Method to Find Times or Heights Between High and Low Waters

Times and heights between high and low waters of standard and secondary ports can be interpolated by fitting a cosine curve. This interpolation can be accomplished graphically with form reproduced on the following pages, the use of which is explained below. This form is a development of the method published in the *ADMIRALTY Tide Tables* and is reproduced with the permission of the Australian Hydrographic Service, Royal Australian Navy.

This method will give acceptable results provided that the duration of rise or fall is between 5 and 7 hours.

Formulae for use with calculators or computers are also provided courtesy of the Australian Hydrographic Service. The same criterion should be satisfied to obtain acceptable results.

To Find the Height of the Tide at a Given Time

Using the form

1. Plot the time of high water on the time axis marked HW, and the time of low water on the time axis marked LW. Connect these two points by a straight line called the "time-line".

   Note: Hours from 0000 to 0800 are repeated on the right hand side of the scale for use when midnight (0000) falls between HW and LW.

2. Plot the height of high water on the height axis marked HW, and the height of low water on the axis marked LW. Connect these two points by a straight line called the "height-line".

3. To find the height of the tide for a given intermediate time, plot the time on the LW time axis, project it up to the time-line, go across to the curve, go down to the height-line then across to the LW height axis, from which the height can be read off.

Using the formula

If t_1 and h_1 denote the time and height of the tide (high or low) immediately preceding time t, and t_2 and h_2 denote the height of the tide (high or low) immediately following time t, then the height h at time t is given by the following formula:

$h = h_1 + (h_2 - h_1)[(\cos A + 1)/2]$

where $A = \pi([(t - t_1)/(t_2 - t_1)] + 1)$ radians

Note 1: On falling tides $(h_2 - h_1)$ will be negative.

Note 2: t , t_1 and t_2 are in decimal hours.

To Find the Time for a Given Height of the Tide

Using the form

1. As above.
2. As above.
3. To find the time at which a given intermediate height occurs, plot the height on the LW height axis, project it across to the height-line, go up to the curve, across to the time-line, and down to the LW time axis, from which the time can be read off.

Using the formula

With t_1, h_1 , t_2, h_2 defined as above, the intermediate time t when the tide is at a given height h, can be calculated from the following formula:

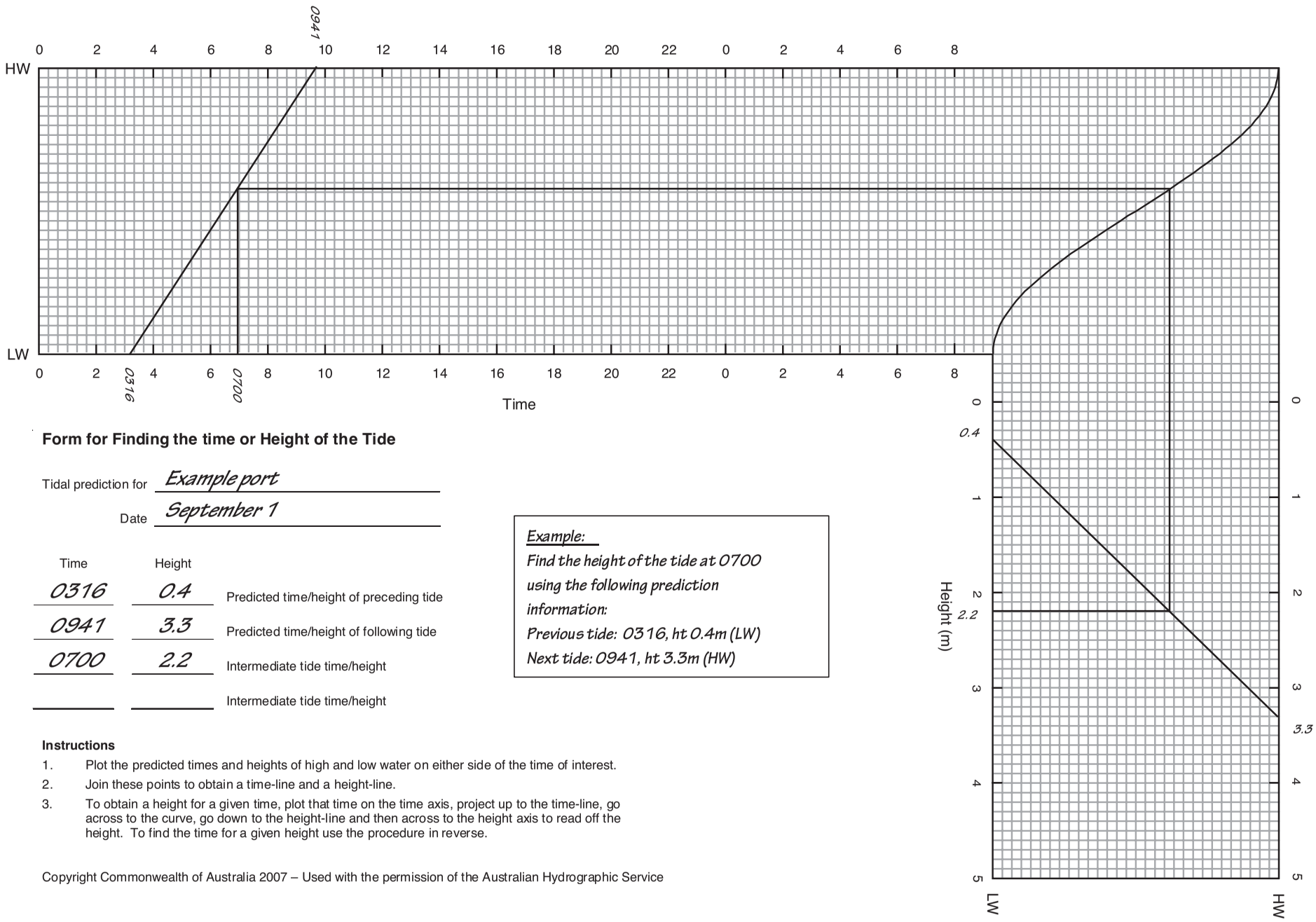
$t = t_1 + (t_2 - t_1)((A/\pi) - 1)$

where $A = 2\pi - \text{acos}([2(h - h_1)/(h_2 - h_1)] - 1)$ radians.

