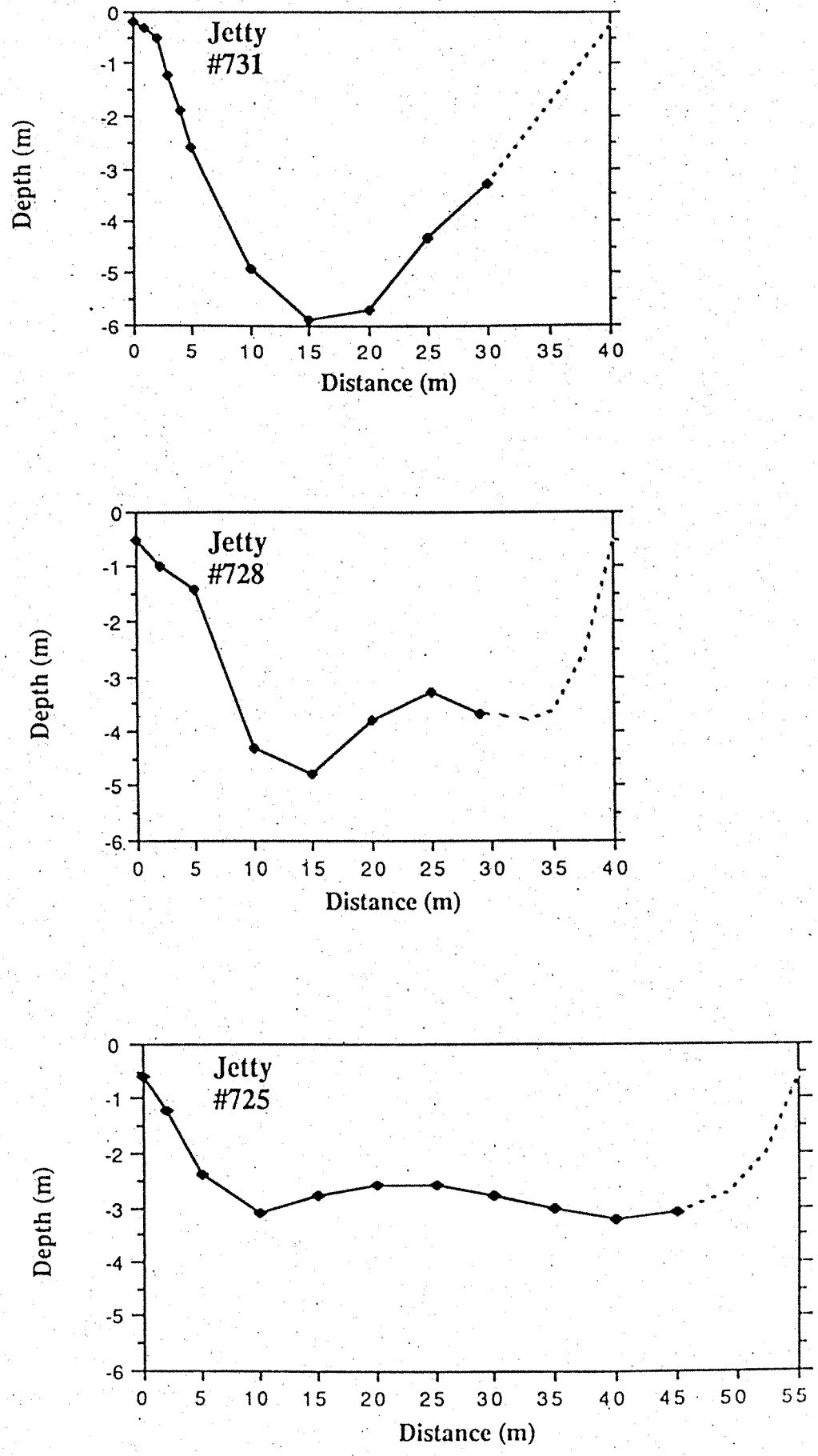
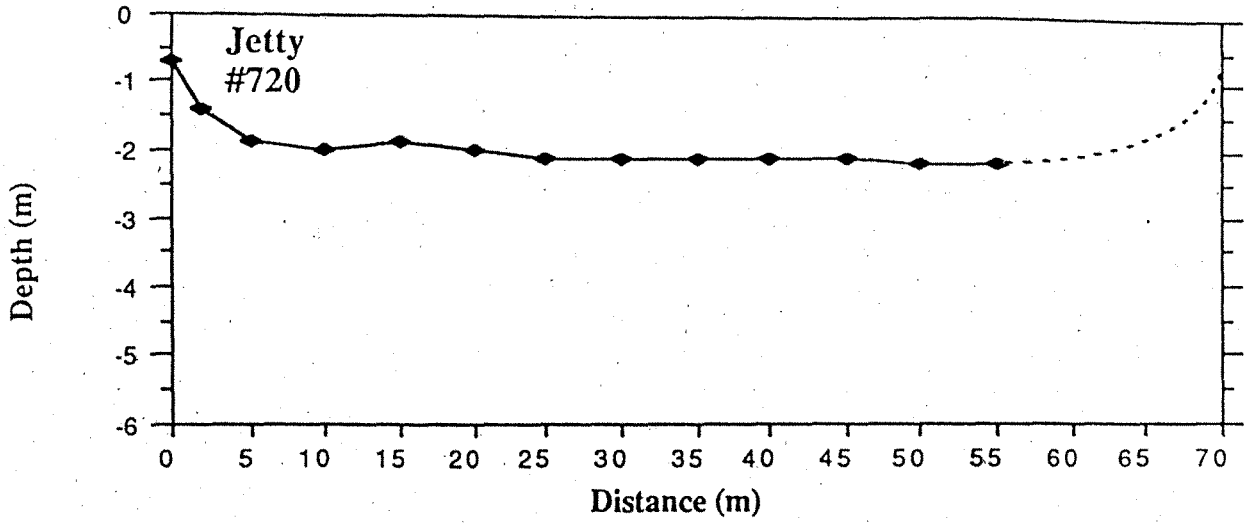
