R. MURRAY

COASTAL OBSERVATION PROGRAMME – ENGINEERING (COPE)

HULL HEADS – CARDWELL SHIRE

FOR THE YEARS 1979 TO 1988

REPORT NO. C26.1

Beach Protection Authority

December 1989

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All reasonable care and attention has been exercised in the collection, processing and compilation of the COPE data included in this report. However, the accuracy and reliability of this information is not guaranteed in any way by the Beach Protection Authority and the Authority accepts no responsibility for the use of this information in any way whatsoever.

DOCUMENTATION PAGE

REPORT NO.:- C26.1

TITLE:- Report - Coastal Observation Programme - Engineering (COPE), Hull Heads - Cardwell Shire

DATE:- December 1989

TYPE OF REPORT:- Technical Memorandum

PREPARED BY:- Coastal Management Programme of the Department of Harbours and Marine on behalf of the Beach Protection Authority.

ISSUING ORGANISATION:- Beach Protection Authority
G.P.O. BOX 2595
BRISBANE QLD 4001
AUSTRALIA

DISTRIBUTION:- Public Distribution

ABSTRACT:-

This report provides a summary of primary analyses of COPE data on wind, wave and beach processes observed at Hull Heads in the Shire of Cardwell, on the north Queensland coast. The data was recorded by volunteer observers during the period December 1979 to December 1988. The Beach Protection Authority wishes to thank all observers involved in the recording of data at the COPE Station. The information published is considered representative of the long term conditions. The station was still active at December 1989.

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Coastal Observation Programme – Engineering (COPE), Kings Beach – City of Caloundra, (Report C24.1)

Coastal Observation Programme – Engineering (COPE), Rainbow Beach – Widgee Shire, (Report C25.1)

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   Queensland Volunteer Coastal Observation Programme – Engineering (COPE). 3rd Australian Conference on Coastal and Ocean Engineering, Melbourne, April 1977.

2. PATTERSON, D.C. AND BLAIR, R.J.

   Visually Determined Wave Parameters. 6th Australian Conference on Coastal and Ocean Engineering, Gold Coast, July 1983.

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1.0 INTRODUCTION

1.1 The Programme

The Beach Protection Authority requires basic data on the behaviour of Queensland's beaches in order to provide well founded advice on coastal management to Local Authorities. The COPE project aims to collect information on wind, waves and beach behaviour in areas where extensive investigations are not practical and where otherwise little or no data exist.

The project is based on the recruitment of volunteer observers who are prepared to record a series of basic parameters once or twice daily for at least a three year period.

1.2 Site Selection

In selecting a site for a COPE station, consideration is given to:-

(a) the general shoreline configuration and the possibility of extrapolation of data to other adjacent beaches;

(b) the distribution of stations along Queensland's coastline;

(c) the need to correlate the COPE data with planned or existing data collection programmes.

1.3 Instrumentation

The COPE observers are supplied with a basic kit of recording instruments including:-

- 30 metre tape, wind meter, stop watch, 2.0 metre measuring sticks, recording forms and fluorescent dye.

A graduated reference pole is installed on the beach to serve as the base point for all plan measurements and the control for vertical levelling.

1.4 Observers

The majority of COPE observers are volunteers, who may be local business people, local residents or school children. Some stations are operated by Government and Local Authority employees who carry out the observations as part of their official duties.

1.5 Accuracy

Individual observers differ in their subjective assessment of the various parameters recorded as part of the COPE programme. Wave parameters such as type, height, and angle of approach together with surf zone width and the location of the vegetation line all require visual assessment, the accuracy of which will vary from observer to observer and from recording to recording.

Although the Authority is confident that all observers make their observations to the best of their ability and accepts these observations without adjustment, the existence of random and non-random errors in the recorded data is to be expected.

Problems associated with the use of data containing these errors are minimised in two ways. Firstly, regular visits are made to the COPE stations by the Authority's COPE Field Officer to provide a check on any bias introduced into the recordings by incorrect observation procedures. Secondly, it has been found that, with a large number of observations taken on a regular basis, a reasonable assessment can be made of the average climatologies of the observed parameters provided the observation errors are random. A minimum recording period of three years has been adopted for the analysis and publication of the data. Five day moving averages are applied to observations of the various beach width and foreshore slope parameters to smooth out random errors.

For these reasons, the Authority is of the opinion that published COPE data can be used with confidence provided the above inherent limitations are recognised.

1.6 Presentation of Data

The purpose of this report is to present COPE data for the nine year period 1979 to 1988 in a useful statistical form. No attempt has been made to interpret the observed data.

If the nine year period is representative of the long term average meteorological conditions, the statistics presented on wind, wave and beach movements can be regarded as typical. However, this recording period may be considered too short to be representative in terms of the average occurrence of extreme events such as cyclones and floods, and this should be taken into account when consideration is being given to the influence of such events on trends of long term beach behaviour.

2.0 STATION PARTICULARS

2.1 Location

Hull Heads is located within the Shire of Cardwell and lies approximately 50 kilometres south of Innisfail on the north Queensland coast. It is a two kilometre stretch of coastline, bounded by Kennedy Bay to the north and Tully Heads to the south.

The location of the Hull Heads COPE station is shown in Figures 1.1 and 1.2.

2.2 Observers

This station has been operated by volunteer observers, Mr and Mrs L. Wilkie (1979–1986) and Mr and Mrs I. MacDonald (1986–1988).

2.3 Observed Parameters

The observers at this station recorded morning and afternoon observations between 7.00 am and 6.00 pm.

This station has recorded:

- Wave Period
- Wave Height
- Wave Direction
- Wave Type
- Surf Zone Width
- Presence of Offshore Bar
- Wind Speed
- Wind Direction
- State of Tide
- Distance to Berm
- Berm Elevation
- Distance to Vegetation Line
- Sand Level at C.O.P.E. Reference Pole
- Foreshore Slope
- Longshore Current Speed
- Longshore Current Direction
- Distance from Shoreline to Dye Patch (Recorded from February 1986)

In addition a monthly sand sample was collected at the station.

2.4 Tidal Information

Tidal information for Hull Heads is presented below. Datum is Low Water Datum.

Using Dunk Island tidal station as reference.

M.H.W.S.	3.00 metres
M.H.W.N.	2.30 metres
M.S.L.	2.01 metres
M.L.W.N.	1.80 metres
M.L.W.S.	1.00 metres

Tidal information was obtained from the 1989, Queensland Tide Tables.

2.5 Description of the Beach

The beach at the Hull Heads COPE Station exhibits the following characteristics:-

- Typical beach slopes: Foreshore slope is in the range 1 in 5 to 1 in 19 ($11^{O} - 3^{O}$).
- Beach width: Varied from 20 to 50 metres measured from the seaward toe of the frontal dune to Low Water Mark over the nine year period (1979–1988).
- D50 sand size: 0.71 mm averaged over nine years (1979–1988).
- Adjoining Landform: Recently accreted frontal beach ridge backed by an older ridge system supporting scrub and forest vegetation.

- Vegetation: The frontal beach ridge supports herbland dominated by goat's foot convolvulus (Ipomoea pes-caprae). Other species include pineapple sedge (Cyperus pedunculatus), beach bean (Canavalia rosea), tridax (Tridax procumbens), sea lettuce (Scaevola sericea), beach sunflower (Wedelia biflora) and young coconut palms (Cocus nucifera).

  Vegetation on the older ridge system includes horsetail she-oak (Casuarina equisetifolia), tea tree (Melaleuca spp.), ball nut (Calophyllum inophyllum), lolly bush (Clerodendrum inerme), sea lettuce and coconut palms.

2.6 Meteorological Events

The following cyclones were recorded by the Brisbane Bureau of Meteorology as having tracks within 500 kilometres of Hull Heads between December 1979 and December 1988. It is considered that the following meteorological events may have had some effect on the condition of Hull Heads beach.

Cyclone Paul	03/01/80 - 08/01/80
Cylcone Ruth	11/02/80 - 19/02/80
Cyclone Simon	20/02/80 - 28/02/80
Cyclone Eddie	09/02/81 - 11/02/81
Cyclone Freda	25/02/81 - 07/03/81
Cyclone Abigail	22/01/82 - 05/02/82
Cyclone Dominic	05/04/82 - 14/04/82
Cyclone Des	16/01/83 - 19/01/83
Cyclone Elinor	12/02/83 - 04/03/83
Cyclone Fritz	10/12/83 - 13/12/83
Cyclone Grace	13/01/84 - 20/01/84
Cyclone Ingrid	20/02/84 - 25/02/84
Cyclone Kathy	16/03/84 - 22/03/84
Cyclone Lance	04/04/84 - 07/04/84
Cyclone Monica	26/12/84 - 28/12/84
Cyclone Odette	17/01/85 - 20/01/85
Cyclone Pierre	18/02/85 - 24/02/85
Cyclone Tanya	29/03/85 - 01/04/85
Cyclone Vernon	21/01/86 - 24/01/86
Cyclone Winifred	27/01/86 - 06/02/86
Cyclone Alfred	02/03/86 - 08/03/86
Cyclone Charlie	21/02/88 - 01/03/88

2.7 Supervision of Station

The observers were instructed in the recording programme by the COPE Field Officer and the initial instruction period was followed up with regular visits to the station during the period of recordings presented in this report.

Installation and maintenance of the reference pole for this station has been carried out by the Cardwell Shire Council and the Authority wishes to thank the Council for its assistance in all matters associated with the COPE project.

3.0 DATA

3.1 General

COPE data for this station for the nine year period December 1979 to December 1988 is presented on the attached figures. The data has been analysed statistically and/or smoothed to reveal long term averages or trends. A brief description of each of the observed parameters is given below with the relevant figure references.

3.2 Wind

The observer recorded the wind speed at the beach using a hand held wind meter at 1.5 metres above beach level. Prior to February 1986 wind direction was estimated to the nearest compass sector. After this time wind direction is recorded in degrees by compass.

A summary of annual wind speed and direction percentage occurrences are shown as a wind rose in Figure 3. Where applicable, morning and afternoon readings as well as the overall average are shown.

Wind speed was recorded in miles per hour (m.p.h.) rather than knots after February 1986. The recordings are converted from (m.p.h.) to knots for Figure 3.

3.3 Waves

The average and maximum breaker height (trough to crest) is usually estimated to the nearest 0.1 metre. From experience the estimate of average breaker height has been found to be comparable with the equivalent deep water significant wave height.

Recordings of maximum wave height and method used to obtain wave height were introduced into the programme from February 1986. Wave type and state of tide were discontinued at this time.

The observers estimate the wave period by recording the time taken for eleven wave crests (the duration of 10 waves) to pass a point.

Wave direction was recorded in degrees of a compass from March 1986. The direction recorded was then converted to a sector (see following paragraph regarding sector system).

The wave direction is estimated as one of five direction sectors indicating the angle to the shoreline alignment from which the waves are approaching the beach. These sectors have been selected as:-

Sector 1	-	0^{o}	to	60^{o}
Sector 2	-	61^{o}	to	85^{o}
Sector 3	-	86^{o}	to	95^{o}
Sector 4	-	96^{o}	to	120^{o}
Sector 5	-	121^{o}	to	180^{o}

Note: 0^{o} is the beach alignment to the left of the observer when facing seaward, and at the COPE station this direction is approximately 37^{o} east of true north.

Statistical representations of the observed wave data include:-

(a) the percentage of wave height recordings which exceed any given wave height for all directions combined (Figure 4).

(b) the percentage occurrence of various combinations of wave heights and periods and directions (Figure 5 and Figure 6).

(c) surf zone width with an indication of the existence or otherwise of an offshore bar (Figure 7 to Figure 25).

(d) tabulation of the occurrence of various wave heights, periods, types and directions (Tables 1 to 10).

3.4 Longshore Currents

The observer measured the distance parallel to the shoreline that a dye patch in the surf zone moved in one minute. Current direction is either upcoast or downcoast, upcoast being to the left when facing the sea from the beach.

The readings are converted to a velocity which is plotted on a daily basis (Figure 26 to Figure 44). Mean upcoast and downcoast components and the overall annual means are also presented.

3.5 Beach Profile Parameters

Beach profile parameters were measured until 1983 using an Abney level, tape measure and reference pole. These include:

- Distance from reference pole to the fixed contour.
- Elevation of the fixed contour.
- Distance from reference pole to the vegetation line.
- The foreshore slope.

Since 1983 profiles have been recorded using a measuring stick, the reference pole, and a line of sight to the horizon.

Sand level at the reference pole was formally recorded from February 1986 and the measurement of foreshore slope was discontinued at this time.

Changes in these parameters with time indicate how the beach moves in response to varying wave attack. Plots of these parameters are shown in Figure 45 to Figure 55.

3.6 Monthly Beach Profiles

Beach profiles are normally taken at the beginning of each month. However, should the beach undergo appreciable erosion or accretion during the month, then the observer is requested to take another beach profile. Monthly beach profiles are shown in Figure 56 to Figure 64.

TABLE 1

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 38

Year 1979

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
DECEMBER	4.2	.24	52.6	7.9	–	7.9	31.6	13.2	28.9	7.9	18.4	–	31.6
WHOLE YEAR	4.2	.24	52.6	7.9	0.0	7.9	31.6	13.2	28.9	7.9	18.4	0.0	31.6

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 2

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads **No. of Observations: 691** **Year 1980**

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.8	.09	32.8	–	–	1.6	65.6	–	18.0	8.2	8.2	–	65.6
FEBRUARY	3.7	.19	41.1	7.1	–	1.8	50.0	–	16.1	8.9	25.0	–	50.0
MARCH	4.0	.39	67.2	6.6	–	4.9	21.3	–	3.3	5.0	70.0	–	21.7
APRIL	4.5	.30	64.4	–	–	3.4	32.2	–	10.2	13.6	44.0	–	32.2
MAY	4.3	.34	80.3	–	–	–	19.7	–	11.5	3.3	65.5	–	19.7
JUNE	4.4	.25	59.3	–	–	–	40.7	–	1.7	1.7	55.8	–	40.7
JULY	4.4	.25	70.8	–	–	–	29.2	–	6.3	2.1	62.4	–	29.2
AUGUST	4.4	.43	93.1	–	–	–	6.9	–	–	–	93.1	–	6.9
SEPTEMBER	3.9	.13	42.1	–	–	–	57.9	–	10.5	5.3	26.3	–	57.9
OCTOBER	3.8	.18	83.6	–	–	–	16.4	–	55.7	6.6	21.3	–	16.4
NOVEMBER	4.0	.23	91.1	–	–	–	8.9	–	39.3	3.6	48.2	–	8.9
DECEMBER	3.9	.29	87.0	1.9	–	–	11.1	–	40.7	1.9	46.3	–	11.1
WHOLE YEAR	4.1	.26	67.6	1.3	.0	1.0	30.1	.0	17.8	5.1	47.2	.0	30.0

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 3

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 550

Year 1981

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.1	.35	90.9	3.0	–	–	6.1	–	36.4	12.1	45.4	–	6.1
FEBRUARY	4.4	.20	66.7	–	–	–	33.3	–	22.2	6.7	37.8	–	33.3
MARCH	4.3	.25	65.2	–	–	–	34.8	–	29.2	8.3	29.2	–	33.3
APRIL	4.0	.30	88.0	–	–	–	12.0	–	24.0	8.0	56.0	–	12.0
MAY	4.4	.38	91.1	–	–	–	8.9	–	4.4	17.8	68.9	–	8.9
JUNE	4.2	.26	97.9	–	–	–	2.1	–	12.5	41.7	41.6	2.1	2.1
JULY	4.0	.38	98.4	1.6	–	–	–	–	8.2	39.3	52.5	–	–
AUGUST	3.6	.25	91.3	–	–	–	8.7	–	40.4	14.9	36.2	–	8.5
SEPTEMBER	4.3	.55	91.4	–	–	–	8.6	–	19.0	15.5	56.9	–	8.6
OCTOBER	4.4	.45	94.9	–	–	–	5.1	–	18.6	23.7	50.9	1.7	5.1
NOVEMBER	3.7	.22	65.3	–	–	–	34.7	–	20.0	34.0	12.0	–	34.0
DECEMBER	3.5	.21	70.9	–	–	–	29.1	–	10.9	43.6	16.4	–	29.1
WHOLE YEAR	4.1	.33	85.3	.4	.0	.0	14.3	.0	20.5	22.1	42.0	0.4	15.1

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 4

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 438

Year 1982

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.7	.21	61.2	–	–	–	38.8	–	14.0	46.0	4.0	–	36.0
FEBRUARY	4.4	.34	73.2	–	–	2.4	24.4	–	2.4	63.5	12.2	2.4	19.5
MARCH	3.8	.35	76.7	–	–	–	23.3	–	2.3	62.8	16.3	–	18.6
APRIL	4.4	.37	90.3	–	–	–	9.7	–	–	19.3	71.0	–	9.7
MAY	4.3	.35	85.4	–	–	–	14.6	–	–	34.1	51.3	–	14.6
JUNE	4.4	.29	59.6	–	–	–	40.4	–	–	25.5	34.1	–	40.4
JULY	4.4	.29	71.8	–	–	–	28.2	–	2.6	38.5	30.7	–	28.2
AUGUST	4.5	.55	96.8	–	–	–	3.2	–	–	22.6	74.2	–	3.2
SEPTEMBER	4.4	.22	58.6	–	–	–	41.4	–	3.4	17.3	37.9	–	41.4
OCTOBER	3.7	.31	71.4	–	–	–	28.6	–	6.9	51.7	13.8	–	27.6
NOVEMBER	3.9	.41	97.3	–	–	–	2.7	–	18.9	64.9	13.5	–	2.7
DECEMBER	2.8	.15	68.4	–	–	–	31.6	–	35.0	20.0	15.0	–	30.0
WHOLE YEAR	4.1	.32	75.4	.0	.0	.2	24.4	.0	7.1	38.9	31.2	.2	23.1

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 5

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 642

Year 1983

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.0	.41	83.6	–	–	5.5	10.9	–	12.7	65.5	10.9	–	10.9
FEBRUARY	4.1	.44	83.0	–	–	7.6	9.4	–	3.8	73.6	13.2	–	9.4
MARCH	3.6	.38	75.9	3.7	–	3.7	16.7	–	5.5	67.2	10.9	–	16.4
APRIL	3.7	.39	78.1	–	–	5.5	16.4	–	3.6	67.8	12.5	–	16.1
MAY	4.3	.48	92.5	–	–	7.5	–	–	–	75.9	24.1	–	–
JUNE	4.3	.36	83.7	–	–	–	16.3	–	–	57.2	26.5	–	16.3
JULY	4.4	.46	86.0	–	–	–	14.0	–	–	52.0	36.0	–	12.0
AUGUST	4.1	.41	84.1	–	–	2.3	13.6	–	–	52.3	34.1	–	13.6
SEPTEMBER	3.6	.28	66.0	3.8	1.9	11.3	17.0	–	14.8	59.2	9.3	–	16.7
OCTOBER	3.4	.36	66.7	–	1.8	10.5	21.0	–	15.8	57.8	5.3	–	21.1
NOVEMBER	3.5	.33	65.5	–	–	14.5	20.0	–	21.8	54.5	5.5	–	18.2
DECEMBER	3.8	.54	48.3	1.7	–	36.2	13.8	–	8.5	64.3	13.6	–	13.6
WHOLE YEAR	3.9	.40	76.1	.8	.3	8.7	14.2	.0	7.5	62.6	16.2	.0	13.7

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 6

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 641

Year 1984

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.8	.34	44.6	1.8	–	23.2	30.4	–	5.4	57.1	7.1	–	30.4
FEBRUARY	4.4	.65	47.9	15.2	–	32.6	4.3	–	–	73.9	21.8	–	4.3
MARCH	3.7	.43	53.6	12.5	–	10.7	23.2	–	–	57.2	19.6	–	23.2
APRIL	3.9	.50	54.9	2.0	–	23.5	19.6	–	–	41.2	39.2	–	19.6
MAY	3.9	.54	66.6	1.9	–	20.4	11.1	–	–	37.0	51.9	–	11.1
JUNE	4.2	.52	72.4	–	–	25.5	2.1	–	–	57.5	40.4	–	2.1
JULY	4.1	.40	73.5	–	–	10.2	16.3	–	–	53.1	30.6	–	16.3
AUGUST	3.9	.30	71.7	–	–	3.8	24.5	–	9.3	42.5	24.1	–	24.1
SEPTEMBER	3.2	.19	52.5	3.4	–	3.4	40.7	–	10.2	44.0	5.1	–	40.7
OCTOBER	3.8	.40	56.9	1.7	–	15.5	25.9	–	6.9	55.1	12.1	–	25.9
NOVEMBER	3.6	.40	43.5	5.5	–	25.5	25.5	–	14.5	49.1	10.9	–	25.5
DECEMBER	3.3	.29	44.7	8.9	–	12.5	33.9	–	14.3	35.7	16.1	–	33.9
WHOLE YEAR	3.8	.41	56.6	4.4	.0	16.8	21.5	.0	5.3	49.9	22.6	.0	22.2

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 7

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 573

Year 1985

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.8	.34	43.1	6.9	–	17.2	32.8	–	6.9	37.9	22.4	–	32.8
FEBRUARY	4.0	.52	45.7	13.0	–	26.1	15.2	–	–	39.1	45.7	–	15.2
MARCH	4.0	.56	47.1	13.7	–	19.6	19.6	–	–	37.3	43.1	–	19.6
APRIL	4.0	.54	40.4	11.5	–	34.6	13.5	–	–	38.5	48.0	–	13.5
MAY	4.3	.69	32.7	9.6	–	51.9	5.8	–	–	19.2	75.0	–	5.8
JUNE	4.3	.41	56.3	7.3	–	25.5	10.9	–	–	38.2	50.9	–	10.9
JULY	3.9	.35	47.1	9.8	–	25.5	17.6	–	–	27.5	54.9	–	17.6
AUGUST	3.8	.32	47.0	11.8	–	13.7	27.5	–	–	39.2	33.3	–	27.5
SEPTEMBER	3.6	.30	31.8	9.1	–	25.0	34.1	–	4.5	36.4	25.0	–	34.1
OCTOBER	3.5	.35	42.6	7.4	–	20.4	29.6	–	11.1	40.8	18.5	–	29.6
NOVEMBER	3.6	.26	16.4	18.2	–	23.6	41.8	–	5.5	49.1	3.6	–	41.8
DECEMBER	2.3	.15	25.0	–	–	25.0	50.0	–	–	50.0	–	–	50.0
WHOLE YEAR	3.9	.42	39.6	9.9	.0	25.7	24.9	.0	2.6	37.8	35.0	.0	24.9

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 8

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads | No. of Observations: 555 | Year 1986

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.1	.39	18.4	22.4	–	30.6	28.6	–	2.0	53.1	16.3	–	28.6
FEBRUARY	3.3	.15	20.7	10.3	–	20.7	48.3	–	13.0	30.5	6.5	–	50.0
MARCH	4.1	.41	CR	CR	CR	CR	CR	–	4.3	6.4	76.6	2.1	10.6
APRIL	4.0	.31	–	–	–	–	–	–	–	2.5	82.5	2.5	12.5
MAY	4.1	.23	–	–	–	–	–	–	2.3	4.7	58.1	7.0	27.9
JUNE	4.4	.28	–	–	–	–	–	1.9	5.8	–	65.4	–	26.9
JULY	4.2	.21	–	–	–	–	–	–	2.2	2.2	67.3	–	28.3
AUGUST	3.7	.15	–	–	–	–	–	2.2	15.6	4.4	40.0	8.9	28.9
SEPTEMBER	3.9	.12	–	–	–	–	–	–	21.2	5.8	38.4	–	34.6
OCTOBER	2.8	.11	–	–	–	–	–	2.0	36.7	6.1	8.3	–	46.9
NOVEMBER	3.9	.28	–	–	–	–	–	–	4.3	10.6	61.7	8.5	14.9
DECEMBER	3.2	.26	–	–	–	–	–	20.5	38.5	12.8	15.4	–	12.8
WHOLE YEAR	3.8	.24	19.6	16.3	.0	25.7	38.4	2.2	12.1	11.7	44.5	2.3	27.4

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging
CR – Ceased Recording Wave Type

TABLE 9

MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads

No. of Observations: 608

Year 1987

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	3.1	.18	–	–	–	–	–	13.2	43.4	20.8	7.5	–	15.1
FEBRUARY	4.6	.50	–	–	–	–	–	2.4	19.0	19.0	50.1	2.4	7.1
MARCH	3.6	.38	–	–	–	–	–	–	20.8	17.0	49.0	–	13.2
APRIL	4.1	.51	–	–	–	–	–	–	2.0	12.0	70.0	6.0	10.0
MAY	4.2	.50	–	–	–	–	–	–	–	2.1	93.7	2.1	2.1
JUNE	4.0	.43	–	–	–	–	–	–	–	–	96.4	–	3.6
JULY	4.1	.35	–	–	–	–	–	–	–	1.6	72.2	26.2	–
AUGUST	4.2	.34	–	–	–	–	–	–	–	–	86.4	9.1	4.5
SEPTEMBER	4.7	.53	–	–	–	–	–	–	3.8	9.4	81.1	5.7	–
OCTOBER	3.8	.23	–	–	–	–	–	–	40.4	25.5	29.8	–	4.3
NOVEMBER	4.2	.23	–	–	–	–	–	1.9	27.8	31.5	25.8	–	13.0
DECEMBER	4.5	.31	–	–	–	–	–	–	14.9	14.8	61.7	4.3	4.3
WHOLE YEAR	4.1	.37	.0	.0	.0	.0	.0	1.5	14.2	12.7	60.2	4.7	6.4

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging

TABLE 10

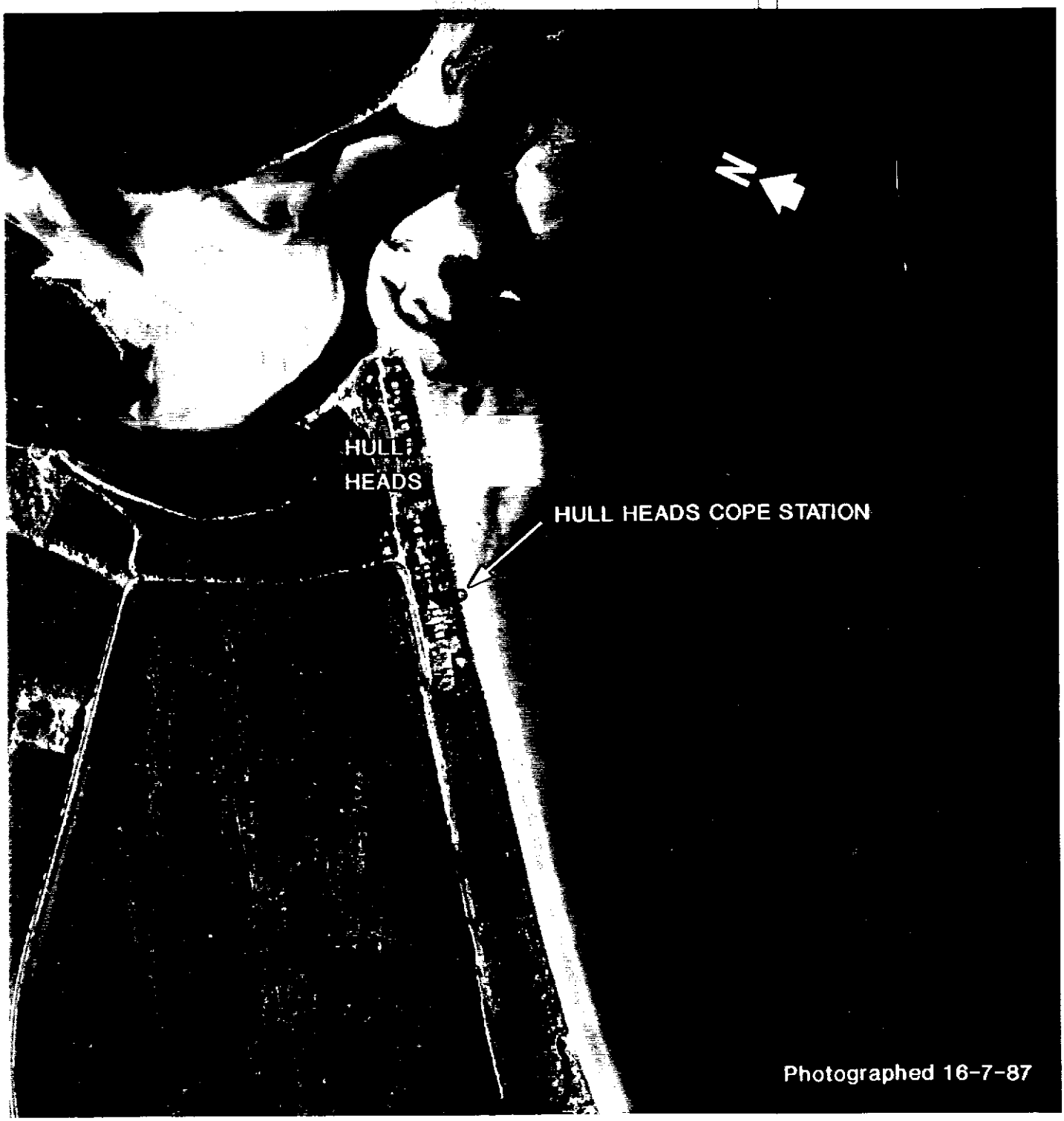
MONTHLY AND ANNUAL

MEAN WAVE HEIGHT/MEAN WAVE PERIOD AND WAVE TYPE/WAVE DIRECTION OCCURRENCES

Hull Heads **No. of Observations: 574** **Year 1988**

MONTH	MEAN WAVE PERIOD (secs)	MEAN WAVE HEIGHT (metres)	Percentage Occurrence – Wave Type/Wave Direction										
			Wave Type					Wave Direction					
			SP	PL	Surge	SP/PL	Calm	1	2	3	4	5	Calm
JANUARY	4.7	.50	–	–	–	–	–	–	16.1	10.7	69.6	3.6	–
FEBRUARY	4.9	.47	–	–	–	–	–	–	6.1	16.3	71.5	6.1	–
MARCH	4.8	.45	–	–	–	–	–	–	4.0	6.0	74.0	16.0	–
APRIL	4.5	.25	–	–	–	–	–	–	11.8	21.6	54.8	9.8	2.0
MAY	3.9	.21	–	–	–	–	–	–	–	–	70.5	4.5	25.0
JUNE	5.7	.39	–	–	–	–	–	–	–	2.5	87.5	10.0	–
JULY	5.1	.45	–	–	–	–	–	2.3	2.3	4.5	90.9	–	–
AUGUST	4.7	.51	–	–	–	–	–	–	8.0	–	82.0	10.0	–
SEPTEMBER	4.7	.28	–	–	–	–	–	2.0	9.8	5.9	76.4	5.9	–
OCTOBER	4.2	.23	–	–	–	–	–	4.3	21.3	14.9	34.0	2.1	23.4
NOVEMBER	3.1	.15	–	–	–	–	–	9.1	27.3	6.8	9.1	–	47.7
DECEMBER	4.5	.30	–	–	–	–	–	13.3	8.9	20.0	37.8	2.2	17.8
WHOLE YEAR	4.7	.35	.0	.0	.0	.0	.0	2.5	9.8	9.1	63.3	5.9	9.1

SP – Spilling
PL – Plunging
SP/PL – Combined Spilling and Plunging



100 0 100 200 300 400 500 metres
Scale 1:12 000 approx.

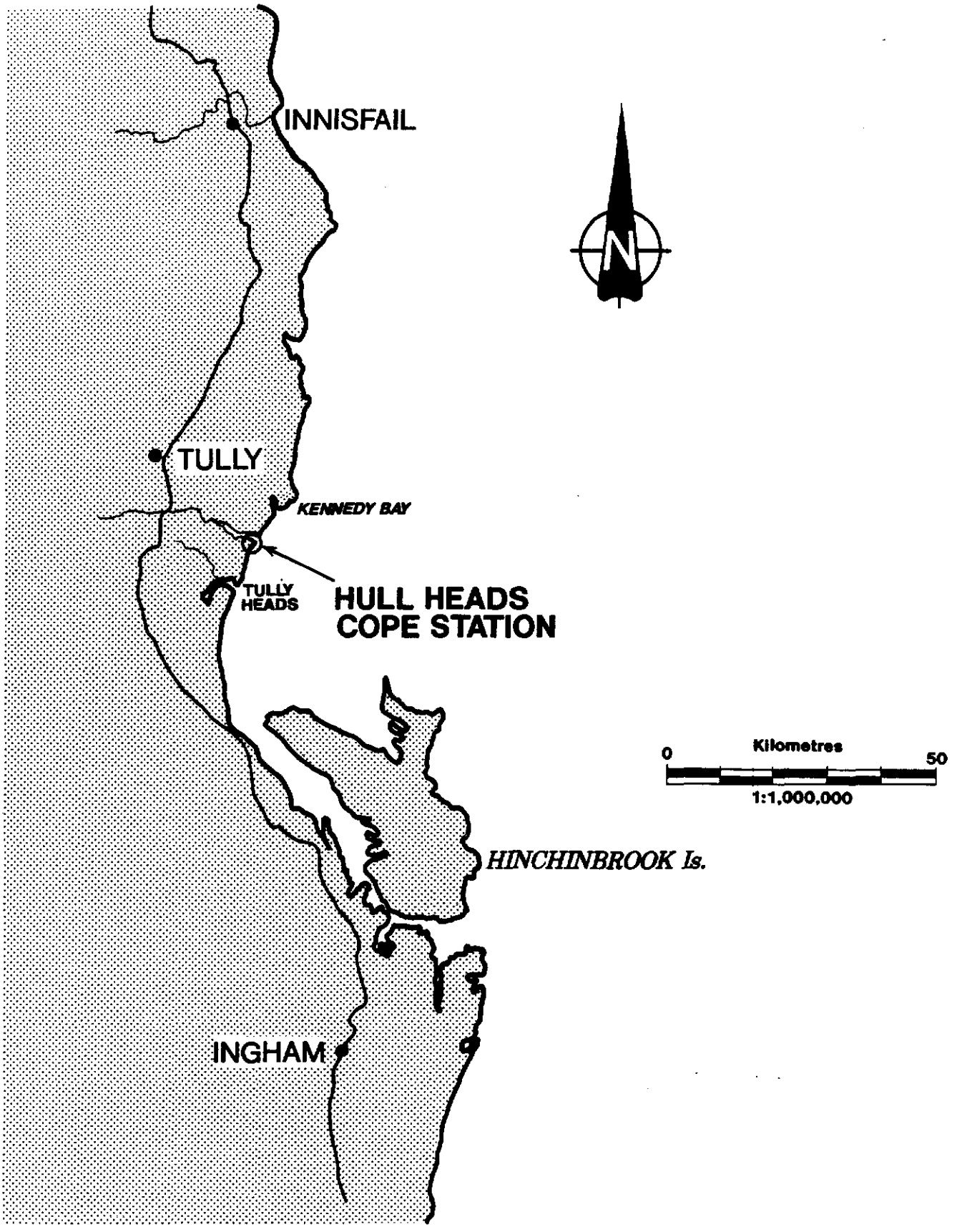
Beach Protection Authority

SITE PLAN

HULL HEADS COPE STATION

COPE
Hull Heads

Figure 1.1
C 26.1



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Queensland

LOCALITY PLAN

COPE
Hull Heads

Figure
1.2
C 26.1

HARBOURS MARINE

Form No. BE 14E

BEACH PROTECTION AUTHORITY OF QUEENSLAND

COASTAL OBSERVATION PROGRAMME – ENGINEERING

COPE

RECORD ALL DATA CAREFULLY AND LEGIBLY

SITE NUMBER	DAY	MONTH	YEAR	TIME
1 2 3 4 5	6 7	8 9	10 11	Record time using 24 hour system 12 13 14 15

(i) **WAVE HEIGHT (AVERAGE)**

Record the best estimate of the average breaking wave height to the nearest tenth of a metre. **If less than 0.1 record as 0.0 and go directly to Section (ii).** 16 . 17

WAVE HEIGHT (MAXIMUM)

Record the best estimate of the maximum breaking wave height during the entire observation period to the nearest tenth of a metre. 18 . 19

WAVE HEIGHT METHOD

Record the method that you used to obtain wave height.
Record 1 if visual estimate
Record 2 if measured with COPE sticks
Record 3 if measured by COPE pole 20

WAVE PERIOD

Record the time in seconds for eleven (11) wave crests to pass a stationary point just seaward of the surf zone. 21 22 23

WAVE DIRECTION

Determine the direction that the waves are entering the surf zone using the compass provided and record the direction in degrees. 24 25 26

SURF ZONE WIDTH

Record the time in seconds for a wave of average height to traverse the surf zone from break point to final run-up on the beach. 27 28 29

(ii) **CURRENT SPEED**

Measure in metres the distance that the centre of the dye patch is observed to move during a one (1) minute period; if no long shore movement record 000. 30 31 32

CURRENT DIRECTION

When the observer faces the sea
0 — no long shore movement
L — dye moves to the left
R — dye moves to the right 33

DISTANCE FROM SHORE

Record the distance in metres from the shore to where the current measurements were commenced. 34 35

OFFSHORE BAR

Is an off-shore bar causing the waves to break?
1—yes 0—no 36

(iii) **WIND SPEED**

Record wind speed to the nearest m.p.h. **If calm record 00 and go directly to Section (iv).** 37 38

WIND DIRECTION

Determine the direction that the wind is coming from using the compass provided and record the direction in degrees. 39 40 41

(iv) **FIXED CONTOUR ELEVATION**

Record the elevation of the fixed contour. 42 . 43

DISTANCE TO FIXED CONTOUR

Record the distance, to the nearest metre, from the reference post to the fixed contour. Distances landward of the reference post are negative.
e.g. 009 measures 9 metres seaward (No sign);
—07 measures 7 metres landward (Minus sign) 44 45 46

(v) **DISTANCE TO THE VEGETATION**

Record the distance from the reference post to the average vegetation line. Distances landward of the reference post are negative. 47 48 49

SAND LEVEL AT POLE

Record to nearest tenth of a metre. 50 . 51

(vi) **SAND SAMPLE**

If sample taken then record 1. Otherwise leave blank. 52

PLEASE PRINT — Please check the form for completeness

SITE NAME _____ OBSERVER _____

REMARKS: _____

Make any additional remarks, computations or sketches on the reverse side of this form.

