



EIS 1131

AB019862

Environmental impact statement : proposed sand and gravel
extraction from Manning River at Taree

L89/489

NSW DEPT PRIMARY INDUSTRIES



AB019862

ENVIRONMENTAL IMPACT STATEMENT

PROPOSED SAND AND GRAVEL EXTRACTION FROM MANNING RIVER AT TAREE

THE READYMIX GROUP

EIS 1131

ENVIRONMENTAL IMPACT STATEMENT

This Statement has been prepared by The Readymix Group being the applicant making the development application referred to below.

The Statement accompanies the development application made in respect of the development described as follows:

Extractive industry - extension of existing area for extraction of sand and gravel from the Manning River.

The development application relates to the land described as follows:

The bed of the Manning River for approximately 1km upstream of Andrews Reserve, and a small shoal downstream of Wingham Wharf as indicated in Figure 4.1 of the EIS accompanying the Development Application

The contents of this statement, as required by clause 34 of the Environmental Planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

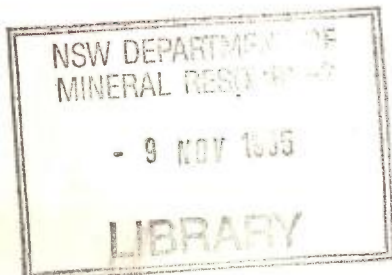
Name, Qualifications and Address of person who prepared Environmental Impact Statement:	The Readymix Group Graeme B. Reid B.E. MIE (Aust.) 291 Victoria St. TAREE 2430
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Certificate:

I, GRAEME BRUCE REID of **The Readymix Group** hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

.....*G. B. Reid*.....
Signature

.....*2/6/89*.....
Date



ENVIRONMENTAL IMPACT STATEMENT

***PROPOSED SAND AND GRAVEL EXTRACTION
FROM MANNING RIVER AT TAREE***

Prepared by:

**THE READYMIX GROUP
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TAREE 2430**

Layout of the EIS

This EIS has been compiled to facilitate public review of the proposed development and is based on the reports of specialist consultants, included in the Appendices and referred to throughout the body of the statement.

The layout of the document is summarised below.

Section 1.0 - Executive Summary

This section provides an overview of the entire EIS summarizing the main aspects of the proposed development. A statement of environmental impact is included.

Section 2.0 - Introduction

This section describes the primary objectives of the proposal and the ensuing secondary benefits, the background of the existing operation and the statutory requirements of this type of development. A summary of aspects of the development that various authorities asked to be addressed and where they can be found is included.

Section 3.0 - Description of the Environment

This section details the existing physical, natural, social and economic environment, with detailed descriptions, in particular, of the aspects that are generally of most concern to the public - the acoustic environment, water quality, flora and fauna.

Section 4.0 - Description of the Proposal

This section outlines the proposed operation and describes the various aspects in detail.

Section 5.0 - Interactions, Impacts and Safeguards

This section discusses the likely interactions and impacts of the proposal and the safeguards included to minimize any adverse impacts. The interactions, impacts and safeguards are included together for brevity and convenience.

Section 6.0 - Justification

This section addresses the economic and social considerations that justify the proposed operation and looks at the product quality advantages, demand and cost advantages and employment aspects.

Section 7.0 - Alternatives and Non Development Option

This section assesses alternative sites to the two proposed, alternative sources of quarry products and the implications of this proposal not proceeding.

Section 8.0 - Wingham Shoal

This section compiles and summarises the various aspects of the proposal to restore the river channel near Wingham by removing a small, recently developed shoal.

Appendix A

Replies received from the Director of the Department of Planning and other statutory authorities advising the matters to be addressed in this study.

Appendix B

Study of the impacts of sand and gravel extraction from the proposed section of the Manning River on river bed and bank stability, the sediment budget, flooding and saline penetration, and a proposed extraction configuration. This study was undertaken by Winders Barlow and Morrison.

Appendix C

Study of impacts of the removal of the recently developed shoal in the Manning River at Wingham, prepared by Winders Barlow and Morrison.

Appendix D

Study of impacts on flora, fauna, water quality, commercial fishing and recreational usage of the river, prepared by Winders Barlow and Morrison.

Appendix E

Noise Impact Statement, prepared by Dick Benbow and Associates.

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1.0 EXECUTIVE SUMMARY

PROPOSED SAND AND GRAVEL EXTRACTION FROM MANNING RIVER AT TAREE BY THE READYMIX GROUP

Introduction

Readymix is a unit of the Building Materials Division of CSR Limited, an Australian Company and is a major supplier of ready mixed concrete and quarry products to the construction industry. The Company operates throughout New South Wales and was formed with the merger of Farley & Lewers Ltd and Readymix Concrete in April, 1982.

The Mid North Coast of New South Wales is one of the State's fastest growing regions. It is likely that the area will continue to develop because of the significant demand for residential accommodation. The market for quarry products, used in significant quantities for a variety of applications, is, therefore, likely to increase.

The Readymix processing plant at Taree, using sand and gravel from the Manning River, currently provides approximately 85% of the gravel and river sand used in the production of concrete in the Forster/Taree region. Significant quantities of products from the plant are supplied to the area for a variety of other uses.

The demand for building products of this nature is directly correlated to the prevailing conditions. The demand for quarry products in the Mid North Coast area has increased substantially in the past 18 months after a period of stagnancy in the local building industry.

The existing crushing and screening plant at Edinburgh Drive, Taree, processes gravel and sand extracted from the Manning River. The plant has been located on this site since the early 1950's. It processes gravel and sand extracted from the section of the river described as Taree Lands Office Permissive Occupancy 81/11. This Crown lease area, comprises two sections of the river as shown in Figure 4.1.

The current development application, which this Environmental Impact Statement accompanies, seeks approval for extractive industry within an area of the Manning River at Taree. The Crown Lands office at Taree has given owners consent for the lodgment of the development application and that office is currently considering the granting of a permissive occupancy over that part of the bed of the Manning River to which the development application relates.

There is a need to obtain new reserves of gravel and sand because the upstream section of the existing lease, which is in close proximity to the plant, is close to being exhausted of readily extractable sand and gravel, and the downstream section involves excessive travel time from the plant.

The current proposal is to extract sand and gravel from the bed of the Manning River to ensure continuity of supply of sand and gravel to the Company's plant. The new permissive occupancy will be immediately south of the existing lease and is shown in Figure 4.1.

Objectives

The primary objectives of the proposal are:-

- * secure additional reserves of sand and gravel to maintain continuity of supply of high quality construction materials for a broad variety of uses in the Taree, Forster and surrounding areas.
- * remove a shoal from the Manning River at Wingham. This shoal has interfered with boating and caused the cancellation of the Wingham Regatta Association's annual carnival in recent years because of the navigational dangers presented by the shoal.
- * design and implement an operation that protects the river and bank environment and complies with the environmental safeguards required by the relevant statutory authorities.
- * supply important products not available from other local sources.

Description of the Proposed Extraction

It is proposed to extract sand and gravel from the river at similar rates as have in the past been extracted from the permissive occupancy immediately adjacent to the existing plant. The rate of extraction has been heavily reliant on market conditions but has averaged approximately 58,000m³ per year over the past eight years.

The estimated extractable reserves contained within the proposed permissive occupancy is 750,000 cubic metres, allowing for a 30m offset from each bank, with stable batters of 1:5 and a maximum depth of extraction to 6m below AHD.

The life of the operation which will be directly related to the prevailing market conditions is expected to be approximately 15 years.

The main characteristics of the proposal are as follows:

Continued extraction of sand and gravel from bed of Manning River:-

- i) extension of existing extraction area near Taree Estate. (see Figures 4.1, 4.4 and 4.5)
- ii) removal of a shoal near Wingham. (see Figures 4.1 and 4.9)

Method - small scale point source dredging.

Plant - mobile barge, tug, dragline and clamshell grab moored at existing plant when not in use.

Duration - approximately 15 years.

Quantity - approximately 750,000m³ of sand and gravel.

Hours of operation - 7.00am to 6.00pm Monday to Friday
7.00am to 1.00pm Saturday

Production uses - concrete manufacture
- road sealing
- filter media
- fill
- manufacture of tanks, paving bricks and concrete blocks
- pipe bedding

Employment - two persons directly on extraction, 12 persons employed on extraction, processing, transport and administration.

The removal of the Wingham shoal will be by the above method and its programming will be in consultation with the Department of Public Works.

Extraction Plan and Method

Extraction of sand and gravel from the bed of the Manning River will continue in the same way as the current operation. The material will be extracted, transported and unloaded by barge mounted dragline with a clamshell grab and pushed by a small tugboat.

This method avoids the need for a long delivery line associated with a cutter section dredge, or the need for

groynes out into the river from which trucks would transport the excavated material.

The barge is manoeuvred into position with the tug and anchors dropped at each end to fix the position of the barge. The dragline works an established face delineated by small marker buoys. The tug will be fitted with a depth sounder to ensure the gravel and sand is removed and the bed left in a condition within the tolerances of + or - 0.5m, recommended in Appendix B.

The tug pushes the barge back to the existing unloading facilities adjacent to the plant where the dragline unloads the material onto a conveyor which moves it to a surge pile within the plant site.

Loading and unloading the barge takes 45 minutes to one hour. The travel time to and from the extraction area will take approximately 15 minutes to the upstream end and 30 minutes to the downstream end of the proposed lease. Travel time by river to Wingham shoal will be approximately 1.5 hours each way.

The tug and barge are moored at the Company's wharf adjacent to the processing plant immediately upstream of Oaky Island. When not operational the plant is generally not visible except from the river itself or the opposite bank.

Extraction will be undertaken so that maximum benefit is obtained from improvement to the river channel cross-section as early as possible in the life of the operation. This will be achieved by working parallel to the river channel in a series of strips.

The five strips, each 30m - 40m wide, will be worked from the upstream end of the lease downstream towards Tinonee and each strip will be extracted from over a 2 - 3 year period.

It is proposed the first strip worked will be in the middle of the river to direct water away from the potentially erodable banks on the Tinonee side of the river. The sequence of working the strips is shown in Figure 4.2.

It is proposed to extract to the configuration recommended by Winders, Barlow and Morrison, included in Appendix B:-

- * extraction limited to 6m below AHD
- * extraction limited to no closer than 30m from the bank water level

* side batters limited to a maximum grade of 1:5

The extraction plan will be amended to accommodate any requirements of the PWD.

Statement of Environmental Impact

The various environmental considerations are discussed in detail in Section 5.0 of this environmental impact statement and the relevant consultant's reports are included in Appendices B, C, D and E.

The summary of relevant environmental interactions is included in Table 5.1.

The net environmental impacts (taking into consideration the safeguards) of this development can be summarised as:-

1. Reduced flood heights across Taree Estate.
2. Improved river bank stability and reduction of tendency of river to meander immediately upstream of Tinonee.
3. No effect on river bed stability.
4. Amelioration of siltation downstream of Taree.
5. No effect on sedimentation.
6. Similar effect on water quality to existing extraction operation i.e. localised increase in turbidity only.
7. No effect on riverine flora.
8. Short term impact on benthic fauna with small alteration in species mix rather than suppression.
9. Preservation of acoustic amenity with implementation of proposed control measures.
10. No effect on saline penetration upstream of Wingham.
11. Insignificant effect on tidal behaviour.
12. No impact on Cocumbac Island.

The impacts of the proposed development are considered to be acceptable in view of the benefits arising, and the means to be employed to minimise impacts contained in the extraction plan and specific safeguards. The expected beneficial impacts of the proposal are considered to greatly outweigh the adverse impacts.

SUMMARY OF ENVIRONMENTAL INTERACTIONS

<u>INTERACTION</u>	<u>EXTENT</u>	<u>SAFEGUARDS</u>
River bank stability	Some improvement	Extraction limits - 30m offsets - extraction to 6m below AHD - side slopes 1:5 Even river bed post extraction - tolerance $\pm 0.5m$ Monitoring - surveyed cross-sections - regular checks with depth sounder Extraction plan - shallow strips removed first
River bed stability	Maintained	As for river bank stability
Flood Behaviour	Reduced flood heights across Taree Estate	Extraction as proposed
Coocumbac Is.	No impact	
Siltation	Amelioration downstream	Extraction as proposed
Water quality	Extraction area - as for existing operation Processing plant - improved	Eliminate river discharge
Dust	Not applicable	
Acoustic environment	Maintained within SPCC criteria	As recommended - water cooled exhaust on new tug - environmental mufflers on all other engines

		-acoustic panelling around dragline engine
Residential Amenity	Unchanged	Extraction with- in proposed area Proposed acoustic measures Restricted work hours Plant put away when not in use
Aquatic flora	Extension -no effect	Extraction as proposed
	Wingham shoal -weed on shoal removed	Restore bed to typical section
Aquatic fauna	Temporary impact on small section	Extraction plan Extraction to 6m below AHD Natural regeneration
Recreational Amenity	Improved	Extraction as proposed Restricted work hours
Visual Amenity	Unchanged/ improved	Extraction as proposed Restricted work hours Plant put away when not in use
Navigability	Improved	Extraction as proposed
Commercial fishing	Improved fish hauls	Extraction limits and tolerances

2.0 INTRODUCTION

2.1 Objectives of the Proposal

Readymix is seeking approval for an extension of the area of the Manning River from which it currently extracts sand and gravel for processing at its plant adjacent to the river, off Edinburgh Drive, Taree.

The primary objectives of the proposal are:-

- * secure additional reserves of sand and gravel to maintain continuity of supply of high quality construction materials for a broad variety of uses, in the Taree, Forster and surrounding areas.
- * remove a shoal from the Manning River at Wingham that has interfered with boating and caused the cancellation of the Wingham Regatta Association's annual carnival in recent years because of the dangers presented by the shoal.
- * design and implement an operation that complies with the environmental safeguards monitored by the relevant statutory authorities and will exist in harmony with the local environment.
- * supply important products not available from other local sources, and maintain an alternative to the local sources of quarry products.

Implementation of the proposal will result in the following secondary benefits to the local community and the condition of the Manning River:-

- * reduced flood heights,
- * amelioration of siltation problems that are of concern to the local community,
- * improved river bank stability which will retard the tendency of the river to meander,
- * improved recreational and navigational amenity in the river,
- * increased knowledge of the Manning River resulting from the close monitoring of the Company's operation required by the Public Works Department.

2.2 Background

Readymix is a unit of the Building Materials Division of CSR Ltd, an Australian company and is a major supplier of ready mixed concrete and quarry products to the construction industry. The Company operates throughout New South Wales and was formed with the merger of Farley and Lewers Ltd and Readymix Concrete in April, 1982.

Readymix currently operates a crushing and screening plant at Edinburgh Drive, Taree, processing gravel and sand extracted from the Manning River. A processing plant has been located on this site since the early 1950s processing gravel and sand extracted from the section of the river now Taree Lands Office Permissive Occupancy 81/11.

The Company has considered it "harvests" the gravel and sand resources deposited by the river as they are naturally replenished by floods. However, the Manning River has not had a significant flood since March, 1978, and so there has been a marked depletion of available reserves as demand has increased due to the population increase in the last decade.

The proposal, for which this Environmental Impact Statement has been prepared, is for the Company to extend the extraction area in the Manning River to permit continuity of production of moderately priced, high grade, building materials. The plant is an important local industry.

In addition, the Company is including a shoal in the Manning River at Wingham that has built up in recent years, interfering with boating and preventing the Wingham Regatta Association from conducting its annual carnival. The Committee and Greater Taree City Council have explored alternative means of removing the gravel buildup without success.

Removal of this shoal will serve a dual function with Readymix extracting approximately 13,000 tonnes of sand and gravel for processing at its plant, and the local community will benefit from restoration of the river to a regular configuration that will allow better recreational use of this section of the river.

The location of the two areas proposed are shown in Figure 4.1.

2.3 Statutory Requirements

The proposed development, being deemed "extractive industry", is a designated development within the meaning of Schedule 3 of the Environmental Planning & Assessment Act Regulation 1980, as amended. The EPA Act 1979, as amended, Part IV details the procedure by which the Development Application is evaluated.

The consent authority is the Greater Taree City Council (GTCC). The EPA Act 1979 requires an Environmental Impact Statement accompany the development application to identify and assess the implications of the proposal to the environment.

2.4 Consultations

In addition to consultations with the Director of the Department of Planning, as required by Clause 35 of EPA Act Regulations 1980, the following authorities were contacted to determine any matters they required to be addressed in this study:-

State Pollution Control Commission

Public Works Department

Department of Lands

Department of Agriculture

Fisheries Division, Department of Agriculture

National Parks and Wildlife Service

Soil Conservation Service

Oxley County Council

Electricity Commission of NSW

Maritime Services Board

Greater Taree City Council

Department of Minerals and Energy

The following authorities were also contacted in person, by phone or by letter in the course of obtaining data for this study:

Australian Bureau of Statistics

Department of Administrative Services (Bureau of Meteorology)

Department of Water Resources

Department of Main Roads

2.5 Requirements of Statutory Authorities

Summarized below are the various aspects of the proposed development the statutory authorities asked to be included and the sections in which they are addressed in this study.

2.5.1 Department of Planning

1. Description of the Proposal

- * Location and extent of works proposed
Sections 4.2, 8.3, Figure 4.1
- * Adjacent developments
Sections 3.15, 3.16, Figures 3.1 & 3.2
- * Details of site
Sections 4.2, 4.3, 4.4, 4.5 & Figures 4.1, 4.4 to 4.12
- * Land tenure
Section 3.16
- * Zonings and forward planning proposals
Section 3.15, Figures 3.1, 3.2
- * Land use constraints
Section 3.15
- * Compatibility with regional strategy for extractive industries and LEP provisions for existing and proposed development
Not affected by Regional Strategy.
- * Processes involved
Sections 4.6, 4.7
- * Disposal of waste
Sections 5.6, 4.7

- * Transport of materials
Sections 4.6, 8.3
- * Use of the end product
Sections 4.10, 6.2.2, 6.2.3, 6.2.4, 6.2.5
- * Characteristics and economic significance of resource
Sections 4.4, 4.5, 6.2, Appendix B
- * Possible availability of alternative resources
Sections 7.1, 7.2
- * Quantity of materials to be extracted
Section 4.11, 8.3
- * Methods of extraction/plans of operation
Sections 4.6, 4.9, 5.17
- * Details of any blasting and/or crushing
not applicable/Section 4.7
- * Effects of vibrations
Sections 4.7, 3.12, 5.11, Appendix E
- * Type of machinery and equipment to be used
Sections 4.6, 4.8, 8.3
- * Expected life of operation
Sections 4.11, 8.3
- * Details of necessary stockpiling
Section 4.7, Appendix B
- * Access arrangements
Sections 5.12, 8.3
- * Site drainage and erosion controls
Section 4.7, 4.9, 5.2 & Appendix B
- * Proposals for rehabilitation
Section 5.20

2. Description of the Environment

- * Sections 3.1 to 3.20

3. Analysis of Environmental Impacts

- * Flow of any affected rivers or watercourses
Sections 5.1, 5.2, 5.3, 5.5, Appendix B,C
- * Effect of extract on sediment transport
Sections 5.1, 5.4, Table 5.1, Appendix B,C
- * Bed and bank stability
Section 5.2, Table 5.1, Appendix B,C
- * Possible siltation, sedimentation or downstream effects
Sections 5.1, 5.4, Table 5.1, Appendix B,C
- * Any likely cumulative effects
Section 5.8
- * Details of floods and any likely effects on the flood liability of surrounding lands
Section 5.3, Table 5.1, Appendix B,C
- * Effects of flooding on the operation
Section 5.7
- * Effects on flora and fauna
Sections 5.13, 5.14, 8.5
- * Agricultural viability of the landholding
Section 5.16, Appendix D
- * Likely noise/vibration disturbance
Sections 5.11, 8.5, Appendix E
- * Other impacts of trucking movements
Sections 5.12, 8.5, Appendix E
- * Dust nuisance likely to be caused
Section 5.9
- * Effects on water quality
Section 5.6, Table 5.1, Appendix C,D
- * Disposal of waste material
Section 3.7, 5.6
- * Effects on visual environment
Section 5.10, Table 5.1
- * Any likely affectation of sites of Aboriginal or European heritage value

not applicable

4. Contact with relevant Government Authorities

- * State Pollution Control Commission
- * Soil Conservation Service
- * Department of Agriculture
- * Public Works Department

Appendix A

5. Specific Aspects

- * Possible effects on ecology of Manning River
Section 5, Appendix B, C, D, E
- * Impacts on recreational amenity of the river
Section 5.15, Table 5.1, Appendix D
- * Flooding potential of site and possible effects on
flood behaviour
Sections 5.3, Appendix C, D
- * Possible impacts on regenerating rainforest at
Coocumbac Island
Table 5.1, Appendix B

2.5.2 Public Works Department

- * Detailed survey
Figures 4.4 to 4.12
- * Proposed method
Sections 4.6, 4.8, 4.9, Appendix B, C
- * Disposal of waste
Section 5.6
- * Realistic yield
Section 4.11, 8.3, Appendix B
- * Extraction plan
Sections 4.9, 8.3
- * Sediment budget
Section 5.4, Appendix B

- * Effects on - bed and bank stability
Section 5.2, Table 5.1, Appendix B, C
- any structures
Appendix B
- tidal prism and flows
Section 5.5, Appendix B, C
- saline intrusion
Section 5.5, Appendix B, C
- flooding
Sections 5.3, Table 5.1, Appendix B, C

2.5.3 Fisheries

- * Water quality
Section 3.11, 5.6, Table 5.1, Appendix C, D
- * Fish habitat disturbance
Sections 5.6, 5.13, 5.14, 5.16, Table 5.1, Appendix D
- * River bank stability
Sections 5.1, 5.2, Table 5.1, Appendix B, C

2.5.4 State Pollution Control Commission

The SPCC is familiar with the company's current operation from past inspections and its own studies of Manning River water quality. The SPCC indicated it had no specific concerns.

2.5.5 National Parks and Wildlife Service

- * Effects on Coocumbac Island Nature Reserve
Table 5.1, Appendix B

2.5.6 Greater Taree City Council

- * Effect of noise on village of Tinonee
Sections 5.11, Table 5.1, Appendix E

2.5.7 Soil Conservation Service

no responsibility

2.5.8 Department of Minerals and Energy

Direct responsibility for operational safety only

2.5.9 Department of Lands

Consent to lodge Development Application
Appendix A

2.5.10 Electricity Commission

- * Travel with dragline boom down when passing under powerlines Section 4.6

2.5.11 Maritime Services Board

- * Compliance with standard conditions
Sections 4.6, 4.8, 4.9, 4.10, Appendix B, C

2.5.12 Department of Agriculture

nil

2.6 Study Contributors

This Environmental Impact Statement has been prepared by the local office of the Readymix Group with appropriate studies and reports from specialist consultants.

- * Winders, Barlow and Morrison (WBM) undertook the investigations of sediment budget, bed and bank stability, hydraulic modelling, effects on flooding and saline intrusion, recommending an extraction configuration for the proposed extension and the shoal at Wingham. The reports are included as Appendices B and C.

The participants in this study were:-

Mr A B McAlister B E (Civil)
Mr D C Patterson B E (Civil), B Sc (Geology), M Eng Sc
(Research) and Dip Hydraulic
Engineering

- * Winders, Barlow and Morrison were also engaged to undertake the study of the impact of this proposal on

the river's flora and fauna, the water quality, and the interests of commercial fishermen and recreational users of the river. This report is included as Appendix D.

The participants in this study were:-

Mr C J Milligan B Sc (Zoology), M Sc (Marine Biology),
M Phil (Water Quality Assessment).
Mr C D Morgan B Sc (Environmental Science), Dip
Environmental & Municipal Engineering.

- * Dick Benbow & Associates prepared the noise impact statement which is included as Appendix E.

The field work was carried out and reported by Mr Dick Benbow B Sc (Eng) M.A.A.S. M.C.A.S.A.N.Z. M.E.I.A.

- * Detailed survey of the proposed extraction extension in the river was undertaken by Degotardi, Smith and Partners.

Survey of the shoal at Wingham was undertaken by Greater Taree City Council.

- * This document was reviewed and its content checked for completeness and compliance with the EPA Act 1979 and Regulation 1980, by Kelvin Auld and Associates Project Planners Pty Ltd. Mr K. Auld B. T.P. (UNSW) completed this review.

The consultants liased with the relevant authorities whilst undertaking their studies and the co-operation and assistance provided is gratefully acknowledged.

3.0 DESCRIPTION OF THE ENVIRONMENT

This section describes the natural, social and economic aspects of the existing environment. Further detail is included in the consultant's reports:-

- * Appendix B Hydrodynamic study of the Manning River including sediment transport, flood heights, bank stability, sediment budget and effects of extraction.
- * Appendix D River biology, water quality, commercial and recreational users.
- * Appendix E Acoustic environment and noise impact.

3.1 Climate

The climate of the Taree district can generally be described as sub-humid temperate, being influenced by its latitude, topography and the proximity to the ocean.

Statistical information has been obtained from the Bureau of Meteorology, Department of Administrative Services and the Soil Conservation Service Technical Manual, Taree District. The figures are based on readings at radio station 2RE, Taree, commenced in 1881.

3.2 Rainfall

Rainfall is summer-autumn dominant resulting from cyclonic tropical and sub-tropical low pressure systems that traverse inland from the Pacific Ocean.

The mean rainfall is 1178mm annually, with 628mm occurring on average in the five months December to April.

3.3 Temperatures

The mean daily maximum and minimum temperatures and humidity readings are shown in Table 3.2. The figures indicate mild winter and warm summer temperatures.

Cool north east sea breezes moderate summer temperatures with excessively hot periods occurring when the sea breezes fail to penetrate inland.

The relative humidity of the area is consistent, falling to its lowest level between July and September.

TABLE 3.1

RAINFALL

Rain	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Fall (mm)													
Mean	123	136	149	118	94	97	76	64	63	78	78	102	1178
Median	91	99	118	79	64	68	47	37	45	62	62	81	1142
Rain Days													
Mean	11	11	13	10	9	8	8	8	8	10	10	10	116

TABLE 3.2

TEMPERATURES AND HUMIDITY

	Mean Temperature (C)		Humidity
	Maximum	Minimum	
January	28.9	17.7	61
February	28.6	18.1	61
March	27.5	16.1	60
April	25.1	12.8	57
May	21.6	9.4	58
June	19.0	7.2	57
July	18.6	5.3	51
August	20.1	5.8	48
September	22.5	8.2	49
October	24.6	11.7	58
November	26.5	14.2	57
December	28.3	16.4	57
Year	24.3	11.9	56

3.4 Wind

Strong winds occur periodically in the Taree district, usually as a result of depressions off the north coast of NSW or localized thunderstorms. Table 3.3 indicates the return period of wind gusts in the Manning Valley.

Summer is characterized by light winds in the morning strengthening to southeast to northeast winds generally up to 30km/hour.

Winter is characterized by light westerlies in the mornings strengthening in the afternoons to 20km/hour.

TABLE 3.3

RETURN PERIOD OF WIND GUSTS IN THE MANNING VALLEY

Return Period (years)	10	20	50	100
Wind gusts equalled or exceeded (km/hr)	145	150	170	175

3.5 Sunshine

The estimated average duration of bright sunshine is shown in Table 3.4.

TABLE 3.4

AVERAGE HOURS OF SUNSHINE PER DAY

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
8.9	7.9	7.3	6.8	6.4	6.3	6.8	7.4	8.0	8.1	8.3	8.7	7.6

3.6 Flooding

Major flooding causes considerable impact with property damage, stock loss, damage to public utilities and disruption, and is a periodic problem along the Manning River, as with all north coast rivers.

Floods usually result from intense cyclonic rainfall in summer-autumn storms. The last major flood experienced was in March, 1978. This flood was regarded as a 1 in 80 year flood in the vicinity of Wingham and Taree. This and the February 1929 flood are the two largest floods experienced this century.

Taree and Wingham have both experienced 27 significant floods in the period 1857 to 1978, measured above 3.3m AHD on the Macquarie Street gauge at Taree, and above 10.6m AHD at the Wingham Road Bridge gauge at Wingham (Reference 11). Table 3.5 indicates the maximum flood heights recorded at these two gauges in the 1929 and 1978 floods.

The 1978 flood caused approximately \$3m in damage (Reference 6) to public utilities, residential and commercial property and rural production.

Laurie Montgomerie and Pettit (Reference 6) estimate that in 1980 there were 330 commercial and residential

properties in Taree at risk from a flood of the magnitude of the 1978 flood. A further 400 ha of land and 30 residences were at risk in Taree Estate.

TABLE 3.5

MAXIMUM RECORDED FLOOD HEIGHTS (AHD)

	1929	1978
Macquarie Street gauge, Taree.	5.6m	5.45m
Wingham Road Bridge bauge, Wingham.	14.9m	14.9m

3.7 Manning River

The Manning River is one of the major rivers on the north coast of New South Wales in terms of both its catchment area and its annual average total discharge.

The river rises in the mountainous area of the Mt Royal range at elevations of over 1000m AHD. The section of the river included in this proposal is situated between Wingham and Taree where the river broadens out into generally level alluvial flats.

The Manning River catchment is more fully discussed in Appendix B Sections 2.1 and 2.2.

The river in the proposed extension of the extractive are, has a relatively uniform cross section. The eastern half of the river channel is shallow, averaging approximately 1m in depth from the Low Water Level with only 0.6m of water in places. The deepest section of the river channel is along the western side of the river varying from 2.7m to 8.8m in depth from the Low Water Level.

Similarly, the bed of the river at Wingham is relatively uniform except for the shoal that has developed in recent years.

The cross sectional profiles of both sections of the river are shown in Figures 4.4 to 4.12, and discussed in Appendices B & C.

3.8 Topography

The alluvial plains either side of the proposed extension to the Company's existing lease in the Manning River are generally flat with slopes of 0 to 3%. The village of Tinonee to the south lies on undulating country with

slopes of up to 10%.

The western bank of the river is on the outside bend of the river and is characterized by erodable, vertical banks extending to Tinonee where the bank transitions to a rock bluff.

The eastern bank is generally flatter and more stable transitioning upstream to a steeper rock bluff at Taree West opposite Mondrook Point. The two rock bluffs act as controls on the lateral movement of the river.

This suggests that with the infill occurring on the eastern side of the river, there is a long term tendency for the river to meander westwards. This is discussed further in Appendix B.

3.9 Geology

The sand and gravel to be extracted is Quaternary age alluvium deposited relatively recently across Taree Estate. The river forms the boundary between Quaternary age alluvium and the much older Devonian age Tinonee Beds of greywacke, mudstone and lithic sandstone, at the bend of the river at Tinonee.

The large sediment fraction consists of metasediments and volcanics and the sand fraction is coarse grained composed of quartz and lithic fragments.

The sediments are generally composed of 20% to 35% sand with a very low silt fraction. Particles range up to 200mm in size generally situated on the outside of bends, with 50% to 60% of the sediment larger than 10mm in diameter. The sediment is limited to a medium grained sand by the junction of the North and South passages downstream of Taree.

The sediment particularly in the proposed extension of the current extraction area, is nearing the end of its journey, having been worked and transported downstream in flood times.

3.10 Recreational and Scenic Value

The Manning River and its immediate environs are of great scenic value and play a major role in attracting tourism to the district.

Residents and visitors use the river for a variety of activities including swimming, fishing, sailing, rowing, water skiing, canoeing and powerboat racing. The aquatic

carnivals and regattas held on the river at Taree and Wingham are major events attracting large numbers of competitors and visitors, contributing to local commerce and charities.

River cruises are conducted on the river by Manning River Cruises from Manning Point to Wingham, and houseboat holiday craft also travel the river.

Davenport, Campbell and Partners (Reference 4) consider the major watercourses, their banks, the shoreline and a strip 500m deep are areas of High Visual Quality requiring careful control.

3.11 Water Quality

Results from SPCC sampling between June 1984 and March 1986, and sampling undertaken for this study are reported and discussed in Appendix D.

This data indicates turbidity and salinity vary with the flow in the river such that turbidity increases exponentially with flow and salinity decreases with the inflow of freshwater runoff.

The salinity of the water in the section of the river proposed for extension of the extraction area is low and can be considered as brackish. The water in the river at Wingham is much less saline being only 5-6km downstream of the tidal limit at Basin Ford.

The SPCC (Reference 14) concludes that water quality in the Manning River is generally good except between Wingham and Taree where there is stimulated algal growth, attributed to treated effluent discharges from dairies and sewage treatment works. In addition, Taree contributes significant pollutants from urban runoff during high flows.

The SPCC report also recommended steps be taken to reduce suspended loads entering the river from the Company's gravel processing plant during low flows. Readymix has initiated steps to rectify this problem, discussed in Section 5.6 of this study.

3.12 Acoustic Environment

The existing background noise levels were measured at several locations around both the proposed extension of the existing extraction area and the shoal near Wingham.

The measured background levels around the proposed extension were in the range 30-37dBA, typical of rural-residential areas. The noise sources were occasional traffic movements, birds, agricultural activities and general community activity.

The measured background levels at Wingham were approximately 35dBA and were typical of residential areas. The sources were attributed to community activity, occasional vehicular movements and bird and animal noise.

The background level is considered by the SPCC to be the L90 level, the level of noise exceeded for 90% of the time, denoting the average minimum fluctuations of noise level that may occur.

The existing acoustic environment, assessment criteria, predicted noise levels and noise control measures are fully discussed in the Noise Impact Statement in Appendix D.

3.13 Flora

The alluvial flood plain on either side of the proposed extension of the extraction area has been cleared of the original scrub (ie riverine forest) of the early nineteenth century (Reference 3). This floodprone land is open pasture with scattered trees and is used mainly for grazing cattle. The remnants of the scrub can be found on Coocumbac Island and along Cedar Party Creek.

Scattered native trees and shrubs occur along both banks of the river with lantana and wild tobacco prevalent along the sloping banks particularly on the steeper western side. These native trees are predominantly she oaks (*casuarina cunninghamiana* and *casuarina glauca*) and figs (*ficus* spp.)

This section of the river is located in the transition zone between highly saline and fresh water and so the intertidal zone is characterised by reeds and rushes with scattered mangroves. This vegetation occurs as a narrow band along the river margins and is the limit of any aquatic vegetation. There is no seagrass or similar aquatic vegetation because of the coarse nature of the river bed.

The shoal at Wingham is flanked on the northern side by the regenerating subtropical rainforest at Wingham Brush and the Picnic Point Aquatic Area's landscaped fringe. The southern side is characterized by native trees and shrubs along the river banks transitioning to open farming and grazing areas interspersed with stands of native trees.

The shoal itself supports freshwater cumbungi, pond weed and strap weed. Both sides of the river support cumbungi along the river margin.

3.14 Fauna

The river fauna obtained from sampling indicate the density and range of fauna is limited due to the coarse nature of the sediment and the mobility of the sand fraction. The species involved are listed in Table 4.2 of Appendix D.

The fish species found in the proposed extension area are typical of estuaries - flathead, mullet, gar, whiting, bream and prawns.

Birds are the most obvious fauna and a wide range of species both passing through and resident are to be found. The species are seasonably variable depending on the food resources. Most of the birds in the vicinity of the extraction area are water birds because of the sparsity of trees and comprise mainly ducks, pelicans, herons, cormorants and wading birds typical of an estuarine habitat. Birds in the vicinity of the Wingham shoal are typical of those found in heavier tree growth.

Terrestrial fauna in the vicinity of the proposed extension is limited, a constraint on the fauna populations being the presence of pets, either domestic or semi feral because they disturb and kill the fauna. The lack of cover favours exotic animals rather than native fauna. Increasing urban development has had similar effects. Water rats (*hydromys chrysogaster*), foxes (*vulpes vulpes*), hares (*hepas capensis*) and brown rats (*rattus norvegicus*) are typical of the mammals to be found on either side of the river in, addition to semi feral pets. The Wingham Brush supports a colony of flying foxes.

Some frogs occur along the river but the brackish conditions are not suitable although temporarily favourable conditions may occur in hollows during prolonged periods of rainfall.

Snakes, in particular the Eastern Brown Snake (*Pseudonaja textilis*) are prevalent in the areas of long grass and along the river banks. The Bearded Dragon (*Amphibolurus barbatus*), Blue Tongued Skink (*Tiligua scinoidis*) and the Pink Tongued Skink (*T. gerrardii*) are to be found in the mixed grassland areas and lighter scrub cover.

3.15 Zoning

The bed of the Manning River in the proposed extension of the extractive area is covered by two planning instruments, Greater Taree Local Environmental Plan No.3 and Manning Local Environmental Plan No.1. The dividing line is approximately the middle of the river.

The eastern half of the river bed is covered by Greater Taree Environmental Plan No.3 and is uncoloured. The western half of the river is covered by Manning Local Environmental Plan No.1 and is zoned Rural 1(a).

Under these two planning instruments extractive industry in the bed of the Manning River is permissible with the consent of Greater Taree City Council.

The zonings of land adjacent to the proposed extension are indicated in Figure 3.1.

The bed of the Manning River at the shoal at Wingham is zoned Rural 1(a) under the Manning Local Environmental Plan No.1. The zoning under this planning instrument permits extractive industry with the consent of Greater Taree City Council.

The zonings of the land adjacent to the Manning River at Wingham, including the recently gazetted Greater Taree Local Environmental Plan No.55 for the town of Wingham are shown in Figure 3.2.

3.16 Land Use

The land either side of the proposed extension to the extractive area is privately owned and used for agriculture, principally the grazing of stock with vegetable cropping in Taree Estate away from the river.

Residences are scattered across Taree Estate particularly north of Edinburgh Drive. Residences on the western side of the river are sparser and set well back from the river.

The residential areas of Taree and Tinonee have grown in recent years, particularly near the existing lease without causing any concerns. The proposed extraction area is situated further away from the residential areas except for a small section of Tinonee referred to in the Noise Impact Statement in Appendix E.

The land on the southern side of the river at the shoal at Wingham is privately owned and used for cropping and grazing stock. The northern side is public land with the Wingham Brush, an aquatic area with a boat ramp, the

Wingham Wharf and picnic facilities. Wingham High School is situated to the back of the Wingham Brush and the sewage treatment works is adjacent to the Brush downstream of the wharf.

3.17 Population

Figures from the 1986 Census for the Greater Taree local government area indicated:-

Total Population -	35,921		
Total Labour Force -	14,134	- employed	11,836
		- unemployed	2,298
Total Dwellings -	13,841		

The Mid North Coast region of New South Wales is one of the state's fastest growing regions. The population is increasing rapidly, attributable to the migration to the area of retirees and young families escaping the spiralling housing costs of Sydney and the Central Coast.

In particular there has been a recent acceleration of the influx of people moving to the Greater Taree local government area. The current population forecasts for the future are listed in Table 3.6. Earlier forecasts for 1986 were for a higher population.

TABLE 3.6

POPULATION FORECAST

GREATER TAREE CITY COUNCIL AREA

	1986 (actual)	1991	1996	2001
Australian Bureau of Statistics	35,921	41,742	46,939	52,025
GTCC Estimate			49,330	55,155

The population of the Greater Taree area has increased from 31,282 in 1981 to 35,921 in 1986, ie. an increase of 14.8% in 5 years or an annual average growth rate of 2.9%.

The population forecast anticipates similar growth to 1991 with a tapering off in the following decade to 2.4% and

2.1% annual growth in the two five year periods to 2001

3.18 Employment

Unemployment grew from 9.5% in 1981 to 15.25% in 1986. The level of unemployment in the Mid North Coast of New South Wales compared with New South Wales overall is indicated in Table 3.7.

These figures indicate unemployment on the mid north coast is significantly above the state average and is particularly high in the age group 15-24 years of age.

TABLE 3.7

UNEMPLOYMENT - MID NORTH COAST OF N.S.W. - MAY 1988
Source: CES September, 1988.

Unemployment	Mid North Coast	New South Wales
15 - 24 years	21.7%	13.7%
25 + years	11.4%	5.9%
Overall	13.7%	8.8%

In the past the Taree area has relied heavily on agriculture for its economic base and this was reflected by the high proportion of the total employment in this sector.

The last two decades have seen the establishment of several manufacturing enterprises employing 60 to 250 persons and increased tertiary activity with the expansion of tourist facilities. Table 3.8 lists the employment in various industries at the time of the 1986 Census.

3.19 Construction Activity

Construction activity in the Greater Taree area is underpinned by housing and accommodation construction. There is currently a shortage of rental accommodation in the Taree area despite the recent growth in housing construction.

In 1988 the number of residential building approvals was 430 compared with 230 and 227 in 1987 and 1986. The total value of all building applications in 1988 was \$54.4m for 1331 applications compared to \$24m for 1001 applications in 1987 and \$28m for 1029 applications in 1986. The increase in building construction has been general

throughout the local government area.

Similar increases in building activity have been experienced in the Hastings Municipal and Great Lakes Shire areas. The level of commercial and industrial construction has increased greatly in 1988. Public sector activity has also increased with roadworks, extensions to local schools and water and sewage works.

TABLE 3.8

EMPLOYMENT BY INDUSTRY
Source: Bureau of Statistics

Industry	Persons Employed	Percentage of Workforce
Agriculture, Forestry, Fishing	1,397	11.8
Mining	27	0.2
Manufacturing	1,605	13.6
Electricity, Gas, Water	177	1.5
Construction	781	6.6
Wholesale/Retail Trade	2,410	20.4
Transport & Storage	761	6.4
Communication	258	2.2
Finance & Business Services	798	6.7
Public Administration & Defence	522	4.4
Community Services	1,988	16.8
Recreation & Other Services	741	6.3
Non Classifiable	84	0.7
Not Stated	287	2.4
Total	11,836	

3.20 Market

There is a direct correlation between the level of construction activity and the demand for quarry products. The level of activity is dependent on the prevailing economic conditions.

In the period 1981 to 1988 production at the Company's processing plant has varied between 86,000t and 128,000t, to meet demand. Readymix is the major supplier of quarry products to the Taree area and also supplies significant quantities to the Forster/Tuncurry area.

Over 60% of the total production is used in concrete plants at Taree, Wingham, Forster and Tuncurry and approximately 15% is used by Councils, the D.M.R. and private contractors for roadworks. The remaining 20-25% is used in a variety of ways, as drainage media, fill materials and for domestic uses.



PLATE 3-1 Section of eastern bank of river of proposed extraction area

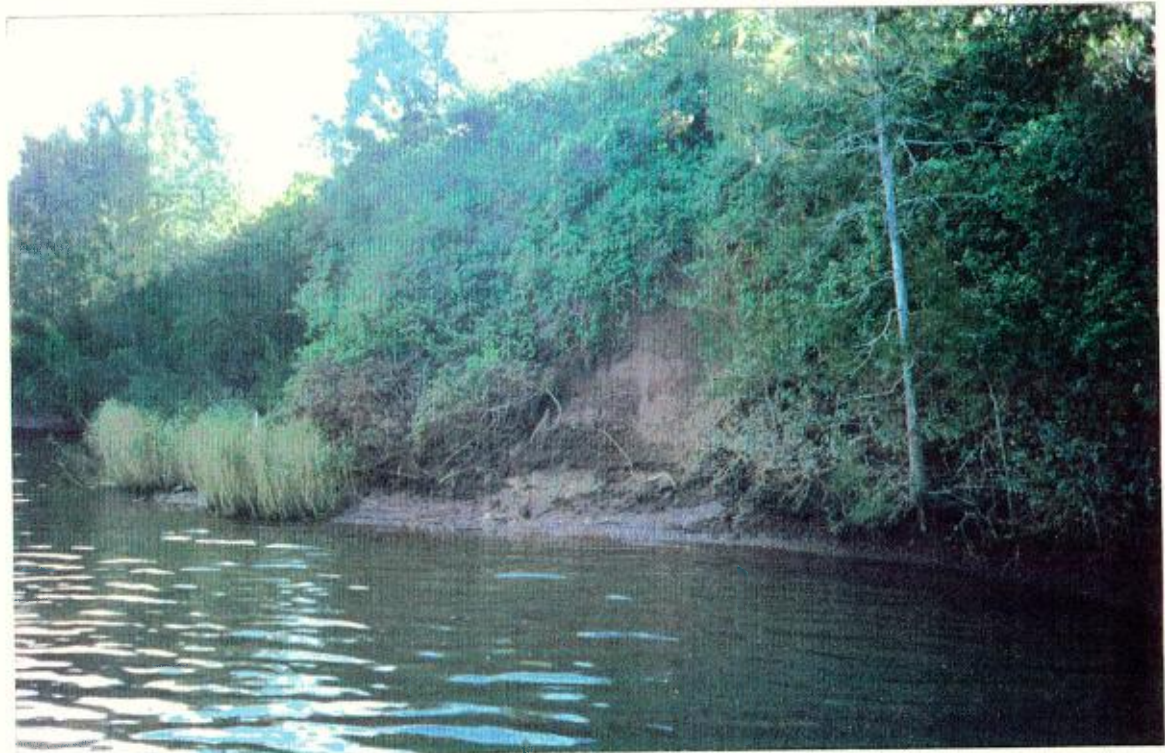
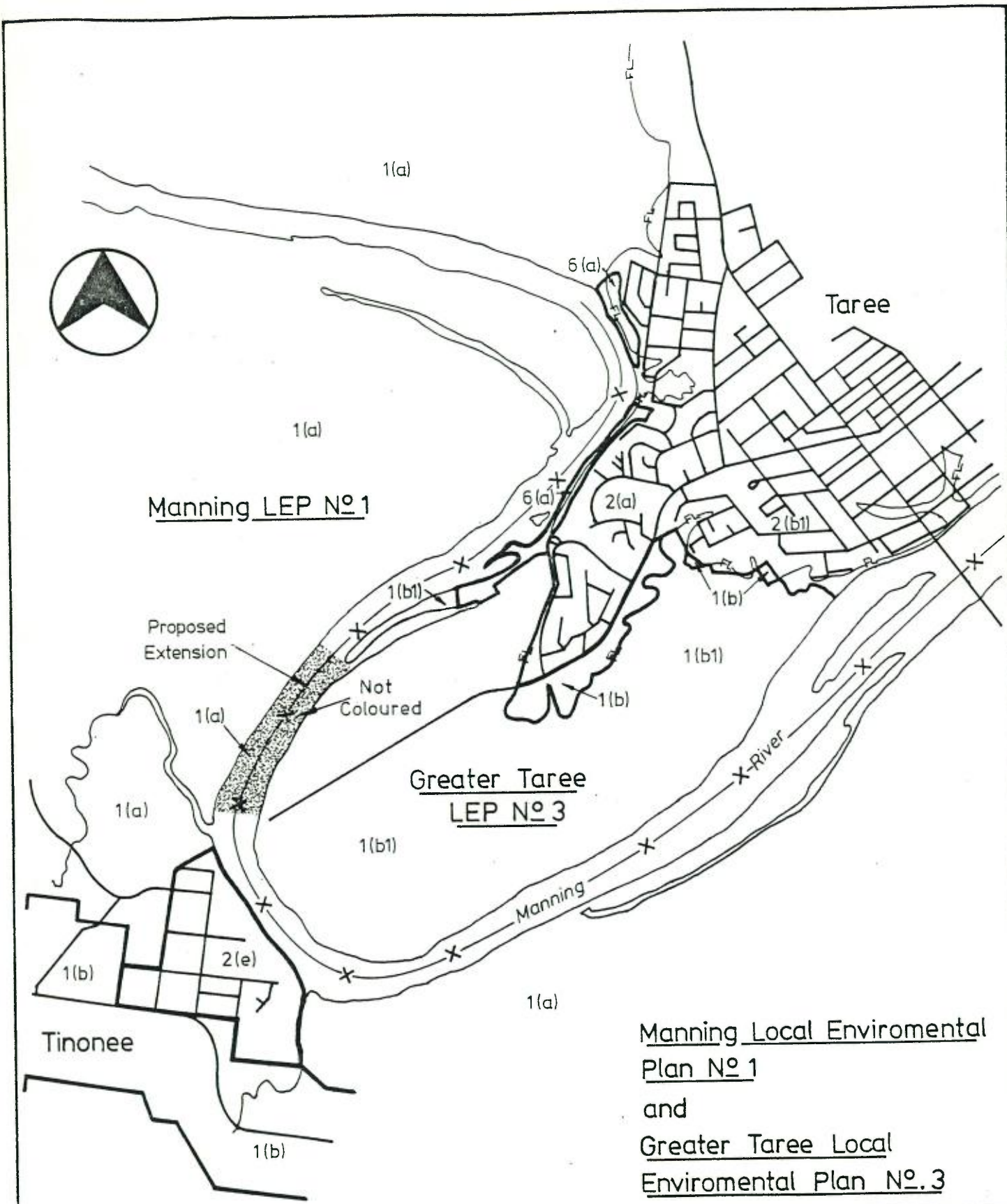


PLATE 3-2 Section of western bank of river of proposed extraction area

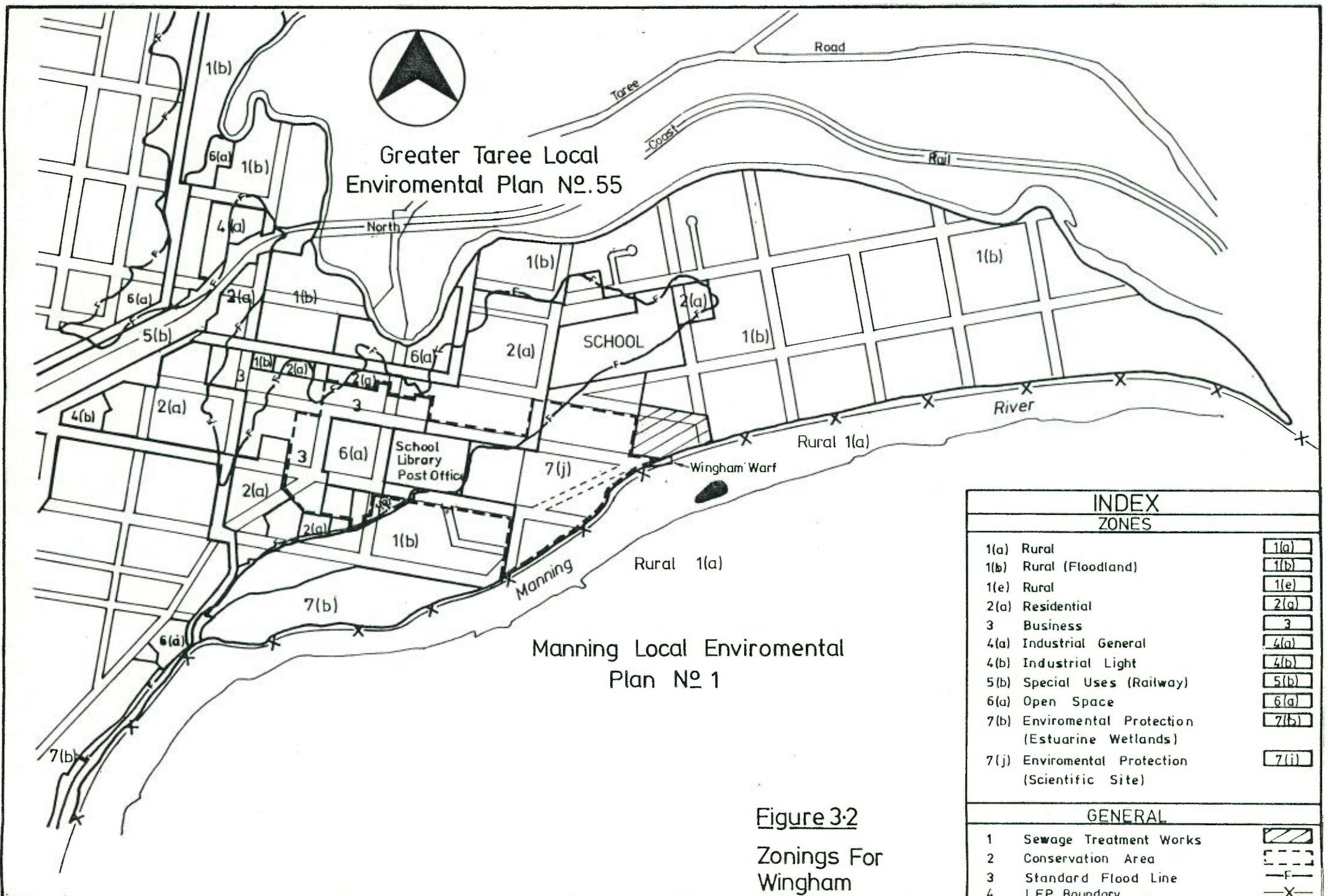


Manning Local Environmental Plan No. 1
and
Greater Taree Local Environmental Plan No. 3

LEGEND
 —FL— Standard Floodline
 —X— Boundary of Planning Instruments

Figure 3.1
 Zonings

INDEX		
ZONES		
1 (a)	Rural "A"	1(a)
1 (b)	Rural "B"	1(b)
1 (b1)	Rural "B1" (Flood Land)	1(b1)
2 (a)	Residential "A"	2(a)
2 (b1)	Residential "B1"	2(b1)
2 (e)	Residential "E"	2(e)
6 (a)	Open Space	6(a)



Greater Taree Local
Environmental Plan No. 55

Manning Local Environmental
Plan No. 1

INDEX ZONES		
1(a)	Rural	1(a)
1(b)	Rural (Floodland)	1(b)
1(e)	Rural	1(e)
2(a)	Residential	2(a)
3	Business	3
4(a)	Industrial General	4(a)
4(b)	Industrial Light	4(b)
5(b)	Special Uses (Railway)	5(b)
6(a)	Open Space	6(a)
7(b)	Environmental Protection (Estuarine Wetlands)	7(b)
7(j)	Environmental Protection (Scientific Site)	7(j)

GENERAL		
1	Sewage Treatment Works	
2	Conservation Area	
3	Standard Flood Line	
4	LEP Boundary	

Figure 3:2
Zonings For
Wingham

4.0 DESCRIPTION OF THE PROPOSAL

4.1 General

The proposal is to extract sand and gravel from the bed of the Manning River to ensure continuity of supply of processed sand and gravel to the Company's plant off Edinburgh Drive, Taree.

The Company's existing lease area, Taree Lands Office Permissive Occupancy 81/11, comprises two sections of the river as shown in Figure 4.1.

There is a need to seek new reserves because the upstream section of the existing lease, in close proximity to the plant, is nearing exhaustion of readily extractable sand and gravel, and the downstream section involves excessive travel time.

The Company's processing plant is an existing operation and is not the subject of this study. Reference is made to the processing plant where applicable.

The environmental controls included in this proposal are described separately in Section 5.0.

4.2 Location

The proposed extension to the extraction area is immediately downstream of the existing extraction area, comprising approximately 1km of river upstream of the Andrews Reserve at the end of Edinburgh Drive.

The small shoal in the river at Wingham is immediately downstream of the Wingham Wharf on the southern side of the river.

Both sites are shown in Figure 4.1 and in greater detail in the surveyed plans and cross sections Figures 4.4 to 4.12.

4.3 Site Selection

The proposed site was selected because it was the only site that met the main criteria. That is :-

- (i) proximity to the Company's processing plant,
- (ii) quantity of clean sand and gravel reserves,
- (iii) improved or neutral effects on flooding,
- (iv) no significant effects on the environment.

In addition there are several positive aspects of this

proposal, described in Section 5.0 which, in combination with points (i) to (iv) above, determined the selection of this site.

Other sites upstream and downstream of the proposed area were investigated. The reasons for not pursuing these areas are discussed in Section 7.1 of this study.

The Wingham shoal has been included because extraction and processing of this small deposit would be of service to the local community and at the same time meet the Company's requirements. The long haul distance presents some problems and this is discussed in more detail in Section 8.3.

4.4 The Materials

The processed sand and gravels are high quality products satisfying the 'severe exposure' criteria of Australian Standard AS2758-1 for use in concrete. The results of quality control testing by the Company in recent years are summarised in Table 6.1.

The source material comprises alluvial deposits of well rounded gravels and sands with 20% to 35% of the material being sand (ie -4.75mm). The sand and gravel is nearing the end of its journey down the Manning River so that the weaker and less sound particles have been abraded off in the process of being continually worked during transport.

The size distribution of the material is largely dependent on the water velocity in flood so that there is a higher proportion of larger cobbles in the Wingham section of the river reducing to mainly gravels and sand in the proposed extension, and finer gravels and sands downstream of the Martin Bridge at Taree.