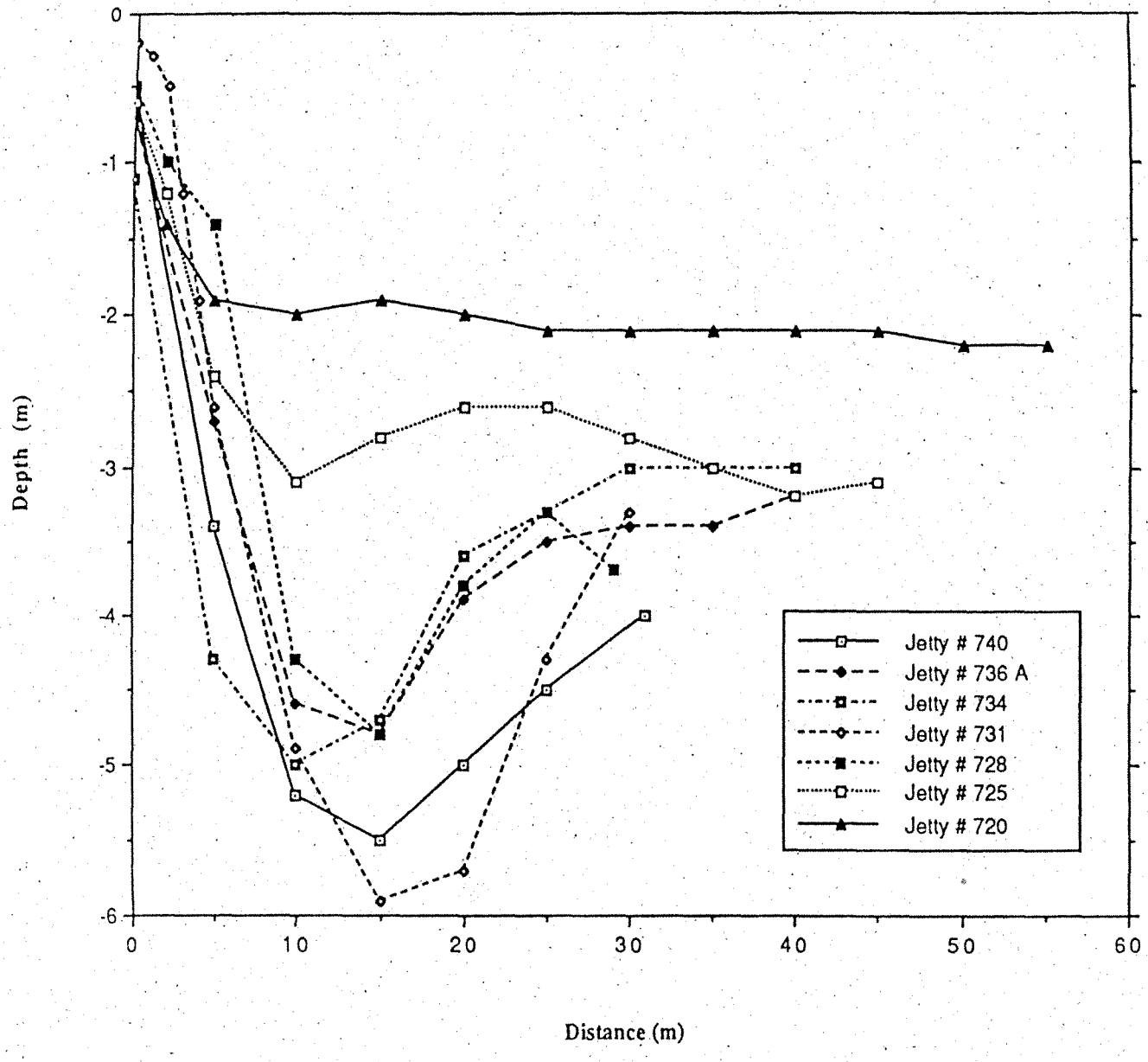


