PUBLIC WORKS DEPARTMENT
NEW SOUTH WALES

MANNING RIVER

GRAVEL EXTRACTION

Preliminary Assessment

P.W.D Report No. 80031

Dec. 1980

PUBLIC WORKS DEPARTMENT, N.S.W.

Coastal Engineering Branch

MANNING RIVER GRAVEL EXTRACTION

Preliminary Assessment

H.G. Evans
Principal Engineer
Coastal Engineering Branch

J.P. Messner
Chief Engineer
Civil Engineering Division

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1. Foreword

This report has been prepared by the Public Works Department as an input to the decision making process on current gravel extraction proposals for the Manning River.

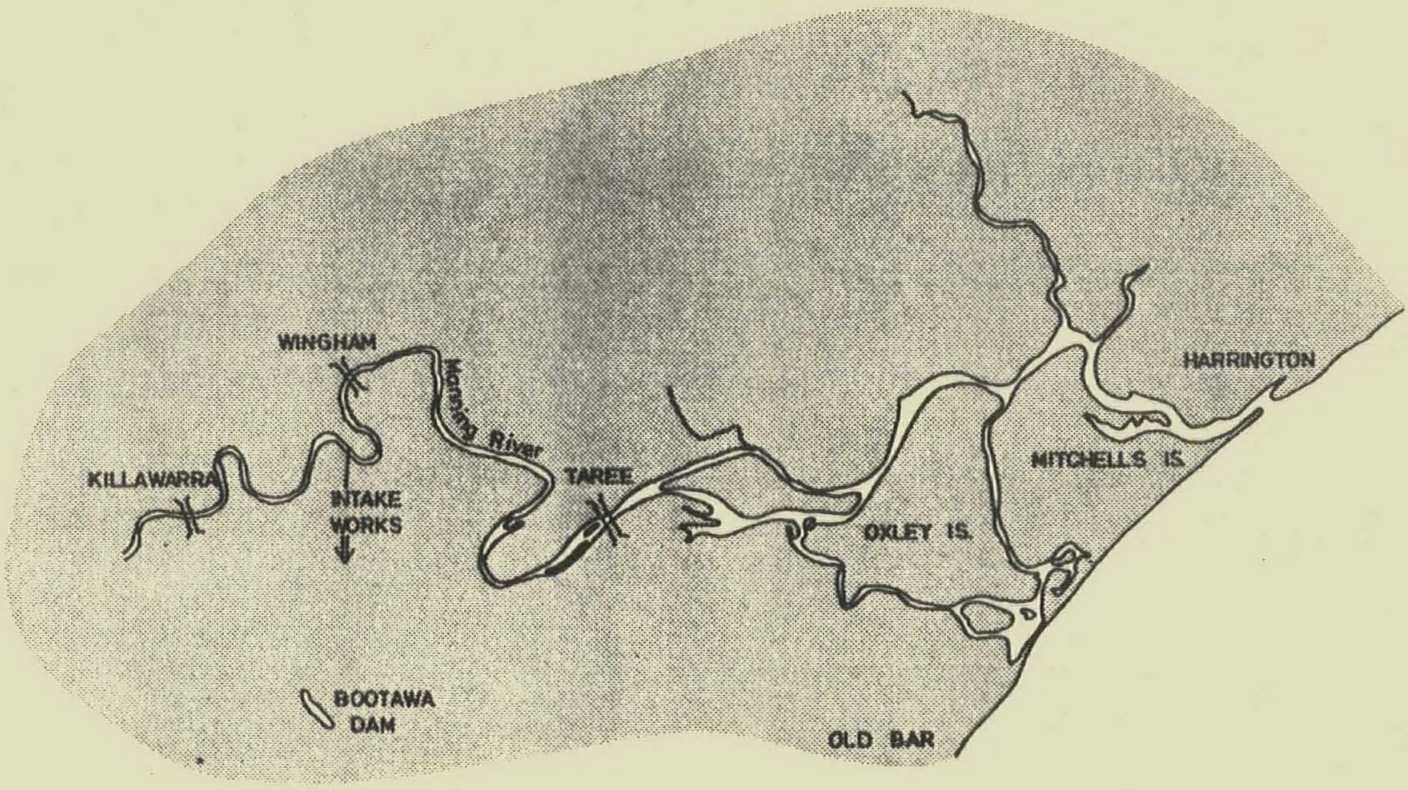
An amount of basic tidal and salinity data was collected and is presented herein. The work was done in the Estuarine Investigations Section of the Coastal Engineering Branch by the project engineer Mr. N. Philip.

2. Summary

Gravel extraction proposals on the Manning River represent a quantum increase on current operations. The operations could threaten the existence of gravel bars in the river which are identified as important low flow hydraulic controls.