(for office use only)
53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

F 402— (11A1/24)—Govt. Printer, Qld

Beach Protection Authority Queensland

OBSERVATION FORM

COPE
Hull Heads

Figure
2.1
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HARBOURS MARINE

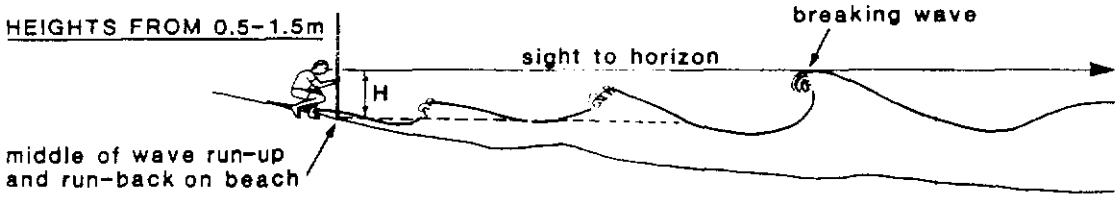
WAVE HEIGHT AND DIRECTION INSTRUCTIONS

METHOD 1 VISUAL ESTIMATION

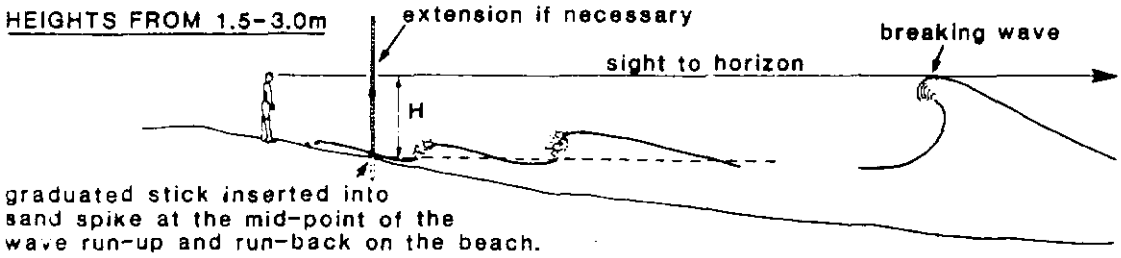
This method should only be used where the waveheights are below 0.5 and it is not practicable to use the preferred Method 2.

METHOD 2

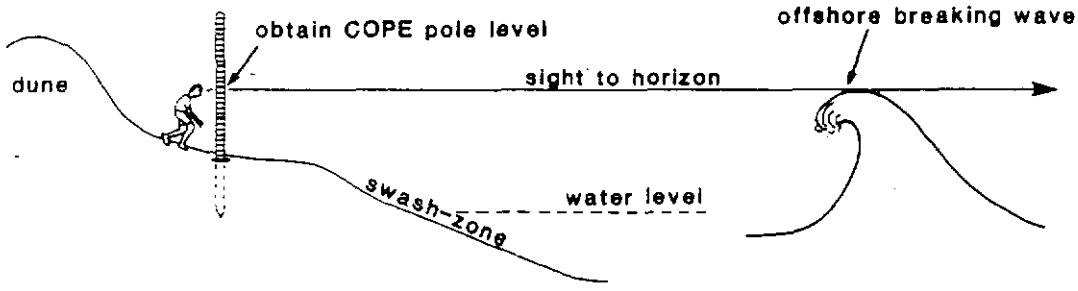
HEIGHTS FROM 0.5-1.5m



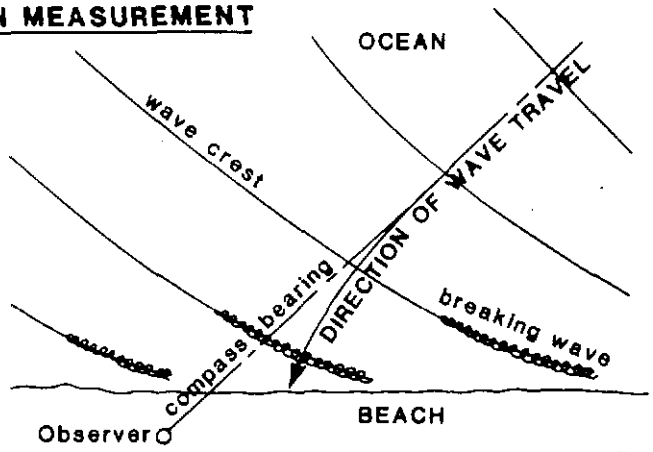
HEIGHTS FROM 1.5-3.0m



METHOD 3 FOR WAVES OVER 3m



WAVE DIRECTION MEASUREMENT



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METHODS FOR RECORDING WAVE PARAMETERS

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Figure
2.2
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HARBOURS MARINE

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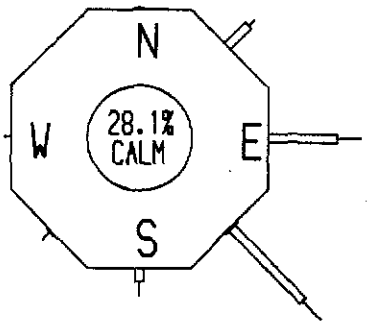
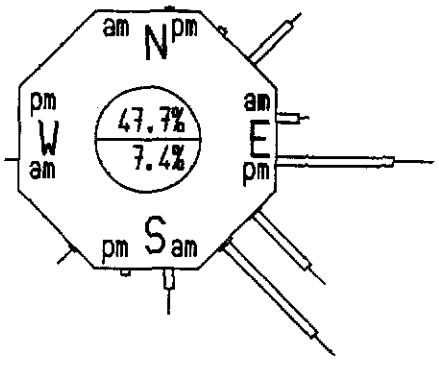
CARDWELL SHIRE HULL HEADS 2702

ALL OBSERVATIONS



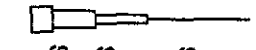
Total No. of Observations : 5298

MORNING - AFTERNOON OBSERVATIONS



NOTES :
Figures in Central Circle Represent Percentage of CALM Observations.
Upper Figure for AM
Lower Figure for PM

LEGEND

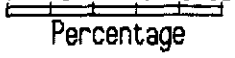


>30 kts
16-30 kts
6-15 kts
1-5 kts

No. of Morning Observations : 2719
No. of Afternoon Observations : 2579

Mean Time :- Morning Obs : 0912 hrs
Mean Time :- Afternoon Obs : 1604 hrs

SCALE



Percentage

WIND DATA - DEC 1979 to DEC 1988

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WIND DATA

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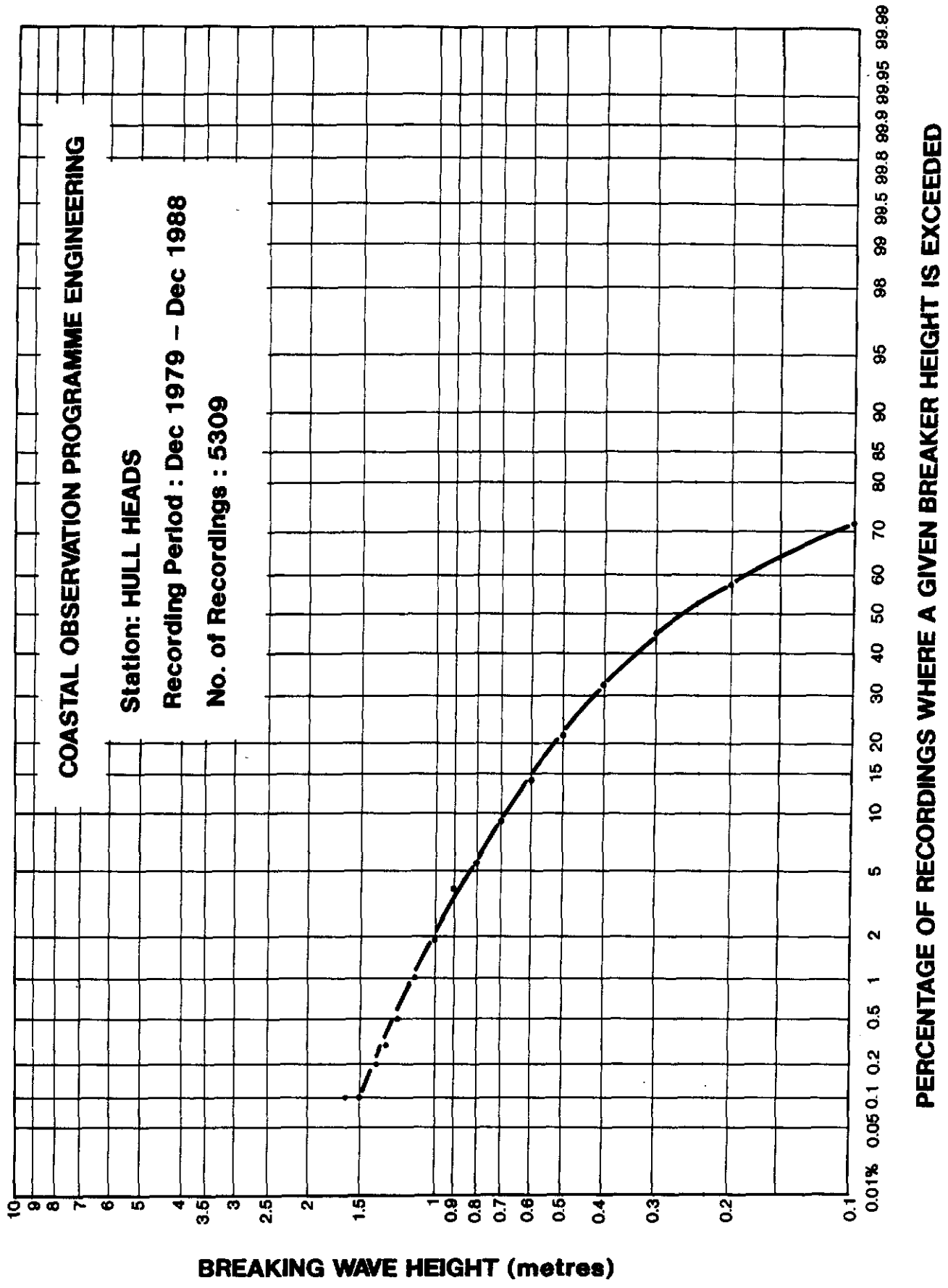
Figure 3
C 26.1

HARBOURS MARINE



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Queensland

WAVE HEIGHT PERCENTAGE EXCEEDENCE ALL DATA

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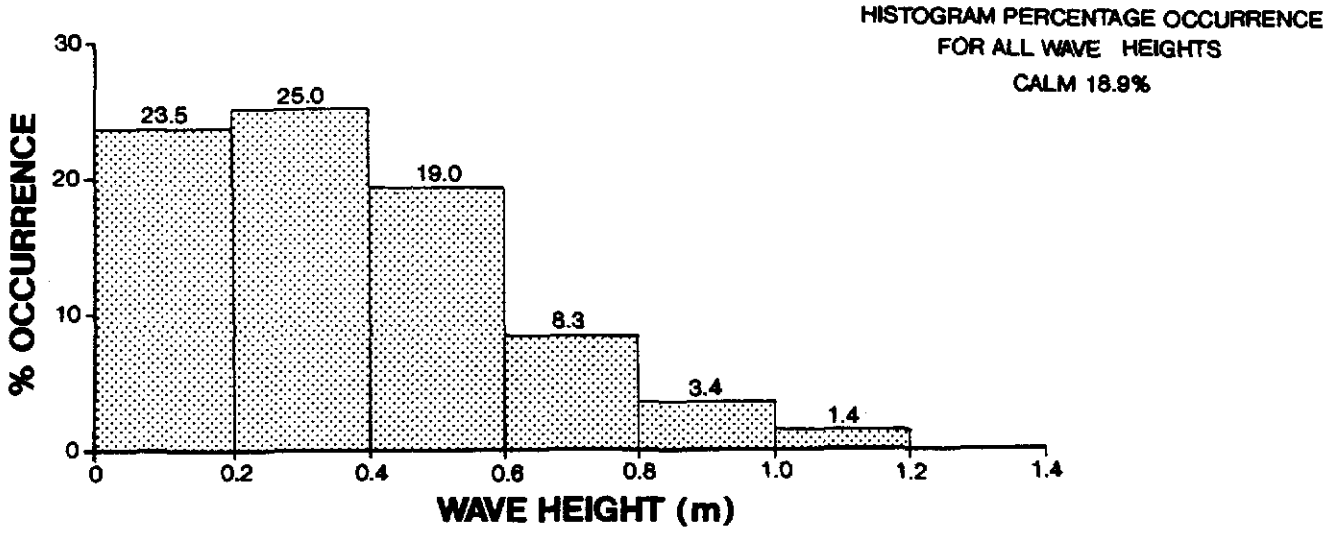
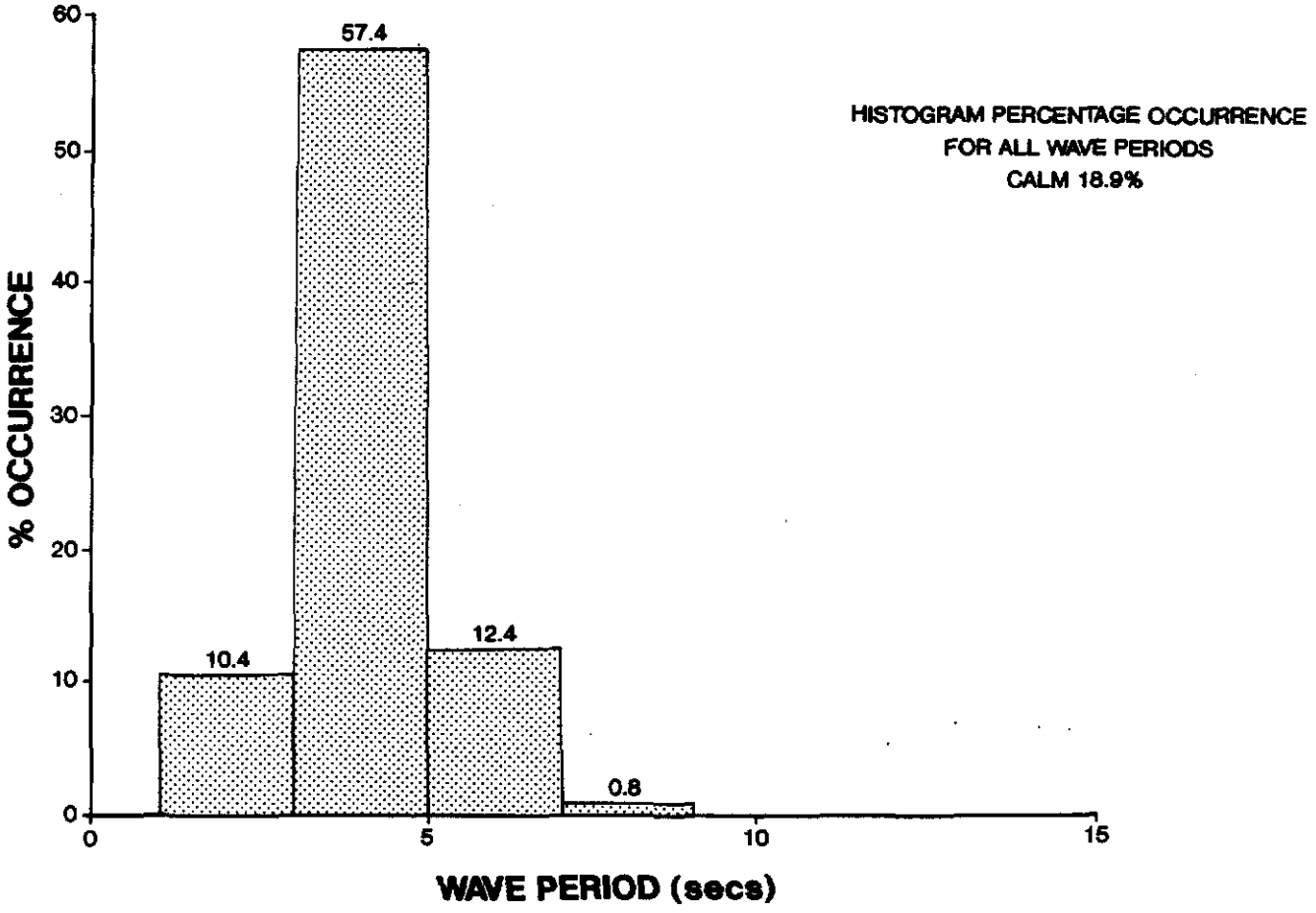
Hull Heads

Figure
4
C 26.1

HARBOURS MARINE





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PERCENTAGE OCCURRENCE OF WAVE HEIGHT AND WAVE PERIOD ALL DATA

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Figure
5
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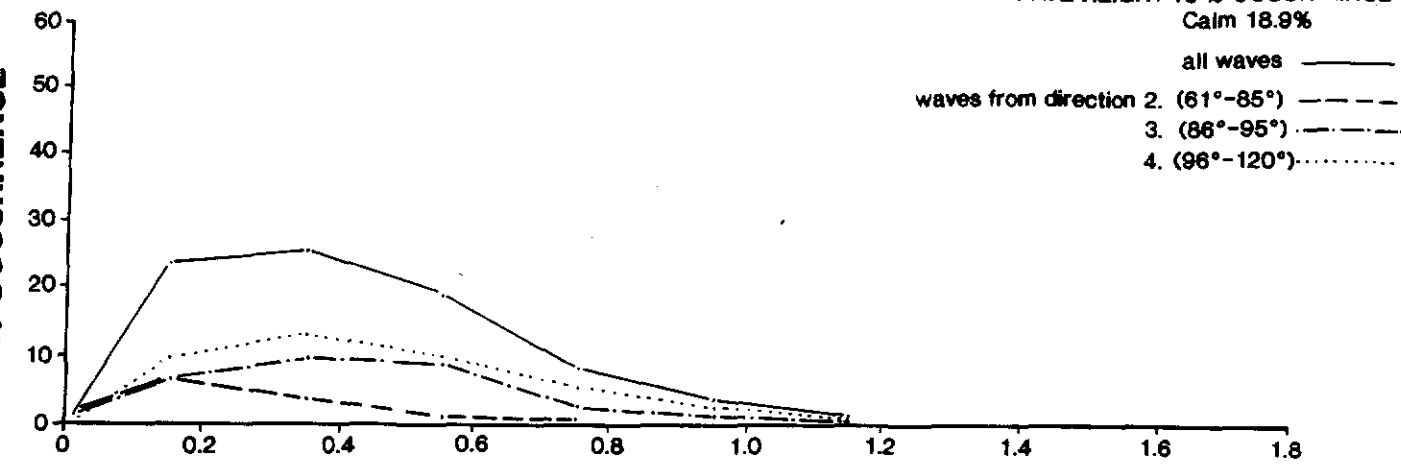
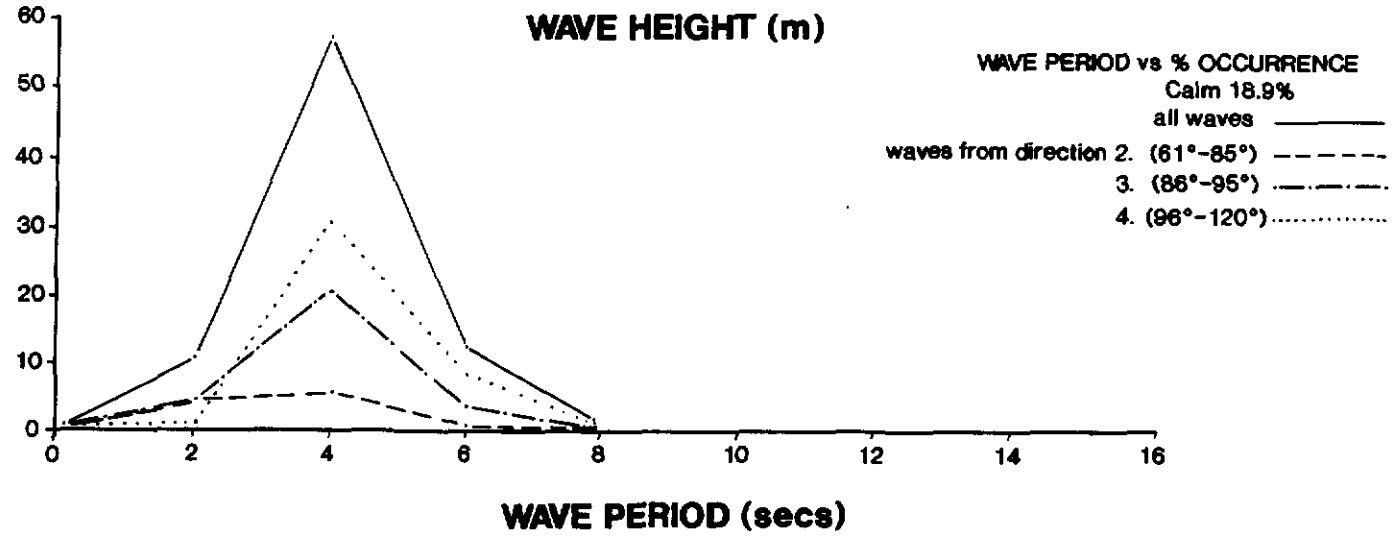
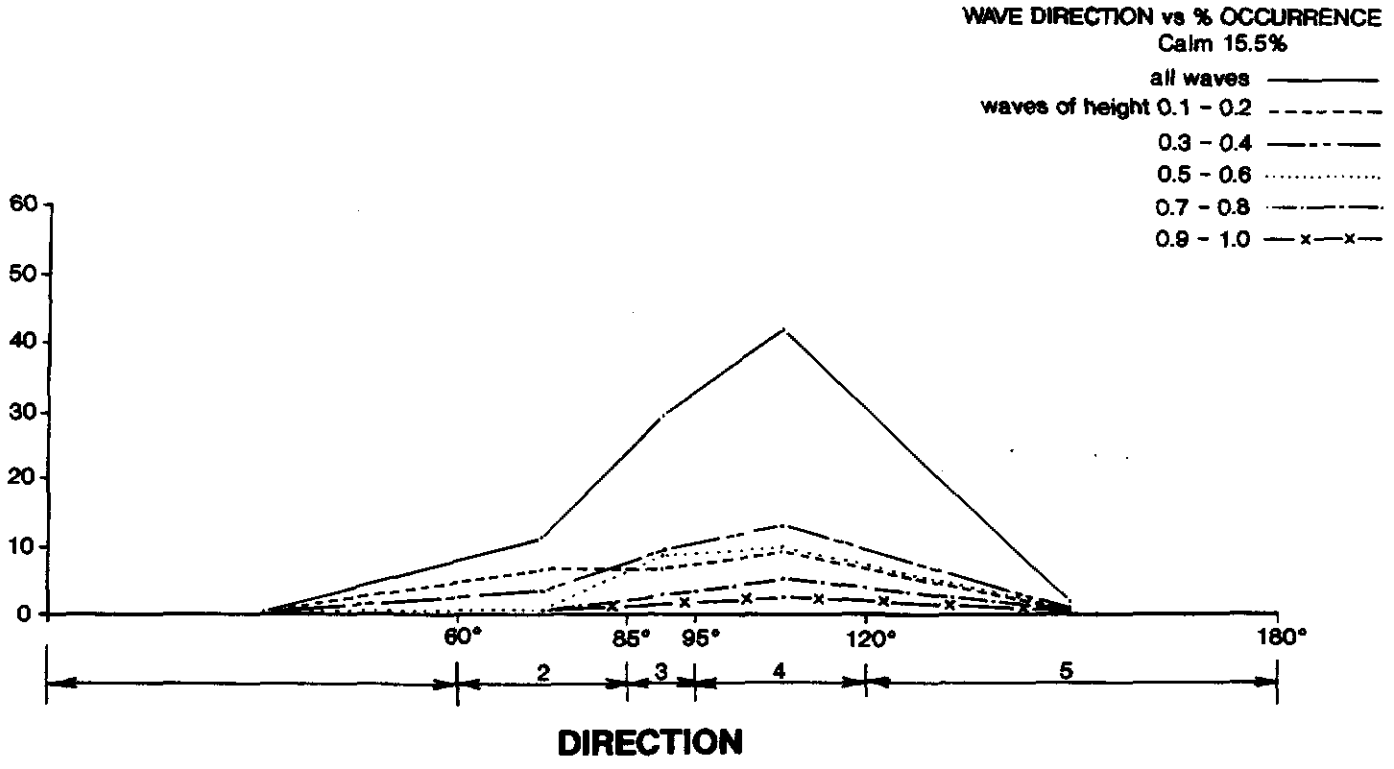
HARBOURS MARINE







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WAVE DIRECTION ANALYSIS
ALL DATA

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Hull Heads

Figure
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HARBOURS MARINE

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SURF ZONE WIDTHS-MORNING 1979

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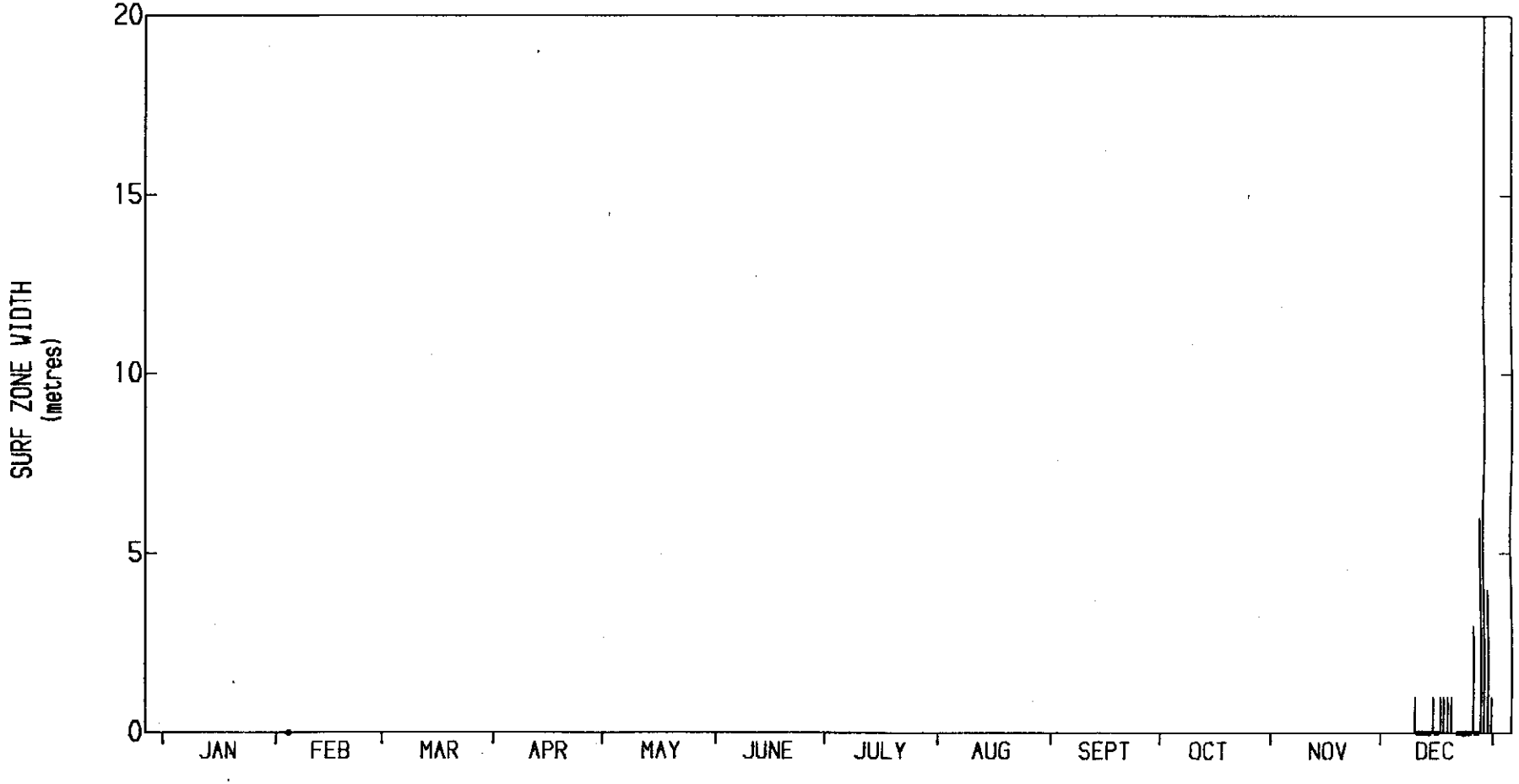
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1979

No. of Observations : 21

MORNING OBSERVATIONS

Mean Surf Zone Width = 1.9 m

HARBOURS MARINE Consultants

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Figure
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SURF ZONE WIDTH-MORNING 1980

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Programme Engineering

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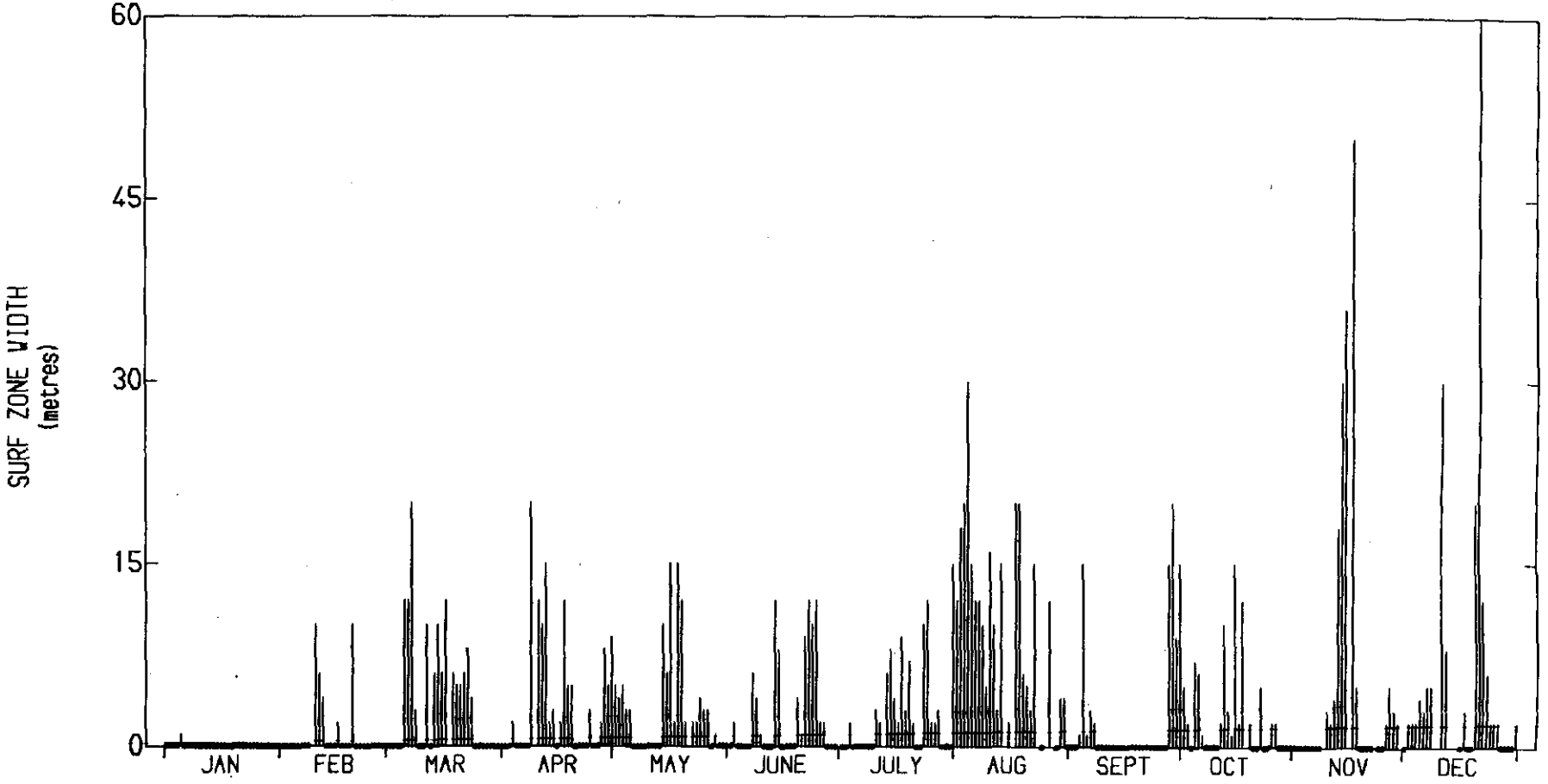
HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1980

No. of Observations : 346

MORNING OBSERVATIONS

Mean Surf Zone Width = 3.8 m

HARBOURS MARINE

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SURF ZONE WIDTH-AFTERNOON 1980

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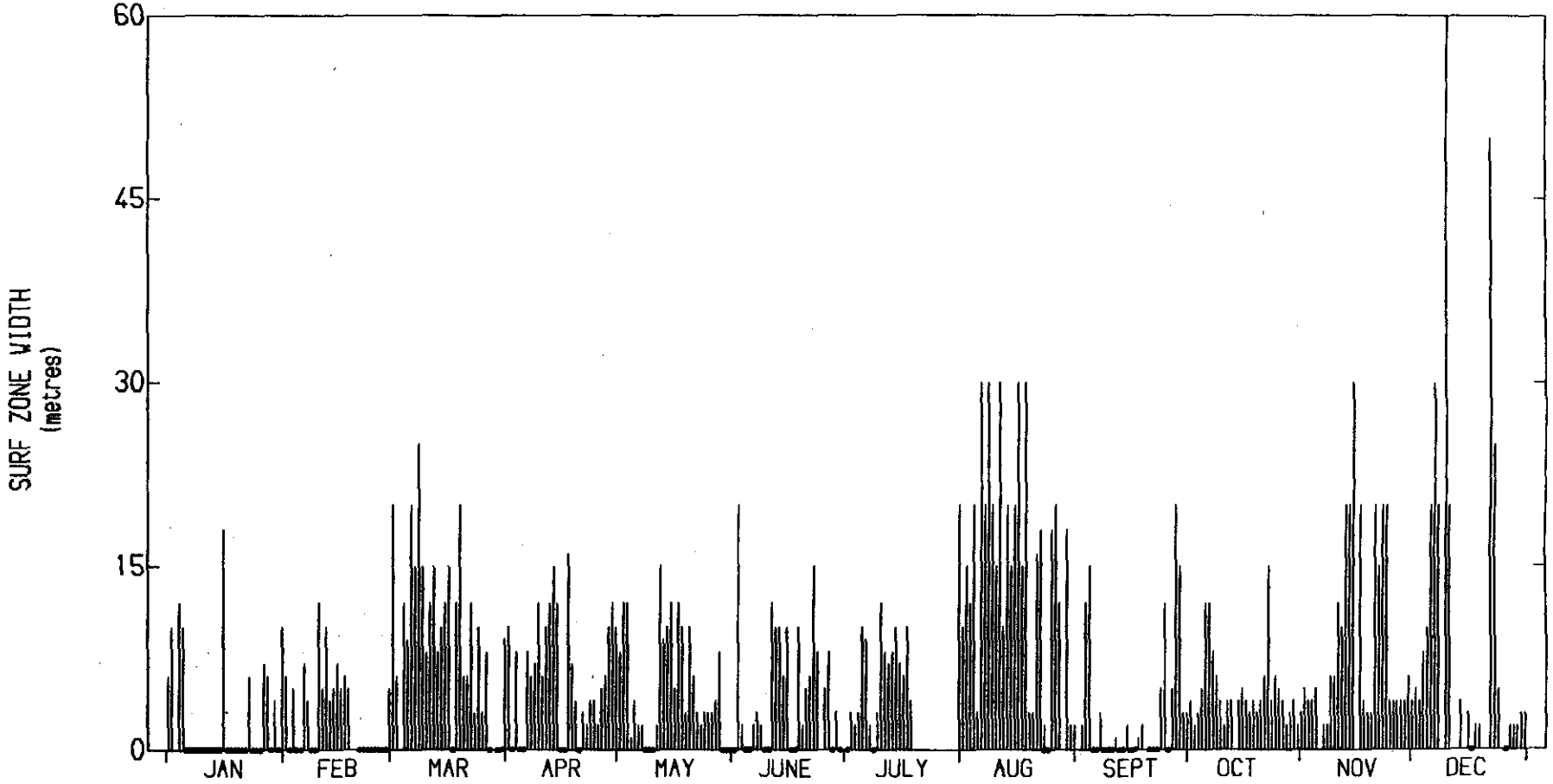
CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1980

