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BRISBANE RIVER MEASUREMENT

29th JUNE, 1983

PORT OF BRISBANE AUTHORITY

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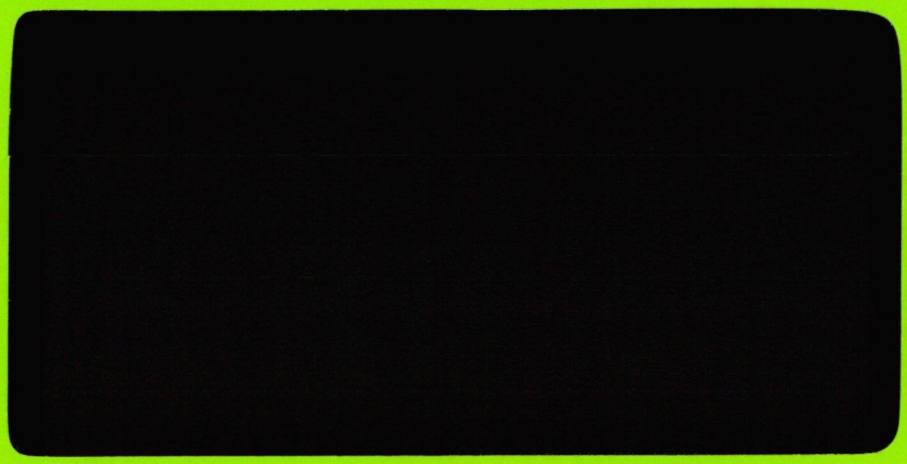

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BRISBANE RIVER MEASUREMENTS
29th JUNE, 1983
PORT OF BRISBANE AUTHORITY

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OCEANICS AUSTRALIA PTY. LTD.

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15th July, 1983.
Our Ref: 1850

General Manager,
Port of Brisbane Authority,
G.P.O. Box 1818,
BRISBANE, Q., 4001

Attention: Mr. S.R. Carr

Dear Sir,

RE: MEASUREMENT OF THE BRISBANE RIVER SALT WEDGE,
29TH JUNE, 1983

We have pleasure in submitting herewith the results of the measurements undertaken in the Brisbane River on 29th June, 1983.

Yours faithfully,
OCEANICS AUSTRALIA PTY. LTD.

Paul Harding.

Enc.

(PAUL HARDING)

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1.0 INTRODUCTION

Following increased flows in the Brisbane River after large rainfalls in the river catchment, a series of measurements were recorded on the 29th June, 1983 to measure the changes in turbidity in the vicinity of the salt wedge, where the turbid freshwater meets the more saline water from Moreton Bay. This series of measurements was recorded after the peak flow as the freshwater flow was decreasing and the saline water was moving back up the river.

An initial survey was carried out at stations from the Grey Street bridge to Pinkenba to establish the position of the salt wedge. Once the position and shape of the wedge was identified, a more intensive series of measurements was taken at the interface between the freshwater and the saltwater.

At each station, profiles of temperature and salinity were recorded at two-metre intervals starting at 1 metre depth in the middle of the river using a YSI Salinity/Temperature Meter. One litre water samples were also collected at these depths and were used to determine the suspended sediment concentration. The current speed and direction were also measured at these depths, as well as at the surface, using a Toho-Denton Current Meter. The direction of the current is specified relative to magnetic north.

The suspended sediment concentrations were determined by ETRS Pty. Ltd., a NATA Laboratory, using the standard procedures prescribed by the Water Pollution Control Federation, the American Water Works Association and the American Public Health Association. The precision of the determination varied directly with the concentration of suspended matter in the sample. The coefficients of variation at the quoted levels are as follows:-

20 mg/l ± 30%
250 mg/l ± 10%

2.0 INITIAL RIVER SURVEY

The initial survey was carried out between 0840 and 1102 on 29th June, 1983 at the seven locations shown in Figure 1 and described in Table 1. The results are presented in Table 2.

The longitudinal salinity profile from the initial survey is presented in Figure 2. The river was completely fresh from the Grey Street bridge to the mouth of Norman Creek. The toe of the more saline bottom water was located between the mouth of Norman Creek and Hornibrooks. The salinity of the bottom layer increased in the downstream direction to 23.5 ppt at Pinkenba. The mainly freshwater layer overlying the bottom layer extended to a depth of 5m. The salinity of this layer also increased in the downstream direction.