FIGURE 3.2 "RIVER BED PROFILES"



"RIVER BED PROFILES"

FIGURE 3.3



Depth Profiles taken from Jetty Face at Rodoreda Crescent.

Figure 3.4

4.0 FORESHORE PROTECTION

The difference in the bend profiles and the downstream profiles means that foreshore protection requirements specified for the bend section are not appropriate for the downstream section. Therefore, the two sections need to be treated differently with respect to foreshore protection. A video survey of the existing foreshore protection works was conducted to determine their effectiveness; however, no conclusive assessments could be made because it was difficult to extract the necessary engineering details from the video.

4.1 Bend profile

The only alternative for stabilising the outer bank in the bend is rock walling or some form of flexible scour matting. The slumping sections of the bank should be filled with rock and shaped to a slope no greater than 2:1 to prevent continual undercutting and collapse. A filter cloth secured from -1.0m AHD up to +1.0m AHD will then prevent leaching of the fine sediments. The filter cloth needs to be covered with stone pitching to protect the bank from boat wash. Larger stones should be anchored at the toe of the rock walling so as to provide a suitable foundation and prevent future subsidence. The top of the rock walling should be cut back into the slope to prevent flood flows from scouring behind the walling. A schematic of these specifications is shown in Figure 4.1, and an example of the desired finished product is evident in Figure 4.2.

The upper bank slope should not exceed 1:2 and longitudinal regularity should be maintained so that flood flows do not encounter any abrupt changes in slope. Likewise, any man-made structures (except licensed jetties) should be removed to minimise the number of obstructions and prevent local scouring under flood flow conditions. The local scouring process caused by flows around an obstacle is illustrated in Figure 4.3.

4.1 Downstream profile

The flatter bank slope of the downstream section does not require rock walling as an erosion prevention programme. Instead, an extensive foreshore planting scheme should be initiated using local, naturally occurring plan species.

Reeds planted at water level are quite effective in binding the soil and dampening the effects of boat wash. A flatter upper bank slope can also be tolerated but should not exceed 1:4. As in the case of the bend profile, the reserve should be cleared of all man-made objects (except licensed jetties) to provide an unimpeded flood flow path. A schematic of the suggested downstream foreshore protection works is shown in Figure 4.4.

