H10897

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DESCRIPTIVE REPORT

Type of Survey Hydrographic

Field No. NA

Registry No. H-10897

LOCALITY

State California

General Locality Suisun Bay

Sublocality Stake Point to New York Point and Vicinity

1999-2000

CHIEF OF PARTY

Johnathan L. Dasler, P.E., P.L.S.

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DATE October 17, 2001

NOAA FORM 77-28 (11-72) U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTER NO.

HYDROGRAPHIC TITLE SHEET

H-10897

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO.

NA

State California

General locality Suisun Bay

Locality Stake Point to New York Point and Vicinity

Scale 1:10,000 Date of survey August 4-12, 1999 and March 2-9, 2000

Instructions dated October 1, 1998 * Project No. OPR-L304-KR-98 & OPR-L304-KR-99

Vessel R/V Osprey, Zephyr

Chief of party Jon L. Dasler

Surveyed by David Evans and Associates, Inc

Soundings taken by echo sounder, ~~[illegible]~~ Reson 8101 Multibeam Sonar

Graphic record scaled by N/A

Graphic record checked by N/A

Digital Record checked by: ~~Processed by~~ David Evans & Assoc Automated plot by HP 750C Color Plotter

Verification by G.C. Nelson, B. Mihailov

Evaluation by: R. Mihailov

Soundings in ~~fathoms~~ feet at ~~MLW~~ MLLW

REMARKS: All times UTC, revisions and marginal notes in black were generated during office processing. All separates are filed with the hydrographic data, as a result page numbering may be interrupted or non-sequential.

All depths listed in this report are referenced to mean lower low water unless otherwise noted.

UTM (Zone 10) Central Meridian 123/00/00W

* Changes No. 1 dated June 4, 1999 and No. 2 dated November 22, 1999

Awards ✓ & SURF ✓ by MBH 9-28-01

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537.

U.S. GOVERNMENT PRINTING OFFICE: 1986 - 652-007/41215

Descriptive Report to Accompany Hydrographic Survey H10897

Project Numbers:
OPR-L304-KR-98
OPR-L304-KR-99

Scale 1:10,000
June 2000
David Evans and Associates, Inc.
Project Manager Jon Dasler

A. PROJECT

David Evans and Associates, Inc. (DEA) conducted a navigable area survey of a portion of the San Joaquin River in accordance with Hydrographic Project Instructions OPR-L304-KR-98, dated October 1, 1998, and Change No. 1, dated June 4, 1999. In addition, the survey was conducted with Hydrographic Project Instructions OPR-L304-KR-99, Change No. 2, dated November 22, 1999.

The area has been assigned Registry Number H10897, and designated sheets "E" and "D" as specified in the Project Instructions of October 1, 1998, November 22, 1999, respectively.

The purpose of the project was to update nautical charts through a hydrographic survey with 100 percent bottom coverage using shallow water multibeam sonar.

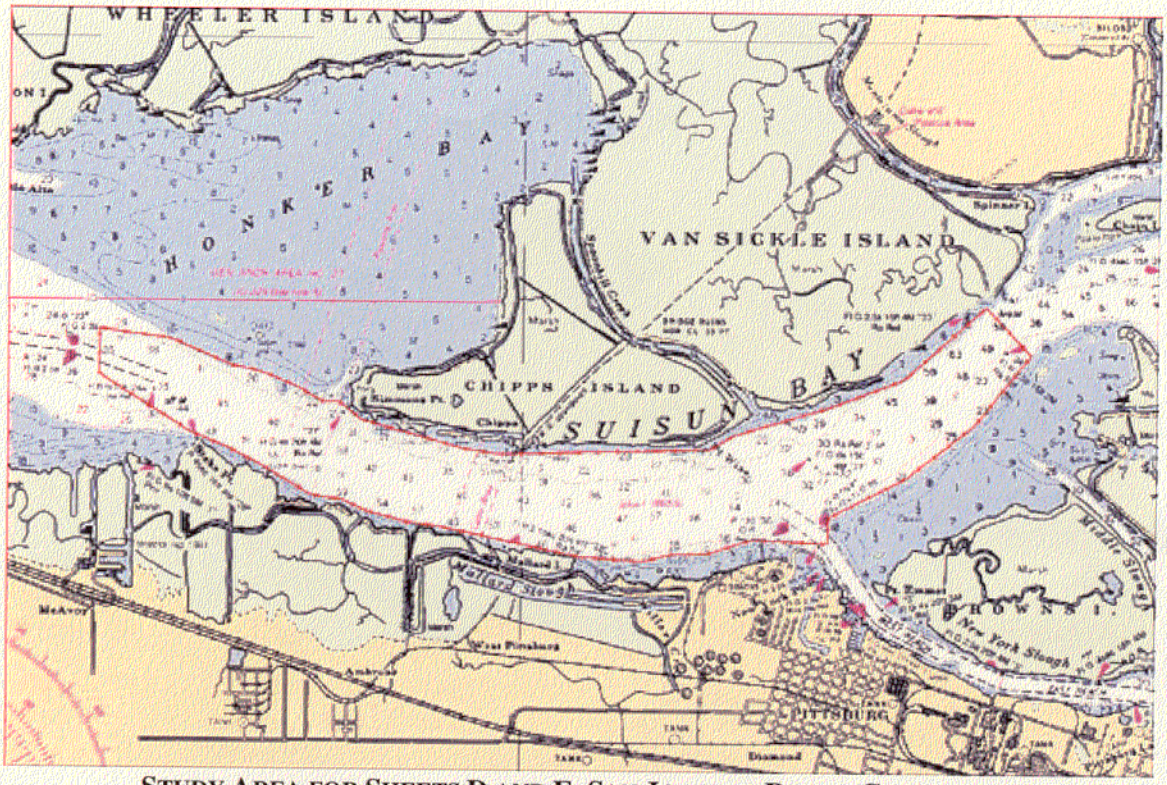
B. AREA SURVEYED

See Eval Rpt., Section B

The area surveyed covers the navigable area of the San Joaquin River, from the eastern end of the East Reach Channel, northwest of Stake Point, to vicinity of Point San Joaquin. The area encompasses a total of 2.03 square nautical miles, 1.6 square nautical miles for the area as specified by Change No. 1 and 0.43 square nautical miles as specified by Change No. 2.

Data acquisition was conducted from August 4, 1999 (Day Number 216) through August 12, 1999 (Day Number 229), and from March 2, 2000 (Day Number 062) to March 9, 2000 (Day Number 069).

The chartlet on the following page shows the approximate survey limits.



STUDY AREA FOR SHEETS D AND E, SAN JOAQUIN RIVER, CALIFORNIA (NOAA CHART NO. 18656)

C. SURVEY VESSELS

For this project, two vessels were used to perform the requirements as specified in the Statement of Work (SOW).

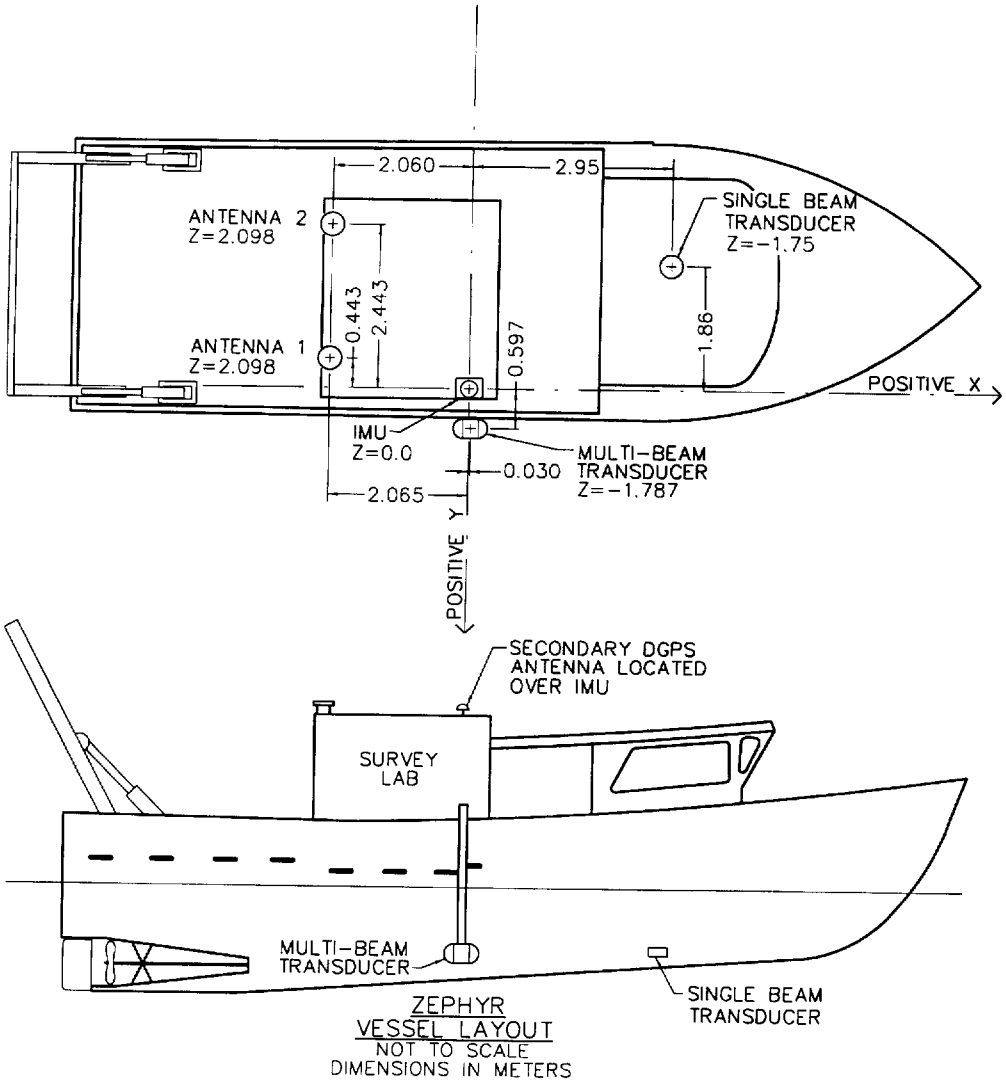
VESSEL	OPERATION
R/V Osprey	Detached Positions
Zephyr	Multibeam data acquisition, sound velocity casts, DGPS position checks

The Osprey, registry number OSD22048H697, is a 22-foot fiberglass vessel with an 8 1/2-foot beam and a draft of three feet. The primary work done by the Osprey was to position all buoys, day shapes and non-floating aids to navigation. The Osprey was equipped with a Leica MX-412 DGPS system.

The Zephyr, registry number 929931, is a 44-foot, 34 gross ton aluminum vessel with a 13-foot beam and a draft of five feet. The Zephyr was equipped with a data acquisition and

processing lab for all survey work. An over-the-side mount for the multibeam transducer was designed for the vessel. No unusual sensor set-up configurations were required.

All sensor offsets were measured from the inertial motion unit (IMU) located inside the acquisition lab on the starboard side, close to the multibeam sensor. Offsets were applied to the data during acquisition, and no changes occurred throughout the survey period. A schematic of the vessel and sensor set-up is shown below.



SENSOR LAYOUT ON THE R/V ZEPHYR

D. AUTOMATED DATA ACQUISITION AND PROCESSING

DEA developed and implemented a state-of-the-art data acquisition and preliminary processing system aboard the R/V Zephyr in accordance with NOAA standards and modern remote sensing techniques. Initial processing was performed aboard the Zephyr, while final processing and review was performed at the DEA office in Portland, Oregon. A detailed description of the data acquisition and processing platform can be found in Appendix G. *

* Filed with the seperates.

The data collection utilized two different acquisition and processing platforms. The first system was used during the 1999 field season and consisted of the ISS-2000 software by SAIC and Caris NT HIPS processing software. The second system was implemented and used during the 2000 field season and consisted of the Triton Elics Isis system and Caris NT HIPS processing software.

E. SONAR EQUIPMENT

No sidescan operations were required for this project.

F. SOUNDING EQUIPMENT

A Reson 8101 multibeam sonar, serial number 17024, was used for the entire survey. The 8101 series operates at 240 kHz, producing a 150° swath of 101 uniform beams of 1.5° x 1.5°. To meet IHO standards, only 108° of the sonar swath are used for coverage and sounding selection.

DATA ACQUISITION LAB ABOARD THE ZEPHYR

The Reson sonar head was installed on the Zephyr on June 29, 1999 (DN180) alongside the Embarcadero Cove Marina in Alameda, California. The original installation of the sensor head and processor, motion sensor and all ancillary sensors was during June 1 through June 3, 1999 (DN152-154) in Portland, Oregon, to allow for initial testing and system check-out. The sonar head was removed for transit to California and reinstalled prior to the beginning of the survey. Once installation was complete, the vessel underwent system calibration tests, including settlement and squat, alignment, and static vessel measurement. At the completion of the 1999 field season, the system was removed from the Zephyr and transported back to Portland, Oregon.

The Reson sonar head and all sensors were reinstalled at the start of the 2000 field season on the Zephyr on February 29 through March 2, 2000 (DN 060-062) alongside the Benicia Marina in Benicia, California. Once installation was complete, the vessel underwent system calibration and tests, including settlement and squat, alignment, and static vessel measurements.

