APPENDIX A
METOCEAN SOLUTIONS DATA REPORT - *1060* TRIALS

SEASCAN BOAT WAKE SURVEY

Data Report

Prepared for Pacific International Engineering

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Report Status

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1 INTRODUCTION

Pacific International Engineering (PIE) has recently undertaken testing with the Teknicraft vessel *Ten sixty* to produce wake and vessel performance data. The measurements were to test the effects of foil aspect on the wake wash performance over a range of speeds to determine the benefits of an adjustable foil design for wake generation performance and in improving wake performance efficiency. PIE engaged the services of MetOcean Solutions Ltd to undertake instrument deployment, data collection and production of time series plots for the experiments. This report provides information on the preparation, programming, deployment and recovery of data from the oceanographic instrumentation, including time series plots of the results. The full data record, including the raw and processed time-series data, are provided on the CD in the appendix to this report.

2 METHODS

2.1 Location

The chosen location for the wake testing with *Ten Sixty was* at the north end of the Waiheke Channel between Waiheke and Pakatoa Island (Pakatoa Channel) (Figure 1). The area was chosen by PIE for its relative shelter from predominant winds the appropriate depths. The depths found throughout the channel were also similar to the depths from the trials run with *Spirit* in Port Orchard Reach in 2005. The boat run line and the final mooring positions are presented in Table 1. The start and end of line was used only as a measure for boat track, the length of the run into the track line was ultimately determined by boat speed, with a greater run-in required to attain and maintain the required speeds in the higher end of the testing range.

The two sensor moorings were positioned perpendicular to the run-line (to the southeast) to record the vessel wake and the ambient currents. The first mooring was positioned in 30 m water depth at 100 m off the run line. The second mooring was in 20 m depth and 200 m off the run line.

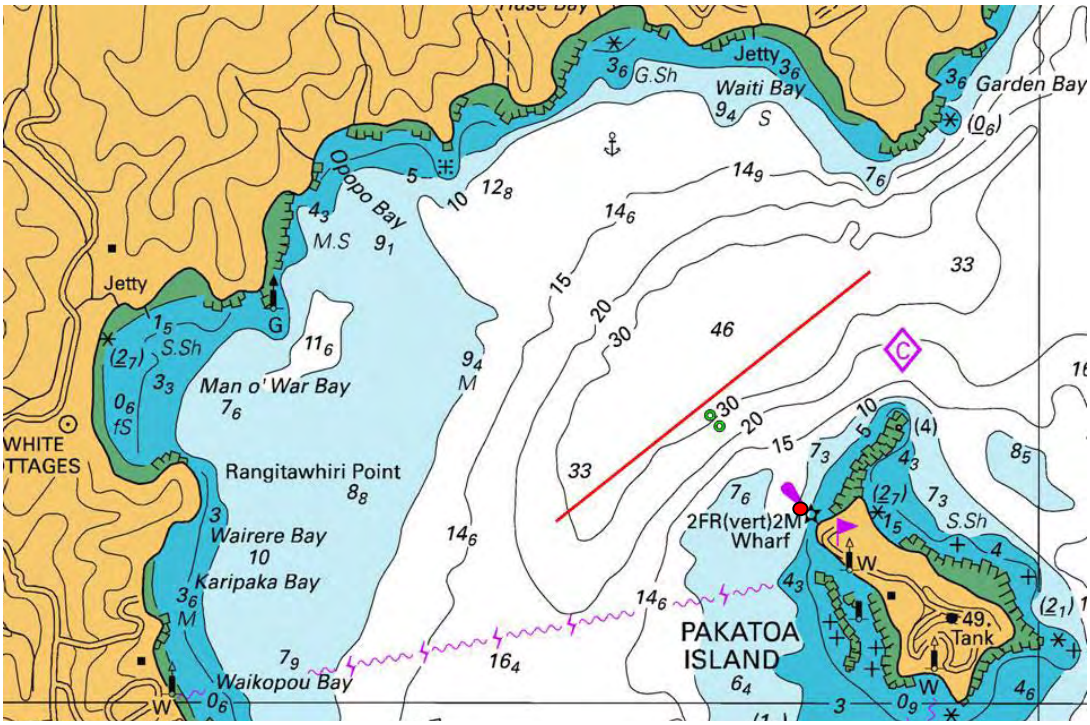


Figure 1 North end of Waiheke Channel (Pakatoa Channel) showing the area of the wake tests with "Ten Sixty". The red line shows vessel track; green circles show the locations of the 2 wave gauge moorings and red circle shows location of the tide guage.