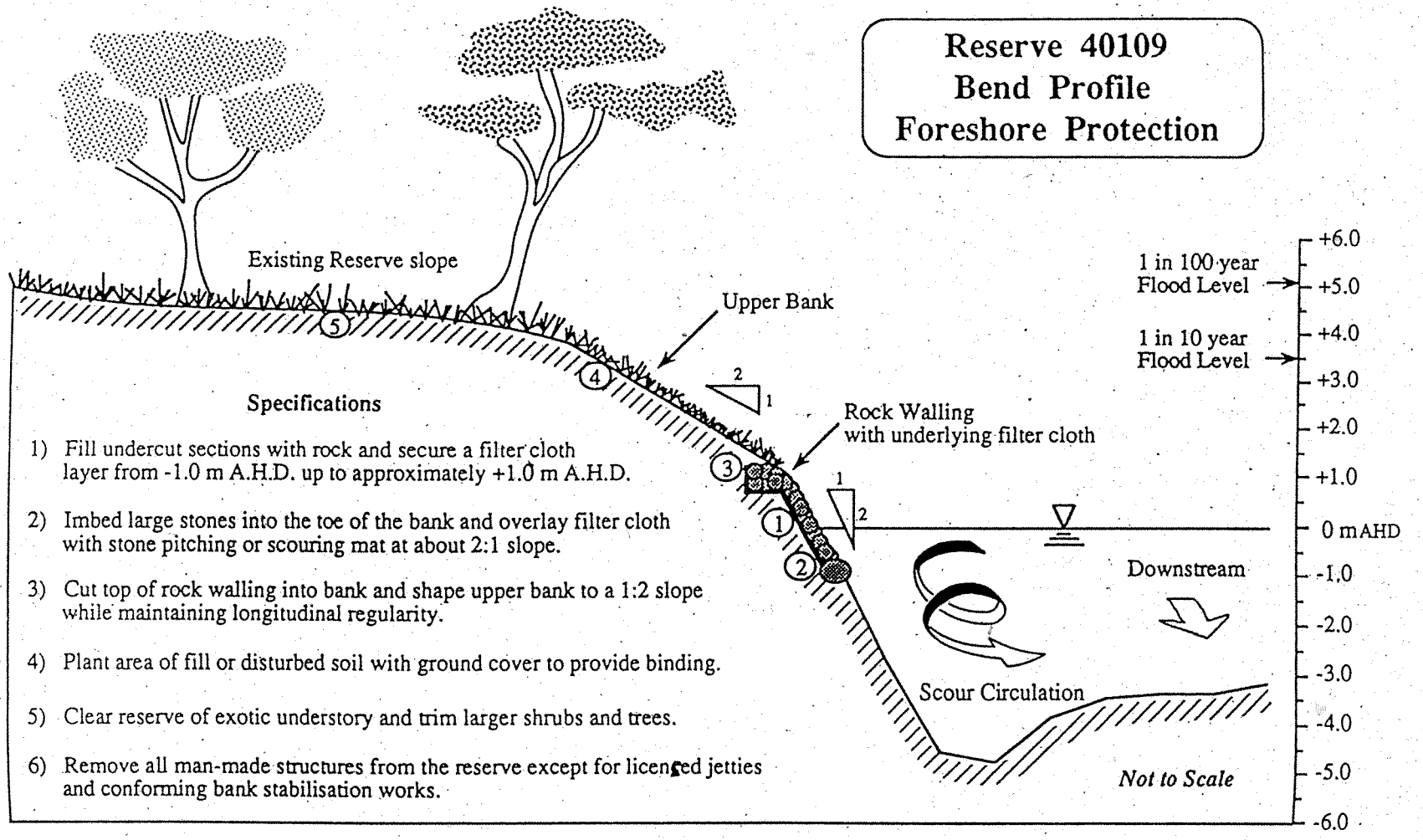

Reserve 40109
Bend Profile
Foreshore Protection
Existing Reserve slope
Upper Bank
Rock Walling
with underlying filter cloth
1 in 100 year
Flood Level
1 in 10 year
Flood Level
+6.0
+5.0
+4.0
+3.0
+2.0
+1.0
0 mAHD
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
Downstream
Scour Circulation
Not to Scale
Specifications
1) Fill undercut sections with rock and secure a filter cloth layer from -1.0 m A.H.D. up to approximately +1.0 m A.H.D.
2) Imbed large stones into the toe of the bank and overlay filter cloth with stone pitching or scouring mat at about 2:1 slope.
3) Cut top of rock walling into bank and shape upper bank to a 1:2 slope while maintaining longitudinal regularity.
4) Plant area of fill or disturbed soil with ground cover to provide binding.
5) Clear reserve of exotic understory and trim larger shrubs and trees.
6) Remove all man-made structures from the reserve except for licenced jetties and conforming bank stabilisation works.

FIGURE 4.1

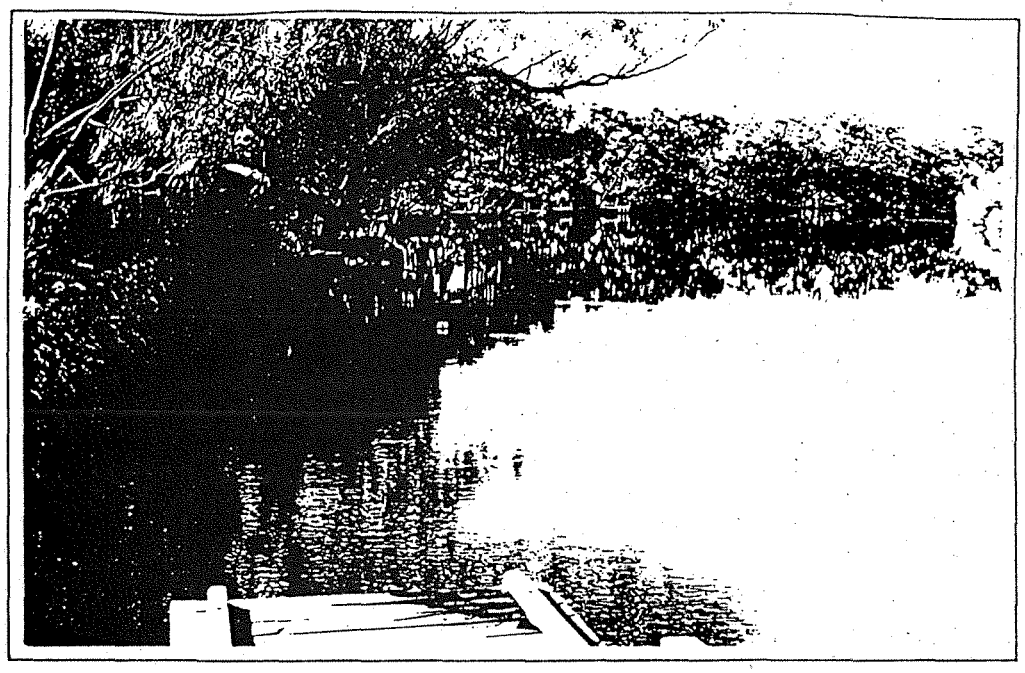


FIGURE 4.2 EXAMPLE OF SPECIFIED ROCK WALLING (LEFT).