The multibeam sonar was operated at different range scales throughout the survey, by adjusting the depth range to obtain the best coverage in different depths of water. In general, the range was kept at four to six times the water depth. Sheets D and E had water depths from 8 feet (2.4 meters) to 89 feet (27.1 meters), resulting in a sonar range of 25 to 100 meters. The majority of the survey was done at the 75-meter range scale.

The vessel maintained an average speed of seven knots throughout the survey. The sonar system was operated at up to 13 Hz, providing complete coverage in the along-track direction. Sonar limitations decreased the update rate to 7.5 Hz when operating at the 100-meter range scale. Using the criteria as specified in the Statement of Work (SOW), the multibeam sonar was able to detect shoals that measure two meters by two meters horizontally and one meter vertically in depths of 40 meters or less. In addition, the speed of the vessel was adjusted to ensure that at least 3.2-beam footprints, center-to-center, fell within three meters in the along-track direction. Based on a sonar update rate of 10 Hz and a vessel speed of seven knots, the bottom coverage averaged 8.5-beam footprints every three meters. At slower speeds, the coverage increased significantly. When the sonar operated on the 100-meter range scale, the bottom coverage averaged 6.4-beam footprints every three meters.

Line planning for Sheets D and E had a general east-to-west direction, in order to minimize turns and to survey approximately with depth contours. Three line plans were developed for Sheet D and one line plan was designed for Sheet E. Line spacing was determined to ensure complete coverage based on using only +/- 54 degrees (2.75 times water depth), bottom topography, and maintaining at least five meters of overlap between successive lines. Line spacing ranged from 10 meters to 30 meters. The survey lines were run based upon obtaining depths to 18 feet or the sheet limits. Depths less than 18 feet were obtained from the off nadir beams of a planned survey line.

The Isis BathyPro software provided near real-time coverage of multibeam sonar data and a color-coded depth display. The sonar coverage used a dynamic 54-degree cut-off angle for swath limits, and depths were color-coded based upon all applied offsets and predicted tides. The coverage plot was used to provide initial quality assurance checks of depth and to assure coverage throughout the area.

An Odom Echotrak DF 3200 MKII echosounder was used for a daily single beam comparison against the multibeam depths. The sonar, serial number 9414, is a 200 kHz sonar with a beam width of three degrees. During daily system checks, a lead line

comparison was made to the Echotrak, followed by a comparison to the multibeam. The multibeam check required using an off-nadir beam of 1.9 meters to account for the differences of the sonar heads. A complete log of daily checks is included in Appendix E.* In general, a difference of less than 10 centimeters was observed daily.

* Filed with the seperates.

G. CORRECTIONS TO SOUNDINGS See Evel Rpt., Section G

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.

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
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.

Velocity of Sound ✓

Data obtained with a Sea-Bird conductivity, temperature, and depth (CTD) recorder computed corrections for the speed of sound through the water column. Two probes were deployed simultaneously, allowing for a confidence check on every sound velocity reading. The Seacat SBE, model 19-03, S/N 1919847-2691 (primary unit) and 1921127-2793 (secondary unit), were the two sensors used throughout the project. Each sensor had been calibrated prior to the start of the fieldwork each season. Factory calibration results are included in Appendix E. *

The downcast data was retrieved using the Sea-Bird Term19 program and data was processed using the Sea-Bird Datcnv program. During the 1999 field season, the velocity tables were loaded into the Reson 6042 software to be applied during data acquisition for use in the ISS-2000 system. During the 2000 field season, a different procedure was followed.

* Filed with the seperates

The program Sv_clean (written at DEA) took data from the Datcnv program, removed the on-deck calibration and warm-up data, and formatted the downcast data to be used directly in Caris HIPS. Under this method, sound velocity data was applied only during processing.

Casts were taken frequently throughout the day, generally within two hours of the previous cast. Each cast was graphically displayed in the acquisition software and compared to the previous cast to verify that there was no significant change in the water column. Throughout the survey, no change of greater than two meters per second (m/s) was seen between casts. A closing cast was taken at the end of each day to verify that the sound velocity had not changed by more than 2 m/s.

A total of 33 casts were taken, recording 66 sound velocity profiles. Casts were taken in the deepest sections of the survey area. Casts were extended by straight-line interpolation in the event a sounding was taken deeper than the cast. No cast was extrapolated more than five percent. Table 1 presents all sound velocity casts throughout the survey. Cast file names were designated by "yyddd_nu" where "yy" is year, "ddd" is Julian day number, "n" is daily cast number, and "u" is sensor unit ("p" for primary and "s" for secondary).

TABLE 1. SOUND VELOCITY CASTS ✓

DAY	CAST FILE NUMBER	START CAST TIME	DEPTH METERS	APPLIED CAST	LATITUDE	LONGITUDE
216	99216_1p,1s	2156	24	1p	38 02 45	121 53 24
216	99216_2p,2s	2358	23	2p	38 02 45	121 53 21
217	99217_1p,1s	1503	24	1p	38 02 45	121 53 26
217	99217_2p,2s	1704	26	2p	38 02 43	121 53 25
217	99217_3p,3s	1934	24	3p	38 02 45	121 53 24
217	99217_4p,4s	2136	23	4p	38 02 46	121 53 31
218	99218_1p,1s	1428	26.5	1p	38 02 44	121 53 25
218	99218_2p,2s	1647	24.2	2p	38 02 46	121 53 23
218	99218_3p,3s	1930	24.8	3p	38 02 45	121 53 27
218	99218_4p,4s	2201	24	4p	38 02 44	121 53 29
219	99219_1p,1s	0120	25	N/A	38 02 47	121 53 29
219	99219_2p,2s	1352	26	2p	38 02 43	121 53 27
219	99219_3p,3s	1603	24	3p	38 02 43	121 53 30
219	99219_4p,4s	1917	26	4p	38 02 44	121 53 28
219	99219_5p,5s	2230	17	5p	38 02 45	121 53 46
220	99220_1p,1s	1535	23	1p	38 02 45	121 53 28
220	99220_2p,2s	1750	26	2p	38 02 44	121 53 29
220	99220_3p,3s	2104	28	3p	38 02 43	121 53 24
220*	99220_4p,4s	2350	17	4p	38 02 31	121 53 21
223	99223_1p,1s	1520	28	1p	38 02 44	121 53 20
223	99223_2p,2s	1830	28	2p	38 02 44	121 53 25
223	99223_3p,3s	2118	25	N/A	38 02 54	121 53 46
228	99228_1p,1s	1852	20	1p	38 02 44	121 53 30
228	99228_2p,2s	2118	20	N/A	38 02 37	121 53 11
062	00062_1p,1s	2143	16.5	1p	38 01 11	121 48 20
063	00063_1p,1s	2123	21.2	1p	38 02 46	121 53 19
064*	00064_1p,1s	1654	16.0	1p	38 03 07	121 36 37
064	00064_2p,2s	2038	17.3	2p	38 02 58	121 55 59
064	00064_3p,3s	2322	17.2	3p	38 02 58	121 56 23
065	00065_1p,1s	1642	16.6	1p	38 02 58	121 56 27
065	00065_2p,2s	2045	16.0	2p	38 03 00	121 56 16
069	00069_1p,1s	1631	9.6	1p	38 02 55	121 53 48
069	00069_2p,2s	1815	12.9	2p	38 03 22	121 56 48

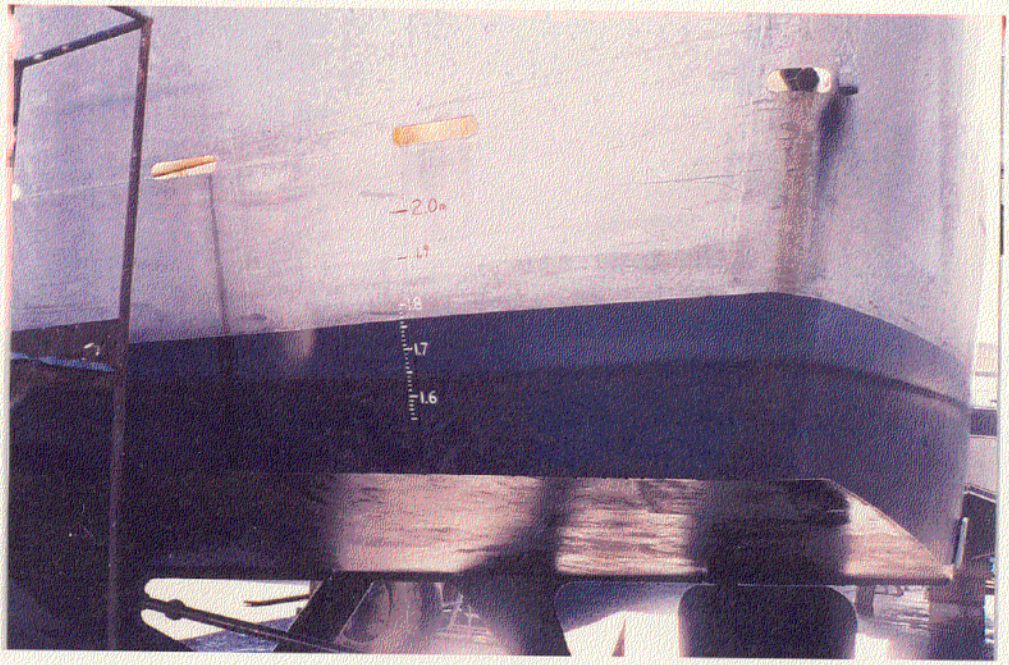
1999

2000

* Plots next to Mean High Water Line

Static Draft ✓

With the vessel out of the water, markings were placed on the aft quarters and the forward section of the hull, providing measurements for vessel draft. These measurements were recorded at the start of each survey day. Changes to vessel loads were kept at a minimum during the survey, resulting in small changes to both the vessel and transducer drafts. The multibeam mount was marked to provide a visual reading of the static draft of the transducer below the water line. Using the TSS POS/MV to monitor vessel roll, draft readings were observed only when roll was less than 0.2 degrees. The draft of the Reson multibeam sonar ranged from 0.96 to 0.98 meters throughout the survey. Markings along the port side of the vessel in line with the Odom transducer indicated the draft of the single beam sensor. With the vessel alongside the pier and a roll angle of less than 0.2 degrees, the draft of the transducer was recorded. The draft of the Odom single beam transducer ranged from 0.64 to 0.66 meters throughout the survey.



R/V ZEPHYR DRAFT MARKS

Dynamic Draft ✓

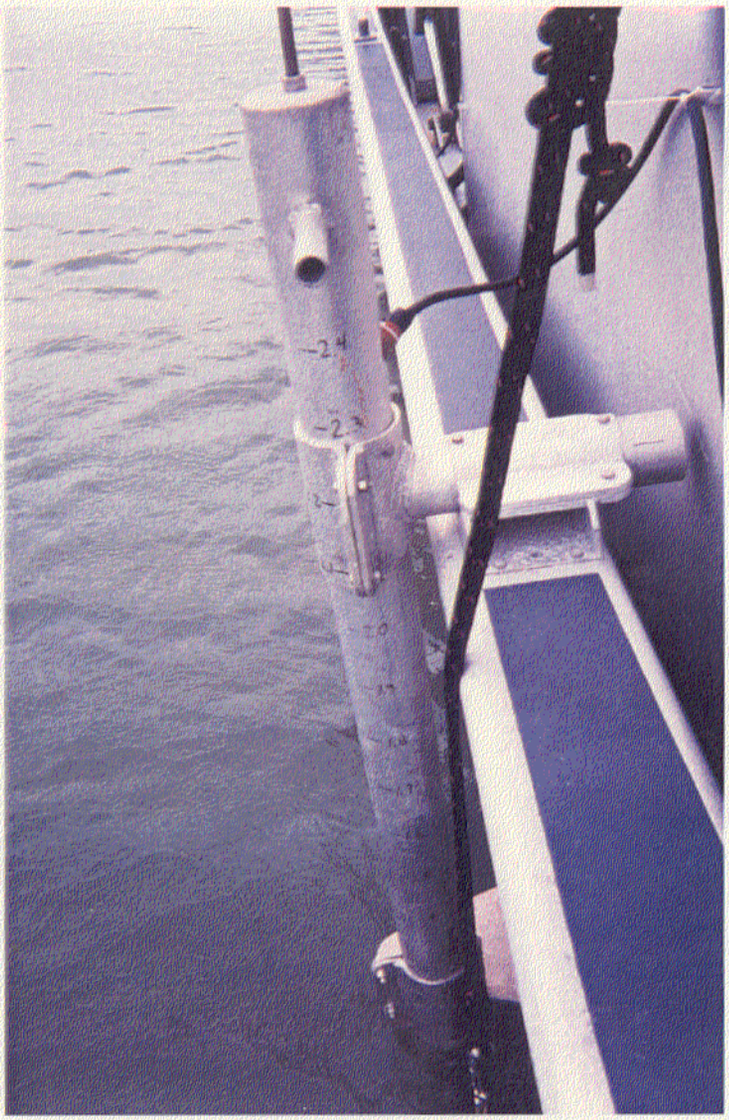
Settlement and squat measurements for the Zephyr were taken on June 29, 1999 (DN180) in the Alameda ship channel and again on March 2, 2000 (DN062) in the San Joaquin River, near the Antioch City Marina. Data from these measurements are included in Appendix E. * Differences of less than two centimeters under all speed conditions were observed. These differences can be attributed to slightly different loading conditions on board the vessel between the two survey seasons.