No. of Observations : 335

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 7.0 m

HARBOURS MARINE

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Figure
9
C 26.1

Beach Protection Authority
Queensland

SURF ZONE WIDTH-MORNING 1981

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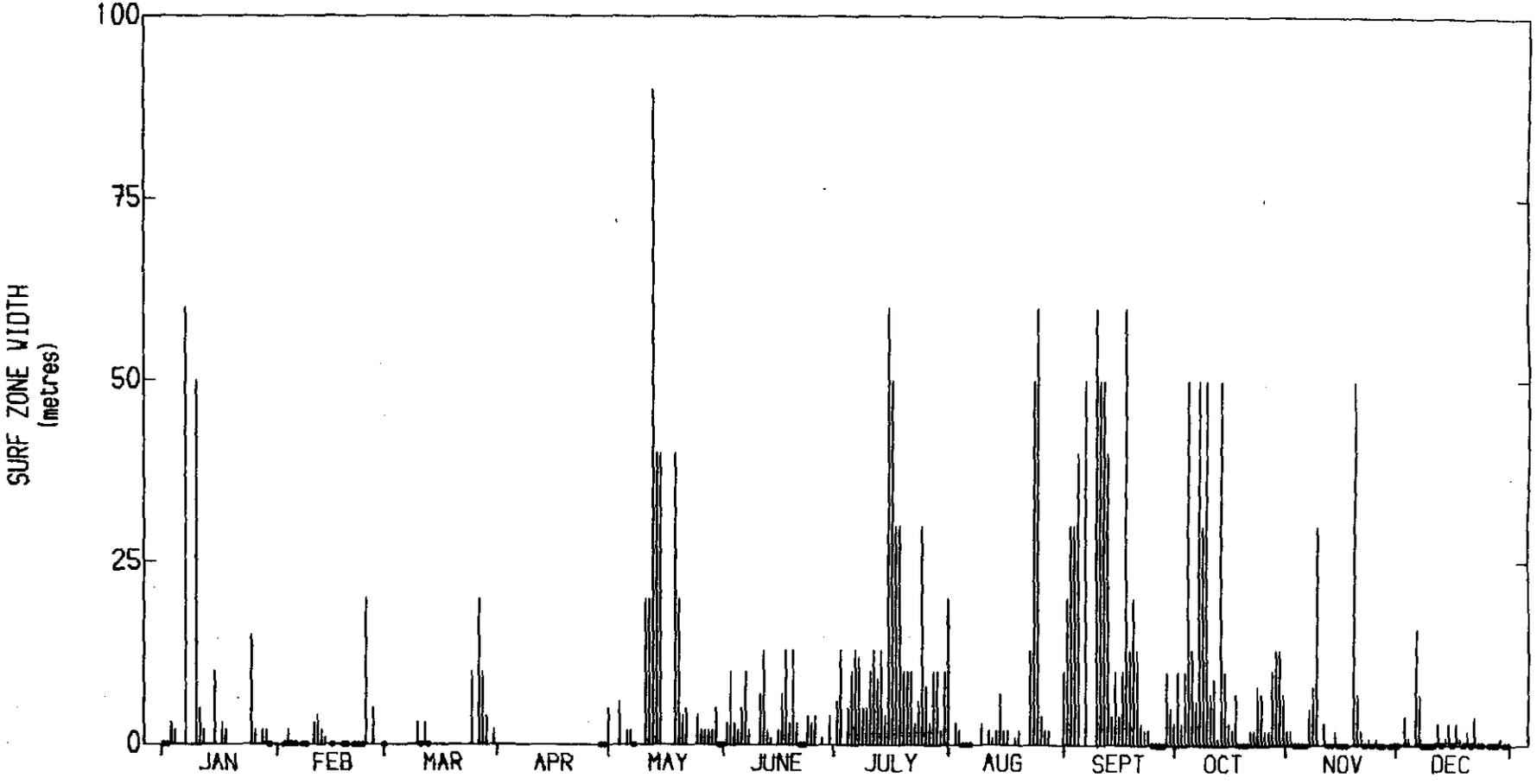
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1981

No. of Observations : 256

MORNING OBSERVATIONS

Mean Surf Zone Width = 9.1 m

HARBOURS MARINE Consultancy

COPE
Hull Heads
Figure
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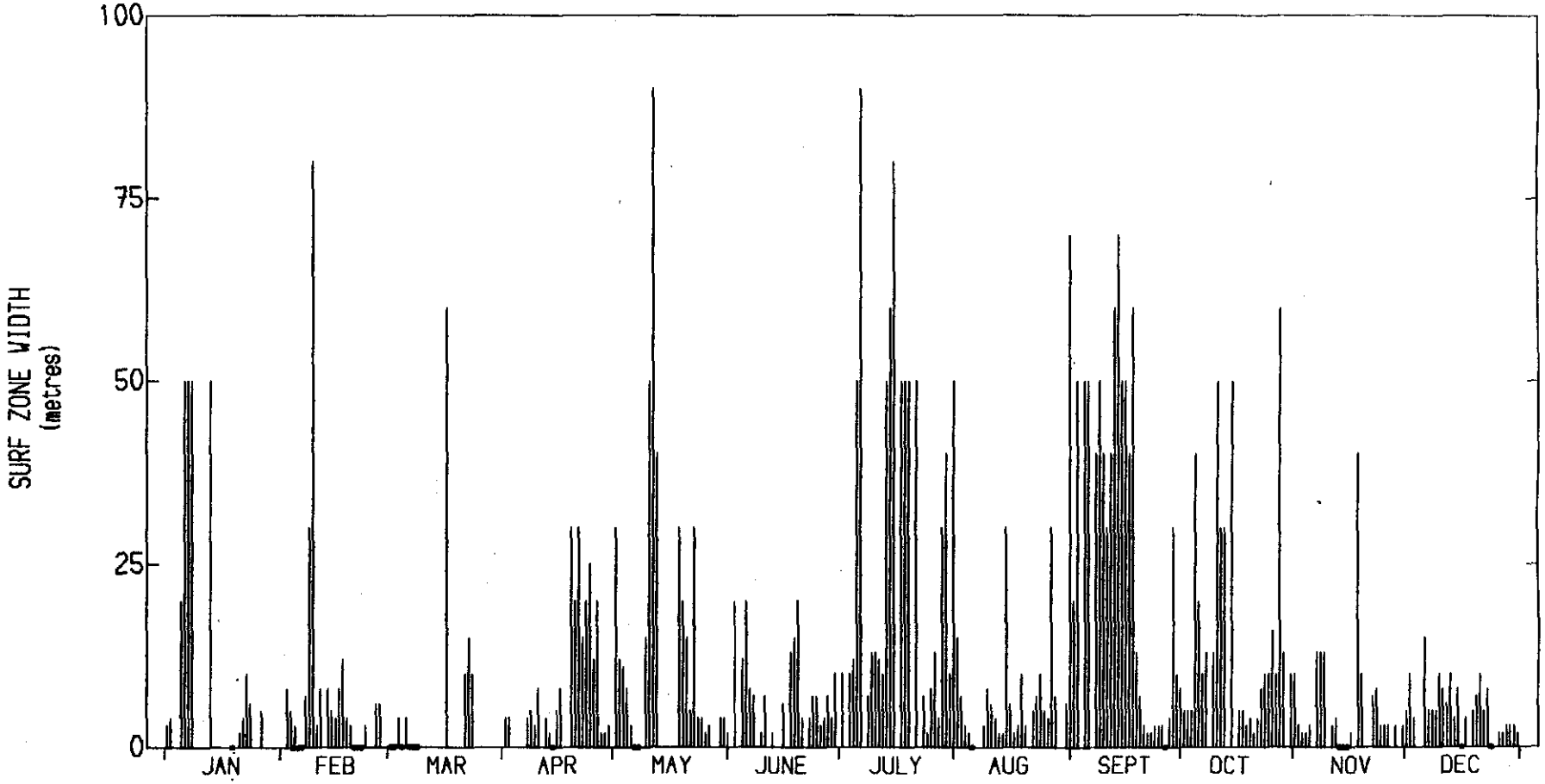
C 26.1

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1981

No. of Observations : 272

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 14.5 m

Beach Protection Authority
Queensland

SURF ZONE WIDTH-AFTERNOON 1981

HARBOURS MARINE

COPE
Hull Heads
Figure
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C 26.1

Beach Protection Authority
Queensland

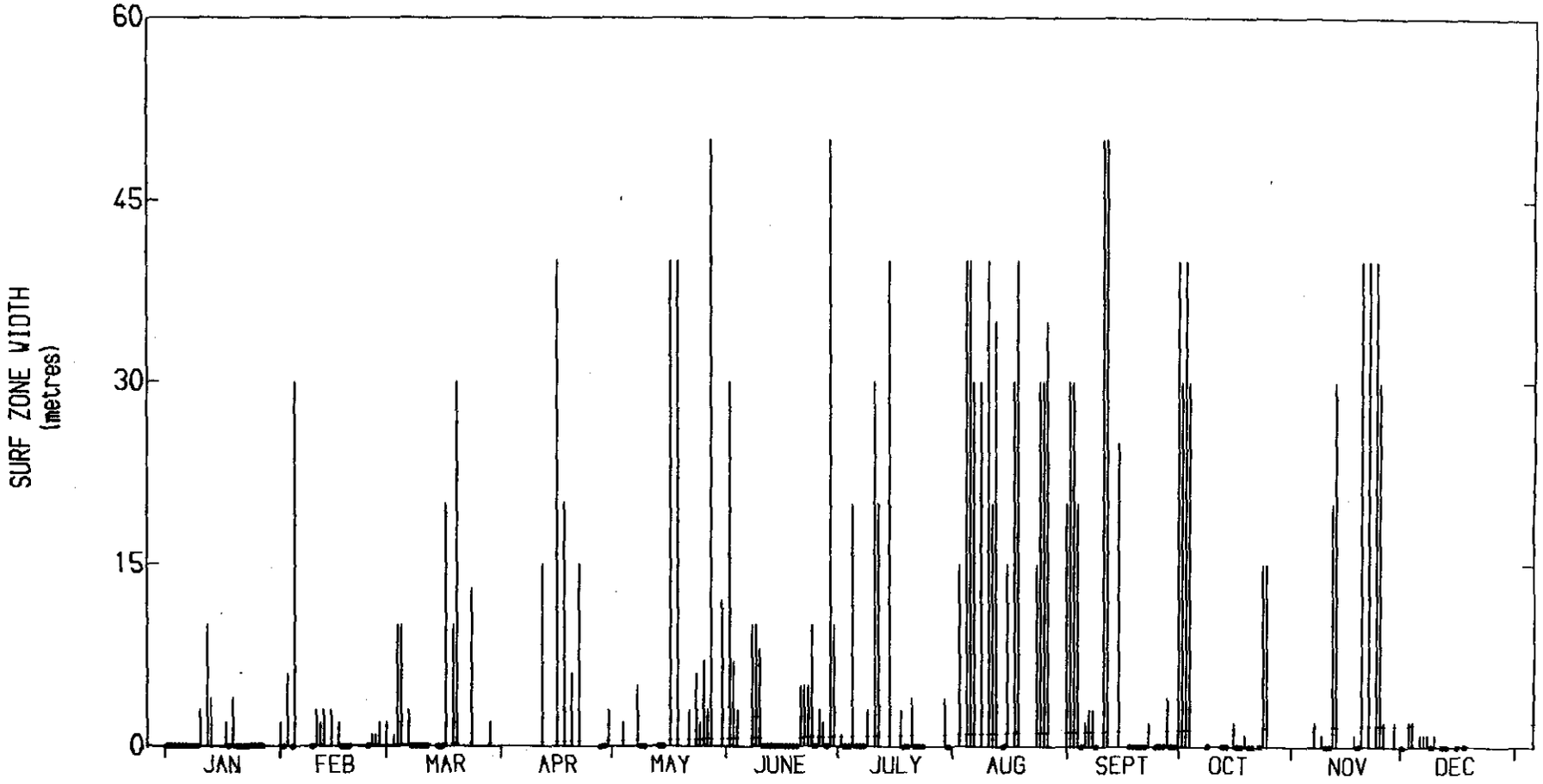
SURF ZONE WIDTH-MORNING 1982

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1982

No. of Observations : 208

MORNING OBSERVATIONS

Mean Surf Zone Width = 8.7 m

HARBOURS MARINE

COPE
Hull Heads
Figure
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C 26.1

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

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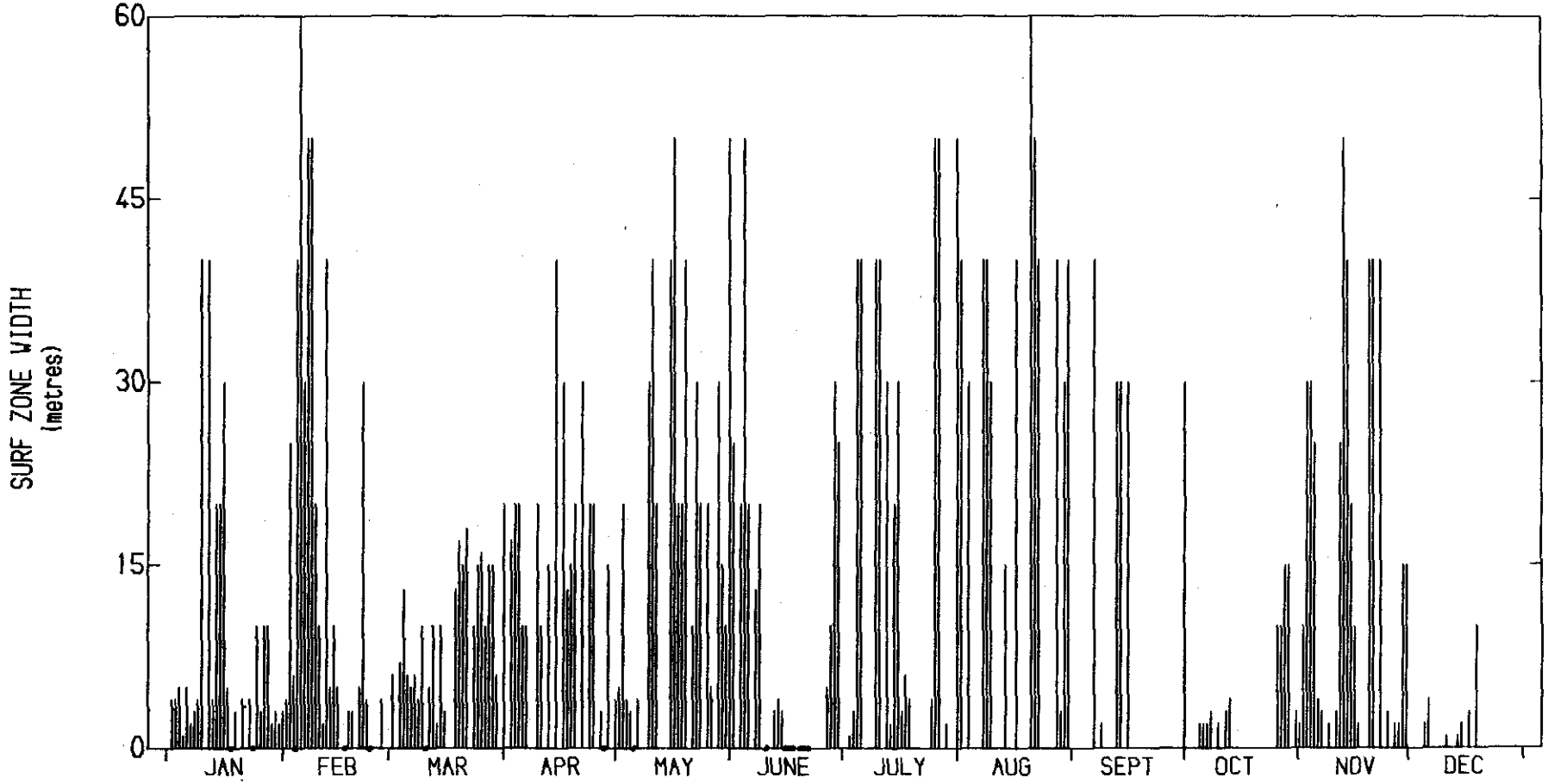


SURF ZONE WIDTH SUMMARY - 1982

No. of Observations : 221

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 16.2 m

Beach Protection Authority
Queensland

SURF ZONE WIDTH-AFTERNOON 1982

HARBOURS MARINE Consultancy

Figure 13 C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

SURF ZONE WIDTH-MORNING 1983

COPE
Hull Heads
Figure
14
C 26.1

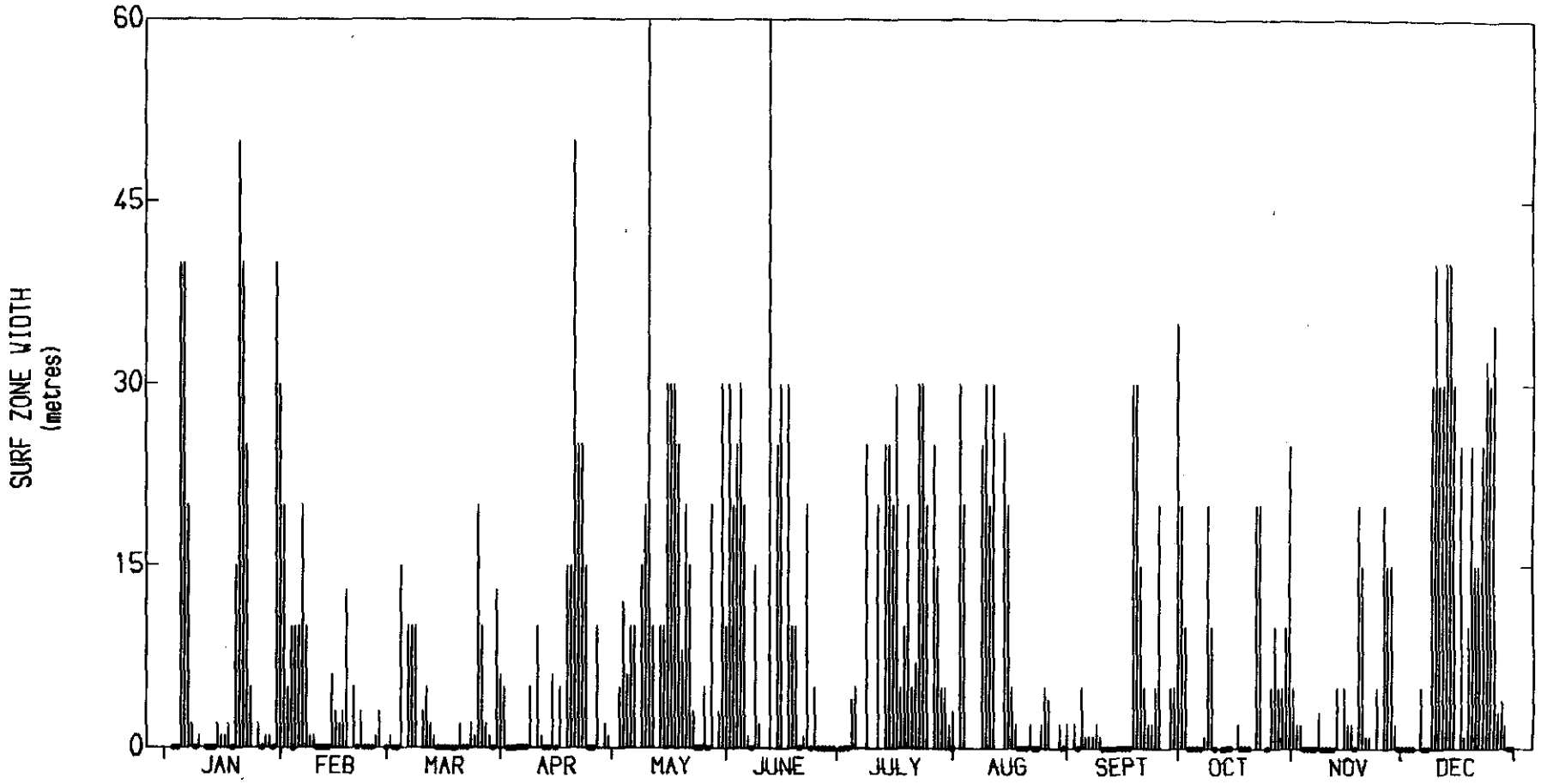
HARBOURS MARINE

COPE - Coastal Observation
Programme Engineering

HULL HEADS

CARDWELL SHIRE

2702



SURF ZONE WIDTH SUMMARY - 1983

No. of Observations : 319

MORNING OBSERVATIONS

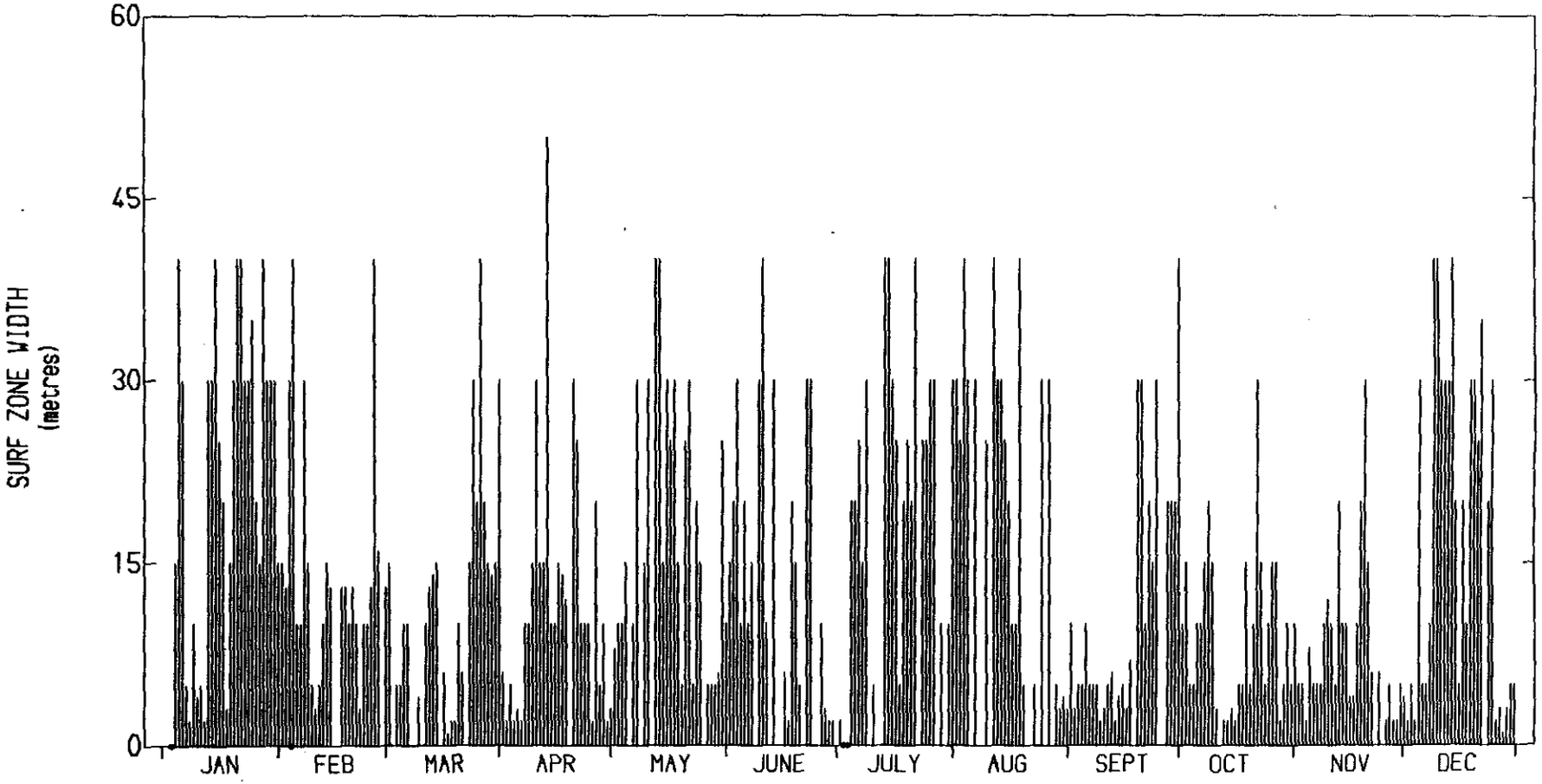
Mean Surf Zone Width = 9.3 m

COPE - Coastal Observation Programme Engineering

HULL HEADS

CARDWELL SHIRE

2702



SURF ZONE WIDTH SUMMARY - 1983

No. of Observations : 324

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 15.2 m

m Indicates Offshore Bar Present

Beach Protection Authority
Queensland

SURF ZONE WIDTH-AFTERNOON 1983

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

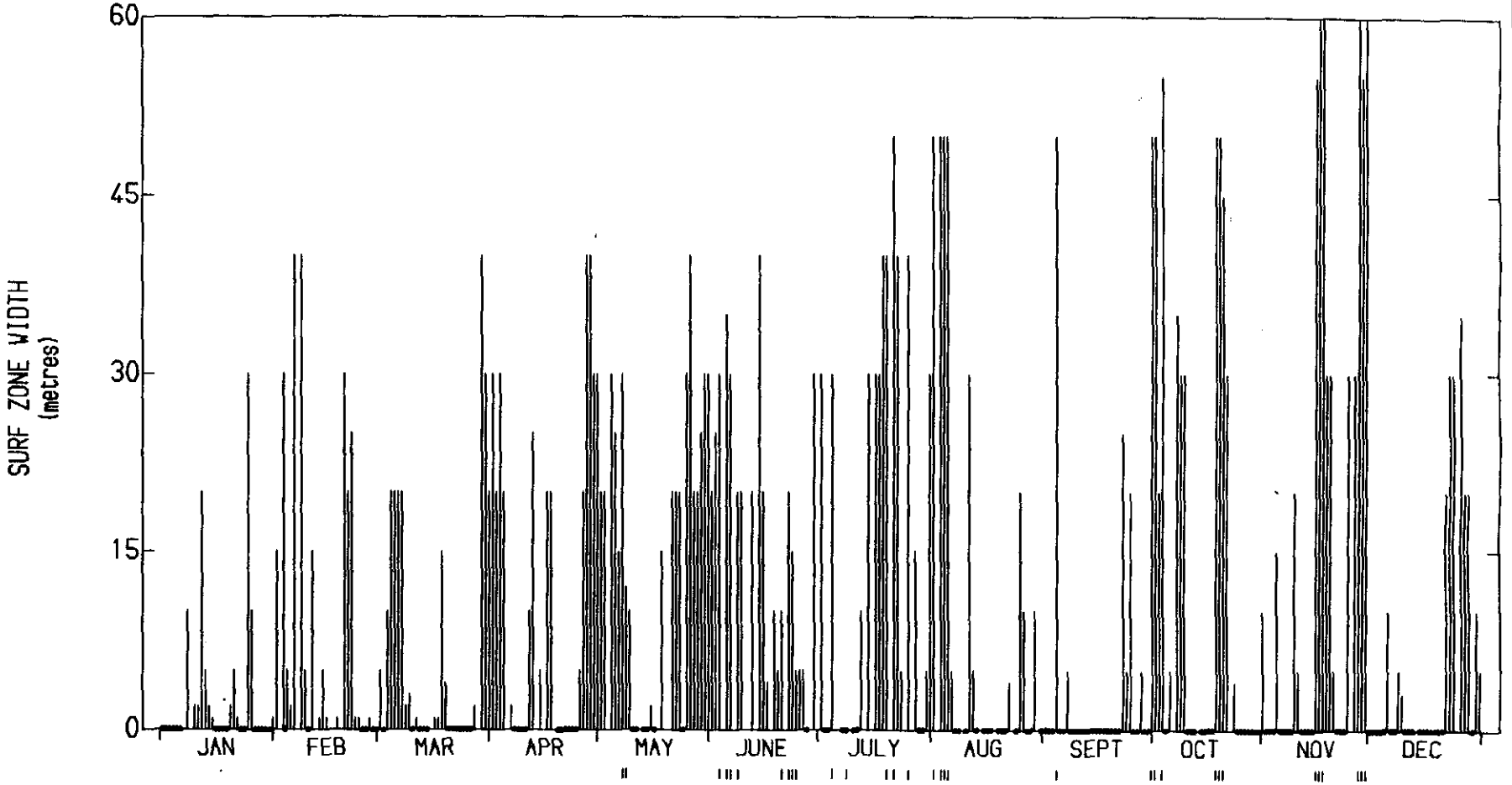
SURF ZONE WIDTH-MORNING 1984

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1984

No. of Observations : 318

MORNING OBSERVATIONS

Mean Surf Zone Width = 11.6 m

III Indicates Offshore Bar Present

COPE
Hull Heads

Figure
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C 26.1

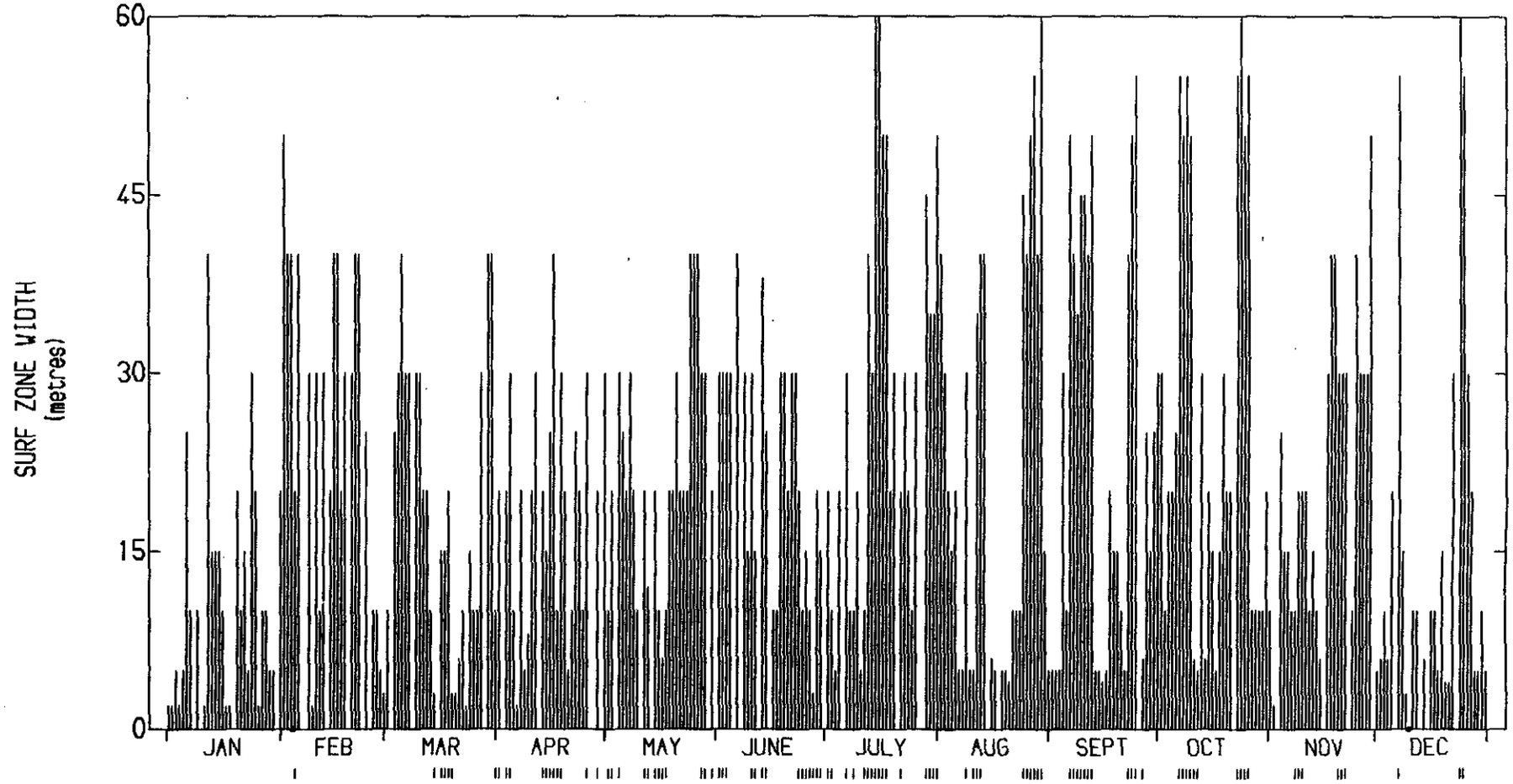
HARBOURS MARINE

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1984

No. of Observations : 322

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 21.6 m

▪ Indicates Offshore Bar Present

SURF ZONE WIDTH-AFTERNOON 1984

Beach Protection Authority Queensland

COPE

Hull Heads

Figure 17 C 28.1

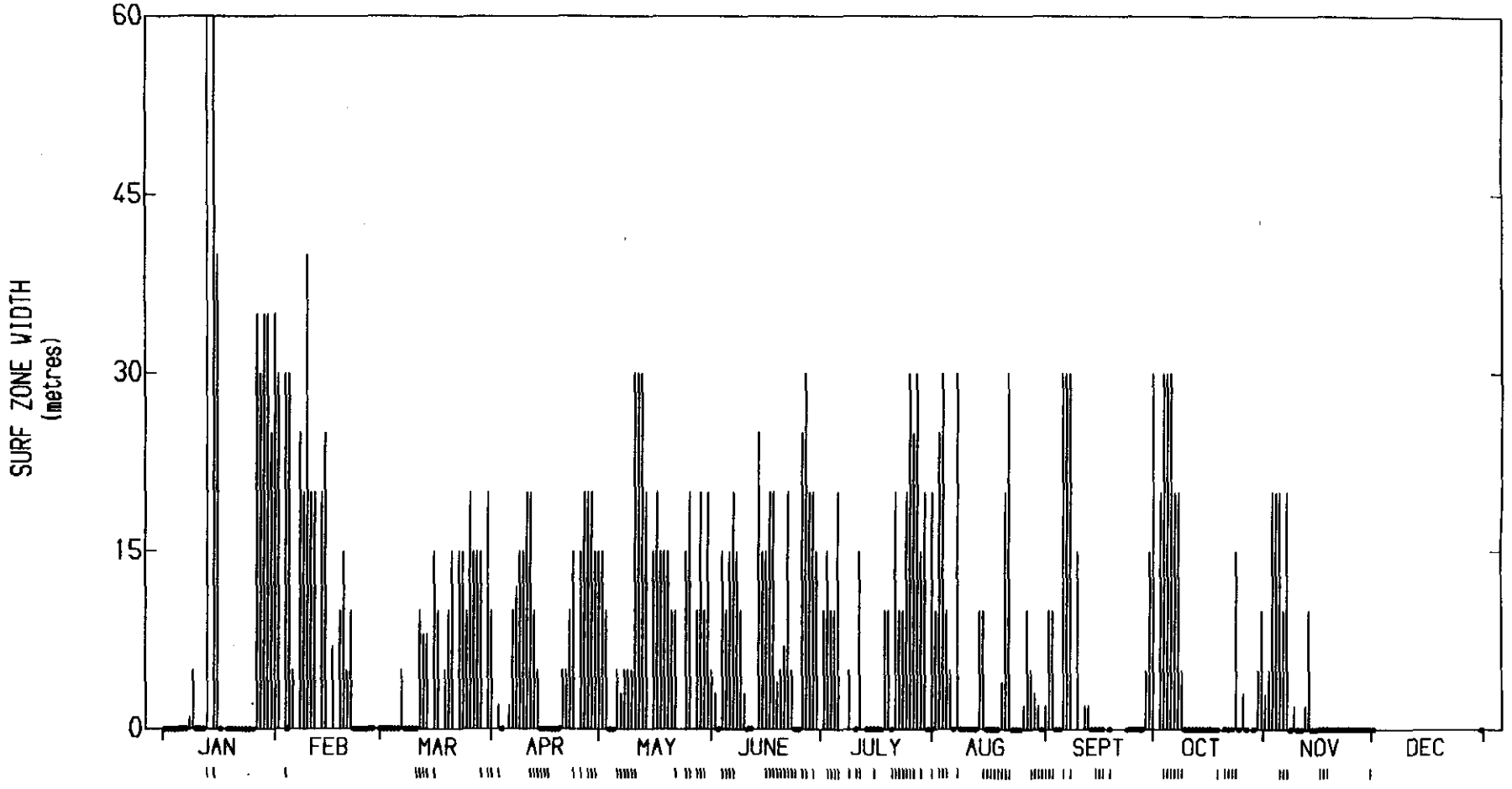
HARBOURS MARINE

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1985

No. of Observations : 303

MORNING OBSERVATIONS

Mean Surf Zone Width = 9.3 m

▥ Indicates Offshore Bar Present

Beach Protection Authority
Queensland

SURF ZONE WIDTH-MORNING 1985

HARBOURS MARINE

COPE
Hull Heads

Figure
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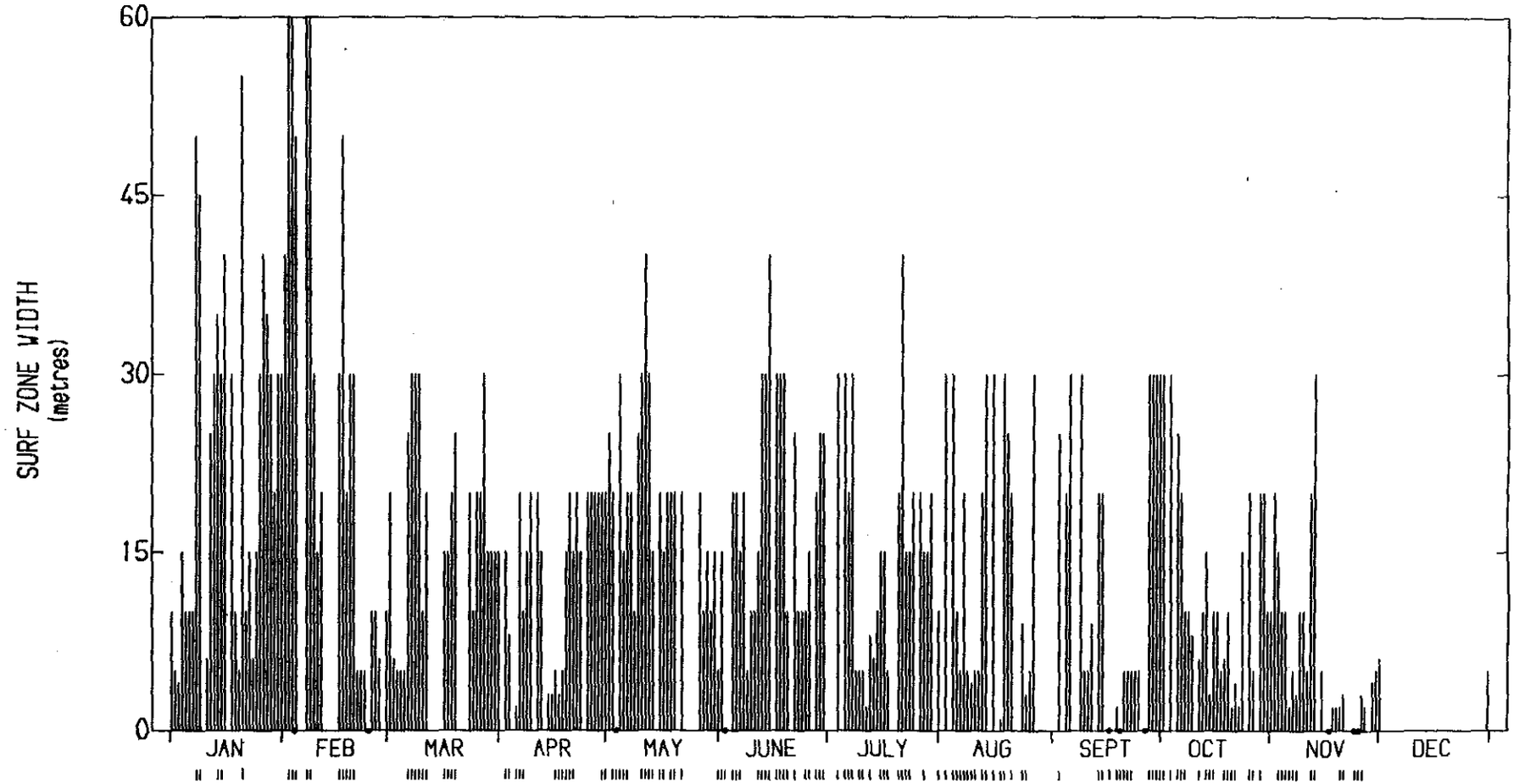
C 26.1