The temperature of the freshwater layer was 15°C while the saline bottom water was about 17°C.

Ebb velocities were measured at the Grey Street bridge, the Port Office and at the mouth of Norman Creek. However, the downstream locations all showed the typical velocity profile for a salt wedge during the flood tide, with ebb velocities in the fresh surface layer and flood velocities in the saline bottom layer. The change in velocity profiles indicates that slack water at low tide occurred at New Farm at 0930. The predicted tide levels for the Brisbane Bar are given in Table 3. The normal tidal delay between New Farm and the Brisbane Bar, according to the Queensland Tide Tables, is 35 minutes. Therefore, the increased freshwater flow had significantly increased the delay in the arrival of slack water at low tide.

Table 1 - Description of Initial Survey Locations

Station No.	Description of Location
1	Upstream side of the Grey Street Bridge
2	Downstream of the ferry crossing at the Brisbane Port Office
3	In the Humbug Reach, opposite the mouth of Norman Creek
4	Opposite Hornibrooks
5	Opposite Bretts Wharf
6	Opposite the abandoned abbattoirs building
7	Opposite Harbours & Marine, Pinkenba

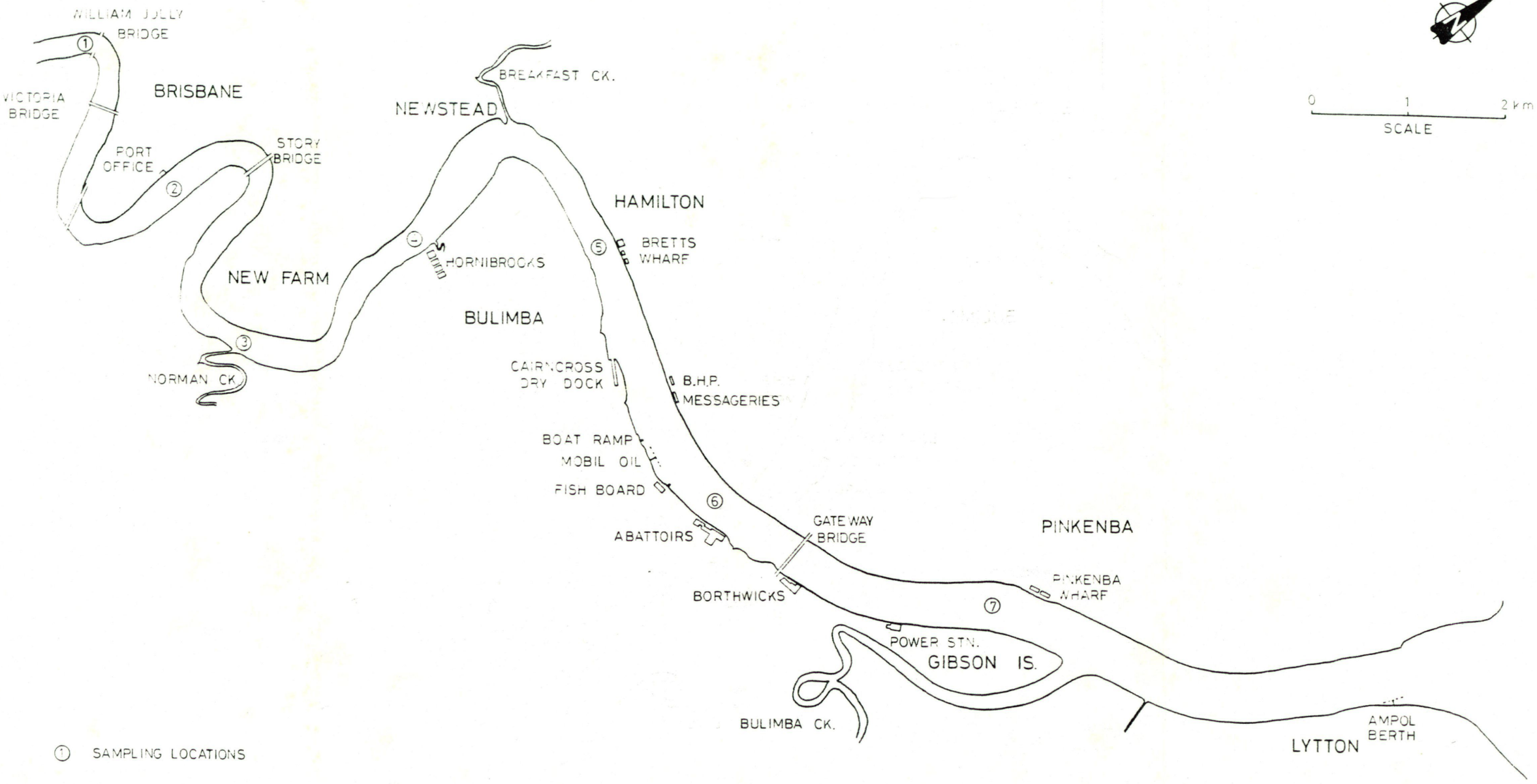

Fig. 1.
INITIAL SURVEY LOCATIONS.