4.5 Size and Economic Significance of Resource

The quantity of material available for extraction within the guidelines recommended by Winders Barlow and Morrison and based on the detailed survey cross sections in Figures 4.4 to 4.8 is approximately 750,000 cubic metres, higher than the estimate of approximately 660,000 cubic metres in Appendix B. The figure of 660,000 cubic metres is based on 4 cross sections surveyed in 1981, cross sections 105 to 108 in Appendix B.

The resource is of considerable economic significance in view of the quality of the finished products, the lack of alternative sources, particularly of natural river sand, and the proximity of the products to the major markets in

the district.

4.6 Extraction Method

Extraction of sand and gravel from the bed of the Manning River will continue in the same way as the current operation. The material will be extracted, transported and unloaded by barge mounted dragline with a clamshell grab and pushed by a small tugboat.

This method negates the need for a long delivery line associated with a cutter section dredge, or the need for groynes out into the river from which an excavator works and along which trucks transport the excavated material.

The barge is manoeuvred into position with the tug and anchors dropped at each end to fix the position of the barge. The dragline works an established face delineated by small marker buoys. The tug will be fitted with a depth sounder to ensure the gravel and sand is removed and the bed left in a condition within the tolerances of $\pm 0.5\text{m}$, recommended in Appendix B.

The tug pushes the barge back to the existing unloading facilities adjacent to the plant where the dragline unloads the material onto a conveyor which moves it to a surge pile.

Loading and unloading the barge takes 45 minutes to 1 hour. The travel time to and from the extraction area will take approximately 15 minutes to the upstream end and 30 minutes to the downstream end of the proposed lease. Travel time by river to the Wingham shoal will be approximately 1.5 hours each way.

The tug and barge are moored at the company's wharf adjacent to the processing plant immediately upstream of Oaky Island when not being operated.

The tug and barge will not pass beneath powerlines transporting sand and gravel from the proposed extension of the extraction area but will do so when travelling to and from Wingham. The boom of the dragline will be in the down position when travelling under powerlines.

4.7 Other Considerations

There are other procedures and impacts usually associated with extractive industries that are not applicable to this development, or are associated with the existing processing plant:-

- * there will be no blasting associated with this proposal,
- * there will be no open cut excavation,
- * stockpiling of processed material will generally be above flood level. The stockpile referred to in Section 7.3.2 of Appendix B is being relocated,
- * processing water is pumped from the Manning River, and following consultation with the SPCC a sediment tank is being constructed so that the system will be closed with no discharge to the river,
- * the existing processing plant is on a large block of land with natural vegetation plus a considerable number of additional planted trees. Runoff follows the natural depressions to the river. The vegetation acts as a form of erosion control. There are no open pits or excavations,
- * sewage disposal is by connection to the town system,
- * the Company is currently undertaking a programme to significantly reduce the noise effects of its processing operation and improve the visual amenity around the plant,
- * there are no buildings or plant to be erected with this proposal,

4.8 Plant and Equipment

The plant used in the extraction of sand and gravel from the bed of the Manning River is the same that has been used for the past 16 years - barges capable of carrying 150 - 180t of material, draglines with clamshell grabs, steel hulled tugboat 8.65m long and anchor winches powered by 4 stoke engines at each end of the barge. A depth sounder being installed in the new tug. The existing wharf and unloading facilities will continue to be used.

The tug is surveyed annually by the Maritime Services Board and checked for safety and seaworthiness. The Department of Mines regularly inspects the safety aspects of the plant and equipment.

4.9 Extraction Plan

Extraction will be undertaken so that maximum benefit is obtained from improvement to the river channel cross-section as early as possible in the life of the operation. This will be achieved by working parallel to the river channel in a series of strips.

The five strips, each 30m - 40m wide, will be worked from the upstream end of the lease downstream towards Tinonee and each strip will be extracted from over a 2-3 year period.

It is proposed the first strip worked will be in the middle of the river to direct water away from the erodable banks on the Tinonee side of the river. The sequence of working the strips is shown in Figure 4.2.

It is proposed to extract to the configuration recommended by Winders, Barlow and Morrison, included in Appendix B :-

- * extraction limited to 6m below AHD,
- * extraction limited to no closer than 30m from the bank water level,
- * side batters limited to a maximum grade of 1:5.

The extraction plan will be amended to accommodate any concerns or requirements of the PWD.

4.10 Products

The extracted sand and gravel will be processed and the following range of products produced for contractors, government authorities, concrete plants, manufacturers and domestic uses:-

- * Concrete and road sealing aggregates, nominal size 20mm, 14mm, 10mm, 7mm and 5mm
- * Riversand
- * Crusher dust
- * Natural rounds

The relative proportions will vary with the size distribution of the raw feed into the plant.

The clean nature of the raw material fed to the processing plant results in very little material being collected in

the settlement pond. This material will be incorporated in the crusher dust so there will be no waste disposal problem.

4.11 Extraction Rate and Expected Life of Operations

It is proposed to extract sand and gravel from the river at similar rates to that in the past. The rate of extraction has been heavily reliant on market conditions but has averaged approximately 58,000m³ per year over the past 8 years.

The existing extractable reserves, allowing for a 30m offset from each bank, with stable batters of 1:5 and a maximum depth of extraction to 6m below AHD, is approximately 750,000 m³.

The life of the operation is directly related to the prevailing market demand but is expected to be approximately 15 years.

4.12 Hours of Operation

Extractive operations will be limited to the hours:

Monday to Friday	7.00am to 6.00pm
Saturday	7.00am to 1.00pm

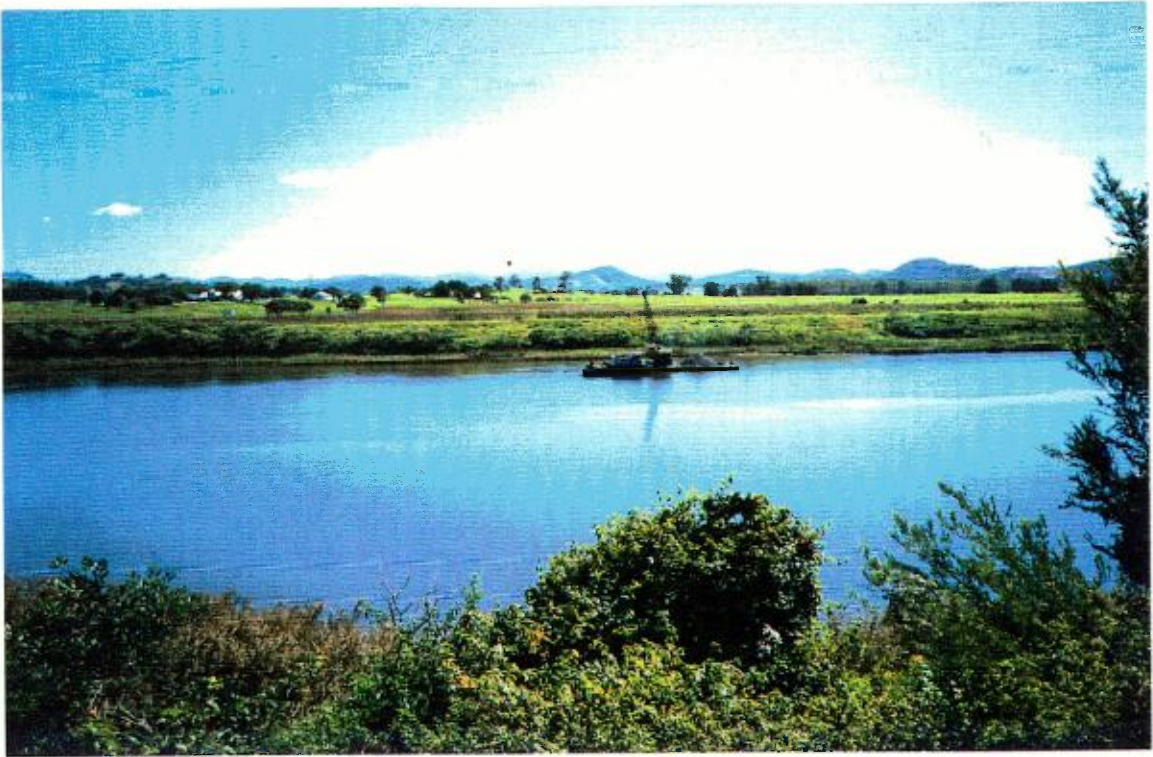


PLATE 4-1 Extracting sand and gravel from existing lease

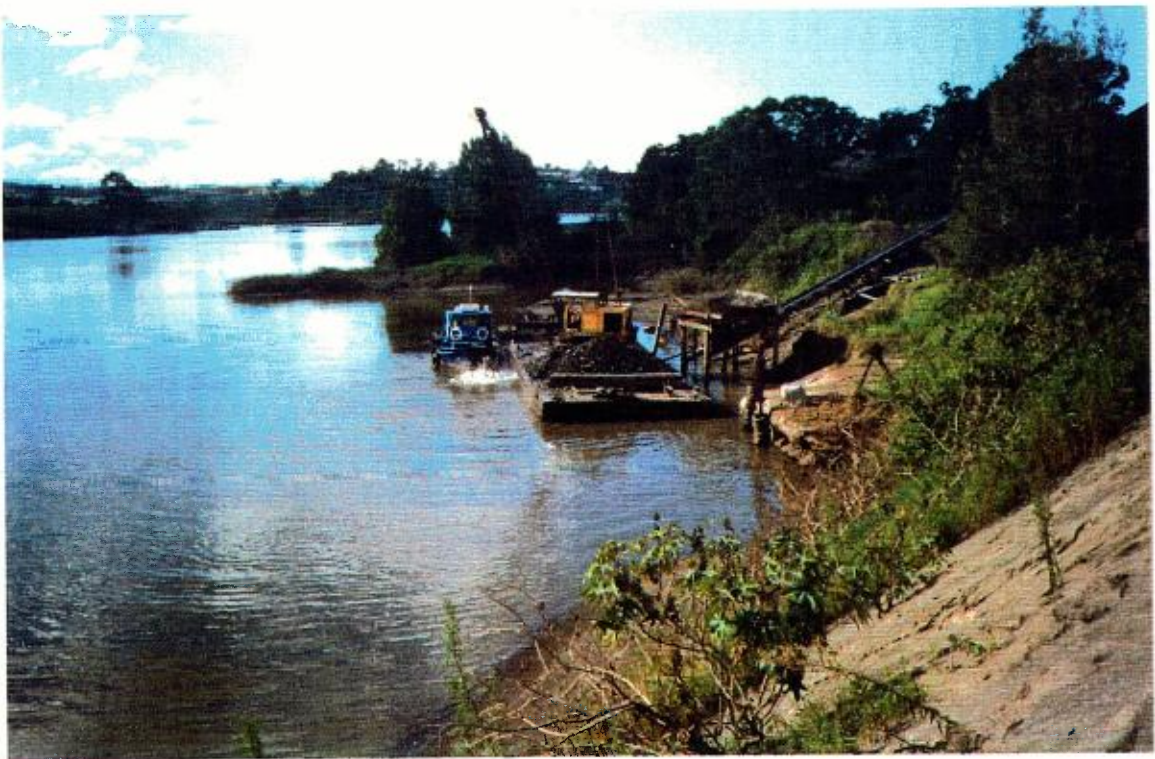


PLATE 4-2 Unloading extracted sand and gravel at processing plant

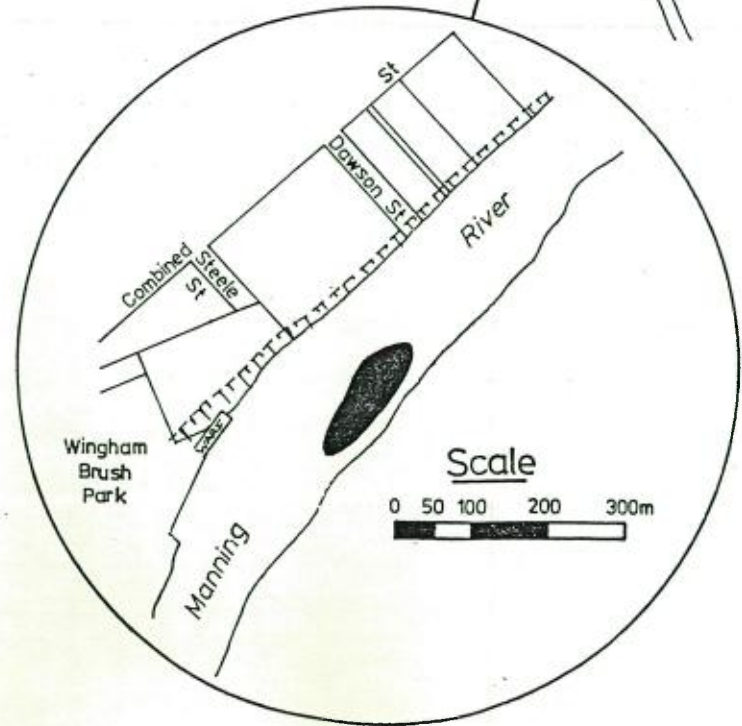
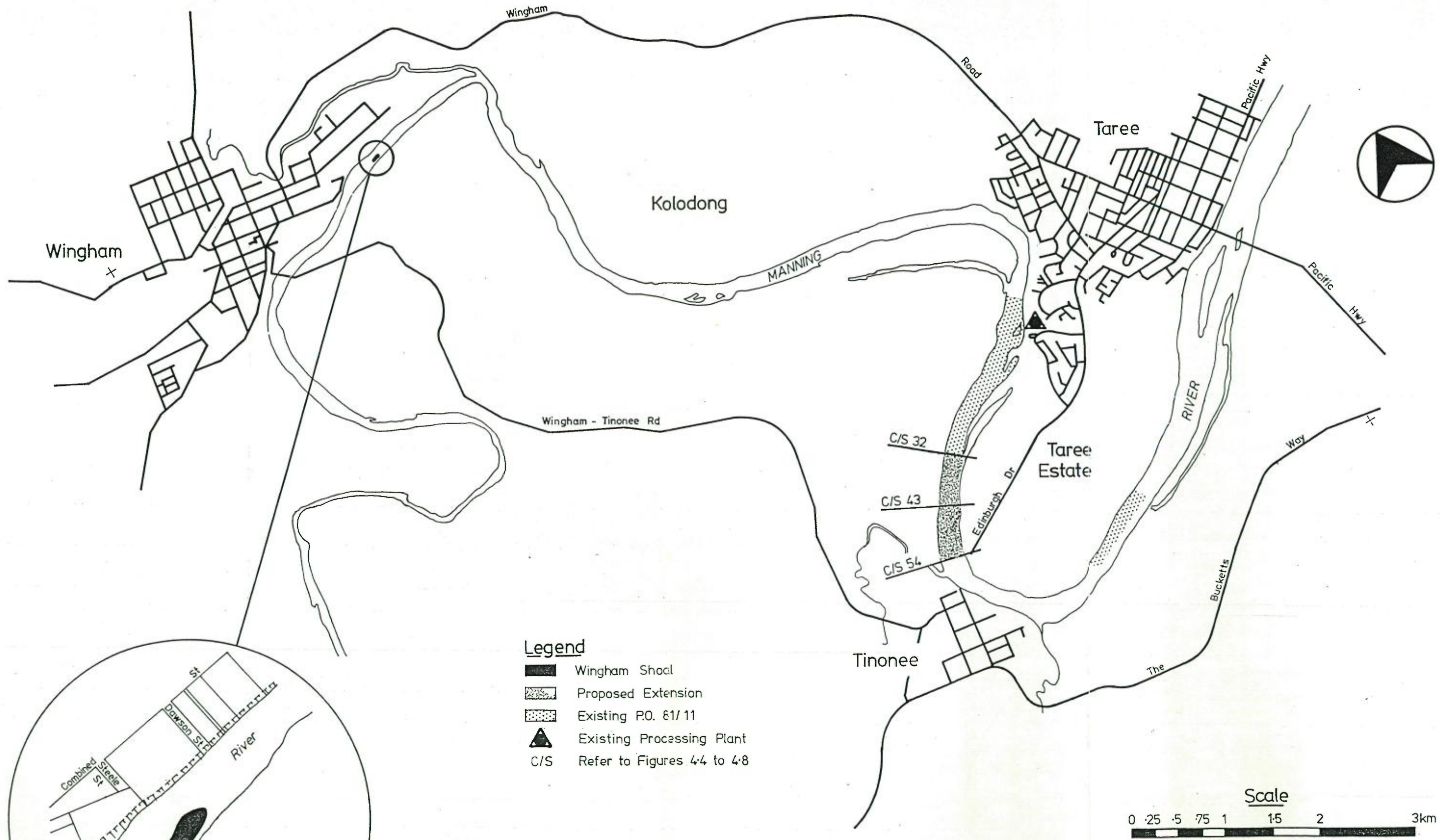
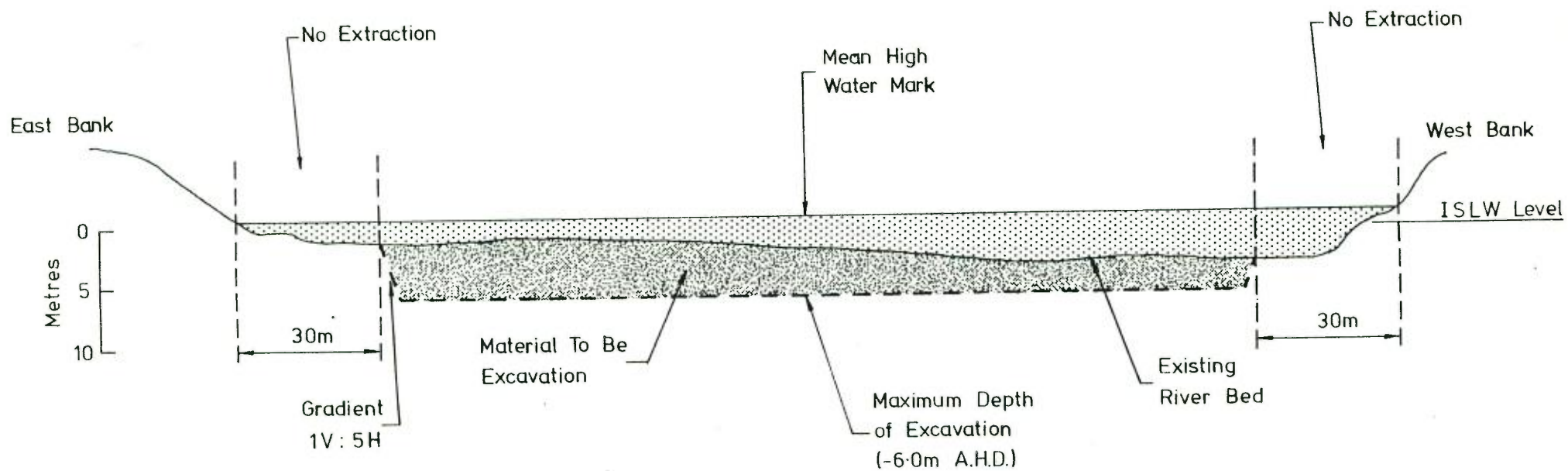
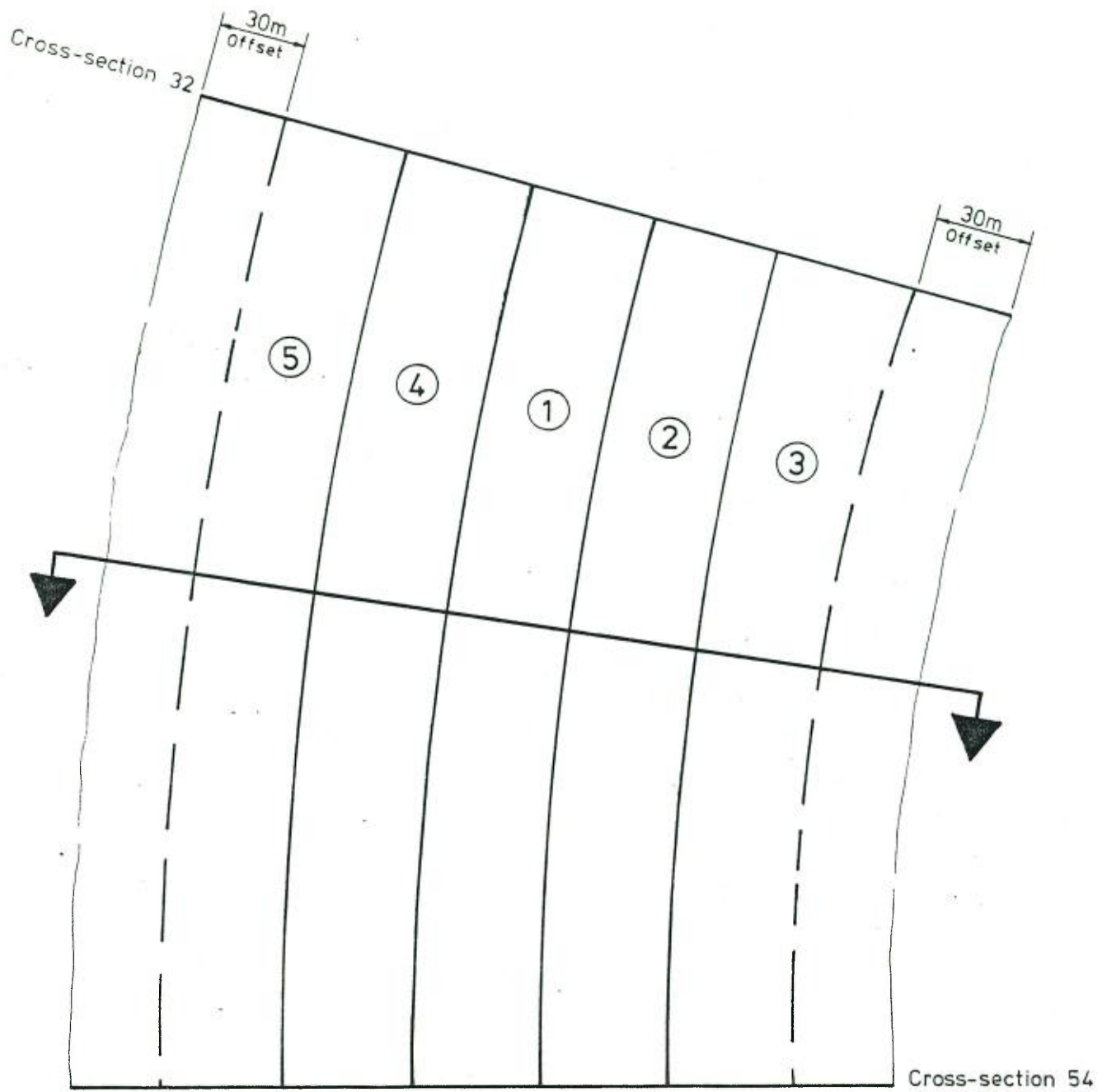


Figure 4.1
Proposed Extraction Areas

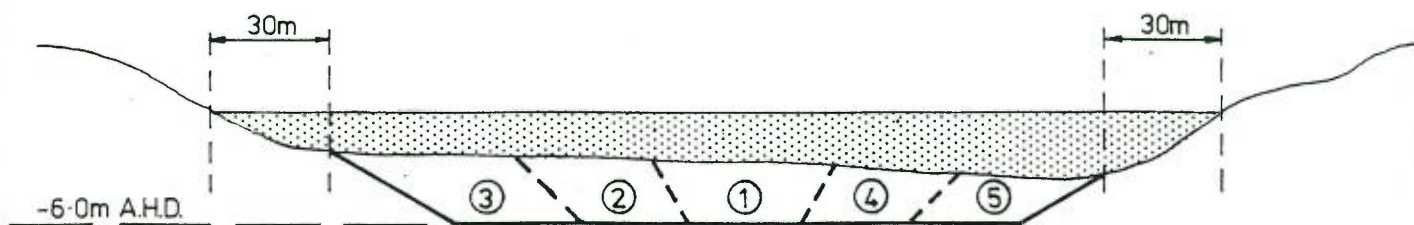


NOTE: • Mean High Water is
0.43m Above 0.0m A.H.D.
• Indian Spring Low Water Level
is 0.4m Below 0.0m A.H.D.

Figure 4.3
Extraction Limits
Typical Cross-section



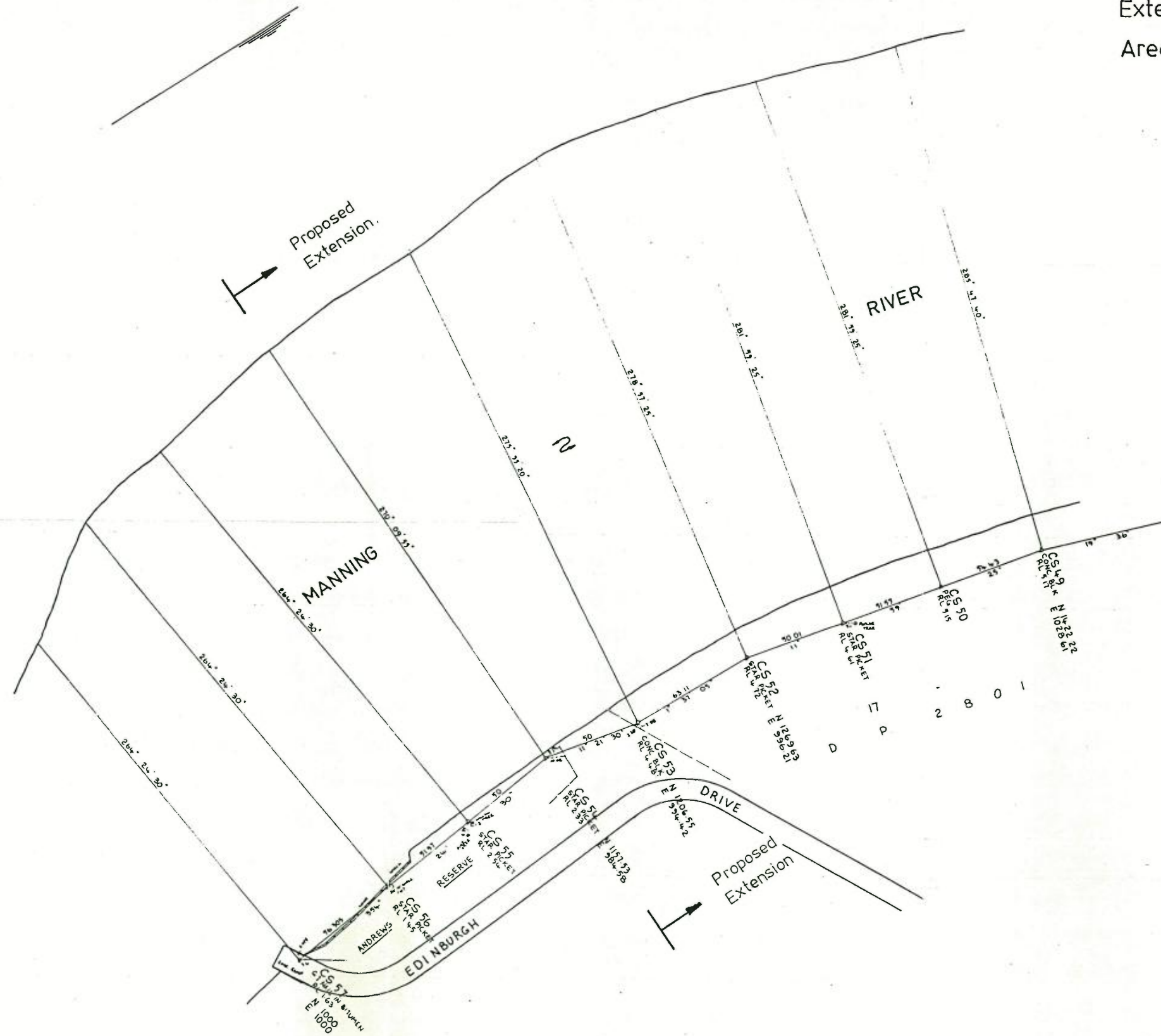
Extraction: Strips worked in numerical order from upstream end.



Typical Cross-section

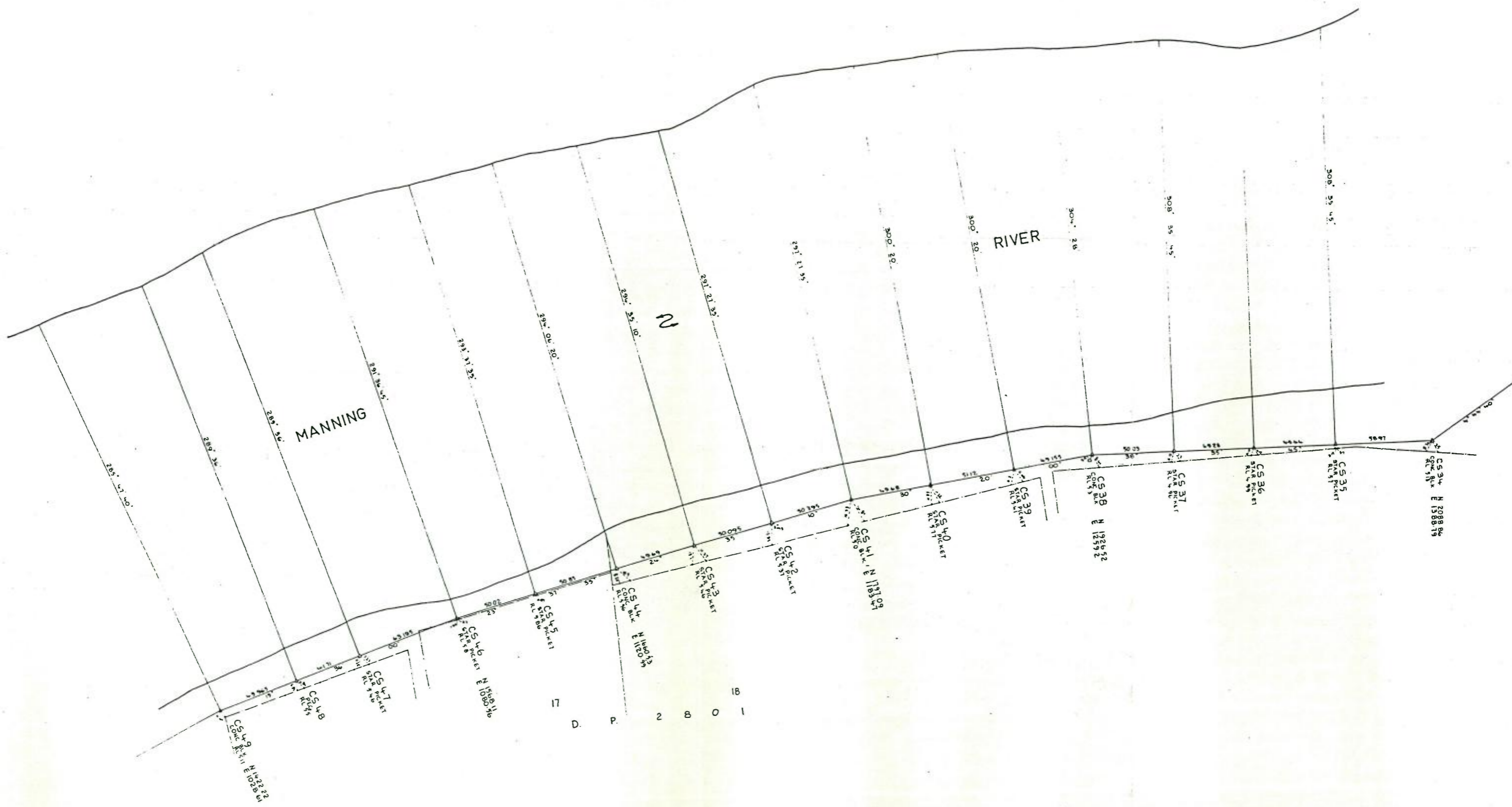
Figure 4.2
Extraction Plan

Figure 4.4
Extension of Extraction
Area.



NOTES	SCALES	HORIZONTAL	VERTICAL	DRAWN	PROJECT	CROSS SECTION DETAIL OF THE MANNING RIVER FOR FARLEY AND LEWERS - TAREE.	DRAWN/CITY/SWIRE	DATE	SHEET 2 OF 4
	HORIZONTAL 1:1000 VERTICAL	CO-ORDINATE SYSTEM ASSUMED MARKS ADOPTED EAST NORTH	DATUM A.H.D. B.M. ADOPTED SOURCE P.L.T. FILES.						
	FIELD SHEETS Date of Survey			PASSED			DEGOTARDI, SMITH & PARTNERS (FORSTER) CONSULTING SURVEYORS & PLANNERS 1st FLOOR, 3 WHARF ST. FORSTER 2428 - (085) 54 7888 - PO BOX 510 FORSTER - 087103 FORSTER 2nd FLOOR, 2428 WHARF ST. FORSTER 2428 - (087) 498 2956 - DDX127 DEE WHF	14-12-88	

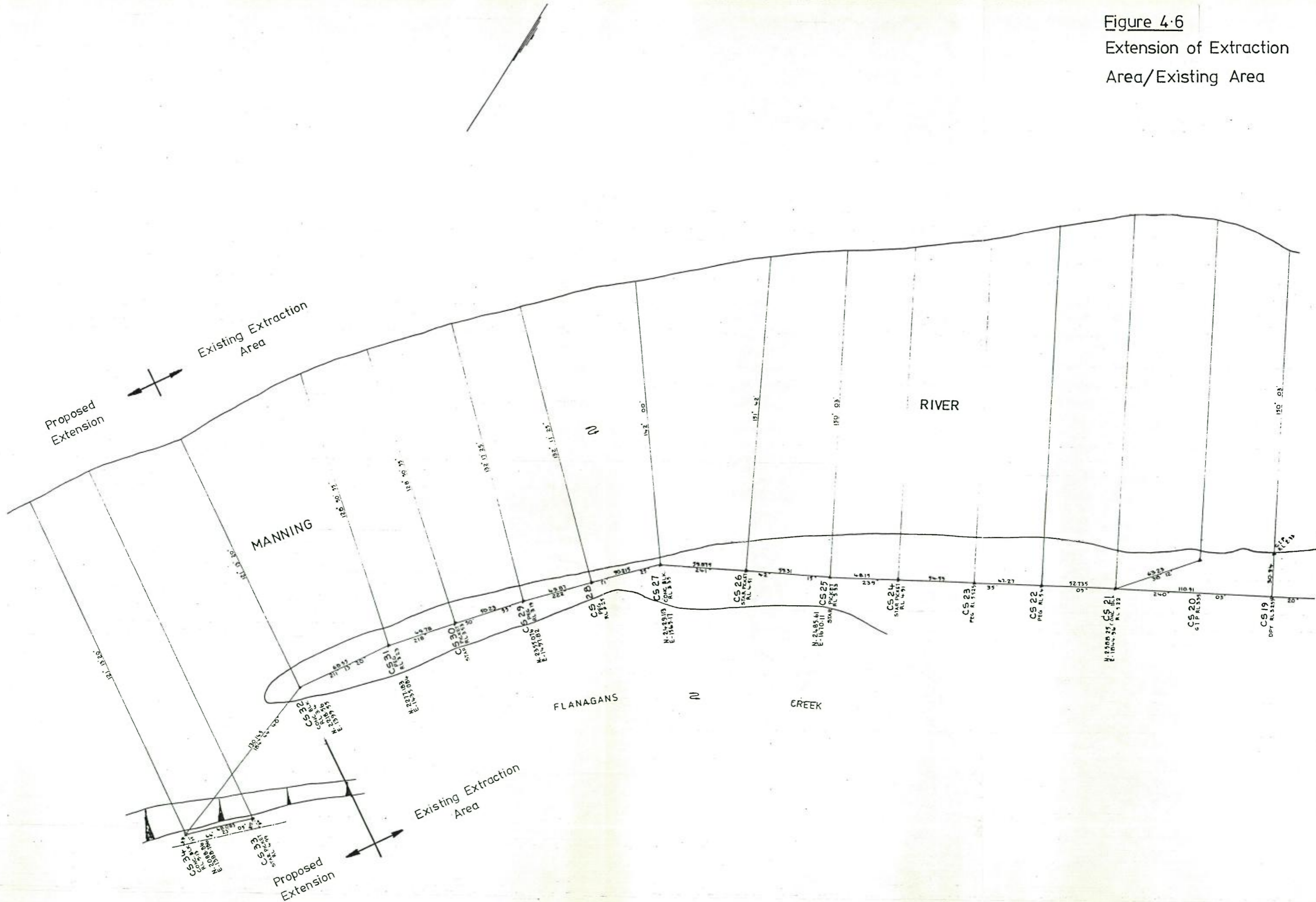
Figure 4-5
Extension of Extraction
Area



17
18
D. P. 2 B O I

NOTES	SCALES		HORIZONTAL		VERTICAL		DRAWN	PROJECT	CROSS SECTION DETAIL OF THE MANNING RIVER FOR FARLEY AND LEWERS - TAREE.	DEGOTARDI, SMITH & PARTNERS (FORSTER)		MUNICIPALITY/SHIRE	SHEET 1 OF 4
	HORIZONTAL 1:1000		CO-ORDINATE SYSTEM ASSUMED		DATUM A. H. D.					CONSULTING SURVEYORS & PLANNERS		GREATER TAREE	
	VERTICAL		MARKS ADOPTED		B.M. ADOPTED					1st FLOOR, 3 WARRAF ST., FORSTER 2428 - (081) 54 7988 - PO BOX 510 FORSTER - 007103 FORSTER		DATE	
FIELD SHEETS		EAST NORTH		SOURCE		2 HERBYA ST., GORDON 2072 - (02) 499 2988 - (03) 27 DEC 1997		14-12-88	408/Rv 7(ii)	PASSED			

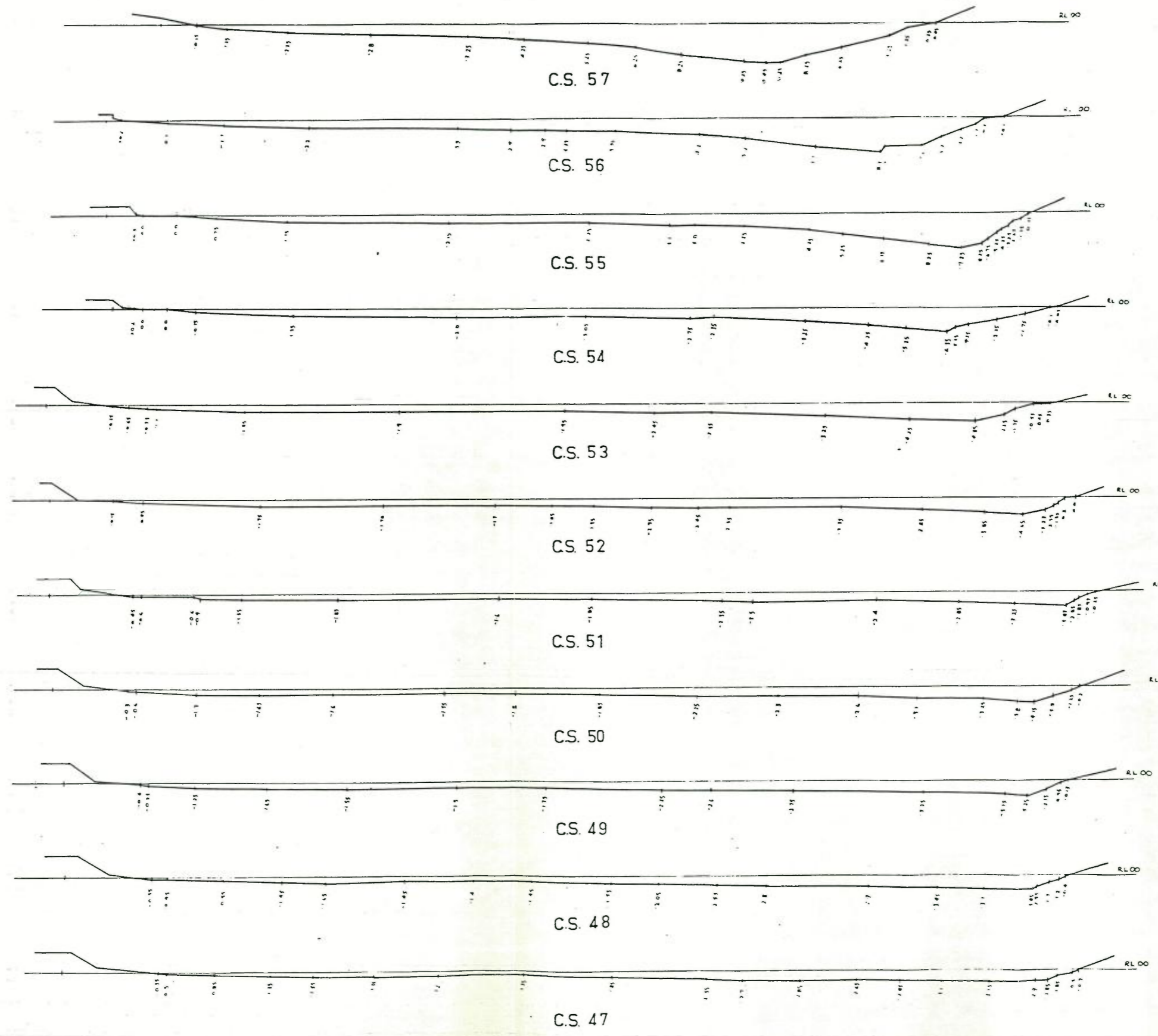
Figure 4.6
 Extension of Extraction
 Area/Existing Area



NOTES	SCALES	HORIZONTAL CO-ORDINATE SYSTEM ASSUMED MARKS ADOPTED: EAST: NORTH:	DATUM A.M.D.	VERTICAL R.L.	DRAWN	PROJECT	MUN./CITY/SHIRE GREATER TAREE	SHEET 2 OF 6
	HORIZONTAL 1:1000 VERTICAL		SOURCE					
FIELD SHEETS Date of Survey			PLOT FILES		PASSED		2-12-88	FILE NO. 4-08/R4.7

DEGOTARDI, SMITH & PARTNERS (FORSTER)
 CONSULTING SURVEYORS & PLANNERS
 1st FLOOR, 3 WILKINS ST., FORSTER 2426 - (082) 54 7988 - PO BOX 510 FORSTER - 24748 FORSTER
 2nd FLOOR, 21 GORDON ST., GORDON 2072 - (02) 498 2988 - 03127 DSE 9847

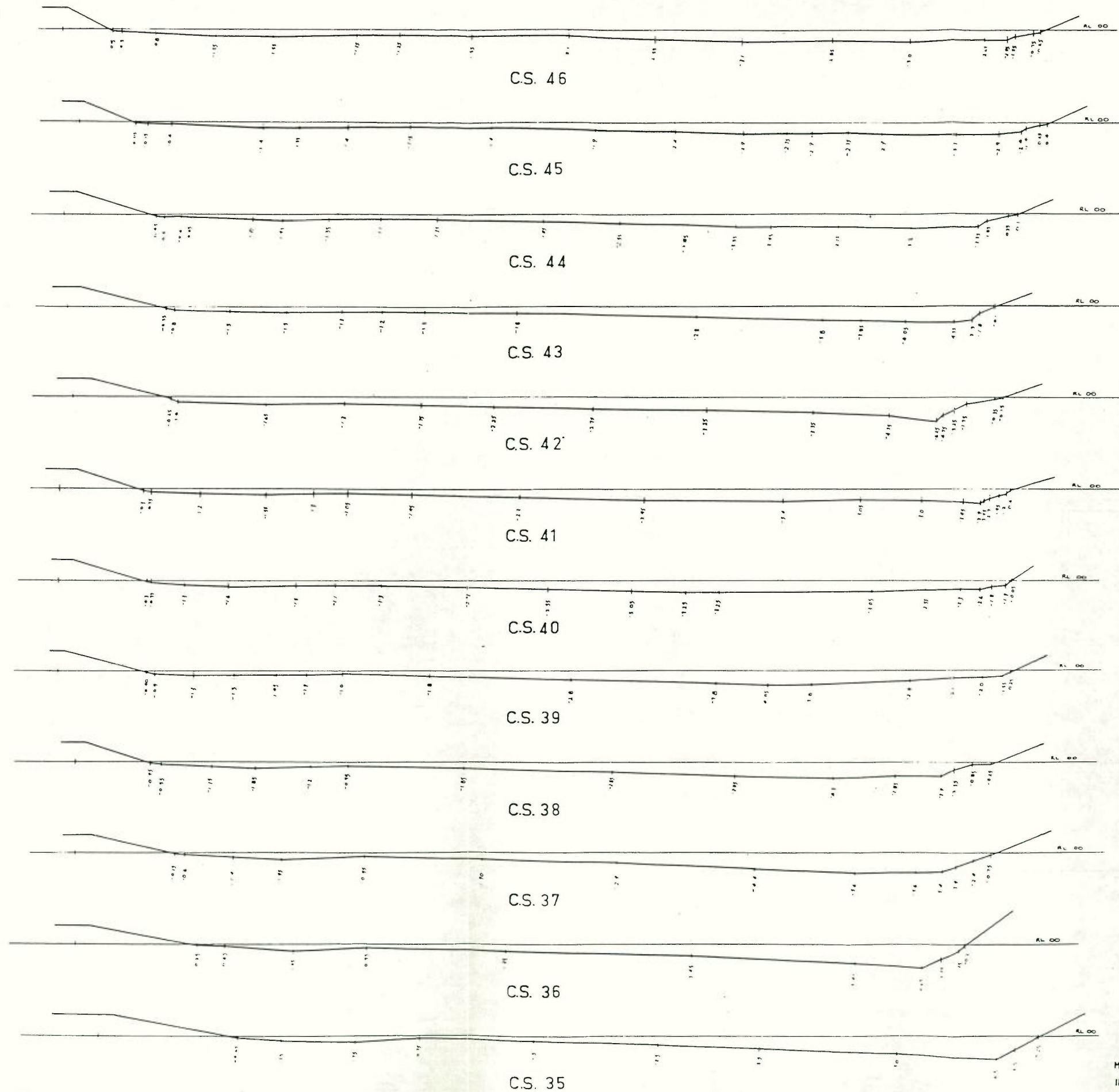
Figure 4.7
 Extension of Extraction
 Area Cross-sections



MEAN HIGH WATER LEVEL +0.43 A.H.D.
 INDIAN SPRING LOW WATER LEVEL -0.4 A.H.D.

NOTES	SCALES	HORIZONTAL CO-ORDINATE SYSTEM MARKS ADOPTED EAST NORTH	VERTICAL	DRAWN	PROJECT	DEGOTARDI, SMITH & PARTNERS (FORSTER) CONSULTING SURVEYORS & PLANNERS 111 FLOOR, 3 WYNDHAM ST., FORSTER 2428 - (085) 54 7166 - PO BOX 510 FORSTER - 027103 FORSTER 2 MERRIMA ST., GORDON 2072 - (02) 498 2965 - DX3127 DEE WHY	DATE	SHEET 4 OF 4
	HORIZONTAL 1:500 (NAT)		DATUM A.H.D. B.M. ADOPTED SOURCE PLDT FILES				CHECKED	
	FIELD SHEETS		PASSED				14-12-05	408/27(2)

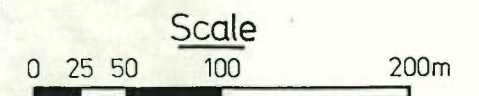
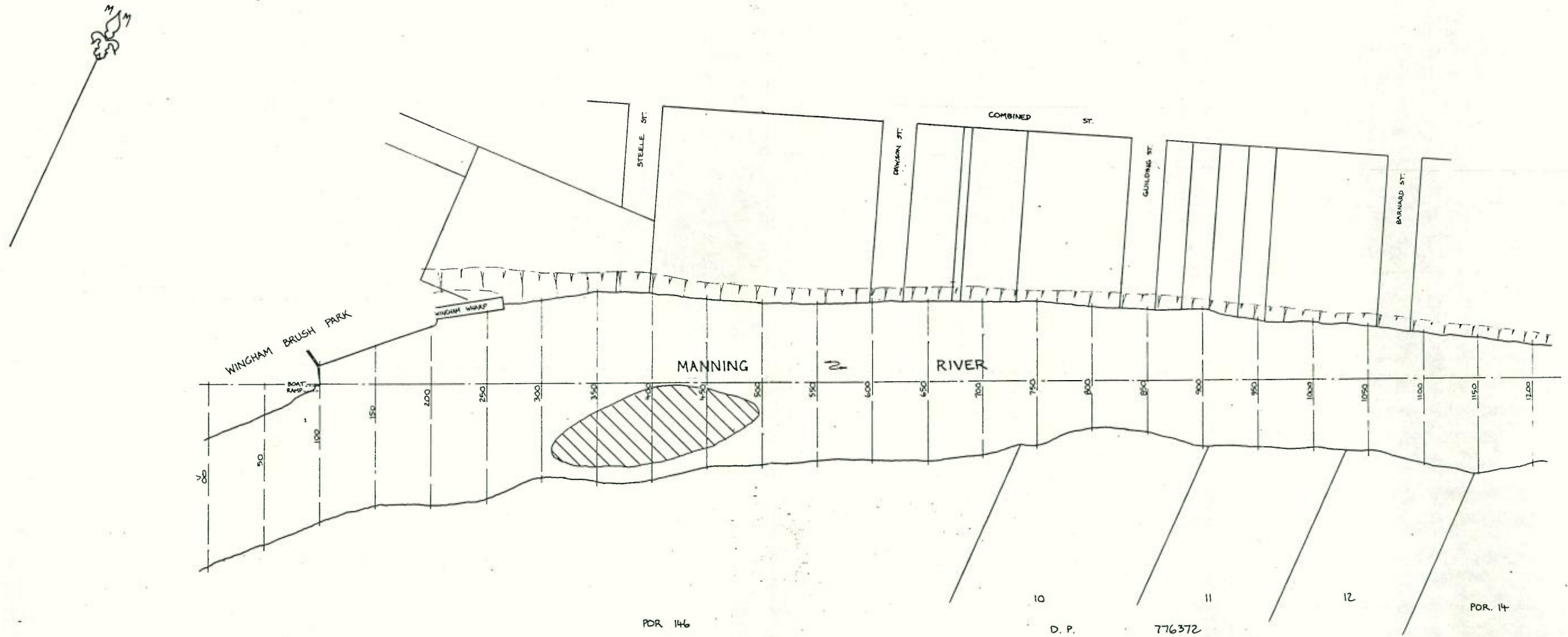
Figure 4.8
Extension of Extraction
Area Cross-sections



MEAN HIGH WATER LEVEL +0.43 A.H.D.
INDIAN SPRING LOW WATER LEVEL -0.4 A.H.D.

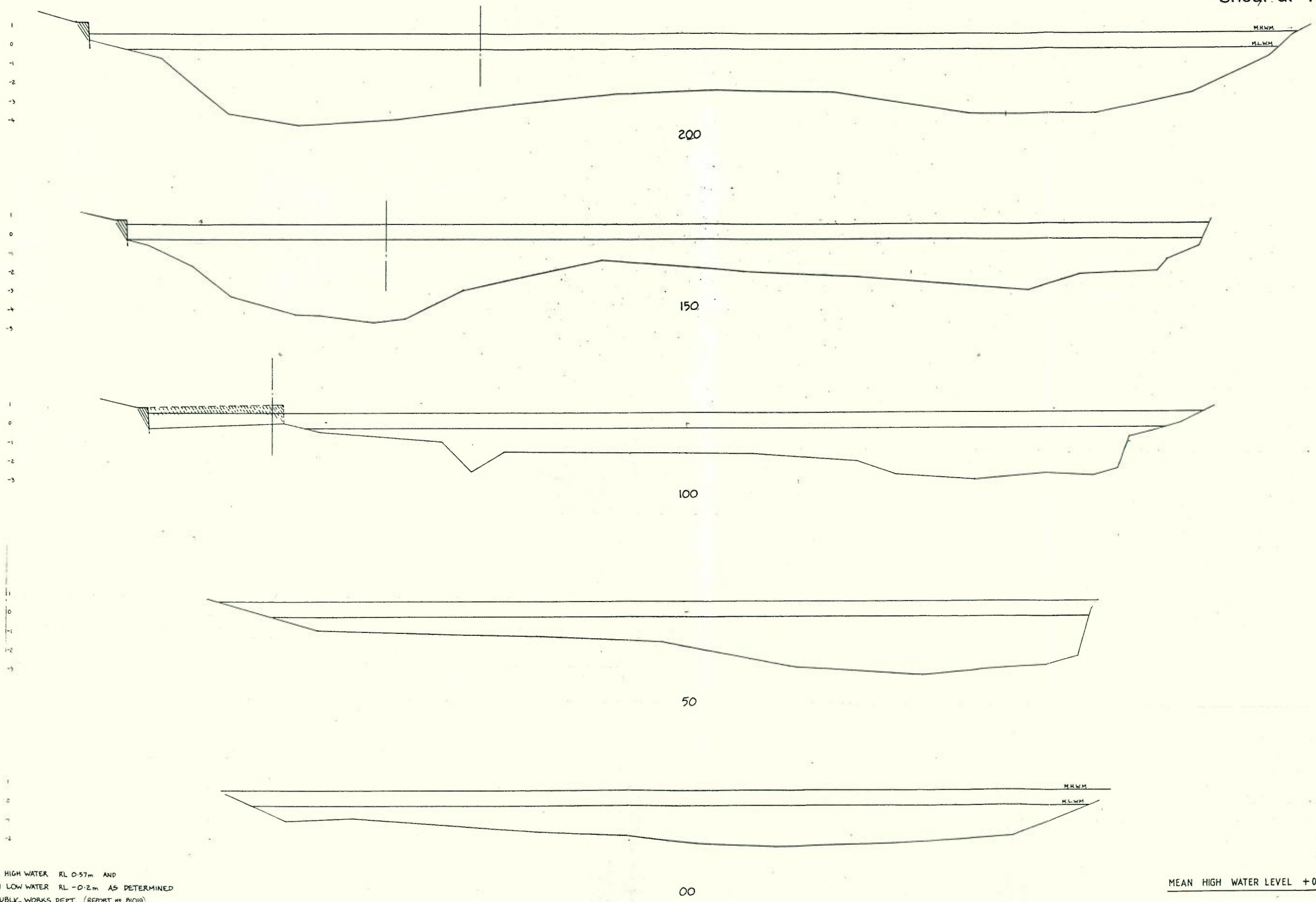
NOTES	SCALES		HORIZONTAL		VERTICAL		DRAWN	PROJECT	DEGOTARDI, SMITH & PARTNERS (FORSTER) CONSULTING SURVEYORS & PLANNERS 1st FLOOR, 3 WAVER ST. FORSTER 2426 - (081) 54 7866 - PO BOX 510 FORSTER - 66103 FORSTER 2 MERRIWA ST. GORDON 2072 - (02) 499 2996 - 613127 DEE WHF	MUNICIPALITY/DISTRICT	
	HORIZONTAL : 1:500 A.A.T. VERTICAL : 1:50		CO-ORDINATE SYSTEM MARKS ADOPTED EAST NORTH		DATUM : A.S.D. B.M. ADOPTED : R.L. SOURCE : PLOT FILES					GREATERTREE	
FIELD SHEETS Date of Survey						CHECKED PASSED		FOR FARLEY AND LEWERS - TAREE		DATE 14-12-88	
										FILE NO 408/4v 7 (4)	

Figure 4.9
Shoal in Manning
River at Wingham



DATUM A.H.D. SURVEYED BY R.L. 27/9/88 FIELD NOTES DESIGNED CHECKED PASSED			GREATER TAREE CITY COUNCIL PLAN OF HYDROGRAPHIC SURVEY ON MANNING RIVER WINGHAM BRUSH			FILE No 88/20	No OF SHEETS	SHEET No 1
					PLAN No G 241			

Figure 4.10
 Cross-sections U/S of
 Shoal at Wingham

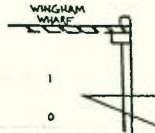
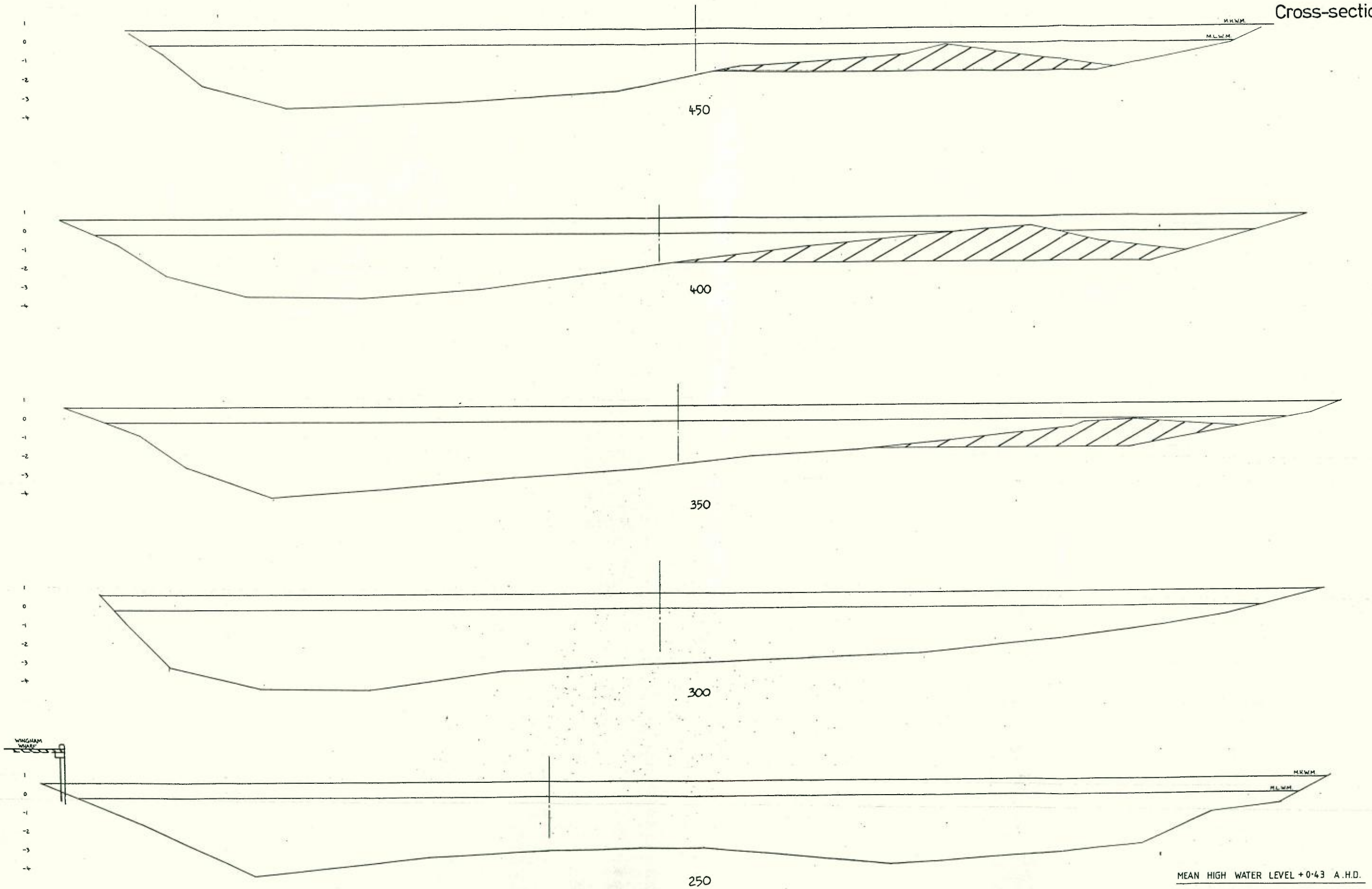


MEAN HIGH WATER RL 0.57m AND
 MEAN LOW WATER RL -0.2m AS DETERMINED
 BY PUBLIC WORKS DEPT. (REPORT NO B1019)
 (LOW WATER ORDINARY SPRING TIDE RL -0.33m)

MEAN HIGH WATER LEVEL +0.43 A.H.D.