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1985

No. of Observations : 270

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 16.7 m

m Indicates Offshore Bar Present

Beach Protection Authority Queensland

SURF ZONE WIDTH-AFTERNOON 1985

COPE
Hull Heads

Figure 19
C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

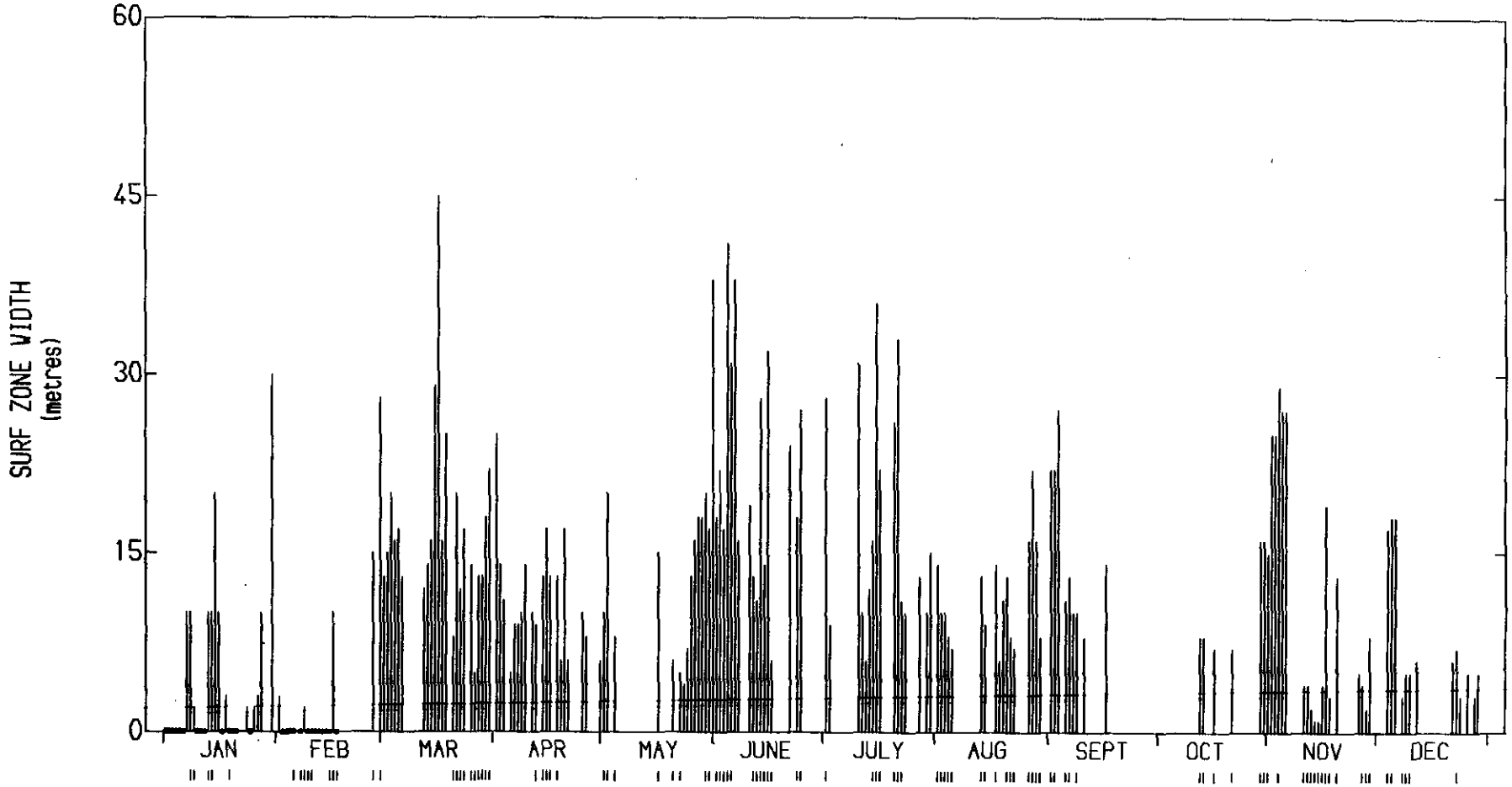
SURF ZONE WIDTH-MORNING 1986

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1986

No. of Observations : 201

MORNING OBSERVATIONS

Mean Surf Zone Width = 11.9 m

Indicates Offshore Bar Present

COPE
Hull Heads
Figure
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C 26.1

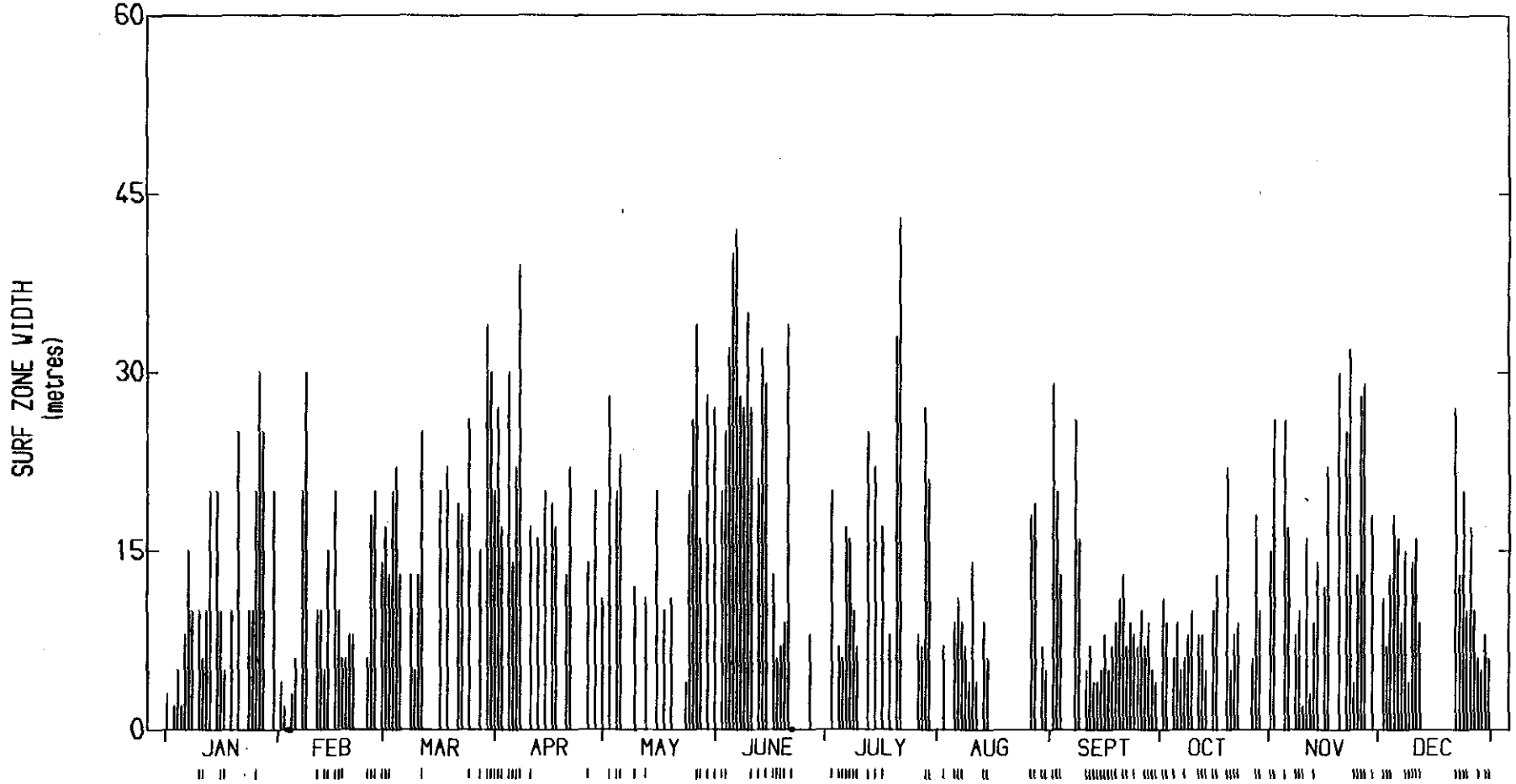
HARBOURS MARINE

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1986

No. of Observations : 229

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 14.7 m

= Indicates Offshore Bar Present

SURF ZONE WIDTH-AFTERNOON 1986

Beach Protection Authority
Queensland

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

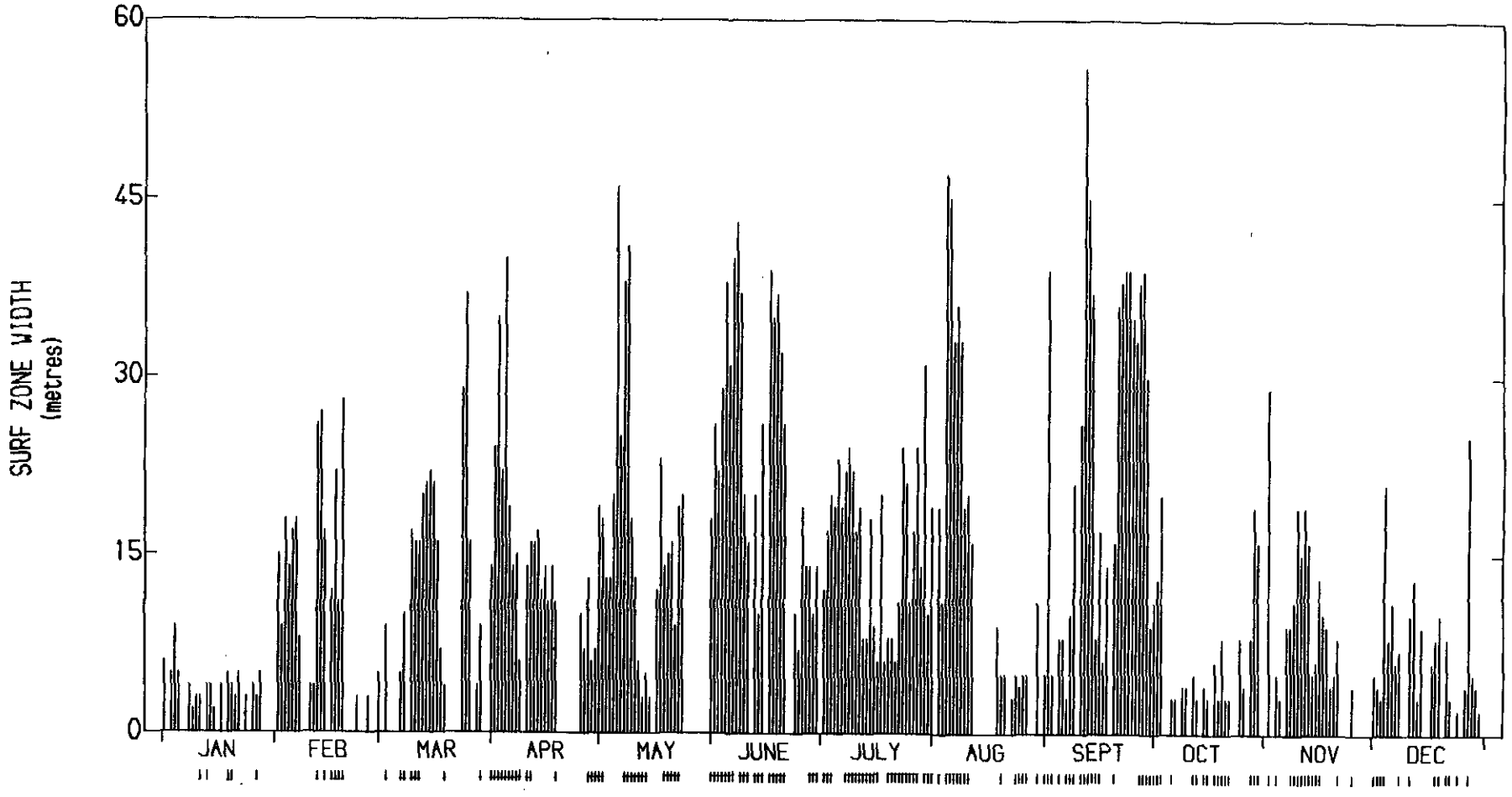
SURF ZONE WIDTH-MORNING 1987

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1987

No. of Observations : 270

MORNING OBSERVATIONS

Mean Surf Zone Width = 15.0 m

Indicates Offshore Bar Present

COPE
Hull Heads
Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

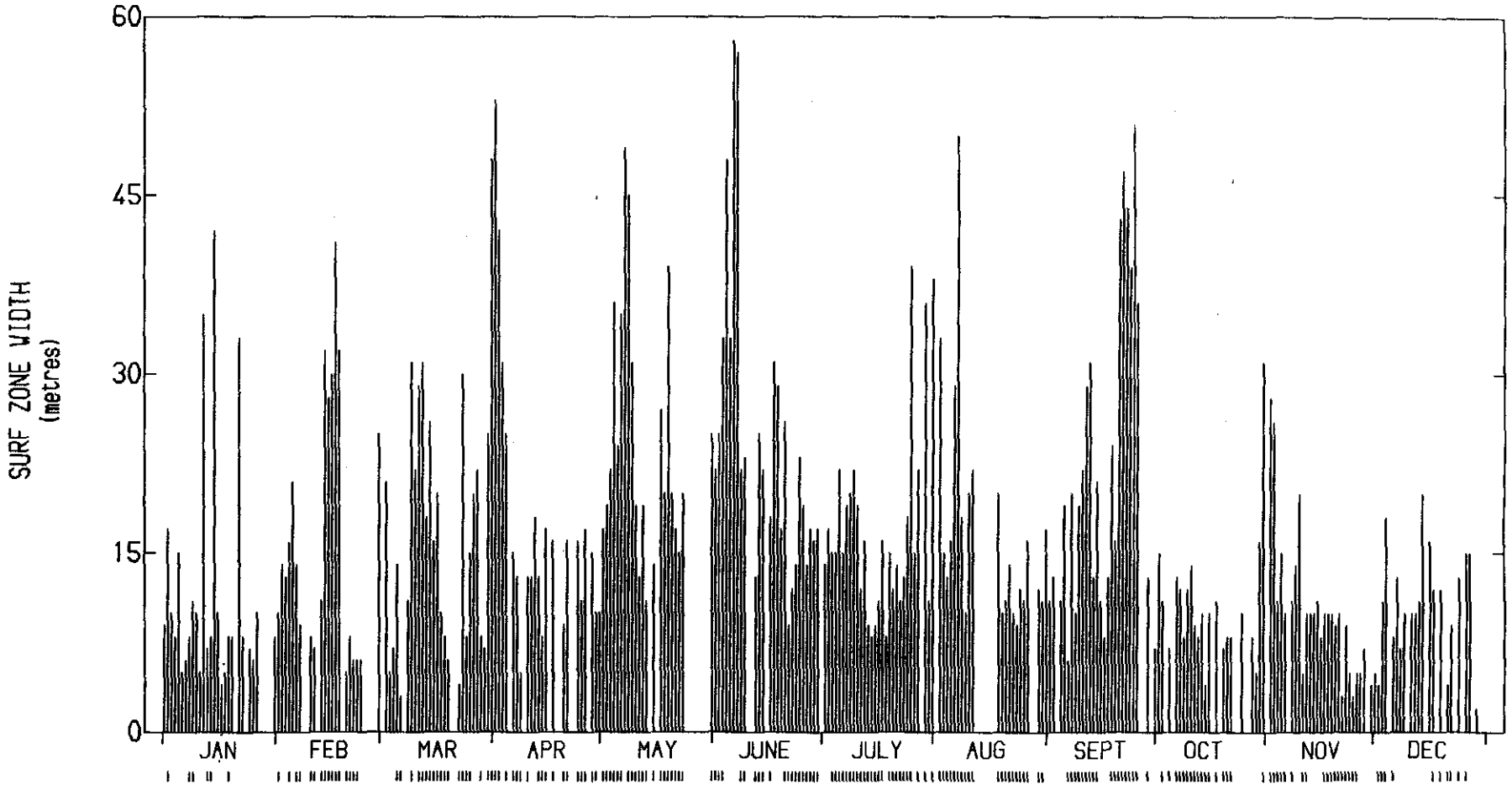
SURF ZONE WIDTH-AFTERNOON 1987

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1987

No. of Observations : 294

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 16.8 m

▥ Indicates Offshore Bar Present

HARBOURS MARINE Consultants

COPE
Hull Heads

Figure
23
C 26.1

Beach Protection Authority
Queensland

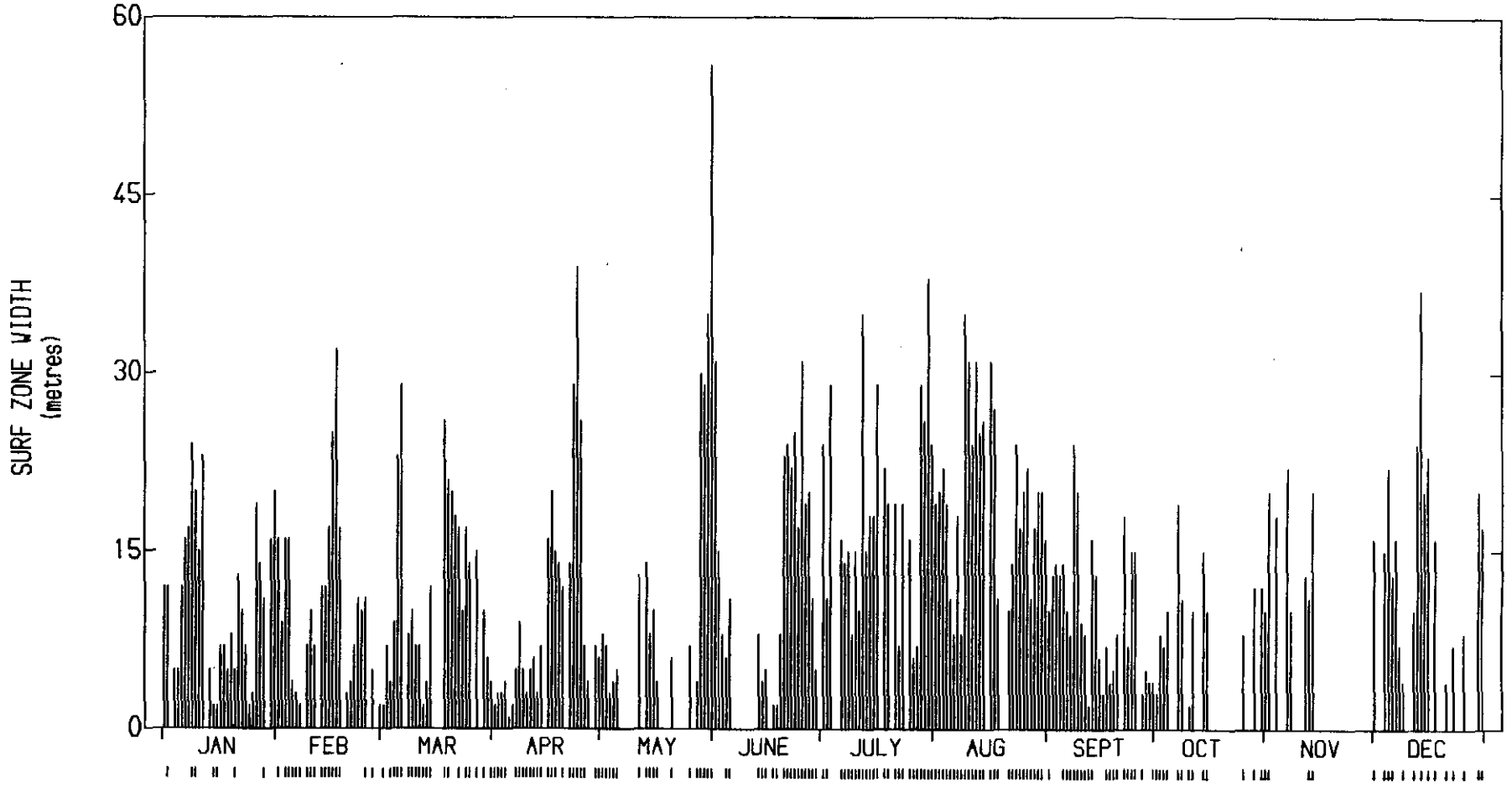
SURF ZONE WIDTH-MORNING 1988

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1988

No. of Observations : 266

MORNING OBSERVATIONS

Mean Surf Zone Width = 13.4 m

Indicates Offshore Bar Present

HARBOURS MARINE

COPE
Hull Heads
Figure
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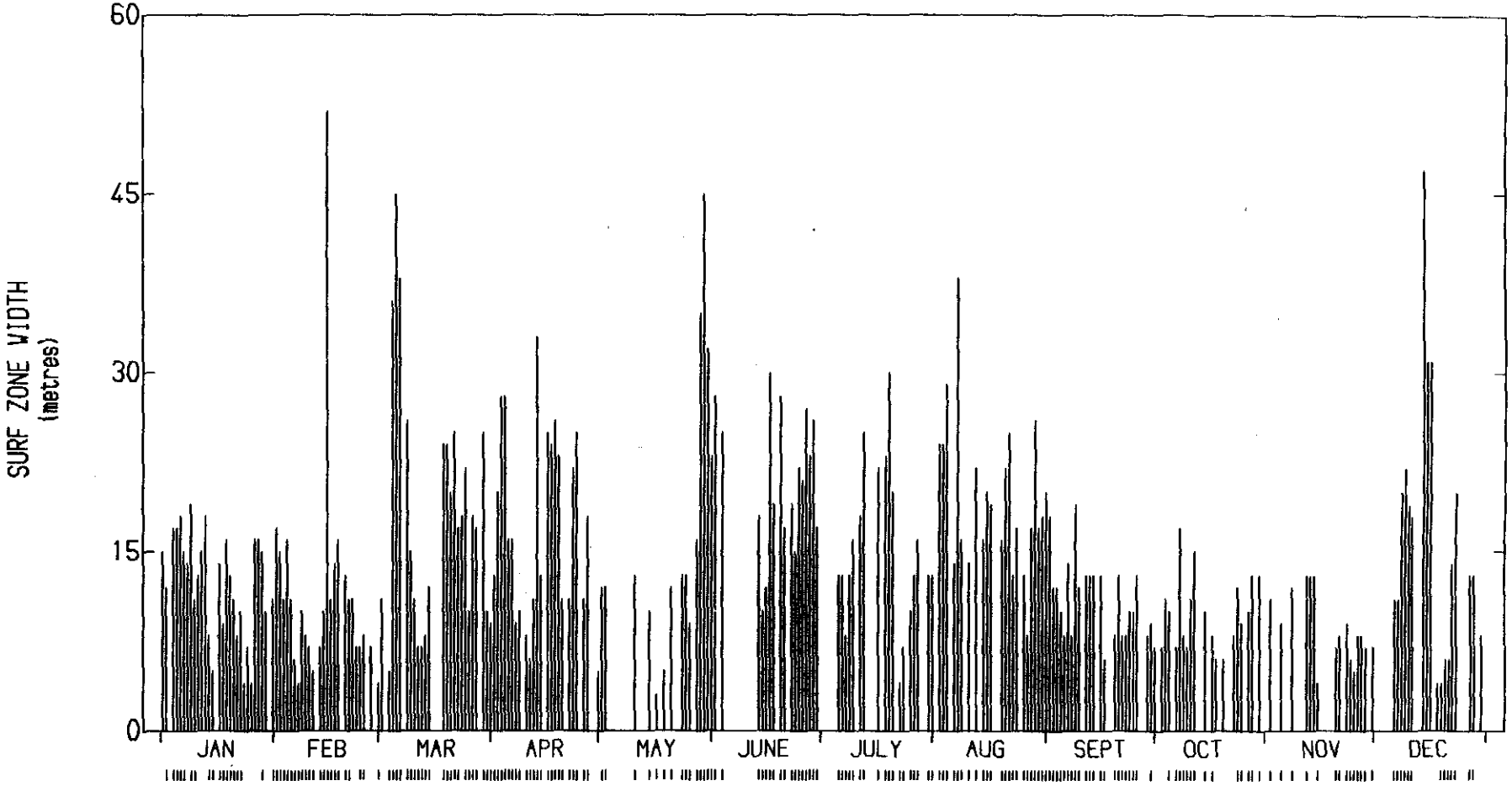
C 26.1

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



SURF ZONE WIDTH SUMMARY - 1988

No. of Observations : 253

AFTERNOON OBSERVATIONS

Mean Surf Zone Width = 14.8 m

m Indicates Offshore Bar Present

SURF ZONE WIDTH-AFTERNOON 1988

Beach Protection Authority
Queensland

HARBOURS MARINE

COPE
Hull Heads

Figure
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C 26.1

Beach Protection Authority
Queensland

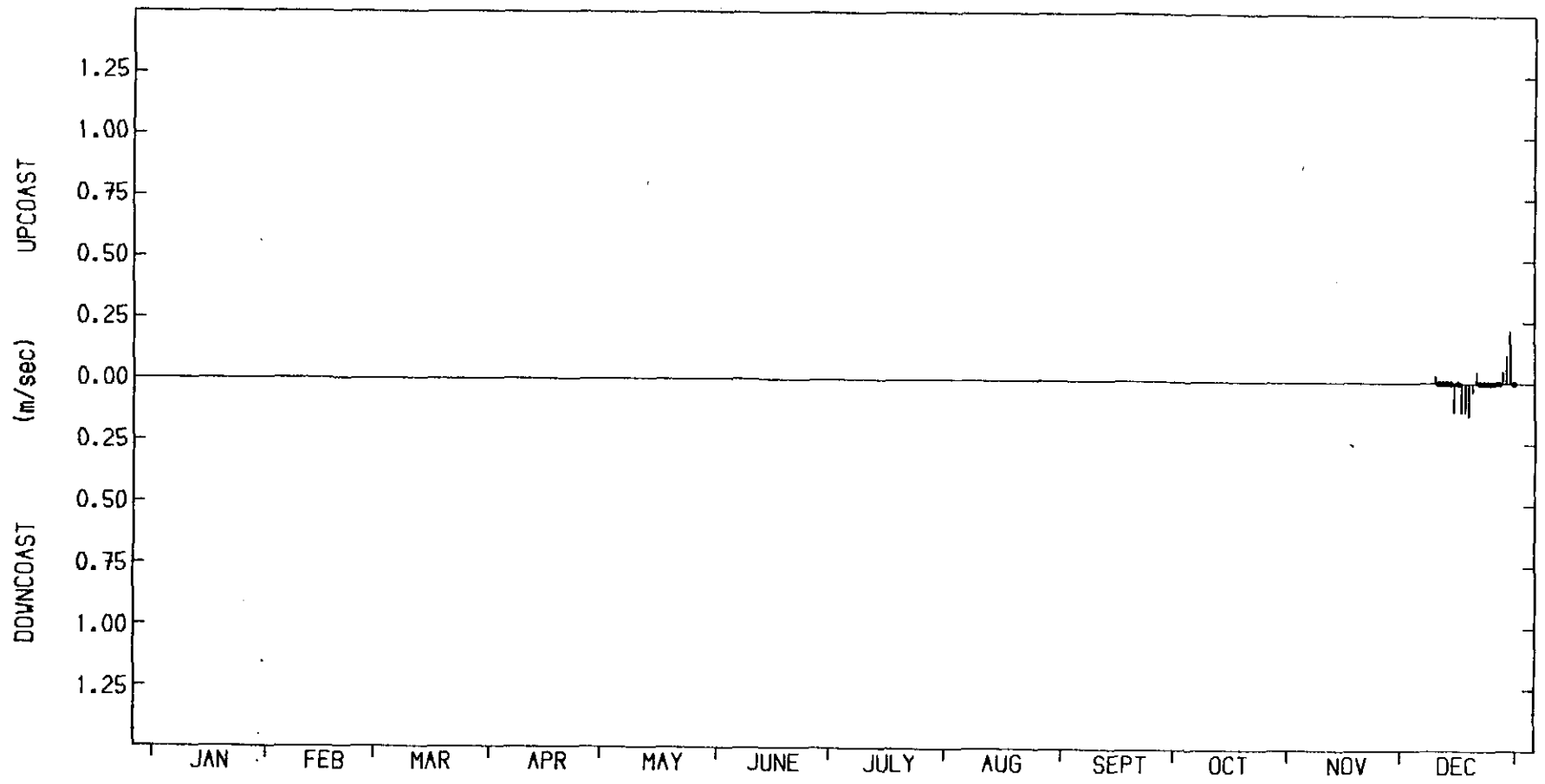
LITTORAL CURRENTS-MORNING 1979

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1979

Mean Vel = -.002 m/sec (down)

Mean Upcoast Vel = .093 m/sec

Mean Downcoast Vel = .103 m/sec

MORNING OBSERVATIONS - (22 recordings)

HARBOURS MARINE

COPE
Hull Heads

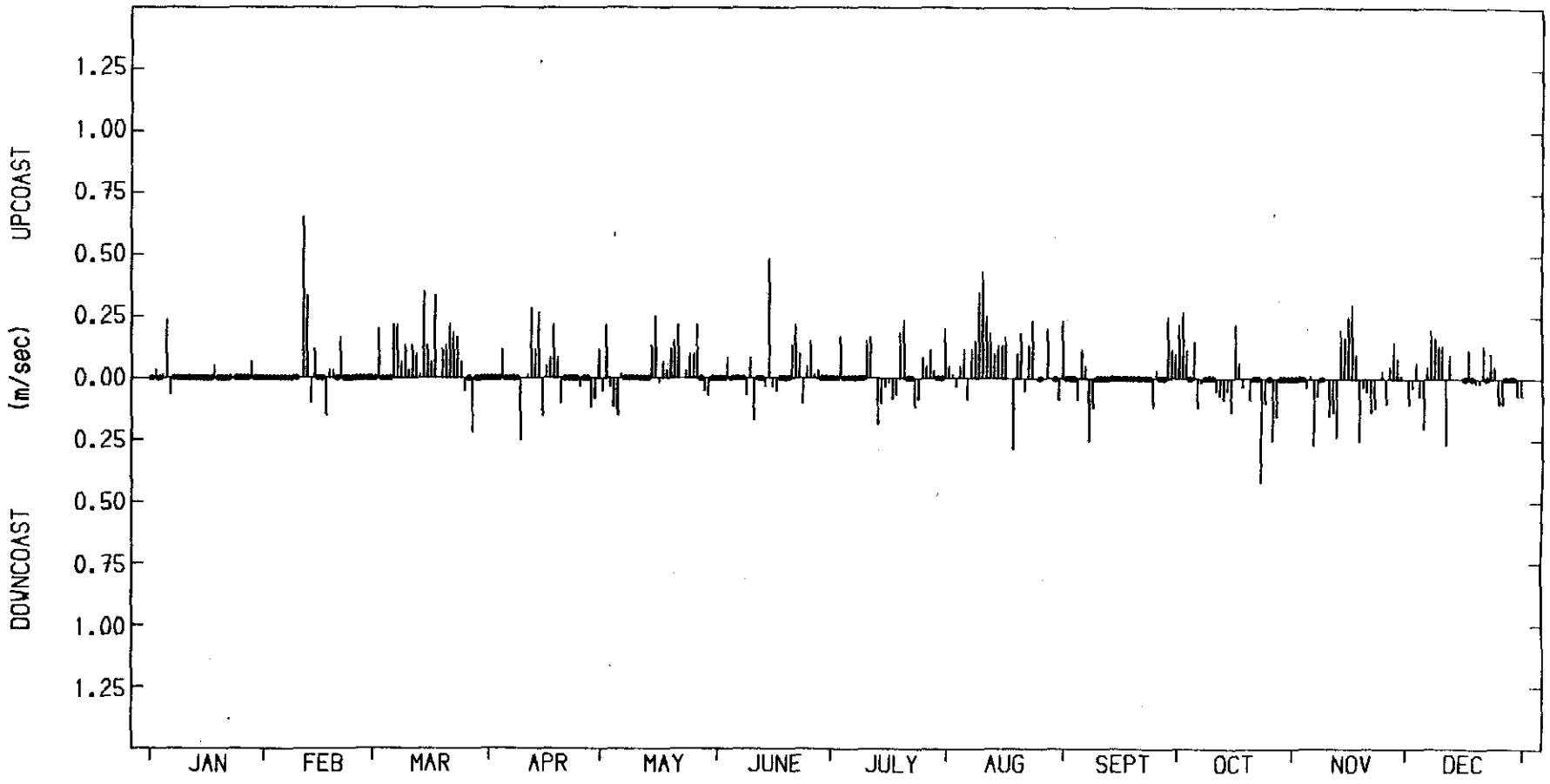
Figure
26
C 26.1

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1980

Mean Vel = .028 m/sec (up)

Mean Upcoast Vel = .142 m/sec

Mean Downcoast Vel = .106 m/sec

MORNING OBSERVATIONS - (349 recordings)

LITTORAL CURRENTS-MORNING 1980

Beach Protection Authority
Queensland

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

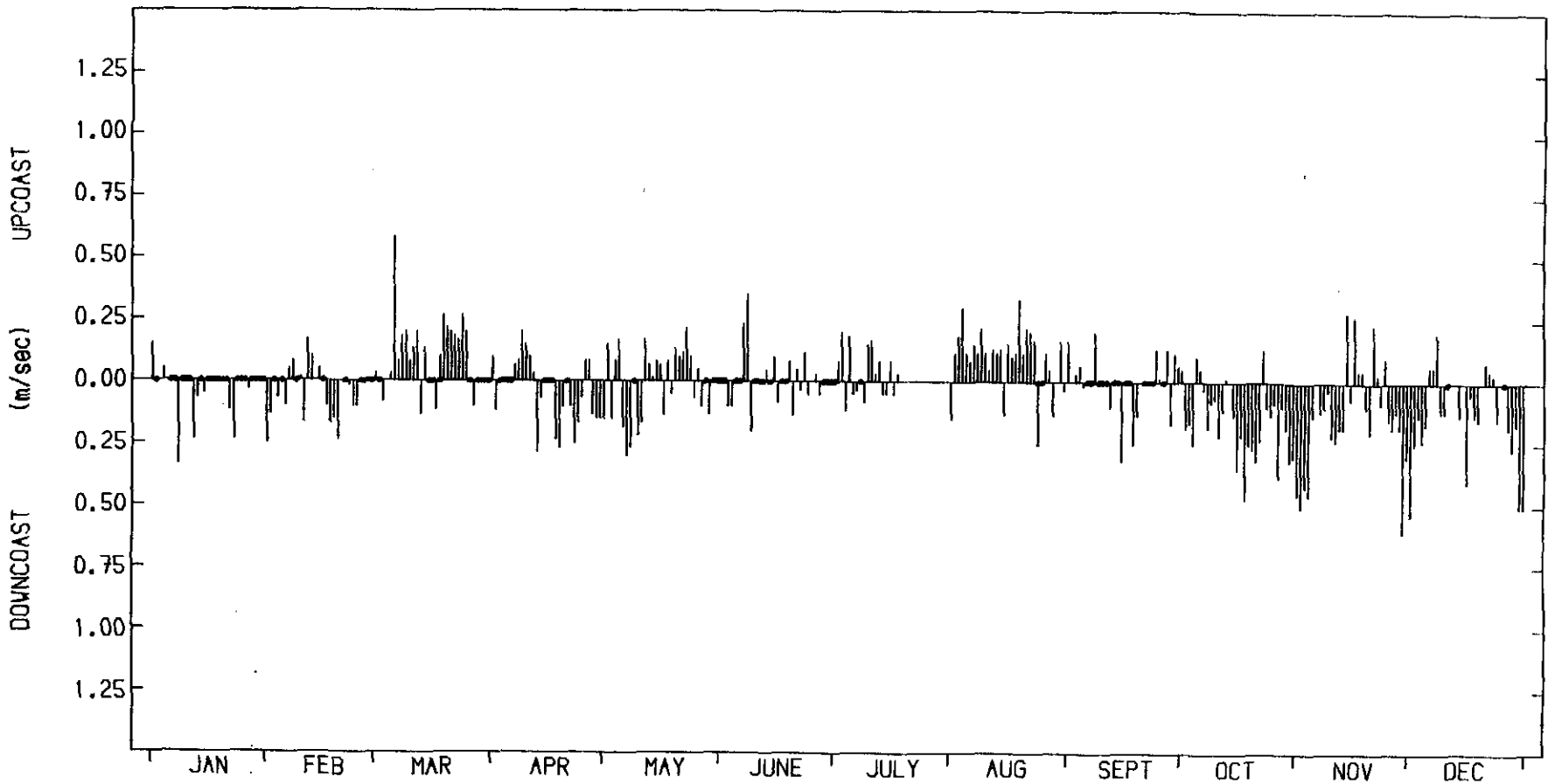
LITTORAL CURRENTS-AFTERNOON 1980

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1980

Mean Vel = -.028 m/sec (down)

Mean Upcoast Vel = .126 m/sec

Mean Downcoast Vel = .175 m/sec

AFTERNOON OBSERVATIONS - (339 recordings)