* Filed with the seperates.

The settlement and squat values were obtained by visually recording the vessel height at different ship speeds, measured in revolutions per minute (RPM) during transects along a pier. Ship speeds in increments of 100 to 200 RPM were observed from 650 to 1600 RPM. Using a Wild NA-2 level on a fixed pier, observations were taken to a metric rod held along the centerline of the vessel directly abeam of the sonar head and IMU location. During each transect, an initial value was recorded while the vessel was at rest followed by ten readings at the designated speed and then a reading with the ship at rest. The ship squat value was based on averaging the ten readings, then subtracting out the average rest values of the line.

Data from the settlement and squat tests were applied to the sonar data during the 1999 field season in the ISS-2000 software. Changes in ship RPM were entered during acquisition to reflect new values for settlement and squat correctors. No additional correction was made during processing.

During the 2000 field survey, the data from these tests were not input in real-time. The Caris Vessel configuration table for settlement and squat correction is based solely on vessel speed over ground, not ship RPM. Due to the high currents in the survey area, it would be impractical to base the vessel speed on ship RPM. At 1200 RPMs, the average ship speed throughout the survey, recorded speeds between 3 and 10 knots were observed. The maximum settlement and squat observed through the tests were less than 3 centimeters, and no corrections to the data were made.



MULTIBEAM MOUNT WITH DRAFT MARKS

Heave, Roll and Pitch Corrections

A TSS POS/MV 320 integrated DGPS (Differential Global Positioning System) and inertial reference system, serial number 040, was used for the motion sensor and primary navigation system for the Zephyr. The system comprised an inertial motion unit (IMU), dual GPS antennas, and a data processor. Using the ISS-2000 set-up, data from the IMU were recorded with the Reson 6042 software program. A ComputerBoards, Inc., CIO-INT32 card installed in the 6042 hardware configuration was used to provide a one-millisecond clock for time stamping data. During the 2000 field season, data from the IMU was recorded directly in the Triton Isis XTF file. The data were logged at 9600 baud, allowing for an update rate of 25 Hz. Neither acquisition system experienced problems with time stamping or data spikes.

The TSS POS/MV 320 is a six-degree of freedom motion unit, with a stated accuracy of 0.05-meter or 5 percent for heave, 0.02 degrees for roll and pitch and heading. Real-time displays of the vessel motion accuracy were monitored throughout the survey with the POS controller program. If any of the vessel motion accuracies degraded to greater than 0.05 degrees, survey operations would stop until the inertial unit was able to obtain the higher degree of accuracy. There were no periods during the survey that the unit experienced degraded accuracy or performance.

Initial System Calibration

To confirm alignment of the IMU sensor with the sonar transducer and to verify delay times applied to the time-tagged sensor data, a patch test was conducted. The patch test consisted of a series of lines run in a specific pattern which were used in pairs to analyze roll, pitch and heading alignment bias angles as well as latency in the time tagging of the sensor data. The patch test lines were run according to NOAA standards in the following order: pitch, latency, roll, and heading. The tests were conducted July 2 and 3, 1999 (DN 182-183) on an area in Hydrographic Survey area Registry Number H10895 in San Francisco Bay. A second patch test was run at the start of the 2000 field season, on March 2, 2000 (DN062) in the San Joaquin River.

Data Procedures and Analysis for 1999

Roll alignment was determined by running reciprocal lines 500 to 1000 meters long over a flat bottom, in the deepest part of the survey area. Pitch and latency errors were determined by running reciprocal lines 500 to 1000 meters in length, over a smooth slope perpendicular to the depth curves. The heading error was determined by running reciprocal lines, made on each side of a submerged feature, in shallow water. Lines were run at 1000 RPM to allow for cross track coverage and overlap.

To measure the alignment error in pitch, the ISS-2000 software analyzed a selected pair of pitch lines through a series of incremental changes in pitch angle over a specified range, and differences were computed. Similarly, yaw, roll and latency patch tests were processed and corrections for each were computed.

Two sets of lines were run and analyzed for pitch, latency, roll and heading. The second set provided a complete analysis and certainty that the bias obtained was correct. Table 2 shows the bias that was determined from the Patch Test using SAIC software.

To ensure no systematic errors were obtained, the entire data set was processed and analyzed with the Caris Patch Test routine for an independent check of the biases. Slight differences were seen and verified on multiple lines, including a line with a known feature. These additional biases, listed in Table 2 below, were applied to the entire data set. Data from the GSF files that had been converted to Caris for processing have the first set of bias applied. Thus any new corrector found is computed as an additional component and only that portion would be included in the Vessel Configuration file.

TABLE 2. BIASES USED FOR DATA ACQUISITION, 1999 FIELD SEASON

ALIGNMENT	SAIC BIAS	CARIS BIAS	TOTAL VESSEL BIAS
Roll	1.09	0.1	1.19
Pitch	0.0	-1.5	-1.5
Yaw	0.0	0.0	0.0
Latency	0.0	0.0	0.0

Data Procedures and Analysis for 2000

Roll alignment was determined by running reciprocal lines 300 to 500 meters long over a flat bottom, in the center of the San Joaquin River in a water depth of 17 meters. Pitch and latency errors were determined by running reciprocal lines 300 to 500 meters in length, over a smooth slope perpendicular to the depth curves. The entrance to the Antioch Marina provided an excellent area for this test. From the center of the San Joaquin River to the entrance of marina, the bank sloped upward to a water depth of 2 meters. The heading error was determined by running reciprocal lines at the entrance to the marina. Distinct bottom features in addition to the upward slope yielded accurate test results. Lines were run at 1000 RPM to allow for a cross track coverage and overlap.

To measure the alignment error in pitch, a selected pair of pitch lines was analyzed in Caris Sub-set under Calibration mode through a series of incremental changes in pitch angle over a specified range. Visual inspection of the data confirmed each adjustment. Similarly, yaw,

roll and latency patch tests were processed, and corrections for each were computed. Two sets of lines were run and analyzed for pitch, roll and heading. The second set was used to confirm the results of the data.

Table 3 shows the biases that were determined from the Patch Test using the Caris software.

TABLE 3. BIASES USED FOR DATA ACQUISITION, 2000

ALIGNMENT	BIAS
Roll	1.75
Pitch	-0.6
Yaw	0.1
Latency	0.860

Lead Line Comparison

Lead line checks were performed against the multibeam and single beam echosounders at the start of each day while the vessel was tied up alongside its berth in the marina. Lead line readings were taken on the starboard side adjacent to the sonar transducer and on the port side abeam to the single beam transducer. Lead line readings were recorded and compared to the multibeam data recorded in the ISS-2000 software (1999 field season) and the Triton Isis beam confidence check dialog window (2000 field season). Lead line data on the starboard side were compared to the Reson nadir beam, while the data recorded on the port side for the Odom were compared to an off-nadir beam at 1.9 meters. Depending upon the water depth, this off-nadir beam varied between beam 22 to beam 31.

The Odom echosounder provided an analog output during lead line checks, and an event mark was recorded on the paper trace. All depths were recorded manually in the daily system check logs.

Differences of less than 10 centimeters were seen throughout the survey. Lead line logs are included in Appendix E. *

* Filed with the seperates.

H. HYDROGRAPHIC POSITION CONTROL

See Evel Rpt, Section H and I

Horizontal Datum

The horizontal control datum for this project is North American Datum of 1983 (NAD83). A Universal Transverse Mercator, Zone 10, projection was used with metric units when exporting to MicroStation. MicroStation was used to prepare preliminary smooth sheets for the project.

Positioning Equipment

For the 1999 field season, the primary positioning system for the survey was a TSS POS/MV 320 integrated DGPS inertial reference system. For quality control, position data from a secondary positioning system was simultaneously acquired using a Trimble 4000SE GPS receiver with differential capabilities. The ISS-2000 software, GPSmon, displayed in real-time the error between the two positioning systems. In general, differences of less than one meter was seen throughout the survey. A Trimble ProBeacon receiver acquiring corrections from the U.S. Coast Guard beacon located at Point Blunt provided differential corrections for both systems.

During the 2000 field season the primary positioning system for the survey was a Trimble 4000 SE GPS receiver with differential capabilities. The TSS POS/MV 320 (version 3) integrated DGPS inertial reference system was used as a back-up due to some uncertainties with the new Novatel GPS cards installed within the unit. Position differences of 2 meters were observed with the TSS POS/MV system. After system tests it was determined that the Trimble system provided better DGPS positions than the Novatel cards in the POS/MV system. A Trimble ProBeacon receiver acquiring corrections from the U.S. Coast Guard beacon located at Point Blunt provided differential corrections for both systems. Positions from both systems were compared and displayed in real-time using Hypack Max. The POS/MV system position and heading was displayed as a vessel shape and the Trimble position was displayed with a circle and cross hair overlaid on the vessel shape in a different color. Position data from both systems were displayed and tracks from both systems were drawn in different colors such that a history of derived positions could be observed for quality control.

Position Control

Differential GPS provided hydrographic control throughout the survey. The following beacons were used during hydrographic operations:

REFERENCE STATION	FREQUENCY (KHZ)	SURVEYING DAYS
Point Blunt (station ID 268)	310	224-230 (1999)
Point Blunt (station ID 268)	310	062-069 (2000)

DGPS Performance Checks

A DGPS performance checkpoint* was established at the Antioch Marina with a Leica MX412 roving DGPS receiver. A mark was set on the roof of slip 99, pier C, Antioch Marina, Antioch, California. The point was referenced as "Antioch Marina."

STATION	LATITUDE	LONGITUDE
Antioch Marina	38 01 10.092 N	121 49 21.372 W ✓

Daily position confidence checks were conducted at the Antioch Marina by placing the Trimble DGPS antenna over the point and comparing the position obtained from the initial established position. Position differences of two meters or less were recorded throughout the survey. A complete log of daily position checks and detached position records is included in Appendix E. *

* Filed with the seperates.

I. SHORELINE See Eval Rpt., section J

Not applicable. Shoreline verification was not required for this project.

J. CROSSLINES ✓

A total of 17.95 ✓ nautical miles of crosslines, or 7.7 percent, was run in the survey area. In general, the crosslines agreed well with the mainscheme data. Statistical analysis of the data set was conducted using the Universal Systems Limited (USL) makehist routine, version dated December 10, 1998. A quality control report was created, which lists statistics by beam number. The report is included in Appendix E. *

* Filed with the seperates.

Two areas were examined within the survey limit using the makehist routine. The first area represented 8.2 percent of the survey area, based on data from the 1999 field season. The second area represented 28.4 percent of the survey area, based on data from the 2000 field season was included in the analysis. The area analyzed ranged in depth from 17.4 feet to 75.2 feet, and is representative of the survey area. A 0.5-meter sort of all crosslines was compared to a two-meter gridded Digital Terrain Model (DTM) based upon a 0.5-meter sort of the section of mainscheme data.

The mean difference of the data set ranged from 11 centimeters at the port beams to 11 centimeters on the outer starboard beams. The majority of the differences was less than 8 centimeters. All beams exhibited greater than 97 percent agreement at the five-decimeter level.

The analysis using the IHO standard equation of

$$\text{sqrt}((a^2 + (b * d)^2) \text{ with } a=0.500 \text{ and } b=0.013$$

showed agreement of greater than 97 percent throughout the entire data set.

The good agreement of the crosslines, surveyed prior to mainscheme acquisition, showed no systematic errors in multibeam acquisition and data processing routines. Minor differences

could be attributed to sediment migration during the survey as large sand waves were observed. Concur

K. JUNCTIONS ✓ See Eval Rpt, Section L

A junction analysis was performed using data from the 1999 field season and comparing it with data from the 2000 field season. Both data sets had registry number H~~10987~~ 10897. Data junctions existed at the western edge of the 1999 data set and the eastern edge of the 2000 field season data, and at a small section on the northern part of the 1999 data set. In general, the data showed good agreement, with less than one-foot difference in soundings. One area that had a large difference can be seen on the western section, in the mid channel area. The area exhibited large sand waves with depth differences of up to two feet deeper observed during the 2000 field season. Sand wave heights may be influenced by seasonal changes, with higher currents flowing through the river in the winter and spring seasons. The 2000 field season took place during the spring season with the higher currents in the river. concur

L. COMPARISON WITH PRIOR SURVEYS See eval. rpt., section M

Comparison with prior surveys was not required under this contract. See Section N for comparison to the nautical charts.

M. ITEM INVESTIGATION REPORTS ✓

No AWOIS items were assigned for the survey area. Four items found during the survey initiated a danger to navigation report, submitted to the Pacific Hydrographic Branch (PHB), Seattle, Washington. A summary of the reports follows; copies of the letters sent to PHB are included in Appendix A.*

Letters included in this report

The first feature was located inside the West Reach Channel of the New York Slough. It rises off the seafloor 6.4 feet. The minimum depth clearance is 36.1 feet, and was detected by the sonar with beam number 67. The object appears to be a large rock on the seafloor at latitude 38° 02' 41.17" N, longitude 121° 53' 21.27" W. The controlling depth of the channel is 35 feet, less than the depth found on this feature. Three charts—18652, 18656 and 18659—are affected by this item. It is recommended that this report be forwarded to the U.S. Army Corps of Engineers and the feature not be charted as an obstruction.