Table 1 Run line and instrument locations for the experiments

Location	Latitude	Longitude
North end of run line	36° 46.950'	175° 11.600'
South end of run line	36° 47.450'	175° 10.560'
Mooring One (20 meter)	36° 47.384'	175° 11.137'
Mooring Two (30 Meter)	36° 47.338'	175° 11.090'
Tide gauge	36° 47.576'	175° 11.347'

2.2 Instrumentation

MSL deployed several wave, current and tide sensors to measure the vessel wake time series, the ambient wind waves, ambient currents and the varying water levels and current flows over the tidal cycle. All instruments were synchronised to UTC + 12 hours (i.e. NZST) using GPS time prior to deployment. The following oceanographic instruments were used.

RBR XR-620 Sensor: A non-directional wave gauge recording continuous pressure data at 6 Hz. The instrument was positioned horizontally on the 30 m mooring, some 29.1 m above seabed. Downloading and reprogramming was

undertaken at the end of each day's experiments, with redeployment the following morning prior to the commencement of trials.

Nortek Aquadop 1 MHz ADCP: Programmed to record the current profile. Instrument was located on the 30 m mooring line in a horizontal orientation with the sensor head pointing downward. The instrument was positioned 28.3 m above seabed level, recording data at 0.5 m cells and averaging over 1 minute intervals.

RBR TWR-2050 Tide/Wave recorder: A non-directional wave gauge recording pressure data at a frequency of 4 Hz in 17-minute bursts every 20 minutes. The instrument was fixed to the upper buoyancy unit on the 20 m mooring location (i.e. some 18.5 m above seabed level).

RBR XR-620 Sensor: Programmed to collect water level data at a 1-minute average every 10 minutes. The instrument was positioned 1 m above seabed on the leeward side of Pakatoa Wharf. Prior to the start of the experiments, a 12-hour trial run was conducted to confirm data collection. The instrument was redeployed and downloaded at completion of the trials

An onboard record of measurements was also taken during trials, these included notes on the fuel volume and start time for each successive run, with notes on passing time, vessel speed, foil angle, engine RPM, fuel consumption and power output taken at the exact moment the boat crossed the perpendicular line-up of the two moorings.

2.3 Instrument deployment

For each taut-wire mooring line, a 160 kg buoyancy unit was used along with a 250 kg railway wagon wheel for an anchor. A small plastic surface float was positioned above the mooring, along with a small lit saxton buoy for navigational safety at night. A detailed mooring sketch is provided on Figure 2.

The survey vessel *Macy Gray* was contracted to undertake the mooring deployment. The mooring systems were constructed on land with the final depth fine-tuned onboard after an accurate on-site depth measurement was established. To deploy, the mooring was trailed behind the vessel with the anchor weight positioned over the side. Once on location, the weight was released and the mooring settled into position. A visual check on the mooring system was then made by a diver.

The RBR tide/wave gauge was deployed off the lee side of the Pakatoa Wharf. The instrument was attached inline, 1 m above seabed using an 8 mm polyprop rope and 2 kg dive weights to keep taut (see Fig. 3)