The intake works for the Manning District water supply scheme are located within the proposed extraction areas, and salinity penetration of the supply has already been experienced. The possibility exists that the proposed extraction operations could exacerbate the salinity problem at least in the short term.

Long term effects on the river's general behaviour cannot be predicted on currently available information. A need for an environmental impact assessment is identified and guidelines for its content are proposed.



5 0 5 10
Kilometres
SCALE 1: 250,000

N

LOWER MANNING VALLEY

FIGURE 1

MANNING RIVER GRAVEL EXTRACTION OPERATIONS PLAN

Figure 2

3. Background Information

Taree and Wingham are experiencing expanding development, with consequential demand for gravel for use in the construction industry. In addition, the rapidly expanding Forster/Tuncurry area is placing demands on the gravel resources of the Manning Valley.

Various gravel extraction proposals on the Manning River recently submitted for approval constitute a potential three-fold increase on current operations. The proposals involve various reaches of the river from Taree past Wingham to Bungay (see Operations plan, figure 2).

Basin Ford, which is regarded as the approximate tidal limit, is upstream of the intake works for Bootawa Dam at Abbotts Falls serving Taree, Wingham and the lower Manning Valley. In early 1980, the low river-flow situation then resulted in penetration of saline water above Abbotts Falls, which subsequently contaminated Bootawa Dam. When lowering flows were again experienced later in the year, it was considered necessary to construct a tidal barrage (sandbag weir) at Abbotts Falls, to prevent saline water from again contaminating the water supply.

With little or no rain in the catchment for some months, the river flow situation deteriorated to the point where, in the first week of December 1980, there was no surface flow at Abbotts Falls, and little if any water available for pumping into the depleting Bootawa Dam. The sandbag weir was left high and dry.

Figure 3. Abbotts Falls 22·10·80.
Note pool of water held by sand bag weir (left of photo).

Figure 4. Abbotts Falls 2.12.80.
Note river has dropped so that sand bag weir is high and dry.

4. Summary of Gravel Extraction Proposals

Existing Operations

There is one existing extraction operation in the river, operated by Taree Crushed Metal Pty. Ltd. between Mondrook Point and Oaky Island (Site A on Figure 2). Figures to March 1980 show total extraction of 320,000 cubic metres from the end of 1964 at an average rate of approximately 21,000 cubic metres per year. Extraction in 1979 averaged approximately 3,000 cubic metres per month.

Proposed Operations

There are three operators who have extraction proposals currently submitted for consideration.

(i) Mitchell's Taree Crushed Metals Pty. Ltd.

An operation to extract 24,000 cubic metres per year over 20 years from the river over a distance of 1.4 kilometres upstream from Coocumbac Island is proposed (Site B on Figure 2).

(ii) Farley and Lewers Pty. Ltd.

Transfer of two leases on either side of Wingham road bridge from Wingham Concrete Industries Pty. Ltd. is proposed (Sites C on Figure 2). The original leases allow the extraction of gravel but they have not been seriously exploited in recent years.

(iii) Kooragang Cement Pty. Ltd.

An operation to extract 60,000 cubic metres per year over 15 years from the river bank between Jacksons Falls and Abbotts Falls is proposed. Future extensions are proposed between Abbotts Falls and Bungay (Sites D on Figure 2).

Figure 5. Part of operations site C, between Abbotts Falls and Jacksons Falls. Extraction is proposed on the inside of the bend.

Figure 6. Jacksons Falls near low tide. The gravel bar is virtually submerged at high tide.

MANNING RIVER GRAVEL EXTRACTION
DATA PLAN

Figure 7

5. Summary of Data Available

When the listed extraction proposals were first received, there was no river behavioural data available to put the proposals in context. Field data collection has subsequently been carried out, and limited appropriate data is now available. The types and locations of available data are shown on the Data plan (figure 7).

(i) Hydrosurvey (not shown)

There are piece meal historical soundings of various sections of the river dating back up to 100 years. In addition, the Department is at present carrying out a hydrosurvey from Jacksons Falls to the ocean.

(ii) Tide Data

Tide levels over a full tidal cycle have been measured twice recently (23.10.80 and 2.12.80) at Wingham and the next three upstream gravel bars (Wingham bar, Jacksons Falls, Abbotts Falls). The results are plotted on figures 13 and 14 in the Appendix.

(iii) Salinity Data

On 22.10.80, salinity measurements were taken at various locations along the full tidal section of the river from the Harrington ocean entrance to Abbotts Falls. The results are presented in the following table showing the depth averaged salinity in parts per thousand. The measurements were taken at or near to high water slack tide.