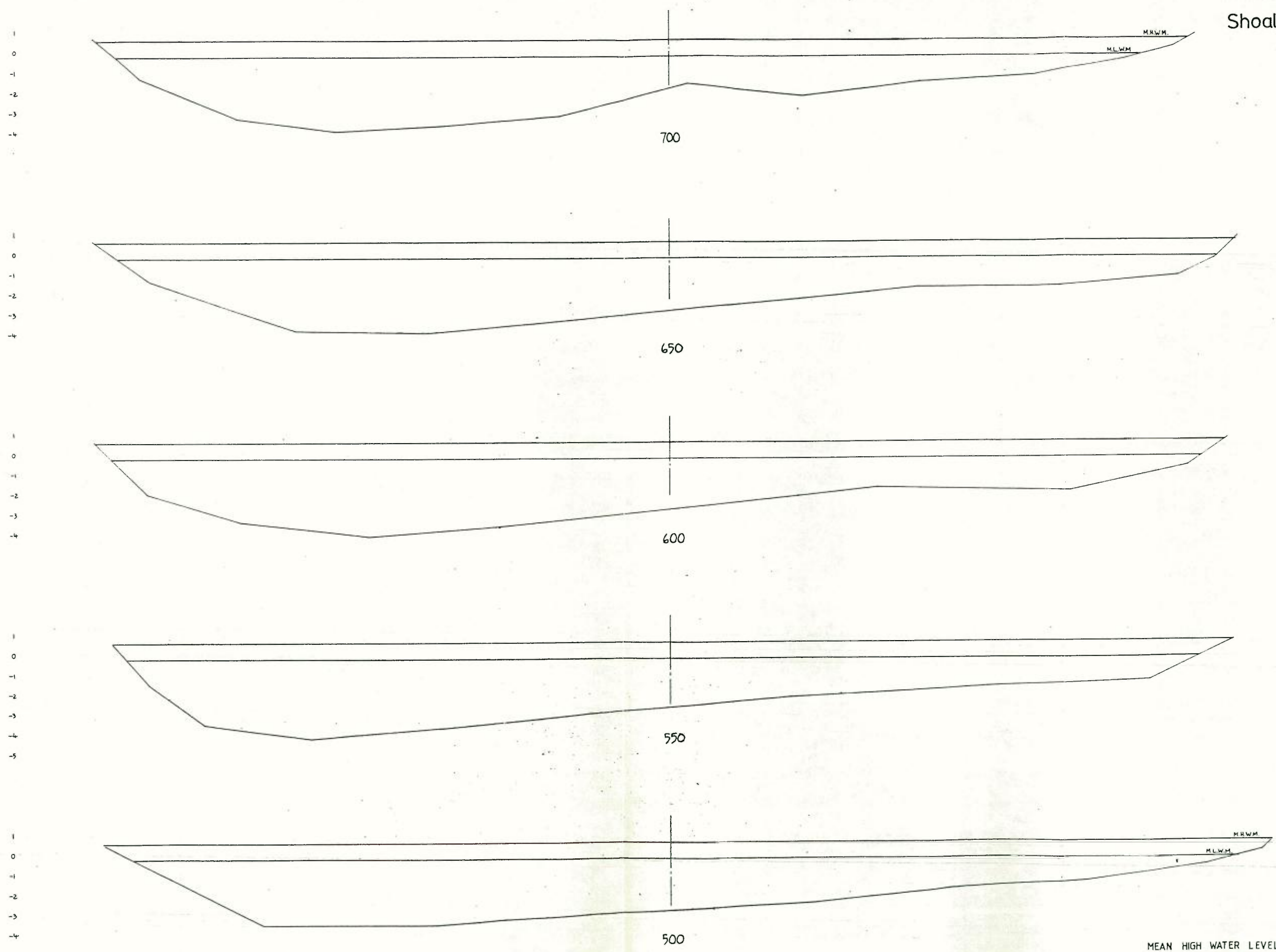
SCALES H 1:250 V 1:100			GREATER TAREE CITY COUNCIL SECTIONS CHN 00-200			FILE No 88/20	NO OF SHEETS	SHEET No 2
DATUM A.H.D.	SURVEYED BY R.L. 27/9/88 FIELD NOTES	DESIGNED CHECKED PASSED						PLAN No G 241

Figure 4-11
Shoal at Wingham
Cross-sections



SCALES H 1:250 V 1:100		GREATER TAREE CITY COUNCIL SECTIONS CHN 250 - 450		FILE No 88/20	No OF SHEETS 3	SHEET No 3
DATUM A.H.D.	SURVEYED BY RL 27/9/88 FIELD NOTES	DESIGNED CHECKED PASSED			PLAN No G241	

Figure 4.12
 Cross-sections D/S of
 Shoal at Wingham



MEAN HIGH WATER LEVEL + 0.43 A.H.D.

SCALES H 1: 250 V 1: 100				GREATER TAREE CITY COUNCIL SECTIONS CHN 500 - 700		FILE No 88/20	No OF SHEETS 4	SHEET No 4
DATUM A.H.D.	SURVEYED BY RL 27/9/88 FIELD NOTES	DESIGNED CHECKED PASSED						PLAN No G 241

5.0 INTERACTIONS, IMPACTS AND SAFEGUARDS

5.1 General

This section identifies and describes the likely interactions and impacts of this proposal and the safeguards and measures incorporated in the proposal to avoid possible adverse impacts on the environment.

The main interactions:- river bed and bank stability, flood behaviour, siltation, water quality, the acoustic environment, aquatic flora and fauna, recreational amenity, visual amenity, navigability and commercial fishing, are discussed in this section and summarized in Table 5.1.

The likely impacts and environmental safeguards are discussed together in this section of the study for the convenience of the reader. There are positive impacts that may result from dredging of the river and where applicable these are also discussed.

There are a number of possible problems that can result from an improperly conducted extraction operation of this type. The proposed extension of the extraction area has been designed so that the optimal site and method is selected to ensure the operation exists in harmony with the environment.

It should be noted that the proposal is an extension of the Company's existing extractive area immediately downstream of the current area, as well as a small channel restoration at Wingham. The same type of equipment will be used that has been used for the last 16 years but the method will be improved through minor modifications. Operations of this type have come under closer scrutiny in recent years and the conditions placed on the Company's current lease by the PWD are conservative to minimize any impacts.

The operations will be closely monitored by the PWD and the Lands Department to ensure the conditions of the Permissive Occupancy are adhered to by the company.

The effects of extraction in the existing extraction area are there to be seen. The impacts are considered to be minimal and the proposed extraction will be worked within even more conservative guidelines.

The hydraulic considerations associated with this proposal have been thoroughly addressed in studies by consultants Winders, Barlow and Morrison (WBM), included as Appendices B and C. Water quality, environmental and other considerations have been addressed also by WBM and

included as Appendix D. The noise impact associated with the proposal has been assessed by Dick Benbow and Associates and included as Appendix E.

TABLE 5.1

SUMMARY OF ENVIRONMENTAL INTERACTIONS

<u>INTERACTION</u>	<u>EXTENT</u>	<u>SAFEGUARDS</u>
River bank stability	Some improvement	Extraction limits - 30m offsets - extraction to 6m below AHD - side slopes 1:5 Even river bed post extraction - tolerance $\pm 0.5\text{m}$ Monitoring - surveyed cross-sections - regular checks with depth sounder Extraction plan - shallow strips removed first
River bed stability	Maintained	As for river bank stability
Flood Behaviour	Reduced flood heights across Taree Estate	Extraction as proposed
Cocumbac Is.	No impact	
Siltation	Amelioration downstream	Extraction as proposed
Water quality	Extraction area - as for existing operation Processing plant - improved	Eliminate river discharge
Dust	Not applicable	

Acoustic environment	Maintained within SPCC criteria	As recommended -water cooled exhaust on new tug -environmental mufflers on all other engines -acoustic panelling around dragline engine
Residential Amenity	Unchanged	Extraction within proposed area Proposed acoustic measures Restricted work hours Plant put away when not in use
Aquatic flora	Extension -no effect	Extraction as proposed
	Wingham shoal -weed on shoal removed	Restore bed to typical section
Aquatic fauna	Temporary impact on small section	Extraction plan Extraction to 6m below AHD Natural regeneration
Recreational Amenity	Improved	Extraction as proposed Restricted work hours
Visual Amenity	Unchanged/ improved	Extraction as proposed Restricted work hours Plant put away when not in use
Navigability	Improved	Extraction as proposed
Commercial fishing	Improved fish hauls	Extraction limits and tolerances

5.2 River Bank and Bed Stability

Dredging of rivers must be carefully designed to avoid, in particular, stability problems with the bed and banks of a river. Poorly designed operations can result in considerable erosion of the river banks and bed leading to loss of vegetation, increased turbidity and increased siltation downstream. WBM have recommended an extraction configuration to ensure such problems do not occur. This configuration is based on the results of numerical modelling of the river, calculations discussed in Appendix B and examination of the effects of the current extraction operation.

Limiting extraction operations to a depth 6m below AHD, according to WBM, will not affect the river morphology or bank stability. Extraction in the current lease has been undertaken to as deep as 8m below AHD, without any discernible problems with river bank and bed stability in or beyond the extent of the extraction area. The river banks in the current extraction area are in good condition.

The proposed extraction configuration limits extraction to a minimum offset of 30m from the river banks. The limit on the current lease is a minimum offset of 15m.

The proposed maximum excavated side slope is 1:5, compared with the current limit of a slightly flatter 1:6. The study by WBM has shown slopes of up to 1:3 to be relatively stable. The excavated slopes during the progress of the operation will be no steeper than 1:3 and more likely 1:5, so that stability during the extraction of the sand and gravel will not be a problem.

The extraction plan will also benefit the stability of the western bank as the first strips worked will be in the shallower middle and eastern sections of the river. This will have the effect of channelling water away from this less stable bank and reducing the high velocities of flow on the outside bend of the river that have been increased by the gravel build up on the eastern side.

The flow velocities after extraction for a flood of similar magnitude to the 1978 flood will be reduced across Taree Estate and along the western bank thereby reducing the erosion potential along the river banks. The increases in velocities upstream and downstream of the extraction area are marginal but there will be no impact on river bank stability because of the rocky nature of the river banks acting as controls, at Tinonee and Taree West.

Major channel bed discontinuities can induce vortices with the potential to cause localized scour. WBM recommend

extraction be undertaken so that a relatively even bed is maintained, within an achievable tolerance of plus or minus 0.5m.

The highly mobile nature of the bed will result in smoothing of any discontinuities in the event of a major flood event, reducing any induced turbulence. However, an even channel bed will be maintained by working to a closely controlled extraction plan. The position of the face being worked will be marked with small marker buoys to ensure pockets of sand and gravel are not missed. In addition the river bed will be monitored on a week to week basis by the use of a depth sounder mounted in the tug, and by periodic surveying of the river, as required by the Public Works Department.

5.3 Effects on Flooding Behaviour

The removal of sand and gravel as proposed will have a beneficial impact on the behaviour of the river under flood conditions.

The maximum flood levels will be reduced by up to 11.5cm upstream of the site in the river and by 10cm typically across Taree Estate and the flood plain on the western side of the river. For a short section of the river downstream of Tinonee the height will be increased by up to 5cm within the river channel only.

The reduction in flood levels across Taree Estate is significant particularly in view of the impacts of flooding referred to in Reference 6, with agricultural damage almost an annual event. In addition there has been urban development at the northern end of Taree Estate.

This report also recommended investigation of possible structural works urgently required in the southern section of Taree Estate to prevent agricultural losses, and investigation of the possibility of raising or relocation of flood effected residences in Taree Estate. The flood mitigation effect of this proposal will reduce maximum flood heights by up to 12cm in the southern section and up to 11cm in the northern section of Taree Estate. Refer to Figure 7.17 in Appendix B.

A single stockpile at the existing processing plant presents a minor obstruction to flood flow along Fig Tree Creek. This stockpile is being relocated. The other stockpiles and ancillary components of the current operation have no discernible effect on flooding.

The proposal will have no impact on the Coocumbac Island Nature Reserve or on flood levels at Taree.

5.4 Sediment Transport and Siltation

The long term average deposition rate of the Manning River between Wingham and Taree is approximately 4500m³/year, as determined by WBM. The sediment transport rate at Wingham is 5000m³/year reducing to 500m³/year in the Taree City Reach.

The section of the river proposed for extension to the extraction area is in the river's zone of maximum deposition. In view of the short section of river to be worked the proposal will have no effect on the sediment transport rate of the river.

The expected infill rate of the proposed extraction may be as high as 4000m³/year including suspended sediment and trapped bedload. Therefore the operation will be in effect a mining rather than a harvesting operation in view of the expected extraction rate averaging up to 58,000m³/year.

The recommended extraction configuration outlined in Section 3.8 has been determined to maintain river bank and bed stability. Siltation in the river downstream of Taree will not be increased but may be slightly reduced by the extracted area trapping some of the sand currently causing siltation downstream.

5.5 River Flow

The proposed operation will increase the efficiency of the river channel resulting in the benefits of flood mitigation, improved bank stability and amelioration of downstream siltation, discussed above.

Extraction from the bed of rivers can lead to saline penetration further upstream, increases in the tidal prism and undesirable changes in the tide levels. However, this will not occur in this instance.

The impact on tidal behaviour at Wingham and Taree is detailed in Section 7.2 of Appendix B where the impact of extraction is assessed for two extreme cases. The impact of the proposed operation will be even less significant.

The impact on tidal behaviour will be negligible with little change in the tidal prism or the maximum and minimum tide levels. Therefore, by working to the limits proposed there will be no need for any further safeguards.

5.6 Water Quality

The proposal will result in no increase in saline penetration to the upstream reaches of the river above Wingham.

Salinity levels will not alter as a result of this proposal although WBM's study in Appendix C indicates small depressions in the bed of the river can assist the benthic fauna by maintaining intermediate buffers of less variable salinity.

The SPCC in its publication "Sand and Gravel Extraction in the Upper Hawkesbury River" (Reference 13), has indicated that a dragline dragging a bucket across the sediment surface to collect the required material suspends fine sediment resulting in turbidity and poor light penetration. The report specifically referred to four dragline operations where the SPCC recommends use of cutter-section dredges to reduce these impacts.

The proposed operation however uses a dragline and clamshell grab so there is no dragging across the river bed although water draining into the river from the grab and barge contains suspended solids.

The proposed operation involves point source dredging on a much smaller scale than that referred to by the SPCC. In addition the relatively coarse nature of the suspended sediment results in a small localised plume in which the sediment rapidly settles out over a short distance.

The current extraction operation has used the same method for the past 16 years without causing turbidity problems. The clarity of the Manning River is considered good and the amount of suspended solids low for all flow conditions according to the SPCC (Reference 14). The SPCC tests revealed a slightly higher but still low suspended solids content in the immediate vicinity of the extraction area that dropped off quickly, at times of low flow.

This can be attributed in part to the discharge from the processing plant also mentioned in the SPCC report. This plant is not a direct concern of this study. Following consultations with the SPCC, Readymix has taken steps to implement measures to make its washing facilities at the plant a closed circuit so that there is no discharge to the river. The SPCC also expressed concern at the dairy wastewater disposal strategies, the impact of urban runoff, and the discharge from sewage treatment plants.

In view of the small plume that rapidly settles out, its localized nature and the SPCC's advice by letter of 25th August, 1988, that the proposal was of no concern to the

SPCC, further controls are not considered necessary.

In summary, the impacts on water quality will be little different from the existing operation except that discharge into the river, discussed above and in other sections of this study, will cease, thereby reducing the impact of the whole operation on water quality.

5.7 Effects of Flooding on Operation

Flooding will have no effect on the proposed operation except to force extraction to cease whilst the water level is up and the flow too swift to work.

5.8 Cumulative Effects

Readymix's extraction operation is the only such operation along the length of the Manning River. Alonbar Pastoral Company Pty Ltd had a Development Application to extract sand and gravel from the Manning River and an alluvial terrace at Charity Creek, approved in November, 1987. The site is approximately 30km by road from Taree and 33km upstream of the proposed extraction area.

Little development work has occurred since approval of the development application. The cumulative effects on the river and environment of both operations, if development at Charity Creek proceeds, will be insignificant because of the separation distance.

5.9 Dust

The extraction operation is a completely wet operation so there will no dust problems. The existing processing plant whilst not a direct consideration, causes minimal dust problems because the plant operates a fully wet process. The access road has been sealed and the plant environs are heavily vegetated. The recent landscaping around the plant will further reduce any dust problems.

5.10 Visual Amenity

The visual impact of the extension of the extraction area in the river will be little different from the current operation. There will be no lasting impact because extraction is carried out below water level. The extraction plant is only on the site for short periods totalling up to 3 - 3.5 hours per day. There are no groynes or fixed dredges and delivery lines as associated with other extraction methods. The plant is moored at the

company's wharf when not in use.

The improvements to the river channel have been shown to improve the bank stability on the western side of the river. This will allow established vegetation to grow to maturity for the betterment of the visual quality along the river.

5.11 Acoustic Environment

The noise impact study shows that without the incorporation of noise control measures the SPCC noise criteria, designed to protect acoustic amenity, will be exceeded at the northern edge of Tinonee, Wingham High School and the Wingham Brush recreation area.

The noise control measures have been designed to reduce noise levels of the plant by 14-16dBA which in all cases will reduce the noise levels well below the SPCC criteria.

The measures being incorporated to reduce the noise levels include:-

- * a water cooled exhaust system on the new tug boat,
- * environmental quality mufflers to be fitted to the exhaust systems of the new anchor winch engines,
- * replacing the dragline exhaust system with an environmental grade muffler,
- * fitting the dragline with sound reducing panels described in Appendix E to reduce the noise of the engine.

Sand and gravel extraction at the extension to the extraction area will be undertaken well within the SPCC criteria.

Possible alternative means of transporting the extracted sand and gravel from the shoal at Wingham are discussed in detail in Section 8.0 of this study. The alternatives would result in noise levels within the SPCC criteria for a recreational reserve, although trucks operating from Picnic Point would be considered a disturbance to the aquatic area.

5.12 Truck Movements

The extension of the extraction area involves no truck movements as all material is transported to the plant on the river by barge.

An alternative to transport the excavated sand and gravel by road from the shoal at Wingham in combination with the

barge is discussed in Section 8. This would involve an increase in truck movements in Wingham along Wynter St and along Edinburgh Drive, Taree. This alternative is not being considered for the reasons discussed in Section 8.

5.13 Flora

No bank vegetation will be removed except the growth on the shoal at Wingham. The only aquatic plants in the proposed extension area are mangroves and reeds along the river margins. According to WBM these mangroves are not expected to survive maturity because of the low salinity of the river at this point.

The Division of Fisheries require buffer zones of 10m around mangrove stands, 30m around seagrass beds and 50m around oyster leases for extractive operations (Reference 8). This proposal includes an offset of 30m from the river banks at water level so that the offset from mangroves will be over 25m. There are no seagrass beds in this section of the river and the nearest oyster leases are approximately 25km downstream.

Similar vegetation and stable foreshores have been maintained along the river margins in the Company's current extractive area despite less conservative criteria i.e. only a 20m offset and extraction to 8m below AHD.

The flora of both sites is discussed in more detail in Appendix D.

5.14 Fauna

Extension of the extraction area will have no effect on the limited terrestrial fauna. The operation is expected to act as a short term stimulus to fish as organisms are released with the disturbance of the river bed.

The coarser gravel is the main site of colonisation of shell fish. The deeper areas of the bed of the existing extraction area after dredging are finer textured although not all the coarse gravel is removed. This results in a small change in the species mix of the benthic fauna because of this reduction in the quantity of the coarser gravel.

However, the reduction in coarser material in the proposed extension will not be as significant because the bed of the river will be left more even and the extraction to 6m below AHD will finish in the same sand and gravel. Therefore material of a similar proportion of coarser gravel will remain in situ.

Normal recolonisation processes after extraction are relatively rapid, being of the order of 3 to 4 months in summer and 7 to 9 months in winter (C. Milligan, WBM, personal communications). On this basis, over the expected life of the operation of approximately 15 years, on average 3% of the whole river bed in this section of the river will be affected at any one time.

Therefore the impact of the extraction of sand and gravel in the extension of the extraction area will be limited in its extent and in time. The fauna of both sites is discussed in more detail in Appendix D.

5.15 Recreational Activity

Extraction from the proposed extraction sites will improve both sections of the river for boating. The shoal at Wingham is a more obvious obstruction that has interfered with boating activities. The reader is referred to the surveyed cross sections, Figures 3.4 to 3.8, for an appreciation of how shallow the river is on the eastern side of the proposed extraction extension.

Visual and acoustic disturbance will be minimized also by the working hours. In addition, extraction will not be undertaken in the vicinity of Andrews Reserve on Saturdays. The dredge plume will be localized and may be noticed by skiers although this is unlikely.

The Andrews Reserve swimming area will not be affected by the proposed extraction. Extraction will cease 80m upstream of this area and the offset from banks will be 30m before extraction commences at a 1:5 slope (11 deg.)

The extraction extension site is part of Taree's most popular waterskiing area and there is potential for some interaction. However, the waterskiers have interacted with the Company's activities in the past without any problems.

In view of the width of the river, being up to 220m wide, the limited speed of travel of the barge, the good sight distance in this section of the river, and the hours of work, the extraction should not adversely impact on the activities of waterskiers.

5.16 Commercial Fishing

The impact on the activities of the commercial fishermen on the Manning River is expected to be minimal. The current extraction area is still used by the fishermen for

netting fish and prawns.

The proposed extraction area contains commercial fish hauls. Section 32 of the Fisheries and Oyster Farms Act protects the interests of commercial fishermen by prohibiting dredging on recognised hauling grounds. However, at a meeting on 29th September, 1988, between representatives of the Manning River Fishermens Co-operative, the Fisheries Division, Winders Barlow & Morrison and Readymix the fishermen indicated they had no objection to Readymix extracting sand and gravel between Peg Leg Creek and the existing extraction area because waterskiing, boating activities and the shallowness of the water resulting from gravel buildup have made the hauls less worthwhile to work.

Extraction to the proposed configuration will improve this section of the river for the fishermen by leaving a shallow shelf from which to haul the nets and overall increased depth of water in the main section of the river channel.

5.17 Control

The Public Works Department and Department of Lands will monitor the progress of extraction from the extension of the existing extraction area, requiring the regular submission of plans of management and detailed survey of the river bed, with cross-sections at 50m intervals, every 12 months and after major flood events.

The survey cross-sections allow the PWD to check the conditions of the Permissive Occupancy are being adhered to and to monitor the effects of extraction.

The base line survey of the proposed section of the river has been completed and plotted. The plans and cross-sections are included as Figures 3.4 to 3.8. The PWD requires the survey to be extended beyond the extraction area .

In addition, Readymix will closely control the operation with a depth sounder mounted on the tug and gauge boards denoting reference levels (to AHD) so that the dragline operator can work to 6m below AHD.

SPCC and Department of Mines and Energy inspectors also make regular inspections of the company's operation.

5.18 Employment

The proposed operation will provide 2 full-time positions employed directly on extraction from the river bed.

The sand and gravel extraction, processing and transporting is an integral operation. A further 8 company positions rely directly on the extraction from the river. A further 2 administrative positions also rely on the existence of the plant. These positions relying on the plant are listed in Table 3.1.

In addition, contract carriers haul from the plant and considerable repair and maintenance work is put out to local engineering and service firms. There is also a flow on effect from the company's practice of purchasing all but the most specialized parts locally.

Table 5.2

EMPLOYMENT ASSOCIATED WITH OPERATION

Tugboat operator	1	extraction operation
Dragline operator	1	extraction operation
Plant operators	2	processing plant
Leading hand allocator	1	processing plant/transport
Truck drivers	4	transport
Quarry manager	1	whole operation
Clerical assistant	1	administration
Area Manager	1	management/sales/transport

	12	

The above positions are existing positions filled by local residents of the Taree area.

5.19 Socio-Economic Impacts

The extension of the extraction area will maintain the current social and economic benefits flowing to the region due to the operation of Company's sand and gravel processing plant. These benefits are not estimates or projections but existing impacts that will be lost if the development does not proceed.

These benefits include reduced impact of flooding, employment, local expenditure, rates and royalties paid, the availability of river sand and other high quality building materials and the cost savings from moderately priced products in close proximity to the primary markets.

In addition, the removal of the shoal from the river at Wingham will be of benefit to the local community allowing greater recreational use of the river and the conduct once again of the Wingham Regatta Association's carnival, with the flow on benefits to local business

5.20 Rehabilitation

There will be no need for any rehabilitation measures. The extraction process will be worked to conservative guidelines controlled and monitored by the Public Works Department, so that the river will be left in better condition with a more efficient channel, more stable banks and greater recreational amenity.

There will be no structures erected. Extraction will not occur within 30m of bank water level so there will be an approximate offset of 25m to any vegetation. There is no seagrass or any other vegetation on the bed that may require compensatory planting.

Natural processes will quickly rehabilitate the river bed fauna with a bed profile suitable for natural recolonisation.

5.21 Energy Requirement

The energy requirements of this proposal is liquid fuel for the tugboat and dragline, both powered by diesel engines.

Generally the dragline and tug are not operated at the same time so that the scale of energy demand for this proposal is not large.

The energy required is to propel the tug while it is pushing the barge to and from the extractive area, and power the dragline when it loads and unloads the barge. The energy requirements of the two four stoke engines used to winch the anchors is insignificant.

Based on current usage and an increased haul distance, the expected annual fuel requirement of the tugboat and dragline is estimated to be approximately 40,000 litres of distillate.

The method used to extract, transport and unload is considered by Readymix, a Company with a great deal of experience in extractive industries, to be relatively energy efficient, particularly when compared with the equivalent loading and hauling with land based equipment. The equipment used matches the scale of the processing

operation.

5.22 Measures to Conserve Energy

- * The Company's existing tug is being replaced with a new boat that has had the various components designed by a naval architect to maximize its efficiency. The engine size has been selected to match the gearbox ratio, the propeller size and the application. The old tug was an ex-fishing boat with illmatched engine and propeller.
- * A shrouded propeller (fixed nozzle) is being installed on the new tug. Sufficient thrust can be obtained with a significantly smaller engine.
- * One of the criteria for selection of the extraction site was that it is as close as possible to the existing processing plant thereby minimizing the energy used in transport to and from the plant.
- * A major proportion of energy expended in extractive industry is in the transport of the finished product to the point of sale. The proximity of the Company's plant to the major markets in Taree reduces the energy consumed considerably. In addition the plant is not a great deal further from Forster than other plants.

6.0 JUSTIFICATION

6.1 Introduction

Readymix has an existing operation, supplying sand and gravel to the local construction industry. It wishes to continue in operation but the limited reserves in its current extraction area make it necessary to acquire an extension to the existing extraction area.

It is important to note the proposed extension is similar in all aspects to the current extraction operation, except that environmental controls and safeguards will be more conservative.

The environmental impacts of the current operation are there to be seen and provide strong supporting evidence to backup the opinions in the various consultant's reports included as Appendices B,C, and D.

The market figures, product range, demands and costs quoted in this study are actual figures based on the existing operations, not projections and estimates based on expectations or tenuous growth statistics.

The predicted impacts of the proposed development are considered to be acceptable in view of the benefits arising, and of a short-term nature. There are several positive impacts related to the development. The expected beneficial impacts of the proposal are considered to greatly outweigh the adverse impacts.

6.2 Economic Considerations

6.2.1 Market

The Readymix processing plant supplying sand and gravel from the Manning River currently provides approximately 85% of the gravel and river sand used in the production of concrete in the Forster/Taree region, the actual quantity varying with the demand for concrete.

The demand for building products of this nature is directly correlated to the prevailing economic conditions. The demand for quarry products has increased substantially in the past 18 months after a period of stagnancy in the local building industry.

The current total demand from the Company's plant is approximately 120,000t per year compared with 87,000t per year in 1988 and 86,000t per year in 1987. The demand for river sand is currently 32,000t per year compared with 21,000t in 1988.

The Mid North Coast of New South Wales is one of the state's fastest growing regions and it is likely development will continue because of the shortage of residential accommodation. Therefore the market for quarry products, used in significant quantities for a variety of applications, is likely to increase.

Readymix cannot increase its processing capacity but its ability to continue to produce is essential if the local area is to retain the supply of the appropriate high quality materials at reasonable cost.

6.2.2 Products and Applications

The sand and gravel extracted from the Manning River is processed in to crushed and graded aggregates nominally 20mm, 14mm, 10mm, 7mm and 5mm in size. Natural riversand is taken off at the start of the processing operation. Crusher grit is produced as a byproduct of the crushing and screening.

The processed material is sold for a range of applications including concrete production, road sealing, water treatment filter material, manufacture of concrete pavers and blocks, fill beneath concrete slabs, pipe bedding, absorption trenches and drains, base for paving bricks and variety of domestic uses.

6.2.3 Concrete Aggregates

River sand and gravels produced have been regularly tested over the past eight years as part of Readymix's quality control programme. The results are summarised in Table 6.1.

The test results indicate the materials satisfy the Severe Exposure criteria laid down in Australian Standard AS2758.1 - 1985: Aggregates and Rock for Engineering Purposes, Part 1 - Concrete Aggregates. The severe exposure condition is the most demanding Australian Standard for concrete aggregates.

The processed river sand and gravel is a particularly hard, dense material with consistently low water absorption (ie low water demand), good strength and durability characteristics, free of organic contamination.

Concrete is a carefully proportioned building material comprised of coarse aggregates (gravels), fine aggregates (sand), cement and water. The proportions are varied to obtain the desired characteristics, strength, workability

and durability, by the most economic combination. The strength of concrete is measured by the compressive stress required to crack standard test cylinders.

The workability of concrete refers to the consistence of the mix such that the concrete can be transported, placed, compacted and finished easily and without segregation of the components.

The durability of concrete refers to its ability to withstand the conditions for which it was designed without deterioration, over a period of years.

TABLE 6.1
SAND AND GRAVEL TEST RESULTS

	AS2758.1 Severe Exposure	Readymix Sand and Crushed Gravel
Particle Density		
- Dry (kg/m ³)	min 2100	2600 - 2630
- SSD (kg/m ³)	min 2100	2630 - 2700
Water Absorption (%)	#	1.1 - 1.8
Sodium Sulphate Soundness (% loss)	6	0.9 - 3.1
Dry Strength (KN)		264 - 295
Wet Strength (KN)	min 100	221 - 250
Wet/Dry Strength Variation (%)	max 25	4 - 16
Los Angeles Value 'B' grading (%)	max 30	16
# - not specified		

The proportions of a concrete mix are varied to suit the properties of the components. The requirements of concrete aggregates, which normally constitute over 60% of the total volume, are generally uniform. The Australian Standard specifies required mechanical and physical properties of the aggregates.

Larger construction authorities usually quote the limits of the Australian Standard, or stricter criteria if required for a particular application, with a qualitative

description of the aggregates required. Typical requirements of the MWS&DB and the Water Resources Commission, now the Department of Water Resources, (References 7,17) include:-

- * preferably rounded or equidimensional
- * clean, tough, durable
- * strong and hard
- * uncoated
- * well shaped, dense, hard

It is worth noting the bulk of the concrete produced in Sydney comprises crushed river gravels and river sand.

Crushed river gravels and natural uncrushed sand from the Manning River at Taree meet the above criteria. Processing in hardrock quarries is generally a dry process and so the aggregates are likely to have coatings of dust. Fine dust is detrimental to the strength and durability of concrete.

The Manning River material is rounded and makes a more workable and therefore more economical mix than crushed hardrock. The material is very clean because of the full washing process at the processing plant. The properties test well within the severe exposure criteria of AS2758.1 - 1985.

6.2.4 River Sand

Natural river sand is an essential component of quality concrete and the river sand produced by Readymix at Taree is the only source of supply in the immediate area. River sand is available from Wauchope and Booral, 80km and 102km from Taree. The approved but undeveloped deposit at Charity Creek will only be capable of satisfying 25% of the market demand.

The importance of this product can be seen by the fact that on the coast south of Sydney where hardrock quarries supply aggregates for concrete Readymix transports river sand over 100km for use in concrete.

A clean sand is important in the production of other products such as paving bricks and concrete blocks and for use as filter media. Whilst it is possible to use a crushed sand there are disadvantages in its use. Construction authorities are also reluctant to use a manufactured sand (Reference 2). The Water Resources Commission specified natural sands, ie river sands, be used in concrete on its projects (Reference 17).

Crushed sands usually have a higher water demand and

therefore higher required cement content than river sands even if they are produced from a superior source rock. Fine dust particles also increase the water demand. The increased water demand means concrete needs additional cement to maintain the design water / cement ratio of the mix.

Crushed sands are typically harsh, with poor particle shape and grading. The use of manufactured sand in concrete results in drying shrinkage and cracking problems. The roughness and splintering shape of a crushed sand also increases the required cement content to achieve the desired workability.

Crushed sands are not suitable alternatives to natural river sands. Without the progress of the proposed development the Taree area will need to import river sand at considerable cost from other areas.

6.2.5 Road Sealing Aggregates

Readymix supplies the major proportion of sealing aggregates used by Greater Taree City Council and by Great Lakes Shire Council at the northern end of the shire. The DMR is also supplied in the Taree area.

The properties of the aggregates supplied by the Company comply with the DMR's Specification for the Supply and Delivery of Cover Aggregate for Sprayed Bituminous Surfacing, MR351. The operation of the Jandra hardrock quarry south of Taree has had an insignificant impact on the market for sealing aggregates although it has been over 2 years since development approval was granted.

It has been argued in previous documents supporting development applications for hardrock quarries that crushed river gravels are inferior for use as sealing aggregates (Reference 15). These arguments need to be put in perspective.

In personal communications in September, 1988, with Mr P. Morris, the DMR Works Engineer, Mid North Coast Division, it was indicated river gravels are suitable road sealing aggregates where the tendency for greater polishing of crushed river gravels and therefore decreased skid resistance is not of prime importance. Further, cost is a consideration when opting for skid resistant sealing aggregates, the extra cost needing to be justified against safety factors. In addition, river gravels possess particularly high strength and hardness and can be used on the first coat of two coat seals where skid resistance is of importance.

These comments are supported by the DMR's own quotes called for sealing aggregates in the period June, 1986, to September, 1988. In this period only 2.3% of the total volume of sealing aggregates for the Mid North Coast Division were specified as "non skid" by the DMR. The quotes are summarised in Table 6.2.

TABLE 6.2
RECENT DMR SEALING AGGREGATE TENDERS
MID NORTH COAST DIVISION

Quote No.	Date	Total (m3)	Non Skid Aggregate Specified (m3)
PM172	Sept 1986	2,100	nil
PM173	Oct 1986	450	nil
PM179	May 1987	2,100	nil
PM187	July 1987	520	nil
PM189	July 1987	150	nil
PM191	Sept 1987	2,970	nil
PM192	Sept 1987	220	220
PM193	Oct 1987	1,365	nil
PM195	Feb 1988	3,570	nil
PM196	Nov 1987	400	nil
PM206	June 1988	2,100	nil
PM212	June 1988	9,450	nil
PM213	June 1988	550	550
PM216	Sept 1988-June 1989	<u>7,500</u>	<u>nil</u>
		33,445	770
			2.3%

The typically higher cost of crushed hardrock sealing aggregates is not justified in most applications. The urban streets of Taree have been sheeted with river gravels for many years even before the material was crushed. The DMR uses crushed river gravels in many instances on the Pacific Highway.

6.2.6 Cost

There will be considerable costs advantages to the community in the continued availability of sand and crushed river gravels at the Company's plant in Taree.

(a) Production Costs

The costs of production of crushed river gravels is typically less than that of hardrock products. River sand is scalped off and undergoes only the washing process. The drilling and blasting operation of a

hardrock quarry adds to the cost of production. There is generally higher operating costs with hardrock operations because of increased wear and tear on machinery, as a proportion of the river gravels is naturally of product size and bypasses the crushers.

The EIS for Wyan's hardrock quarry at Possum Brush in August, 1985, quoted an average sales price of \$14.59 per tonne. This figure with CPI increases would be \$18.82 per tonne in January, 1989. The average cost of Readymix's products in January, 1989, was \$13.47 per tonne and averaged \$13.58 over 1988.

(b) Transport Costs

The cost of transport of sand and gravel is a major component of their cost. The Readymix plant is at Taree within 5 km of the three concrete plants in town and well positioned for servicing the Greater Taree local government area.

The existing hardrock quarry is 18 km south of Taree and the second approved quarry at Possum Brush is 25 km south of Taree. The approved river gravel operation at Charity Creek is 30 km west of Taree. The savings in transport cost for the Company's plant at Taree is significant, being \$2.00 to \$3.70 per tonne.

The proximity of the plant to the Taree market results in considerable sales direct to the public, avoiding the additional cost of double handling products transported and stored at points of sale in Taree. The saving in double handling is of the order of at least \$2.00 per tonne without including a margin for the retailer.

The overall cost saving on equivalent volumes from alternative sources is therefore considerable.

(c) Material Properties

The savings attributable to different properties of hardrock and river gravel are relatively minor. Both materials available locally are suitable for Severe Exposure condition concrete, and whereas there is a small saving in cost from the lower water demand of crushed hardrock, there are savings from the superior workability obtainable with river gravels.

On the other hand the alternative to river sand in concrete is a crushed sand and the cost of compensating for the high water demand, the flakey

and harsh nature of the product and associated problems is high.

6.2.7 Local Industry

The Company's plant is an existing local industry of importance to the local community. Moderately priced building products important to development have been supplied in the area for the past 30 years.

Numerous local businesses benefit from the Company's policy of purchasing all but specialized products, not available locally, from local firms.

In 1988 more than \$300,000 was paid to local firms. In addition the local wages paid to workers at the processing plant in 1988 was more than \$282,000. This infusion of money into the local economy and the associated multiplier effect is significant and of benefit to the local community.

6.2.8 Government Revenue

The State Government will benefit from the revenue raised by the royalty paid to the Lands Department for the sand and gravel extracted from the river. In 1988 \$57,462 was paid in royalties to the Lands Office. Taree Council also levies rates on the Company's Permissive Occupancy in the river.

6.3 Social Considerations

6.3.1 Employment

The Company's sand and gravel plant relies directly on extraction of material from the bed of the Manning River. Ten positions including 4 drivers are employed directly at the plant and a further 2 positions in the Company at Taree are dependent on the operations at the plant. In addition contract drivers and owner-drivers cart out of the plant. Local employment is supported in the numerous businesses contracted or patronized by the Readymix because of the operation of the plant.

Non development as proposed will close down the entire operation with the direct and flow on effects adding to the high level of unemployment in the Taree area. Development will maintain the existing positions.

6.3.2 Recreational Amenity

The survey cross-sections of the proposed extraction area of the river indicate the extent of the buildup of gravel in the river. Removal of the gravel to the guidelines recommended will make this well used section of the river safer for waterskiing and power boat activities, as well as improve the navigability of the river.

Restoring the river channel by removing the shoal built up in the river at Wingham will also remove the dangers presented to boating and improve the recreational amenity.

6.3.3 Flood Mitigation

The flood mitigating effects of this proposal are probably not on the scale envisaged by the P.W.D.'s consultant (Reference 6) but nevertheless are significant and will assist in reducing the impact of a major flood event in the Manning Valley. It should be noted there has not been a significant flood in the Manning Valley since the 1978 flood, a situation which is unusual based on previous records.

7.0 ALTERNATIVES AND NON DEVELOPMENT OPTION

7.1 Alternative Sites

Other sites in the river upstream and downstream of the proposed extension of the extraction area were investigated:-

- * adjacent to Mondrook Point upstream of Taree West. Large reserves of suitable gravel and sand are available in this section of the river. However, the travelling time is greater than the proposed area and involves travelling under high voltage power lines. The hydrodynamic consultant indicated there could be adverse effects on flooding behaviour. This section of the river is in good condition with good depth of water and so there would be greater benefits to be gained from extracting from the proposed area.
- * downstream of Tinonee. There are again large reserves of sand and gravel but the travel time would be greater.

The proposal to remove the recently built up shoal in the river at Wingham has been included in this study to restore the recreational amenity of this section of the river.

7.2 Alternative Sources

The two closest sources of river sand, necessary for the production of high quality concrete, are Booral and Wauchopo, 102 km and 30 km from Taree.

Alonbar Pastoral Company had a development approved in November 1987 at Charity Creek approximately 30 km from Taree. In addition to the disadvantage of the haul distance, the approved capacity of this development will supply only approximately 25% of the local market for river sand. Development of this operation has not proceeded.

There are known deposits of river sand and gravel in Taree Estate and Kolodong. Both deposits would not be suitable for extractive industry for a number of reasons. The Department of Agriculture would be likely to object to such a development on quality agricultural land. There are numerous residences to take into consideration and the visual quality of both sites is outstanding and would be impaired.

Two hardrock quarries near Possum Brush south of Taree,

have received development approval but only one is operating. Neither will be capable of producing a river sand but will provide an alternative to river gravels, particularly in road construction. The quarries involve a haul of approximately 21 km and 25 km to Taree.

Jandra Blue Metal Quarries is currently operating, having received development approval in June 1986, but is restricted to a total annual production of 50,000t per year. This quarry has had no impact on the market for concrete raw materials and minimal impact on the market for road sealing aggregates.

Wyan Holdings Pty Ltd received development approval in July 1987 to establish a hardrock quarry and crushing plant at Possum Brush. Development does not yet appear to have commenced.

These two hardrock quarries will compete with Readymix in a common market for concrete aggregates and in particular road sealing aggregates, but cannot produce a river sand essential for the production of concrete. It is expected the Readymix plant will continue to provide the bulk of the aggregates used in concrete because of the inherent advantages of crushed river gravels. However, market forces will ultimately determine which product is more cost effective.

The Alonbar development and other extractive industry proposals upstream of Wingham will not be capable of producing the quantity of river sand and aggregates required in concrete production in the area.

Development of a quarry to viable production takes a considerable amount of time, particularly with the environmental controls and conditions placed on the other potential developments. This development is essential to maintain continuity of availability of products to the local market.

The hardrock quarries will also compete with each other in what is expected to be a developing market for high quality road base to substitute for the lower quality stabilised ridge gravels currently used in the major roads in the area.

The four developments in total will have surplus capacity for the districts' current requirements but the competition will be healthy and ultimately of benefit to the public. In the medium term failure of this development to proceed will result in the inability of essential quarry products to be supplied locally.

7.3 Non Development

The non-development option could be described as a "lost opportunity" for the Taree district. Lost would be the opportunity to have a form of flood mitigation recommended as urgently required (Reference 6) for Taree Estate and undertaken at no cost to the State Government or Council.

Lost will be the opportunity to maintain the essential supply of riversand. Riversand will not be available in the immediate proximity of Taree with the closest source only capable of supplying 25% of the market demand, being 30km, if Alonbar Pastoral Company proceeds with its development. The only option available will be to import the sand a minimum of 80 km at considerable cost that will be passed onto the purchasers of concrete.

Lost will be the opportunity to maintain the supply of crushed river gravels with their technical and cost advantages for concrete production. In addition the quarry products needed to meet the area's requirements will not be available locally in the medium term and will have to be imported.

There has been considerable public concern and activity endeavouring to have the shoal at Wingham removed. Not proceeding with this development will mean it is unlikely this hazard will be removed and so the recreational amenity and navigability of this section of the river will continue to be impaired.

Not proceeding with this development will be a lost opportunity to satisfy the above with a development in harmony with the environment and satisfying the interests of all sections of the community.

8.0 WINGHAM SHOAL

8.1 General

The proposal to remove the shoal in the river at Wingham has been discussed throughout this study. This section summarizes the various aspects of this proposal.

The removal only of this shoal for channel restoration purposes does not constitute designated development. The processing and sale of the material as proposed, which would seem to be the only means by which the shoal will be removed, changes the operation into a designated development.

8.2 Objective

The objective is to restore the river bed to a more regular channel by removing the buildup of sand and gravel. This will improve the recreational amenity of this section of the river and allow the Wingham Regatta Association to conduct its annual carnival.

The extracted material is suitable for processing at the Company's plant at Taree. The community's interests and Readymix's needs can be met by removal of the shoal.

8.3 Description of the Development

The shoal is a small buildup of sand and gravel of approximately 7,500m³ or 13,000t. The location is shown in Figure 3.1 and the detailed survey in Figures 3.9 to 3.12. It is a recent buildup of river sediment and extends less than half way across the river. It is not a control of the tidal limit.

It is proposed to use the same method, plant and equipment currently operated by the company on its existing Permissive Occupancy adjacent to Taree Estate. These items are detailed in Sections 4.6 and 4.8.

The quantity of material to be removed constitutes a little more than one and a half month's supply of raw feed to the processing plant. However, the distance of the shoal from the plant only allows transport by river of approximately 50% of the plant's current daily requirements.

Therefore, to transport the material by river in the usual way this work would have to be deferred until market demand is half its current level. This may never occur.

There are 3 possible alternatives:-

- (i) transporting the extracted material in a continuous operation by river only, when market conditions are suitable.
- (ii) a combination of river and road transport using the company's trucks. This would involve the barge and dragline extracting material and unloading it onto a grassed area adjacent to the retaining wall on the northern bank of the river. The barge would be used to transport a single load back to the plant at the end of each day. A front end loader would be used to load the material on to the trucks.
- (iii) intermittent extraction to fit in with the company's operations. This would involve river transport only over a longer period as the barge and dragline are available, for example, when the processing plant is undergoing periodic maintenance.

This proposal is not a long term development but should be viewed as a short term restorative activity. The impact of alternative (ii) on acoustic amenity is discussed in Appendix E.

In view of the impacts on the recreational amenity of the picnic area and the practical difficulties involved with using road transport, including additional costs, restoration of the stockpile and loading area, damage to roads and dredging of the river to allow the barge to get close enough to a stockpile area, it is proposed that the removal of the shoal is undertaken in a way similar to alternative (iii). The timing of the work would be by arrangement with the PWD.

8.4 Description of the Environment

Section 4.0 describes the existing environment of the Taree district. Appendices B,C,D and E discuss in detail the relevant environmental aspects.

The shoal supports cumbungi, pondweed and strapweed. The river fauna comprises shellfish and crustaceans listed in Table 4.2, -Appendix D.

8.5 Impacts and Safeguards

The removal of the shoal will restore the river channel to a similar configuration to that upstream and downstream of the shoal.

This will involve removal of the cumbungi, strapweed and pondweed growing on the shoal. The extent of this growth is small and of little significance as the channel is being restored to a more natural state.

This section of the river is an area of accretion so that removal of the shoal should not affect river bank or bed stability. Refer to Appendix C.

The major impact will be short term noise effects during extraction and transport of the material. The Noise Impact Study in Appendix E indicates the noise levels of the dragline and tugboat to be within the acceptable limits for a recreational area but that the truck movements of alternative (ii) could be considered a disturbance to the recreation area.

The road transport method would require partial removal of the buildup of silt and cumbungi adjacent to the retaining wall to allow the barge to get close enough to the bank. This would require the approval of the PWD.

The use of road transport will increase truck movements. The greater impact will be experienced with movements through Wingham and along Edinburgh Drive, Taree. The increase in heavy traffic flow between Wingham and Taree would be of less significance.

Stockpiling and loading from the northern bank of the river may cause some interference to the recreational use of the aquatic area. The area used to stockpile material and load the trucks will be disturbed and will require restoration on completion of the work.

The material in the shoal contains a greater proportion larger sized gravels than the proposed extension at Taree and, in view of the limited depth of extraction, there will be large gravels on which the shellfish can recolonize. Therefore, the impact on the river fauna will only be short term in nature.

8.6 Justification

The removal of this shoal will improve the recreational amenity of the river and make it safer for boating. Efforts to remove the shoal by the Wingham Regatta Association have been unsuccessful. This proposal would seem to be the only means by which this channel obstruction will be removed.

9.0 CONCLUSION

The proposal is, in effect, a continuation of the existing operation, however, even more conservation safeguards are proposed than those to which the Company is currently required to work.

Other positive aspects of the proposal have been identified - reduced flood heights across Taree Estate, improved river bank stability, improved recreational amenity and amelioration of siltation downstream of Taree.

The continued operation of Readymix's processing plant is of benefit to the local community because it supplies river sand not available locally, continued employment of 12 persons within the Company plus the flow-on effects to other businesses, continued local expenditure and moderately priced products available in close proximity to the major markets.

Readymix wishes to continue in operation but the limited reserved in its current extraction area make it necessary to acquire an extension to the existing extraction area.

The extension of the extraction area in the Manning River will permit continuity of production of moderately priced, high grade, building materials. The plant is an important local industry.

In addition, the Company has included in its proposal the removal of a shoal in the Manning River at Wingham that has built up in recent years, interfering with boating and preventing the Wingham Regatta Association from conducting its annual carnival. The Committee and Greater Taree City Council have explored alternative means of removing the gravel buildup without success.

Removal of this shoal will serve a dual function with Readymix extracting approximately 13,000 tonnes of sand and gravel for processing at its plant and the local community will benefit from restoration of the river to a regular configuration that will allow better recreational use of this section of the river.

The proponent has offered to undertake the removal of the shoal because of the social benefits in so doing. This undertaking is not necessary for the success of the dominant proposal but is a voluntary offer by Readymix to assist the local community's recreational need. The programming of this project will be subject to agreement with the Department of Public Works.

Non Development Options

The non-development option could be described as a "lost opportunity" for the Taree district. Lost would be the opportunity to have a form of flood mitigation recommended as urgently required (Reference 6) for Taree Estate and undertaken at no cost to the State Government or Council.

Lost will be the opportunity to maintain the essential supply of riversand. Riversand will not be available in the immediate proximity of Taree with the closest source only capable of supplying 25% of the market demand, being 30km from Taree, if Alonbar Pastoral Company proceeds with its development. The only option available will be to import the sand a minimum of 80km at considerable cost that will be passed onto the purchasers of concrete and filter material.

Lost will be the opportunity to maintain supply of crushed river gravels with their technical and cost advantages for concrete production. In addition the quarry products needed to meet the area's requirements will not be available locally in the medium term and will have to be imported.

There has been considerable public concern and activity relating to the need to have the shoal at Wingham removed. Not proceeding with this development will mean it is unlikely this hazard will be removed and so the recreational amenity and navigability of this section of the river will continue to be impaired.

Statement of Environmental Impact

It is important to note the proposed extension is similar in all aspects to the current extraction operation, except that environmental controls and safeguards will be more conservative.

The environmental impacts of the current operation are there to be seen and provide strong supporting evidence to backup the conclusions of the consultant's reports and conclusion of this environmental impact study and included as Appendices B, C and D.

The various environmental impacts are discussed in detail in Section 5.0 of this study and the relevant consultant's reports are included in Appendices B, C, D and E. These impacts and means of amelioration are outlined in Table 5.1.

The environmental inputs of this development can be summarised as follows:-

- * reduced flood heights across Taree Estate.
- * improved river bank stability and reduction of tendency of river to meander immediately upstream of Tinonee.
- * no effect on river bed stability.
- * amelioration of siltation downstream of Taree.
- * no effect on sedimentation.
- * similar effect on water quality to existing extraction operation i.e. localised increase in turbidity only.
- * no effect on riverine flora.
- * short-term impact on benthic fauna with small alteration in species mix rather than suppression.
- * preservation of acoustic amenity with implementation of proposed control measures.
- * no effect on saline penetration upstream of Wingham.
- * insignificant effect on tidal behaviour.
- * no impact on Coocumbac Island.

The above impacts are of overall benefit to the river and community.

The impacts of the proposed development are considered to be acceptable in view of the benefits arising, and the means to be employed to minimise impacts contained in the extraction plan and specific safeguards. The expected beneficial impacts of the proposal are considered to greatly outweigh the adverse impacts.

Conclusion

The findings of this study are that, with the undertaking of the development as proposed, extraction of sand and gravel can occur in harmony with the environment and the interests of the community. Potential negative impacts have been ameliorated by an appropriate extraction configuration and conservative safeguards (see Table 5.1).

The impacts on the environment can be predicted with confidence from observation and study of the effects of the extraction over the past 30 years on the section of the river adjacent to the proposed site.