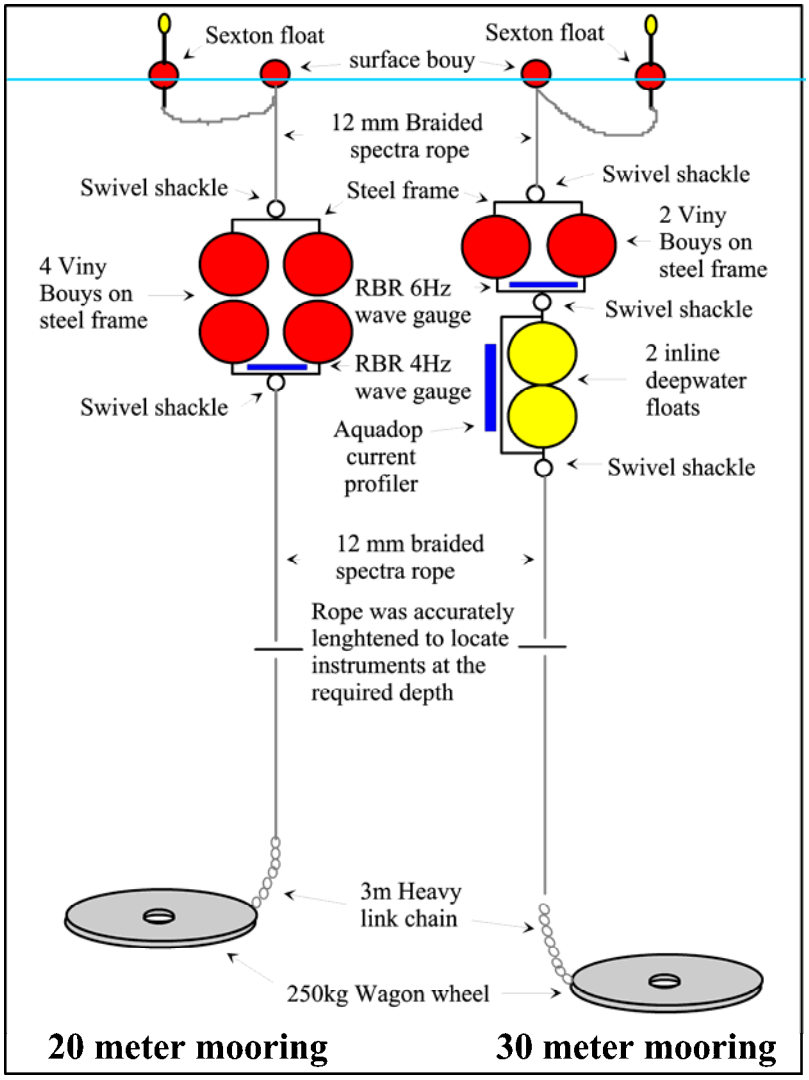


Figure 2 **Mooring schematic.**

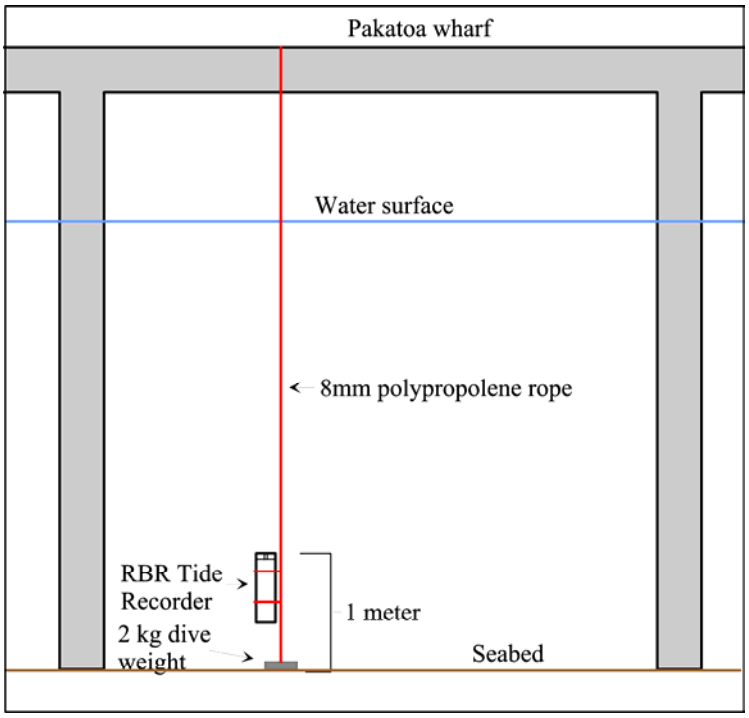


Figure 3 Mooring system for the RBR Tide gauge deployed from the Pakatoa wharf

3 DATA RECOVERY

A data recovery of 100% was obtained over the experimental program. Table 2 provides a list of the files collected and the timing errors (if any) due to clock drift in the instrument loggers.

Table 2 Data recovery and logger timing errors

Instrument	Logger start	Logger end	Time error	Instrument location	Instrument depth	File name
RBR XR-620 Tide gauge	18/02/06 12:00:00	26/02/06 23:00:00	Logger slow by 2 s	Pakatoa Wharf	1 m above seabed	011739TideFri24th.hex
RBR TWR-2050 wave Gauge	20/02/06 00:00:00	26/02/06 23:00:00	Logger fast by 2 s	20 m mooring	18.5 m above seabed	Foilcat 12465TWR.hex
RBR XR-620 wave gauge	20/02/06 06:00:00	20/02/06 17:41:11	Logger fast by 3 s	30 m mooring	29.1 m above seabed	011740Mon20th.hex
	21/02/06 06:00:00	21/02/06 21:30:51	Time correct	30 m mooring	29.1 m above seabed	011740Tue21st.hex
	22/02/06 06:00:00	22/02/06 21:21:53	Time correct	30 m mooring	29.1 m above seabed	011740Wed22nd.hex
	23/02/06 06:00:00	23/02/06 12:55:05	Time correct	30 m mooring	29.1 m above seabed	011740Thu23rd.hex
	24/02/06 06:00:00	24/02/06 22:01:49	Time correct	30 m mooring	29.1 m above seabed	011740Fri24th.hex
Nortek Aquadop ADCP	20/02/06 00:00:00	26/02/06 19:00:00		30 m mooring	28.3 m above seabed	Foilct01

4 TIME SERIES DATA PLOTS

Representative time-series data plots are provided in this section. The full data record is appended to this report in a digital form on CD, with both the processed and raw data format stored on the CD.

A time-series plot of the mean water levels recorded by the RBR TWR (20 m mooring) is provided in Figure 4, and the tidal water levels from the Pakatoa Wharf are presented in Figure 5. The instantaneous water levels recorded by the RBR XR-620 (30 m mooring) and the TWR (20 m mooring) for a representative 20 minute sampling period on each consecutive day are presented in Figures 6, 7, 8, 9 and 10.