Distance from Entrance (km)	Average Salinity (ppt)	Remarks
4.5	35.1	Harrington entrance
9.7	33.4	
13.2	32.7	
19.3	30.6	
23.0	29.5	
27.5	28.0	Taree
30.9	26.2	
35.7	22.9	
40.1	18.7	
46.7	11.1	Wingham boat ramp
48.0	7.5	
48.5	6.7	
49.4	5.1	d/s Jacksons Falls
50.7	3.2	
52.3	2.6	d/s Abbotts Falls

Salinity readings were also taken over a full tidal cycle at Jacksons Falls (23-10-80 and 2-12-80) and Wingham Bar (2-12-80). These results are plotted on Figure 15 in the Appendix.

Figure 8. Jacksons Falls on ebb tide.
Note obvious drop in level between pool above the gravel bar and that below bar.

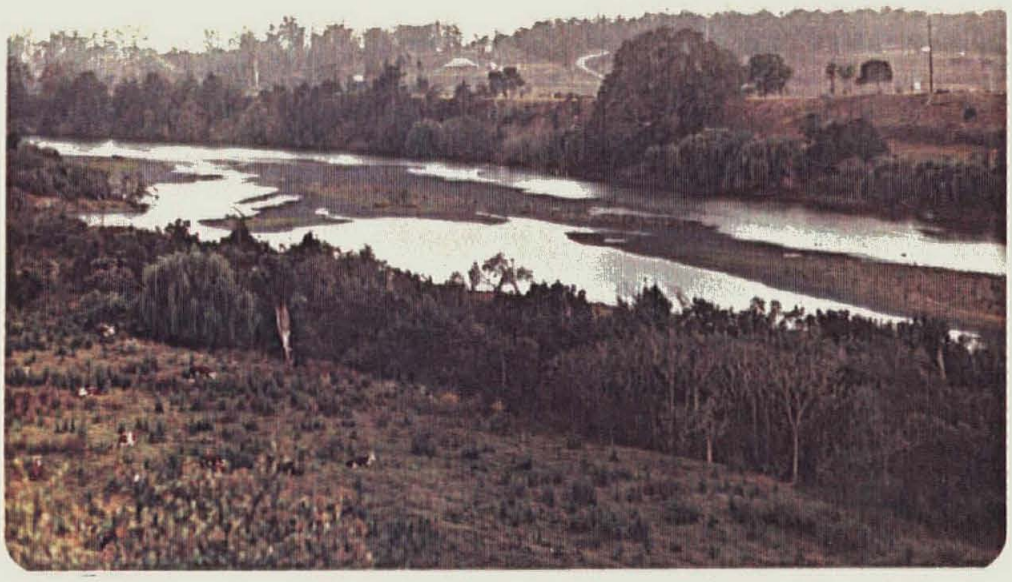


Figure 9. Wingham Bar.
This bar is very extensive in plan area with its shallowest point near the large tree on the far bank.

6. Data Interpretation

The following interpretations concentrate on the short term present behaviour of the river as identified by the data collected recently. In this context, the historical hydrosurvey information is not considered.

The data collected in October and December 1980 in the reaches above Wingham clearly demonstrate that under low river flows there are high salinity levels in these reaches, and show the substantial effects that the gravel bars have upon tide levels and salinity in the river, and bear testimony to the then prevailing drought situation.

Tides

The tide curve at Wingham Ramp i.e. downstream of the gravel bars, shows a pronounced reduction of the duration of the flood phase of the tide cycle, and an elongation of the ebb phase. This is the phenomenon of tidal phasing, where the ebb flow, running through shallower depths, is retarded by river bed friction.

Observation in figure 13 or 14 of any two tide curves which straddle a gravel bar quickly reveals the way in which the bars are affecting the river's behaviour in these reaches. The bars are acting as weirs, which is an extreme example of a friction dominated situation described above, and shown by a characteristic shape of the tide curve.

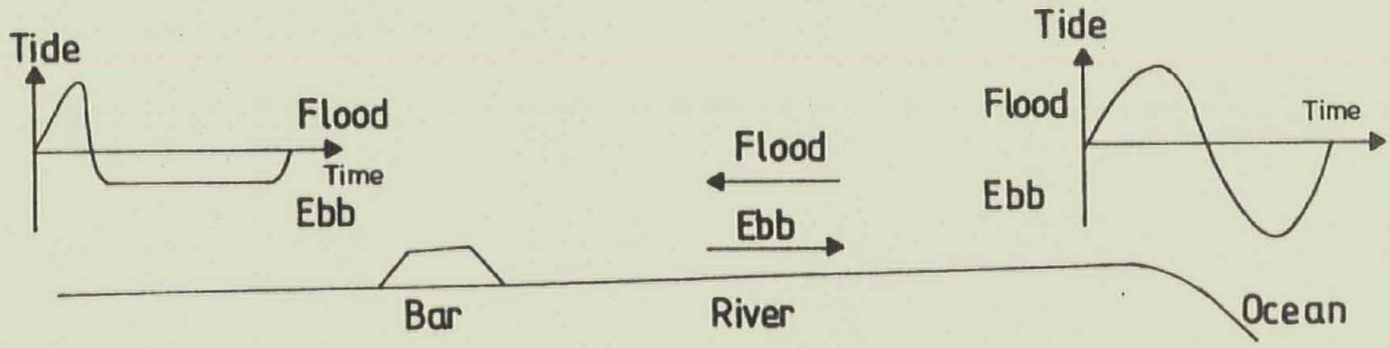


Figure 10

More importantly, the weir effect causes perching of the ebb tide upstream of the bar, the water level upstream remaining much higher than the level downstream of the bar. This results in a lesser tidal range than would be expected if the bar was not present, and a relatively level pool of water is created upstream of the bar.

