

TIDE PREDICTIONS

(9tidepredictions.doc, revision -12/18/2000)

PREDICTION OF TIMES AND HEIGHTS OF TIDES

In tidal theory astronomical forces of harmonic nature produce tides. A definite relationship exists between the tide generating forces and the observed tides. But, because of factors influencing local heights and times, it is not feasible to predict tides purely from knowledge of the positions and movements of the moon and sun obtained from astronomical tables. A partially empirical approach based upon actual observations of tides in many areas over an extended period of time is necessary. To achieve maximum accuracy in prediction, a series of tide observations at any one location over a full 19-year tidal cycle is required. Less accurate predictions can be made using time and height constants applied to these 19-year stations. These constants are obtained by analysis of tidal observations at tide stations operated for less than 19 years, but usually more than 29 days.

Predictions of times and heights of high and low water are prepared by the National Ocean Service for a large number of stations in the United States and its possessions as well as in foreign countries and United Nations Trust Territories. These predictions are no longer published by the National Ocean Service (NOS). They are available to private publishers and computer programmers, each year, six months or more in advance, in four sections. The titles are: 1) East Coast of North and South America, Including Greenland; 2) Europe and West Coast of Africa, Including the Mediterranean Sea; 3) West Coast of North and South America, Including the Hawaiian Islands; and 4) Central and Western Pacific Ocean, and Indian Ocean.

The tide tables for Florida are contained in the tables for the "East Coast of North and South America" which contain full daily predictions for 50 reference tide stations and differences and other constants for about 2,500 additional stations. The dates of the Moon's phases; apogee; perigee; and greatest north, south and zero declination are included.

Times and heights of high and low waters can be obtained from the Oceanographic Products and Services Division (OPSD) of National Ocean Service (NOS) at www.opsd.nos.noaa.gov. Click on "Tide Predictions". Then on the map, click on Florida. Choose the general location in Florida and then click on the "?" mark for instructions on how to apply differences. Find your tide station and record the correction constants. Click on the reference station, find the date in question and apply the corrections. This NOS division will soon be renamed the Center for Operational Oceanographic Products and Services (CO-OPS). At that time, a link will go to the new Web address.

HEIGHT OF TIDE AT ANY TIME

If the height of the tide is required for a number of times on a certain day the full tide curve for the day may be obtained by the one-quarter, one-tenth rule. The procedure is as follows:

1. On cross section paper plot the high and low water points in the order of their occurrence for the day, measuring time horizontally and height vertically. These are the basic points for the curve.
2. Draw straight construction lines connecting the points representing successive high and low waters.
3. Divide each of these straight lines into four equal parts. The halfway point of each line gives another point for the tide curve.

4. At the quarter point adjacent to high water draw a vertical line above the point and at the quarter point adjacent to low water draw a vertical line below the point, making the length of these lines equal to one-tenth of the range between the high and low waters used. The points marking the ends of these vertical lines give two additional intermediate points for the curve.

5. Draw a smooth curve through the points of high and low waters and the intermediate points, making the curve well rounded near high and low waters. This curve will approximate the actual tide curve and heights for any time of the day may be readily scaled from it. You can get good results by, simply, connecting the three intermediate points with a straight line and drawing curves to the high tide and to the low tide points.

6. The method presented is based on the assumption that the rise and fall of the tides conform to simple cosine curves. Therefore, the heights obtained will be approximate. The roughness of approximation will vary as the tide curve differs from a cosine curve.

Computer programs are available that show the tide curve as predicted for each day at every referenced subordinate tide station for which predictions are available from NOS. The programs can be found by searching the INTERNET. The NOS web site will soon have this capability.

TIDE PREDICTIONS WHEN NONE ARE AVAILABLE FROM NOS

If a search of the tide tables reveals that there is no subordinate tide station predictions available for the tide station that you plan to use for a mean high water (MHW) line project, you can produce your own constants to determine the time of high and low water using Greenwich high and low water intervals. These intervals are the occurrence of high or low water after the passage of the moon over the Greenwich Meridian.

For example, if the tide station nearest the project site has a high water interval (HWI) of 7.7 hours and the reference tide station for the area has a HWI of 5.2 hours, the tide at the project site will be 2.5 hours later than the times listed for the reference tide station.

1. Find your general location in the list of subordinate tide stations.
2. Determine which reference station is used for that general geographical area.
3. Access the NOS Oceanographic Products and Services Division (OPSD) Web site at "www.opsd.nos.noaa.gov". Click "Water Level Observations". Then click "Global and U.S. Coastal Stations". Choose the appropriate reference station. Then under "Data Interval" select "Accepted Values" and click "Screen Display". Record the Accepted Values of the Greenwich High Water Interval (HWI) and Greenwich Low Water Interval (LWI) for the referenced station. (This NOS division will soon be renamed the Center for Operational Oceanographic Products and Services (CO-OPS). At that time, a link will go to the new Web address and there will be a direct link to accepted values.
4. Back up to the main page and click "Water Level Observations". Then click "Geographical Index" and then select "Florida". Find the tide station near the project site and record the seven-digit ID number. Hit the back key twice and click "Unlisted Stations". Enter the station ID. Then under "Data Interval" select "Accepted Values" and click "Screen Display". Record the Accepted Values of the Greenwich High Water Interval (HWI) and Greenwich Low Water Interval (LWI). The listing will also show the accepted values for the tidal datums. At the present time, the accepted values have not been entered for older stations. If this is the case, call OPSD at 1 (301) 713-2877 to obtain the data.
5. Determine the numerical difference in the high and low water intervals.
6. Now, to predict the time of any high or low water, simply apply this difference to the predictions at the reference station.