Do not concur, chart 36 obstn

A second feature was found 240 meters offshore of Pittsburg, California, in an area indicated onshore on the charts by Stacks. The feature rises 9 feet off the surrounding seafloor and has a minimum depth of 14 feet, detected by the sonar with beam number 42. The area has a charted depth of 19 feet. The obstruction could possibly be a submerged pipeline or sewer outfall though the charts do not indicate any type of pipeline extending out from shore. Depths of less than 16 feet are in the vicinity of this obstruction. Three charts—18652,

18656 and 18659—are affected by this item. It is recommended that the charts indicate this obstruction. The obstruction should be charted at 38° 02' 33.~~141~~" N, longitude 121° 53' 51.562" W, with a depth of 14 feet. Concur, chart 14' obstn

Items three and four are two wrecks identified in the survey area, both previously uncharted. They are both located on the north side of Suisun Bay. The first wreck rises five feet off the seafloor and has a least depth of ~~9.55~~ 8.6 feet. It is located on the 18-foot curve. The least depth was detected by the sonar with beam number 58. Two charts—18652 and 18656—are affected by this item. It is recommended that the charts ~~indicate~~ portray this wreck at position 38° 03' 05.38" N, longitude 121° 55' 44.29" W, with a depth of ~~9~~ 8 feet. Concur The second wreck was found to be four feet off the seafloor, with a least depth of 25.3 feet detected by the sonar with beam number 65. Three charts—18652, 18656 and 18659—are affected by this item. It is recommended that the charts ~~indicate~~ portray this wreck at position 38° 02' 58.62" N, longitude 121° 54' 57.42" W, with a depth of 25 feet. Concur There are wrecks currently located on the chart in the vicinity of this one; however, those wrecks were outside the survey limits and not investigated. It is recommended that no previously charted wrecks be removed from the charts at this time. – concur

N. COMPARISON WITH THE CHART See Eval. Rpt., section O.

Three published charts cover the survey area and listed in Table 4. From the selected sounding plot, comparisons were made to the depths on each of the charts.

TABLE 4. CHARTS COVERING THE SURVEY AREA

CHART	SCALE	EDITION	DATE
18652	1:40,000	30	May 1, 1999
18656	1:40,000	51	September 11, 1999
18659	1:10,000	14	September 18, 1999

A comparison to chart 18659 showed good agreement in the survey area. The chart covered the eastern portion of the survey limit. Differences of less than 2 feet were observed, with a general trend indicating shoaler depths throughout the area. One area exhibited a deepening trend, with depths 3 to 5 feet deeper than the charted depths. This area is on the south edge of Chipps Island, inside the 30-foot contour. No other significant differences were observed. – concur

A comparison to chart 18656 showed good agreement throughout the survey area. In general, depth differences of one to two feet were observed. Deeper depths were observed in two areas of the survey limit: in the western portion of the survey limit, in the center of the channel and at the eastern most section, south of Van Sickle Island between Lights 33 and 34. Depths of 6 to 8 feet deeper were observed in these areas. No indication of the

concur

dolphin by the G "31" pile in Suisun Bay was observed by multibeam data. This charted feature appeared on the 18656 chart, edition number 50, but is not shown on edition 51. No other significant differences were observed. - concur

A comparison to chart 18652 showed good agreement throughout the survey area. In general, depth differences of up to two feet were observed. An area west of Simmons Point exhibited a general deepening, with observed depths three to four feet deeper. No shoaling of areas existed throughout the survey limits. - concur

An area on chart 18656 and chart 18652 indicates a shoal sounding of six feet at a location of 38° 03' 26.57" N, longitude 121° 56' 48.02" W. This area was approximately 120 meters outside the survey limits; the survey was extended to obtain full coverage with the multibeam sonar over the charted shoal. No indication of shoaling exists, and the minimum depth in the area is 17.9 feet. concur, chart area as shown on smooth sheet.

An area by Point Wise on Chipps Island indicated submerged piles* on the three charts. A total of seven piles were located with the multibeam sonar in the vicinity of the charted piles. Although the piles were observed with the multibeam data, a least depth for the submerged piles could not be accurately determined. The piles were off to the side of the sonar head and the top of the piles may not have been observed. This area of piles has been indicated on the preliminary smooth sheet with no minimum depth stated. - Retain subm piling as charted. * Lat 38/03/01 N, Long 121/53/54 W
Prior data from H-10317 has been transferred to the smooth sheet.
An abandoned railroad track was observed extending into the survey area on the south end of Chipps Island. All three charts indicate a foul area* in this vicinity. Debris from the submerged tracks were observed during survey operations and surveyed with the multibeam sonar. The area was observed to have numerous steel structures on the seafloor and a least depth for the debris could not be accurately determined. This area of debris has been labeled foul on the preliminary smooth sheet. Retain area as charted.
* Foul area has been transferred to smooth sheet from H-10317 and is centered at Lat. 38/03/00 N, Long 121/55/03 W.
An exposed obstruction, ruins, possibly an extension of the railroad line, was observed to the east of the abandoned railroad line on the south shore of Chipps Island. A portion of the ~~obstruction~~ ruins is awash, extending 4 to 6 feet above MLLW. The portion of the submerged obstruction was surveyed with the multibeam sonar, and observed to have numerous structures on the seafloor. No least depth could accurately be determined from the submerged portion of the obstruction due to the area of debris. The limits of the obstruction are indicated on the preliminary smooth sheet and labeled as an obstruction. The ruins (c) has been shown on the smooth sheet at latitude 38/02/59N longitude 121/54/56W. Prior survey data from H-10317 has been transferred to the smooth sheet. Retain this area as charted.
There are two areas within the survey limits that contain a submarine cable crossing and a pipeline area. The seabed in the area was disturbed and showed slight mounds indicating the pipeline. Where the pipeline is identifiable on the hill-shaded model, it was ~~charted~~ depicted on the preliminary smooth sheet as a submerged pipeline. No hazard to navigation exists from these cable and pipeline crossings. Warning signs on the shore indicate the presence of buried

pipeline and cables located inside the cable corridor. The cable and pipeline are inside the charted corridors on the published nautical charts. Pipeline and cable are shown on the smooth sheet as delineated by the hydrographer. Retain these features as charted.

O. ADEQUACY OF SURVEY ✓ See Evel Report, section M

The survey should supersede all common areas of depths of prior surveys. No shoreline verification or bottom samples were taken during the survey. Multibeam sonar used on the survey allowed for complete bottom coverage, identifying all features and possible obstructions.

P. AIDS TO NAVIGATION ✓

Twelve navigational aids are within the survey limits. The aids were positioned using differential GPS on board the R/V Osprey, by averaging two marks taken at each aid. A detached position record is included in Appendix E.* The positions of two navigational buoys, Channel Buoy 30 and Light Buoy NY, were obtained by locating the buoy blocks with the multibeam data. Both the buoy blocks and anchor chains were observed while surveying lines adjacent to the navigational aids. Positions of all the aids were compared to both the charted positions and to the position listed in the Light List (Volume 6, 1999); differences are noted below in Table 5.* Each aid properly served its function and was operating correctly. Concur

* attached to this report.

TABLE 5. POSITIONS OF AIDS TO NAVIGATION

Name	Type	Surveyed Position	Chart 18656 Position	Chart 18659 Position	Chart 18652 Position
Channel Buoy 23	Buoy	38 03 31.12 121 57 46.05	38 03 31.36 121 57 44.89 (11.3 m)*		38 03 31.21 121 57 46.05 (1.2 m) *
Channel Buoy 24	Buoy	38 03 26.57 121 57 47.65	38 03 27.00 121 57 45.89 (31.5 m) *		38 03 26.87 121 57 46.93 (4.9 m) *
Channel Light 24A	Pile	38 03 18.43 121 57 15.56	38 03 17.58 121 57 15.55 (26.2 m) *		38 03 18.75 121 57 16.14 (17.2 m) *
Light 26	Pile	38 03 03.28 121 57 00.00	38 03 03.18 121 56 59.67 (8.6 m) *		38 03 02.33 121 57 00.98 (37.8 m) *
Light 27	Pile	38 03 11.58 121 56 06.67	38 03 11.17 121 56 06.29 (15.7 m) *		38 03 10.28 121 56 07.98 (51.2 m) *
Light 28	Pile	38 02 33.09 121 55 06.42	38 02 32.55 121 55 06.40 (16.7 m) *	38 02 33.89 121 55 05.97 (27.0 m) *	38 02 33.18 121 55 07.96 (37.6 m) *
Channel Buoy 30	Buoy	38 02 38.84 121 53 25.03	38 02 38.66 121 53 23.93 (27.4 m) *	38 02 39.07 121 53 24.70 (10.7 m) *	38 02 39.06 121 53 24.87 (7.8 m) *
Light Buoy NY	Buoy	38 02 39.81 121 53 08.94	38 02 41.11 121 53 08.92 (40.1 m) *	38 02 40.20 121 53 08.79 (12.6 m) *	38 02 40.83 121 53 08.42 (33.9 m) *
NY Slough Light 2	Pile	38 02 34.01 121 53 11.57	38 02 33.31 121 53 11.35 (22.2 m) *	38 02 33.92 121 53 11.79 (6.0 m) *	38 02 33.30 121 53 12.21 (26.9 m) *
Light 31	Pile	38 02 58.10 121 53 15.65	38 02 58.96 121 53 15.27 (28.1 m) *	38 02 58.02 121 53 15.74 (3.3 m) *	38 02 57.89 121 53 15.54 (7.0m) *
Light 33	Pile	38 03 39.99 121 52 18.68	38 03 40.38 121 52 18.16 (17.5 m) *	38 03 39.77 121 52 18.38 (10.0 m) *	38 03 39.91 121 52 19.13 (11.2 m) *
Light 34	Pile	38 03 29.73 121 52 02.92	38 03 30.11 121 52 03.39 (16.4 m) *	38 03 29.57 121 52 02.88 (5.0 m) *	38 03 29.77 121 52 02.46 (11.3 m) *

*Difference between charted and surveyed position.

Q. STATISTICS

Table 6 shows statistical information of the survey conducted for this project.

TABLE 6. SURVEY STATISTICS

DESCRIPTION	QUANTITIES
Days of Acquisition	12
Total Soundings (mainscheme)	125,174,047
Total Soundings (crosslines)	9,888,506
Total Selected Soundings	3,489
Total Mainscheme (nm)	232.35
Total Crosslines (nm)	17.95
Total Mainscheme (no. of lines)	300
Total Crosslines (no. of lines)	42
Total Detached Positions	12
Total Square Nautical Miles	2.03
Velocity Casts	66
Tide Stations Installed	1

R. MISCELLANEOUS

Selected Soundings

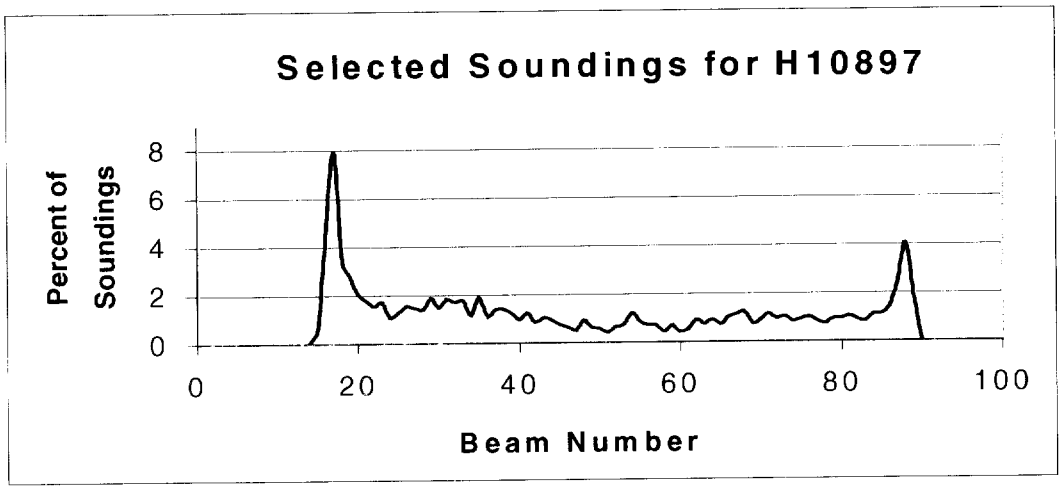
The majority of the beams used in the selected soundings was taken at +/- 54 degrees from nadir. Fewer than 15 soundings were selected out to 56 degrees from nadir to provide coverage in two areas of ping dropouts. All selected soundings exceeded Class I IHO standards.

The entire survey had overlapping lines, in some cases as much as 40 percent, increasing the number of outer beams being grouped with more nadir beams during the binning process.

A histogram of all selected soundings was made and is plotted below. The graph represents the number of times each beam is used as a selected sounding. The selected sounding process was a shoal-biased selection, based on a 10-meter bin selection and exported through a Caris overplot routine. This procedure examines the entire survey area and reduces the number of soundings to avoid text overwrites. A total of 3,489 soundings were selected.