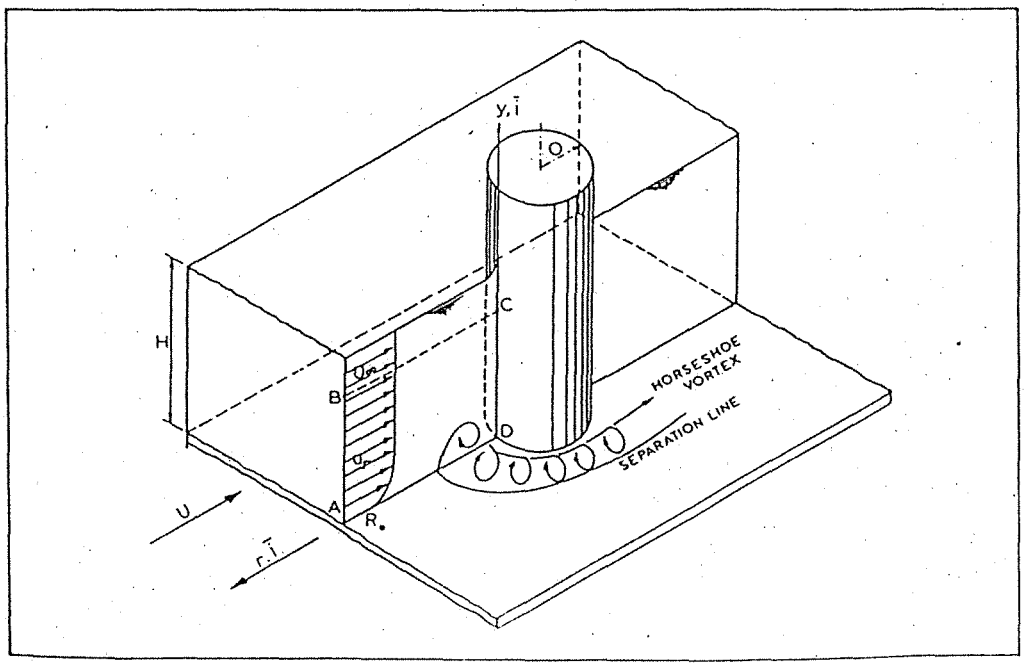


FIGURE 4.3 LOCAL SCOURING CAUSED BY AN OBSTRUCTION IN A STREAM FLOW.