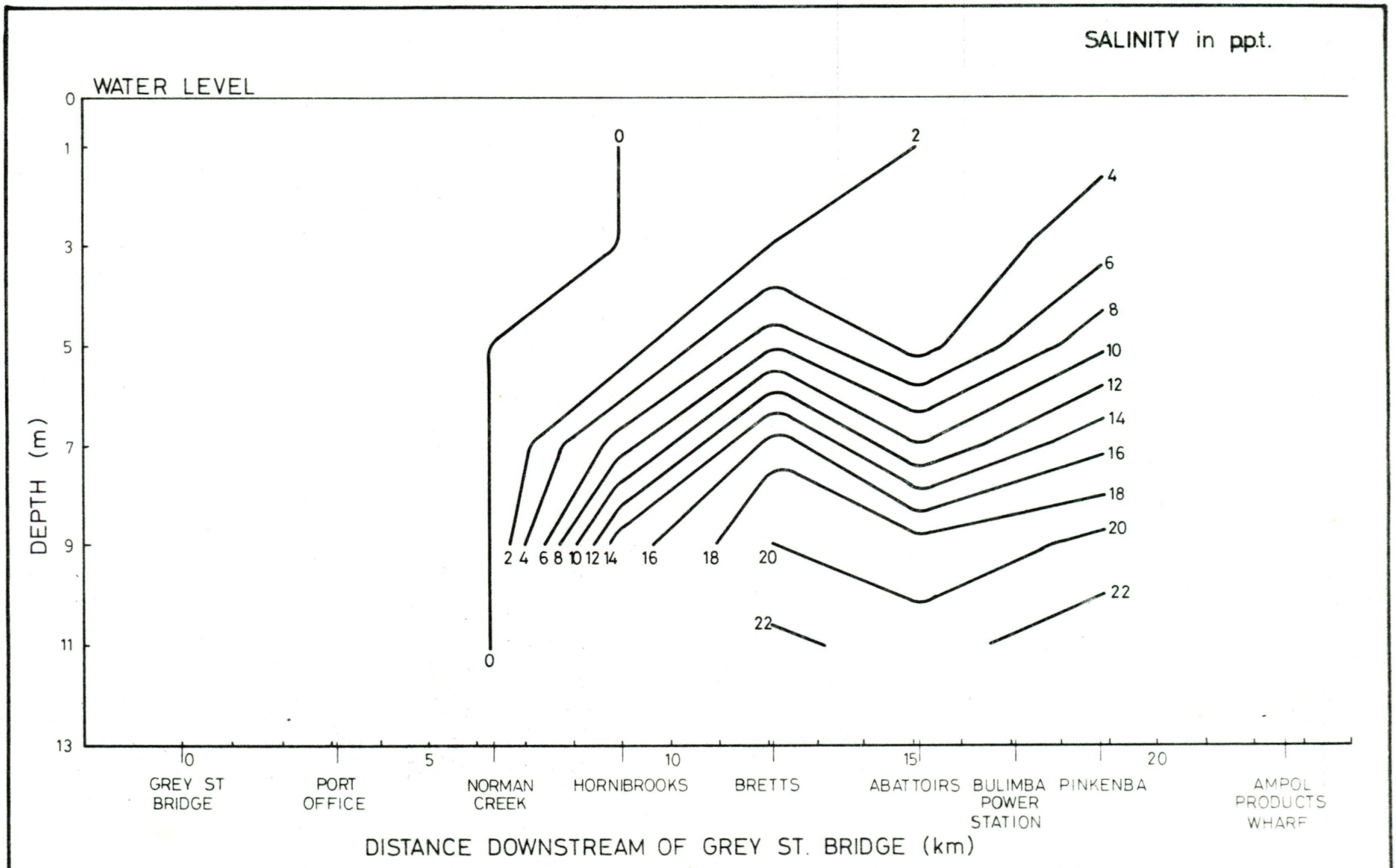

Fig. 2 . LONGITUDINAL SALINITY PROFILE 0840– 1102, 29 JUNE 1983.