As an example examine the tidal behaviour measured on 23.10.80 (figure 13). Figures quoted are for downstream of Wingham bar, upstream of Wingham bar (downstream of Jacksons Falls), and upstream of Jacksons Falls respectively. Low tide levels were 0.68 m, 1.06 m, and 1.31 m, and tidal ranges were 0.92 m, 0.46 m and 0.25 m.

The high tide level however did not decrease in an upstream direction, which would be expected in a friction-dominated situation. This suggests the possible existence of a resonance effect.

Salinity

The Public Works Department guidelines for non-metropolitan water supplies recommend a maximum chloride concentration of 0.35 parts per thousand. The table in section 5 demonstrates the serious situation which has been experienced at the water supply intake, with the salinity level just downstream of Abbotts Falls on 22.10.80 approximately 3 parts per thousand.

The salinity measurements also demonstrate the weir effect of the bars, forming upstream pools of water of measurably different salinity, as shown in the table and figure 15. The table shows salinities on 22.10.80 downstream and upstream of Jacksons Falls of approximately 5 and 3 parts per thousand respectively. Figure 15 shows water with these salinities exchanging over the Falls with the flood and ebb tides on 23.10.80.

With continuing low fresh water flows coming down the river, this situation will worsen, albeit slowly, resulting in increased salinity of the upstream pools. Evidence of this is found in figure 15, comparing results at Jacksons Falls for 23.10.80 and 2.12.80, during which time salinity values substantially increased even further beyond recommended water supply limits. Figure 11 below demonstrates schematically the above phenomenon.

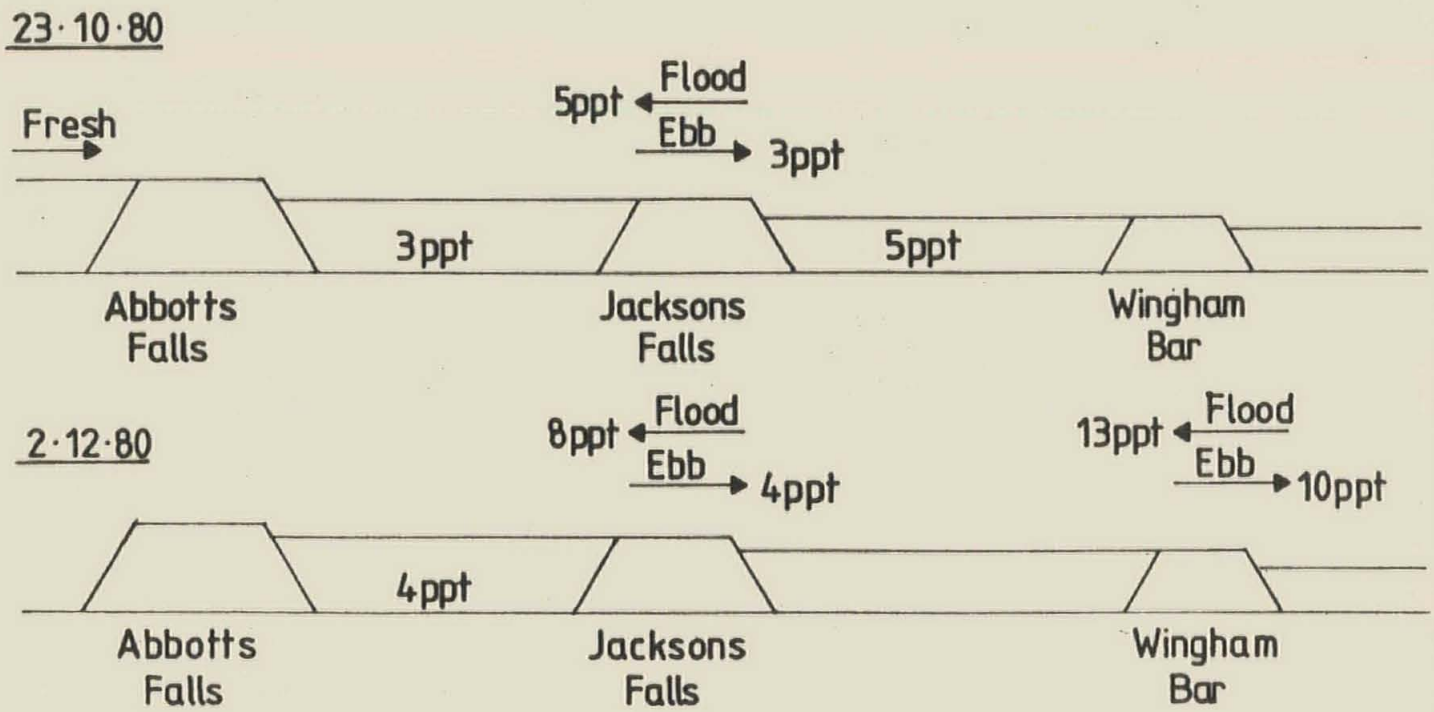
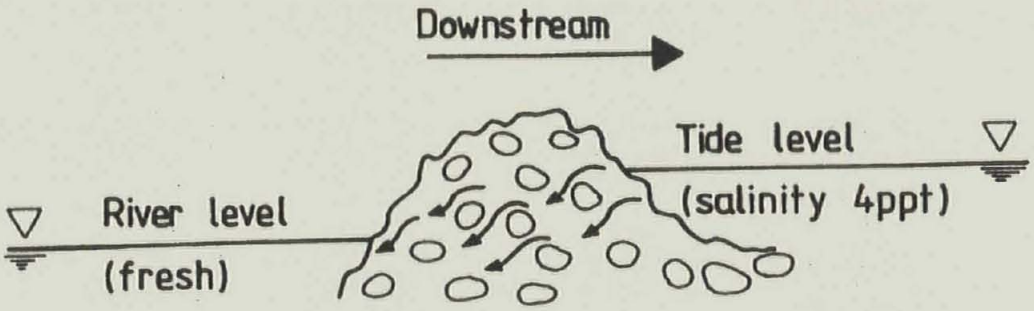