A high incidence of outer beams was selected in the sounding routine and investigated to determine if a systematic bias was introduced into the data. No single source was found. The

selected data can be attributed to a number of factors; the primary reason is due to the nature of a multibeam system with outer beams having a lower incident angle. This may result in shoaler depths when comparing outer beams to near nadir beams. Beam number 17 was selected more frequently, when compared to all other beams. Inshore lines were run port side to for safety reasons. This technique may favor the selection of port side beams as analysis of the data showed no single source of error.



No magnetic disturbances were observed.

S. RECOMMENDATIONS

Although the required accuracy was obtained, tide artifacts were observed in the hill-shaded model. It is recommended that future surveys in the vicinity establish a subordinate tide station closer to the survey area.

The area of the river surveyed is subject to changes in bottom topography due to the highly dynamic nature of the river. A significant change was observed in the sand wave field at the junction between the surveys from August, 1999 and March, 2000. It is recommended that the area be monitored for any major changes in the river to ensure safe navigation.

T. REFERRAL TO REPORTS

None

Danger to Navigation Report

ADVANCE INFORMATION

Hydrographic Survey Registry No.: H-10897

State: California

General Locality: Suisun Bay

Sublocality: Simmons Point to Point San Joaquin

Project Number: OPR-L304-KR-98

The following item was found during hydrographic survey operations:

Object discovered: Obstruction

Description: An object was found rising 6.4 feet above the surrounding seafloor. Using predicted tides, a depth of 36.2 feet below MLLW was computed from multibeam data. The item is located inside the West Reach Channel of the New York Slough.

Afftected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horiz. Datum	Geographic Position	
	No.	Date			Latitude	Longitude
18656	50	08-Aug-92	36 feet	NAD 83	38 02 41.17 N	121 53 21.28 W
18659	13	18-Oct-97	36 feet	NAD 83	38 02 41.17 N	121 53 21.28 W

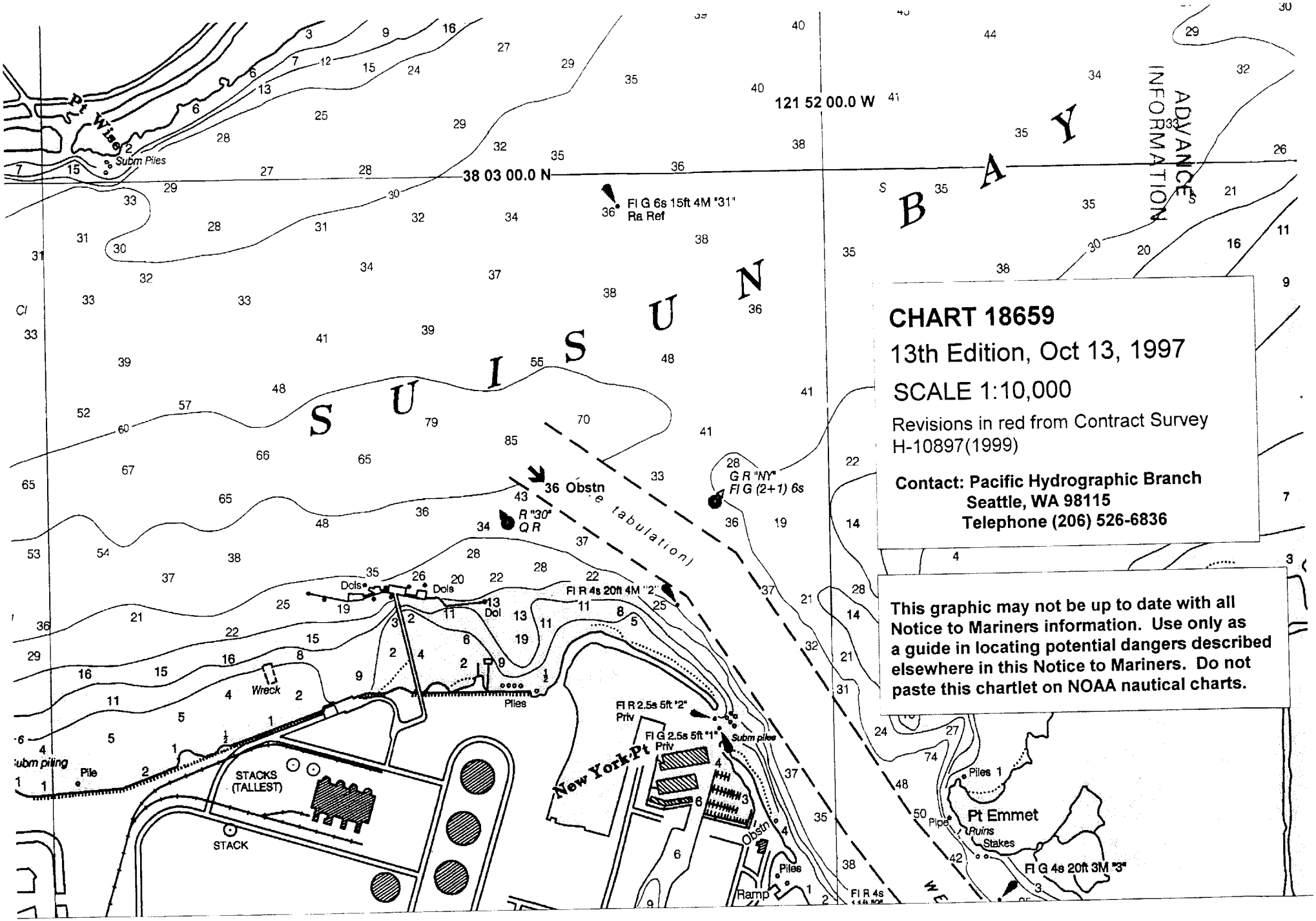


CHART 18659

13th Edition, Oct 13, 1997

SCALE 1:10,000

Revisions in red from Contract Survey H-10897(1999)

Contact: Pacific Hydrographic Branch
Seattle, WA 98115
Telephone (206) 526-6836

This graphic may not be up to date with all Notice to Mariners information. Use only as a guide in locating potential dangers described elsewhere in this Notice to Mariners. Do not paste this chartlet on NOAA nautical charts.

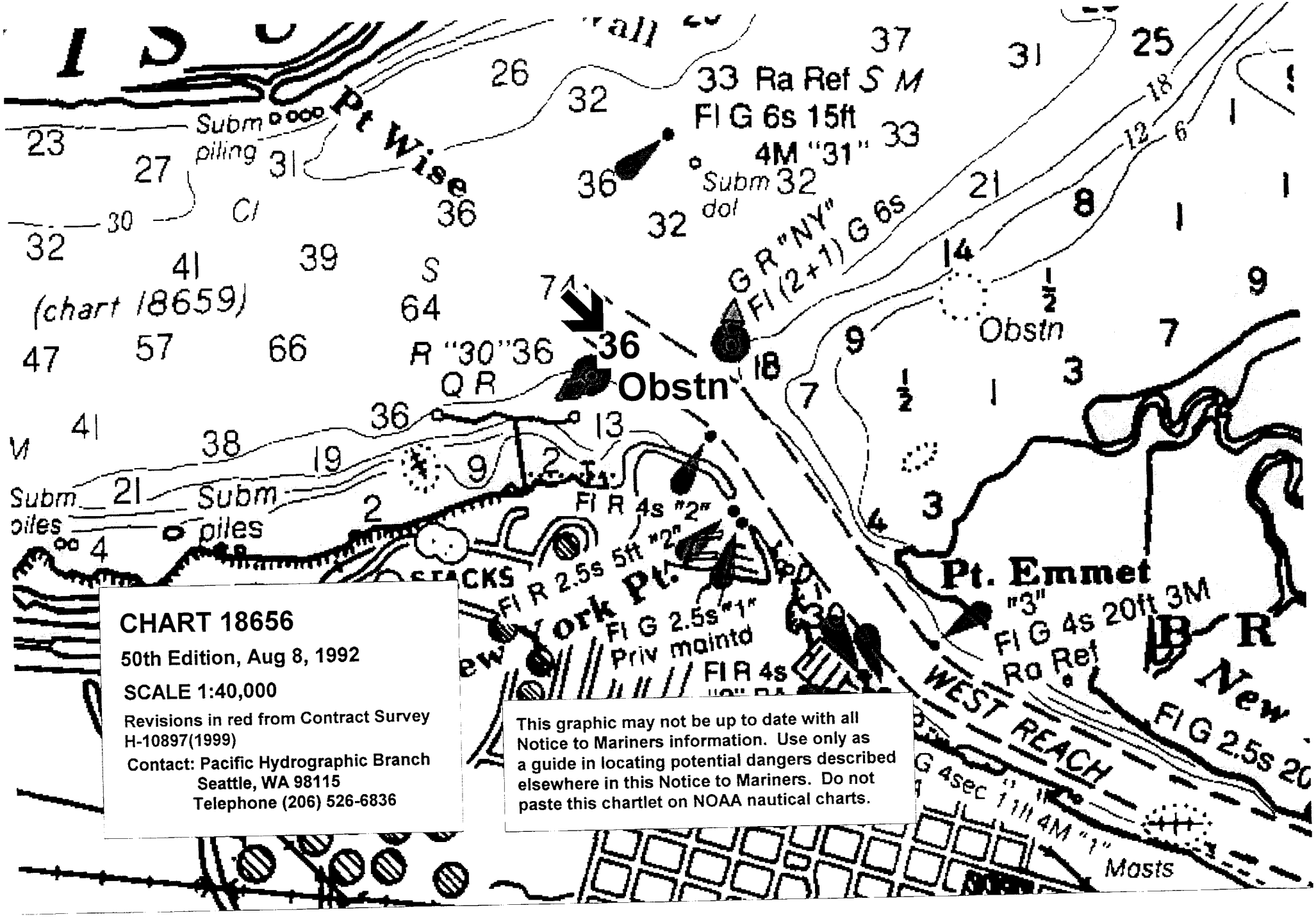


CHART 18656

50th Edition, Aug 8, 1992

SCALE 1:40,000

Revisions in red from Contract Survey H-10897(1999)

Contact: Pacific Hydrographic Branch
Seattle, WA 98115
Telephone (206) 526-6836

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Danger to Navigation Report

ADVANCE INFORMATION

Hydrographic Survey Registry No.: H-10897

State: California

General Locality: Suisun Bay

Sublocality: Simmons Point to Point San Joaquin

Project Number: OPR-L304-KR-98

The following item was found during hydrographic survey operations:

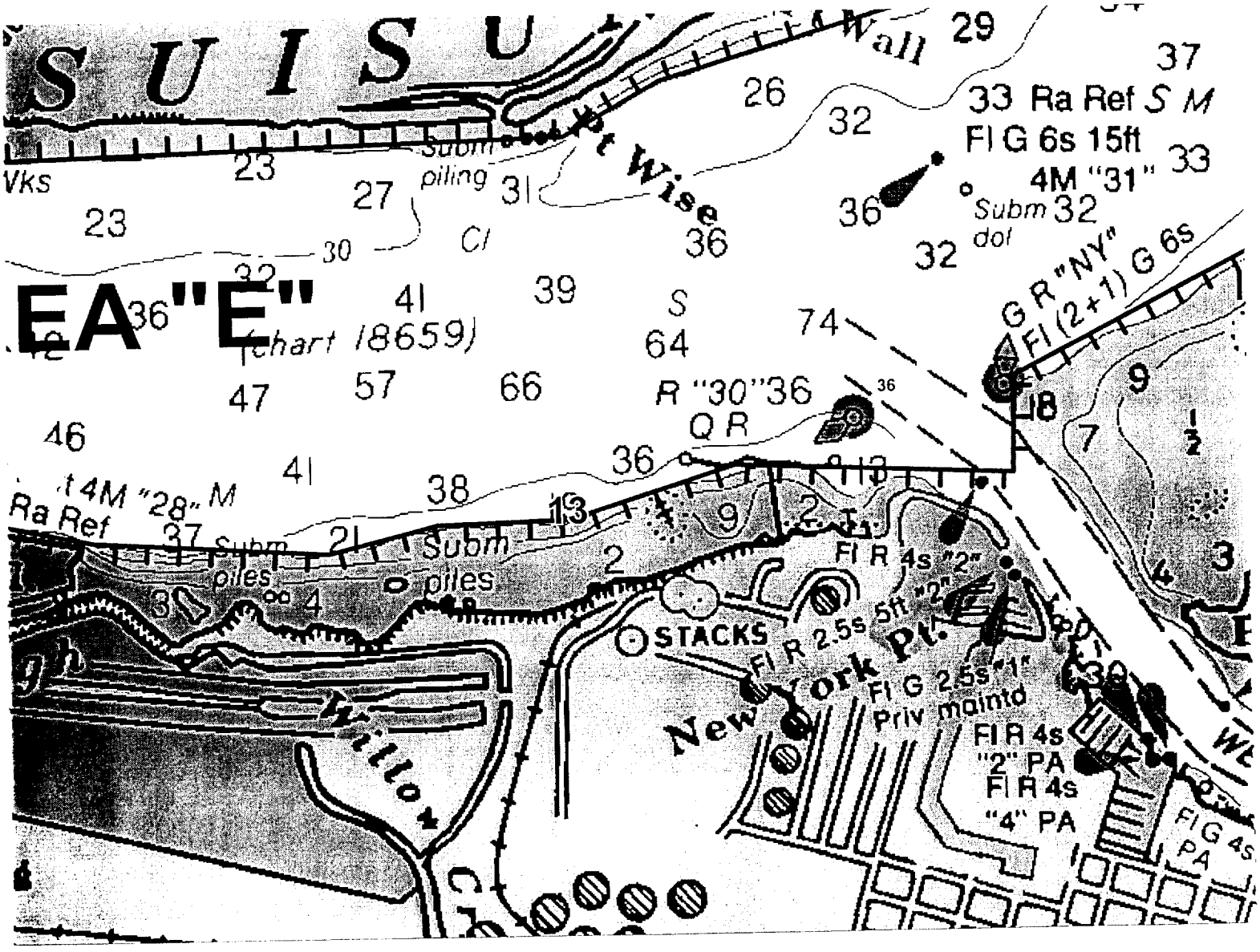
Object discovered: Obstruction

Description: An obstruction, rising 3 feet above the surrounding seafloor was found. Using preliminary observed tides, a depth of 13 feet below MLLW was computed from multibeam data. The obstruction could possible be a submerged pipeline or sewer outfall, with a diffusor at the northern portion of the obstruction. Depths of less than 16 feet are in the vicinity of this obstruction.