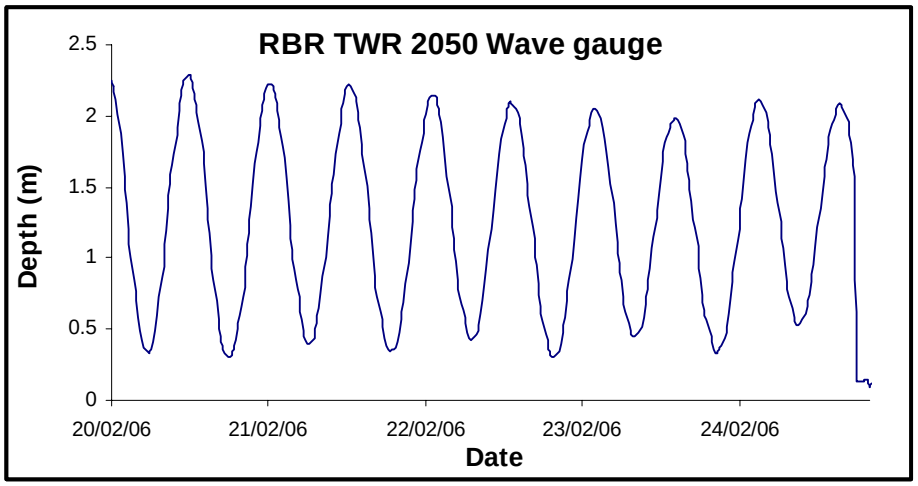


Figure 4 **Water levels recorded on the 20 m mooring**

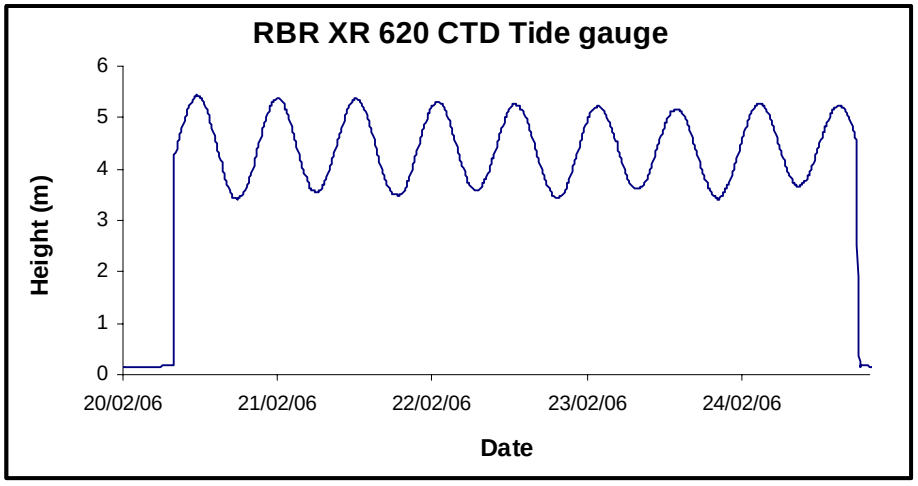
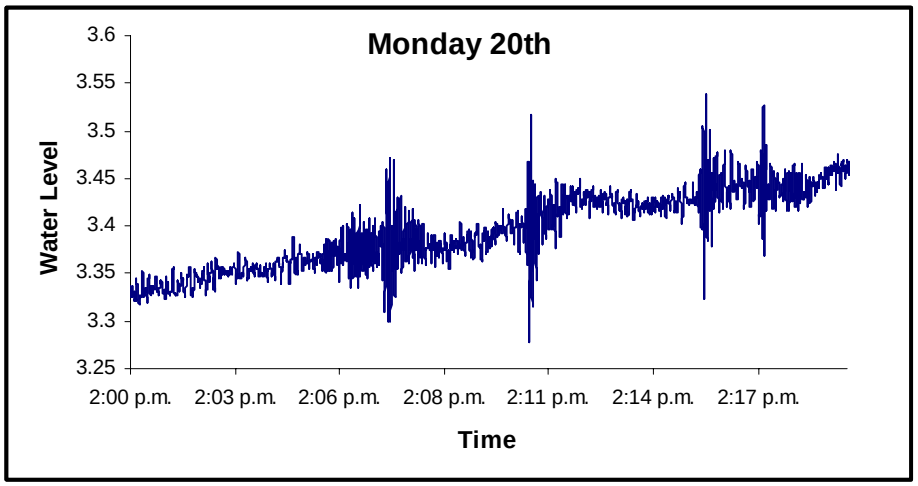