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

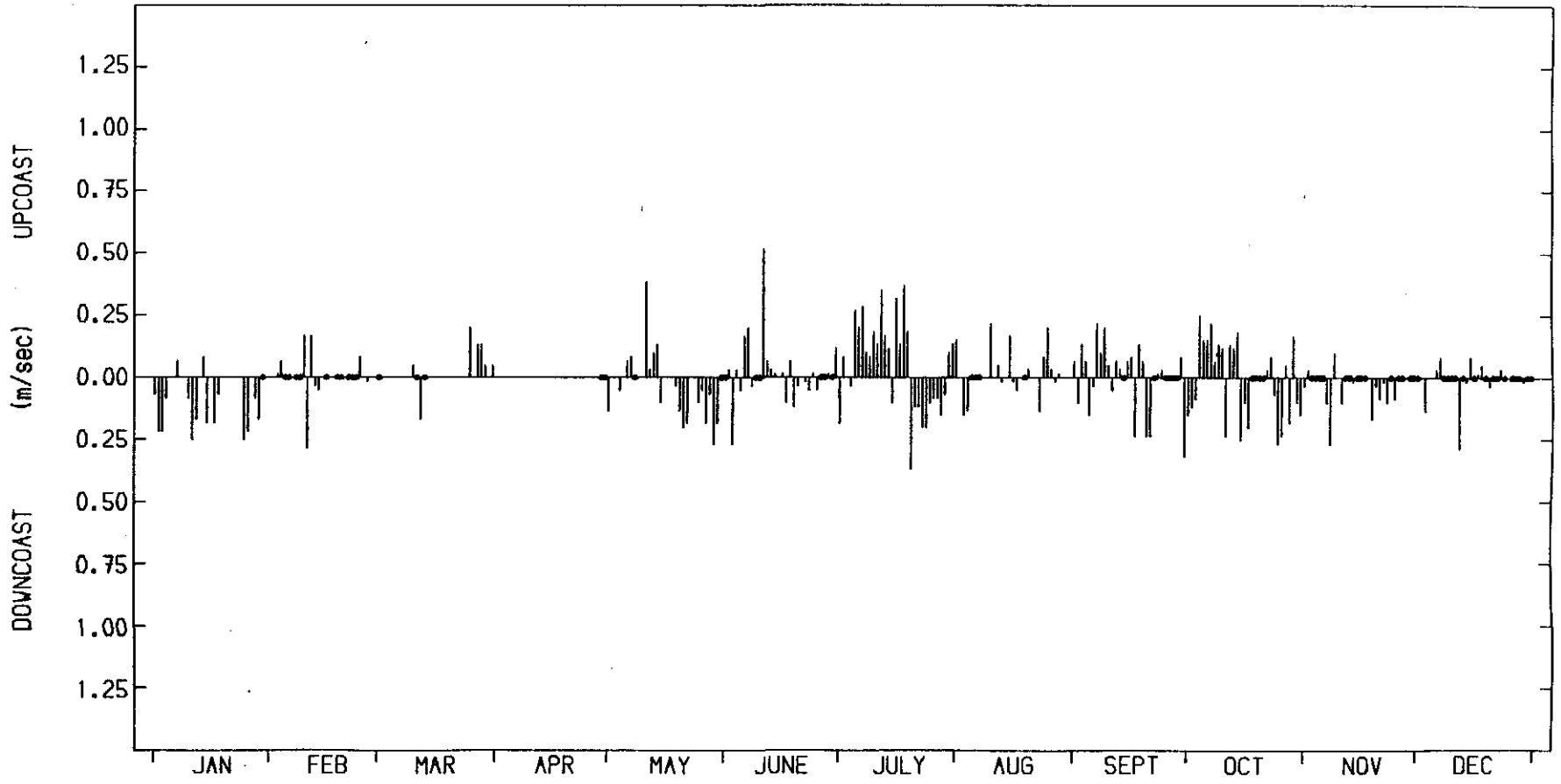
LITTORAL CURRENTS–MORNING 1981

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1981

Mean Vel = -.005 m/sec (down)

Mean Upcoast Vel = .117 m/sec

Mean Downcoast Vel = .127 m/sec

MORNING OBSERVATIONS - (262 recordings)

HARBOURS MARINE

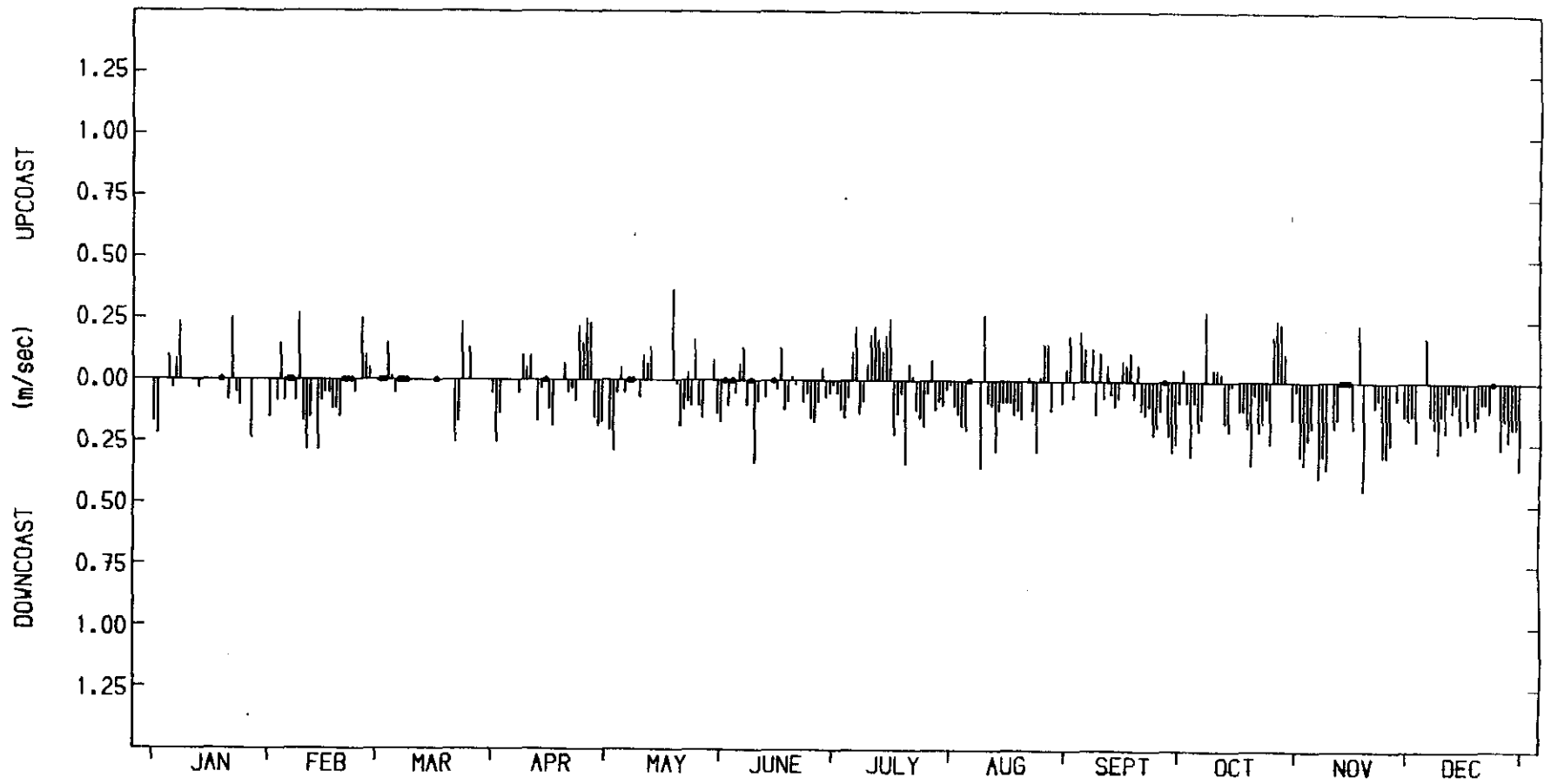
COPE
Hull Heads
Figure
29
C 26.1

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1981

Mean Vel = -.059 m/sec (down)

Mean Upcoast Vel = .134 m/sec

Mean Downcoast Vel = .141 m/sec

AFTERNOON OBSERVATIONS - (287 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-AFTERNOON 1981

HARBOURS MARINE

Figure
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C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

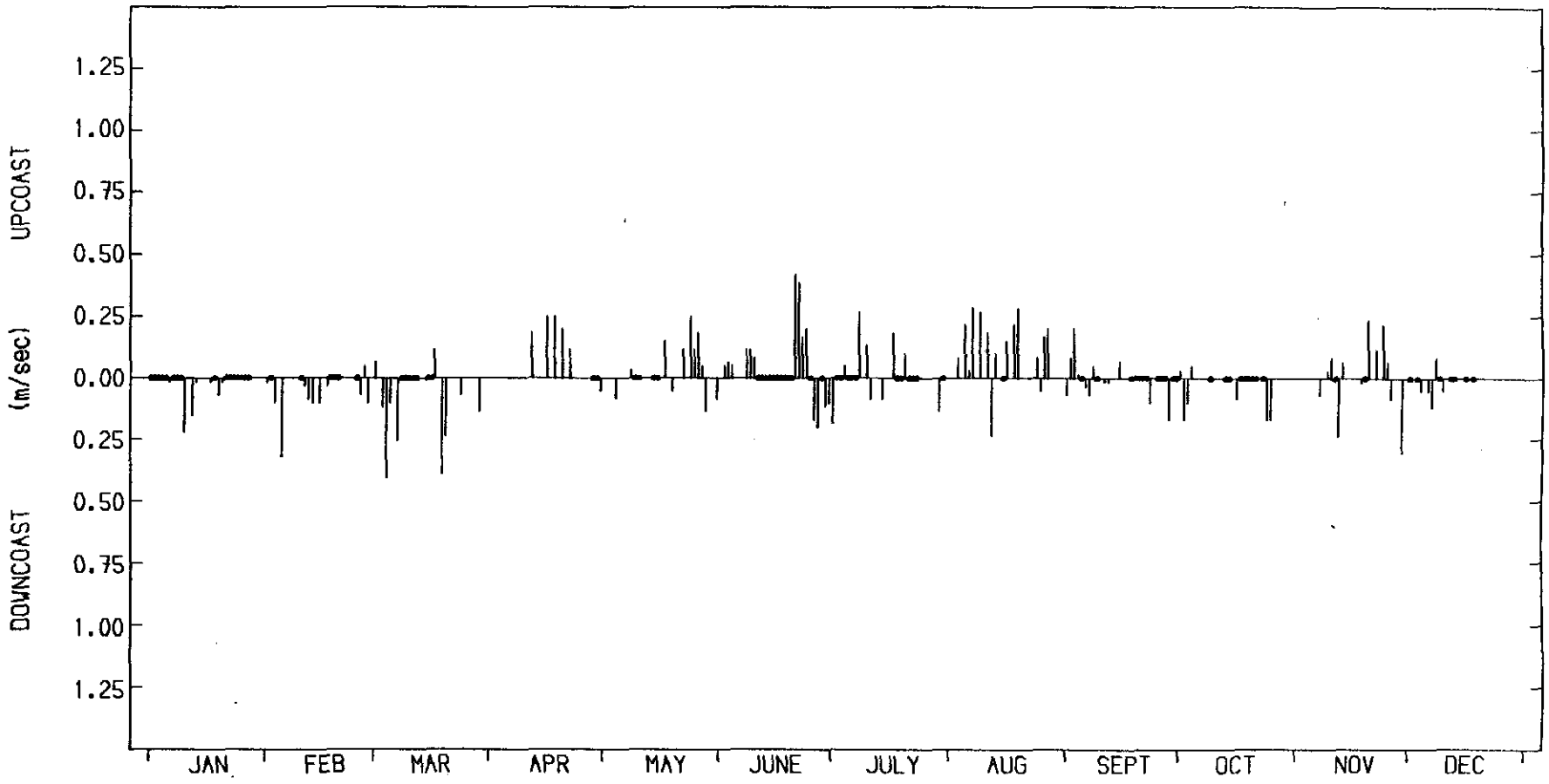
LITTORAL CURRENTS-MORNING 1982

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1982

Mean Vel = .006 m/sec (up)

Mean Upcoast Vel = .141 m/sec

Mean Downcoast Vel = .115 m/sec

MORNING OBSERVATIONS - (208 recordings)

HARBOURS MARINE

COPE
Hull Heads
Figure
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C 26.1

Beach Protection Authority
Queensland

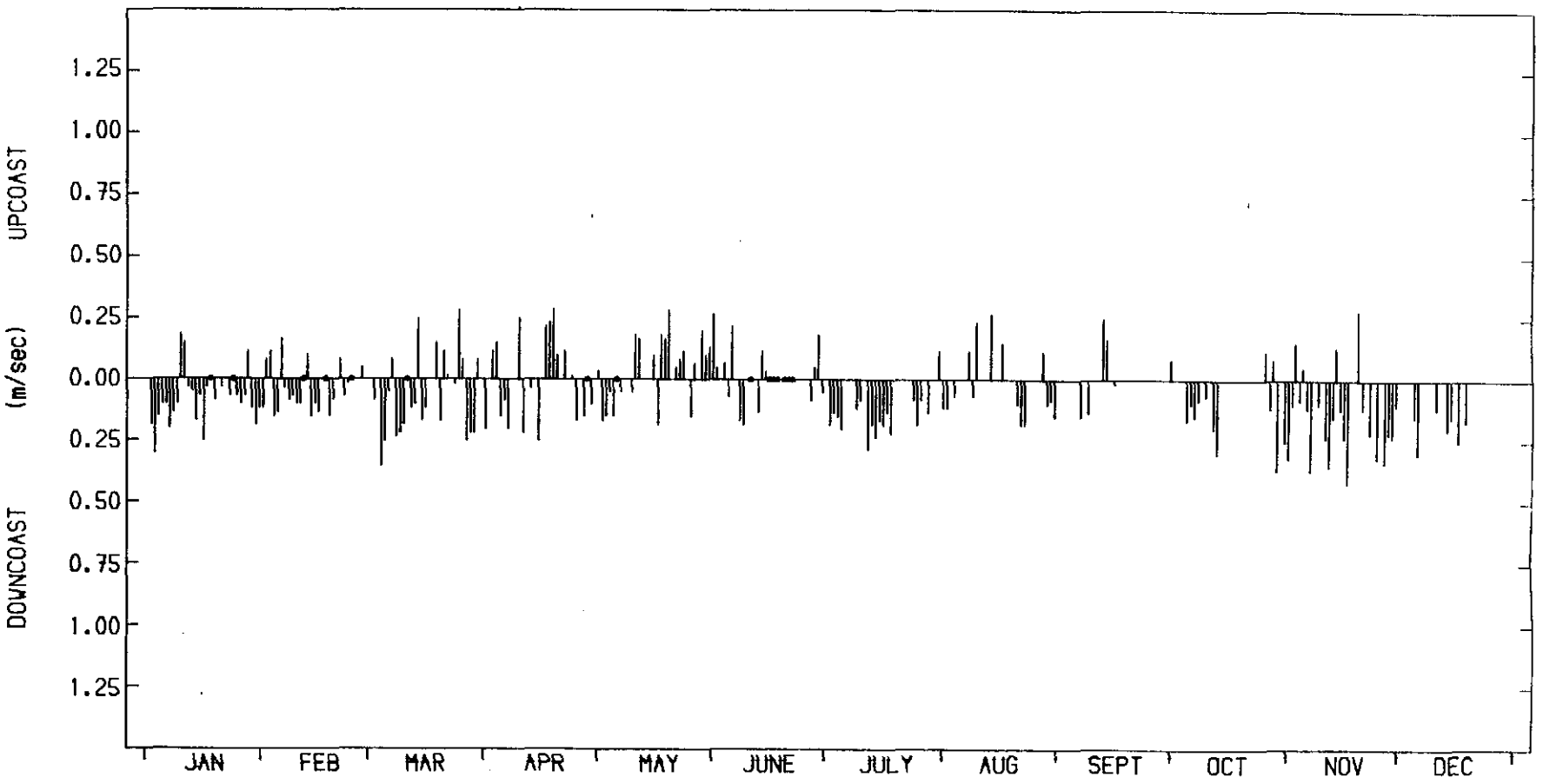
LITTORAL CURRENTS-AFTERNOON 1982

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1982

Mean Vel = -.058 m/sec (down)

Mean Upcoast Vel = .139 m/sec

Mean Downcoast Vel = .150 m/sec

AFTERNOON OBSERVATIONS - (222 recordings)

HARBOURS MARINE

COPE
Hull Heads

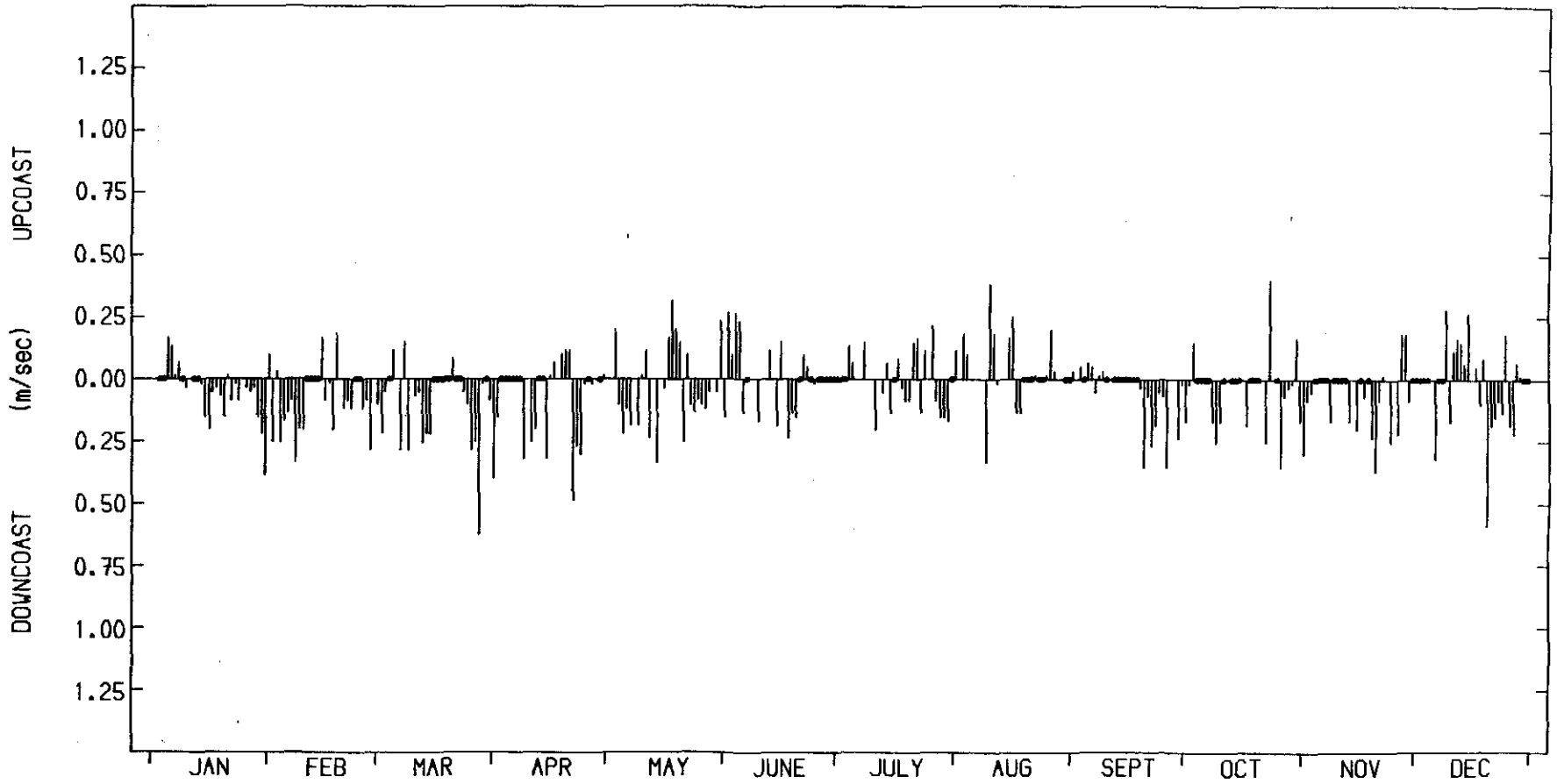
Figure
32
C 26.1

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1983

Mean Vel = -.043 m/sec (down)

Mean Upcoast Vel = .129 m/sec

Mean Downcoast Vel = .160 m/sec

MORNING OBSERVATIONS - (315 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-MORNING 1983

HARBOURS MARINE

COPE
Hull Heads

Figure
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C 26.1

Beach Protection Authority
Queensland

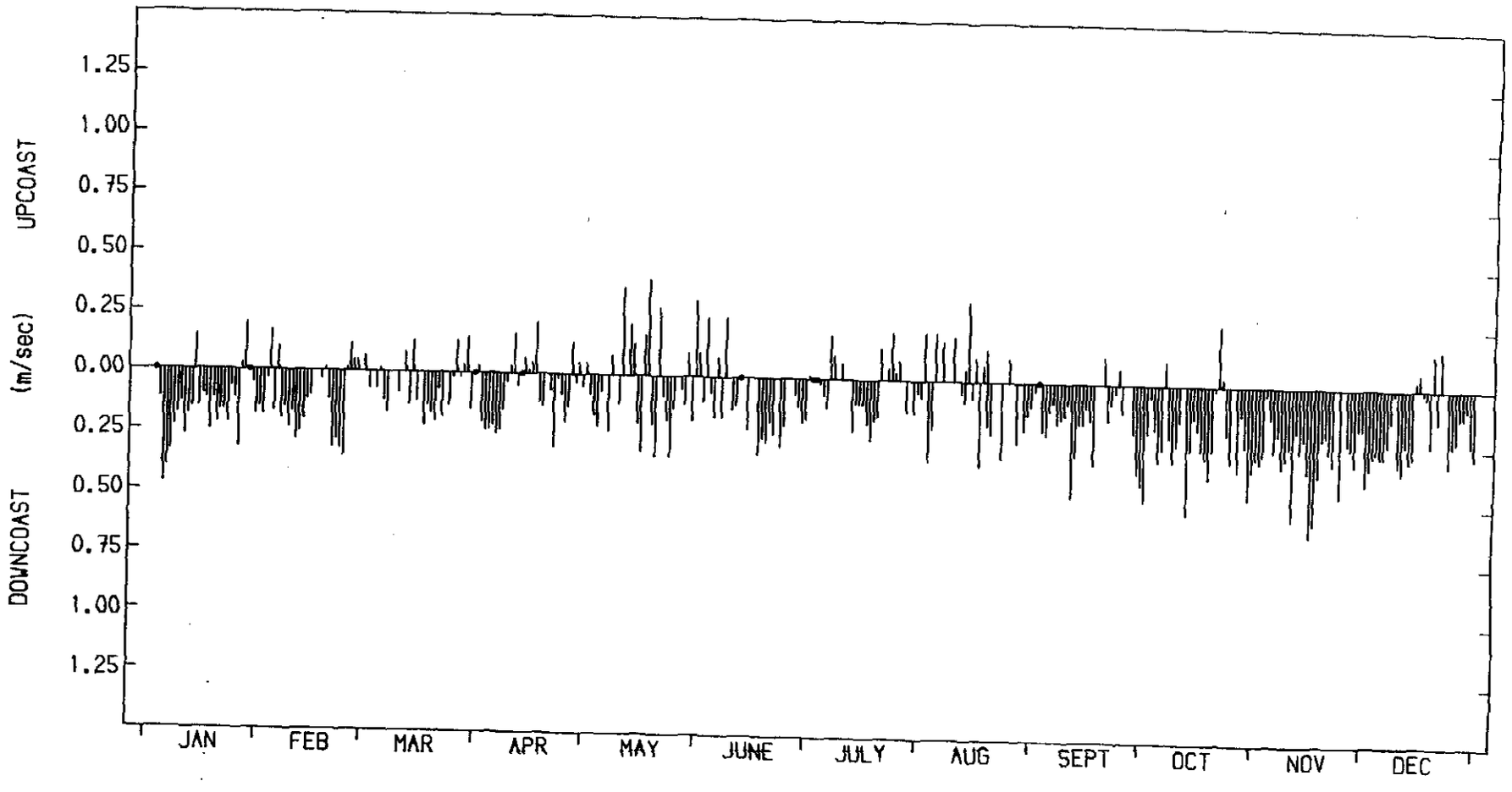
LITTORAL CURRENTS-AFTERNOON 1983

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1983

Mean Vel = -.125 m/sec (down)

Mean Upcoast Vel = .125 m/sec

Mean Downcoast Vel = .198 m/sec

AFTERNOON OBSERVATIONS - (322 recordings)

COPE
Hull Heads

Figure
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C 28.1

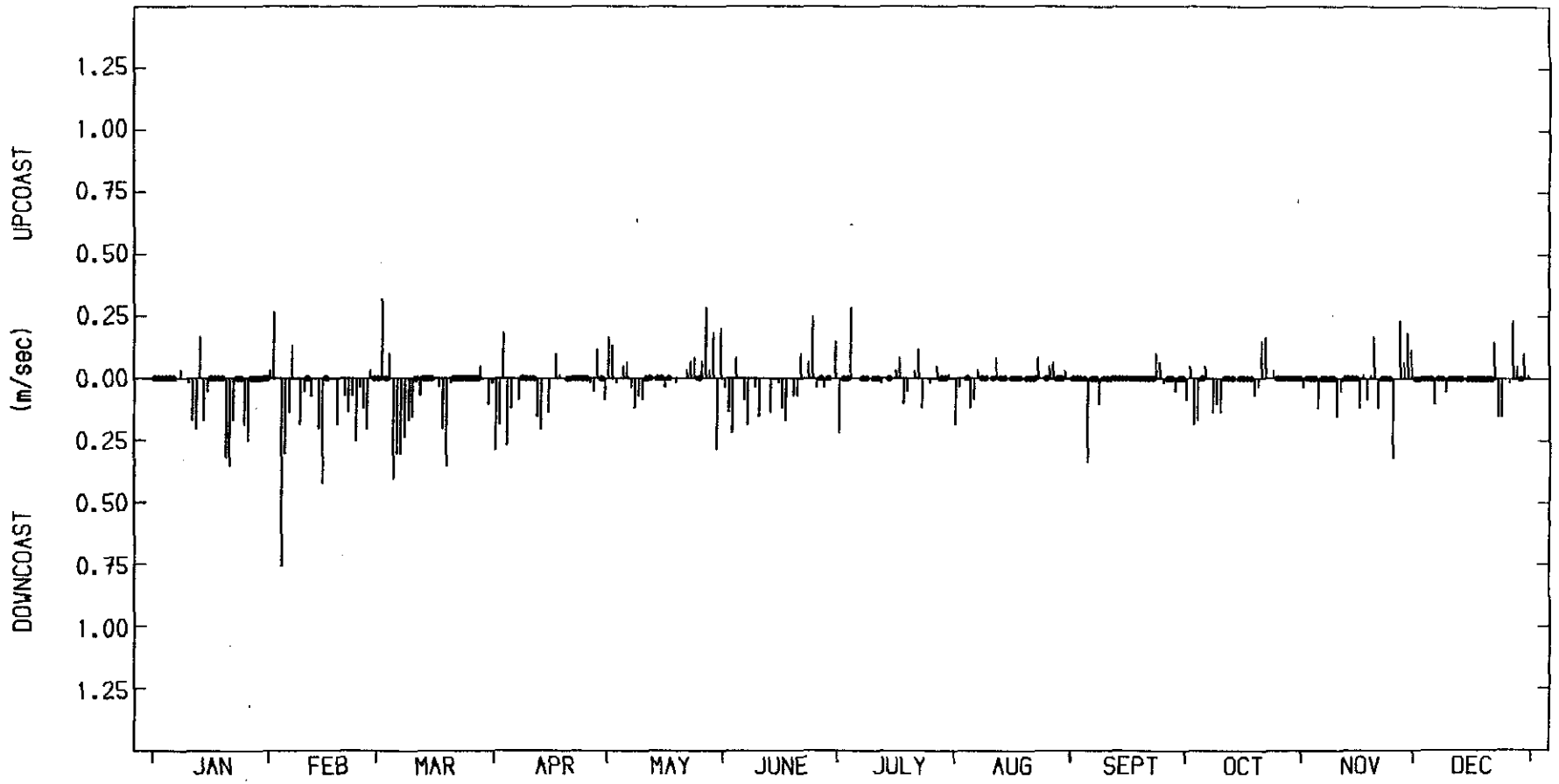
HARBOURS MARINE

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1984

Mean Vel = -.026 m/sec (down)

Mean Upcoast Vel = .105 m/sec

Mean Downcoast Vel = .137 m/sec

MORNING OBSERVATIONS - (318 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-MORNING 1984

COPE
Hull Heads

Figure
35
C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

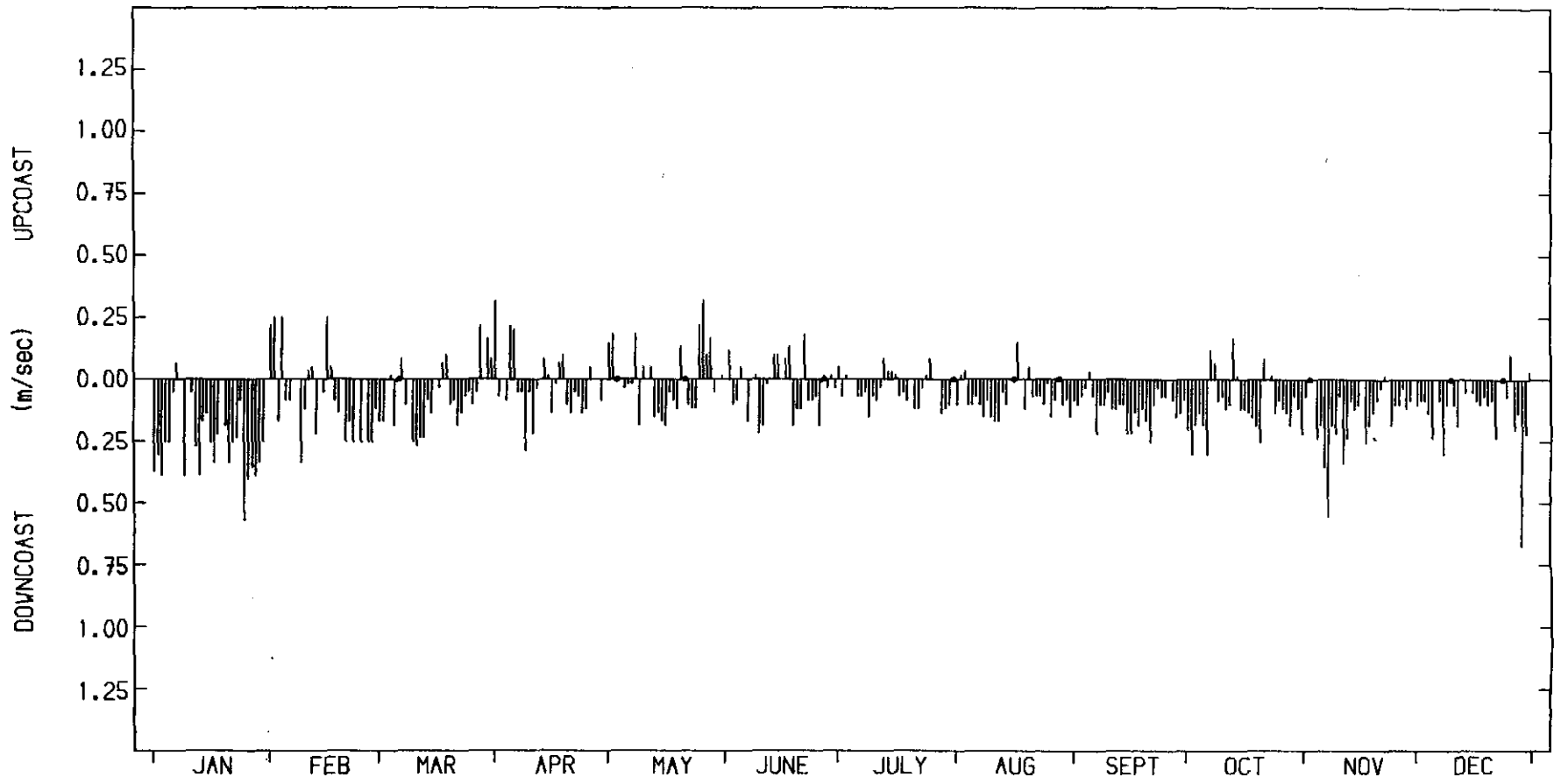
LITTORAL CURRENTS-AFTERNOON 1984

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1984

Mean Vel = -.090 m/sec (down)

Mean Upcoast Vel = .101 m/sec

Mean Downcoast Vel = .144 m/sec

AFTERNOON OBSERVATIONS - (322 recordings)

HARBOURS MARINE Consultancy

Figure 36 C 26.1

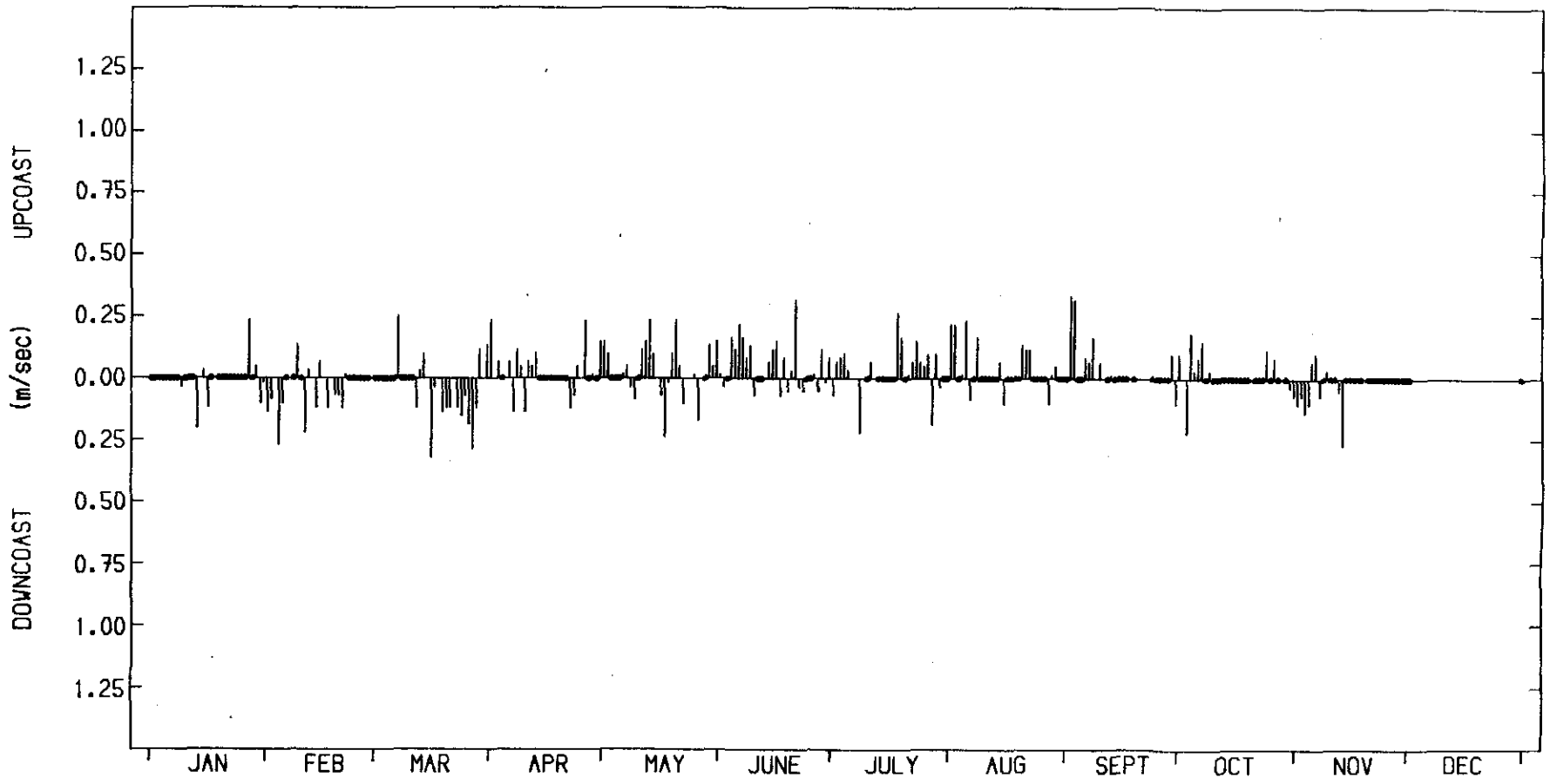
COPE
Hull Heads

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1985

Mean Vel = .012 m/sec (up)

Mean Upcoast Vel = .109 m/sec

Mean Downcoast Vel = .109 m/sec

MORNING OBSERVATIONS - (302 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-MORNING 1985