REFERENCES

- 1 Australian Standard 2758.1-1985
**Aggregates and Rock for Engineering Purposes
Part 1 - Concrete Aggregates**
- 2 Cement and Concrete Association of Australia 1974
The Design, Control and Characteristics of Concrete
- 3 Connors W.F. 1985
Pioneering Days Around Taree
- 4 Davenport, Campbell and Partners Pty Ltd 1984
Rural Lands Study Within 20km of Taree
- 5 Greater Taree City Council August 1988
Growth of Greater Taree File S23-1
- 6 Laurie Montgomerie and Pettit Pty Ltd 1980
**New South Wales Coastal Rivers Flood Plain
Management Studies - Manning Valley**
- 7 M.W.S.& D.B. 1983
Concrete Manual
- 8 Middleton M.J., Williams R.J., Pollard D.A.
Estuarine Habitat Management Guidelines Draft 1985
Fisheries Research Institute Department of
Agriculture
- 9 Neville, A.M. 1975 Pitman Publishing
Properties of Concrete
- 10 Public Works Department 1980
**Manning River Gravel Extraction Preliminary
Assessment**
PWD Report No. 80031
- 11 Public Works Department
Manning River Flood History 1831-1979
- 12 Soil Conservation Service 1985
Taree District Technical Manual
- 13 State Pollution Control Commission 1984
**Sand and Gravel Extraction in the Upper Hawkesbury
Valley**
- 14 State Pollution Control Commission 1987
Water Quality in the Manning River
- 15 Wyan Holdings Pty Ltd 1985
EIS Proposed Hardrock Quarry and Crushing Plant

- 16 Wallace I. "Benefits Accruing to Society of
Extraction"
Proceedings of Seminar on River Rehabilitation and
Stabilization 1986, Nepean-Hawkesbury Joint Council
River Committee Water Quality Group
- 17 Water Resources Commission 1984
Contract 2950 Split Rock Dam and Appurtenant Works

APPENDIX A

CONSULTATIONS



Department of Planning

The Readymix Group,
Taree Area Office
PO Box 312
TAREE NSW 2430

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX. 15 Sydney

Telephone: (02) 266 7111 Ext. 7590
Fax No: (02) 266 7599

Contact: J Wright

Our reference: 88/1439

Your reference:

Dear Sir,

GRAVEL EXTRACTION, MANNING RIVER, TAREE

Thank you for your letter of 7 June 1988 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. As development consent is required for the proposal and it is a designated development within the meaning of Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, as amended, an EIS must accompany the development application to the Greater Taree City Council. The EIS shall be prepared in accordance with clause 34 of the Regulation and shall bear a certificate required by clause 26(1)(b) of the Regulation (see Attachment No.1).

3. In addition, pursuant to clause 35 of the Regulation, the Director requires that the following matters be specifically addressed in the EIS:

- . Any possible effects of the proposal on the ecology of the Manning River (eg. soil erosion, runoff, water quality, bank stability, siltation) and a description of any proposed measures to minimise impacts;
- . Impacts of the proposal on the recreational amenity of the river (eg. noise, siltation, turbidity);
- . Flooding potential of the site and any possible effects of the proposed extraction on flood behaviour;
- . Possible impacts on the regenerating rainforest at Coocumbal Island;
- . An assessment of the magnitude and economic significance of the resource.

4. Attachment No. 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

5. In preparing your EIS you should approach Greater Taree City Council and take into account any comments Council considers may apply to its determination of the proposal.

6. In addition, the following government agencies should be consulted with respect to this proposal and appropriate documentary evidence of such consultation should be provided in the EIS:

- . State Pollution Control Commission;
- . Department of Lands;
- . Public Works Department; and
- . Department of Agriculture and Fisheries.

7. Should you require any further information regarding this matter please do not hesitate to contact us again.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'R Mason', with a small arrow pointing downwards from the end of the signature.

R Mason
Acting Manager, Assessments Branch
As Delegate for the Director

DEPARTMENT OF ENVIRONMENT AND PLANNING
ATTACHMENT No.1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS.

In accordance with Part V of the Environmental Planning and Assessment Act, 1979, an environmental impact statement (EIS) must meet the following requirements:

Pursuant to clause 57 of the Environmental Planning and Assessment Regulation, 1980, as amended:

(1) An environmental impact statement referred to in section 112 (1) of the Act shall be prepared in written form and shall be signed by the person who has prepared it.

(2) The contents on an environmental impact statement referred to in subclause (1) shall include the following matters:-

- (a) a full description of the proposed activity;
- (b) statement of the objectives of the proposed activity;
- (c) a full description of the existing environment likely to be affected by the proposed activity, if carried out;
- (d) identification and analysis of the likely environmental interactions between the proposed activity and the environment;
- (e) analysis of the likely environmental impacts or consequences of carrying out the proposed activity (including implications for use and conservation of energy);
- (f) justification of the proposed activity in terms of environmental, economic and social considerations;
- (g) measures to be taken in conjunction with the proposed activity to protect the environment and assessment of the likely effectiveness of those measures;
- (g1) details of energy requirements of the proposed development and measures to be taken to conserve energy;
- (h) any feasible alternatives to the carrying out of the proposed activity and the reasons for choosing the latter;
- (i) consequences of not carrying out the proposed activity.

The EIS must also take into account any matters required by the Director of Environment and Planning pursuant to clause 58 of the Regulation, which may be included in the attached letter.

The EIS must bear a certificate as required by clause 59 of the Regulation.

DEPARTMENT OF ENVIRONMENT AND PLANNING
ATTACHMENT No.2

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR AN EXTRACTIVE INDUSTRY.

A definition of extractive industry may be found in paragraph (n) to Schedule 3 of the Environmental Planning and Assessment Regulation, 1980, (as amended). These industries are operations undertaken for the purpose of winning sand, gravel, clay, turf, soil, rock, stone or similar substances. The definition of extractive industry specifically excludes coal, petroleum or minerals which are prescribed under the Mining Act, 1973. Extractive industries may take the form of dredging operations, quarrying operations, turf farms or various forms of land excavation etc. Processing of extracted material on the same site as the winning of the material may also constitute an extractive industry.

Extractive industries have prompted considerable public controversy in the past since, among other things, they affect visual amenity, generate heavy vehicle movements, raise dust and cause disturbance through noise and blasting. This is the prime reason for designation of extractive industries under the Environmental Planning and Assessment Act, 1979.

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for extractive industries. It is intended to assist the preparation of the EIS. However, it is the applicant's responsibility to identify and address as fully as possible the matters relevant to the specific development proposal in complying with the requirements for EIS preparation (see Attachment No.1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of an extractive industry. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and where appropriate be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the consent authority (usually the Council) and the Department of Environment and Planning to properly understand the environmental consequences of the proposed development.

1. Description of the proposal.

The description of the proposal should provide general background information on the location and extent of the works proposed, an indication of adjacent developments, and details of the site, land tenure, zonings and relevant forward planning proposals and any other land use constraints.

The EIS should address the compatibility of the proposal with any regional strategy for extractive industries in the area and with the provisions of the Local Environmental Plans for existing and proposed development.

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the processes involved (highlighting any proposed crushing or blasting), disposal of wastes, landscaping and site rehabilitation. A description should also be provided of associated operations such as the transport of materials and use of the end product if likely to have environmental implications.

Particular details that may be relevant include:

- . Characteristics and economic significance of the resource
- . Possible availability of alternative resources.
- . Quantity of materials to be extracted.
- . Methods of extraction / plans of operations.
- . Details of any blasting and/or crushing.
- . Effects of vibrations.
- . Type of machinery and equipment to be used.
- . Expected life of the operation.
- . Number of persons to be employed.
- . Hours of operation.
- . Details of necessary stockpiling.
- . Access arrangements - truck routes, truck numbers etc.
- . Site drainage and erosion controls.
- . Proposals for rehabilitation.

2. Description of the Environment.

This should provide details of the environment in the vicinity of the development site and also of aspects of the environment likely to be affected by any facet of the proposal. In this regard, physical, natural, social, archaeological and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development.

3. Analysis of Environmental Impacts.

Environmental impacts usually associated with extractive industries are listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them.

- . The flow of any affected rivers or watercourses.
- . The effect of the extraction on the sediment transport rate of any affected rivers or watercourses.
- . The bed and bank stability of any affected rivers during and after completion of the operations.
- . Any possible siltation, sedimentation or downstream effects of the operation.
- . Any likely cumulative effects of the proposed operation when considered together with other operations in the vicinity.
- . Details of floods and any likely effects of the operation on flood liability of surrounding lands.
- . The possible effects of flooding on the operation.
- . Effects on flora and fauna.
- . The agricultural viability of the landholding.
- . Likely noise/vibration disturbance caused by the operations, including transport operations, on nearby residences.
- . Other impacts of trucking movements, including access over railways and onto highways.
- . Dust nuisance likely to be caused.
- . Effects on water quality of nearby watercourses.
- . Disposal of waste material.
- . Effects on the visual environment.
- . Any likely affectation of sites of Aboriginal archaeological or European heritage value if located in the vicinity of operations.

In addition, any potential for hazard or risks to public safety and any proposals to monitor and reduce environmental impacts should be included.

4. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- . The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- . The Soil Conservation Service regarding appropriate erosion control and rehabilitation procedures;
- . The Department of Agriculture if prime agricultural land may be affected by the proposal; and
- . The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State; the National Parks and Wildlife Service if aboriginal places or relics are likely to be affected.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.



AC:JS



Public Works Department

COFFS HARBOUR OFFICE

Mr. G.B. Reid,
Area Manager,
The Readymix Group,
P.O. Box 312,
TAREE. NSW. 2430

359 High Street,
Coffs Harbour Jetty N.S.W.

Postal Address:
Box J63 P.O.,
Coffs Harbour Jetty, 2450
CR846 (150)

Our reference:

Your reference:

Telex: 166808

Fax: (066) 52 0405

Telephone: (066) 52 0411

Contact: Mr. Caruana

Dear Sir,

Proposed Sand and Gravel Extraction, Manning River


Reference is made to your letter dated 26th July 1988 regarding matters which are required by the Department to be addressed in an E.I.S. for sand and gravel extraction in the Manning River. These are as follows :

1. A proper metes and bounds survey of the proposed area to be dredged which complies with the following :
 - a) The origin of co-ordinates of the survey to be related to cadastral or other official survey.
 - b) Cross sections to be extended 200 metres upstream and downstream of the proposed areas to be undertaken at no more than 50 metre intervals.
 - c) Cross sections to be extended to both banks of the river and shall show the local Indian Spring Low Water and Mean High Water Spring Levels.
 - d) Soundings to be taken at changes in grade and/or every 20 metres.
 - e) The boundary of proposed dredge areas to be clearly shown on the plan together with all proposed depths of dredging and side batters.
 - f) Dimensioned drawings of any proposed structures and including groynes together with a plan showing their location on site.
 - g) The proposed method and area in which any dredge waste is proposed to be discarded is to be clearly indicated on the survey plan.
2. Estimation of realistic yields after appropriate allowances for offsets from river banks, stable batters and proposed maximum depths. The preparation of an extraction plan showing proposed annual cumulative extraction of the shoal for the period of operation. A prediction should be made of the likely infill rate of the dredged area.

Proposed Sand and Gravel Extraction, Manning River

3. An estimation of the sediment budget of the river at the proposed extraction site and immediately upstream and downstream. The effects of extraction on sediment transport and its implications to bed and bank stability at the site, upstream and downstream.
4. An examination of the effects the extraction may have on any structures including the traffic bridge and any utility services.
5. The effects of the extraction on the estuary's tidal prism, tidal flows and saline intrusion.
6. An examination of historical changes to the bank and bed of the river in the vicinity of the proposed extraction particularly as a result of major floods.
7. Details of the effects on flooding of the dredging, stock pile area and any associated structures (including any groynes etc) are required. The impact on existing development of any changes in flooding patterns should be addressed.

Yours faithfully,


A. GRIFFITHS
Regional Engineer
Coffs Harbour



Department of Agriculture

REGION I



Mr. Graeme Reid,
Readymix Taree,
P.O. Box 312,
TAREE. 2430

North Coast Agricultural Institute
Wollongbar 2480

Our reference:

DL:cb

Your reference:

Telephone: 240...
STD: 066

1st July, 1988

Dear Sir,

Further to our telephone conversation yesterday, I have enclosed a copy of the following documents to aid the preparation of your environmental impact statement.

1. Agfact FO.3.1 Trees and streams
2. Agfact F2.0.1 Mangroves
3. Agfact F2.3.1 Estuaries - their ecological importance
4. Estuarine Habitat Management Guidelines (Draft)

There are three general areas of investigation to which your consultant should direct his/her attention, as follows:-

1. Water quality
2. Fish habitat disturbance
3. River bank stability

I would suggest that your consultant contact me, when your plans have been further developed, in order to address specific areas. Such a contact will avoid unnecessary expenditure on unimportant components.

I trust the above information is of assistance. The Department will specify any necessary conditions on your development following an assessment of the Environmental Impact Statement.

Yours faithfully,

D. Leadbitter
Biologist, Habitat Management Fisheries



State Pollution Control Commission



The Area Manager
The Readymix Group (NSW)
PO Box 312
TAREE NSW 2430

New South Wales
Government Offices
117 Bull Street
Newcastle West 2302
P.O. Box 5268D 488G
Newcastle West 2302 2300

Our reference: 271173A1 CH:SS

Your reference:

Telephone: (049) 26 9711
Telex: AA 28110

Dear Mr Reid

25 AUG 1988

We refer to your letter of 27 July 1988 and subsequent inspection of your premises by one of our officers in connection with the planned expansion of your gravel dredging operations. The verbal advice given that the Commission has no concerns regarding this matter is now confirmed.

As a result of the inspection of your premises and discussions on the discharge of process water from the plant we understand that the company is now investigating measures to either reduce the sediment load in this discharge or to eliminate the discharge altogether.

We thank you for your co-operation in this matter and look forward to your early advice as to the outcome of these investigations.

Yours faithfully

B M Gibbs
Regional Manager
Hunter & North Coast
for Secretary



Lands Office Taree



Department of Lands

The Readymix Group,
Taree Area Office,
P.O. Box 312,
TAREE. 2430

Valley Fair Centre, Victoria Street, Taree
P.O. Box 440, Taree, 2430

Our reference: TE81 H 825

Your reference:

Telephone: (065)
52 0811
Fax 52 0874

Dear Sir,

Consent to the Lodgement of Development Application

The Minister for Natural Resources, being responsible for the administration of the Crown land described in the schedule hereunder, has consented to the lodgement of a development application over that land pursuant to the Environmental Planning and Assessment Act, 1979.

This consent is subject to the following stipulations:

1. It does not imply the Minister's approval of the development proposal.
2. The granting of a Crown tenure should not be presumed. This will be investigated independently by the Crown Lands Office.
3. Development on the land should not be commenced without the consent of the Minister being first obtained.
4. Before the Minister can approve the development proposal evidence will be required that it meets the requirements of all relevant authorities.
5. Development works approved will be subject to any further conditions that may be imposed by the Crown Lands Office.

A copy of this advice should accompany lodgement of the development application and reference to other relevant authorities.

Applicant/s: THE READYMIX GROUP.....

Schedule of Crown Land: VACANT CROWN LAND - MANNING RIVER BED.....
(Area shown by red edge on attached diagram)

Crown Tenure Applied For: PERMISSIVE OCCUPANCY.....

Description of Development Proposed: GRAVEL EXTRACTION.....

Yours sincerely,

Regional Manager.



Lands Office Taree



Department of Lands

Valley Fair Centre, Victoria Street, Taree
P.O. Box 440, Taree, 2430

Our reference: TE81 H 825

Your reference:

Telephone: (065)

52 0811

Fax 52 0874

The Area Manager,
The Readymix Group,
Taree Area Office,
P.O. Box 312,
TAREE. 2430



Dear Sir,

8 DEC 1983

The Readymix Group - Proposed Extension of Area
for gravel and sand extraction from the
Manning River

Receipt is acknowledged of your application for extension of your Permissive
Occupancy 1981/11 Taree.

Further action on your above application will await Greater Taree City
Council's determination of your Development Application.

Yours sincerely,

M. Lynch
For Regional Manager

Tel (049) 26 5111
Telex AA 28761
Fax (049) 26 4746
Telegraph MARBOARD NEWCASTLE

Maritime Services Board
Chr Scott & Newcomen Sts
PO Box 653
NEWCASTLE 2300

File No.

AEC:SV
Your Ref:

Office Contact:
A E Crebbin
Telephone (049) 265111

11 August 1988

Mr Graeme Reid
Area Manager
The Readymix Group
PO Box 312
TAREE NSW 2430

Dear Sir

Re: Gravel Extraction from Manning River

Further to your letter dated 28 July 1988, the Board wishes to apologise for the delay in replying. In regards to your application we wish to inform you that the Board can only grant official approval to a formal application made through the appropriate authority.

The Board has no navigational objections to this proposal subject to compliance with Standard Conditions 1,2,3,18,19,22-26 inclusive, as attached.

Yours faithfully



A E Crebbin
REGIONAL OPERATIONS OFFICER
HUNTER & NORTH COAST

MARITIME SERVICES BOARD
STANDARD CONDITIONS FOR PERMISSIVE OCCUPANCIES:
OYSTER LEASES, ETC.

- (1) The Tenant shall not be exempted from the provisions of the Management of Waters and Waterside Lands Regulations - N.S.W. and shall at all times comply with the requirements of all Acts and Regulations administered by the Maritime Services Board.
- (2) The Tenant shall at all times comply with any directions given by the Board or an officer of the Board in regard to painting, lighting or use or alteration of any structure as may from time to time be required in the interests of safe navigation, equitable use of and conservation of waterways and the prevention of pollution.
- (3) Area of tenure shall include only that area below high water mark covered by the actual structures plus the berthing area.

DREDGING (General)

- (18) All operations shall be carried out in accordance with the Board's Acts and Regulations and any special conditions which may from time to time be required.
- (19) Only anchors and mooring arrangements approved by the Board shall be used and plant not working is to be hove clear of navigation or to the bank in restricted areas.

The lights and shapes to be displayed by vessels, plant and pipelines associated with dredging operations are as prescribed in the Navigation (Collision) Regulations 1983, Rule (d) (i) (ii) and (iii), or as otherwise directed.

No outlying wires, cables or pipes shall be used unless with the approval of the Board.

DREDGING (General) cont'd.

- (22) Any required depth shall be evenly maintained and the bottom left clear of debris, rubbish, potholes, etc. No slope to be steeper than 3 in 1.
- (23) No dredging shall be permitted closer than 9m from any shore, jetty structure or navigation mark.
- (24) Any licensed structure or occupation and/or apparatus licensed by the Board, if affected by dredging operations, shall be moved, re-aligned temporarily or permanently, re-built or replaced with additional equipment, if required, to the Board's satisfaction and without cost to the licensee.
- (25) Dredging shall be carried out so that no loss of depth is caused in adjacent waterways.
- (26) No dredged material shall be deposited in any lake, river or waterway.



Soil Conservation Service



The Area Manager,
Readymix Group,
P.O. Box 312,
TAREE NSW 2430

P.O. Box 182,
TAREE NSW 2430

3rd August, 1988

Contact: J C PALMER

Our reference: 129

Your reference:

Dear Sir,

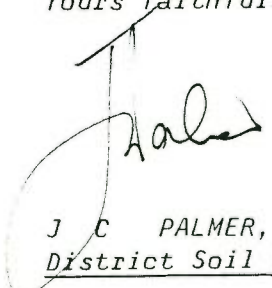
Gravel Extraction - Manning River

We are in receipt of your letter dated 28th July, 1988, outlining your proposal to prepare an E.I.S. in applying for an extension to your gravel extraction operations.

This Service has no authority nor responsibility for any matters concerning major rivers or water courses, be they tidal or non-tidal. As such we have little interest in this proposal.

The Soil Conservation Act, however, prohibits the destruction of trees within, or within 20 metres of the banks of the Manning River. Any proposal to remove or destroy trees must be covered by an Authority from the Catchment Areas Protection Board.

Yours faithfully,


J C PALMER,
District Soil Conservationist

jcp/jpe



Department of Minerals and Energy

Mr G Reid
Area Manager
Taree Area Office
The Readymix Group
TAREE NSW 2430

8-18 Bent Street
Sydney
Postal Address:
GPO Box 5288
Sydney NSW 2001
Telex AA74875
Facsimile: (02) 233 7017

Our reference:

L88/0411

Your reference:

For further
information ring: J Brownlow

Telephone: 231 0922
Extension: (067) 737289

Dear Sir,

PROPOSED EXTENSION TO GRAVEL EXTRACTION OPERATION MANNING RIVER, TAREE

I refer to your recent request for advice on the above proposal. Preliminary advice has previously been sent directly from the Department's Armidale office.

Sand and gravel are not classified as minerals under the Mining Act, 1973, and hence this Department has no statutory responsibility with respect to their extraction, apart from the responsibility under the Mines Inspection Act (1901) for ensuring the safe conduct of mining operations. However, the Department is the principal government authority responsible for assessing the State's resources of sand gravel, and other construction materials and for advising State and local government on their planning and management. The Department therefore reviews and comments on proposals for the extraction of these materials wherever possible.

The areas which are being considered for extraction by your company are not affected by any current mining or exploration titles issued under the Mining Act, and are not subject to any applications for titles.

This Department would support extraction from the subject areas in principle provided that it can be undertaken in an environmentally acceptable manner.

A copy of an information leaflet on environmental impact assessment procedures for mining proposals, prepared by this Department for the guidance of proponents, is enclosed. Although this leaflet is concerned specifically with proposals to mine substances which are prescribed minerals under the Mining Act, 1973, much of the information it contains is equally applicable to proposals involving materials not covered by the Mining Act. Section 3 of the leaflet discusses the preparation of environmental impact statements for mining proposals and lists a range of specific issues which should be addressed. Issues of particular concern to this Department in assessing extractive industry proposals include the following:

- * Characteristics of the resource - geology, size, and quality.
- * Exploration methods and results (including references to any relevant supporting documentation).
- * Quantity of material to be extracted.
- * Rate of extraction.
- * Expected life of the operation.
- * Proposed methods of extraction, plan of operation (including staging).
- * Rehabilitation procedures, during and after completion of extraction operations.
- * Proposed final use of site.
- * Disposal of waste materials.
- * Location and size of stockpiles.
- * Transport routes.
- * Assessment of noise, vibration, dust, and visual impacts, proposed measures to minimize these impacts.
- * Any likely cumulative impacts of the proposal when considered together with similar operations in the vicinity.
- * Alternative sources, and their availability.
- * Justification for the proposal - the need for the proposed operation in a local or regional context.

Because extractive proposals are commonly controversial and are subject to close public scrutiny, the environmental impact statement should be carefully prepared and contain all the relevant information a consent authority requires to make a fully informed decision. This Department would be pleased to comment on a draft copy of the environmental impact statement if you so desire. This will help ensure that the document is adequate and accurate before being placed on public exhibition and hence avoid the need for subsequent changes and ultimately facilitate processing of the application. In any event, it would be appreciated if a copy of the completed environmental impact statement could be forwarded to the Department.

If you have any further queries relating to the proposal, please contact Mr J Brownlow of the Department's Armidale regional office (067) 737289).

Yours faithfully,

N L Markham
for Director-General

IP/MF

23rd November, 1988.



National Parks and Wildlife Service

PORT MACQUARIE DISTRICT



P.O. Box 61
Port Macquarie 2444

Our reference: SL/SP
PM: F209
Your reference:

Telephone: 83 5518
STD: 065

9th August, 1988

Area Manager,
The Readymix Group
Taree Area Office
P.O. Box 312
TAREE 2430

Dear Mr. Reid,

Re: Gravel Extraction from Manning River

Thank you for your letter informing the Service of the intended areas for sand and gravel extraction. At this stage the Service has no objections to your proposal. We would appreciate a copy of the E.I.S. and the opportunity to fully assess potential impacts on Coocumbac Island Nature Reserve.

Susan Luscombe,
RANGER
for DIRECTOR



Department of Agriculture

REGION I



North Coast Agricultural Institute
Wollongbar 2480

Our reference:

Your reference:

Telephone: 240.....
STD: 066

Mr. Graeme Reid,
The Readymix Group,
P.O. Box 312,
TAREE NSW 2420

13 September, 1988.

Dear Sir,

RE: PROPOSED EXTRACTION OF SAND AND GRAVEL FROM
THE MANNING RIVER AT TAREE

NSW Agriculture & Fisheries is in receipt of your letter and provides the following information:

1. There are no agricultural issues to be taken into account.
2. As per our letter of 1 July, 1988, your consultant, Mr. Chris Milligan of Winders, Barlow & Morrison has been in contact with Mr. Duncan Leadbitter of this office to discuss the biological aspects of the Environmental Impact Statement. I understand that Mr. Milligan will keep you informed of what investigations are necessary.

Please contact Mr. Duncan Leadbitter on (066) 240 394 if you require further information.

Yours faithfully,

Brian Scarserrick

BRIAN SCARSERRICK,
Regional Director of
Agriculture & Fisheries

per JFW

11, Phillip Street
Water Division, 24 Rankin Drive,
Waratah 2298
Postal Address:
P.O. Box 300, Newcastle 2300

Area Manager
The Readymix Group
Taree Area Office
P O Box 312
TAREE 2430 NSW

Telephone (049) 57 8511
Fax (049) 57 8515
Extension: 682

Your Ref:

Our Ref: PS/RE/N/AW:GF
File No: 643/963/5
643/96F/5
643/866/5

Dear Sir,

132kV TRANSMISSION LINES 963 AND 96F
66kV TRANSMISSION LINE 866
PASSAGE OF BARGE AND DRAGLINE BENEATH
TRANSMISSION LINES ON THE MANNING RIVER

I refer to your letter of 28th July 1988 regarding the passage of machinery beneath transmission lines on the Manning River.

The Commission has three transmission lines within the area indicated on your map. These are two 132kV wood pole lines and one 66kV wood pole line as described above. The approximate position of these lines is indicated on your map by their voltage rating.

Transmission lines number 96F and 866 have insufficient minimum clearance to the water to allow the passage of your dragline in the fully extended position. Also the clearance from the conductors to the water level will vary depending on the level of the river and the operating conditions of the line. It is therefore requested that in all circumstances the boom should be in the down position while moving the dragline under the Commission's transmission lines.

Yours faithfully

R O CALDWELL
REGIONAL ENGINEER

/ /

APPENDIX B

**HYDRAULIC & GEOPHYSICAL
INVESTIGATIONS**

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1.0 INTRODUCTION

1.1 BACKGROUND

The Readymix Group presently operate a sand and gravel extraction operation within the Manning River, west of Taree. Deposits of material within the existing permissive occupancy (P/O) lease area have been extracted almost to the limits of allowable removal. The investigation described in this report was instigated by the desire to relocate operations from the present area, to other areas of the river.

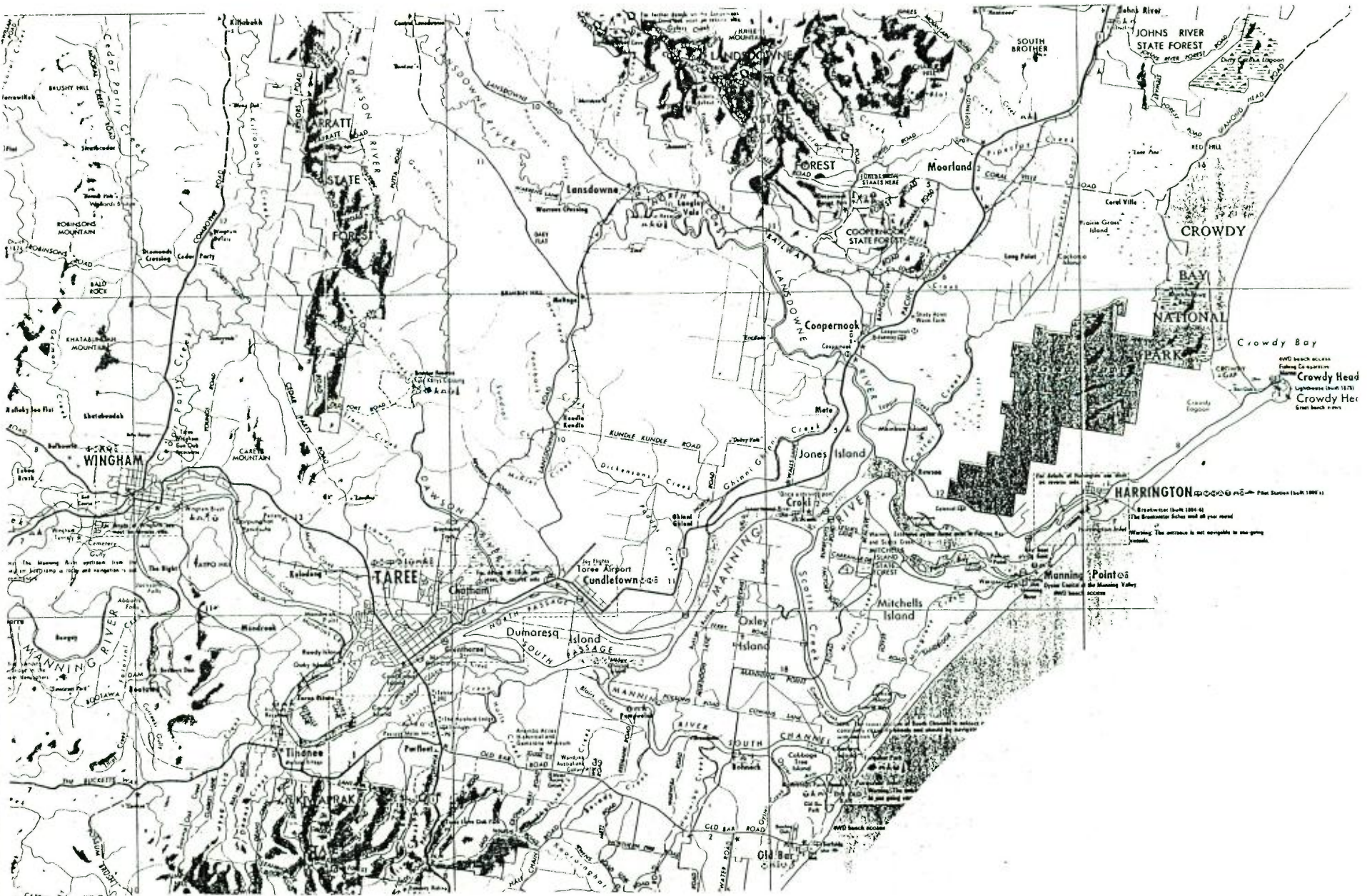
1.2 OBJECTIVES

This report addresses items of interest in relation to the environmental impact of proposed extensions to the area of extraction of sand and gravel, to allow continuity of supply from the Manning River by The Readymix Group. The particular areas of investigation are as follows:

- Examination of historical changes to the bank and bed of the river in the vicinity of the proposed extraction site, particularly as a result of major floods.
- Estimation of both the sediment budget of the river at the proposed extraction sites, and immediately upstream and downstream.
- Assessment of the effects of extraction on sediment transport and its implications to bed and bank stability at the site, upstream and downstream.
- Prediction of the likely infill rate of the dredged areas.
- The effects of the extraction on the estuary's tidal prism, tidal flows and saline intrusion.

2.

- Quantification of the effects on flooding of the dredging activities, stockpile area and any associated structures, including the impact on existing development of any changes in flooding patterns.
- The effects of dredging operations on Coochumbac Island.



LOCALITY PLAN

FIGURE 2.1

Winders, Barlow & Morrison Pty Ltd

2.0 CATCHMENT AND LOCALE DESCRIPTION

2.1 THE CATCHMENT

The Manning River catchment on the New South Wales lower North Coast (Figure 2.1) has an area of approximately 8400 km². Much of the river catchment, particularly in the west where elevations rise to nearly 1600 metres, is rugged country. In this headwater zone, comprising some 67% of the entire catchment, slopes are in the range of 15° to 40° and stream beds generally have substantial lengths of falls and rapids. With such steep slopes and high intensity coastal rainfall, this area might be expected to contribute to the bulk of sediment moving through the river system. In fact, in the Manning Valley, it is very difficult to differentiate the sources of gravels deposited in the river because large areas of the catchment are comprised of similar rock types (Reference 1).

The river is partially bounded by bedrock bluffs as far downstream as Taree West and Tinonee. Hill slopes through this region range from 3° to 15° and the river characteristically meanders through relatively extensive floodplain and terrace systems with deposits of moderately sized gravel forming high bars on the inside of bends. In these reaches, the bed of the river appears to be on bedrock with deep pools which are separated by riffles formed predominantly of armoured gravels and bedrock bars. The deposition of these coarse gravels in the middle reaches of the river is attributed to a dramatic decrease in channel gradient (Reference 1).

This part of the river is also periodically tidal. The tidal limit of the Manning River is at Abbott's Falls, but tidal influences upstream of Wingham are frequently reduced by freshwater discharge which prevents the upstream passage of estuarine water.

In the truly estuarine section downstream of the tidal limit, the river meanders through progressively fluvial, estuarine and marine sediments.

2.2 SOURCES OF SEDIMENT

A comprehensive review of available geological and field data by others (Reference 1) resulted in the conclusion that the principal source of sediment supply to the lower reaches of the Manning River are the vast quantities of such material stored within the river and floodplain areas in the upper reaches of the river upstream of Wingham, being gradually re-worked and transported downstream under riverine flooding influences. This conclusion has been confirmed as part of the present study and enables the assumption of an uninterrupted sediment supply from upstream regions to those areas of river under investigation.

The principal approach to confirmation of the above was to analyse the likely developed bed shear stress within the main river channel under various flood flows, and to compare this developed shear stress with critical values for particle movement. Figure 2.2 shows the developed shear stress values, while Figure 2.3, the Shields Curve, indicates the relationship between particle size and critical shear stress. Comparison of the two figures indicates that material presently within the river bed is in a dynamic state, i.e. moving with flood flows, rather than being some form of residual material remaining after river meandering. This analysis supports the conclusion that an uninterrupted sediment supply from upstream reaches will occur. Also, it is obvious that the reduction in shear stress within the river bed with distance downstream is reflected by the dominant size of particle found within reaches of the river. This factor is discussed in more detail in Section 5.1.

BED SHEAR VERSUS RIVER LOCATION

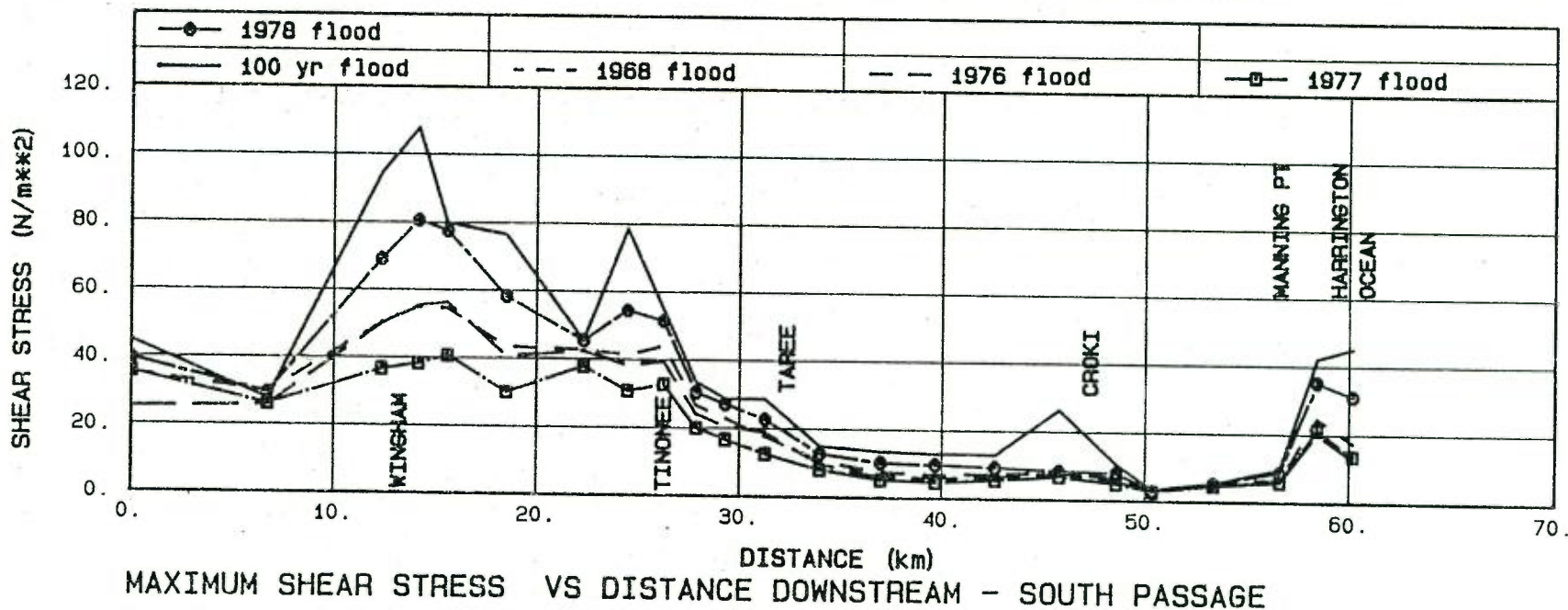
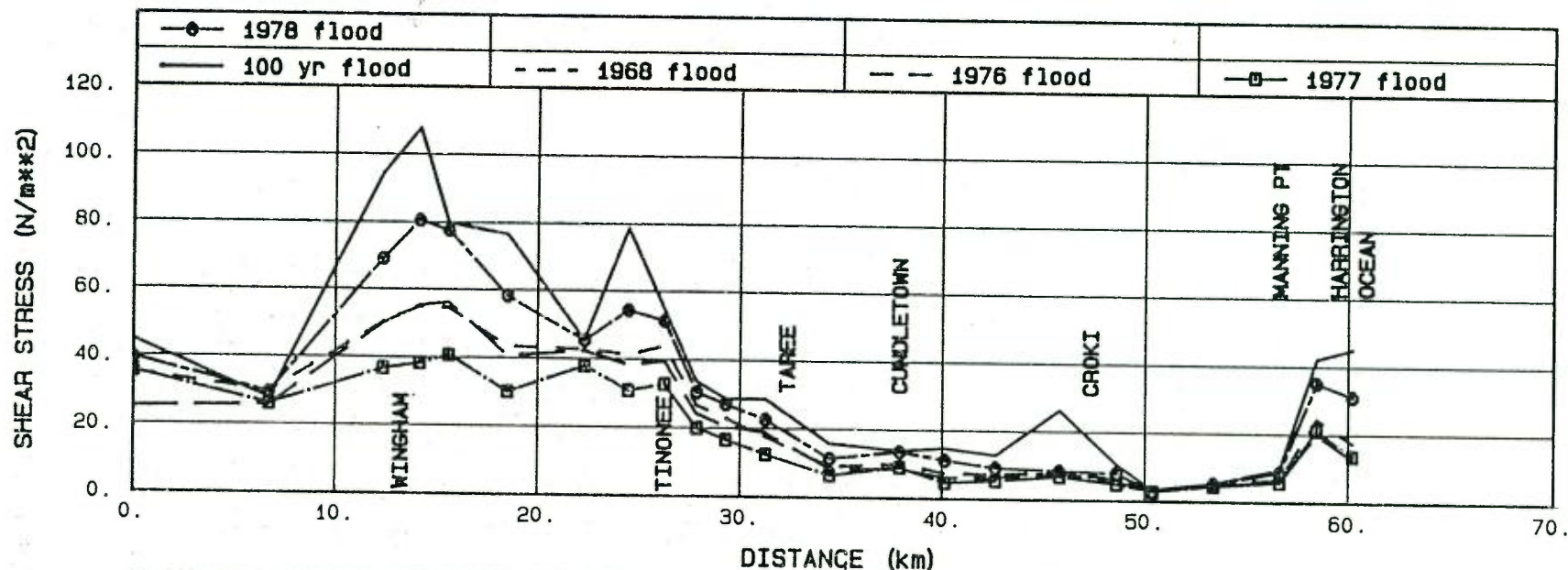
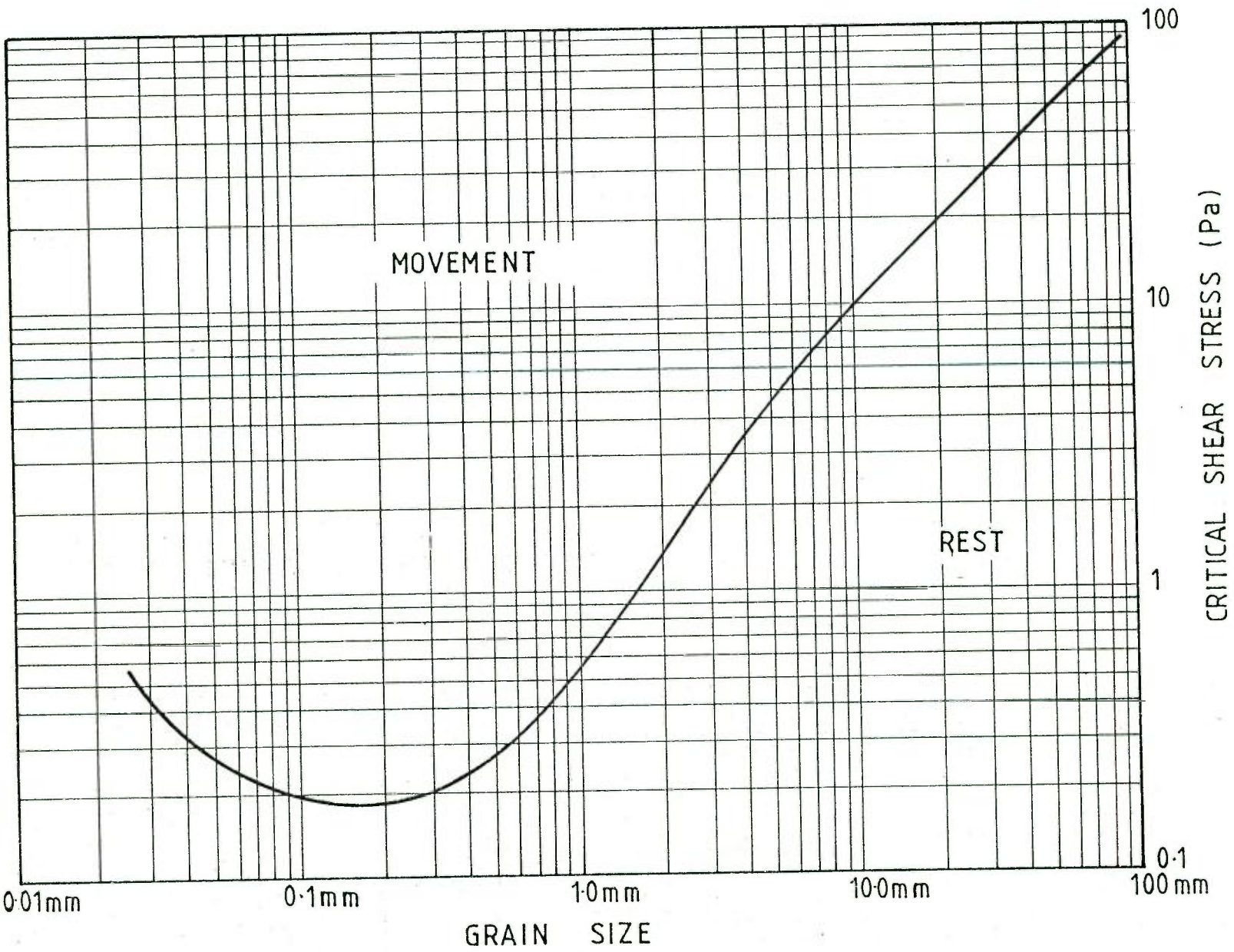


FIGURE 2.2



SHIELDS DIAGRAM

2. 3

FIGURE

3.0 GRAVEL EXTRACTION OPERATIONS

3.1 HISTORY

Since 1964, only one sand and gravel extraction operation has existed within the lower Manning River in the vicinity of Taree, operating from 1964 to 1980 as Taree Crushed Metal Pty Ltd, and subsequent to 1980 as Farley and Lewers, Readymix Farley and The Readymix Group. The location of this operation is shown on Figure 3.1. Extraction records prior to 1980 are unavailable, however, available data indicates an average extraction rate for this period of 21,000 m³/year (Reference 2).

Subsequent to 1980, those recorded production values given in Table 3.1 are available.

TABLE 3.1 Recorded Gravel Extraction Rates

Year	Weight (tonnes)	Volume (cubic metres)
1981 (6 mths)	56,000	31,000
1982	128,000	71,000
1983	118,000	65,600
1984	99,000	55,000
1985	115,000	63,900
1986	103,000	57,200
1987	86,000	47,800
1988	87,000	48,300
1989 (6 mths)	44,000	24,400

The average extraction rate for this period is some 58,000 m³/year.

The mode of extractive operations from this section of the river for the last 16 years has been by barge/grab dredge. Prior to this, a "scoop" was used, dragging bed and bank material from the river just upstream of Oaky Island. This mode of operation

resulted in the effective removal of a major depositional formation between Oaky Island and Taree Estate which was reportedly formed during the 1929 flood. Exhaustion of this formation for gravel extraction purposes obviously precipitated the change of mode of operation to use of a grab dredge from mid-stream areas of the river.

The formation, and subsequent removal of the Oaky Island deposition is further discussed in Section 4.0.

3.2 PROPOSED FUTURE OPERATIONS

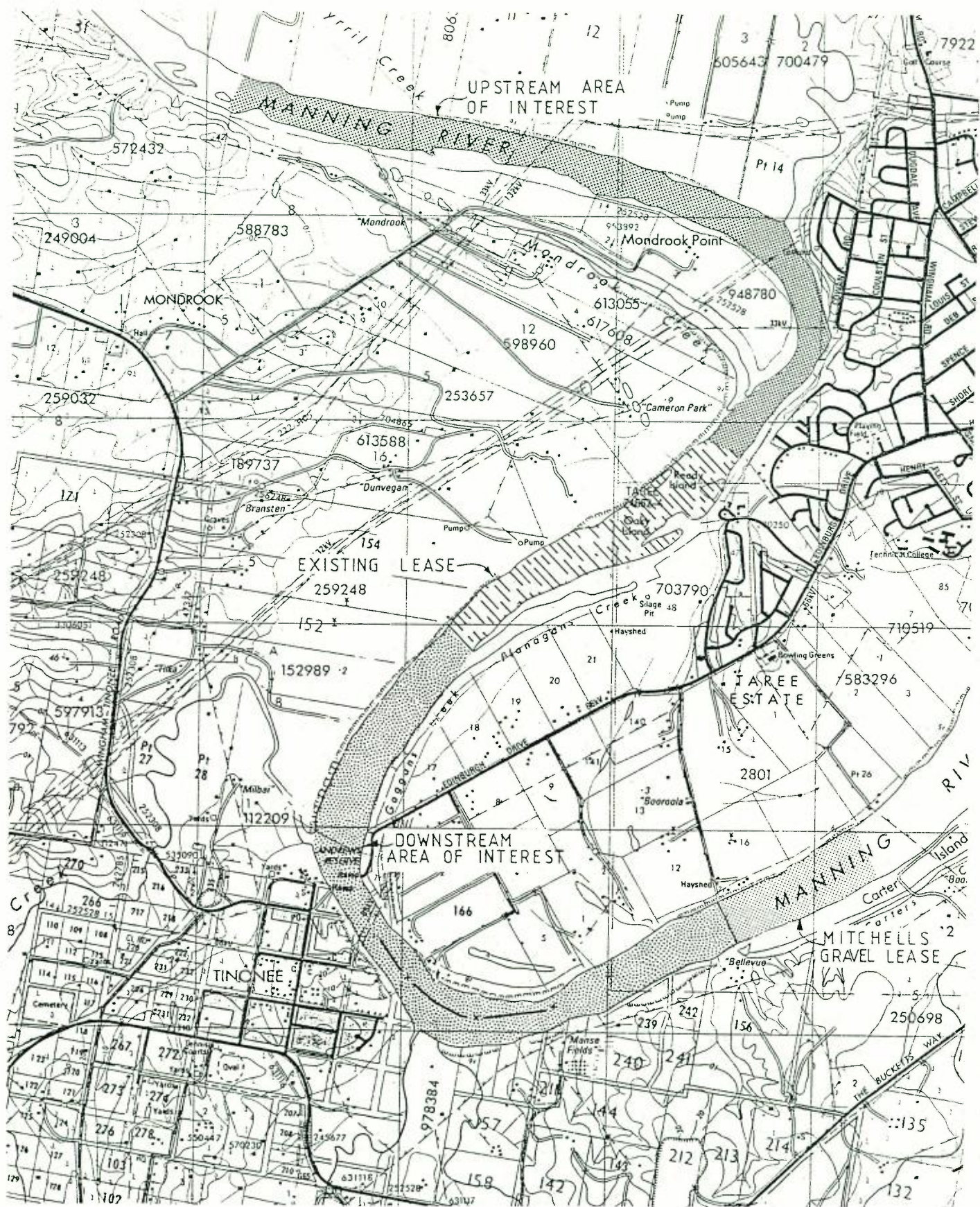
The Readymix Group wish to continue to extract sand and gravel from the Manning River at a rate similar to the previous years of operation. The reach of the river from which extraction operations are proposed is illustrated in Figure 3.1.

Options for extraction considered include

- (i) Upstream of the present lease area
- (ii) Between the downstream boundary of the present lease area and the previous Mitchells Gravel lease.
- (iii) Downstream of the previous Mitchells Gravel lease.

Option (ii) has been identified as the area for further detailed investigations due to the following

- . reasonable proximity to existing processing plant
- . likely maximum beneficial effects of gravel extraction on existing bank scour and sediment deposition problem areas
- . desirable grading of bed material.
- . potential for flood mitigation effects in the Taree Estate area as a result of extraction operations.



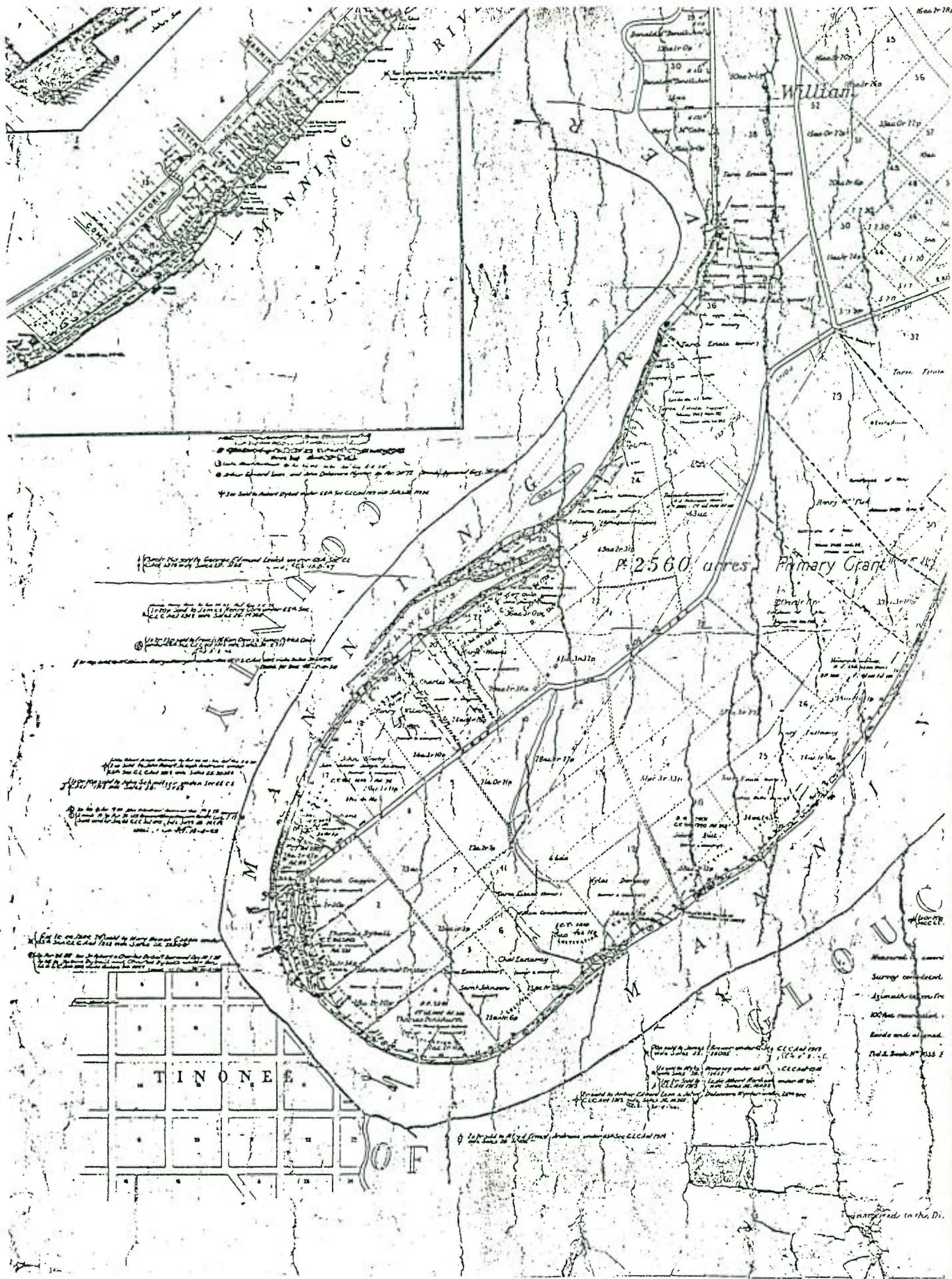
AREA OF INTEREST

FIGURE
3.1

4.0 BANK MOVEMENT/MORPHOLOGICAL PROCESSES

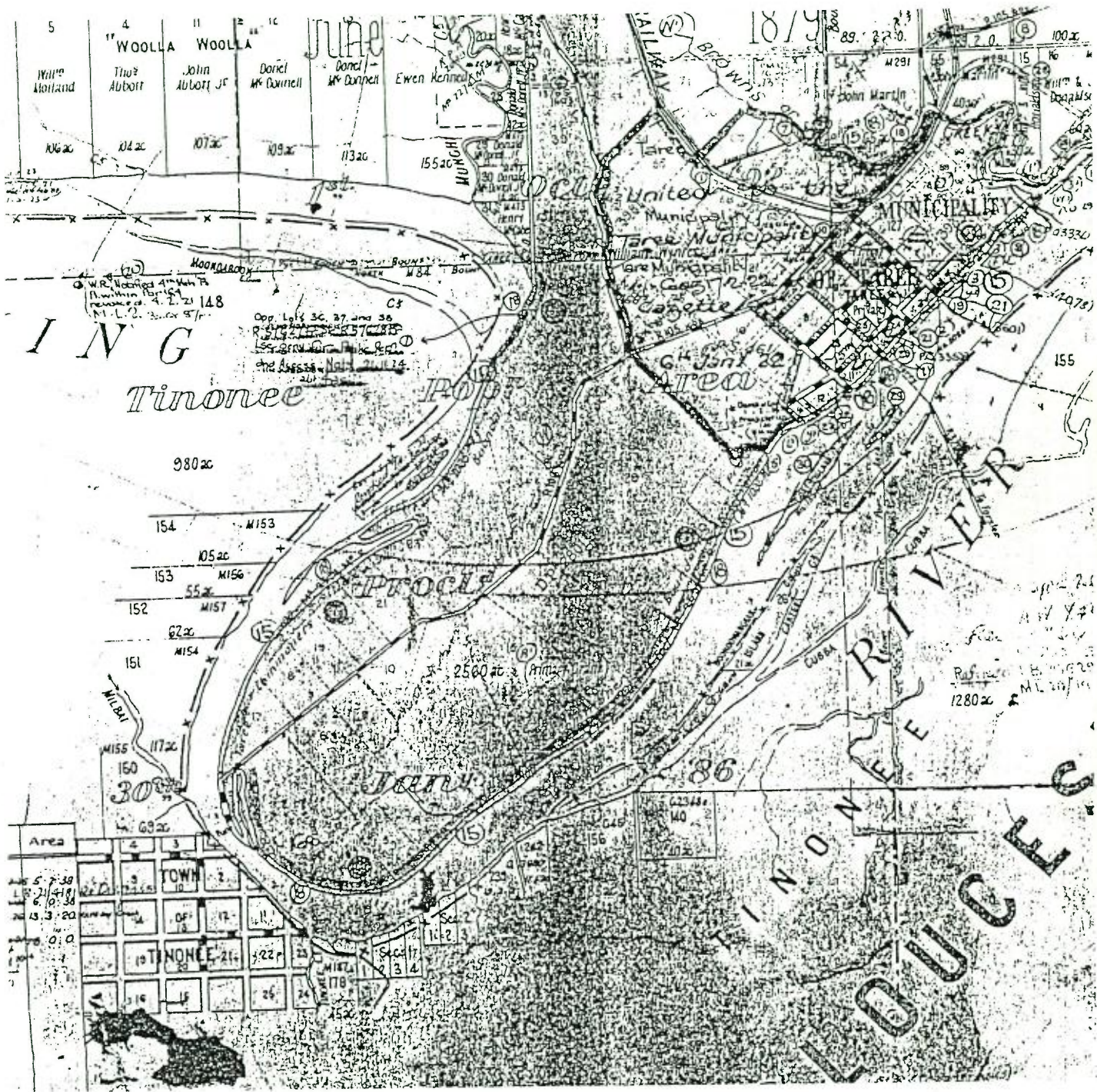
During the course of investigations pertaining to this study, a number of relevant factors relating to the morphological processes which may be currently occurring in the section of the Manning River between Wingham and Taree became apparent. Prior to discussion of the nature of river behaviour considered likely in recent geological time, these factors are outlined below.