Table 3 - Predicted Tide Levels at the Brisbane Bar, 29th June, 1983

Time	Predicted Level (m Chart Datum)
0614	0.36
1149	1.71
1727	0.28

The suspended sediment profile during the initial survey is shown in Figure 3 and shows that the transition from the turbid freshwater to the cleaner saltwater occurs at the salt wedge. The suspended sediment concentration of the saltwater was about 20mg/l while the concentration of the freshwater was about 180mg/l.

This survey shows the salinity and suspended sediment profiles when the salt wedge was at its minimum intrusion at low tide. At the downstream stations, the saline bottom water was already beginning to progress upstream.

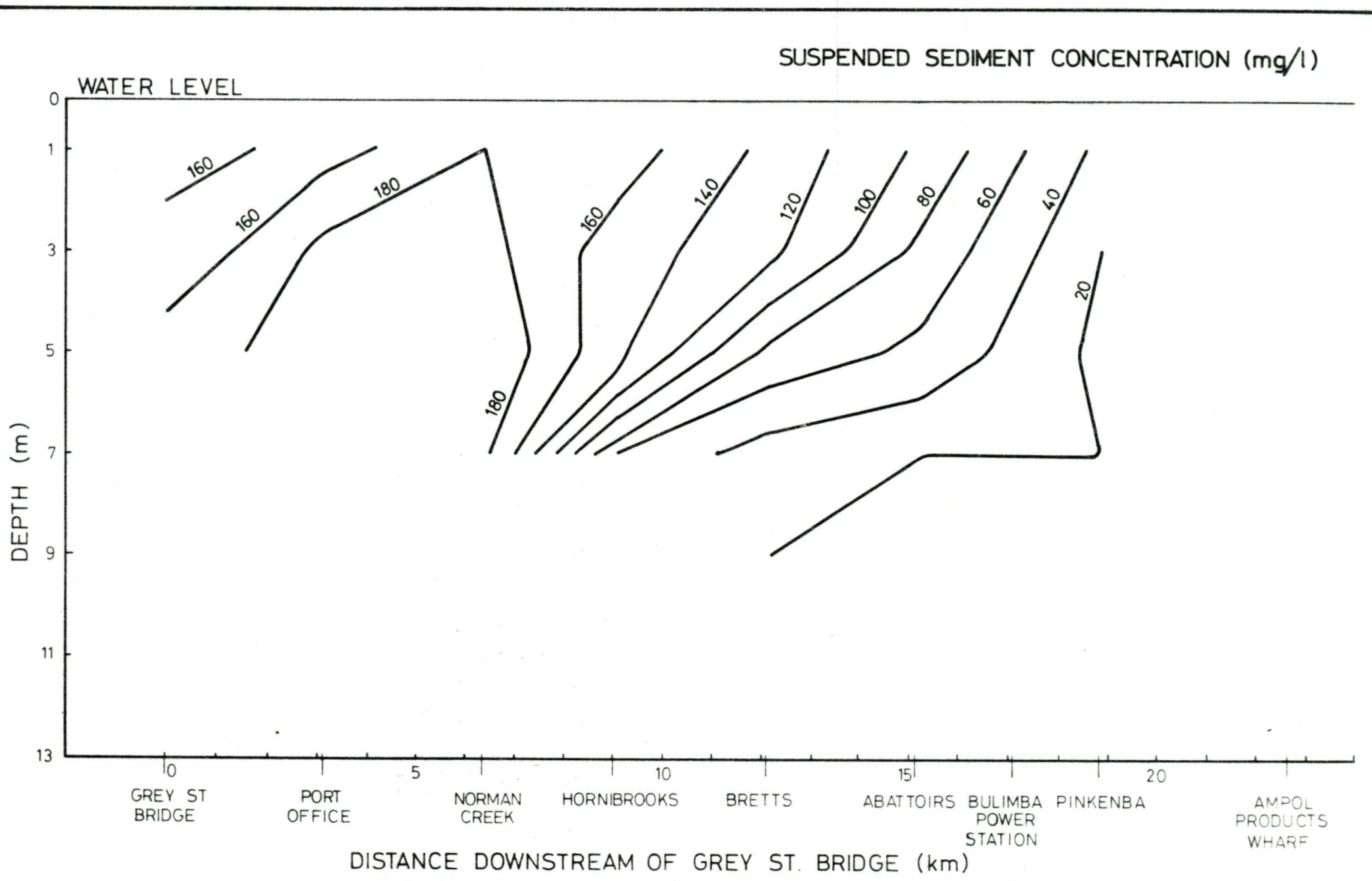

Fig. 3. LONGITUDINAL SUSPENDED SEDIMENT PROFILE 0840–1102, 29 JUNE 1983.