HARBOURS MARINE

Figure
37
C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

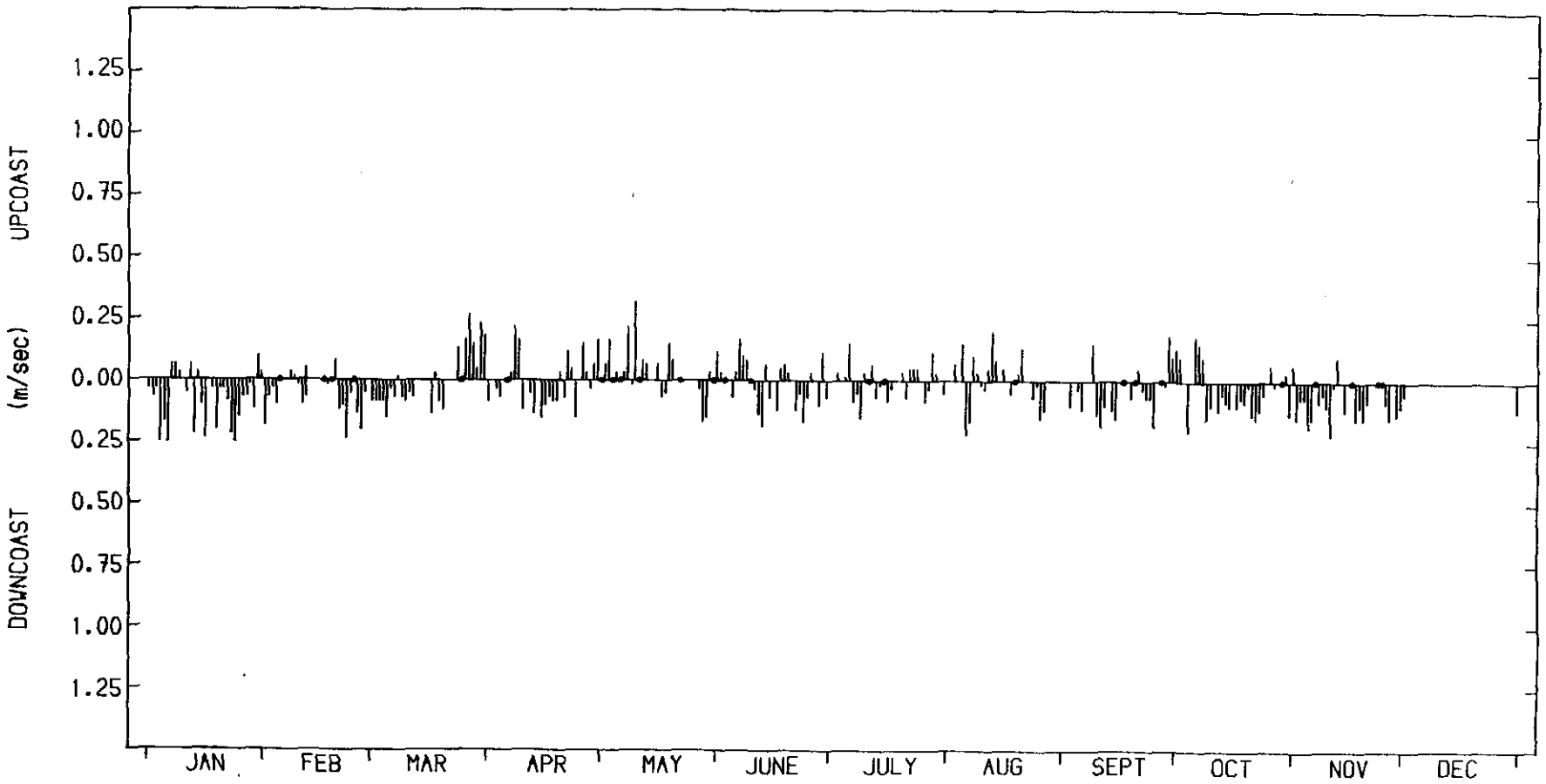
LITTORAL CURRENTS-AFTERNOON 1985

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1985

Mean Vel = -.026 m/sec (down)

Mean Upcoast Vel = .091 m/sec

Mean Downcoast Vel = .097 m/sec

AFTERNOON OBSERVATIONS - (268 recordings)

COPE
Hull Heads

Figure
38
C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

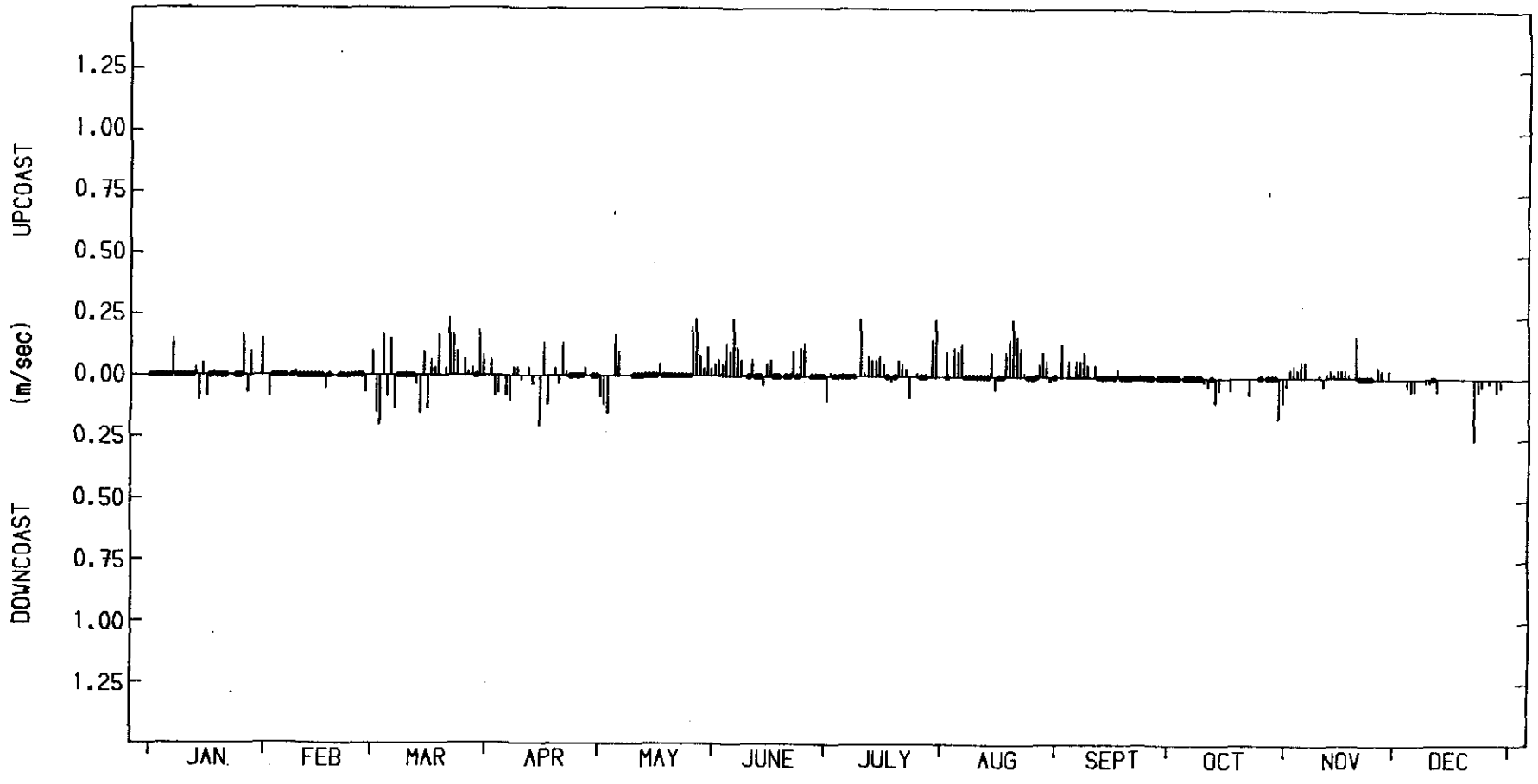
LITTORAL CURRENTS–MORNING 1986

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1986

Mean Vel = .018 m/sec (up)

Mean Upcoast Vel = .085 m/sec

Mean Downcoast Vel = .076 m/sec

MORNING OBSERVATIONS - (297 recordings)

HARBOURS MARINE

Figure
39
C 26.1

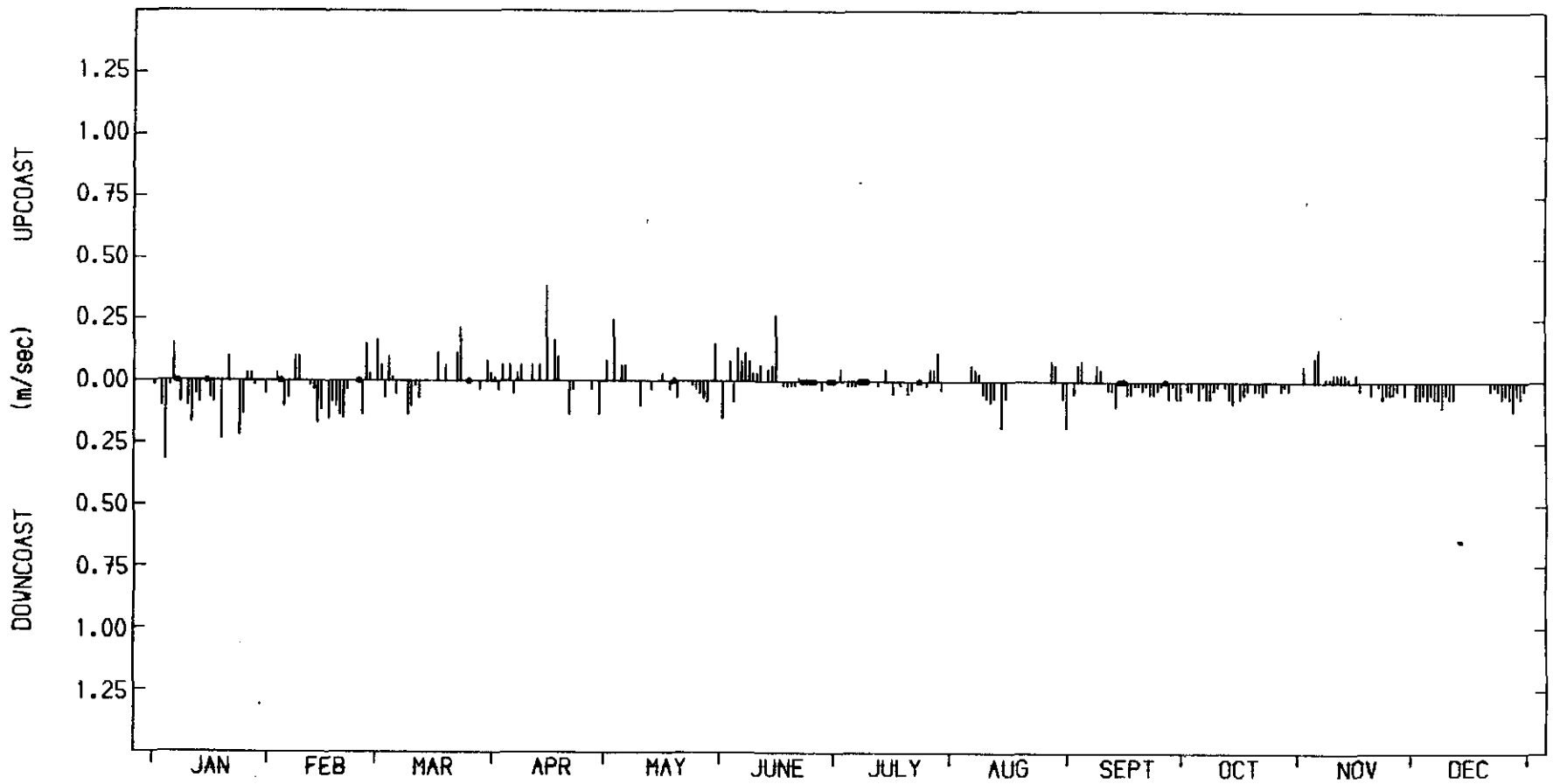
COPE
Hull Heads

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1986

Mean Vel = -.014 m/sec (down)

Mean Upcoast Vel = .081 m/sec

Mean Downcoast Vel = .062 m/sec

AFTERNOON OBSERVATIONS - (236 recordings)

LITTORAL CURRENTS-AFTERNOON 1986

Beach Protection Authority Queensland

HARBOURS MARINE Consultancy

Figure 40 C 26.1

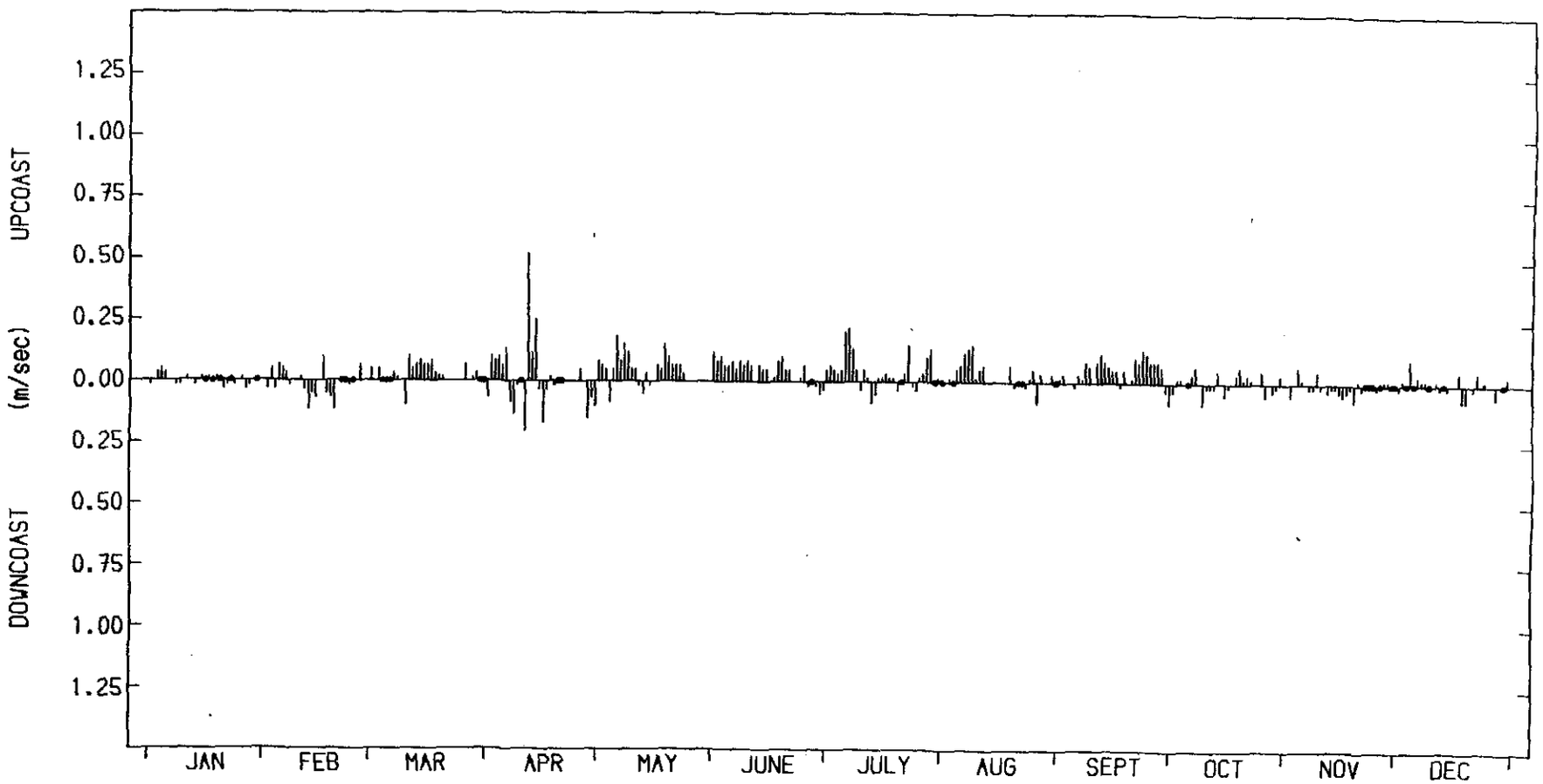
COPE Hull Heads

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1987

Mean Vel = .024 m/sec (up)

Mean Upcoast Vel = .063 m/sec

Mean Downcoast Vel = .044 m/sec

MORNING OBSERVATIONS - (290 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-MORNING 1987

COPE
Hull Heads

Figure
41
C 26.1

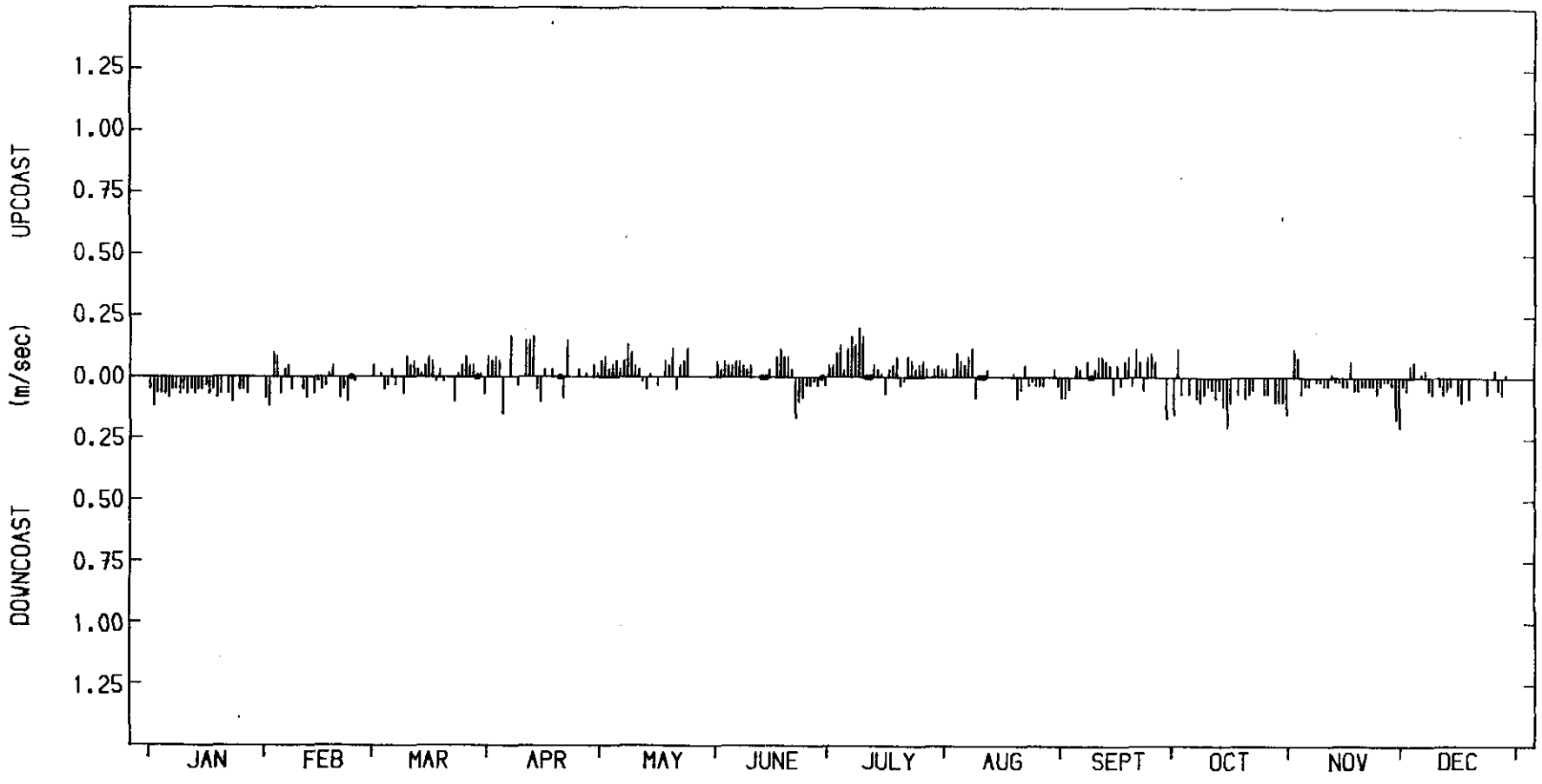
HARBOURS MARINE

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1987

Mean Vel = .000 m/sec (down)

Mean Upcoast Vel = .065 m/sec

Mean Downcoast Vel = .061 m/sec

AFTERNOON OBSERVATIONS - (293 recordings)

Beach Protection Authority Queensland

LITTORAL CURRENTS-AFTERNOON 1987

HARBOURS MARINE Consultancy

COPE
Hull Heads

Figure 42
C 26.1

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

LITTORAL CURRENT SUMMARY - 1988

Mean Vel = .044 m/sec (up)

Mean Upcoast Vel = .063 m/sec

Mean Downcoast Vel = .046 m/sec

MORNING OBSERVATIONS - (281 recordings)

Beach Protection Authority
Queensland

LITTORAL CURRENTS-MORNING 1988

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

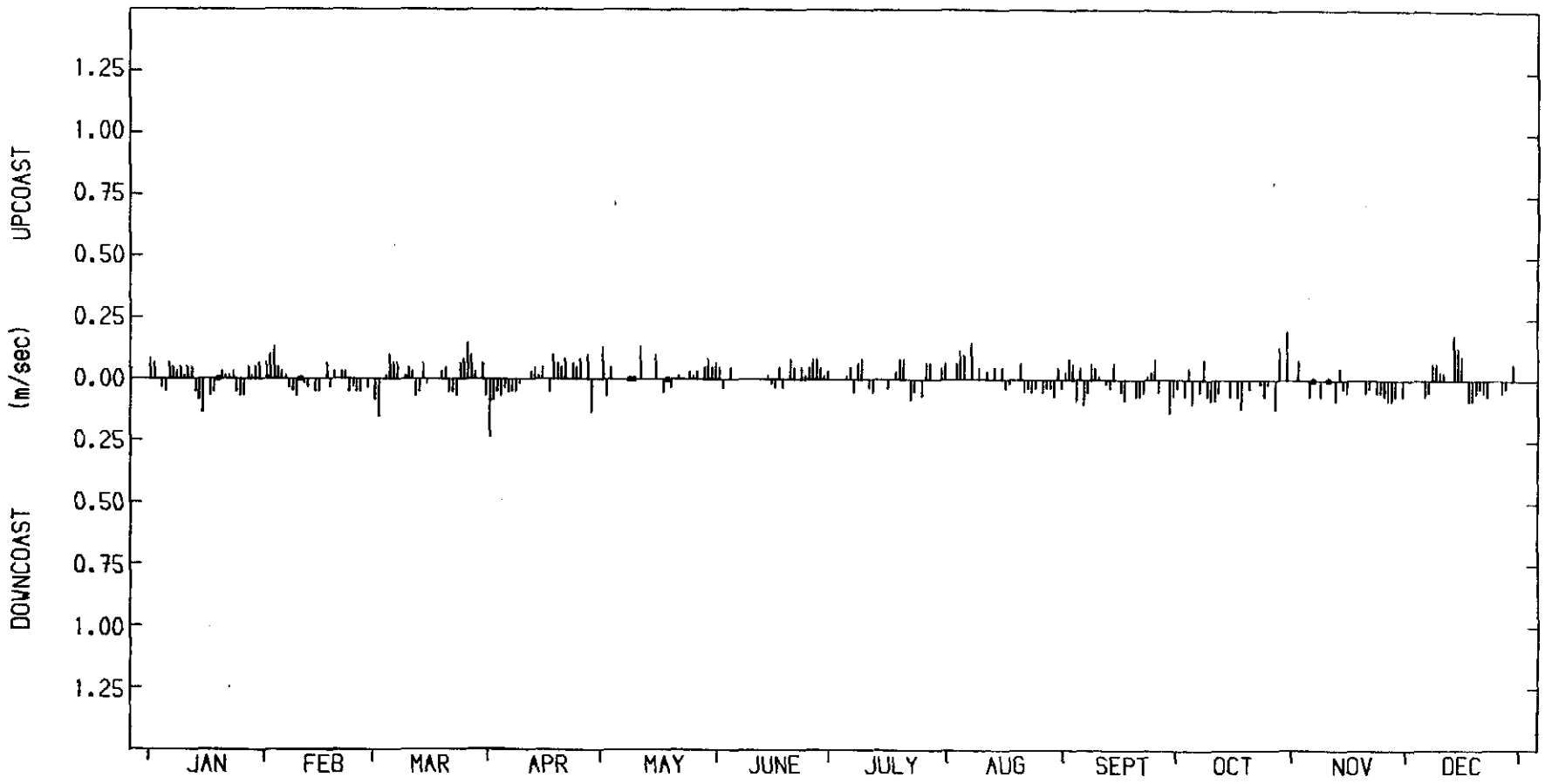
LITTORAL CURRENTS-AFTERNOON 1988

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702



LITTORAL CURRENT SUMMARY - 1988

Mean Vel = .003 m/sec (up)

Mean Upcoast Vel = .061 m/sec

Mean Downcoast Vel = .058 m/sec

AFTERNOON OBSERVATIONS - (255 recordings)

HARBOURS MARINE

COPE
Hull Heads

Figure
44
C 26.1

Beach Protection Authority
Queensland

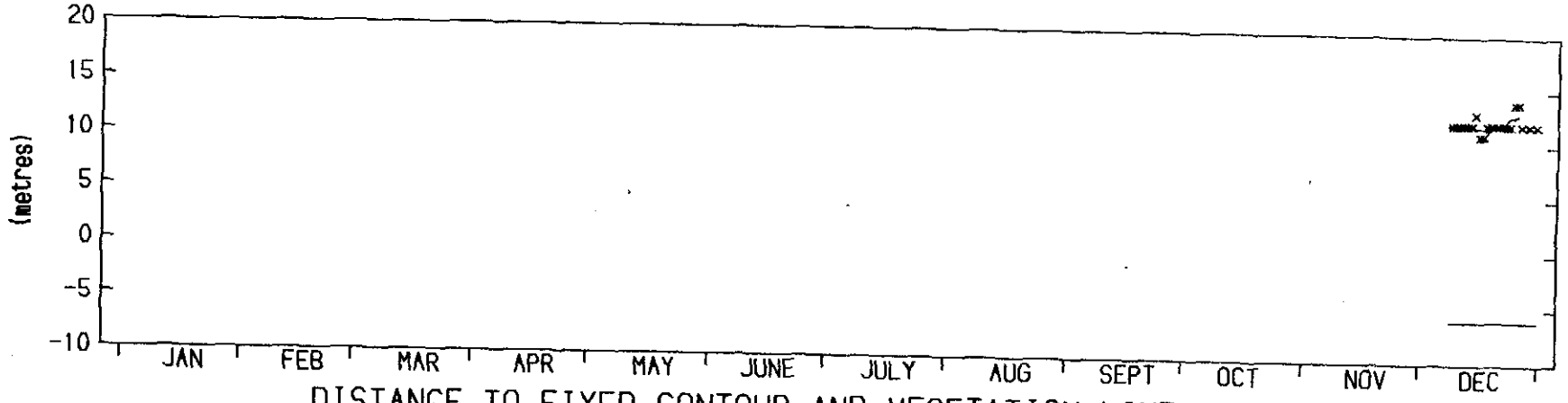
BEACH PROFILE PARAMETERS-1979

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

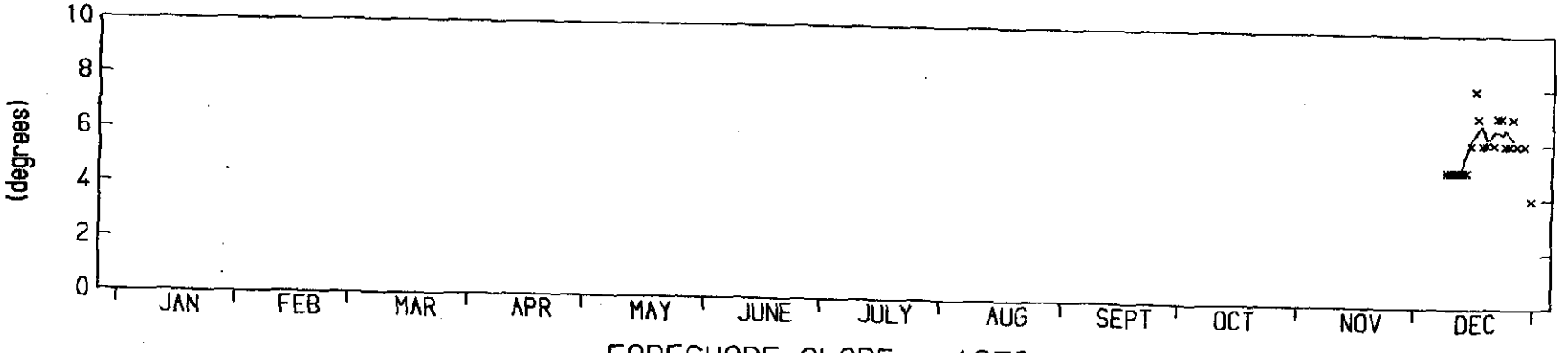


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1979

×××× Indicates Distance to Fixed Contour : 20 Observations

— Indicates Distance to Vegetation Line : 23 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1979

Five Day Moving Average

No. of Observations : 20

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

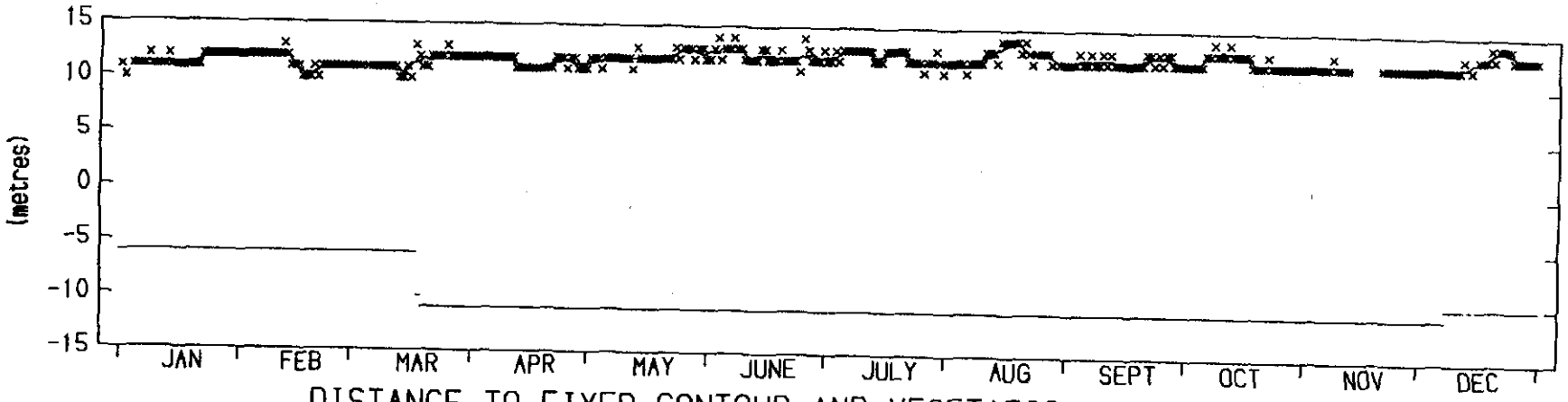
BEACH PROFILE PARAMETERS-1980

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

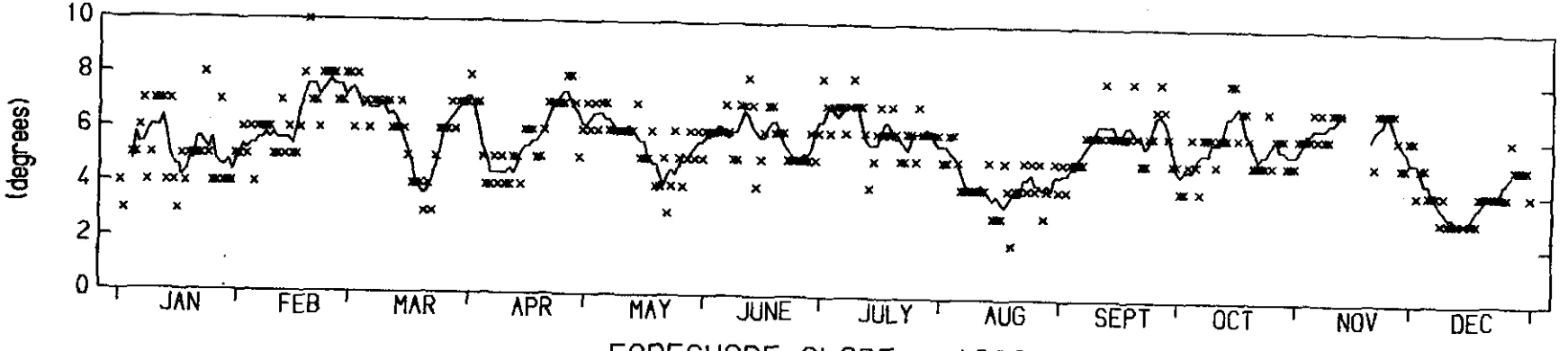


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1980

xxxxx Indicates Distance to Fixed Contour : 353 Observations

— Indicates Distance to Vegetation Line : 364 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1980

Five Day Moving Average

No. of Observations : 352

COPE
Hull Heads

Figure
46
C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

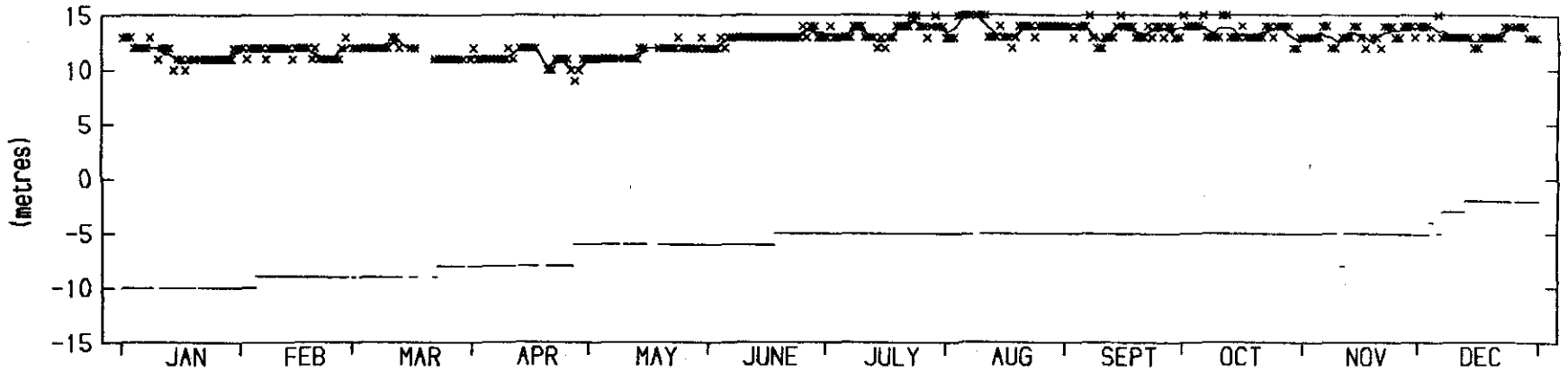
BEACH PROFILE PARAMETERS - 1981

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

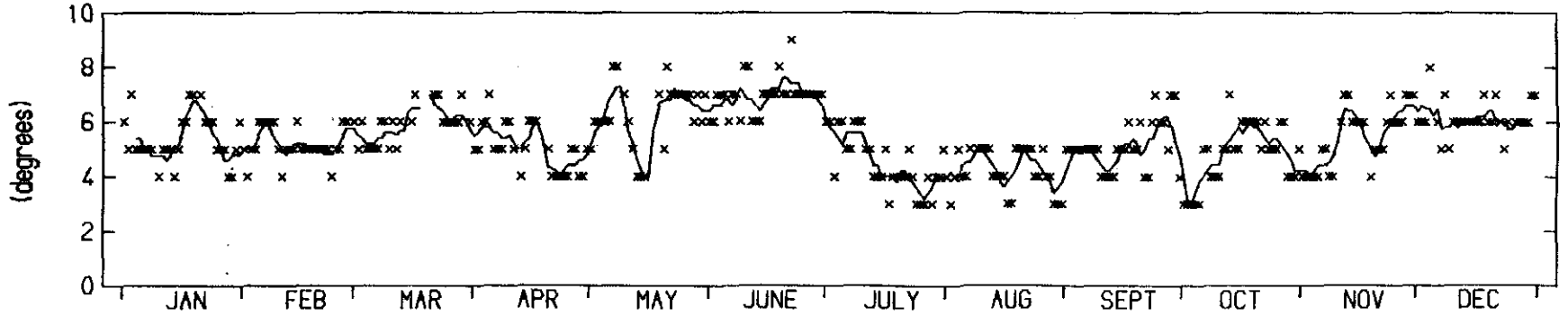


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1981

xxxxx Indicates Distance to Fixed Contour : 344 Observations

— Indicates Distance to Vegetation Line : 342 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1981

Five Day Moving Average

No. of Observations : 344

HARBOURS MARINE

Figure 47 C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

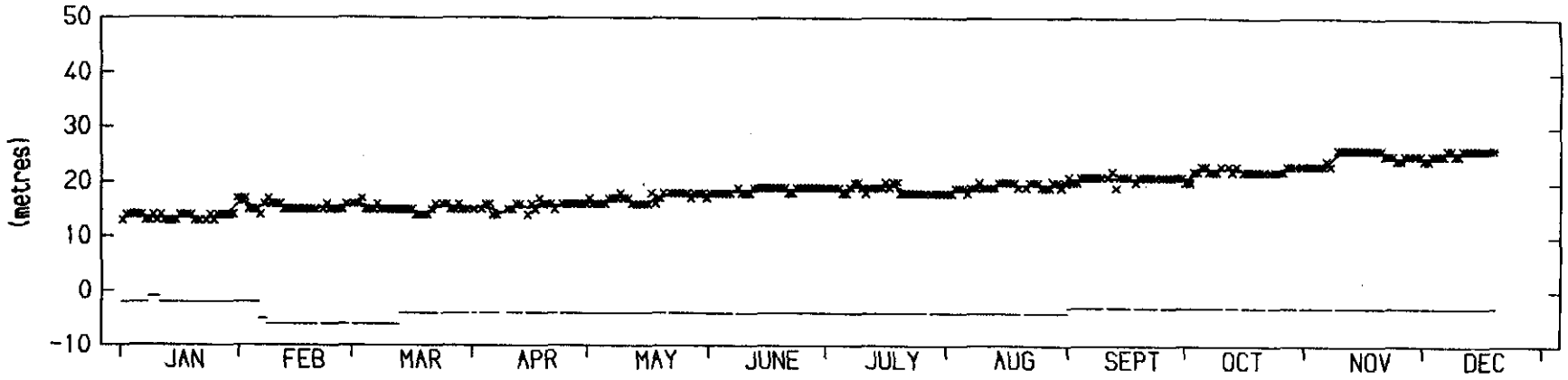
BEACH PROFILE PARAMETERS — 1982

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

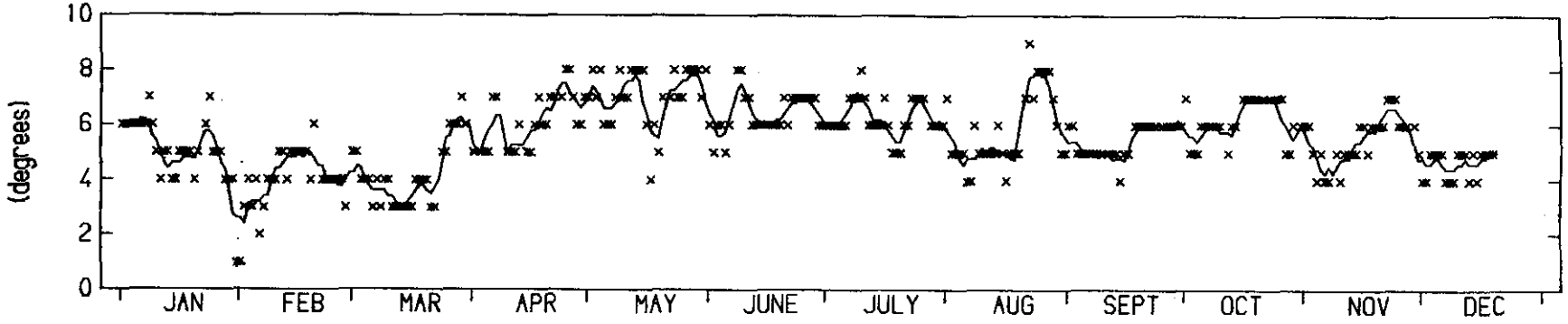


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1982

xxxxx Indicates Distance to Fixed Contour : 331 Observations

— Indicates Distance to Vegetation Line : 333 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1982