Figure 11

Even at the tidal limit, i.e. the first gravel bar which is not overtopped by the highest high tide, a potential still exists for saline intrusion. At Abbotts Falls on 2.12.80, with no surface fresh water flow, the level of the upstream fresh pool was lower than the tide levels in the downstream tidal pool (salinity 4 parts per thousand approximately), and upstream percolation through the gravel was probably occurring.



SALINE PERCOLATION

Figure 12

In short, Wingham bar, Jacksons Falls, and Abbotts Falls are significant hydraulic controls in the upper tidal reaches of the river.

7. Implications For the River

The proposed extraction operations at Wingham and upstream are in the immediate vicinities of Wingham bar, Jacksons Falls, Abbotts Falls and Basin Ford beyond. The operations could contribute to the removal of these bars, either directly or indirectly by increasing the scour potential of flood flows from upstream.

The implications of loss of these bars are increased tidal range (lower low tide) in the upper reaches and increased salinity. The tidal limit, presently considered to be Basin Ford, could be expected to shift further upstream if Basin Ford and the downstream bars were lost.

The intake works for Bootawa Dam are currently located in the pool between Basin Ford and Abbotts Falls. Loss of the Abbotts Falls bar particularly would be a most serious situation, and it is understood that relocation of the intake works further upstream is currently being investigated by the Department's Water Supply Branch, because of the currently increasing salinity in the adjacent downstream reaches. Wherever located, the intake works would be susceptible to potential water turbidity from upstream extraction operations, and this would always have to be taken into account.

The differences in water levels upstream and downstream of the bars at low flows are testimony to their action as hydraulic controls. The losses of head across the bars may be a mitigating effect on downstream flood velocities, and their removal might result in a transfer of their energy dissipating function to the downstream river bed in the form of friction loss. This would be manifested in the form of shifting shoals and erosion.

The above implications are the immediate ones directly associated with the gravel bars. Nothing is currently known about the sediment budget of the river and the possible long term implications for the river as a whole associated with the total amount of materials proposed to be removed over the life of the operations.

The rate of supply of material (sediment supply) from upstream is not known, and hence it is not known whether the proposals will result in a nett loss of material from the river in these upper tidal reaches, with the inherent ramifications for increased bank erosion of the rich dairying lands downstream.

Only with this knowledge can the proposals be put into proper perspective.

There might also be some small increase in flood levels in the Wingham/Taree reaches downstream, because the bars act to hold back flood waters to some extent (increasing flood heights in their vicinity but reducing heights downstream).

8. Environmental Impact Assessment

The potential adverse impacts identified in the preceding discussion related to removal of the gravel bars and the consequent effects on tides, salinity, the water supply intake, flooding and bank and bed erosion lead to the conclusion that an Environmental Impact Assessment of the extraction proposals is necessary. Both short term and long term effects would need to be assessed. There are of course environmental issues other than river behavioural aspects which are important, but only the latter are discussed here.