- (i) The Taree Estate area is reported to be underlain by vast sheets of riverine gravel.
- (ii) A highly armoured layer within the bed of the river has been reported by the gravel extraction operators, with an alignment roughly between Mondrook Creek and Fig Tree Creek. This is believed to be the bed of an ancient river alignment. There is a possibility that this may also be natural bedrock material.
- (iii) Prior to the 1929 flood, Oaky Island was in fact an island. This body of land was apparently connected to Taree West by sand and gravel deposition during the 1929 flood, as is illustrated in Figures 4.1 to 4.4. The bedrock outcrop which protects Taree West from erosion would appear to deflect flow to the western side of the river, thus resulting in the Oaky Island area being a form of backwater, hence attracting deposition of alluvium.
- (iv) The western bank of the river just north of Tinonee was reported to have been severely denuded of vegetation, and partially eroded, by the 1978 flood. This is supported by the relatively low, regrowth nature of vegetation presently existing along this bank.
- (v) The two major bends in the river in this area are effectively constrained from further lateral movement by the rocky bluffs of Taree West and Tinonee.
- (vi) Local opinion indicates progressive siltation of the reaches



1900 SURVEY

FIGURE
4. 1



1919 SURVEY

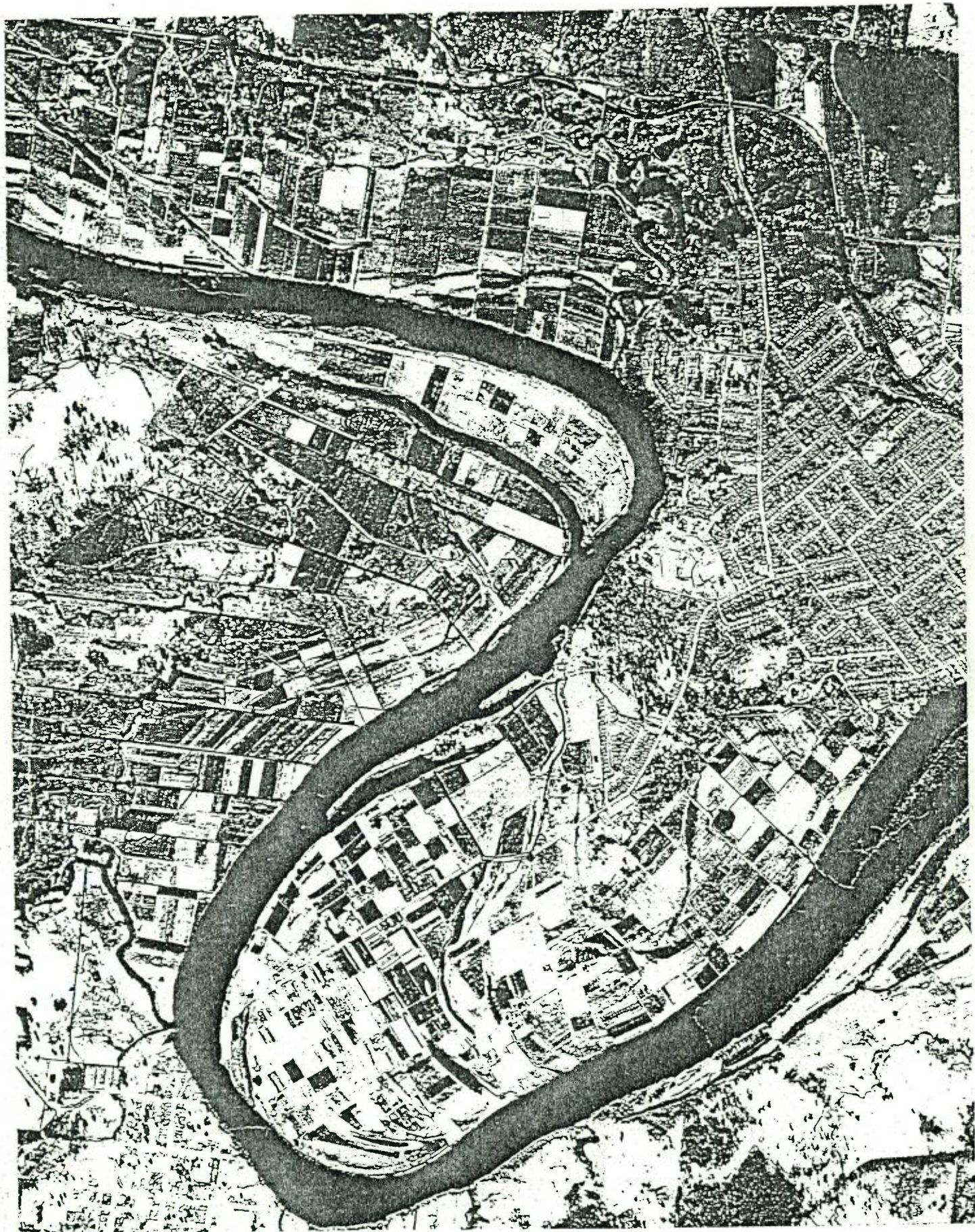
FIGURE

4. 2



1969 AERIAL PHOTOGRAPHY

FIGURE
4.3



1979 AERIAL PHOTOGRAPHY

FIGURE
4. 4

of the river adjacent to the main city areas of Taree. Also, gravel bank expansion downstream of the Wingham Bar area is apparently occurring.

A morphological history of the river in this area is believed likely to indicate the gradual meandering of the river from an alignment at some time in the past which followed the present Mondrook and Fig Tree Creeks. The river meandered from this alignment by a process of coarse material deposition at the inside of the two bends, thus forming Mondrook Point and Taree Estate, and erosion at the outside of the bends. The process of meandering was effectively halted by the river encountering the rock bluffs of Taree West and Tinonee. Subsequent to this the only areas of deposition appear to have been in the Oaky Island area, and at the inside of the river bed adjacent to Taree Estate. Continued deposition at this location may lead to greater flow velocities at the outside of the bend, adjacent to Tinonee, and this phenomena is believed to be resulting in the gradual erosion and natural instability of those river banks north of Tinonee.

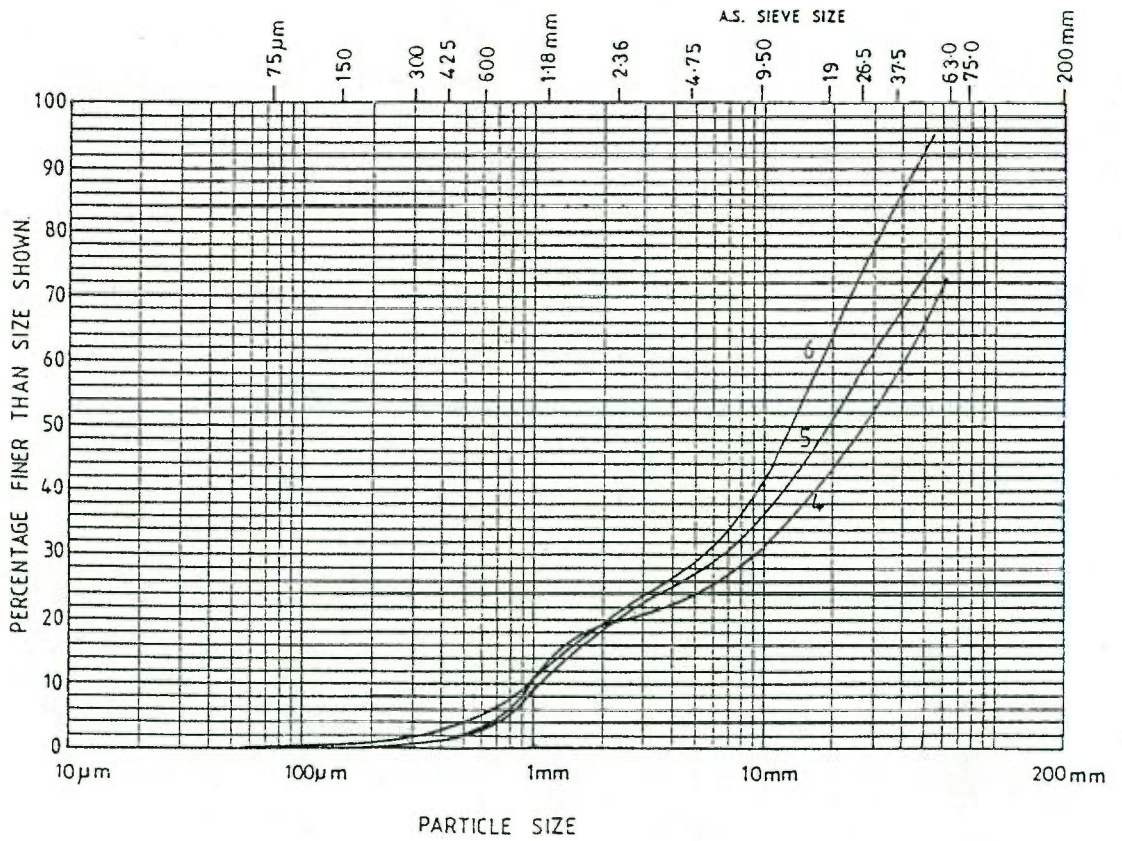
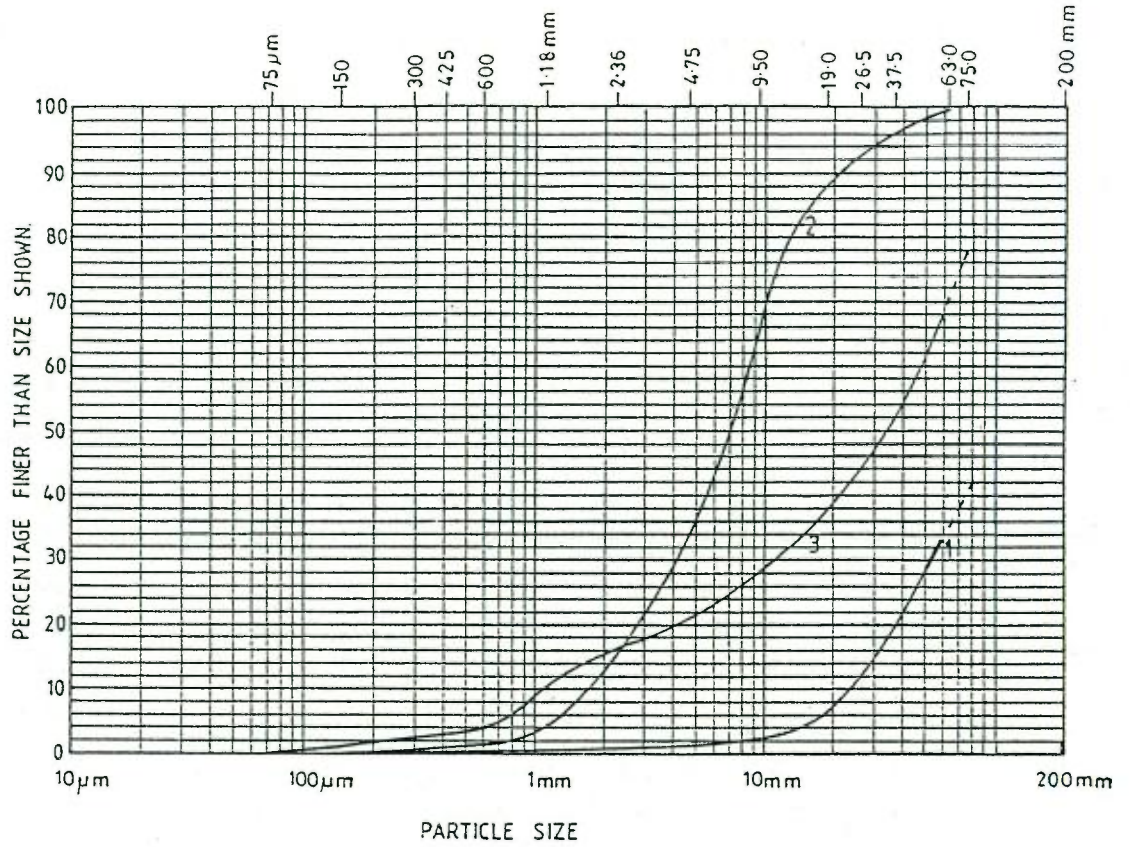
5.0 SEDIMENT BUDGET

5.1 NATURE OF MATERIALS

The nature of the bed material along the length of the lower reaches of the Manning River is widely variable in response to the water velocity which exists when the river is in flood. In the vicinity of the upper tidal limit at Abbots Falls, the bed material gradation is from large cobbles and boulders (size range 100 - 200mm) to gravel depending upon the depth of water. This substrate association persists downstream till Wingham where smaller cobbles and gravels become predominant. In the upper tidal reaches the exposed bed material is very much dependent upon the recent flow regime. In those periods where significant flood flows have not occurred, finer overlying sediments such as gravels and sands may be deposited and cover the coarser bed material. Overlying sand and gravel deposits were evident in the quieter reaches of the river above and below Wingham during the field inspection of September 1988.

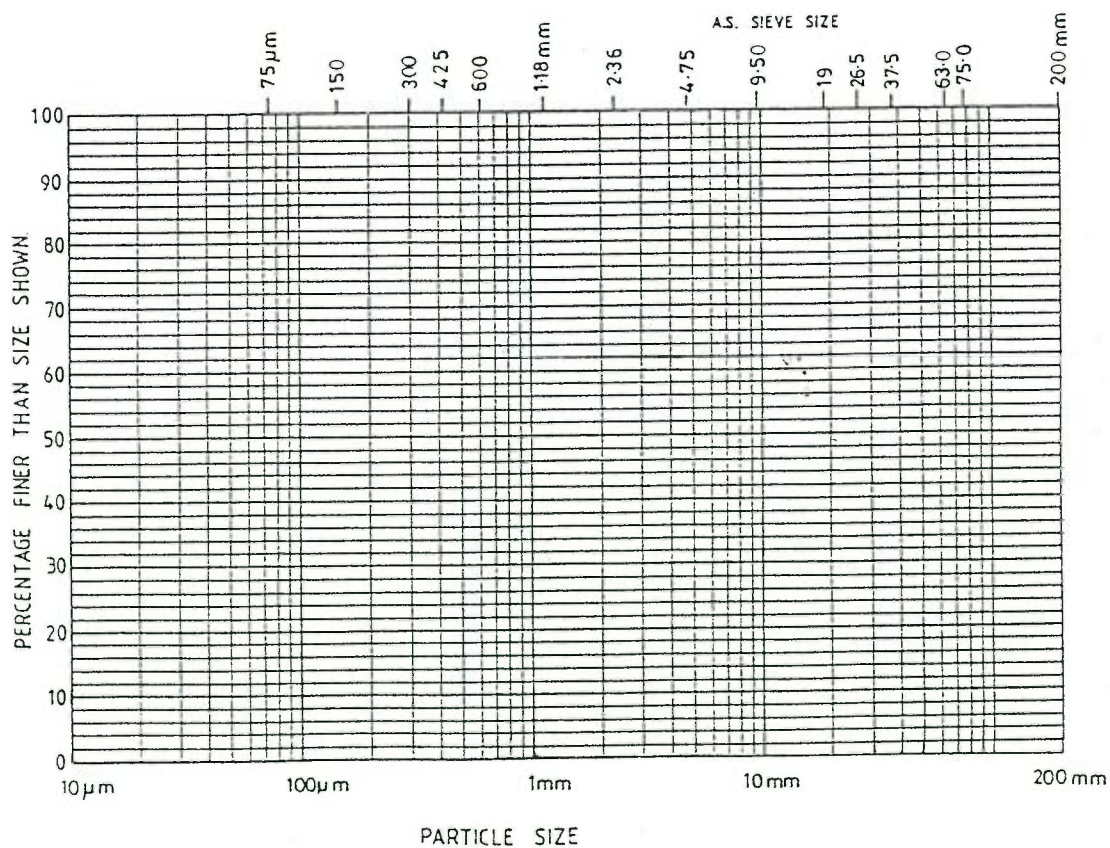
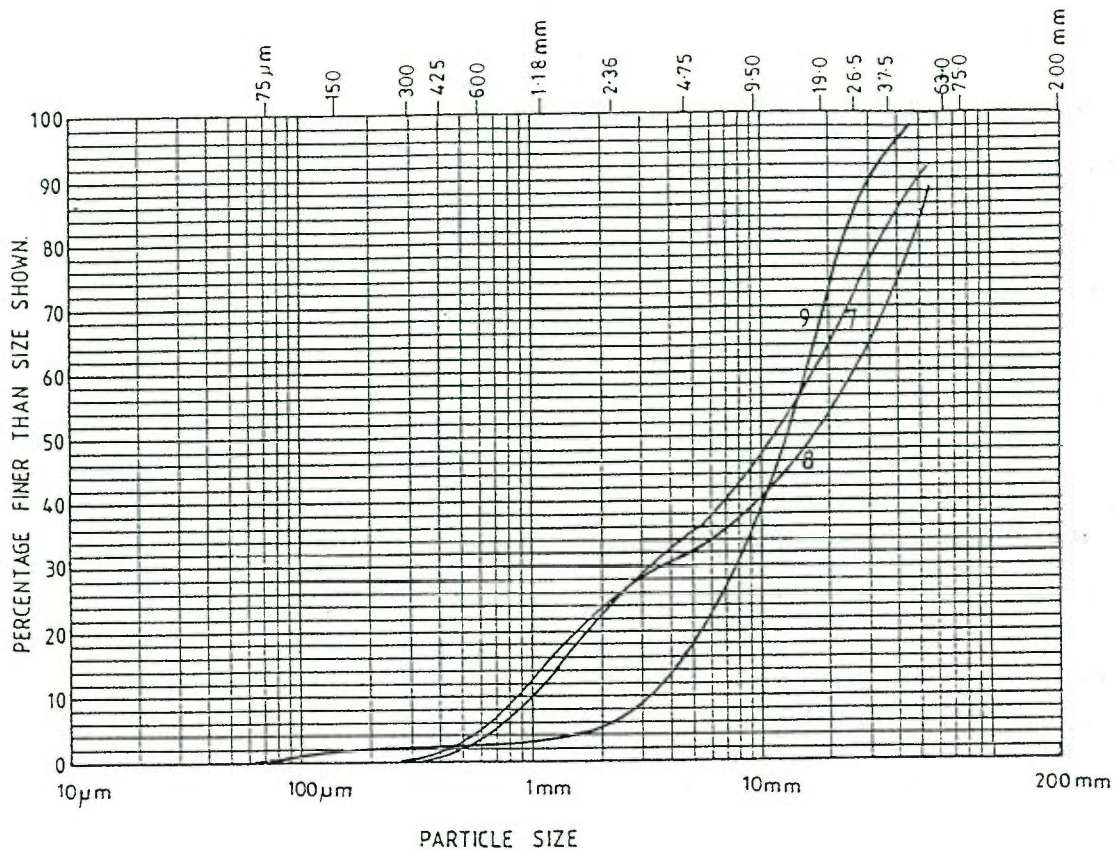
Continuing downstream of the junction of the Manning River with Cedar Party Creek to Taree, the bed material becomes predominantly gravel, with a continuing occurrence of occasional larger cobbles. Figures 5.1, and 5.2 illustrate the component particle size categories of bed material collected from the Manning River within those areas proposed for dredging, while Figure 5.3 shows the sampling locations. As shown, the bulk of the sediments can be classified as gravels (i.e. >2mm) however depending upon location there may be little or sizeable variation in the constituent components of the bed at a single section across the river bed. These variations are in response to the flood flow regime and the tractive capacity of the river during floods.

In the river reaches around Taree West and Tinonee, finer sands and silts are evident in the shallows away from the main river channel and on the inside of meander bends. Bedrock outcrops intersect the river bed at Wingham, Carpunghat Peninsula, Yaypo, Taree West and Tinonee.



PARTICLE SIZE DISTRIBUTION

FIGURE 5.1



PARTICLE SIZE DISTRIBUTION

FIGURE 5.2



LOCATION OF SAMPLING

FIGURE 5.3

Along the Taree Town reaches, the bed material is still predominantly gravel, grading to a coarse sand in some areas downstream of the Pacific Highway bridge. At the junction of the North and South Passages, the bed material is predominantly a medium-fine sand, and this substrate type continues downstream along either passage past Dumaresq Island to Croki. In those quieter nearshore shallows, a silt layer up to several centimeters thick is often apparent overlying the sand below.

5.2 METHODOLOGY

It was necessary to determine the annual average sediment load at Wingham and Taree, thus indicating both the total mass transport/deposition of sediment in the river reach of interest, and also anticipating similarity between the predicted nature of material deposited within the river, and that actually observed, as discussed in the previous section; as validation of the analysis methodology.

The analysis approach was as follows:-

- (i) 42 years of daily flow data at the WRC gauge at Killawarra were analysed, to enable the daily river flow versus probability plot shown as Figure 5.4 to be produced.
- (ii) The range of flow values presented in Figure 5.4 was subdivided into a number of representative sub-intervals. From the available rating curve at Killawarra, the adopted flow value for each of these sub-intervals was converted to a water level.
- (iii) Using derived relationships between the water level at Killawarra and Wingham, and a similar relationship between Wingham and Taree, the representative water levels at Killawarra for each adopted recurrence sub-interval were converted to the representative levels at Wingham and Taree. The nature of these relationships (Reference 3) is reproduced in Figure 5.5.

FLOW — PROBABILITY OF OCCURRENCE
RELATIONSHIPS

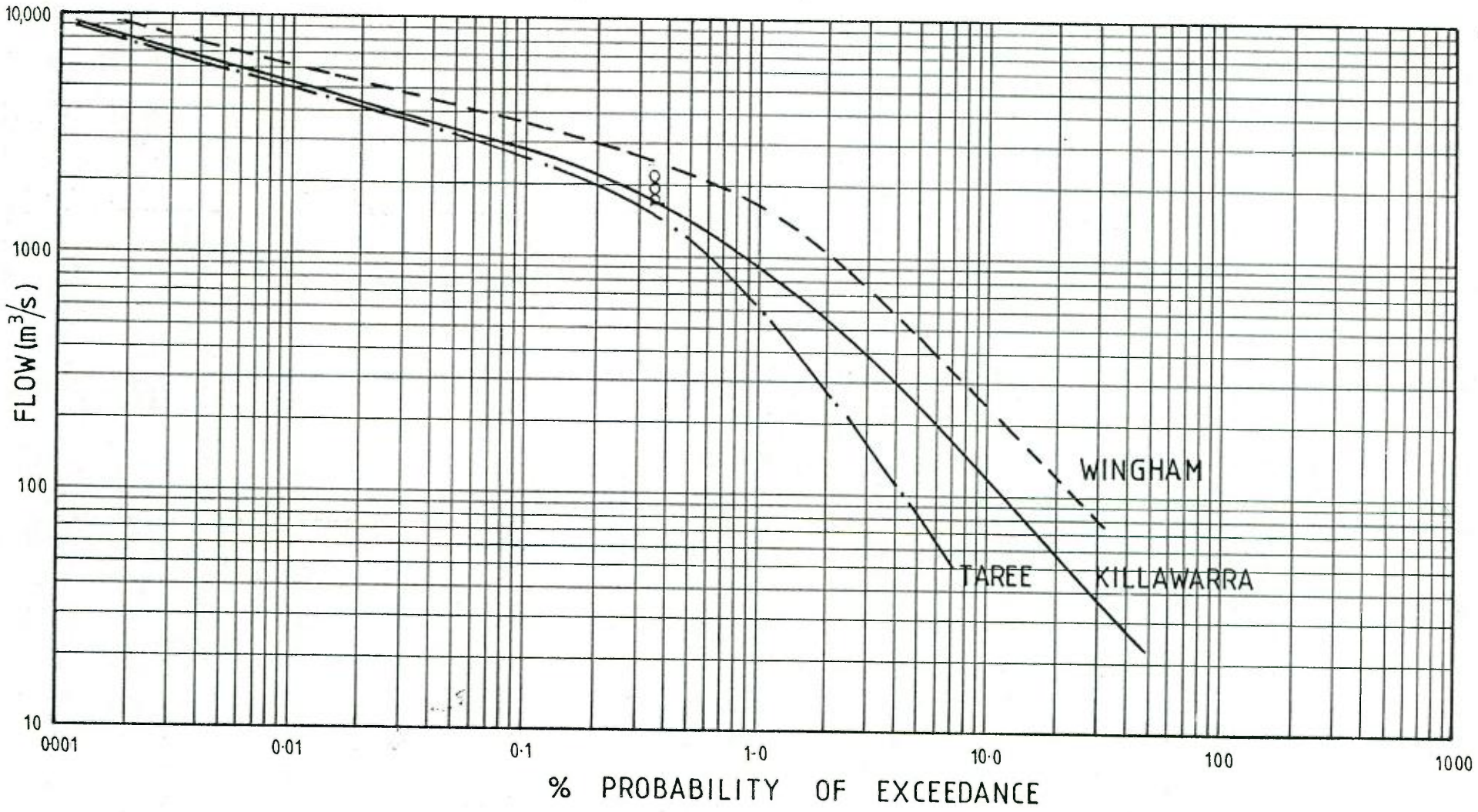
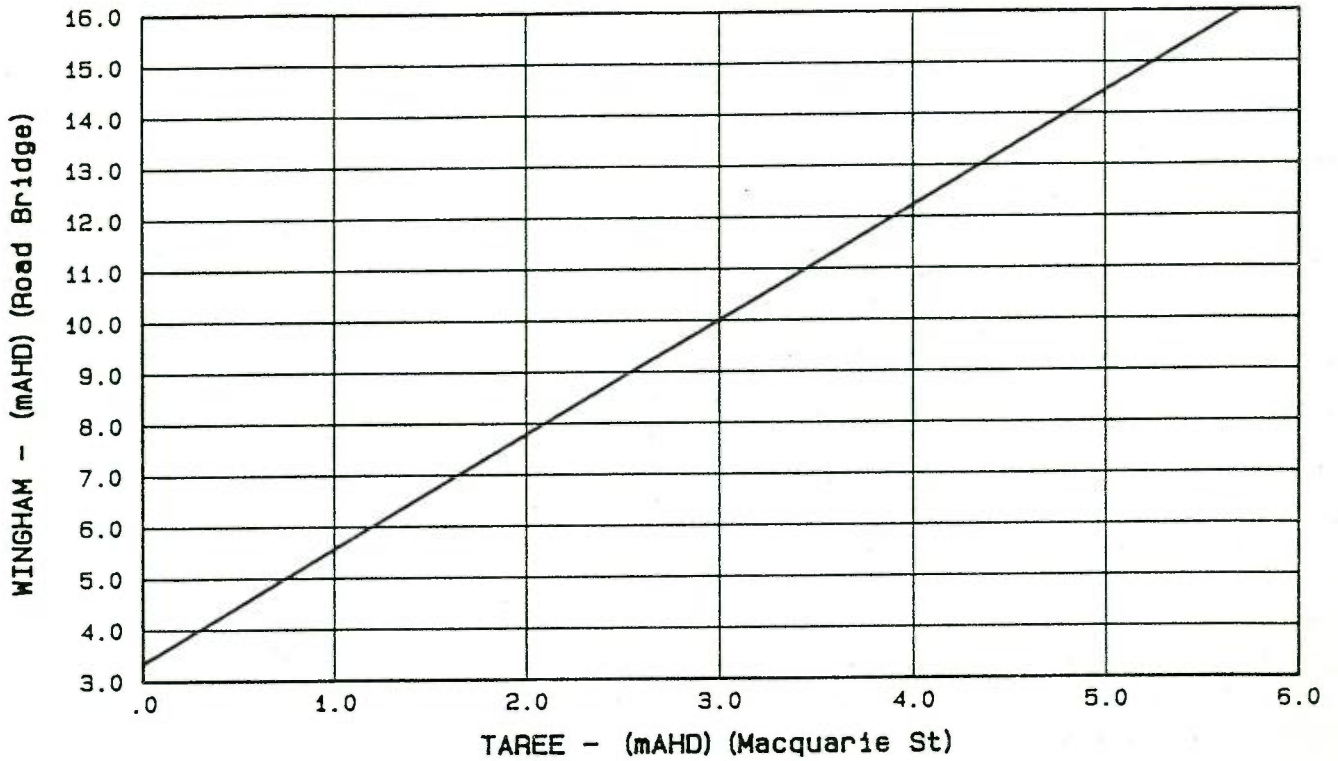
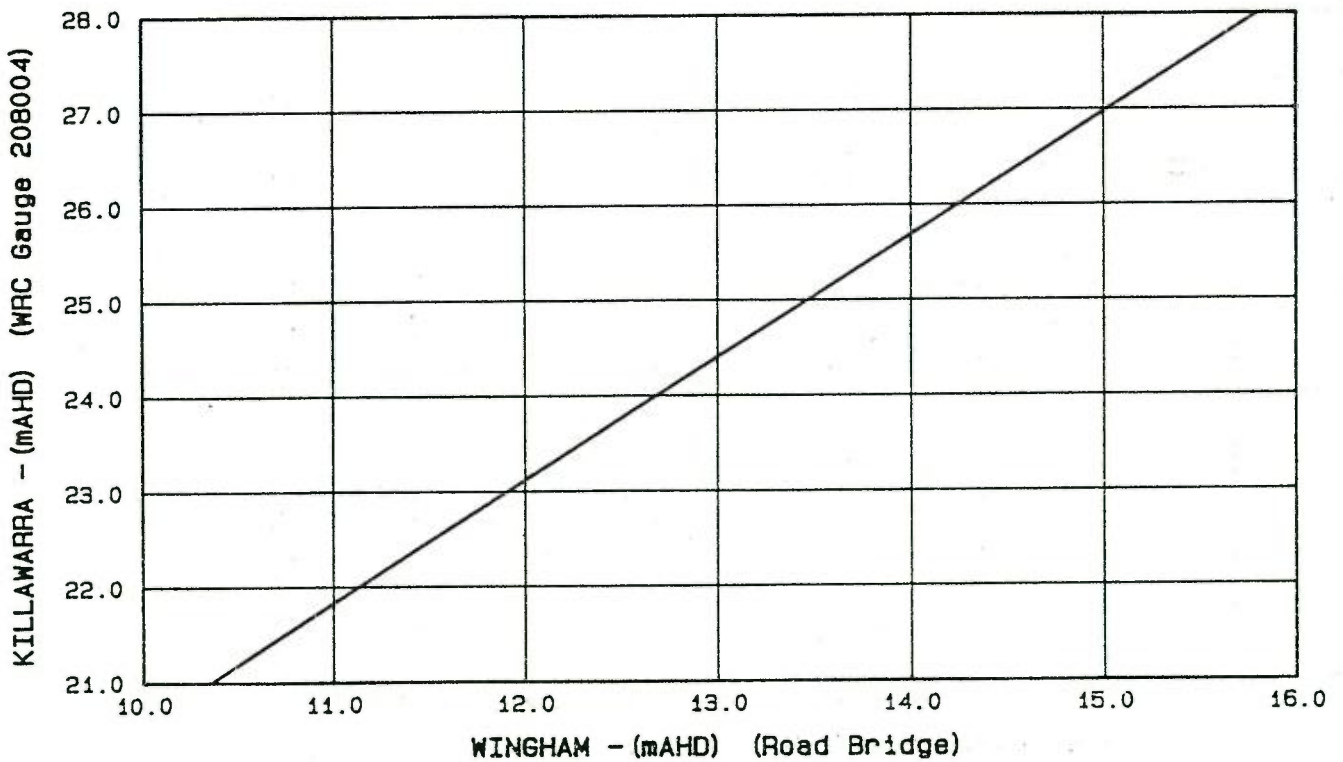


FIGURE
5.4



WINGHAM - TAREE CORRELATION



KILLAWARRA - WINGHAM CORRELATION

- (iv) Using rating curves for Wingham and Taree, derived from results of the mathematical flood model discussed in Section 7.1, it was possible to convert the representative levels from (iii) to river flows, and hence enable the daily river flow versus probability plots at Wingham and Taree to be deduced. These plots are shown in Figure 5.4 for comparison with the Killawarra data. For a given recurrence period, flows at Wingham are typically higher than at Killawarra due to the influence of Dingo Creek, a major tributary entering the river downstream of Killawarra. Natural attenuation within the river, and the influence of various alternative flood flow paths, results in the reduction of these flows by Taree.
- (v) Using a particle size distribution typified by the results of Figures 5.1 and 5.2. considered to be representative of the bed material at Wingham, and the derived flow-probability relationships, in combination with the sediment transport approach of Meyer-Peter and Muller, an estimate of the annual average sediment transport rate of the river at Wingham and Taree was possible.

5.3 RESULTS

The resultant annual average sediment transport rates at Wingham and Taree which resulted from those analyses outlined in Section 5.2 are as follows.

Wingham	- 5000m ³ /year
Taree City Reach	- 500m ³ /year

Hence the ultimate rate of deposition of material transported by flood and other riverine flows in the section of river between Wingham and Taree is some 4,500 m³/year. Calculations indicated that 70% of the material transported past the Taree road bridge are finer than, or equivalent to a coarse sand grading, with 90% of the material being coarse gravel, or finer. These results are supported by the field observations of a predominance of coarse sands downstream of the Pacific Highway bridge, as introduced in

Section 5.1.

5.4 DISCUSSION

The key conclusions of the matters outlined above are as follows -

- . The predicted sediment deposition rate for the section of the Manning River between Taree and Wingham, on an annual average basis, is 4,500 m³/year.
- . The desired sand and gravel extraction rate from this section of the river is likely to average 55,000m³/year.
- . The Manning River, in its present plan form layout, is believed to be relatively stable. Exposed bedrock bluffs at Taree West and Tinonee act as controls on lateral movement of the river bends. Some erosion, particularly related to major flood events may be occurring on the western bank of the river, north of Tinonee.

From the first two of the above points, it is apparent that sand and gravel extractions as proposed are of a magnitude in excess of natural river bed material replenishment rates. Hence, sand and gravel removal must be considered as a mining operation of a resource of potentially limited magnitude. With this in mind, and as further discussed in Appendix 3, operations must be closely controlled and proceed in a logical fashion, always with strict control based on routine survey information to ensure maximization of material extraction.

From the third of the above points, it is believed that extraction operations, to a limited depth, will not affect river morphology or bank stability. In fact, operations initially within the shallow areas of the river bed adjacent to the inside of the river bend at Taree Estate are recommended in order to reduce, or alleviate, present bank erosion problems on the opposite bank. Also, extraction operations should have an ameliorating influence on reported siltation problems in sections of the river downstream of Taree.

The permissible extent (depth) of sand and gravel extraction within the river is considered likely to be controlled primarily by the impact of such works on flood and tidal phenomena, with an upper limit on such increases in river depth as a result of bank stability issues. Subsequent sections of this report quantify the relative impacts of the proposed dredging strategy.

6.0 PROPOSED GRAVEL EXTRACTION OPERATIONS

It is apparent that the potential for future dredging operations within the existing lease area is limited (Refer to Figure 6.1). Comprehensive surveys would show the extent and location of any remaining deposits within this lease. Continued extraction will need to be relocated elsewhere.

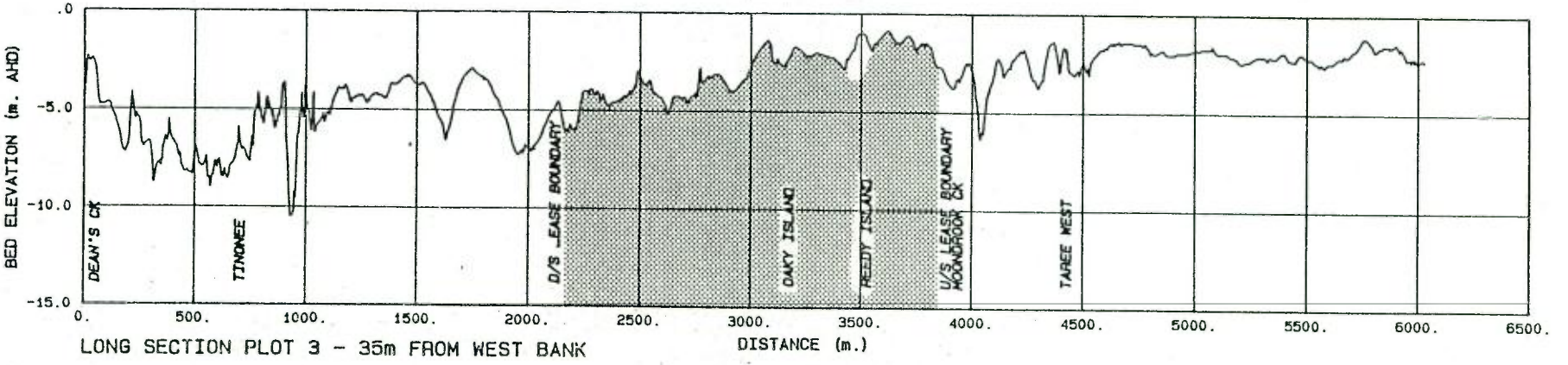
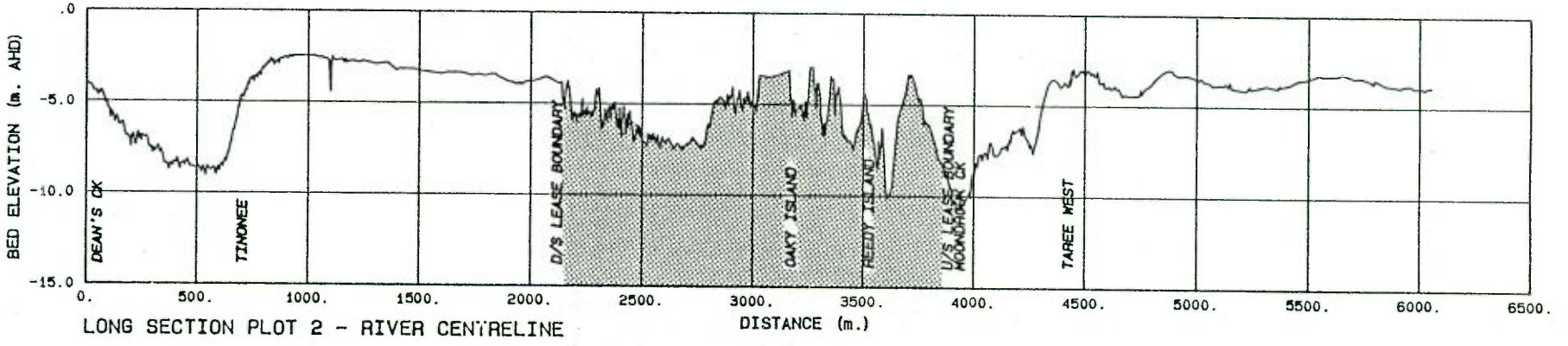
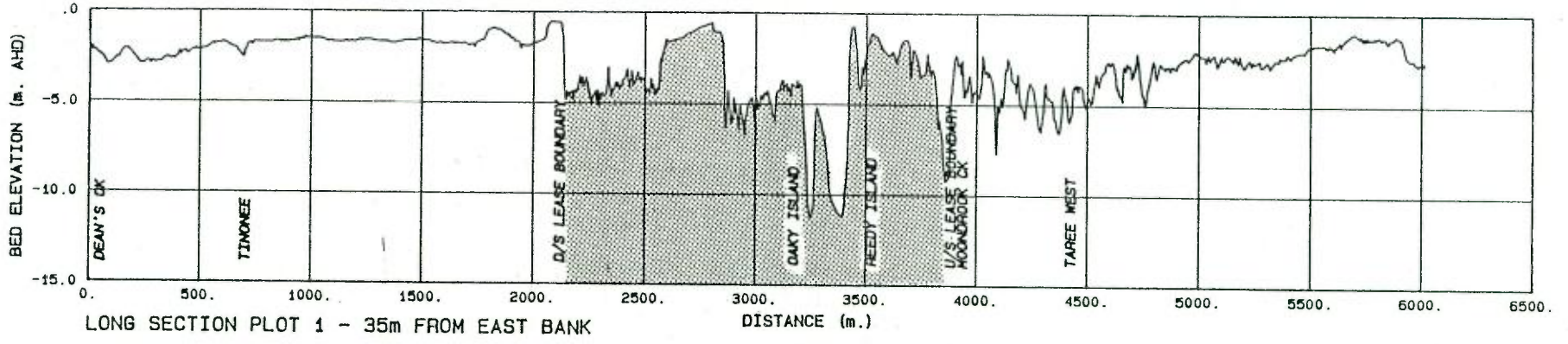
As discussed in Section 3.2, a number of areas of the river were preliminarily assessed for suitability for extraction purposes. That section of the river between the downstream boundary of the present lease and the upstream boundary of the Mitchells Gravel lease was identified as the most desirable new operations area on the basis of a number of criteria, previously described.

Within this area of river, three strategy options of extraction operations have been considered, as follows

- (i) OPTION A - Extraction to 4m below AHD, no operations within 20m of the present mean water level bank mark. Option A is denoted by cross sectional surveys 97 - 108.
- (ii) OPTION B - As for (i) with additional extraction to 6m below AHD, with such extraction commencing 30m from the present mean water level bank mark. Option B is denoted by cross sectional surveys 97 - 108.
- (iii) OPTION C - As for (ii), however operations are limited to a distance of 1km downstream of the existing Readymix lease area. Option C is denoted by cross sectional surveys 105 - 108.

The first of the above cases is considered the lower feasible economic limit for continued long term extraction i.e. Adequate material for 10 years gravel extraction, at an average rate of 55,000m³/year. The second of the above is considered the likely upper limit on extraction operations and would enable up to 26 years operations at the maximum extraction rate. The third option,

LONGITUDINAL RIVER PROFILES - MANNING RIVER

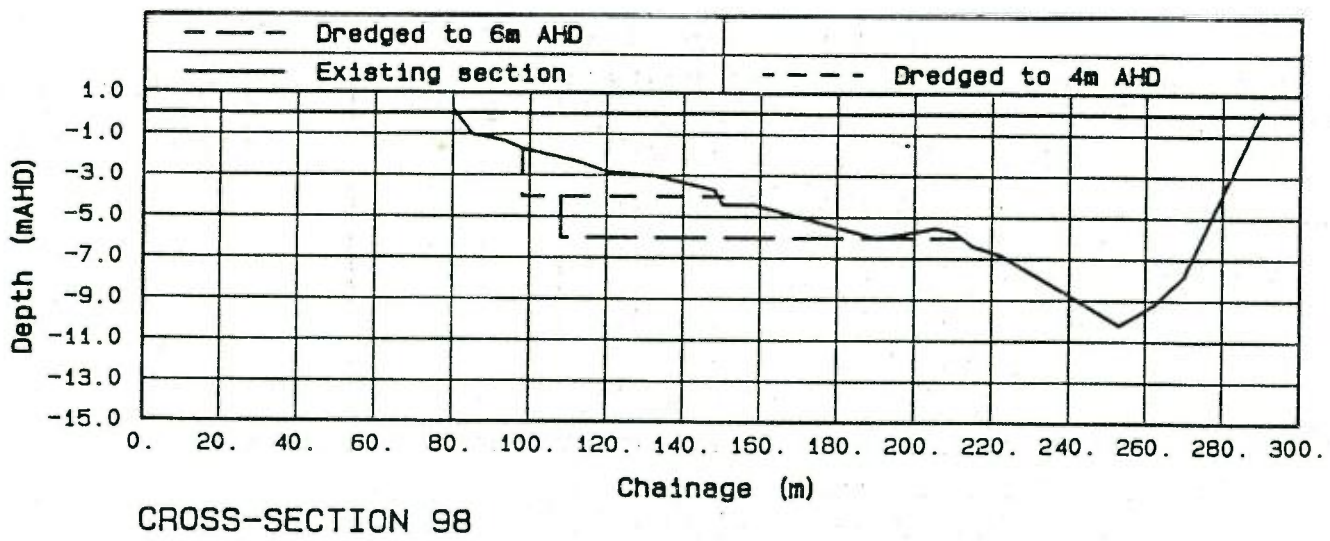
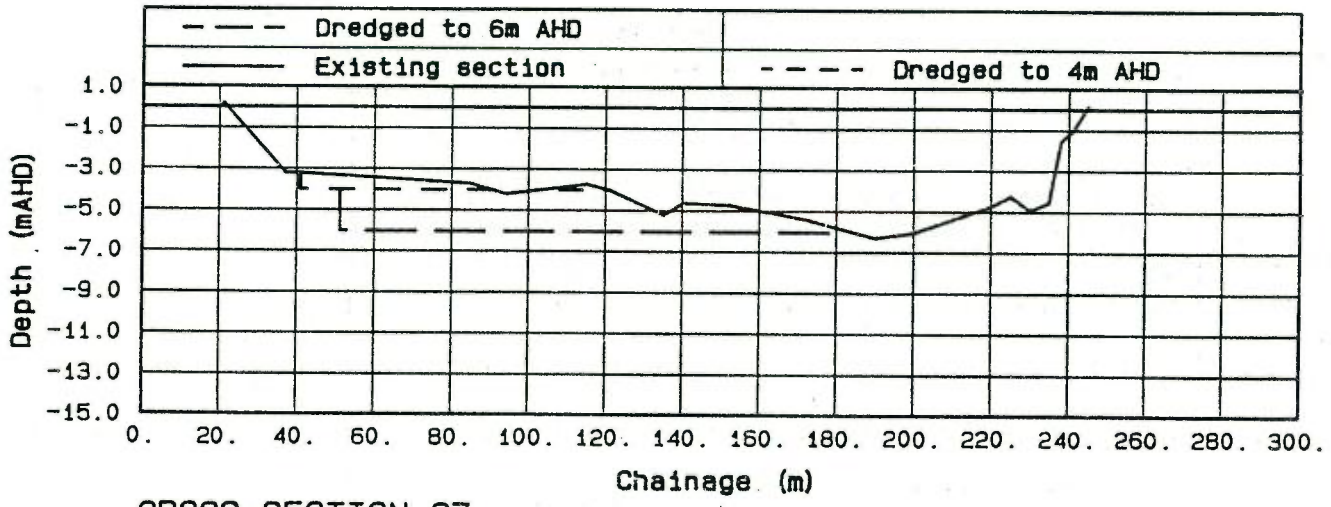
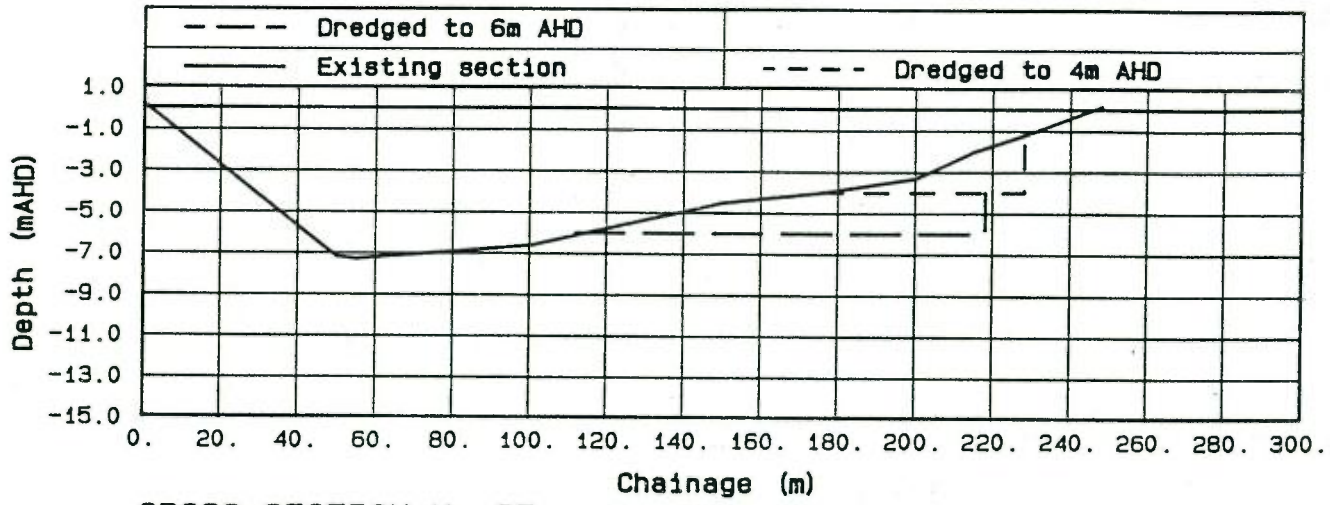


6.1

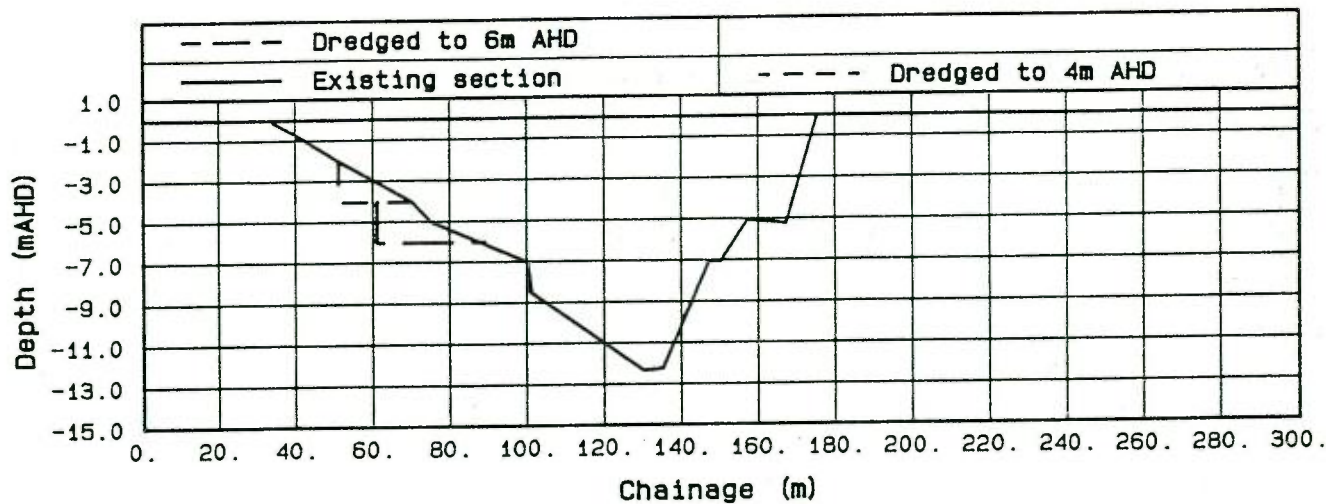
FIGURE

being the likely extraction scenario in the short term, would enable 12 years extraction at an average rate of 55,000 m³/year. In all cases, the likely equilibrium (post-dredging) bank profile which is considered inherently stable, under tide and moderate flood flow regimes has been used. This profile is further discussed in Section 7.5. The nature of the excavations which will result from these proposed excavation limits are illustrated in Figures 6.2 to 6.7.

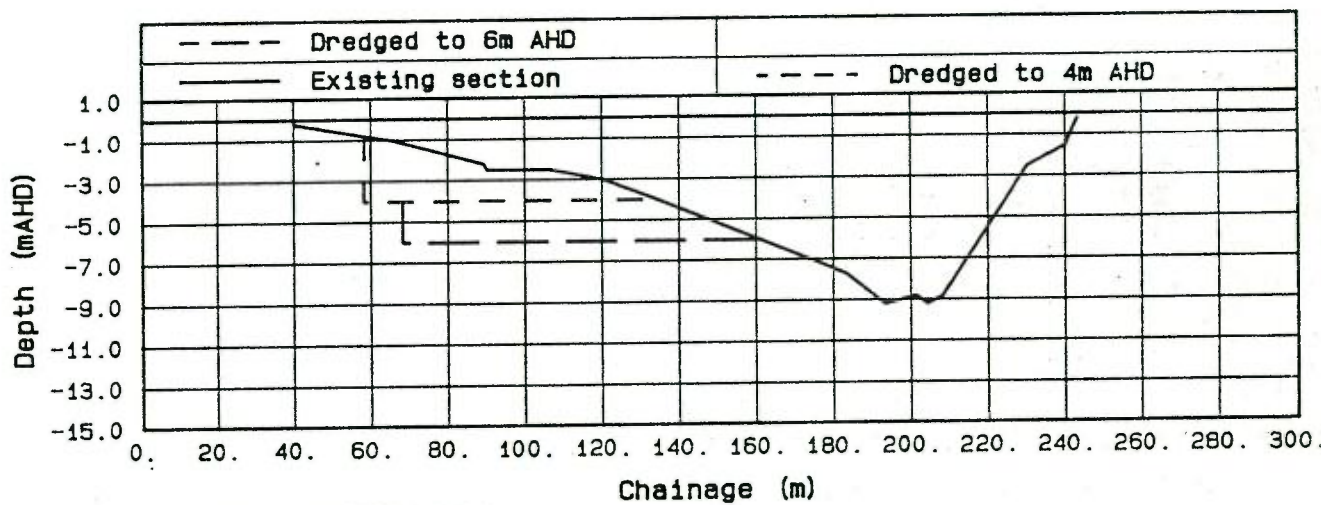
Further investigations into the effects of gravel extraction on the tidal and flood regimes of the river have assumed the adoption of the strategies outlined above. At such a time as exhaustion of this source of gravel is imminent, further re-evaluation of the present P/O to indicate any recovery or redeposition of material will be necessary, potentially leading to the evaluation of alternative gravel supplies, or of alternative extraction strategies within the areas of present and proposed operation.