Five Day Moving Average

No. of Observations : 331

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

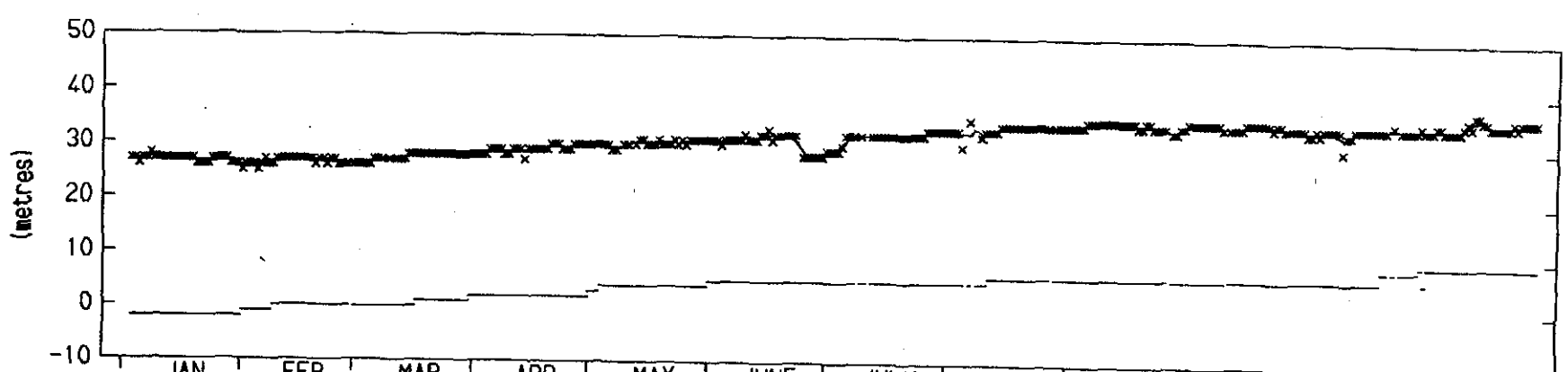
BEACH PROFILE PARAMETERS — 1983

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

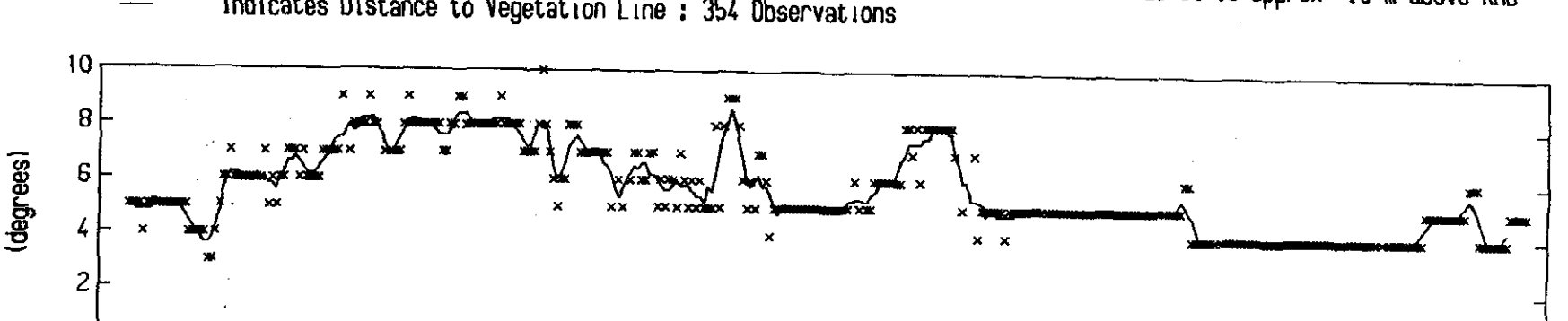


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1983

xxxxx Indicates Distance to Fixed Contour : 347 Observations

— Indicates Distance to Vegetation Line : 354 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1983

Five Day Moving Average

No. of Observations : 349

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

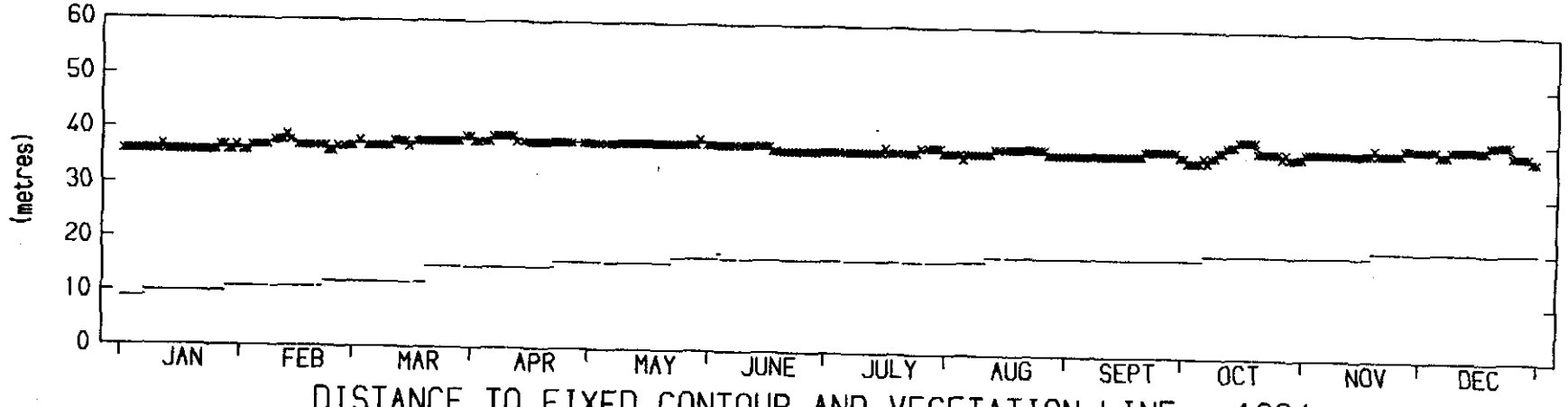
BEACH PROFILE PARAMETERS – 1984

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

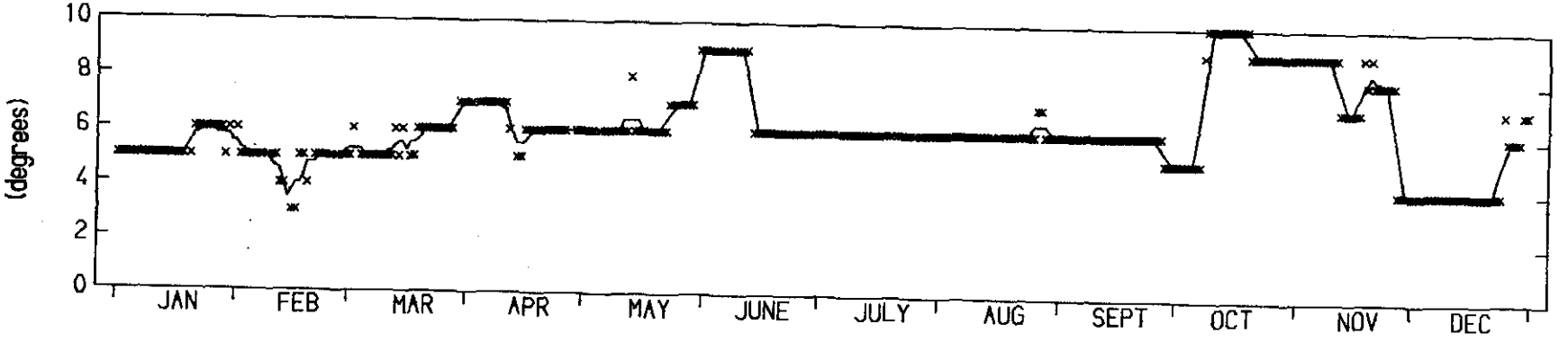


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1984

xxxxx Indicates Distance to Fixed Contour : 344 Observations

— Indicates Distance to Vegetation Line : 356 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1984

Five Day Moving Average

No. of Observations : 345

HARBOURS MARINE

COPE
Hull Heads
Figure
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C 26.1

Beach Protection Authority
Queensland

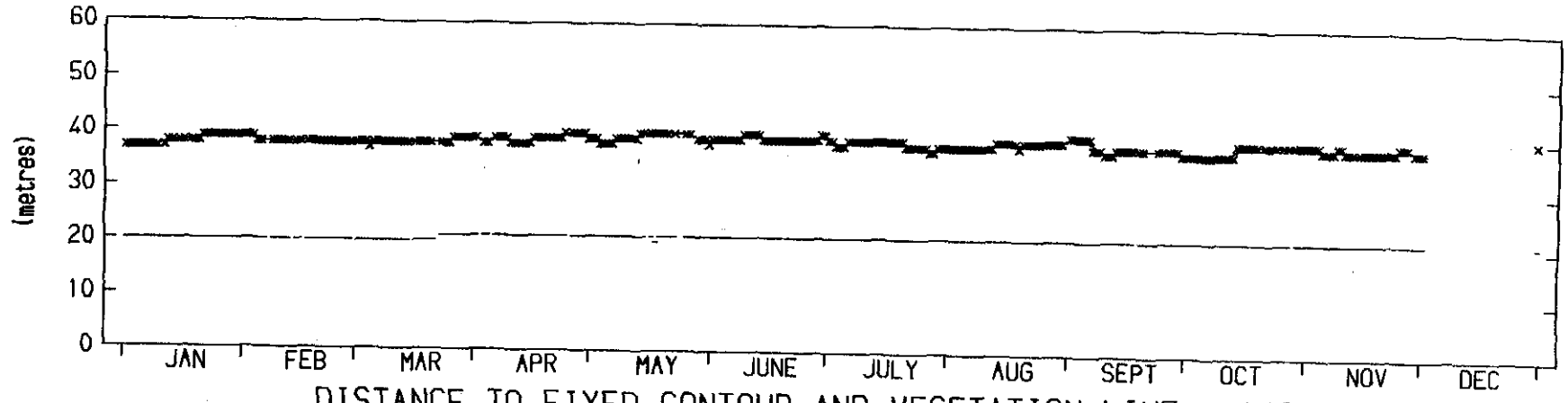
BEACH PROFILE PARAMETERS – 1985

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

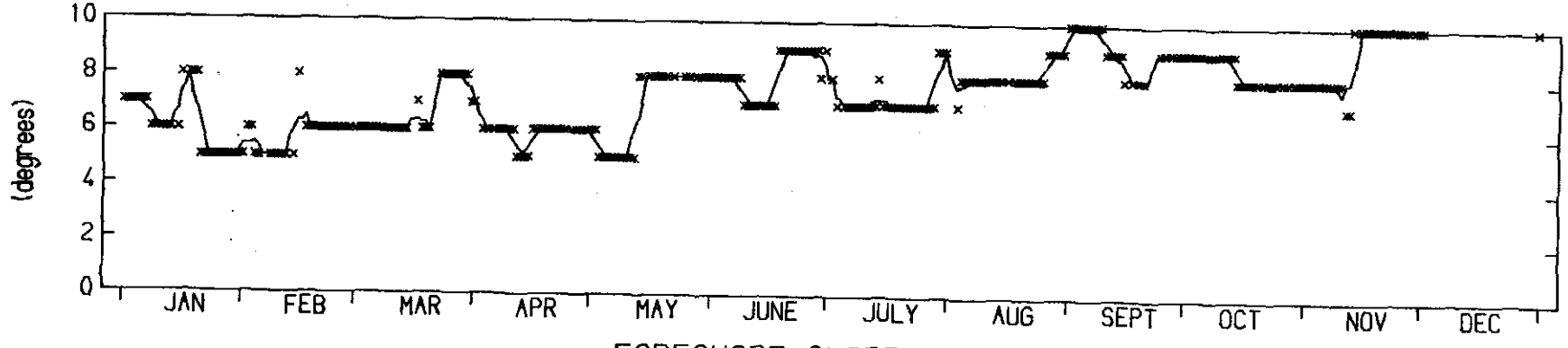


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1985

xxxxx Indicates Distance to Fixed Contour : 307 Observations

— Indicates Distance to Vegetation Line : 323 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1985

Five Day Moving Average

No. of Observations : 299

HARBOURS MARINE Consultancy

Figure 51 C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

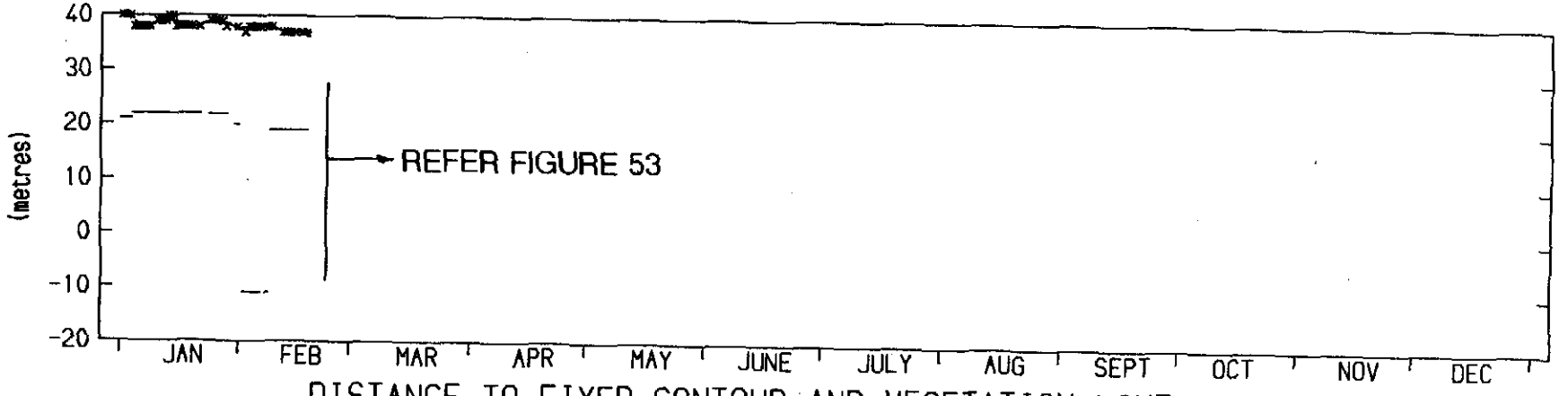
BEACH PROFILE PARAMETERS — 1986

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

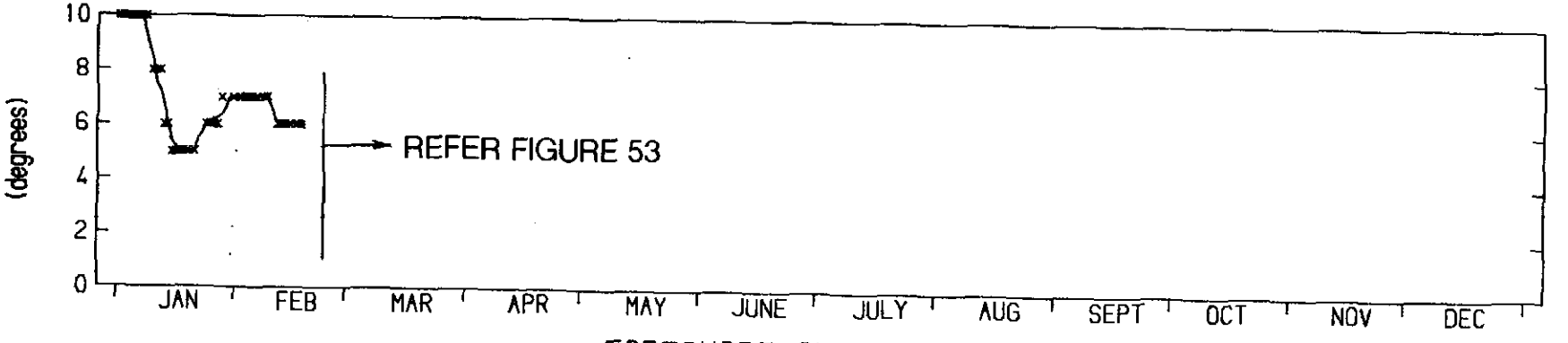


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1986

xxxxx Indicates Distance to Fixed Contour : 38 Observations

— Indicates Distance to Vegetation Line : 43 Observations

Fixed Contour Level is approx .3 m above AHD



FORESHORE SLOPE - 1986

Five Day Moving Average

No. of Observations : 38

HARBOURS MARINE

Figure 52
C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

BEACH PROFILE PARAMETERS - 1986

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1986

xxxxx Indicates Distance to Fixed Contour : 229 Observations

— Indicates Distance to Vegetation Line : 287 Observations

Fixed Contour Level is approx .3 m above AHD

SAND LEVEL AT POLE - 1986

Five Day Moving Average

No. of Observations : 287

HARBOURS MARINE

Figure 53 C 26.1

COPE
Hull Heads

Beach Protection Authority
Queensland

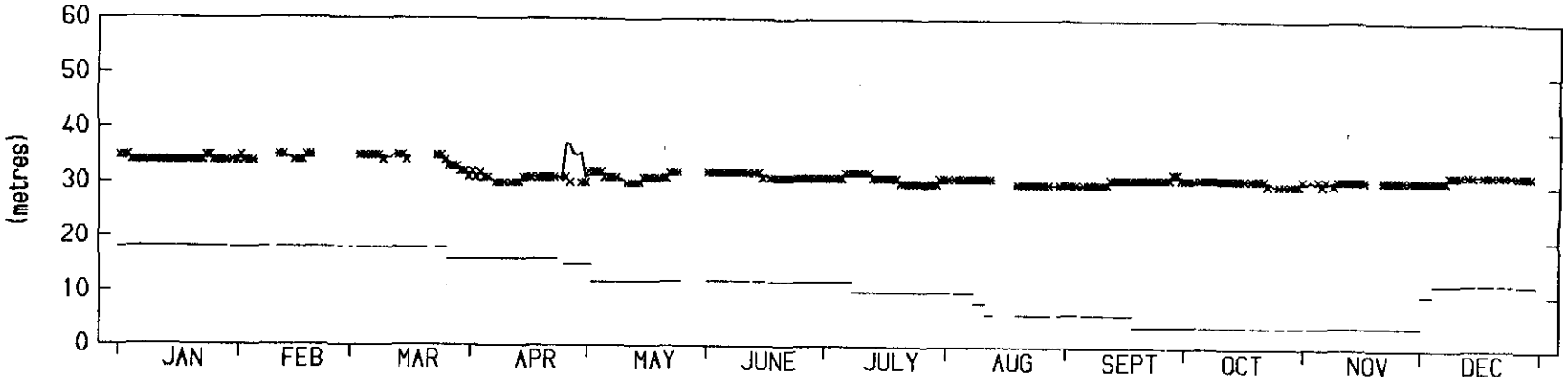
BEACH PROFILE PARAMETERS - 1987

COPE - Coastal Observation
Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

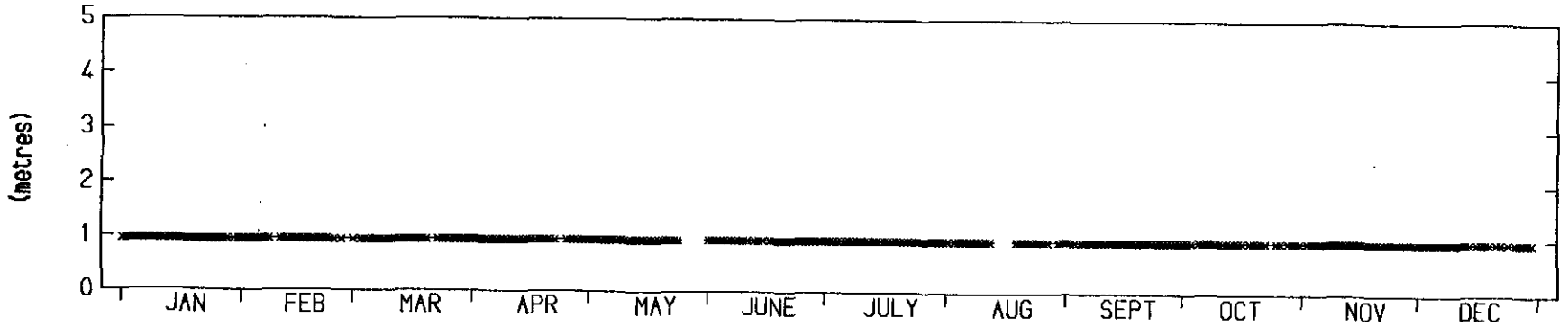


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1987

xxxxx Indicates Distance to Fixed Contour : 286 Observations

—— Indicates Distance to Vegetation Line : 325 Observations

Fixed Contour Level is approx .3 m above AHD



SAND LEVEL AT POLE - 1987

Five Day Moving Average

No. of Observations : 325

COPE
Hull Heads

Figure
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C 26.1

HARBOURS MARINE

Beach Protection Authority
Queensland

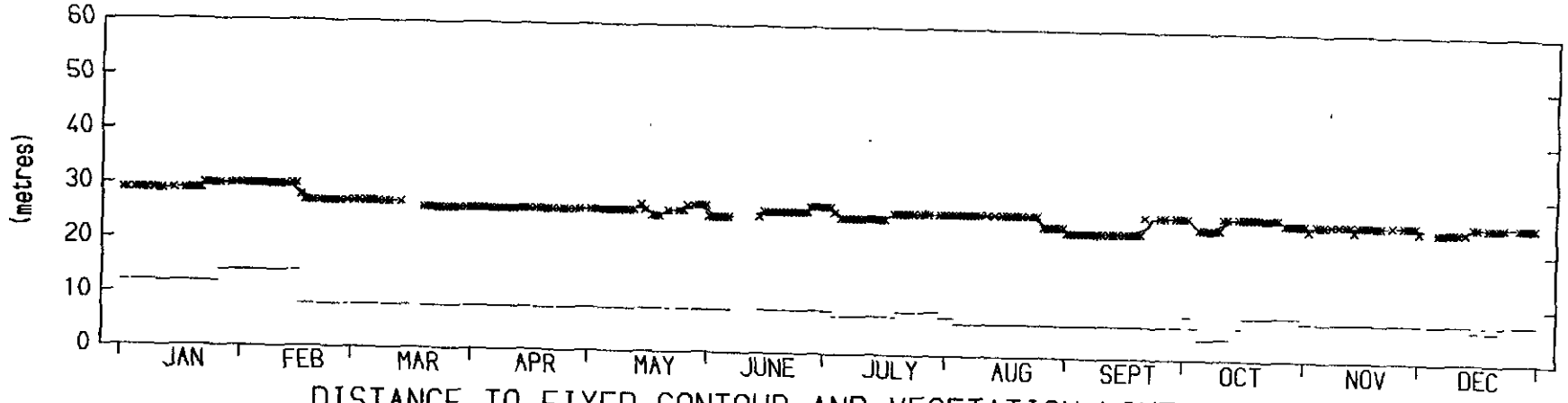
BEACH PROFILE PARAMETERS - 1988

COPE - Coastal Observation Programme Engineering

CARDWELL SHIRE

HULL HEADS

2702

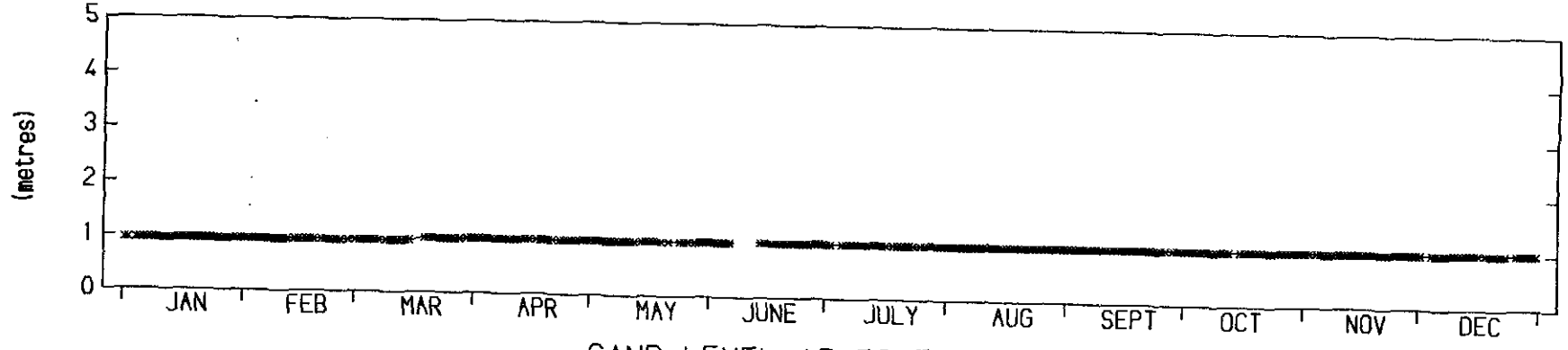


DISTANCE TO FIXED CONTOUR AND VEGETATION LINE - 1988

xxxxx Indicates Distance to Fixed Contour : 284 Observations

— Indicates Distance to Vegetation Line : 330 Observations

Fixed Contour Level is approx .3 m above AHD



SAND LEVEL AT POLE - 1988

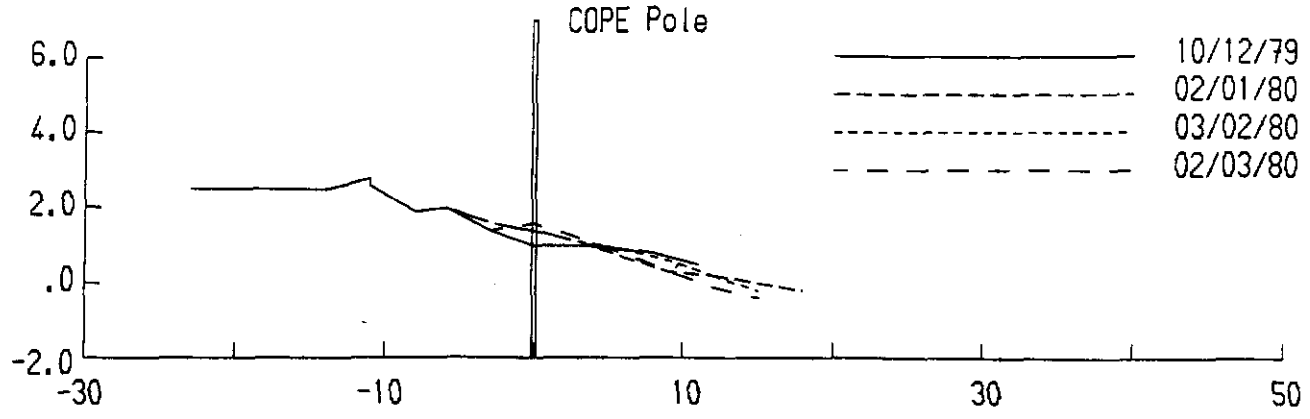
Five Day Moving Average

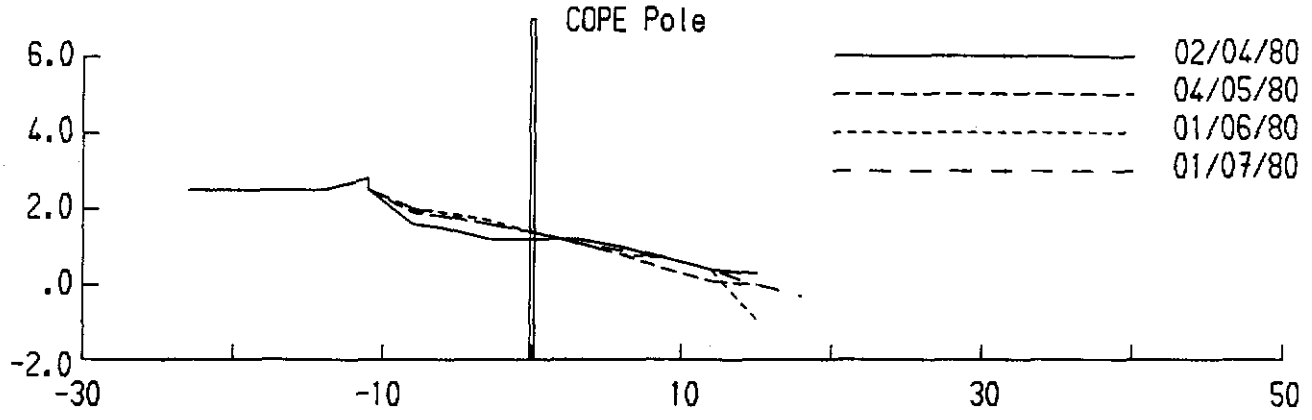
No. of Observations : 329

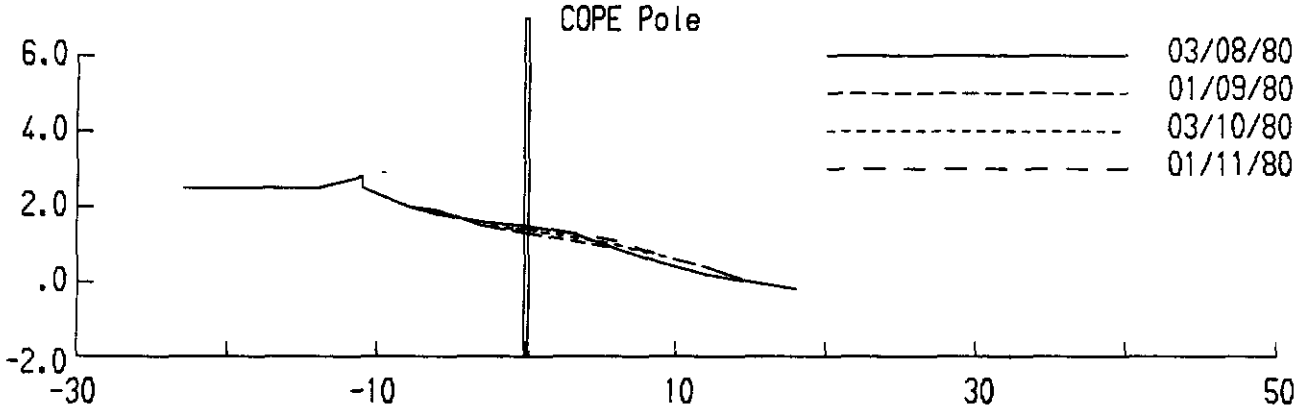
HARBOURS MARINE

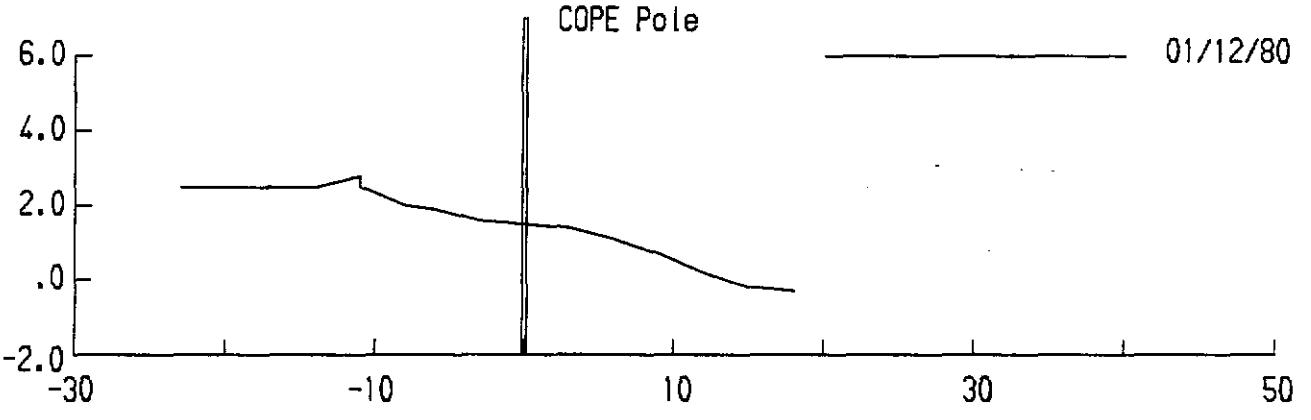
Figure 55 C 26.1

COPE
Hull Heads









Level Datum is 0.402 A.H.D.