In the short term, it would need to be demonstrated that either the operations would not contribute to loss of the gravel bars, or alternatively that their loss would not produce an unacceptable adverse impact.

For the long term, the present status of the river on a valley scale would need to be assessed. In particular, the sediment budget must be estimated, and the present behavioural patterns of the river identified. Then the relative significance of the extraction operations in the upper tidal reaches could be determined. If the operations proved to be significant, then an opinion based on current hydraulic practices and river regime theories would need to be given on the nature and extent of the adverse effects to be expected as a consequence.

Guidelines for the river behavioural aspects of an Environmental Impact Assessment of the gravel extraction proposals are presented on the following page. This assessment should be a part of the normal approval process for such operations.

Manning River Gravel Extraction: Guidelines for Environmental Impact Assessment: River Behavioural Aspects

For a gravel extraction operation in the upper tidal reaches to proceed, the following guidelines should be followed:

Short Term

Requirements: Demonstrate in appropriate detail that extraction operations will not directly or indirectly remove the gravel bars, nor cause a significant change in flood flow behaviour sufficient to cause scouring of the bars.

Alternative Requirements: If the gravel bars are removed, demonstrate in appropriate detail that increased salinity and flood velocities and altered flood heights will not have unacceptable adverse effects on water licence holders (including the town water supply), bank erosion, and on flood behaviour.

Long Term

Requirements: Demonstrate in appropriate detail that the removal of gravel in the quantities proposed over the life of the operations will not have unacceptably adverse effects on the sediment processes in the river with consequent ramifications for bank erosion and other behavioural patterns.

9. Addendum -

March 1981

2. Summary of Gravel Extraction Proposals

Existing Operations

In 1980, the area operated by Taree Crushed Metal Pty. Ltd., now controlled by Farley and Lewers Pty. Ltd., produced 80,000 cubic metres.