Table 2a - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
1	0841	Surface	-	-	0.43	35	-
		1	15	0	0.42	0	175
		3	15	0	0.33	0	145
		5	15	0	0.32	0	170
		7	15	0	0.27	0	160
		9	15	0	0.22	0	150
		11	15	0	0.22	0	155
		13	-	-	0.21	0	-
2	0906	Surface	-	-	0.21	0	-
		1	15	0	0.20	0	150
		3	15	0	0.20	0	185
		5	15	0	0.17	0	190
3	0928	Surface	-	-	0.06	240*	-
		1	15	0	0.00	25	180
		3	15	0	0.02	20	185
		5	15	0	0.02	25	185
		7	15	0	0.02	20	185
		9	15	0	0.02	15	190
		11	15	0	0.02	210	205
4	0948	Surface	-	-	0.17	350	-
		1	15	0	0.18	350	170
		3	15	0	0.18	320	150
		5	15	0.5	0.13	330	145
		7	16	7.0	0.22	180	60
		9	16	15.0	0.44	180	-
		11	-	-	0.19	170	-

* Surface flow direction was variable

Table 2b - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current Speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
5	1013	Surface	-	-	0.27	95	-
		1	15	1	0.28	120	135
		3	15.5	2	0.24	180	125
		5	15.5	7.5	0.22	260	75
		7	16.5	17.5	0.36	270	30
		9	17	20	0.47	290	20
		11	17	22.5	0.48	280	45
		13	-	-	0.14	265	-
6	1036	Surface	-	-	0.27	80	-
		1	15.5	2	0.27	130	95
		3	15.5	2.5	0.05	220	75
		5	15.5	3	0.13	205	55
		7	16	10	0.38	270	20
		9	16	18.5	0.83	270	15
		11	17	21	0.63	250	10
		12	17	20	0.25	270	-
7	1102	Surface	-	-	0.22	50	-
		1	16	3.5	0.21	10	35
		3	16	5	0.15	150	20
		5	16	9.5	0.22	210	15
		7	17	15.5	0.52	200	20
		9	17	20.5	0.47	200	40
		11	17.5	23.5	0.43	180	-

3.0 INTENSIVE SURVEY OF THE SALT WEDGE

The intensive survey was carried out from 1200 to 1600 following the initial survey. The survey locations are shown in Figure 4 and are described in Table 4. Table 5 presents the measurements at each station.

The salinity and velocity profiles showed that the saline bottom water was still progressing upstream at Mowbray Park (station 10) at 1305. However the current in the bottom layer was quite low indicating that the upstream movement of the wedge was nearly arrested by the freshwater flow. By 1322, the bottom saline layer was moving downstream with the freshwater layer at the mouth of Norman Creek. By 1516, the ebb velocity in the Hamilton Reach was quite high, up to 1.24 m/s at the surface and up to 0.37 m/s in the bottom layer. The ebb velocities were high enough to cause problems anchoring so that no velocities were measured at location 17. The depth of the freshwater/saltwater interface varied from 11m at Mowbray Park (station 11) to 9m at the other downstream stations. The anamolous decrease in the salinity of the bottom layer between stations 12 and 13 was probably caused by the downstream movement of the salt wedge between measurements.

The velocity measurements indicated that slack water following high tide occurred at New Farm about 1315, well after the high tide expected from the tidal predictions at the Brisbane Bar and the usual 30 minute tidal delay for high tide between the Brisbane Bar and New Farm.

