

NSW DEPARTMENT OF COMMERCE

MANLY HYDRAULICS LABORATORY

Electromagnetic Wave and Tide Monitoring System

Manly Hydraulics Laboratory (MHL) has successfully used the EWS since the early 1980s to collect tide and wave data at over 20 sites along the New South Wales coast. Data has been collected for both site-specific studies and ongoing tide and wave data collection programs. At present EWS capture tide data at ten sites and wave data at five sites in New South Wales. In addition, in recent years, MHL has commissioned twelve EWS at five Australian ports to collect real-time wave and tide data for input to Dynamic Underkeel Clearance Systems.

EWS Principle of Operation

The EWS is a co-axial transmission line having a 50mm diameter perforated copper staff as its outer conductor that is the tuning element of an electronic oscillator. This staff, with the oscillator (electronic head) fixed to its top end, becomes the measuring staff. When immersed in water a sharp change in the electrical impedance of the staff occurs at the water surface. The period of the oscillation is linearly proportional to the length of the un-immersed part of the staff.

The EWS samples the water surface continuously and relays the signal by radio link to a suitably located shore station with 240V mains power supply. The water level samples from the EWS receiver can then be processed to generate wave and tide information.

The EWS can be fabricated to suit site requirements but typically the staff sections are 3m long for ease of handling and transportation. The electronic head is approximately 275mm long with a diameter of 50mm. A coupling system allows several staff sections to be joined to meet the length requirements of a particular site. Power to the EWS and the radio transmitter is normally provided by a 12V lead acid battery that is charged during daylight hours by a solar panel.

The radio transmitter and power supply are usually housed in a weatherproof enclosure mounted above the EWS on the support structure. An antenna is fixed to the top of the enclosure to relay the water level samples to the shore station for processing. A schematic diagram of a typical EWS installation is shown in the following Figure.

The primary specifications of the EWS are as follows:

Static Accuracy	:	<i>0.25% of range or ± 10 mm, whichever is greater.</i>
Dynamic Accuracy	:	<i>Electronic response is instantaneous, accuracy subject to the hydraulics of the water flow within the EWS staff section. Dual 90 mm x 5 mm perforations every 50 mm along the staff allow the measurement of wave periods of less than 0.5 seconds.</i>
Temperature Limits	:	<i>0° to 50° C</i>
Resolution	:	<i>Continuous along length of wave staff.</i>
Sensitivity	:	<i>2.8 mm steps (controlled by the signal processing equipment).</i>
Output Signal	:	<i>AC signal (period is a function of water level).</i>
Head Power Requirement	:	<i>12V, 20mA (isolated from ground). Additional power is required by the communications equipment and varies according to equipment used.</i>
Wave Staff Dimensions	:	<i>Staff sections are normally fabricated in 3 m lengths for ease of transportation. The outer diameter of the wave staff section is 50 mm. The electronic head is 275 mm long with a diameter of 50 mm.</i>
Weight	:	<i>A 3 m wave staff section (including the inner core) weighs 10 kg. The electronic head weighs 2 kg.</i>

Maintenance Requirements

In general, the EWS is a reliable instrument with data recovery usually exceeding 95%. Operational problems that occasionally occur include transmitter faults, electronic head failure and power supply problems. Damage to wave staffs due to vessel collisions has also been reported at a number of sites. Whilst the wave staffs are manufactured from copper pipe which inhibits marine growth, fouling of a wave staff by marine growth usually occurs at the low tide level after one to three years. Unfortunately it is not possible to predict the rate of marine growth at a particular site. Fouling by marine growth results in corrupt wave and tide data during lower tide levels.

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