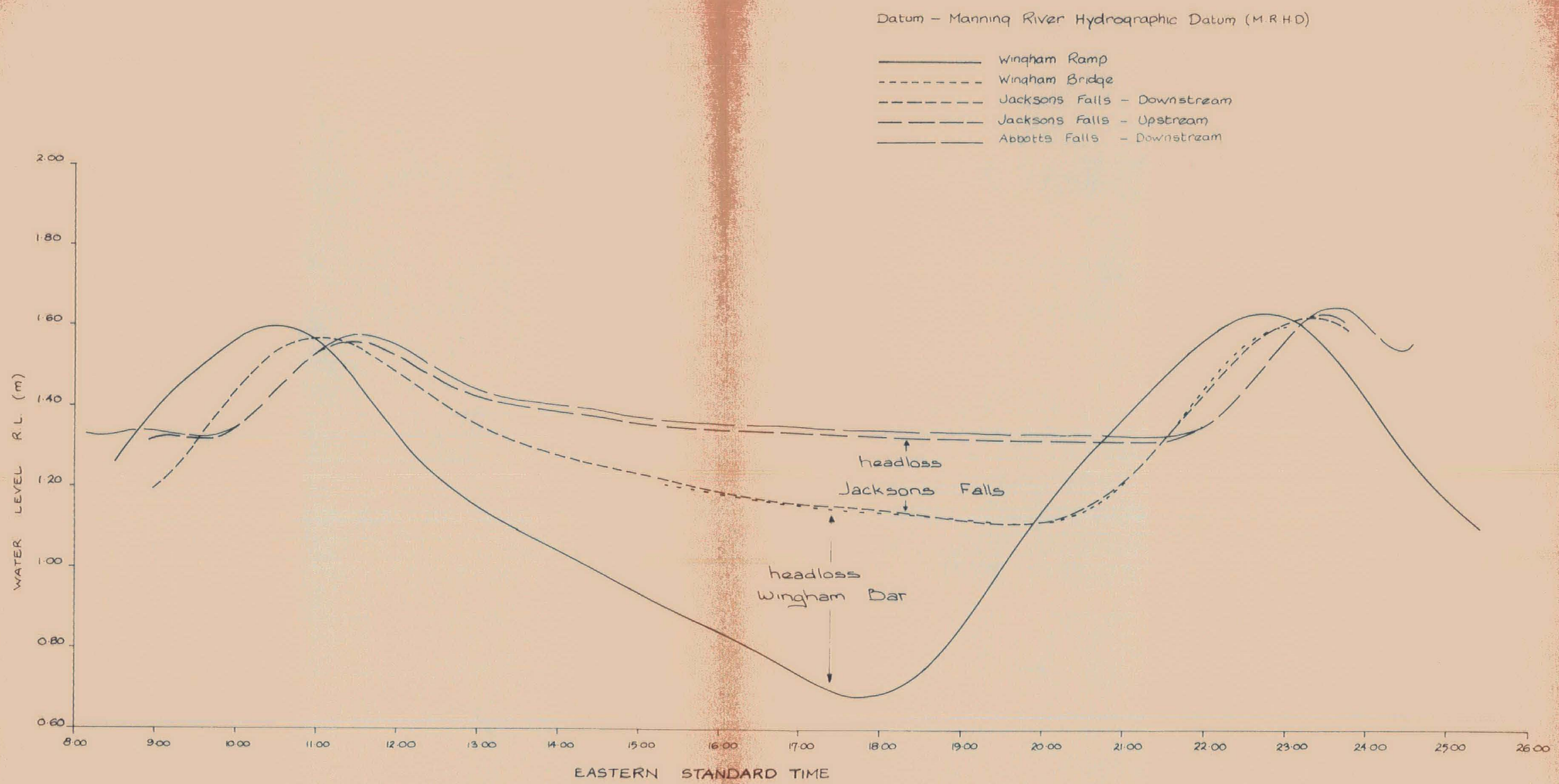
Proposed Operations

(i) Mitchell's Taree Crushed Metals Pty. Ltd.,

This proposal, involving the removal of 24,000 cubic mtres per year, has received the concurrence of the Public Works Department, subject to conditions.

10. Appendix

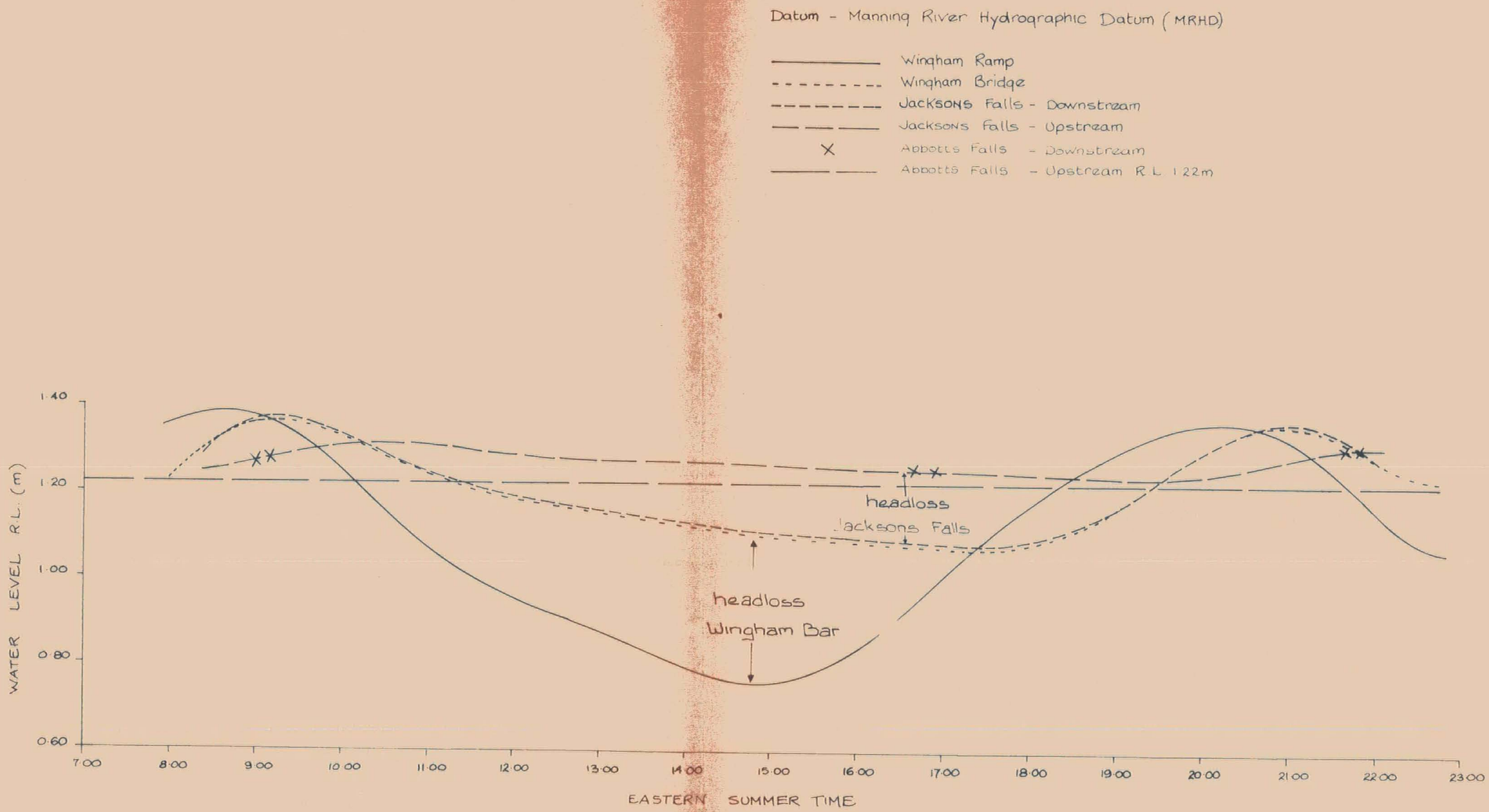
Figures 13, 14, 15 following present data collected in the upper tidal reaches of the Manning River on 23-10-80 and 2-12-80.