Afftected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horiz. Datum	Geographic Position	
	No.	Date			Latitude	Longitude
18656	50	08-Aug-92	13 feet	NAD 83	38 02 32.88 N (3 141)	121 53 52.11 W (1 562)
18659	13	18-Oct-97	13 feet	NAD 83	38 02 32.88 N (3 141)	121 53 52.11 W (1 562)

ADVANCE
INFORMATION



Danger to Navigation Report

ADVANCE INFORMATION

Hydrographic Survey Registry No.: H-10897

State: California

General Locality: Suisun Bay

Sublocality: Simmons Point to Point San Joaquin

Project Number: OPR-L304-KR-98

The following item was found during hydrographic survey operations:

Object discovered: Wreck

Description: A wreck was found rising 5 feet off the surrounding seafloor. Using predicted tides, a depth of 8.1 feet below MLLW was computed from multibeam data. The item is located on the 18-foot curve on chart 18656.

Afftected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horiz. Datum	Geographic Position	
	No.	Date			Latitude	Longitude
18656	50	08-Aug-92	8 feet	NAD 83	38 03 05.38 N	121 55 44.29 W

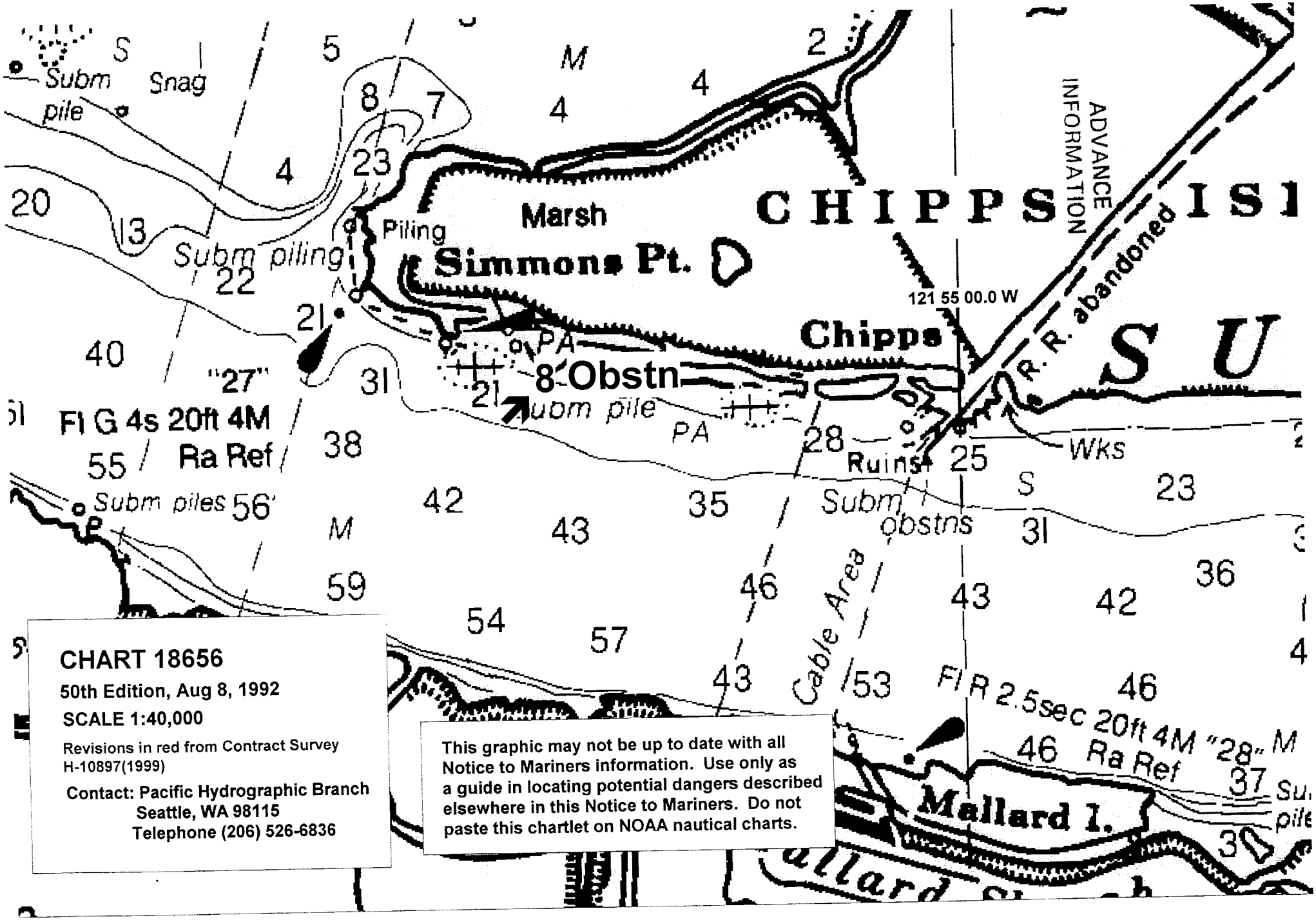


CHART 18656

50th Edition, Aug 8, 1992

SCALE 1:40,000

Revisions in red from Contract Survey H-10897(1999)

Contact: Pacific Hydrographic Branch
Seattle, WA 98115
Telephone (206) 526-6836

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Danger to Navigation Report

ADVANCE
INFORMATION

Hydrographic Survey Registry No.: H-10897

State: California

General Locality: Suisun Bay

Sublocality: Simmons Point to Point San Joaquin

Project Number: OPR-L304-KR-98

The following item was found during hydrographic survey operations:

Object discovered: Wreck

Description: A wreck was found rising 4 feet off the surrounding seafloor. Using predicted tides, a depth of 25.2 feet below MLLW was computed from multibeam data. The charted depth in the area is 23 feet on chart 18659 and 25 feet on chart 18656.

Afftected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horiz. Datum	Geographic Position	
	No.	Date			Latitude	Longitude
18656	50	08-Aug-92	25 feet	NAD 83	38 02 58.62 N	121 54 57.42 W
18659	13	18-Oct-97	25 feet	NAD 83	38 02 58.62 N	121 54 57.42 W

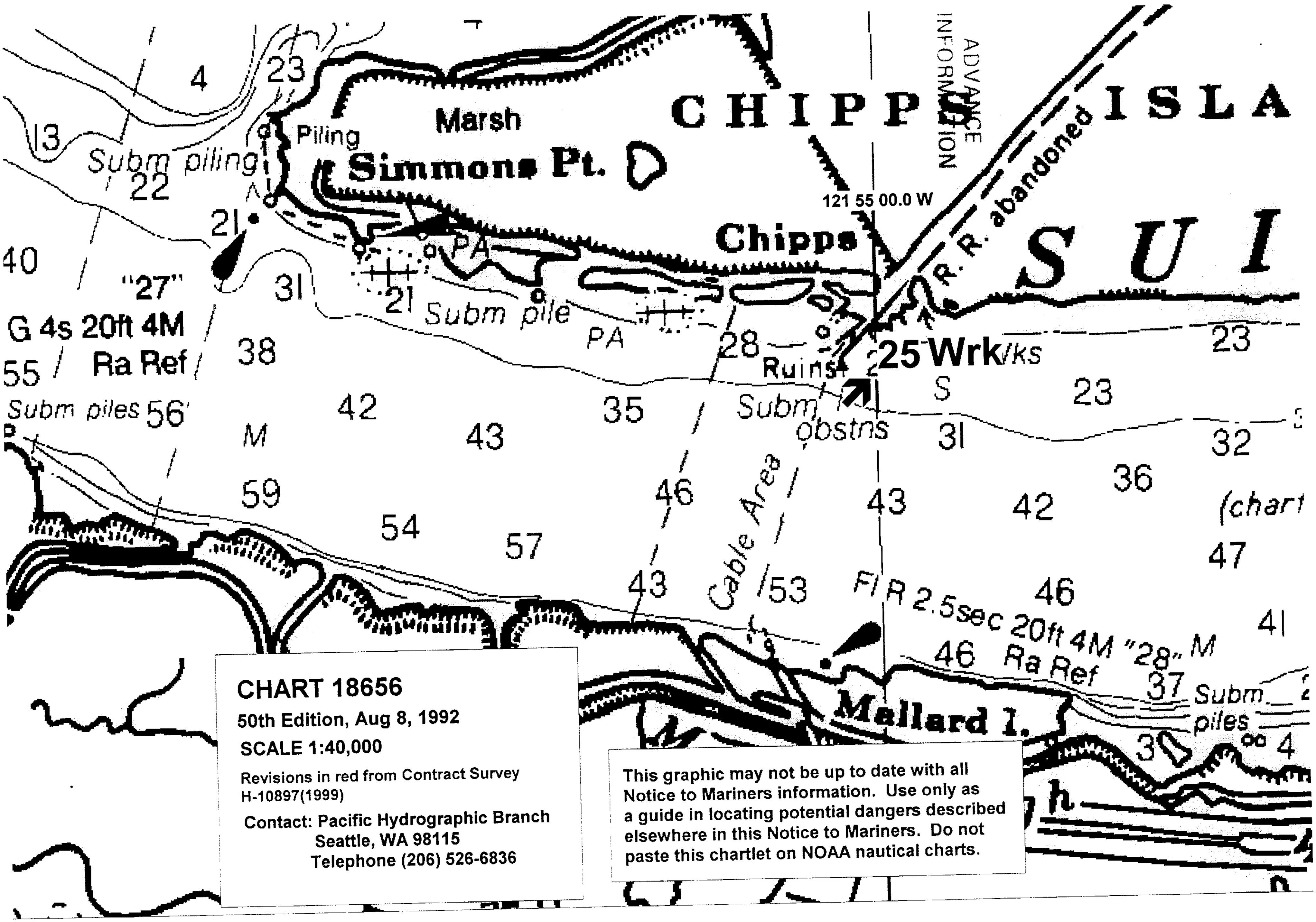

CHART 18656

50th Edition, Aug 8, 1992

SCALE 1:40,000

Revisions in red from Contract Survey H-10897(1999)

Contact: Pacific Hydrographic Branch
Seattle, WA 98115
Telephone (206) 526-6836

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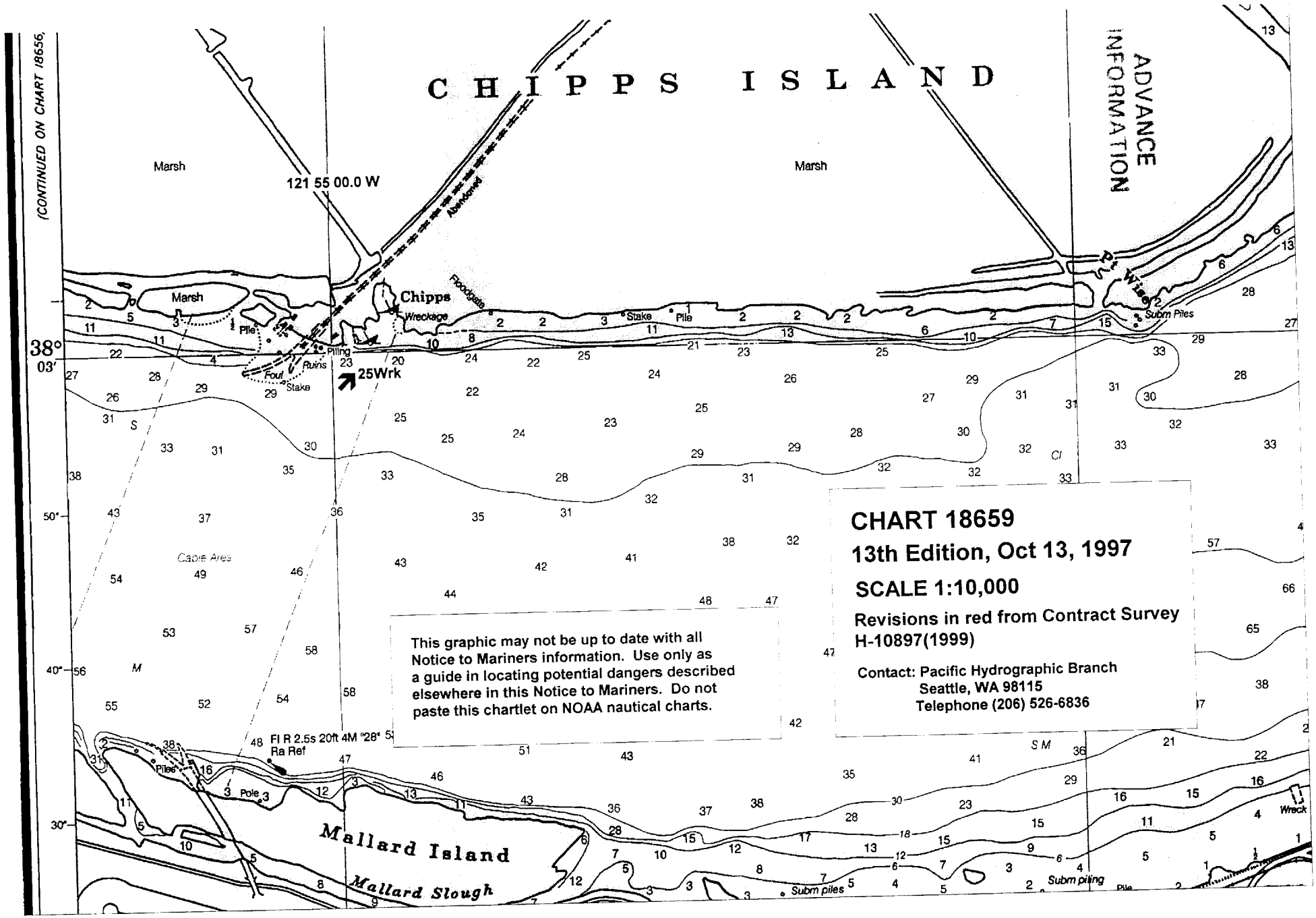