Figure 5 **Water levels recorded at the Pakatoa Wharf .**



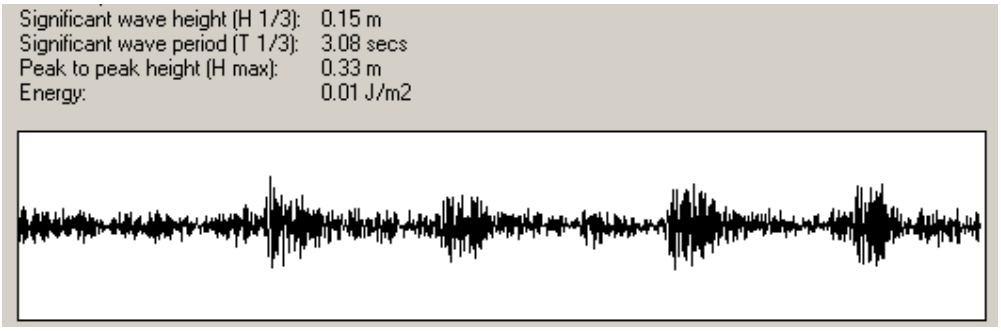
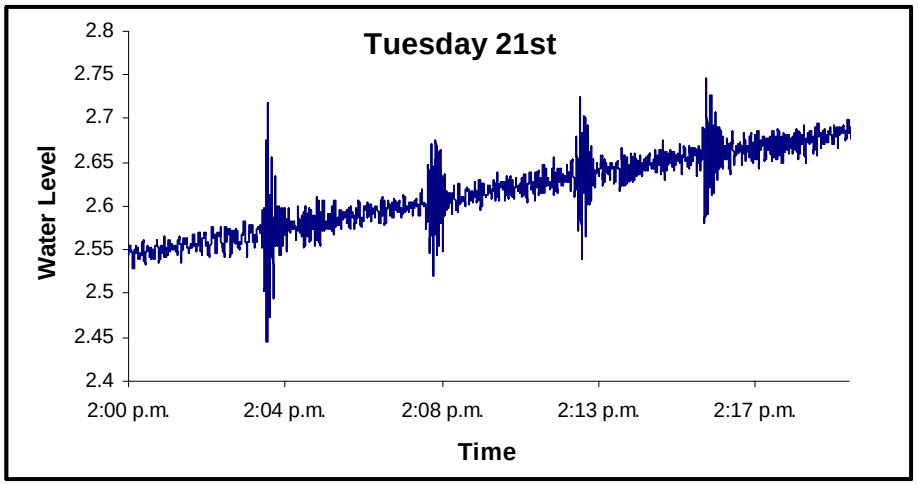


Figure 6 Example water levels recorded on Monday 20th February from the 30m mooring (upper plot) and the 20 m mooring (lower plot).



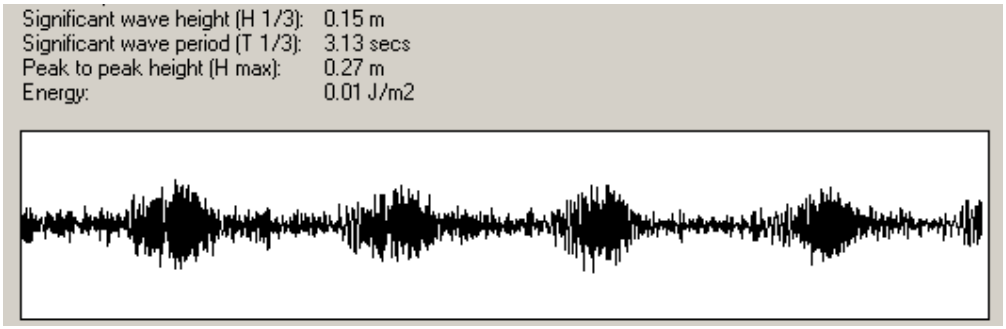
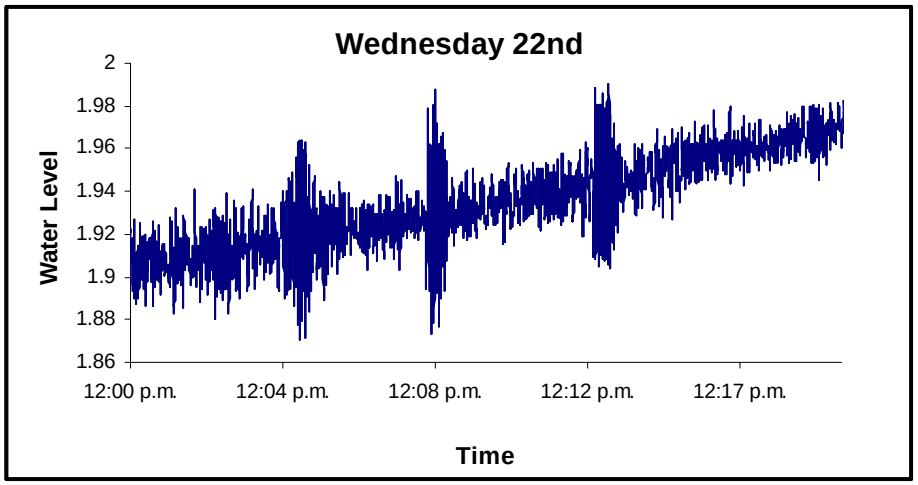


Figure 7 Example water levels recorded on Tuesday 21st February from the 30m mooring (upper plot) and the 20 m mooring (lower plot).