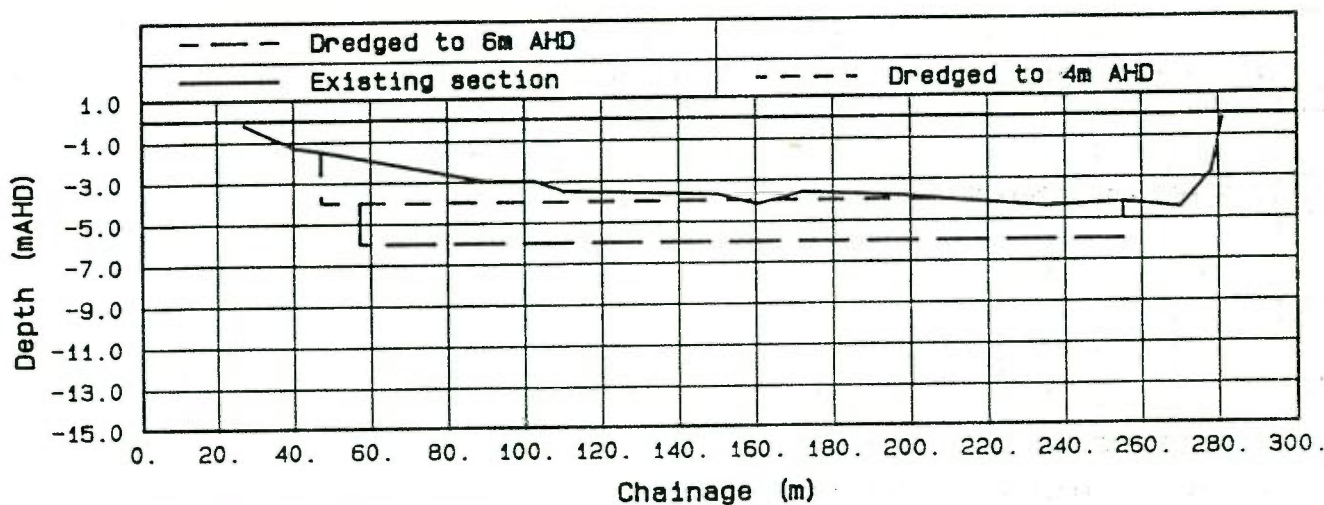
PROPOSED SAND AND GRAVEL EXTRACTION MODIFICATIONS TO RIVER CROSS-SECTIONS. FIGURE 6.2
 Winders, Barlow & Morrison Pty Ltd



CROSS-SECTION No 99



CROSS-SECTION 100

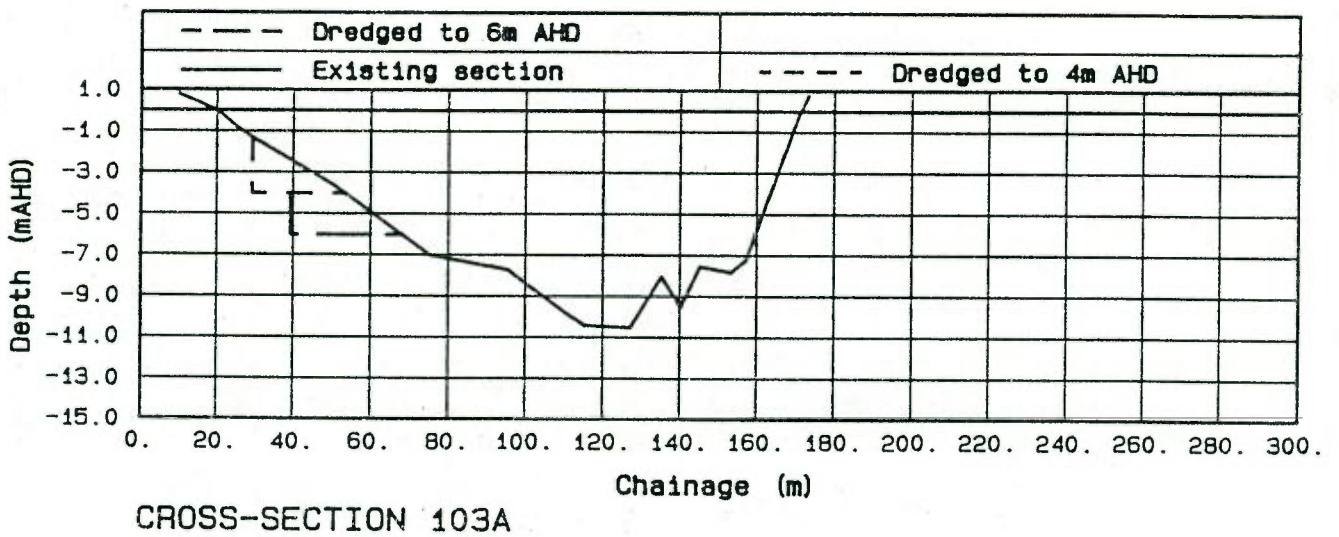
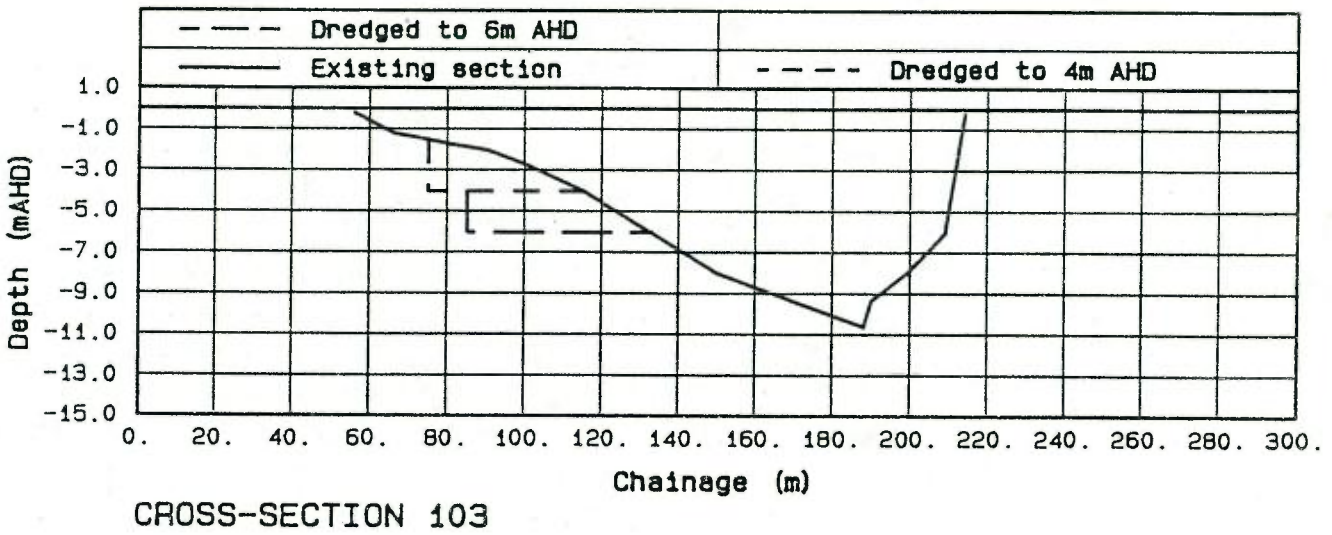
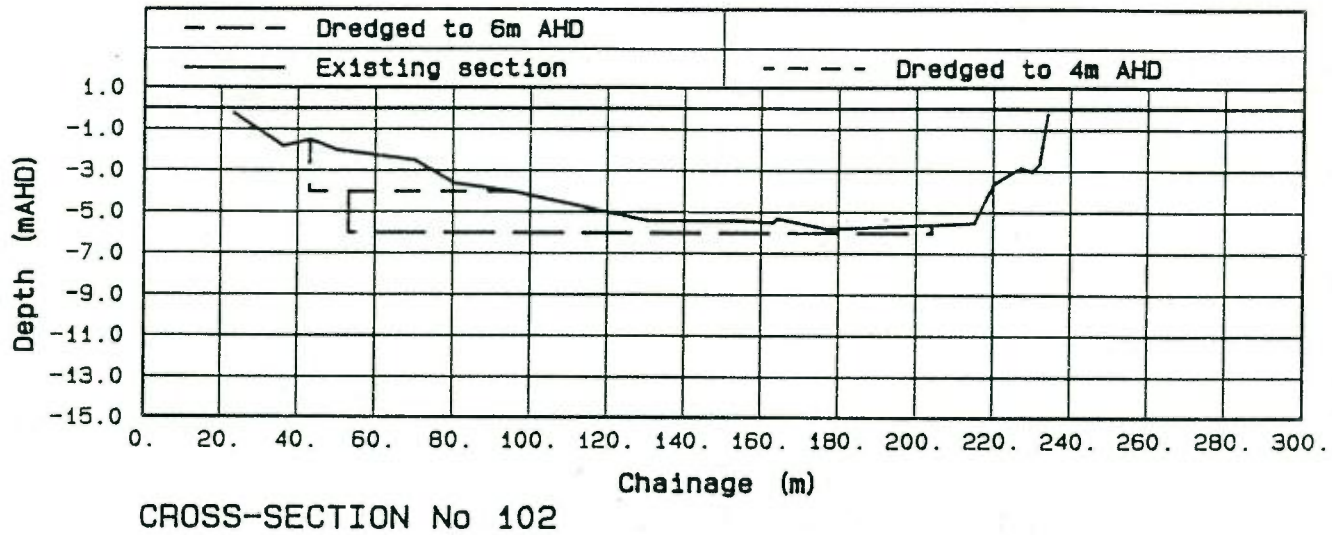


CROSS-SECTION 101

PROPOSED SAND AND GRAVEL EXTRACTION
 MODIFICATIONS TO RIVER CROSS-SECTIONS.

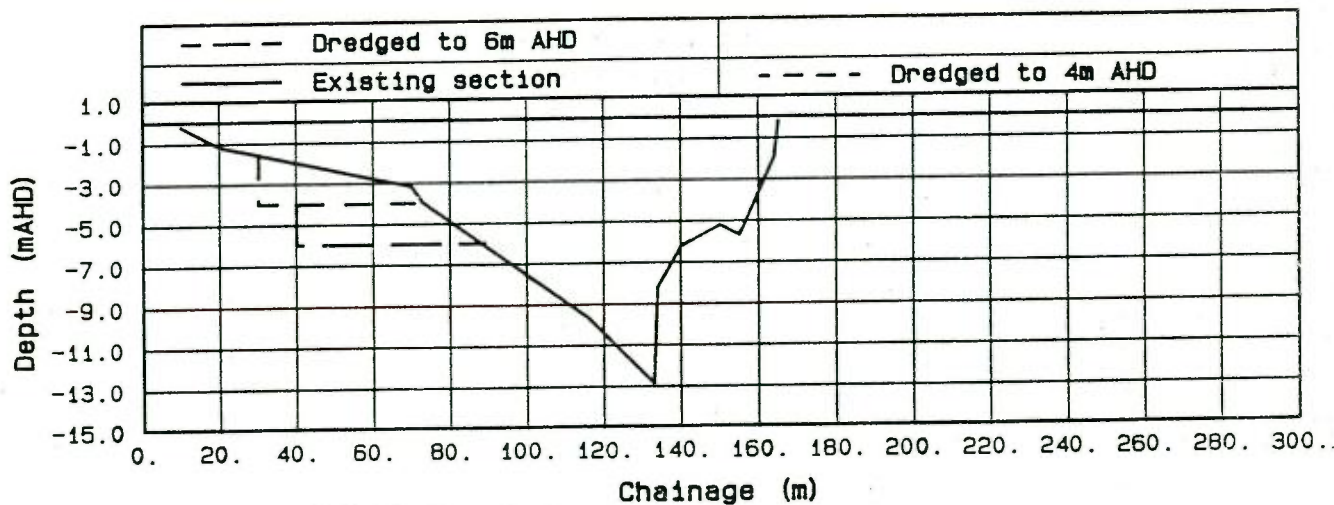
FIGURE

6.3

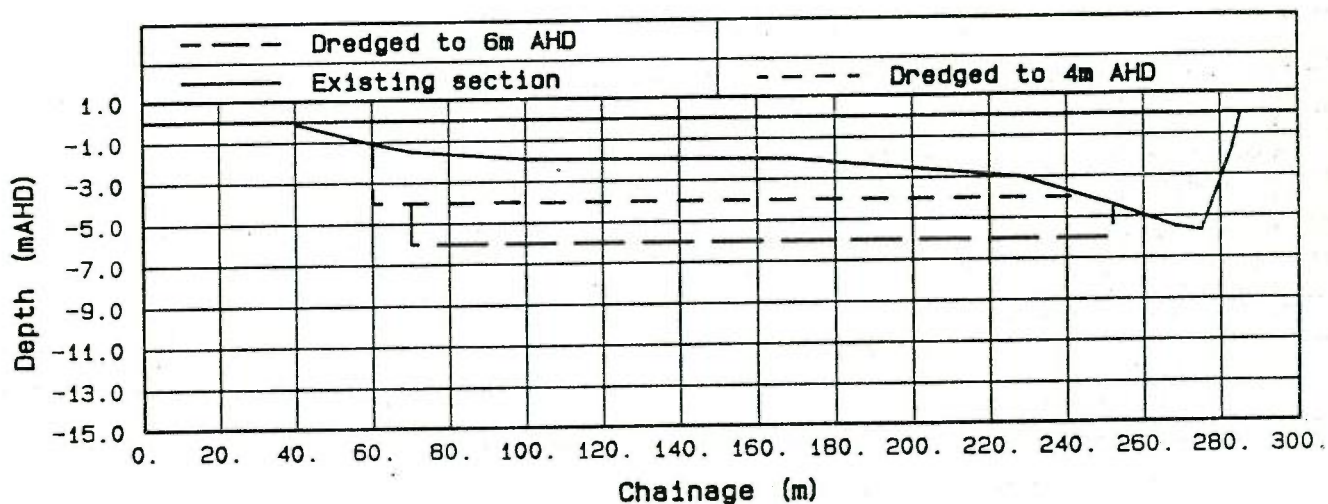


PROPOSED SAND AND GRAVEL EXTRACTION MODIFICATIONS TO RIVER CROSS-SECTIONS.

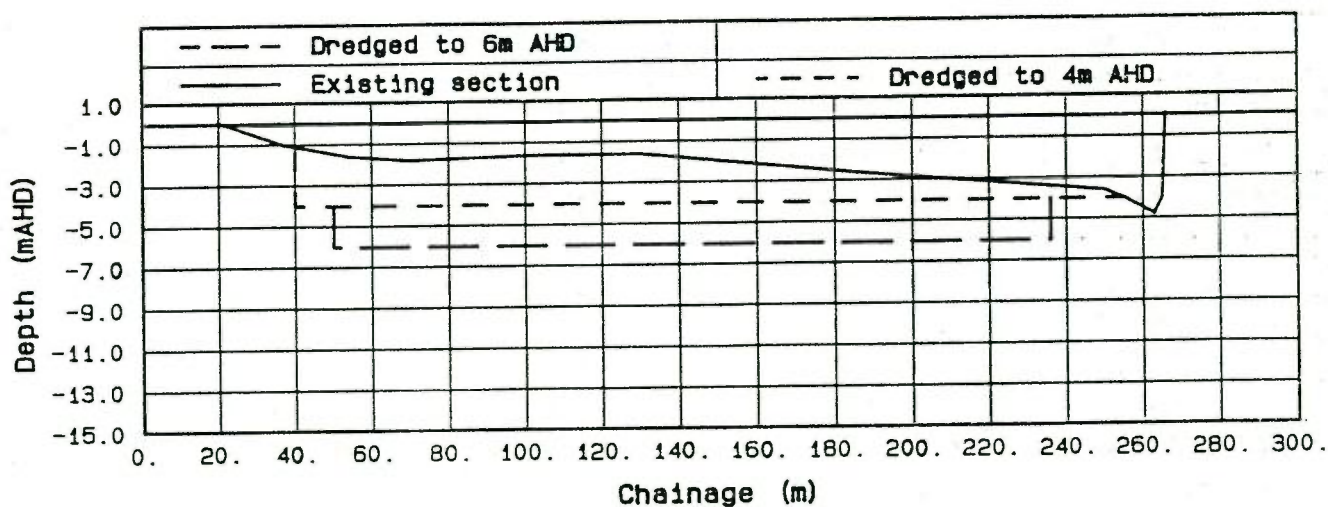
FIGURE 6.4



CROSS-SECTION No 104



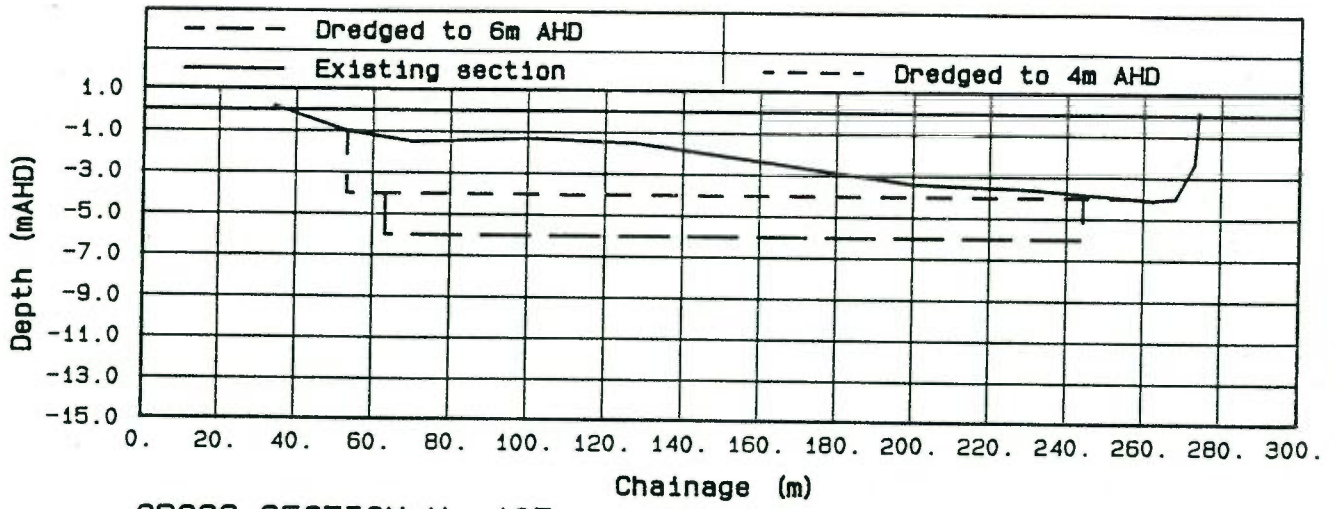
CROSS-SECTION 105



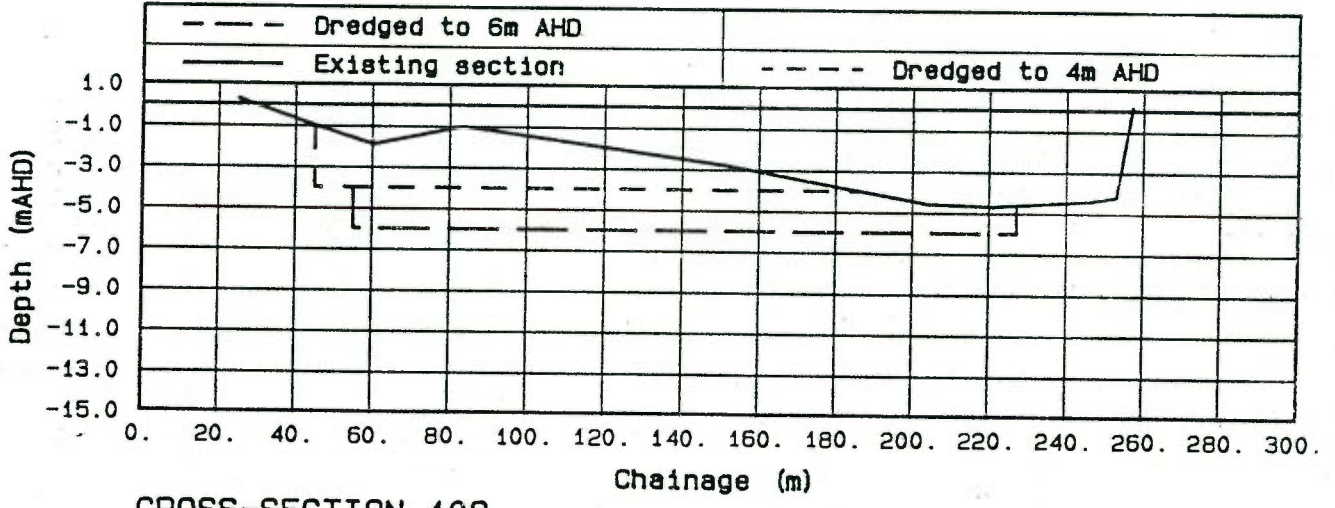
CROSS-SECTION 106

PROPOSED SAND AND GRAVEL EXTRACTION
 MODIFICATIONS TO RIVER CROSS-SECTIONS.

FIGURE
 6.5



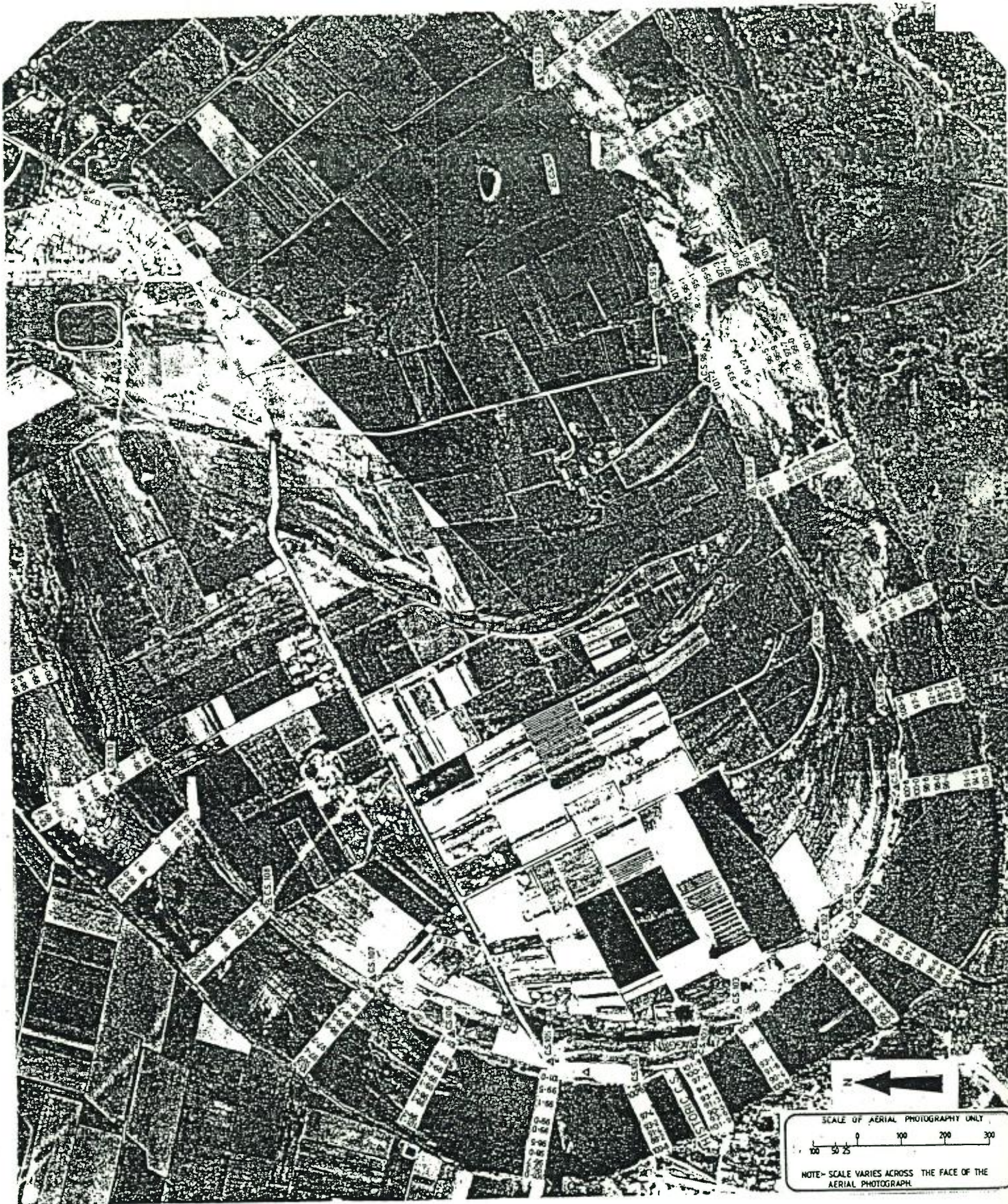
CROSS-SECTION No 107



CROSS-SECTION 108

PROPOSED SAND AND GRAVEL EXTRACTION MODIFICATIONS TO RIVER CROSS-SECTIONS.

FIGURE 6.6



LOCATION OF RIVER CROSS SECTIONS

FIGURE

6. 7

7.0 IMPACTS OF FUTURE OPERATIONS

7.1 GENERAL CONSIDERATIONS

Analysis of the potential impacts of the proposed gravel extraction strategy on tidal and flooding phenomena has been undertaken by the application of mathematical models of the Manning River downstream of Killawarra. These models were developed by Winders, Barlow and Morrison for the Public Works Department (Reference 5) using the hydrodynamic modelling program "ESTRY" (Appendix 1). The models have been calibrated and verified against various recorded data to ensure the satisfactory replication of flood and tide phenomena within the river.

7.2 IMPACTS ON TIDAL BEHAVIOUR

During tide model calibration and verification for the Public Works Department (Reference 5), information on tidal behaviour was largely unavailable upstream of Taree. To ensure model reliability, in this section of the river, a field measurement exercise was performed from 20-22/9/88, whereby tidal levels were measured at Wingham, Croki and Pampoolah. In addition, Public Works Department data was available for Taree, Harrington and Old Bar. The location of these gauging sites is illustrated on Figure 2.1. Recorded water levels from the PWD gauge at Crowdy Head were used as the ocean boundary conditions for the model. Flow data from the Killawarra gauging station was also available to quantify river inflows.

Figures 7.1 and 7.2 compare recorded and predicted water levels at each of the gauging sites mentioned above. Model reproduction of recorded water levels is considered acceptable at all sites. Those results for Wingham Road Bridge, located upstream of the Wingham Bar, indicate the obvious impact of this natural bar structure on upstream penetration of tidal influences. This effect was accentuated at the time of field measurement by the significant freshwater flow which was present.

In order to ascertain the likely impacts of the proposed sand and

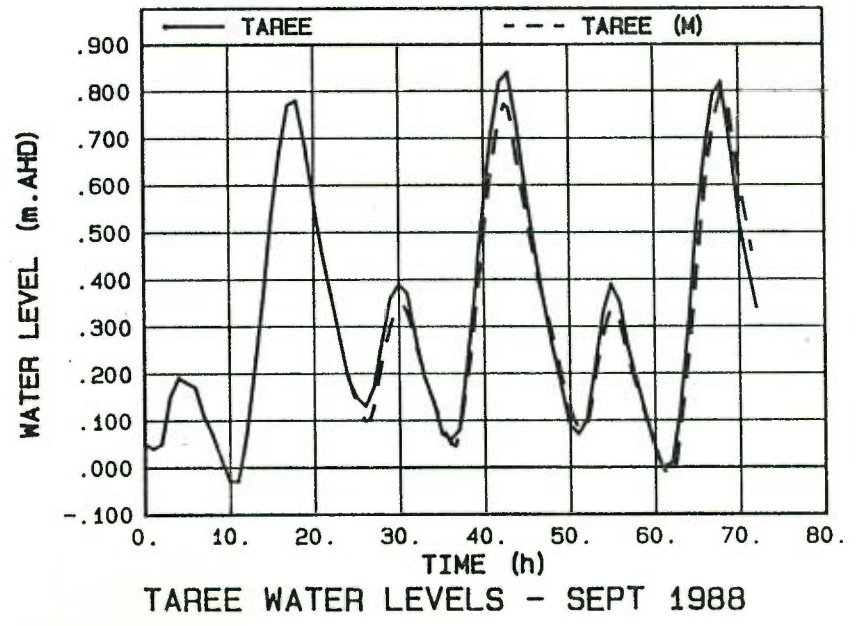
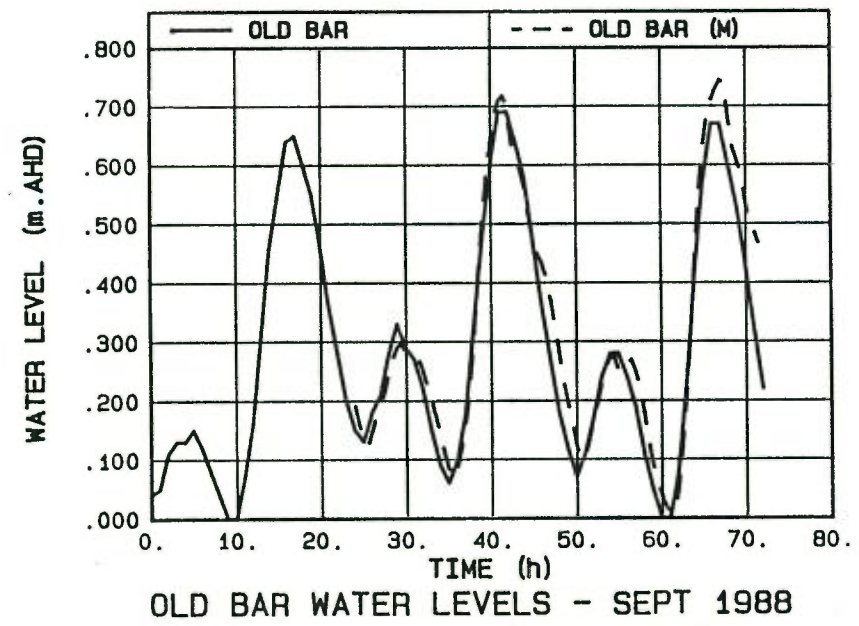
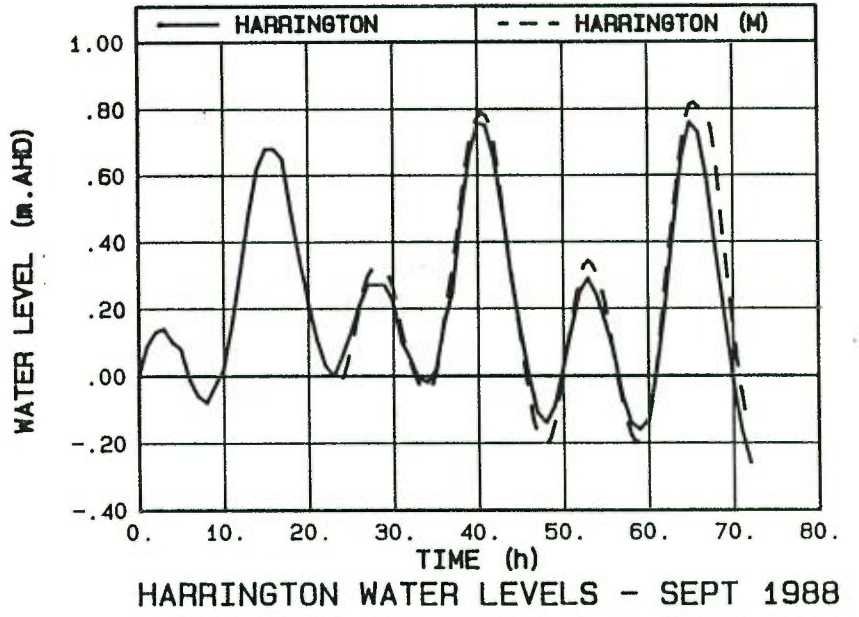
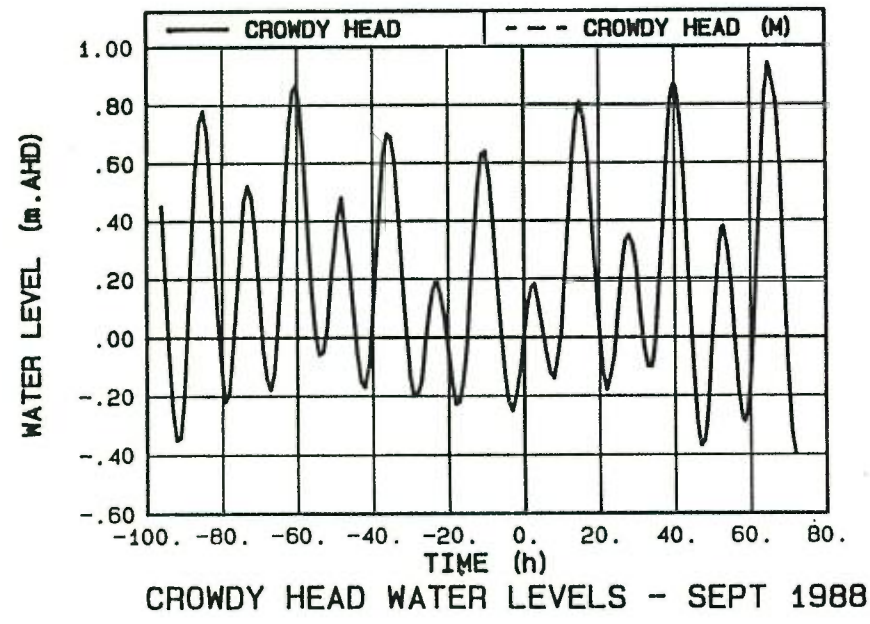
MEASURED WATER LEVEL-MODEL
PREDICTION COMPARISON

Winders, Barlow & Morrison Pty Ltd

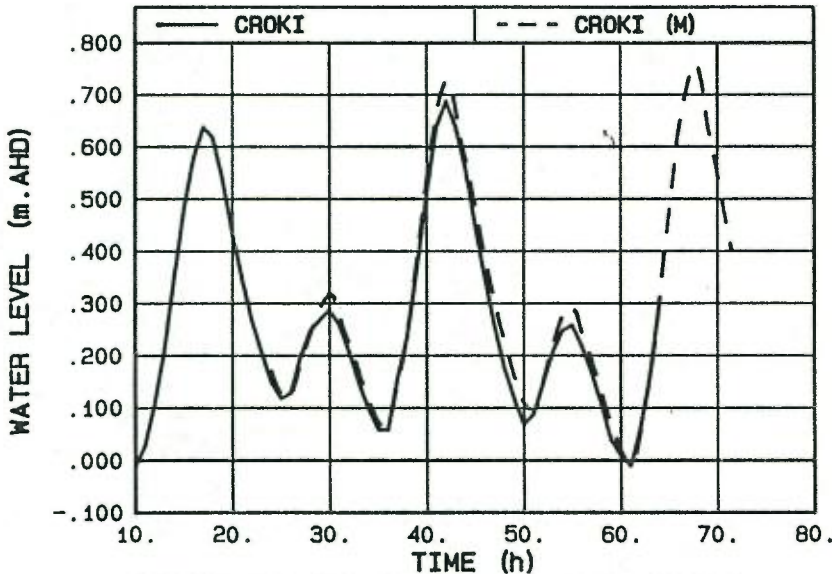
(M) denotes model results

7.1

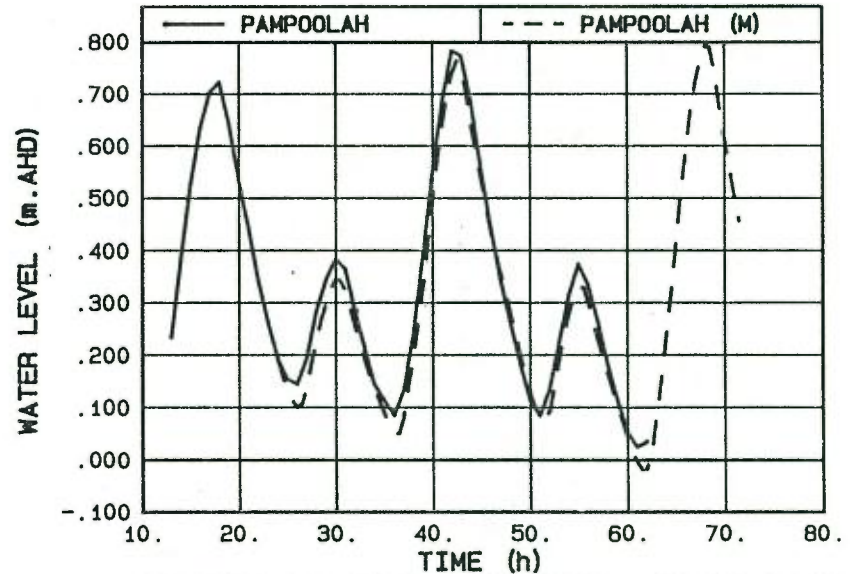
FIGURE



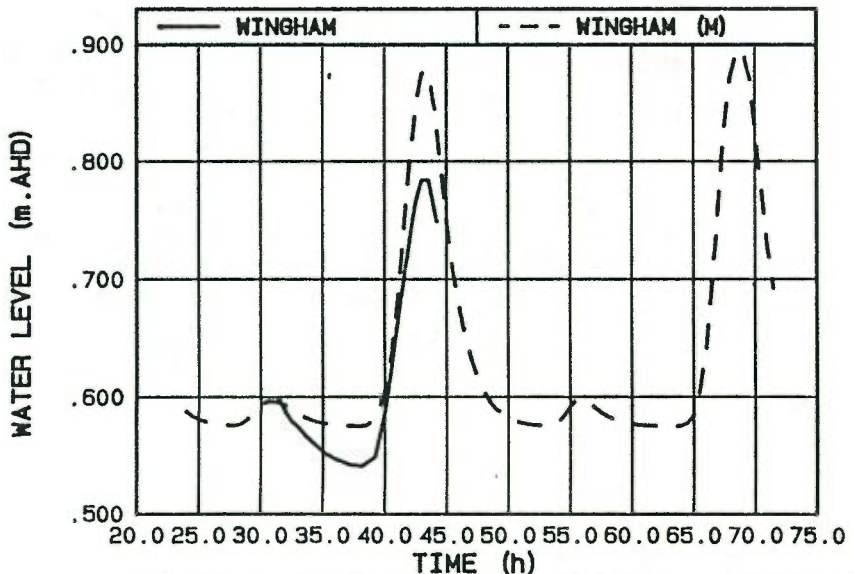
MEASURED WATER LEVEL-MODEL
PREDICTION COMPARISON



CROKI WATER LEVELS - SEPT 1988



PAMPOOLAH WATER LEVELS - SEPT 1988



WINGHAM BRIDGE WATER LEVELS - SEPT 1988

(M) denotes model results

gravel extraction strategies outlined earlier on tidal behaviour within the river, those cross-sectional alterations outlined in Figures 6.2 to 6.6 were incorporated within the calibrated and verified tidal model. Those gravel extraction works in the present P/O area which have occurred since 1980, when previous cross-section data is available, were included in the previously discussed calibration model. Pre and post dredging model runs for an ocean tide of 0.8m magnitude, with no upstream freshwater flow were performed. There would appear to be no discernible difference in tide levels before and after the proposed dredging activities. Model output indicates the practically negligible changes in tidal characteristics at Wingham and Taree, as outlined below.

As the two extreme cases of dredging illustrated below have shown to have a negligible impact on tidal behaviour, Option (C) from Section 6.0 has not been analysed as the impact of such a dredging strategy could be expected to be less than that for the other cases.

	PRESENT	POST-DREDGING (-4m AHD)	POST-DREDGING (-6m AHD)
Taree			
Max. Level	0.548m	0.548m	0.548m
Min. Level	-0.069m	-0.069m	-0.069m
Max. Flood Discharge	211.9m ³ /s	212.9m ³ /s	212.3m ³ /s
Max. Ebb Discharge	184.4m ³ /s	190.3m ³ /s	191.7m ³ /s
Tidal Prism	2.67 x 10 ⁶ m ³	2.685 x 10 ⁶ m ³	2.685 x 10 ⁶ m ³
Wingham			
Max. Level	0.624m	0.625m	0.624m
Min. Level	0.004m	0.004m	0.005m
Max. Flood Discharge	16.2m ³ /s	16.2m ³ /s	16.1m ³ /s
Max. Ebb Discharge	12.2m ³ /s	12.2m ³ /s	12.2m ³ /s
Tidal Prism	0.132 x 10 ⁶ m ³	0.132 x 10 ⁶ m ³	0.132 x 10 ⁶ m ³

The magnitude of these changes, particularly when the period required for the proposed dredged material removal is considered, is negligible.

7.3 FLOOD REGIME

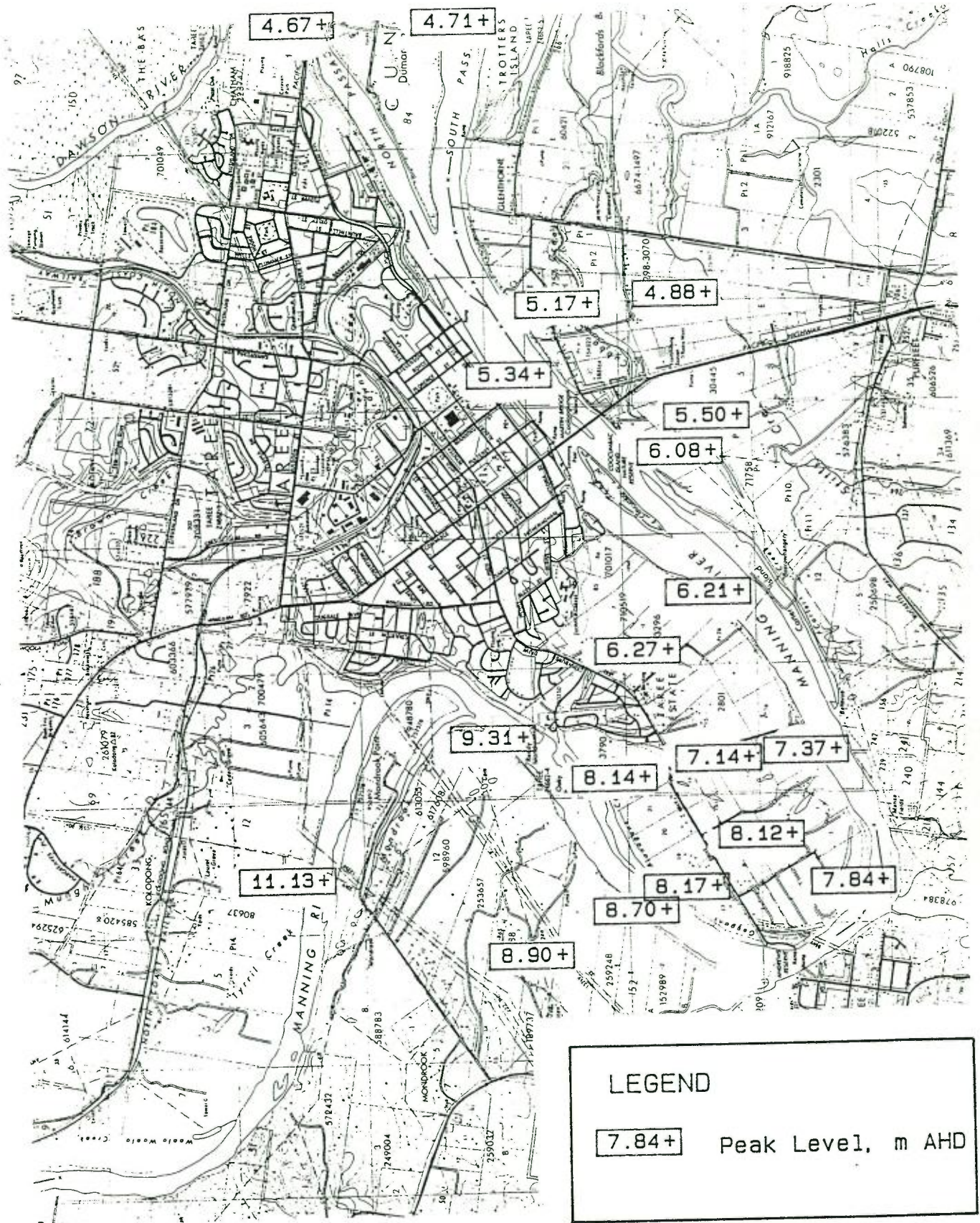
A calibrated flood model of the March 1978 flood was used as the base, or test case on which to determine the relative impacts of the proposed sand and gravel extraction options. This flood has an approximate return period at Taree of 80 years (based on some 140 years of recorded data) i.e. a flood of similar magnitude could be expected, on average, once every 80 years.

As for the tidal situation, those cross-sectional alteration options outlined in Section 6.0 were incorporated in the calibrated 1978 flood model to enable determination of the relative impact of both previous (1980 - date) and proposed dredging works on flood behaviour.

The maximum flood levels, velocities and flows in the river and floodplain in the vicinity of Taree for the various situations modelled are as follows.

- (i) Option A - Figures 7.3, 7.4, 7.5
- (ii) Option B - Figures 7.6, 7.7, 7.8
- (iii) Option C - Figures 7.9, 7.10, 7.11
- (iv) 1978 flood - Figures 7.12, 7.13, 7.14

Figures 7.15, 7.16 and 7.17 show the differences in maximum flood levels between the pre and post dredging cases. Note that a negative value indicates a reduction in peak level. It is apparent from perusal of the above figures that removal of the material outlined by the various options will result in the following changes in typical flood phenomena.



PEAK FLOOD LEVELS-DREDGING TO -4m AHD

FIGURE
7.3

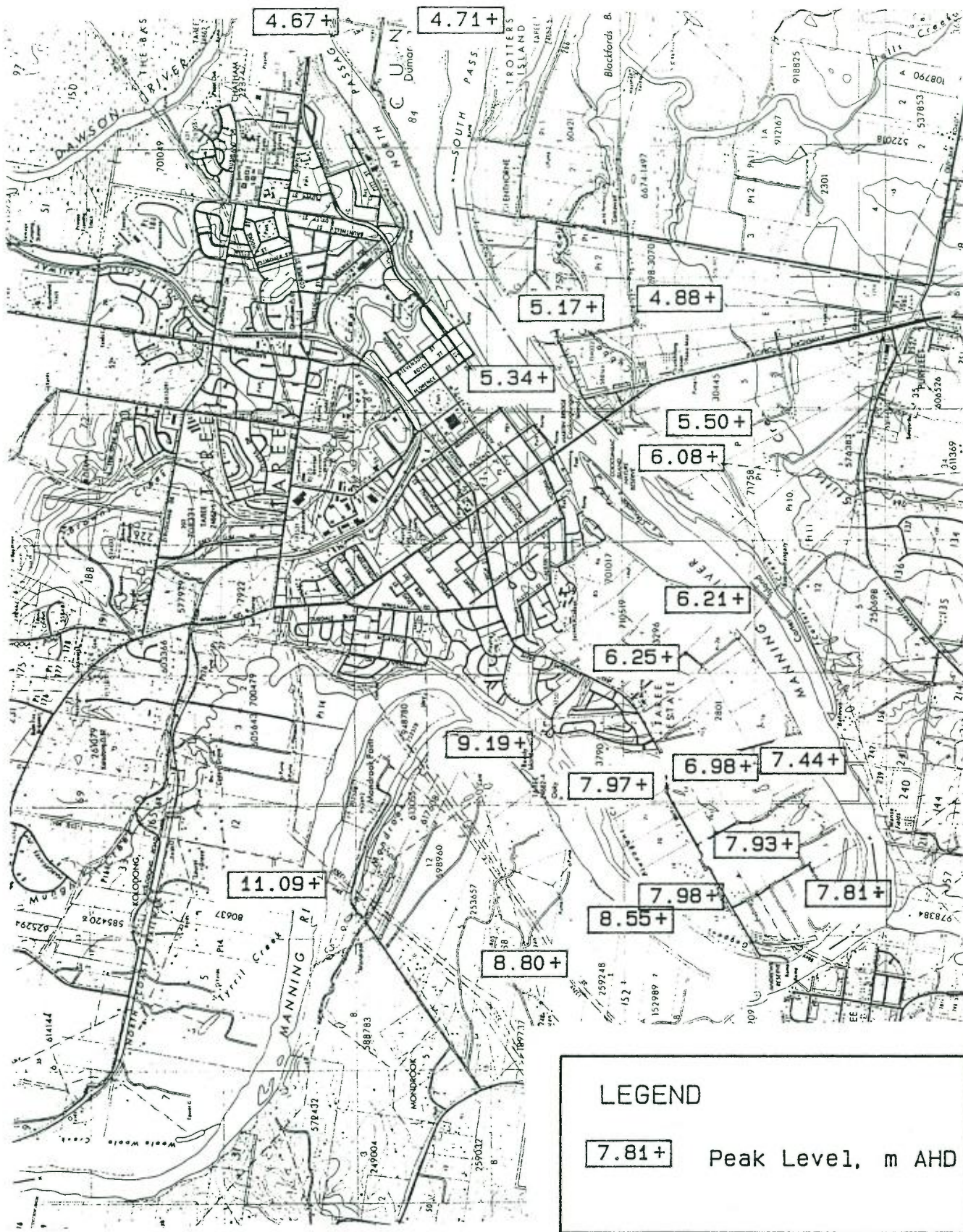


FIGURE
 PEAK FLOOD VELOCITIES—DREDGING TO -4m AHD 7.4



PEAK FLOOD FLOWS-DREDGING TO -4m AHD

FIGURE
7.5



PEAK FLOOD LEVELS—DREDGING TO -6m AHD

FIGURE
7.6



PEAK FLOOD VELOCITIES—DREDGING TO -6m AHD

FIGURE 7.7



PEAK FLOOD FLOWS-DREDGING TO -6m AHD

FIGURE 7.8

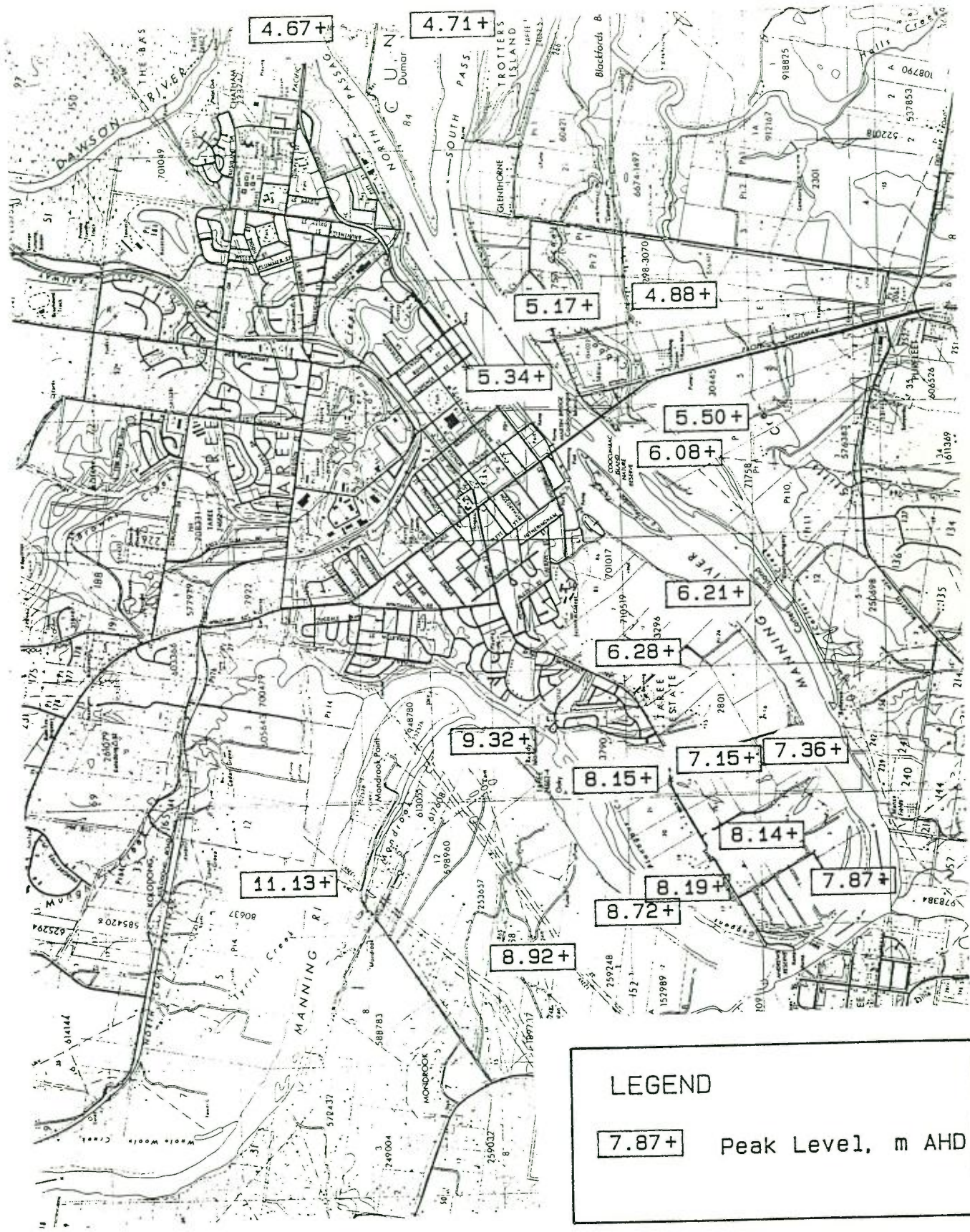


FIGURE
 PEAK FLOOD LEVELS—LIMITED DREDGING TO -6m AHD 7.9



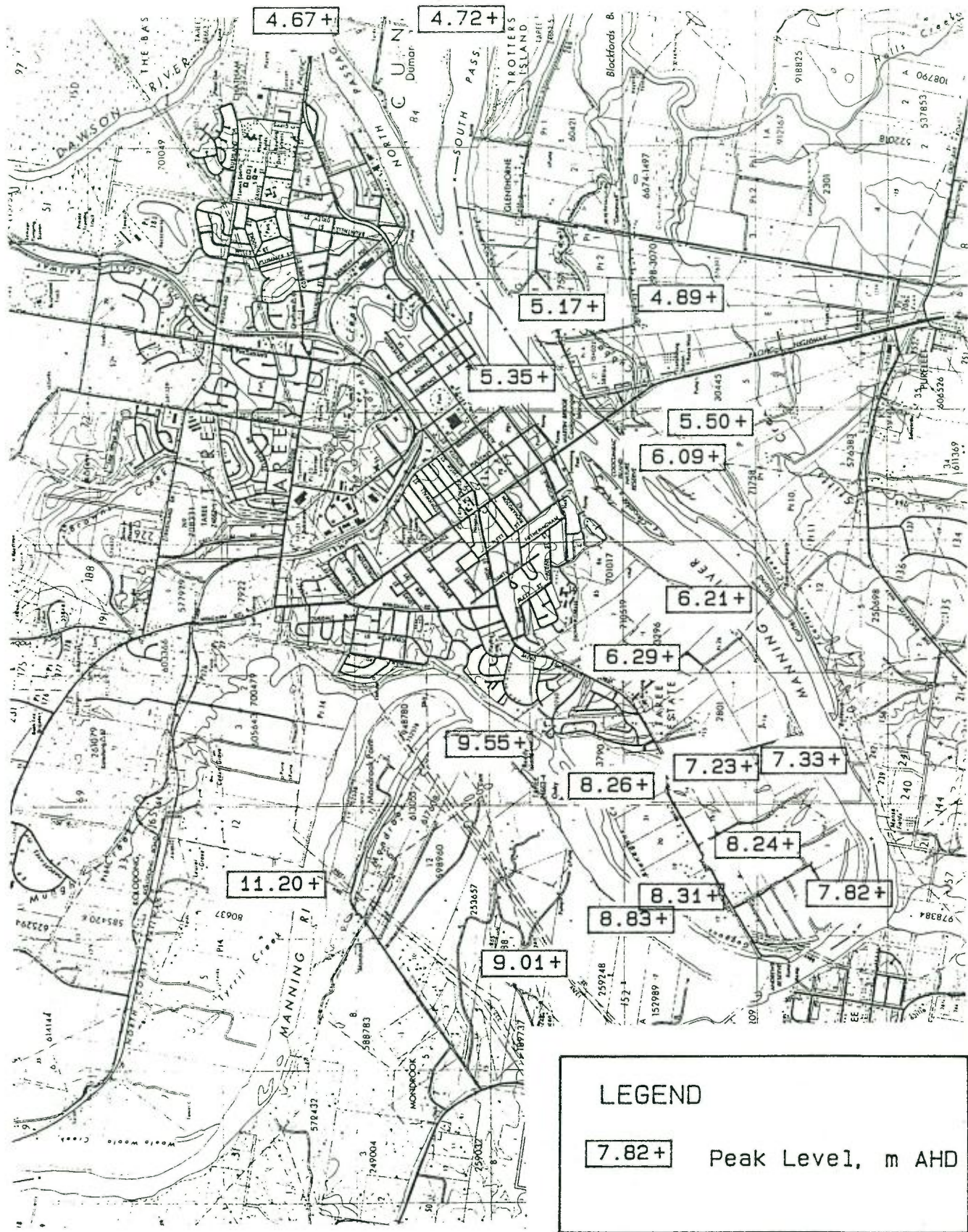
PEAK FLOOD VELOCITIES—LIMITED DREDGING
TO -6m AHD

FIGURE
7. 10



LEGEND
 2885. ↗ Peak Flow, cumecs

FIGURE 7.11
 PEAK FLOOD FLOWS—LIMITED DREDGING TO -6m AHD



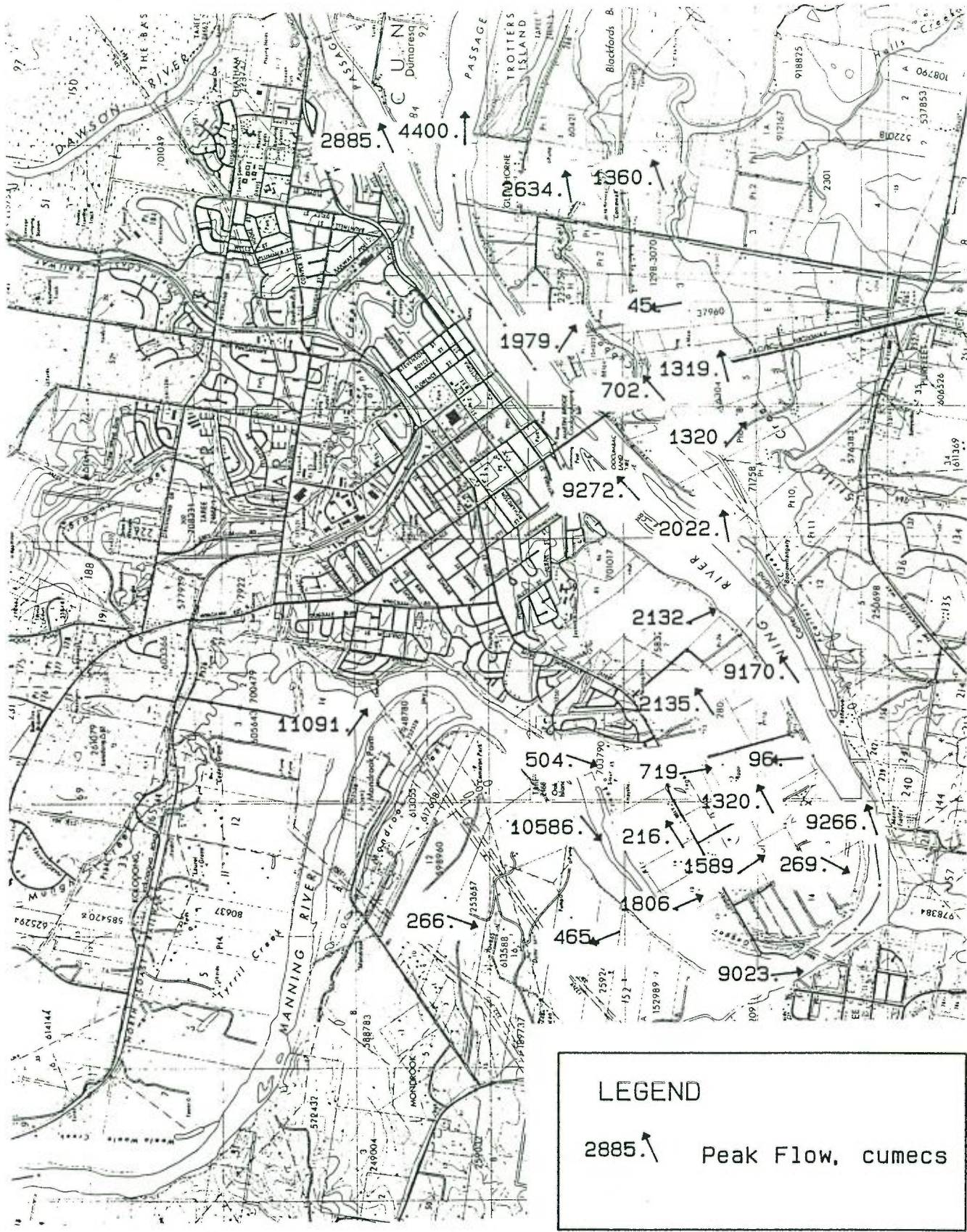
PEAK FLOOD LEVELS-1978 FLOOD

FIGURE
7. 12



PEAK FLOOD VELOCITIES-1978 FLOOD

FIGURE 7.13

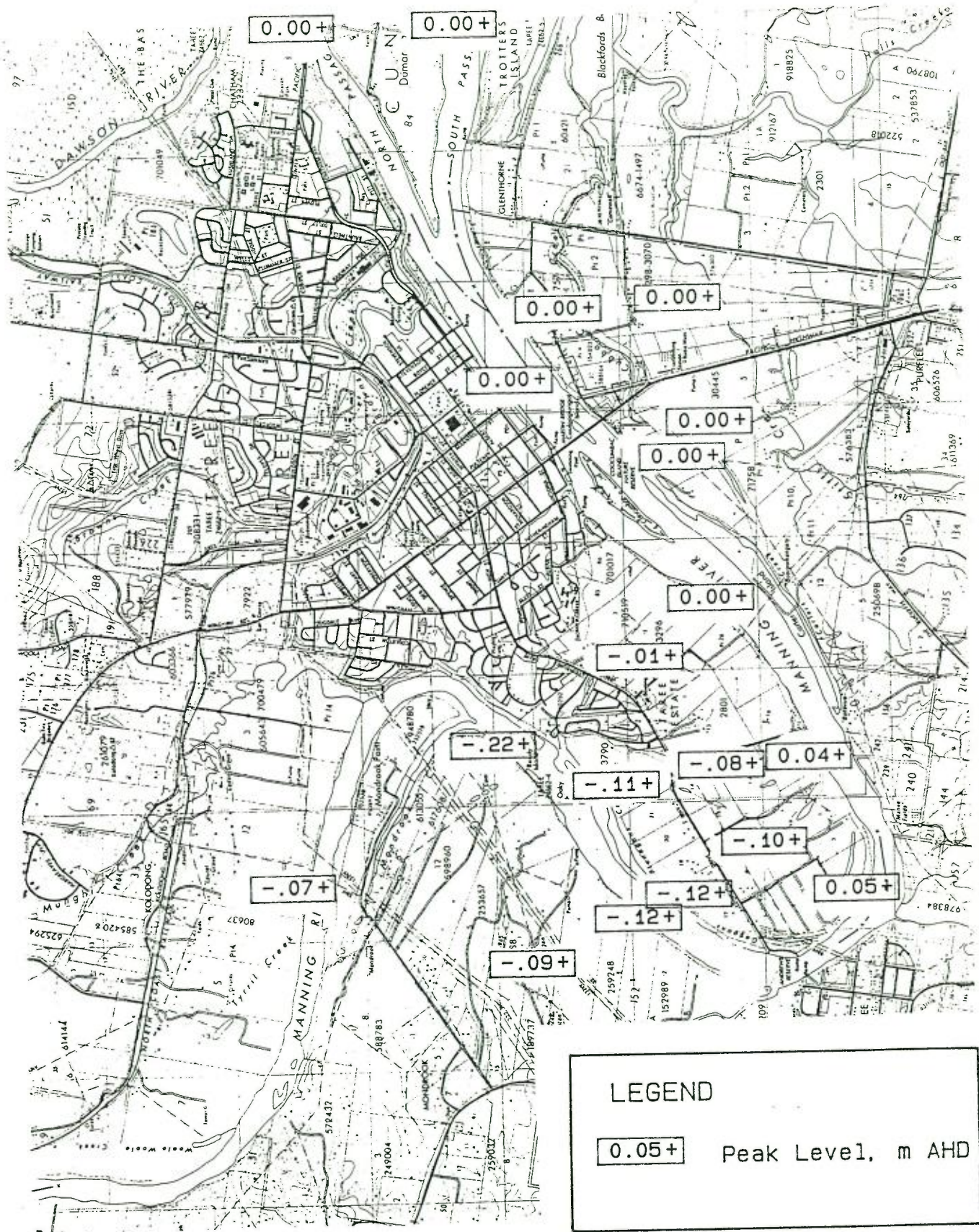


LEGEND

2885. ↗ Peak Flow, cumecs

PEAK FLOOD FLOWS-1978 FLOOD

FIGURE 7. 14



LEGEND

0.05+ Peak Level, m AHD

EFFECT OF LIMITED DREDGING TO -6m AHD ON
MAXIMUM FLOOD LEVELS

FIGURE
7. 17

- Option A

- . Maximum increase in downstream water level of 4cm in the river channel.
- . Maximum decrease in upstream water level of 24cm.
- . No increase in flood levels at Taree.
- . Flood levels across Taree Estate reduce typically by 12cm.
- . Average velocity adjacent Tinonee reduces by 3.3%.
- . Average velocity adjacent Taree West increases by 8%.