Distances and Levels are measured in Metres

Beach Protection Authority
Queensland

MONTHLY BEACH PROFILES

COPE
Hull Heads

Figure
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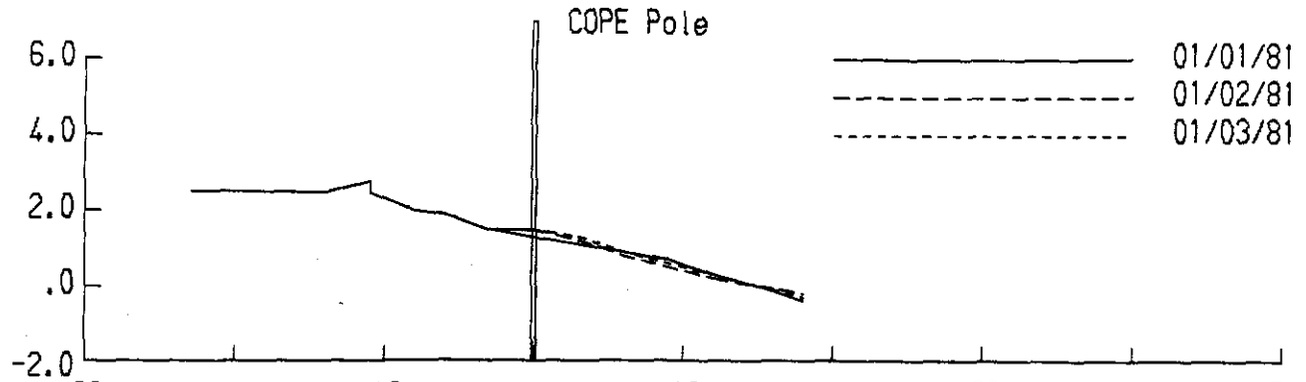
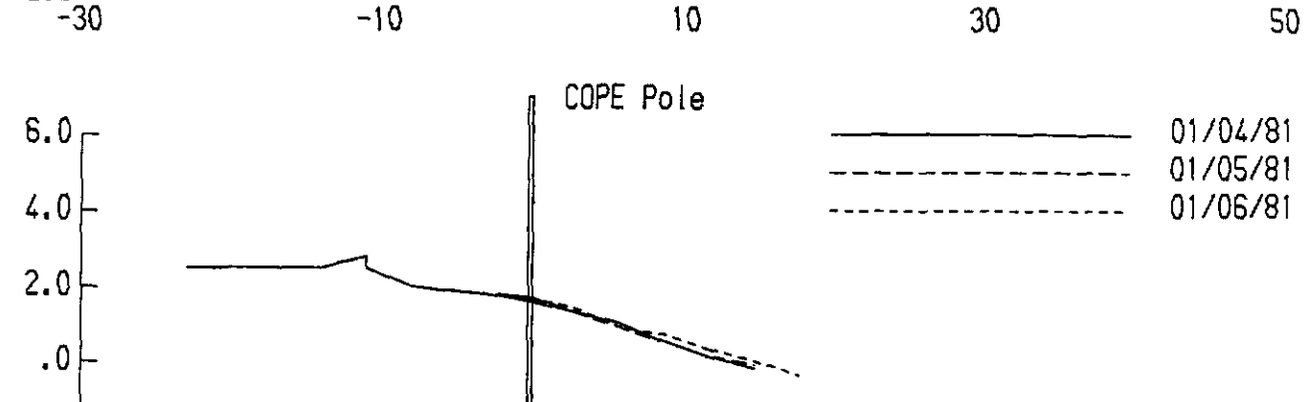
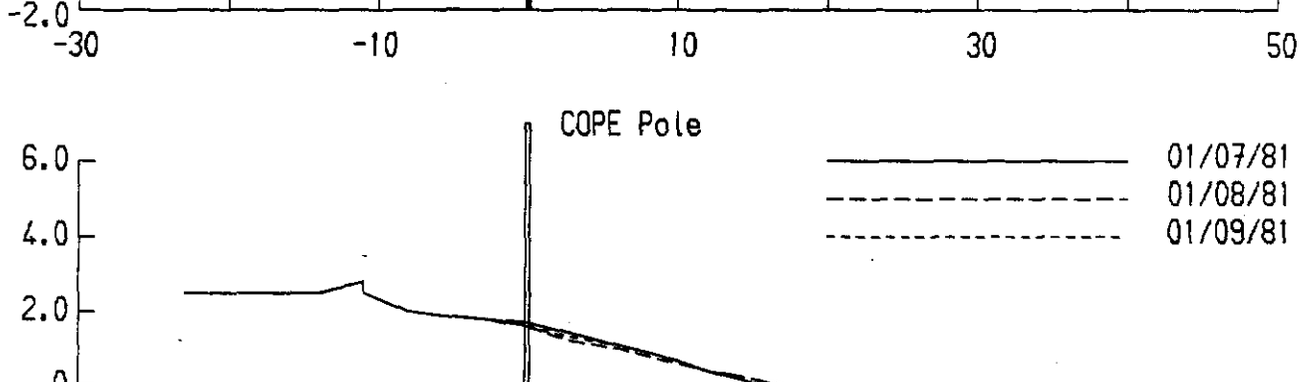
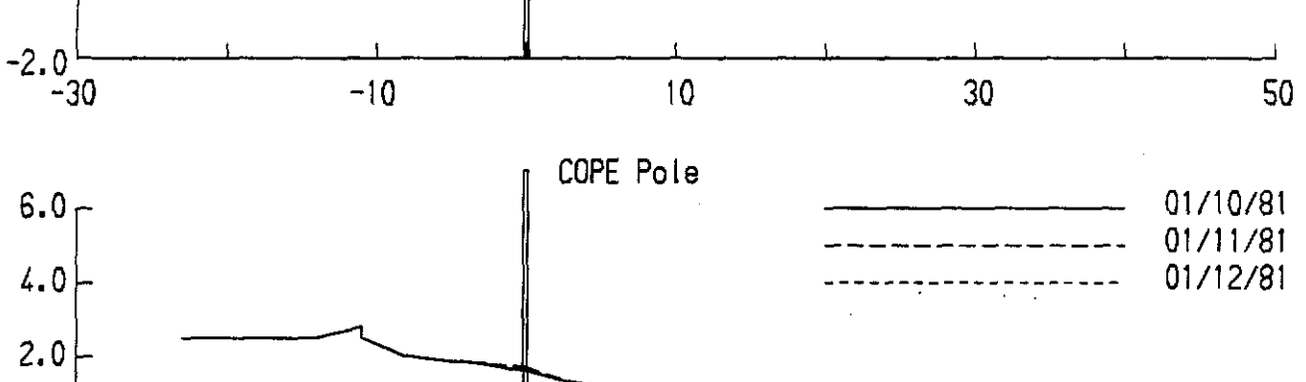
C 26.1

HARBOURS MARINE









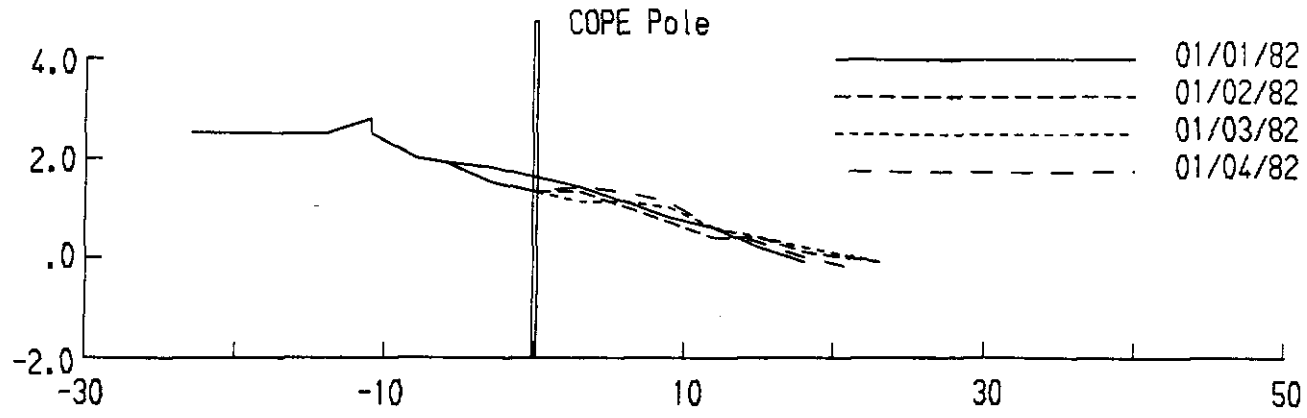
Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

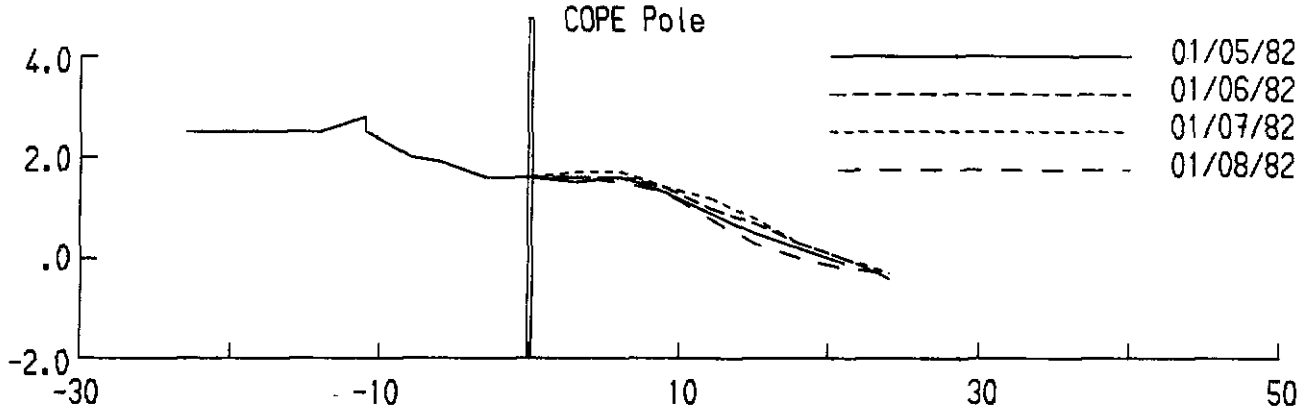
Beach Protection Authority
Queensland

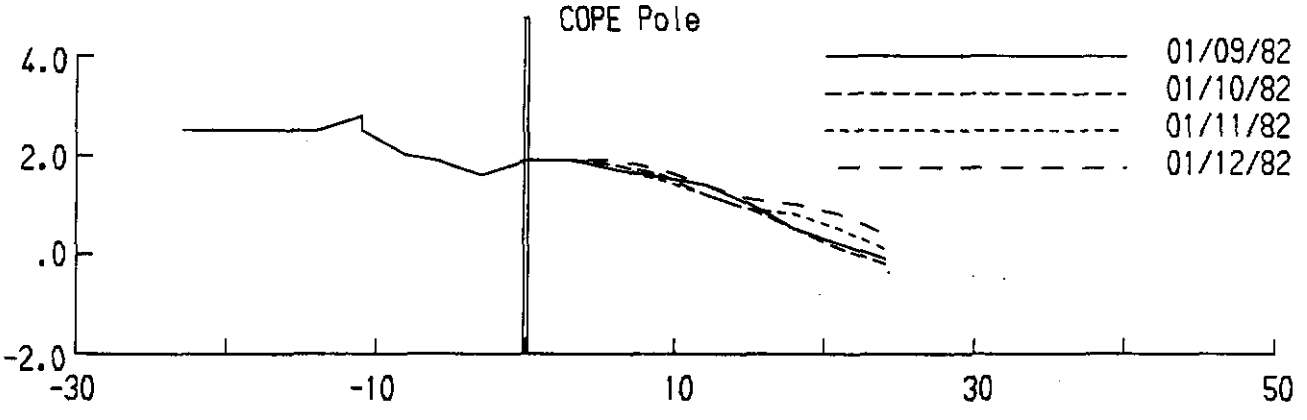
MONTHLY BEACH PROFILES

COPE
Hull Heads
Figure
57
C 26.1

HARBOURS MARINE







Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

Beach Protection Authority
Queensland

MONTHLY BEACH PROFILES

COPE
Hull Heads
Figure
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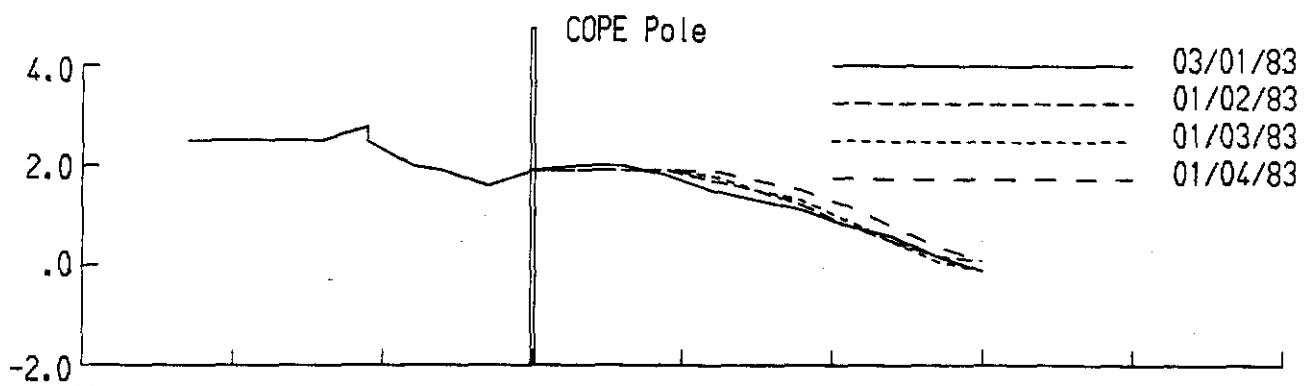
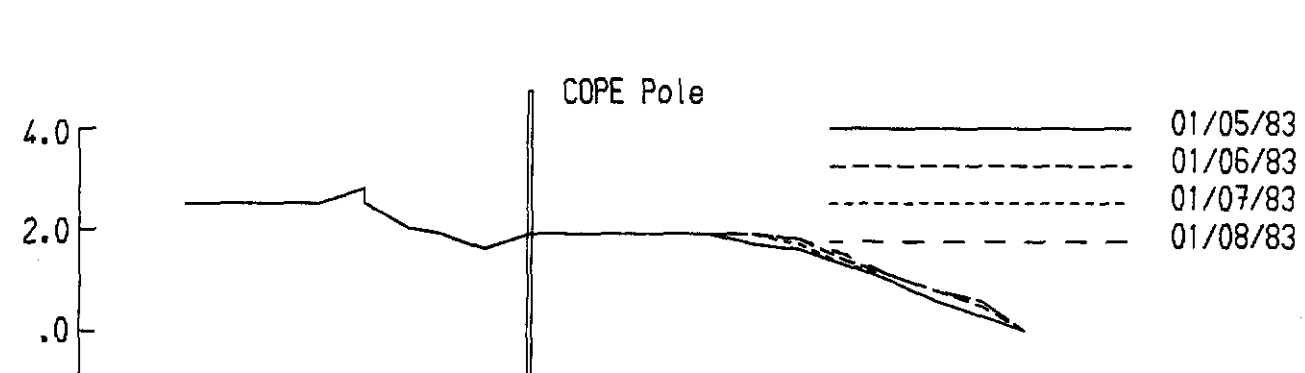
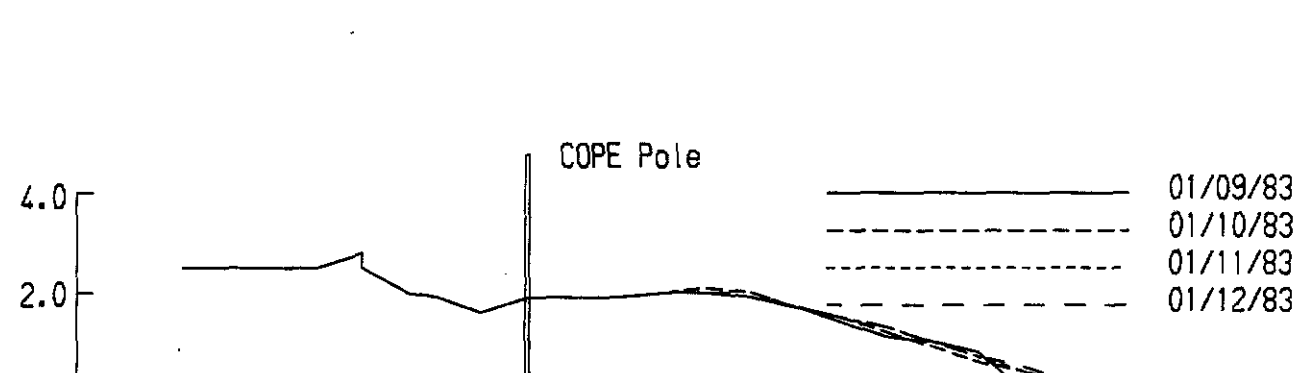
C 26.1

HARBOURS MARINE







Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

Beach Protection Authority
Queensland

MONTHLY BEACH PROFILES

COPE
Hull Heads
Figure
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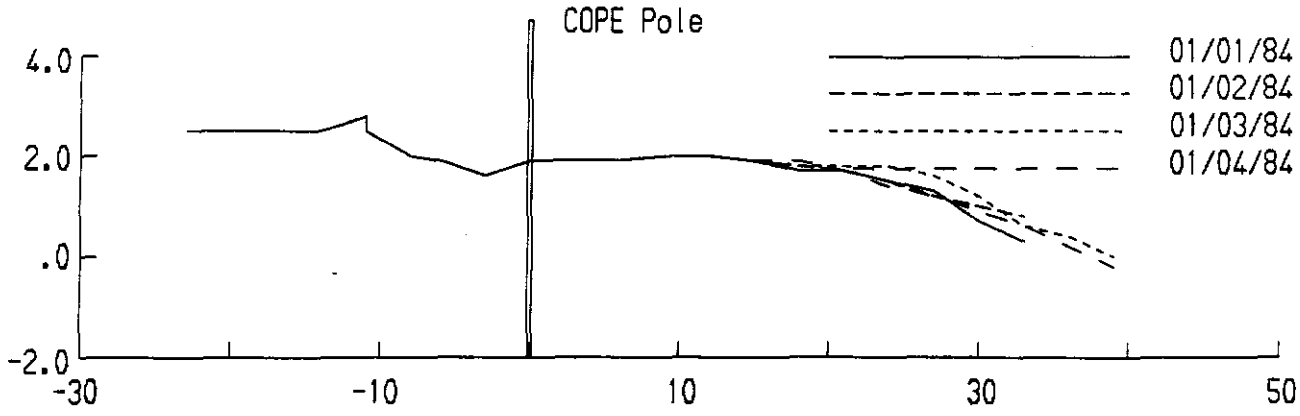
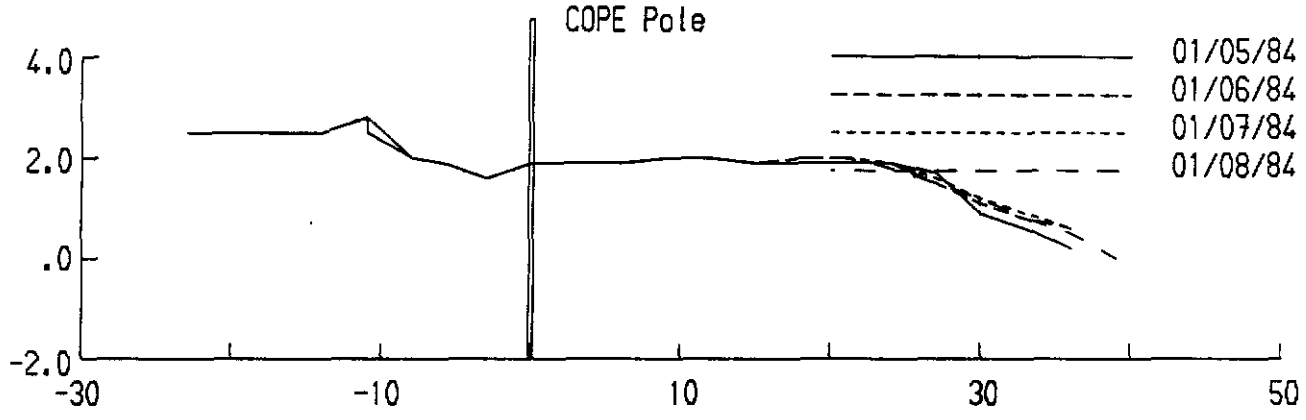
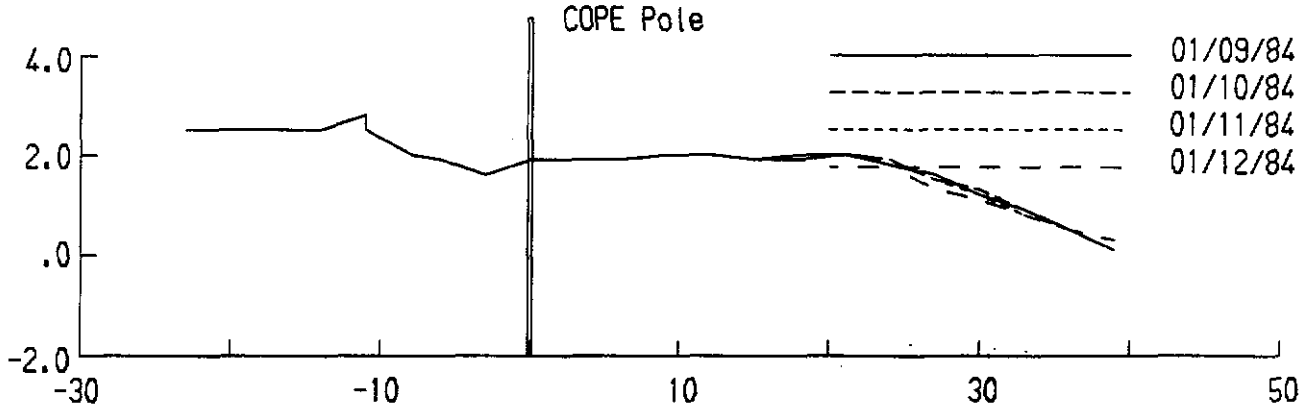
C 26.1

HARBOURS MARINE







Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

Beach Protection Authority
Queensland

MONTHLY BEACH PROFILES

COPE
Hull Heads
Figure
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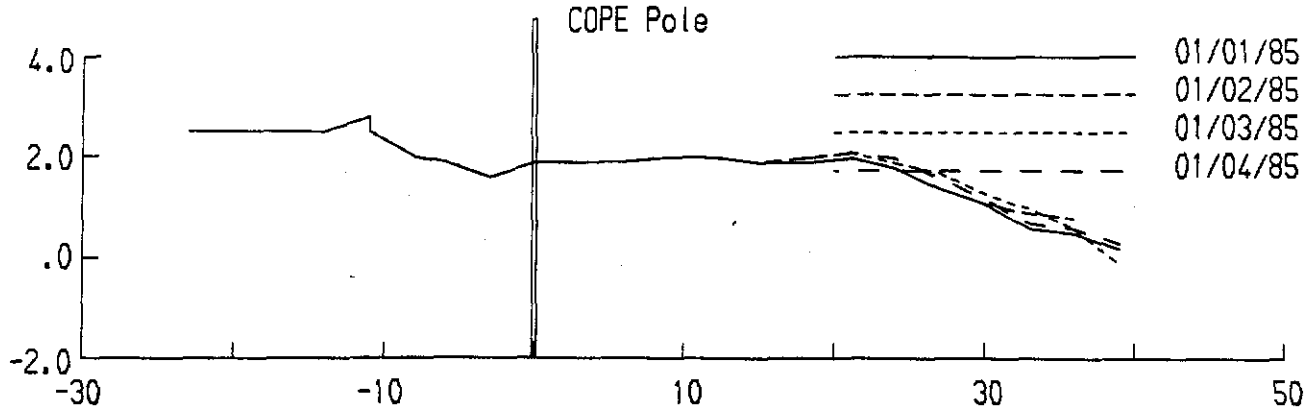
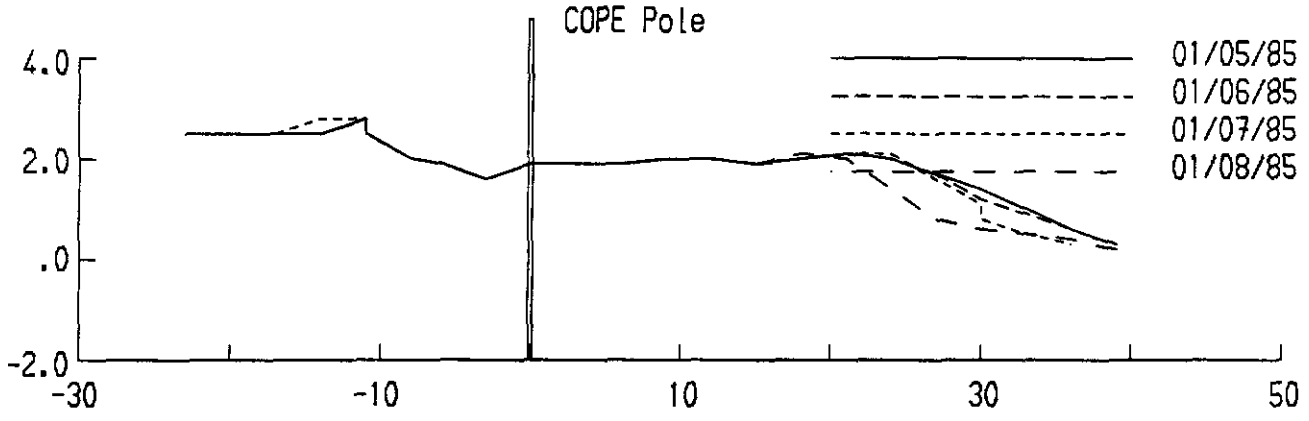
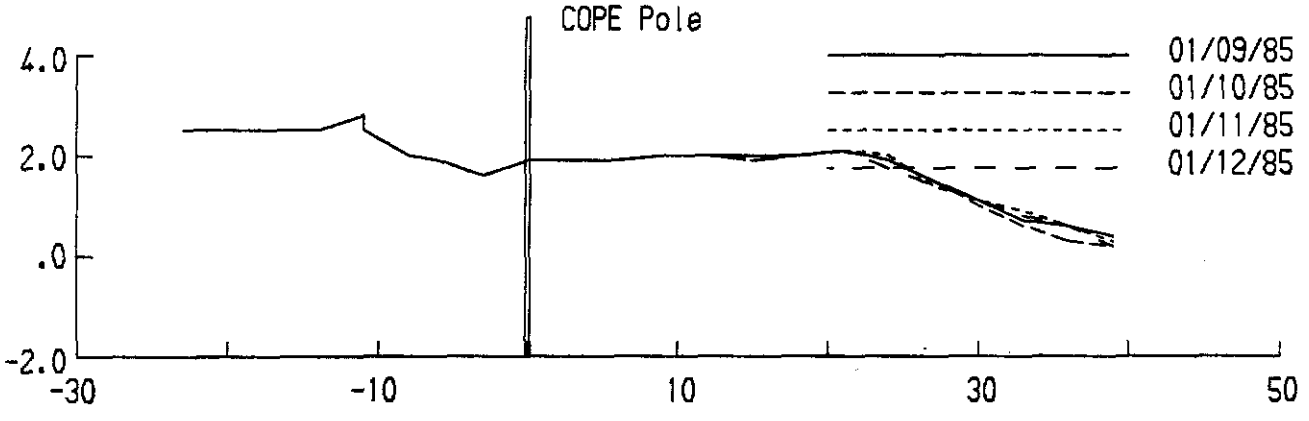
HARBOURS MARINE







Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

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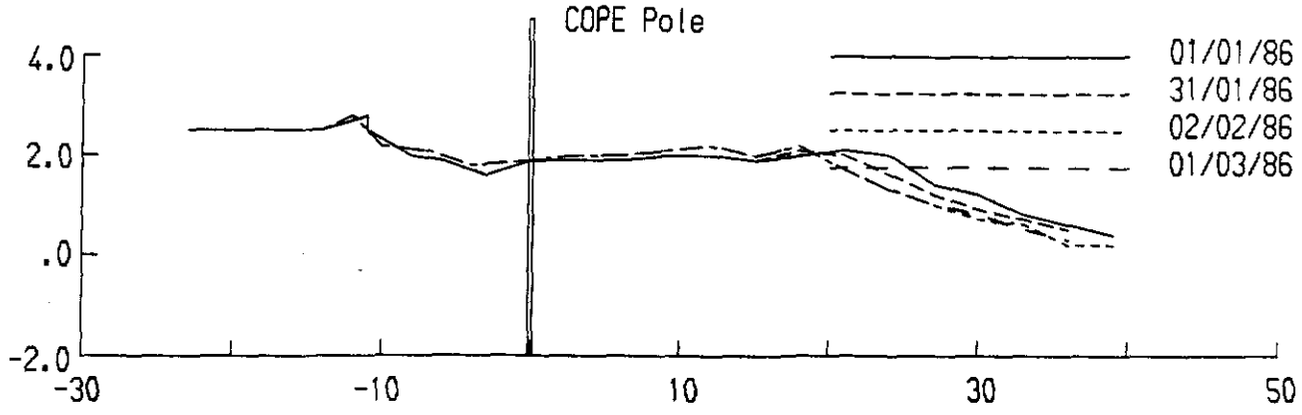

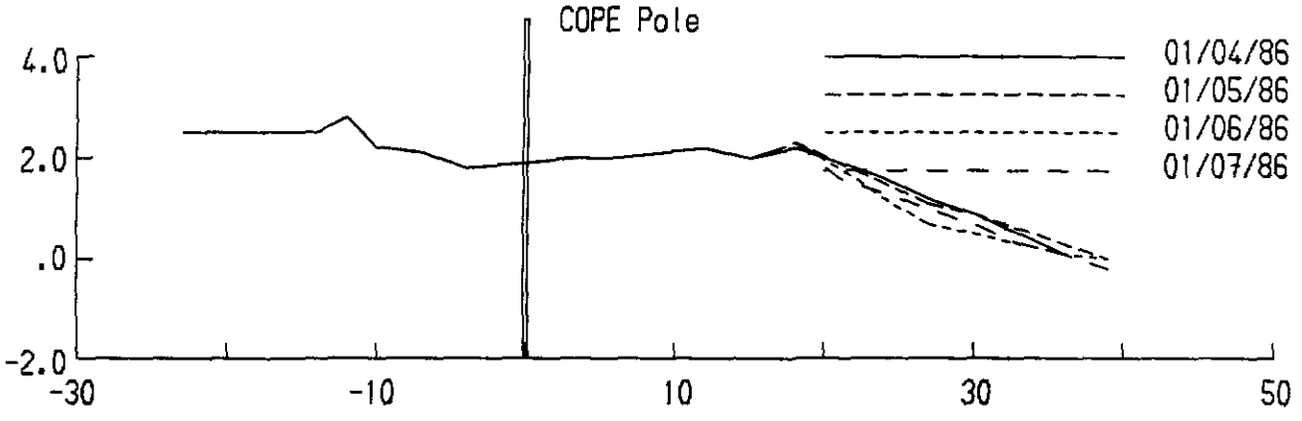

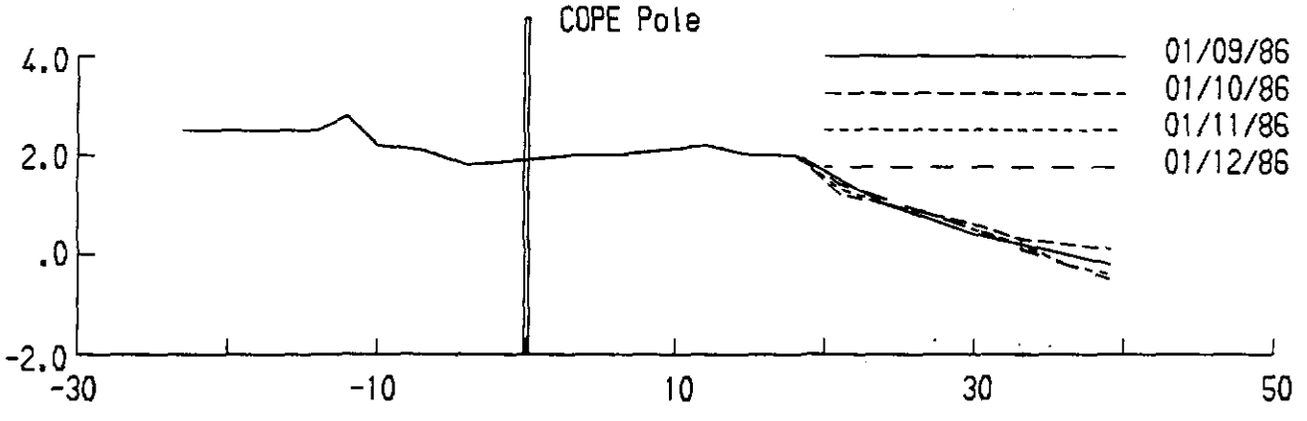

Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

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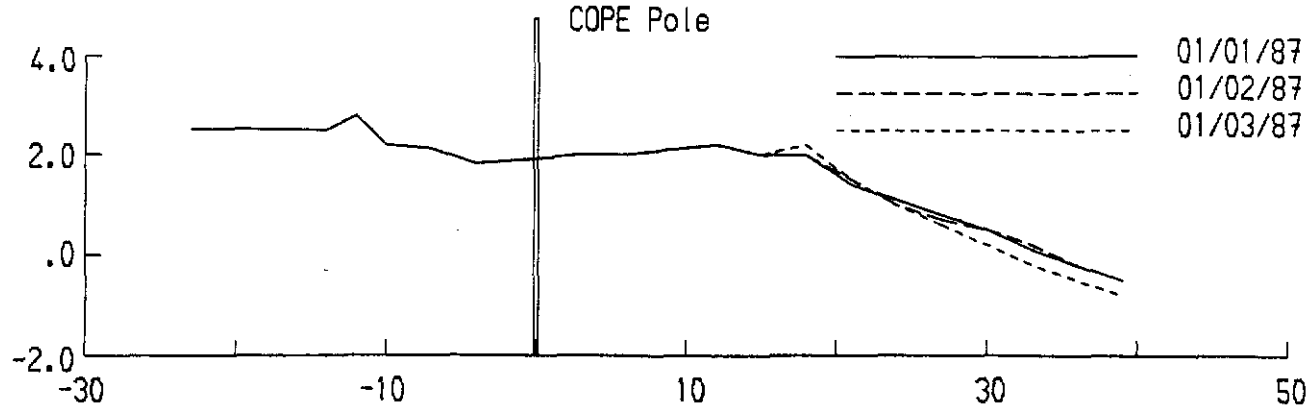

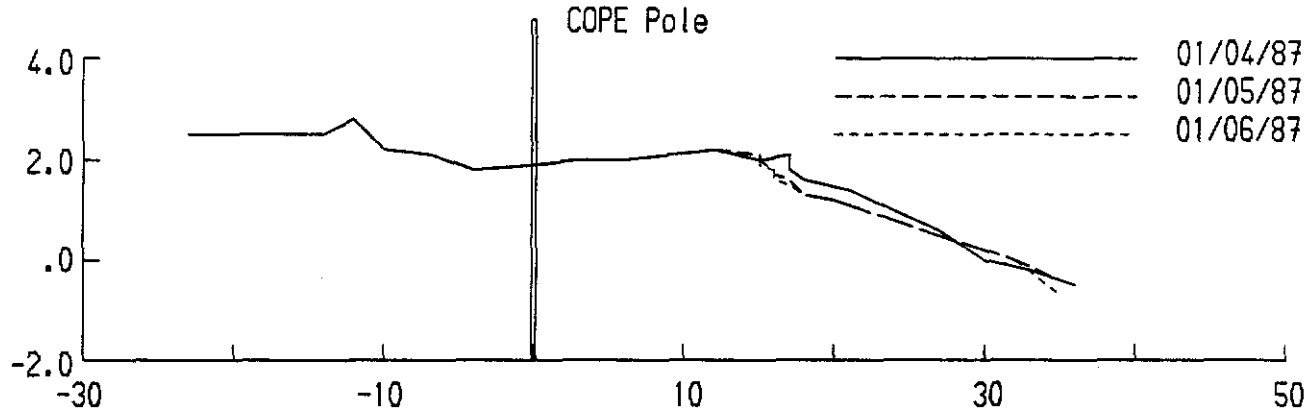

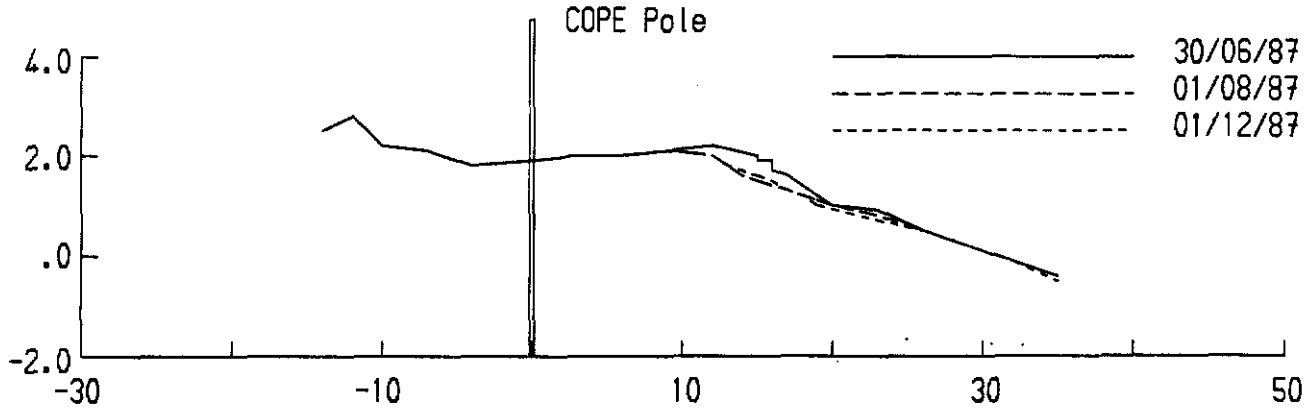

Level Datum is 0.402 A.H.D. Distances and Levels are measured in Metres

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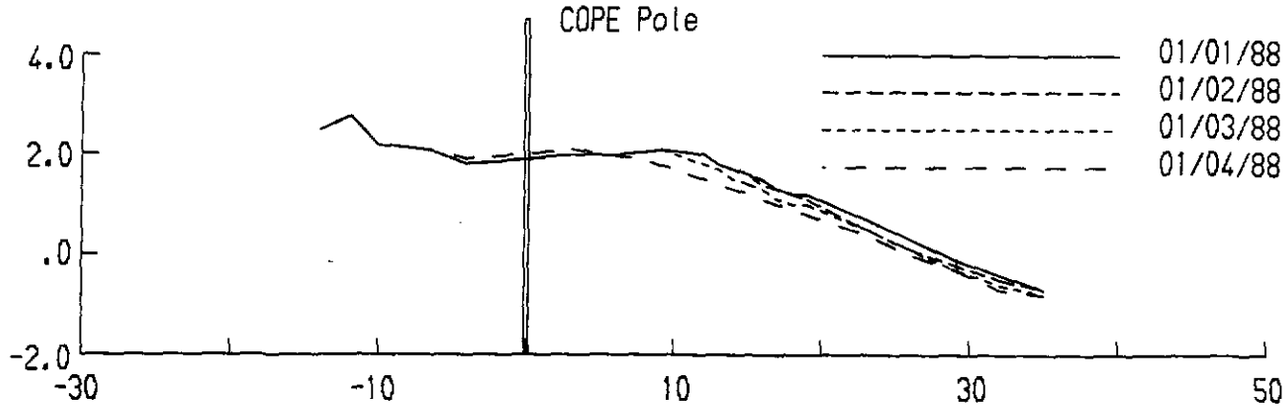

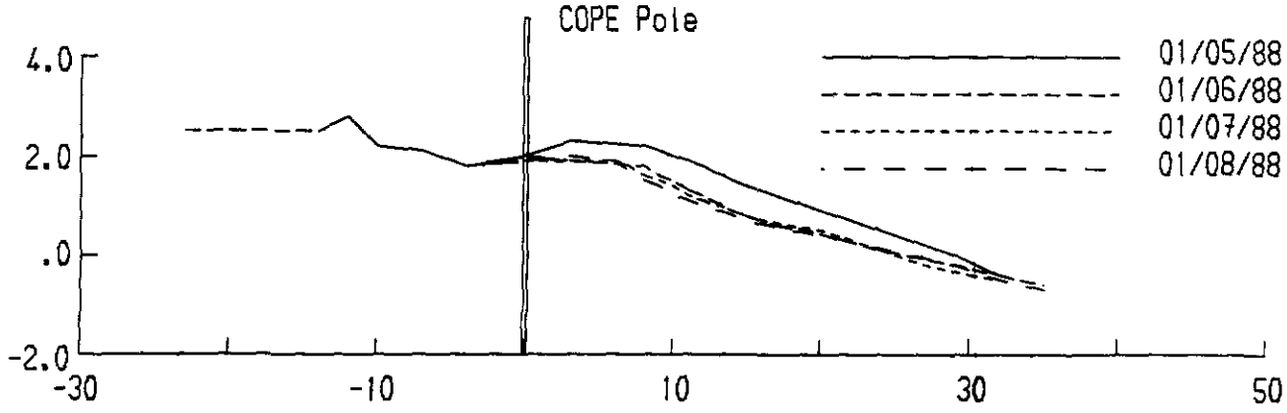

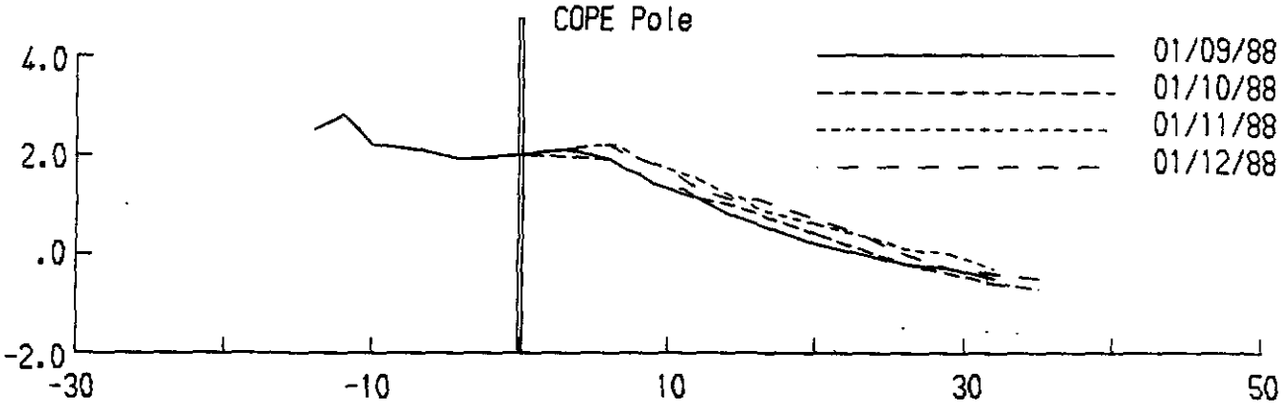

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