

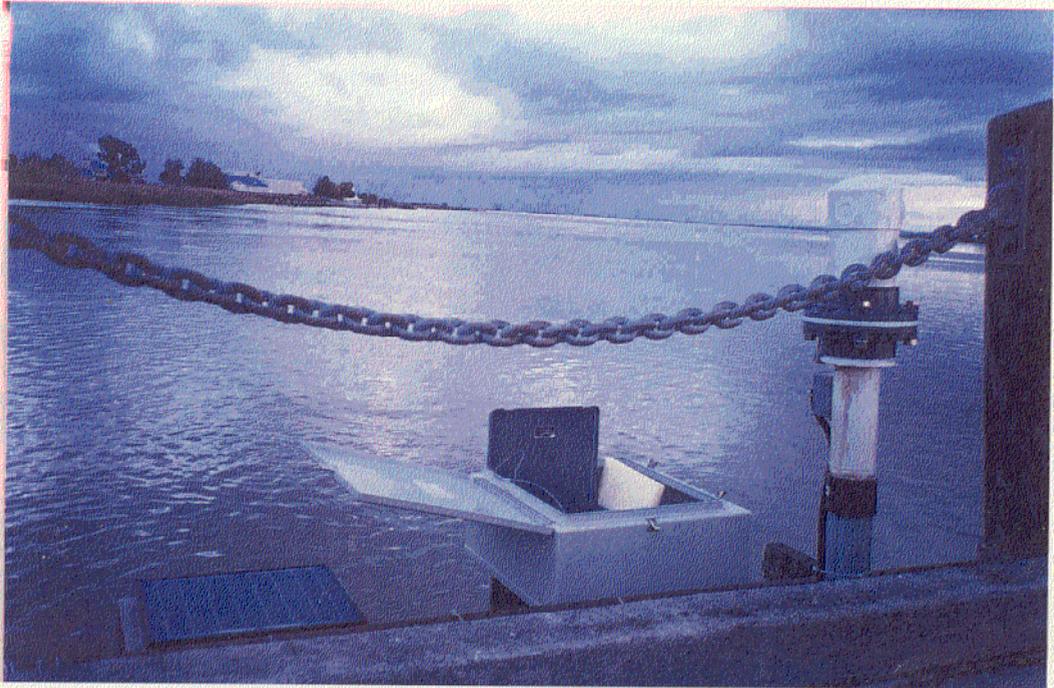
## Tide and Water levels ✓

In accordance with Attachment #7, dated October 1, 1998, of the Project Instructions, the existing primary tide station at Port Chicago, California, (station number 941-5144) was used for the survey. DEA installed a subordinate tide station at Antioch, California (station number 941-5064).

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE
941-5144	Port Chicago, CA	37° 03 24.0' N	122° 02 18.0' W
941-5064	Antioch, CA	38° 01 06.6' N	122° 48 57.0' W

Two tide zones were established on Sheets D and E as specified by Section 1.2.1 of the project instructions. The time corrector and ratio were based on data from the Port Chicago Station. Zone information is listed below.

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
SF 67	+36 min	0.91
SF 76	+60 min	0.84



**TIDE GAUGE AT ANTIOCH, CA**

Additionally, tidal data from the Antioch gauge was examined and compared to data from the Port Chicago station. The Antioch gauge lies approximately 4.2 nautical miles upstream of the survey area, compared to the Port Chicago station at 6.2 nautical miles downstream of the survey area. Zone information for the Antioch, California, gauge was obtained from Steve Gill, Center for Operational Oceanographic Products and Services (CO-OPS), on March 20, 2000. The zones were established in the survey area and named Antioch1 and Antioch2. The time corrector and ratio information is listed below.

<b>TIDAL ZONE</b>	<b>TIME CORRECTOR</b>	<b>HEIGHT CORRECTOR RATIO</b>
Antioch1	-18 min	1.06
Antioch2	-42 min	1.15

During survey operations for the 1999 field season, the real-time unverified tide data was downloaded from the CO-OPS on the National Ocean Service web page. The tides were zone corrected and used for initial processing of the data with the ISS-2000 Geoswath data cleaning routine. For the 2000 field season, no preliminary data was applied during initial processing using Caris Swath editor. All data sets had verified tides with zone correctors applied during Caris sub-set editing.

The gauge at Antioch recorded data on six-minute intervals throughout the survey and operated for a 60-day period beginning on August 1999 for datum recovery. See Appendix D \* for a complete analysis of the tide station data, level history and datum calculations. The Antioch tide data were reviewed for fliers, and those data points with a high standard deviation or which showed a high incidence of outliers were eliminated. On average, four data points per survey day were eliminated. At no time were two points, or 12 minutes of data, eliminated successively. The data fliers occurred randomly and at all stages of the tide.

Tidal zoning parameters provided in the SOW were applied using Caris HIPS software. Data from the Antioch tide station were compared with zoned tide data from the Port Chicago station for quality assurance. Differences of less than 10 centimeters were seen on the high and low tide. Slight time variations were also evident. However, the close relationship between the two stations provided confidence that the two independent stations were working correctly.

For final processing and data verification, water levels from the Port Chicago tide gauge were used.

Upon review of the Digital Terrain Model (DTM) slight tide artifacts were observed in the survey area. The tide difference was evident when comparing lines that were run in sequence to those lines run later in the survey. Depth differences of 10-15 centimeters were found between adjacent lines. Although the error in tides can be observed in the DTM, the entire survey exceeded Class 1 IHO standards. It is recommended that future surveys in the vicinity establish a subordinate tide station closer to the survey area. *Concur*

The Port Chicago and Antioch tide stations experienced no down time during periods of hydrographic survey. All data were successfully retrieved and are included on tape #2 with the processed data.