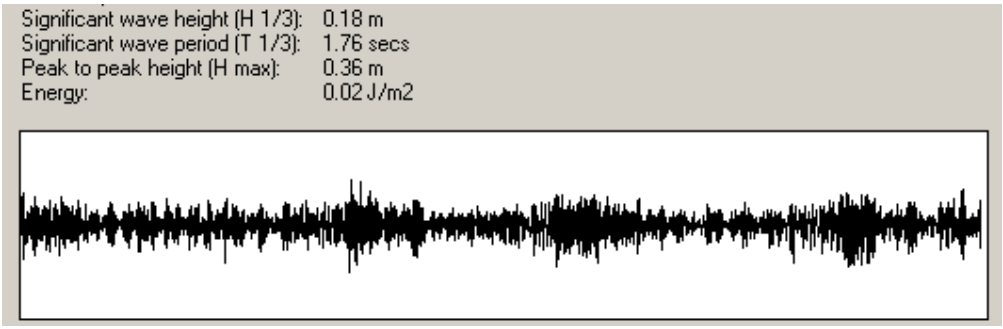
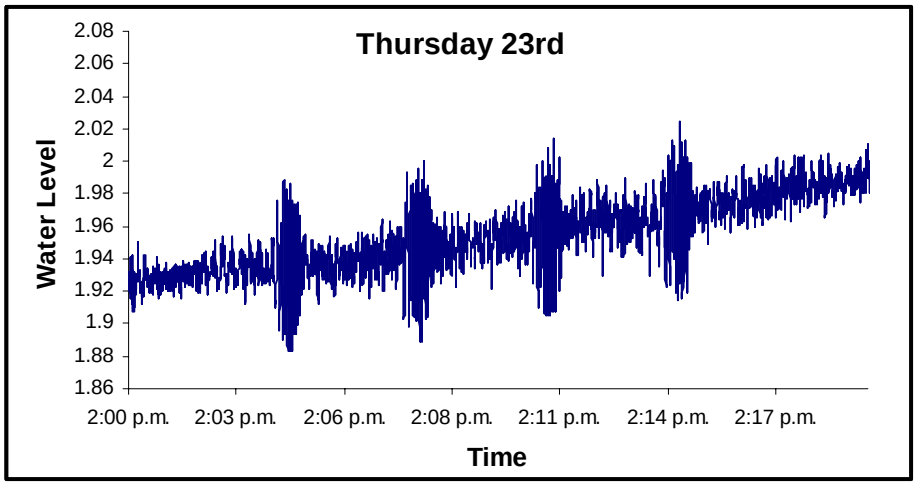


Figure 8 Example water levels recorded on Wednesday 22nd February from the 30m mooring (upper plot) and the 20 m mooring (lower plot).



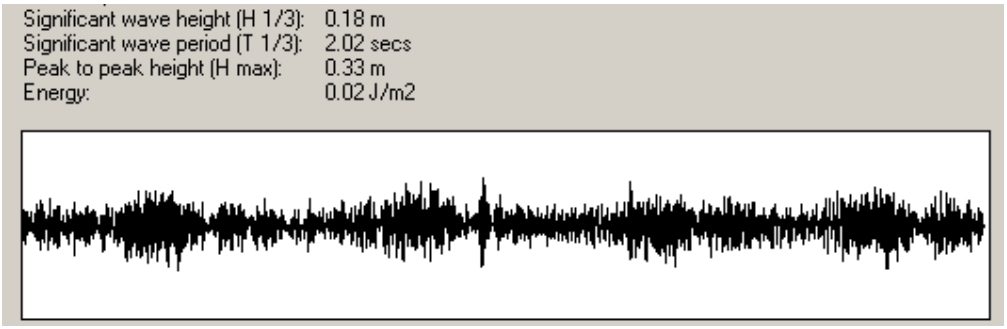
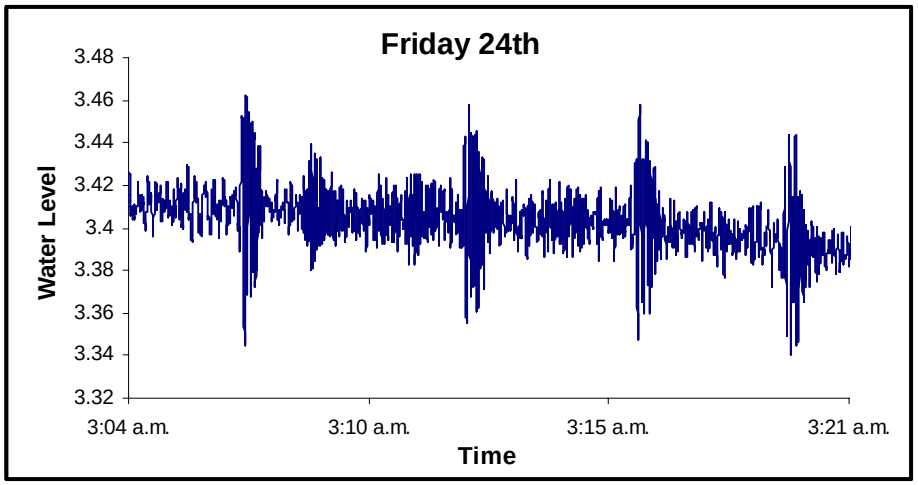