(CONTINUED ON CHART 18656)
CHIPPS ISLAND
ADVANCE INFORMATION
Marsh
121 55 00.0 W
Abandoned
Marsh
Chipps
Wreckage
Floodgate
Stake
Pile
Subm Piles
Pt Wise
38° 03'
Piling
Ruins
Foul
Stake
25Wrk
Cable Area
Fl R 2.5s 20ft 4M "28"
Ra Ref
Piles
Pole
Mallard Island
Mallard Slough
Subm piles
Subm piling
Wreck
CHART 18659
13th Edition, Oct 13, 1997
SCALE 1:10,000
Revisions in red from Contract Survey H-10897(1999)
Contact: Pacific Hydrographic Branch
Seattle, WA 98115
Telephone (206) 526-6836
This graphic may not be up to date with all Notice to Mariners information. Use only as a guide in locating potential dangers described elsewhere in this Notice to Mariners. Do not paste this chartlet on NOAA nautical charts.

APPROVAL SHEET

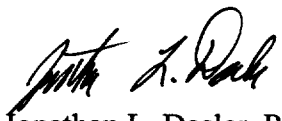
for

H10897

Standard field surveying and processing procedures were followed in producing this survey in accordance with the Hydrographic Manual, Fourth Edition; the Hydrographic Survey Guidelines; and the Field Procedures Manual, as updated for 1997. The data were reviewed daily during acquisition and processing.

The digital data and supporting records have been reviewed by me, and are considered complete and adequate for charting purposes, and are approved. All records are forwarded for final review and processing to N/CS34, Pacific Hydrographic Branch.

Approved and forwarded,



Jonathan L. Dasler, P.E., P.L.S.
Director of Hydrographic Services
David Evans and Associates, Inc.

NOAA FORM 76-155
(11-72)

U.S DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SURVEY NUMBER

H-10897

GEOGRAPHIC NAMES

Name on Survey	A ON CHART NO	B ON PREVIOUS SURVEY NO	C ON U S QUADRANGLE MAPS	D FROM LOCAL INFORMATION	E ON LOCAL MAPS	F P O GUIDE OR MAP	G RAND MCNALLY ATLAS	H U S LIGHT LIST	K	
CALIFORNIA (title)	X		X							1
BROWNS ISLAND	X		X							2
CHIPPS (ppl)	X		X							3
CHIPPS ISLAND	X		X							4
HONKER BAY	X		X							5
MALLARD ISLAND	X		X							6
MALLARD SLOUGH	X		X							7
NEW YORK POINT	X		X							8
PITTSBURG (ppl)	X		X							9
POINT EMMET	X		X							10
POINT WALL	X		X							11
POINT WISE	X		X							12
SIMMONS POINT	X		X							13
STAKE POINT	X		X							14
SUISUN BAY	X		X							15
VAN SICKLE ISLAND	X		X							16
										17
										18
										19
										20
										21
										22
										23
										24
										25

Approved: Chief Geographer SEP 13 2001

NOAA FORM 76-155 SUPERSEDES C&GS 197

NOAA FORM 77-27(H)
(9-83)

U.S. DEPARTMENT OF COMMERCE

HYDROGRAPHIC SURVEY STATISTICS

REGISTRY NUMBER
H-10897

RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.

RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT
SMOOTH SHEET	1	SMOOTH OVERLAYS: POS., ARC, EXCESS	NA
DESCRIPTIVE REPORT	1	FIELD SHEETS AND OTHER OVERLAYS	NA

DESCRIPTION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS	
ACCORDION FILES						
ENVELOPES						
VOLUMES						
CAHIERS						
BOXES						

SHORELINE DATA

SHORELINE MAPS (List):

PHOTOBATHYMETRIC MAPS (List):

NOTES TO THE HYDROGRAPHER (List):

SPECIAL REPORTS (List):

NAUTICAL CHARTS (List):

OFFICE PROCESSING ACTIVITIES

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS		
	VERIFICATION	*EVALUATION*	*TOTALS*
POSITIONS ON SHEET			
POSITIONS REVISED			
SOUNDINGS REVISED			
CONTROL STATIONS REVISED			
	TIME-HOURS		
	VERIFICATION	*EVALUATION*	*TOTALS*
PRE-PROCESSING EXAMINATION			
VERIFICATION OF CONTROL			
VERIFICATION OF POSITIONS			
VERIFICATION OF SOUNDINGS			
VERIFICATION OF JUNCTIONS			
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION/VERIFICATION			
COMPILATION OF SMOOTH SHEET			88
COMPARISON WITH PRIOR SURVEYS AND CHARTS			
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT			44
GEOGRAPHIC NAMES			
OTHER: (Chart Compilation)			54
USE OTHER SIDE OF FORM FOR REMARKS — TOTALS			186

Pre-processing Examination by	*Beginning Date* 08/10/2000	*Ending Date*
Verification of Field Data by B. MIHAILOV	*Time (Hours)* 88	*Ending Date*
Verification Check by	*Time (Hours)*	*Ending Date*
Evaluation and Analysis by G. NELSON	*Time (Hours)* 44	*Ending Date* 03/30/2001
Inspection by B.A. OLMSTEAD	*Time (Hours)* 36	*Ending Date* 08/31/2001

U.S. GOVT. PRINTING OFFICE 1983: 764-008/606

EVALUATION REPORT

H-10897

A. PROJECT

Survey H-10897 was conducted under contract number 50-DGNC-9-90011. NOAA/NOS issued the Statement of Work (SOW) containing specific requirements for the contracted services and the areas of performance. This contract survey was conducted by David Evans and Associates, Inc. (Portland, Oregon). Specific information pertaining to this contract may be obtained from National Ocean Service, Office of Coast Survey, Hydrographic Survey Division (N/CS3).

Additional information is found in the hydrographer's report, section A.

B. AREA SURVEYED

The survey area is adequately described in the hydrographer's report and supplemented as noted below.

The inshore limits of this survey are generally the 18-foot depth curve with the exception of those areas directly west of Stake Point and east of New York Point. In addition, the hydrographer was not required to conduct shoreline verification and collect bottom samples. Charted features and soundings inshore of the survey limit line have not been specifically addressed during hydrographic operations and should be retained as charted. IN addition, two federally maintained channels (Middle Ground Channel East Reach, New York Slough West Reach) reside within the survey area. Page-size plots of the charted area depicting the specific limits of supersession accompany this report as Attachments 1 and 2.

The bottom consists mainly of mud and sand. Depths range from 8 to 89 feet. The deepest depths are found off New York Point in Suisun Bay.

C. SURVEY VESSELS

The hydrographer's report contains adequate information relating to survey vessels.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

The acquisition and processing of data in the field has been adequately addressed in the hydrographer's report, section D.

Office processing of survey data was conducted using the same Computer Aided Resource Information System (CARIS) and MicroStation 95 as used by the hydrographer. MicroStation 95 was used during office processing to compile the smooth sheet.

Processed digital data for this survey exists in the CARIS format, a database format using the .dat extension. In addition, the smooth sheet drawing is filed in the MicroStation format, i.e., .dgn extension. Copies of these files have been forwarded to the Hydrographic Surveys Division and a backup copy retained at PHB.

The drawing files necessarily contain information that is not part of the CARIS data set such as geographic names text, line-type data, and minor symbolization. In addition, those soundings deleted from the drawing for clarity purposes remain unrevised in the CARIS digital files to preserve the integrity of the original hydrographic data set. Cartographic codes used to describe the digital data are those authorized by Hydrographic Surveys Specifications and Deliverables dated 1999 and 2000.

The data are plotted using a Universal Transverse Mercator (UTM) projection, Zone 10, and are depicted on a single sheet.

E. SONAR EQUIPMENT

Side scan sonar equipment was not used during survey H-10897

F. SOUNDING EQUIPMENT

Sounding equipment has been adequately addressed in the hydrographer's report.

G. CORRECTIONS TO SOUNDINGS

Soundings and elevations below Mean High Water (MHW) have been reduced to Mean Lower Low Water (MLLW). The reducers include corrections for an actual tide, dynamic draft, and sound velocity. Additional reducers for multibeam survey data include heave, latency, pitch and roll. These reducers have been reviewed and are consistent with NOS specifications.

Real-time unverified tide data was used during initial field processing of the survey data. During final field processing soundings have been reduced to Mean Lower Low Water (MLLW) or Mean High Water (MHW) as appropriate using zone information from the statement of work (SOW) and verified tide data information using Port Chicago tide gage, 941-5144. Additional information is found in the hydrographer's report, section G.

H. CONTROL STATIONS

Section H of the hydrographer's report contains an adequate discussion of horizontal control and hydrographic positioning.

The positions of horizontal control stations used during hydrographic operations are published values based on NAD 83. The geographic positions of all survey data are based on NAD 83. The smooth sheet is annotated with an NAD 27 adjustment tick based on values determined with the NGS program NADCON. Geographic positions based on NAD 27 may be plotted on the smooth sheet utilizing the NAD 83 projection by applying the following corrections:

Latitude:	-.288 seconds	(-8.880 meters)
Longitude:	3.855 seconds	(93.985 meters)

I. HYDROGRAPHIC POSITION CONTROL

Differential GPS (DGPS) was used to control this survey. A horizontal dilution of precision (HDOP) not to exceed 4.0 for 1:10,000 was computed for survey operations. There were no apparent problems with the positional data as collected during survey operations.

DGPS performance checks were conducted in the field. Additional information concerning specific control system type, calibrations and system checks, can be found in the hydrographer's report, section H.

J. SHORELINE

Shoreline verification was not required. Shoreline shown on the smooth sheet originates from prior surveys H-10317 (1989) and H-10342 (1990) and has been shown in color for orientation only. The shoreline and the hydrographic data were merged in MicroStation during the compilation of the smooth sheet.

K. CROSSLINES

Crosslines are adequately discussed in the hydrographer's report.

L. JUNCTIONS

There are no contemporary junctional surveys with H-10897.

M. COMPARISON WITH PRIOR SURVEYS

The following prior surveys fall within the common area of the present survey and have been compared with during office processing.

Survey	Year	Scale	Datum
H-10317	1989	1:10,000	NAD 27
H-10342	1990	1:10,000	NAD 27

Prior surveys H-10317 and H-10342 are the source data for much of the existing charted soundings and features. Comparison with H-10897 was made using raster copies of the prior surveys. The registration and legibility of the prior survey work to the present survey was good.

H-10317 and H-10342 cover the entire area of the present survey. These surveys were conducted using single beam echo sounders and a pneumatic depth gage for dive investigations. Positioning was accomplished using Miniranger. Present survey depths generally reflect differences of 1-3 feet with H-10317. There appears to be no consistent pattern of shoaling and or an increase in depths except as follows; between Stake Point and Simmons Point in the central portion of Suisun Bay (Long. 121/55/45W to Long. 121/56/45W), there is a consistent 2-11 feet deeper bias than shown in 1989. These differences appear to be attributed to migrating sand waves as discussed in the hydrographer's report. The comparison with H-10342 shows a consistent shoaler bias of 1-2 feet than depths collected in 1990. The depth differences with the prior surveys are likely attributed to constant dredging and dumping of sediment to support channel maintenance and alongshore cultural activity. Other discrepancies in depths, could be the result of lateral shifting of bottom sediment due to strong tidal currents along portions of Suisun Bay.

Portions of H-10317 and H-10342 have been superseded by Corps of Engineer surveys along and in the vicinity of the federally maintained channels. Discussion of controlling depths is found in Section N.

Additional information is found in the hydrographer's report, section K, N and S.