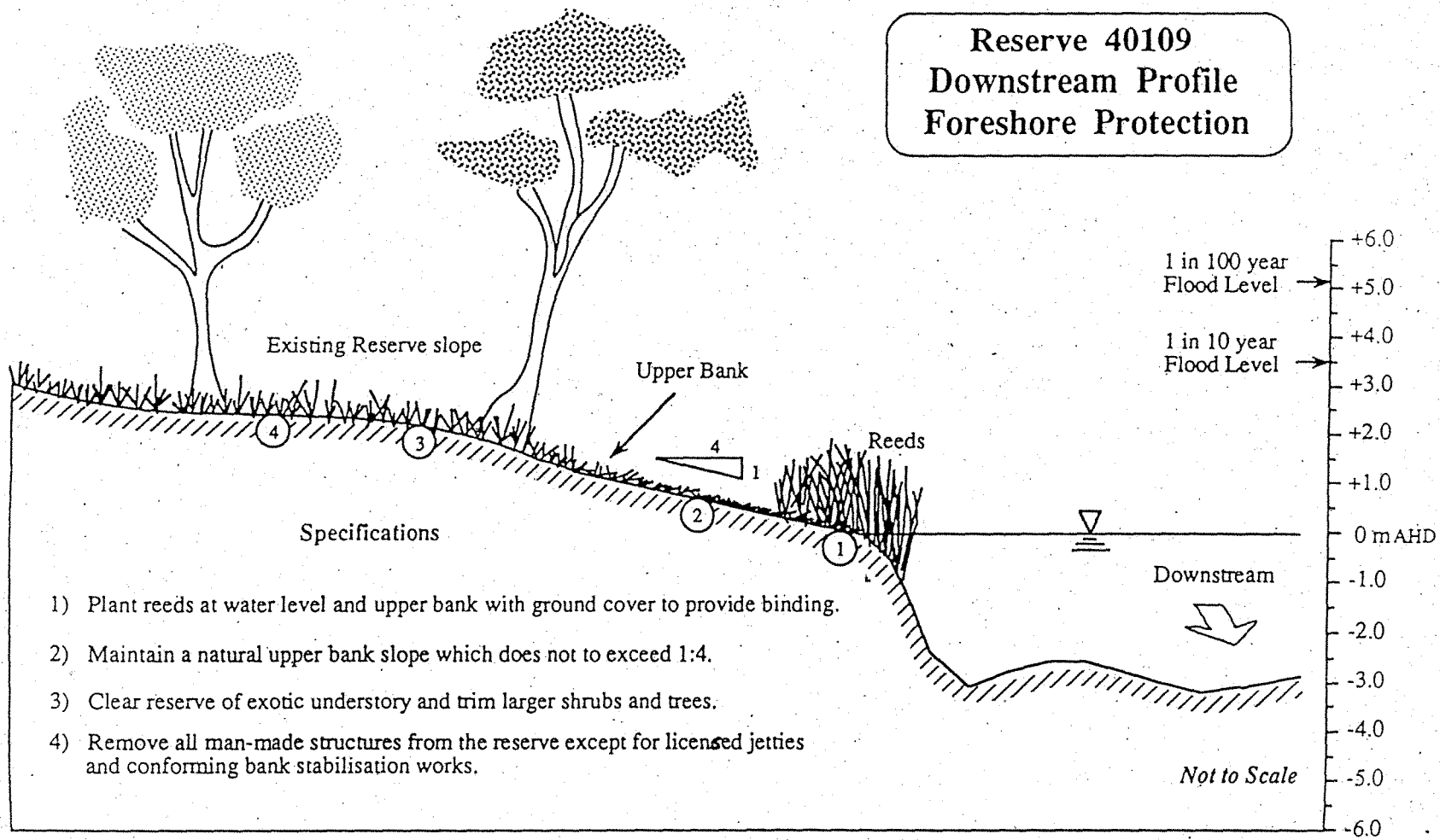

Reserve 40109
Downstream Profile
Foreshore Protection
Existing Reserve slope
Upper Bank
4
1
Reeds
1 in 100 year
Flood Level
1 in 10 year
Flood Level
+6.0
+5.0
+4.0
+3.0
+2.0
+1.0
0 m AHD
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
Downstream
Specifications
1) Plant reeds at water level and upper bank with ground cover to provide binding.
2) Maintain a natural upper bank slope which does not to exceed 1:4.
3) Clear reserve of exotic understory and trim larger shrubs and trees.
4) Remove all man-made structures from the reserve except for licensed jetties and conforming bank stabilisation works.
Not to Scale

FIGURE 4.4

5.0 CONCLUSIONS AND RECOMMENDATIONS

Although evidence of foreshore erosion can be seen on the banks of the Murray River at Rodoreda Crescent, the overall extent of the erosion problem does not appear at this time to be worthy of an extensive foreshore protection works programme. It is instead recommended that isolated occurrences of severe erosion be repaired in accordance with the specifications outlined in the previous section, and a policy be implemented with regard to the removal of all man-made obstacles in the flood flow path. It is also suggested that a monitoring programme be implemented which includes annual surveys of the area. Regular surveys of the river bank profile and river bed profile will provide the necessary data needed to assess the erosion rate.

Other suggested protective measures include the establishment of controlled access ways to the water for people and animals on both sides of the river. At present, the licensed jetty system provides controlled access points and should therefore be maintained. The issue of boat wash has been reviewed in the previously mentioned reports and consideration should be given to their recommendations together with those in the Murray-Serpentine Rivers Boating Policy Review 1983.

The effectiveness of the existing foreshore protection measures was examined by a video survey which revealed very little about the engineering aspects of the bank stabilisation works. It was also difficult to determine whether some of the erosion existed prior to the construction of the intermittently spaced protection works, or whether the erosion was caused by longitudinal discontinuities arising from their construction. It can therefore only be concluded that the acceptable existing foreshore protection works are those which comply with the guidelines presented in this report.

In summary, erosion is a natural process which exists in many forms. Human influences generally act to increase the natural rate of erosion. There should therefore be minimised, and a well planned management programme is an effective way of doing so. Reserve 40109 is on a naturally eroding section of the Murray River and the natural erosion process should not be excessively exasperated by unnatural influences. This natural eroding process should be monitored and allowed to continue with minor maintenance repairs until such a time when structural property becomes threatened.

6.0 REFERENCES

D'Adamo, N and Lukatelich, R (1985) Water Quality of the Murray River Estuary. Centre for Water Research, UWA, report number ED-85-108.