Figure 9 Example water levels recorded on Thursday 23rd February from the 30m mooring (upper plot) and the 20 m mooring (lower plot).



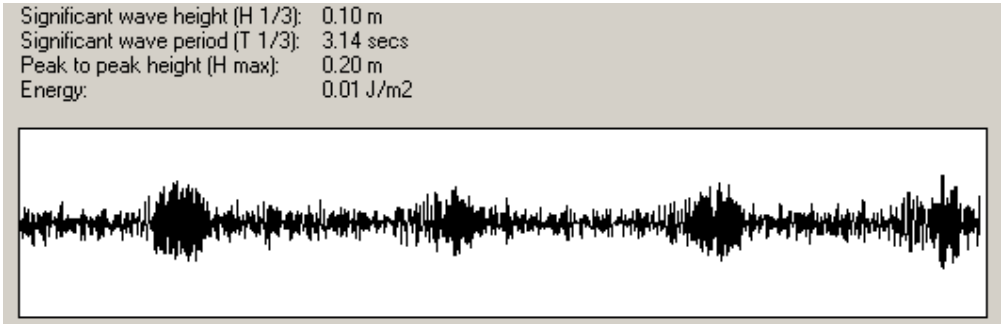


Figure 10 Example water levels recorded on Friday 24th February from the 30m mooring (upper plot) and the 20 m mooring (lower plot).