MANNING RIVER GRAVEL EXTRACTION

MANNING RIVER 23-10-80
COMPARISION OF WATER LEVELS

Figure 13

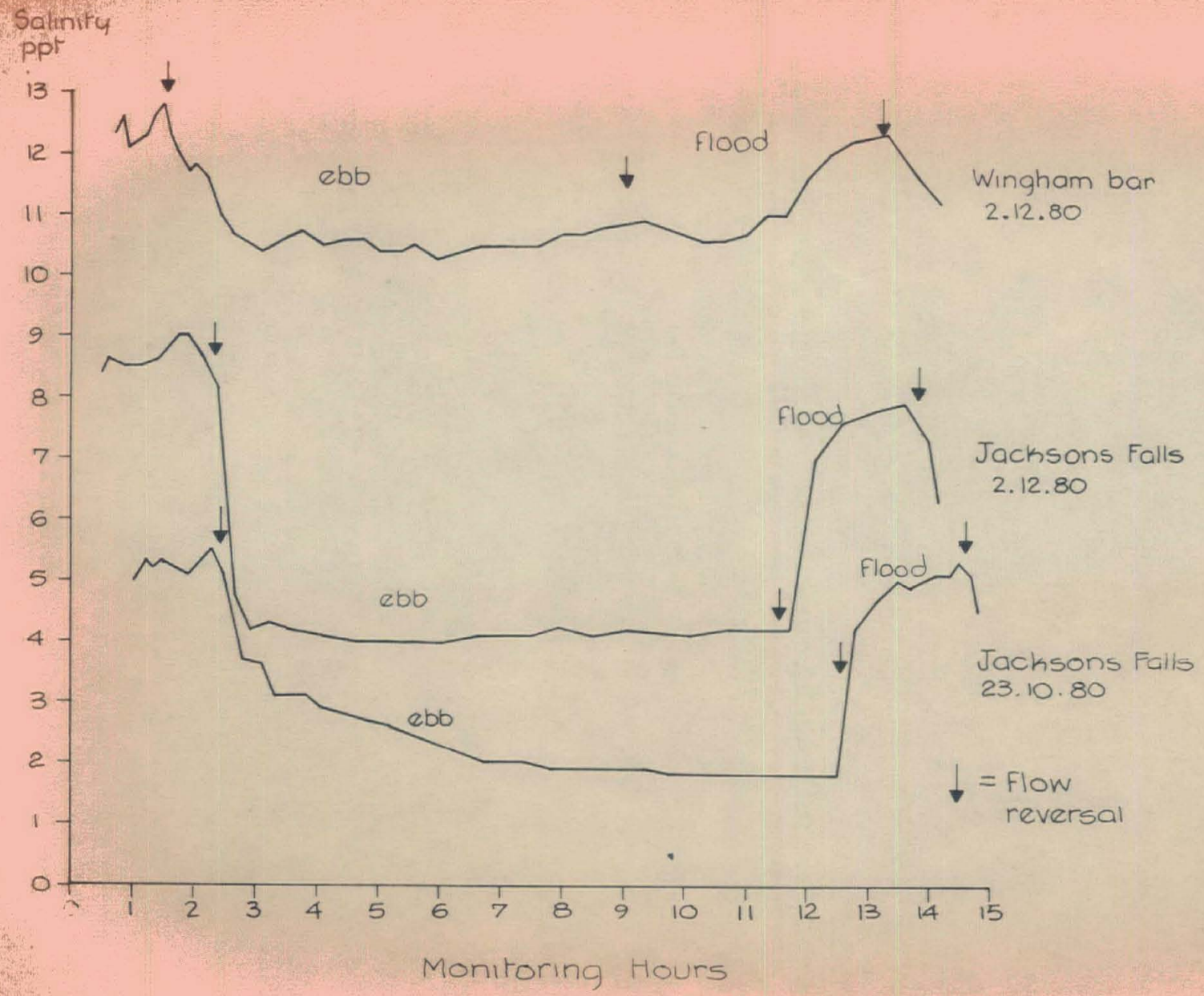


MANNING RIVER GRAVEL EXTRACTION

MANNING RIVER 2-12-80

COMPARISION OF WATER LEVELS

Figure 14



MANNING RIVER GRAVEL EXTRACTION

SALINITY AT GRAVEL BARS

Figure 15