Dick, R C (1978) Effects of Increased Boat Populations on Foreshore Erosion and Congestion, Particularly in the Murray and Serpentine Rivers. Waterways Commission WA, Peel Inlet Management Authority.

George, P L (1984) Murray River Flood Study. PWD Engineering Division, WA.

Mollet, S (1983) Murray-Serpentine Rivers Boating Policy Review. Waterways Commission WA, Peel Inlet Management Authority.

Appendix 3

Survey of property lines and existing structures on Reserve 40109 as of 5.5.92

The Survey Co-Ordinator

Department Of Land Administration

Cathedral Avenue

PERTH WA 6000

Dear Sir

Re: Job No. 910460

File No. 708/978

This survey was carried out as instructed in Field Book No's 653 and 655. The following comments are made:

1. The development on the reserve adjacent to some lots varies considerably from substantial buildings through reticulated landscape gardens to little or no development. There were numerous brick and stone barbecues, retaining walls and paved areas. To accurately locate all these did not seem justified.

I therefore -

(a) Remarked all bends in the reserve boundary.

(b) Located all building encroachments over the common boundary. Some of these are calculated from radiations or by approximate chaining from to the rear boundary. They are therefore not precise to the centimetre but should be sufficient to allow rationalisation of the rear boundaries if required.

(c) Located all substantial buildings such as sheds and gazebos which are situated well into the reserve.

(d) Located most minor improvements such as retaining walls, barbecues, steps in Diagram form to show which lots they adjoin. No attempt was made to locate these as it would be a major cost.

(e) Where possible rear intermediate pegs were located but no field check was made as to their reliability.

(f) All traverse points are either sunken spikes or felt pen marks on paved areas. These can be quickly located should further detail be required.

2. Two corners, particularly at the rear of Lot 7 and Lot 39, appear to be out of position. The peg on Lot 7 was referenced and its position has been perpetuated by more recent repegs. No adjustment was therefore made. Similarly, the bend peg at the rear of Lot 39 was of a recent repeg and the position has been adopted for adjoining pegs. One reference mark was found but this is not on the specified alignment and becomes worse if the obvious adjustments are made.

3. The errors mentioned in item 2 caused intermediate miscloses when closing back to Rodoreda Crescent up to 7 minutes in arc. A return trip to the site was necessary to carry out further work to substantiate our survey.

4. Photos were taken at several locations to give some indications of the type of encroachments and developments. The aim was to provide an indication of the developments only and are not a complete record.

5. A check of prints of pages 8, 9 and 10 of Field Book 653 has revealed a few omissions and errors. I have indicated these in red on the attached prints. I would be grateful if the Field Book could be amended as shown.

Should you require any further work or pick up of detail, please contact me.