The suspended sediment measurements further showed the difference between the saline bottom layer and the overlying freshwater layer. The suspended sediment concentration was only about 20mg/l in the bottom layer compared with about 150mg/l in the surface layer. At the mouth of Breakfast Creek, at station 8, 15 and 18, a higher

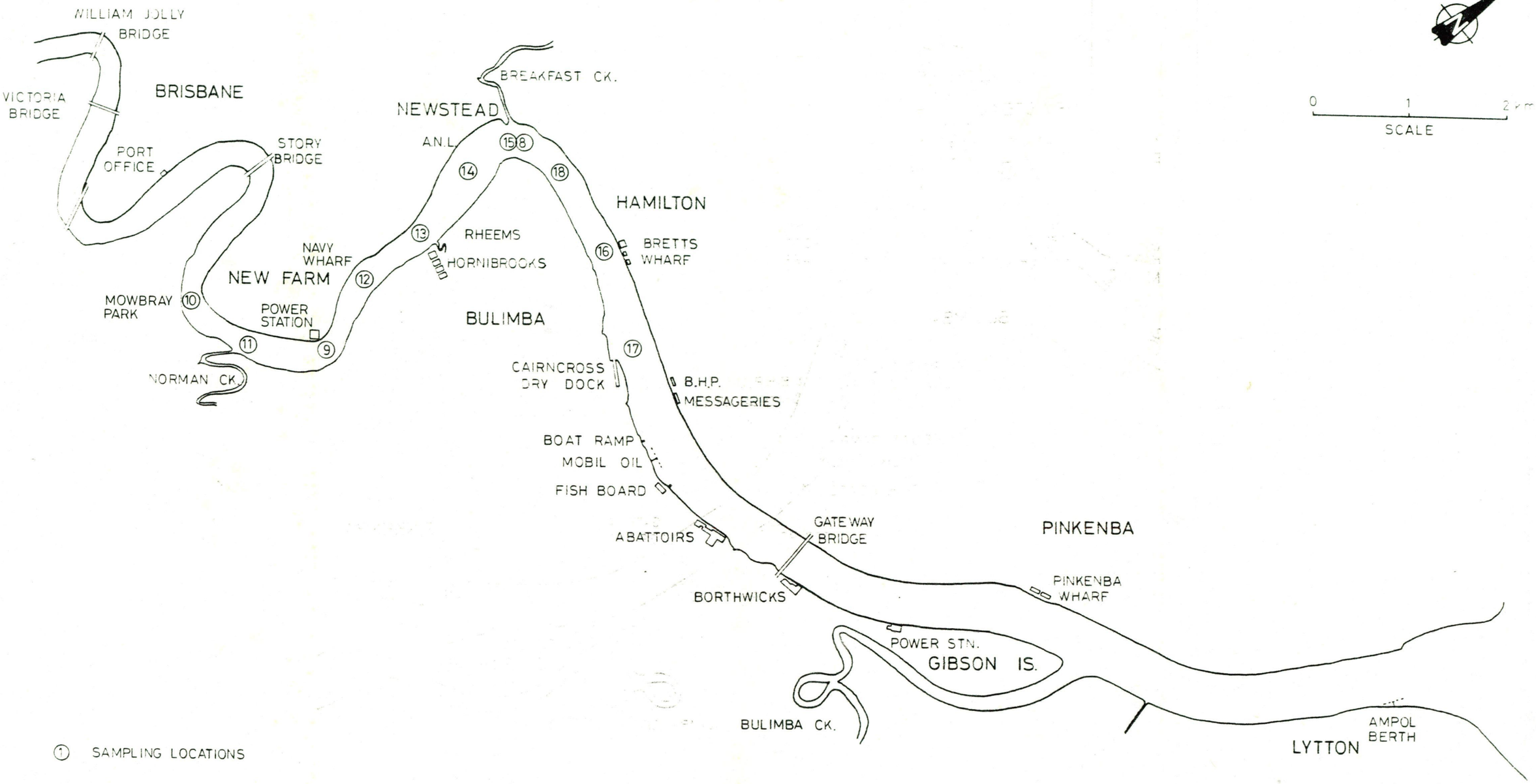

Fig. 4 .
INTENSIVE SURVEY LOCATIONS.

suspended sediment concentration of 55 - 60 mg/l was measured in the bottom layer. Station 17 was affected by dredging of the main channel about 20 minutes prior to the measurements.

Both the salinity and suspended sediment measurements confirm that during the intensive survey, the interface between the fresh and salt water extended over a considerable length of the river from upstream of Mowbray Park to downstream of Cairnscross Dock. The profile shows the shape of the wedge at high tide when the salt water had progressed to its maximum upstream extent.