- Option B

- . Maximum increase in downstream water level of 11cm in the river channel.
- . Maximum decrease in upstream water level of 35cm.
- . No increase in flood levels at Taree.
- . Flood levels across Taree Estate reduce typically by 28cm.
- . Average velocity adjacent Tinonee reduces by 7.8%.
- . Average velocity adjacent Taree West increases by 11.3%

- Option C

- . Maximum increase in downstream water level of 5cm in the river channel.
- . Maximum decrease in upstream water level of 11.5cm.
- . No increase in flood levels at Taree.
- . Flood levels across Taree Estate reduce typically by 10cm.
- . Average velocity adjacent Taree West increases by 7.1%.

7.3.1 Discussion

Of those flood cases analysed in 7.3, Option (C) is that which is recommended. The impacts on flooding of this extraction case are discussed below -

- . Maximum levels throughout the Taree Estate area for a flood similar to the 1978 event would be reduced by approximately 10cm due to the proposed dredging. This is an area particularly sensitive to flooding, and the predicted reduction in maximum flood levels is considered to be significant.
- . Associated with the reduction in flood levels across Taree Estate is a corresponding reduction in flood flows. This also is desirable from the viewpoint of improving the amenity and safety of this area under flood events.
- . The increases in maximum flood levels downstream of the proposed dredging lease will be relatively difficult to distinguish from natural water level variations due to wave and localized effects, and also occur in an area where such localized increases are relatively insignificant, as the effects are constrained within the river, not affecting levels over developed floodplain areas.
- . Additional flow will occur in the Tinonee reach of the river by dredging upstream, however as no such works will occur adjacent Tinonee itself, an increase in river velocity can be expected. This increase is predicted to be approximately 4.2%, and given the nature of the river banks at Tinonee, and their apparent stability, is likely to be of no consequence.
- . The predicted increase in river flow upstream at Taree West is approximately 0.2%. Once again, considering the nature of the river banks (rock) in this reach of the river, such an increase is considered to be of no consequence.

7.3.2 Impacts of Ancillary Works on Flooding

The Readymix gravel processing plant and stockpile area are presently located in the vicinity of a flood flow path from the Manning River into Fig Tree Creek, adjacent to Oaky Island. This

stockpile area may presently be a minor obstruction to flood flows, however it is intended to relocate this stockpile in the near future to prevent any potential influence on flood flows. No other ancillary components of the proposed Readymix operation are envisaged as having any discernible impact on flooding.

7.4 SALINE INTRUSION

As documented elsewhere (Reference 4), concern has been expressed that dredging activities within the Manning River may enable increased penetration of saline waters to the upper reaches of the river, potentially threatening the quality of the source of water supply to the Taree region. Those results shown in Section 7.2 indicate that the influence on tides at Wingham of those dredging activities assessed within this report is negligible, and could be expected to have no impact on the present situation of saline intrusion to the upper reaches of the river.

In addition to the above, the principal barriers to saline penetration to the upstream reaches of the river are the gravel bar structures at Wingham Bar, Jackson's Falls and Abbott's Falls. As the gravel extraction works discussed in this report have no influence or effect on these bar structures, then no impact on saline intrusion, or salt wedge penetration, to the upper reaches of the river is likely.

7.5 RIVER BANK STABILITY

7.5.1 General Considerations

As a guide to the likely stability of the river bank following gravel extraction to those limits recommended within this investigation, comparison has been made between typical submerged river bank slopes in other sections of the river and likely slopes following dredging.

Examination of available cross-sections indicates a stable river bank slope on either side of the river of approximately 1 vertical : 3 horizontal, extending to some 10m below AHD. This slope would appear to have remained stable for the 10 year duration of representative sections.

Typical maximum angles of repose of sand and gravel material are between 1 vertical : 1.6 horizontal and 1 vertical : 1.4 horizontal (Reference 6). Comparison of these values with those given above would indicate that the slope of 1 vertical : 3 horizontal is relatively stable. For the proposed operations, assuming some redistribution of material within the initially excavated face, a submerged river bank slope of 1 vertical : 5 horizontal (i.e. 6m below AHD : 30m from river bank level) will result. Given the considerations above, this slope would appear to be inherently stable.

7.5.2 Bank Stability Calculations

Adopting the approach given in Chow (Reference 7) to assessing the likely erodability of a channel bank under flood flow conditions, and assuming a likely long term submerged bank slope of 1 vertical : 5 horizontal, calculations indicate that for a flood of similar magnitude to the 1978 flood, i.e. an 80 year flood, no significant bank erosion should result. Calculations supporting this finding are outlined in Appendix 2.

7.5.3 Other Considerations

All previous bank stability considerations have assumed uniform flow essentially parallel to the river bank. Any flows directed laterally towards the bank, or localized vortices, induced by major channel bed discontinuities have not been specifically considered, and may produce localized river bank scour.

Due to the potential for such localized scour, sand and gravel extraction operations should be such that a relatively even river bed is maintained. This is achievable with a tolerance of $\pm 0.5\text{m}$ relatively easily by routine, periodic surveying of the river, and by extraction procedures such that the recommended maximum dredge limit is adhered to. The mobile nature of the bed material should allow some river bed smoothing during a major flood, acting to reduce localised water turbulence and scour at the bed. Appendix 3 contains further recommendations pertaining to this issue.

Also, principal areas of extraction are located within relatively straight sections of the river, and on the inside of river bends. These actions should have no effect on river meander patterns, and should in fact reduce any such tendencies.

8.0 CONCLUSIONS

The findings of this investigation into the sediment transport regime of the Manning River between Wingham and Taree, and the potential impacts of a proposed sand and gravel extraction strategy on tidal, flood, bank stability and other issues are as follows:-

- (i) For the proposed area of sand and gravel extraction, as shown in Figure 3.1, the long term average sediment transport/infill rate is 4,500 m³/year. Comparison of this sediment replenishment rate with the proposed average extraction rate of 55,000 m³/year indicates that the extraction operations must be viewed as a mining operation of a limited resource. Such a project can therefore not be considered of unlimited viability.
- (ii) Operating within the proposed extraction area downstream of the present Readymix lease, three options of dredging constraints have been assessed.

Option A- Operation no deeper than 4m below AHD, and no closer than 20m to the river bank, from the present downstream lease boundary to the upstream limit of the Mitchells Gravel lease.

Option B- As for Option (A), with additional extraction to 6m below AHD, no closer than 30m to the river bank.

Option C- As for Option (B), however extending only 1km downstream of the present lease boundary.

These proposals would provide sufficient material for respectively 10 years, 26 years and 12 years at the likely average extraction rate. No confirmation of the availability of gravel reserves to 6m below AHD has been undertaken.

(iii) Tests with fully calibrated and verified hydrodynamic tide and flood models of the river of modified river cross-sectional data, simulating the complete extraction of the above material resulted in the recommendation of Option (c) for future operations. This option has the following impacts on flood and tidal phenomena within the Manning River.

- . no discernible effect on tidal descriptors at Wingham and Taree.
- . maximum flood levels within the river only immediately downstream of the extraction area increased by 5cm. No increase in flood levels at Taree. No effect on Cocumbac Island.
- . maximum flood levels upstream of the site reduced by up to 11.5cm within the river, and typically by 10cm across Taree Estate.
- . marginal increases in flow velocities upstream and downstream of the operations area. The rocky nature of river bank bends in these areas (Taree West and Tinonee) should see no impact of such velocity variations on present river bank stability.
- . no impact of ancillary works associated with dredging (e.g stockpiles) on flooding.

(iv) No increase in present saline penetration to the upstream reaches of the river, above Wingham, is predicted.

(v) Limitation of operations within the river to those constraints outlined previously should see the production of no river bank stability problems. Satisfactory survey control to ensure relative uniformity of the excavated bed is recommended in order to reduce turbulence which may contribute to bank scour problems.

- (vi) Dredging operations should be initially contained within the shallow areas of the river bed adjacent to the inside of the river bend at Taree Estate so as to reduce or alleviate present erosion on the opposite river bank.
- (vii) Continued extraction operations in the area of river considered within this report should have an ameliorating effect on reported river siltation problems downstream of Taree.
- (viii) The principal areas of proposed sand and gravel extraction are located within relatively straight sections of the river and on the inside of river bends. These extractive operations should have no effect on river meander patterns, and should in fact reduce any such tendencies.

9.0 RECOMMENDATIONS

Given that gravel extraction as outlined in Option (C) to a maximum depth of 4m below AHD no closer than 20m to bank water level, and 6m below AHD no closer than 30m to bank water level for a distance of 1km downstream of the present downstream lease boundary has been shown to have no deleterious effects on tidal, flooding or saline movement phenomena, results in significant reductions in likely peak flood levels in the Taree Estate area, and is expected to produce no river bank stability problems, this strategy is recommended for application by Readymix.

REFERENCES

Reference 1 "A Study of Estuarine Channel Morphology having Special Reference to the Manning River Delta, New South Wales" Ph.D Thesis - University of Newcastle, W.N. Jenks, 1982.

Reference 2 "Manning River Gravel Extraction - Preliminary Assessment", PWD Report No 80031, December 1980.

Reference 3 "Manning River Flood History, 1831 - 1979", PWD Report No PWD 81019, October 1981.

Reference 4 "An Appraisal of Tidal and Survey Data From the Upper Reaches of the Manning River Estuary", PWD July 1983.

Reference 5 "Manning River Flood Study - Hydraulic Report" - prepared for the Public Works Department, by Winders, Barlow & Morrison.

Reference 6 "Soil Mechanics", Lambe and Whitman.

Reference 7 "Open Channel Hydraulics", V T Chow.

APPENDIX 1
HYDRODYNAMIC MODEL
DESCRIPTION

APPENDIX 1

HYDRODYNAMIC NETWORK MODEL

In ESTRY, a network-type hydrodynamic simulation program, the waterway is broken up into a number of nodes, with a portion of the surface area being identified with each node. For the channel between each pair of nodes, the cross-sectional shape is defined numerically. This allows the width, cross-sectional area and surface area to be varied with varying flow depth.

The one-dimensional continuity and momentum equations may be written thus:

$$\frac{\partial}{\partial x} (VA) + B \frac{\partial H}{\partial t} = 0$$

$$\frac{\partial V}{\partial t} + v \frac{\partial V}{\partial x} + g \frac{\partial H}{\partial x} + K|V|V = 0$$

Where V = average channel velocity (m/s)

A = cross-sectional area of channel (m²)

H = height of water surface (m)

B = channel width (m)

g = acceleration due to gravity (m/s²)

K = friction coefficient (based on Manning's "n" and the hydraulic radius)

x = distance along the channel (m)

t = time (s)

These equations are solved by a Runge-Kutta method (Reference 1) from a given starting condition, subject to given boundary conditions; namely the level and/or inflow being defined at certain nodes.

Provision is made for varying water level and inflow conditions with time. Since the non-linear inertia and friction terms are included, this allows dynamic modelling of transient responses to tides, flood run-offs, etc.

Looped and branched networks can be set up, thereby allowing a wide variety of configurations to be modelled; including, for example, braided streams and complicated estuaries with islands and inlets. Provision can be made for channels which flow only above certain water levels.

The accuracy of the numerical model is limited only by the capacity of the computer used and the time available for computation. The maximum permissible time step proportional to the shortest channel length, while the computation time per step is roughly proportional to the number of channels in the model.

PROGRAM OPTIONS

Solution can be carried out either explicitly using a Runge-Kutta technique, or implicitly using a matrix solution method.

The input channel data can take a variety of forms. Channel length and Manning's "n" are specified as well as the width of the channel at different levels. The area of cross-section can be calculated from these widths or input directly. The wetted perimeter is also specified at different levels. The gradient of the channel bed and the divergence of the channel may also be specified. Manning's "n" can either be constant or vary with the water level.

Special channels are available:

- (1) Bridge Channels calculate the losses due to a bridge in accordance with the procedures outlined in "Hydraulics of Bridge Waterways", Hydraulic design Series No. 2., Second Edition, U.S. Department of Transportation 1973.

- (2) Culvert channels incorporate the effects of either rectangular or circular culverts. Six different flow regimes are simulated with flow in either direction. Adverse slopes are accounted for and flow may be subcritical or supercritical.

The basic culvert flow regimes considered are shown in Figure A.1.

The calculations of culvert flow and losses are carried out using techniques from "Hydraulic Charts for the selection of Highway Culverts", Hydraulic Engineering Circular No. 5, U.S. Bureau of Transportation, together with additional information provided in "Open Channel Flow" by Henderson. The calculations have been compared and shown to be consistent with manufacturer's data provided by both "Rocla" and "Armco".

- (3) Uni-directional channels to reproduce the effect of flood gates, or tide gates.
- (4) Weir channels to represent broad-crested weirs. The governing equations have been extracted from the reference described in (1) above.
- (5) Variable geometry channels simulate the effect of scour during a flood.

Nodal surface areas are specified at different water levels. Either linear interpolation or cubic spline interpolation is available for intermediate levels.

Boundary conditions that are available are as follows:

- (1) A sinusoidal head boundary, allowing up to two components with different periods and phases.

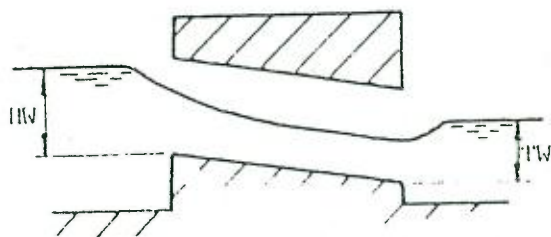
- (2) A head versus time boundary of any specified form.
- (3) A head as a function of flow boundary.
- (4) A fixed volume flow boundary or flow hydrograph.
- (5) A flow as a function of head boundary.

Boundary conditions (2), (3), and (5) are input as a table of ordinates and interpolated either linearly or with cubic splines.

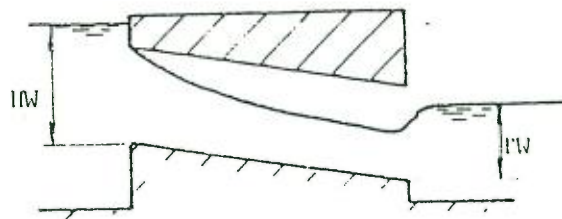
REFERENCES

1. Morrison, W.R.B. and Smith, P.A., (1978), "A Practical Application of a Network Program", Published in Numerical Simulation of Fluid Motion, North-Holland Publishing Co., Amsterdam, pp 407-434.

INLET CONTROL FLOW REGIMES

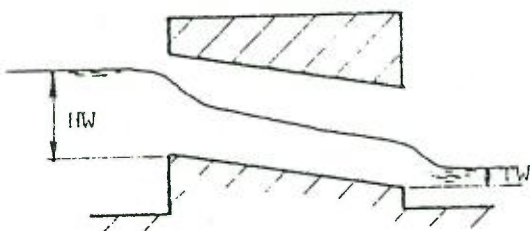


A: Unsubmerged entrance, supercritical slope

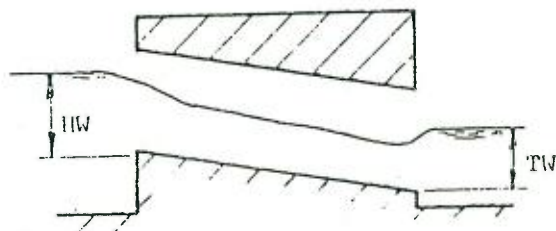


B: Submerged entrance, supercritical slope

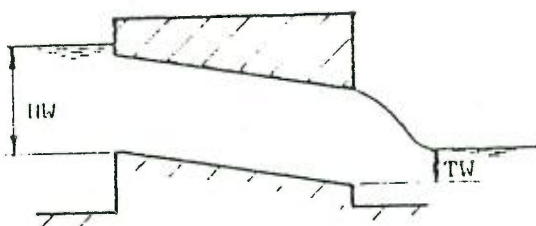
OUTLET CONTROL FLOW REGIMES



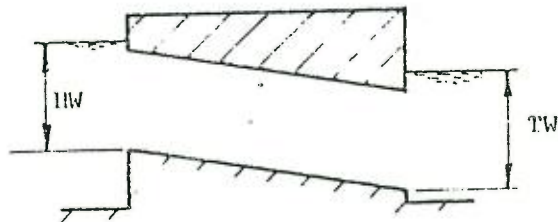
C: Unsubmerged entrance, critical exit



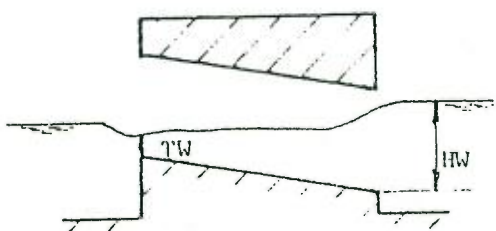
D: Unsubmerged entrance, subcritical exit



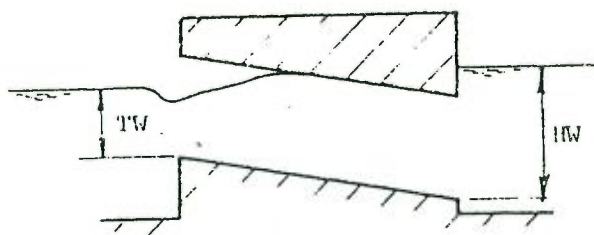
E: Submerged entrance, unsubmerged exit



F: Submerged entrance, submerged exit



I: Adverse slope, unsubmerged entrance (Critical or subcritical at exit)



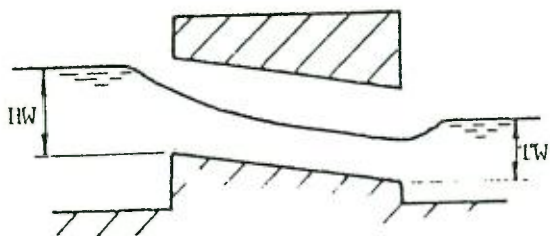
II: Adverse slope, submerged entrance

CULVERT FLOW REGIMES

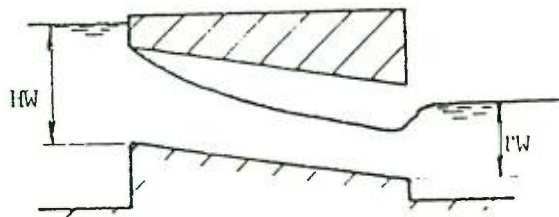
FIG

A

INLET CONTROL FLOW REGIMES

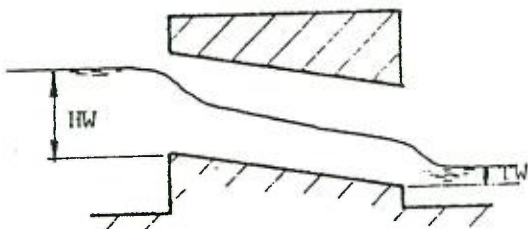


A: Unsubmerged entrance, supercritical slope

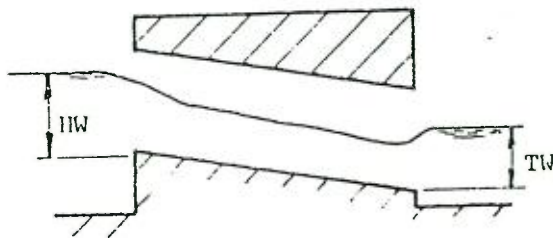


B: Submerged entrance, supercritical slope

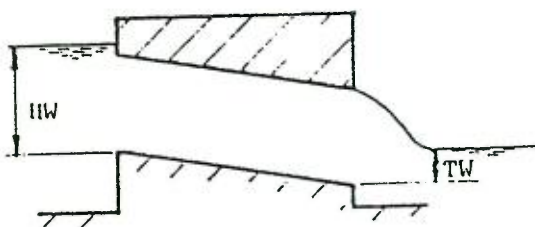
OUTLET CONTROL FLOW REGIMES



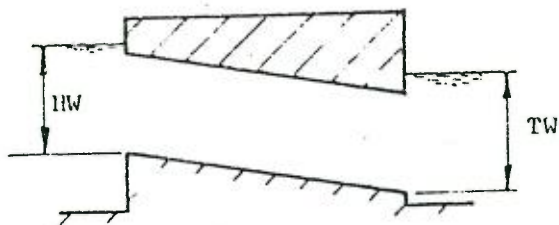
C: Unsubmerged entrance, critical exit



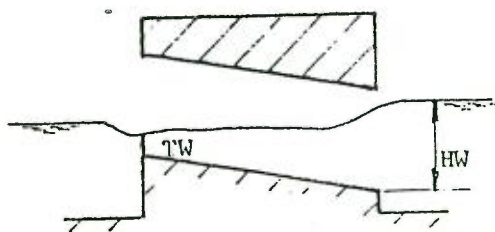
D: Unsubmerged entrance, subcritical exit



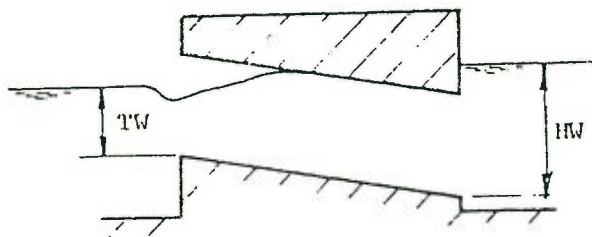
E: Submerged entrance, unsubmerged exit



F: Submerged entrance, submerged exit



J: Adverse slope, unsubmerged entrance (Critical or subcritical at exit)



H: Adverse slope, submerged entrance

APPENDIX 2
BANK STABILITY
CALCULATIONS

BANK STABILITY CALCULATIONS

Chow recommends that the tractive stress on the side slope of a channel similar to that in the Manning River, adjacent to Tinonee, be given by

$$t_d = 0.775 w \cdot y \cdot s$$

where

- t_d = shear stress (developed)
- w = unit weight of water (9810 N/m³)
- y = hydraulic radius
 - = 10.8m for the peak flood level
- s = water surface slope
 - = $\frac{8.7 - 7.84}{2125} = 0.0004$ m/m

hence $t_d = 33$ Pa

For material at Tinonee, with $d_{75} = 50$ mm, the permissible tractive force for material on the bottom of the channel is 38.3 Pa.

To convert this to the permissible tractive stress (t_p) on the sides, the tractive force ratio is used (k)

$$\text{where } k = \left[\frac{\sin^2 \phi}{1 - \frac{\sin^2 \phi}{\sin^2 \theta}} \right]^{1/2}$$

where ϕ = bank angle (1 in 5 or 12°)
and θ = angle of repose = 30°

Hence, $k = 0.909$

$$t_p = 0.909 \times 38.3 = 34.8 \text{ Pa}$$

Therefore, as $t_d < t_p$, then no bank erosion for a flood similar to the 1978 flood can be expected for a bank with a slope of 1 in 5, the likely natural slope angle following gravel excavation.

APPENDIX 3
RECOMMENDED OPERATIONS
STRATEGY

RECOMMENDED OPERATIONS STRATEGY

Recommendations applying to the operations strategy for sand and gravel extraction are as follows:

- (i) Surveys of river cross-sections at 50m intervals are recommended at 12 month intervals. These surveys provide the following.
 - . an accurate record of changes to the river bed due to dredging and flood effects.
 - . a control mechanism to ensure maximisation and uniformity of extraction operations (i.e. to ensure that no areas of the river are "missed")
 - . management supervision of dredge operator.

- (ii) Special surveys of the river immediately after a major flood event.

- (iii) Instruction and supervision of dredge operator to ensure maintenance of the recommended extraction depth. This would require -
 - . placement of accurately levelled tide boards adjacent to the area of operation within the P/O, in sight of the dredge operator.

 - . instruction of the operator to ensure his depth of extraction, relative to the water level as shown on the tide board, is approximately equivalent to 6m below AHD.

- (iv) The extraction strategy should be to "work" a lateral face of appropriate width (10 - 15m), progressively moving along the river within the confines of the lease. Such operations should be repeated until exhaustion of the defined extraction body.

APPENDIX C

**EXTRACTION OF
WINGHAM GRAVEL DEPOSIT**

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1.

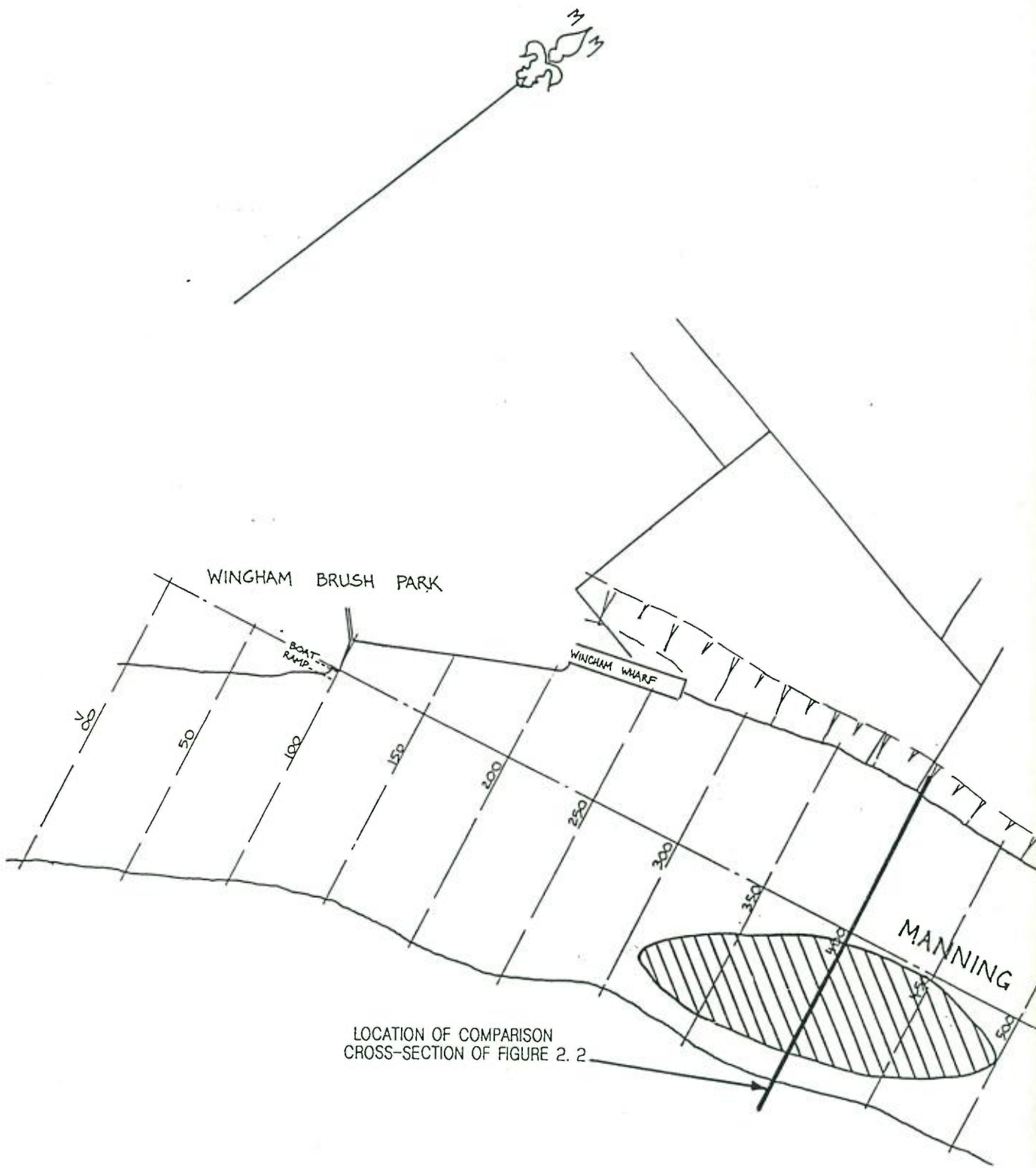
1.0 BACKGROUND

The occurrence and gradual build-up of a significant gravel deposit within the Wingham Reach of the Manning River has been noted in recent years. This deposit is having an impact on the local amenity of the river in this area, particularly affecting power boat usage and water skiing, popular pastimes with local residents. This gravel deposit has not been removed to date by dredging or other means as the potential local environmental impacts of this removal have not been identified. Certain of these issues are addressed in the following sections of this report. Biological aspects of removal of the deposit are discussed in report Section 2 - Biological Assessments.

2.0 NATURE OF GRAVEL DEPOSIT

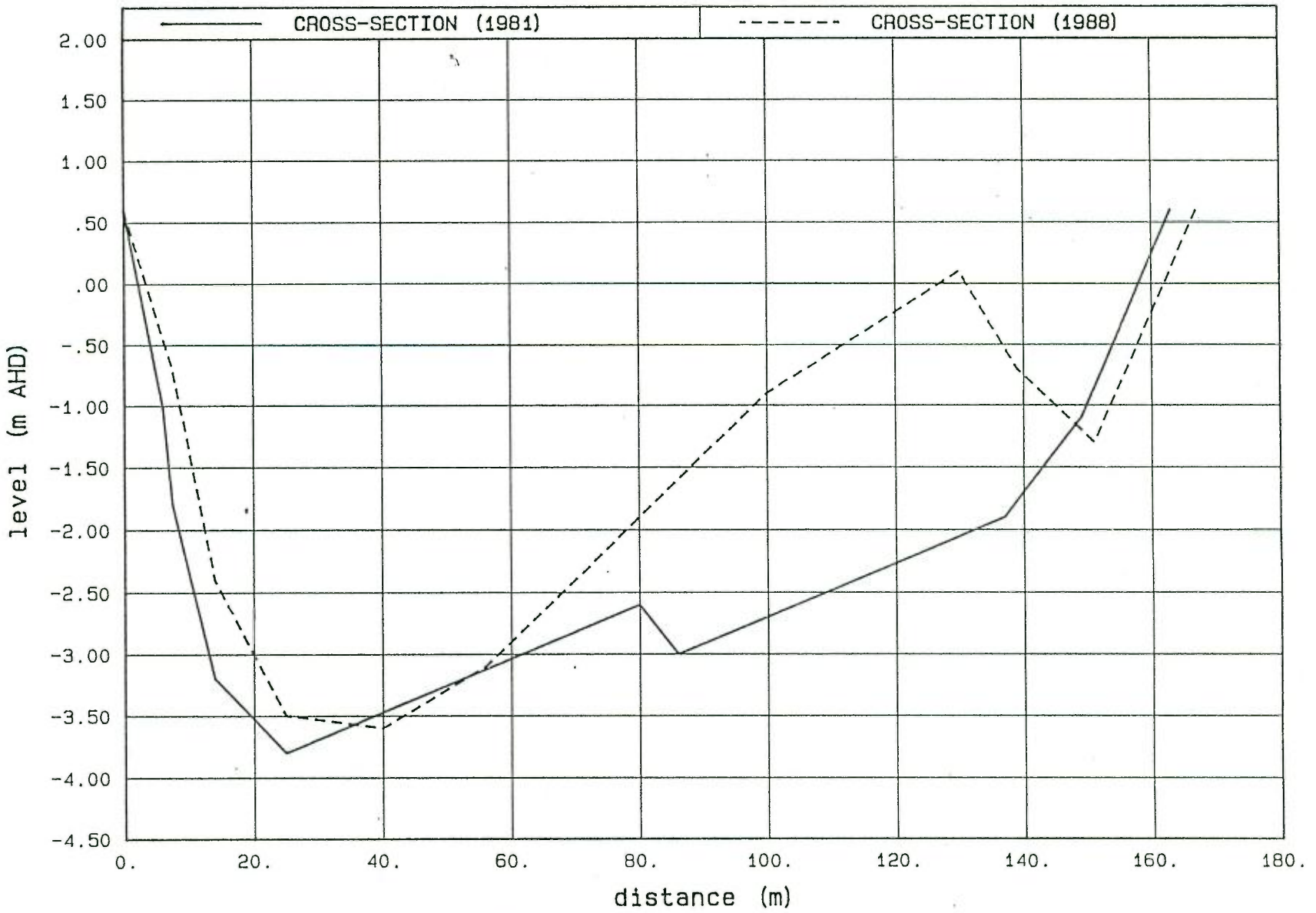
The extent and location of the gravel deposit is illustrated in Figure 2.1, with a comparison between recent and historical cross-sectional data being shown in Figure 2.2, for a cross-section approximately 150 metres downstream of the Wingham Wharf.

This build-up of gravel would appear to have resulted from that a "significant" freshwater flow event has not occurred within the Manning River since March 1978. Thus, no significant flood related scouring of the river bed has occurred, enabling the gradual accumulation of material as illustrated in Figure 2.2.



EXTENT AND LOCATION OF
GRAVEL DEPOSIT - WINGHAM

FIGURE
2. 1



WINGHAM CROSS - SECTION COMPARISON

WINGHAM GRAVEL DEPOSIT
- CROSS-SECTIONAL COMPARISON

FIGURE
2.2

3.0 POTENTIAL IMPACTS OF GRAVEL DEPOSIT REMOVAL

3.1 FLOODING

The nature and extent of the gravel deposit are of such relatively small magnitude that evaluation of the impacts of removal of the deposit on flooding by computer modelling, as for the proposed extraction works adjacent Taree Estate, is impractical.

Prior to further discussion of the impacts of the gravel deposit on flooding, the following points should be noted.

- . The gravel deposit has 'occurred' since the last significant flood within the Manning River (1978). Hence, comparison of the impact of removal of the deposit on flood levels resulting from the 1978 flood, as was performed for the proposed Readymix lease area, would be invalid. Removal of the deposit would return the upstream and downstream flood levels to those which could have been expected prior to, and including, the March 1978 flood.
- . Hand calculations indicate that for a flood of similar magnitude to the March 1978 event, removal of the gravel deposit under consideration would result in a maximum increase in downstream flood levels, above those that would result were the deposit to remain, of the order of 1cm, with a corresponding reduction in upstream flood levels.
- . The nature of the materials within the deposit (predominantly coarse sands and gravels) are such that upon occurrence of a significant flood, erosive effects would in all probability see the rapid removal of this deposit.

Given those points outlined above, it is considered that removal of the gravel deposit would have a negligible effect on flood levels both upstream and downstream of the site.

3.2 WATER QUALITY

Some transient impacts on the local water quality regime of the river may result due to the resuspension of finer sediment material from within the gravel deposit during dredging. However, the relatively coarse nature of the majority of sediments within the deposit, and the likely short duration of dredging works necessary to remove the small quantities of material involved, should see the water quality impacts within the river as being indistinguishable from normal diurnal fluctuations in water quality within the river.

3.3 BANK STABILITY

Removal of material within the Wingham deposit, to the level indicated by the 1981 cross-section in Figure 2.2 would return the river bed profile to that which occurred prior to development of the deposit. This should not alter river-bank stability within this region of the river. Removal of the material extending to 3.0m below AHD, with operations no closer than 20m to the river bank, would improve the amenity of the river for recreational pursuits, with no bank stability impacts.

3.4 SALINE PENETRATION

The deposit of gravel being investigated would offer no significant resistance to the penetration of tidal, saline waters to the upstream reaches, as a 'complete' barrier across the river does not exist. The first of a series of gravel 'bars' across the river which actually present an 'obstacle' to upstream penetration of saline waters is the Wingham Bar some 500m upstream of the deposit being investigated herein. Removal of the Wingham gravel deposit should in no way influence this bar formation.

4.0 CONCLUSIONS

In this section of this document, "physical" factors relating to removal of the gravel deposit shown in Figure 2.1 have been investigated. In each case, no deleterious environmental effects of removal of the gravel deposit have been identified.

Elsewhere within this document, the "biological" factors of gravel deposit removal have been evaluated, also with the conclusion that deposit removal would be environmentally acceptable.

APPENDIX D

BIOLOGICAL ASSESSMENTS

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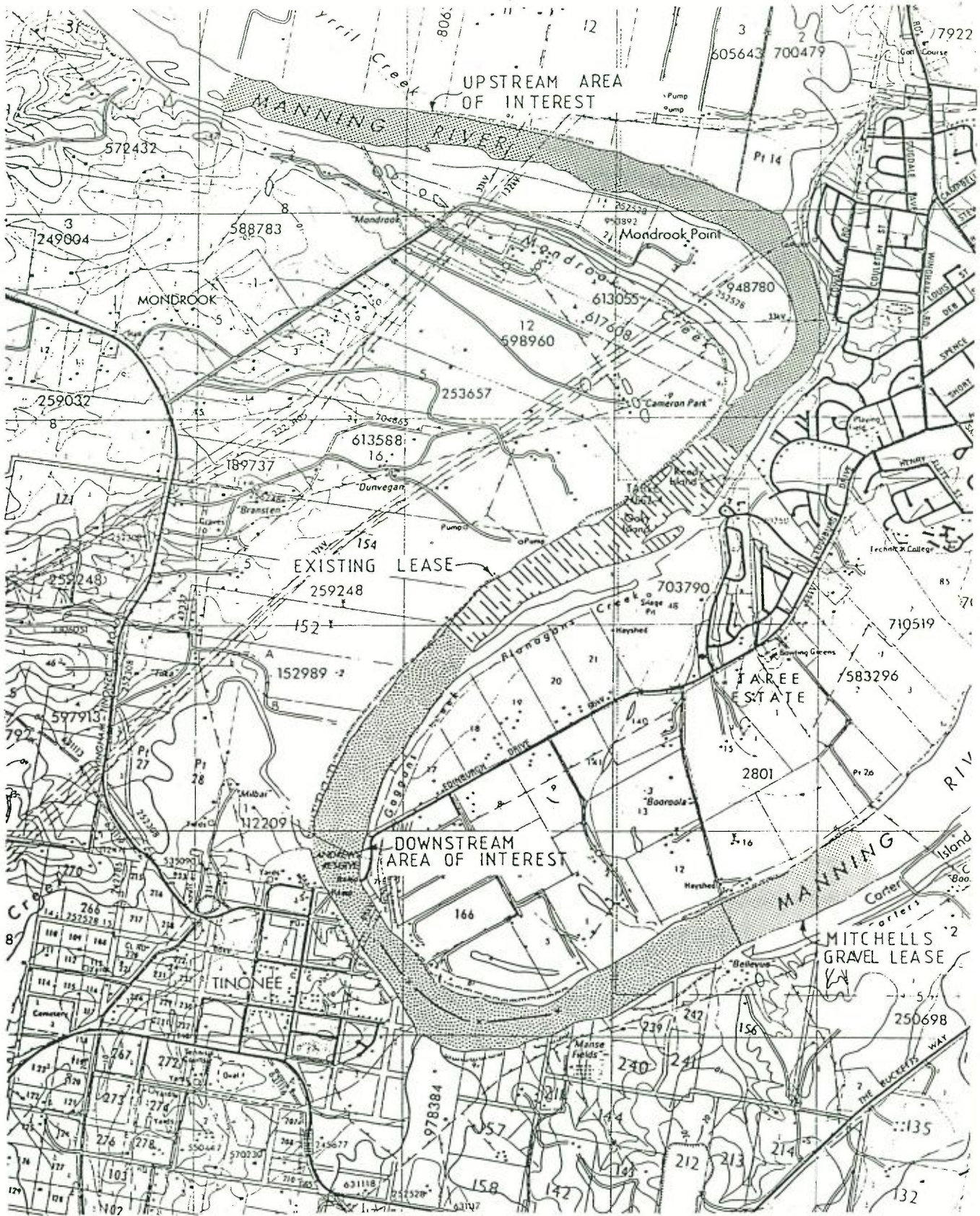
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1.0 BACKGROUND INFORMATION

Readymix (Taree) Ltd has been operating a sand and gravel dredging operation in an estuarine reach of the Manning River near Taree since 1981 (see Figure 1.1). The current operation is an extension of an earlier extractive industry that had been undertaken using shore-based equipment for at least 15 years prior to the establishment of the current operation. In order to maintain the continuity of this operation, Readymix wish to expand their lease areas to include additional alluvial deposits within economic distance of the shore based crushing plant.

To this end, this section of the report details various investigations undertaken in the prospective and existing lease areas (the principal study area) in order to document existing environmental conditions, contrast these to conditions within actively dredged areas and project these findings into an assessment of the impact of dredging operations upon the environmental characteristics of the proposed lease area and more distant parts of the estuary. A secondary issue also discussed is associated with the effects of removing a gravel bank at Wingham, 6kms upstream of the study area.

The areas of investigation were discussed during liaison with the regional officer, Department of Fisheries, based in their regional office near Alstonville. These areas of investigation were supplemented by other technical information on the effects of dredging upon flooding, bed scour and other pertinent factors. These additional issues are documented in report Section 1 - Hydraulic and Geophysical Investigations.



AREA OF INTEREST

FIGURE 1.1

2.

2.0 PHYSICAL CHARACTERISTICS OF THE MANNING RIVER ESTUARY

2.1 TIDAL REGIME

The extent of tidal influence within the estuary is dependent upon the rate of inflow of freshwater from the upper catchment. Under average discharge conditions this can result in brackish conditions extending into the upper reaches beyond Wingham. Conversely, during floods, freshwater conditions can prevail through most of the central and upper estuary. The extent, duration and influence of freshwater inflow causing periodic flooding is documented separately.

In the tidal reaches adjacent to the existing lease area, prolonged freshwater conditions can occur during minor freshes, and were present during the field survey associated with the preparation of this report. Details of measurements of flows and associated factors are contained in Section 6 below.

2.2 BENTHIC SEDIMENT CHARACTERISTICS

The combination of recurrent floods, suitable gradients and appropriate source material in the lower catchment have resulted in a relatively coarse sediment texture throughout the upper estuarine reaches above Taree.

Bulk benthic samples collected by the barge mounted clamshell dredge and supplemented by small check samples collected by a Van Veen grab indicated that mixed texture sandy gravel occurred upstream of Dumaresq Island with a tendency to coarser material up to cobble size becoming dominant in the reaches beyond the Tinonee corner.

2.3 BATHYMETRY AND SHORELINE PROFILES

A series of cross-sectional profiles of the river have been surveyed at various locations in the principal study area and these indicate that the river has a relatively uniform cross-section along major reaches with a flat floor and regular nearshore profiles sloping up to a limited inter-tidal area. Above this tidal shore, profiles are relatively sheer reflecting the moderately incised nature of the river channel within its broad flood plain. Elsewhere various flood bypass channels, prograding and aggrading bends of variable curvature have less regular cross-sections with sheer cliffs on the outer sides of bends occurring both upstream and downstream of the working reach reflecting the resistant rock strata limiting bend development at these locations.

3.0 WATER QUALITY CHARACTERISTICS OF THE UPPER ESTUARY

3.1 CATCHMENT INFLUENCES

The Manning River catchment is primarily used for rural and native forestry operations. The generally regular rainfall pattern results in persistent freshwater discharge and it is fluctuations in this inflow that determines the general physico-chemical water quality.

3.2 CLIMATIC INFLUENCES

Of significance to the present survey are the fluctuating concentrations in suspended load and salinity of the water in the study area resulting from variations in freshwater inflow. An increase in discharge rates results in an increase in suspended solids concentrations throughout the estuary related to an increase in catchment soil erosion, resuspension of bed material due to increased current velocities and suppression of precipitation of fine material normally induced by marked salinity increases in the upper and central estuary.

By way of example, the period of field survey coincided with a minor freshwater flow event which caused elevated suspended sediment concentrations and essentially freshwater conditions to occur throughout the water column for a considerable distance downstream in a normally brackish water area. An illustration of these changes is contained in Table 7.1, while discussion of changes to these conditions induced by dredging operations is contained in Section 6.2.

4.0 BIOLOGICAL CHARACTERISTICS OF THE MANNING RIVER ESTUARY

4.1 INTERTIDAL WETLANDS

A marked variation in the composition of intertidal communities is evident between the lower and upper estuarine areas and can be directly associated with the tidal regime. In areas with consistently high salinities, indicative of regular tidal penetration, mangrove communities have developed. These gradually decline and are replaced with rush and reed communities more tolerant of brackish to freshwater conditions. The transition zone between these communities occurs in the town reach of the river downstream of the Tinonee bend as a full mangrove fringe is evident downstream of the highway bridge (i.e. around the Dumaresq Island junction) while only isolated low shrubs occur in the intertidal zone within the principal study area tapering to a pure rush/reed community upstream of the western edge of Taree. The existing and proposed lease areas are thus within the transition zone. The distribution of different wetland areas in the estuary is illustrated in Figure 4.1 and Plates 1 and 2. A listing of the principal species appears in Table 4.1.

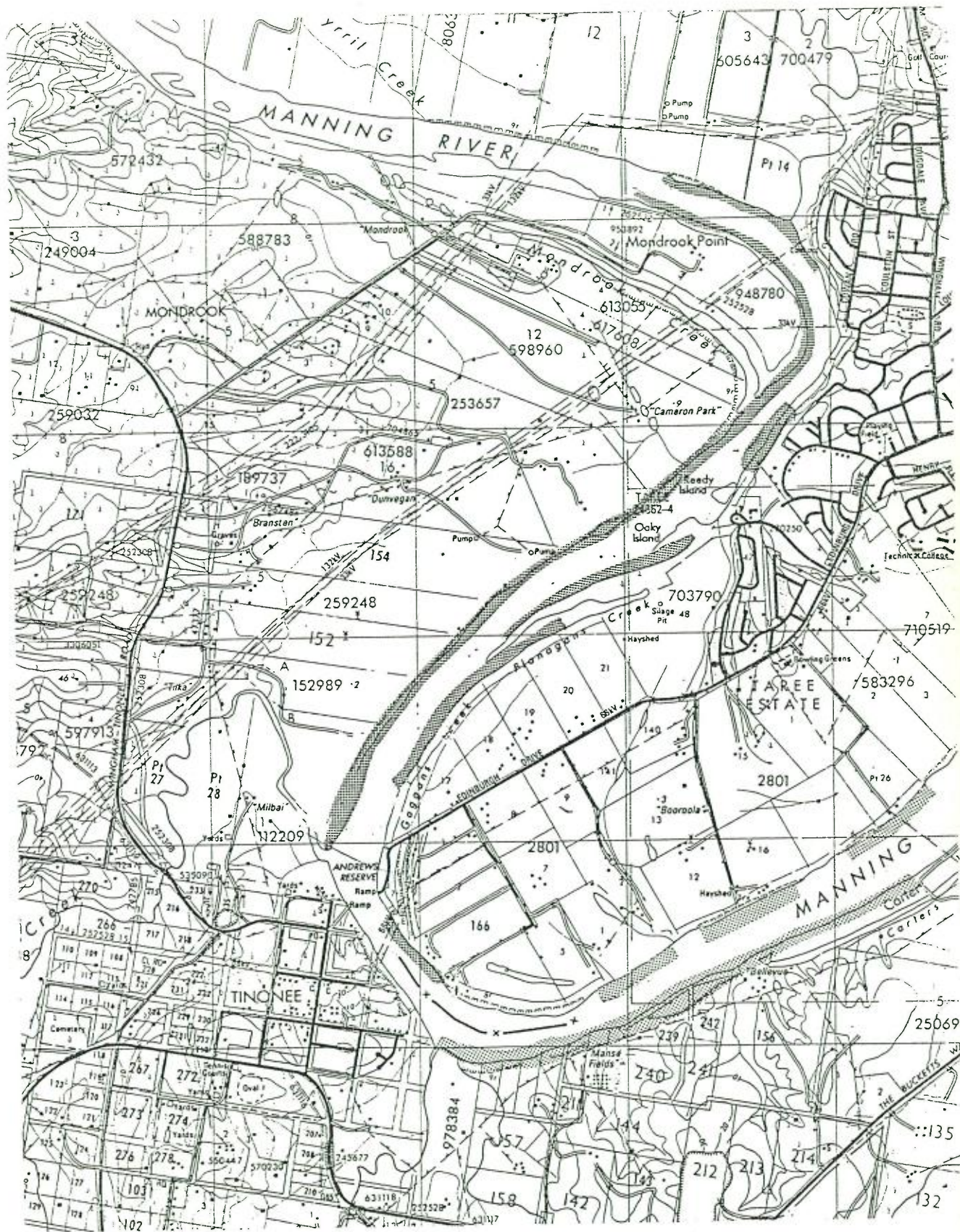
Associated with these intertidal vegetation communities are various fauna, however these were not surveyed in detail as estuarine fauna in the principal study area appeared suppressed, probably due to the wide fluctuations in salinity and elevated water levels.



Plate 1: Typical fringing reed community.