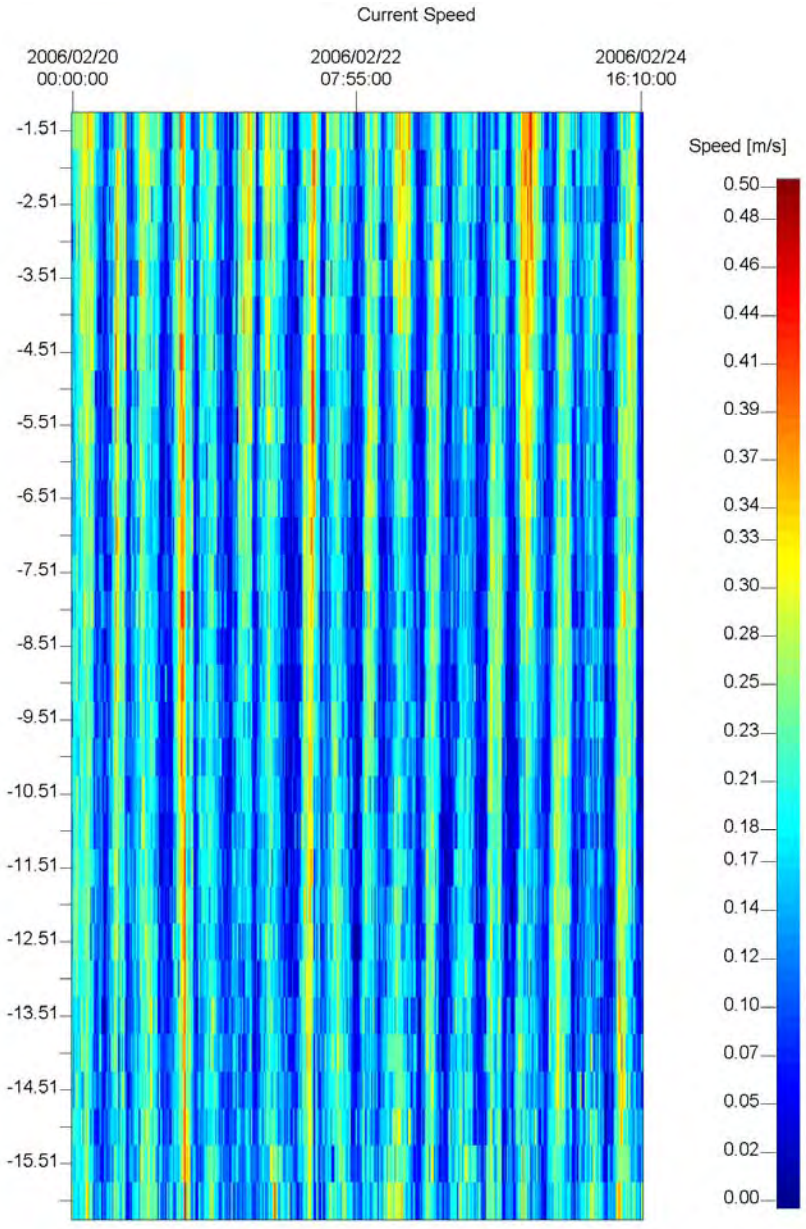


Figure 11 Current speed profile measured on the 30 m mooring over the experimental period.

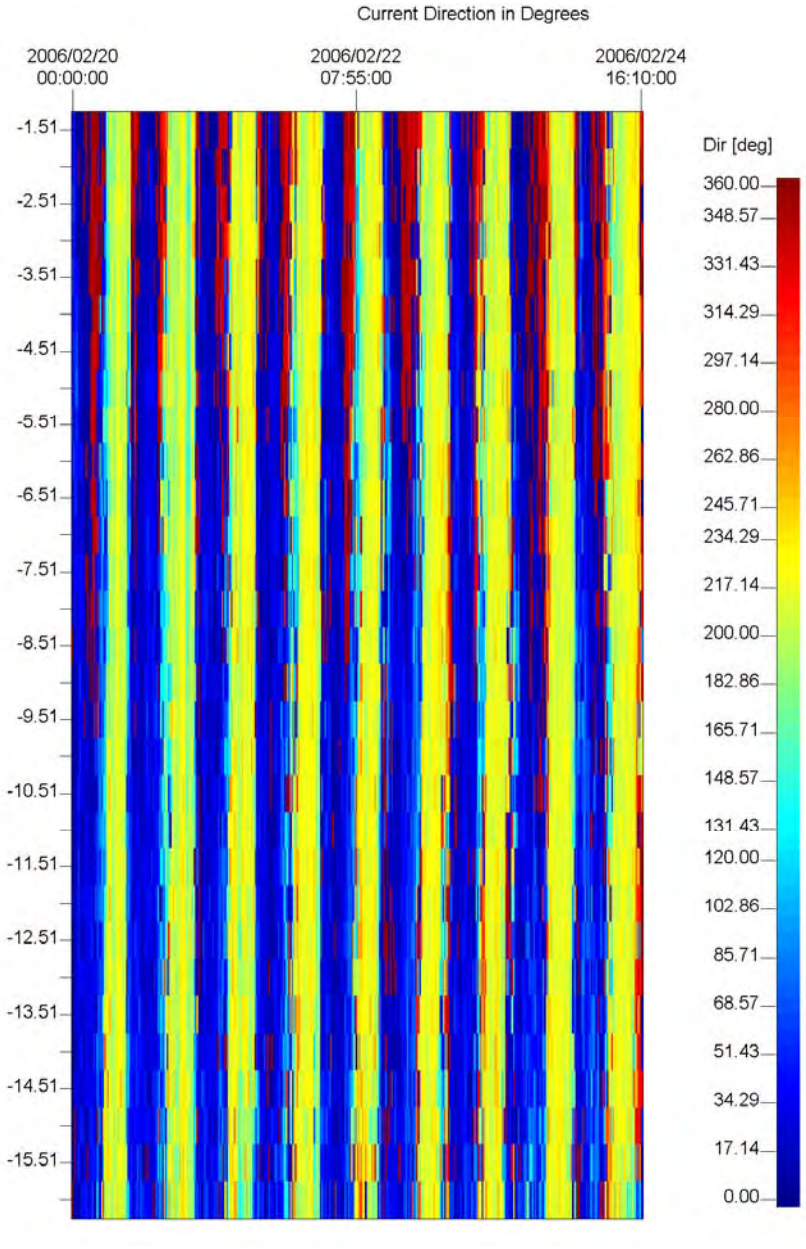


Figure 12 Current direction profile measured on the 30 m mooring over the experimental period.

5 APPRENDIX ONE - DATA ON CD

The data appendix is organised as follows. There are two folders, one for the ADCP data and the other for the RBR data (i.e. the tide gauge, the TWR-2050 and the XR-620).

For the ADCP data, the log file provides a complete record of the logging and deployment details. Similarly, the *.hdr file provides a full description of the processed parameters. The raw data file name is given in Table 2.

For the RBR data, the file naming is a provided in Table 2, with daily files for the XR-620 on the 30 m mooring, and a single file for the tide gauge and the TWR on the 20 m mooring. Raw and proceeded files are within the labelled sub-folders, along with the software routines should further processing be required.