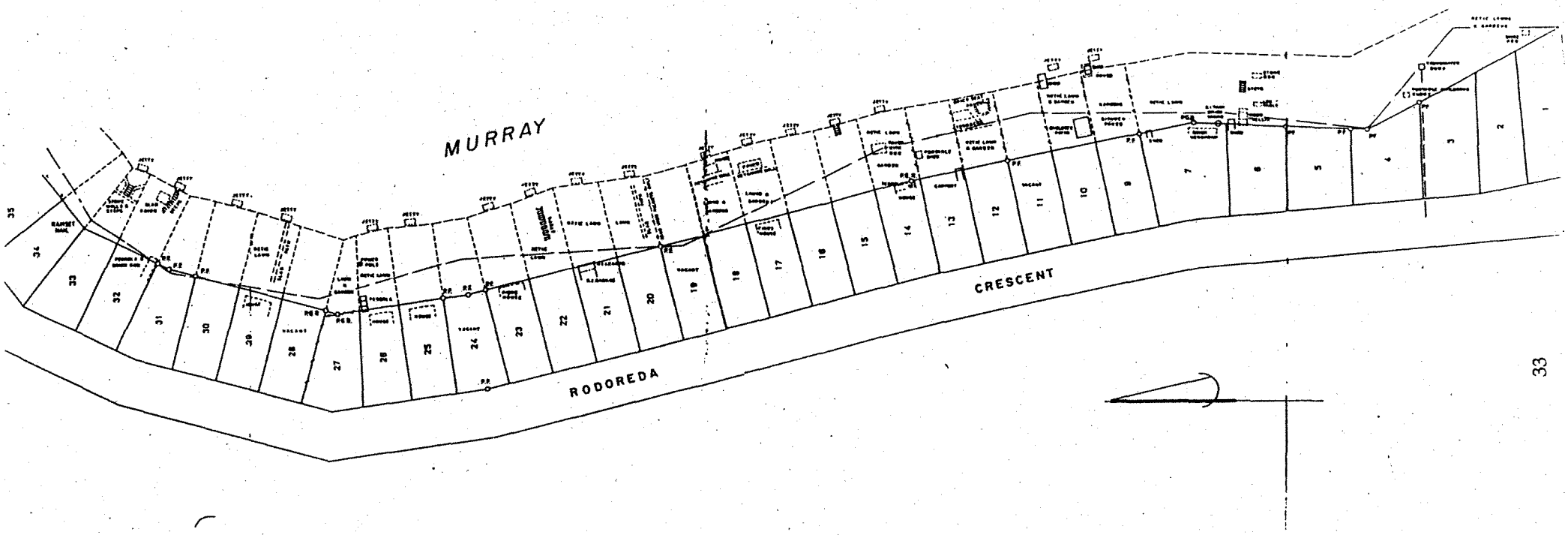
Yours faithfully

(Signature)

R J RULE

STEFFANONI, EWING & CRUICKSHANK PTY LTD

encs ...



N BROKEN ARE NOT TO SCALE
IMATE RELATIVE POSITIONS ONLY.

CL

By | Date

TITLE: PLAN SHOWING SOME IMPROVEMENTS ON COCKBURN SOUND LOCATION 2904.

CLIENT: DEPARTMENT OF LAND ADMINISTRATION

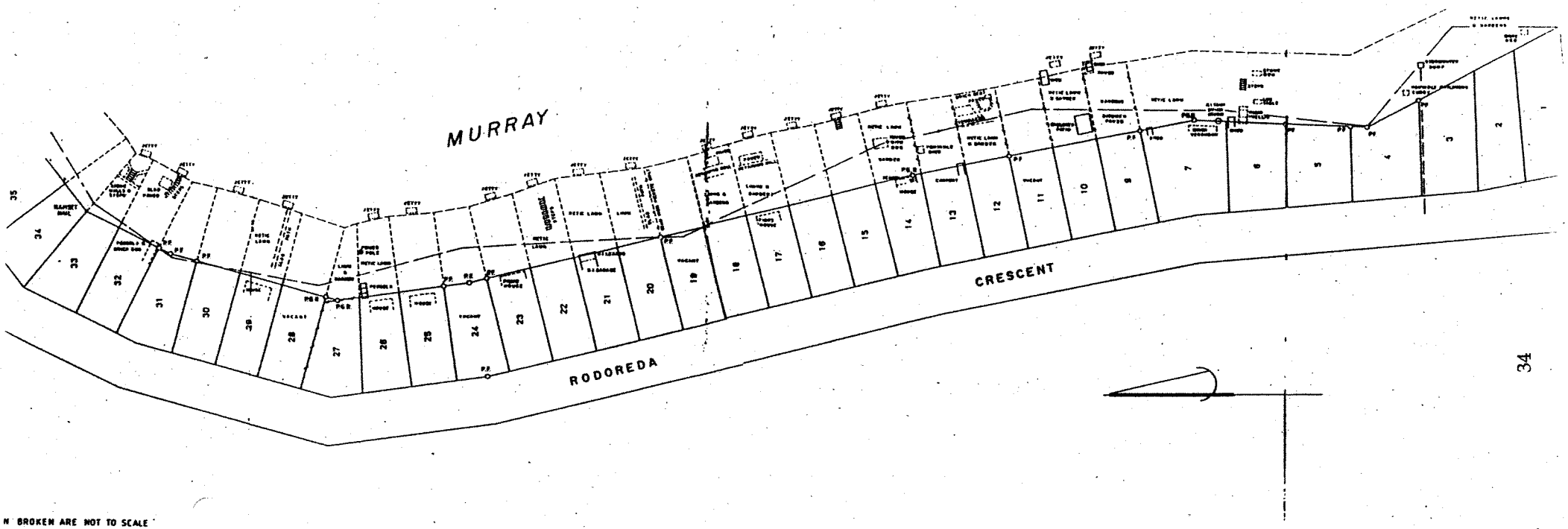
Location

SHEET DETAILS

SCALE 1:1000	S.P.C. Ref.	Surveyed	R. J. RULE
	Plan	Drawn	A.C.L. P.G.D.
	Diagram	Date	9.6.97
DATUM	Certificate of Title	File	DOLA 705/1576
	Vol. Fol.	F/Book	

STEFFANONI EWING & CRUIC
Licensed Surv

PERTH 283 Rokeby Rd Subiaco W.A. 6008 MANDURAH 110 Pinjarra Rd W.



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Location

SCALE: 1:1000

DATUM

SHEET DETAILS

S.P.C. Ref.	
Plan	
Diagram	
Certificate of Title Vol / Fol	
Surveyed	R. J. RULE
Drawn	A.E.L. P.G.D.
Date	9.6.92
File (WALIA)	705/1576
F/Book	

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