Plate 2: Mixed species reed community, southern lease boundary, showing scattered even age river mangrove saplings.



-  REED & RUSH COMMUNITY (NARROW BAND, DISCONTINUOUS DISTRIBUTION)
-  NARROW RIVER MANGROVE FRINGE & RUSH COMMUNITY

LOCATION OF LOCAL WETLAND AREAS

FIGURE 4.1

TABLE 4.1 WETLAND AND AQUATIC VEGETATION

SCIENTIFIC NAME	GENERAL DESCRIPTION
<i>Juncus maritimus</i>	tall brownish coloured rush
<i>Phragmites australis</i>	common reed (seepage areas)
<i>Scirpus nodosus</i>	tall light coloured pointed reed, grows with <i>Juncus</i>
<i>Sporobolus virginicus</i>	salt marsh couch
<i>Aegiceras corniculatum</i>	river mangrove
<i>Eleocharis sphacelata</i> *	cumbungi (freshwater)
<i>Elodia canadensis</i> *	pond weed
<i>Valisneria giganteus</i> *	strap weed

* on gravel bank at Wingham, not seen within principal study areas.

4.2 SUBTIDAL COMMUNITIES

Characteristics of the biota of the river bed were determined using a series of composite benthic samples collected by a Van Veen grab from various locations within the working reach and adjacent sections of the river (see Figure 4.2). These were sieved through a 0.6mm sieve at the time of collection then preserved in alcohol for later examination in the laboratory.

As a general trend, the range of species and the number of individuals per sample were very limited reflecting the generally coarse texture and poorly sorted nature of sediments, also the high mobility of some of the finer sand fractions. The outcome of the benthic sampling programme is contained in Table 4.3 with locations indicated in Figure 4.2.



LOCATION OF BENTHIC SAMPLES

FIGURE 4.2

TABLE 4.2 BENTHIC FAUNA

	SAMPLE SITE*					
	1	2	3	4	5	6
<u>Fauna</u>						
Phylum Annelida						
Class Polychaeta						
Perinereis nuntia	3					
Lumbrinereis sp.		2				
Notomastus sp.			1			
unknown Capitellid				1		
Class Annelida						
Lumbriculus sp.						1
Phylum Mollusca						
Class Bivalvia						
Xenostrobus securis	25					
Fluviolanatus amarus		1			4	9
Class Gastropoda						
Isadorella sp.						1
Phylum Arthropoda						
Class Crustacea						
Eriopisa sp. (Amphipoda)					3	
Class Insecta						
Tasmanocoenis sp.						1
Hydropsyche sp						1

* Site 1 undisturbed coarse textured sediment, cobbles-coarse sand.

Site 2 Coarse sand to fine-medium gravel

Site 3 Medium to coarse sand

Site 4 Medium to coarse sand and fine gravel

Site 5 Coarse sand to medium gravel

Site 6 Coarse textured poorly sorted, sand to cobbles
located at Wingham.

An extension of the main programme of investigation was to examine conditions at Wingham where an accreting gravel bank has limited the recreational usage of a formerly popular area adjacent to the public reserve. Samples of sediment from around the bar and further upstream indicate that this section of the river maintained predominantly freshwater conditions as both the emergent reeds species and submerged aquatic plants (Table 4.1) were those tolerant of only mildly brackish conditions indicating that salt water penetration was very limited. The coarse nature of bottom sediments prevented the collection of benthic fauna other than occasional individuals adhering to rocks. These were primarily insect larvae and may reflect drift from upstream areas during the freshwater flow event. The less mobile molluscs are indicative of slightly brackish conditions which probably occur in this reach of the river during low flow conditions.

From Table 4.2, it is evident that the fauna collected at the Wingham gravel bank are distinct from more downstream areas.

These species readily and rapidly recolonise newly available areas by drifting down from upstream areas, particularly during elevated runoff. During periods of low flow, this area is recolonised by brackish water fauna transported by tidal penetration into these upper reaches.

5.0 COMMUNITY UTILISATION OF THE RIVER

5.1 RECREATIONAL USAGE

The Manning River provides a range of recreational opportunities to residents in the district. These include both active recreation (power boating, water skiing, yachting and fishing) as well as more passive pursuits (picnics, walking, shore based activities). Boat ramps have been provided at many locations along the river in the vicinity of Taree and Wingham as well as at the main river mouth at Harrington and Manning Point.

Discussion with local Fisheries and Boating Patrol officer, Mr Keith Pryor, indicated that recreational fishing was primarily divided into downstream and open coastal fishing, targeting marine species, with freshwater bass fishermen in the upper reaches. There are also casual fishermen who sporadically fish in the town reaches but these people are usually less proficient nor as well prepared as the two main recreational fishing groups identified above. It should be noted that offshore fishermen gain access to the open ocean waters through Crowdy Head harbour as the Manning River bars are generally too hazardous for safe boating.

Within the principal study area, recreational fishing is anticipated to be sporadic as there are only two main areas of public access; the recreational area opposite Tinonee together with the Tinonee Ramp and the rocky outcrop on the upstream bend below the western edge of Taree. Elsewhere, the river banks are within privately owned farmland with shallow, gently sloping shore profiles. Swimming occurs at the above public areas with water-skiing in the area between the Tinonee Bend and the downstream boundary of the present lease area.

At Wingham, the area occupied by the gravel bank interferes with recreational boating by restricting small boat sailing and water skiing to effectively half the river width.



These various recreational users and their areas of particular influence are illustrated in Figure 5.1.

5.2 COMMERCIAL FISHERIES AND ACTIVITY PATTERNS

A variety of fish and prawn species are caught in the estuary of the Manning River with the species caught and location of fishing effort varying markedly with season and river conditions. Methods of commercial fishing permitted on the river are restricted to haul netting and limited seining with no trawling or long lining. There is an extensive oyster industry established in the estuary however this is based at Harrington and Manning Point near the main river mouth in areas of consistently good water quality, little influenced by flooding.

Within the principal study area, haul netting is undertaken for most estuarine species including flathead, mullet, gar, whiting, bream and school prawns. Capture involves paying out a net, (whose end is fastened on shore) over the stern of a boat eventually forming a U shape, then hauling in each end from shore eventually resulting in the concentration of fish in the last net section for haul out onto the shoreline. To be successful, a shallow shelf area is needed on the shoreline in order to provide a working beach for hauling. As these are not particularly common, hauling areas are of particular significance to commercial fishermen. Fishermen based in Taree do not necessarily concentrate their fishing efforts upon the Manning River but also utilise other areas including, for example Camden Haven and Lake Wallis respectively north and south of Taree. Catch statistics for the Manning River are not readily accessible as the only records available relate to catches landed at the Taree Fish Co-op and are not broken down by species or locale. Given that 26 commercial fishermen support the local co-operative, the Manning River estuary in combination with other large estuaries to the north and south provides a significant harvestable and diverse fisheries resource. This has noticeably seasonal characteristics in yield, species and location of fishing



-  RECREATIONAL AREA
-  WATER SKIING AREA

LOCATION OF RECREATIONAL AREAS

FIGURE 5.1

effort within the estuary.

In the particular area of specific interest, there is limited commercial fishing due to the lack of suitable haul areas (limited to perhaps 2), and a build up of gravel in the proposed lease area resulting in shallow (approximately 2 metres deep) conditions not particularly suited to fishing. An additional factor is the effect of water skiing over this reach from Tinonee Ramp to the upstream end of the existing working area. Discussions held during a meeting of fisherman at the co-operative on 29th September 1988 indicated that this reach was sporadically used by perhaps 3-4 fishermen and that netting could still be successfully carried out even in the current lease area. There is negligible commercial fishing adjacent to the Wingham gravel bank.

Further discussion of these interactions appears in Section 7.

6.0 EXISTING WATER QUALITY DATA

6.1 BACKGROUND

A water quality survey on the Manning River has been undertaken by the State Pollution Control Commission (SPCC) of NSW (Williams 1987). The survey was conducted over the period of June 1984 to March 1986 concentrating on event sampling for low, moderate and high flow conditions in the river. The survey covered 27 points on the greater Manning River estuary, including sampling locations within Cattai and Ghinny Ghinny Creeks and the Dawson River. The location of those sampling points appears in Figure 6.1.

6.2 SPECIFIC CHARACTERISTICS OF LOCATIONS ADJACENT TO THE STUDY AREA

Of interest to this investigation are the sampling points 49, located approximately 2km downstream of Tinonee and 50, located 3km upstream of the shore based operation. At these sites, as elsewhere in the river, a variety of in situ measurements were taken and samples of water collected for later analysis. In all, 11 sampling events occurred over the survey period. The results of salinity profiles, secchi disc depths, turbidity and non-filterable residue concentrations were particularly pertinent to this study. Of the 11 surveys, 2 were undertaken during high flows, 3 were taken during moderate flows and the remaining 6 were for low flow periods. The actual data collected on these surveys has been averaged so the variation between sampling results for similar flow conditions has not been published. A summary of the data collected at the two points (ie. approximately equally upstream and downstream of the shore plant and working area) is presented in Table 6.1.

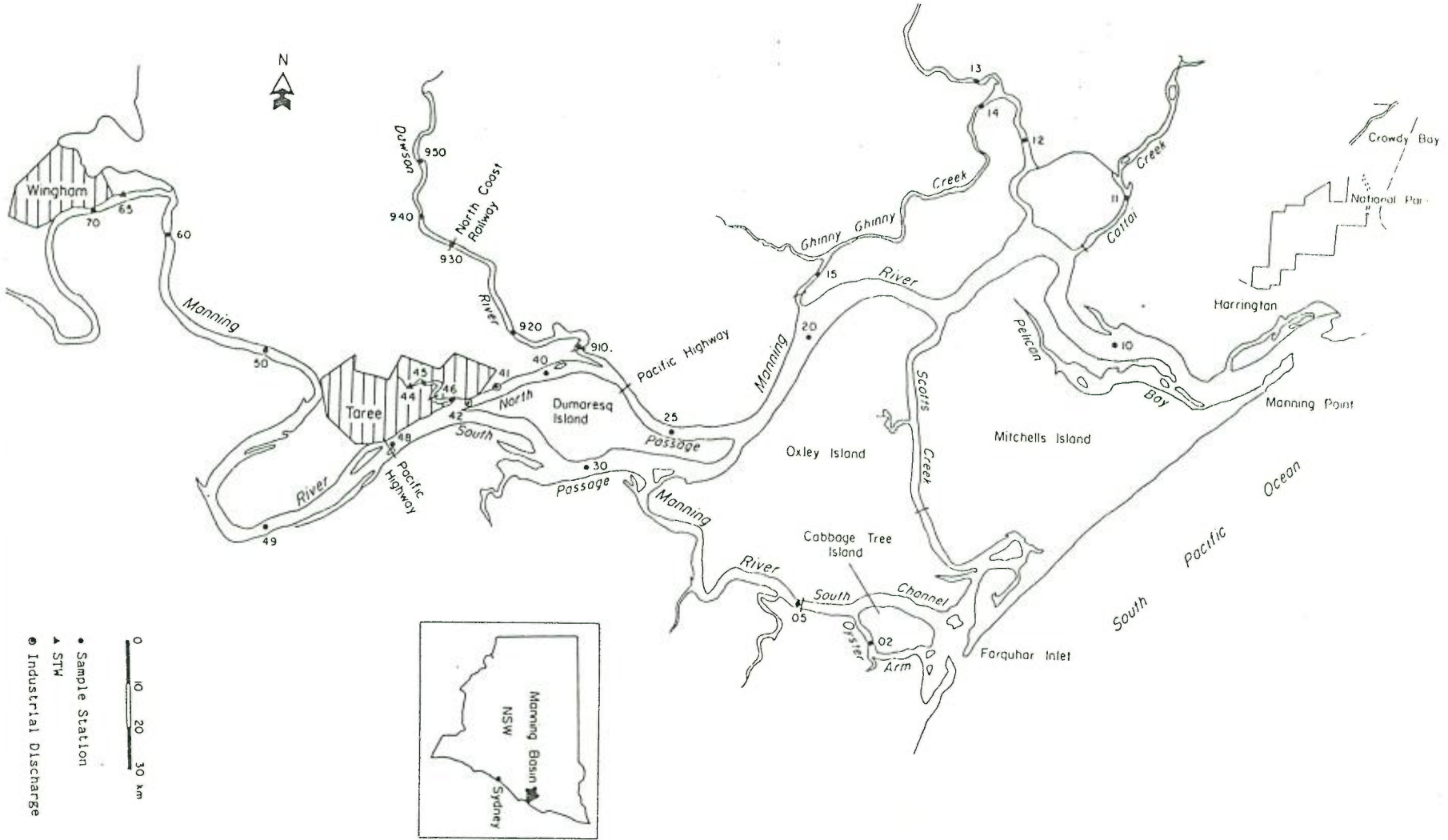


FIGURE 6.1

TABLE 6.1 WATER QUALITY DATA, POINTS 49 AND 50*, MANNING RIVER,
JUNE 1984 - MARCH 1987

Rated Flow Cond.	Low	Medium	High
Mean upstream inflow (ML/day)	595	2346	2735
Mean Salinity (Stn 40) (ppt)	20	10	1

Location	Point 49			Point 50		
	Low	Medium	High	Low	Medium	High
Flow Rate						
Salinity (ppt)	15	4	0	4	0.5	0
% saturation (D.O)	94	111	97	96	112	100
Secchi (m)	1.8	-	1.2	1.8	-	1.4
NFR (mg/l)	6.5	3	5	5.5	2.8	7
Turbidity (NTU)	2	2	8	2.1	2.2	6
Total N (mg/l)	0.35	0.36	0.46	0.31	0.29	0.47
Total P (mg/l)	0.07	0.04	0.04	0.03	0.03	0.04
Chl a (ug/l)	6.4	4.4	2.8	8.5	2.0	3.2

* located on Figure 7.1

6.3 INTERPRETATION OF THE SPCC DATA

From these data it is evident that the downstream site (Point 49) has closely similar suspended load characteristics (as NFR) to the upstream location (Point 50) and that turbidities similarly showed close similarities except under high flow conditions when there was a slight (2 NTU units) difference between the sites. Dissolved oxygen as percentage saturation showed very little difference between sites under the same flow conditions, with salinity showing the highest variation in that there was a 4 fold difference under low flows, 8 fold under moderate flows but negligible (ie fresh conditions at both) under high flows. These salinity readings clearly confirm the principal study area as being within the

transition zone of the river where brackish to freshwater conditions predominate.

Nutrient concentrations obtained by the SPCC survey indicate that the downstream location (Point 49) has higher nutrient concentrations than the upstream site (Point 50) except under high flow conditions when both locations have equal or closely similar concentrations. These high flow conditions have nutrient loads that are significantly higher than occur under low and moderate flow conditions but, in all cases, these are under the generally accepted criteria for the onset of eutrophic (nutrient enriched) conditions. For temperate rivers in NSW, the standards adopted are 0.5 mg/l Total Nitrogen and 0.05 mg/l Total Phosphorus (SPCC criteria) which are not exceeded in this river except for Total Phosphorus concentrations which average at 0.07 mg/l at Point 49 under low flow conditions. At this time, total nitrogen concentrations are well below the threshold (0.35 mg/l) suggesting potential nitrogen limitations to aquatic plant growth under these conditions. Chlorophyll a concentrations are inconsistent with location and nutrient concentrations suggesting other factors (eg. variable salinity) may be operating in determining the growth response of simple aquatic plants (phytoplankton) to these nutrient conditions.

6.4 EXISTING WATER QUALITY DATA IN RELATION TO RIVER CONDITIONS

The data set collected by SPCC show some dissimilarities when compared to data collected during this survey of the existing dredging operation. These differences include a considerably higher flow rate that occurred during the survey compared to the "high flow" SPCC surveys and that average water turbidities and NFR concentrations were considerably higher than previous concentrations recorded on the river.

These results are discussed in Section 7.2 below and illustrate that water characteristics of the Manning River in the principal study area have greater variability than established by the existing survey data set.

7.0 EFFECTS OF THE EXISTING DREDGING OPERATION

7.1 DREDGING TECHNIQUES

Sand and gravel is dredged from the river bed by a clamshell bucket operated from a diesel powered dragline located on a barge. This barge and dragline unit is propelled and guided by a small tug operated by the tug skipper. An anchor hand assists in barge handling and also operates the dragline.

Material raised from the river bed is deposited on the open barge deck until the design load has been attained. Back at the onshore screening and crushing plant, this material is transferred to a hopper by the bucket and fed by a rising conveyor to the gravel preparation plant.

7.2 EFFECTS OF THE DREDGING OPERATION UPON RIVER WATER QUALITY

The primary influence of the dredging operation is the liberation of fine material from the bottom sediments into the water column. This occurs during the hoisting of a loaded bucket through the water column and by runoff from the deck of the barge after deposition of the contents of the bucket. Operating in this manner effectly washes much of the finer sediment from the collected material leaving the coarser fraction behind.

To investigate the potential influence upon water quality of this extractive method, samples were taken of river water prior to dredging, then further samples were taken within the dredge plume at various depths and distances downstream during a dredging operation. A constraint to sampling was the high suspended load in the river during the survey period requiring further check samples of background levels and concentrations within the plume. These were taken 3 weeks later when normal flow conditions had been restored. The results of these measurements are contained in Table 7.1 with locations as per Figure 7.1. The data was obtained by



○ SPCC POINT
 LOCATIONS OF WATER QUALITY
 SAMPLING PROGRAMME

FIGURE
 7.1

analysis of water samples for conductivity and turbidity with a selection of these samples also being analysed for non-filterable residue in order to establish a correlation between the latter parameters. All analyses were performed by Simmonds and Bristow Pty Ltd, NATA registered chemists.

TABLE 7.1 WATER QUALITY ANALYTICAL DATA

Sample No	Depth (m)	Conduct. (us/cm)	Sal. (ppt)	Turb. (NTU)	NFR (mg/l)	Max.Depth (m)	Location
<u>Survey 1 : Flood Conditions</u> (water flow ~ 0.1 m/sec)							
Sample Series 1							
1	0.5	160	0	150	140	1.5	Downstream end of
2	1.0	170	0	140	140		lease adjacent to dredge
3	0.5	160	0	50	(39)*	1.5	40 metres downstream
4	1.0	150	0	55	(46)		of site 1
5	0.5	160	0	30	(18)	1.6	100 metres
							downstream of site 1
6	1.0	160	0	30	(18)		of site 1
7	0.5	160	0	35	21	2.0	Background levels for
							site 1
Sample Series 2							
8	0.5	160	0	45	34	3.5	Downstream end of lease,
9	3.0	160	0	55	46		mid channel, next to dredge
10	0.5	160	0	28	(16)	3.8	40m downstream of
11	3.0	155	0	30	(18)		site 8
12	0.5	185	0	27	(15)	3.5	Background level, site 2
13		5830	4	6400	7350		Runoff water from barge deck

*values calculated from regression equation of turbidity vs NFR.

Survey 2 : Normal River Conditions (tide running in)

14	0.5	10900	8	13	25		Background sample
14	0.5	11300	8	26	90		Dredge plume at the barge

From Table 7.1 it is evident that the plume very rapidly sinks to bottom; a response confirmed by the water sample collected from the barge deck. This material rapidly settled out in the collecting bottle in less than 3 minutes indicating a sediment predominantly of coarse silt and fine sand. The results of plume monitoring clearly indicates this situation as within 100m of the active dredge, water clarity was comparable to background levels during the prevailing flow conditions. Even greater clarification is anticipated to occur under conditions approaching average flows when flow velocities are lower and salinities are higher.

These data clearly indicate that the dredge plume is highly localised and that suspended solids concentrations initially generated around the barge rapidly decay to background levels within a short distance from this location. The elevated salinity in sample 13 reflects the saline interstitial water released from the deposited sample on the barge deck and is comparable to water column salinities during more normal conditions, illustrated by samples 14 and 15.

A comparison of flow conditions at the time of survey to those experienced during the SPCC series is entirely relevant in that events classed as high flows registered an average discharge of 2735 ML/day at Killawarra whereas the gauge records at Killawarra for the day of survey (21st September) were 5,500 ML/day and were on the falling section of the runoff hydrograph. Delay time between the gauge and sampling site was of the order of 3-4 hours hence the daily total at Killawarra Gauge is a good representation of discharge magnitudes through the principal study area on the same day.

On this basis, the water quality measurements taken during the survey show conditions not formerly registered for the river and indicate that turbidities increase perhaps exponentially with flow, in that an approximate doubling in flow volume resulted in a sixfold increase in turbidity. Nutrient concentrations were not

sampled as these parameters were not considered relevant to the determination of the influence of sand and gravel extraction.

Inspection of the gauging data at Killawarra indicates flow events of this magnitude or higher are common (2-4 times/year) hence the principal study area is typified as a reach which regularly experiences wide salinity fluctuations and can be subject to low salinity conditions for much of the year. These physico-chemical water quality conditions are reflected in the lack of a developed mangrove community with tidal wetlands occurring as a brackish tolerant fringing rush and reed association.

The change in the suspended load of the dredge plume immediately adjacent to the dredge varied in composition between high flow and moderate flow conditions; the latter ratings being defined by the salinity regime. The two sampling occasions indicate that during high flow conditions, turbidity levels are numerically higher than non-filterable residues, whereas the opposite occurs under lower flow regimes. Comparing the plume concentrations between high and moderate flow events indicates that a denser plume was generated under high flow conditions (NFR 121 mg/l) compared to moderate flows (NFR 65 mg/l). These results possibly reflect the resuspension of fine material, as there is higher variance in the two turbidity readings between these two flow conditions (115 NTU, high flow cf 23 NTU, moderate flow) conditions. .

From this interpretation, it can be concluded that a denser dredge plume is generated under high flow conditions, probably due to the resuspension of recently deposited silt, but that this plume attains background levels within 100 metres of the site of generation. During moderate flows, the sediment in the dredge plume is coarser, as turbidities are much lower compared to the suspended load concentration, with a result that the plume is anticipated to be even less dispersive. Water quality changes can hence be described as very localised and of short duration. Influences on downstream recreational uses of the waterway are

thus considered to be unaffected.

7.3 EFFECTS OF DREDGING OPERATIONS UPON BENTHIC COMMUNITIES

The recolonisation of benthic sediments following dredging was investigated by sampling within the existing dredged area using a Van Veen grab. Composite samples of sedimentary material were obtained, sieved on site then preserved in alcohol for later sorting in the laboratory. A record was also kept of the sediment texture as often samples could not be collected due to the stony bottom. The results of this benthic survey are contained in Table 4.2 in Section 4 above.

The results from sampling formerly dredged areas indicate that the bathymetry is uneven in places, that coarse material still generally predominates on the surface but ranges into lower size classes (small - large gravel, few cobbles) and that deeper depressions are floored with medium-coarse sand. These sandy sections were successfully sampled (Sites 2, 3 & 4) but still maintain a biota of species suited to these more mobile substrate conditions.

The higher salinity runoff from the barge indicates that despite an overlying outflow of freshwater, interstitial water within the sediment is comparable to normal estuarine conditions. In this way, benthic sediments maintain a less variable saline environment which would buffer the benthic fauna against extremes in variation. The bathymetry induced by dredging could probably assist this process by providing depressions less-likely to fully mix with floodwater, thus maintaining intermediate levels of salinity. This phenomenon was observed in the deeper back channel downstream of the plant. Unfortunately an instrument malfunction prevented dissolved oxygen concentrations from being measured but a salinity of 6ppt was recorded in this deeper backwater area below an overlying 2.5m freshwater layer. Further detailed survey would be necessary to determine bottom conditions. Overall, the influence

of dredging, after allowing for a period of recolonisation, would appear to have a neutral influence upon benthic fauna particularly as future dredging will be under better survey control, with a logical and progressive extraction plan within the lease area. The result will be a more uniform bathymetry within dredged areas of the lease.

At Wingham, removal of the gravel bank will return the area to a bathymetry and sediment texture similar to the adjacent river channel. Removal of the gravel bank would only result in minor changes to the local biota while recreational benefits would be greatly improved. The post-dredging situation would result in the creation of a coarse textured permanently submerged river bed comparable to the balance of the channel floor between the bank and the northern (Wingham) shore.

8.0 ASSESSMENT OF ENVIRONMENTAL IMPACT

8.1 IMPACT ON ESTUARINE FLORA

Rooted aquatic plants in the principal study area were confined to a limited variety of common reed species. Isolated, low, river mangrove saplings observed in this reach were outliers of a more continuous fringe which first occurred downstream of Tinonee, and are representatives of a species most tolerant of brackish conditions. These low saplings may represent a single year class that established during the drought of 1980 - 1982 when upper river salinities were at their highest for many decades due to a drought (Evans and Messner 1980). There is little likelihood of their long term survival under more regular flow conditions given the lack of mature mangroves in this river reach and further upstream.

Conditions on the existing dredging lease require a 15 metre buffer zone to be maintained from mean water level however the offset in the proposed extractive area will be 30m. As shore profiles are relatively uniform, this condition will result in the complete avoidance of any macrophyte zones as these occur as a narrow band along the river margins. The proposed buffer will also provide an adequate margin of safety for any bed movements thus shoreline profiles will remain stable. This situation is confirmed in the existing extractive area where a stable shoreline fringe has been maintained despite several decades of dredging.

Given these conditions, no changes to the distribution or viability of macrophyte communities would occur as a result of expanded dredging operations into the proposed new lease area.

8.2 IMPACT ON THE ESTUARINE BENTHIC FAUNA

Extraction of gravel reserves will remove larger rock sizes which are the primary site for fauna colonisation, particularly for shellfish. The post-dredging areas have a finer textured bottom

sediment although the extractive process is not completely uniform and does not remove all coarse material, hence sites are retained which enable continued fauna usage.

Species identified in the dredged area were also present in undisturbed areas although the species present and their densities differed slightly due to changes in substrate texture. It is highly likely that dredging operations act as a short term stimulus to fish as disturbance of bottom fauna results in the release of organisms of otherwise limited availability.

Normal recolonisation processes following dredging result in a benthic community that is similar in its characteristics but reflects the finer texture of sediments in the post-dredge areas.

On this basis, there is anticipated to be a small reduction in the density of benthic fauna due primarily to a reduction in the availability of the coarsest gravel fractions.

8.3 IMPACT ON COMMERCIAL FISHERIES

Discussions with commercial fishermen indicate that the dredged areas still retain commercial fish species, often in large quantities (eg. flathead in deeper holes) and that the dredging operation has not had a major effect upon fishing activities in the reach. Some problems with irregular bottom conditions are experienced but can be compensated for by changes in techniques and equipment. The principal study area is irregularly utilised by 2-3 commercial fishermen and is part of a wider range of fishing areas in the Manning and other coastal rivers that are used on a seasonal basis. Catch rates and species sought varies by season and river conditions, which are external to the existing and proposed operation. Agreement has been reached with these commercial interests on the dimensions of the proposed lease thus the changes foreseen are not considered significant to the people most likely to be affected.

8.4 IMPACT ON RECREATIONAL INTERESTS

Recreational fishermen in the principal study area are sporadic users, generally shore based, as the main recreational fishery is concentrated either upstream in freshwater or in the outer estuary and near shore areas. Dredging activities will not occur adjacent to the recreational area opposite Tinonee while water frontage facing the extension area is under rural ownership. It has been noticed that recreational fishermen like to fish in the vicinity of the working dredge as disturbance of the bottom, with associated release of concealed forage species, attracts fish.

Under these conditions, detrimental interactions with recreational fishery interests are not foreseen.

There will not be any changes to the nearshore swimming areas along the foreshore of the reserve, hence future parkland based recreation would be unaffected by the proposed extension of the working area.

The only potential interactions could be with water skiing as this occurs within the proposed lease extension. Given observance of a shoreline buffer zone and that only one barge would operate in the area, future disturbance to skiing activities, as is the case at present, is anticipated to be negligible enabling this recreational past-time to continue in the designated area. By agreement, no extraction occurs during carnivals or other peak skiing occasions. The dredge plume may be noticed by skiers but would be localised to a relatively short distance (50-100m) downstream of the operation. Peak turbidity within the plume under moderate flow conditions is still less than mean river water turbidity under high flow conditions.

The dredging plan will improve navigationn by providing a deeper, progressively wider channel parallel to the shoreline, thereby improving boat access under low flow conditions.

8.5 IMPACT ON WATER QUALITY

Measurements of changes to water quality arising from the dredging operation indicate that a small sediment plume is generated by the dredging operation but that this plume decays rapidly as the sediment settles out of the water column. During normal flow conditions, the sediment load within the plume immediately adjacent to the dredge is nearly four times the background level. The reversal in turbidity to suspended solids between high flow and low-moderate flow conditions is due to the lack of soil colloids and clays associated with the incoming freshwater. These two data sets also confirm the suspended load in the plume changing in texture from fine to coarse as inflows diminish and regular tidally driven circulation again occurs.

For these reasons, the effects on water quality of the existing and future dredging operations are only of immediate and localised significance as there is rapid settlement of the relatively coarse sediment in the plume. Sediment textures in the dredged areas generally lack a noticeable silt fraction, hence there is negligible potential for generating a long lasting bouyant plume, capable of degrading downstream recreational and other uses of the river.

9.0 SUMMARY

1. Sand and gravel extraction has occurred within the present lease area for over 30 years and has resulted in an irregular bathymetry within the lease area.
2. Benthic fauna found in undisturbed areas upstream and downstream of the present lease also occur within the lease area. Minor changes to the species composition reflects a change in substrate texture as a result of dredging rather than suppression of fauna. Viable populations of forage species for fish readily re-establish in dredged areas.
3. Water quality measurements clearly indicate a non-buoyant plume is generated by dredging and that its characteristics are influenced by river water quality at the time of dredging. Under low to moderate flows, the coarse textured sediment is expected to deposit within the immediate locale of dredging. This plume is slightly more dispersive under high flow conditions, but still reduces to background concentrations within 100 metres of its origin.
4. No significant interactions between commercial and recreational users is anticipated to occur within the proposed extension of the lease area.
5. Removal of the gravel bank at Wingham would result in a uniform benthic community across the width of the river. Species presently utilising this area are typical of shallow water communities in this reach of the river and are subject to a widely fluctuating salinity regime due to variations in upstream inflow of freshwater.

REFERENCE

Evans, H.G. and Messner, J.P. (1980) Manning River Gravel
Extraction: Preliminary Assessment.
PWD Report No. 80031 December 1980.

Williams, R. (1987) Water Quality in the Manning River.
State Pollution Control Commission, Northern Rivers Study
No. 7.

APPENDIX E

**NOISE IMPACT
STATEMENT**

NOISE IMPACT STATEMENT

for proposed

EXTENSION TO SAND & RIVER GRAVEL

EXTRACTION FROM MANNING RIVER

Prepared for : The Readymix Group (NSW) Taree Area

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Report No. EE1383RM.

November - December 1988.

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ATTACHEMENT

Diagrams 1 & 2 Background Noise Measurements Locations

1.0 INTRODUCTION

It is proposed to extend the existing lease area for the extraction of sand and river gravel from the Manning River. These construction materials have been obtained from certain areas of the river for over 25 years. The noise impact statement considers the potential impact of noise emissions from the following:

- . The proposed new extraction area in the stretch of river - south of the existing extraction area below the crushing and screening plant to the north of Tinonee.
- . A buildup of sand and gravel from a boating channel opposite the reserve at Wingham Brush.

The full details of the proposal are contained in the Environmental Impact Statement and will not be duplicated in this report.

1.1 Assessment Criteria

There are well established acoustic criteria for the assessment of the potential noise impact from an extractive industry operation. The following criteria is presented, summarised from the SPCC Environmental Noise Control Manual (1985).

- . The noise level at residential properties is maintained within an acceptable daytime limit of 45 dBA between the hours of 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturday.
- . The noise level from the operation of the extraction equipment be within 5 dBA of the measured background levels during daytime hours to ensure preservation of the acoustic amenity of the residences at Tinonee.

- . The removal of the buildup of material at the Wingham Brush reserve is a short term operation and although materials are extracted, the removal is being conducted to clear the river channel. This operation is therefore more of a construction activity.

Criteria for Construction Site Noise vary from the extraction industry criteria, the following noise level restrictions are summarised from Chapter 171-1 of the Environmental Noise Control Manual.

- . For a construction period of 4 weeks and under: the L10 noise level, measured over a period of not less than 15 minutes with the construction site in operation, must not exceed the background level by more than 20 dBA.
- . For a construction period of 4 - 26 weeks: the L10 level, measured over a period of not less than 15 minutes, must not exceed the background level by more than 10 dBA.
- . For a construction period of greater than 26 weeks, the 5 dBA above background level criterion applies. Noise levels in passive recreational areas (ie. areas not involved with pursuits that would give rise to machinery noise emissions) should be within the range 40-50 dBA.

These criteria are the essential requirements that would apply to prevent an unacceptable impact on the residential and community areas.

1.2 Assessment Methods

The report presents the following information:

- . The background noise levels at the nearest residences to the proposed sections of the river where material would be removed.
- . The noise levels of the proposed tugboat and dredging equipment measured during normal operations.

An extensive set of noise measurements were taken

- . within close proximity to the equipment.
- . at the river bank within 150 m of the existing extraction operation.
- . during a trial period of extraction at the closest point to the Tinonee residential area with noise measurements conducted at the nearest residence.

The measured and calculated noise levels are compared to the relevant criteria and practical noise control measures are examined to preserve the acoustic amenity of the residents if the criteria should be exceeded.

2.0 EXISTING ACOUSTIC ENVIRONMENT

The existing acoustic environment within the area adjacent to the proposed operations was investigated by measuring the background noise levels adjacent to the nearest residential areas.

The noise measurements were conducted using a Bruel & Kjaer Statistical Level Analyser Model 4426, fitted with a 12.5 mm microphone, windshield and mounted on a tripod approximately 1.2 m above ground level. The analyser was calibrated before and after a measurement period using a Bruel & Kjaer Calibrator Type 4230. Measurement periods of 15 - 20 minutes were used. The measurements were carried out during acceptable weather conditions. Location points are shown on Diagrams 1 and 2 at the end of the report.

The results are presented in Table '1' below. The two main noise levels of relevance are the L90 and L10 levels. Briefly, the L90 term is the level of noise exceeded for 90% of the time and indicates the average minimum fluctuations of noise level that may occur. This is the background level used in the assessment criteria. The L10 term is the level of noise exceeded for 10% of the time and is the average maximum of the fluctuations in noise.

Table 1. Background Noise Levels dBA
 Dates 19/20th October 1988

Location	Time	L90	L10	L1	L5	L50
A.	6.50 am	30.8	39.8	50	42.5	34
	1.25 pm	30	34.8	39.5	36.3	31.8
B.	7.18 am	35.5	48	56	50	41.5
	8.04 am	37	56.3	61.3	58.3	47
C.	2.04 pm	37.3	43.5	48.8	45.3	40
	8.37 am	34.8	47.3	59.5	52.8	39.8
D.	4.10 pm	35.8	49.3	60.8	56.5	39.3
	9.25 am	29	39.3	47.8	42	33
F. & G. - refer to Diagram 2						
F.	2.25 pm	35.5	48.3	67.3	55	37.8
G.	10.00 am	34.3	48.5	60	51.3	39.5

Comments:

Locations A and B are along Edinburgh Drive in Taree Estate. The residences are on land that is relatively flat, and raised in elevation from the river. The river bank provides a useful degree of acoustic shielding from the extraction operation to these residences and others along Edinburgh Drive.

The existing noise sources consist of agricultural and farming activities, occasional traffic movements in Edinburgh Drive, bird and farm animal noise.

Location C There are a group of residences at this location. These residences are the nearest to the southern portions of the proposed extraction operation. The extraction would take place over approximately a 15 year period with removal of material from the portion closest to Tinonee requiring a total of 2-3 years in the 15 year period.

Existing noise sources included general community activity, a primary school, numerous bird life and occasional vehicular movements.

The residences at this location have direct line of site from an elevated position to the river. Trial noise tests using the existing dredge and tugboat were conducted. The full results are presented later in the report.

Location D

There are a small number of residences at this location which is at the end of Milbai Street. This location is elevated and has direct line of sight to the river.

Existing noise sources included vehicular movements on the Tinonee - Wingham Road, agricultural activities and bird noise.

Location E

This location is at the end of Bishops Lane off the Wingham - Tinonee Road. The residences are located within rural properties, land to the river is relatively flat, acoustic shielding of the extraction equipment is provided by the river banks.

Noise sources included bird noise and occasional traffic.

The noise levels are very low.

As a general comment, measured background levels are within the 30 - 37 dBA range which is typical of rural - residential areas. To preserve the acoustic amenity of the residential area, the 5 dBA above background noise level will be applied as the relevant acoustic criteria.

The locations F and G are shown on Diagram '2'. Wingham Brush is a well known tourist attraction and habitat for large numbers of flying foxes. The recreational area adjacent to Wingham Brush is used for fishing and a boat ramp is provided. A high school in Combined Street would require protection from excessive noise levels. The 45 dBA noise level is an acceptable level for schools located in a residential area. The Wingham area is considered as residential - not rural residential.

Existing noise sources at these locations consisted of general community activity, occasional vehicular movements, bird and animal noise. The background noise levels were typical of a quiet residential area.

2.1 Description of Sites

A complete description of the two proposed extraction sites in the river is provided in the Environmental Impact Statement.

Separation distances have been obtained from the following CMA maps

- . Taree 9334 - 2 - S
- . Wingham 9334 - 2 - N

The extraction operation from the river opposite Taree Estate will take place over a 5 stage programme with each stage requiring approximately 3 years. Each longitudinal strip of river would require an approximate 3 year extraction operation beginning at the end of the strip furthest from Tinonee and working down the river.

Locations A & B Closest distances 150 - 400 m.

Acoustic shielding is provided by the river bank. During the extraction from the down river sections of stages 1, 2 and 4, the minimum separation distances will vary from 150 m to 250 m.

Location C Closest distances 250 m during the down river extraction section of stages 1-5.

No acoustic shielding will be present. At later stages, the separation distances increase to 500 - 1300 metres.

Location D All residences are more than 500 m at the closest point of the extraction operation with separation distances of up to 1500 m. No acoustic shielding is provided by the river bank.

Location E The separation distances are 800 - 1000 m, and the river bank provides acoustic shielding.

Location F and G are at Wingham

Location F The nearest residence will be 300 m from the area of the river that requires clearing. The school is a further 100 - 150 m from where the clearing would take place.

The recreational reserve is 200 - 300 metres from this area of the river. The closest part of the township - eg. Post Office is 800 m from the area of the river where material would be removed. There is significant acoustic shielding provided by the buildings and landform between the river and the post office.

Comment:

The predicted noise levels are determined for the closest residences and community areas likely to be the most affected by the proposed extraction operations.

2.2 Times of Operation

The times of operation are proposed to be 7.00 am to 6.00 pm Monday to Friday and 7.00 am to 1.00 pm Saturday.

Truck movements may not be associated with either extraction area. The removal of the material at Wingham Brush has a severe time penalty if the material loaded onto the barge is transported to the processing plant without being transferred to trucks.

For the Wingham Brush site a second option is examined that would involve altering the times of operation during the 3 - 4 month extraction period.

Option 1. Removal and Barge Operations on the river from 7.00 am - 4.00 pm weekdays only.

Option 2. Removal and Unloading at the recreational reserve, transfer to trucks using a front end loader, times of operation and truck movements restricted to 8.00 am - 4.00 pm weekdays only.

There will be no truck movements associated with transferring the material from the Taree Estate section of the river where all material is transferred to the processing site by barge.

3.0 DESCRIPTION OF PROPOSED EXTRACTION OPERATIONS

The extraction of the material and transport by barge to the processing plant uses similar equipment that is currently in operation. There is a second option for the removal of material from the Wingham Brush area that will also be discussed.

The existing operation consists of the following:

- . The barge is transported along the river using a tugboat. The existing tugboat is currently being renewed with a modern and quieter designed vessel.
- . Once at the location where material is to be removed from the river, the barge is anchored. The tugboat motor is shut down. A dragline (dredge with mechanical bucket) mounted on the barge is used to remove material. The dragline is powered by a diesel engine which is the predominant source of noise. The dragline requires 45 - 60 minutes to load the barge with approximately 150 tonne of sand and river gravel.
- . With the barge loaded with material the dragline engine is shut down. The anchors are raised using small four stroke petrol engines, one located at each end of the barge. These engines operate for 30 - 60 seconds. Once the anchors are up, the barge is moved to the processing plant. Unloading requires 60 minutes. Travel times to the extraction area will vary from 15 minutes to the upstream and to 30 minutes to the Tinonee end of the proposed extraction area.

3.1 Alternate Method at Wingham Brush

At the Wingham Brush area the barge travel time would be 1.5 hours, limiting the number of loads to 2 per day. It has been suggested that a more viable alternative would be to use a temporary unloading area at the recreational reserve for the 3-4 month extraction period.

The alternate method would require trucks to be loaded using a front end loader parked at a suitable portion of the recreational reserve. The barge movements and unloading would require short periods of time. There would be increased noise emission levels from the operation of the front end loader and trucks. The noise emission levels at the nearest residential and community areas have been determined for this alternate method.

3.2 Proposed Equipment

The operation is such that the tugboat is not operated when the dragline is being used. The dragline is the major noise source with the predominant source of noise being the diesel engine.

The alternate method for Wingham Brush would also involve a front end loader and trucks. The noise levels for the front end loader are also presented.

The proposed equipment is listed in the following tables. The noise emission levels were obtained from measurements at the existing extraction operations.

Table '2' Noise Emission Levels of Equipment dBA

Description	Noise Level
Extracting material	
. 150 m lower bucket	56 - 57 dBA
raise bucket	60 - 61 dBA
anchor motors	61 dBA
. 3 m dragline	85 - 89 dBA
tugboat	84 - 86 dBA
anchor motor	90 - 94 dBA
Alternate Method for Wingham Brush	
Front End Loader	
. 7 m	80 - 86 dBA during loading operations

3.3 Haulage Route and Truck Movements

The main extraction area at Taree Estate will not require any truck movements as all material transport is by barge on the river.

At the Wingham Brush site a 3/4 month extraction period is required, however a shorter period will occur if the material is transported by trucks. Material may be transported either by river or unloaded at the recreational reserve and transferred to trucks. The trucks would use the major arterial route between Edinburgh Drive and Wingham.

Truck speeds would need to be restricted to 40 km/hour as the vehicles left Farquhar Street and entered the recreational reserve. The preferred truck route would be along the Wingham - Taree road as it is a more direct route and involves the least travel time through Wingham itself.

If this alternative is accepted, then truck movements would be restricted to earliest start time of 8.00 am. Speed control and traffic direction signs would need to be erected at the recreational reserve and the most suitable unloading/loading site would need to be selected.

4.0 PREDICTED NOISE LEVELS

Noise levels from the proposed extraction operations have been determined based on direct measurements during trial noise tests at the closest affected residences at Tinonee and calculation procedures at all other residential areas. The calculations are carried out using procedures acceptable to the SFCC.

The following would apply:

- . A 6 dBA attenuation for each doubling of distance from the plant and equipment. (Refer to SFCC Environmental Noise Control Manual, 205-5). Noise levels at Tinonee are based on actual site measurements, operational noise levels include reflection over the water surface of the river.
- . Attenuation due to topographical shielding. Reductions of up to 10 dBA will apply for locations A, B, and E. No shielding applies for the other locations i.e. C and D at Taree Estate, F and G at Wingham Brush.
- . Conservative allowance for excess attenuation of 2 - 3 dBA where soft ground cover exists over the propagation path. e.g. locations A,B and E. At other locations no excess attenuation has been provided.
- . Noise control measures will be applied to the following equipment:

Tugboat

The tugboat is being replaced with a modern vessel that features a wet exhaust system, a new 140 HP Yanmar diesel engine, a hydraulic reduction gearbox of ratio 2.5:1, and a shrouded propellor. Noise reduction of 5 - 8 dBA is anticipated from the water cooled engine exhaust.

Anchor Engines

The 4 stroke engines at each end of the barge were due for replacement due to corrosion. Environmental quality mufflers will be fitted to each new engines' exhaust system. Noise reduction of 10 dBA will be provided.

Dragline Diesel Engine

The predominant source of noise on the dragline is the diesel engine. The engine compartment will be fitted with acoustic materials to absorb and reduce the noise transmission by 14-16 dBA. Acoustic louvres will be fitted to the radiator cooling air inlet to prevent noise breakout. The practical noise control measures are similar to the steps taken to silence stationary diesel engine - air compressor sets. Sheet metal panels of 1.2 mm steel sheeting lined with 50 mm thick Fibertex 450 sound absorptive material will provide the basic noise reduction construction.

The existing exhaust system will be upgraded to include an environmental grade muffler.

These noise control measures are essentially required to enable the dragline and barge to operate within the closer distances to the residential area at Tinonee. The application of these measures will however provide advantages to all other existing and proposed areas.

4.1 Taree Estate Extraction Area

Locations A & B

The noise levels at these locations will be 35.5 - 39.5 dBA without noise control measures being applied to the dragline or tugboat. The attenuations are based on:

The equipment noise levels are to be reduced to 41 - 41.3 dBA. The noise control measures are designed to reduce the equipment noise levels by 14 - 16 dBA although a minimum reduction of 10 dBA is only required.

The additional noise reduction of 4 - 6 dBA has been included as a safeguard measure to preserve the acoustic amenity of the residents at Tinonee. The worst case situation will satisfy the acoustic criteria. As other stages of the extraction proceed, the noise levels will be further reduced as the separation distance increases.

Location D

The noise levels at this location will be 37.5 - 41.5 dBA without noise control measures being applied to the dragline or tugboat. The attenuations are based on

- . 44.5 dBA for the closest distance of 500 m.
- . no acoustic shielding.
- . excess attenuation for ground absorption and vegetation cover of 3 - 4 dBA.

With noise control measures in place, the equipment noise levels will be significantly below measured background noise levels.

Location E

The noise levels at this location will be less than 27 dBA without noise control measures in place. The extraction operation noise levels will be further reduced so that no contribution to the measured background noise levels would occur.

4.2 Wingham Brush Extraction Area

Location F

The equipment noise levels at this location would be reduced by distance and ground absorption to:

- . dragline 43 - 47 dBA
- . tugboat 42 - 44 dBA

which exceed the acoustic criteria of 40 - 41 dBA. (This is based on the measured background level + 5 dBA).

The noise control measures designed for the Tinonee residents will effectively reduce the above noise levels to well below the acoustic criteria:

- . dragline 29 - 33 dBA
- . tugboat 37 - 39 dBA

Location G

The equipment noise levels at the recreational reserve would be reduced by distance only.

The noise levels would be:

- . dragline 48.5 - 52.5 dBA
- . tugboat 47.5 - 49.5 dBA

These levels far exceed acoustic criteria of 40 - 50 dBA for a recreational area.

The noise control measures already discussed would reduce the above noise levels to:

- | | |
|------------|-----------------|
| . dragline | 34.5 - 38.5 dBA |
| . tugboat | 42.5 - 44.5 dBA |

These levels are considered to be acceptable.

4.3 Alternate Method at Wingham Brush

The alternate method of using a front end loader (FEL) at the recreational reserve would increase the noise levels during the truck loading operations to:

- | | |
|------------------|-------------|
| . dragline + FEL | 44 - 45 dBA |
| . tugboat + FEL | 46 - 47 dBA |

These noise levels are within the 40 - 50 dBA criteria acceptable for a recreational reserve. The operation would be limited to a 3/4 month period and although the levels are above the measured background levels, the disturbance that may be considered to occur is not excessive when compared to the following:

- . the recreational reserve is used to launch motor boats and is subject to vehicular movements from tourist traffic.
- . the construction site criteria allows for a 10 dBA above background level ie. 45 dBA.
- . the acceptable criteria for passive recreational areas is 40 - 50 dBA, a passive recreational reserve does not include vehicular or motor boat noise.

- the movement of trucks would increase the above noise levels for the period of time that the trucks would require to travel across the recreational area, speed control and "driving neighbourly" techniques would minimise the noise levels.

Comment:

The operation of the FEL and truck movements would be considered as a disturbance to the recreational area, however as the time period is limited and the removal of the sand and gravel is to aid the community's use of the river, the disturbance is considered acceptable.

5.0 STATEMENT OF IMPACT

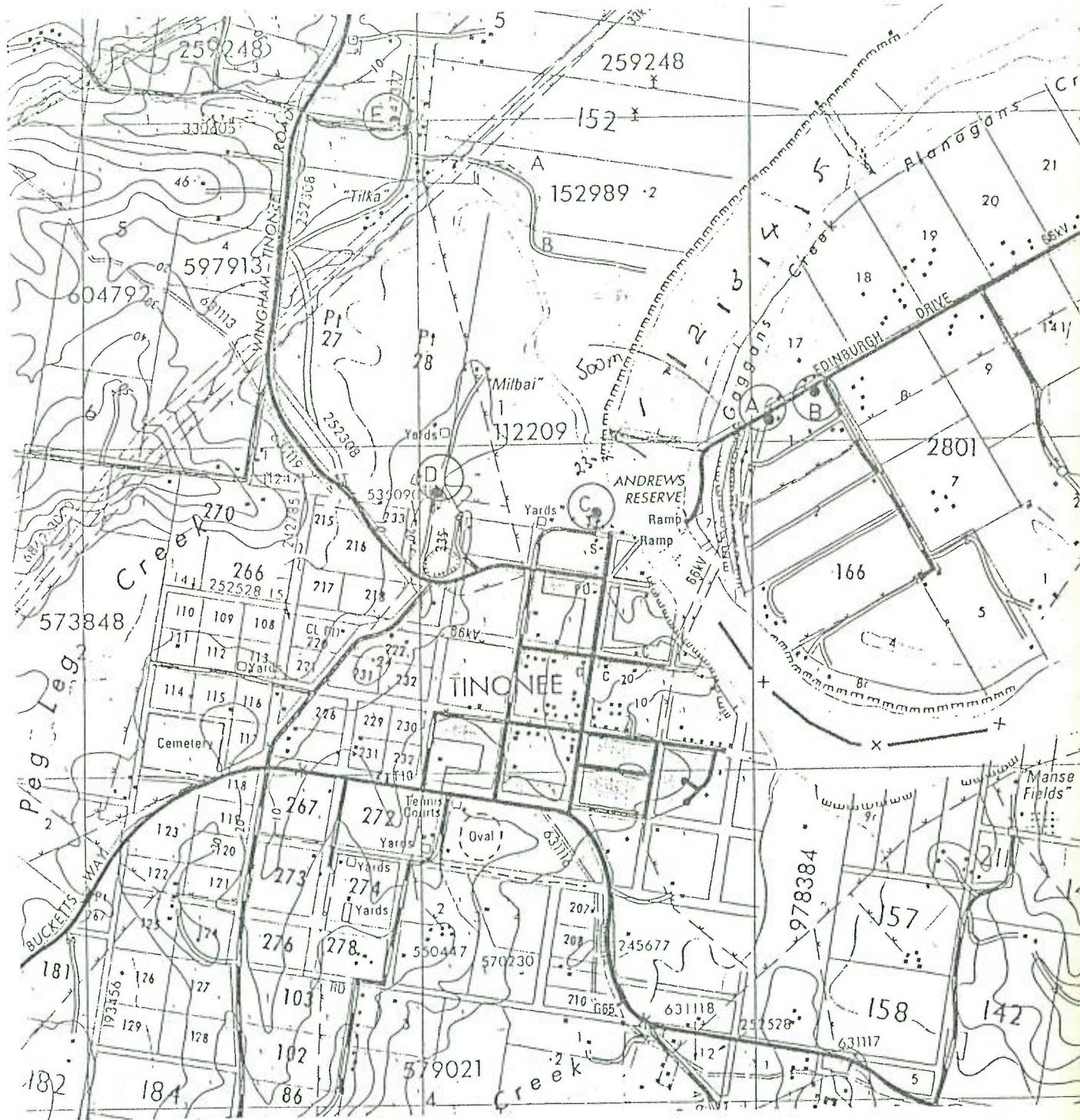
The extraction of sand and river gravel at the proposed extraction areas will comply with SFCC criteria. The replacement of the existing tugboat and the fitting of practical noise control measures to the dragline diesel engine and barge anchor engines will enable the acoustic amenity of the nearest residences at Tinonee and Wingham to be preserved.

The noise control measures that have been proposed are more extensive than what would be required to satisfy SFCC criteria. It is considered that the existing acoustic amenity is enjoyed by the residents and should be safeguarded given that the extraction of sand and river gravel from the proposed section of the Manning River will take place over a fifteen year period.

R.T. Benbow,
Principal Consultant.

DIAGRAM 1

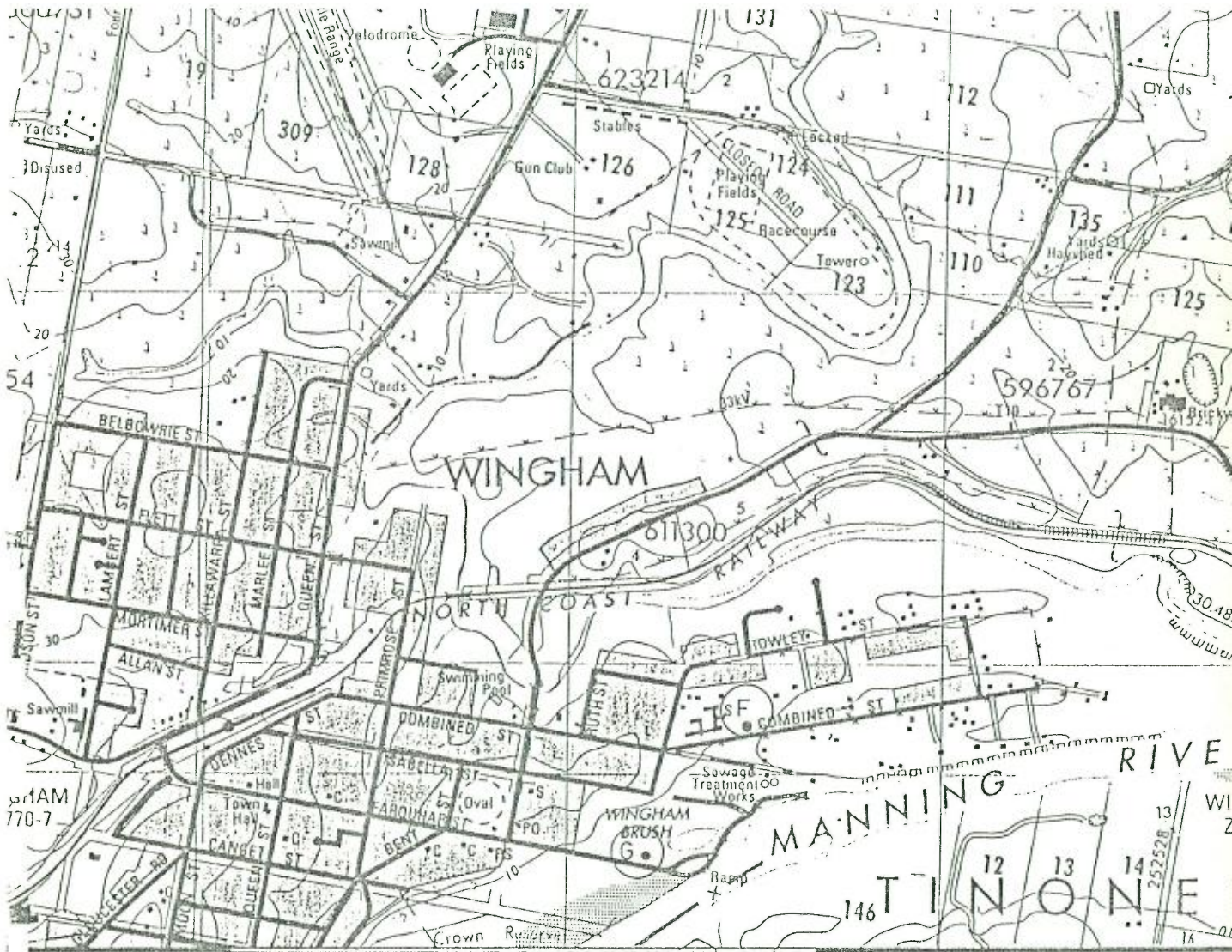
Background noise measurement locations.



not to scale

DIAGRAM 2

Background noise measurement locations



not to scale.