Prior shoreline, soundings, features and bottom samples were transferred in color to the smooth sheet in order to supplement the present survey. The prior data largely resides inshore of the 18-foot depth curve.

With the transfer of the prior data, survey H-10897 is adequate to supersede the prior surveys within the common area.

N. ITEM INVESTIGATIONS

No AWOIS items were assigned for this survey.

O. COMPARISON WITH CHART

Survey H-10897 was compared with the following charts.

Chart	Edition	Date	Scale
18656	52nd	March 31, 2001	1:40,000
18659	14th	September 18, 1999	1:10,000

a. Hydrography

Charted hydrography originates with the previously discussed prior surveys which have been adequately addressed in section M of the evaluation report and miscellaneous source data.

Except for those soundings listed below, the sounding data obtained during the survey are consistent with the charted controlling depths for Middle Ground Channel East Reach and New York Slough West Reach. These federally maintained channels are subject to shoaling along the edges and the following depths are noted from the current survey.

Depth(feet)	Lat(N)	Long(W)
35	38/03/28.6	121/57/37.0
32	38/02/35.9	121/53/13.8
36 Obstr	38/02/41.1	121/53/21.2 (Danger to Navigation)

Survey H-10897 is adequate to supersede charted hydrography within the common area. In addition, the evaluator recognizes that more recent sounding information may be available from the Corps of Engineers and should be considered during the next chart update. Additional discussion can be found in the hydrographer's report, section N.

b. Dangers To Navigation

Four potential dangers to navigation were identified during survey operations. These dangers were reported to the USCG, NIMA, and N/CS261. No additional dangers to navigation were identified during office processing at PHB

P. ADEQUACY OF SURVEY

Hydrography contained on survey H-10897 is adequate to:

a. Delineate the bottom configuration, determine least depths, and draw the required depth curves;
b. Reveal there are no significant discrepancies or anomalies requiring further investigation; and
c. Show the survey was properly controlled and soundings are correctly plotted.

The hydrographic records and reports received for processing are adequate and conform to the requirements of the Hydrographic Manual, 4th Edition, revised through Change No. 3, the Hydrographic Survey Guidelines, the NOS Hydrographic Surveys Specifications and Deliverables, and the Statement of Work dated October 1, 1998 except as follows;

Q. AIDS TO NAVIGATION

Four floating aids and eight fixed aids to navigation were located within the survey area and adequately serve the purpose intended. Additional information is found in the hydrographer's report, section P.

Landmarks within the survey area were not addressed by the hydrographer and should be retained as charted.

R. STATISTICS

Statistics are adequately itemized in the hydrographer's report, section Q.

S. MISCELLANEOUS

Miscellaneous information is adequately discussed in the hydrographer's report, section R. No additional miscellaneous items were noted during office processing.

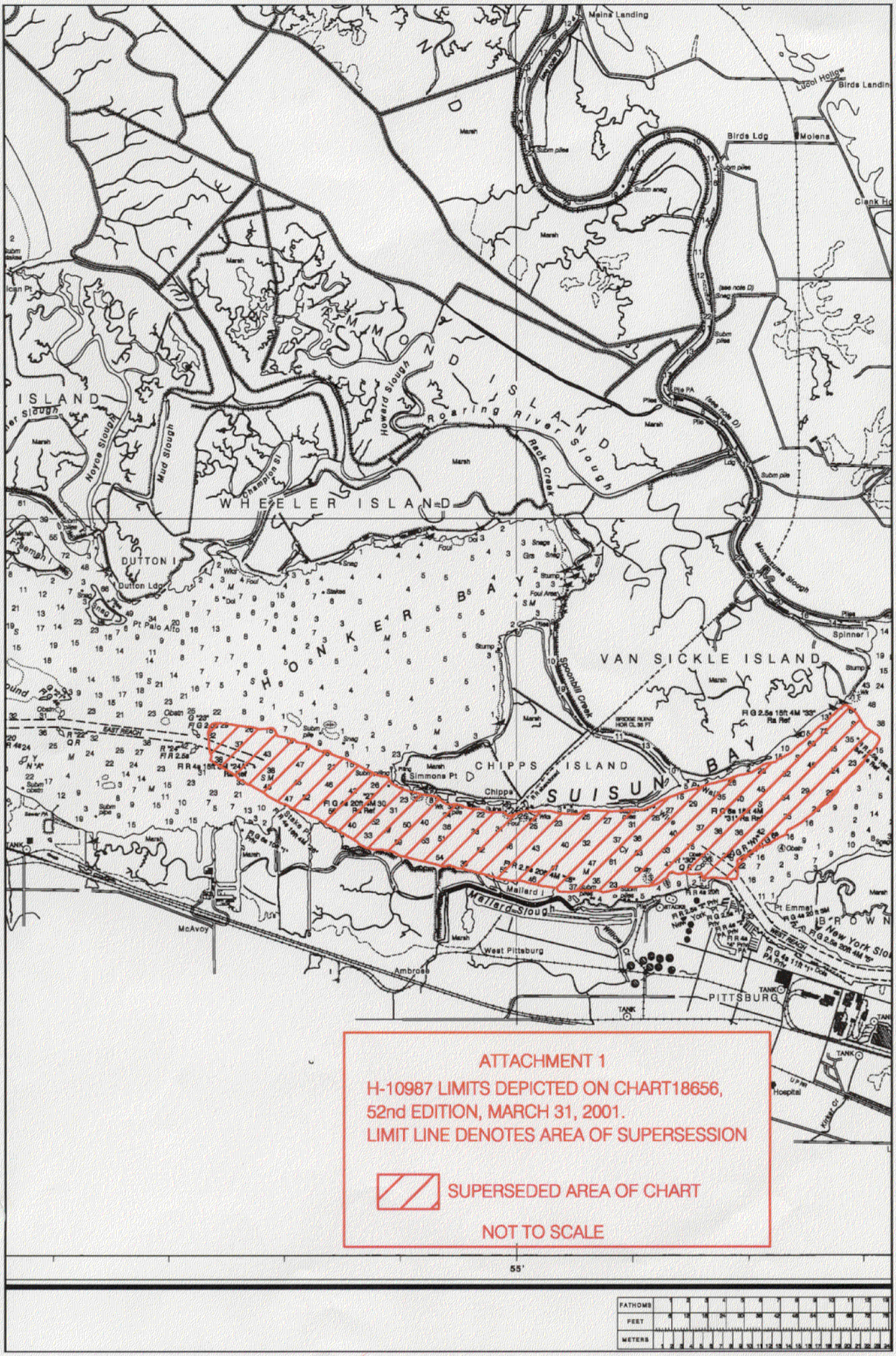
T. RECOMMENDATIONS

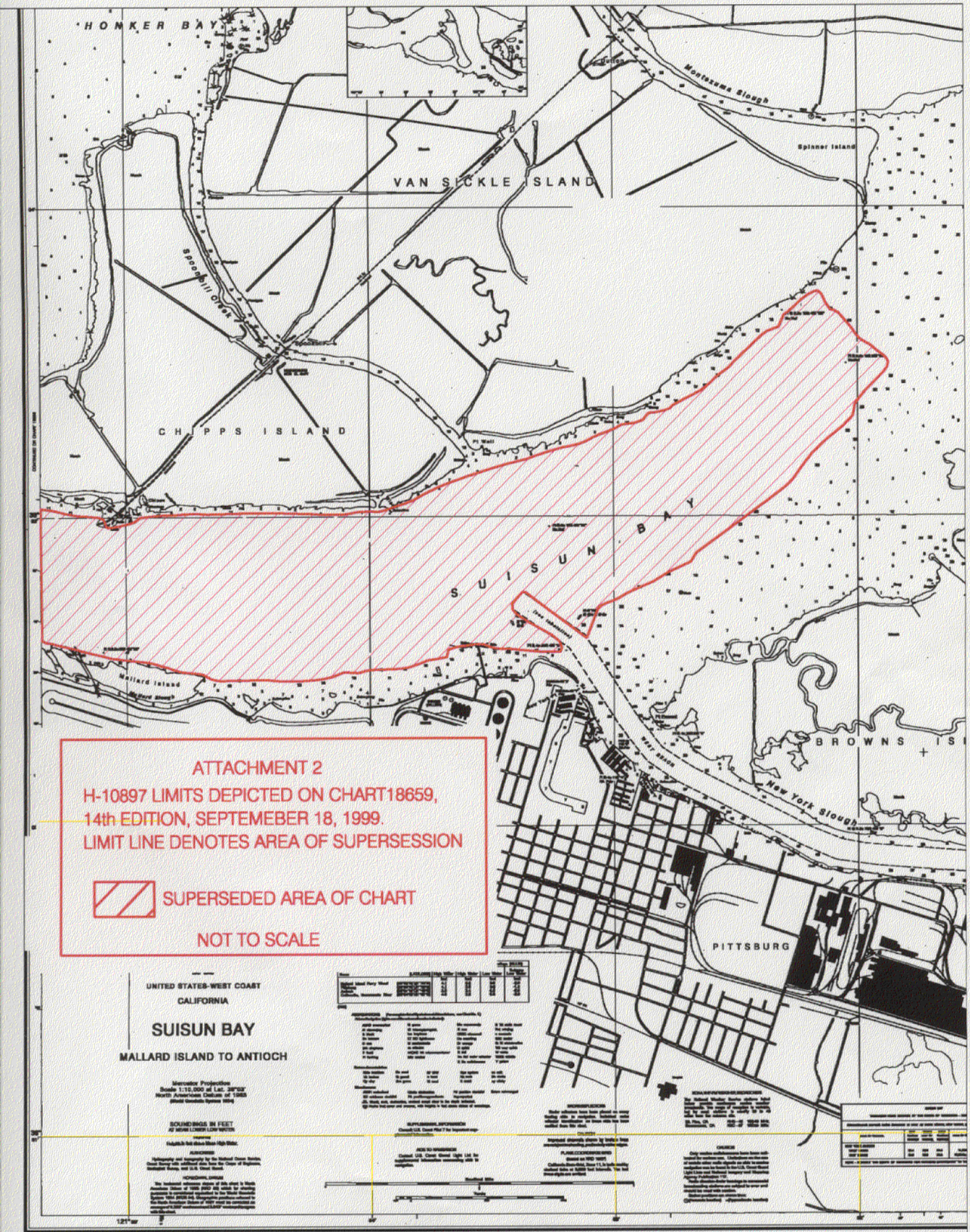
This is a good hydrographic survey. Additional information regarding recommendations is found in the hydrographer's report, section S.

U. REFERRAL TO REPORTS

Referral to reports is adequately discussed in the hydrographer's report, section T.

Bob Mihailov
Cartographer


Meins Landing
Birds Landing
Birds Ldg
Molens
HAMMOND ISLAND
Roaring River Slough
Howard Slough
Hoyos Slough
Mud Slough
Champion Sl
Rock Creek
WHEELER ISLAND
DUTTON I
Dutton Ldg
Freeman I
Pt Palo Alto
SUISUN BAY
CHIPPS ISLAND
Simmons Pt
Chipps
VAN SICKLE ISLAND
Montezuma Slough
Spoonbill Creek
Spinner I
Mallard I
Mallard Slough
West Pittsburg
Ambrose
McAvoy
Pt Emma
New York Slough
PITTSBURG
Hospital
EAST REACH
WEST REACH
ATTACHMENT 1
H-10987 LIMITS DEPICTED ON CHART18656,
52nd EDITION, MARCH 31, 2001.
LIMIT LINE DENOTES AREA OF SUPERSESSION
SUPERSEDED AREA OF CHART
NOT TO SCALE
55'
FATHOMS
FEET
METERS


HOMKER BAY
VAN SICKLE ISLAND
Montezuma Slough
Spinner Island
Spoonbill Creek
CHIPPS ISLAND
SUISUN BAY
Mallard Island
Mallard Slough
BROWNS ISL
New York Slough
PITTSBURG
ATTACHMENT 2
H-10897 LIMITS DEPICTED ON CHART18659,
14th EDITION, SEPTEMEBER 18, 1999.
LIMIT LINE DENOTES AREA OF SUPERSESSION
SUPERSEDED AREA OF CHART
NOT TO SCALE
UNITED STATES-WEST COAST
CALIFORNIA
SUISUN BAY
MALLARD ISLAND TO ANTIOCH
18659

APPROVAL SHEET
H-10897

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, comparison with prior surveys and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

Date: 9-12-01

Dennis Hill,
Chief, Cartographic Team
Pacific Hydrographic Branch

I have reviewed the smooth sheet, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Evaluation Report.

Date: 9/20/01

John E. Lowell, Jr.
Commander, NOAA
Chief, Pacific Hydrographic Branch

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Final Approval

Approved:

Date: 10/17/01

Samuel De Bow, Jr.
Captain, NOAA
Chief, Hydrographic Surveys Division

NOAA FORM 75-96
(10-83)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10897

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.
1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
18656	03/14/01	B. MIHAILOV	Full Part Before After Marine Center Approval Signed Via Full application
			Drawing No. of sndgs, curves and features from
			the smooth sheet
18659	03/29/01	B. MIHAILOV	Full Part Before After Marine Center Approval Signed Via Full application
			Drawing No. of sndgs, curves and features from
			the smooth sheet.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
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			Full Part Before After Marine Center Approval Signed Via
			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.