Table 4 - Description of Intensive Survey Locations

Location No.	Description of Location
8	Downstream of the mouth of Breakfast Creek
9	Opposite the old Power Station, New Farm
10	Opposite Mowbray Park
11	Opposite the mouth of Norman Creek
12	Opposite Navy Wharf
13	Opposite Rheem's Factory
14	Opposite A.N.L. Wharf
15	Opposite mouth of Breakfast Creek
16	Upstream of Bretts' Wharf
17	Opposite the upstream end of Cairnscross Dock
18	Opposite the beacon downstream of Breakfast Creek.

Table 5a - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current Speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
8	1204	Surface	-	-	0.11	40	-
		1	15.5	0.5	0.15	10	175
		3	15.5	0.5	0.13	100	15
		5	15.5	3.5	0.15	210	15
		7	16.5	12.5	0.39	250	10
		9	17	16.5	0.47	255	35
		11	17	18.5	0.35	260	60
		13	17	15.5	0.35	260	-
9	1240	Surface	-	-	0.36	360	-
		1	15.5	0	0.33	330	145
		3	15.5	0	0.31	360	145
		5	15.5	0	0.27	345	155
		7	17	17	0.27	175	25
		9	17	19	0.11	150	25
		11	17	19	0.10	220	40
10	1305	Surface	-	-	0.34	120	-
		1	15.5	0	0.38	120	155
		3	15.5	0	0.40	120	155
		5	15.5	0	0.42	120	165
		7	15.5	0	0.35	110	20
		9	15.5	4	0.12	330	20
		11	16	10.5	0.07	360	30
		13	16.5	14	0.02	350	-

Table 5b - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current Speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
11	1322	Surface	-	-	0.18	45	-
		1	15.5	0	0.22	20	135
		3	15.5	0	0.53	25	190
		5	16	2	0.43	35	35
		7	16	8	0.16	0	20
		9	16.5	10.5	0.10	5	20
		11	16.5	13	0.03	30	-
12	1341	Surface	-	-	0.57	350	-
		1	15.5	0	0.67	355	145
		3	16	0	0.67	345	140
		5	16	3	0.43	350	80
		7	16.5	13.5	0.15	40	15
		9	16.5	19	0.12	20	-
13	1401	Surface	-	-	0.94	350	-
		1	16	0	0.94	340	155
		3	16	0.5	0.95	345	135
		5	16.5	1	0.80	340	125
		7	16.5	11	0.23	360	45
		9	17	17	0.18	360	20
14	1429	Surface	-	-	0.83	350	-
		1	16	0.5	0.87	350	155
		3	16	0.5	0.87	345	145
		5	16	4	0.50	340	75
		7	16	6.5	0.23	340	25
		9	16.5	15	0.15	330	20
		11	17.0	21	0.17	340	68,200*

* Sample was the bottom layer

Table 5c - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current Speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
15	1448	Surface	-	-	0.57	20	-
		1	16	1	0.62	30	150
		3	16	1	0.66	25	135
		5	16	1	0.64	15	135
		7	15.5	1.5	0.63	25	130
		9	15.5	13	0.45	50	95
		11	17	20	0.28	10	55
		13	17	20.5	0.37	15	-
16	1516	Surface	-	-	1.23	70	-
		1	16.5	1	1.24	70	140
		3	16	2	1.17	60	100
		5	16.5	5	0.54	80	25
		7	16.5	11.5	0.42	50	10
		9	17	18	0.37	30	20
		11	17	22	0.33	0	25
		13	17.5	18.5	0.22	0	-
17	1533	Surface	-	-	*-	-	**-
		1	16	1.5	-	-	140
		3	16	2	-	-	200
		5	16	8	-	-	1160
		7	16.5	12	-	-	750
		9	17	20.5	-	-	245
		11	17	22.5	-	-	-

* Velocity measurements were not recorded because of mooring difficulties

** This section had been dredged about 20 minutes earlier

Table 5d - Results of Brisbane River Survey, 29th June, 1983

Location	Time (EST)	Depth (m)	Temp. °C	Salinity (ppt)	Current Speed (m/s)	Direction (degrees)	Suspended Sediment (mg/l)
18	1555	Surface	-	-	1.26	80	-
		1	16.5	2	1.08	75	105
		3	16	2	1.08	70	115
		5	16	2	1.14	70	115
		7	16.5	9	1.13	120	55
		9	17	14.5	0.53	120	115
		11	17	20.5	0.42	10	55
		13	17	21	0.22	240	-