Note 1: On falling tides $(h - h_1)$ and $(h_2 - h_1)$ will be negative.

Note 2: t , t_1 and t_2 are in decimal hours.

Note 3: It is presumed that the range of the acos function is $[0, \pi]$.



Form for Finding the time or Height of the Tide

Tidal prediction for *Example port*

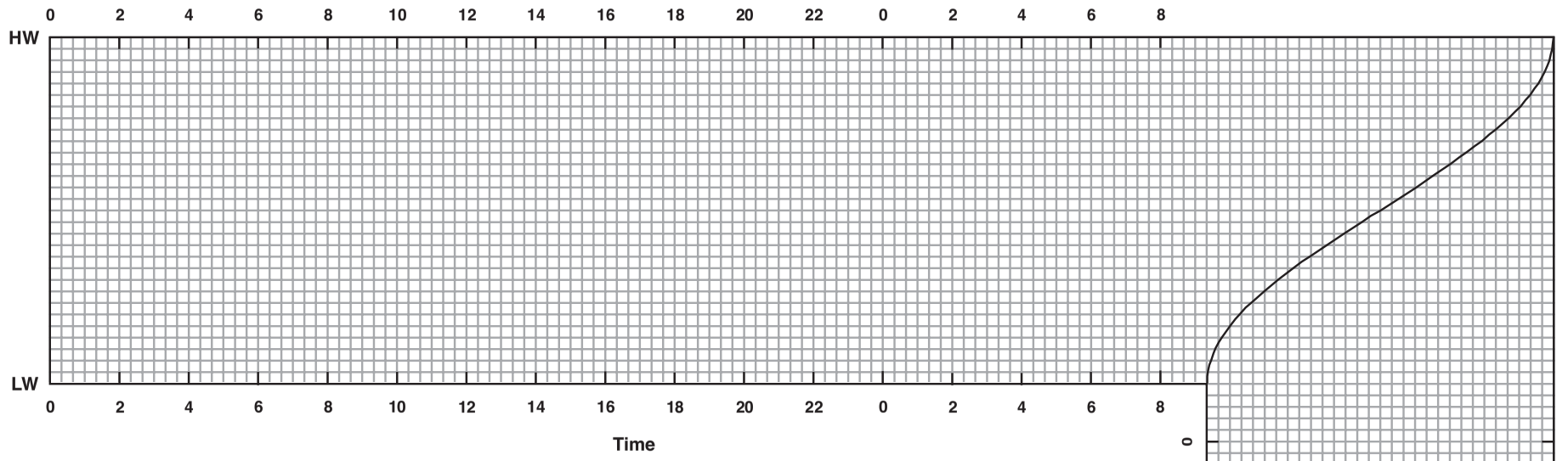
Date *September 1*

Time	Height	
0316	*0.4*	Predicted time/height of preceding tide
0941	*3.3*	Predicted time/height of following tide
0700	*2.2*	Intermediate tide time/height
		Intermediate tide time/height

Example:
Find the height of the tide at 0700 using the following prediction information:
Previous tide: 0316, ht 0.4m (LW)
Next tide: 0941, ht 3.3m (HW)

Instructions

1. Plot the predicted times and heights of high and low water on either side of the time of interest.
2. Join these points to obtain a time-line and a height-line.
3. To obtain a height for a given time, plot that time on the time axis, project up to the time-line, go across to the curve, go down to the height-line and then across to the height axis to read off the height. To find the time for a given height use the procedure in reverse.

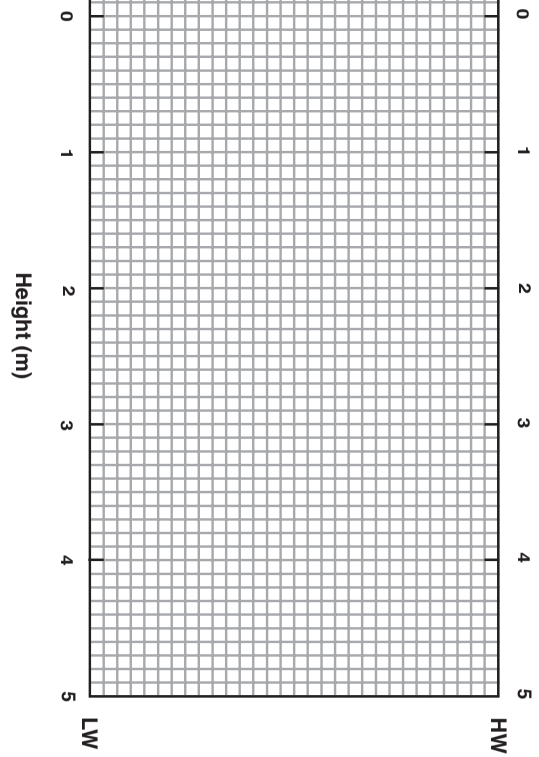


Form for Finding the Time or Height of the Tide

Tidal prediction for _____

Date _____

Time	Height	
_____	_____	Predicted time/height of preceding tide
_____	_____	Predicted time/height of following tide
_____	_____	Intermediate tide time/height
_____	_____	Intermediate tide time/height



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